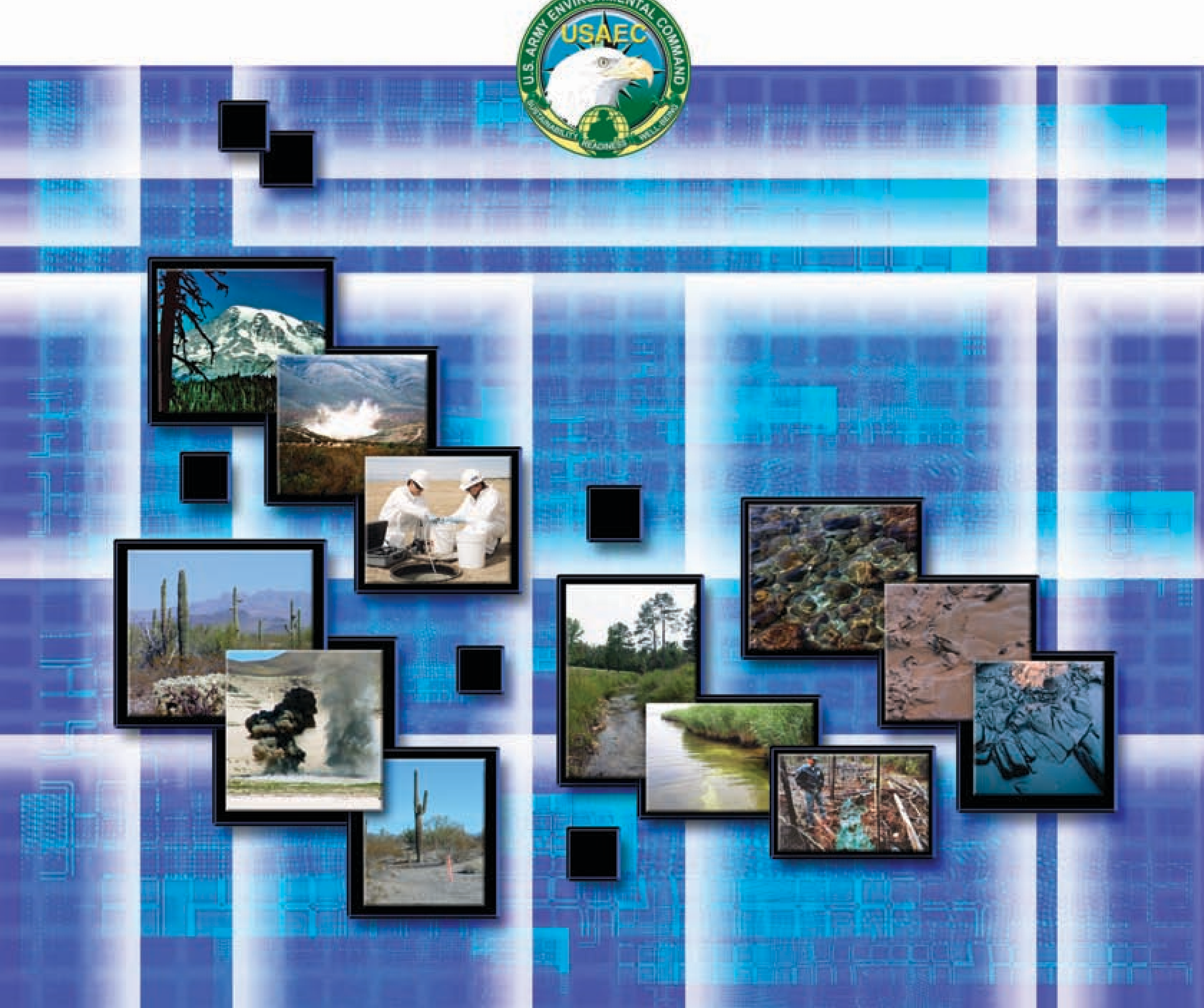
NEPA Analysis Guidance Manual

May 2007



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14. ABSTRACT
The development of this NEPA Analysis Guidance Manual is based on the need for a specific, detailed Army methodology to implement requirements outlined in the Council for Environmental Quality (CEQ) Cumulative Effects Analysis (CEA) guidelines. This Army manual will support Army National Environmental Policy Act (NEPA) analysis and documentation. The primary goals are to: (1) serve as a practical and usable tool to effectively support Environmental Assessment and Environmental Impact Statement preparation; (2) be cost-effective in its use, presenting large quantities of practical, focused information, selected and organized to streamline CEA studies; and (3) be scientifically and legally defensible. In this regard, the manual builds upon the foundation of the CEQ's 11-step CEA process and scientific approaches, methods, and processes developed by key environmental and resource agencies.

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EXECUTIVE SUMMARY

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As a result of the 1970 National Environmental Policy Act (NEPA), federal agencies must integrate environmental values into their decision making processes; and analyze the environmental impacts of any proposed actions and reasonable alternatives before the action is undertaken. This analysis must be documented in an environmental assessment (EA), or an environmental impact statement (EIS).

To oversee the NEPA process and ensure compliance by federal agencies, NEPA established the Council on Environmental Quality (CEQ). The functions of the CEQ include: (1) gathering information on the conditions and trends in environmental quality; (2) evaluating federal programs against the goals established in NEPA; (3) developing and promoting national policies to improve environmental quality; and (4) conducting studies, surveys, research, and analyses relating to ecosystems and environmental quality.

In 1978, the CEQ set forth regulations for the implementation of the NEPA process. NEPA and the CEQ regulations require proponents of a federal action to undertake effects analysis, including cummulative effects analysis (CEA), in their NEPA documents. While specific direct or indirect environmental effects may not be significant by themselves, the minor effects can accumulate over time and degrade important resources. Proper CEA must assess the effects of a proposed action when combined with other past, present and reasonably foreseeable (PPRF) future actions, including the actions of other federal, non-federal and private organizations and agencies.

Cumulative impacts are often inadequately addressed in NEPA documents, as these issues are complex and difficult to address. To improve agency CEA practice, CEQ published, in 1997, specific guidelines for CEA, establishing a new impact assessment approach that focuses on important regional resources, as opposed to the traditional action-impact approach used for direct and indirect effects. The new assessment approach focuses on valued environmental components (VECs) or resources that are important in a specific region. The new approach also addresses the need for involvement of regional and community stakeholders to eliminate or mitigate any cumulative impacts. In addition, the new approach developed "back-casting" and "forward-casting" to determine the PPRF actions that affect or have affects on the resource.

The development of this Army NEPA Analysis Guidance Manual is based on the need for a specific, detailed Army methodology to implement NEPA analysis requirements outlined in the CEQ CEA guidelines. This Army manual will support Army NEPA impact analysis and documentation. The primary goals are to: (1) serve as a practical and useable tool to effectively support EA and EIS preparation; (2) be cost-effective in its use; presenting large quantities of practical, focused information, selected and organized to streamline impact analysis and CEA studies; and (3) be scientifically and legally defensible. In this regard, the manual builds upon the foundation of the CEQ's 11-step CEA process and scientific approaches, methods, and processes developed by key environmental and resource agencies.

The 11 steps of CEQ's CEA process are grouped according to three major components of the NEPA process: scoping (Steps 1-4), describing the affected environment (Steps 5-7), and determining environmental consequences (Steps 8-11). This Army guidance manual incorporates the 11 CEQ steps for each selected VEC. Step 1 identifies the significant effects issues associated with the proposed action and defines assessment goals. Step 2 establishes the analysis geographic scope. Step 3 establishes the analysis time frame. Step 4 identifies other actions affecting the resources, ecosystems, and human communities (VECs) of concern. Steps 5 and 6 characterize the VECs identified in steps 1-4 and their responses to environmental changes.

Step 7 defines the baseline condition for the VECs. Step 8 identifies the important cause-and-effect relationships between human activities and the VECs. Step 9 determines the magnitude of cumulative effects on the selected VECs. Step 10 modifies alternatives to avoid, minimize, or mitigate significant cumulative effects. Step 11 monitors cumulative effects of the proposed action and management adaptation.

Three levels of effects analysis can be used to evaluate VECs or resources: Quick Look, Analysis and Discussion, and Detailed Analysis. The level of analysis is based on answers to Quick Look questions. The questions were initially developed to easily screen VECs to determine if detailed effect analysis is warranted. If the answers to the Quick Look questions show significant impacts are not likely, no further analysis is needed. Many of the Quick Look questions cannot be easily answered, therefore more detailed analysis may be required using a second level of analysis, Analysis and Discussion. Issues that have potentially significant impacts require more rigorous analysis, Detailed Analysis.

The Quick Look Level is appropriate if the answers to Quick Look questions indicate that the chance for significant impacts is low. The appropriate level of documentation is an EA.

The Analysis and Discussion Level is warranted when additional analyses may be required to thoroughly answer the Quick Look questions. Analysis should be documented at the EA level in proportion to the severity of the issues. The EA should focus on issues that interest the decision maker and the public, which will likely require consideration of CEQ Steps 1-4, 6, and 7.

A Detailed Analysis is required if EA level analyses identify any direct or indirect effects that cannot be mitigated, or potentially will contribute to cumulative effects. The level of analysis should be evaluated at the EIS level of documentation, addressing all 11 CEQ steps.

As described in CEQ guidelines and Army guidance, NEPA analysis, including CEA, must focus on important local regional resources, as opposed to the traditional "action-impact" approach. This means focusing on VECs that are important in a specific region or Army installation. For example, seven VECs applicable to the cumulative effects associated with Army ranges were included in the initial development of the Army NEPA Analysis Guidance Manual. They included air quality, air space, cultural resources, noise, soil erosion, threatened and endangered species, and wetlands.

As the initial effort focused on training ranges, the second phase of the manual focused VEC selection on cantonment and Base Realignment and Closure (BRAC) issues. The BRAC NEPA Guidance Manual was reviewed for development of the new list of VECs. The list contains six "super-VECs" with numerous subsequent "sub-VECs" under each super-VEC. This hierarchy is intended to provide a systematic approach to CEA that will encompass all of the issues from the previous list, cantonment issues, and BRAC issues.

The seven super-VECs are Water Resources Management, Facilities, Socioeconomics, Energy Demand/Generation/Transmission/Use, Land Use Conflicts/Compatibilities, Hazardous Material/Hazardous Wastes, and Traffic and Transportation Systems. Three sub-VECs are addressed within Water Resources Management; one related to water demand/usage, water supply, source water protection, and water treatment; another addressing domestic/industrial wastewater infrastructure/treatment; and the third focusing on storm water management. The sub-VECs for Facilities are real estate acquisition, excess land/facility transfer, and demand for facilities.

Socioeconomics contains four sub-VECs including one encompassing business volume, income, employment, and population; government services; housing; and environmental justice. There are eight sub-VECs under Energy Demand: fossil fuels, solar power, wind power, hydropower, nuclear power, refuse-derived fuel, conservation, and residual effects. Hazardous Materials and Wastes includes two sub-VECs, waste minimization and spill prevention control and countermeasure plans.

Currently the Army is engaged in three major efforts that can complement and benefit from the NEPA analysis process: Army Transformation, the Installation Sustainability Program (ISP), and the Sustainable Range Program. All can contribute to the long-term reduction of environmental impacts associated with Army programs and projects. Their combined processes directly support and complement CEQ's CEA process and the success of the NEPA process overall. As a result, Army planning documentation will benefit from the process established by this NEPA analysis Guidance Manual.

The Army Transformation process is extensive, including the expansion and upgrading of installation training ranges, or the development of new ranges. As training requirements become more collaborative and sophisticated, training ranges may require different land areas, airspace, and support facilities. As this complex Army Transformation process proceeds, NEPA planning is increasingly integrated into Army policies. The planning process associated with the Army's ISP to address installation encroachment issues integrates the NEPA analysis process and is similar to CEQ's CEA process. The installation and community jointly identify affected resources within the region in both processes. Once the resources have been identified and evaluated, a collaborative management plan is developed that will provide solutions for all stakeholders. The Army's Sustainable Range Program incorporates the same principles of these processes into its planning procedures. Site selection and range design for training facilities begin with a design "charrette" to insure stakeholder collaboration. This effort ensures a design that will satisfy training requirements and environmental issues.

The CEQ guidelines and this Army NEPA Analysis Guidance Manual focus more on EA or EIS application. However, impact analyses requirements also apply to smaller, day-to-day applications in the form of simple EAs. To simplify these more routine applications, potentially affected VECs could be prescreened by reviewing installation EISs and EAs, and other regional resources. A documented review could then provide a summary of locally and regionally sensitive VECs, and answers to the Quick Look questions.

Reviewing installation and regional EISs can also provide knowledge of past and present actions that must be considered as part of the more complex CEA process. The Northwestern University NEPA Repository contains all federal EISs, and can be used to characterize issues within a region. The Repository was used to develop a regional historical record for the Fort Irwin, California case study. This case study is included in this manual in a generic way to illustrate the dynamics of direct and indirect environmental effects.

This Army NEPA Analysis Guidance Manual provides a comprehensive framework of environmental planning tools. This manual can be improved as new tools are found, developed, and refined. As this manual evolves, VECs may be added as experience grows. Numerous technical documents and Web sites are available to address impact analysis, including CEA, requirements for each VEC in this manual. These resources are included on the accompanying CD. Section

6 gives a list of the complete CD contents. The CD contains bookmarked references related to NEPA impact analysis in general, or to specific cumulative effects for selected VECs. The bookmarked references presented for each VEC typically include laws, regulations, and guidelines; and literature, review documents, and papers. The VEC-specific sections also include links to Web sites containing regulations, guidance, environmental information, etc.

This manual includes seven sections and an accompanying CD. Section 1.0 is the introduction, and Section 2.0 includes CEQ's 11-step CEA process. Section 3.0 discusses the process of selecting the VECs, which are then each detailed in Section 4.0 in alphabetical order. Each VEC subsection focuses on the application of CEQ's 11-step process to CEA for that VEC. Section 5.0 contains the conclusions and field findings to date. One major conclusion is that installations typically have numerous existing reports, plans, and environmental management resources which are useful in conducting overall NEPA analyses for specific VECs.

INTRODUCTION

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1.0 Introduction

The National Environmental Policy Act (NEPA) (USC, 1970) and subsequent federal regulations (CEQ, 1978) require that the proponents of a federal action evaluate the direct, indirect, and cumulative environmental impacts associated with that action. The requirement for cumulative effects analysis (CEA) is recognized as a weak component in traditional NEPA practice (CEQ 1997b), leading to specific guidelines to correct these weaknesses (CEQ, 1997a). At the direction of the U.S. Army Environmental Command, this effort, the development of an Army NEPA Analysis Guidance Manual, investigated the requirements outlined in the CEQ CEA procedures and developed the following draft methodology for Army analyses of impacts, including detailed instructions on addressing and performing CEA.

Cumulative impacts and issues constitute a major growth area in NEPA litigation (Cohen, 2001). It is increasingly seen as a weakness in agency practice, and reflects a growing recognition that multiple small (individually insignificant) impacts can create greater impacts than the single, major impacts traditionally addressed in NEPA analyses. Such cumulative impacts include: wetland destruction, through development and dredge and fill activities; rangeland stress due to overgrazing; acid rain, the end result of numerous air emissions from multiple sources; interrupted fish spawning due to multiple dam construction on major rivers; stream sedimentation from numerous solid disruptions in a watershed; and increased cancer (and hormonal effects) from exposure to man-made chemicals; to name a few. These cumulative effects, often from small past, present, and reasonably foreseeable (PPRF) actions, are often referred to as the “tyranny of small decisions”.

Often a challenge to the NEPA practitioner, CEA has often been limited to an “obligatory paragraph” claiming that no significant cumulative effects have been identified. Often unsupported by actual analyses or formal methodology, this conclusion is often one of the last sections of the NEPA analyses to be produced, and could benefit from CEQ’s recommended methodological approach.

Traditionally, agencies have focused on “direct” and “indirect” effects, and resultant methodologies are difficult to apply to CEA. The CEQ CEA guidelines establish a new and different impact assessment paradigm focused on important regional resources, as opposed to the traditional “action-impact” paradigm that evolved to address direct and indirect impacts. This new paradigm focuses on the valued environmental components (VECs) (i.e., resources) that are important in a specific region, somewhat independent of the proposed project or action; the involvement of regional and community stakeholders to eliminate or mitigate any cumulative impacts; and “back-casting” to determine those PPRF actions that affect or have affected the resource. While the VEC approach was initially designed for CEA analyses, its use can also facilitate better analysis of direct and indirect effects.

This CEA approach may also affect Army “programmatic” documents, particularly for large, geographically-dispersed projects, which are often independent of a specific place or region, rendering much of the VEC-focused (resource-focused) CEA paradigm difficult to implement. While the general direct and indirect effects of a particular Army program or Army activities can be addressed in a programmatic way, CEA analyses will inevitably require site-specific consideration. These considerations can be used to ascertain the need to further CEA at a specific installation. This can be facilitated through the “pre-emptive” determination of regionally-important issues or resources, prior to a specific proposed action. This can be done through the analyses of past publications, particularly EAs and EISs.

CEA issues, under this new approach, will require site-specific delineation of issues prior to CEA. Within programmatic Army documents, some of these issues are probably best presented in summary, if available, for specific, affected installations. Site-specific analyses will likely be required for broad-scale Army NEPA documents, as “tiered” or supplemental documents. For example, the programmatic NEPA evaluation of major Army acquisition systems can incorporate summary installation issues, but will also often require subsequent detailed CEA for each affected site or installation.

While CEQ has published these CEA guidelines, a specific, detailed methodology is still needed, and this Guidance Manual provides information on CEA and direct and indirect impact analyses and serves as the initial attempt at an Army methodology. It is a first attempt, this effort can be viewed as an evolving process, one that continually improves through use and calibration, and will become the collaborative product of Army NEPA practitioners. It is intended to be used in the development of EAs and EISs. If a REC is used to meet NEPA requirements, the enabling CX will be sufficient to meet any effects analyses, including, CEA, requirements, or the enabling EA/EIS (referenced by the REC) will have addressed or established any supplemental efforts needed to meet CEA requirements.

1.1 NEPA Contribution to Army Transformation and Sustainability Planning

The U.S. Army is currently engaged in three major efforts that can complement and benefit from the CEA process: Army Transformation, the Installation Sustainability Program (ISP), and the Sustainable Range Program. All can contribute to the long-term reduction of environmental impacts associated with Army policies, programs, plans, and projects; and their combined constituent processes directly support (and complement) overall NEPA analysis and CEQ’s CEA process (to be described in the next section). As a result, related Army planning documentation will prove valuable to the process established by this Guidance Manual, and vice versa.

Responding to future and evolving National Security threats, the Army is transforming from a Cold War reliance on heavy, largely pre-positioned forces and materiel; toward a more mobile, flexible, and (necessarily) lighter force. The force will be deployed in smaller units of action (UAs), capable of greater tactical dispersion and mobility over larger geographic areas. Lighter equipment and its increased spatial dispersion reduce the intensity of stress for a given increment of Army training. Army Transformation is also focused on minimal logistics requirements (fuel; petroleum, oils, and lubricants (POL), parts, etc.) to support tactical operations; which will also reduce environmental effects and risks during tactical unit training and operations. Since the late 1990s, transformation and modernization is an ongoing effort involving considerable planning and implementation. This transformation process is extensive, including the reorganization of Army units, modernization of Army equipment, and the development of new doctrine (procedures) for deployment and war fighting. This also includes the expansion and upgrade of existing installation training ranges, or the development of new ranges at existing or expanded Army installations. Multiple installations may be involved, sharing local training areas, major training areas, and combat training centers (USA, 2004d, pp. 3-1 and 3-2). As training requirements become more collaborative and sophisticated, additional multipurpose ranges will be needed, with differing requirements for land areas and terrain features, airspace, and support facilities. Rangeland acquisition and modernization may require extended construction periods followed by multiple ground-and air-related training activities, over many years. As this complex Army process proceeds, environmental compliance is increasingly integrated into new and evolving Army processes, consistent with strategic guidance from senior Army leaders (USA, 2004a). This strategic integration includes the incorporation of NEPA into ongoing Army planning, incorporating environmental considerations “on a par” with other economic and technical considerations.

Long-term Army planning incorporates sustainability as a means to integrate mission requirements with environmental, economic, and social (community) goals (USA, OASA (I&E), 2004), and to address installation “encroachment” issues affecting the Army mission (Jones, et al, 2002). Such comprehensive planning is methodologically similar to overall NEPA analysis and CEQ’s CEA process, as affected critical resources within the community (or region) are identified, and all stresses on the resources are collaboratively analyzed. Jointly identified by the installation and the surrounding community, these critical resources have typically included water supply, air quality, transportation, solid waste management, surface water pollution, and other traditional environmental resource issues. Once these resource issues have been identified and evaluated, a collaborative management plan is developed by the installation and community. This resource focus (and associated regional planning and collaboration) is critical to the long-term viability of these installations mirrors the spirit and intent of NEPA and CEQ’s CEA process. Long-term installation sustainability requires collaborative solutions that engage installation staff, regulators, interest groups, and all stakeholders.

The Army also incorporates sustainability principles and concepts into the planning, development, and upgrade of training ranges and maneuver areas. From the outset, site selection and range design follow sustainability principles, starting with design “charrettes” to insure stakeholder collaboration toward optimal range design; encompassing training requirements, fiscal constraints, local characteristics and constraints, and environmental issues. Many of these activities are also mirrored in the installation Master Planning process.

The Army NEPA implementation regulation (32 CFR 651) provides the following broad policy statements (USA, 2002, Sec. 651.5 (a) and (b)):

“NEPA establishes broad federal policies and goals for the protection of the environment, and provides a flexible framework for balancing the need for environmental quality with other essential societal functions, including national defense. The Army is expected to manage those aspects of the environment affected by Army activities, comprehensively integrating environmental policy objectives into planning and decision making. Meaningful integration of environmental considerations is accomplished by efficiently and effectively informing Army planners and decision makers. The Army will use the flexibility of NEPA to ensure implementation in the most cost-efficient and effective manner. The depth of analyses and length of documents will be proportionate to the nature and scope of the action, the complexity and level of anticipated effects on important environmental resources, and the capacity of Army decisions to influence those effects in a productive, meaningful way from the standpoint of environmental quality.

The Army will actively incorporate environmental considerations into informed decision making, in a manner consistent with NEPA. Communication, cooperation, and, as appropriate, collaboration between government and extra-government entities is an integral part of the NEPA process. Army proponents, participants, reviewers, and approvers will balance environmental concerns with mission requirements, technical requirements, economic feasibility, and long-term sustainability of Army operations. While carrying out its mission, the Army will also encourage the wise stewardship of natural and cultural resources for future generations. Decision makers will be cognizant of the impacts of their decisions on cultural resources, soils, forests, rangelands, water and air quality, fish and wildlife, and other natural resources under their stewardship, and, as appropriate, in the context of regional ecosystems."

In consonance with the CEQ regulations, 32 CFR 651 requires cumulative effects analysis, as follows (USA, 2002, Sec. 651.16 (a)):

"NEPA analyses must assess cumulative effects, which are the impact on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Actions by federal, non-federal agencies and private parties must be considered."

1.2 Effects Definitions and Implementation Principles

CEQ regulations (40 CFR 1508.8) define effects in two categories, direct or indirect. Direct effects are those which are caused by the action and occur at the same time and place. Indirect effects are those which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth including effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (CEQ, 1978).

For purposes of this Guidance Manual, the terms "impacts" and "effects" will be considered synonymous.

CEQ regulations (CEQ, 1978 and 1997a) define cumulative impacts, as follows:

Cumulative impact is the "cumulative effect on the environment which results from the incremental impact of the action" when added to "other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions". Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

This definition prompts several requirements, as follows:

(a) consideration of the incremental impacts of Army action relative to other actions;

(b) an expanded time frame, extending from the past to the future;

(c) larger study areas, encompassing more actions that could also affect important resources;

(d) consideration of multiple actions from multiple public and private sector sources; and

(e) determination of cumulative significance of incremental impacts of the proposed action, along with the significance of the direct and indirect impacts.

The CEQ CEA guidelines refer to affected resources as "resources, ecosystems, and human communities of concern". An early approach to CEA established the term "Valued Environmental Component", or VEC, to refer to the resource category (or issue) being analyzed. This Guidance Manual will use that terminology.

CEA is eased by adoption of a VEC orientation or "mindset", in lieu of the traditional action-impact paradigm used for assessing direct and indirect effects. To facilitate this mindset, the following eight principles (CEQ, 1997a) are useful:

- Cumulative Effects (CEs) are the total effect, including both direct and indirect effects, on a given VEC, no matter who (federal, non-federal, or private) performs the actions.
- CEs need to be analyzed in terms of the specific VEC being directly or indirectly affected. The direct and indirect incremental impacts of the proposed action determine if cumulative effects on a VEC need to be addressed. Alternatively, if the action has no effects on a given VEC, then further CEA on the VEC is not required.
- CEs are caused by the aggregate of PPRF actions. CEA must consider the direct and indirect effects of PPRF actions on the relevant VEC. Present actions include those in detailed planning, under construction, or which have been recently initiated; and reasonably foreseeable future actions include those beyond mere speculation, but within the time frame for analysis. Cumulative effects may have been, or will be, the result of decisions made by various levels of governmental agencies (federal, state, or local), or the private sector. Further, such actions may be on Army installation lands, or off site (the key issue being any VECs being affected).
- CEs must be analyzed from a place-based perspective (the situation at specific Army installations and associated training ranges), and on the VECs being affected.
- Each VEC must be analyzed in terms of its sustainability, and capacity to assimilate additional effects, based on its own time and space parameters (CEQ, 1997a).
- It is impractical to analyze CEs of an action on the universe; and analyses must focus on those truly meaningful. The scoping process is critical.
- CEs on a given VEC are rarely aligned with political or administrative boundaries.
- CEs may result from the accumulation of similar effects, or the interaction of different effects.
- CEs may last far beyond the life of the action that caused the effects.
- Each VEC must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters. (This infers site-specific consideration of carrying capacity and environmental sustainability of each subject VEC).

1.3 The Army NEPA Analysis Guidance Manual – Purpose and Features

This manual was developed to support Army NEPA analysis and documentation. Its primary goals are to:

- Serve as a practical and useable tool to effectively support EA and EIS preparation, as appropriate;
- Be cost-effective in its use, presenting large quantities of practical, focused information, selected and organized to streamline NEPA analyses and studies; and

- Be scientifically and legally defensible. In this regard, the manual builds upon the foundation of the CEQ's 11-step CEA process, and scientific approaches, methods, and processes developed by key environmental and resource agencies such as Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFW), etc.

Some basic tenets and assumptions framed the preparation of this manual:

- Army installations and associated training ranges should be NEPA compliant.
- While the CEQ CEA process provides general guidance, more detailed Army guidance can facilitate efficient and effective NEPA compliance, particularly important when litigation is increasingly focused on the adequacy of CEA.
- The VECs addressed in the manual represent documented impact analysis issues in past and current Army EAs and EISs.
- The manual can facilitate the required NEPA "hard look" test, at both EA and EIS levels. Appropriate significance thresholds and levels should be incorporated for each VEC, along with detailed information to address CEs in EISs.
- While the manual provides detailed information on CEA, much of this information can also facilitate better analysis of direct and indirect effects.
- The manual can facilitate early identification of issues related to proposed impacts and encourage their appropriate avoidance, mitigation, or management.
- The manual can facilitate sustainability planning through improved communication between installation planners, environmental personnel, and NEPA practitioners.
- The manual is based upon existing methods and processes from the Army, other military services, and key environmental and resource agencies.
- This manual is optional, as it is not mandatory guidance.

This manual also incorporates the following features, either directly or indirectly:

- A user-friendly format for NEPA practitioners.
- A modular organization, expandable as new information becomes available.
- A practical step-wise approach for specific VECs. User flexibility is encouraged through the illustration of optional approaches.

1.4 Structure of the Manual and CD

This Army NEPA Analysis Guidance Manual includes six sections, one appendix, and an accompanying CD with selected reference documents and Web links. Following this Introduction section, Section 2.0 includes information on the CEQ's 11-step CEA process (CEQ, 1997a) and the cumulative impacts section in the Army's NEPA regulations (USA, 2002). Section 3.0 highlights the process used to select the 14 VECs, each methodologically detailed in Section 4.0. Each VEC subsection is focused on the application of CEQ's 11-step process for that VEC. Section 5.0 contains the conclusions developed from the assemblage of this Guidance Manual and its modest field testing to date. Section 6.0 includes a composite listing of all cited references, Appendix I includes annotated citations of the CD contents.

The accompanying user-friendly CD contains 96 key bookmarked references related to the general topic of NEPA analysis, including CEA, or to specific processes and methods for addressing CEs for the selected VECs. The first 12 bookmarked references are divided into two categories: (a) laws, regulations, and guidelines; and (b) literature, review documents, and papers. The remaining 84 bookmarked references are presented for various VECs. The VEC-specific sections also include 75 links to Web sites containing regulations, guidance, environmental information, etc.

2.0 NEPA Analysis, including CEA

This section includes five subsections, starting with a discussion of CEQ's 11-step CEA process and its applicability to Army installations and associated training ranges. The second subsection delineates the use of these steps to address a two-stage NEPA approach, for preparation of either an EA or EIS. The third subsection highlights Army NEPA analysis policies articulated in 32 CFR 651, linking them to the CEQ steps. The fourth subsection articulates an approach to identify past and present actions (Step 4 in CEQ CEA process). Finally, the last subsection focuses on impact monitoring and management requirements (Step 11 in the CEQ CEA process) and their linkage to Environmental Management System (EMS) requirements.

2.1 CEQ's 11-Step CEA Process

CEQ's CEA process was published as a "handbook" for addressing CEs under NEPA (CEQ, 1997a). The 11-steps are grouped according to three major components of the NEPA process; (a) scoping (Steps 1–4), (b) describing the affected environment (Steps 5–7), and (c) determining environmental consequences (Steps 8–11). The 11 steps can apply to both general impact analysis planning or a detailed effects analysis on individual VECs (the purpose of this Guidance Manual). This Guidance Manual incorporates the 11 CEQ steps for each selected VEC. The 11 CEQ steps were generally applied to each of the selected VECs, as follows:

- **Step 1: Identification of significant effects issues associated with the proposed action and definition of assessment goals.** This step is focused on the direct and indirect effects of the proposed action. Further, if the incremental impacts were deemed to be inconsequential or unimportant in the region, no analyses of cumulative effects need be conducted. The "quick-look" questions (presented for each VEC in Section 4) can facilitate proper orientation of the issues and consideration of potential incremental direct and indirect effects of the proposed action. The assessment goal is to determine the direct, indirect, and contributed impacts of the proposed action on nearby resources, ecosystems, and human communities and identify those resources that may be subjected to cumulative effects.
- **Step 2: Establishment of the geographic scope for the analysis.** The geographic scope is dependent on the characteristics and location of affected resources, ecosystems, and human communities (VECs). In some cases, localized installation, training range, or site boundaries may be appropriate, while in other cases, regional boundaries (watersheds, air quality regions, etc.) may be appropriate.
- **Step 3: Establishment of the time frame for the analysis.** The time frame for the analysis must include the past, present, and future. As an initial consideration, the historical (past) temporal boundary often can be assumed prior to establishment of the Army installation if that marks historical changes for that VEC. If the VEC historically has been altered by non-Army influences, the temporal boundary must be extended further back in time. For current CEA, past (and present activities) must include programs, projects, activities, and facilities until the approximate 2005-2006 time frame. The future temporal boundary should include the useable life of the proposed action and other reasonably foreseeable actions within that overall time line. As in the case of major Army systems, this time frame can be very long.
- **Step 4: Identification of other actions affecting the resources, ecosystems, and human communities (VECs) of concern.** This step should include the review of other on-installation actions (past, present, and future), as well as the consideration of

off-installation actions that could influence the same VEC. This includes consideration of the other past and present actions and their locations, the extent of their direct and indirect effects, any likely future actions, and their relative contribution to cumulative effects on the specific VEC. Further VEC-specific guidance is provided in later chapters.

- **Steps 5 and 6: Characterization of the VECs (identified in Steps 1 through 4), in terms of their responses to change and capacity to withstand stresses; and characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.** Considerable information on the conditions of these VECs, their current stresses, and their relation to regulatory thresholds and requirements can be found in installation and other federal, state, or local agency documents.

Examples include:

Installation air pollutant emissions inventories and regional inventories by county and air quality control region (Section 4.1 – air quality);

Restricted Area Annual Utilization Reports (Section 4.2 – airspace resources);

Installation Integrated Cultural Resources Management Plans – ICRMPs (Section 4.3 – cultural resources);

Installation Compatible Use Zone (ICUZ) designations based on installation noise monitoring data (Section 4.4 – noise);

Sections in the installation Integrated Natural Resources Management Plan (INRMP) pertaining to land management and erosion control activities performed via the Integrated Training Area Management (ITAM) Program (Section 4.5 – soil erosion);

The installation Endangered Species Management Plan (ESMP), applicable sections of the INRMP, and pertinent biological assessments (Section 4.6 – threatened and endangered species);

Pertinent sections of the INRMP that summarize wetlands resources on the installation, and information from the National Wetlands Inventory (Section 4.7 – wetlands resources);

Installation stormwater management plans and wastewater management plans (Section 4.8 – water resources management);

Pertinent sections of the Real Property Master Plan (RPMP) that highlight various facilities and cantonment areas (Section 4.9 – facilities);

Installation housing plans and local/regional demographic and economic studies (Section 4.10 – socioeconomics);

Installation-specific energy conservation and management plans (Section 4.11 – energy);

Examples include (continued):

Pertinent sections of the RPMP related to installation land uses (Section 4.12 – land use);

Installation-level solid waste management plans and pollution prevention plans (Section 4.13 – hazardous materials/hazardous wastes); and

Pertinent sections of the RPMP associated with roads, along with local/regional transportation studies and plans (Section 4.14 – traffic and transportation systems).

- **Step 7: Definition of the baseline condition for the resources, ecosystems, and human communities (VECs).** "Baseline conditions" can be used to: (a) define the conditions of pertinent resources, ecosystems, and human communities at an "historical reference date, and as reflected by trends" — most important to CEA; (b) define "current conditions", reflective of historical cumulative effects; and (c) define the "future without the proposed action conditions", based upon extension of current trends into the future time period for the analysis. For this purpose, useful reference documents are included in Steps 5 and 6 for the individual VECs (in Section 4).
- **Step 8: Identification of the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities (VECs).** These relationships can be addressed by identifying and describing common impact pathways and their interconnections. These include direct impacts of the proposed activity and any subsequent indirect impacts (such as erosion creating stream sediments); and if effects do occur, the cumulative effects of past, present, and reasonably foreseeable future actions; and the affected resources, ecosystems, and human communities (VECs). This step is related to Steps 1 and 4 above; and common methods include simple matrices and network diagrams (also in Section 4 for individual VECs), to identify and illustrate connections and inter-relationships.
- **Step 9: Determination of the magnitude and significance of cumulative effects on the selected VECs.** The magnitude of the effects depends on compiled information on the individual VEC, and the Step 8 results. Further, depending on the VEC, there may be models or other methods or procedures that can quantify or assess the relative contributions of various actions (past, present, and reasonably foreseeable). The significance of the effects CEs in particular, must be based on historical, current, and forecasted conditions for the affected VECs, along with percentage changes, regulatory thresholds, and professional judgment. CEQ guidelines (CEQ, 1978) recognize two components of a significance determination: intensity or magnitude of anticipated impacts, and their context. VEC-specific tools and procedures are presented in later chapters.
- **Step 10: Modification or addition of alternatives to avoid, minimize, or mitigate significant effects.** The importance of Step 10 will depend on Step 9 results. If a proposed action contributes insignificant incremental effects on the VEC, Step 10 may not be necessary; though the reduction of any impact is a NEPA objective. Most proposed actions include design, construction, and other measures to avoid, minimize,

or mitigate direct, indirect, and cumulative effects. If Step 9 impacts are deemed significant, specific mitigation measures may be required, as well as coordination with other agencies for joint mitigation programs. Mitigations can also reduce direct and indirect impacts, even if insignificant, and preclude the need for additional CEA.

- **Step 11: Monitoring effects of the proposed action and adaptation of management.** Most installations extensively monitor critical or important physical-chemical and biological conditions. If a proposed action creates direct, indirect, or cumulative impacts, whether significant or not, monitoring programs can be an integral component of an adaptive environmental management (AEM) strategy in which specific management actions follow specific site conditions. Any relevant ongoing monitoring should be identified for selected VECs, and any monitoring should be incorporated into any pending installation EMS, increasing the utility of both NEPA and EMS (Boling, 2005) (See Section 2.5).

2.2 Flowchart for Applying the 11 CEQ Steps to EAs and EISs

The CEQ guidelines (CEQ, 1997a) clarify NEPA requirements for impact analysis, encouraging focus on those issues affected by the proposed action, and resource-based (or VEC-based) analyses, as opposed to activity-based analyses, once an impact is identified on a valued resource, or VEC. The recommended CEQ methodology then facilitates back-casting to identify other past and present projects and actions, and forecasting for future projects and actions that have or will affect that VEC in the region. Thus, CEA is VEC-specific, addressing only those VECs directly or indirectly affected by a proposed action or alternative.

Although these direct and indirect impacts are determined insignificant, they require further evaluation for potential contributions to cumulative impacts on the VEC. (This concept is at the heart of the definition of cumulative impacts.) Three levels of impact analysis can be used to evaluate resources (VECs) (a) Quick Look, (b) Analysis and Discussion, and (c) Detailed Analysis. The level of analysis is based on Quick Look questions (Canter et al. 2005). These were initially developed to easily screen subject VECs and ascertain if detailed impact analysis, including CEA, is justified. If the answers to the Quick Look questions imply that the likelihood of significant cumulative impacts is quite small, no further analysis is necessary (Canter et al. 2005). However, in practice, many of these questions cannot be readily answered, and more detailed attention is required to address potential effects, using a second level analysis (Analysis and Discussion). Issues that leave definite, potentially significant incremental impacts require more rigorous, analytical analysis (Detailed Analysis).

Figure 2.0-1 depicts a general flowchart, applicable to all VECs addressed in Section 4.0, where each of the VEC discussions is structured to include the indicated Quick Look questions, followed by further guidance on each of CEQ's 11 steps for the specific VEC.

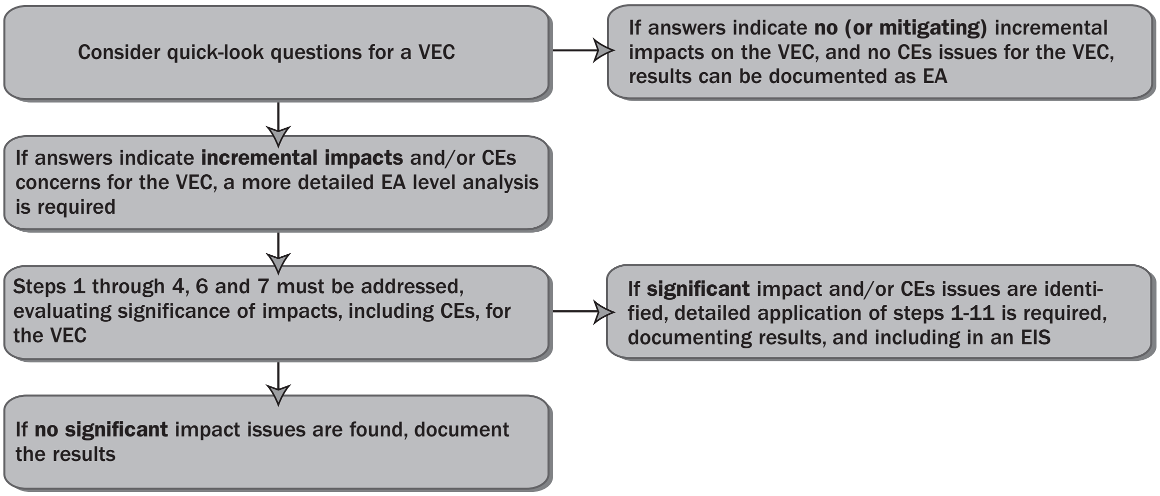

Figure 2.0-1: *General CEA Flowchart Applicable to All VECs*

As inferred in Figure 2.0-1, Quick Look questions can be used to evaluate the need for further impact analysis for the specific VEC. The answers to these questions may require some analysis of direct and indirect effects, and can be fully documented to potentially serve as an EA. After a particular VEC has been addressed, the analyst then returns to the top of Figure 2.0-1 to consider each VEC.

The “Quick Look” Level – If the answers indicate that likely impacts are quite small or can be mitigated and will unlikely contribute to significant impacts on the VEC; an EA-level of documentation is required. This “hard look” need not be extensive or costly; and (per 32 CFR 651) can be quite brief.

The “Analysis and Discussion” Level – Additional analyses may be required to thoroughly answer the questions, and should be more thoroughly documented, again at the EA-level of analysis “…in proportion to the nature and severity of the issues addressed; and they should focus on those issues that interest the decision maker and the public” (from 32 CFR 651). This will likely require some consideration of CEQ Steps 1–4, 6 and 7.

The “Detailed Analysis” Level – If the EA-level analyses identify any direct or indirect effects that cannot be mitigated or could contribute to cumulative effects, a more-rigorous impact analysis, including CEA is required and should be evaluated at an EIS-level of analysis, addressing all 11 CEQ steps. The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impacts is determined.

2.2.1 Day-to-Day Application

While the methodological approach to Army impact analysis is evolving, its application at Army installations (required by Army Environmental Command (AEC) during methodological development) has identified the challenge of day-to-day application (small EAs). The CEQ guidelines and draft Army guidelines both focus more on EIS (or major EA) application, but the effects analysis requirements also apply to smaller (routine) installation actions, in the form of relatively simple EAs. Application of these Army guidelines has clarified the need for different levels of detail (and analysis) for impact evaluation, even if the direct and indirect effects of the proposed action appear minor. This three-tier hierarchical approach is a means to evaluate the need for detailed impact analysis, including CEA; and the approach is consistent with CEQ regulations and guidelines. However, this approach seems overly complex for efficient day-to-day application, particularly for small installation actions.

In application of the impact analysis guidelines to date, the regional sensitivity and importance of specific VECs has proven very important at the Quick Look and the Analysis and Discussion levels of analysis. Certainly, if impacts are minor and the affected VEC is unimportant, the need for further analyses could be appropriately discounted. Thus, the day-to-day need for detailed impact analysis and CEA would depend more on the importance of the VEC than the magnitude and significance of the direct and indirect impacts (already part of the EA).

To enable this part of the analysis, an installation could pre-screen potentially affected VECs, prior to any specific analysis. This could be accomplished through a review of installation EISs and major EAs, but should also include similar data sources within the broader region (for example, NEPA documents produced by other agencies in the region). Such documented review could produce a defendable summary of regionally sensitive VECs, and provide a systematic, defensible means to address to both the Quick Look and, if needed, Analysis and Discussion.

A quick, obvious source of such analysis would include current installation EISs/EAs; but a credible regional analysis must include an analysis of issues identified by other agencies (including other DoD entities). As mentioned elsewhere in these guidelines (Section 2.4), the Northwestern University (NU) NEPA Repository can be queried on line; and identified. Through this repository potentially relevant documents can be obtained, and regionally specific lists of important VECs or matrices linking specific regional activities to important VECs can be developed. Such analysis can be limited to recent EISs (starting in the 1990's, for example) to meet the immediate need to identify important VECs; or it can be more extensive (all inclusive) to better categorize past actions in the region that have affected all VECs (as required by CEQ Step 4: Identification of other actions affecting the resources, ecosystems, and human communities (VECs) of concern).

If such analyses are done, several "lessons learned" from previous studies should be applied:

(1) A broad regional definition should be used; as analysis should follow the impacts, and impacts follow drainages, airsheds, and other non-political features.

(2) VEC terminology and definitions (as well as activity terminology and definitions, if a matrix is being developed) should be defined and refined as the analysis process unfolds, in order to capture minor, yet important variations.

(3) As the analysis is regionally specific, the VECs can be more detailed as many issues are localized (i.e., a specific stream or watershed, instead of a general VEC such as stream water quality).

(4) Specific references or mitigations (in the subject EISs) should be captured for future installation use; as these two components of a NEPA document may be more generally applicable.

Once such analyses are completed, they can form the basis for two-fold, day-to-day inclusion of detailed impact analysis. First, a determination of the magnitude and significance of the actions (already in the EA); and, second, a determination of their relation to any cumulatively important VECs in the region. If the impacts are minor and the affected VEC is unimportant, a Quick Look approach will suffice. If impacts are minor and the affected VEC is important, an Analysis and Discussion approach is required, which may prove adequate or lead to detailed analysis, if warranted.

2.3 U.S. Army NEPA Analysis Process Guidance

Department of the Army Regulations implementing NEPA (36 CFR Part 651) require early integration of NEPA with Army planning (Section 651.14). The Army's goal is to concurrently integrate environmental reviews with other Army planning and decision-making actions, and effectively maintain mission requirements. During the planning process the Army will identify issues that are likely to have an effect on the environment, or to be controversial. Effective outreach to local citizens and existing advisory groups assist in identifying issues. Minor issues, or ones that have little or no measurable environmental effect, are also identified through the process. Once identified, these kinds of issues are either eliminated from further study or the focus on that resource is reduced.

While the formal scoping process is normally an element in the EIS process, the Army may incorporate an informal scoping process for EAs as well. Through scoping, many future controversies can be eliminated, and public involvement can be used to narrow the scope of the study, concentrating on those aspects of the analysis that are truly important (Section 651.14).

Sections 651.16(b) and (c) of the U.S. Army's NEPA regulations (USA, 2002) identify those aspects of CEA that can be facilitated by proper scoping; addressed in Section 651.16(b) as follows:

"The scoping process should be used to identify possible cumulative impacts. The proponent should also contact appropriate off-post officials, such as tribal, state, county, or local planning officials, to identify other actions that should be considered in the cumulative effects analysis."

By inference, the above scoping process is primarily and appropriately oriented to accomplish CEQ Steps 1 (identify cumulative effects issues on pertinent VECs) and 4 (identify other relevant past, present, and future actions).

Section 651.16(c) delineates the aspects of CEA that should be introduced during scoping and refined through public participation. These are as follows:

- Identify the boundary of each VEC. Boundaries may be geographic or temporal. For example, the Air Quality Control Region (AQCR) might be the appropriate boundary for the air quality analysis, while a watershed could be the boundary for the water quality analysis. Depending on the circumstances, these boundaries could be different and could extend beyond the installation.
- Describe the threshold level of significance for that resource category. For example, a violation of air quality standards within the AQCR would be an appropriate threshold level.
- Determine the environmental consequence of the action. The analysis should identify the cause and effect relationships, determine the magnitude and significance of cumulative effects, and identify possible mitigation measures.

Again, by inference, the boundary phase encompasses CEQ Steps 2 (establish spatial boundary) and 3 (identify temporal boundary). The second phase includes CEQ Steps 6 (delineate current stresses and their relationship to regulatory thresholds) and implies CEQ Step 9 (determine magnitude and significance of CEs). The third phase includes CEQ Steps 8 (identify cause and effect relationships), 9 (magnitude and significance), and 10 (identify management or mitigation measures).

2.4 A Method for Addressing Past and Present Actions – The Fort Irwin Case Study

As the impact analysis process requires knowledge of the past and present actions within a given region or community (CEQ Step 4), a background review of past and present EISs can prove very useful. The NU NEPA Repository contains all federal EISs; and was used as a case study of the historical record for the region around Fort Irwin, California (USAEC, 2004). This repository, http://www.library.northwestern.edu/transportation/searcheis.html, is a centralized source for applicable past and present EISs, and it can be used to characterize issues within a region, illuminate past controversies, highlight major sources of these controversies, and provide useful information on mitigation, technical references, and indirect impacts in the region. The Fort Irwin case study was used to produce a large Leopold-type matrix (Leopold, 1971), relating major past and present projects and human activities to specific VECs in the region.

Potentially useful EISs, prepared by all federal agencies in the region, were identified and analyzed to establish regional issues/impacts and their sources. In addition to actions and impacts, useful references and potential mitigation measures were identified and keyed to appropriate actions and impacts, for potential future use. This effort constituted an initial attempt to develop a methodological tool for CEA analysis in a specific geographic region. The results can be used for both internal scoping (prior to public involvement) (32 CFR 651, Section 651.49), and to facilitate and guide stakeholder discussions during formal scoping (32 CFR 651, Sections 651. 50 and 651.51). While the Army has used the Leopold matrix as a procedural methodology in the past, these historical approaches have been based on professional judgment and experience, conjectural in nature. This Fort Irwin study was not conjectural, representing the results of considerable historical impact evaluation in the region. In addition, the actions of other agencies in the region are also included, replacing the "obligatory" paragraph with a more defensible methodological approach for the past and present actions (CEQ Step 4).

Prior to visiting NU, titles of potentially useful EISs (at the repository) were reviewed on line, and candidates for further analysis were identified, focusing on the time period of 1980–2004. The remaining EISs were further screened to capture pertinent regional VECs. Further screening was done on those applicable to the immediate Fort Irwin region (451 EISs). Titles were reviewed for specific applicability, and 148 were selected for detailed, on-site, in-depth review. A total of 35 highly relevant EISs were finally selected, and portions were photocopied for final detailed review and further analysis. These reflected a variety of projects in the local region, along with their relevant and numerous natural, cultural, social, demographic and economic issues.

A Leopold matrix (Leopold, 1971) for the Fort Irwin region was developed to capture and display identified relationships between agency activities and their impacts on regionally important VECs. These numerous major actions in the region were grouped into the following broad categories (and lists of constituent consolidated activities), comprising the vertical axis of the matrix:

- DoD Operations
- Waste Disposal Facilities
- Mining
- Resort Development
- Power Generation Facilities
- Pipelines
- Commercial Development

Within these broad categories, basic activities were broken out, further consolidated, and grouped into construction-related activities and operational and maintenance activities associated with different actions.

The regional environment in the Fort Irwin area was categorized from the EIS analyses as follows:

- Land Use
- Biological Resources
- Cultural Resources
- Science Issues
- Infrastructure
- Geology
- Water Resources
- Aesthetics
- Air Quality
- Soils
- Regional Economics
- Sociology
- Environmental Justice
- Solid Wastes
- Hazardous Materials/Hazardous Wastes

These major environmental categories (VECs) were further broken into constituent environmental attributes.

The Fort Irwin case study and methodological approach are (a) consistent with the CEQ's CEA paradigm, and (b) is far superior to the traditional obligatory paragraph. Instead of an unbounded, unfocused approach, this approach categorizes traditional issues and their sources in the Fort Irwin region and, after additional site-specific research, a potential project (proposed action) can be assessed in coordination with the local stakeholders. Thus, the scope of the CEA can be better framed. Actions that cumulatively impact a specific VEC (whether past, present or reasonably foreseeable) can be readily identified and final cumulative effects can be systematically addressed using the supporting references and mitigation measures gleaned from the

NU Repository, or using traditional sources. The actions axis of the final matrix will reflect all actions across all agencies that have historically impacted each VEC.

While the entire Fort Irwin matrix has proven large and unwieldy, excerpts of it have been used in the discussions of each VEC as part of this NEPA Analysis Guidance Manual. These excerpts illustrate the inter-relationships of direct impacts (immediate) and indirect impacts (those that appear at a different place or later in time). It is important to note that indirect effects can occur in VECs that are different from the VEC in which the direct effects occur. The effects analyst must follow the impacts, along the cause-effect chain, and address significance along the way.

The Fort Irwin case study is used in this NEPA Analysis Guidance Manual, in a generic way, to illustrate the utility of a matrix approach and the dynamics of direct and indirect environmental effects. If feasible and affordable, a similar study may be performed for the region of any installation. Such analysis can provide considerable assistance and value in the completion of CEQ's 11 steps.

2.5 Relation of EMS to the NEPA Analysis Process

All federal agencies must develop and implement Environmental Management Systems (EMSs) (EOP, 2000), to enable these agencies to reduce environmental impacts and increase operating efficiency, both consistent with NEPA and sustainability principles. The EMS requirement directly applies to most of the recommended CEQ CEA steps; generally to CEQ Steps 1, 4, 5, 6, 7, 8, 9, and 10; but specifically to CEQ Step 11. While the general applicability, overlap, and compatibility of NEPA and EMS provisions are well documented (Sinclair and Tschirhart, 2001, Eccleston, 1998, and Eccleston and Smythe, 2002); perhaps best, from a NEPA context, is a recent paper titled "Environmental Management Systems and NEPA: A Framework for Productive Harmony" (Boling, 2005). This potential synergy applies to all VECs addressed in this Guidance Manual. NEPA implementation has historically been deficient, from the standpoint of full environmental integration into ongoing agency decision making (CEQ, 1997b), in spite of potential utility and efficiency. The NEPA process is also lacking in follow-up, monitoring and feedback regarding identified mitigation measures. While required in the mitigation monitoring provisions of Army NEPA requirements (USA, 2002), such requirements often remain compliance deficiencies and relegate potential NEPA utility to mere documentation. The integration of EMS and NEPA mitigation monitoring can address EMS provisions for "monitoring, preventive and corrective action, auditing, and management review", and can "extend the NEPA process to actual implementation and results" (Boling, 2005). This integration can complete the CEA process as recommended by the CEQ (CEQ, 1997a); and more importantly, promote the overall utility of NEPA. The "feedback loop" (monitoring and adaptation) of EMS requirements are consistent with military decision making as taught in Army doctrine (USA, 1992-1993) and illustrated in Figure 2.0-2.

Military Decision Process Including NEPA Analyses

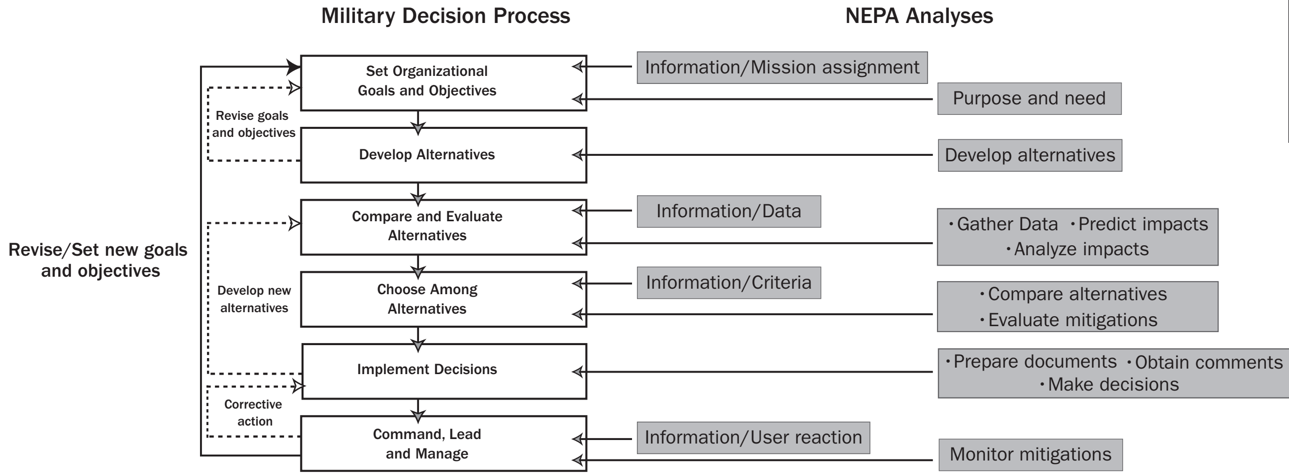

Figure 2.0-2: *Military Decision Process Including NEPA Analyses*

Army decision making doctrine is illustrated on the left, while the right side illustrates the NEPA process, including mitigation monitoring. Project monitoring and adaptation (CEQ Step 11) is evident in both processes and can be implemented as part of EMS requirements. Other supportive aspects of EMS and NEPA requirements, are discussed elsewhere (Boling, 2005, Sinclair and Tschirhart, 2001, Eccleston, 1998, and Eccleston and Smythe, 2002); and are not further addressed herein.

3.0 Selection of Valued Environmental Components (VECs)

3.0 Selection of Valued environmental Components (VECs)

Numerous VECs can be associated with the U.S. Army installations and training ranges and can be impacted by combinations of PPRF actions. Given the large number of issues normally associated with Army NEPA analyses and the potentially large number of VECs that could be identified, an early decision was made to include seven VECs that focus on and are applicable to the cumulative effects associated with Army ranges. The selection process was based upon:

- The review of the CEs sections in several recent draft and final EISs related to Army training ranges; and
- The consideration of rising CE issues in current installation planning charrettes. (U.S. Army Environmental Command staff were participants in the charrettes.)

Specific examples of reviewed EISs include: the DEIS on military training activities at Makua Military Reservation in Hawaii (USACE, 2004); the Final Environmental Impact Statement (FEIS) on the 2nd Armored Cavalry Regiment Transformation and mission support, Joint Readiness Training Center and Fort Polk, Louisiana (Tetra Tech, 2004a); and the FEIS on the Transformation of the 2nd Brigade, 25th Infantry Division to a Stryker Brigade Combat Team in Hawaii (Tetra Tech, 2004b). The following findings were noted from these reviews:

- The EISs typically addressed up to 20 VECs; and the VECs were typically grouped according to local community concerns.
- Common VECs typically included cultural resources, threatened and endangered species, and air quality.
- Some additional VECs included airspace, sedimentation/erosion, wetlands, surface and groundwater, and fish and wildlife.

Specific results from range planning charrettes were dependent on the environmental and natural resources at the host installation, as well as the history and anticipated future of the installation. They also included the same VECs as those highlighted above.

After initial development of the NEPA Analysis Guidance Manual draft which focused on CE's, a second phase was chartered by USAEC. As the initial effort focused on training ranges, the new VEC selection focused on garrison issues and issues likely to arise through Base Realignment and Closure (BRAC). These BRAC efforts are also accompanied by similar re-stationing issues resulting from the ongoing Army Transformation and the Department of Defense Integrated Global Presence and Basing Study (IGPBS), involving the return of overseas forces to the United States over a period of years.

The original VECs in the first draft manual included:

- Air Quality
- Airspace Resources
- Cultural Resources
- Noise Effects
- Soil Erosion Effects
- Threatened and Endangered Species
- Wetlands Resources

After production of the first draft manual, these initial seven VECs were reviewed for inclusion in this manual, and are modified, as appropriate, to facilitate application for cantonment areas and BRAC actions.

The following list of hierarchical VECs is a composite depiction of the seven new selected cantonment and BRAC issues; reflecting the review of available EISs and the pragmatic treatment of these issues in representative documents. Further, the current BRAC NEPA "How To" Manual was also reviewed. As shown, seven "super-VECs" are devised with several associated "sub-VECs". This hierarchy is intended to provide a systematic approach to CEA that will encompass all of the issues that are relevant to and consistent with previous VECs, cantonment issues, and BRAC issues. As work proceeds and the Guidance Manual evolves, this list may require some adjustments to produce a workable, practical manual over the long term.

Water Resources Management	• Water Demand/Usage • Surface Water Quality/Quantity (Storm Water Management, • Water/Wastewater Infrastructure/Treatment) • Groundwater Quality/Quantity • Source Water Protection (Drinking/Other)
Facilities	• Real Estate Acquisition • Excess Land/Facility Transfer • Demand for Facilities (By Category Codes)
Socioeconomics	• Business Volume • Income • Employment • Population - Government Services (Per Capita Basis) – Utilities, Solid Waste, Hospitals/Health Care, Law Enforcement, Recreational Services, and Education/School Systems) - Housing • Environmental Justice
Energy Demand/ Generation/Transmission/Use	• Fossil Fuels • Solar Power • Wind Power • Hydropower • Nuclear Power • Refuse-Derived Fuel (RDF) • Conservation • Residual Effects
Land Use Conflicts/ Compatibilities	• Encroachment • Land Use Changes
Hazardous Materials/ Hazardous Wastes	• Waste Minimization (Prevention, Reduction, Recycling, Treatment, and Disposal) • SPCCPs, etc.
Traffic and Transportation Systems	• Installation-Related • Regional Demand

4.0 Valued Environmental Components

4.0 Valued Environmental Components

This section includes detailed information on the specific application of CEQ's CEA process for selected VECs. Subsets of the process (CEQ Steps 1 through 4, 6, and 7) can be useful at the EA level, while all 11 CEQ steps would be appropriate for addressing significant impacts, including CEs, on the VECs. The 14 VECs include:

4.1 Air Quality
4.2 Airspace Resources
4.3 Cultural Resources
4.4 Noise Effects
4.5 Soil Erosion
4.6 Threatened and Endangered Species
4.7 Wetlands Resources
4.8 Water Resources Management
4.9 Facilities
4.10 Socioeconomics
4.11 Energy
4.12 Land Use
4.13 Hazardous Materials/Hazardous Wastes
4.14 Traffic and Transportation Systems

Cited references are included in the Reference section of this manual.

4.1 Air Quality

4.1 Air Quality

4.1.1 Introduction

Effects on ambient air quality are a major issue of concern for the modernization of U.S. Army installations. This is demonstrated in extensive air quality management requirements (associated with the Clean Air Act) in the Final Programmatic Environmental Impact Statement (PEIS) for Army Transformation (USACE, 2002a, pp. 3–32 to 3–40 and pp. 4–11 to 4–17). The scope, policy, and objectives of the Army's air management program are described in Chapter 6 of AR 200-1 (USA, 1997a *). *[1]Key Army program management components include, but are not limited to, identifying sources, types, and quantities of pollutant emissions; complying with permit requirements; and conducting conformity determinations. Pollutant emissions are associated with CEQ Steps 1 and 4; permit requirements are related to CEQ Step 6; and conformity determinations can be used as a tool for accomplishing CEQ Step 9.

The following reports, papers, and NEPA documents emphasize the importance of Army effects on ambient air quality:

- Report titled DOD Lacks a Comprehensive Plan to Manage Encroachment on Training Ranges (GAO, 2002, pp 7, 10, and 15) – This document recognizes air quality as an installation encroachment issue for the Army. Concerns include smoke generation; conformity rules requiring the analysis of emissions from proposed projects or activities at federal installations; emission offsets (reductions) in non-attainment areas; and potential competition with local developers for air emission budgets and increases in offsets.
- Presentation titled Air Quality Issues in Range Sustainment (Bowers, 2004) – This presentation was given at the Sustainable Range Management Conference in Jan 04. by T. Bowers, Key issues included: opacity issues from the use of fog oil and other pyrotechnic smoke-producing munitions; conformity requirements, including the incorporation of aircraft emissions; and additional permitting for New Source Review and Prevention of Significant Deterioration.
- EIS for Military Training Activities at Makua Military Reservation, Hawaii (USACE, 2004) – This EIS addresses cumulative effects of emissions from multiple PPRF projects, primarily identified by the Army DPW Master Planning Division and the Honolulu Planning and Permitting Department.
- EIS for 2nd Armored Cavalry Regiment Transformation and installation Mission Support, Joint Readiness Training Center (JRTC) and Fort Polk, Louisiana and Long-Term Military Training Use of Kisatchie National Forest Lands (Tetra Tech, 2004a) - This EIS addresses increased stationary and mobile sources in the air quality control region, along with non-anthropogenic sources.
- EIS for Transformation of the 2nd Brigade, 25th Infantry Division (L) to a Stryker Brigade Combat Team in Hawaii (Tetra Tech, 2004b) – This EIS addresses training on the islands of Oahu and Hawaii; specifically, addresses cumulative effects of ozone precursor emissions and Particulate Matter 10 (PM 10)emissions using a detailed list of past, present and future actions in the vicinities of training activities on the two islands.

* (The asterisk (*) denotes a reference document on the accompanying CD.)

This section is structured around the application of CEQ's CEA process to the ambient air quality VEC. For each CEQ step, as appropriate, specific information is included on operational implementation. Reference materials and web sites are noted, as appropriate, along with scientific methods and related tools.

4.1.2 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect effects of a proposed action on ambient air quality. In addition, they can be used to determine if cumulative effects also need to be considered. The quick look questions include:

- Is the installation located completely, or partially, in a designated non-attainment area or maintenance area relative to compliance with ambient air quality standards?
- Will the proposed action emit of a criteria type of pollutant and/or hazardous air pollutants during its construction and/or operational phase?
- Will such emissions exceed "de minimus" standards, as designated in federal or state air quality regulations?
- Are there any sensitive receptors of air pollutant effects associated with the installation (examples of such receptors include forests, agricultural crops, threatened or endangered plant or animal species, and human beings with breathing difficulties or other respiratory illnesses)?
- Are there wide variations in the monthly and/or seasonal patterns of atmospheric dispersion conditions at the installation?
- Within the last five years, has the installation been subject to Notices of Violations (NOVs) or fines relative to Clean Air Act requirements?
- Are there any concerns that federal and state source-oriented permits may not be up to date, and are there any specified conditions not being met?
- Is additional cumulative effects analysis needed?

If the answers indicate that likely impacts are quite small or can be mitigated, and will unlikely contribute to significant cumulative impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly and can be quite brief as discussed in the "Quick Look" discussed in Section 2.2 (requiring CEQ steps 1-4, 6 and 7). In some cases, additional analysis may be required to completely answer the questions and should be documented, again at the EA level of analysis, "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level of analysis identifies any direct or indirect effects that cannot be mitigation, or could contribute to cumulative effects, a more rigorous CEA is required, and should be evaluated at an EIS level of analysis as discussed in the "Detailed Analysis, Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined through the EA process, as the significance of potential impact is determined.

4.1.3 Impact Analysis Steps Defined by CEQ

CEQ Step 1 – Identify the significant air quality effects issues associated with the proposed action and define the assessment goals.

The first step involves the identification of types and quantities of air pollutant emissions associated with the proposed action and activities. The following "emission factor" documents contain an abundance of information on the types and quantities of emissions of conventional (CO, VOCs, NOx, SOx, PM) and toxic air pollutants:

- **Air CHIEF CD-ROM**, Version 11 (USEPA, 2004) – AirCHIEF is the acronym for Air Clearing House for Inventories and Emission Factors. This CD includes the 15-chapter compilation of air pollutant emission factors (document AP-42), including Army emission sources such as external combustion sources (Ch. 1); refuse combustion, medical waste incineration, and open burning (Ch. 2); stationary gas turbines and gasoline and industrial engines (Ch. 3); evaporation losses from dry cleaning, wastewater treatment, asphalt paving operations, and tank and drum cleaning (Ch. 4); organic liquid storage tanks (Ch. 7); tilling operations, and fertilizer and pesticide application (Ch. 9); hot mix asphalt plants and concrete batching (Ch. 11); wildfires and prescribed burning, paved and unpaved roads, heavy construction operations, aggregate handling and storage piles, and explosives detonation (Ch. 13); emissions from soils – greenhouse gases (Ch. 14); and ordnance detonation (Ch. 15), of particular relevance to training ranges. In addition, this CD-ROM contains several background documents for determining emission factors and compiling emission inventories. (Note: Searching for Ch. 15 information at Web site www.epa.gov/ttn/chief/software/airchief/, is necessary until release of a new version of AirCHIEF in June, 2005.)
- **MOBILE6** Vehicle Emission Modeling Software – This accompanying CD includes a Web link to both this software (USEPA, 2005a), and the MOBILE6 Motor Vehicle Emissions Factor Model (USEPA, 2002). These references can be used to address air pollutant emissions from cars, trucks, and military vehicles; an important consideration, as most installation emissions inventories address only stationary sources.
- **Non-road mobile source emissions model** (agricultural equipment, construction equipment, locomotives, marine vessels, etc.) (USEPA, 2005b) (Web linked on accompanying CD)
- **Emissions and Dispersion Modeling System** (EDMS) for aircraft (FAA, 2004) (Web linked on the accompanying CD). Also included is an evaluation of air pollutant emissions from subsonic commercial jet aircraft, which includes a protocol for addressing aircraft emissions from military aircraft (USEPA, 1999).*
- **General pollution estimation factors** associated with Army installations (Schanche, et al., 1976).
- **Prescribed burning emission factors** at U.S. Army installations – Wildfires and prescribed burning are addressed in the AirCHIEF CD-ROM (Section 13.1), noted above. An additional reference (Battye and Battye, 2002*) summarizes a research study on emissions inventory methods for wild land fires.

- **Smoke and obscurant emissions** are addressed in numerous references (Cataldo, D.A., et al., 1990; Driver, C., et al *., 2002a; NAS, 1997 and 1999; Hayden, et al., 1996; Shinn, J.H., et al., 1987a and 1987b).
- **Background references** contain information on air pollutant emissions from munitions firing at training ranges (Cover, Siemann, and Ortega, undated; Floyd, King, and Roenbeck, 2004; Mitchell, undated; Rehm and Rush, undated; Spicer, et al., 2004; and Szostak and Cleare, 2000*). Further information is available on the background documents for Ch. 15 in AP-42 (USEPA, 2004).

CEQ Step 2–Establish the geographic scope for the analysis.

The geographical (spatial) boundaries for considering air quality effects, including CEA, should include the county (or counties) where the training range is located, as well as the air quality control region (or regions) encompassing the range. These boundaries are typically used for emission inventories, attainment (or non-attainment) determinations for ambient air quality standards, and the delineation of appropriate air quality management strategies within the pertinent State Implementation Plan (SIP).

The following references should be reviewed in establishing the geographic scope:

- **General information** should be obtained on the physical boundaries of the installation and associated ranges, the boundaries of adjacent easement lands, and land uses and boundaries of adjacent non-Army lands. The determination of geographic scope should also encompass atmospheric dispersion of pollutants from the installation on topographic features and large bodies of water.
- **Counties associated with federal air quality control regions** should be identified (USEPA, 1972a). Information on such regions within states can be obtained by Internet search.
- **Geographic boundaries of designated attainment and non-attainment areas**, as contained in the pertinent SIP, should be obtained, along with the counties included in the applicable air quality control region. This information can be obtained from regional or state offices responsible for air quality management.

CEQ Step 3–Establish the time frame for the analysis.

The temporal boundaries should include consideration of past and future actions that may have influenced air quality within the drawn boundaries (CEQ Step 2). However, no specific requirements have been developed for the time period to be encompassed by the retrospective and prospective temporal boundaries. Some practical questions to ask or consider in establishing the historical boundary (reference point in time) include:

- When was the installation and associated training ranges established, and when have historical mission changes or modernizations occurred? Have range expansions or reductions occurred in the past, and when did they take place?
- When was the first air pollution emission inventory compiled for the installation and associated range(s)? How frequently has the inventory been updated?

- Has an air quality monitoring program been established for the installation? If so, when did it start, and has the program evolved over time, relative to pollutants monitored and location of monitoring stations?

Based upon the answers to the above questions, the earliest date can serve as the initial historical reference point.

Some practical questions to ask or consider relative to a future time horizon include:

- What is the time period required by the proposed action, and what is its anticipated period of use?
- What are the military construction plans for the installation over the next two, five, and 10 years?
- Are any major changes in the installation mission anticipated, and if so, when will such changes occur and how long will they last?

Depending upon the answers to these questions, the most distant time can be used as the initial prospective reference point to encompass future actions.

CEQ Step 4–Identify other past, present, and reasonably foreseeable future actions that have affected, or are anticipated to affect, air quality.

Past actions can be identified through the review of historical annual emission inventories for (or on) the installation. These reviews can highlight contributing past actions and establish emission trends. During any reviews, the scope of the inventories must be ascertained to insure appropriate coverage. For example, an inventory may address only permitted stationary sources, or all stationary sources; or it may or may not include both road and non-road mobile sources. Some sources in the air quality control region can be identified and characterized from EPA's National Emission Inventory (NEI) database (USEPA, 2005c) (Web linked on the accompanying CD). The NEI database contains information about sources that emit criteria air pollutants, their precursors, and hazardous air pollutants. It includes estimates of annual air pollutant emissions from point, non-point, and mobile sources in the 50 states; and is updated every three years. The review of current and numerous recent versions can identify important pollutant sources and establish emissions trends in the local region.

Present (current) actions include both on-going past actions and new actions, including those in the construction stage. Information can be obtained from various installation directorates (proponents), the planning departments of local towns and cities, and other Federal, state, and local agencies. These same information sources can often identify reasonably foreseeable future actions (within the temporal boundaries of the CEA study). The likelihood of future actions, and their potential timeframes, should be carefully considered; and any unlikely or uncertain actions can be eliminated from further study.

Depending upon the scope of installation or other local inventories, current and anticipated specific inventories may be required. The following reference materials would be useful:

- A historical, detailed guide is available for the development of comprehensive emission inventories (USEPA, 1972b). While specific methods have evolved, this guide displays the details and complexities of developing an inventory. Updated inventory information built on the principles in this 1972 document, is reflected in the previously identified AirCHIEF Web site

- Emissions inventory guides have been developed for stationary sources (O'Brien, Blasch, and Johnson, 1999*), and mobile sources (Wade and O'Brien, 2002*) at USAF installations. These guides can be used, with appropriate care, for Army applications.
- A methodology for the use of emission inventories in cumulative air quality evaluations for military installations has been developed (Rumrill and Canter, 2000*). Such inventories can be useful in describing historical and current conditions and to anticipate air quality changes resulting from future inventory increases or decreases.
- A case study is available regarding the use of multiple inventories in a cumulative effects study at a United States Air Force (USAF) installation (Rumrill and Canter, 1999*). This case study illustrates the methodology as described by Rumrill and Canter (2000).

Other on-base past and present actions may be identified through the careful review and analysis of historical and current emission inventories. As an example, the 2003 annual inventory for Fort Bliss (USA, 2004b*). This installation point-source inventory includes emission information for power plant boilers; an aviation fuel farm; diesel emergency generators; portable generators; fuel-dispersing stations for automobiles, jeeps, and trucks; an unpaved sanitary landfill road; unpermitted natural gas combustion units; a paint booth building; a painting facility; and base-wide solvent usage. On-base mobile sources are not included.

CEQ Steps 5 – 7 – Characterize the air resources identified in scoping in terms of their response to change and capacity to withstand stresses (Step 5); characterize the stresses affecting these air resources, ecosystems, and human communities and their relationship to regulatory thresholds (Step 6); and define a baseline condition for the air resources (Step 7).

The primary emphases of these three CEQ steps relate to historical trends in ambient air quality, the comparison of such quality with National Ambient Air Quality Standards to establish attainment or non-attainment conditions, and the consideration of sensitive non-human receptors of air quality effects. Further, and depending on local conditions, broader issues may require consideration, such as photochemical smog formation producing ozone, acid rain, and long-range transport of air pollution. Key references for accomplishing these CEQ steps include:

- Historical and current reports on installation air quality monitoring.
- The Air Quality System (AQS) database on the AirData Web site (USAEPA, 2005d*). This database addresses ambient concentrations of criteria and hazardous air pollutants, primarily in cities and towns.
- Historical and current monitoring reports from the state or (in-state) regional air quality agencies where the installation is located.
- Current National Ambient Air Quality Standards (NAAQS) (USEPA, 2005e*).
- Monitoring data and information related to hazardous air pollutants (HAPs) at the installation. An EPA database regarding HAPs can be queried (USEPA, 2005f*).
- Pertinent installation atmospheric dispersion information. Examples include daily, monthly, and seasonal mixing heights, wind speeds and direction, and inversion heights. The installation meteorological office, state meteorological office, and/or the National Oceanic and Atmospheric Administration (NOAA) could be queried for pertinent information. Information typically can be procured via Internet search

- Additional factors which could be used in evaluating the significance of cumulative air quality effects are found in the section titled “Significance Determination for Air Quality CEs” in Rumrill and Canter (2000)*. The factors are categorized as follows: characteristics of pollutant emissions; compliance with ambient air quality standards; public perception and concerns; follow-on atmospheric reactions (generating ozone, acid rain, etc.) and their effects; specific carcinogenic and non-carcinogenic effects; and opportunities for, and the potential effectiveness of, mitigation measures.

CEQ Step 8–Identify the important cause-and-effect relationships between human activities and ambient air quality.

Air pollutants can be transported via atmospheric dispersion, be converted (from precursor forms to secondary forms) through atmospheric reactions, or be deposited locally, depending upon particle size and composition. Atmospheric pollutants can produce a variety of impacts; encompassing health-related effects, damage to property or materials, or decreased atmospheric aesthetics, to name a few. Human health effects can include eye irritation, headaches, and aggravation of respiratory difficulties. Undesirable impacts on plants and crops can include abnormal growth patterns, leaf discoloration or spotting, and death. Animals such as cattle have exhibited undesirable consequences from atmospheric fluorides. Property and material damage can include property devaluation from odors, deterioration of objects such as concrete statuary, and discoloration of painted surfaces on cars, buildings, and bridge structures. Aesthetic effects include reduction in visibility, discoloration of air, photochemical-smog-related traffic disruptions at airports, and the general nuisance aspects of odors and dust (Canter, 1996a, p. 147).

Such cause-effect relationships can be depicted in several ways, including maps that illustrate source (emission) locations and receptor areas. Network diagrams depicting transport mechanisms and types of effects, can also be useful.

CEQ Step 9–Determine the magnitude and significance of cumulative air quality effects.

Several procedures and models can be used to determine the magnitude of cumulative air quality effects. Two examples of procedures are a cumulative air quality effects assessment approach using eight separately derived steps (Rumrill and Canter, 2000*), and guidance related to the General Conformity Rule (as contained in Section 176(c) of the Clean Air Act of 1990), and subsequent related regulations (USEPA, 2001) (Web linked on the accompanying CD).

One specific step in the eight-step procedure (Rumrill and Canter, 2000*), addresses the magnitude of cumulative effects on air quality. In this step, the quantitative and qualitative change to air quality resulting from the cumulative influence of the evaluated activities, must be determined. This can be accomplished through either direct comparison of the pre-existing and resultant annual emission levels from inventory reports or through the use of modeling techniques, to approximate changes to ambient concentrations. Regardless of the method used, a clarification should be provided regarding the uncertainty of the predictive methods employed, eliminating any potential undue dependency on forecasted results (Rumrill and Canter, 2000*).

Conformity procedures are based on specific requirements delineated in 40 CFR Subpart B – determining conformity of federal actions to state or federal implementation plans (USEPA, 2001) (Web linked on the accompanying CD). These requirements, along with a procedural approach for Army or other installations, are incorporated in the following references and included on the accompanying CD.

- Army installations and activities (Polyak and Webber, 2002*)
- Navy installations and activities (USN, 2002*)
- Department of Energy installations and activities (DOE, 2000*)

These references utilize the following review procedures: (a) evaluation of the action's location in an air quality non-attainment or maintenance area; (b) applicability of project emissions to those regulated due to the non-attainment or maintenance status of the region; (c) evaluation of potential exemption under the conformity rule; (d) comparison of anticipated project air pollutant emissions and specified threshold levels, and (e) determination of regional significance (Polyak and Webber, 2002*). If the action is regionally significant, a detailed conformity analysis is required. Both emission factors and annual emissions from the proposed action, and installation and pertinent air quality control region emission inventories, are critical items for both review and analysis.

Atmospheric dispersion modeling could be required in certain situations. Useful information on air modeling, as well as several models, is readily available (Turner, 1994). Other useful information can be found on the following Web sites (Web linked in the accompanying CD):

- USEPA's Technology Transfer Network Support Center for Regulatory Air Models (USEPA, 2005g) (Web linked on the accompanying CD), and its specific detailed information on dispersion models (Web linked on the accompanying CD) and guidance/support.
- Extensive guidelines on air quality models, found in 40 CFR Part 51, Appendix W (USEPA, 2003).
- SCREEN3 model software (USEPA, undated) and the SCREEN3 user's guide (USEPA, 1995). This screening model provides an easy method to estimate pollutant concentrations using a generic suite of meteorological conditions for the site. It is a single source Gaussian plume model which provides maximum ground-level concentrations for point, area, flare, and volume sources, as well as concentrations in the cavity zone and concentrations due to inversion breakup and shoreline fumigation. It is a screening version of the more sophisticated ISC3 (Industrial Source Complex3) model; and can be downloaded from the Web site. Several commercial software companies also offer user-friendly versions of the SCREEN3 model, along with detailed documentation. Such companies can be located via Internet search.
- Cumulative visibility effects from Army activities may be a concern, including the use of fog oils during training activities. VISCREEN is available on the Web site for USEPA's Technology Transfer Network Support Center for Regulatory Air Models; and calculates the potential impact of plume, specified emissions or specific transport and dispersion conditions.

In a discussion of pertinent models for addressing the broader scale nature and future aspects of cumulative air quality effects, particularly in the absence of detailed information on reasonably foreseeable future actions, research (Rumrill and Canter, 2000*) noted that three types of models are potentially useful: simple area source models, rollback models, and box models. A preceding case study for a military installation (Rumrill and Canter, 1999*) utilized a simple area source model.

Significance of direct, indirect, and cumulative air quality effects can be determined from the following considerations:

- Compliance with NAAQS and standards/guidelines for hazardous air pollutants.
- Allowable increases in ambient concentrations based on Prevention of Significant Deterioration (PSD) guidance and conformity analyses.
- Factors in a significance scoring procedure (Rumrill and Canter, 2000*). Six categories of these factors were noted under CEQ Steps 5-7, above.

CEQ Steps 10 and 11 – Modify or add alternatives to avoid, minimize, or mitigate significant direct, indirect, and cumulative effects on air quality (Step 10), and monitor the cumulative air quality effects of the selected alternative and adapt management (Step 11).

Mitigation of direct, indirect, and cumulative air quality effects may be limited to installation activities or involve joint installation and community measures, collaborating with state or regional air quality management agencies, other state or federal agencies, local towns and cities, and the private sector. Examples of such mitigation measures are described in the following references:

- The PEIS for Army Transformation (USACE, 2002a, pp. ES-10 and ES-11) summarizes five types of mitigation measures: (a) mitigation in conjunction with site-specific NEPA analyses; (b) fostering of a "sustainable environment" ethic; (c) implementation of an EMS; (d) use of best management practices; and (e) programmatic environmental compliance, safety, and health evaluations for weapon systems acquisition.
- Chemical and biological dust control technologies for training ranges (Cowherd, et al., 2004).
- Ozone-depleting chemical abatement plans for Army facilities (Bush and Koehler, 1996)..
- An emission reduction credits policy and guidance manual developed for the Army Environmental Policy Institute (ICF, undated).
- Use of pollution control equipment, process or procedure change, emissions trading, or rescheduling of activities (Rumrill and Canter, 2000*).

Monitoring of selected air quality indicators and related direct, indirect, and cumulative effects may be necessary. This monitoring may be incorporated into existing installation air quality monitoring programs or as a part of a newly implemented EMS. Guidance for planning and implementing a monitoring program is available (Marcus, 1979*). Monitoring results can be used within an organized feedback and decision-making system to adapt management activities and thus reduce undesirable air quality effects.

4.1.4 Summary

Extensive policy guidance and technical information is available for planning and conducting air quality effects analyses for Army installations, driven primarily by the Clean Air Act of 1990 and its associated regulations. Key information sources include historical and current annual emission inventory reports, and, if a monitoring system exists for the installation, ambient air quality monitoring reports. Compliance with ambient air quality standards and the conditions associated with permitted sources are fundamental features of installation air quality management programs. Extensive technical information includes available emission factors for various point, area, and mobile sources; and regulatory models ranging from simple area source models, to screening models, to sophisticated atmospheric dispersion models. Finally, a variety of mitigation measures could be used by an installation to address overall impacts including cummulative, and heightened air quality concerns.

4.2 Airspace Resources

4.2 Airspace Resources

4.2.1 Introduction

Effects on airspace resources are a recognized issue for Army modernization, demonstrated by the extensive discussion of airspace and associated requirements in the Final Programmatic Environmental Impact Statement (PEIS) for Army Transformation (USACE, 2002a, pp. 3–28 to 3–32). The key conclusion regarding airspace was stated as follows (USACE, 2002a, p. 4–10):

"Army transformation would result in short-and long-term direct adverse effects to air space use. Construction or modification of airfields and training and maneuver areas could result in changes to existing airspace use. Significant cumulative effects could occur at installations with currently limited or over-utilized airspace. Airspace use would be most affected by the brief intense activities of deployment exercises and by routine training exercises of varying intensities. Over time, airspace use effects would be dependent also upon the degree of use of modified or new systems and their associated support requirements (e.g., unmanned aerial vehicles (UAVs))."

The fielding of UAVs has become a primary driver in considering airspace resource impacts for the Army. The number of programmed UAV units within the Army will increase by tenfold in the next five years. UAV units are now a part of every Brigade Combat Team (BCT), Stryker Brigade Combat Team (SBCT), and will soon become part of every Fire Brigade and Combat Aviation Brigade (CAB). Army UAVs will include the Medium UAV (MUAV), Tactical UAV (TUAV), and the Small UAV (SUAV) ranging in physical size from a 54' wingspan of the MUAV to a 4' wingspan for the SUAV. BCTs, SBCTs, and IBCTs will all have as many as seven TUAVs and 45 SUAVs each. This equates to nearly two aviation Battalion's worth of aircraft requiring nearly the same airspace footprint, as well as Special Use Airspace (SUA) since the FAA currently mandates that UAVs can only fly in restricted airspace unless special short-term waivers are granted. Consideration of the routine training requirements for these important Army assets and the impact to airspace resources will be a complex challenge for many installations.

Airspace was also identified as an encroachment issue for Army installations and associated training ranges (GAO, 2002, pp. 7, 14–15, and 40). Referenced concerns include increased airspace congestion from airline industry demands and Army (and other military) training and testing needs, such as the use of unmanned aircraft in training scenarios. The congestion problem was described as follows (GAO, 2002, pp. 14–15):

"Commercial air traffic growth is expected to result in an increase in passengers from 600 million to an estimated one billion by 2010, increasing the overall demand for airspace volume. Military use of airspace will also increase with the next generation of high-performance weapon systems, standoff munitions, and unmanned aerial vehicles. In many instances, the military's use of airspace is tied directly to its ground infrastructure, which cannot be changed easily. The Federal Aviation Administration is in the process of redesigning the nation's airways to accommodate this growth. DoD is participating in the process to ensure that its requirements are known early. There is no schedule for completing the redesign, and until the redesign is completed, DoD cannot be certain how its training will be affected."

Several recent EISs and court decisions have also noted and emphasized the importance of airspace resources, as follows:

- EIS for Military Training Activities at Makua Military Reservation, Hawaii (USACE, 2004)

- EIS for 2nd Armored Cavalry Regiment Transformation and installation Mission Support, Joint Readiness Training Center (JRTC) and Fort Polk, Louisiana and Long-Term Military Training Use of Kisatchie National Forest Lands (Tetra Tech, 2004a)
- EIS for Transformation of the 2nd Brigade, 25th Infantry Division (L) to a Stryker Brigade Combat Team in Hawaii (Tetra Tech, 2004b)
- Civil Action No. 5:00-CV-392-C, US District of Texas (Welch v USAF, 2003) regarding Air Force activities in West Texas.
- Action No. 2:98 cv 800, US District Court for the Eastern District of Virginia (Citizens v Dalton, 1999) regarding Navy aircraft squadron upgrades on the U.S. East Coast.
- Civil Action No. 2:04-CV-3-BO (2) and No. 2:04 CV-2-BO (2), US District Court for the Eastern District of North Carolina (Washington County v Navy, 2005) regarding Navy aircraft squadron upgrades on the U.S. East Coast..

4.2.2 Airspace Policies and Procedures

Numerous policies and procedures affect Army airspace management. To address airspace effects, the following documents contain useful information:

- **Army Regulation (AR) 95-2** (USA, 1990*) contains information on airspace requirements; SUA, including restricted areas and other categories such as military operations areas; terminal airspace and related requirements; and special military operations such as remotely piloted vehicles (RPVs), or UAVs.
- **Federal Aviation Administration (FAA) Order 1050.1D** (USAF, 2000) establishes FAA policy and procedures, and assigns responsibility for assuring compliance with CEQ regulations. Appendix 3 describes FAA environmental responsibilities in relation to Special Use Areas.
- **FAA Order 7490**, “Policies and Procedures for Air Traffic Environmental Actions” (USACE, 2002a, p. 3-30), includes procedures and guidance for addressing SUA-related environmental conflicts between FAA and DoD.
- **FAA Order 7610.4H**, “Special Military Operations”,(USACE, 2002a, p. 3-30) specifies procedures for air traffic control planning, coordination, and services during defense activities and special military operations conducted in airspace controlled by, or under the jurisdiction of, the FAA.
- **The Memorandum of Understanding Between the Federal Aviation Administration and the Department of Defense** concerning SUA Environmental Actions (USACE, 2002a, p. 3-30 and FAA/DoD, 1998) provides compliance guidelines for NEPA and CEQ regulations without unnecessary duplication of effort by the FAA and DoD. It promotes early coordination between the FAA and DoD, during the environmental review process, associated with the establishment, designation, and modification of a SUA; permits the application of lead and cooperating agency procedures; and provides for the issuance of environmental documents for the development, designation, and use of a SUA.

The FAA is the primary manager of all airspace within the U.S. and its territories. As such, FAA recognizes the military's need for certain flight operations and training within airspace separated from that used by commercial and general aviation. Accordingly, some fundamental definitions and categories of airspace have been developed and can be used in impact analysis: airspace, controlled airspace, and SUA (USACE, 2002a, pp. 3-28 to 3-32). Airspace is defined in vertical and horizontal dimensions, and by time; a finite resource that must be managed to insure equitable allocation among commercial, general aviation, and military needs. The FAA has established various airspace designations to protect aircraft near and between airports, and in airspace used for military purposes.

Controlled Airspace is a generic term for the different types of airspace (Classes A, B, C, D, E, and G), and defined dimensions of air traffic control provided to instrument-flight-rules (IFR) flights and visual-flight-rules (VFR) flights. These airspace classifications are as follows (USACE, 2002a, pp. 3–28 and 3–29).

- **Class A Airspace.** This airspace occurs from 18,000 to 60,000 feet above mean sea level (MSL), and all operations within Class A airspace must comply with IFR requirements. This airspace is dominated by commercial aircraft, mostly using jet routes between 18,000 and 45,000 feet above MSL.
- **Class B Airspace.** This airspace occurs from the surface to 14,500 feet above MSL around the nation's busiest airports. Before operating in Class B airspace, pilots must contact controlling authorities and receive clearance to enter the airspace. Aircraft operating within Class B airspace must be equipped with specialized electronics that allow air traffic controllers to accurately track aircraft speed, altitude, and position.
- **Class C Airspace.** This airspace occurs from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports with an operational control tower, serviced by a radar approach control, and meet specified levels of IFR operations or passenger enplanements. Aircraft operating within Class C airspace must be equipped with a two-way radio and an operable radar beacon transponder with automatic altitude reporting equipment. Aircraft may not operate below 2,500 feet above the surface within four nautical miles of the primary airport of a Class C airspace area, and at an indicated airspeed of more than 200 knots or 230 miles per hour.
- **Class D Airspace.** This airspace occurs from the surface to 2,500 feet above the airport elevation (charted in MSL) encompassing a five-statute-mile radius from the airport, for those airports that have a control tower. Unless otherwise authorized by air traffic control (ATC), aircraft must be equipped with a two-way radio. Aircraft may not operate below 2,500 feet above the surface within four nautical miles of the primary airport of a Class D airspace area, and at an indicated airspeed of more than 200 knots or 230 miles per hour.
- **Class E Airspace.** This airspace is any controlled airspace not designated as Class A, B, C, or D airspace. It includes designated federal airways, portions of the jet route system, and area low routes. Federal airways have a width of 4 statute miles on either side of the airway centerline and occur between the altitudes of 700 feet above ground level (AGL) and 18,000 feet above MSL; but they may have a floor located at ground level at non-towered airfields. No specific equipment is required to operate within Class E airspace.

- **Class G Airspace.** Class G airspace (uncontrolled) is that portion of the airspace that has not been designated as Class A, B, C, D, or E airspace. ATC does not have authority over operations within uncontrolled airspace. Primary users of Class G airspace are VFR general aviation aircraft.
- Special Use Airspace (SUA) permits activities that either must be confined because of their nature, or require limitations on aircraft that are not part of those activities. Prohibited Areas and Restricted Areas are regulated special use airspace. Warning Areas, MOAs, Alert Areas, and Controlled Firing Areas are nonregulated special use airspace (USACE, 2002a, p. 3–29). The Army's regulation related to airspace (USA, 1990), defines the following terms and other related terms (USA, 1990, pp. 11–12):
    - **Prohibited Areas** require rulemaking action and are designated "in the best interest of national security and welfare"; used by the Army only in unusual circumstances.
    - **Restricted Areas** require rule-making action, and are established to confine or segregate activities incompatible with (or hazardous to) nonparticipating aircraft. Such areas normally extend upward from the surface to more than 45 meters, covering the following activities: the firing of field artillery, air defense artillery, mortars or small similar weapons; drone or remotely piloted vehicle (RPV) operations; certain types of aircraft ordnance delivery and test flights; some types of laser activity; electronic, chemical, and nuclear warfare measures; and various types of research and development efforts.
    - **Warning Areas** are established in international airspace to contain activities potentially hazardous to nonparticipating aircraft.
    - **Military Operations Areas** (MOAs) are volumes of airspace with specific vertical and lateral limits, used to separate certain military aviation training from nonparticipating IFR traffic. MOAs are normally established to contain aircraft operating in excess of 250 knots below 10,000 feet MSL. They do not impose flight restrictions or communication requirements on nonparticipating aircraft operating under VFR.
    - **Alert Areas** are established, if requested, when a high volume of pilot training or unusual amount of aeronautical activity (more than 250,000 movements annually) is being conducted.
    - **Controlled Firing Areas** (CFAs) are established to contain activities that, if uncontrolled, would be hazardous to nonparticipating aircraft.

Military airspace operations are conducted within FAA-designated airspace, following specific procedures to maximize flight safety for nonparticipating civil and military aircraft. this special military use airspace consists of MOAs, and Military Training Routes, which are generally below 10,000 feet above MSL, used for high speed navigation and tactical flight training (USACE, 2002a, p. 3–29).

Additional airspace-related Army terms include the following (USACE, 2002a, pp. 3–29 and 3–30):

- Installation Compatibility Use Zones (ICUZs) or Air ICUZs (AICUZs) consist of: (a) land areas where certain land uses may obstruct the airspace or otherwise be hazardous to aircraft operations, and (b) land areas that risk health, safety, or welfare threats from aircraft operations. AICUZs minimize potential major catastrophes from aircraft accidents; prevent incompatible development in noise exposure and accident areas; assist local authorities in protecting and promoting the public health, safety, and welfare of area inhabitants; and protect, through compatible land use planning and control, installation operational capability.
- Clear Zones represent the areas at the end of or just beyond the runway surface, where most land uses are incompatible with military aircraft landing operations.
- Accident Potential Zones (APZs) extend beyond the Clear Zone along the aircraft flight path, allowing a variety of land uses. Intensive uses (e.g., schools, churches, and restaurants) are restricted, due to increased risk of accidents. Outside the Clear Zone and APZ, accident risk is generally smaller and does not warrant special consideration in land use planning.

The following examples illustrate airspace size designations at several Army installations and associated training ranges (USACE, 2002a, pp. 3-31 and 3-22):

- Fort Bliss, Texas – SUA designation; 1,260 square miles; unlimited altitude and continuous hours of operation
- Fort Hood, Texas – SUA designation; 269 square miles; altitude to 45,000 feet and continuous hours of operation with some restrictions
- Fort Irwin, California – SUA designation; 955 square miles; unlimited altitude and continuous hours of operation
- Yakima Training Center, Washington – SUA designation with restricted areas; 451 square miles; altitude to 55,000 feet; advance notice required for operation
- Fort Stewart, Georgia. – SUA designation; 386 square miles; altitude to 29,000 feet; hours of operation from 1100 to 0500 daily

In addition, MOAs are designated for Fort Benning, Georgia.; Fort Bragg, North Carolina; Fort Campbell, Kentucky; Fort Lewis, Washington; Fort Polk, Louisiana; Fort Pickett, Virginia; Fort Hood and Fort Stewart (USACE, 2002a, p. 3-32).

An Interagency Airspace Coordination Guide is available (DOI/USDA, 1993), for both military and commercial usage of airspace. This guide is particularly useful for understanding and addressing airspace issues; discussing Airspace Basics (Ch. 3), Airspace Hazards and Conditions (Ch. 4), Airspace Conflicts (Ch. 8), and NEPA and Airspace (Ch. 9). The Airspace Basics topic includes airspace categories and classifications; special use airspace, including military operations areas, controlled firing areas, and military training routes; and other military airspace structures such as local flying areas and cruise missile routes. The Airspace Hazards and Conditions topic includes information on bird strikes, particularly in or near flyways.

4.2.3 Quick Look Questions

Quick Look questions can be used to determine the need to address the direct and indirect effects of a proposed action on airspace resources; in addition, they can be used to determine if cumulative effects also need to be considered. These questions were developed in a CEA field study at Fort Wainwright, Alaska. These Quick Look questions are:

- Assuming that airspace designations (e.g., SUAs, MOAs, MTRs, etc.) have been previously established for the installation, are these airspaces currently subject to over utilization?
- Are public concerns about airspace usage and environmental consequences (e.g., strikes on migratory birds) being routinely expressed?
- Are future actions by non-military and other military entities expected, and would they cause impacts on airspace resources?
- Will the proposed action cause increased usage of existing airspace, and will such usage cause over utilization?
- Are future actions by non-military and other military entities expected, and would they cause impacts on airspace resources?
- Will the proposed action require new airspace designations or expansions in existing airspace?
- Is additional cumulative effects analysis needed?

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant direct, indirect, and cumulative impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly; and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the "Detailed Analysis", Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

4.2.4 Impact Analysis Steps Defined by CEQ

CEQ Step 1 – Identify the significant cumulative airspace effects issues associated with the proposed action and define the assessment goals.

The first CEQ step involves identification of issues or concerns related to airspace, many from previously-identified relevant airspace management regulations. Some additional applicable regulations and procedures include:

- Function descriptions of the FAA Office of Air Traffic Airspace Management (FAA, 2005).
- Air Force range planning and operation procedures related to airspace considerations

(USAF, 2001*) and associated NEPA documentation (USAF, 2003). The range planning and operations procedures provides guidance for the planning, operations, management, safety, equipment, facilities, and security of Air Force ranges; including one section on airspace establishment and land acquisition (USAF, 2001, Section 3.4*), and interagency cooperation (Section 3.4.4).

- Air Force guidance and procedures for developing and processing SUA proposals (USAF, 2001), address the management and use documentation of allocated airspace. This guidance requires an "in-house" assessment of potential competing interests, briefly addressing recreational areas (parks – federal, state, and local); Native American reservations, lands, or areas of special interest; grazing and/or farming; endangered species; wildlife refuges; hunting and fishing; archaeological sites; population centers, communities, previously identified or potential noise sensitive areas; possible impact on ongoing litigation; other training space actions that may be impacted by this initiative; regional actions by other military activities; and consultation with other state/federal agencies (USAF, 2001, p. 19).

Effects on airspace resources that can produce effects on other VECs (resources) should be recognized and considered. These "other connected" effects include:

- effects of increased noise levels and/or sonic booms on human populations, wildlife in general, specially designated wildlife areas and sanctuaries, and/or threatened or endangered animal species;
- effects of strikes on migratory and non-migratory birds; and
- contributions by military aircraft to the annual air pollutant emissions in the study area.

During CEQ Step 1, the need for modification or new establishment of one or more SUAs must be determined. The environmental evaluations of these SUAs, including associated airspace areas, airfields, navigation facilities, terminal instrument procedures, and similar activities, must be planned and conducted to reduce or remove adverse environmental effects (USA, 1990, p. 9); and must encompass the following:

- The environmental impact of a proposal will be assessed during the planning stage, and will be evaluated along with technical and economic factors.
- After completion of the EA, the proponent of the action (proposal) will determine whether the EIS or a finding of no significant impact (FONSI) is required. An EIS or a FONSI with an accompanying EA will always be required for SUA proposals if –
  (1) The floor of the proposed area is less than 3,000 feet above the ground.
  (2)Supersonic flight is anticipated at any altitude.
- The proposal will –
  (1) Identify the installation or activity that serves as the lead agency for NEPA compliance.
  (2) Identify by name, address, and telephone number, the office at the installation or activity to which comments on environmental aspects may be addressed.
  (3) Include documentation detailing NEPA compliance.
- EAs or EISs will be prepared and processed in accordance with 32 CFR 651 (USA, 2002). A copy of the final environmental documentation will be forwarded to the FAA prior to final FAA action.

While these requirements do not specifically address cumulative effects; such requirements are incorporated in 32 CFR 651 (USA, 2002).

Much of the specified format directly applies to CEQ's CEA process.

- Parts 1b (boundaries) and 1c (altitudes) relate to CEQ Step 2 (establish geographic boundaries).
- The entirety of Parts 4 (activities) and 8 (graphic display) relate to CEQ Step 1 (identify effects issues), CEQ Step 8 (identify cause-effect relationships), and CEQ Step 9 (determine the magnitude and significance of effects).
- Part 5 (safety considerations) relates to CEQ Step 10 (avoid, minimize, or mitigate significant effects).
- Part 9 (joint use) relates to CEQ Step 4 (other past, present, or future actions).

As proposed new or expanded SUAs are subject to public scrutiny and possible opposition, the installation Public Affairs Office must continually inform various agencies and stakeholder groups, discussing airspace requirements and availability, and sharing the findings of specific analyses. Air Force guidance (USAF, 2001, Chapter 3) stresses the value of an informed public in mitigating or addressing increased noise levels and sonic boom events, as well as the imperative to protect civilian populations and communities (USAF, 2001, pp. 24–26).

To illustrate the importance of airspace effects, the following information is provided (USAF, 2005):

This DEIS analyzes potential environmental consequences of more realistic training opportunities for the 27th Fighter Wing (27 FW) and the New Mexico Air National Guard (NMANG) in Cannon Air Force Base airspace. These improvements, the New Mexico Training Range Initiative (NMTRI), modify the existing configuration of airspace, creating new airspace, authorizing supersonic flight above 10,000 feet above MSL in the airspace (or approximately 5,000 to 6,000 feet AGL), and expanding use of defensive countermeasures (chaff and flares) in the new and modified airspace. The resulting airspace would allow pilots to train in the full range of missions and tactics required for combat preparation, including supersonic simulated weapons delivery and defensive maneuvers (UASF, 2005, p. ES-1). The cumulative effects section addresses PPRF actions in the region of influence (CEQ Steps 2 and 4 of CEQ's 11-step CEA process); and can provide useful insight into CEA for airspace resources.

CEQ Step 2 – Establish the geographic scope for the analysis.

The geographical (spatial) boundaries for considering airspace effects should include the county (or counties) where the proposed action is located, as well as regional boundaries encompassing the site. The following should be reviewed prior to identification of the geographic scope:

- General information on the location of the physical range or installation boundaries, the boundaries of adjacent easement lands, and land uses and boundaries of adjacent non-Army lands.
- Geographic boundaries dictated by the requirements of installation actions (both the proposed action and others).

CEQ Step 3–Establish the time frame for the analysis.

The temporal boundaries should include consideration of past actions that may have influenced airspace, current actions affecting air space, and future actions that may affect airspace; all within the delineated spatial boundaries (CEQ Step 2). While no specific guidelines exist to temporally frame these retrospective and prospective considerations. The following practical questions or considerations can be helpful; as follows:

- When was the installation and training range(s) established, and when did mission changes or modernizations occur? Have range expansions or reductions occurred in the past, and, if so, when did they take place?
- When was the first airspace range resources study compiled? How frequently has the study been updated?
- Are there Restricted Area Annual Utilization Reports available for the installation and associated ranges? What is the date of the earliest report?
- Has an airspace monitoring program been conducted for the installation and associated ranges? If so, when did it start and has the program evolved over time?

Based upon answers to these questions, the earliest date can be identified, and used as the initial historical reference point.

Some practical questions or considerations, for the future time horizon include:

- What is the estimated time period required to modernize the installation and associated ranges, and what is the anticipated time frame of airspace use for the completed, modernized installation?
- Are any anticipated changes in the installation mission, and, if so, when will such changes occur?

Depending upon the answers to these questions, the most distant time frame can be identified, and used as the initial prospective reference point to encompass future actions.

CEQ Step 4–Identify other past, present, and reasonably foreseeable future actions that have affected, or are anticipated to affect, airspace.

The identification of past actions can be aided by the review of historical installation airspace use. Key review documents include all available Restricted Area Annual Utilization Reports. Such reviews can highlight both contributing past actions as well as trends. Present actions affecting airspace include both ongoing past actions and current actions. Information can be obtained from installation planners and stakeholders, planning departments of local towns and cities, and other federal, state, and local agencies. Any airspace usage by commercial and private aircraft should also be addressed. These same information sources can help identify and evaluate reasonably foreseeable future actions affecting the airspace within the future temporal boundary. The likelihood of future actions and their potential time frames should be considered and evaluated before inclusion.

Depending upon the status or scope of exiting inventories, new inventories may be necessary to address current and anticipated airspace use.

CEQ Steps 5-7–Characterize the airspace identified in scoping in terms of its capacity to withstand stresses (Step 5); characterize the stresses affecting airspace and their relation to regulatory thresholds (Step 6); and define a baseline condition for the airspace (Step 7).

These three CEQ steps emphasize historical airspace usage trends, and comparison of such trends with appropriate thresholds and associated safety concerns. Key references include:

- Historical and current Restricted Area Annual Utilization Reports for airspace usage.
- Historical and current airspace monitoring reports from the FAA, state or in-state regional agency.
- Pertinent meteorological information; examples include daily, monthly, and seasonal mixing heights, wind speeds and direction, inversion heights, and visibilities. The closest meteorological office, state meteorological office, FAA, and/or the National Oceanic and Atmospheric Administration can provide such information.

AR 95-2 requires that Army installations maintain records of all activities that require their restricted area to be activated (USA, 1990, p. 11). The following examples of daily use information must be maintained:

- Time that area was activated and deactivated, if joint use.
- Total hours of use, listing subdivision or segment, if divided.
- Type or extent of ground-based activity – type of activity, number of firings, launchings, etc. and total hours of operation.
- Type and extent of air operation – type of aircraft or aerial vehicle (for example, RPV, fighter, bomber), number of sorties, altitudes or flight levels by type of aircraft, and total hours of aircraft operation.

This information is used to prepare annual utilization reports for restricted areas. The specific format for these annual reports is depicted in Table 4.2-2 (USA, 1990, pp. 14–15).

A checklist for conducting periodic reviews of existing airspace, or for assessing proposed SUAs or MTRs has been developed (USAF, 2001, pp. 48–51), (Table 4.2-3) This checklist can guide the description of affected airspace resources at Army installations.

CEQ Step 8 – Identify the important cause-and-effect relationships between human activities and airspace.

Cause-and-effect relationships can be depicted in several ways, including three-dimensional maps illustrating airspace usage patterns and human population areas. Network diagrams can also be developed to relate airspace usage to environmental effects.

CEQ Step 9 – Determine the magnitude and significance of cumulative airspace effects.

Several procedures and special tools are available to assess the magnitude of airspace effects, as discussed in the following two examples

Computer simulation modeling can be used to ascertain and present the magnitude of cumulative effects on airspace. For example, a special airfield and airspace study, on the introduction of 11 Navy Super Hornet Squadrons on the US east coast, a general simulation model for naval aviation operations, the Naval Aviation Simulation Model (NASMOD), was used (ATAC, 2001, p. 1-1). The model was used to illustrate anticipated effects at several airfields and their associated airspace; including several bombing ranges, MOAs, and warning and restricted areas.

NASMOD included the following components (ATAC, 2002, p. 1–4):

- A graphical user interface (GUI) for data entry, including database table editing and graphical tools for building airfields, routes, and mission profiles; simulation control; and additional analysis, including a database querying tool.
- A traffic animator, which replays a simulated day of air traffic and training operations as an animated, graphical approximation of the events simulated by the NASMOD mathematical model.
- Relational databases of input and output data, wherein the input data control the model assumptions and parameters, and the output data contain the results for the simulation period.
- Simulation modules that model squadron mission scheduling, central scheduling of airspace areas, and the evolution of military missions and their interactions with other modeled traffic.
- A performance calculator that computes selected measures of performance for squadrons and their training activities, airfield operations, and airspace and range area scheduling and utilization.

The NASMOD outputs enabled the calculations of percentage changes from current operations, using a variety of alternative training scenarios. More specifically, the following metrics were used to display the cumulative effects of projected sorties in identified warning areas under different scenarios (USN, 2003, p. 13–4):

- Existing total sorties
- Projected sorties for Super Hornet siting alternatives
- Percent change over baseline
- Projected change due to Raptor sorties
- Total projected sorties under Super Hornet siting; alternatives and Raptor sorties
- Percent change over baseline

A Resource Capability Model (RCM) has been proposed for Air Force "adequacy" assessment of environmental, airspace, and spectrum resources (Rowe, et al., 2004). The RCM compares installation resource requirements to availability of such resources for airspace, airshed emissions capacity, surface and subsurface land access, surface and groundwater access (supply), surface water discharge availability, and frequency spectrum. A resource readiness (or adequacy) rating is assigned, using a consistent protocol.

The RCM includes defined metrics for each resource. Five such metrics are defined for airspace:

- Compatible Volume compares total volume of an airspace unit to the volume remaining after avoidance/incompatible areas are removed, establishing available volume.
- Time Volume Denied indicates the amount of time that airspace is unavailable to support flight missions.
- Hours compares required hours for training (i.e., scheduled hours) to available hours for training in a specific airspace unit.

- Distance compares maximum desired distance to the airspace unit with actual distance to the airspace unit.
- Minimum Size Dimensions uses calculated airspace volume for a specific type of training (e.g., Air-Ground Basic Surface Attack), and Mission Design Series (i.e., F-16), and compares this calculated volume with available airspace resources, the Compatible Volume metric.

These metrics can be used to assess operational and resource requirements for airspace and the airspace availability.

The airspace resource readiness (or adequacy) rating includes consideration of both the resource deficiency and opportunity. The following rating scales are used for each metric (Rowe, et al., 2004; and Cornell and Pease, 2004):

- Resource Opportunity (RO) – RO3 – Major opportunities – >140% above the breakpoint of matching resource requirements to availability
- RO2 – Significant opportunities – >120% to 140%
- RO1 – Some opportunities – >110% to 120%
- RR – Adequate (minor opportunities or deficiencies) – 110% to 90%
- Resource Deficiency (RD) – RD1 – Some deficiencies – <90% to 80%
- RD2 – Significant deficiencies – <80% to 60%
- RD3 – Major deficiencies – <60%

(Note: These percentages result from the comparison of resource availability with resource requirements, using 100% as the baseline for confluence.)

The significance of airspace effects can be derived from the following considerations:

- Compliance with airspace procedures and regulations (federal, state, or local).
- Consideration of percentage changes from historical and current conditions based on identified airspace metrics.
- Use of specific designated criteria as contained in the Makua Military Reservation DEIS (USACE, 2004).

CEQ Steps 10 and 11 – Modify or add alternatives to avoid, minimize, or mitigate significant effects on airspace (Step 10), and monitor the airspace effects of the selected alternative and adapt management (Step 11).

Mitigation of direct, indirect, and cumulative airspace effects may involve unilateral Army decisions or collaborative decisions, including FAA, other DoD entities, the state or regional management agency, other state or federal agencies, local towns and cities, and the private sector. Examples of such mitigation measures may include:

- Scheduling of airspace usage based on both spatial and temporal considerations to minimize potential conflicts.
- Minimizing certain airspace usage during particular time periods that are environmentally important (e.g., minimization during certain bird migration, mating, or birthing seasons).

Monitoring of selected airspace indicators and related effects may be required as modifications to existing installation airspace monitoring programs or as part of EMS. Guidance for the planning and implementation of a monitoring program is available (Marcus, 1979*); and should include an organized feedback and decision-making system to adapt management activities for reduction in undesirable cumulative airspace effects.

4.2.5 Summary

Extensive information is available for Army installation airspace effects analysis, including detailed regulations and procedures (USA, 1990). Restricted Area Annual Utilization Reports can provide a basis for addressing effects; and coordination with FAA will be required for addressing direct, indirect, and cumulative effects. Restricted Area Annual Utilization Reports can provide a basis for addressing cumulative effects; and coordination with FAA will be required for addressing direct, indirect, and cumulative effects.regulations and procedures (USA, 1990). Restricted Area Annual Utilization Reports can provide a basis for addressing cumulative effects; and coordination with FAA will be required for addressing direct, indirect, and cumulative effects.

1. Description
   - a. Title (A short definitive description of what is proposed.)
   - b. Boundaries (A definitive description of the proposed area's perimeter.)
   - c. Altitudes (Minimum and maximum altitudes proposed.)
   - d. Times of use (Local time operations are normally expected to begin and end.)
   - e. Controlling agency (Applies only when area is joint use.)
   - f. Using agency (Name of responsible Army agency.)
2. Coordination (Furnish a summary of the coordination accomplished. For new proposals, indicate that shared use and/or expansion of existing areas have been explored and determined unacceptable to satisfy the requirement for airspace.)
3. Justification (The need for the proposed SUA must be definitive and able to support any resultant imposition on nonparticipating (or affordance of priority to) the SUA proponent. Statements such as "the containment of military activity",or "in support of national defense", or other statements of a similar nature are inadequate.)
4. Activities: Activities include–
   - a. A detailed list of activities to be conducted by each organization proposing to use the area.
   - b. Local times daily operations normally are scheduled to begin and end. Include weather requirements if it is a condition of use.
   - c. Number of hours (daily) the area will be used.
   - d. Days per week, weeks per month, or months per year (as appropriate) the area will be used.
   - e. If the area is to be used for aircraft operations, include the information below:
     - (1) The number and type of aircraft normally involved in performing activities for which the area is established.
     - (2) A statement as to whether ground or airborne radar surveillance will be used. Indicate on appropriate charts where the radar coverage is available.

Table 4.2-1*–Suggested Format for Special Use Airspace (SUA) Proposals*

(3) The altitudes to be used in daily aircraft operations, expressed in feet above MSL or flight levels, as appropriate. For each type of activity, include the altitude (or blocks of altitudes) and the number of hours the altitudes will be used.

(4) The intentions regarding flight at supersonic speeds.

f. If the area is to be used for surface firing, include the information below.

(1) Type of weapon(s) to be fired.

(2) Maximum altitude of surface firing (expressed in feet MSL) used in accomplishing required operations.

(3) Number of hours maximum altitude is to be used.

(4) Altitude normally used for daily firing operations, expressed in feet above MSL.

g. Any special requirements.

5. Safety Considerations (Include an explanation as to how each of the factors below, if applicable, is to be accomplished.)

a. How activity will be confined within the proposed area.

b. Procedures for handling malfunctions.

c. Tolerance for ordnance trajectory.

6. Communications and Radar (Specify the availability of ground and/or airborne communications coverage; for example, range control, military radar unit, airborne radar unit, or fleet area control and surveillance facility.

7. Environmental and Land Use Information

a. Identify the lead agency or appropriate representative responsible for compliance with NEPA.

b. Certify NEPA compliance.

c. Furnish the name, address, and telephone number of persons to whom comments on environmental and land use aspects may be submitted.

d. Proposals requesting designation of SUA below 1,200 feet above ground level, which is overlying private or public use land, will indicate agreement to provide reasonable and timely aerial access to such land. Prohibited and restricted area proposals requesting designation from the surface, will indicate that the proponent owns, leases, or by agreement controls, the underlying surface.

8. Graphic Display (Proposals will include a graphic presentation of the proposed area on maps and aeronautical charts, as appropriate. If applicable, the presentation should indicate which are owned, leased, or controlled by the using agency. All proposals should, at a minimum, be depicted on sectional aeronautical charts.)

a. If the area is to contain aircraft operations, the location and the representa tive pattern of firing and/or bombing runs will be depicted;.indicating where the run begins, where lock-in occurs, and where any firing commences and ends.

b. If the area is to contain surface-to-surface or surface-to-air firings, the information below will be depicted.

(1) Firing points

(2) Impact areas
(3) Perimeter or firing fans for each weapon type used.

9. Joint Use State whether the area will be joint use, where appropriate, and if not, include justification.
10. Remarks Specify any pertinent data not indicated elsewhere.

Much of the specified format directly applies to CEQ's CEA process.

Table 4.2-2 *– Special Use Airspace (SUA) /Military Training Route (MTR) Review Checklist (as modified) (USAF, 2001, pp. 48-51)*

1. Description

    a. Name (Enter name of restricted area as published in FAA Order 7400.6)
    b. Number (Enter number of restricted area, including all subdivisions)
    c. Reporting period (Reporting period begins 1 October and ends 30 September the following year)

2. Activities (List all activities for which the restricted area was activated.)

    a. Aircraft operations
        (1) Types of aircraft

        (2) Narrative description of purpose or mission

    b. Surface-originated activity
        (1) Types of activities

        2) Narrative description of purpose or mission

    c. Other (List all activity not included above)

    d. Electronic monitoring devices
        (1) List the devices currently used. Give a description of any electronic monitoring devices and the purpose for which they are used.

        (2) List the devices planned for future use. Describe any devices planned for future use and the purpose for which they will be used.

3. Time of Utilization

    a. Subdivision A
        (1) Average number of hours used daily (Divide the total number of hours used by the total number of days used)

        (2) Number of days used weekly (Divide the total number of days the area was activated during the year by the number of weeks the area was activated)

        (3) Number of weeks used yearly (State the number of weeks the area was used)

    b. Subdivision B (Repeat format for a. above for this and all other subdivisions.)

4. Time Released to Controlling Agency. (This pertains to joint use areas only. Use format in 3 above. Areas should be released to the controlling agency when not in use by the using agency. If not, state reason why)

5. Altitudes Utilized

    a. Aircraft (Indicate flight level or altitude MSL)
    b. Surface originated activity
        (1) Maximum ordinate (Express in feet MSL)

        (2) Average ordinate (Express in feet MSL)

6. Charts (Original or revised – if no change, so state)

7. Other information (Include any other information pertinent to activities conducted within the restricted area.)

***Table 4.2-3** – Special Use Airspace (SUA) /Military Training Route (MTR) Review Checklist (as modified) (USAF, 2001, pp. 48-51)*

This checklist is referenced in CEQ Step 7. It is provided to guide periodic airspace reviews and should be used as questions arise requiring background information on airspace.

1. Land Ownership (Restricted Areas):

1.1 – Are all lands inside the airspace boundary owned, leased, or controlled by agreement?
1.2 – Are the safety danger zones (SDZs) of each employed weapon system within the airspace boundary?
1.3 – Are adequate safety measures taken to protect public and private lands?
1.4 – Are the land areas within the restricted airspace congested, sparsely populated, or uninhabited?
1.5 – Does the SUA allow aerial access to private and public lands?

2. Intended Use:

2.1 – Does the original intended use match the actual use?
2.2 – Is the airspace adequate for intended use?
2.3 – Is the SUA/MTR shared with other users?
2.4 – Does actual activity justify the designated type of airspace?
2.5 – Is the activity in restricted areas:
2.5.1 Air-to-air?
2.5.2 Air-to-ground?
2.5.3 Ground-to-ground?
2.5.4 Ground-to-air?
2.5.5 What mission profiles are utilized?
2.6 Does the unit initiate return of airspace to the National Airspace System when no longer required for the mission?
2.7 – Are available military radar units used to provide military command and control in the SUA, and enhance safety and utility?

3. Activation Procedures:

3.1 – Is the SUA/MTR scheduled sufficiently in advance?
3.2 – Is the SUA/MTR coordinated with FAA IAW LOA/LOP?
3.3 – Is the controlling agency properly notified when scheduled activities are canceled?
3.4 – What are the activation/deactivation procedures?
3.5 – Is there a coordination point of contact (name/phone number) established between using and controlling agencies?
3.6 – Are "real time use" concepts efficiently used in daily activities?
3.7 – Is the airspace efficiently subdivided to use the minimum of required airspace for particular missions?
3.8 – Is the SUA released to other users when not required for military operations?

4. Letters of Agreement/Letters of Procedure (LOA/LOP):

4.1 – Are LOA/LOPs current and accurate?
4.2 – Are "real time use" procedures incorporated into the LOA/LOPs?
4.3 – Do LOA/LOPs contain provisions for safe operations when radar/communications fail?
4.4 – Are operating procedures for joint-use restricted areas outlined in a LOA/LOP?

5. Records:

5.1 – Are utilization records available for the past two years?
5.2 – Are records of activation changes kept?
5.3 – Do records describe times and portions of airspace activated?
5.4 – Do records reflect scheduled versus activated times?

Table 4.2-3 *– Special Use Airspace (SUA) /Military Training Route (MTR) Review Checklist (as modified) (USAF, 2001, pp. 48-51) (continued)*

6. Weather Observations (Restricted Areas):

6.1 – Is ceiling and visibility information available?
6.2 – What are the minimal weather conditions for SUA/MTR use?

7. Communications:

7.1 – What type of air-to-ground communications are available?
7.2 – What type of communications are available to FAA or other agencies?
7.3 – Is communication/radar coverage with a military or FAA ATC agency available when entering or exiting SUA/MTRs?

8. Briefings (To aircrews):

8.1 – Is the SUA/MTR briefing current, and are procedures established to update the briefing?
8.2 – How are briefings and procedures made available to other users of the SUA/MTR?
8.3 – Are aircrews, especially non-unit aircrews, briefed on environmental hot spots and noise-sensitive areas?

9. Environmental

9.1 – Does the current Description of Propsed Action and Alternatives (DOPAA) define current operations, and if so, was it used for the latest environmental analysis and supersonic waiver, if required?
9.2 – Do you have a copy of the environmental document?
9.3 – Were the basic environmental analyses and all additional supplements filed?
9.4 – Do the supplementals address cumulative effects?
9.5 – Does the DOPAA include all the shared users of the airspace?
9.6 – List the aircraft authorized (by the environmental document) to routinely fly in the airspace.
9.7 – List the flares and chaff (by type) authorized for use in the airspace.
9.8 – What is the date that the environmental office reviewed the annual utilization review?
9.9 – Was a supplemental document required as a result of the annual utilization review?

10. Miscellaneous:

10.1 – Does the airspace proposal describe the current airspace requirement?
10.2 – Is radar available/used for control?
10.3 – Are spill-ins/outs recorded, and what follow-up actions are taken?
10.4 – Are public-use airports avoided by 3 NM or 1500’ AGL?
10.5 – Do aircraft operations within the SUA/MTR conform to applicable FARs?
10.6 – Does the SUA/MTR create potential air traffic conflicts with terminal VFR and IFR operations?
10.7 – Does the SUA/MTR create potential air traffic conflicts with federal airways or regularly used VFR routes?
10.8 – Are there waivers to ensure exclusion of nonparticipating aircraft from airspace boundaries?
10.9 – Are waivers up to date?
10.10 – Have all MTRs been surveyed for obstacles (at least annually)? (Slow moving aircraft are recommended to conduct the survey.)
10.11 – Are uncharted obstacles on MTRs reported to the scheduling agency as soon as possible after landing, and included in aircrew briefings?
10.12 – Have MTR surveys considered potential bird attractant areas such as landfills, wildlife refuges, wastewater treatment plants, stockyards or food processing plants, which may attract large concentrations of birds harmful to aircraft operations?
10.13 – Have MTR surveys been documented and maintained?
10.14 – Have potential flight safety hazards (e.g., obstacles, migratory bird routes, possible bird attractant areas, etc.) been identified and published?
10.15 – Have MTR special operating procedures or remarks been reviewed annually for accuracy?

4.3 Cultural Resources

4.3.1 Introduction

Cultural resources are defined within Army Regulation 200-4, Cultural Resources Management, as: historic properties, as defined in the National Historic Preservation Act; cultural items as defined in the Native American Graves Protection and Repatriation Act; archeological resources as defined in the Archeological Resources Protection Act; sacred sites as defined in Executive Order 13007 to which access is provided under the American Indian Religious Freedom Act; and collections as defined in 36 CFR 79, Curation of Federally-Owned and –Administered Collections.

Within the context of NEPA, a broader definition of cultural resources is used; including prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious or other reasons.

NEPA requires a comprehensive assessment of impacts on such cultural resources. Compliance with cultural resources statutes and regulations produces considerable information and findings, and should be integrated into NEPA analyses and documents; including direct, indirect, and cumulative impacts and issues.

4.3.2 "Quick Look" Questions

"Quick Look" questions can be used to determine the need to address impacts on cultural resources via Section 106 of the National Historic Preservation Act (NHPA), including the need to consider cumulative effects.

"Quick Look" Questions (Historic Properties)

Some questions can help determine whether a cultural resource is a source of concern. Answers can determine if a property is historic, or has other cultural resource implications. If so, any actions, including but not limited to ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance activities, new construction, demolition, deconstruction and salvage, remedial activities, ground disturbing activities including training, and transfer, sale, lease, or closure, must be assessed to determine if there will be an adverse effect, and, if so mitigation actions must be taken to try to lessen the impacts of the adverse effect. Mitigation actions may include, but are not limited to: documentation according to National Park Service Historic American Buildings Survey (HABS), Historic American Engineering Record (HAER), and Historic American Landscape Survey (HALS) standards; alteration of proposed action to limit effects; creation of documents for public information; and data recovery. These questions were developed in a CEA field study at Fort Wainwright, Alaska.

- Is there an inventory of historic properties (buildings)?
- Is the property 50 years of age or older?
- Has the property been evaluated for exceptional significance?
- Is the property eligible to be on the National Register?
- Is the property included in a Programmatic Agreement or Memorandum of Agreement that would govern work items (repair, replace, modernize, demolish) in the building?
- Is the property a contributing resource in a National Register eligible or listed Historic District or Cultural Landscape?

- Is the property a National Historic Landmark or located in a National Historic Landmark District?
- Is the property located near or in the view shed of a National Register eligible or listed Historic Property, Historic District, Cultural Landscape, or archaeological site?
- Is the property a National Register eligible or listed archaeological site?
- Is the property a National Register eligible property of traditional religious and cultural importance to Federally-recognized Indian tribes,
- Is the property located in or near a sacred site (AIRFA), or Native American burial area
- Is an additional cumulative effects analysis needed? (i.e., Have previous actions incrementally changed the environment of the building or its surroundings?)
- Does the proposed action have an effect on a historic district as a whole?
- Have there been previous effects to the historic district, including alterations to viewsheds?
- Does the proposed action have an effect on any aspect of the property's integrity? (materials, design, workmanship, setting, location, feeling, association)
- Have any of these aspects of integrity been previously affected?

If a historic property is determined ineligible, in consultation with the State Historic Preservation Office (SHPO), further analysis and documentation is not required. However, if determined eligible, the Section 106 process must be followed.

"Quick Look" Questions (Archaeological Resources)

An archaeological resource includes any material remains of past human life or activities that are of archaeological interest. This includes pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal material, or any portion or piece of any of the aforementioned (USC, 1979).

- Has the area of the proposed project been surveyed for archaeological resources?
- Are there prehistoric or historic sites present in the area?
- Have these sites been studied/evaluated?
- Is the site 100 years of age or older, and subject to ARPA?
- Is the site eligible for or on the National Register?
- Is the site associated with a significant event?
- Is the site a contributing resource in a National Register eligible or listed Historic District or Cultural Landscape?
- Is the site located in or near a Native American cemetery, traditional cultural property or sacred site?
- Is there a Memorandum of Agreement in place that applies to the proposed project area?
- Will the proposed action create an increased likelihood of public access to the site, knowledge of the site, or looting of the site?

If, from the answers to these questions, it is determined that an MOA is not in place and that the project area will need to be intensively surveyed by an archaeologist, the area should be surveyed as early as possible in the project planning. If a survey report is not clear, the SHPO can assist in deciding whether a survey was intensive or not. If Native American or burial objects are discovered, then consultation with the lineal descendants or culturally-affiliated tribe must occur in accordance with NAGPRA, to determine whether repatriation is appropriate.

Figure 4.3-1 depicts the relationship between "quick look" questions for historic buildings and archaeological resources and the Section 106 process.

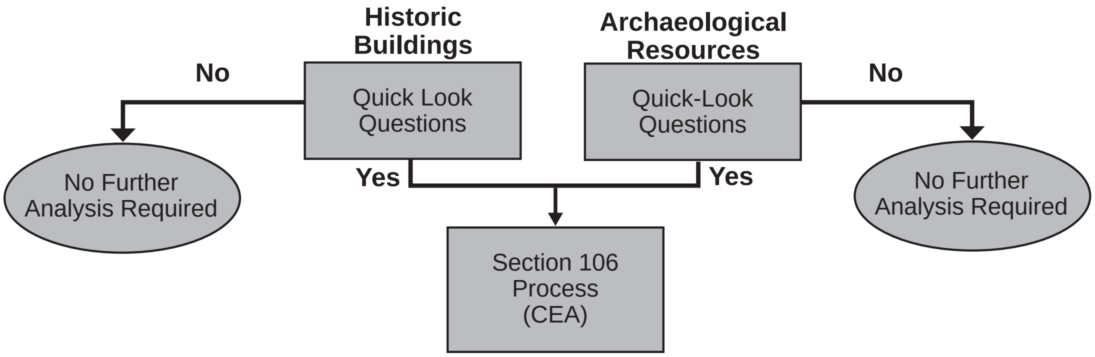

Figure 4.3-1 – "Quick Look" Questions and Section 106 Flowchart

"Quick Look" Questions (Native American Resources)

4.3

The intent of the Native American Graves Protection and Repatriation Act (NAGPRA) is to protect, identify proper ownership, and ensure the rightful disposition of Native American human remains and cultural objects discovered on federal or tribal lands. NAGPRA requires that certain procedures be followed when there is an intentional excavation or inadvertent discovery of Native American human remains and cultural objects (USC, 1990). The NAGPRA regulations (43 CFR 10) develop a systematic process for determining the rights of lineal descendants and Native American tribes and Native Hawaiian organizations, to certain Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony, with which they are affiliated.

- Has the installation identified all Federally-recognized Indian tribes or Native Hawaiian organizations that are culturally affiliated with the area?
- Has the area of the proposed action been surveyed for funerary objects, sacred sites, or objects of cultural patrimony (objects of ongoing historical, traditional, or cultural importance central to the Native American tribe or Native Hawaiian organization)?
- Are the resources mentioned above present in the area of the proposed action?
- Have these resources been studied and summaries of these collections prepared?
- Have these summaries been provided to lineal descendants and culturally affiliated Native American tribes or Native Hawaiian organizations that may wish to request repatriation of such objects?
- Will the resources that that are found within the area of potential effect (APE) require consultation with Native American tribes?
- Is it likely that unevaluated resources will be found in the area of proposed action?
- Are activities (construction, maintenance, or use of the range) conducted as part of the proposed action likely to have an adverse affect on the integrity of the resource?
- Will the proposed action have the likelihood of altering Native American access to any identified sacred sites?

If from answering these questions, it is determined that the above mentioned resources are not present in the APE, or have been evaluated and will not be adversely affected, then further analysis and documentation would not be required. However, if the resource is likely to be impacted by the activity, then NAGPRA procedures must be followed.

4.3.3 Section 106 Process and Impact Analysis Steps

The National Historic Preservation Act (NHPA) of 1966, as amended, establishes the federal government's policy to: "provide leadership in the preservation of historic properties and to administer federally owned or controlled historic properties in a spirit of stewardship". The Army must administer, manage, and treat historic properties in accordance with the NHPA; and must identify, evaluate, and nominate historic properties for listing in the National Register of Historic Places (NRHP), consistent with the policies and guidelines of AR 200-4 and DA PAM 200-4. (Bookmarked versions of these two references are on the accompanying CD.) NHPA and NEPA compliance are separate and parallel processes, and the standards and thresh¬olds of the two acts are not precisely the same. Section 106 and its implementing regulations state that an undertaking has an effect on a historic property when it could alter those characteristics of the property that qualify it for inclusion in the NRHP. An undertaking is considered to have an adverse effect on a historic property when it diminishes the aspects of integrity that existed at the time the property was determined eligible. The 11 CEQ steps were adjusted to fit the Section 106 process, as shown in Figure 4.3-2.

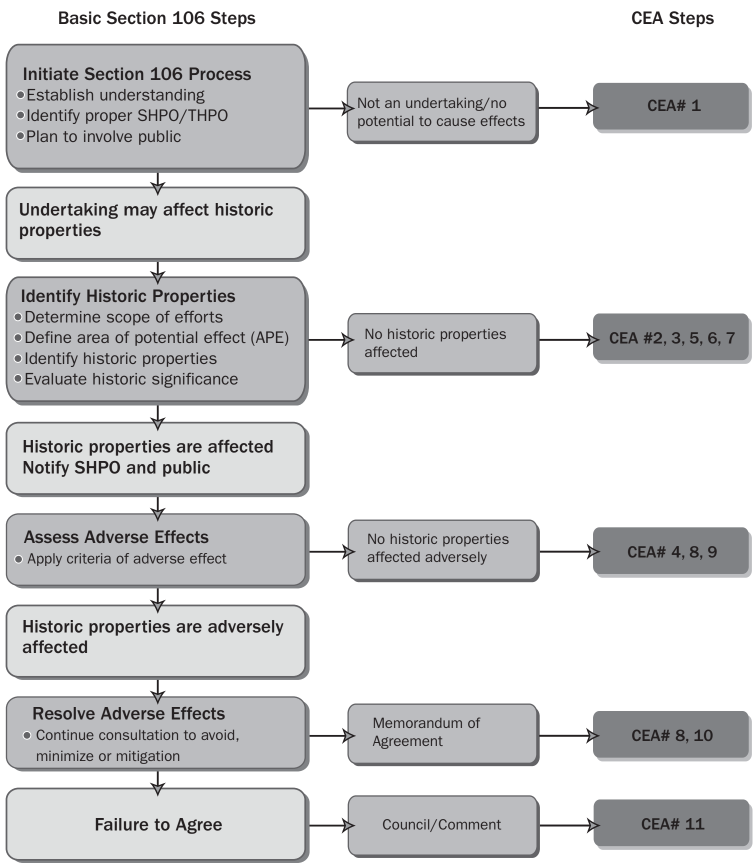

Figure 4.3-2 *Section 106 Process and CEQ CEA Steps*

In Step 1 of the Section 106 process, the agency must determine if the undertaking (action) has the potential to affect historic properties. If so, a NEPA review may be initiated at this stage. During preparation of the EA (or draft EIS), the agency shall (through the NEPA scoping process) identify consulting parties pursuant to 36 CFR 800.3(f), identify historic properties and assess effects of the undertaking on such properties (Steps 2 and 3 of the Section 106 process), provided that the scope and timing of these steps may be phased to reflect the agency's consideration of project alternatives in the NEPA process. In cases where a proposed action is determined to be a Categorical Exclusion under NEPA, further NEPA analysis would not be required, and a Record of Environmental Consideration (REC) would be the final NEPA document. However, a NHPA Section 106 review would still need to be conducted to determine if the proposed action would result in an undertaking that could affect historic properties.

The cultural resources section of the AEC Web site includes copies of 9 federal statutes, 19 regulations and guidelines, and five executive orders related to cultural resources. A link to this Web site (http://aec.army.mil/usaec/cultural/laws.html) is available on the accompanying CD.

4.3.4 ICRMPs and Impact Analysis Steps

An Integrated Cultural Resources Management Plan (ICRMP) is required by AR 200-4, "Cultural Resources Management", (USA, 1998b) at each military installation that has cultural resources, constituting a five-year plan for compliance with cultural resource statutes, executive orders, regulations and other requirements. The ICRMP is a component of the installation master plan and is the commander's decision document for cultural resources management actions and specific compliance procedures. The ICRMP integrates the entire installation cultural resources program with the ongoing military mission, allows identification of potential conflicts between the installation's mission and cultural resources, and identifies actions necessary to meet statutory and regulatory requirements.

ICRMPs are subject to NEPA, and should be accompanied by appropriate NEPA analysis and documentation. AR 200-4 recommends that an EA and Finding of No Significant Impact (FONSI) be prepared to support and implement the ICRMP, considering effects for cultural resources within the installation boundary (DA PAM 200-4).

ICRMPs for Fort Leonard Wood (FLW) (Edging, 2003) and Fort Bliss (Bowman, 2000) were examined to determine how ICRMP information can be potentially used to address the CEQ CEA steps. A table was prepared, illustrating these relationships. Table 4.3-1 shows the table of contents sections from the Fort Leonard Wood ICRMP, along with the relevant CEQ steps that could be supported by information from the sections.

The entirety of the Fort Leonard Wood (FLW) ICRMP can be found on the CD accompanying this guidance manual. This ICRMP has four major sections: (1) Introduction (2) Installation Contexts (3) Planning Level Survey, and (4) Integration. The Standard Operating Procedures (SOPs) are contained in section 5. As can be seen from the examination of Table 4.3-1, information that could be used to address all 11 CEQ steps is found in the ICRMP.

The Fort Bliss ICRMP is organized differently than FLW. Information on contexts is not as detailed, and information on supporting studies, such as planning level surveys, historic projects, and evaluation, was not part of the ICRMP. These studies were done separately, and are contained in separate focused reports that support the ICRMP. The Fort Bliss ICRMP provides detail on projects for every fiscal year from FY01 to FY05, and nine SOPs are part of the plan. A table of contents was prepared for the Fort Bliss ICRMP and information that would lend itself for effects analysis, including CEA, was noted. This information is presented in Table 4.3-2.

Table 4.3-1 *Relationship between FLW ICRMP Sections and CEA Steps*

TOC	CEA Steps
Sec 1.2 Fort Leonard Wood (FLW) ▪ 1.2.1 Historical Events ▪ 1.2.2 Location and Setting ▪ 1.2.3 Description	5. Characterize the resources, ecosystems, and human communities identified in scoping, in terms of their response to changes and capacity to withstand stresses. 6. Characterize the stresses affecting these resources, ecosystems, and human communities, and their relation to regulatory thresholds. 7. Develop a baseline condition for the resources, ecosystems, and human communities.
Sec 1.6 Statutes and Regulations ▪ 1.6.1 Statutes ▪ 1.6.2 Executive Orders ▪ 1.6.3 Presidential Memoranda ▪ 1.6.4 Federal Regulations and Guidance ▪ 1.6.5 Military Regulations and Guidance	5. Characterize the resources, etc. 6. Characterize the stresses affecting these resources. 7. Develop a baseline condition for the resources, ecosystems, and human communities.
Sec. 2.3 Prehistoric and Historic Context (2.3.1 to 2.3.21) includes: ▪ 2.3.1 Pre-Clovis or Early Man Period (more than 11-13000 B.C.) ▪ 2.3.4 Archaic Period (7800-6000 B.C.) ▪ 2.3.7 Woodland Period (1000 B.C.-A.D. 1500) ▪ 2.3.13 Exploration and Early Settlement (A.D. 1700–1840) ▪ 2.3.19 World War II Mobilization (1940-1946) ▪ 2.3.21 Permanent Installation (1956-Present)	2. Establish the geographic scope for the analysis. 3. Establish the time frame for the analysis. 5. Characterize the resources, etc. 6. Characterize the stresses affecting theses resources. 7. Develop a baseline condition for the resources, ecosystems, and human communities.
Sec 3.1 Previous and Ongoing Research at FLW 1922-2003 (3.1.1 to 3.1.15) includes: ▪ 3.1.1 Cultural Resources Inventory ▪ 3.1.2 Phase I Archaeological Survey ▪ 3.1.3 National Register of Historic Places (NRHP) Testing Project ▪ 3.1.8 Native American Consultation ▪ 3.1.9 Historic Projects ▪ 3.1.10 Districts ▪ 3.1.11 Historic Sites Evaluation	5. Characterize the resources, etc. 6. Characterize the stresses affecting these resources. 7. Develop a baseline condition for the resources, ecosystems, and human communities.
Sec 3.2 Preservation Activities Recommendations ▪ 3.2.1 Historic Landscapes ▪ 3.2.2 Monuments and Memorials ▪ 3.2.3 Installation Building Stock	10. Modify or add alternatives to avoid, minimize, or mitigate significant effects.

Table 4.3-1 *Relationship between FLW ICRMP Sections and CEA Steps*

TOC	CEA Steps
Sec 3.6 Types of Undertakings and Effects of Vandalism ▪ 3.6.1 Resource Assessment Priorities ▪ 3.6.2 Risks to Cultural Resources ▪ 3.6.3 Routine Activities ▪ 3.6.4 Future Undertakings	
Sec 4.7 External Coordination and Consultation ▪ 4.7.1 Public Involvement plan (Based on HPP (1992:94)) ▪ 4.7.2 Missouri State Historic Preservation Office ▪ 4.7.3 Advisory Council on Historic Preservation ▪ 4.7.4 Other Interested Parties Sec 4.8 Public Access to Cultural Resources	1. Identify the effects issues associated with the proposed action and define the assessment goals. 4. Identify other actions affecting the resources, ecosystems, and human communities of concern. 8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human comms? 9. Determine the magnitude and significance of cumulative effects.
Sec 5.1 SOP#1: Section 106 Compliance Sec 5.2 SOP#2: Section 110 Compliance ▪ 5.2.1 Inventory Survey for Archaeological Res. (*Resource Evaluation, step 5*) ▪ 5.2.2 Archaeological Resource Evaluations (*Resource Evaluations, step 5*) ▪ 5.2.3 Phase II NRHP Testing Guidelines (*Resource Evaluations*) Sec 5.3 SOP#3: Emergency Archaeological Discovery Sec 5.4 SOP#4: Curation of Artifacts and Data Sec 5.5 SOP#5: ARPA Compliance Sec 5.6 SOP#6: Inadvertent Discovery of Native American Human Remains, Funerary Objects, Sacred Objects, or Objects of Cultural Patrimony Sec 5.7 SOP#7: Intentional Archaeological Excavation of Native American Human Remains, Funerary Objects, Sacred Objects, or Objects of Cultural Patrimony Sec 5.8 SOP#8: Treatment and Disposition of Native American Human Remains, Funerary Objects, Sacred Objects, or Objects of Cultural Patrimony Sec 5.9 SOP#9: Assessing Military Landscapes	5. Characterize the resources, etc. 10. Modify or add alternatives to avoid, minimize, or mitigate significant effects. (mainly mitigation)

Table 4.3-2 – Relationship between Fort Bliss ICRMP Sections and the CEA Steps

TOC	CEA Steps
Section 1 Introduction ▪ 1.1 Fort Bliss Mission and Land Use ▪ 1.2 Property Types Eligible for Inclusion in the NRHP ▪ 1.3 Potential Impacts and Threats ▪ 1.4 CRM Responsibilities ▪ 1.5 The Players ▪ 1.6 Properties Subject to Section 106 Review ▪ 1.7 Responsibility for Identification ▪ 1.8 Section 106: Scope and Process ▪ 1.9 Programmatic Compliance ▪ 1.10 Compliance Under this ICRMP ▪ 1.11 Brief History of the Fort Bliss CRM Program	2. Establish the geographic scope for the analysis. 8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.
Section 2 ICRMP Goals	1. Identify the cumulative effects issues associated with the proposed action and define the assessment goals.
Section 3 Management Plan ▪ 3.1 Archaeological Management Program ▪ 3.2 Curatorship ▪ 3.3 Architectural and Landscape Management Plan ▪ 3.4 Landscape Evaluation ▪ 3.5 Building and Structures Evaluation ▪ 3.6 Object Management ▪ 3.7 Cold War Properties ▪ 3.8 Non-Cold War Properties Less Than 50 Years Old	*Overall Program Context* 5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to changes and capacity to withstand stresses. 6. Characterize the stresses affecting these resources, ecosystems, and human communities and their regulatory thresholds. 7. Develop a baseline condition for the resources, ecosystems, and human communities. 10. Modify or add alternatives to avoid, minimize, or mitigate significant effects. 11. Monitor the effects of the selected alternative and adapt management.
Section 5 Projected Schedule ▪ 5.1 to 5.5 Fiscal Year 2001 thru 2005 o Curatorship o NAGPRA o Historical Archaeology o Prehistoric Archaeology o Architecture and Landscape Architecture	*New Information being gathered* 5. Characterize the resources, etc. 6. Characterize the stresses affecting these resources. 7. Develop a baseline condition for the resources, ecosystems, and human communities.

Table 4.3-2 – *Relationship between Fort Bliss ICRMP Sections and the CEA Steps*

TOC	CEA Steps
Section 6 Professional Standards	9. Determine the magnitude and significance of effects.
Section 7 Standards and Procedures for Determining for Significance of Fort Bliss Cultural Properties ▪ 7.1 Legally Mandated Standards ▪ 7.2 Standards for All Property Types	9. Determine the magnitude and significance of effects.
Section 8 Standard Operating Procedures ▪ 8.1 CRM SOP#1A: Archaeological Site, Landscape, Native American, and Cultural Properties Clearance for Large-Scale Operations and/or Exercises. ▪ 8.2 CRM SOP#1B: Archaeological Site, Landscape, Native American, and Cultural Properties Clearance for Training, Firing Impact, and Maneuver Areas. ▪ 8.3 CRM SOP#1C: Archaeological Site, Landscape, Native American, and Cultural Properties Clearance Dig Permits for Areas not located in Training, Firing Impact, and Maneuver Areas. ▪ 8.4 CRM SOP#2A: NHPA Section 106 Compliance for Historic Structures, Landscapes, and Other Aboveground Properties (for Organizations WITH Implemented Historic Facilities Treatment and Management Plans) ▪ 8.5 CRM SOP#2B: NHPA Section 106 Compliance for Historic Structures, Landscapes, and to Historic Properties, Buildings, Sites, Landscapes, Districts, Objects, etc. Other Aboveground Properties (for Organizations WITHOUT an Implemented Historic Facilities Operating Treatment and Management? Plans) ▪ 8.6 CRM SOP#3: Archaeological Survey Standards ▪ 8.7 CRM SOP#4: Identification of Historic Structures, Landscapes, and Other Aboveground Properties	5. Characterize the resources, etc. 6. Characterize the stresses affecting these resources. 7. Develop a baseline condition for the resources, ecosystems, and human communities. 10. Modify or add alternatives to avoid, minimize or mitigate significant effects.

***Table 4.3-2** – Relationship between Fort Bliss ICRMP Sections and the CEQ Steps*

TOC	CEA Steps
Properties That Meet the Criteria of Eligibility for Inclusion in the NRHP ▪ 8.8 CRM SOP#5: Reporting Damage ▪ 8.9 CRM SOP#6: Accidental Discovery of Archaeological Properties ▪ 8.10 CRM SOP#7: NHPA Section 106 Compliance for Construction Modifications ▪ 8.11 CRM SOP#8: Mobilization and/or Military Training in Anticipation of Immediate Deployment ▪ 8.12 CRM SOP#9: Public Involvement in the Fort Bliss Cultural Resource Management Program ▪ 8.13 CRM SOP#10: Annual Report on the Status of those Portions of this ICRMP to which the NHPA Applies	5. Characterize the resources, etc. 6. Characterize the stresses affecting these resources. 7. Develop a baseline condition for the resources, ecosystems, and human communities. 10. Modify or add alternatives to avoid, minimize or mitigate significant effects.
Appendix A – Cultural Resource Laws and Regulations (list) Appendix B – Activities reviewed by Fort Bliss Appendix C – Definitions, Acronyms, and Abbreviations Appendix D – Resolution of Adverse Effects	4. Identify other actions affecting the resources, ecosystems, and human communities ofconcern.

Ten of the eleven CEQ steps are found in the Fort Bliss ICRMP. Only CEQ Step 3 is not listed in Table 4.3-2, as the cultural resources findings at Fort Bliss are contained in separate, focused reports. Further, information related to other CEQ steps can also be found in these reports.

It is important to note that both of the reviewed ICRMPs contain SOPs directly applicable to describing the affected environment (CEQ Steps 5–7), impact mitigation (CEQ Step 10), and cultural resources management (CEQ Step 11).

4.3.5 Application of CEQ Steps to Cultural Resources

CEQ Step 1 – Identify the significant effects issues associated with the proposed action and define the assessment goals.

This CEQ step involves the identification of resources potentially affected the proposed projects or activities. An ICRMP, or associated reports or records, would typically provide a summary of completed inventories and management plans for historic buildings, structures, and archaeological sites. It can also provide information on conditions of these resources, and establish context to allow the determination of significance for identified impacts. Information on the ICRMP goals and installation policy (Bowman, 2000) can be used to set priorities based on cur¬rent available information; and questions pertaining to the significance of the affected resource can be addressed. In addition, including CE, and impacts (issues) can be identified through external coordination, consultation, and collaboration.

CEQ Step 2 – Establish the geographic scope for the analysis. (Spatial Boundary)

The geographical boundary should include the cultural landscape of the installation's cultural resources. This includes the affected area as well as the distribution of that resource in the region. Information on installation mission and land use is useful; and an ICRMP, or associated reports or records, would typically provide information on the location of historic buildings, archaeological resources, and the status of knowledge on other areas of concern (e.g. sacred sites, cemeteries). Prehistoric and historic context information also informs this CEQ step. For cumulative effects analysis, boundaries should be expanded to the scale of human communities; including neighborhoods, rural communities, cities, states, tribal territories, and known or possible (eligible) historic districts. Such information can be gleaned from historical societies at the local, state, and regional levels, as well as from maps and newspapers of that period. Installations may also have historic context reports on the type of historic property affected, which provides background on the property type and its historical setting, and can assist in analyzing effects to a district or geographically dispersed group of properties.

CEQ Step 3 – Establish the time frame for the analysis. (Temporal Boundary)

The temporal boundary should include consideration of past and future actions that may have impacted cultural resources within the spatial boundaries mentioned in CEQ Step 2, above. This includes identification of future undertakings, projected over a five-year period, which may trigger compliance with cultural resources requirements. Such information can be found in the Installation Master Plan and the ICRMP, both of which are updated on an annual basis, and revised every five years. For example, the Fort Bliss ICRMP has a detailed listing of projects (per fiscal year) for five years. Information on past actions can be found in inventories and surveys of specific resources, as well as mitigation prepared under those projects. An example study (archaeological resources) is provided under CEQ Step 4, below. The SHPO, as well as local and state historical societies, often has useful information on these regional resources.

CEQ Step 3 should include the following questions: What period do the sites represent? Are there temporal markers to indicate periods of occupation? Is there evidence of peaks in recent activity at any of the sites?

Questions to consider for the future time frame include:

- What is the time period required to upgrade the facility?
- What areas will be affected, if it is new construction?
- What is the time period for this construction activity?
- Has the area of proposed construction been surveyed for cultural resources?
- What are the potential effects that may linger beyond the construction phase? and
- What effects could reasonably be expected to occur within the foreseeable future?

CEQ Step 4–Identify other actions (past, present, foreseeable future) affecting the resources, ecosystems, and human communities of concern.

Present actions include both ongoing and past actions and new actions that may be in the construction stage. Information related to these actions can be obtained from installation organizations (directorates), local and county planning agencies, and the SHPO.

Identification of past actions can be aided by historical research and archaeological investigation. A good study can summarize current knowledge on the prehistory and history of the study area, providing a cultural context for interpreting and evaluating potential effects. Information on other actions can be obtained from the Real Property Master Plan (e.g. paving and repair of roads, driveways, replacement of sidewalks, repair/replacement of existing electrical and communications lines, etc.) The Fort Bliss ICRMP provides this type of information, dividing activities into two categories, Land Management and Real Property Maintenance (Bowman, 2000, Appendix B).

CEQ Steps 5, 6, & 7–Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to changes and capacity to withstand stresses; characterize the stresses affecting these resources and their relation to regulatory thresholds; and develop a baseline condition for these resources.

CEQ Steps 5, 6, and 7 describe the Affected Environment section of an EIS, is similar to that required for project-specific analyses. For, CEA, extended geographic and temporal boundaries are needed, and must encompass more resource or system interactions; as it must identify and characterize the effects (direct, indirect, and cumulative) of numerous other actions on those cultural resources. Baseline conditions provide the context for evaluation of environmental consequences (impacts), and should include historical cumulative effects, to the extent feasible.

The affected environment includes a description of the pertinent regulations, administrative standards, and development plans (CEQ, 1997a). The Army must administer, manage, and treat historic properties and cultural resources in accordance with the NHPA, NAGPRA, AIRFA, ARPA, EO 13007, and EO 13175 (USA, 1998b and DA PAM 200-4). Most compliance actions, however, involve the NHPA. The Army Alternate Procedures (AAP) (USA, 2004c) establish a proactive planning and management approach for NHPA compliance, precluding the usual, formal "project by project" review process prescribed by ACHP regulations (36 CFR 800) by establishing SOPs in consultation with stakeholders. (A bookmarked copy of the AAP is on the accompanying CD). Each installation ICRMP has a section devoted to compliance with the NHPA; this section becomes the basis of the installation's Historic Properties Component (HPC), or the collection of SOPs, under the AAP. As the decision to implement the AAP rests with the installation, some installations may not have an HPC in place. Other options, such as a Programmatic Agreement, can also be implemented to streamline the Section 106 review process.

Information about the resources and their characterizations can be found in various types of studies, such as a Historic Properties Survey/Building inventory, an Architectural Survey for an installation, and an Archaeological Survey. Examples of such studies (for Army installations) are provided below:

- National Register of Historic Places Eligibility Assessment of Ten Archaeological Sites at Fort Riley (Wrobleski, et al, 2004). This study provides relevant historic context (i.e., a brief history of Kansas and Fort Riley). This historic context provides a means to organize information about the past; by theme, place, and time. This information is used to determine the NRHP status of sites.
- National Register Evaluation of Five Prehistoric Stratified Archaeological Sites at Fort Leonard Wood (Ahler, et al, 2003). This study uses previous archaeological investigations on five sites and assesses NRHP eligibility and status for these sites. It provides detailed information on cultural history and geomorphology, previous archaeological investigations, and results of current archaeological investigations. This information is useful to characterize the resource and determine its significance.
- Geophysical Surveys in Archaeology: Guidance for Surveyors and Sponsors (Somers, et al, 2003).
- Archaeological Reconnaissance and Geomorphological Testing of 2,500 acres in Seven Training Areas at Fort Riley (Krejsa, et al, 2004).
- Needs Assessment for Historic Documents Management at Fort McPherson and Fort Gillem (Enscore, et al, 2003).
- Identification and Evaluation of Cold War Properties at Fort Bliss (Nowlan, 1999a)..
- National Register of Historic Places Multiple Property Documentation Form, Historic Cold War Properties at Fort Bliss (Nowlan, 1999b).
- Assessing the Potential for Traditional Cultural Properties of Historic Communities Associated with Fort Riley (Morrison, 2001).
- Native American Territorial Ranges in the Central Region of Texas (USACE, 2001a). This report was prepared to support NAGPRA consultation.

Other information on resource characterization and stresses can also be found in SOPs included in ICRMPs. Both the FLW and Fort Bliss ICRMPs contain several SOPs to address Section 106 compliance, as well as inadvertent/accidental discovery and treatment. Relevant information can also be found under the history, location, and setting sections of the ICRMP. The history of the installation provides information regarding dates when certain construction activities took place, and the evolution of the mission and training on the installation over time.

CEQ Step 8–Identify the important cause-and-effect relationships (pathways and linkages) between human activities and resources, ecosystems, and human communities.

The ICRMP requires internal procedures for consultation, survey, inventory, evaluation, treatment, recording, monitoring, emergency or inadvertent discovery, reporting, etc. This allows the process to be tailored for the particular conditions and specific requirements at the installation. Interface requirements, between cultural resources management programs and other program areas, should be identified. The coordination processes within the installation, Installation Management Agency (IMA), Headquarters Department of the Army (HQDA), regulatory agencies, and the interested public, should be defined (USA, 1998b, Chap 4-2, Step 6). In the Fort Bliss ICRMP, this information is found under the CRM Responsibilities, “The Players, Properties Subject to Section 106 Review,” and “Responsibility for Identification”.

CEQ Step 9–Determine the magnitude and significance of cumulative effects.

The cause-and-effect relationships for the specific VEC can determine the source of the effects (including those from other VECs), and frame the effects of all contributing actions. The final import of this total effect is determined by its magnitude, nature, and significance of the resource, and the amount of area that is disturbed. A critical component of this CEQ step involves the definition of an appropriate baseline or threshold condition for the VEC, beyond which significant degradation (or enhancement, if beneficial) of the VEC would occur. The baseline discussion and threshold determination should reflect changes in conditions over time, and trends that exist in the absence of the proposed action.

CEQ Step 10–Modify or add alternatives to avoid, minimize, or mitigate significant effects.

If significant effects from the proposed action are identified, the project proponent should avoid, minimize, or mitigate adverse effects by modifying or adding alternatives. By analyzing the cause-and-effect relationships resulting from cumulative effects, strategies to mitigate effects or enhance resources can be developed. Mitigation measures can be found in the ICRMP SOPs, as well as provisions to limit access to identified locations of cultural resources, to protect them from damage (USACE, 1998b, Chap 4, Step 8). Examples of other guidelines or studies include

- HABS/HAER/HALS Documentation
- HABS Guidelines: Guidelines for Architectural and Engineering Documentation, (National Park Service, 68 FR 139, July 2003).
- Historic American Buildings Survey: Level II Documentation of Building 431, Theater, and Building 439, Seaside Chapel at Patrick Air Force Base (Enscore, et al, 2004).

CEQ Step 11–Monitor the cumulative effects of the selected alternative and adapt management.

Monitoring is critical, to assess the accuracy of prediction and ensure the success of mitigation measures, and can identify the need to modify mitigation efforts. Adaptive management can establish a flexible program for achieving identified goals (CEQ, 1997b). Examples of two relevant studies include:

- Automated Tool for Monitoring Archaeological Sites (Meyer, et al, 2003).
- An Archaeological Site Monitoring Strategy for Fort Campbell in Kentucky and Tennessee (Kreisa, 2001).

4.3.6 Summary

There are many laws, regulations, and procedures that govern the management of cultural resources. These include consultation processes in which the SHPO (in each state or territory) is a significant participant in the Section 106 process, and the ACHP can be engaged during special situations (such as disputes between the Army and the SHPO). The ICRMP, required at each military installation, can be a vital cultural resources CEA resource. ICRMP SOPs can serve as guidelines for appropriate mitigation.

Reasonably-Foreseeable Future Actions are difficult to define for cultural resources. While project-specific information is readily available, the effects analysis, including CEA time frame must expand to encompass effects of further actions. While ICRMP information is usually confined within the installation boundary, the cumulative effects spatial boundary must often be more expansive. The applicable geographic boundary could be dependent upon the specific resource. (For example, for historic resources, it could be the community, city, state, tribal territory, and known (or possible) historic district). ICRMP information can be further supported by other focused installation studies identified in discussions of each CEQ step.

4.4 Noise Effects

4.4.1 Introduction

Noise issues are a major constraint on military activities (LaPorte, 2001) and can become very controversial within affected adjacent communities. Military noise impacts on the environs of a military installation and, accordingly, community reaction to that noise can reduce an installation's capability to train. The importance of these issues is magnified when the civilian population increases near the installation and adjacent land uses become incompatible with the effects of installation training. The goals of the Army noise management program, as articulated in AR 200-1 (USA, 1997a) are to protect the health and welfare of people on and off installations affected by Army-produced noise, and to reduce community annoyance from noise emitted by military activity, particularly training activity that involves noisy weapons and aircraft. The program seeks to achieve these goals in a manner consistent with an installation's military mission. AR 200-1 is included on the accompanying CD.

4.4.2 "Quick Look" Questions

Quick Look questions can be used to determine the need to address the direct and indirect effects of a proposed action on noise and, in addition, they can be used to determine if cumulative effects also need to be considered. These Quick Look questions include:

- Will the proposed action create noise zones (Zones 1, 2, or 3) that will extend off the installation?
- Does the proposed action increase the level or intensity of military activity?
- Does the proposed action include the use of noisier equipment (or munitions) than that historically used at the proposed site(s)?
- Are there any human populations or populations of sensitive animal species within the noise zones?
- Has the adjacent civilian community (nearest the location of the proposed action) complained about any noise associated with past or on-going activities?
- Are there local or regional controversies over noise levels at the installation that would indicate the need for CEA?
- Is additional cumulative effects analysis needed?

CEA Level:

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly; and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the "Detailed Analysis", Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

At the EA level, attention must be given to CEQ Steps 1–4 (the scoping steps) and CEQ Steps 6 and 7, describing the affected environment. The findings from these CEQ steps can be documented to serve as a "hard look", if it is determined that an EA is appropriate. However, if significant impacts are identified from consideration of CEQ Steps 1–4, 6 and 7, then an EIS is appropriate. For an EIS, all 11 CEQ steps should be addressed.

4.4.3 Impact Analysis Steps Defined by CEQ

CEQ Step 1 – Identify Significant Effects Associated with the Proposed Action and Define the Assessment Goals.

From the outset of any noise effects analysis, historic records should be reviewed. These include documentation of military noise issues at the affected installation; and should be readily available as a result of the Army's compliance with AR 200-1 (USA, 1997a), which includes well-established policies for noise issues. As part of these mandated procedures, existing noise contours should be available, as well as documentation of past noise complaints, their sources, and their resolution. These can be used to identify significant effects (CEQ Step 1), identify existing critical noise receptors, establish the geographic scope of the analyses (CEQ Step 2), and establish the noise baseline for the affected installation (CEQ Step 7). Once these past experiences have been characterized, the important sources of noise impacts can be used to assess the tools necessary to predict resultant project specific stresses and ascertain their regulatory import (CEQ Step 6).

Noise effects are generated by a variety of Army actions, some with analogies in the civilian community and some without. The Army for example, uses fixed-wing aircraft (planes) and rotary wing aircraft (helicopters), and engages a variety of heavy equipment in the performance of the Army mission. These are, generally speaking, the same types of impacts associated with similar civilian activities; from automobiles, trucks, trains, and other common noise sources. The Army also produces unique noise sources such as the firing and release of munitions from aircraft and artillery and arms firing during training exercises. Some of these noise sources, particularly those associated with civilian-like activities, emanate from the garrison, (the built-up) portions of the installation; while the truly unique source from the Army emanate from firing ranges and maneuver areas on other parts of the installation.

These impacts can be verified by public scoping, either new scoping to support CEA or using past records of noise complaints and their resolution. A review of past public interaction often will establish the tolerance level for noise levels through the NEPA process. The effects of mission noise can vary, but include physiological (health) effects, disruption and annoyance, structural damage, and disruption of wildlife (of particular import, threatened and endangered species (TES) or other sensitive species). Over the years, the Army has adopted (or developed) tools to address these impacts; predicting noise levels, establishing their acceptability, and mitigating their effects, when required or desirable. Ongoing noise producing installation operations are typically covered by the Operational Noise Management Program (ONMP), establishing the spatial relationship between predicted noise levels and the affected (surrounding) land uses. The ONMP was established in response to early noise assessment guidelines (FICUN, 1980). An example noise contour map is shown in Figure 4.4.1. As the technology has evolved for noise assessment and management, they have been reflected in Army policies and procedures. Further clarification of the process is available (Marlatt, et al, 1988).

A recently developed noise "primer" is available on the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) Web site. The "Tri-Service Community and Environmental Noise Primer: A Primer on Facilitating Community Involvement and Communicating with the Public" can help safeguard the installation mission, ensuring that Soldiers, Sailors, Airmen and Marines are trained and ready when needed. The primer is an introduction to Department of Defense (DoD) noise issues, management, and resources, with an overview on using community involvement to generate support for noise management planning and abatement activities. The entire primer is available electronically and can be downloaded or used from the web site, or is available in print with a companion CD that contains an "how-to" on community involvement, "ready-to-use" fact sheets, and direct Internet links to important Web sites and electronic resources.

These tools are intended for all DoD personnel who might communicate with the public about any noise-related matter including the garrison commander, master planner, and public affairs staff. It will also be useful to those who are likely to have noise management responsibilities. Installation personnel involved in noise management will vary from installation to installation, but will likely include range control, environmental management, and the Staff Judge Advocate's office. Many other installation personnel will also benefit from a better understanding of environmental noise and its impacts on both neighboring communities and military operations.

This primer is an initiative of the Defense Environmental Noise Working Group (DENWG). The DENWG provides the single authoritative voice for the DoD in the area of:

- Developing scientific and policy foundation for community/environmental noise effects, mitigation, prediction, noise management, and outreach capabilities
- Coordinating and recommending policy
- Endorsing official DoD noise models and databases
- Coordinating research between services
- Reviewing Service proposals

This Primer was developed by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) Operational Noise Program, Risk Communication Office, and WPI, a Virginia Tech affiliated corporation. The conversion of the Primer from an Army specific publication to a Tri-Service document was funded by the U.S. Air Force. The Primer is available in hard copy from USACHPPM Operational Noise Program or can be downloaded from their homepage http://chppm-www.apgea.army.mil/dehe/morenoise/.

The day-night level (DNL) is the primary descriptor for military noise, with the exception of small arms, and is shown in Table 4.4-1. The DNL is the time-weighted energy average sound level with a 10-decibel (dB) penalty added to the nighttime levels (2200 to 0700 hours). The DNL noise metric may be further defined, as appropriate, by the installation with a specific, designated time period (e.g.: annual average DNL, average busy month DNL). The typical assessment period over which the noise energy is averaged is 250 days for Active Army installations and 104 days for Army Reserve and National Guard installations. The use of average busy month DNL is appropriate when the op tempo is significantly different during certain peak periods of the year.

For future land use planning and encroachment assessment purposes, a reasonable annual growth factor in activity (e.g. 10 or 15 %) may be assumed.

Supplemental metrics, such as single event noise data (e.g. Peak, PK 15(met) or C-weighted sound exposure level (CSEL)), may be employed, where appropriate, to provide additional information on the effects of noise from test and training ranges. A-weighted maximum noise levels will be used to assess aviation low level military training routes (MTRs) and/or flight tracks.

The use of average noise levels over a protracted time period generally does not adequately assess the probability of community noise complaints. The risk of noise complaints from large-caliber impulsive noise (resulting from testing and training activities involving armor, artillery, mortars and demolition activities) should be assessed using a single event metric, either peak sound pressure level (Pk 15(met)) or a CSEL. The Pk 15(met) metric accounts for statistical variation in received single-event peak noise levels as a result of weather. It is the calculated peak noise level, without frequency weighting, expected to be exceeded by 15 percent of all events that might occur. If there are multiple weapon types fired from one location, or multiple firing locations, the single event level used should be the loudest level that occurs at each receiver location.

The assessment of noise risks from small arms ranges should use a single event metric, either Pk 15(met) or A-weighted sound exposure level (ASEL).

The Land Use Planning Zone (LUPZ) contour should be used to better predict noise impacts when levels of operations at airfields or large caliber weapons ranges are above average.

Available DoD noise assessment software should be used as the primary means of operational noise assessment; and noise maps (showing noise zones and limits) should be produced as defined in Tables 4.4-1 and 4.4-2.

Noise-sensitive land uses, such as housing, schools, and medical facilities are acceptable within the LUPZ and noise zone I, but are normally not recommended in noise zone II, and never recommended in noise zone III (See Table 4.4-1).

Single event noise limits in Table 4.4-2 indicate areas of low to high risk of noise complaints from large caliber weapons and weapons systems. These should be used to supplement the noise zones defined in Table 4.4-1 for land use decisions. Noise sensitive land uses are discouraged in areas between PK 15 (met) measures of 115 to 130 dB (medium risk of complaints), and strongly discouraged in areas when 130 dB or greater (high risk of noise complaints). For infrequent noise events, installations should determine if land use compatibility within these areas is necessary for mission protection. In the case of infrequent noise events, such as the detonation of explosives, the installation should communicate with the public prior to these noise events.

Transportation and industrial noise will be assessed on a case by case basis using appropriate noise metrics, including U.S. Department of Transportation guidelines.

Noise Zone III consists of the area around the source of the noise in which the DNL is greater than 75 decibels, A-weighted (dBA) or 70 decibels, C-weighted (dBC) for high energy impulsive events. Within the Noise Zone III noise-sensitive land uses are not recommended.

Noise Zone II consists of an area where the day-night sound level is between 65 and 75 dBA or 62 and 70 dB dBC. Within the Noise Zone II noise-sensitive land uses are normally not recommended and should be limited to activities such as industrial, manufacturing, and transportation and resource production. Where the community determines that these uses must be allowed, measures to achieve an outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB to 30 dB in Noise Zone II, from small arms and aviation noise, should be incorporated into building codes and be in individual approvals. The NLR for communities subject to large caliber weapons and weapons system noise is lacking scientific studies to accomplish the recommended NLR. For this reason it is strongly discouraged that noise-sensitive land uses be allowed in Noise Zone II from large caliber weapons.

Noise Zone I includes all areas around a noise source in which the day-night sound level is less than 65 dbA 62 dBC. This area is usually acceptable for all types of land use activities.

Noise Zone a, b, c, d	**Noise Limits**		
	Aviation ADNL	**Impulsive CDNL**	**Small Arms PK 15(met)**
I	< 65	< 62	< 87
II	65 – 75	62 - 70	87 – 104
III	> 75	> 70	> 104

CDNL = C-weighted Day-Night Levels
PK 15(met) = Single Event Peak Level exceeded by 15% of events
< = less than
> = greater than
N/A = Not Applicable

Table 4.4-1: *Noise Zones and Noise Limits.*

Risk of Noise Complaints	**Large Caliber Weapons Noise Limits PK 15(met)**
Low	< 115
Medium	115 – 130
High	130 – 140
Risk of physiological damage to unprotected human ears and structural damage claims	> 140

Notes:

a) Although local conditions regarding the need for housing may require noise-sensitive land uses in Noise Zone II, on or off post, this type of land use is strongly discouraged. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the noise-sensitive land use would not be met if development were prohibited in Noise Zone II.

b) Where the community determines that these uses must be allowed, measures to achieve and outdoor to indoor NLR of at least 25 dB to 30 dB in Noise Zone II, from small arms and aviation noise, should be incorporated into building codes and be in individual approvals. The NLR for communities subject to large caliber weapons and weapons system noise is lacking scientific studies to accomplish the recommended NLR. For this reason it is strongly discouraged that noise-sensitive land uses be allowed in Noise Zone II from large caliber weapons..

c) Normal permanent construction can be expected to provide a NLR of 20 dB, for aircraft and small arms, thus the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation, upgraded Sound Transmission Class (STC) ratings in windows and doors and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.

d) NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, and design and use of berms and barriers, can help mitigate outdoor noise exposure NLR particularly from ground level aircraft sources. Barriers are generally not effective in noise reduction for large arms such as artillery and armor or large explosions.

Table 4.4-2: *Risk of Noise Complaints*

The isopleths (contours) of a noise contour map delineate the different noise zones and, within these noise zones, acceptable land uses have been established. Numerous tools, for each specific noise source, are commonly used to produce the ONMP noise contours. These tools typically include computerized algorithms and software applications that address military-unique noise; and similar tools to address civilian noise sources are available. These are enumerated in the discussion of CEQ Step 6.

The models enumerated in CEQ Step 6 (or some comparable equivalent) are commonly used to establish the noise contours associated with various noise sources, such as military activities, airports, highways, or other noise sources in a region. If any significant sources exist in the region, they have likely been modeled, and some noise contour maps likely exist. If the noise source is new, for example due to a new training area or the relocation of one or more military units, some useful information may be available by obtaining data from the units' previous location or from locations that host similar units. As any federal actions in the region would be addressed under NEPA, existing EAs and EISs should be investigated. The Northwestern University NEPA Repository (http://www. library.northwestern.edu/transportation/searcheis.html) is a good centralized source for applicable EISs, though EAs are rarely included. The Repository can be used to characterize the noise issues within a region, illuminate past noise-related controversies, highlight major sources of noise, and provide useful information on mitigations, technical references, and indirect impacts associated with noise impacts in the region (CEQ Step 6).

The analysis of historical records should include a definition and examination of adjacent land uses (on land near the installation). These records can identify other noise sources that contribute to overall (cumulative) noise effects (required for CEQ Step 4), as well as identify sensitive current or future receptors.

Reasonably foreseeable future actions will require some consultation and collaboration with local planning or governmental agencies. These agencies should be easily identified at the installation level, as a proactive noise program (per AR 200-1) requires interaction with local land use authorities. These information sources can identify and provide future plans and identify future developments which could culminate in additional noise sources, the reasonably foreseeable components of the effect analysis process.

For the military noise sources of the effect analysis, the current noise contours, in conjunction with supporting data such as noise complaints and other aspects of the installation noise program, can identify those issues associated with current actions. These must be augmented based upon the characteristics of the proposed action, including type and nature of the noise, frequency and duration of noise generation, weather conditions, etc. Tools to address these noise sources are addressed in the predictive guidelines for CEQ Step 6, as well as the means for combining different noise sources to produce a composite measure. The real issues/impacts occur when predicted noise levels exceed the land use compatibility guidelines, especially for sensitive receptors such as residential dwellings, schools, etc., also enumerated under the guidelines for CEQ Step 6.

CEQ Step 2–Establish Geographic Scope of the Analysis.

The geographic scope of the noise effect analysis can be established during CEQ Step 1. Cumulative effects analysis must include all past, present, or reasonably foreseeable noise effects, particularly if they overlap the projected contours of the existing installation noise effects, including those associated with the proposed action. While these other noise sources must be identified, the aerial extent (geographic scope) of the CEA can be defined as the outer geographic limit of the direct noise effects. It is critical to realize that the geographical area impacted by noise can be significant, sometimes extending many miles beyond the installation boundary.

CEQ Step 3 – Establish the Time Frame for Analysis.

From a cumulative effects perspective, a broader, overall temporal scale must be established to encompass all applicable (or relevant) PPRF actions that affect noise within the region of influence (ROI). Going back in time, the effected environment was once unaffected by man's (or Army) activities. This historical analysis can often be based upon critical points in time (e.g. points at which the prevailing (ambient) levels of impact changed), establishing an earlier start date for the analysis of PPRF actions. These can certainly predate Army land use and subsequent noise sources, but must also evaluate other historical sources of noise and their temporal origins. If land uses prior to Army use were rural or agricultural in nature, the temporal start for past noise effects can probably be best handled in aggregate and general terms.

Similarly, reasonably foreseeable future actions must be included in the CEA, expanding the temporal timeframe for CEA analysis beyond the present time. These actions can include those envisioned by long-range Army plans, comprehensive community or regional development plans, or similar planning actions from which potential and likely future actions can be identified. Software applications that forecast community population growth are available.

These temporal boundaries for PPRF analyses can be illustrated as shown in Figure 4.4-2. Relative, not necessarily absolute, scales can be established along this continuum, as shown in the figure.

* **Unaffected environmen**t (indigenous cultures, background noise)

* **Occupation/settlement** (residential/ agricultural noise sources)

* **The industrial revolution** (industrial/commercial noise sources)

*I**nstallation arrival** (military noise)

* **Growth/urban development** (airport/traffic noise, industrial commercial noise)

* **THE PRESENT**

. *****Future, reasonably foreseeable action** (future noise sources)

. • Army Transformation

. • Regional development

.

{aggregate/general measures} {ICUZ/present} {estimates for the future}

----------------Timeline-->

{TOTAL EFFECTS, INCLUDING CUMULATIVE---}

Figure 4.4-2: *Temporal Boundaries*

This temporal representation can be used to establish useful perspective for the public and the decision maker; (1) identifying other noise sources and their origins (CEQ Step 4), (2) establishing the nature and temporal extent and visual characterization of the noise baseline (CEQ Steps 5 and 7), (3) depicting the various noise sources and their effects (CEQ Step 8), (4) evaluating the significance of direct, indirect, and cumulative effects (CEQ Step 9), and (5) evaluating the effects of potential mitigations (CEQ Step 10).

These temporal boundaries are very important for those VECs that represent an irretrievable or irreversible resource use. While noise issues are normally short-term in nature, and long-term effects are rare, some resource decisions regarding other VECs are long-term and consequential. In such cases, the trends between the spatial boundaries are very important. Classic cases of such long-term trends (often visually depicted) include urbanization (a build-up) and deforestation (resource extraction).

CEQ Step 4–Identify Other Actions Affecting the Resources, Ecosystems, and Human Communities of Concern.

Other noise sources can include other military sources, or can include civilian noise sources. Noise sources can originate on and off the installation, and can be military or civilian in nature. These new, additional sources must be evaluated, and incorporated into the current installation noise map. If their effects (contours) overlap those of the combined existing ONMP and proposed action's direct noise effects, these new noise sources must be included as part of the required PPRF actions. It is appropriate to consider the impact of on-post and off-post noise sources on communities on both sides of the installation boundaries.

Once the broader ROI has been established, other key noise sources can be tabulated and evaluated, using appropriate tools. These potentially include highways, airports, power plants, railroads, other non-military noise sources, blast noise (e.g. stone quarries, etc.), and heavy manufacturing, to name a few. To identify other actions that could affect the noise levels, existing sources can be identified and researched. This can be done through collaboration within the region through scoping, and can be supplemented with independent research, such as the analyses of past EAs and EISs (see discussion of CEQ Step 1). A valuable technique includes any time spent in the community listening to the acoustic environment and conversing with residents. If direct and/or indirect noise impacts have been identified, other actions that affect those resources, ecosystems, and human communities of concern must be identified. This includes all action in the region, regardless of the source.

The NEPA Repository has been used to investigate potential cumulative effects for one Army installation (USAEC, 2004), and these initial results are discussed in Section 2.4.

This study created a Leopold matrix (Leopold, 1971) to relate Army actions to potential direct and indirect environmental effects and illustrate the inter-relationships that exist between direct and indirect (occurring at a different location or point in time) effects. As a result of cause-effect relationships, indirect effects often appear under other VECs. This matrix indicated that the noise effects themselves create indirect effects on biological resources (habitat disturbance, effects on flora/fauna (including common wildlife, invertebrates and fish, aquatic and terrestrial organisms, and TES), species diversity and mortality, and breeding and migration behaviors), geology (seismic shaking and landslides), and sociology (public annoyance).

In addition to summarizing direct and indirect impacts and their sources (the activities that caused them), this study also identified contributing sources of impacts from other agencies (including other DoD agencies), as required by and the CEQ CEA guidance. The EISs for these other agencies readily identified the attributes or VECs affected by their actions/activities. These identified contributions are a firm basis for effects analysis, and a conceptual summary of the Fort Irwin findings are shown in the following figure. As shown in the matrix, other environmental effects in the Fort Irwin region are attributable to waste disposal facilities, mining, resort development, other DoD operations, power generation facilities, pipelines, and commercial development. While the entire matrix is too large to display, the conceptual approach is apparent-the identification of other regional activities that impact on a given attribute/VEC.

A similar study can be performed for any installation, and may prove valuable in the performance of CEQ Steps 1, 4, 5, 6, 7, and 8. Though desirable, a similar, separate study may prove impractical. In such cases, some research has produced more general, complementary notions of various general operations and their effects (EIT, 2004) that relate potentially affected VECs to regional activities that might also affect those VECs.

Such findings, much as the referenced Fort Irwin study, are general in nature; but can be used to prompt and guide the consideration of other actions in the defined region.

CEQ Step 5–Characterize the Resources, Ecosystems, and Human Communities Identified During Scoping in Terms of Their Response to Change and Capacity to Withstand Stresses.

Once existing noise contours have been established, combined with the effects of the proposed action and reasonably foreseeable actions and compared to existing land uses, the effects have been reasonably characterized. The impacts and receptor response can be either long-term or short-term, depending on the nature and response of the receptor.

Two temporal aspects (different than considerations in CEQ Step 3) must be considered in analyzing direct and indirect noise impacts: the time of day (day or night) and the long-term versus short-term nature of the effects. Acceptable levels of noise are generally much lower at night than during the day (Luz, 2004), so the DNL levels account for this by adding a penalty of 10 decibels (dB) to noise events occurring between 10:00 p.m. and 7:00 a.m. Although some noise impacts are short-term in nature, they have been evaluated as averages over time. While previous work (Novak and Goff, 1977, Hottman, 1986, U.S. Air Force, 1990, U.S. Army, 1996, NRC, 1977, Lipscomb and Taylor, 1978, and others) dating back to the origins of regulatory concern over noise (NPAA, 1970, Title IV to the Clean Air Amendments of 1970 (PL 91-604), USEPA, 1972c and 1974, and others) have focused on long-term averages, more recent and emerging noise analysis techniques focus on extreme, instantaneous, or impulse events. Average noise levels, evaluated by metrics such as DNL, provide an assessment of the overall noise environment, but loud individual noise events also play an important role in determining community reaction, and typically trigger noise complaints and other community attempts to curtail the offending noise. The Army is engaged in research and development efforts to better understand the effect of individual loud noise events, and has provided interim tools and guidance based on the best information currently available.

The other temporal considerations include the times when receptors are most sensitive to the stress. Humans, and some wildlife, are generally thought to be uniformly more sensitive to noise effects at night due to rest/sleep expectations. Some wildlife species have exhibited considerable adaptability to stresses associated with Army impacts, including noise (Hayden, 1994, 1999a, and 1999b, Hayden, et al, 2003, Carter, et al, 1994, Delaney, et al, 2002, Pater, et al, 1999, and Trame, 1997). The final receptor response (impact) may also differ in the case of nocturnal animal species. Wildlife species are particularly sensitive to such effects during breeding or birthing/nesting timeframes. The severity of these impacts and their respective sensitive time frames (actual months or weeks of sensitivity) vary by species, and are the subject of ongoing research. A summary of available information regarding response to noise by both humans and animals may be found in the International Bibliography on Noise (IBON) contained on the accompanying CD.

CEQ Step 6–Characterize the Stresses Affecting These Resources, Ecosystems, and Human Communities and Their Relation to Regulatory Thresholds.

Metrics that are used to characterize sound levels include a technique called frequency weighting. One characteristic of sound is the frequency, or pitch. The human ear is more sensitive to sounds of about 1,000 to 3,000 Hertz (Hz), and less sensitive at higher and lower frequencies. Therefore, it is appropriate to apply a weighting function to the noise spectrum that will approximate the response of the human ear. The A frequency weighting function de-emphasizes the lower and higher frequency portion of the noise spectrum to approximate the human ear's response. The A-weighting approach is used to evaluate transportation (vehicle and aircraft), small arms, and continuous noise sources. A-weighting is not necessarily appropriate for species other than human, since animals may have quite a different hearing range and sensitivity. The lower threshold of human hearing is 0 dB. Illustrative and typical A-weighted decibel levels for adjacent sounds (Thurman and Miller, 1990 and Powell and Forrest, 1988) include: soft whispers (30 dBA), background noise in a wilderness or rural setting (35-50 dBA), freeway auto traffic (65 dBA), and jet takeoff (120dBA).

The C-weighting scale does not de-emphasize low frequency sound energy to the extent that the A-weighting does. It is used to better assess the annoyance caused by low frequency vibration of structures excited by impulsive noise. Impulsive noise generated by larger caliber weapons (>20 mm, e.g. armor, mortars and artillery) and demolition activity, is rich in low frequency sound energy. These weighting functions are specified by the American National Standards Institute (ANSI, 1986) standard.

There are times when infrequent, loud events may generate complaints in areas that are outside of the Noise Zones, as illustrated on ICUZ maps. A small number of loud noise events averaged over a long time period, yield a small average level, even though the individual noise events may be quite disturbing, perhaps even loud enough to exceed the threshold for hearing damage. Since DNL is based on an average, there are times when there are not enough operations to generate a noise contour of significant magnitude, though people might still question why they can hear and feel the effects of training noise at their home. In these instances, it is useful to supplement the Noise Zones or ICUZ maps with information on instantaneous or single event noise levels. Average noise levels such as DNL, have been shown to correlate with long-term community annoyance, and are used to guide decisions regarding land use that is compatible with the noise environment. The single event levels can be used to anticipate the risk of community disturbance and adverse reaction, such as noise complaints caused by infrequent noise events. Noise experts use three measurements to describe the noise of single noise events: maximum level, peak level, and sound exposure level. At most Army installations, sound level meters, capable of measuring maximum level, are available in the Preventive Medicine section of the local medical facility. In some cases, other sound level meters capable of measuring peak or sound exposure level, are also available.

The characterization of noise effects is normally accomplished using computer software applications that address the various different noise sources. For the ICUZ maps, specific models are used to address military noise sources. These include the following models:

> BNOISE2™ (Hottman et al. 1986) has been a standard tool for assessing military noise impacts for over 25 years, and has recently been modernized and improved. It was developed by the Construction Engineering Research Laboratory (CERL), a part of the Corps of Engineers Engineer Research and Development Center (ERDC). BNOISE2™ is used to assess noise impacts from large caliber weapons and explosions. The software package includes a database of sound source emission characteristics for Army weapons, and accounts for source directivity and spectrum of muzzle blast, projectile detonation and projectile sonic boom. BNOISE2™ enables use of average or single event metrics, and allows a wide range of assessment periods. Output consists of contours for chosen metrics and level values; detailed statistical values for single event metrics at specific locations can also be calculated. The BNOISE2™ software requires input of operational data concerning types of weapons fired from each range or firing point, as well as information regarding locations of firing and projectile impact. To use average metrics such as DNL, it is critical to have accurate data regarding number and timing of firing operations, since this directly determines the value of average metrics and thus the accuracy of the assessment. These data may not be readily available. The BNOISE2™ software may be obtained by contacting Larry.L.Pater@erdc.usace.army.mil, or by mail at USACERL, 2502 Farber Drive, Champaign, IL 61821. A Web site will soon be available for downloading the software.

SARNAM™, an acronym for Small Arms Range Noise Assessment Model (U.S. Army 1996), was recently developed by CERL. It is a software application designed to assess small arms (rifles, pistols and shotguns) noise impacts. The software incorporates the latest available information on weapons noise source emissions (including directivity and spectrum) for both muzzle blast and projectile sonic boom, and incorporates sophisticated sound propagation algorithms and community response protocols for small arms noise. It is particularly useful for exploring the effect of new or retrofit noise mitigation and safety structures such as walls, berms, and ricochet barriers. SARNAM™ enables both average and single event noise metrics. Input data requirements and output data formats are similar to those described above for BNOISE2™.

The NOISEMAP computer software application is the official DoD tool for military airfield noise impact assessment. This program was developed for the U.S. Air Force by Wyle Laboratories (U.S. Air Force 1990a). The required input to the program includes the location of the flight tracks and the number of each type of aircraft using each flight track, obtained from airfield operational data. A revised Army helicopter database was added to NOISEMAP in 1993.

The RMTK Noise Tool, which is one element of the new Range Manager's Tool Kit (RMTK), is a simplified tool for evaluating the noise impacts associated with range operations. The RMTK Noise Tool is based on BNOISE2™ and SARNAM™. It is easy to learn and use, but does not include many features of the more complex software packages. Developed by CERL and originally named RONIP (Range Operators' Noise Impact Predictor), the RMTK Noise Tool produces single-event estimates in terms of peak level contours, as opposed to the long- term averages associated with the ICUZ process. This software is intended for noise management by training range operators, and can be very useful for NEPA and CEA applications, as it provides an efficient means to evaluate alternate siting locations for new proposed ranges.

RNM (Rotocraft Noise Model) is new software developed by NASA that calculates the noise footprint of rotary wing aircraft using new, sophisticated calculation techniques. The noise source emission characteristics account for directivity and spectral acoustic energy distribution.

Civilian noise sources can be addressed using a variety of similar tools, below is one example:

The Traffic Noise Model (TNM) (http://www.trafficnoisemodel.org) was developed and released by the Federal Highway Administration (FHWA) as a means of predicting noise impacts in the vicinity of highways. It models five standard vehicle types, including automobiles, medium trucks, heavy trucks, buses, and motorcycles, as well as user-defined vehicles.

Past and present actions may be accurately described by existing noise estimates and contours, from past or existing studies, such as the documents obtained in CEQ Step 1. The proposed action and other reasonably foreseeable future actions will require some further analysis at either a screening or a detailed level, based upon the nature of their likely effects. These likely future actions can be identified through consultation with local planning or governmental agencies (CEQ Step 1). Once all PPRF actions have been identified and their cumulative contours have been estimated, respective acceptable land use patterns can be used to evaluate the compatibility or incompatibility of existing land uses; and appropriate mitigations can be taken. For military noise sources, these contours may be used to establish Army Compatible Use Buffers (ACUBs).

Noise prediction using any of the noise prediction models is subject to the intensity and duration of the actions producing the noise, weather conditions (wind speed, cloud cover, etc.), and the topography. For purposes of cumulative effects analysis, some noise templates for various noise sources and levels of activity can be presented, representing worst-case scenarios for the various noise sources that may be part of an Army CEA action. If the noise templates developed for CEA analyses do not overlap within the selected geographic region, no further cumulative noise analysis is required. If such overlaps do occur, detailed analysis must be completed and addressed as a composite noise impact, for all noise sources combined. While these templates may be used to determine the need for a composite overlay of cumulative noise effects, it is important to note that such combined noise effects are not simply additive.

While no specific noise criteria are legislated, impacts are regulated through the requirement for consistent matching of noise sources (and their impacts) and affected land use within the various noise Zones I-III. Noise impacts should not exceed the thresholds (criteria) established in AR 200-1 for each of the Army noise zones (introduced in CEQ Step 1). These land use criteria reflect considerable concern for the effects of noise on human populations (USEPA, 1972 and 1974 and FICUN, 1980), and these approaches have proven effective over the years. Noise levels can be mitigated, reduced to acceptable levels or limited to particular time periods; eliminated, often through relocation of the noise source; or managed, through land use controls.

As the Army undergoes transformation, some future noise trends are evident, and certainly relevant to reasonably foreseeable Army actions, and, subsequently, their reasonably foreseeable direct and indirect effects. Weapon systems are becoming smaller, more agile, lighter, and quieter. In a modern battlefield environment, unnecessary noise is undesirable; quieter, stealth-like battlefield operations are preferred. As a result, noise levels will likely be reduced within the various categories of equipment. Similarly, a transition from some legacy systems such as larger, noisier howitzer configurations are being replaced by less disruptive alternatives such as more accurate, guided missile technologies that tend to be quieter during warhead launch, though similar upon delivery. For a given level of training, the source of most installation impacts within the continental United States, more simulators will likely be used, in lieu of actual field training with attendant noise impacts. While some actual in-field training will occur, it will be proportionately less. Overall, noise impacts from a given category of activity and for each individual noise source, will likely diminish.

In addition, the new warfare doctrines focus on larger, more widely dispersed operations. This greater dispersion can lessen the overall severity of impacts at a given site, and tends to dilute overall noise impacts. These future operations are also accomplished by smaller units of action (UAs) equipped with more sophisticated technologies, and provide greater situational awareness on the battlefield. This superior awareness allows the more focused and efficient use of munitions during actual field training (as well as during actual combat).

CEQ Step 7–Define a Baseline Condition for the Resources, Ecosystems, and Human Communities.

The baseline conditions for noise are normally established during CEQ Step 1, using the existing noise contours, from installation noise contour maps. For CEA, any existing overlapping noise source contours (normally not included in the determinations) must be evaluated, and added, if applicable, as discussed in CEQ Step 4.

As part of the Army's noise management guidelines and policies, complaint records are routinely kept and evaluated. These records can be used to supplement the noise contour maps and any composite maps made in support of effects analysis. Such records are a means to evaluate the response of the noise receptors (the adjacent community) to past and present noise levels, and to assess their likely response to future predicted levels.

CEQ Step 8 – Identify the Important Cause-and-Effect Relationships between Human Activities and Resources, Ecosystems, and Human Communities.

The cause-effect relationships for direct noise impacts are well-known (Schomer, 1983a and 1983b), and are adequately reflected in the models identified in CEQ Steps 1 and 6. All of these computer tools capture similar relationships between noise pressure waves, propagation and transport of these waves (under different atmospheric conditions) in the natural environment, dissipation during transport, and mechanisms to measure overall receptor dosage or exposure over time.

Noise-induced vibration, associated with many Army noise sources, can represent significant impacts (NRC, 1977 and Schomer, 1987). Impulse (C-weighted) noise can produce severe vibration effects that can affect structures (NRC, 1977). The acceleration rate of the vibrations is used to measure and assess these effects. The overall vibration that will cause an adverse impact for any condition and time period corresponds to a root mean square (rms) value above 0.0036 meters per second squared (mpss). This level should not be exceeded for hospital operating rooms or other such critical areas. For residential and other similar areas, continuous acceleration of even greater values is normally expected to cause virtually no complaints (less than one percent). Even greater acceleration values can be permitted for shorter times during the hours of 7 a.m. to 10 p.m. Similarly, the maximum value of the impulsive shock (vibration) can be raised (with no appreciable complaints), depending on the number of such impulses in the daytime. For residential areas or other areas where people sleep, the nighttime peak should be less than 0.01 mpss at any time, and the continuous rms acceleration should remain below 0.005 mpss. For office spaces, the acceptable levels are twice the daytime residential rms or peak values; and no distinction is made between daytime and nighttime exposure. For factory or similar spaces, the thresholds can rise to four times the daytime residential values, and again, there is no distinction between daytime and nighttime values.

The potential structural damage of these vibrations is usually first indicated by window damage and damage to plastered walls or ceilings. These can be estimated and addressed using simple calculations.

The cause-effect relationships for some indirect noise impacts are more difficult to address. Both humans and animal species respond differently to noise, though human response is often used as a proxy. Human physiological responses are well known, varying from severe health effects, both long-term and short-term, to annoyance, which can be extremely variable, depending on conditions. The response of wildlife to noise effects is more difficult to determine, as discussed previously, though some species have shown considerable resilience to such effects (Hayden, 1994 and 1999, Hayden, et al, 2003, Carter, et al, 1994, Delaney, et al, 2002, Pater, et al, 1999, and Trame, 1997). Some species are less tolerant, particularly during specific periods such as mating and birthing. Janssen (1980) described three levels of impact of noise to wildlife. Primary effects include hearing damage leading to temporary or permanent loss of hearing. Secondary effects include alteration of behavior to include startle response or movement away from the noise, or inducement of the physiological stress response. Tertiary effects lead to population-level changes, including increased mortality, reduced reproductive rate, or habitat abandonment. While the effects of aircraft noise have been studied on a variety of wildlife species; less is known about the effects of artillery firing and other Army-induced effects, but research is ongoing. While the long-term viability of many sensitive species is in question, these same species often exist and flourish on military installations. As these installations often provide the last bastion of suitable habitat for these species, some compatibility with military stresses is implied, particularly when the habitat exists near ongoing military operations.

As discussed under CEQ Step 4, these cause-effect relationships cross into VECs other than noise. Two presentation techniques can be used to capture and illustrate the cause-effect relationships between direct and indirect impacts or effects. In addition to matrix technique, a network representation can be useful, as shown in the following figure:

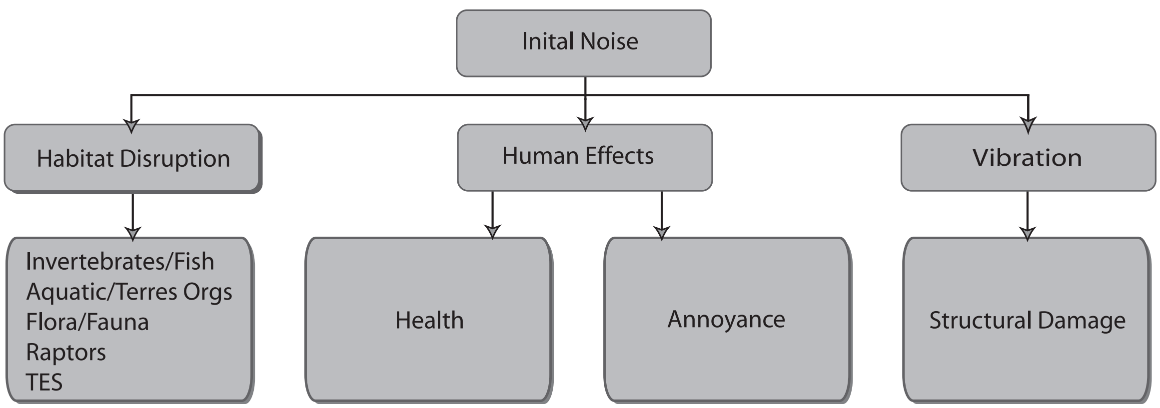

Figure 4.4-3: *Direct and Indirect Impact Network for Noise.*

CEQ Step 9–Determine the Magnitude and Significance of Cumulative Effects.

The magnitude of combined effects can be established through the use of worst case noise templates, or if warranted through the use of specific computer tools to produce cumulative measures of impact. The significance of the impacts is determined by the comparison of affected receptors to the acceptable compatible land uses specified in AR 200-1. These land use criteria reflect an effective means for establishing when significant effects are present, and can be used to select and implement effective mitigation strategies (CEQ Step 10). These noise zone comparisons do not automatically imply significance, unless there are affected populations that fall within the zones. As a result, the significance of these noise impacts may be based upon both present and likely future land uses for those areas with the noise contours.

The comparisons of noise levels, the predicted noise levels of the proposed action and other commonly recognized noise levels, can establish useful perspective. Human response to noise (or annoyance) varies, however. Reactions to desirable events are less annoying than those associated with others (such as an Army training event). These representative measures do not mean that a noise impact is acceptable to the receptor; but can only be used to establish perspective.

CEQ Step 10–Modify or Add Alternatives to Avoid, Minimize, or Mitigate Significant Effects.

Any incompatibilities between predicted noise impacts and existing land uses can often be mitigated in a variety of ways. These mitigations may include: altering the proposed action by time of day; frequency or duration of firing; structural modifications to reduce major vibration effects; modification or establishment of compatible adjacent land uses, in some cases, to prevent future conflicts; and a variety of other measures including adaptive environmental management (AEM).

As promoted through AR 200-1, sound land use planning is the primary means through which noise impacts can be addressed. This approach requires the determination of the three noise zones and procedures to insure that generated noise levels are acceptable. In some cases, this may require comprehensive noise management plans; but in all cases, coordination and collaboration with local planning and governmental agencies is essential (PMC, 1990). This joint land use planning is supported and promoted by both DoD and Army policies, and must be implemented to eliminate noise as an encroachment issue at Army installations.

Considerable research has focused on mitigations of noise effects, both noise source reductions (Pater, 1994a) and structural protection (FAA, 1992 and Pater, 1994b). These mitigations apply to both base operations and training operations. In general, mitigations for O&M noise sources include convoy coordination, generator placement/location, noise/vibration absorption, noise barriers/walls, and land use planning/zoning (PMC, 1990). Similar general mitigations for training actions include siting/location of facilities and actions, coordination of activities to account for sensitive receptors, barrier walls/enclosures, and land use planning/zoning (Ibid). These mitigations and management requirements must be implemented in the context of a comprehensive noise management plan, which ensures that effective mitigations are completed.

CEQ Step 11–Monitor the Effects of the Selected Alternative and Adapt Management.

The monitoring of effects is consistent with the management provisions and requirements of AR 200-1. These requirements call for comprehensive management of environmental issues at an installation, tactical and strategic mechanisms to minimize effects, and comprehensive coordination with surrounding communities to insure fewer conflicts between Army activities and subsequent direct and indirect effects. For the resolution of contentious issues, in which actual effects are uncertain, solutions may require collaborative approaches and adaptive environmental management (AEM).

This CEQ step can easily be integrated with the EMS requirements that are currently being developed and implemented in the Army, pursuant to EO 13148 "Greening the Government Through Leadership in Environmental Management" (EOP, 2000). This final step in the CEQ CEA process is consistent with Army doctrine and a recognized shortcoming of traditional NEPA practice; and, as discussed in Section 3.4, such integration is desirable.

4.5 Soil Erosion Effects

4.5 Soil Erosion Effects

4.5.1 Introduction

Soil erosion, a natural process, is accelerated by many military and civilian activities within a given landscape. Soil erosion, and other associated impacts, undermine the ability of the natural environment to support the Army mission; and once the erosion process has started, the direct effects usually cannot be reversed. The most important source of soil erosion impacts, vehicle traffic, is summarized in the literature (Anderson, et al, in publication). This reflects considerable ongoing Army research and support of evolving Army policies and management to reduce the effects of soil erosion.

4.5.2 Quick Look Questions

Quick Look questions can be used to determine the need to address the direct and indirect effects of a proposed action on soil erosion; in addition, they can be used to determine if cumulative effects also need to be considered. Quick Look questions include:

- Does the proposed action involve a new range or maneuver area, or does it extend beyond the existing boundaries of either?
- Is the proposed site effectively managed as part of an installation ITAM program?
- Does the proposed action increase the level of intensity of military activity at the site?
- Is the site characterized by “gullies” and or/poor vegetative cover on the site?
- Are there sensitive downstream land uses, and has sedimentation/pollution been a downstream issue in the past?
- Will permafrost be significantly impacted?
- Is additional cumulative effects analysis needed?

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant direct, indirect and cumulative impacts on the VEC, an EA level of documentation is required. This “hard look” need not be extensive or costly; and can be quite brief as discussed in the “Quick Look’ segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis “in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public” (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous effects analysis is required, and should be evaluated at an EIS level of analysis as discussed in the “Detailed Analysis”, Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

At the EA level, attention needs to be given to CEQ Steps 1-4, the scoping steps, and CEQ Steps 6 and 7, describing the affected environment. Documentation of the findings from these steps could serve as a hard look, if it is determined that an EA is appropriate. However, if potentially significant concerns are identified from consideration of CEQ Steps 1-4, 6 and 7, then an EIS would be appropriate. For an EIS, all 11 CEQ steps should be addressed.

4.5.3 Impact Analysis Steps Defined by CEQ

CEQ Step 1 – Identify Significant Effects Associated with the Proposed Action and Define the Assessment Goals.

From the outset of any soil erosion effects analysis, historic records should be reviewed. These include documentation of soil erosion issues at the subject installation, which can be found in required installation management plans and can also be gleaned from local controversies (such as sedimentation in a downstream recreational lake or valued or ecologically important stream). Major controversies often result from the subsequent, indirect effects of soil erosion such as sedimentation in streams, stream turbidity, effects on aquatic species, etc., and should be readily identified from the implementation of the Army's ITAM program through AR 350-19 (USA, 2005) and associated guidance. The ITAM program is both comprehensive and effective as a source of information; and given its genesis and evolution, provides a comprehensive means to address the cumulative effects of soil erosion on Army training lands. As subsequent paragraphs will show, all aspects of the CEQ methodology are present in an effective installation ITAM program.

AR 350-19, "Army Sustainable Range Program", provided on the accompanying CD, establishes the objectives, responsibilities, and policies for the Army's ITAM Program. It identifies necessary procedures to achieve optimum and sustainable use of Army training lands. This comprehensive program, implementing a uniform land management regimen, includes the periodic inventory and monitoring of land conditions, integration of training requirements with land carrying capacity, education of land users to minimize adverse impacts, and the provision of required training land rehabilitation and maintenance.

Army procedures implementing the ITAM Program (USA, 1999a) describe how each ITAM component contributes to the overall sustainability of a well-trained and equipped combat force, through sound environmental stewardship of natural and cultural resources on lands under the control of the Army. These procedures are included on the accompanying CD.

The ITAM Five-year Plan (KSU, 2002) identifies, over the long-term, installation funding requirements for the sustainment of its ranges. This plan becomes a tool to assist the ITAM coordinator in the production of the Workplan Analysis Module (WAM), and provides the supporting justification for ITAM requirements. These guidelines for development of the ITAM five-year plan are included on the accompanying CD.

Army technical guidance (USA, 1999a and 1999b) provides information for ITAM installations to implement a successful RTLA program, one that provides a scientifically valid baseline and long-term monitoring data. This data is required to address short-term and long-term objectives, and to support informed stationing decisions, mission change analysis, and ecosystem management activities. This guidance is included on the accompanying CD.

Given these specific Army initiatives and the more-general requirements of AR 200-1 (U.S. Army, 1997a), included on the accompanying CD, an ongoing and proactive Army management program is in place for Army maneuver, firing, and training ranges. These records can be used to identify significant effects (CEQ Step 1), identify existing critical natural resource issues, establish the geographic scope of the analyses (CEQ Step 2), and establish the soil erosion baseline for the affected installation (CEQ Step 7). Once these ongoing and past experiences have been characterized, the important soil erosion sources, and any of their historic and potentially significant secondary issues can be identified. The appropriate tools can then be arrayed to predict resultant project-specific stresses and ascertain their regulatory import (CEQ Step 6).

The Army has numerous programs and management initiatives to minimize environmental damage to Army training lands. The principal mechanism for this management is the ITAM program, as previously discussed.

The soil erosion effects of mission activities stem primarily from construction activities and training activities (on maneuver areas and firing ranges). Soil erosion effects are generated by a variety of Army actions, but are similar, to large extent, to the same soil erosion effects associated with civilian activities and their impacts. Army activities affect soils in the same general manner: surface vegetation is removed, soil particles are subsequently dislodged by wind or water, and the transport of these soil particles creates numerous indirect or secondary effects, which are discussed in more detail in CEQ Step 4. These indirect effects are generally more important than the direct effect, which is the actual soil erosion, as they contribute to the degradation of other VECs deemed important from the standpoint of regional stakeholders.

The applicable general soil erosion models are discussed in CEQ Step 6. These, or some equivalent, comparable models, are commonly used to address soil erosion from civilian applications, such as agricultural activities.

If any significant soil erosion issues exist in the region, they have likely been evaluated in other NEPA analyses and documentation. As any federal actions in the region would be addressed under NEPA, existing EAs and EISs should be investigated. The Northwestern University NEPA Repository (www.library.northwestern.edu/transportation/searcheis.html) is a good centralized source for applicable EISs, though EAs, increasingly more important as a data source, are rarely included. The Repository can be used to characterize these and other related issues within a region, illuminate past controversies, highlight major sources of these controversies, and provide useful information on mitigations, technical references, and indirect impacts associated with these impacts in the region (CEQ Step 6).

The Army has numerous programs and management initiatives to minimize environmental damage to Army training lands. The principal mechanism for this management is the Integrated Training Area Management (ITAM) program, as previously discussed.

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The analysis of historical records should include a definition and examination of uses for land adjacent to the installation. These records can identify other soil erosion and related issues that contribute to overall, cumulative effects (required for CEQ Step 4).

Reasonably foreseeable future actions will require some consultation and collaboration with local planning or governmental agencies. These information sources can identify existing plans and future developments which could culminate in additional impacts. The existence of these impacts can be easily verified by public scoping, using new scoping to support CEA, or using past NEPA or ITAM (and related) documentation.

CEQ Step 2 – Establish Geographic Scope of the Analysis.

The geographic scope of direct soil erosion impacts is very localized, limited to the actual construction or training site on which the proposed action occurs. However, effects analysis also requires the consideration of indirect effects, as identified and discussed in CEQ Step 1. If the indirect effects are created through water erosion, the appropriate extent of the geographic scope would be determined by the downstream watershed, following the effects of soil sediments as far as they are felt (measurable). Other PPRF actions contributing to cumulative effects must include other activities in that same watershed. As a result, for water-based soil erosion, the real extent or geographic scope of the entire effects analysis, including CEA, is defined as the outer geographic limit of the affected watershed (See Section 4.8).

For wind-based erosion, the determination of an appropriate geographic scope is much more difficult, as once soil particles become airborne, they contribute to air pollution, specifically particulates. The geographical spatial boundaries for considering such cumulative air quality effects should include the county or counties where the training range is located, as well as the air quality control region or regions encompassing the range. These boundaries are chosen because they represent typical geographical boundaries used for emission inventory data compilation, determination of attainment (or non-attainment) of ambient air quality standards, and the delineation of appropriate air quality management strategies within the pertinent State Implementation Plan (SIP). These indirect effects are more appropriately addressed under the Air Quality VEC (Section 4.1).

CEQ Step 3 – Establish the Time Frame for Analysis.

The temporal aspects of a soil erosion effects analysis must be bracketed or defined by both the past and future time at which these direct and indirect effects are felt or not felt. In the case of stream water quality, or the quality of the airshed, there was some past time during which the streams and air existed in their natural state, unaffected by man’s activities. This would be one logical time frame to initiate a true appreciation for the cumulative effects of man's activities over time. Future temporal limits are best ascertained by the future limits on watershed or airshed alterations from the proposed action. In some cases, the deterioration of watersheds and airsheds has slowed, and their conditions are still improving; while in other cases, considerable work remains.

As the historical temporal aspects of the effected landscape are characterized, a recurring cycle of conditions will likely occur. Prior to settlement and exploitation by man, the landform was in a natural state; covered by natural vegetation and subject to only minor disruption by the wildlife that occupied that landform. Commonly, these lands were, at some time, opened for farming and ranching operations; a use of the landform that gave rise to accelerated erosion patterns. As a result of these landform alterations, soil erosion became a national issue; epitomized by the "dust bowl" period that affected many of these areas, including those where many Army installations exist today. This national resources emergency led to the development of the R&D programs that produced the models, methods, computer tools, and mitigation/management procedures that are used and recommended in this document. Many of the current Army installations were created from the legacy of these periods; and, over time, military stewardship of these lands have proven better, from a stewardship perspective, than the preceding civilian land use. When such temporal situations are evident, they should be presented. Likewise, if these lands became degraded, prior to the implementation of the ITAM program, this trend should also be noted; and the long-term objectives of the ITAM program, for that landform, can be used to address future trends.

When wildlife effects are included in the effects analysis as indirect effects, temporal considerations may include the times when receptors are most sensitive to the stresses of the effects. Some wildlife species may be particularly sensitive during breeding or birthing/nesting/spawning time frames. The severity of these impacts and their time frames (actual months or weeks of sensitivity) vary by species. In the case of stream sedimentation, the impacts might be manageable in a temporal sense; but the best management/mitigation option remains the complete elimination of the direct effect, and the resultant elimination of all the indirect, and often more significant or controversial, effects.

The aforementioned temporal considerations deal with the time exposure of actual direct and indirect impacts. From a CEA perspective, a broader, overall temporal scale must be established to encompass all applicable or relevant PPRF actions within the geographic scope of the CEA. If previous land uses, prior to Army use, were rural or agricultural in nature, the temporal start for past effects can probably best be handled in aggregate, and in general terms.

Similarly, reasonably foreseeable future actions must be included in the CEA, expanding the temporal time frame for CEA analysis beyond the present time. These actions can include those envisioned by long-range Army plans, comprehensive community or regional development plans, or similar planning actions from which potential and likely future actions can be identified.

These temporal boundaries for PPRF analyses can be illustrated as shown in Figure 4.5-1. Relative but not necessarily absolute scales can be established along this continuum, as shown in figure.

* **Unaffected environment** (indigenous cultures, minor induced erosion)

* **Occupation/settlement** (residential construction/ agricultural disruption---accelerated erosion)

* **The industrial revolution** (industrial/commercial construction)

* **Dust Bowl** (major resource disruption and impacts)

* **Installation arrival** (military stewardship and effects)

* **Growth/urban development** (construction/sprawl effects)

* **THE PRESENT**

. * **Future, reasonably- foreseeable action** (future noise sources)

. Army Transformation

. Regional development

{aggregate/general measures}{ITAM /present} {estimates for the future}

----------------Timeline-->

{TOTAL EFFECTS, INCLUDING CUMULATIVE --}

Figure 4.5-1: *Temporal Boundaries for Soil Erosion*

Such temporal representation can be used to establish useful perspective for the public and the decision maker in; (a) identifying other soil erosion sources and their origins (CEQ Step 4), (b) establishing the nature and temporal extent and visual characterization of the soil erosion baseline (CEQ Steps 5 and 7), (c) depicting the various soil erosion sources and their effects (CEQ Step 8), (d) evaluating the significance of direct, indirect, and cumulative effects (CEQ Step 9), and (e) evaluating the effects of potential mitigations (CEQ Step 10).

These temporal boundaries are very important for those VECs that represent an irretrievable or irreversible resource use. Soil erosion issues such as the loss of soil, reduction in landform productivity, etc., is both long-term and consequential. As a result, the best management involves stabilization and management to preclude erosion. Army lands, in order to sustain long-term training, must remain viable and be maintained in good condition.

CEQ Step 4–Identify Other Actions Affecting the Resources, Ecosystems, and Human Communities of Concern.

Other erosion sources can include other military or civilian sources. Any activities in the watershed or airshed must be included. Once the broader ROI has been established, other key erosion sources can be measured. Potentially, these include construction, agricultural, recreational, and other military or non-military sources. To identify other actions that could affect erosion, existing sources can be identified and research may be required. This can be done through collaboration within the region, through scoping, and can be supplemented with some independent research, such as the analyses of past EAs and EISs (see discussion of CEQ Step 1). If direct and/or indirect soil erosion impacts are identified, other actions that affect the soil erosion VEC must be identified. These include all actions in the region, regardless of their source. The NEPA Repository has been used to investigate potential cumulative effects for Fort Irwin (USAEC, 2004).

This study created a Leopold matrix (Leopold, 1971) to relate Army actions to potential direct and indirect environmental effects and illustrate the inter-relationships that exist between direct (immediate) and indirect (occurring at a different location or point in time) effects. As a result of cause-effect relationships, indirect effects often appear under other VECs, such as biological resources (habitat disturbance, effects on flora/fauna (including common wildlife, invertebrates and fish, aquatic and terrestrial organisms, and TES), species diversity and mortality, and breeding and migration behaviors), water resources (increased flooding, disturbance of natural drainages, groundwater or surface water contamination, sedimentation and stream deposition, and disturbance of wetlands/floodplains), and air quality (air emissions and NAAQS, fugitive dust emissions, and visibility/aesthetics).

In addition to summarizing direct and indirect impacts of soil erosion and their sources (the activities that caused them), this study also identified contributing sources of impacts from other agencies, including other DoD agencies, as required by the CEQ CEA guidance. The EISs for these other agencies readily identified the VECs affected by their actions/activities. These identified contributions are a firm basis for CEA analysis, and a conceptual summary of the Fort Irwin findings are shown in the following figure. As shown in the matrix, other environmental effects in the Fort Irwin region are attributable to waste disposal facilities, mining, resort development, other DoD operations, power generation facilities, pipelines, and commercial development. While the entire matrix is too large to display, the conceptual approach is apparent-the identification of other regional activities that impact on a given VEC.

A similar study can be performed for any installation, and may prove valuable in the performance of CEQ Steps 1, 4, 5, 6, 7, and 8. Though desirable, a similar, separate study may prove impractical. In such cases, some research has produced more general, complementary notions of various general operations and their effects (EIT, 2004). These findings, much as the referenced Fort Irwin study, are general in nature; but can be used to prompt and guide the consideration of other actions in the defined region.

CEQ Step 5–Characterize the Resources, Ecosystems, and Human Communities Identified During Scoping in Terms of Their Response to Change and Capacity to Withstand Stresses.

Once an appreciation for the overall soil conditions and dynamics of the affected watersheds and airsheds has been achieved, the impacts, and receptor response (in the case of biological resources), can be determined either long-term or short-term, depending on the nature and response of the environment/receptor. Some physical responses such as gulley formation, are irreversible from an ecological perspective; while others such as air or water pollution, disruption of species or habitat, etc., may be more easily mitigated and are generally temporary and/or reversible. Fortunately, the often more significant indirect effects are the least permanent and reversible over time, while the direct impacts, though often less controversial, are permanent and irreversible.

The Army management of training lands has evolved, over the last decade, to embrace both environmental stewardship, and their direct and essential relationship to the sustainment of long-term Army mission goals. Stimulated initially by the stresses of seemingly contradictory requirements for stewardship and mission support (LaPorte, 2001), the Army adopted a more holistic approach to training land management; one which adopts the tenets of the CEQ CEA guidelines. Recognizing that management of single training events had historically proven inadequate to sustain these ranges over time, this more comprehensive approach focuses on the ”carrying capacity” of the land (total stresses on these ranges) and the relationship between use (maneuver impact miles), condition of the land, and required maintenance to meet desired goals.

The Army approach focuses on the cumulative erosion conditions on the training lands, eliminating the previous event-by-event approach to land management; and complying well within the CEQ CEA guidelines. This approach has been articulated in installation guidelines (USA, 1999a and 1999b) which (a) estimate training land carrying capacity, to support maintenance and optimal use for realistic training, and (b) establish mechanisms that predict and secure required land rehabilitation and maintenance requirements based on training usage. This approach ensures the active and ongoing characterization of the issues (CEQ Step 5), analysis of stresses and thresholds (CEQ Step 6), establishment of baseline conditions (CEQ Step 7), analysis of cause-effect mechanisms (CEQ Step 8), establishment of the magnitude and significance of effects (CEQ Step 9), design and implementation of mitigations (CEQ Step 10), and monitoring of predicted effects, adapting management along the way (CEQ Step 11). All of these issues and concepts have been included in a new composite approach to sustainable Army range management through AR 350-19, The Sustainable Range Program (USA, 2006).

CEQ Step 6–Characterize the Stresses Affecting These Resources, Ecosystems, and Human Communities and Their Relation to Regulatory Thresholds.

The prediction of water-based soil erosion is usually based on the Universal Soil Loss Equation (USLE) (Wischmeier and Smith, 1978); and the Wind Erosion Equation (WEQ) model is commonly used to predict wind-based soil erosion (Woodruff and Siddoway, 1965, and Skidmore, 1970). Both general purpose tools evolved through extensive research initiated and supported by the U.S. Department of Agriculture (USDA), to address the soil erosion effects associated with agricultural land uses. Over several decades of research and implementation, these tools take the form of nomographs and models that can be used to estimate soil loss.

The USLE has been modified to address military actions and their associated stresses (Sullivan, et al, 2000). The WEQ can be used directly, without modification, as military stresses are directly comparable to their civilian counterparts. These tools can be used to estimate and evaluate impacts, in terms of acceptable levels, and significance can be determined (CEQ Step 9).

Erosion prediction using any of a variety of models derived from the WEQ or USLE, is subject to the intensity and duration of the actions producing the erosion impacts, some of which are unique to the military. As part of the research supporting the ITAM program, considerable military-specific research has been accomplished (Grein, 1997, Skidmore, et al, 2002, and Riggins, et al, 1981). In addition, much of this research has addressed some of the indirect effects of soil erosion (Riggins, et al, 1984 and 1989). A majority of this research, in addition to evaluating the fundamental mechanisms of cause (military activities) and effect (erosion), has expanded to establishing stress thresholds based on the ability of the natural environment, under various conditions, to support levels or intensities of military stress (Anderson, et al, 1999, Sullivan, et al, 2000, van Donk, et al, 2003, and MacAllister, et al, 2003).

Independent of regulatory or statutory thresholds, installation training land managers can approach thresholds (levels of “acceptable” erosion) from a variety of vantage points. Given the critical value of the training mission, the importance of national security, and the critical life-value of soldier training; considerable erosion could be tolerated to meet these important objectives. For example, training may be so important that any level of site degradation is acceptable. While this may still occur in extreme cases, the Army has come to realize that the long-term mission is best sustained through the establishment of more thoughtful thresholds (see CEQ Step 5).

A more reasonable scientific approach can be established. USDA, in support of agricultural applications, has established measures of unacceptable, or "accelerated" erosion (T values), specific to given geographic locations and soil types, and reflecting numerous local considerations. Such thresholds can be used as one mechanism to establish the significance of cumulative effects (CEQ Step 9). As the ITAM program has matured, a methodology for establishing thresholds for specific Army training lands has been developed. It is a multi-objective approach that incorporates Army stewardship responsibilities, mission needs, and budgetary needs and constraints. These thresholds drive the long-term five-year plans for the management of these training lands, and recognize the compatibility of well-maintained lands with Army training requirements and the increased carrying capacity that stewardship enables.

Some indirect soil erosion effects are extensively regulated, either directly or indirectly, by statute. The Clean Water Act (CWA) and the Clean Air Act (CAA); as well as their amendments and subsequent federal, state, and local implementation; establish a variety of constraints that affect both military and civilian activities. While such issues fall into the domain of another VEC such as the water quality VEC, they can become a critical part of the more-comprehensive (multi-VEC) CEA. Furthermore, the indirect effects can include impacts prohibited by statute, as in the case of the Endangered Species Act (ESA). For example, ESA impacts can emerge through the resultant deposition of soil particles in streams (sedimentation) and the detrimental effects these particles can have on critical in-stream aquatic habitat requirements. Similarly, the ESA can become an environmental issue for terrestrial species if the direct/indirect impacts (such as vegetation, gulley formation, etc.) alter a TES habitat beyond its ability to recover.

The assessment of indirect watershed effects often requires very specific water quality models, reflecting the regional stream characteristics, weather characteristics, and soil and geologic characteristics, among other variables. Soil erosion CEA analysis from Army lands may lead to the analyses of indirect effects; sediment loads, turbidity, and inevitable effects of these issues on the biology of receiving streams (Riggins, et al, 1984 and 1989, Peirson, et al, 2002, Pelletier, 2002, and USN, 2004). This issue is much easier on the water quality VEC than other effects such as chemical and/or related toxic pollution from Army training lands.

Within the last decade, new, more holistic approaches (NRC, 2001b, and WMC, 1991) are being investigated for the management of stream water quality. These approaches promise to produce a more effective regulatory approach, accounting for regional and stream-specific variability; and they will be included in future methodological development for the surface water VEC.

As the Army undergoes transformation, some trends are evident and certainly relevant to reasonably foreseeable Army actions and their reasonably foreseeable direct and indirect effects. Weapon systems are becoming smaller, lighter, and more agile, and include more wheeled vehicles replacing some tracked vehicles in the Army inventory. While research on these changes is still underway, it is possible that some changes may reduce soil erosion for a given level of activity. Similarly, a transition from some legacy systems may create less disruptive alternatives.

For a given level of training, which is the source of most installation impacts within the continental United States, more simulators will be used in lieu of actual field training with its attendant impacts. While some actual in-field training will occur, proportionately, it will occur less often.

In addition, the new warfare doctrines focus on larger, more widely dispersed operations. This greater dispersion can lessen the overall severity of impacts at a given site, although more land is affected and tends to dilute overall effects. These future operations are also accomplished by smaller Units of Action, equipped with higher technologies and providing greater situational awareness as an advantage on the battlefield. This superior awareness allows for more focused and efficient field training (as well as during actual combat).

CEQ Step 7–Define a Baseline Condition for the Resources, Ecosystems, and Human U.S. Communities.

The baseline conditions for direct erosion effects and other, indirect effects, are normally established during CEQ Step 1, using existing data from the various Army environmental management policies and guidelines.

As part of the Army's natural resource management, specifically the ITAM program, landscape conditions such as vegetative cover and soil surface conditions, have been documented and trends established for Army training ranges (USAEC, 1999). These same tools establish the relationship between this monitoring data and training activity on those ranges.

CEQ Step 8–Identify the Important Cause-and-Effect Relationships between Human Activities and Resources, Ecosystems, and Human Communities.

The cause-effect relationships for direct soil erosion impacts are well-known and are adequately reflected in the models identified in CEQ Steps 1 and 6. These models reflect the state of the art for erosion prediction that has been established by USDA over several decades, and modified to reflect military activities and their impacts (Grein, 1997, Skidmore, et al, 2002, and Riggins, 1981). In addition, they have been incorporated into the more proactive management practices of the Army (Anderson, et al, 1999, Sullivan, et al, 2000, van Donk, et al, 2003, and MacAllister, et al, 2003).

The indirect soil erosion cause and effect relationship impacts, while well established in the literature, are less developed in general, and are likely to be very site specific, as the mechanisms are often framed by the specific environmental setting. However, some of these relationships have been documented (Riggins, 1984 and 1989), and are available for general use in the CEA process. In the case of air quality and water quality issues (from wind and water erosion, respectively), relevant and pragmatic application of the cause-effect mechanisms are readily accomplished. The impacts on biological resources are less defined, in terms of cause-effect. Animal species respond differently to the indirect effects of soil erosion, including effects on habitats. The response of wildlife is less known, and some may have considerable resilience to such effects; although aquatic or stream-oriented species are more-likely affected. Some of these species are less tolerant, particularly during specific periods such as mating, birthing, etc. Tertiary effects result in population-level changes, including increased mortality, reduced reproductive rate, and/or habitat abandonment.

As shown on the sample Leopold matrix for direct and indirect impacts (discussed under CEQ Step 4), these cause-effect relationships cross into VECs other than soil erosion. Two presentation techniques can be used to capture and illustrate the cause-effect relationships between direct and indirect impacts or effects. In addition to matrix technique, a “network” representation can be useful. Such a representation is shown in Figure 4.5-2.

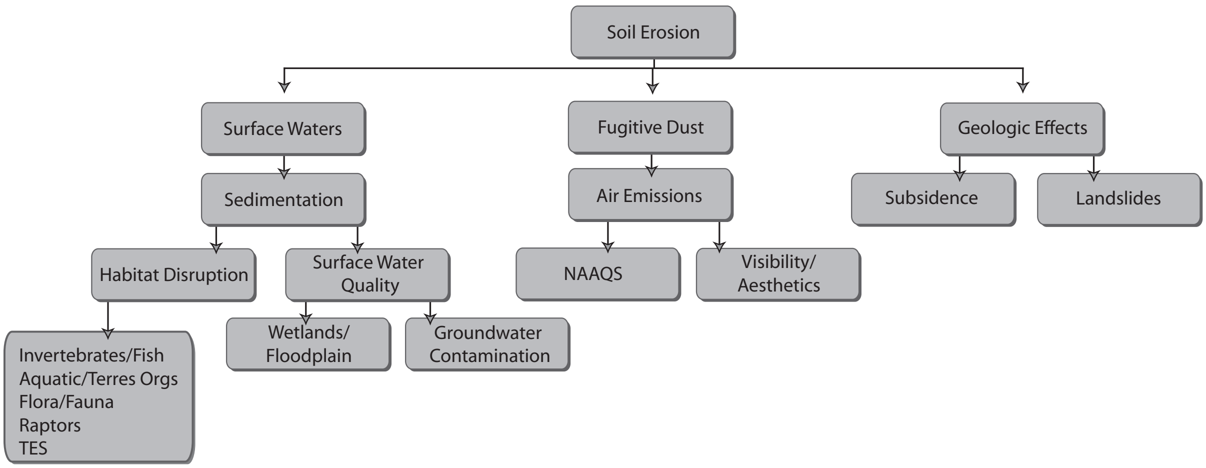

Figure 4.5-2: *A Network Representation of Direct and Indirect Soil Erosion Effects*

CEQ Step 9–Determine the Magnitude and Significance of Cumulative Effects.

The magnitude of direct soil erosion can be established as discussed in CEQ Step 6.

The significance of these impacts must be based on the intensity and severity of the impacts; as well as their irreversible and/or irretrievable nature. Given the long cause-effect chain of impacts that follows the water erosion and sedimentation stages, the point at which soil particles are dislodged and transport begins, it becomes apparent that early erosion prevention or early capture of the soil particles is essential. This concept gains additional support when the irreversible/irretrievable aspects of the process are analyzed. For example, the reclamation of a site exhibiting gully erosion is very difficult, and, even if successful, could not duplicate the original soil conditions such as texture, profile, permeability, etc.

The long-term Army range maintenance policies and guidelines support this proactive approach. Supported by considerable Army research on the fundamental mechanisms for analyzing such significance (Vaughn, et al, 1983 and Riggins, et al, 1979), the concept of carrying capacity can now be used to eliminate significant impacts, by managing training stresses on the landscape (Anderson, et al, 1999, Sullivan, et al, 2000, van Donk, et al, 2003, MacAllister, et al, 2003).

Indirect effects are more difficult to address in a cumulative sense. As they are mostly outside the soil erosion VEC, they are not discussed in this section.

CEQ Step 10–Modify or Add Alternatives to Avoid, Minimize, or Mitigate Significant Cumulative Effects.

Direct and indirect soil erosion impacts are best addressed early in the erosion cause-effect process, prior to the dislodging and transport of soil particles as sediment. In the case of stream sedimentation, the impacts might be manageable in a temporal sense; but the best option would likely be complete elimination of direct effects, and the resultant elimination of all the indirect and often more significant, or controversial, effects. This can be best addressed through the maintenance of surface vegetation cover, as the disruption of such cover is a prerequisite for both the water and wind erosion processes. This is best accomplished through the application of carrying capacity concepts, limiting the stresses from military training to stay below the ecosystem's natural ability to support them.

When disruption of the vegetative cover and soil surface is inevitable, as with many construction activities, soil erosion can often be contained using Best Management Practices (BMPs). A good source of BMPs is available at http://www.cabmphandbooks.com/Construct.asp

A body of research has been developed which supports the re-vegetation of Army ranges and evaluates alternative species (Ostler, 2002, and Hinchman, et al, 1990). Also, some additional management alternatives have been evaluated for a variety of specific applications (Riggins, 1987).

CEQ Step 11 – Monitor the Effects of the Selected Alternative and Adapt Management.

The monitoring of effects is consistent with the management provisions and requirements of AR 200-1. These requirements call for comprehensive management of environmental issues at an installation, tactical and strategic mechanisms to minimize effects, and comprehensive coordination with surrounding communities to ensure fewer conflicts between Army activities and subsequent direct and indirect effects. For the resolution of contentious issues for which actual effects are uncertain, solutions may require collaborative approaches and adaptive environmental management (AEM).

This CEQ step can easily be integrated with the EMS requirements that are currently being developed and implemented by the Army pursuant to EO 13148, "Greening the Government Through Leadership in Environmental Management" (EOP, 2000). This final step in the CEQ CEA process is consistent with Army doctrine and a recognized shortcoming of traditional NEPA practice; and, as discussed in Section 3.4, such integration is desirable.

4.6 Threatened and Endangered Species

4.6 Threatened and Endangered Species

4.6.1 Institutional Requirements

Over the years, laws have been enacted to conserve and protect natural resources. The 1960 Sikes Act (USC, 1960) was the first legislation to specifically promote conservation and management of natural resources on military lands. The Sike Acts mandated the protection and enhancement of fish, wildlife, and the ecosystems on which they depend, and promoting these lands and game for public recreation. Just over a decade later, the Endangered Species Act (ESA) (USC, 1973) became a critical mechanism in the conservation of vulnerable natural resources; ensuring the protection of plants, wildlife, and fish threatened with extinction, as well as the ecosystems upon which they are dependent. The ESA also promote vital cooperation between federal, state, and local agencies in the conservation of natural resources.

The ESA defines relevant terms as follows: "Endangered species are in danger of extinction throughout all or a significant portion of its range." "Threatened species are at risk of becoming endangered in the near future throughout all or a significant section of their range." "Critical habitat consists of specific areas within or in certain circumstances outside the geographical area occupied by the species on which are found those physical or biological features essential to its conservation and that may require special management considerations or protection." "Federally listed" is not an ESA term; but refers to species that have been federally designated as endangered or threatened. Although they are afforded no protection under the ESA, Candidate Species are also of concern to federal agencies because they are warranted for listing but precluded by higher listing priority actions. Consideration of these species early in the process can avoid complications by preparing the action agency in case a candidate species is proposed for listing or is listed prior to or during implementation of the proposed action. It is also possible that modifications to a proposed action could help preclude the need to list a candidate species, thus avoiding possible complications/restrictions in the future.

AR 200-3, Natural Resources-Land, Forest and Wildlife Management (USA, 1995)[1], enumerates the Army policy for natural resources management. It provides the framework for the conservation, management, and rehabilitation of natural resources on Army lands, in conjunction with federal statutes and regulations, using Integrated Natural Resources Management Plans (INRMPs). INRMPs apply to the management of all installation natural resources, incorporating ESA and Sikes Act requirements. AR 200-3 also delineates Endangered Species Management Plans (ESMPs) which are required for each listed and proposed species, as well as critical habitat on military lands. However, terminology has been revised from endangered species management "plans" to "components" to reflect that endangered species management on installations is an integral component of natural resource management activities on Army installations. Therefore ESMPs are now considered Endangered Species Management Components (ESMCs). ESMCs are installation-specific and included in the installation INRMP; ESMCs outline the present knowledge of the species or critical habitat on the installation, the Army goals for the ESMC, the interrelationship between the species or habitat and military training, and the need for continual monitoring of the species or habitat. The ESMCs are thus used to balance federal regulations with the military mission, and are reviewed annually.

The Sikes Act frames the military responsibility to promote natural resources conservation and rehabilitation on military land. The required strategy is described in the INRMP, collaboratively developed with the U.S. Fish and Wildlife Service (FWS) and state agencies. The plan identifies possible conflicts and actions required to meet federal and state regulations, and integrated the strategy with the military mission.

Section 7(a)(2) of the ESA requires federal agencies to consult with the appropriate regulator (FWS or the National Oceanic Atmospheric Agency – Fisheries [NOAA Fisheries]) if a proposed action authorized, funded, or carried out by them may affect a listed species or critical habitat. Pursuant to Section 7(a)(4) of the ESA, Federal agencies must confer with FWS or NOAA Fisheries on proposed actions that are likely to jeopardize proposed species or result in the destruction or adverse modification of proposed critical habitat. During consultation, a biological assessment or other evaluation document must be developed that assesses the proposed action's effects on listed species. If the action agency determines that the proposed action will not likely adversely affect the listed species or critical habitat and FWS or NOAA Fisheries concurs, then consultation concludes and no formal consultation is required. If the action agency determines that a proposed action will likely adversely affect a listed species or critical habitat, then formal consultation is initiated. Formal consultation results in a Biological Opinion by FWS or National Marine Fisheries Service (NMFS) which concludes whether the proposed action is likely to jeopardize the continued existence of the species and/or will result in destruction or adverse modification of critical habitat. For "non-jeopardy" opinions, an incidental take statement (if applicable) will be issued if take is anticipated. The incidental take statement will include the number of authorized take and non-discretionary reasonable and prudent measures that the installation must undertake to minimize the incidental take. If a "jeopardy" opinion is issued, potential impacts are indicated, reasonable and prudent alternatives are recommended that would avoid the likelihood of jeopardizing the listed species or the destruction or adverse modification of designated critical habitat, and measures to minimize the effect are listed. If "jeopardy" or "adverse modification" can not be avoided, an exemption from the ESA may be requested by the action agency.

4.6.2 ESA Requirements and Definitions

Prior to addressing cumulative TES effects, the Endangered Species Consultation Handbook (FWS/NMFS, 1998) should be reviewed, as it discusses biological assessments, and their preparation by proponent agencies for proposed actions. The Web site for the handbook minus the appendices, is http://endangered.fws.gov/consultations/s7hndbk/s7hndbk.htm (The accompanying CD includes a link to this Web site).

This handbook includes the following chapters related to definitions, policies, and regulatory requirements, developed in response to the ESA:

- Ch. 1 – General information (introduction to ESA, Section 7 consultation, and agency responsibilities)
- Ch. 2 – Coordination (coordination with other ESA functions, with the action agency and applicant, between FWS and NMFS, with other federal agencies, with state agencies, and with tribal governments)
- Ch. 3 – Informal consultation (the informal consultation process; identification, resolution, and conservation; technical assistance; biological assessments; and concurrence/non-concurrence letters)
- Ch. 4 – Formal consultation (the formal consultation process; initiating formal

consultation; evaluating initiation packages; formal consultation procedures; components of a formal consultation including the biological opinion and the need to address cumulative effects, and incidental take statements; procedures for modifying biological opinions and incidental take statements; handling classified documents; protection of confidential business information; and distribution of final formal consultation documents)

- Ch. 5 – Special consultations and reviews (proactive conservation reviews, national consultations, regional or ecosystem consultations, streamlined consultations, and incremental consultations)
- Ch. 6 – Conference (the need for conference, informal conference, and formal conference)
- Ch. 7 – Early consultation (eligibility for early consultation, procedures, and confirmation as a final biological opinion)
- Ch. 8 – Emergency consultation (the need for emergency consultation and procedures for handling emergency consultations)
- Ch. 9 – Monitoring and reporting (monitoring implementation/effects of reasonable and prudent alternatives and measures, and tracking collective effects on species and their habitats)

An extensive review of each chapter's direct or indirect applicability to CEQ's 11-step CEA process is included in Section 4.6.10 of this manual.

The following handbook appendices, although not included on the Web site, can be obtained from the FWS:

App. A – Regulations and Policies Relating to Consultation
App. B – Formats for Consultation
App. C – Examples of Consultation
App. D – FWS Solicitor Opinions
App. E – U.S. Fish and Wildlife Service Intra-Service Consultation Handbook
App. F – FWS/NMFS Offices Handling ESA Section 7
App. G – Exemption Process
App. H – Interagency Memorandum of Agreement on Streamlined Consultations

Key information related to biological assessments in Chapter 3, includes the following (FWS/NMFS, 1998, pp. xi, 3–10 and 3–11):

- A biological assessment refers to a report prepared by or under the direction of a federal action agency, to determine whether a proposed action is likely to: (a) adversely affect listed species or designated critical habitat; (b) jeopardize the continued existence of species that are proposed for listing; or (c) adversely modify proposed critical habitat. The outcome of this biological assessment determines whether formal consultation or a conference is necessary (50 CFR §402.02, 50 CFR §402.12).
- A biological assessment must be prepared for major construction activities (construction projects or other undertakings having similar physical impacts) considered "major federal actions significantly affecting the quality of the human environment," as referenced in NEPA. These typically include dams, buildings, pipelines, roads, water resource developments, channel improvements, and other such projects that modify the physical environment. As a rule, if an EIS is required for the proposed action and construction-type impacts are involved, it is considered

a major construction activity. The biological assessment shall be completed before any contract for construction is entered into and before construction is begun. (50CFR402.12(b)(2))

- The action agency is not required to prepare a biological assessment for actions that are not major construction activities, but, if a listed species or critical habitat is likely to be affected, the agency must provide the FWS or NMFS with a documented basis for evaluating the action's likely effects.
- A biological assessment is required if listed species or critical habitat may be present in the action area, optional for only proposed species or proposed critical habitat. However, if both proposed and listed species are present, a biological assessment is required, and must address both proposed and listed species.
- The biological assessment should address all listed and proposed species found in the action area (not just those listed) and the proposed species that are likely to be affected. The biological assessment determines whether the proposed action is likely to adversely affect listed species and critical habitat; addressing all species. Such assessment can determine the need for conference with FWS or NMFS, as well as the need for formal consultation.
- The federal action agency may designate the applicant or a non-federal representative (often a consultant) to prepare the biological assessment, although the action agency is responsible for the content of the assessment, and for the findings of effect.
- The contents of biological assessments prepared pursuant to the Act are largely at the discretion of the action agency, although the regulations provide the following list of items to be considered for inclusion (50 CFR Section 402.12, Part (f)):
  (1) The results of an on-site inspection of the area affected by the action to determine if listed or proposed species are present or occur seasonally.
  (2) The views of recognized experts on the species at issue.
  (3) A review of the literature and other information.
  (4) An analysis of the effects of the action on the species and habitat, including consideration of cumulative effects, and the results of any related studies.
  (5) An analysis of alternate actions considered by the federal agency for the proposed action.
- Biological assessments are not required to analyze alternatives to proposed actions.

Finally, regarding biological assessments, 50 CFR Section 402.12 Part (g) notes the following:

If a proposed action requiring the biological assessment is identical, or very similar, to a previous action with a biological assessment, the federal agency can fulfill biological assessment requirements by "incorporating by reference" the earlier biological assessment, adding any other supporting data (from other documents) pertinent to the consultation, into a written certification that:

(1) The proposed action involves similar impacts to the same species in the same geographic area;

(2) No new species have been listed or proposed or no new critical habitat designated or proposed for the action area; and

(3) The biological assessment has been supplemented with any relevant changes in information.

As mentioned, biological assessments must include a CEA on the species and habitat, though the ESA definition of cumulative effects is narrower than CEQ's definition. These two differing definitions are as follows:

- ESA-related definition – Cumulative effects are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR §402.02). This definition applies only to ESA Section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws (FWS/ NMFS, 1998, p. xii).
- NEPA-related definition – Cumulative impact is the effect on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actins regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (CEQ, 1978, Section 1508.7).

In addition, the following definitions are relevant to the ESA Section 7 process (FWS/NMFS, 1998, pp. xi – xvi):

- Biological opinion – a document which includes: (a) the opinion of the Fish and Wildlife Service or the National Marine Fisheries Service as to whether or not a federal action is likely to jeopardize the continued existence of listed species, or result in the destruction or adverse modification of designated critical habitat; (b) a summary of the information on which the opinion is based; and (c) a detailed discussion of the effects of the action on listed species or designated critical habitat. (50 CFR §402.02, 50 CFR §402.14(h))
- Critical habitat – for listed species, the critical habitat consists of: (1) the specific areas within the geographical area occupied by the species at the time it is listed, in accordance with the provisions of ESA Section 4, on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species and (b) which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed, in accordance with the provisions of Section 4 of the Act, upon a determination by the Secretary of Interior that such areas are essential for the conservation of the species. (ESA §3 (5) (A)) Designated critical habitats are described in 50 CFR §17 and 226.
- Environmental baseline – refers to past and present impacts of all federal, state, or private actions and other human activities in an action area, the anticipated impacts of all proposed federal projects in an action area that have already undergone formal or early ESA Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR §402.02).
- Jeopardize the continued existence of – refers to engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild; by reducing the reproduction, numbers, or distribution of that species. [50 CFR §402.02]

- Destruction or adverse modification of critical habitat – refers to a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 CFR §402.02).

The following key points apply to CEA in biological assessments and biological opinions (FWS/NMFS, 1998, pp. 4–30 and 4–31):

- ESA Section 7 regulations require the federal action agency to provide an analysis of cumulative effects, along with other information, when requesting initiation of formal consultation. Additionally, the services are required to consider cumulative effects in formulating their biological opinions (50 CFR §402.14(g) (3) and (4)).
- The concept of cumulative effects, as applied to determination of likely jeopardy or adverse modification, is frequently misunderstood. In this context, cumulative effects include the effects of future state, tribal, local, and private actions, but not other federal actions, although some are reasonably certain within the action area under consideration. Future federal actions require separate consultation (unrelated to the proposed action), but are not considered in the assessment of cumulative effects. (Note: This is based on the ESA-related definition of cumulative effects.)
- The reasonably certain to occur clause is a key factor in assessing and applying cumulative effects in biological opinions. First, while cumulative effects involve only future non-federal actions; past and present impacts of non-federal actions are part of the environmental baseline. Indicators of actions reasonably certain to occur, may include but are not limited to: approval of the action by state, tribal or local agencies or governments (e.g., permits, grants); indications by state, tribal or local agencies or governments that granting authority for the action is imminent; project sponsors' assurance the action will proceed; obligation of venture capital; or initiation of contracts.
- The cumulative effects analysis is the last factor considered in formulating the biological opinion. Sometimes, cumulative effects can be the deciding factor in determination of the likelihood of jeopardy or adverse modification. However, the determination of cumulative effects is frequently the least documented part of biological opinions, due to the lack of definitive information on future state, tribal, local, or private actions unrelated to the action undergoing consultation.

4.6.3 Quick Look Questions

Certain questions can used to determine whether TES is a concern at a particular installation. If it is determined that TES would not be adversely affected, then no further analysis would be required as shown in Figure 4.6-1.

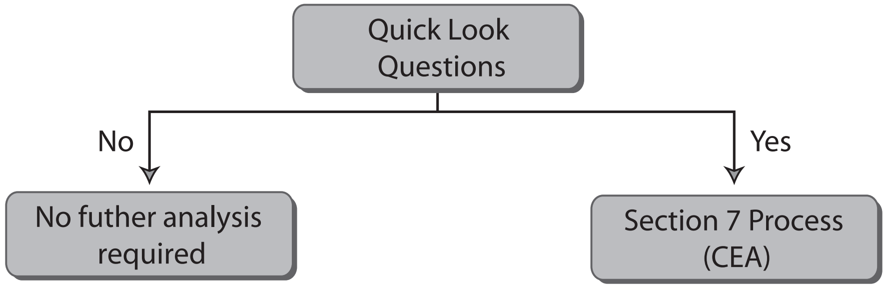

***Figure 4.6-1**–Quick Look Questions and ESA Section 7*

The answers to these questions can be documented in an EA or an EIS, if other potentially significant impacts are identified.

- Has the installation been surveyed for the presence of federal- or state-listed Threatened or Endangered species (TES)?
- Did the survey reveal presence of any listed or proposed TES, federal candidate species or state-listed TES?
- Are there any proposed species that may be placed on the TES list in the future?
- If TES have been found, has the FWS been consulted?
- Does the installation have an INRMP?
- Does the installation have an ESMC?
- What is the viability, size, and distribution of the TES?
- What pertinent factors adversely affect the TES?
- Is the critical habitat within or adjacent to the proposed project site?
- Would the actions involved in construction, operation, and maintenance of the proposed project affect TES or its habitat?
- What are the immediate and long-term threats to any TES and its habitat according to the Biological Assessment and/or the ESMC?
- Does the FWS agree, in writing, with the Biological Assessment and its determination of jeopardy?
- Does the biological assessment find that the TES could potentially be in jeopardy from the proposed action?
- Are there any candidate species that could be impacted by the proposed action to the point that a proposal to list the species may be warranted?

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly; and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the “Detailed Analysis”, Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

4.6.4 ESA Section 7 & CEQ’s 11 Steps

If the proposed action may potentially adversely affect TES or critical habitat, a more detailed analysis is required under ESA Section 7. Figure 4.6-2 illustrates the linkage between the ESA Section 7 process and the CEQ CEA steps.

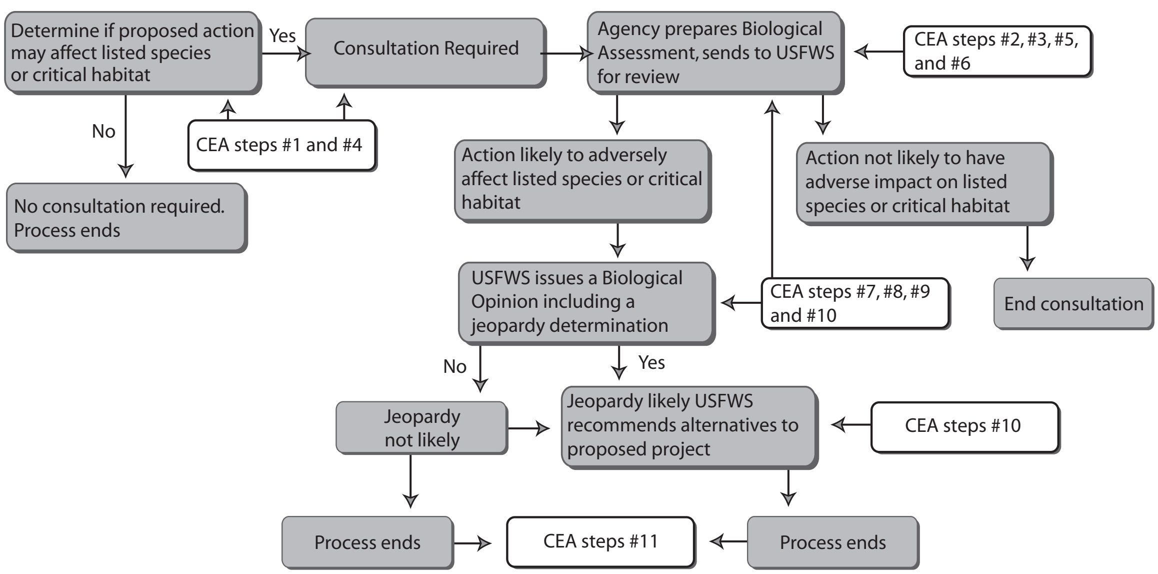

Figure 4.6-2*–ESA Section 7 Process and CEQ Steps*

4.6.5 Endangered Species Management Components (ESMCs) and CEQ’s 11 Steps

The development of an installation ESMC (USA, 1995, Chapter 11-5) is directly comparable to the steps in the CEQ CEA process. The initial ESMC step determines and assesses the population size (current and goal), habitat (current and potential), and mission requirements (present and future), and their associated influences on each other. This correlates with CEQ Steps 1-9, defining all required background research for the initial plan. Other subsequent ESMC steps require goal-setting for species and habitat conservation (CEQ Steps 1 and 3); identifying measurable criteria to meet the goals (CEQ Steps 9 and 10); identifying management actions to reach the goals (CEQ Steps 10 and 11); plans to incorporate ESMC provisions into the ITAM program, devising an inventory and monitoring plan (CEQ Step 11); assessment of funds, duration, staff required for the plan (CEQ Step 3); and development of a checklist for ESMC compliance (CEQ Step 11).

The INRMP (REF, 1999-2003) and the ESMC (BHE, 2005) for Fort Leonard Wood (FLW) were examined to evaluate their applicability to CEQ steps; and a table was prepared to illustrate the identified relationships. Three federally listed species occur on FLW (bald eagle, Indiana bat and gray bat), and were addressed in the ESMC. The same type of information is presented for each of the species, and the information for the Indiana bat is presented in Table 4.6-1. The draft recovery plan for the Indiana bat (FWS, 1999) was also examined, and pertinent CEQ steps were noted.

The INRMP for Fort Bliss (SAIC, et al, 2001) was also examined, and Table 4.6-2 illustrates the linkage between its Table of Contents (TOC) and the relevant CEQ steps, based on information in the TOC section.

This INRMP is comprehensive and is included on the CD accompanying this guidance manual.

The recovery plan for the Mexican spotted owl (Block, et al, 1995) was examined and a similar table was developed for linkage to relevant CEQ steps (Refer to Table 4.6-3).

Table 4.6-1 – Fort Leonard Wood ESMP (Indiana bat)

TOC	CEA Steps
Management Goals & Conservation Objectives	
Sec 1.0 Introduction	
	Steps 1&3
1.4 Management Areas	
	Step2
1.4.1 Cave Management Areas	
1.4.2 Riparian Mgmt. Areas	
Sec 2.0 Indiana Bat (*Myotis sodalist*)	
2.1 Species Information	
	Step 2
2.1.2 Distribution	
	Step 3
2.1.4 Life History/Ecology	
	Steps 5&6
2.1.4 Reasons for listing	
2.2 Conservation Measures and Management Guidelines	
2.2.1 Rangewide Conservation Measures and Management Guidelines	Steps 7, 8, 9, and 10
2.2.2 Installation Conservation Measures	
2.2.3 Conservation Measures required in two Biological Opinions	Steps 8–11
2.3 Conservation Goals	
	Step 1
Sec 6.0 Prescribed Management Actions	
6.2 Prescribed Mgmt. Actions for Indiana bats	
	Steps 8 & 9
Sec 7.0 Monitoring Plan	
7.2 Indiana bat	
	Steps 10 & 11
Fort Leonard Wood INRMP	**CEA Steps**
Sec 8.5.2 Endangered, Threatened, and Species of Special Concern	
8.5.2.5 Indiana Bat	
	Steps 10 & 11
Indiana Bat Recovery Plan	**CEA Steps**
Distribution	
Current Status and Population Trends in Hibernacula	
Reasons for Decline	
	Step 2
Recovery	
	Step 7
	Steps 8, 9, 10, & 11

Table 4.6-2 *– Fort Bliss INRMP TOC*

TOC	CEA Steps
Sec 6.0 Natural Resources and Climate	
6.7 Biological Resources	Step 2
6.7.3 Sensitive Species	Step 7 (context for TES)
Sec 7.0 Land Use and Management Units	Step 4
7.1 Military Land Use	
7.2 Nonmilitary Land Use	General land-use planning
7.3 Ecosystem Management Units	
Sec 8.0 Natural Resource Management	
8.1 Ecosystem-Based Natural Resource Management	
8.17 Adaptive Management	Step 10
8.2 Ecosystem Management Objectives	Step 2
8.5 Habitat Protection and Management	Steps 10 & 11
8.7 Rare, Threatened, or Endangered Species Management	Steps 10 & 11
Sec 9.0 Inventorying and Monitoring	Step 2
8.3 Planning Level Surveys	Step 11
9.3.7 Threatened and Endangered Species	
9.7 Five-Year Plans	
Sec 16.0 BioPolitical Issue Resolution	Steps 9–11
16.2 Species of Special Interest	
Appendix D Management Plans	Management Plans

Table 4.6-3 *− Mexican Spotted Owl Recovery Plan*

TOC	CEA Steps
Part I: Plan Development	Step 1
Sec B: Listing	Step 4
Sec C: Past and Current Management of the Mexican Spotted Owl	
Forest Service	
Other Federal Agencies	
Department of Defense	
States	Steps 3, 11
Sec D: Considerations in Plan Development	
The Current Situation	
Recovery Plan Duration	Step 6 (regulatory thresholds)
Economic Considerations	
Part II: Biological and Ecological Background	
Sec A: General Biology and Ecological Relationships of the Mexican Spotted Owl	Steps 2, 7
Distribution and Abundance	
Habitat Associations	Step 4
Mortality Factors (Predation, Starvation, Accidents, Disease and Parasites)	
Sec D: Conceptual Framework for Recovery	Steps 4, 5
Ecosystem or Landscape Management	
Fire	
Other Natural Disturbances	
Degradation of Riparian Forests	Steps 4, 5, 6
Historical Perspectives	
Past Practices	
Forest Plans	Steps 7, 8, 9
Habitat Trends	
Silvicultural Practices and Forest Management	
Grazing	
Recreation	
Part III: Recovery	
Sec A: Delisting	Steps 10, 11
The Delisting Process	
Delisting Criteria	
Monitoring Population Trends	
Monitoring Habitat Trends	
Long-term Management Plan	
Sec B: General Approach	Step 10
Grazing Recommendations	
Recreational Recommendations	Steps 8, 9
Recovery Unit Considerations	
Potential Threats	Step 11
Sec C: Monitoring Procedures	
Habitat Monitoring	
Population Monitoring	

4.6.6 Impact Analysis Steps as Defined by CEQ

CEQ Step 1 – Identify the significant effects issues associated with the proposed action and define the assessment goals.

This CEQ step involves the identification of TES, their habitat requirements, and location of these species and their habitat, relative to the proposed action.

To identify significant TES effects, Chapter 9 of INRMPs (USA, 1995) can be reviewed, as well as INRMP Chapter 11 and INRMP Section 11-5 for endangered species guidance. The INRMP and draft ESMC for FLW were reviewed, and pertinent information (for this CEQ step) was noted in Table 4.6-1. Management goals and conservation objectives were identified in the FLW draft ESMC. Additional information is available in the Case Study – Protocol for Addressing Cumulative Effects on an Endangered Species (Section 4.6.8).

CEQ Step 2 – Establish the geographic scope for the analysis.

The geographical (spatial) boundary for TES effects analysis should include the region (county or counties) in which the action is proposed. Installation ESMCs include survey and inventory information on the species, including habitat distribution, and the location and size of the installation population (USA, 1995, Section 11-5); identifying both current and potential critical habitat. Table 4.6-1 illustrates such information from the FLW ESMC. Information on species distribution can also be found in Recovery Plans. The species' range should be consistently noted. (For additional information, see Section 4.6.10 discussion of ESA Handbook Chapter 1).

CEQ Step 3 – Establish the time frame for the analysis.

Temporal boundaries should encompass past and future actions that may affect TES within the boundaries delineated in CEQ Step 2. This must reflect the life history/ecology of the species; for example, Indiana bats migrate in the spring and fall and hibernate in the winter.

Some pertinent questions include: When was the training range established? Are there major changes anticipated in the installation mission, and, if so, when will such changes occur? When have range expansions, if any, occurred? Historical NEPA documents should be examined to identify training and land use trends.

CEQ Step 4 – Identify other actions (past, present, and reasonably foreseeable) affecting the resources, ecosystems, and human communities of concern.

Past actions can be identified and evaluated through the review of historical records on TES and designated habitats, highlighting any changes that have occurred. Present actions include both ongoing and new actions. Consideration of future actions should include the likelihood and time frame for execution. Other future actions include state, tribal, local and private actions, excluding federal actions, that are reasonably likely to occur within the area of the proposed action. Existing biological assessments for specific species can identify future non-federal activities reasonably certain to occur and likely to affect the species. (For additional information on the contents of biological assessments, see Section 4.6.10 for a discussion of ESA Handbook Chapter 3.)

CEQ Steps 5, 6, & 7 – Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to changes and capacity to withstand stresses (CEQ

Step 5); Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds (CEQ Step 6); and Develop a baseline condition for the resources, ecosystems, and human communities (CEQ Step 7).

These three CEQ steps identify and characterize historical and current information on TES, monitoring activity and impacts, field studies (behavioral, disturbance), and other available trends reports. Examples of such studies are provided as follows:

- Effects of maneuver training activities on red-cockaded woodpecker populations on Fort Stewart, Georgia (Hayden, et al, 2003)
- Effects of fog oil smoke on the hatchability and fledgling survival of the house sparrow, a nestling surrogate for the red-cockaded woodpecker (Driver, at al, 2002)
- Population viability of avian endangered species (Melton, et al, 2001)
- Research plan to evaluate relationship between maneuver training activities and red-cockaded woodpecker populations and habitats on Fort Stewart, Georgia (Hayden, 1999a)
- A functional description of the Ecological Dynamics Simulation (EDYS) Model, with applications for Army and other federal land managers (Childress, et al, 1999)
- Simulating land use alternatives and their impacts on the desert tortoise at Fort Irwin, California (Aycrigg, et al, 1998)
- A dynamic simulation model of the desert tortoise habitat in the Central Mojave Desert (Westervelt, 1997)
- Integrated endangered species management recommendations for Army installations in the southeastern United States (Jordon, et al, 1997)
- Preliminary assessment of the potential impact of fog oil smoke on selected TES (Getz, et al, 1996)
- Modeling cowbird occurrences and parasitism rate (Shapiro, et al, undated)

Information on stresses, historical reference points, and trends was also found in the recovery plans that were examined (refer to Tables 4.6-1 & 4.6-3). The environmental baseline refers to past and present impacts of all federal, state, or private actions, and other human activities in the area. The discussion in Section 4.6.10, regarding ESA Handbook Chapter 3, provides detailed information regarding past FWS determinations, made through evaluations of potential effects, based on biological assessments.

CEQ Steps 8, 9, 10 & 11 – Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities (CEQ Step 8); Determine the magnitude and significance of cumulative effects (CEQ Step 9); Modify or add alternatives to avoid, minimize, or mitigate significant effects (CEQ Step 10); and Monitor the effects of the selected alternative and adapt management (CEQ Step 11).

These CEQ steps evaluate the environmental consequences; dealing with the scale and significance of anticipated direct, indirect, and cumulative effects, identifying cause-and effect relationships, and developing appropriate mitigation strategies.

Although the FWS needs rigorous, species-specific scientific evidence to establish cause-effect relationships between military training activities and TES, the ESA only requires FWS to base their opinions on the "best available scientific and commercial data available." Any incompatibilities can often be mitigated in a variety of ways: alteration of the proposed action; time of day, time of year (reproductive season), and duration of activity, etc.; designation of buffer zones; or establishment of distance/sound thresholds (in case of noise) based on animal responses to military stresses. Selected behavioral patterns can be monitored, determining relationships between military activities, and identifying receptor response thresholds for adaptive environmental management (AEM).

Information for these CEQ steps is readily available in installation INRMPs. Tables 4.6-1 & 4.6-3 identify relevant sections in the FLW and Fort Bliss INRMPs. Pertinent mitigation and monitoring information is also available in recovery plans. The Indiana bat (FLW) and Mexican spotted owl (Fort Bliss) recovery plans contained useful information for CEQ Steps 8 through11. The recovery plan for the Mexican spotted owl is very detailed (See Table 4.6-3). The Section 4.6.10 discussion of ESA Handbook Chapter 2 provides additional information on recovery plans. If recovery plans identify specific essential habitats for species' survival and recovery, close attention should be given to other actions that might affect that habitat, as these additional single, and perhaps minor, actions or combination of actions, may generate cumulative effects.

4.6.7 The Direct and Indirect Effects Associated with TES

General interactions between Army activities and TES issues, as established from the Fort Irwin analysis (See Section 2.4), are illustrated in Table 4.6-4

The direct effects of Army actions on biological resources are quite complex. These are “filled” on the matrix extracted from the Fort Irwin Study (AEC, 2004), as shown in Table 4.6-4. These can include noise exposure, the introduction of toxic materials (including the settlement of air pollutants) or hazardous debris, disturbance of existing habitats, impacts on invertebrates/fish and aquatic/terrestrial organisms, sedimentation, effects on raptors and avian species, general effects on flora/fauna (including TES, native vegetation, exotic/invasive species, migratory wildlife, riparian vegetation, and breeding/migration effects), general effects on wetland ecosystems, and species diversity and mortality. These lead to indirect effects; (shown by an “x” on land use) land use and air space conflicts or restrictions; protection of sensitive areas; and the preservation of rural areas or the desire for limited use of specific lands; health science (operational and bird air strike hazards); infrastructure (facility closures and demands on recreational resources); aesthetics; sociology (public perceptions, social character, and public annoyance); and environmental justice (use of subsistence resources and the reduced availability of important resources).

Both the direct and indirect effects are usually addressed in existing Army procedures, but the linkage among the various multi-VEC issues must be recognized and acknowledged by the CEA analyst.

	BIOLOGICAL RESOURCES	Noise Exposure	Releases to the Biosphere	Toxic Material	Hazardous Debris	Habitat Disturbance	Impacts: Invertebrates/Fish	Impacts: Aquatic/Terres. Organ.	Sedimentation	Avian Species Mortality	Raptor Mortality (Nesting Sites)	Settlement of Air Pollutants	Flora/Fauna	Threatened/Endang. Species	Wetlands	Species Diversity	Vegetation	Rem. of Native Veg. Species	Exotic/Invasive Species	Species Mortality	Migratory Wildlife	Breeding Amphibians	Common Wildlife	Riparian Vegetation	Migration Patterns	Vehicle Strikes	LAND USE
Construction																											
General Construction Operations		■				■									■											■	
Ground Equipment Operation		■				■									■											■	
Accidents/Spills			■	■		■	■	■		■	■		■	■	■	■	■	■	■	■		■	■	■			
Blasting/Vibration		■				■							■	■									■				
Vegetation Removal						■	■	■	■				■	■	■		■	■	■			■		■			
Generators		■				■						■	■	■								■	■				
Off-site Transportation		■				■							■	■	■						■	■	■			■	
Cable Laying						■	■	■	■				■	■	■			■						■			
Road/Utility Corridors		■				■	■	■	■	■	■		■	■	■		■	■			■	■	■	■	■	■	
Operations																											
Ground Equipment Operation		■				■									■											■	
Generators		■				■						■	■	■								■	■				
General Operations		■				■									■											■	
Facility Modification						■	■	■	■				■	■	■		■	■				■	■	■		■	
Earth Disturbing Activities						■	■	■	■				■	■	■	■	■	■				■		■			
Accidents/Spills			■	■		■	■	■		■	■		■	■	■	■	■	■	■	■		■	■	■			
Towers										■	■			■													
Road/Utility Corridors		■				■	■	■	■	■	■		■	■	■		■	■			■	■	■	■	■	■	
Aircraft Operations		■				■							■	■							■				■	■	
Irrigation (Land Application)																		■	■								
Site Access						■																				■	
Industrial Operations			■	■	■	■						■														■	
Cable Laying						■	■	■	■																		
Road/Utility Corridors		■				■	■	■	■	■	■		■	■	■		■	■			■	■	■	■	■	■	
Blasting/Explosives Ops		■				■	■	■		■	■		■	■							■	■	■				
Irrigation (Land Application)																		■	■								
Off Highway Vehicles		■				■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Stream Crossings						■	■	■	■				■	■	■		■	■	■			■	■	■			
Flight Operations																											
Overflights		■	■			■	■	■		■	■	■	■	■		■				■	■	■	■		■	■	
Missile Operations		■	■	■	■	■	■	■		■	■	■	■	■	■	■				■	■	■	■		■	■	
Static Firing		■										■															

***Table 4.6-4** – Effects of Army actions on Biological Resources*

The following section 4.6.8 provides a CEA case study for the Sonoran pronghorn (USN, 2001). This case study provides a systematic review, and follows CEQ's 11 CEA steps..

4.6.8 Case Study – Protocol for Addressing Cumulative Effects on an Endangered Species

In February 2001, the U.S. District Court for the District of Columbia ruled that the Yuma Training Range Complex (YTRC) FEIS prepared by the U.S. Marine Corps in 1997, failed to adequately address the cumulative impacts of range activities on the endangered Sonoran pronghorn located on YTRC in southern Arizona. To remedy this deficiency, the court remanded to the Marine Corps that portion of the YTRC FEIS that addressed cumulative impacts on the Sonoran pronghorn. In accordance with the court order, the Marine Corps/Navy prepared a Supplemental EIS (SEIS) (USN, 2001) reconsidering the cumulative impacts of the proposed actions and alternatives, together with other relevant past, present, and reasonably foreseeable future actions, on the Sonoran pronghorn.

The SEIS used CEQ's 11 steps, though they were included by inference rather than direct specification. The CEQ process is organized into three major components: scoping (four steps), describing the affected environment (three steps), and determining environmental consequences (four steps).

Scoping for the Study Boundaries

The SEIS scoping process identified effects of the proposed actions and alternatives on measurable species-related issues (Step 1 of the CEQ process), delineated spatial and temporal boundaries for the study (CEQ Steps 2 and 3), identified other pertinent actions (CEQ Step 4), and specified relevant environmental resources. Although the SEIS, resulting from a remand, addressed the proposed actions and alternatives, an EIS with a preferred alternative format need only include the proposed preferred actions and past, present, and future actions in the CEA.

The SEIS addressed the effects, spatial and temporal boundaries, other actions, and relevant environmental resources in a screening presentation of the proposed actions and alternatives, and other past, present, and reasonably foreseeable future actions, along with environmental resources relative to their anticipated connections to general listing (delisting) factors for the TES (the Sonoran pronghorn). The screening presentation was accomplished via the following five activities:

(1) Review of factors for the species from FWS or NMFS TES Web sites (U.S. Fish and Wildlife Service, undated); delineating objective, measurable criteria associated with the species (Table 4.6-5 provides an example for the Sonoran pronghorn). The known range for the species was included in a core SEIS area; and in a contiguous regional area beyond the core area that could include actions influencing Sonoran pronghorn populations in the core area. (USN, 2001, pp. 2-6 and 2-7)

If the action is within the core SEIS area, it will be retained for further analysis if the action has resulted or potentially will result in:	
1.	Habitat loss or curtailment, including barriers or impediments to movement or access to habitat
2.	Habitat modification or diminished quality of habitat, including habitat fragmentation and degraded air quality
3.	Overutilization (e.g., hunting and research activities) of Sonoran pronghorn
4.	Disease and predation, including the potential of increasing predator populations or opportunities for predators to prey on Sonoran pronghorn
5.	Management or regulatory conflicts
6.	Death or injury of Sonoran pronghorn, including potential death or injury from collisions with vehicles and munitions delivery or detonations
7.	Harassment of Sonoran pronghorn, including surface vehicles, human presence, surface noise sources, overflight noise and visual presence of aircraft
8.	Diminished fawn recruitment
9.	Exposure to toxic substances or materials, including toxins found in forage plants or surface water and exposure to harmful radio frequency energy
10.	A change in other activities that occur within the regional influence area that may, in turn, affect Sonoran pronghorn per criteria listed above for YTRC actions within the core SEIS area
11.	A displacement of other activities into the core SEIS area that may, in turn, affect Sonoran pronghorn per criteria listed above YTRC actions within the core SEIS area
12.	Environmental effects that are generated outside of the core SEIS area but that are transported or transferred into the core area and may affect Sonoran pronghorn per criteria listed above for YTRC actions with the core SEIS area

Note: The first nine criteria are related to the five listing/delisting factors as follows:

(1) The present or threatened destruction, modification, or curtailment of Sonoran pronghorn habitat or range – criteria 1 and 2
(2) Over-utilization of Sonoran pronghorn for commercial, recreational, scientific, or educational purposes – criterion 3
(3) Disease or predation – criterion 4
(4) The inadequacy of existing regulatory mechanisms – criterion 5
(5) Other natural or manmade factors affecting its continued existence – criteria 6, 7, 8, and 9

Note:

Criteria 10, 11, and 12 apply to activities in the regional area; such actions can influence the Sonoran pronghorn population outside the core area by directly affecting the nine criteria listed for the core area (criterion 10), or they can cause a displacement of activities into the core area (criterion 11), or the environmental effects generated in the regional area can be transported or transferred into the core area (criterion 12).

Note:

Natural climatic factors which might influence the Sonoran pronghorn population (e.g., annual rainfall) are not addressed within the 12 criteria

Table 4.6-5*: Criteria for Screening YTRC Proposed Actions and Alternatives and Other Past, Present, or Reasonably Foreseeable Future Actions (USN, 2001, pp. 2-6 and 2-7)*

(2) Evaluation of information for the factors, criteria, and spatial boundaries specified or inferred in Table 4.6-5, including basic species ecology studies and monitoring results originally used to justify endangered species listing; as well as related biological assessments by other federal agencies in the core and regional areas, and corresponding biological opinions by the FWS. (This information was obtained from the basic FWS Web site for endangered species, http://endangered.fws.gov. A link is included in the accompanying CD.) For this case study, the sources were updated to 2005. Specifically, the following information was assembled and reviewed:

- Specific information on the current status of the Sonoran pronghorn, 2005 (http://ecos.fws.gov/species_profile/SpeciesProfile?spcode=A009)
- Federal Register documents for the Sonoran pronghorn, 2005 (http://ecos.gov/species_profile/Species_FRDoc)
- Sonoran pronghorn information related to Arizona and New Mexico, contained in the Biota Information System of New Mexico (BISON), 2000 (http://www.fw.vt.edu/fishex/nmex_main/species/050585.htm)
- U.S. Fish and Wildlife Service report, "Recovery Criteria and Estimates of Time for Recovery Actions for the Sonoran Pronghorn: A Supplement and Amendment to the Final Revised Sonoran Pronghorn Recovery Plan," 2003, Albuquerque, New Mexico (available on Internet). A link to this plan, as well as a copy of it, is included on the accompanying CD. (Note: a 1998 recovery plan was released in 2001.)

(3) Use of the 12 criteria in Table 4.6-5 to screen the proposed action(s) and alternatives, and "past, present, and reasonably foreseeable future actions"; evaluating potential contributions to cumulative effects on the Sonoran pronghorn. This was accomplished using a simple matrix; listing actions and alternatives on the y-axis, and findings and decisions on the x-axis; indicating their interrelationships. Table 4.6-6 illustrates one page of the 11-page matrix (USN, 2001, pp. 2–8 to 2–18).

The final screening decision for each proposed action and alternative is shown in the two final matrix columns. Actions or alternatives requiring further analysis are also indicated. Sixteen separate proposed actions and 18 alternatives were originally identified (YTRC FEIS, 1997). The screening process addressed 34 actions or alternatives, five proposed actions and six alternatives, and contributions to cumulative effects on the Sonoran pronghorn was evaluated.

4.6

(4) Use of a screening process for past, present, and reasonably foreseeable future actions, initiated by reviewing historical and current NEPA documents prepared by other federal agencies in the previously defined core area and regional area for the Sonoran pronghorn population. In addition, systematic coordination with agencies operating within (and having management responsibilities in) the core area was initiated. The historical past started in the mid-to-late 1800's, as some Sonoran pronghorn population data was available for that period. The future time line covered the planning period for the military mission. Sixty-eight other actions were identified, and their relationship to the YTRC and Sonoran pronghorn was described. Screening was accomplished using the simple matrix illustrated in Table 4.6-7 (one example page of a seven-page matrix) (USN, 2001, pp. 3–6 to 3–12), focusing on geographical proximity; also depicted, as appropriate, on study area maps.

Alternatives within BMGR Airspace	Proposed Action or Alternative			Screening Findings	Screening Decision
	No.	**Name**	**Status**		**Eliminate from Further Analysis**
	1-1	No action – Maintain existing flight corridors and holding areas over Cabeza Prieta NWR.	Not selected in the ROD	The low-level flight corridors and holding areas overlie central portions of the current distribution of Sonoran pronghorn and may subject individual Sonoran pronghorn to effects from aircraft overflight noise as well as visual contact with low-flying aircraft. Aircraft accidents could cause localized impacts on Sonoran pronghorn habitat.	No
	1-2	Alternative – Replace 11 helicopter flight corridor segments with 3 corridors.	Not selected in the ROD	The 11 low-level flight corridors for helicopters overlie central portions of the current distribution of Sonoran pronghorn and may subject individual Sonoran pronghorn to effects from overlfight noise and visual contact with low-flying helicopters. Aircraft accidents could cause localized impacts on Sonoran pronghorn habitat.	No
	1-3	Preferred – Discontinue low-level holding areas for fixed wing aircraft over Cabeza prieta NWR.	Selected in the ROD and implemented.	The two low-level holding areas for fixed-wing aircraft overlie central portions of the current distribution of Sonoran pronghorn and may have the potential to relieve individual Sororan pronghorn to effects from overlfight noise. This action would reduce the potential for aircraft accidents..	No
	1-4	Preferred – Allow low-level overflights of Cabeza Prienta NWR for use on up to 60 days per year.	Selected in the ROD but pending development of a new MOU with FWS before implementation	The two low-level flight corridors for fixed wing aircraft overlie central portions of the current distribution of Sonoran pronghorn and may subject individual Sonoran pronghorn to effects from overlfight noise and visual contact with low-flying helicopters. Aircraft accidents could cause localized impacts on Sonoran pronghorn habitat.	No
	1-5	Preferred – Replace 11 helicopter flight corridor segments with 3 corridors designed to minimize wildlife impacts.	Selected in the ROD and implemented.	The 11 low-level flight corridors for helicopters overlie central portions of the current distribution of Sonoran pronghorn and may subject individual Sonoran pronghorn to effects from overlfight noise and visual contact with low-flying helicopters. Aircraft accidents could cause localized impacts on Sonoran pronghorn habitat.	No
	1-6	Alternative – Allow low-level overflights of Cabeza Prienta NWR for use on up to 36 days per year.	Not selected in the ROD	The two-level flight corridors for fixed wing aircraft overlie central portions of the current distribution of Sonoran pronghorn and may subject individual Sonoran pronghorn to overlfight noise and visual contact with low-flying helicopters. Aircraft accidents could cause localized impacts on Sonoran pronghorn habitat.	No

***Table 4.6-6**: Screening Results for YTRC Proposed Actions and Alternatives (USN, 2001, pp. 2-8 to 2-18)*

ACTION		AREA AFFECTED							COMMENTS
No.	Name	See Map	BMGR East	BMGR West	Organ Pipe	Cabeza Prieta NWR	Ajo allot-ments	Mexico	
Numbers 1-23: Past and Present Actions Within the Core SEIS Area									
1	Historical Mining and Ranching Activities in the Vicinity of Sonoran Pronghorn Habitat		√	√	√	√	√	√	Fortuna Mine located west of Gila Mts. Ajo Mine located near Ajo. Betty Lee mine located near Cooper Mts. Cattle ranching located from north of Ajo, south to Mexico and west to Mohawk mts.
2.	Phelps Dodge Ajo, Inc. Mine	√							
3.	Lower Gila South Resource Manage-ment Plan (Goldwater Amendment)		√	√			√		
4.	Lechuguilla-Mohawk Habitat Management Plan (HMP)			√					Also includes public lands north and west of BMGR-West.
5.	Draft Barry M. Gold-water – East HMP		√						Also includes Sand Tank Mt. Area.
6.	Transportation/Utility Corridors	√							Major highways include Interstate 8 from east of Gila Bend to east of yum, State Route 85 from Gila Bend into Mexico and Highway 2 in Mexico. Also includes canals, railroad track and utility lines gener-ally situated along highways.
7.	Agricultural Develop-ment								Current croplands are generally interspersed along Interstate 8 and in the Yuma Valley.
8.	BLM Livestock Graz-ing Allotments-	√					√		Five livestock grazing allot-ments include the Cameron, Childs, Coyote Flat, Sentinel and Why allotments. The Sentinel allotment is located south of Interstate 8. The remaining four allotments include all public lands surrounding Why and Ajo, Arizona.
9.	Improvements at Childs Mountain	√				√			

Table 4.6-7: *Past, Present, and Reasonably Foreseeable Future Actions and Area Affected (USN, 2001, pp. 3-6 to 3-12)*

ACTION			SCREENING FINDINGS	SCREENING DECISION	
No.	**Name**	**Action Era**		**Eliminate from Further Analysis**	**Retain for Further Analysis**
Actions Within The Core SEIS Area					
1	Historical Mining and Ranching Activities in the Vicinity of Sonoran Pronghorn Habitat	Mining 1880-1941, Ranching 1880-1981	While some disturbance from past mining activities remains within the current distribution of the Sonoran pronghorn, there is minimal disturbance in valley floors from this activity. However, historically, the noise and human activity associated with the introduction of this activity in Sonoran pronghorn habitat may have harassed Sonoran pronghorn. Cattle grazing allotments were cancelled within approximately 95 percent of the Cabeza Prieta NWR in 1941 and 1942 with the establishment of the BMGR. The remaining 5 percent of the refuge, in the area north of Organ Pipe Cactus National Monument, remained a part of the Cameron allotment and cattle grazing continued in this area until 1981 when the grazing permit expired and was not renewed (University of Arizona 1980). Cattle Grazing was eliminated in Organ Pipe Cactus National Monument by 1976 (U.S. Air Force 1986). According to the *1998 Sonoran Pronghorn Recovery Plan*, livestock overgrazing has contributed to the changing vegetation composition of the desert region, resulted in severe (and continuing) soil erosion, which in turn has changed site-potential for vegetation. Sonoran pronghorn radio telemetry data show that relatively recently Sonoran pronghorn have been frequenting portions of the Valley of the Ajo and Growler Valley wehre perennial grasses, favored by domestic livestock are now becoming reestablished after livestock grazing activities have ceased. These observation support speculation that livestock grazing may have competed with or excluded Sonoran pronghorn foraging. The Sonoran Pronghorn Recovery Plan further asserts that it is possible that Sonoran pronghorn might have been displaced from preferred habitat by livestock, given the distribution of sightings seems to have shifted to the east with cattle removal (USFWS 1998).	No	Yes, (Criteria 1,2,6 and 7)

***Table 4.6-8**: Screening Results for Other Actions within the Core SEIS Area and the Greater Regional Influence Area (USN, 2001, pp. 3-59 to 3-83)*

Table 4.6-8 illustrates the “screening matrix” for the 68 future actions (one example page of the 25-page matrix) (USN, 2001, pp. 3-59 to3-83), clarifying the general location, name, and time period (action area) of the actions.

Summary descriptive information is included on the action and previously experienced or anticipated effects. The final two matrix columns present the screening decisions for each action. Applicable criteria from Table 4.6-5 are listed for retained other actions. Fifty-four of the evaluated 68 actions were determined applicable to cumulative effects on the Sonoran pronghorn.

(5) Relation of final screening to CEA environmental resources for the Sonoran pronghorn.

These resources are directly applicable to one or more of the first nine decision factors listed in Table 4.6-5. Table 4.6-9 contains the first page from the three-page matrix used to screen these environmental resources (USN, 2001, pp. 3-2 to 3-4).

AFFECTED ENVIRONMENT RESOURCE ELEMENT FROM YTRC SEIS	SCREENING FINDINGS	SCREENING DECISION	
		Eliminate from Further Analysis	Retain for Further Analysis
Military Land Use	Military land use activities within the active range of the Sonoran pronghorn are required to support military missions. These activities affect vegetation and soils and may affect Sonoran pronghorn in other direct or indirect ways	No	Yes. Military land use is combined with non-military land use (i.e., utilities, wilderness and wildlife refuges and recreation) in a comprehensive land use section to provide an assessment of the cumulative effects of all land-based activities on Sonoran pronghorn.
Airspace Use	The active range of the Sonoran pronghorn is entirely overlain by special use airspace. Military and non-military aircraft routinely overfly this habitat on a wide variety of missions. Airspace use produces noise and includes some low-level flight activity. Aircraft noise and low-level flights may affect Sonoran pronghorn. Aircraft crashes are rare but may affect Sonoran pronghorn habitat.	No.	Yes
Geology and Soils	Conservation of natural soils is an important factor in the conservation of native vegetation communities. Disturbed soils may have an increased vulnerability to colonization by invasive plant species. Eroding soils lead to habitat loss. Topographic features define the overall shape of Sonoran pronghorn habitat. Other geologic resources are of concern only in term of potential sand and gravel extraction for the purpose of supporting on-range military missions (see Section 3036 of the MLWA of 1999).	No	Yes
Water Resources	Natural surface water resources are limited to natural tanks, ephemeral playa lakes and ephemeral storm water drainage. Wildlife that require freestanding water benefit principally from the rock tanks or other depression that hold water for some length of time. Also important are human-made catchments that are either artificial or artificial enhancements of natural catchments.	No	Yes
Biological Resources	The extent of the habitat available to Sonoran pronghorn and the quality of that habitat are critical to the survival and recovery of the species. Also important are potential disease vectors, predation levels, habitat response to climatic conditions, Sonoran pronghorn population dynamics and fawn recruitment and a number of other biological resource factors.	No	Yes. This element is essential, but the assessment of biological issues is specifically focused on those factors that influence Sonoran pronghorn survival and recovery. The description of the biological resource environment that may affect Sonoran pronghorn is presented under two subheadings-3.3.4 Habitat and Habitat Conditions and 3.3.5 Climatic and Biotic Factors Affection Sonoran Pronghorn Population Health.

***Table 4.6-9**: Screening Results from Evaluating Environment Resource Elements for Their Potential to Affect Sonoran Pronghorn (USN, 2001, pp. 3-2 to 3-4)*

Summary information is included for each resource, and the final two matrix columns present the screening decision for each element. Of the 16 listed resources, 11 were retained for further analysis, and five were eliminated (public health and safety, socioeconomics, visual resources, cultural resources, and environmental justice). One resource element, management and regulatory environment, was excluded in the initial FEIS, but was added to the SEIS, as the expanded SEIS study area encompassed additional resource management entities.

Describing the Affected Environment

CEQ Steps 5–7 describe the resources that affect the VEC in the affected environment. When a protected species is the direct, indirect, or cumulative effects analysis focus, related resource elements, species requirements, and populations should be addressed; characterizing resources, ecosystems, and human communities in terms of their response to change and capacity to withstand stresses (CEQ Step 5); the stresses affecting them and applicable regulatory thresholds (CEQ Step 6); and baseline conditions (historical reference points and trends) should be addressed for them (CEQ Step 7).

The YTRC SEIS described the affected environment in these terms for the Sonoran pronghorn population and their relationship to specific measurable criteria for the species. The following resources and associated topics were addressed:

(1) **Management and regulatory environment**–management jurisdictions and resource protection responsibilities of one state and six federal agencies within the core and regional study areas, the history and responsibilities of the Sonoran pronghorn recovery team, and the history and current status of Sonoran pronghorn research and management activities, including several focused on military impacts.

(2) **Past, current and reasonably foreseeable future land use**–land management jurisdictions since 1900; current jurisdictions and historical trends in land use by geographical areas, within the core study area (including the Barry M. Goldwater Range – East and West, the Organ Pipe Cactus National Monument and Cabeza Prieta National Wildlife Refuge, and Bureau of Land Management (BLM), Bureau of Reclamation (BR), state, and private lands); and an overall summary of land uses for lands with a slope of less than 20 percent, since the Sonoran pronghorn do not use lands with slopes greater than 20 percent.

(3) **Airspace use**–military and non-military operations over geographical areas within the core and regional study areas.

(4) **Sonoran pronghorn habitat**–historic and current distribution; habitat characterization; and Sonoran pronghorn requirements in terms of a biotic factors such as physiography, natural barriers, elevation, precipitation, temperatures, and water; and biotic factors such as ground cover, composition of vegetation, and vertical obstructions such as trees and large shrubs.

(5) **Sonoran pronghorn population health**–population dynamics and trends; reasons for declining population; influences of climatic factors, predation, and human encroachment; and population viability analysis (PVA), as delineated in a 1996 workshop to model the population and discuss/promote long-term survival strategies.

(6) **Water resources** – natural and artificial wildlife waters, watersheds and surface flows, and groundwater in the Lower Gila Basin, Western Mexican Basin, and Yuma Basin.

(7) **Earth resources** – general description, topographic features, soil surface disturbance and erosion, by local geographical areas, and mineral resources.

(8) **Air quality** – introduction, climatology and meteorology, air quality regulations, and existing air quality and associated attainment and non-attainment areas.

(9) **Noise** – general noise sources, and existing noise sources and conditions in the core and regional study areas.

Determining Environmental Consequences

CEQ Steps 8–11 address the scale and significance of anticipated cumulative effects, and appropriate mitigation, monitoring and effects management strategies (CEQ, 1997a and 1997b). In this case study, they include identify important cause-and-effect relationships between human activities and the Sonoran pronghorn population (Step 8), determining the relative magnitude and significance of cumulative effects, pertinent to ESA requirements (Step 9), evaluating alternatives to avoid, minimize, or mitigate significant cumulative effects (Step 10), and monitoring of cumulative effects for adaptive management (Step 11). The following methods and approaches were used to address these topics:

(1) Nine categories of potential cumulative effects were used in the analyses, coinciding with the first nine screening criteria listed in Table 4.6-5. Relationships between the 102 screened actions and the nine screening criteria is illustrated in Tables 4.6-6 and 4.6-7 (each including only the first of several pages of the detailed SEIS Tables), connecting each action with the nine categories of effects.). As a result of screening, 65 actions (five proposed actions by the Marine Corps, six alternatives to those actions, and 54 other actions) were identified for further analysis.

(2) For each of the 65 actions, incremental and cumulative effects were analyzed; (a) identifying by category, their contribution to cumulative effects (delineating adverse incremental effects, beneficial incremental effects, or no effects); and (b) determining aggregate resultant cumulative impact on the Sonoran pronghorn.

(3) The PVA model, from the 1996 Population Viability Analysis Workshop for Sonoran pronghorn, was used to assess effects under many categories. It accounts for the relative importance of different factors (criteria or effects) on the likelihood of extinction; and indicates that the improvement of one factor is insufficient to fully protect the species from extinction, while the deterioration of a single factor can produce substantial adverse effects. The model also provides useful indicators of the relative importance of individual factors on species survival. The PVA, as with any model, is a simplification based on numerous assumptions. Accordingly, it is most valuable to interpret the general, various factor trends that dictate the future Sonoran pronghorn population, rather than predicting a final outcome (USN, 2001, pp. 4-2 and 4-6). Where possible, a quantitative and descriptive discussion of the influence of each factor was included in the SEIS, as a prelude to the analytical process noted in (2) above. The discussion provided the scientific basis for overall CEA, partially based on the description of the affected environment.

Action				Level of Effect	
No.	Name	Status or Era	Rationale	Habitat Loss	Habitat Curtailment
YTRC Proposed Actions and Alternatives					
7-1	No action – Restrict ground units on the BMGR to 1988 locations	Not selected in the ROD, 1988 – Present	Eight existing ground support areas and part of a ninth comprising 2,887 acres are within the current distribution of the Sonoran pronghorn. Nine additional support areas are in close proximity. Incremental losses of habitat may occur as a result of years of repetitive use of these sites.	Incremental adverse effect	
7-2	Consolidate selected ground support areas into three zones, designate five new ones and close four old ones.	Not selected in the ROD	This action would create new Ground Support Zone 3 and a ground support area near Stoval Airfield consisting of 1,674 acres combined and located within the current distribution of the Sonoran pronghorn. The Stoval site is within the previously disturbed MAV study site, but the new support zone could lead to incremental habitat loss within 1,424 acres with years of repeated use. Nine support areas under Alternative 701 would continue with potential for habitat loss in 2,887 acres.	Incremental adverse effect	
7-3	Same as 7-2 but locate ground support area near Stoval Airfield out of ACEC	Selected in ROD but not yet implemented	Same effects as described for Alternative 7-2.	Incremental adverse effect	
8-1	No action – Maintain existing TACTS range facilities	Not selected in ROD	No change to existing facilities, but these facilities have eliminated about 12.4 acres of habitat.	Incremental adverse effect	
8-2	Install five new TACTS range threat emitters	Selected in ROD and implemented	Five new threat emitters in aggregate, could potentially curtail use of about 6 acres of habitat.		Incremental adverse effect
Other Past, Present, and Reasonably Foreseeable Future Actions					
1	Historical Mining and Ranching Activities in the Vicinity of Sonoran pronghorn Habitat	Mining 1880-1941, Ranching 1880-1986	Mining activities ceased 60 years ago and the individual mining claims did not affect suitable habitat. Permitted grazing was limited in most areas after 1941 and eliminated everywhere except for the BLM allotments near Ajo and Sentinel in 1986. Given that Sonoran pronghorn currently occupy formerly grazed habitat and recovery of habitat appears to be taking place, this action did not permanently remove or curtail habitat.		
2	Phelps Dodge Ajo, Inc. Mine	1916-1985	It is difficult to separate the impact of mining activities in the Ajo area from the habitat loss and curtailment caused by State Route 85 and human development around Ajo. However, the mine spoils and tailings likely removed an area of available habitat.	Incremental adverse effect	

***Table 4.6-10**: Evaluation of Actions for Habitat Loss or Curtailment (USN, 2001, pp. 4–13 to 4–1)*

(4) The cumulative effects of all actions were considered, based on a series of simple matrices relating identified, pertinent, and screened Marine Corps actions and alternatives, as well as the other actions for the nine categories. The final number of pertinent actions was defined for each category as follows, and a one-page illustration is shown for the first category in Table 4.6-10 (USN, 2001, pp. 4–13 to 4–17)

- The loss or curtailment of habitat applied to 32 actions (5 YTRC actions or alternatives, and 27 other actions). Table 4.6-10 illustrates the format used for the summary (USN, 2001, p. 4-13). The Action Column status or era designation indicates the status of YTRC actions or alternatives, or the time period in which other actions occurred or will occur. The Rationale Column summarizes the basis for the level of effect designation in the last two columns. Nineteen actions having an incremental effect on habitat loss or curtailment were identified and grouped as: past and/or present actions (including YTRC actions or alternatives) with incremental adverse effects, reasonably foreseeable future actions with incremental adverse effects, past and present actions with incremental beneficial effects, past and present actions with incremental beneficial and adverse effects, and reasonably foreseeable future actions with incremental beneficial effects. Effects associated with these action groupings were included.
- Habitat modification or habitat quality effects apply to 30 actions (three YTRC actions or alternatives and 27 other actions). Twenty-two actions with an incremental adverse or beneficial effect were identified and discussed. These effects were further divided into those producing drought effects, forage effects, or water source effects.
- Effects on over-utilization of Sonoran pronghorn habitat, increase or prevention, applied to only one ongoing action, identified through screening, and was described.
- Effects on disease or predation applied to seven actions; all were evaluated. Six were found to produce potential incremental effects. Management or regulatory conflicts applied to two actions, which were evaluated. Both were found to have potential incremental effects.
- Effects on death or injury (cause or prevention) applied to 37 actions (11 YTRC actions or alternatives, and 26 other actions), and all were evaluated. Thirty-two actions were found to have incremental adverse or beneficial effects, or both. Groups of actions, with similar types of effects, were discussed.
- Harassment (cause or prevention) applied to 57 actions (11 YTRC actions or alternatives, and 46 other actions), and were evaluated. Twenty-four actions were found to have incremental adverse harassment effects. Levels of effect considered areas of human activity and overflights.
- Retardation or enhancement of fawn recruitment was evaluated for all 65 actions, and 14 were identified as potentially important. Six were beneficial and eight were adverse.
- Exposure to toxic substances or materials was evaluated for seven actions, and two were found to exhibit incremental effects. Both exhibited incremental adverse and beneficial effects.

(5) A summary analysis included 48 actions deemed contributors to cumulative effects on the nine CE categories. The 48 actions included 11 YTRC actions or alternatives and 37 other actions. Table 4.6-11 includes the first page of the summary table for this analysis (USN, 2001, pp. 4–74 to 4–79), and displays the potential contributing actions relative to the nine factors.

Action		CUMULATIVE EFFECT FACTORS												
		Habitat Loss or Curtailment		Habitat Modification and Quality							Harassment			
No.	Name	Habitat Loss	Curtailment	Drought Effects	Forage Quality Effects	Water Resource Effects	Overutilization	Disease and Predators	Mgmt and Regulatory Conflicts	Death and Injury	Area of Human Activity	Overflights	Fawn Recruitment	Toxics
YTRC Proposed Actions and Alternatives														
1-1	No action – Maintain existing flight corridors over Cabeza prieta NWR									X		X	X	
1-2	Alternative – Replace 11 helicopter flight corridor segments with three distinct corridors									X		•	•	
1-3	Preferred action – Discontinue low-level holding areas for fixed-wing aircraft over the Cabeza Prieta NWR									•				
1-4	Preferred action – Allow low-level overflights of Cabeza Prienta NWR for use on up to 60 days per year									X				
1-5	Preferred action – Replace 11 helicopter flight corridor segments with corridors designed to minimize wildlife impacts									X		•	•	
x = causes an adverse incremental effect ɵ = causes a beneficial incremental effect														

Table 4.6-11: *Summary of Potential Cumulative Impacts (USN, 2001, pp. 4–74 to 4–79)*

The 11 YTRC actions or alternatives would not all be implemented. The SEIS included a composite summary discussion of Table 4.6-11 in relation to the nine categories of cumulative effects.

(6) The cumulative effects of all actions were then described in aggregate. The first part of the discussion focused on the cumulative impacts of past actions, the current status of the Sonoran pronghorn population, and the cumulative effects of climatic factors and all past human actions. These cumulative effects were described in terms of habitat loss, degradation and protection; climatic factors; advancing age distribution of the population; direct death or injury, harassment, or fawn recruitment; and other considered cumulative effects factors such as over-utilization, disease and predation, management or regulatory conflicts, fawn recruitment, and exposure to potentially toxic material (including chaff). The second part of the discussion addressed incremental contributions of YTRC actions or alternatives to the aggregate cumulative effects on the Sonoran pronghorn. For this part, the discussion was centered on the nine CE categories (factors).

(7) As a result of the YTRC CEA, the Marine Corps committed to mitigation measures to increase the knowledge base regarding the pronghorn and various anticipated effects related to proposed Marine Corps actions, based on the SEIS findings and the Sonoran pronghorn recovery plan (USN, 2001, p. 5–1). These included:

- Study of the potential effects of chaff, in coordination with other federal agencies, emphasizing possible toxic contamination of waters at two locations within the core study area.

- Support of the 51 management and research projects developed by the Sonoran Pronghorn Recovery Team to promote subspecies recovery.
- Production of an annual monitoring report to the FWS Phoenix Ecological Services Office and the Cabeza Prieta NWR detailing prior year implementation progress for the mitigation measures and provided dates and locations of any Sonoran pronghorn (including injured or dead), observed by Marine Corps personnel.
- Support for an annual period of public closure of the Mohawk Valley area of Barry M. Goldwater Range West from March 15 to July 15, beginning in 2002, reducing human disturbance of the Sonoran pronghorn during the period critical to early fawn survival. This includes permanent closure of roads unnecessary for agency administrative use.

Key Conclusions from this Case Study

Key scientific SEIS conclusions (USN, 2001, pp. 4–109 and 4–110) included:

(1) Cumulative effects of past actions and climatic factors have reduced the range and size of the Sonoran pronghorn population to its current endangered status. The effects of currently active factors are exacerbated by the limited range of this subspecies, its division into three isolated subpopulations, and its relatively small population size.

(2) The Sonoran pronghorn is not threatened with further significant habitat loss or degradation as a result of current or reasonably foreseeable future actions.

(3) The long-term prospects for Sonoran pronghorn survival and recovery depends on the timing, distribution, and abundance of rainfall, which controls the availability of adequate forage, above all other currently active factors and activities.

(4) The advancing age the current population is a near-term threat to continued survival. More than half of the population will likely die over the next two to three years, even with favorable rainfall and forage production. Adequate rainfall and forage production is essential over this same period if the losses of older animals are to be offset by fawn recruitment.

(5) A capture and radio-collaring program has produced Sonoran pronghorn casualties. However, the risks of the death or injury from vehicle use or munitions use and delivery are manageable, posing insignificant incremental impacts on this subspecies.

(6) No cumulative impacts on the U.S. Sonoran pronghorn population were found from hunting, abnormal disease, or predation rates induced by human activities, management or regulatory conflicts, or exposure to toxic substances or materials.

(7) Marine Corps air and surface activities (within BMGR–West and BMGR–East, and within the restricted airspace overlying the Cabeza Prieta NWR) have contributed some incremental, adverse effects to overall cumulative impacts on Sonoran pronghorn. However, the magnitude of these effects is negligible and insignificant.

General Conclusions

The following key general conclusions address the cumulative effects of training ranges on threatened or endangered species.

- The YTRC CEA case study and SEIS provides a useful conceptual protocol for CEA on TES.
- The protocol is heavily dependent on species-specific information on FWS Web sites.
- The protocol addresses the CEQ 11-step CEA process and can be further adapted to Army CEA for TES.
- Adherence to the protocol provides evidence of a "hard look", and "rationale connections" between scientific facts and information, and the decisions of the proponent agency.

4.6.9 Summary

Extensive information is available for planning and conducting effects analysis, including CEA, for TES. There are laws and regulations and consultation processes that provide useful information to address effects. There are additional documents that can be used to address CEQ's 11-step CEA process, as detailed in following sections. Specifically, the case studies and the information in the Endangered Species Consultation Handbook provides useful information that can be adapted to address cumulative effects on any TES found on training ranges.

- INRMP – baseline document (first tier)
- ESMC – species document (second tier)
- FWS/ NMFS Web site for species information, listing, history, population factors, recovery plans
- Biological Assessment
- Biological Opinion
- Endangered Species Consultation Handbook
- Case Studies (Examples/Protocols)

4.6.10 Analyzing Effects, as Addressed by the Endangered Species Handbook

A review of the Endangered Species Consultation Handbook (subtitled Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act) was completed to ascertain compatibility with CEQ's 11 CEA steps and focused on CEA. The handbook was jointly published in 1998 by the FWS and the NMFS; and a Web link is provided on the accompanying CD.

Collectively, the FWS and NMFS are referred to as the "Services", and should not be confused with the "military services". In addition, an "action agency" is (a) the proponent for the action that requires ESA evaluation, or (b) the permitting agency (i.e., the Corps of Engineers for CWA Section 404 permits) that must insure ESA considerations in the permitting process. In the case of a permitting agency, an applicant is the agency or individual desiring the required permit.

The handbook definition of cumulative effects differs from that of CEQ. For this review however, the CEQ definition was used, as follows:

A cumulative effect is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions.

Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time."

The handbook does embody CEQ's 11 steps. Even a cursory review of the introduction, glossary, and table of contents reveals terms associated with the 11 CEQ steps, at a pervasive level, including requirements to identify other actions by working with partners; identifying consequences; avoiding, minimizing and mitigating adverse effects; monitoring and, by implication, adaptive management. Specific sections of the handbook, such as those titled "Incremental Step Consultations" and "Tracking Collective Effects on Species and their Habitats," are strongly linked to the 11 CEQ steps.

The chapters enumerate specific procedures to addressing various aspects of ESA Section 7 consultation requirements. Nearly every chapter has direct or implied references to cumulative effects as outlined in the CEQ's 11 steps, and readily identifiable links in addition to those less discernable. In the following discussions, specific handbook chapters and their constituent ESA Section 7 activities are examined, and the connections to the 11 CEQ steps or to the broader CEQ CEA components of Scoping, Describing or Determining. The contents of the handbook are as follows:

Contents:

4.6

Chapter 1 – General Information

This chapter establishes principles that guide subsequent ESA Section 7 activities. These guiding FWS/NMFS principles are consistent with CEQ CEA components, and steps (in parentheses), are as follows:

- The biology comes first. The facts must be known; and the case must be stated with supporting documentation incorporating the FWS's ecosystem approach to TES conservation (Describing – including CEQ Steps 5–7)
- Determination of jeopardy/no jeopardy must be based on careful analysis of the best available scientific and commercial data. Conclusions of a biological opinion should never be reached prior to complete analysis of the best available data. (Determining – especially CEQ Steps 8–9)
- ESA Section 7 consultation is a cooperative process, and the Services do not have all the answers. The views of the action agency should be actively sought through its designated representatives, and they should be involved in opinion preparation, especially in development of reasonable and prudent alternatives;

reasonable and prudent measures, terms and conditions to minimize the impacts of incidental take; and conservation recommendations. (Scoping – CEQ Steps 1–4, Determining – especially CEQ Steps 10–11)

- All aspects of ESA Section 7 should be used, especially informal consultation, to reach solutions prior to structured process mandated by formal consultation. Participants should be creative, using the process for the species' advantage (scoping). In addition, this tenet establishes the resource or VEC perspective established by the CEQ CEA process. ESA Section 7 implementation must be consistent throughout a species' range. Flexibility is encouraged, but not inconsistency. (Scoping – especially CEQ Step 2)
- An effective ESA Section 7 biologist is a good teacher and a good student, seeking opportunities to inform within and outside the Services, in a non-threatening way. (Related to CEQ Step 11, including adaptive management principles.)

In addition to the overarching ESA Section 7 philosophy, the handbook guides users through specific tasks, providing numerous examples of letters and conclusions while promoting best professional judgment, as appropriate.

Chapter 1 outlines the Services' responsibilities, as follows:

- **Determining the lead region for the consultation** – This is established by the geographic scope for the species (Scoping – CEQ Step 2), as the lead FWS region usually has the greatest impact or largest species population. The NMFS has a similar process to designate lead regions, though programmatic and national scope consultations are often conducted by the NMFS Endangered Species Division in the Office of Protected Resources.
- **Conducting Intra-Service ESA Section 7 Consultations** – This is determined by the geographic scope and identified actions affecting species (Scoping – CEQ Steps 2 and 4, respectively). Lead FWS regions must consult with FWS field offices to evaluate and address actions that may affect listed, proposed or candidate species or their habitat.
- **Using best available data concerning impacts on species and their habitats** – This requirement is pertinent to all CEQ components and the 11 CEQ steps, including monitoring and adaptive management. The proponent of a proposed action must be aware of data gaps and understand that, if further data become available, such data may trigger re-initiation of the consultation process. (See comments on handbook Chapter 4.)
- **Maintaining the administrative record** – This entails Scoping, Describing and Determining and directly documents and supports the consultation and resulting biological opinion, discussed later in this section.

Chapter 2 – Coordination

Coordination is required with (a) other ESA organizations, (b) the action agency and applicant, (c) between FWS and NMFS, and (d) with other federal agencies, state agencies, and tribal governments. These various functions and interactions epitomize Scoping, and can also provide information for the Describing and Determining components of CEQ CEA.

The final listing of a species and/or critical habitat identification is followed by the development and implementation of a comprehensive Recovery Plan, embodying several CEQ steps and including “a description of such site-specific management actions as may be necessary to achieve the plan’s goal for the conservation and survival of the species,” as established in 1988 by amendments to the ESA. Required components of recovery plans include:

- Numbers and distribution of recovery units (Scoping – CEQ Step 2 and Describing – CEQ Step 5)
- Basic life history of the species and its relationships to its supporting habitat (Describing – all CEQ steps)
- Natural and human-related factors affecting the species or its habitat, including elements of the species’ critical habitat (e.g., requirements for cover and nutriment; effects of fire, flooding, and climatic features; relationships with other species; and other limiting factors, such as the need for isolation from human-related activities or commensals), whose alteration can lead to the species’ decreased capability for survival (Describing, Determining – especially CEQ Steps 8-10)
- Any distinction in species’ behavior or required habitat needs, if the species has a different core area or need for another life cycle period (breeding, non-breeding, migrating or over-wintering period) (Scoping – CEQ Steps 2 and 3 and Describing)
- Tolerance of the species (or essential elements of its habitat) to human activities (Describing – CEQ Step 6)

If recovery plans identify specific habitats as essential for species' survival and recovery, close attention should be given to any other actions that may affect that habitat. (Such additional single actions or combination of actions may cause cumulative effects, as defined by CEQ).

Coordination is required if a non-federal party (without a federal nexus) is required to develop a Habitat Conservation Plan (HCP), when a proposed action could result in the incidental take of a listed, proposed or candidate species. This process reflects all CEQ steps under Determining, because HCPs require determination of effects (of the proposed action) on affected species, and identification of measures to minimize and mitigate adverse effects.

Chapter 2 discusses required interagency interactions during the consultation processes. In the case of tribal governments, it emphasizes sensitivity to tribal cultures, religions and spirituality, which often involve ceremonial and medicinal uses of plants, animals and specific geographic places – an important perspective to address during Scoping.

Chapter 3 – Informal Consultation

Most species consultations are informally conducted with the federal action agency, or a designated non-federal representative, often the proponent of the proposed action. Informal consultations:

- Identify listed, proposed, and candidate species (or designated or proposed critical habitats) in the action area (Scoping – CEQ Step 2 and possibly CEQ Step 3, depending on a species’ life cycle).
- Determine effects of the action on these species or critical habitats (Determining – CEQ Steps 8 and 9)
- Explore ways to modify the action to reduce or eliminate adverse effects on the species or critical habitats (Determining – CEQ Step 10)

- Determine the need for formal consultation for listed species (or designated critical habitats), or conference for proposed species (or proposed critical habitats) (Determining – related to CEQ Step 9), and
- Explore the design or modification of an action to benefit the species (Determining – CEQ Steps 10 and 11).

The term "informal" suggests an unstructured consultation approach to meet ESA Section 7 requirements. Such consultation can include phone contacts, meetings, conversations, letters, project modifications and concurrences that occur prior to: (a) initiation of formal consultation or (b) the Services' concurrence that formal consultation is not necessary (Scoping – all CEQ steps). The informal consultation process may identify data gaps that complicate ESA Section 7 analysis. If so, additional studies may be required to document species' status in the action area, or improve the database supporting the biological assessment or, if formal consultation is warranted, a biological opinion (Describing). Figure 3-1, page 3-3 in the handbook, illustrates the informal consultation process.

Informal consultation is used to: (a) identify adverse effects, and suggest ways to avoid them (Determining – CEQ Steps 9–10), (b) resolve project conflicts, or differences of opinion between the Services and the action agency regarding the nature and extent of adverse effects (Describing – CEQ Steps 5 and 6, Determining – CEQ Steps 8 and 9), (c) provide opportunities for the action agency to implement conservation activities (Determining – CEQ Step 10), and (d) help monitor cumulative effects on a species or ecosystem (Determining – CEQ Step 11).

A biological assessment is required if listed species or critical habitat may be present in the action area for "Federal actions significantly affecting the quality of the human environment." (NEPA terminology) (Scoping – CEQ Steps 2 and 3, may be related to species life cycle or migration). Major construction activities include dams, buildings, pipelines, roads, water resource developments, channel improvements, and other such projects that modify the physical environment and constitute major federal actions. Such projects typically have cumulative effects as defined by the CEQ and NEPA.

A biological assessment is optional if only proposed species or proposed critical habitat is involved. (In such a case, actual listing of a proposed species could be considered an reasonably foreseeable future actions (RFFA.) However, if both proposed and listed species are present, a biological assessment is required, and must address both proposed and listed species. When Services biologists advise the need for a biological assessment, the letter indicates the importance of completion prior to contracts award or initiation of construction, in order to avoid compounding and serious, potential environmental effects.

The assessment generally includes the results of on-site inspections, determining the presence of listed or proposed species (Scoping), and an analysis of likely effects on the species or habitat, based on biological studies, review of the literature, and the views of species experts (Determining – CEQ Steps 8 and 9). The assessment also describes any known unrelated future non-Federal activities reasonably certain to occur within the action area and likely to affect the species. Such activities are termed "cumulative effects" in the handbook glossary. The biological assessment addresses all listed and proposed species found in the action area, not just those listed and proposed species that are likely to be affected by the proposed action. One purpose of the biological assessment is to determination whether the proposed action is likely to adversely affect listed species and critical habitat. To make such a determination, all species must be addressed, thus accounting for species interactions.

The action agency is not required to prepare a biological assessment for actions that are not major activities, but if a listed species or critical habitat is likely to be affected, the agency must provide an evaluation of likely effects of the action. The Services use this documentation along with any other available information, to establish their concurrence or non-concurrence with the agency's evaluation of effects such as a "may affect, not likely to adversely affect" determination.

CEQ's Steps 5-9 are related to determinations the Services make after evaluating potential effects, based on the biological assessment. Determinations regarding the proposed action include:

- No effect on listed species or critical habitat - an action agency is not required to obtain FWS or NOAA-Fisheries concurrence when they make a "no effect" determination. However, such concurrence is useful for the administrative record.
- Is not likely to adversely affect – includes insignificant effects related to size of the project (Scoping), discountable effects that cannot be measured or are not likely to occur, and beneficial effects that produce only contemporaneous positive effects and no adverse effects (Determining – CEQ Step 9).
- Non-concurrence with the action agency's determination, possibly due to failure to provide adequate information.
- Is likely to adversely affect – occurs as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not insignificant, discountable or beneficial. Therefore, an "adversely affects" determination may be based on cumulative impacts.
- Is likely to jeopardize proposed species/adversely modify critical habitat – Such a conclusion means that an action is likely to jeopardize the continued existence of a proposed species, or adversely modify proposed critical habitat. This conclusion signals that a conference is required. (See comments in handbook Chapter 6.)

Chapter 4 – Formal Consultation

The formal consultation process is required when a determination of "likely to adversely affect" is found. Accordingly, formal consultations determine whether a proposed agency action is likely to jeopardize the continued existence of a listed species (jeopardy), or destroy or adversely modify critical habitat (adverse modification). The process also aids in determining the amount or extent of anticipated incidental take in an incidental take statement. Figure 4-1 (page 4-3) in the handbook illustrates the informal consultation process.

Formal consultations perform several other functions that are linked to the CEQ's 11 CEA steps, as follows:

- Identify the nature and extent of the effects of federal (agency) actions on listed species and critical habitat (Scoping – CEQ Steps 2 and 3, and Determining – CEQ Step 8)

- Identify reasonable and prudent alternatives, if any, when an action is likely to result in jeopardy or adverse modification (Determining – CEQ Step 10)
- Provide an exception for specified levels of incidental take otherwise prohibited under ESA Section 9 (Determining – CEQ Step 9)
- Provide mandatory reasonable and prudent measures to minimize the impacts of incidental take to listed species (Determining – CEQ Step 10)
- Identify ways action agencies can help conserve listed species or critical habitat when they undertake an action (Determining – CEQ Step 11, and adaptive management); and
- Provide an administrative record of effects on species that can help establish the species' environmental baseline in future biological opinions (Describing – CEQ Step 7).

The formal consultation process must result in a biological opinion, with either a finding of jeopardy or no jeopardy to listed species or adverse or no adverse modification of critical habitat. But the process is flexible, and can be adapted at any point in response to project modifications by the action agency and/or applicant (Determining – CEQ Step 10). Moreover, in locations where numerous actions impact a species, changes in the baseline due to successive effects, can be addressed on a continuing basis using biological opinions. Such a series of biological opinions can be used to first establish a concern, then warn of potential impacts, and finally result in a jeopardy determination (based on a CEA). Successive biological opinions can be used to monitor trends in the species' baseline, thus improving predictions of future impacts (Determining – CEQ Step 11). Extrapolation of a diminishing baseline can indicate when future jeopardy thresholds may be reached (Describing future trends, in this case – CEQ Steps 5 and 6).

Formal consultation is necessary, even when the action is not a major activity, if a "may affect" situation exists. To comply with the ESA Section 7 regulations, the action agency must submit an initiation package and request formal consultation. The content of the initiation package reflects many functions of the formal consultation process and CEQ's 11 CEA steps. Package components include:

- A description of the action being considered
- A description of the specific area that may be affected by the action
- A description of any listed species or critical habitat that may be affected by the action
- A description of the manner in which the action may affect any listed species or critical habitat
- An analysis of any cumulative effects as defined in the handbook
- Relevant reports, including any EISs, EAs, biological assessment or other analyses prepared on the proposal, and
- Any other relevant studies or other information available on the action, the affected listed species, or critical habitat.

The action agency can initiate formal consultation on a number of similar actions within the same geographic area, which may result in Regional or Ecosystem Consultations, or a portion of a comprehensive plan of action (developing Incremental Step Consultations – see handbook Chapter 5), as long as the effects of the entire action are considered. The information provided by an action agency must include the best available scientific and commercial data. Therefore, the consultation may focus on the effects of similar actions on several populations of a species within a geographic area, or a series of different actions and their effects. Either case requires consideration of cumulative effects.

As the Services evaluate formal consultation initiation packages, the handbook encourages communication with the action agency and any applicant to develop a better understanding of direct, indirect, and cumulative effects. Data gaps should be identified during this time. As in the informal consultation process, the ESA requires that, after initiation of formal consultation, the federal action agency may not make any irreversible or irretrievable commitment of resources that could limit future options and, consequently, compound impacts.

The Services' formal consultation package, at a minimum, includes a biological opinion and incidental take statement (if applicable, incidental take statements does not apply to plants or critical habitat), which can be linked to several aspects of CEQ's 11 CEA steps. The seven-section outline of the Biological Opinion is presented below, with brief notes relating to CEQ's 11 CEA steps.

Biological Opinion Outline

I. Description of proposed action -- This includes a description of the action area (Scoping – CEQ Step 2), which must include all areas of direct, indirect and interrelated effects; as well as any conservation measures proposed as part of the action (Determining – CEQ Steps 10 and 11). Figures 4.6-3 through 4.6-5 illustrate variations.

II. Status of the species/critical habitat – This includes a habitat analysis (letter E, below) that is a CEA, as it documents effects of all past human and natural activities or events that have led to the current status of the species.

A. Species/critical habitat description

B. Life history of the species

C. Species population dynamics

D. Status and distribution of the species

E. Analysis of the species/critical habitat likely to be affected

III. Environmental baseline – This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat,including designated critical habitat and ecosystem, within the action area. The environmental baseline is a snapshot of a species' health at a specified point in time. It does not include the effects of the action under review in the consultation, but, in other respects, is cumulative in the CEQ sense of past and present actions.

A. Status of the species within the action area

B. Factors affecting species environment within the action area – This section considers other federal, tribal, state, local, and private actions that cumulatively affect resources already affecting the species, or that will occur contemporaneously with the consultation action in progress. Unrelated federal actions affecting the same species or critical habitat, that have completed formal or informal consultation, are also part of the environmental baseline, as are federal and other actions that may benefit listed species or critical habitat. If not, then the activity would need to be analyzed with the affects of the action.

IV. Effects of the action – This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities.

A. Factors to be considered – Individual factors to be considered incorporate various CEQ steps, indicated as follows:

1. Proximity of the action: to the species, management units, or designated critical habitat units.
2. Distribution: geographic areas where the disturbance occurs (e.g., may be several small or one large area) (Scoping – CEQ Step 2).
3. Timing: relationship to sensitive periods of a species' life cycle (Scoping – CEQ Step 3, Describing – CEQ Step 5).
4. Nature of the effect: effects of the action on elements of a species' life cycle, population size or variability, or distribution; or on the primary constituent elements of the critical habitat, including direct and indirect effects (various steps in Scoping, Describing and Determining).
5. Duration: The effects of a proposed action on listed species or critical habitat depend largely on the duration of its effects (Scoping – CEQ Step 3, Describing – CEQ Steps 5 and 6, and Determining CEQ Step 8).

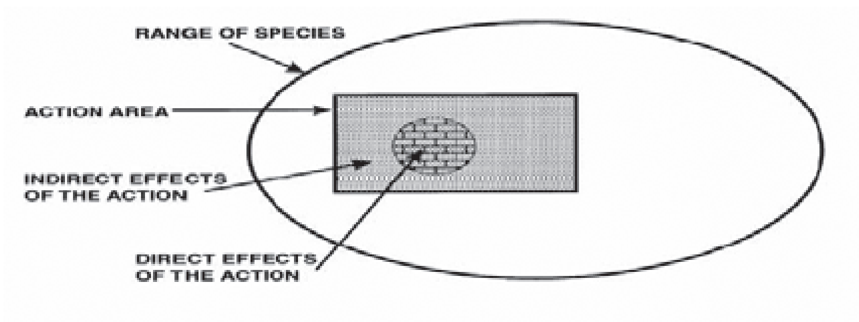

Figure 4.6-3 *Example of an action area within the species' range.*

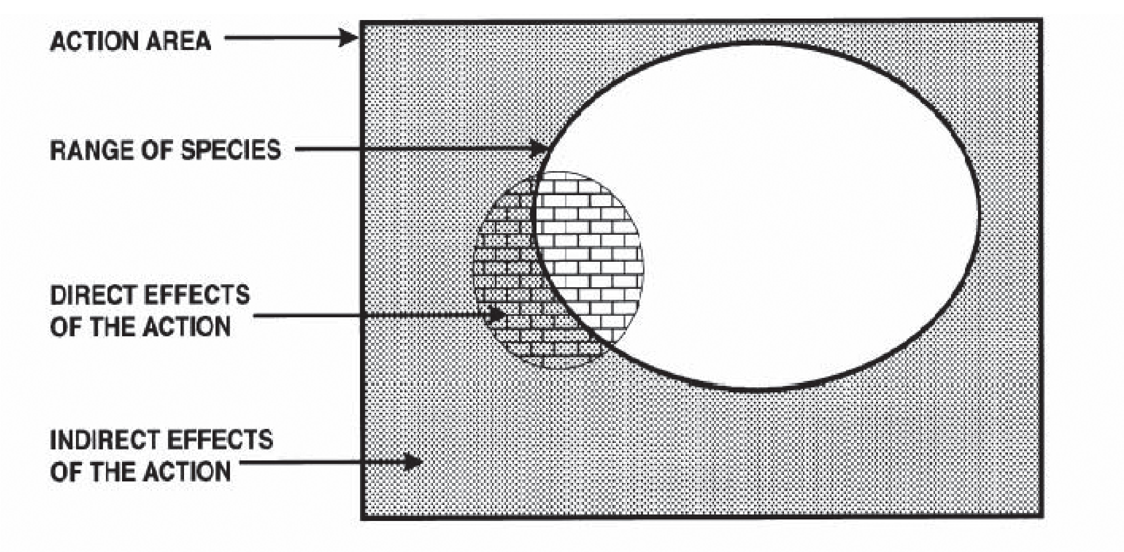

Figure 4.6-4. *Example of an action area that encompasses the species' range.*

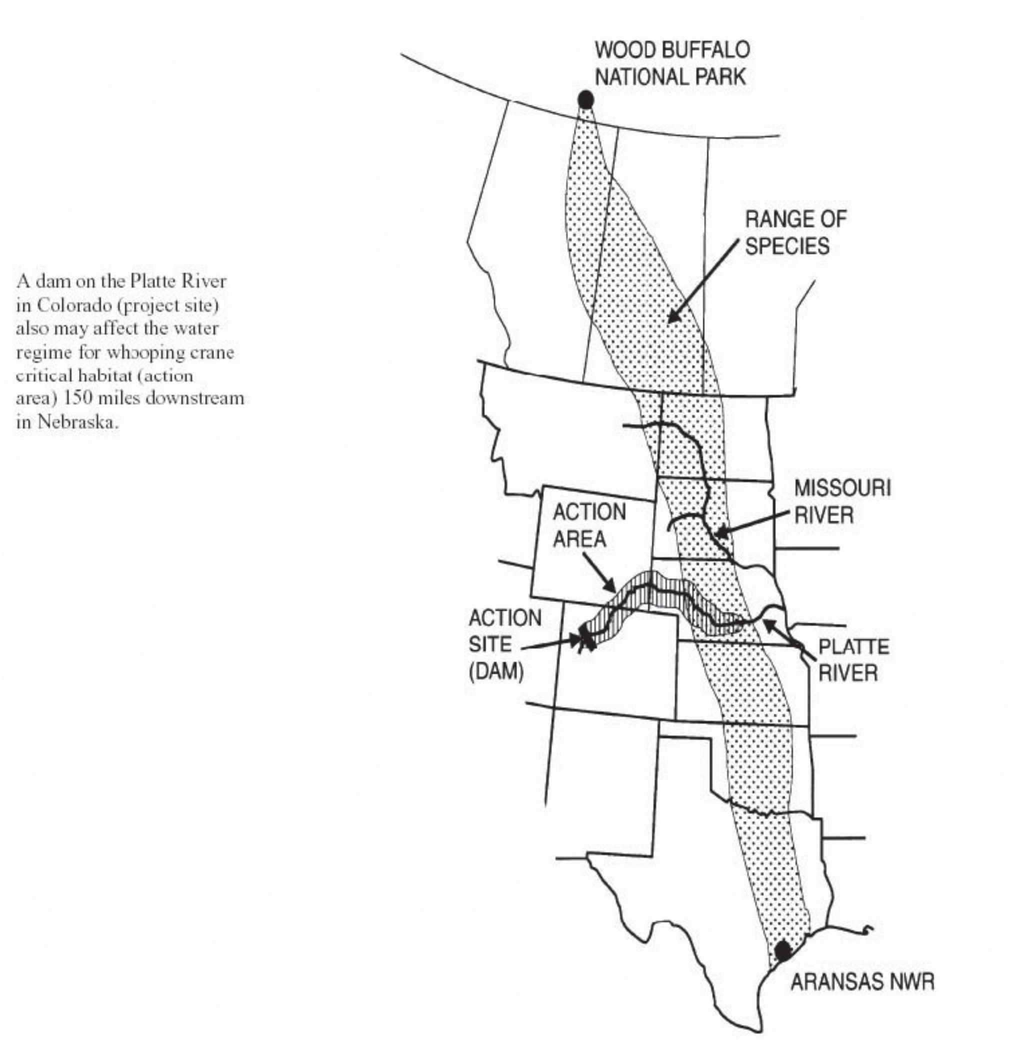

***Figure 4.6-5**. Example of an action area involving an effect not at the project site.*

6. Disturbance frequency: the mean number of events per unit of time affects a species differently depending on its recovery rate. Disturbance frequency is an important consideration when evaluating the accumulating effects of proposed actions on listed species and/or designated critical habitat, particularly when it is combined with information on a species' recovery rate. (Scoping – CEQ Step 3, Describing – CEQ Steps 5 and 6, and Determining – CEQ Step 8; also "accumulating effects" are essentially cumulative.)

B. Analyses for effects of the action – This section refers to beneficial effects, direct effects, indirect effects and interrelated/independent effects which are subjected to a "but for" test. The biologist conducting the consultation must therefore ask whether the activity in question would occur "but for" the proposed action under consultation. If not, then the activity would need to be analyzed with the effects of the action.

C. Species' response to a proposed action – This section also includes several factors related to the 11 steps and concepts of environmental sustainability: numbers of individuals / populations affected sensitivity to change, resilience and recovery rate.

V. Cumulative effects – ESA Section 7 regulations require the federal action agency to provide an analysis of cumulative effects, when requesting initiation of formal consultation. The standardized paragraph to introduce the cumulative effects section illustrates the difference between the CEQ and handbook definitions of cumulative effects:

A. Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

B. The handbook states that the concept of cumulative effects is frequently misunderstood as it relates to determining likely jeopardy or adverse modification. Cumulative effects include effects of future state, tribal, local, and private actions not involving a federal action, that are reasonably certain to occur within the action area under consideration. Future federal actions requiring separate consultation unrelated to the proposed action, are not considered in the cumulative effects section because it is assumed they will be analyzed at a later date if a federal action occurs. The "reasonably certain to occur" clause is a key factor in assessing and applying cumulative effects in biological opinions. First, cumulative effects involve only future non-federal actions; past and present impacts of non-federal actions are part of the environmental baseline. Indicators of actions "reasonably certain to occur" may include, but are not limited to: approval of the action by state, tribal or local agencies or governments (e.g., permits, grants); indications by state, tribal or local agencies or governments that granting authority for the action is imminent; project sponsors' assurance the action will proceed; obligation of venture capital; or initiation of contracts. The more state, tribal or local administrative discretion remaining to be exercised before a proposed non-federal action can proceed, the less there is a reasonable certainty the project will be authorized. Speculative non-federal actions that may never be implemented are not factored into the cumulative effects analysis. At the same time, reasonably certain to occur does not require a guarantee the action will occur. The handbook notes cumulative effects are frequently the least documented part of the Biological Opinion due to lack of definitive information on future state, tribal, local or private actions. (All components, particularly Scoping – CEQ Step 4).

VI. Conclusion – The conclusion section of a Biological Opinion incorporates cumulative effects, because the Handbook states this section presents the Services' opinion regarding whether the aggregate effects of the factors analyzed under environmental baseline, effects of the action, and cumulative effects in the action area – when viewed against the status of the species or critical habitat as listed or designated – are likely to jeopardize the continued existence of the species or result in destruction or adverse modification of critical habitat. The final analysis then examines whether, given the aggregate effects, the species can be expected to both survive and recover (Determining – CEQ Steps 8 and 9).

VII. Reasonable and prudent alternatives – This section includes actions that may be taken to avoid the likelihood of jeopardy to the species, or adverse modification of critical habitat, and address minimization and mitigation of impacts and monitoring requirements (Determining – CEQ Steps 10 and 11).

Chapter 4 of the handbook also mentions that, under certain conditions, re-initiation of formal consultation may be necessary. Some of these conditions are related to unexpected and/or cumulative effects as follows:

- The amount or extent of incidental take is exceeded (change in geographic scope – CEQ Step 2)
- New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered (new actions identified – CEQ Step 4)
- The action is modified in a manner causing effects to listed species or critical habitat not previously considered (new actions identified – CEQ Step 4 or change in magnitude or significance – CEQ Step 9)
- A new species is listed or critical habitat designated that may be affected by the action (new action identified – CEQ Step 4).

Chapter 5 – Special Consultations and Reviews

Three of the special consultations and reviews included in this chapter are of noteworthy for CEA:

- National consultations, in which the Services are requested to consult on an action or series of actions affecting many species over all or a major portion of the country. An example is a pesticide consultation requested by EPA to review the potential effects of all registered pesticides used on listed species. In such cases, many effects were additive or synergistic.
- Regional or ecosystem consultations, which are exemplified by river main stem-focused biological assessments conducted by the Corps of Engineers.
- Incremental step consultations, which can occur when a statute authorizes an agency to complete an action in incremental steps such that the Services issue a biological opinion on each incremental step being considered. Such a consultation is inherently cumulative and is most appropriate for long-term, multi-stage activities. An action agency may proceed with each proposed step after consultation when the biological opinion concludes that the incremental step does not violate ESA section7(a)(2); the action agency continues consultation with respect to the entire action and obtains biological opinions as required for each incremental step; the action agency fulfills its continuing obligation to obtain sufficient data upon which to base the final biological opinion on the entire action (therefore addressing data gaps); the incremental step does not violate ESA Section 7(d) concerning irreversible or irretrievable commitment of resources; and there is a reasonable likelihood that the entire action will not violate ESA Section 7(a)(2).

Chapter 6 – Conference

A conference is required only when a proposed action is likely to jeopardize the continued existence of a proposed species or destroy or adversely modify proposed critical habitat. During the conference, the Services may assist the action agency in determining effects and may advise on ways to avoid or minimize adverse effects to proposed species.(Determining – CEQ Steps 8–11).

If a proposed species becomes listed during the conference process, and the proposed action may affect the newly listed species, the formal conference ends and the formal consultation process begins. The proposed species, therefore, is similar to an RFFA that becomes a reality when the species is formally listed.

Chapter 7 – Early Consultation

Early consultation is an optional process that occurs before a prospective applicant files for a federal permit or license to conduct an activity that may impact a listed species. The purpose of early consultation is to reduce the potential for conflicts between listed species or critical habitat and proposed actions. To qualify for early consultation, an applicant must certify (a) a definite proposal, outlining the action and its effects, and (b) that the proposal will be implemented if authorized. Connections between early consultation and the CEQ's 11 CEA steps are essentially the same as for formal consultation, as similar levels of documentation and evaluation are required prior to the Services' determination.

Chapter 8 – Emergency Consultation

Emergency consultation is a consultation process that occurs after-the-fact, when damage to a listed species or its critical habitat has occurred in response to a major emergency or natural disaster. The handbook defines an emergency as "a situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property." CEQ Step 10 is applicable after an emergency, as the Services' offer recommendations to minimize and mitigate the effects of the emergency response action on listed species or their critical habitat.

Emergency consultation results in an after-the-fact biological opinion that documents the effects of the emergency response. The emergency response, resulting in an incidental take of a species or its critical habitat, is then added into the cumulative effects, and is included in a species' updated environmental baseline. The handbook notes that, while the timing of emergencies is unpredictable, appropriate measures to minimize damage to endangered species and their habitats can be determined in advance, and should be incorporated into emergency response measures as appropriate (Determining – CEQ Step 10).

Chapter 9 – Monitoring and Reporting

Regarding the monitoring of the implementation/effects of reasonable and prudent alternatives and measures, the first paragraph to this chapter states:

When incidental take is anticipated, the terms and conditions must include provisions for monitoring project activities to determine the actual project effects on listed fish or wildlife species (50 CFR §402.14(i)(3)). Project monitoring, carried out by the federal agency or applicant, provides the Services with information essential to assessing the effects of various actions on listed species and designated critical habitat. Monitoring allows the Services to track incidental take levels and refine biological opinions, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions (Determining – CEQ Step 11, and Describing – CEQ Steps 5–7).

Monitoring programs should be designed to:

- detect adverse effects resulting from a proposed action (Determining – CEQ Step 8)
- assess the actual level of incidental take in comparison with the anticipated incidental take level documented in the Biological Opinion (Describing – CEQ Step 7)
- detect when the level of anticipated incidental take is exceeded (Describing – CEQ Step 6), and
- determine the effectiveness of reasonable and prudent measures and their implementing terms and conditions (Determining – CEQ Steps 10 and 11)

The chapter outlines steps that should be taken to develop a monitoring program; these steps generally adhere to the principles of adaptive management. The Services' personnel are encouraged to coordinate monitoring, to eliminate duplication, standardize sampling methods, and improve geographic coverage.

Chapter 9 concludes with guidance on tracking collective effects on species and their habitats, and states that managing collected information efficiently improves the overall effectiveness of interagency consultations, making it easier to:

- evaluate the effects of various actions as they accumulate over time (implies cumulative effects as defined by the CEQ)
- determine which consultations need to be reinitiated when a new species is listed (related to identification of new actions, Scoping – CEQ Step 4)
- determine when the level of incidental take approaches the likely jeopardy/adverse modification thresholds (Describing – CEQ Steps 5 and 6)
- exchange similar information across Regional Services' boundaries (Scoping – CEQ Step 2), and
- determine if reasonable and prudent alternatives and measures are carried out (Determining – CEQ Steps 10 and 11).

The chapter concludes with formats for management of collective effects data by the Services.

Suggested Reading Associated with the Handbook

This final section of the handbook lists 14 references for further reading. The following may be supportive of CEQ's 11 CEA steps:

- Clark, T.W., R.P. Reading, and A.L. Clarke (eds.) 1994. Endangered Species Recovery – Finding the Lessons, Improving the Process. Island Press; Washington, D.C. 450 pp.
- Goodman, D. 1987. How do any species persist? Lessons for conservation biology. Conservation Biology 1:59-62.
- National Research Council. 1995. Science and the Endangered Species Act. National Academy Press; Washington, D.C. 271 pp.
- Underwood, A.J. 1989. The analysis of stress in natural populations. Biological Journal of the Linnean Society 37:51-78.

Summary

In summary, a careful analysis implies that the Endangered Species Consultation Handbook is applicable to CEQ's 11-step CEA procedure. Given the implicit nature of these mutually supportive requirements, careful reading is required. Accordingly, the user of this manual should thoroughly review the handbook prior to TES effects analysis.

4.7 WETLANDS RESOURCES

4.7 Wetlands Resources

4.7.1 Introduction

Wetlands effects are a potential issue for the modernization of Army installations and training ranges, as demonstrated by the discussion of wetland characteristics and functions, and regulatory requirements, in the Final Programmatic EIS for Army Transformation (USACE, 2002a, pp. 3–72 to 3–76), as well as the discussion of transformation effects on wetland resources (USACE, 2002a, pp. 4–22 to 4–25).

Several recent EISs for Army training ranges have addressed wetlands effects in detail, including cumulative effects. The following EISs provide examples of overall effects analysis and detailed CEA which addressed size and function reductions of existing wetlands, relative to wetlands resources for the installations:

- DEIS on Military Training Activities at Makua Military Reservation (USACE, 2004
- FEIS on specific transformation and mission support at the Joint Readiness Training Center and Fort Polk (Tetra Tech, Inc., 2004)

These CEAs addressed size and function reductions of existing wetlands, relative to wetlands resources for the installations.

A widely-used and accepted wetlands definition follows (Cowardin, et al., 1979, p. 3):

“Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water…[W]etlands must have one or more of the following three attributes: (a) at least periodically, the land supports predominantly hydrophytes; (b) the substrate is predominantly undrained hydric soil; and (c) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.”

A more recent definition was promulgated by a National Research Council (NRC) Committee of wetland experts (NRC, 1995). The definition is:

“A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development.”

A variation of the above definitions is: “Wetlands are areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Given the broad nature of these definitions, numerous classifications (and types) of wetlands have been defined; primarily based on assessments of three major factors – water, substrate (physicochemical features), and biota. A large number wetland types can be identified across all Army installations, and several types are often found on individual installations.

Wetlands are important, providing a range of important functions and benefiting both natural and environmental resources, as well as associated societal values. Brief descriptions of nine functions follow (Kusler, et al, 1983, p. 7):

- **Flood conveyance**–Some wetlands (particularly those immediately adjacent to rivers and streams) serve as floodway areas, conveying flood flows from upstream to downstream points. The importance of this function depends on stream characteristics, wetland topography and size, vegetation, location of the wetland in relationship to the river or stream, and existing encroachment on the floodplain (dikes, dams, levees, etc.).
- **Wave barriers and shoreline and bank stabilization**–Wetland vegetation, with massive root and rhizome systems, bind and protect soil; and act as wave barriers. The importance of this function depends on location of wetland adjacent to coastal waters, lakes, and rivers; wave intensity; type of vegetation; and soil type.
- **Flood storage**–Some wetlands store and slowly release flood waters. The value of this function depends on the wetland area relative to the watershed, wetland position within the watershed, surrounding topography, soil infiltration capacity in the watershed, wetland size and depth, stream size and characteristics, outlets (size, depth), vegetation type, and substrate type.
- **Sediment control (retention)**–Wetland vegetation binds soil particles, retarding sediment transport in slowly flowing water. The value of this function depends on the depth and extent of wetland, wetland vegetation (including type, condition, density, and growth patterns), soil texture type and structure, normal and peak flows, and wetland location relative to sediment of vegetated buffer.
- **Pollution control (nutrient removal and transformation, and toxicant removal)**–Wetlands act as settling ponds, removing nutrients and other pollutants through filtering, and facilitating the chemical breakdown of pollutants. The value of this function depends on the type and size of wetland, wetland vegetation (including type, condition, density, and growth patterns), source and type of pollutants, water course, size, water volume, streamflow rate, microorganisms, etc.
- **Fish and wildlife habitat (including aquatic and wildlife diversity and abundance)**–Wetlands provide water, food supply, and nesting and resting areas. Coastal wetlands contribute nutrients (needed by fish and shellfish) to nearby estuarine and marine waters. The value of this function depends on wetland type and size, dominant wetland vegetation (including diversity of life form), edge effect, location of wetland within watershed, surrounding habitat type, juxtaposition of wetlands, water chemistry, water quality, water depth, and existing nearby land uses.
- **Aquifer (ground water) recharge**–Some wetlands store and release water slowly to ground water deposits. However, many other wetlands serve as discharge areas to streams, rivers, lakes, and coastal areas for a portion (or all) of the year. The value of this function depends on the location of the wetland relative to the water table, fluctuations in water table, geology (including type and depth of substrate), permeability of substrate, size of wetland, depth, aquifer storage capacity, ground water flow, surface water flow, and runoff retention measures.

- **Water supply (surface water)** – Some wetlands store flood waters, reducing and slowing surface runoff, and filtering pollutants. Some serve as sources of domestic water supply. The value of this function depends on precipitation, watershed runoff characteristics, wetland type, size, outlet characteristics, and location of wetland in relationship to other water bodies.
- **Recreation (water-based)** – Wetlands provide wildlife and water for recreational uses, including sight-seeing and educational purposes. The value of recreational uses depends on wetland vegetation, wildlife, water quality, accessibility to users, size, relative scarcity, facilities provided, surrounding land forms, vegetation, land use, degree of disturbance, availability of similar wetlands, distribution, proximity of uses, and vulnerability.

Extensive information on wetlands characteristics and boundaries, and associated ecological processes and functions, can be found in the following references:

- The National Research Council book entitled Wetlands Characteristics and Boundaries (NRC, 1995). Chapters are included on the ecology of wetland ecosystems; wetland characterization, based on water, substrate, and biota; use of mapping, geographic information systems, and hydrologic modeling in the assessment of wetlands; and systematic assessment of the functions of wetlands.
- A report on incorporating ecological considerations in environmental impact studies (U.S. Environmental Protection Agency, 1999*)[1]. This guidance encourages ecological considerations into NEPA analyses, emphasizing the maintenance of ecological and evolutionary processes, thus enhancing environmental sustainability, via a heightened understanding of fundamental processes. The guidance is structured around the following ecological topics that capture ecosystem functioning: habitats critical to ecological processes, pattern and connectivity of habitat patches, natural disturbance regime, structural complexity, hydrologic patterns, nutrient cycling, purification services (pollution control), biotic interactions, population dynamics, and genetic diversity. Most of these topics are directly related to wetlands.
- The National Research Council book entitled Riparian Areas – Functions and Strategies for Management (NRC, 2002). The Committee developed the following ecological definition for riparian areas:

"Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines."

* The asterisk denotes that the referenced document is on the accompanying CD

As riparian areas can include wetland areas, wetlands considerations often include ecological processes associated with the riparian zone. Further, the NRC book includes information on the structure and functioning of riparian areas across the U. S., and human alterations of such areas.

This Wetlands Resources section is structured around the application of CEQ's 11-step CEA process. Specific information is provided to accomplish each step for wetlands resources. Further, reference materials and Web sites are noted, as appropriate, along with scientific methods and related approaches for wetlands evaluation.

4.7.2 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect effects of a proposed action on wetland resources; in addition, they can be used to determine if cumulative effects also need to be considered. These questions were developed in a CEA field study at Fort Wainwright, Alaska. These "quick look" questions include:

- Assuming that the locations, types, and sizes of wetlands on the installation have been documented, are these wetland resources now subject to decreases in size and functioning due to activities on the installation?
- Are threatened or endangered species associated with any of the wetlands resources in the vicinity of potential installation proposed actions?
- Are any wetlands in the vicinity of potential installation proposed actions considered by resource agencies to be particularly significant from an ecological perspective?
- Will the potential installation proposed actions cause losses in the sizes, and/or decreases in the functioning, of local wetlands resources?
- Have previous actions in the vicinity of the potential installation proposed actions caused negative impacts on local wetlands resources, and/or are future actions planned that would impact such resources?
- Would the proposed action result in a significant impact to wetlands?
- Are Donnelly Training Area (DTA) East's wetlands subject to a decrease in overall size due to the proposed action and other military actions?
- Are there any threatened and endangered species associated with the wetlands in the vicinity of the proposed action?
- Are any wetlands in the vicinity of the proposed action considered to be particularly ecologically important?
- Will the proposed action cause losses in the size and/or function of local wetland resources?
- Is additional cumulative effects analysis needed?

If the answers indicate that likely impacts are quite small, or can be mitigated, and will probably not contribute to significant impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis “in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public” (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the “Detailed Analysis”, Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

4.7.3 Impact Analysis Steps as Defined by CEQ

CEQ Step 1 – Identify the significant wetlands resources issues associated with the proposed action and define the assessment goals.

This step identifies the types and extent of Army wetland disruptions; including reductions in wetland size, alterations of the variety of wetland functions, and disturbances of “natural connections” between wetlands and associated surface water and ground water resources. Size reductions can occur from drainage and/or filling, and often subsequent conversion to other land uses. Wetland functions can be impaired by reductions in urban or rural runoff waters, or through the introduction of additional (or excessive concentrations of) pesticides, herbicides, and/or nutrients. “Natural connections” can be disturbed by excessive groundwater withdrawals for domestic, industrial, or agricultural usage; and/or from changes in local surface water flows from upstream or downstream water control structures. The loss of different wetlands types can result from anthropogenic and natural causes (Canter, 1996b).

The Integrated Natural Resources Management Plans (INRMPs), described in AR-200-3 (USA, 1995, Ch. 2, 6, and 9*) are key installation documents for wetlands CEA, as they summarize installation policies on wetlands and fish and wildlife cooperative plans. As basis for identifying significant cumulative effects issues, wetland-related information in the INRMP (for the installation and associated training range(s)) should be reviewed. Each INRMP, based on the Sikes Act, (Sikes Act Improvement Amendment, 1998), should address wetland resources, as required by Army guidance (USAEC, 1997, Chapter 8, Section 8.10), providing spatially-based information on the types and sizes of wetlands on the installation.

To illustrate INRMP applicability to CEA, the Fort Bliss INRMP (SAIC, et al, 2001*) can be used. Section 8.5.1 of the Fort Bliss INRMP includes summary wetlands information; in particular, approximately 1200 acres of ephemeral wetland habitats, commonly (locally) known as “playas.” These playas are “off-limits” for vehicles, concentrations of personnel, or any activities that would impact these sensitive, easily-damaged areas. Further, wetland habitat size and condition are periodically monitored. Section 9.3.2 addresses wetlands surveys at Fort Bliss (a basic survey for the entire installation was completed in 1998). In addition, site-specific wetlands delineations are required for any actions impacting wetlands.

Wetlands effects analysis requires familiarity with several pertinent laws and regulatory requirements. Key laws include the Clean Water Act (CWA); the Endangered Species Act; the Coastal Wetlands Planning Protection, and Restoration Act; and the North American Wetlands

Conservation Act. Reference information on these laws and associated regulations, along with a 1977 Executive Order, includes:

- Executive order on protection of wetlands (EOP, 1977*).
- Laws related to wetlands (USEPA, 2005h) (Web linked on the accompanying CD).
- Regulations related to wetlands, including the CWA Section 404 permit program administered by the U.S. Army Corps of Engineers (USEPA, 2005k) (Web linked on the accompanying CD).
- Wetlands-related policy and technical guidance documents (USEPA, 2005j) (web linked on the accompanying CD).
- Federal and state policies, legislation, and programs (GAO, 1991).

CEQ Step 2 – Establish the geographic scope for the analysis.

The geographical (spatial) boundaries for wetlands effects analysis should include the physical boundaries of the installation and associated training range(s), as well as the watershed(s) encompassing the installation. These boundaries represent a watershed approach and typical geographical boundaries used for wetlands delineation and management. The following key information can help establish the geographic scope:

- Location of the installation boundaries, the boundaries of adjacent easement lands, and land uses and boundaries of adjacent non-Army lands.
- Boundary information on watersheds associated with the installation.
- Geographic boundaries of designated special wetland conservation and protection areas.

This information should be included in the installation INRMP.

CEQ Step 3 – Establish the time frame for the analysis.

Temporal boundaries should include past and future actions that may have influenced (or will influence) wetland resources within the delineated spatial boundaries. While no specific guidelines exist to encompass these retrospective and prospective temporal boundaries, the following practical questions (or things to consider) can be used to establish the appropriate historical boundaries:

- When was the installation and associated training range(s) established, and when did certain mission changes or modernizations occur? Have range expansions or reductions occurred in the past, and when did they take place?
- When was the first wetlands inventory compiled for the installation? How frequently has the inventory been updated?
- Has a wetlands monitoring program been implemented for the installation? If so, when did it start, and has the program evolved over time?

Based upon the answers to the above questions, the earliest date should be identified and used as the initial historical reference point.

Similarly, the following questions (or things to consider) can establish the future time:

- What is the time period required to “modernize” the installation and associated range(s), and what is the anticipated period of use of the completed modernized facilities?

- What are the military construction plans for the installation over the next 2, 5, and 10 years?
- Are any major changes in the installation mission anticipated, and if so, when are such changes anticipated to occur?

Depending upon the answers to the above questions, the most distant time should be used to establish the initial prospective reference point to encompass future actions.

CEQ Step 4 – Identify other past, present, and reasonably foreseeable future actions that have affected (or are anticipated to affect) wetlands resources.

Past actions can be identified through the review of historical land usage for the installation and associated range(s), highlighting contributing past actions, and identifying land use trends. Historical studies and inventories of installation wetlands, along with the INRMP and its precursor documents, are also useful.

Present actions include both on-going past actions and new actions. Information for such actions can be obtained from installation sources (directorates), planning departments of local towns and cities, and other Federal, state, and local agencies. These same information sources can be used, along with discussions with installation and regional planners, to identify reasonably foreseeable future actions within temporal boundary for the study. The inclusion of future actions should consider their likelihood and the time period of their implementation.

Depending upon the scope of on-installation and off-installation inventories, site-specific wetland inventories may be required. The following reference materials should be useful:

- Classification of wetlands and deepwater habitats of the United States (Cowardin, et al., 1979*) – This document highlights a widely used classification scheme developed by the U.S. Fish and Wildlife Service.
- Guidance for wetlands delineation (USACE, 1987*) – This document is designed to assist users in making wetland determinations, using a multi-parameter approach requiring positive evidence of hydrophytic vegetation, hydric soils, and wetland hydrology. The multi-parameter approach provides a logical, easily defensible, and technical basis for wetland determinations. Hydrophytic vegetation, hydric soils, and wetland hydrology are also characterized, and wetland indicators for each parameter are listed.

CEQ Steps 5-7 – Characterize the wetlands resources identified in scoping in terms of their response to change and capacity to withstand stresses (Step 5); characterize the stresses affecting these resources and their relation to regulatory thresholds (Step 6); and define a baseline condition for the wetlands resources (Step 7).

These three CEQ steps emphasize historical wetlands trends within the spatial boundaries for the effects analysis. The following key information and references can be used:

- Historical and current reports on installation wetlands monitoring relative to size and functioning.
- Historical and current wetlands monitoring reports from the state or in-state regional agency.
- Five-year national wetlands status and trends report (FWS, 2005b)

(http://wetlands.fws.gov) (Web linked on the accompanying CD). This report could be used to examine recent regional and local trends in wetlands resources.

- Status and trends of wetlands in the conterminous United States from 1986 to 1997 (Dahl, 2000*). This report provides information on regional and local trends in wetlands resources from the mid-1980s to the mid-1990s.
- A strategy for the 21st century for the National Wetlands Inventory (FWS, 2002*). This report identifies future actions by the FWS regarding the National Wetlands Inventory.
- Wetlands losses in the United States from the 1780's to the 1980's (Dahl, 1990*). This report delineates historical wetlands resources losses in regional and local areas.
- Current annual national wetlands inventories (NRCS, 2005) (Web linked on the accompanying CD). This report provides current annual updated information on regional and local wetlands resources.
- Geographically isolated wetlands (Tiner, et al., 2002) (Web linked on the accompanying CD). This report includes information on playa areas and other geographically isolated wetlands which characterize certain areas of the United States.
- Review of commonly requested publications associated with the National Wetlands Inventory for their relevance (FWS, 2005a) (Web linked on the accompanying CD).
- Review of list of selected wetlands publications, updated in November, 2003, for relevant studies (FWS, 2003) (Web linked on the accompanying CD).

CEQ Step 8–Identify the important cause-and-effect relationships between human activities and wetlands resources.

Cause-and-effect relationships can be depicted in several ways. Maps can be used to locate activities and wetland areas, and network diagrams can depict various types and inter-relationships of effects. The relationship between wetlands and watersheds can be used to illustrate cause-effect relationships (USEPA, 2005l) (Web linked on the accompanying CD), such as effects of non-point pollution sources, the effects of urban stormwater, or the efficacies of best management practices.

Information is available to link multiple land-use activities and resultant changes in watershed and ecosystem functions, and the processes that arise from them (Reid, 1993*). The addressed land-use activities include roads, impoundments and water development, timber management, grazing, mining, agriculture, urbanization, flood control and navigation, and recreation and fishing. These linkages can be considered from a holistic perspective, providing the basis for watershed CEA, including wetlands.

"Connections" between land uses (and associated activities) and habitats, including wetlands can be defined using an EPA guidance manual for habitat evaluation (Southerland, 1993*). This manual includes descriptive information on impacts of numerous types of projects and activities. Regional concerns, related to habitat type, are summarized, including wetlands. While originally focused on EIS review, it can also support NEPA and CEA analyses.

CEQ Step 9–Determine the magnitude and significance of cumulative wetlands effects.

Several procedures and methods are available to determine the magnitude of cumulative wetlands effects. The following key references summarize several options:

- A comparative review of 16 rapid assessment methods for assessing the condition of a wetland (Fennessy, Jacobs, and Kentula, 2004*). These simpler and less data-intensive methods could be used for installations.
- A description of six methods for cumulative wetlands effects determinations (Vestal, et al., 1995*). The six methods include a landscape conservation approach, the cause-effect process of the U.S. Fish and Wildlife Service, a synoptic approach by the U.S. Environmental Protection Agency, the wetland evaluation technique (WET) of the U.S. Army Corps of Engineers, an indicator species approach, and a habitat-based landscape approach, by the National Oceanic and Atmospheric Administration. The latter approach, which appears promising for installations and associated training ranges, includes the following steps adapted to wetland habitats: (a) determine whether to review in-depth for cumulative wetlands effects; (b) collect and synthesize pertinent scientific information on indicators and historical anthropogenic sources of stress; (c) identify goals and objectives for the study area; and (d) evaluate the effects of individual new projects along with those from past, present, and reasonably foreseeable future actions. Several examples and case studies are presented, and they could be useful in choosing a wetlands evaluation method for use at an installation.
- Detailed and summary information on the synoptic approach (Leibowitz, et al., 1992, Abbruzzese and Leibowitz, 1997, and USACE, 2001), involving the measurement and evaluation of numerous indicators to evaluate wetlands functions.
- A comprehensive methodology, called the Hydrogeomorphic Approach (HA), by the U.S. Army Corps of Engineers, for measuring capacity of a wetland to perform basic functions (Clairain, 2002), and a case study of its application (Powell, 1997) (can find via Internet "googling"). This HA approach is also very data-intensive.
- The use of GIS as a tool for inventorying wetlands and assessing potential cumulative effects (LaPoint, et al., 2004, Tims, et al., 2004, and Sclafani and Mathers, 2004).
- A useful database on information sources for ecosystem management and restoration (O'Neil, 2001) (Web linked on the accompanying CD). This database, the Ecosystem Management and Restoration Information System (EMRIS), includes a wealth of information on Habitat Suitability Index (HSI) models for indicator species, as developed by the FWS. Copies of 153 models are included; and such models can be used for evaluating habitat conditions for selected invertebrates, fishes, birds, mammals, etc. EMRIS also includes other references on pertinent laws; plants, animals, and communities; and community-based models.
- A reference on roads and their effects on wetlands (Cusic, 2000).
- A conceptual paper on strategies to assess cumulative effects of wetland alteration on water quality (Brinson, 1988).

In summary, various "methods" can be used to determine the magnitude of cumulative wetlands effects. A simple approach involving the determination of the sizes of potentially affected wetlands resources, and the use of a few indicators of the functions of such wetlands would seem most practical. Further, evaluations of wetlands habitat for selected indicator species could also be included, as appropriate.

The significance of wetlands effects can be determined from the following considerations:

- Compliance with policies and regulations related to wetlands conservation and protection, and
- Percentage losses in size and functions of local and regional wetland resources

CEQ Steps 10 and 11 – Modify or add alternatives to avoid, minimize, or mitigate significant wetlands effects (CEQ Step 10), and monitor the wetlands effects of the selected alternative and adapt management (CEQ Step 11).

Mitigation of wetlands effects may involve both on-post and off-post decisions, the latter accomplished collaboratively with the state or regional management agency, other state or federal agencies, local towns and cities, and the private sector. Examples of such mitigation measures are described in the following references:

- The PEIS for Army Transformation (USA, 2002a, pp. ES-10 and ES-11) summarizes five types of measures – mitigation in conjunction with site-specific NEPA analyses; fostering of a "sustainable environment" ethic; implementation of an EMS; use of best management practices; and programmatic environmental compliance, safety, and health evaluations for weapon systems acquisition.
- Development of a wetland mitigation banking program, following Federal guidance for establishment, use, and operation of mitigation banks (USACE, et al 1995*). An installation-level banking program could prove useful for mitigating cumulative wetlands effects.
- Development of an off-site (and out-of-kind) compensatory mitigation program under the auspices of Section 404 of the Clean Water Act (USACE, et al., 2002b*). A comprehensive document for such compensation is available from the National Research Council (NRC, 2001a). Regulatory guidance on compensatory mitigation is also available (USACE, 2002b).

Monitoring of selected indicators of wetland size and functions, and related cumulative effects, may be necessary. Such monitoring could be introduced as modifications to existing on-installation monitoring programs, or as a part of a newly implemented EMS. A useful reference for planning and implementing a monitoring program is available (Marcus, 1979*). The monitoring results can be incorporated into an organized feedback and decision-making system to adapt management activities, and thus reduce undesirable direct, indirect, and cumulative wetlands effects. Another useful reference is available from the USEPA wetlands monitoring and assessment Web site (USEPA, 2005i) (Web linked on the accompanying CD).

4.7.4 Summary

Extensive information is available for planning and conducting wetlands effects analysis on Army installations and associated training ranges. A critical key installation document is the INRMP, providing specific information on the types, sizes, and locations of wetlands, and the functions they provide. The NEPA analyst, using this volume of information (including that on the accompanying CD) has several choices (for example, a choice between methods for determining the magnitude of cumulative effects). Further, considerable coordination will be necessary with the FWS and pertinent state and local agencies, as appropriate, regarding mitigation options and their planning, implementation, and monitoring.

4.8 Water Resources Management

4.8 Water Resources Management

4.8.1 Introduction

Effects on water resources and their management have been identified as issues of concern related to modernization of U.S. Army installations with training ranges. Water resources are inclusive of surface water like that in streams, rivers, lakes, and estuaries, groundwater, wetlands, and floodplains. Effects concerns may exist in relation to available water quantities and usage patterns, water quality and compliance with various standards, the use of engineering controls and management measures to reduce both point and nonpoint source discharges while meeting various permitting requirements, and the potential for surface water and groundwater degradation from installation soils contaminated with chemicals associated with the firing of large weapons or the use of small arms training ranges. Water resources management requirements are typically derived from the Clean Water Act (CWA), Safe Drinking Water Act (SDWA), and water rights laws that vary from state to state. Particular concerns related to excessive water usage may arise for installations in western states with low annual rainfalls. Summary discussions of the institutional requirements of the CWA and SDWA were included in the Final Programmatic Environmental Impact Statement (PEIS) for Army Transformation (U.S. Army Corps of Engineers, February 2002, pp. 3 – 42 to 3 –54). Further, the PEIS also included a discussion of the effects on water resources from systems acquisition; construction of new buildings, ranges, and infrastructure; land acquisitions that would become subject to federal protection of water resources; land disposal that could result in reduced natural resources protection and water rights and land use conflicts; training activities that cause soil and habitat impacts and chemical spills resulting in subsequent impacts on water quality; and positive long-term water resources benefits from implementing key elements of water resources plans (U.S. Army Corps of Engineers, February 2002, pp. 4 –18 to 4 –19).

Specific examples of direct, indirect, and detailed cumulative effects on water resources can be found in the following recent Army-related EISs:

- PEIS for Army Transformation (U.S. Army Corps of Engineers, February, 2002, p. 4-32)

  Cumulative water supply demands on aquifers were identified as a result of human population encroachment near Army installations, along with increased water demands from on-post Army activities. Cumulative degradation of water quality was also identified as a result of discharges of treated effluents that could exceed the carrying capacity of the receiving waters

- FEIS for the 2nd Armored Cavalry Regiment Transformation and Installation Mission Support, Joint Readiness Training Center and Fort Polk, Louisiana (Tetra Tech, Inc., January 2004, pp. 4-367 to 4-369)

  This EIS delineated four cumulative water resources effects. First, long-term moderate cumulative surface water quality effects in the watershed-based Region of Influence (ROI) are anticipated from increased erosion rates due to training and other human activities, e.g., timbering; sources of chemicals and excess nutrients such as wastewater treatment plants; storm water runoff from surrounding towns, businesses, and roadways; and agricultural activities. Cumulative effects on 34 acres of wetlands within the installation boundary are expected, due to some filling required for the proposed action. Long-term moderate regional adverse impacts and long-term significant localized adverse impacts on wetlands would be expected. Long-term minor adverse cumulative effects on groundwater withdrawals could also occur in the region over the next 10 – 20 years when non-military growth and encroachment activities are added to the proposed action. Such changes could lead to an increased use of groundwater resources in the vicinity that are not widely used at present. Further, releases of explosive constituent compounds during training activities, when added to the existing contaminant loads on live-fire ranges, could contribute to cumulative groundwater quality concerns. However, future range sustainability measures would be expected to facilitate reductions in these groundwater quality effects.

- DEIS for Military Training Activities at Makua Military Reservation (MMR) on Oahu and Hawaii (U.S. Army Corps of Engineers, April, 2004, pp. 5 – 41 to 5 – 45)

  This DEIS identified both surface water, including coastal water, and groundwater cumulative effects issues. The groundwater ROI is the aquifer system beneath the Makua Valley. Numerous past, present, and future non-military projects in the environs of MMR were considered contributors to cumulative effects, along with the past and planned MMR activities. Examples of cumulative effects concerns include the contributions of nonpoint sources of pollutants to coastal water quality. Of particular concern is soil erosion associated with the prescribed burn program, as well as wildfires at MMR. Chemicals from training activities on the MMR, as well as past disposal activities, are a current concern relative to the concentrations in the local aquifer system, and planned future training could also contribute to these contaminant concentrations.

- FEIS for the Transformation of the 2nd Brigade, 25th Infantry Division to a Stryker Brigade Combat Team in Hawaii (Tetra Tech, Inc., May 2004, pp. E – 43 and 9 – 34 to 9 – 38)

  This EIS identified several cumulative water resources effects. The Stryker Brigade FEIS address training on both the islands of Oahu and Hawaii. Four specific effects were identified – impacts on surface water quality, impacts on groundwater quality, increased flood potential, and the adequacy of groundwater supplies. The impacts on surface water quality were deemed to be the most important. Such impacts are anticipated from nonpoint source pollutants, contaminated suspended sediment, transport of trace levels of explosives residues, and soil loss and suspended sediments.

This section is structured to follow application of the CEQ's 11-step CEA process to the water resources management VEC. For each step, specific information is included on how the step can be utilized for the VEC. Further, reference materials and Web sites are noted, along with scientific methods and related tools. Prior to beginning the 11-step process, detailed summary information is included on the overall objective of the Army's water resources management program, on pertinent requirements of the SDWA and CWA, and on key Army documents related to these two laws. Many of the requirements form the basis for compliance with the 11-step process. In addition, brief information is included on related executive orders regarding wetlands protection and floodplain management.

4.8.2 Objective of Water Resources Management

The overall objective of the Army's installation-specific water resources management program is to ensure the availability of an adequate water supply of either surface water, groundwater, or a combination of the two, for multiple uses, to conserve water usage as appropriate, and to protect both surface water and groundwater from pollutant stresses reflective of non-compliance with requisite laws, regulations, and permit conditions (U.S. Department of the Army, 1997)*. As described in Chapter 2 of AR 200-1, compliance with federal, state, and local institutional requirements necessitates that the Army will (U.S. Department of the Army, 1997, p. 9):

- Obtain and comply with all required waterworks permits.
- Provide drinking water which meets applicable laws and regulations or satisfies Army standards developed for field environments and other military-unique situations.
- Conserve water resources including wetlands, estuaries, watersheds, and groundwater.
- Control or eliminate sources of pollutants and contaminants to protect water resources.
- Obtain and comply with wastewater discharge permits.
- Identify and implement pollution prevention initiatives.
- Participate with regional authorities in the development and implementation of water resource initiatives.
- Incorporate nonpoint source (e.g., stormwater runoff, soil erosion) abatement measures in construction, facility operations, and land management activities.
- Encourage the beneficial reuse of wastewater and sludge.
- Use regional or municipal water supply and wastewater collection and treatment systems, when economically feasible.

It should be noted that the focus herein is on water resources management related to fixed facilities at Army installations. However, information on the management of water resources in support of tactical operations is available in AR 700-136 (U.S. Department of the Army, 2005*). Key policies are included on water support requirements for Army forces; water support for other Services; water standards; and water treatment, storage, and distribution.

To illustrate the diversity of surface and groundwater resources associated with Army installations, the following context information is summarized. For example, the names of the watersheds associated with 24 Army installations are included in the PEIS for Army Transformation (U.S. Army Corps of Engineers, 2002, p. 3–48 and 3–49). The number of watersheds per installation ranges from one (Fort Bragg, North Carolina, Fort McClellan, Alabama, and Fort Pickett, Virginia) to seven (Fort Lewis/ Yakima, Washington). To serve as specific examples of watersheds by name, Fort Bragg is associated with the Upper Cape Fear Watershed; Fort Bliss, Texas, with the El Paso-Las Cruces, Rio Grande-Fort Quitman, Salt Basin, and Tularosa Valley watersheds; and Fort Wainwright, Alaska, includes the Chena River, Salcha River, and Tanana River watersheds.

The PEIS also lists the miles of streams and acres of lakes on the 24 Army installations (U.S. Army Corps of Engineers, 2002, p. 3–52). Stream miles range from 49 miles at Fort McClellan to

1,160 miles at Fort Bliss. Lake acreages range from zero at four installations (Fort Lewis/ Yakima, Fort Irwin, California, Fort Wainwright, and Orchard Training Area, Idaho,) to 1375 miles at Fort Drum, N.Y.

Finally, the PEIS listed major aquifers for 19 Army installations (U.S. Army Corps of Engineers, 2002, p. 3–51 to 3–52). To illustrate, Fort Bliss is underlain by the Rio Grande aquifer system; and Fort Lewis/Yakima by the Columbia Plateau aquifer system, the Pacific Northwest basin-fill aquifers, and the Puget-Willamette Lowland aquifer system.

4.8.3 Safe Drinking Water Act

The key federal law related to water consumption is the Safe Drinking Water Act (SDWA), as amended. The Army is required to provide drinking water to fixed facilities at installations in accordance with requirements of the SDWA and applicable state and local regulations. For example, the SDWA includes both Primary and Secondary Drinking Water Standards. The Primary Standards regulate substances that may have an adverse effect on human health, while the Secondary Standards regulate substances that may have an objectionable impact on aesthetic parameters of water quality (U.S. Department of the Army, 2002)*. Table 2-1 in DA PAM 200-1 delineates the maximum contaminant levels (MCLs) for the regulated contaminants subject to Primary Standards, while Table 2-2 does similarly for the Secondary Standards (U.S. Department of the Army, 2002, pp. 7–10). The contaminant categories in Table 2-1 include inorganics, volatile organics, herbicides/pesticides/others, trihalomethanes, disinfection by-products and precursors, disinfectant residuals, radiochemicals, and microbiological indicators. Table 2-2 lists six metals, foaming agents, odor, and other parameters that can influence color and corrosivity.

Detailed information on the national primary drinking water regulations can be found in 40 CFR Part 141 (U.S. Environmental Protection Agency, 40 CFR 141, 2005), Web linked on the CD. Similar information on the national secondary drinking water regulations are in 40 CFR Part 143 (U.S. Environmental Protection Agency, 40 CFR 143, 2004), Web-linked on the CD. Topics in 40 CFR Parts 141 and 143 include definitions, MCLs for specific contaminants, and monitoring frequency and compliance requirements.

The SDWA also requires planning to protect water supplies. Three programs related to groundwater protection include the Underground Injection Control Program(CFR Part 144-146), the Sole Source Aquifer Protection Program (Section 1424(e) of the SDWA) (CFR Part 149, and the Wellhead Protection (WHP) Program (Section 1428 of the SDWA). Implementation of the WHP Program is accomplished via state and local initiatives. The four key elements for a well-specific plan include (U.S. Department of the Army, 2002, p. 3):

- Delineation of the WHP area, a recharge zone based upon a set radius or time of groundwater travel.
- An inventory of potential sources of contamination within the area.
- Development of a management plan to control or remove contamination sources and regulate activities within the area that may impact groundwater quality.
- Establishment of a contingency plan to provide an alternate source of drinking water in the event that the well becomes contaminated.

The overall WHP plan would comprise the aggregate of the individual well plans.

The 1996 amendments to the SDWA required that the states develop Source Water Assessment and Protection (SWAP) programs by 1999. Key elements of a SWAP program focused on surface water sources include a strategic approach for conducting assessments, information on delineating the area of influence from which a contaminant may enter a public water supply (PWS), descriptions of how to compile inventories of sources of known or unknown contaminants within the delineated area, and procedures for determining the susceptibility of a PWS to such contaminants (U.S. Department of the Army, 2002, p. 3).

Conservation measures to reduce water consumption from surface water or groundwater supplies at federal facilities were required as part of the Energy Policy Act of 1992. As a result, a number of planning and management initiatives have emerged in recent years on Army installations. Water efficiency measures seek the efficient use of water through behavioral, operational, or equipment changes. Water recycling, reclamation, or reuse measures include use of treated wastewater for beneficial purposes, such as landscape irrigation, industrial processes, toilet flushing, and replenishing a groundwater basin (referred to as groundwater recharge). Water is sometimes recycled and reused on site; for example, when a facility recycles water used for cooling purposes. A common type of recycled water used for nonconsumptive purposes is water that has been reclaimed from municipal wastewater or sewage (U.S. Army Corps of Engineers, February, 2002, p. 3-53).

Executive Order 12902, titled "Energy Efficiency and Water Conservation at Federal Facilities", was issued on March 8, 1994 (Executive Office of the President, 1994) (Web-linked). It calls for the implementation of water conservation measures by federal agencies. Examples of measures that are increasingly being adopted by the Army pertain to universal metering, water accounting and loss control, costing and pricing, information and education programs, water use audits, retrofits, water pressure management, landscape efficiency, reuse and recycling, water use regulation, and integrated resource management (U.S. Army Corps of Engineers, February, 2002, p. 3-53).

Finally, several Army and/or Joint Services Technical Manuals address water supply and drinking water issues; the following are examples of such Technical Manuals (TMs):

- TM 5-813-1 – provides guidance for selecting water sources, determining water requirements for Army and Air Force installations and special projects, and for developing suitable sources of supply from groundwater or surface water sources (U.S. Department of the Army, TM 5-813-1, 1987). Available for download via Internet search.
- TM 5-813-7 – establishes the minimum water supply requirements for fire protection and domestic purposes at various small Army and Air Force projects (U.S. Department of the Army, TM 5-813-7, 1986). Available for download via Internet search.
- TM 5-813-3 – presents information on water quality standards, design criteria for water treatment processes, overall water treatment systems, measurement and control, treatment chemicals, and treatment plant wastes (U.S. Department of the Army, TM 5-813-3, 1985). Available for download via Internet search.
- TM 5-813-8 – addresses the use of desalination as a process for converting brackish water or sea water into a useable water source; extensive information is included

on distillation/condensation techniques, membrane techniques, and ion exchange processes (U.S. Department of the Army, TM 5-813-8, 1986). Available for download via Internet search.

- TM 5-813-4 – includes design criteria for water storage requirements at Army and Air Force facilities, design analyses for tanks and reservoirs, and guidance on site selection for such storage works (U.S. Department of the Army, TM 5-813-4, 1985). Available for download via Internet search.
- TM 5-813-5 – provides information on Army and Air Force water distribution systems, including system and transmission line design, system pressures and equipment, and service connections (U.S. Department of the Army, TM 5-813-5, 1986). Available for download via Internet search.

4.8.4 Clean Water Act

The U.S. Army is obligated to comply with various requirements in the Clean Water Act (CWA) that are associated with control and abatement of water pollution (U.S. Department of the Army, AR 200-1, 1997). Following is a list of principal Army responsibilities under the CWA, and which have relevance to Army installations (U.S. Army Corps of Engineers, 2002, p. 3–46):

- Obtaining a National Pollutant Discharge Elimination System (NPDES) permit and managing direct discharges in compliance with permit conditions
- Managing discharges to a publicly owned treatment works in accordance with established federal, state, and local pretreatment standards
- Managing domestic treatment works in accordance with sludge requirements
- Applying for CWA Section 404 dredge and fill permits for construction and development projects
- Monitoring, recording, and reporting pollutant effluent concentrations
- Developing, implementing, and maintaining Storm Water Pollution Prevention plans and obtaining necessary permits
- Developing Spill Prevention, Control, and Countermeasure plans

Selected principal sections of the CWA that have relevance to Army installations include (U.S. Army Corps of Engineers, 2002, pp. 3–43 to 3–45):

- CWA Section 303 (Water Quality Standards and Implementation Plans). Section 303(d) requires states to identify waters that do not meet or are not expected to meet water quality standards even after technology-based or other required controls are in place. States establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters. The applicable standards and conditions of water quality for installation streams and rivers must be known and included in any CEA for water resources.
- CWA 307- National and Local Pretreatment Standards. Facilities that discharge to Publicly Owned Treatment Works (POTWs) are excluded from NPDES permitting requirements but are subject to national general pretreatment standards (40 CFR Part 403), applicable categorical pretreatment standards (specified in 40 CFR Parts

405-471), and any state or local pretreatment standards. Army installations include facilities that discharge to POTWs.

- CWA Section 402- National Pollutant Discharge Elimination System. Point source discharges of wastewater must comply with requirements established by an NPDES permit issued by the EPA or a state agency that has an approved NPDES program. NPDES permits contain water quality-based and/or technology-based standards for effluent discharges (specified in 40 CFR Parts 405–471 or by the best professional judgment of the permit writer), monitoring requirements, analytical testing methods, and reporting requirements. Dischargers must submit discharge monitoring reports that record flow measurement, sample collection data, and laboratory test results on a quarterly or monthly basis. Noncompliance reports must be submitted quarterly or monthly stating the cause of the noncompliance, period of noncompliance, and plans to eliminate recurrence of the incident. Point source storm water discharges that are associated with certain industrial activities or are designated by the EPA for contributing to a violation of water quality standards also require a permit.
- CWA Section 404- Permits for Dredged or Fill Material. Facilities that discharge dredged or fill materials into navigable waters must apply for a permit issued by the U.S. Army Corps of Engineers. The EPA may restrict or deny the dredging or filling of any site where the activity could have an adverse effect on the environment. States may apply for the authority to implement the CWA Section 404 program. However, the Corps retains authority over navigable waters within the state. Under limited circumstances, the discharge of dredged or fill materials, as part of a federal project specifically authorized by Congress, is not prohibited by or subject to regulation under CWA Section 404.
- CWA Section 405- Permits of Sludge Management. All works that treat domestic sewage are required to meet federal requirements for the use and disposal of sewage sludge through land application, surface disposal, or incineration. These requirements are incorporated into permits issued under CWA Section 402, under the appropriate provisions of other legislation (e.g., Solid Waste Disposal Act; Safe Drinking Water Act; Marine Protection, Research, and Sanctuaries Act; Clean Air Act), under EPA-approved state sludge management programs, or, in the case of a treatment works that is not subject to the above requirements, through a sludge-only permit.
- CWA Section 311- The EPA Oil Pollution Prevention regulation establishes requirements for facilities to prevent oil spills from reaching navigable waters of the United States or adjoining shorelines. The rule applies to owners or operators of certain facilities that drill, produce, gather, store, process, refine, transfer, distribute, or consume oil. The regulation requires that all regulated facilities, including federal facilities as specified in 40 CFR 112.1(c), have a fully prepared and implemented a Spill Prevention, Control, and Countermeasures (SPCC) plan. A SPCC plan is a detailed, facility-specific, written description of how a facility's operations comply with the prevention guidelines in the Oil Pollution Prevention regulation. The guidelines include measures such as secondary containment, facility drainage, dikes or barriers, sump and collection systems, retention ponds, curbing, tank corrosion protection systems, and liquid devices. Unlike oil spill contingency plans that typically address spill cleanup measures after a spill has occurred, SPCC plans ensure that

facilities put in place containment and other countermeasures to prevent oil spills from reaching navigable waters.

Additional details related to the above CWA requirements for pretreatment, NPDES permits, industrial wastewater treatment systems, and sludge management are in DA PAM 200-1 (U.S. Department of the Army, Pamphlet 200–1, 2002, pp. 4–5). Further information on storm water permits, under the auspices of the NPDES permit program, is also described in DA PAM 200-1 (p. 5).

Finally, regarding the design, operation, and maintenance of Army installation wastewater treatment plants, two technical manuals, available for download via Internet search, can be noted:

- TM 5-814-3 (U.S. Army Corps of Engineers, TM 5-814-3, 1988) – This manual includes detailed information on site selection and designs for various treatment processes associated with wastewater treatment plants.
- MIL-HDBK-1138 (U.S. Department of Defense, MIL-HDBK-1138, 1997) – This DoD handbook addresses operations and maintenance in relation to the following topics for military wastewater treatment systems: regulatory compliance and monitoring; septic tanks; grease traps; oil/water separators; septage management; extreme climate operation; corrosion control; and chemical shipping and feeding.

4.8.5 Executive Orders on Wetlands Protection and Floodplain Management

Two Presidential Executive Orders (EOs) also have relevance to water resources management. First, EO 11990, titled "Protection of Wetlands," requires federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands (Executive Office of the President, EO 11990, 1977). This EO is included in the Wetlands VEC section on the accompanying CD. The second EO (EO 11988), titled "Floodplain Management," requires federal agencies to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values served by floodplains (Executive Office of the President, EO 11988, 1977). Floodplain determinations may be required for training range modernizations or new ranges at existing installations. At specific installations, the requirements of both of these EOs are typically addressed in Integrated Natural Resources Management plans (INRMPs) and are associated with the Integrated Training Area Management (ITAM) program. Guidelines for preparing INRMPs are included in the Wetlands VEC section on the accompanying CD; further, a procedural manual for the ITAM program is in the Sedimentation/Erosion VEC section on the accompanying CD.

4.8.6 Quick Look Questions

"Quick Look questions can be used to determine the need to address the direct and indirect effects of a proposed action on water resources; in addition, they can be used to determine if cumulative effects also need to be considered. These questions include:

- Is the installation located completely, or partially, in a designated sole source aquifer area, and/or have local surface waters been designated as having water quality concerns relative to compliance with water quality standards or criteria?

- During its construction and/or operational phase, will the proposed action exhibit point and/or nonpoint emissions of water pollutants? Will such emissions exceed standards as designated in federal or state water quality regulations or permits?
- Is the installation located in an area where the available surface and/or groundwater supplies are already stressed due to excessive usage and/or drought conditions?
- Will the water requirements for the proposed action be large in relation to the available surface and/or groundwater supplies?
- Are there wide variations in the monthly and/or seasonal patterns of water usage at the installation?
- Are there any sensitive receptors of water pollutant effects associated with the installation? (Examples of such receptors include aquatic ecological resources, threatened or endangered plant or animal species, and excessive human health risk levels.)
- Within the last 5 years, has the installation been subject to Notices of Violations (NOVs) or fines relative to SDWA or CWA permit requirements? Are there any concerns that federal and state source-oriented permits may not be up to date, and are there any specified conditions not being met?
- Does the installation drain to an impaired waterbody?

If the answers to all of the above questions are "no," then it will probably not be necessary to address the direct, indirect, and cumulative effects of the proposed action. However, if one or more of the above questions has a "yes" or "do not know" answer, then attention will need to be given to all three types of effects. Conversely, a "yes" or "do not know" answer does not automatically trigger an EIS. Consideration should first be given to the preparation of an EA for the proposed action.

At the EA level, attention needs to be given to the four scoping steps (Steps 1–4) described below, and Steps 6 and 7 related to describing the affected environment. Documentation of the findings from these steps could serve as a "hard look" if it is determined that an EA is appropriate. However, if concerns are identified from consideration of Steps 1–4, 6 and 7, then an EIS would be appropriate. For an EIS, all 11 steps described below should be addressed.

4.8.7 Impact Analysis Steps

CEQ Step 1 – Identify the significant water usage and water quality effects issues associated with the proposed action, and define the assessment goals.

The first step involves identifying the anticipated water usage patterns and the types and quantities of water pollutant emissions associated with the construction and operation of training range projects or activities, and garrison area projects or activities. The following documents contain an abundance of information on water usage and on the types and quantities of point and nonpoint water pollutants.

The key document related to identifying cumulative water resources issues is the installation's Water Resources Management Plan (WRMP). Information related to such plans is included in the guidelines for preparing Integrated Natural Resources Management Plans (INRMPs) for Army installations (U.S. Army Environmental Command, 1997*). Specifically, the following is identified in the guidelines (U.S. Army Environmental Command, 1997, pp. 18, 20, 24, and 26):

- Section 4.3 on Water Supply (in Chapter 4.0 on Facilities) – Describes the installation's water quantity needs to support domestic use, irrigation, or wildlife watering. Describes water quality as it affects domestic use, wildlife, or aquatic species. Describes the sources of water for the various uses, and the effects of water withdrawal on aquifers, streams, or other natural resources.
- Section 6.7 on Water Resources (in Chapter 6.0 on Natural Resources and Climate) – Describes both surface and groundwater resources, including lakes, ponds, perennial and intermittent streams, wetlands, and floodplains. Summarizes the status of water quality and identifies the recent trend of that quality. Particular attention should be paid to nonpoint source pollution, especially sedimentation and other pollutants most affected by the INRMP.
- Section 8.10 on Wetlands Management (in Chapter 8.0 on Natural Resources Management) – Describes programs that improve the quality of wetlands or efforts to develop, protect, or enhance wetlands. Includes specific areas to be managed, management techniques, and species and habitat types that benefit from such management. Floodplain and riparian area management is included in this section.
- Section 8.11 on Water Quality Management (in Chapter 8.0 on Natural Resources Management) – Describes programs specifically designed to improve the quality of water. Discusses how these programs affect water quality off the installation. Describes the use of Storm Water Pollution Prevention plans within the natural resources program. Discusses the effects of off-installation activities on installation water quality. Related to the Water Quality Monitoring section in Chapter 9.
- Section 9.5 on Water Quality Monitoring (in Chapter 9.0 on Inventorying and Monitoring) – Describes systems used to monitor water quality as it relates to land use and management.

More specifically, AR 420-49 indicates that a Water Resources Management Plan (WRMP) should be included as part of the Installation Utilities Management Plan (IUMP) (U.S. Department of the Army, AR 420-49, April 28, 1997, pp. 4–7*). The WRMP should include policies for water supply development; water conservation; water treatment; disposal of water treatment plant sludges; nonpoint source pollution control; wastewater treatment; disposal of wastewater treatment plant sludges; testing of water quality in water supplies, effluents from water and wastewater treatment plants, and in water distribution systems; and water reuse.

In addition to construction phase environmental impacts associated with the water supply infrastructure (e.g., intake structures for surface waters, pumping of groundwater, water treatment plants, water storage, and water distribution systems), two other types of impacts may be of concern. First, usage of surface water or groundwater may be subject to allocation restrictions and previously established water rights. Such restrictions may be derived from state or local laws, river basin commissions, or groundwater protection districts. New or updated water usage permits may be required. One key consideration may be related to cumulative water withdrawals in areas subject to drought or limited water availability. Further, excessive cumulative water withdrawals may have implications for the quality characteristics of the surface and/or groundwater resources. For example, excessive withdrawal of available groundwater could cause groundwater depletion, and it may cause intrusion into saline water zones in the subsurface (salt water or saline water intrusion).

A second environmental impact concern is related to the effects of discharges of water treatment plant brines or sludges. Such discharges may require the procurement of National Pollutant Discharge Elimination System (NPDES) permits. Expansions of water treatment plants at Army installations due to increased water demands could increase concerns associated with discharges of such brines or sludges.

As noted earlier, source water assessments have been required as a result of the 1996 amendments to the SDWA. For surface waters, a watershed approach has been developed. A basic technical reference document for assessing watersheds was promulgated by the U.S. Environmental Protection Agency in 1994 (Euphrat and Warkentin, 1994*). The watershed approach is described along with various federal laws and policies that support the use of watersheds for assessing public water supplies. Water quality impacts from land uses involving crops and livestock agriculture, grazing lands, mining, and urban areas and storm water are described. Similar information on the effects of multiple land uses on watershed and ecosystem functions and processes are in a U. S. Forest Service research report (Reid, 1993*). For example, the land uses include roads, impoundments and water development, timber management, grazing, mining, agriculture, urbanization, flood control and navigation, and recreation and fishing. Many of these uses are on or adjacent to Army installations.

Cumulative effects issues of unique concern at Army installations include the buildup of soil contamination via lead and/or explosives used at training ranges. Such contamination can have implications for surface water quality via runoff, and for groundwater quality via infiltration of specific constituents. For example, the unexploded ordnance (UXO) problem is widespread at installations, and future training endeavors are expected to further contribute to cumulative soil contamination concerns. To illustrate, a 1997 executive action taken under the authority of the SDWA, essentially terminated live-fire training on the Massachusetts Military Reservation because of UXO and munitions constituents leaching into the groundwater source of drinking water (U.S. General Accounting Office, 2002, p. 6). The UXO problem was recently subjected to a comprehensive review by the Defense Science Board Task Force on Unexploded Ordnance (Defense Science Board Task Force, 2003). The report can be found and downloaded through Internet search. The Task Force found that both advanced sensing technology and advanced remediation technologies can provide opportunities to mitigate current problems. Further, it was determined that future problems could be minimized via the use of environmentally friendly munitions, simulation techniques, and training range protocols suitable for specific installations.

To further illustrate specific cumulative effects concerns associated with military ranges, including small arms ranges and large-scale live munitions training ranges, five written presentations from the 2004 proceedings of the Sustainable Range Management Conference are included on the CD. One paper summarizes state and U.S. Environmental Protection Agency management programs for lead and other constituents associated with active small arms ranges (Callahan and Begley, 2004). The fate and transport of constituents in explosives used on live fire training ranges have been explored via batch soil/water equilibration and partitioning studies conducted under laboratory conditions (Brannon, et al., 2004). It was determined that several constituents could be readily transported to groundwater.

Three papers from the 2004 Conference proceedings focused on the examination of potential remediation technologies. For example, phytoremediation technology was examined by Van Aken and Schnoor (2004). Bioremediation of explosives in soils via the use of standard composting techniques was studied for locations in Arizona and Nevada by Brunner (2004). Finally, alkaline treatment for remediation of explosives on training ranges has been researched by Davis, et al. (2004). The alkaline treatment was based on the alkaline hydrolysis of the explosives contained in the range soils.

CEQ Step 2 – Establish the geographic scope for the analysis.

The geographical (spatial) boundaries for considering water resources effects should include the watershed or watersheds wherein the training range and cantonment area is located, as well as the aquifer systems underlying the installation. These boundaries should be chosen because they represent typical geographical boundaries used for water supply evaluations, determination of compliance with water quality standards or criteria, and the delineation of appropriate water resources management strategies within the pertinent state source water assessment programs. Key references that should be reviewed prior to establishing the geographic scope include:

- General information on the location of the physical boundaries of the installation and associated ranges, the boundaries of adjacent easement lands, and land uses and boundaries of adjacent non-Army lands. Further, consideration should be given to the boundaries of watersheds and aquifer systems associated with the installation.
- Counties associated with the installations, including larger bodies of water such as lakes and estuaries.
- Geographic boundaries of designated areas of concern in relation to water usage or water quality impairment. This information can be obtained via the regional or state office contacts responsible for water resources management.

CEQ Step 3 – Establish the time frame for the analysis.

The temporal boundaries should include consideration of past and future actions that may have influenced water resources within the delineated spatial boundaries previously listed. However, no specific requirements have been developed for the time period to be encompassed by the retrospective and prospective boundaries. Some practical questions to ask or things to consider in establishing the historical boundary or reference point in time include:

- When were the installation and associated training ranges established, and when did historical mission changes or modernizations occur? Have range expansions or reductions occurred in the past, and if so, when did they take place?
- When was the first water resources inventory compiled for the installation and associated range(s)? How frequently has the inventory been updated?
- Has a water quantity and/or quality monitoring program been established for the installation? If so, when did it start and has the program evolved over time relative to water sources and pollutants monitored and the locations of monitoring stations?

Based upon the answers to the above questions, identify the earliest date and use it as the initial historical reference point. Some practical questions to ask or things to consider relative to a future time horizon include:

Some practical questions to ask or things to consider relative to a future time horizon include:

- What is the time period required to modernize the installation and range(s), and what is the anticipated period of use of the completed modernized range or ranges?
- What are the military construction plans for the installation over the next two, five, and 10 years?
- Are any major changes in the installation mission anticipated, and if so, when will such changes occur?

Depending upon the answers to the above questions, establish the most distant time as the initial prospective reference point to encompass future actions.

CEQ Step 4–Identify other past, present, and reasonably foreseeable future actions that have affected, or are anticipated to affect, water resources.

The identification of past actions can be aided by the review of historical water usage and water quality information developed for the training range. Such reviews can highlight both contributing past actions as well as usage and quality trends and garrison areas. Several installation-specific plans and reports can be useful in Step 4. For example, the previously mentioned WRMP should be reviewed.

Some installations may have conducted source water assessments, with the results particularly useful for identifying past and present actions that have affected water sources.

As noted earlier, the SDWA Amendments of 1996 required states to develop and implement Source Water Assessment Programs (SWAPs) focused on analyzing existing and potential threats to the quality of public drinking water sources. Both surface water and groundwater sources are to be addressed. Most states now have approved programs, and are in the process of actually completing the necessary source-specific assessments. The key elements of such source-specific assessments include: delineating the source water protection area, conducting a contaminant source inventory, determining the susceptibility of the public water supply to contamination from the inventoried sources, and releasing the results of the assessments to the public. The U.S. Environmental Protection Agency has a comprehensive Web site on the basics and status of SWAPs, and funding for such programs, along with specific information on methodologies and tools (e.g., the use of geographic information systems for assessing watersheds) (U.S. Environmental Protection Agency, "SWAP", 2005). The site also includes EPA final guidance for state programs (U.S. Environmental Protection Agency, "State SWAP Programs Final Guidance", 2005), and a citizen's guide for groundwater protection (U.S. Environmental Protection Agency, "Citizen's Guide" 2005).

More specifically, the U.S. Army Environmental Command sponsored the development of a practical user's guide for conducting surface water and/or groundwater assessments, and developing protection programs at Army installations (U.S. Army Center for Health Promotion and Preventive Medicine, 1998)*. The guide is also linked to other Web sites containing information on included steps and specific topics. The five steps in the guide include (U.S. Army Center for Health Promotion and Preventive Medicine, 1998, pp. 6–7):

- Step 1- Delineate the protection area. The first step is to define the physical area to be protected. This means identifying the groundwater aquifer and recharge area or the surface watershed area, or combinations of the two that make up the water source.

- Step 2- Identify potential contamination sources. This step is where the major portion of effort will be dedicated. The quality of this step will ultimately affect the ability of the overall plan in achieving its intended goals.
- Step 3- Rank each potential contaminant source. This step prioritizes the identified potential contaminant sources to find the most significant potential sources, through use of various criteria and weighing factors.
- Step 4- Develop protection strategies. After the prioritization is completed, strategies for reducing or eliminating the contamination threat must be developed. These often take the form of community action groups, zoning and planning modifications or restrictions, and awareness programs.
- Step 5- Contingency planning. This final step addresses how to react to the identified contamination threats, should they occur. This involves operational and treatment changes, identification of temporary or alternate water sources, and remediation of the contamination.

These five steps are generally related to the CEQ's 11-step process as follows:

- Step 1 – delineate the protection area – related to CEQ's Step 2 on defining spatial (geographic) boundaries for the VEC.
- Step 2 – identify potential contamination sources – related to CEQ's Step 4 (identify other actions affecting the VEC), Step 6 (describe current stresses on the VEC), and Step 7 (delineate historical conditions and trends for the VEC).
- Step 3 – rank each potential contaminant source – related to CEQ's Step 1 (identify cumulative effects issues), Step 8 (connect past, present, and future actions to the VEC), and Step 9 (determine magnitude and significance of cumulative effects on the VEC).
- Step 4 – develop protection strategies – related to Step 10 (develop appropriate mitigation strategies for impacts on the VEC).
- Step 5 – contingency planning – related to Step 10 and particularly to Step 11 (monitor effects on the VEC and adapt management as appropriate).

Further, installation-specific studies may have been conducted on storm water management. To illustrate, in 1987, the CWA was amended to require implementation of a comprehensive strategy for addressing storm water discharges under the NPDES program (U.S. Department of the Army, DA PM 200-1, 2002). Further, the U.S. Environmental Protection Agency also has a comprehensive Web site related to the storm water program (U.S. Environmental Protection Agency, "NPDES – Stormwater Program", 2005). Following are some of the key contents of this Web site; specific Web citations are included for each of the following in the selected references:

- State or territorial authorization status for storm water construction and industrial programs (U.S. Environmental Protection Agency, "NPDES – Authorization Status", 2005)
- Permit requirements, policies, and related guidance for storm water discharges from construction activities (U.S. Environmental Protection Agency, "NPDES – Stormwater … Construction …", 2005)

- Guidance manual for developing pollution prevention plans and best management practices for storm water from construction activities (U.S. Environmental Protection Agency, "NPDES – SPPPs …", 2005)*
- Guidance related to storm water discharges from industrial facilities (U.S. Environmental Protection Agency, "NPDES – Stormwater … Industrial …", 2005)
- An electronic library of storm water publications (U.S. Environmental Protection Agency, "NPDES – Stormwater Publications", 2005)

In the compliance area of the U.S. Army Environmental Command Web site, http://aec.army.mil/usace/compliance-p2/watershedoo.html, a section is included on watershed and storm water management More specifically, registered DENIX users can enter this part of the Web site and find the July 2005 edition of the USAEC Storm Water Guidance Manual (U.S. Army Environmental Command, "Storm Water …", 2005). This manual provides detailed information related to Army installation requirements for compliance with the storm water provisions of the CWA.

Further Army-related practical information on the phasing of installation storm water management can be found in a PowerPoint presentation from the U. S. Army Center for Health Promotion and Preventive Maintenance (USACHPPM) (Fifty, 2005). Find via Internet search and download the slides for viewing.

Finally, another example of a military-related management guide for storm water is the 1997 publication by the U.S. Air Force (U.S. Air Force, 1997).* This guide includes comprehensive sections on the regulatory background and framework for storm water management, practical considerations in program management (e.g., roles and responsibilities, record keeping, BMPs, sampling and analysis, etc.), and technical implementation.

Current actions include both ongoing past actions and new actions that may be in the construction stage. Information related to these actions can be procured from the range DPW, the planning departments of local towns and cities, and other federal and state agencies. These same information sources could be used to identify reasonably foreseeable future actions within the future temporal boundary for the study. The likelihood of future actions and the time period of their potential occurrence should be considered.

Finally, depending on the scope of existing installation documents such as the WRMP, source water assessment report, groundwater protection plan, and/or storm water plan, it may be necessary to update these documents. If a source water assessment report or other related plans have never been developed, it may be necessary to conduct such studies for the installation.

CEQ Steps 5-7 – Characterize the water resources identified in scoping in terms of their response to change and capacity to withstand stresses (Step 5); characterize the stresses affecting these water resources, ecosystems, and human communities and their relation to regulatory thresholds (Step 6); and define a baseline condition for the water resources (Step 7).

The primary emphases of these three steps are related to historical trends in water quantity and quality, the comparison of such quality with pertinent water quality standards and criteria, and the consideration of sensitive non-human receptors of water quality effects. Further, and depending on local conditions, broader issues such as fluctuations in rainfall and the availability of water supplies may also need to be addressed. Key references that should be reviewed to accomplish these steps include:

- Historical and current reports on installation water quantity and quality monitoring.
- Historical and current monitoring reports from the state or in-state regional water resources and water quality agencies wherein the installation is located.
- Current water quality standards and criteria.
- Historical and current compliance with various permit requirements associated with the CWA and SDWA.

If it is determined that field studies are needed to characterize the current conditions of the water, several reference materials are available. For example, Euphrat and Warkentin (1994) described four inventory methods for characterizing the current conditions of a watershed. The inventory methods are expected to incorporate continuing historical stresses and reflect current cumulative effects on the watershed. The most widely used method, referred to as the water column method, involves the collection and analysis of strategically located water samples. The basic assumption of this method is that the water column serves as an integrator of the effects of a range of actions in the watershed. Examples of parameters that can be measured include sediment, turbidity, pesticides and petroleum products, and nutrients and pathogens.

A second group of inventory methods focuses on the measurement of the physical and biological characteristics of stream channels in the watershed (Euphrat and Warkentin, 1994). Such methods give emphasis to stream cross-sections, sediment storage, bank stability, amount and location of large woody debris, aquatic vegetation, and vegetation over the channel. Categorizations of stream segments can also be used, as well as indices of biotic integrity (IBI).

The third group of methods involves inventories of watershed features such as various land uses, total length of road miles, aquatic and terrestrial habitats, and avian and mammalian guilds (Euphrat and Warkentin, 1994). The fourth group is referred to as integrated inventories, they combining selected features of the first three groups in order to provide a more holistic perspective of current watershed conditions.

The U.S. Environmental Protection Agency has a comprehensive Web site related to the Clean Water Act (U.S. Environmental Protection Agency, "CWA," 2005) Web linked. Following are some of the key contents of this Web site; specific Web citations are included for each of the following in the Selected References:

- Introduction to the CWA (U.S. Environmental Protection Agency, "Introduction…," 2005)
- Title III (Standards and Enforcement) of the CWA (U.S. Environmental Protection Agency, "Title III," 2005)
- Water quality standards and criteria (U.S. Environmental Protection Agency, "Water Quality…," 2005)
- Current national recommended water quality criteria (U.S. Environmental Protection Agency, "Current …," 2005)
- State, tribal, and territorial water quality standards (U.S. Environmental Protection Agency, "WQS-State …," 2005)

- Total maximum daily load (TMDL) program and regulations, and national overview (U.S. Environmental Protection Agency, "Overview of Current TMDL …", 2005; and U.S. Environmental Protection Agency, "TMDLs – National Overview," 2005)
- Effluent guidelines for industrial water pollution controls (U.S. Environmental Protection Agency, "Industrial …" 2005). Examples of relevant guidelines for Army installations include construction and development, drinking water treatment, industrial laundries, landfills, and transportation equipment cleaning.
- Title IV (Permits and Licenses) of the CWA (U.S. Environmental Protection Agency, "Title IV," 2005)

A major program within the CWA involves NPDES permits. Such permits are required for all point source discharges into U.S. waters, as well as specified storm water discharges (U.S. Department of the Army, DA PAM 200-1, 2002, pp. 4–5). Again, the U.S. Environmental Protection Agency has a comprehensive Web site related to the NPDES program (U.S. Environmental Protection Agency, "NPDES Permitting Program," 2005), Web linked. Following are some of the key contents of this Web site; specific Web citations are included for each of the following in the Selected References:

- Pretreatment program for dischargers to POTWs (U.S. Environmental Protection Agency, "NPDES Pretreatment …," 2005)
- Regulations related to the NPDES program (U.S. Environmental Protection Agency, "NPDES Regulations," 2005)
- Information on NPDES permits organized by zip code (U.S. Environmental Protection Agency, "NPDES," 2005)

Detailed information on criteria and standards for the NPDES is found in 40 CFR Part 125 (U.S. Environmental Protection Agency, "Criteria and Standards for the NPDES," 2005), Web linked. Part 125 addresses numerous issues, including a monitoring program, toxics control program, and a range of frequently asked questions related to NPDES permits.

The U.S. Environmental Protection Agency Office of Compliance has recently promulgated a planning guide for construction-related permits and other requirements during development planning (U.S. Environmental Protection Agency, EPA/305-B-04-003, 2005)*. The guide encompasses the requirements of a number of environmental laws; and it includes Web links to numerous sources of information. Further, self-audit checklists are included for seven specific issues. Specifically, Part I summarizes the following permits and related requirements during construction and development; several are related to water resources (U.S. Environmental Protection Agency, EPA/305-B-04-003, 2005, p. iii):

- Stormwater Permit Requirements for Construction Projects
- Dredge and Fill/Wetlands (Section 404) Permit Requirements for Construction Projects
- Oil Spill Prevention Requirements for Construction Activities
- Hazardous and Nonhazardous Solid Waste Requirements for Construction Projects
- Hazardous Substances (Superfund Liability) Requirements for Construction Activities
- Polychlorinated Biphenyl (PCB) Waste Requirements for Construction Activities

- Air Quality Requirements for Construction Activities
- Asbestos Requirements for Construction Activities
- Endangered Species Act (ESA) Requirements for Construction Activities
- National Environmental Policy Act (NEPA) Requirements
- National Historic Preservation Act (NHPA) Requirements

The following self-audit checklists are included in Part II of the planning guide (U.S. Environmental Protection Agency, EPA/305-B-04-003, 2005, p. iii): Stormwater Checklist; Dredge and Fill/Wetlands (Section 404) Checklist; Oil Spill Prevention Checklist; Hazardous Waste Checklist; Hazardous Substances (Superfund Liability) Checklist; Polychlorinated Biphenyl (PCB) Checklist; and Asbestos Checklist. These checklists represent useful aids for complying with the permits and other requirements listed above.

Finally, three USAEC guides related to water system compliance assessment, wastewater system compliance assessment, and contracting for wellhead protection planning are located on DENIX (a password is required for access). The three guides can be identified at http://toolbox.nfesc.navy.mil/cgi-bin/bGMed.cfm; their contents are described as follows:

- Water System Compliance Assessment Protocol – This protocol has been developed for use by individuals at Army installations responsible for the operational performance of existing water systems. It can be used to help assess the capability of the treatment system to meet regulatory requirements based on its capacity, operation and maintenance, and physical condition. It is intended to complement, not replace, regulatory compliance information collected for the Installation Status Report (ISR) or during Environmental Performance Assessment System (EPAS) audits. It can provide a basis for identifying corrective actions necessary to achieve or ensure continued compliance, and for developing related funding requirements.
- Wastewater Systems Compliance Assessment Protocol – This protocol has been developed for use by individuals at Army installations responsible for the operational performance of existing wastewater treatment systems. It can be used to help assess the capability of the system to meet regulatory requirements based on capacity, operation and maintenance, and physical condition. It is intended to complement, not replace, regulatory compliance information collected for the ISR or during EPAS audits. Finally, it can provide a basis for identifying corrective actions necessary to achieve or ensure continued compliance, and for developing related funding requirements.
- Wellhead Protection Plan – Model Scope-of-Work User's Guide – This model schedule of services has been developed to assist staff at Army installations in contracting services to develop WHPPs. It is intended to serve as a model that can be adapted to meet an installation's specific requirements for wellhead protection.

CEQ Step 8 – Identify the important cause-and-effect relationships between human activities and water usage and water quality.

The delineation of cause-and-effect relationships may require determination of the quantities of surface water and/or groundwater usage, the types and quantities of potential surface water pollutants to be utilized or generated during the project, and/or the activities that will alter the amount and quality of runoff from a precipitation episode (Canter, 1996, p. 207). The effects of point and nonpoint pollution sources on receiving water quality are manifold and dependent upon the type and concentration of pollutants. Soluble organics, as represented by high BOD wastes, cause depletion of oxygen in the surface water. This can result in fish kills, undesirable aquatic life, and undesirable odors. Even trace quantities of certain organics may cause undesirable taste and odors, and certain organics may be biomagnified in the aquatic food chain. Suspended solids decrease water clarity and hinder photosynthetic processes; if solids settle and form sludge deposits, changes in benthic ecosystems result. Color, turbidity, oils, and floating materials are of concern because of their aesthetic undesirability and possible influence on water clarity and photosynthetic processes. Excessive nitrogen and phosphorus can lead to algal overgrowth, with concomitant water treatment problems resulting from algae decay and interferences with treatment processes. Chlorides cause a salty taste to be imparted to water, and, in sufficient concentration, limitations on water usage can occur. Acids, alkalies, and toxic substances have potential for causing fish kills and creating other imbalances in stream ecosystems. Thermal discharges can also cause imbalances, as well as reductions in stream waste-assimilative capacity. Stratified flows from thermal discharges minimize normal mixing patterns in receiving streams and reservoirs (Canter, 1996, pp. 195-196).

The aforementioned cause-and-effect relationships can be depicted in several ways, including maps showing source locations and receptor areas. Network diagrams and connector tables (matrices) could also be developed to depict transport mechanisms and types of effects. Examples of such aids are available in Reid (1993) and Canter (1996, pp. 189-247 for surface water, and pp. 248-303 for soil and groundwater).

CEQ Step 9–Determine the magnitude and significance of cumulative effects on water resources

Several procedures and models are available for determining the magnitude of cumulative effects on water resources. One example involves mass balance calculations to determine percentage changes in usage patterns for surface water and/or groundwater supplies. Such mass balance calculations can also be used to determine average downstream concentrations resulting from point- or nonpoint-source discharges or to determine percentage changes in stream flow or pollutant loadings. The results can be compared to pertinent effluent limitations, quality-quantity standards, or baseline flow and quality characteristics (Canter, 1996, p. 221)

Surface water and/or groundwater quality modeling could be required in certain situations at Army installations. Such modeling can be data intensive, technically complicated, and require specialized expertise. Further, determining which model would be most appropriate for a given situation can also require careful analysis and decision-making. To provide an appropriate background for the wide range of available surface water and groundwater models, the reader is referred to Chapters 7 (surface water models) and 8 (groundwater models) in Canter (1996). Further, the U.S. Environmental Protection Agency has a Web-linked site that summarizes key information on selected surface water quality models (U.S. Environmental Protection Agency, “Water Quality Models,” 2005). Five EPA-supported models listed on this Web site include:

- **BASINS** (Better Assessment Science Integrating Point and Nonpoint Sources)–This is a multi-purpose environmental analysis system that integrates a geographical information system (GIS), national watershed data, and state-of-the-art environmental assessment and modeling tools, into one convenient package.

- **AQUATOX** – This is a freshwater ecosystem simulation model to predict the fate of various pollutants such as nutrients and organic toxicants, and their effects on the ecosystem, including fish, invertebrates, and aquatic plants. AQUATOX is a valuable tool for ecologists, water quality modelers, and anyone involved in performing ecological risk assessments for aquatic ecosystems.
- **CORMIX** (Cornell Mixing Zone Expert System) – This is a mixing zone model to assess water quality impacts from point source discharges at surface or sub-surface levels. CORMIX contains three major subsystems (U.S. Environmental Protection Agency, "Water Quality Models – CORMIX," 2005). The first subsystem, CORMIX1, is used to predict and analyze environmental impacts of submerged single port discharges to lakes, rivers, and estuaries. The second subsystem, CORMIX2, may be used to predict plume characteristics of submerged multiport discharges. The third subsystem, CORMIX3, is used to analyze positively and neutrally buoyant surface discharges to lakes, rivers, and estuaries, with a high degree of accuracy.
- **WASP6** – WASP6 is an enhanced version of the Water Quality Analysis Simulation Program (WASP). This version runs more quickly than previous versions of WASP, and allows for graphical presentation of results. This version includes kinetic algorithms for (1) eutrophication/conventional pollutants, (2) organic chemicals/ metals, (3) mercury, and (4) temperature, fecal coliform, and conservative pollutants.
- **QUAL2K** – This is a river and stream water quality model that is intended to represent a modernized version of the QUAL2E (or Q2E) model.

In addition, the U.S. Environmental Protection Agency has a Watershed/Water Quality Modeling Technical Support Center. This center assists EPA regions, state and local governments, and their contractors, by providing access to technically defensible tools and approaches that can be used to develop Total Maximum Daily Loads (TMDLs), wasteload allocations, and watershed protection plans. Further, the comprehensive EPA water quality models Web site also has Web links to government-supported water quantity and quality models, available through the U.S. Geological Survey and the U.S. Army Corps of Engineers (U.S. Environmental Protection Agency, "Water Quality Models," 2005). In addition, another EPA Web site includes specific links to the above listed models and other guidance for water quality management (U.S. Environmental Protection Agency, "Water Quality Modeling and TMDLs Guidance," 2005).

Although not described herein, other EPA Web sites include detailed information on modeling of groundwater quantity and quality; in addition, links are also found to modeling resources available from the U.S. Geological Survey and the U.S. Army Corps of Engineers.

Finally, eight methods for evaluating potential cumulative watershed effects (CWEs) are summarized by Reid (1993*). These eight methods include three procedures for calculating rates or indices, several analytical procedures, and a checklist of issues for consideration. The specific eight methods, which exhibit comparative advantages and disadvantages in their usage, include:

- Equivalent Clear-cut Area (frequently used)
- Klock Watershed Cumulative Effects Analysis (Klock refers to the name of the developer of the method)
- Equivalent Roaded Area
- R-1/R-4 Sediment Fish Model (R-1/R-4 refers to Regions 1 and 4 of the U.S. Forest Service)
- California Department of Forestry Questionnaire
- Water Resources Evaluation of Nonpoint Silvicultural Sources
- Limiting Factor Analysis
- Rational Approach (Grant was the developer of the Rational Approach)

Determining the significance of cumulative water resources effects can be based on the following considerations:

- Compliance with CWA and SDWA permit requirements and standards/criteria for specific water pollutants.
- Consideration of the historical and existing conditions of the water supply sources, as well as their water quality conditions, in relation to anticipated changes in these resources as a result of the proposed action and other reasonably foreseeable future actions.

Relative to significance determinations, there is growing interest in using broader scale considerations of environmental sustainability. Accordingly, two such methodologies are described herein. First, a Resource Capability Model (RCM) has been proposed for U.S. Air Force use in assessing the adequacy of environmental, airspace, and spectrum resources at USAF installations (Rowe, et al., 2004). The RCM requires a comparison of resource requirements for the installation against the availability of such resources for airspace, airshed emissions availability, surface and subsurface land access, surface and groundwater access (supply), surface water discharge availability, and frequency spectrum. A resource readiness or adequacy rating is then assigned via use of a consistent protocol. The surface and groundwater resources are of interest herein. Further, airspace resources were addressed in the earlier VEC on airspace.

The RCM includes six defined metrics for water supply, and four for water discharge. They are (Rowe, et al., 2004):

- Water Supply – System Capacity vs. Usage – Quantifies the current capacity of the water supply system and compares it to the current annual water requirements.
- Water Supply – Constrained Month System Capacity vs. Usage – Quantifies the degree to which current water supplies meet the demand in the month with the most significant difference between water supply and demand.
- Water Supply – Unconstrained Months – Quantifies the number of months where there is not a constraint on water supply.
- Water Supply – Months Restricted -- Quantifies the number of months where there is a restriction on water supply.
- Water Supply – Quality – Quantifies the quality of consumable water available at the tap.

- Water Supply – Physical Supply vs. Usage – Addresses the status of the water supply in the geographic area to help ascertain whether additional activities at the infrastructure asset are likely to tax water resources.
- Water Discharge – Wastewater Volume Capacity vs. Discharge – Quantifies discharge volumes and compares them to discharge system capacity based on an average in gallons per day.
- Water Discharge – Overflow Frequency – Evaluates the frequency of overflows of the wastewater and storm water systems.
- Water Discharge – Water Quality Discharge – Evaluates the quality of the discharge relative to regulatory or permit limits.
- Water Discharge – Receiving Body Water Quality – Evaluates the quality of the water body where the installation is located, relative to local or state water quality standards.

As noted above, these metrics could be used to assess operational and resource requirements for surface and/or groundwater quantity and quality.

The water resource readiness or adequacy rating includes consideration of both the resource deficiency and opportunity. The following rating scales are used for each metric (Rowe, et al., 2004; and Pease and Cornell, 2004):

- Resource Opportunity (RO) – RO3 – Major opportunities – greater than 140 percent above the breakpoint of matching resource requirements to availability
- RO2 – Significant opportunities – greater than 120 percent to 140 percent
- RO1 – Some opportunities – greater than 110 percent to 120 percent
- RR – Adequate (Minor opportunities or deficiencies) – 110 percent to 90 percent
- Resource Deficiency (RD) – RD1 – Some deficiencies – from less than 90 percent to 80 percent
- RD2 – Significant deficiencies – from less than 80 percent to 60 percent
- RD3 – Major deficiencies – less than 60 percent

Note: The above percentages result from the comparison of resource availability to resource requirements, using 100 percent as the baseline for breakpoints.

Secondly, the U. S. Army Engineer Research and Development Center (ERDC – CERL) is developing a Sustainable Installations Regional Resource Assessment (SIRRA) methodology. The methodology incorporates 48 relative regional indicators for ten sustainability issues – air, energy, urban development, threatened and endangered species, locational, water, economic, quality of life, infrastructure, and security (Jenicek, et al., 2004). Of interest herein are the three indicators (or stressors) for water; vulnerability, quality and security (Fournier, et al., 2002, pp. 26, 35, and 36):

- Water Vulnerability Index (WV) – This index is a composite index that measures the overall health of the local water supply in terms of development, natural variability, dryness ratio, groundwater depletion, industrial water use flexibility, institutional flexibility, and population. The risk classes are Low (low vulnerability), Medium (moderate vulnerability), and High (high vulnerability). The vulnerability of the water supply is a strong indicator of ability to sustain current water consumption levels and sensitivity to climate change.

- Water Quality Index (WQ) – The WQ score is a composite index and provides a measure of overall watershed health in terms of flood risk, navigation, ecosystem thermal sensitivity, dissolved oxygen, low flow sensitivity, species at risk, and population. The indicator value is found by indexing several national watershed characterization indicators into a composite rating for each watershed. The risk classes are Low (better water quality), Medium (less serious water quality problems), and High (more serious water quality problems). The degree of watershed health is a strong indicator of local water quality.
- Sole-Source Aquifer (As) – This indicator measures the degree to which an installation is located over a sole source/primary aquifer supplying water for the public. The risk classes are Low (not over a primary aquifer location), Medium (partially over an aquifer), and High (over a primary aquifer). The degree to which an installation is located over a primary aquifer is a strong indicator of the risk the Army runs of polluting waters intended for public use.

The SIRRA methodology can be used as an evaluation tool for encroachment concerns at specific Army installations. Further, it can be used relative to the evaluation of the cumulative effects of new training initiatives on water resources management. The GIS-based SIRRA methodology draws on data from open, well documented national-level sources such as the U.S. Geological Survey, Bureau of Census, NatureServe, and the U.S. Environmental Protection Agency. This approach allows the use of national-level data to evaluate regional aspects of an installation's setting. Such an evaluation provides additional information related to long-term issues that could threaten mission sustainment at a given installation (Jenicek, 2005).

CEQ Steps 10 and 11 – Modify or add alternatives to avoid, minimize, or mitigate significant effects on water resources (Step 10), and monitor the water resources effects of the selected alternative and adapt management (Step 11).

Mitigation of water resources effects may involve installation decisions only, or it could include off-installation measures, with the latter done in a collaborative manner with the state or regional water resources management agency, other state or federal agencies, local towns and cities, and the private sector. Examples of such mitigation measures are described in the following references:

- PEIS for Army Transformation (U.S. Army Corps of Engineers, February, 2002, pp. ES-10 and ES-11) – This PEIS summarizes five types of measures: mitigation in conjunction with site-specific NEPA analyses; fostering of a "sustainable environment" ethic; implementation of an EMS; use of best management practices; and programmatic environmental compliance, safety, and health evaluations for weapon systems acquisition.
- Web site for the Army's water conservation policy, http://hqda-energypolicy.pnl.gov/programs/water.asp - This site also includes an Assistant Chief of Staff for Installation Management (ACSIM) memorandum (March 18, 2003) on the Army's adoption of the Department of Energy's ten best public awareness, and implementing conservation practices; and an associated handbook.
- U.S. Navy Conservation Guide related to compliance with EO 12902 (Web linked on CD) (U.S. Navy, undated) – The guide includes key information on conducting a water

usage audit at an installation or specific facility. Also included is useful information is on the identification and evaluation of conservation options; including a life cycle cost analysis to aid in determining the payback gap between the installation and maintenance costs of a conservation measure, and the resultant savings in water usage costs.

- Watershed Protection and Restoration Techniques (Center for Watershed Protection, 2002) – the non-profit Center for Watershed Protection (CWP), Ellicott City, Md, has compiled this comprehensive book to be practice-oriented and provide valuable information on land conservation measures, aquatic buffers, environmentally friendly site design, erosion and sediment control, storm water management, and controlling pollution from septic tanks.
- Stream Corridor Restoration - Principles, Processes, Practices (Federal Interagency Stream Restoration Working Group, 1998) – As part of a mitigation program for historical effects, and/or current or anticipated concerns, U.S. Army installations may need to develop such a restoration plan for on-post streams. This handbook provides basic information on various stream processes and their relationships to current water quality and ecological characteristics. Disturbances from various land use characteristics are also summarized. Part II of the handbook is focused on developing a comprehensive restoration plan, including the identification of restoration goals and alternative selection and design. Further, follow-on monitoring, evaluation, and decision-making related to adaptive management is also addressed. Examples of the application of restoration principles are included in Part III.

Monitoring of selected indicators of water quantity and/or quality and related direct, indirect, and cumulative effects, may be necessary. Such monitoring could be introduced as a modification to existing installation water monitoring programs, or as part of a newly implemented EMS. A useful reference for planning and implementing a monitoring program is Marcus (1979*). It should be noted that such monitoring results could be used within an organized feedback and decision-making system to adapt management activities and thus reduce undesirable cumulative water resources effects.

4.8.8 Summary

Extensive policy and technical information is available for planning and conducting an assessment of water resources effects for Army installations and associated training ranges. The federal laws driving water resources management include the SDWA, CWA, and their associated regulations. Key information sources for addressing direct, indirect, and cumulative impact effects at an installation include the Water Resources Management Plan, a source water assessment report, a storm water management plan, and/or a groundwater protection plan, along with water resources monitoring reports (if a monitoring system exists for the installation). Compliance with water quality standards and the conditions associated with permitted sources and other general permits are fundamental features of installation water resources management programs. Extensive technical information can be found in available technical manuals and in regulatory models ranging from screening models to sophisticated pollutant transport and fate models. Finally, a variety of mitigation measures could be used by an installation to address concerns related to ,water resources effects.

4.9 Facilities

4.9.1 Introduction

The Facility VEC encompasses all aspects of Army real property management. Army real property includes lands, facilities, and infrastructure. This includes land (and interests in land), leaseholds, standing timber, buildings, improvements, and appurtenances. Facilities are the buildings, structures, and other improvements to support the Army's mission. Infrastructure is the combination of supporting systems that enable the use of this land and resident facilities.

Army real property includes Army-owned lands, and lands that are "withdrawn" from other federal agencies such as the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). Increasingly, the Army seeks to control lands adjacent to Army installations that can buffer the effects of Army activities and reduce the severity of impacts on sensitive natural resources. Often, these lands can be collaboratively "set aside" to meet both Army and community needs. The Army holds real estate in every state, providing a variety of terrain with characteristics and settings that support the Army mission. These are shown in the following table:

State	Principal Installations				Other Sites
	Number	Bldgs Owned	Bldg Sq Ft	Total Acres	Number
Alabama	23	6,646	34,366,644	176,435	32
Alaska	10	1,538	16,670,342	1,678,396	77
Arizona	6	2,645	10,131,391	1,111,414	3
Arkansas	5	2,211	8,348,128	86,299	16
California	26	8,940	47,913,852	976,780	47
Colorado	7	3,697	22,307,949	414,122	8
Connecticut	4	113	1,797,530	186	7
Delaware	1	31	118,296	30	4
District of Columbia	3	204	5,612,675	227	0
Florida	7	39	282,162	72,117	36
Georgia	11	6,892	49,679,491	514,966	18
Hawaii	16	3,910	27,502,861	141,140	12
Idaho	0	0	0	0	8
Illinois	14	2,090	16,258,934	27,102	32
Indiana	9	2,419	9,153,229	111,103	18
Iowa	4	1,105	46,460,808	19,105	21
Kansas	9	4,439	21,467,731	129,858	20
Kentucky	7	5,473	31,007,030	161,225	21
Louisiana	3	3,306	18,263,247	213,843	15
Maine	0	0	0	0	7
Maryland	14	4,531	29,470,359	81,329	19

***Table 4.9-1**: Army Lands by State*

State	Principal Installations				Other Sites
Michigan	7	642	4,850,438	1,829	20
Minnesota	3	187	3,575,588	2,457	23
Mississippi	1	2	75,625	13	18
Missouri	9	2,983	16,163,900	74,255	17
Montana	3	118	606,303	6,207	11
Nebraska	4	807	2,365,880	15,909	13
Nevada	2	2,796	10,450,726	1,523,172	2
New Hampshire	2	18	310,557	252	5
New Jersey	11	3,100	22,649,170	39,783	9
New Mexico	4	3,085	8,241,920	4,657,995	7
New York	23	5,472	31,381,821	137,442	34
North Carolina	6	4,644	27,750,950	177,094	43
North Dakota	9	157	866,437	2,760	3
Ohio	13	1,538	13,106,628	23,037	40
Oklahoma	4	4,684	23,262,890	172,053	24
Oregon	3	1,292	3,468,812	21,315	8
Pennsylvania	23	2,746	20,319,729	23,530	67
Rhode Island	4	56	186,852	505	6
South Carolina	2	1,166	9,159,203	52,311	15
South Dakota	0	0	0	0	4
Tennessee	10	4,265	21,209,347	112,920	12
Texas	14	12,645	67,172,210	434,758	60
Utah	9	2,290	13,370,010	846,836	10
Vermont	1	7	70,217	667	4
Virginia	19	6,750	45,035,122	155,108	23
Washington	8	4,722	22,950,529	407,195	16
West Virginia	4	7	77,861	85	28
Wisconsin	5	2,678	10,056,665	135,261	27
Totals	392	129,982	781,850,182	14,949,856	984

Notes:
1. Building data reflect all types of facilities (administrative, classroom, medical, residential, storage, warehousing, maintenance, etc).
2. Acreage data identify the total number of acres occupied by the Army, including public land, state land, and land controlled by other federal agencies.

***Table 4.9-1**: Army Lands by State*

This table indicates the number of buildings and their combined square footage at principal Army installations, information that provides some insight into the size of Army infrastructure demands.

In addition to these major installations, the Army has other, smaller properties that support local Army National Guard or Army Reserve functions. These are shown as “Other sites” in the table, if they are greater than 10 acres in size and have a replacement value of $1 million or more.

Army real property also includes all ecosystems in the U.S. These are articulated and discussed in specific analyses (http://www.cemml.colostate.edu/bailey_ecoregion.hm) that places Army properties within recognized ecosystem types (Bailey, 1995). As a result of urban growth and development around existing Army (and DoD) installations, the natural resources associated with these ecosystems (Threatened and Endangered Species, etc.) are often concentrated on Army properties (USAEC, 2005). The subsequent Army natural stewardship responsibilities profoundly affect the management of Army real estate, facilities, and infrastructure. These are detailed in the discussion of the other VECs.

Army land management complies with numerous statutory requirements, regulations, and federal policies; all subject to the following applicable definitions:

Disposal: Any authorized method of permanently divesting Army control of (and responsibility for) real estate.

Excess Real Estate: Any real property under any federal control that is not required for agency responsibilities.

Fee Owned: Real property for which the U. S. has all rights, title, and interest; rather than a partial interest.

Improvements: Additions beyond repair or replacement to land, costing labor or capital (e.g., buildings, pavement, pipelines, and other structures attached to the land).

Ingrants: Property acquired for Army use by lease, license, or permit.

Nonexcess Property: Property required for an Army mission, but proposed for sale to fund acquisition of replacement land or facilities.

Nonusable Condition: Used to describe a facility as unserviceable, through deterioration; and needing extensive restoration, is dangerous to personnel health and safety, or potentially damaging to equipment.

Personal Property: Any property not considered real property.

Public Domain: Land owned by the federal government for the benefit of the citizens. The original public domain included both the lands that were turned over to the federal government by the colonial states and the areas acquired later from the native Indians or foreign powers. (Sometimes used interchangeably with Public Lands.)

Real Property: Real estate owned by the U.S. and under Army control. It includes the land, right, title, and interest therein, and improvements thereon. The land includes minerals in their natural state and standing timber (when severed from the land, these become personal property). GSA has exempted growing crops from the definition of real estate when the disposal agency designates such crops for disposal by severance and removal from the land. Rights and interest include leaseholds, easements, rights-of-way, water rights, air rights, and rights to lateral and subjacent support. Installed building equipment is considered real estate until severed. In-place equipment is considered personal property.

Reassignment: Change of jurisdiction (over real estate) from one Army command or agency to another.

Surplus Real Estate: Any excess real property not required for the responsibilities of all federal agencies, as determined by the GSA Administrator.

Transfer: Change of jurisdiction (over real property) from one federal agency or department to another, including military departments and defense agencies.

Withdrawn Public Lands: Public domain held back for the use or benefit of an agency; by reservation, withdrawal, or other restriction, for a special governmental purpose.

Army lands are managed pursuant to several statutory authorities that strictly control Army land and real property acquisition and disposal. No land is purchased in the name of the U.S. without specific authorization. By far, the Military Construction Authorization Act is most often used. Land acquisition is generally controlled through 41 U.S.C. 14 Restrictions on Purchases of Land and 10 U.S.C. 2676 Real Property Acquisition. Army real property is governed by the following authorities:

Acquisition Limitation: 10 USC 2676(a) provides "No military department may acquire real property not owned by the United States unless the acquisition is expressly authorized by law."

Annual Military Construction Authorization Acts: These acts authorize acquisition of lands and rights and interests thereto (or therein) at specified installations and facilities, or for specified military purposes. The acquisitions are accomplished by donation, purchase, exchange of government-owned lands, or other means.

Armed Forces Reserve Facilities: The National Defense Facilities Act of 1950, as amended (10 USC 2233), authorizes the acquisition of real estate by purchase, lease, or transfer for Armed Forces Reserve Facilities.

Contiguous parcels not exceeding $25,000 in cost, needed in the interest of national defense: 10 USC 2672 authorizes the Secretary of the Army to acquire any interest in land that the Secretary (or designee) determines needed in the interest of national defense, and which costs no more than $25,000, exclusive of administrative costs and the amounts of any deficiency judgments. Acquisition may be by gift (donation), purchase, exchange of government-owned land, or otherwise.

Transfer from the Departments of the Navy and the Air Force, the Marine Corps, and the Coast Guard: 10 USC 2571 authorizes the interchange of supplies and real estate owned by the government between the Army, Navy, Air Force, Marine Corps, and Coast Guard without compensation, provided the request is made by the Secretary of the Army and is approved by the Secretary of the transferring department.

Use of public domain lands under public land orders or permits from the Department of the Interior: Until passage of the Engle Act (43 USC 156) (February 28, 1958), this type of acquisition was accomplished by withdrawal and reservation of public domain lands by Executive Order of the President or by Public Land Order of the Secretary of the Interior (or designee). The Engle Act requires legislation to withdraw, reserve, or restrict more than 5,000 acres.

Exchange of military lands for national forest lands (Secretary of Agriculture): Public Law 804, 84th Congress, authorizes the Secretary of a military department to acquire national forest lands by exchange (interchange) of lands under the control of a military department that lie within (or adjacent to) the exterior boundaries of a national forest, with the Secretary of Agriculture without reimbursement or transfer of funds.

Acquisition of leasehold interests: There is no specific authorization for Army acquisition of real property by lease, except 10 USC 2675, which authorizes certain leases in foreign countries. For authority to lease elsewhere, the Army relies on the language in the general provisions of the annual appropriation acts for leasing buildings and facilities.

Army land and easements can be obtained through purchase, condemnation, donation, and exchange, when specifically authorized. Licenses in non-government real property are generally acquired by donation, although a non-revocable license may be acquired by purchase. Leaseholds in non-government-owned real property (giving the government exclusive use or co-use with the owners for specific purposes) are acquired by negotiation or condemnation. Permanent custody and control over government-owned real property is acquired by transfer, reassignment, withdrawal, reservation, or exchange. Permits to use government-owned real property are instruments issued by another government department or agency. Although the nature of a license may be revocable or non-revocable, they are designated as permits, as they apply to government-owned real property. This distinguishes them from licenses for non-government-owned real property. The Army may also obtain real property through recapture. This method allows use of former government-owned real property that underwent disposal under a National Security Clause, a National Emergency Clause, or a similar provision. Procurement of options on real property needed for a military project before or after its acquisition is authorized by law, and is acquired by negotiation. When acquiring lands, the Army extinguishes third-party interests, such as outstanding oil, gas, mineral, grazing, timber, and water rights. Easements for rights-of-way for highways, railroads, power lines, communication lines, waterlines, and sewer lines are obtained through purchase, condemnation, donation, or exchange.

Army real property acquisition requests are undertaken by transfer, purchase, lease, or condemnation only when (a) needed to accommodate an assigned mission, (b) when existing Army real property is inadequate to satisfy the requirement, and (c) when no real property under the control of the Navy, Air Force, or other federal agency is suitable and available on a permit or joint-use basis.

Real estate interests fall in to the following general categories:

Fee: Real estate for which an owner has all right, title, and interest. A fee estate is without condition, limitation, or restriction. Title to most U.S. real property is held in fee.

Leasehold: An estate, in realty, held under a lease for a fixed period of time. A lease is a contract for exclusive possession of property for a determinate period. The lessor grants a leasehold in consideration of a return of rent.

License: An authority to perform a specified act on the property of another without acquiring any estate or interest in that land.

Permit: A temporary authority given to a government agency to use real property under the jurisdiction of another government agency.

Easement: A right to use the land of another for a special purpose.

Option: A right to purchase real estate at a specified price during a stipulated period of time.

If permanent facility construction is required (with few exceptions), the government must have fee title or acquire title to the land (including all mineral rights and improvements), or a permanent easement interest must be secured. Land for use as a Reserve component training site is not acquired when the value of the land exceeds that of rural farmland in the area. In acquiring real estate, the Army sometimes obtains less than full ownership; and the degree of Army property rights depends on the circumstances; though the Army typically acquires title in fee.

Real property disposal authority is vested in Congress (Under Article IV, Section 3, Paragraph 2 of the U.S. Constitution), principally authorized by the Federal Property and Administrative Services Act of 1949, as amended (40 USC 471 et seq.) (http://www.wbdg.org/references/us_code.php). Each federal agency must report any real estate that is excess to its requirements to the GSA for evaluation to meet an unfulfilled requirement of any other federal agency, and eventual disposal of any surplus property (under the authority of the Federal Property Act and implementing GSA regulations, the Federal Property Management Regulations (FPMR), at 41 CFR Part 101). If other legislation authorizes disposal, the GSA regulations can still prove helpful as nonbinding guidelines. Other important statutes include:

Interchange between military departments (10 USC 2571): Authorizes interchange of real estate without compensation between the Army, Air Force, Navy, and Coast Guard. At the direction of the Deputy Secretary of Defense, this authority is not used except for property actively used by another military department. The military departments must normally acquire such property through GSA and pay fair-market value, unless the department has been using the property under a permit.

Exchange 10 USC 2672: Authorizes exchange of government-owned land valued at less than $100,000 for other lands for national defense purposes.

Exchange 10 USC 2672a: Authorizes exchange of government-owned land for other land for national defense purposes, to maintain the operational integrity of a military installation and under conditions of urgency that do not permit the delay needed to include the exchange in an annual Military Construction Authorization Act.

Federal highway transfers (23 USC 317): Authorizes transfer, without charge and under certain conditions, of land or material resources for the construction or maintenance of federal highways from adjacent lands to the Department of Transportation.

Interchange National Forest (16 USC 505a): Authorizes interchange, without reimbursement or transfer of funds, of Department of the Army-controlled real estate and adjacent national forest lands under certain conditions.

Transfers to District of Columbia (40 USC 122): Authorizes transfer of jurisdiction over property interests to the District of Columbia for purposes of administration and maintenance under certain conditions.

GSA has delegated the disposal of Base Realignment and Closure (BRAC) real property to DoD (USA, 2005); and USACE, through its district offices, is the real estate agent for both acquisition of any necessary leased space or real property disposal at Army installations. While Army disposal is not required (by either Public Law 100-526 or Public Law 101-510), prompt disposal is desirable. Surplus property is governed by the Federal Property and Administrative Services Act, and implementing regulations (41 CFR 102-7470).

Property disposal can be accomplished in a variety of ways, with different end results for the potential use of transferred property (USA, 2005). When BRAC actions lead to excess facilities, they can be transferred to affected communities in a variety of ways. Unencumbered disposal involves the transfer of the property with no conditions imposed by the Army or other agencies. Encumbered disposal places limitations on the property, generally to protect public health, or to protect valuable resources, sensitive species, cultural resources, etc.

Real property can be leased early in the community reuse process, as an effective way to quickly attract new jobs to replace any that may be lost through BRAC or other Army actions. As the Army cannot convey contaminated property until cleanup measures are established, leasing can allow suitable economic reuse on substantial portions of installations with excess real estate and facilities. The Army is authorized (10 U.S.C. 2667) to lease property for less than the fair market value if (a) the public interest will be served, and (b) the fair market value is either unobtainable or incompatible with public benefit. The three options for leasing include:

Interim lease. An interim lease is generally a short-term lease that makes no commitment for future use or conveyance upon property disposal. It is used before final disposal decisions are made by the Secretary of the Army. Before NEPA requirements have been completed, the term of an interim lease may last for up to 5 years, including options to renew. At NEPA completion, the lease can convert into a long-term lease or deed transfer. Separate NEPA analyses (as well as air pollution, wetland, floodplain, historic structure, and other natural and cultural resource determinations and consultations) are required prior to a decision to lease. An interim lease must be preceded by an Environmental Baseline Survey (EBS) and a Finding of Suitability to Lease (FOSL).

Lease in furtherance of conveyance. A lease in furtherance of conveyance may be established after the Army has (1) complied with NEPA and (2) issued a final property disposal decision providing immediate possession. Such a lease may be long-term, and may apply to all or a portion of the property. A lease in furtherance of conveyance must be preceded by an EBS and a FOSL; and terminates with the deed transfer.

Master lease. A master lease may be an interim lease or a lease in furtherance of conveyance. It serves as the principal lease instrument for the entire installation or for major portions of it. Individual parcels and properties may be sublet under the terms of a master lease. The master lease and each subsequent sublease must comply with appropriate EBS, FOSL, NEPA, and other applicable natural and cultural resource determinations and consultation requirements.

A Report of Availability (ROA) must be prepared by the installation commander when a real estate parcel is no longer needed, providing the following information:

- Legal, policy, and military considerations affecting the outgrant;
- Supporting justification to DA or DoD;
- Statement of safety for nonmilitary purposes, or safety factors that exist;
- Description of the parcel, including acreage, character, and improvements;
- Map depicting relationship of improvements to the installation boundary;
- If for a public road, a statement of proposed access and type of U.S. jurisdiction;
- If only building space, total usable square feet, type of construction, and availability of utilities;

- Any reasons the parcel cannot be declared excess and disposal cannot follow Army Regulation 405-90;
- EA or EIS describing all potential impacts of the proposed action;
- Eligibility for inclusion on the National Register of Historic Places;
- Flood hazard evaluation if the lands are on a floodplain;
- Any proposed destruction, relocation, and replacement of Army facilities;
- Recommendation of any limitations imposed on subsequent use, often dictated by:
    - Executive Order 11990, Protection of Wetlands
    - Executive Order 11988, Floodplain Management
    - Endangered Species Act
    - Wilderness Act of 1964
    - Wild and Scenic Rivers Act
    - Coastal Barrier Resources Act of 1982
    - National Historic Preservation Act;
- Date of availability, and period of time the property is available;
- Estimates of cost, fair market value, and rental;
- Any potential jeopardy or impacts on any threatened or endangered species, or their habitat;
- Consistency of the proposed action with an approved State Coastal Zone Management Plan; and
- Justification for granting a Waiver of Competition, if appropriate.

For the lease of excess Army property, DoD has established FOSLs to identify and document real estate parcels available through the BRAC process and environmentally suitable for outgrant. This policy meets the following objectives:

- Ensure protection of human health and the environment;
- Develop a DoD-wide process to assess, determine, and document the environmental suitability of properties (parcels) for outgrant;
- Ensure that outgrants do not interfere with environmental restoration schedules and activities;
- Ensure compliance with all applicable environmental requirements and insure lessee notification of potentially present hazardous substances (including asbestos and any substance regulated under CERCLA, RCRA, or state law) and petroleum products (including their derivatives, such as aviation fuel and motor oil); and
- Provide adequate public and regulatory participation.

An Environmental Baseline Survey must be conducted to assess the environmental condition of the property. After EBS completion and review and any available local community reuse plans are reviewed; the Army will prepare and sign the FOSL, based on the following information:

- Hazardous substance notice is not given because no hazardous substances or petroleum products were stored for one year or more, or are known to undergo release, treatment, or disposal;
- Hazardous substance notice is given identifying the types and quantity of hazardous substances or petroleum products, and the time at which storage for one year or

more, release, treatment, or disposal took place, but the property is currently not contaminated with hazardous substances or petroleum; and

- The property contains some level of contamination, and hazardous substance notice will be given. However, the property can be used pursuant to the proposed lease; with specific use restrictions in the proposed lease; with acceptable risk to the environment or human health; and without interference with the environmental restoration process.

Similar to a FOSL, a Finding of Suitability to Transfer (FOST) is prepared once a determination has been made that a property is environmentally suitable for transfer.

The Army can acquire land (or entitlements) that can protect installation mission interests from land use encroachment (LaPorte, 2001, GAO, 2002, and Westervelt, 2004), which can constrain military use of Army real property, and Army responsibilities for natural resource conservation (under specific sections of the National Defense Authorization Act (USACE, 2002a). Section 2811, “Agreements to Limit Encroachments and other Constraints on Military Testing, Training and Operations” enables agreements to limit such encroachment and subsequent constraints on military training, testing, and operations. The Army can enter into an agreement (with an eligible entity) to address use or development of adjacent real property to (a) limit any development or use that is incompatible with the mission, or (b) preserve habitat to eliminate or mitigate current or foreseen restrictions on installation activities. Eligible entities include states, political subdivisions of states, and private entities organized (as a stated principal) to conserve, restore, or preserve land and natural resources. Such agreements may provide acquisition (by the entity) of all right, title, and interest in (and to) any real property (or any lesser interest in the property), and costs can be shared by the Army and the entity. Suitable tracts could serve as a buffer between installation and non-military land uses. Such acquisition could aid in installation realignment or reconfiguration, and changing land use classifications over an installation. Section 2812, “Conveyance of Surplus Real Property for Natural Resources Conservation Purposes” enables the Army to convey surplus real property for natural resource protection to an eligible entity. This includes any surplus real property (a) under Army administrative control, (b) suitable and desirable for conservation purposes, (c) available for public benefit transfer (for a sufficient period of time) to potential claimants, and (d) not subject to pending transfer requests to another federal agency, or for conveyance to other qualified recipients for public benefit. The accompanying deed requires use and maintenance for natural resource conservation in perpetuity; and failure can revert property ownership to the United States. Such property disposal is most common after installation realignment or closure, but may also support other installation objectives. As indicated, such disposal requires that all other disposal avenues be reasonably exhausted. Both of these provisions can be useful mitigations for CEA (See CEQ Step 10).

Army facilities support particular mission functions, and are classified into facility category groups (FCGs), represented by the following partial listing (USACE, 2002a):

Example FCG Code Type of Facility

11110	Fixed wing runway
17121	Indoor firing range
17160	Training aids center
17907	Sniper training field firing range
21110	Aviation unit maintenance hangar

21410	Vehicle maintenance shop, organizational
30000	Research, development, and test facilities
44100	Controlled humidity warehouse
44110	General purpose warehouse
51010	Hospital
61050	Administration building general purpose
72100	Unaccompanied personnel housing – enlisted personnel
73010	Fire station
73073	Post office main
74021	Commissary
75030	Outdoor swimming pool
81100	Electric power source
83200	Sewage and Industrial Waste Collection
85210	Parking area – organization vehicles
85215	Parking area – nonorganization vehicles

The demand for these facilities is established by mission requirements, Army doctrine, and Army and DoD guidelines (regulations, directives, and manuals).

Facility demands can be met through the provision of Army assets, through provision by the local community, or by some combination. For example, housing facilities are normally provided by a combination of Army and community assets. Such arrangements can produce positive social or economic impacts in a local economy; but in some cases, they can produce demands of government services (such as schools) without accompanying government revenues (such as property taxes, as Army lands are not taxed) (See discussions in the Socioeconomics VEC (Section 4.10).

Once the demand for facilities has been established, strategies can be developed to meet the demand, from installation resources and/or community resources as well. Army planning usually performed ascertains facility needs, resources, and shortfalls. As an illustrative example, the Fort Bliss Housing Survey (U.S. Army, 2005) can be used {copy available for CD}, as housing is perhaps the most complex facility requirement. As indicated in the following figures, the requirements are calculated in detail (accompanied and unaccompanied personnel; 1, 2, and 3-bedroom; standard and substandard; etc), both installation and community capacities are analyzed, and shortfalls are documented.

Similar, though often less-complex, studies are used to establish other facility (FCG) needs.

Once shortfalls have been identified, facilities may be obtained through Army mechanisms, or through a variety of other community mechanisms. The Military Construction- Army (MCA) program is the traditional mechanism to obtain major new construction projects over $500,000 (USACE, 2002a). MCA projects commonly include barracks, motor pools, ranges, family housing, administrative buildings, and gymnasiums, among others. The yearly Military Construction-Army (MCA) program is very large (approximately 1 – 1 ½ billion), and can constitute a major influence on a local economy, as discussed in CEQ Step 6 in the Socioeconomic VEC section (Section 4.10).

While the MCA program traditionally provided housing facilities, much of the Army's housing does not meet current Army standards; leading to the initiation of the Residential Communities Initiative (http://rci.army.mil/programinfo/rci_overview_8mar05.pdf), using both public and private funding to meet Army housing requirements (USACE, 2002a). This program was established to improve available Army housing, a principal component of soldier health, well-being, and quality of life (QOL).

Current Army programs seek high facility utilization rates, maximizing return on capital by minimizing vacant space, and removing old unusable space. These have lead to recent development of the following two initiatives:

- The New Leasing Initiative seeks private enterprises to lease under-utilized Army facilities and property for commercial use or joint-use. (Initial participating installations were Fort Sam Houston, Fort Bliss, Fort Leonard Wood, Picatinny Arsenal, and Yuma Proving Ground.) Historically, rental payments from leases of Army non-excess real property were deposited into the U.S. Treasury (as miscellaneous receipts). Under Section 2806 of the National Defense Authorization Act of 1991, the Army retains these receipts, and Army Headquarters may share lease proceeds with the installation. Lease proceeds are desirable as "no year" funds, usable only for facilities maintenance and repair or for environmental restoration. Army policy dictates return of all lease proceeds to the installations, as needed capital for real property purposes and reductions of competing demands inherent in the Army budget.
- The Facilities Reduction Program seeks to eliminate excess space. The program eliminated approximately 58 million square feet between 1992 and 1999. The Army also invested $104 million between 1998 and 2003 to consolidate 112 Army activities into Army-owned space, reducing annual rental costs by approximately $70 million.

Infrastructure includes systems and physical structures to enable Army military and civilian employees to accomplish the installation mission. This infrastructure must often have the capacity to support both mission growth and economic growth in the surrounding community (USACE, 2002a), as they are increasingly shared. Infrastructure includes:

- Water systems to provide water for potable use, industrial applications (including fire suppression), and agricultural irrigation. Water system issues focus on availability and quality of water supplies, treatment processes, distribution, and consumption rates.
- Wastewater systems treat sanitary sewer, industrial, or both kinds of wastes. Most sanitary systems used by the Army are publicly-owned treatment works (POTW); and federally-owned treatment works (FOTW) are those sanitary and industrial systems owned and operated by the Army. These systems include the pipe network system conveying wastes to the central treatment site. In general, treatment works are (a) primary (mechanical treatment only), (b) secondary (mechanical and biological treatment), or (c) tertiary (mechanical and biological or chemical treatment); and operate under EPA (or state) National Pollutant Discharge Elimination System (NPDES) permits, pursuant to the CWA (covered under the Water Resources VEC in Section 4.8). System issues typically deal with the age of the system and treatment plant, treatment plant capacity, and any permit issues (such as records of violation, or other regulatory enforcement).
- Storm water systems convey precipitation from developed sites to appropriate receiving surface waters, often employing devices to slow (or temporarily impound) their movement; often reducing sediments and other contaminants that enter receiving waters. Such facilities are designed to convey/hold (or delay) the large expected rainfall events (often the 50 or 100-year event). Failure often results in downstream flooding, environmental impacts, and economic damages. In general, the impervious surfaces associated with higher development dictate greater storm water management.

- Solid waste management has historically focused on landfill capacities, the ability to accommodate a given population's residential, commercial, and industrial solid waste. Landfill alternatives are increasingly used to reduce the competition and pressure on limited landfill capacities. Alternatives include waste-to-energy programs, incineration, specialized landfills for construction and demolition debris, and reuse or recycling programs for various waste categories (e.g., glass, metal, cardboard, paper, etc.). At DoD facilities, excess buildings are also increasingly deconstructed and salvaged, as opposed to demolition and landfill disposal.
- Energy supply is provided through electrical power, natural gas, fuel oil, and steam; all used at various Army installations. Energy issues include the level of demand, sources of energy, conservation measures, availability, costs, or consumption rates.
- Traffic and circulation deals with the smooth flow of traffic and the ability of road networks to efficiently meet transportation demands. Traffic congestion often occurs from inadequate or marginal supporting road networks. The Transportation Research Board Highway Capacity Manual (TRB, 1985) classifies traffic conditions using the Level of Service (LOS) approach, a scale from "A" to "F":

  LOS A: free flow traffic operations
  LOS B: reasonably free flow
  LOS C: stable
  LOS D: borderline unstable
  LOS E: extremely unstable
  LOS F: breakdown in traffic operations

LOS ratings are assigned based on traffic counts and observation. A second approach is the average daily traffic (ADT) approach (TRB, 1985), usually expressed as the average number of vehicles passing a fixed point over a 24-hour period. This measure is particularly useful when evaluating a particular roadway or intersection.

- Transportation systems are designed to move both people and commodities; and include commercial air carriers, maritime shipping, railroads, bus services, and trucking. People are usually transported by privately-owned vehicles (POVs), or, if available, mass transit systems.
- Communications systems consist primarily of radio and telecommunications systems.

Army infrastructure management includes the privatization of utilities infrastructure, to provide reliable utility systems (USACE, 2002a). This initiative reflects the historically low and inadequate funding levels that led to the deteriorating Army utility infrastructure. This approach exploits private capital, experience, and technologies to upgrade these Army systems. The Defense Reform Initiative Directive 49 (DRID 49) requires privatization of non-mission-essential utilities systems.

The installation master plan is the Army mechanism to plan and manage land, facilities, and infrastructure. Each installation has a real property management plan (RPMP), based on assigned mission and other guidance that reflects Army trends, strategies, goals, and objectives (USACE, 2002a). The RPMP addresses both long-range and near-term plans for fully supporting Army goals, objectives, missions, and populations. These include a comprehensive plan that integrates Army and community assets into a collaborative, long-term solution to Army mission needs. This process is farmed by five tenets:

- Maximum facility utilization – optimal allocation of existing facilities, utilities, and transportation networks and information systems.

- Maintenance of Army assets – maintaining Army assets reducing any backlogs of maintenance and repair.
- Regulatory and environmental compliance – demonstration of Army leadership, and compliance with both the letter and intent of federal, state, local, DoD, and Army environmental policies and guidance.
- Renewal of Army facilities – enabling orderly and cost-effective rehabilitation, replacement, or elimination of Army facility and infrastructure deficiencies.
- Provision of new facilities – As a last resort, new construction can be proposed if the requirement cannot be supported by existing underutilized adequate facilities.

The installation master planning process is governed by Army Regulation 210-20 Real Property Master Planning USA, 2005), which establishes four components within the RPMP:

- The Long Range Component (LRC) of the RPMP establishes the basic framework and specific options for installation development and management; documenting installation capabilities, constraints, and opportunities; and noting specific optimum land use and expansion capabilities, based on a thorough analysis. LRC elements include long-range analysis; environmental, natural, and cultural resource analysis; land use analysis; utilities assessment; transportation assessment; and supporting graphics, including various plans, an environmental overlay, and the installation design guide.
- The Capital Investment Strategy (CIS) of the RPMP is the installation plan for real property use, and investment to support installation missions and the Army Long-Range Facilities Plan; a status summary of real property support for installation missions; and a link between real property deficiencies (described in the LRC) and the projects listed in the Short-Range Component (SRC). The CIS includes an executive summary, consideration of alternatives, an action plan, and supporting graphics. It is supported by the tabulation of existing and required facilities (TSB); additional graphics, including the future development site plan; environmental analyses; and the facilities reduction plan.
- The Short-Range Component (SRC) of the RPMP integrates real property master planning into the Army's operational planning process (over thesix-year budget period), specifying CIS projects for real property management and development. The SRC reflects installation plans for facilities construction, revitalization, major repair, major environmental undertakings, and disposal actions. The SRC incorporates facility investment plans for non-appropriated funds and other separate funds; the real property investment plan; and supporting graphics, including site-specific project location plans and site-specific extracts of the environmental overlay.
- The Mobilization Component (MC) of the RPMP supports the installation mobilization strategy; to allocate and acquire additional needed facilities to support mobilization missions, functions, and tasks. The MC includes a narrative report, land use plan, a tabulation of existing and required mobilization facilities, mobilization site plans, and environmental analysis.

Many Army installations are engaged in the ISP. For those installations, collaboration is already underway with the local community to plan infrastructure and facility requirements into the future. These are reflective of long-term sustainability goals established in concert with the community, and can be very useful for effective NEPA analysis, including CEA.

As the Army plans for the provision of both facilities and infrastructure, these plans must include an appreciation for impacts within the local off-post community. As the Army often obtains some of these requisite facilities, infrastructure, and implicit services from the local community, these are often considered as socioeconomic consequences, as well real property (and related) management issues. As discussed in the discussion of the Socioeconomics VEC (Section 4.10), these socioeconomic "subVECs" are as follows:

- Government Services
  - Fire Protection (Garrison)
  - Utilities
  - Telecommunications
  - Water/Wastewater Infrastructure/Treatment
- Wastewater and Potable Water Treatment
- Solid Waste
  - Waste Minimization
- Hospitals/Health Care
  - Human Health
- Law Enforcement
- Recreational Services
- Education/ School Systems
  - Housing

To facilitate a more comprehensive approach to DoD real property management, Executive Order 13327, "Federal Real Property Asset Management" (2004) was enacted to promote efficient and economical use of federal real property, resulting in the Defense Installations Strategic Plan (DUSD, 2005). Effectively and appropriately subtitled "Transforming Installations to Meet the Emerging Needs of the Warfighter", this plan expands the scope and enhances some of the previous DoD real property management principles, defines the integral relationship between natural and manmade installation assets, and advances the integration of installations and environmental, safety, and occupational health (ESOH) activities to enhance overall support of the military mission. "Installation assets" include all natural and manmade assets associated with owning, managing, and operating an installation. This includes the facilities, people, and internal and external environment, which are consistent with sustainability principles that embrace three major capital accounts: economic capital, natural capital, and human capital (Hawkin, et al, 1999). This plan is particularly applicable to Facility impact analysis, as it recognizes the mutually supporting interdependencies of these components (direct and indirect linkages of impacts), and establishes stewardship as a strategic long-term goal.

The following DoD objectives apply to the Facility VEC:

Provide reliable and cost-effective utility services to minimize facility energy consumption, focusing on (a) investments in cost-effective renewable energy sources, (b) energy-efficient construction designs, and (c) aggregating bargaining power among regions and Components to reduce energy costs. This objective focuses on the reduction of standard building energy consumption from 1985 baseline by 30 percent, and the reduction of industrial and laboratory energy consumption from 1990 baseline by 25 percent; by FY 2010.

Reduce consumption of energy as one way to minimize unnecessary life cycle costs, focusing on innovative technologies, state-of-the-art techniques, and alternative sources. This includes active technology development and testing of bio-based lubricants/fuels as alternatives to fossil-fuels; and management of the DoD motor vehicle fleet to reduce petroleum fuel consumption through increased fleet fuel efficiency (and increasing the ratio of alternative fueled vehicles in the non-tactical fleet). This objective focuses on reductions in vehicle petroleum consumption from FY 1999 baseline year by 75 percent of ordinary (non-tactical) vehicles by 2005; and use of alternative fuels by 2008.

Implement new management systems based on the "plan-do-check-act" framework of the international standard for environmental management systems (ISO 14001) to manage worldwide ESOH aspects of the mission, and to insure that DoD operations more efficient and sustainable.

Broaden stakeholder engagement through outreach efforts to sustain access to DoD installations and ranges. This objective includes partnerships with various stakeholder groups and innovative efforts towards conservation and sustainability of military installations, ranges and operating areas. Outreach efforts include opportunities for DoD and stakeholder communities to identify mutual goals and pursue collaborative efforts towards conservation of resources needed to maintain the military mission. DoD recognizes that the creation of meaningful partnerships with non-governmental organizations, other federal agencies, and associations with land use and conservation interests can further both national defense and natural resource conservation goals.

This DoD real property guidance supports the integration of environmental planning to facility and infrastructure planning; and is consistent with AR 210-20, AR 350-9, and overarching Army sustainability policy (USA, 2004a). It is also consistent with the CEQ CEA guidelines (CEQ, 1997), as well as the emphasis on EMS implementation (See Section 2.5).

4.9.2 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect effects of a proposed action on facilties; and, in addition, they can be used to determine if cumulative effects also need to be considered. These "quick look" questions include:

- Is the community undergoing rapid growth, or is the community seeing reductions in growth?
- Does the proposed action add to that trend, or does it reduce (mitigate) that trend?
- Are political stresses evident over the use of community lands or services infrastructure?

Effects Analysis Level:

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly; and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the “Detailed Analysis”, Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

At the EA level, attention must be given to CEQ Steps 1–4 (the scoping steps) and CEQ Steps 6 and 7, describing the affected environment. The findings from these CEQ steps can be documented to serve as a “hard look”, if it is determined that an EA is appropriate. However, if significant impacts are identified from consideration of CEQ Steps 1-4, 6 and 7, then an EIS is appropriate. For an EIS, all 11 CEQ steps should be addressed.

CEQ Step 1 – Identify Significant Effects Associated with the Proposed Action and Define the Assessment Goals.

Army mission requirements and activities produce a demand for real estate, facilities, and the infrastructure systems. Some of these are provided through Army or DoD sources, and some are provided by both the Army and the surrounding community. In either case, the cumulative demands for these assets, from the Army installation and the surrounding community, must be coordinated (per AR 210-20). These demands can become competitive and/ or controversial if the resources become scarce or limited.

Real property (land) assets can become scarce within a community, as illustrated by the “encroachment” of community development around existing installations (LaPorte, 2001, GAO, 2002, and Westervelt, 2004). While the direct effect of such development is a land use issue (See the Land Use VEC), the indirect effects can become quite severe, such as those cases where the remaining DoD real estate has become the last bastion for protected species (Fiori, 2002 and USAEC, 2005), or have other amenities that are valued by the community. Many current and potential stresses can be easily identified through a review of land use patterns around the installation and coordination with local planning agencies. Such interaction is required for the comprehensive installation master planning required by AR 210-20.

In many cases, facility demands must be met through Army assets, as in the case of direct mission support, as illustrated by the following sample FCG codes:

11110	Fixed wing runway
17121	Indoor firing range
17160	Training aids center
17907	Sniper training field firing range
21110	Aviation unit maintenance hangar
21410	Vehicle maintenance shop, organizational
30000	Research, development, and test facilities
61050	Administration building general purpose
73010	Fire station
73073	Post office main
74021	Commissary

Such facilities benefit from location on the installation and proximity to supporting and related installation activities. Other facilities can be obtained from the assets of the local community, depending on the level and duration of demand, timelines for provision, and other operational requirements, illustrated as follows:

44100	Controlled humidity warehouse
44110	General purpose warehouse
51010	Hospital
72100	Unaccompanied personnel housing – enlisted personnel
75030	Outdoor swimming pool
81100	Electric power source
83200	Sewage and Industrial Waste Collection
85210	Parking area – organization vehicles
85215	Parking area – nonorganization vehicles

In many cases, facilities and services can be provided by the community and private sector. When feasible, the use of community assets can support the major tenets of RPMP, limiting the inventory of owned assets and providing flexibility for meeting facility needs. Again, the installation master plan can provide insights into both the demand and supply of facilities, using both installation and community assets. Housing facility requirements are perhaps the best example of commonly utilized community assets (USA, 2005).

Infrastructure mission requirements are increasingly provided through community or private sector mechanisms. If local conditions allow, these mechanisms address Army needs for water systems, wastewater systems, storm water systems, solid waste management, energy supply, traffic and circulation systems, transportation systems, and communications systems. Such infrastructure mechanisms can reduce installation costs and facilitate a shared solution to overall community or regional needs. In some cases, the installation can become a catalyst for needed community-wide solutions (Fort Bliss, 2004), facilitating needed community infrastructure investments.

As indicated in the discussion of the Socioeconomics VEC (Section 4.10), many service demands are the indirect effects of realignments of the installation mission, as illustrated below:

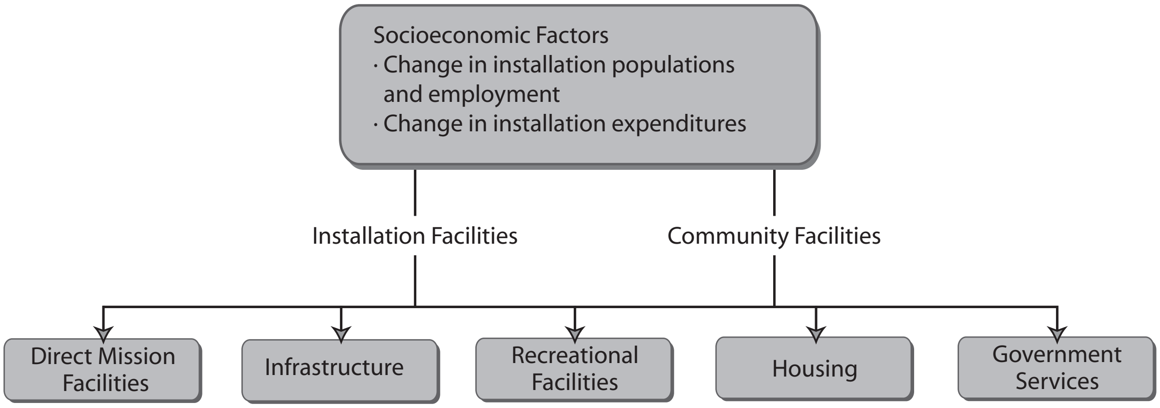

Figure 4.9-1 *Service Demands at an Installation Community*

4.9

Likely impacts on these installation and community assets can be found in the LRC of the installation master plan. The LRC can present the demand for real property, facilities, and infrastructure and the strategy for their provision through installation and community assets. If the installation is engaged in the ISP, critical community and installation assets can be easily identified, and can prove useful to the effect analysis process.

If land, facilities and infrastructure are precipitated by new mission requirements, they will be addresses earlier in the NEPA analysis, as part of the direct and indirect impact assessment process, often under the Government Revenues and Expenditures section of Socioeconomic Consequences (See Section 4.10) and/or in the Infrastructure of Facilities section.

CEQ Step 2 – Establish Geographic Scope of the Analysis.

The geographic scope for the Facilities VEC is dependent upon the target subVEC. Land (real property) issues are usually limited to the land use patterns (compatibilities and conflicts) that immediately surround the installation (See the Land Use VEC). Other facilities and infrastructure considerations are geographically expanded to the surrounding community, and the extent of affected (or potentially affected) community facilities and infrastructure. If the community is large and diverse, this geographic region can be large; while, if the community is small, the geographic boundary will be characteristically smaller.

Many facilities will fall entirely on the installation, as illustrated by the following partial list of illustrative FCGs:

11110	Fixed wing runway
17121	Indoor firing range
17160	Training aids center
17907	Sniper training field firing range
21110	Aviation unit maintenance hangar
21410	Vehicle maintenance shop, organizational
30000	Research, development, and test facilities
61050	Administration building general purpose
44100	Controlled humidity warehouse
44110	General purpose warehouse
85210	Parking area – organization vehicles
85215	Parking area – nonorganization vehicles

Some of these facilities, illustrated in the following list, may be supplied by the surrounding community (by private or governmental entities). While such facilities have historically been provided on Army installations, trends indicate growing acceptance of some facility location within local communities. In some cases, better facilities can often be constructed and maintained, and overall costs (to the Army) may be reduced. These options and trends are, however, very dependent of local site-specific conditions (geographic proximity, community attributes, etc.), as well as security implications of facility location and installation access.

73010	Fire station
73073	Post office main
74021	Commissary

51010 Hospital
72100 Unaccompanied personnel housing – enlisted personnel
75030 Outdoor swimming pool

In such cases, the geographic scope must extend to encompass the community that shares in the facility or supplies it for the installation.

Housing facilities are typically supplied, in part, from the local community; and are coordinated through the periodic assessment of overall installation housing needs, the quality of housing (both on the installation and in the community), and the appropriate mix of supply to meet Army needs. As the location of military employees and families in the local economy can represent a tremendous social and economic influence, the geographic scope for effect analysis, including CEA, must include the entire community (or ROI), as discussed in the Socioeconomics VEC (Section 4.10).

Some infrastructure facilities and services are likewise provided and maintained on the installation, and some are provided through community assets. Water, wastewater and storm water systems; energy supplies; traffic and circulation systems; transportation systems; and communications systems are increasingly integrated with (and into) community infrastructure. The mass transit components of transportation systems may often depend on community/ installation integration; and the installation can potentially provide the “critical mass” to make a mass transit system economically feasible. Some communications infrastructure is increasingly constrained and critical to the installation mission (GAO, 2002). In cases where the infrastructure in provided or shared, the geographic scope of effect analysis must encompass both the physical infrastructure and the total geographical extent of its service area.

CEQ Step 3 – Establish the Time Frame for Analysis.

The temporal scale for Facility effect analysis is easy to address through the articulation of existing assets (real property, facilities, and infrastructure) on the installation and community. These assets are the end result of “past and present” temporal components, in spite of how they evolved. These assets and their growth can be linked to population and demographic trends over time, on the installation and in the community (See CEQ Step 3 of the Socioeconomics VEC). Trends in facility and infrastructure growth and accompanying reductions in undeveloped real estate can be linked to these trends over the previous decade (possibly five past decades, if development is extensive and varied). If the community a long history of demographic growth (or fluctuation), a longer historical characterization (50 years, or even longer, depending on circumstances) may be required for full understanding, appreciation, and characterization.

The future temporal boundary can be established by evaluating future anticipated facility and infrastructure demands. The temporal extent of these projections is a reasonable limit for the evaluation of consequences including cumulative.

Cumulative effects on other VECs can also influence the timelines for Facility CEA. In many cases, the limit to growth in an ROI is a natural resource (water, land, etc.) or a man-made resource (transportation, public service infrastructure, etc.); often established by the stresses of economic growth or population changes. Proposed growth can produce indirect effects on these VECs, and the inter-relationships (correlations) between them can affect the demand for facility and infrastructure. For example, the desirability of a given community is diminished by frequent water rationing or high water costs. Similarly, long commuting patterns and traffic congestion can render good jobs unacceptable or make a particular city less desirable. The success of future plans can become questionable, if such situations emerge; and they may be reasonably foreseeable. If so, they may be identified by local planning agencies or organizations that can assist in the determination of upper temporal boundaries for the analysis.

CEQ Step 4–Identify Other Actions Affecting the Resources, Ecosystems, and Human Communities of Concern.

Other sources of community growth can also place demands on community assets, and indirectly affect their provision for Army mission needs. As a result, local community plans should be incorporated into Army planning (per AR 210 -20), anticipating reasonably foreseeable growth in the affected community. This is especially true in those communities that have undergone considerable growth in the past, and may be encountering limits to continued expansion. In such cases, collaboration with the affected community agencies and organizations is often possible, and is certainly desirable.

As discussed in the Socioeconomics VEC, the increased demand for facility and infrastructure services is usually precipitated by population change. While identifying other actions or activities (in the region) that may increase these demands, focus should be placed on any likely large developments (new factories or businesses) or other large projects that will substantially change the population in the region, and hence increase facility and infrastructure demands.

Future facility and infrastructure demands will occur as a result of (a) the afore-mentioned larger projects or developments, and (b) background demographic trends. These background overall trends can be determined through the analyses of population trends in the service areas of the facilities or infrastructure. Uniform growth trends can be projected through simple extrapolation, while highly fluctuating trends can best be projected through the use of average yearly growth (or reduction) rates. These longer term trends are the result of existing regional growth, trends that vary from community to community. If resource, facility, or infrastructure limits are becoming an issue, they are likely reflected in local plans.

In projecting future demands and potential cumulative effects, local planning agencies and facility/infrastructure suppliers should be contacted. In meeting their customer or constituent needs, such organizations will likely have good projections, and their assessments of likely impacts can be very valuable.

CEQ Step 5–Characterize the Resources, Ecosystems, and Human Communities Identified During Scoping in Terms of Their Response to Change and Capacity to Withstand Stresses.

The response of the Facilities VEC (real estate, facilities, and infrastructure) to change varies, depending on the subVEC, as well as the communities in which they occur. The established land use patterns in the community can preclude easy adaptation or the provision of needed resources, particularly if these land use patterns are already fully developed and providing current community needs. Undeveloped lands (open space or agricultural) are more adaptable to land use changes, but may also be required to meet community needs for open space, or to counterbalance intensive community population densities.

Facilities and infrastructure can usually be readily expanded to meet community needs, unless hindered (or constrained by physical limitations (such as the lack of available land), or institutional/regulatory constraints (such as environmental limitations).

Some facility and infrastructure demands can be managed through a combination of new facilities and conservation measures. As communities grow and demands are made on resources, upper limits on resource exploitation are increasingly recognized (Meadows and Meadows, 1992). These resource constraints can be regional (community-specific) in nature, and can include such issues as water supply; or can be global in nature, such as the increasing demand on energy resources (Westervelt and Fournier, 2005).

The effects of conservation measures are articulated in the discussion of specific VECs (and subVECs). U.S. resource consumption is unprecedented and represents a disproportionate drain on both U.S. and global resources. As global limitations are increasingly recognized, facility and infrastructure planning will increasingly include a conservation component; managing the "demand component" while developing a strategy for the supply component. Whether the result of resource limitations, or the application of the Army sustainability principles (USA, 2004a) that encourage resource conservation, facility and infrastructure management will increasingly require the inclusion of conservation measures (See CEQ Step 10).

Some Facility subVECs are more adaptable to change than others. Real property (land) is essentially an established (fixed) commodity at an installation. As discussed in the Introduction section of this VEC, land acquisition has been traditionally difficult, but provisions are increasingly provided to facilitate less stress on DoD property and surrounding civilian land uses. While the purchase of additional land remains unlikely, except when authorized by special circumstances, site-specific mitigations are a common approach to relieve stresses on land resources (See CEQ Step 10), and enhance installation mission performance.

Some facility demands, as illustrated through the following partial list, can prove more adaptable, as their "throughput" (or service) level is dictated by scheduling and individual (or unit) demands:

11110	Fixed wing runway
17121	Indoor firing range
17160	Training aids center
17907	Sniper training field firing range
21110	Aviation unit maintenance hangar
21410	Vehicle maintenance shop, organizational
30000	Research, development, and test facilities

These types of facilities can prove adaptable through prudent multiple use, coordination of use, and collaboration to solve problems and conflicts.

Many facilities are less adaptable to stress (demand), and require a level of accessibility (availability). This availability must be maintained and certain levels of service (often specified through per capita demand estimates). These are illustrated in the following partial illustrative list:

61050	Administration building general purpose
73010	Fire station

73073	Post office main
74021	Commissary
44100	Controlled humidity warehouse
44110	General purpose warehouse
51010	Hospital
72100	Unaccompanied personnel housing – enlisted personnel
75030	Outdoor swimming pool
85210	Parking area – organizational vehicles
85215	Parking area – nonorganizational vehicles

Most infrastructure services are a matter of availability, often determined by maximum instantaneous demand. A certain level of service must be available, in case demands rise. Demand can be inflexible (as illustrated by electricity demand for air conditioning "in the heat of the day" during periods of high temperature), and supporting infrastructure becomes inflexible when capacity is exceeded (as illustrated by subsequent 'blackouts"). On a lesser scale (less severe or catastrophic scale), water can become less available, "brownouts" can occur, solid waste can accumulate, pollution can occur, or any other myriad indirect effects (on other VECs) can punctuate the failure of infrastructure systems. In this regard, these subVECs often seem flexible and adaptable, until the supply (availability threshold) is exceeded, and system failure illustrates their significance.

CEQ Step 6 – Characterize the Stresses Affecting These Resources, Ecosystems, and Human Communities and Their Relation to Regulatory Thresholds.

Facility and infrastructure requirements are generated through the same mechanisms, whether generated by the Army installation or by the local community. Often, they are generated and can be estimated by per capita demand or usage rates, whether water or energy consumption, or the need for solid waste, school, police, fire, or other services. The quality and acceptability of these services is often regulated to insure public health; and regulatory issues often dictate the limits of available resources (adequate potable water, safe wastewater treatment and solid waste disposal, acceptable housing and transportation facilities, etc.).

Almost all facility subVECs are subject to regulatory control. Land resources, and their use, can be regulated to insure land use compatibilities. Facility design, construction, operations, and disposal are regulated in the interest of worker safety and public health; and are subject to additional DoD, Army, and other governmental requirements. Infrastructure systems are generally regulated in the interest of public health and safety and environmental protection and enhancement.

CEQ Step 7 – Define a Baseline Condition for the Resources, Ecosystems, and Human Communities.

Baseline conditions can be established for any of the Facility subVECs, drawing from installation master plans, ISPs, or community land use plans. Specific metrics include capacity, expandability, future demand (with and without the proposed action), and long-term regional sustainability.

Baseline conditions for land resources are generally established through land use plans. The availability of land can be evaluated through a review of resident population densities and the intensities of regional land use; and trends can be established by reviewing installation and community land use maps over time. Many regions have illustrated regional land use saturation (and inflexibility) through land use controls (building moratoriums, zoning referendums, etc.) and many communities have adopted smart growth strategies (USEPA, 2005) to relieve land use and resource stresses. These land use controls are often implemented to reduce indirect facility and infrastructure stresses that occur through development and population growth.

Land use patterns and trends can encroach on the military mission (LaPorte, 2001, GAO, 2002, and Westervelt, 2004). When these surrounding land use patterns mature, they often limit installation support of the military mission. In such cases, the baseline conditions leave only limited land, facility, and infrastructure options for the installation decision maker.

Facilities and infrastructure can be characterized by both capacity and condition. Most facilities have finite capacity limits, though some are more adaptable than others (See CEQ Step 5) and some mitigations can be used to reduce demand and resource conflicts (See CEQ Step 10).

The condition of facilities or infrastructure is often dictated by regulatory controls (See CEQ Step 6). As a result, their condition can often be established by their regulatory status. If they are incompliant or inconsistent with regulatory controls, their expansion can either (a) exacerbate existing issues with their expansion, or (b) can improve conditions, if facility or infrastructure upgrades are sufficiently funded and implemented. In this regard, expanded demand can prove either positive or negative.

Many Army facilities are closely managed and evaluated regarding their baseline condition. Implementation of Army Regulation 210-14 (The Army Installation Status Report Program) (USA, 2001) is overseen by the Assistant Secretary of the Army (Installations and Environment), and administered by the Assistant Chief of Staff (Installations and Environment), functional proponent for the program (USACE, 2002a). The ISR Program facilitates appropriate and responsible decision making to sustain and improve the management of installation facilities and services. Each facility capability area is "scored" to reflect overall condition and readiness. The ISR is a valuable source of information for the categorization of facility and infrastructure baselines.

Community baselines may be reflected in some ISR data, but community agencies and organizations sources are the best source of baseline data on community facilities and infrastructure (See CEQ Steps 1, 4, and 5).

CEQ Step 8–Identify the Important Cause-and-Effect Relationships between Human Activities and Resources, Ecosystems, and Human Communities.

The demands for these facilities and services are simple from a direct cause-effect relationship, addressed through an assessment of increased demand (changes in population or facility occupancy), the application of established factors (levels or acceptable service), and comparisons to facility or infrastructure capacity.

Example demand factors are presented in the following table, on page 224.

This table provides "demand factors" that can be used to anticipate the need for additional services as a result of population increases. These estimated demands will vary from community to community and should be verified with local officials and planners when possible. In cases where the range may be significant, they are noted.

Water/Wastewater:	102 to 278 gallons per day (gpd) per capita depends on location & includes industrial/commercial demand 100-150 gpd per capita is a good planning figure domestic consumption only
Health Care:	4.5 hospital beds per 1000 population
Library:	1 library per 40,000- 60,000 residents 400-500 sq. ft. per 1000 population
Law Enforcement:	1.7 personnel (policeman, etc.) per 1000 population range varies from 1.68 to 2.89 (city of 500,000)
Fire Protection:	1.43 firemen per 1000 population range varies from 1.29 to 1.72
Schools:	0.18 to 1.17 students per individual or family dwelling unit 1.17 single family 1.46 duplex 1.28 townhome 0.31 mobile home 0.40 garden apartment 0.18 high rise)
Transportation:	6 to 10 average daily trips (ADT) per dwelling unit for apartments 7 to 15 ADT per dwelling unit for single family homes
Open Space:	7-25 acres per 1000 population
Parks:	neighborhood parks (5-20 acres): 2.5 acres per 1000 population district parks (20-100 acres): 2.5 acres per 1000 population large parks (100+ acres): 5.0 acres per 1000 population regional parks (250+ acres): 20.0 acres per 1000 population
Taken from Environmental Impact Analysis Handbook by John Rau and David Wooten, McGraw-Hill, 1980, ISBN 0-07-051217-5	

Table 4.9-2 *Example Facility/Infrastructure Demand Factors*

The indirect effects, however, stem from a very complex network of inter-relationships, from the basic resource to the facility or service delivered to the final demand location.

The indirect consequences of land (real property) decisions are often critical, extensive, and long-lasting. Once development has commenced (even minor development), a long "chain" of subsequent and often incremental land use changes normally follow. Over time, these effects lead to facility and infrastructure demands, often culminating in physical, social, natural, and fiscal resource constraints. The incremental effects of individually small and inconsequential land use decisions are often used to illustrate cumulative effects. These are better addressed in the effect analysis associated with the Land Use VEC.

Environmental impacts associated with installation facilities and infrastructure are mostly affected through indirect mechanisms, the indirect impacts of facility or infrastructure operations and activities. As a result, these impacts follow the traditional environmental "pathways" (watersheds, airsheds, groundwater, and infrastructure systems) and causal networks. While the impacts of shared or community facilities and infrastructure also follow these same pathways; the direct effects also include competition for fixed or finite resources.

Facility and infrastructure projects and actions are perhaps the predominant topic in environmental analysis (i.e., NEPA analyses) and the environmental effects are far-reaching. Whether these analyses are performed at a strategic level that evaluates broad alternatives (as in the case of a "Strategic Environmental Assessment (SEA)"), expands existing facilities, or attempts to stimulate innovation in the delivery of infrastructure (Mariah Associates, 1995, Fort Bliss, 2004), impacts are inevitable. While the objectives of many proposed infrastructure projects are environmentally desirable, the decision maker must mediate between the negative environmental effects of traditional infrastructure systems (such as greenhouse gases and global warming), the often localized effects of alternative systems (such as aesthetics, land utilization, bird mortality, etc.), economic tradeoffs (such as capital investment strategies), and technical issues (reliability, technological uncertainty, etc.).

CEQ Step 9–Determine the Magnitude and Significance of Cumulative Effects.

The magnitude of direct effects is often estimated through per capita demand estimates, such as those shown in CEQ Step 8; applying them to the aggregate demands anticipated after projecting regional growth. These growth projections must include the current demands (representing past and present actions), the demands of the proposed action (and any alternatives), and any reasonably foreseeable other actions in the region. The significance of the direct effects is established by the long-term ability to supply the required facilities or services. Indirect effects, as illustrated in the discussion of CEQ Step 8, is considerably more difficult to establish, as regional and site-specific characteristics determine the final outcome, and the significance of any indirect effects is certainly a VEC-specific regional determination.

The assessment of cumulative effects, from other (past, present, and reasonably foreseeable) actions can prove difficult if done action by action. To establish a reasonable perspective, and a reasonable estimate of effects; an estimate of total change in demand within the region can be estimated, reviewing other planned growth within the service area of a facility or service, and simple using proportions based on changes in population. Representative facility and infrastructure demand functions are illustrated in Figure 4.9-1 (CEQ Step 8).

The significance of land (real property) impacts is a function of availability and access. Land utilization becomes most controversial when shortages of land lead to contention or when the access to “open land” or “green space” is limited. While these controversies are often “after the fact”, after pressures and shortages are recognized; they do establish a significance threshold that should be addressed in CEA (if such controversies exist in the region).

The significance of facility and infrastructure impacts can be indicated by excess demand, beyond the ability of the system to sustain such demand. Any such excess aggregate demands may lead to system degradation or regulatory issues (non-compliance). The condition of facilities or infrastructure, whether supplied by the installation or the community, is often dictated by regulatory controls (See CEQ Step 6). As a result, their condition can often be implied by their regulatory status. If they are incompliant or inconsistent with regulatory controls, significant impacts are implied.

For Army (installation) facilities, impacts can be significant if the ISR determinations

(See CEQ Step 6) indicate deteriorating conditions. If the proposed action or cumulative trends imply further deterioration, significance is implied.

As part of a research effort supporting the Army’s ISP and recent Army policies (USA, 2004a and 2005), a web-based Sustainable Installations Regional Resource Assessment (SIRRA) tool (ERDC/CERL TN-03-3 rev. March 2005) has been developed. SIRRA is a national level screening tool to evaluate the ability of Department of Defense (DoD) installations to sustain, and sometimes alter or expand their mission activities. This system provides some measure of regional competition for land, transportation, energy, water, and other resources which may limit (or enhance) an installation's ability to perform essential activities, either at present or in the future, based on regional resource conditions and trends. While not specifically developed for NEPA applications, SIRRA does present useful summary data that can be used to identify potentially significant issues at a given installation, or important regional issues that should be addressed in CEA. Addressing nine sustainability issue areas (air, energy, urban development, TES, locational issues, water, economic issues, quality of life, and infrastructure), SIRRA characterizes any potential competition for scarce regional resources, such as land for growth, water supply, air space, and frequency bandwidth. (SIRRA is being designed to stimulate needed dialog between installations and communities, and can provide indications of potential significant issues at Army (and DoD) installations.)

SIRRA provides a screening level characterization of regions surrounding installations, based on a set of risks, or stressors. These characterizations use data drawn from open, well-documented, national level sources, such as the U.S. Geological Survey, Bureau of Census, NatureServe, and the EPA. The sustainability ratings are used to express the relative ranking of these regions using single measures, or groups of measures, that define a stress. This approach allows the use of national-level data to evaluate regional aspects of the installation setting; and provide some insight into installation-level environmental (or sustainability) issues that could threaten long-term mission sustainment. Using such data sources and existing scientific measures, SIRRA provide a unique, nation-wide planning asset for Army decision makers. These data sources are especially useful for NEPA analyses and planning, as they represent independent measures of conditions "over the installation fence". As a central compendium of such information, SIRRA should provide a tool for the early identification of potentially significant installation-specific issues from the vantage point of the affected (non-Army) community.

Numeric ratings, reasoning, and actual data are also available for each rating. The SIRRA web-based analysis tool allows users to select scaled rating schemas (e.g., such as red/amber/green (RAG) depiction of high/medium/low sustainability vulnerability), or to view the actual data tables. SIRRA is also associated with the Fort Future research initiative, a technology suite designed to help installations and units plan for future requirements. SIRRA is on an open and accessible web site. No logins or passwords are required (https://ff.cecer.army.mil/ff/sirra.do).

SIRRA has been developed as part of the Sustainability Encroachment and Room to Maneuver (SERM) research program (https://eko.usace.army.mil/cop/serm/). Ongoing work includes developing the ability to conduct sustainability analyses on the watershed level, a sustainability analysis for 308 DoD installations by service and mission type, and a study of regional sustainability that uses SIRRA to correlate indicators to land use changes, and to predict the impact of alternative future scenarios. This research is supported by the DoD Strategic Environmental Resources and Development Program (SERDP), the Army's Fort Future research program, the Army Environmental Policy Institute (AEPI), and the Total Army Basing Study (TABS).

The following table is a general summary of SIRRA contents, many of which are directly applicable to Facility effect analysis , primarily CEA:

Issue	Indicator	Latest Data Source Update	Data Source	Data Level
Air	Criteria Pollutant Non-Attainment	2003	EPA/EIA	county
	Noise Sensitivity	2000	USCB	installation
Energy	Electrical Grid Congestion	2004	NERC	NERC Subregion
	Electrical Reserve Margin	2003	NERC	NERC Region
	Wind Resources	1986	NERL	solar grid unit
	Solar Resources	1992	NERL	wind grid unit
	Biomass Resources	1999	NERL	state
	Electrical Price Structure (Deregulation)	2003	EIA	state
Urban Development	Regional Population Density	2003	USCB	county
	Incr. Regional Growth Rate	2003	USCB	county
	Regional Population Growth	2003	USCB	county
	Regional Land Urbanization	1992	NLCD	installation
	State Smart Growth Plans	2002	APA	state
	Joint Land Use Study (JLUS)	2003	JLUS	installation
TES	TES by State	2004	FWS	state
	Species at Risk	1990	JAWRA	watershed
	Federally Listed TES	2004	Nature Serve	Eco-region
	TES of Concern	2004	Nature Serve	Eco-region
Location	Federally Declared Floods	2004	FEMA	county
	Seismic Vulnerability	2002	USGS	zone
	Weather-Related Damage	2003	NWS/NOAA	state
	Federally Declared Disasters	2004	FEMA	county
	Tornadoes	2002	NOAA	county
Water	Level of Development	1990	JAWRA	watershed
	Ground Water Depletion	1990	JAWRA	watershed
	Flood Risk190	JAWRA	watershed	
	Low Flow Sensitivity	1990	JAWRA	watershed
	Water Quality	1990	JAWRA	watershed
	DoD Local Employment	2002	REIS	county
	Job Availability (Unemployment)	2003	BLS	county
	Housing Affordability	2000	USCB	county
	Poverty	2000	USCB	county

Table 4.9-3 *SIRRA Database Contents* *(continued on page 230)*

Issue	Indicator	Latest Data Source Update	Data Source	Data Level
QOL	Crime Rate	2001	NACJD	county
	Housing Availability	2000	USCB	county
	Rental Availability	2000	USCB	county
	Healthcare Availability	2000	HHS	county
	Educational Attainment	2000	USCB	county
	Commute Times	2000	USCB	county
Infrastructure	Capacity of Commercial Airports	2002	TAF	installation
	Airport Suitability C5	2001	FAA	installation
	Airport Suitability C141	2001	FAA	installation
	Railroad Capacity	2004	FRA	county
	Proximity to Interstate	2003	IRRIS	installation
	Roadway Congestion		FHWA	state
	Traffic Volume	2002	TTI & FHWA	state
Security	Air Space Demand	2003	--	installation
	Net Metering	2003	Green Power Network	state
	Proximity to MSA	2003	USCB	installation

***Table 4.9-3** SIRRA Database Contents*

CEQ Step 10 – Modify or Add Alternatives to Avoid, Minimize, or Mitigate Significant Effects.

As discussed in the introduction for this VEC, the direct, indirect, and cumulative effects of Army actions on real estate (land) is minimized by strict controls on the Army's ability to acquire lands. The same restrictions apply to most built facilities, often requiring square footage reductions before such new facilities can be constructed. These requirements automatically mitigate the otherwise unconstrained direct and indirect effects of many potential land use and facility decisions, especially those related to installation garrison facilities. In effect, these land acquisition and land use controls provide limits on potential impacts and effectively mitigate the types of environmental issues that often accompany uncontrolled land development in the civilian sector. In addition, the adoption of the ISP and evolving Army sustainability policies (USA, 2005) are insuring that lands are available, protected, and enhanced over the long-term.

Land impacts can often be mitigated through cooperative agreements with adjacent entities (organizations, governments, or individuals). As discussed in the Introduction to the Facility VEC, Sections 2811 and 2812 of the National Defense Authorization Act (USACE, 2002a) authorize the acquisition of land or entitlements to protect installation mission interests from land use encroachment (LaPorte, 2001, GAO, 2002, and Westervelt, 2004). In some cases, additional land resources can be made available for compatible military activities, important natural resources can be better protected, and encroachment pressures can be minimized. As a result, such mitigations should be encouraged, where applicable, and should be incorporated into installation and community master plans.

The disposal of solid waste is increasingly a major infrastructure issue, second only to energy (See Section 4.11). From the Army vantage point, this waste stream is broken into two major components, municipal solid waste (MSW) (35 percent of the 2004 Army solid waste stream) and construction and demolition waste (63 percent). MSW is addressed, both in the Army and the US at large, through the adoption of recycling and re-use, increasingly effective in the reduction in demand for land fill space. As indicated by these percentages, the Army demand for land fill space is dictated primarily by construction and demolition debris; characterized as follows (EPA, 1996):

Construction – 8%
Renovation – 44%
Demolition – 48%

Conservatively, some 20-30 percent of this C&D waste stream (concrete, asphalt, metals, plastic, and wood) can be recovered and can be re-used in the construction process.

This closed loop concept is increasingly supported as a model of "natural processes", as such loops always exist in nature (Benyus, 1997); and should be increasingly adopted into any sustainable business model (Anderson, 1998, and McDonough, et al, 2002). As deconstruction (and material salvage) is increasingly incorporated into the process, the indicated waste streams will become smaller, resources efficiencies will rise, and true sustainability (USA, 2004a) can be realized. These potential waste stream reductions can be substantial, and reduce related land fill infrastructure demands. This can be very effective in reducing these often community-specific demands. The following notable research (some specific to the military) implies even better potential performance (waste reduction and resource recovery):

- Deconstruction of a WWII-era warehouse building at The Presidio of San Francisco, California, 1996 http://www.ciwmb.ca.gov/ConDemo/CaseStudies/Presidio/default.htm
- Deconstruction of Riverdale Village apartments in Baltimore County, Maryland, 1997 http://www.smartgrowth.org/pdf/deconstruction.pdf
- Deconstruction of eight WWII-era industrial buildings at Alameda Naval Air Station, California, 1997 http://www.conversion.org/cec/dsrr.pdf
- Deconstruction of Stowe Village apartment units in Hartford, Connecticut, 1998 http://www.jlsr.org/recycling/deconatwork.html
- Deconstruction of ten houses in Gainesville, Florida, 1999-2000 http://www.cce.ufl.edu/past/deconstruction/reuse.html
- EPA initiatives for innovative C&D debris management can be found at www.epa.gov/epaoswr/non-hw/debris.

In addition, the positive effects of construction and demolition waste reductions on global warming can be estimated using an EPA tool at http://yosemite.epa.gov/oar/globalwarming.nsf. The Waste Reduction model (WARM) was developed by EPA to help solid waste planners and organizations estimate greenhouse gas emission reductions from different waste management practices; such as source reduction, recycling, combustion, composting, and landfilling (http://www.epa.gov/globalwarming/actions/waste/usersguide.htm).

USACE support for these deconstruction initiatives are emerging through support through the support of the following federal guidelines and USACE guidelines:

UFGS 01572 Construction & Demolition Waste Management

- Government policy to divert C&D waste from landfills
- Contractor responsible to take a pro-active role, and require subcontractors, vendors and suppliers to participate
- Revenue or other savings accrue to the contractor

UFGS 02220 Demolition

- Title to materials is vested in the contractor

Salvage to be pursued to the maximum extent possible for Section 01572 PWTB 200-1-17 Recycling Interior Finish Materials – Carpet and Ceiling Tiles

PWTB 200-1-23 Guidance for the Reduction of Demolition Waste Through Reuse and Recycling

PWTB 420-49-30 Alternatives to Demolition for Facility Reduction

PWTB 420-49-32 Selection of Methods for the Reduction, Reuse, and Recycling of Demolition Waste

The technical knowledge base for deconstruction, and the supporting organizations is now emerging, and growing rapidly. Army sources are illustrated in the following list:

- Resources and Organizations
    - Austin HfH deconstruction; http://www.re-store.com/deconstruction.htm
    - USEPA C&D Debris Web site; http://www.epa.gov/epaoswer/non-hw/debris/
    - USEPA WasteWise Web site; http://www.epa.gov/wastewise/wrr/cbres.htm
    - Building Material Reuse Association; http://www.ubma.org/
    - Building Deconstruction Consortium; http://bdc.org
    - Deconstruction Institute; http://www.deconstructioninstitute.com/
    - Construction Materials Recycling Association; http://www.cdrecycling.org/
    - WasteCap Wisconsin; http://www.wastecapwi.org/
    - California Integrated Waste Management Board (re: C&D debris); http://www.ciwmb.ca.gov/ConDemo/
    - Triangle J Council of Governments; http://www.tjcog.dst.nc.us/cdwaste.htm
- Guides on Deconstruction & Recycling
    - Deconstruction Institute's *"A Guide to Deconstruction"*; http://www.deconstructioninstitute.com/files/learn_center/45762865_guidebook.pdf
    - CIWMB's *"Deconstruction Training Manual; Waste Management Reuse & Recycling at Mather Field"*;

http://www.ciwmb.ca.gov/Publications/ConDemo/43301027.pdf

- Triangle J Council's *"WasteSpec"*; http://www.tjcog.dst.nc.us/cdwaste.htm#wastespec
- Residential C&D Waste Guide Information Links; http://peakstoprairies.org/p2bande/Construction/C&DWaste/infolinks.cfm
- Center for Construction & Environment's "Advanced Construction & Demolition Waste Management for Florida Builders; http://www.cce.ufl.edu/publications/wordfiles/Advanced_C&D_Waste_Management_for_Florida_Builders.doc
- Alameda County's *"A Builder's Guide to Reuse & Recycling"*; http://www.stopwaste.org/bg2001.pdf

■ Miscellaneous References

- EPA's *"Characterization of Building Related Construction & Demolition Debris in the United States"*; http://www.epa.gov/epaoswer/hazwaste/sqg/c&d-rpt.pdf
- HUD's *"A Report on the Feasibility of Deconstruction: An Investigation of Deconstruction Activity in Four Cities"*; http://www.huduser.org/publications/destech/deconstruct.html
- HUD's "Building Deconstruction and Material Reuse in Washington, D.C.; http://www.smartgrowth.org/library/DCdeconreport.html
- Center for Construction & Environment's *"Implementing Deconstruction in Florida: Materials Reuse Issues, Disassembly Techniques, & Policy"*; http://www.cce.ufl.edu/past/deconstruction/final_report.html
- EPA's State-by-State Recycled Materials Exchange Directories; http://www.epa.gov/jtr/comm/exchstat.htm
- C&D Recycler magazine; http://www.cdrecycler.com/
- CERL Technical Report *"US Army Concepts for Reuse & Recycling of Construction & Demolition Waste"*; http://www.deconstructioninstitute.com/files/learn_center/27449035_LAM_RERE_FLM_post.PDF
- CERL Technical Report *"Cost Analysis for Building Removal at Fort Chaffee, Arkansas"* http://www.cecer.army.mil/td/tips/pub/details.cfm?PUBID=4081&LAB=1
- CERL Technical Report *"Deconstructing Buildings at Fort Campbell KY; A Pilot Project"*

The deconstruction process, as currently practiced, suffers from inadequate information to facilitate efficient and needed changes in industry practice. The construction industry is heavily-dependent on existing procedures, standards, and codes; justifiably supporting public health and safety, and insuring the integrity of final construction. However, resource re-use efficiencies (the use of deconstructed/salvaged materials of deconstruction in lieu of demolition), are often hindered more by established procedures, misconceptions, and ignorance of alternative materials and processes. Some impediments will be removed through the development and incorporation of specific standards for the use of reclaimed building materials (Lantz and Falk, 1996, Falk, 1997, Horne-Brine and Falk, 1999, Falk and Greene, 1999, Falk, et al, 1999, and Falk, 2002). Many of these references chronicle deconstruction work on DoD installations, and the opportunities they represent.

The growing acceptance of these mitigations are evident (USEPA, 2000, and USA, 2000) and are reflected in AR 420-49 "Solid Waste Management and Recycling". While impediments to wide-spread adoption still exist (Webster and Napier, 2003), these mitigations can reduce the demands on solid waste infrastructure; and may prove useful in overall effect analysis. Recent emphasis on proactive C&D waste reduction has been provided by the ACSIM (USA, 2006).

Other non-garrison facilities are less-strictly regulated. Mission facility demands on training ranges are, however, dictated by well-established requirements (USA, 2004d). Recent Army policies have been developed to facilitate a better "total systems" approach that promote a sustainable approach to all Army activities (USA, 2004a), and specific training range facilities and activities (USA, 2006*). Environmental mitigations are introduced throughout their life cycle, through collaborative siting, design, construction, operation, and maintenance of these training facilities; and their inclusion in range-specific Environmental Management Systems (EMSs). These environmental provisions are introduced in the early "design charrettes", in which alternate sites are considered and potential environmental issues are "scoped". Construction impacts are minimized through the careful application of specific Best Management Practices (BMPs) (USAEC, 2006). Operations and maintenance is integrated and managed through the Integrated Training Area Management (ITAM) program (USA, 1999a).

For most infrastructure services, however, growth in resource consumption is largely "unbounded", a situation that applies to both the Army and the U.S., as a whole. While some energy conservation policies have been noteworthy exceptions (precipitated by oil/energy shortages in the '70s), most demands have been allowed to grow until natural resource constraints and availability are limited. These resource issues can commonly include water supply, open space, environmental contamination, or a myriad of other specific regional issues. In such cases, mitigations can include resource conservation measures, a major tenet of sustainability principles (Nattrass and Altomare, 1999).

Resource conservation (or resource efficiencies) can be effected through both human behaviors and through effective facility design. Such design is increasingly accepted in the building industry's Green Building Council (GBC), with specific modifications for Army use (USACERL, 2005). Supported by existing Army facility and infrastructure guidelines, and embraced by installations undertaking ISP, these facility design guidelines will provide noteworthy mitigations within the facility VEC.

Infrastructure mitigations and innovations are common in the Army. Illustrative Army examples include xeriscaping initiatives (Fort Huachuca, 2002), desalination efforts (Fort Bliss, 2004), wind power initiatives, and numerous other innovations to support resource efficiencies. To reduce the demands on infrastructure systems, conservation measures are often encouraged and facilitated to meet desired sustainability goals.

CEQ Step 11–Monitor the Effects of the Selected Alternative and Adapt Management.

The long-term monitoring of Facility effects is certain. When the ability to supply needed facilities, services, and infrastructure is exceeded, regional or community crises are the usual result. These manifest themselves through high costs, rationing, and local political solutions.

Installation management of real property, facilities, and infrastructure is intensive; and is facilitated through comprehensive planning (AR 210-20). During this planning process, community coordination and collaboration insures that the installation and community resources and demands are integrated. Installation participating in the ISP extend community participation through community inclusion into a long-term planning process that anticipates constraints and issues, sets regional and community goals, and allocates responsibilities among community participants (in the community and on the installation). Both normal installation planning and the ISP require tracking of progress by both installation IMA management and the senior Army leadership.

4.10 SOCIOECONOMICS

4.10.1 Introduction

Social and economic effects of Army actions can be both positive and negative; and extremely controversial, particularly when associated with installation force reductions. In the context of this manual, the Socioeconomics VEC includes numerous sub-VECs, or VEC sub-elements, as shown in the following hierarchy:

- Socioeconomics
  - Business Volume
  - Income
  - Employment
  - Population
    - Government Services and Revenues
      - Fire Protection (Garrison)
      - Utilities
        - Telecommunications
        - Water/Wastewater Infrastructure/Treatment
    - Wastewater and Potable Water Treatment
    - Solid Waste
        - Waste Minimization
    - Hospitals/Health Care
        - Human Health
    - Law Enforcement
    - Recreational Services
    - Education/ School Systems
      - Housing
      - Environmental Justice
        - Low Income Issues
        - Minority Issues
        - Native American Issues
        - Subsistence Issues

The principal mechanisms for Army socioeconomic effects are Army expenditures and population or employment changes. As the Army increases (or decreases) either expenditures or strength (military or civilian) at an Army installation, these are felt within the three basic components of the local economic region local businesses, local individuals, and local governments. The interdependence of these components is illustrated in the following figure:

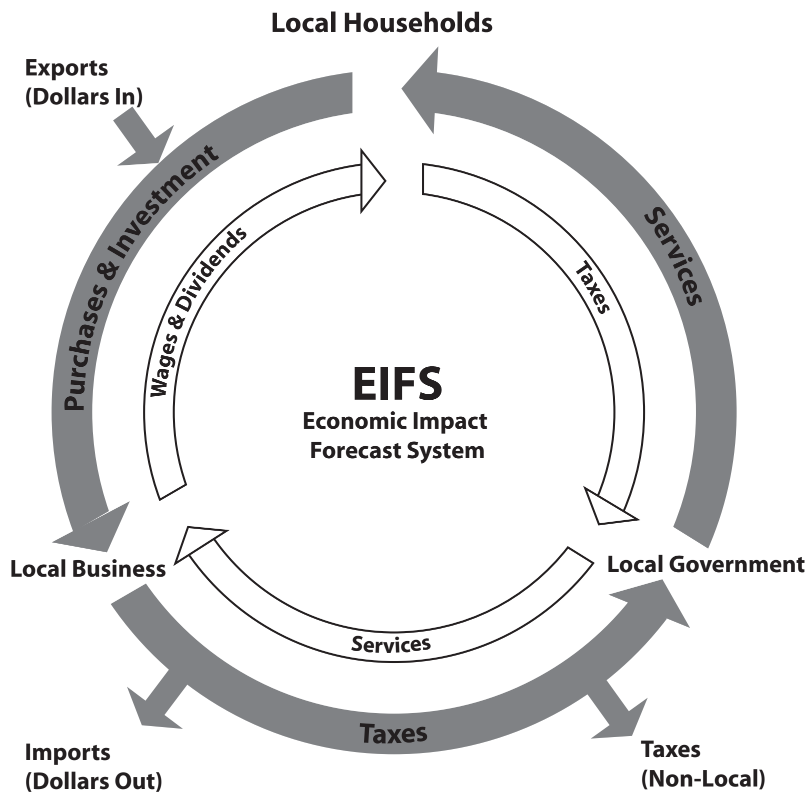

Figure 4.10-1 Flow of Dollars in a Local Community

The negative effects of proposed Army (or DoD) actions can be very controversial, as indicated by the controversies and political import of installation closures. The two court cases that firmly established the need to include socioeconomics in NEPA analyses (Breckinridge vs. Schlesinger, 1975 and McDowell vs. Schlesinger, 1975) were ill-fated attempts to close military installations prior to the establishment of Base Realignment and Closure (BRAC) mechanisms that exclude closure decisions from NEPA requirements. Both litigations were successful, and, unless excluded through law, socioeconomics must be addressed. While installation closures are most always contentious, even small reductions can precipitate political scrutiny and anguish in the community. Usually this anguish is overblown, and the NEPA analyses can often establish some needed perspectives among the affected stakeholders.

Positive changes, through large projects or increased installation strength, are normally considered a positive effect, and are not accompanied by the apprehension and scrutiny associated with reductions. However, the general public has become more critical of “too much growth”, as rapidly growing communities deal with inadequate services (schools, police, water, sewer, etc.)

to support the growth. An acceptable threshold is often symbolic of "sustainable growth" (sometimes called "smart growth"), the levels of growth that can be sustained by the local community and its existing and planned infrastructure. Most community growth issues are best precluded by appropriate planning and the controlled development of community services and infrastructure. This linkage among the elements of the socioeconomics VEC is illustrated in the following figure:

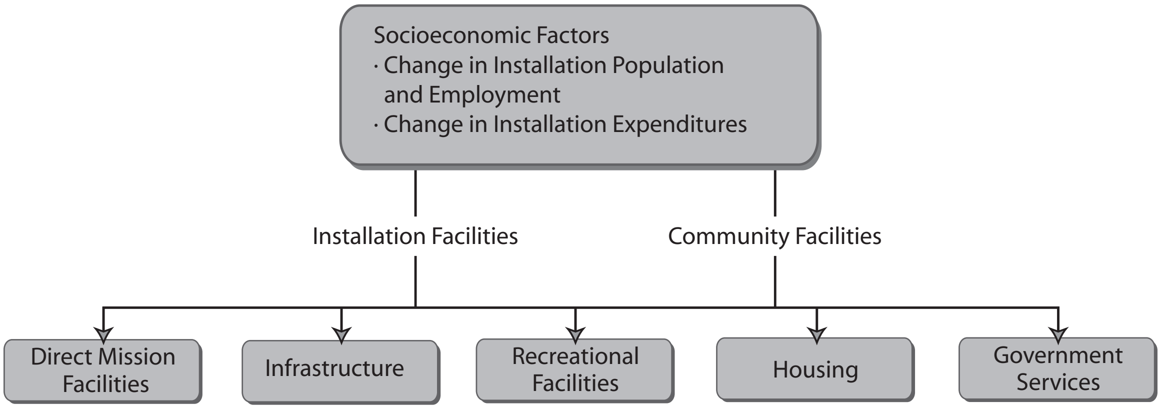

Figure 4.10-2 *Inter-relations of Socioeconomic Factors*

(a) Government services and revenues and (b) housing can be viewed as indirect effects of population change; as the demands for such services is generated on a per capita (or per family) basis. However, the revenue to support such services often comes from a variety of taxes and fees, as well as state and federal funding (indirectly provided from taxes, as well). Given these linkages to population shifts, these impacts are often addressed under the socioeconomics VEC; but can also be addressed separately, as indicated in the Facility VEC (Section 4.9).

Economies respond to installation demands for services and infrastructure. This community response directly supports and sustains the mission of the installation and the Army. When this demand, reflected by year-to-year troop strength, is consistent or uniform, community economic conditions are best sustained, and the relationship (between the installation and local economy) is symbiotic. Large fluctuations, on the other hand, can disrupt the local economy, requiring supportive community businesses to rapidly expand and contract, and creating wide variations in required local government and private services. This type of "boom-bust" economy is often associated with energy development activities in the western United States, but applies to many military training facilities where trainee strengths vary.

Over the last few decades, concerns have evolved over the disproportionate exposure of poor and minority communities to toxic chemical releases (generally through air and water mechanisms) and other environmental impacts. To address the concerns, the President issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (EOP, 1994), requiring the Army (and other federal agencies) to "make the achievement of environmental justice (EJ) part of its mission by identifying and addressing disproportionately high and adverse human health and environmental effects on minority and low-income populations. This Executive Order (and an accompanying Presidential Memorandum) directed federal agencies to identify and analyze the potential socioeconomic impacts of proposed actions in accordance with health and environmental laws. The Executive Order further mandated the creation of the Federal Interagency Working Group on Environmental Justice to (1) develop a strategy for implementation of environmental justice requirements and (2) monitor federal agencies to ensure that activities and policies are undertaken in a consistent and appropriate manner.

4.10.2 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect socioeconomic effects of a proposed action; and, in addition, they can be used to determine if cumulative effects also need to be considered. These quick look questions include:

Quick Look Questions

- Is the community undergoing rapid growth, or is the community seeing reduction in growth?
- Does the proposed action add to that trend, or does it reduce (mitigate) that trend?
- Is additional cumulative effects analysis needed?

Impact Analysis Level:

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly; and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the "Detailed Analysis", Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

At the EA level, attention must be given to CEQ Steps 1-4 (the scoping steps) and CEQ Steps 6 and 7, describing the affected environment. The findings from these CEQ steps can be documented to serve as a "hard look", if it is determined that an EA is appropriate. However, if significant impacts are identified from consideration of CEQ Steps 1-4, 6 and 7, then an EIS is appropriate. For an EIS, all 11 CEQ steps should be addressed.

CEQ Step 1 – Identify Significant Effects Associated with the Proposed Action and Define the Assessment Goals.

The assessment of Army socioeconomic effects began (in earnest) in the mid-1970s, immediately after the previously-referenced successful NEPA litigation, after injunctions were obtained over DoD failure to address socioeconomic effects under NEPA (McDowell v Schlesinger, 1975 and Breckinridge v Schlesinger, 1975). These court cases affirmed this requirement, leading to joint Army and Air Force research to address this need under NEPA. This research produced the Economic Impact Forecast System (EIFS), a two-tiered approach to modeling socioeconomic effects (See discussion of CEQ Step 6), and some specific techniques to evaluate the significance of predicted impacts (See discussion of CEQ Step 9).

Tier 1:

The tiered approach provides a means to screen potential impact scenarios, essentially at an EA level of detail, to determine if likely impacts are significant enough to warrant more detailed, costly, and time-consuming analyses, at an EIS level of detail. This tiered approach need not be followed, and the more detailed analysis can start immediately; but the potential efficiencies are usually sufficient to justify its application. Four variables are used as "indicator" variables for the initial analyses: business volume, income, employment, and population. These are evaluated using the Rational Threshold Value (RTV), of Finding of Significant Impacts (FSI) techniques (See discussion of CEQ Step 9). If the significance criteria are not exceeded, significant socio-economic impacts are thus deemed unlikely, and this documentation and determination can be included in an EA or EIS.

The use of the initial EIFS model and the RTV or FSI techniques does not insure a lack of risk. However, the EIFS methodology is based on sound regional economic theory and is generally accepted as a quick and efficient means to assess aggregate regional economic impact, the very application that initial NEPA analyses require. The EIFS research is referenced later in this manual (See CEQ Step 6).

The significance criteria were likewise developed after affected communities criticized the application of seemingly (and actual) arbitrary values for significance (variously set at 1 percent, 5 percent, etc.). Charged with the responsibility to develop a defensible rationale, community-specific measure (the RTV and FSI techniques (detailed in CEQ Step 9)) were developed.

Business volume, employment, and income are straightforward in their use as indicators. They typically fluctuate within the ROI, and predicted impacts can be readily compared to the significance criteria (RTV or FSI). The negative RTV significance criteria are already weighted to reflect relative impacts on affected individuals (75 percent for business volume and 67 percent for employment and income); and dollar values are adjusted, using the Consumer Price Index (CPI) to reflect current-year dollars (See discussion of CEQ Step 9). If the affected stakeholders (community) reject the process, their concerns can be either validated and addressed, or discounted. In any case, a frame of reference is established to facilitate the NEPA process.

Population, as an indicator, is very important. Previous Army research proved ineffective in addressing many of the social effects of proposed actions, at least as easily as the economic impacts could be assessed. For this reason, the negative population threshold (RTV) is weighted (reduced) by 50 percent. This more severe weighting (safety factor) was justified to insure that potential indirect social effects are adequately addressed in the Tier 1 (screening process), based upon the assumption that these effects are primarily stimulated by population (and accompanying demographic) change. Similarly, numerous other secondary impacts are a result of population change: government services and revenues for fire protection, utilities, telecommunications, water/wastewater infrastructure/treatment, wastewater and potable water treatment, solid waste, waste minimization, hospitals/health care, law enforcement, recreational services, education/school systems, and housing. These form the majority of potential direct and indirect socioeconomic effects (except for those associated with EJ, which is handled differently). The detailed analysis of economic effects and social effects, if deemed potentially significant, can then proceed as a Tier 2, detailed analysis. If deemed insignificant, the Tier 1 results can be documented, and the analysis is complete except for EJ considerations, discussed later.

EJ issues must be evaluated at the same time that Tier 1 socioeconomic analyses are done. These requirements are established in EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (EOP, 1994). EO 12898 addresses national concerns over disproportional impacts that may fall on minority populations or low-income populations, which theoretically experience disproportionate political representation in agency decision making; and affirms that agency missions must include the achievement of environmental justice. EJ analyses and consideration are also extended to Native American populations. Specific requirements are detailed in the discussion of CEQ Step 6.

This CEQ step is particularly important for EJ compliance (USA, 2005). Public involvement (and scoping) in the NEPA process meets two requirements of the Executive Order: (1) aiding the identifying minority and low-income groups, and (2) providing a means for these groups to fully participate in the decision making process. Persons and organizations known (or thought to have) a potential interest; including minority, low-income, disadvantaged, and Native American groups; must be identified, informed, and afforded the opportunity to participate.

Tier 2:

The analysis of economic effects and social effects, if deemed potentially significant, can proceed in more detail. More detailed analysis can be accomplished using a variety of more detailed economic models (for business volume, employment, and income) and a more sophisticated analysis of population effects can be completed (some tools are further detailed in CEQ Step 6).

The demand for government services and housing can be addressed using per-capita demand factors to ascertain increased requirements. These can be combined with estimates of existing demand, compared to capacity (and the ability to expand capacity) (both detailed in CEQ Step 6), and mitigations (or development strategies) can be developed (see discussion of CEQ Step 10).

Government revenues, to provide needed services, are considerably more complex to address. These revenues are obtained and distributed among various county, city and municipality, and other governmental entities; and the sources vary among different tax sources (sales, gasoline, property, etc.), bond obligations (schools, transportation, etc.), special assessments, and, more recently, levied specifically to pay for needed services associated with large developments, particularly residential subdivisions. These development fees are evolving in communities that cannot provide adequate services (particularly schools) to support urban growth around major U.S. cities. Appropriately, they are called impact fees. The particular mix of local government revenue is site-specific; one of the reasons it is best suited for Tier 2 analyses.

The complete two-tier approach, and alternate tools to accomplish them are detailed under the discussion of CEQ Step 6.

CEQ Step 2 – Establish Geographic Scope of the Analysis.

The definition of the appropriate economic region can be done in a number of ways. From a practical standpoint, these will be defined as a combination of counties, as county-level data is the most readily available from secondary sources, and the county or multi-county level of regional definition is adequate and preferable, as models seldom work well at small, sub-county levels. The primary source of this data is the Department of Commerce, specifically the Bureau of Census and Bureau of Economic Analysis (BEA).

While some data is available at a sub-county level (minor civil divisions (MCDs), tracts, and blocks), the combined set of data is generally insufficient for economic modeling. Most sub-county data is available from the Bureau of Census, based upon the national census that is constitutionally mandated every 10 years. This demographic data is a rich source of information for more detailed social impact assessment described later in this manual in CEQ Step 6.

The most appropriate study area or ROI, must be selected by combining counties (or parishes and independent cities, where such units are used in lieu of counties). This may be the most challenging issue, or it may be the simplest, depending on the region, and its inherent characteristics. This decision may also significantly affect the analysis, as the magnitude of forecasted impacts varies with the size of the study area (Chalmers and Anderson, 1977). Definition of an appropriate ROI may be difficult; and experienced regional analysts often view it as a thorny, but important, issue.

Fundamentally, the ROI must encompass three necessary segments of a local economy: local business, local governments, and individuals. All comprise the basic elements and system flows that constitute the "multiplier" effect, the successive re-expenditure of incoming dollars until their effects are lost to non-local expenditures and taxes, as shown in Figure 4.10-1 (see Introduction to this VEC Section).

A proposed activity may affect areas outside traditional regional boundaries such as a given single county or Metropolitan Statistical Area (MSA) boundary. Many times, the definition will require local knowledge of the area-- a general sense of where people shop, work, play, and live. When counties or parishes and independent cities are used as the constituent units of the ROI, many considerations become moot, as many county aggregations become obvious, particularly in small, rural regions. In metropolitan areas, the appropriate ROI can be difficult to define, as commuting patterns, topographical and natural transportation barriers become important, and local customs and mores may prevail.

To clarify, an ROI can often be more rigorously defined (Chalmers and Anderson, 1977) in three steps: (1) defining the primary impact area; (2) defining the secondary impact area; and (3) performing geographic analysis.

The Primary Impact Area is often determined by the residence pattern of the affected personnel, as most people shop near their residences. If geographic expenditure patterns are affected by local conditions such as the unavailability of shopping malls or other services near residences, this has to be addressed, broadening the primary impact area. Two techniques are often used to delineate primary impact areas; (1) a simple radius approach, and (2) a survey approach. A simple radius can be defined surrounding the installation, and any counties that fall wholly or partially into the radius can be included in the ROI. This will often encompass the region in which employees are likely to live and shop, and a 50-mile radius will often represent a comfortable commute to work. One recent survey of military and civilian air force personnel indicates that fewer than one percent live more than 50 miles from the base where they work (Gunther, 1992).

Alternately, the ROI can be derived through the use of personnel records or surveys, ascertaining the actual residences of affected employees from zip codes or other data. Once residence patterns are established, a simple "rule of thumb" can be adopted – such as the inclusion of any counties in which five percent or more of the affected personnel live. If the residence patterns of affected employees cannot be determined from existing records, the residence pattern of the entire installation work force can be used, if known.

Another more-rigorous approach involves the survey of personnel. This is often advisable if initial analysis indicates that the proposed project will generate significant economic and social impacts, or if it is likely to be controversial within the community. While the ROI is often easy to define in terms of a multi-county region, some cases are not as clear, and litigation can turn on the appropriate definition of the ROI.

The Secondary Impact Area must include the following:

- Where the installation spends money for supplies and services;
- Where merchants, providing installation services and supplies, purchase inventories; and
- Where employees of these merchants live.

The secondary impact area is where secondary and tertiary effects, the "multiplier" effect, are felt; encompassing the primary impact area and adjacent business centers and their market areas. In general, a sparsely populated study area will have a larger overall market area serving as a wholesale-retail center. Consequently, the secondary impact area may be much larger than the primary impact area. In more densely populated regions, the primary and secondary impact areas will more often overlap, due to increased availability of local goods and services. In many U.S. locations in the East or Upper Midwest, the two areas coincide (Chalmers and Anderson, 1977, p. 40).

MSA boundaries may delineate secondary impact areas, though not always. MSAs include a central city (or cities) and the surrounding economically (and socially) dominated counties. An MSA is defined as a major regional trade and service center, and is an appropriate secondary impact area, though local interpretations may be required. MSAs commonly include central counties (in which the central city is located) and any adjacent counties with at least 50 percent of their population within the urbanized area. Additional outlying counties are included if they meet specified commuting requirements and exhibit metropolitan character. Primary metropolitan statistical areas (PMSAs) are metropolitan complexes of over one million people. Any area containing both MSAs and PMSAs is a consolidated metropolitan statistical area (CMSA). The worker commuting patterns largely determine the boundaries of MSAs and PMSAs, and many areas of the country fall outside MSAs or PMSAs. MSAs near the primary impact area may not be appropriate for inclusion if the MSA is not a trade and service center that attracts shoppers and businesses from the primary impact area.

Instead of MSAs or PMSAs, BEA economic areas may serve as a secondary impact area. These areas – 183 in all – cover the entire United States, including Alaska and Hawaii. Defined to facilitate regional economical analysis, each area consists of a central economic node – an MSA or similar area that serves as a center of economic activity – and surrounding counties that are economically related to the center. To the extent possible, each area includes the workplace and residence of its labor force (USDC, 1977, p. 1).

Geographic Sensitivity Analysis can often reduce controversy associated with the ROI definition. Any regional definition can be contested, but the final analyses often remain the same; as a result of two counterbalancing phenomenon: if the defined ROI is large, the percentage change (impact divided by existing level) is reduced, allegedly diluting effects; on the other hand, a large region generally has a larger multiplier, as it is more self-supporting and diverse in its industrial composition. While both phenomena can appear to tailor results to support perceived outcomes, and can often form the basis for challenge and even litigation, these two counter-effects often render these controversies more academic than pragmatic.

In any case, the solutions to controversies often lie in "gaming" alternate ROI definitions, to determine the sensitivity of a decision to the defined ROI. History has shown that the end result (the percentage change and the significance criteria) produce the same final decision, although the numbers may vary. When controversies arise, such an approach can often be used, dissipating controversies before they become larger problems. Such an approach is recommended as an alternative to arguments over competing versions of technical validity (Funtowicz and Ravetz, 1991). Research indicatess that perceived high value or perceived high risk (regarding a debated issue) will dictate a collaborative solution.

CEQ Step 3 – Establish the Time Frame for Analysis.

The temporal scale for socioeconomic effects analysis is fairly easy to address, particularly the "past and present" components. The economic and most social information on a given ROI has been extensively documented by the Department of Census Bureau and the BEA. The Census Bureau is constitutionally required to perform a census of the population every 10 years; a rich information source that establishes the economic and social characteristics of any ROI in the United States. This rich database provides an easy means to visualize social and economic trends, and to identify the characteristics of the ROI. Some communities exhibit widely fluctuating growth trends, while some indicate a slight and consistent growth pattern over time. This variability among communities was the basis for community over significance criteria that prompted the RTV/FSI research, previously mentioned in the introduction. The "past" temporal boundary can easily be established through characterization of the ROI at least one, and possible five (depending on conditions), decades in the past. Absent any major growth or prior economic controversies, one decade can be sufficient. However, a ROI that exhibits a long history of economic or demographic growth or fluctuation requires a longer historical characterization of 50 years or even longer, depending on circumstances.

The "future" temporal boundary can be established by evaluating the lifetime of the proposed action, and the lifetime of other accompanying actions in the ROI. The greater timeline of these foreseeable consequences is a reasonable limit for the evaluation of cumulative consequences.

Cumulative effects on other VECs can also influence the timelines for a socioeconomic effects analysis. In many cases, the "limit to growth" in an ROI (community) is a natural resource (water, land, etc.) or a man-made resource (transportation, public service infrastructure, etc.); often established by the stresses of economic growth or population changes. Proposed growth can produce indirect stresses (effects) on these VECs, and the inter-relationships (correlations) between them can become important to the eventual development of mitigation strategies. For example, the desirability of a given community is diminished if accompanied by water rationing and high water costs. Similarly, long commuting patterns and traffic congestion can render good jobs unacceptable or make a particular city less desirable. The success of future plans can become questionable if such situations emerge, and they may not be "reasonably foreseeable".

CEQ Step 4 – Identify Other Actions Affecting the Resources, Ecosystems, and Human Communities of Concern.

Past and present socioeconomic actions are reflected in the time series data available through BEA and the Census Bureau, and their effects are already aggregated in these trends. Future, reasonably foreseeable actions can be identified through coordination with local planning agencies, city Chambers of Commerce, local political leaders, and potentially, any large companies or government agencies that historically influence the local region.

EJ concerns were initially based on chemical contamination and the disproportionate exposure of low-income or minority populations. If the analysis indicates similar potential effects, some EPA databases and tools can prove useful. Those tools include:

- **The Toxic Release Information System (USEPA, 2004)**: The Toxic Release Inventory (TRI) contains regionally specific information about more than 650 toxic chemicals that are used, manufactured, treated, transported or released into the environment. TRI can be used for basic facility information and chemical reports, which tabulate air emissions, surface water discharges, releases to land, underground injections, and transfers to off-site locations.
- **The CERCLA Information System (CERCLIS)**, http://www.epa.gov/superfund.
- **The RCRA Information System (RCRIS) (USEPA)**: RCRA Info is a national hazardous waste program management and inventory system regarding hazardous waste handlers. In general, all generators transporters, treaters, storers, and disposers of hazardous wastes are required to provide information about their activities to state environmental agencies. These agencies, in turn, pass on the information to regional and national EPA offices. This system is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984. The system contains data for specific hazardous waste handlers, and information on treatment, storage, and disposal facilities (i.e., permit/closure status, compliance with federal and state regulations, and cleanup activities), http://www.epa.gov/enviro/html/rcris.
- **Enviromapper (EPA, 2005)**: Enviromapper provides one-stop access to environmental information. It also functions as a tool to map various information, including toxic releases, hazardous wastes, water discharge permits and Superfund sites.

If potential direct or indirect effects include the release of a particular contaminate, these data sources can be used to identify, characterize, and evaluate other cumulative contributions to EJ impacts in the region.

CEQ Step 5 – Characterize the Resources, Ecosystems, and Human Communities Identified During Scoping in Terms of Their Response to Change and Capacity to Withstand Stresses.

The ROI baseline characterization can be readily-accomplished through Department of Commerce sources:

- The Bureau of the Census produces an extensive tabulation of demographic data every 10 years. These data are reported at various and a variety of geographic levels; states, MSAs, cities and municipalities, counties, MCDs, tracts, and blocks.
- The BEA produces yearly estimates of population, employment, and income and their distributions by state and county.

These government information sources serve as a rich "point of departure" for demographic estimates and projections by private firms. Often these firms provide marketing services to numerous companies that locate franchises, branch offices, and other facilities based upon demographic profiles. This same data is used by the Army Recruiting Command to development recruitment strategies. This information can be very detailed (block-level), and can be very useful for very detailed analyses or mitigation planning. (See the figure in the discussion of CEQ Step 2.)

While these data sources can articulate past trends, and the stresses that an ROI has endured; community response and capacity is often "in the eye of the beholder". While the RTV/FSI techniques (See CEQ Step 9) can establish a common historical perspective (a common sense of past trends), acceptability is matter of personal perspective. Some individuals desire growth, while others prefer serenity, often expressed as a way of life; and this is the source of the "pro-growth" and "smart growth" conflicts in many rapidly expanding U.S. communities.

CEQ Step 6–Characterize the Stresses Affecting These Resources, Ecosystems, and Human Communities and Their Relation to Regulatory Thresholds.

The Army and the Air Force funded research to address this need for a NEPA-focused tool to address socioeconomic impacts; producing the Economic Impact Forecast System (EIFS) (Mathur and Rosen, 1974, Mayer and Pleeter, 1975, Isserman, 1977 and 1980, and Robinson, et al, 1984). This research focused on the development, implementation, and refinement of a NEPA-specific tool, one that has since become prevalent in Army NEPA practice (USA, 1980, 1995, 1997, 2002, and 2005). Through research and application, the EIFS approach evolved through numerous improvements and enhancements (Robinson and Webster, 1984), to produce a "two-tier" approach (USACERL, 1987 and Webster, et al,). This two-tier approach is roughly applicable to and synonymous with the EA and EIS levels of NEPA analysis (respectively), and separated by a supportive methodology to determine significance (See CEQ Step 9). EIFS thus provides a two-tier approach: (a) a simple and quick aggregate model sufficient to ascertain the overall magnitude of impacts, and (b) a more detailed, sophisticated input-output (I-O) model to further analyze impacts that appear significant, in NEPA terms, and worthy of additional expenditures and analyses. Such an approach can facilitate efficient and effective NEPA analyses.

Whether the first or second tier analysis, and independent of the model selected for analysis, the Army principally affects local communities through the salaries paid to military and civilian employees, and subsequently spent in the local economy (ROI); and through procurements in the local economy, which can include purchases and contracts (including construction contracts).

Salaries are the annual take-home pay of the affected employee, after taxes and other non-local deductions are made. This component of the input data should reflect the amount of money spent in the local region, and available for circulation in the economy between local businesses, government, and other individuals (the essence of the "multiplier effect"). While the estimate of initial civilian effects can be straight-forward, the military equivalent becomes more complex, as some of these employees live on-post. As a result, they pay no rents (or house payments) or utilities and are more likely to use on-post facilities (AAFES, PX, etc.) for individual purchases.

Procurements are the services and supplies that the installation procures in the local economy to support the mission or proposed action. Out-sourced employees are often included in procurement data, or they can be included as civilian employees, depending on the data reported.

Construction impacts can be very significant economic stimuli. Major MCA contracts and major renovation expenditures can provide construction and service jobs that can stimulate considerable multiplier effects.

Tier 1: At the outset of the research, EIFS implementation (USACERL, 1975) included the analysis of numerous variables: business volume, personal income, employment, government revenues and expenditures, income and employment distribution, local housing impacts, regional economic stability, school system impacts, government bond obligations, population, welfare and dependency, social control, and aesthetic considerations. This initial enthusiasm proved difficult; and over some 30 years of practice, pragmatism, and sufficiency, four variables were selected as indicators of impacts (as a "first tier" approximation of effects): business (or sales) volume, employment, personal income, and population. These effects can be readily evaluated and significance determined as described in CEQ Step 9, using yearly BEA time series data. Population, important in its own right, is also a valuable indicator of other factors (e.g., impact on local government revenues and expenditures, housing, local school systems, and the change in welfare and dependency), as impacts on such variables are driven to a large extent, by a population change.

EIFS has been used by the Army for some 3 decades. During its use in the analysis of BRAC actions, community concerns and subsequent controversies led to two GAO reviews, which supported its use, supporting EIFS as a uniform (non-arbitrary and non-capricious) approach which (a) draws from a national, uniform database, (b) allows comparison of project alternatives (the heart of NEPA analysis), and (c) provides comparable analyses across the United States.

The EIFS system is well documented (Huppertz, et al, 1994, and Webster and Bragdon, 2002).

EIFS is an economic base model, a technique that has considerable history (Haig, 1928, Hoyt, 1939, Isard, 1960; and Isard and Langford, 1971); and thus assumes that a local economy depends upon the external demand for its services and supplies to sustain its internal welfare. This type of model assumes that local economies depend on income from such exports, providing a simple framework to approximate the relationship between two general sectors, (a) an export (basic) sector and (b) a service sector. This export sector consists of firms and their employees that sell products to businesses and households outside the ROI. By extension, the export sector also includes other establishments that also import "exogenous" funds into the area (such as tourist facilities and federal agencies). The local service sector, in contrast, is made up of firms that sell their goods and services within the local economy, either to firms in the export sector or to the local populace.

The EIFS model uses the "location quotient" technique to estimate the ratio of "total" employees to "export" employees, or the "export employment multiplier" for the defined ROI (e.g., a region with 1000 employees, 200 of which are exporters, would have a multiplier of five). This technique is used in EIFS, as it is theoretically sound, easily implemented, requires minimal input data, can be applied nation-wide; and easily addresses EA-level requirements.

To establish the ratio between total and export employees in a region, EIFS applies the location quotient technique to a very detailed distribution of employees by economic sector, for the aggregate of those counties that are defined as part of the ROI. The number of export employees in any economic sector is determined by comparing the proportional employment of that sector to that of the United States as a whole. For example, an ROI that has five percent of its employees in a specific sector which nationally has only four percent employed in that sector will thus show one percent of this sector's employed as export (basic) activity in the ROI. All federal or other "obviously basic" sectors are allocated as 100 percent export. (For example, EIFS assigns all federal employment (both military and non-military) and hotel, tourist, court, and motel employment to the exogenous (or export) sector, as they generate exogenous income for the region.) The export employment multiplier for the ROI is obtained by simply dividing total employment by total export employees.

The location quotient technique has often been criticized for under-counting export-related activity, and, hence, overstating the multiplier and subsequent estimates of impacts (Tiebout, 1962; Greytak, 1969; Leigh, 1970). This tendency to overstate impacts stemmed from an inability to account for "cross hauling" in the ROI, the flow of both import and export products within the same category of industry data. This was overcome by calculating EIFS multiplier at a high level of dis-aggregation (Isserman, 1977); producing aggregate impact estimates that are comparable to more sophisticated and more costly analyses. A more complete discussion of the EIFS Tier 1 model is available on the EIFS Web site. The Web link can be found on the accompanying CD.

EJ can be addressed in accordance with CEQ guidelines (CEQ, 1997c) and specific provisions of the Army NEPA implementation regulation (USA, 2002). If any biophysical impacts are identified (whether significant, or not), care must be taken to insure that they do not disproportionately affect minority populations, low-income populations, or Native American populations.

Once the geographic extent of any direct, indirect, or cumulative effects has been established, minority and low-income populations can be identified through the analysis of detailed demographic data available from the Census Bureau (http://www.census.gov, Web linked on the accompanying CD). Some general guidelines reflect the results of the Interagency Working Group on Environmental Justice (IWG) mandated by the EO (USEPA, 1998). The definition and identification of these populations is subject to case-specific determinations during the analysis process, and can be found in CEQ and EPA guidelines (CEQ, 1997c and USEPA, 1998). These are available at the following Web sites, respectively: http://ceq.eh.doe.gov/nepa/regs/EJ/justice.pdf, and http://www.epa.gov/compliance/resources/policies/ej/index.html (both Web linked on the accompanying CD).

Typically, these two populations are defined as follows:

- Minority populations – 50 percent of population minority or disproportionate relative to the area
- Low-income populations – 50 percent of population considered low-income or disproportionate relative to the area

EJ also requires the participation of these communities in the analysis process. This public participation and involvement is essential to sound NEPA practice, but is even more important under the EJ objectives. EJ is defined in associated EPA guidelines (USEPA, 1998) as:

"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, or commercial operations or the execution of federal, state, local, and tribal programs or policies."

This public involvement and participation is both required, and potentially valuable for identifying potential issues, evaluating their severity, and framing needed mitigations. If used early in the NEPA process, this scoping process can be valuable in framing and focusing analyses (Yost, 1981), but is especially useful in addressing EJ. To meet these requirements, the following groups and organizations can be contacted:

- environmental organizations and agencies
- minority businesses, associations, and trade organizations
- civic associations and public interest groups
- grassroots/community-based social service organizations
- elected officials and agencies
- homeowner/tenant associations, neighborhood watch groups, and resident organizations
- news media, the internet, and electronic media
- tribal governments and organizations
- religious groups and organizations
- libraries, vocational and other schools, colleges, and universities
- medical community
- legal aid providers
- rural cooperatives
- civil rights organizations
- senior citizen groups

Other sources for EJ data include:

- EJ Resource Center at Clark Atlanta University (http://www.ejrc.cau.edu)
- Centers for Disease Control (http://www.cdc.gov)
- Agency for Toxic Substances & Disease Registry (http://www.atsdr.cdc.gov)
- Journals of Medicine (http://content.nejm.org, www.thelancet.org)

The latter three references reflect the origins of EJ concerns, exposure of specific communities to toxic material or waste.

Impacts on Native American populations can be considerably more complex, as these communities have distinguishing cultural and religious practices, and some impacts can be unique to those practices. EPA guidance (USEPA, 1998) establishes three categories of tribal issues; treaty-protected resources, cultural resources, and sacred sites; that can precipitate tribal involvement as a NEPA cooperating agency. During scoping and involvement, tribal interactions must be undertaken in a government-to-government context. Guidance for such interaction is established in Department of Defense policies for interaction with American Indians and Alaska Natives (DoD, 1998). Many of issues also fall under the Cultural Resources VEC, discussed in Section 4.3 of this manual.

To pursue EJ issues in more detail, the following references are helpful: Toward Environmental Justice: Research, Education, and Health Policy Needs (1999), National Academies Press (http://www.nap.edu/catalog) Environmental Justice Analysis: Theories, Methods, and Practice (September 21, 2000), by Feng Liu, Lewis Publishers (http://www.amazon.com) A Citizen's Guide to Using Federal Environmental Laws to Secure Environmental Justice (January, 2002), Environmental Law Institute Research Report

Tier 2: Once warranted by the examination of potential significance, or required by controversies or apprehension, detailed socioeconomic analysis can be broken into three general categories: (a) economic effects, (b) effects on government revenues and expenditures, and local housing, and (c) social effects.

(a) Economic effects are best detailed through the use of either Input-Output (I-O) or econometric models. These are more complex than the export-base approach used in the basic EIFS model and require more data and costs. I-O models explicitly consider the interrelationships between industrial sectors of the ROI, and how these interactions affect the process of economic change. These models also provide more information than economic base models (such as EIFS) on the economic transactions within a local economy. They also model the mechanisms through which impacts in one sector are transmitted throughout the economy. Since data to establish a ROI's inter-industry transactions can be quite expensive, various non-survey methods can be used, adjusting coefficients borrowed from other studies (e.g., location quotients, regional purchase coefficients, and the Regional Accounting System (RAS)). However, these techniques are often subject to the same criticisms as economic base models.

In terms of data requirements and derived information, regional econometric models are a compromise between economic base and I-O analysis (Glickman 1977, p. 38); and they incorporate time series data to model the temporal pattern of impacts over a period of years. While econometric models are better suited for long-term predictions, few sub-state econometric models have been developed, as little time series data is available at the substate level. They also lack a consistent theoretical base, unlike economic base and I-O models that are based in regional growth theory; and they often suffer from statistical estimation problems such as autocorrelation, multi-collinearity, and few degrees of freedom.

Given the desirability of I-O models as a more detailed modeling technique, a number of models can be used:

The Automated Input-Output Multiplier System (AIMS) (Bloomquist, et al, 1987), available as a second tier through EIFS, requires (a) identification of the industries affected by a project, (b) estimation of an industry's or industries' change in final demand, and (c) the correct application of the AIMS multipliers.

Economic impacts can be expressed as the change in output for a given industry, or set of industries; and this is the added advantage of an I-O model. The increase in output for one industry might lead to increased output on other industries. For example, higher production in primary metals might result in increased production of corrugated metal stampings or some other commodity related to primary metal requirements. This relationship can be represented as a change in final demand (e.g., sales to end users), or the total effect of an initial sale to all affected industries; and also encompassing sales to industries outside the region, sales to governments, and investment activities. The identification of directly impacted industries can be difficult, and must include both backward and forward linkages, and interdependent connections among industries.

Final demand (the indirect consequences of direct spending) must be ascertained; and can often be obtained from department reports, the media, etc. Once flows to other regional industries have been identified, changes in these industries can be estimated. These inter-industry flows can be estimated using national data available from BEA (USDC, 1977).

AIMS multipliers summarize the chain of reactions from direct changes in final demand (the direct effects of the proposed action). The output multipliers indicate the dollar value of that initial injection in a given industry.

An AIM estimates industry-specific multipliers using a quicker, non-survey technique (Drake, 1976). This procedure breaks multipliers into three components: the initial effect, the direct effect, and the indirect effect. The initial effect (always equal to 1.0), represents the initial final demand change. The direct effect is the sum of the first round of inter-industry sales. The indirect effect is the sum of all other rounds of expenditures. The initial 517-sector version of AIMS was derived from the 531-sector 1977 national I-O table (USDC, 1977). Once an ROI is defined (See discussion of CEQ Step 2) and the target industry (or industries) is identified, the national I-O table is "regionalized" using data from the Enhanced County Business Patterns (CBP) from BEA to identify regional industries and delete any sectors absent in the region.

Other I-O models are also available for use in Tier 2 analyses; and offer the same advantages as AIMS. Some of the more-popular models include:

- IMPLAN is a popular PC-based economic analysis system that uses the I-O technique (http://www.implan.com/products.html).

- RIMS is the I-O model that is provided by BEA for regional impact analysis (DOC, 1981).

Numerous other models of various types exist, and many are just as acceptable as the ones listed above. In many cases, these models may be highly specialized for a particular region or community, and are calibrated to produce optimal modeling results for that area. While these models cannot provide comparability across the United States, such comparability is less desirable for Tier 2 analyses. Such models are normally associated with major cities and they are usually supported by local university staff as part of their research and community support efforts.

(b) Effects on government revenues and expenditures can become very controversial, as the Army can affect both the revenue side and the demand side of these services. While the Army can provide needed services on post, and has done so in the past, these services are increasingly sought from the local communities in which installations reside. Such demands can often require the creation of a service infrastructure to support the needs of the Army. These services can include the following:

Fire Protection
Utilities
Telecommunications
Water/Wastewater Infrastructure/Treatment
Solid Waste Services
Hospitals/Health Care
Law Enforcement
Recreational Services
Education/ School Systems
Housing

Decreases in installation strength require fewer services, but often leave communities with a requirement for a larger revenue stream, without the economic activity to generate tax and property revenues. These can become very significant for BRAC actions or major non-BRAC reductions in installation civilian or military strength.

Once needed community facility and infrastructure has been identified, local governmental revenues (in some form) are required. These are seen as indirect impacts of base expansions; in which case, they are often considered acceptable by-products of positive economic growth. Community leaders often support (and promote) such expansions, and see increased tax revenues of the economic expansion as a logical "bill-payer" for such services. Schools services are often a notable exception to this rule, as on-post students can rely on local community schools, and the installation properties pay no property taxes (the usual source for school budgets) to the local community. As a result, DoD supports a program to reimburse these school districts on a per-student basis.

Deceases in installation strength require less services, but often leave communities with a requirement for a larger revenue stream, without the economic activity to generate tax and property revenues. These can become very significant for BRAC actions or major non-BRAC reductions in installation civilian or military strength.

(c) Social effects. A step-by-step procedural approach for social impact assessment has been developed by prominent professionals. Initially developed over a decade ago, this methodology has been recently updated, and is available through the International Association for Impact Assessment (IAIA, 2003). This methodology is included on the accompanying CD. The detailed assessment of social effects involves considerable interaction with the affected communities and the incorporation of community views and perceptions throughout the life cycle of the proposed action.

(d) EJ effects Once low income or minority populations have been identified in the ROI, detailed analyses involve the analyses of projected impacts across all VECs, to ascertain their EJ status. If any of the projected impacts fall disproportionately on any of these identified communities, specific mitigations must be identified, and detailed planning may be required to ameliorate such effects. Through this process, these communities must be collaboratively involved.

CEQ Step 7 – Define a Baseline Condition for the Resources, Ecosystems, and Human Communities.

Baseline conditions are readily defined in the data sources and community inquiries previously discussed in CEQ Steps 5 and 6.

CEQ Step 8 – Identify the Important Cause-and-Effect Relationships between Human Activities and Resources, Ecosystems, and Human Communities.

As discussed in CEQ Step 6, Army activities directly affect business volume, income, employment, and population; through changes in employment (including salary effects) and procurements (including major construction, and through direct alterations in local population, the relocation, assignment, or establishment of military and civil employees and their families).

The indirect effects of these changes provide both revenue streams and service demands. Revenues accrue primarily through taxes (property, sales, etc.) and demands for services are often directly related to population or the number of households; and can be estimated on a "per-capita" basis. These facility demand functions (including housing) are further explained in the Facility VEC (Section 4.9).

This VEC also encapsulates the addition of populations and activities to a given region or ecosystem; and the inevitable impacts on the natural systems (all other VECs) that are implied by that addition.

CEQ Step 9 – Determine the Magnitude and Significance of Cumulative Effects.

The magnitude of social and economic effects can be ascertained using the tools specified and discussed in CEQ Step 6 and through the analyses discussed in CEQ Step 9. Once projected changes are obtained, their significance must be analyzed.

While EIFS was being developed, communities began to question the rationale for Army (and DoD) significance determinations. As a result, a systematic, more-defensible approach was sought, resulting in the Rational Threshold Value (RTV) technique (Webster and Shannon, 1978). This technique relies on the yearly BEA time series data on employment, income, and population to evaluate historical trends within a subject community (region); and uses those trends to measure the "resilience" of the local community to change, or its ability to accommodate such change. This approach has worked well when communicating with affected communities. The combined use of the EIFS model (or any similar model) and the RTV technique address both recommended CEQ components: intensity and context (CEQ, 1978).

Over years of practice, and as the statistical record in the BEA time series grew, an alternate more statistically-based technique was developed (to supplement the RTV approach), the Forecast Significance of Impacts (FSI) approach. Both are detailed as follows:

The RTV approach uses the BEA time series data to analyze trends for four variables in the ROI; business (sales) volume, employment, personal income, and population. In this process, the RTV methodology produces positive and negative thresholds for assessing the significance of impacts.

The RTV technique is simple, starting with a straight line between the first year of record and the last year of record for that variable, establishing the average rate of change, over time. Then, each yearly deviation from that growth rate is calculated and converted to a percentage. The largest historical changes (both increase and decrease) are used to define significance thresholds. The following figure illustrates the RTV concept:

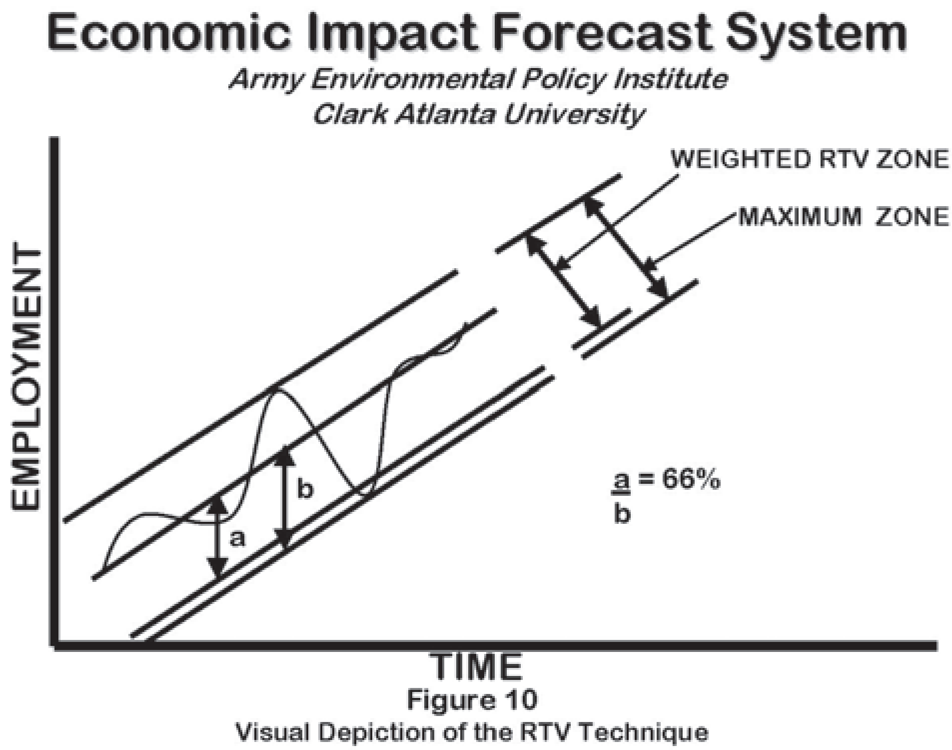

Figure 4.10-3: *Rational Threshold Value (RTV Technique for Ascertaining Significance).*

To produce a more conservative threshold, a "factor of safety" is applied to negative thresholds, as shown in the figure; while 100 percent of the maximum positive thresholds is used; as indicated below:

Variable	Increase	Decrease
Business volume	100 percent	75 percent
Employment	100 percent	66 percent
Income	100 percent	66 percent
Population	100 percent	50 percent

The maximum positive historical fluctuation is used because of the positive connotations generally associated with economic growth. While economic growth can produce unacceptable impacts and the "smart growth" concept is increasingly favored, the effects of reductions and closures are usually much more controversial. These adjustments, while arbitrary, are sensible. The negative sales volume threshold is adjusted by 75 percent, as sales volume impacts can be absorbed by such factors as the manipulation of inventory, new equipment, etc; and the impacts on individual workers or proprietors is indirect, if at all. Changes in employment and income, however, are impacts that immediately affect individuals; thus they are adjusted by 66 percent. Population is extremely important, as an indicator of other social issues, and is thus adjusted by 50 percent.

4.10

To adjust dollar amounts for inflation to create "constant dollars" prior to calculations, the Consumer Price Index (CPI) is used for appropriate years, and all dollar values are adjusted to current year equivalents.

The main strength of the RTV approach stems from its reliance on data for each individual ROI. This approach addressed criticisms of more simple approaches applying the same, arbitrary criteria (one percent, five percent, etc.) to all communities. This approach establishes unique criteria, representative of local community patterns, and, while a community may not completely agree, a common frame of reference is established. Critics of the RTV technique have questioned the arbitrary selection of the maximum allowable deviations to indicate impact significance, but the process has proven workable over the years.

The FSI approach can also be used to determine thresholds for evaluating the significance of predicted economic impacts. However, unlike the RTV method which defines thresholds using arbitrary, fixed percentages of maximum historical deviations from an average growth trend, the FSI approach defines these thresholds using statistical procedures. In fact, the RTV approach was initially selected when the BEA time series record was quite short, and statistically difficult to defend. In the intervening period, this record has grown, and the FSI technique is now a valid approach.

The FSI method is based on the following precepts. First, "significance" is relative, and must be set in context (CEQ, 1978 and Duinker and Beanlands, 1986). For example, a county with a work force of 5,000 workers, losing 1,000 jobs as a result of an action, is more likely to experience serious economic consequences than a county with 50,000 workers losing 2,000 jobs. Therefore, the magnitude of impacts must be assessed in relationship to this relative hardship as a result of changes affecting the local economy. In this respect, the RTV and FSI techniques are similar, as the RTV employs the percent historic deviation, a relative measure, to determine significance.

Second, future conditions resulting from a proposed action should be evaluated relative to conditions expected from normal change. In other words, an action's impacts should be compared to the status quo (Finterbusch, Llewellyn, and Wolf, 1986). This implies a different significance context from that used in the RTV technique. While the RTV technique measures the capacity of the ROI to adapt to change, the FSI technique indicates the level of change that would not otherwise be historically expected. The latter approach can be preferable as (a) the measure of a community's adaptability may prove elusive and difficult to reveal from data covering the most recent 20 year period, and (b) the FSI technique, while admittedly crude, does provide some indication of impacts on future economic growth, and important information for planners.

Procedurally, the same indicator variables are selected as those used by the RTV approach (business volume, employment, personal income, and population), based on the same rationale. The FSI approach calculates the standard error of the forecast by means of linear extrapolation, assuming no action occurs. This is automatically accomplished after the user specifies a desired level of confidence. If, for example, a 90 percent confidence level is selected, there is a 90 percent probability that future socioeconomic activity will fall within the forecast margin of error. An action that would cause a level of change in excess of this probability whether positive or negative, is assumed to be significant (i.e., not otherwise expected as a result of normal growth). Note, that as the level of confidence increases, the confidence "band width" also increases. Thus, the threshold for significance is higher for a 90 percent level of confidence than for a 60 percent level of confidence.

While the FSI procedure has the advantage of simplicity, linear extrapolation may be inappropriate in forecasting changes that are clearly nonlinear, as implied in the time series data. Moreover, such an approach tends to penalize regions that have experienced wide fluctuations in growth over time, compared to regions that have had a history of steady or slow growth (a shortcoming also applicable to the RTV technique). The FSI forecast's statistical error will be greater for a ROI with large historic swings in economic activity, and that ROI will thus be more susceptible to "insignificant" determinations than a ROI of similar size experiencing steady or slow growth.

If, after comparing predicted impacts to the RTV or FSI thresholds, the impact appears insignificant, the analyses are essentially complete, and simply require documentation in the EA or EIS, consistent with Army guidance (USA, 1997, 1995, 2002 and 2005, USACERL, 1987, and Webster, et al, undated 2T).

Also within Army guidelines (USA, 1997, 1995, and 2002, USACERL, 1987, and Webster, et al), any impacts that appear significant must be further analyzed in detail. While this would normally be addressed in an EIS, the current court interpretation precludes the development of an EIS from significant socioeconomic effects alone, in the absence of accompanying significant physical or biological impacts.

In any regard, the EIFS-based two-tier approach (Webster, et al) requires further analysis of potentially significant impacts, as defined by the RTV or FSI thresholds. In the case of business volume, employment, and income; the recommended second-tier analysis is some form of input-output (I-O) model; as such models can detail impacts on specific sectors of a local economy, and can be quite valuable in subsequent planning and mitigation selection. These detailed models, as well as the EIFS model, are detailed in the discussion of CEQ Step 6.

The significance thresholds can also establish the need for more detailed analysis of other direct and indirect socioeconomic effects on government services and revenues and the demands for services or facilities in the local community.

Second-tier, more-detailed procedures are detailed in the discussion of CEQ Step 6.

Caution should be taken in the use of the two-tier approach, in spite of its apparent success in the past. Two factors – significance or controversy – can trigger detailed socioeconomic analysis. This approach has proven useful and pragmatic in Army application over some three decades, but may not always prevail. Both EIFS (the first tier) and the RTV/FSI technique were specifically developed as NEPA tools; primarily for EA level analyses. While application has proven acceptable in the past, some specialized (localized) conditions may warrant detailed analysis from the outset, or community controversies may dictate rigorous treatment. In any case, the first tier and significance analyses will establish a common perspective for community collaboration and discussion. With that context, remaining controversies, and subsequent detailed analyses, may reflect legitimate stakeholder (community) concerns; as NEPA intended.

The potential for a boom-bust effect must be evaluated. Affected communities view economic growth as a positive effect (and sometimes encourage it), but its long-term sustainability must also be considered. Classic examples of boom-bust effects can be found in past energy developments (i.e., mining, or mineral extraction) throughout U. S. history. The "boom" component often created communities that thrived until the source of growth (the mines) ceased (or reduced). Many of these examples precede the establishment of large pockets of poverty in the Southeastern United States, and similar events have occurred in western and southwestern states. The potential for such effects increases when communities grow dependent on any one source of economic growth which could easily be a manufacturing facility, a tourist attraction, or any other singular activity. To preclude a boom-bust situation, local economies need numerous, diverse, and balanced sources of economic growth; and industries that have a more consistent activity profile.

CEQ Step 10–Modify or Add Alternatives to Avoid, Minimize, or Mitigate Significant Effects.

Direct socioeconomic effects can be initially mitigated through timing. As a result of logistics requirements, the expansion or reduction of activity in an ROI is often spread over time; and the intentional extension of time lines can work in a similar manner, and just as well. If the project is spread over a number of years, any major fluctuations can be “smoothed” to reduce the magnitude of fluctuations in growth; negating impacts such as those associated with boom-bust situations (See discussion of CEQ Step 9).

In instances of major installation drawdowns, Army real property may be leased, and can attract new jobs to replace those lost by the closure or realignment (USA, 2005). The Secretary of the Army is authorized (10 U.S.C. 2667) to lease real and personal property for less than the fair market value if “the public interest will be served as a result of the lease and if the fair market value of the lease is unobtainable or not compatible with such a public benefit.” These leasing and disposal options, and other real estate management guidelines, are further detained in the discussion of the Facility VEC (Section 4.9).

CEQ Step 11–Monitor the Effects of the Selected Alternative and Adapt Management.

The monitoring of social and economic effects is readily accomplished by the myriad of agencies and organizations that survey and measure the trends in any ROI. These entities vary in scope and authority, from the Department of Commerce to local governments to social service providers in the community.

4.11 Energy

4.11.1 Introduction

As an organization, the Army is faced with rising infrastructure costs and challenges associated with extensive land-based assets (See the Facilities VEC (Section 4.9) of this report), assets that were established in a different time and supporting a different Army with a different mission. The older paradigm has given rise to the Base Realignment and Closure (BRAC) process, and the Army Transformation (Steele, 2001 and USACE, 2002a). Both initiatives are part of Army redesign and reorganization, focused on current, updated national security needs of the nation. Through previous and future BRAC actions, the Army infrastructure will be reduced to reflect the current needs of the Army, and much of that will be dictated by Army requirements that will evolve through Army Transformation.

Energy consumption is perhaps the major infrastructure and budgetary challenge to Army leadership, encompassing both domestic (stateside) challenges and both garrison and tactical challenges abroad. The generation, transmission, and use of power has significant economic, environmental, and mission implications. Since World War II, the tremendous growth in U. S. energy consumption has led to a wide range of environmental, social, and economic impacts; including (1) environmental pollution and (2) dependence on foreign sources of oil and natural gas. This reliance on foreign fossil fuels is both an economic drain on Army fiscal resources, but is also a natural security threat (IAGS, 2005), also seen as a potential catalyst for future hostilities.

Energy costs will rise from resource depletion, unacceptable environmental impacts, and sociopolitical ramifications (Holdren, 1992). While energy will be available, in the absolute sense, the capacity to expand or continue present energy supply patterns and technology will cost much more

In 1999, the U. S. spent approximately $500 billion for 100 quadrillion Btu (quads) of energy, as shown in the following figure:

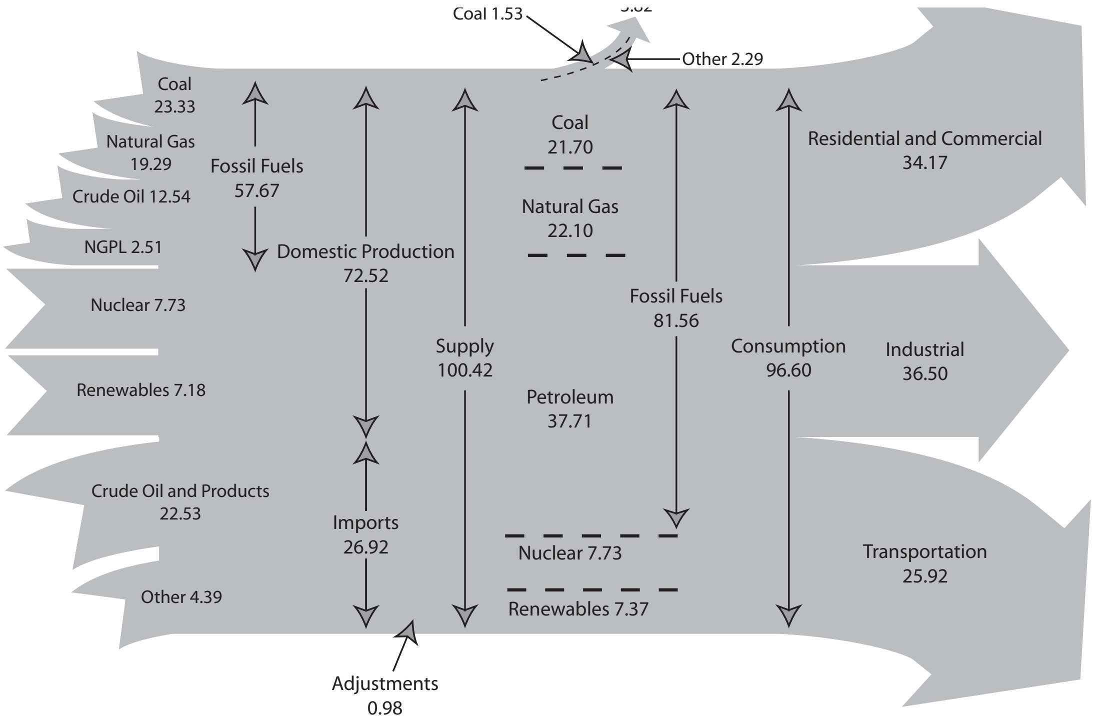

Figure 4.11-1 (1999) *US Energy Flows EIA, 2000*

As 20 quads of this demand were imported, this created a negative balance of trade, coupling the U.S. to the international energy trade. The U.S. energy demand was 34.2 quads for residential and commercial use, 36.5 quads for industrial use, and 25.9 quads for transportation use. 85% of this U.S. energy supply is derived from fossil fuels, which are finite and nonrenewable (EIA, 2000). In 1999, electric utility power generation required 32.6 quads of energy (22.3 quads as fossil fuels) to deliver 10.7 quads of electricity to customers, as illustrated in the following figure:

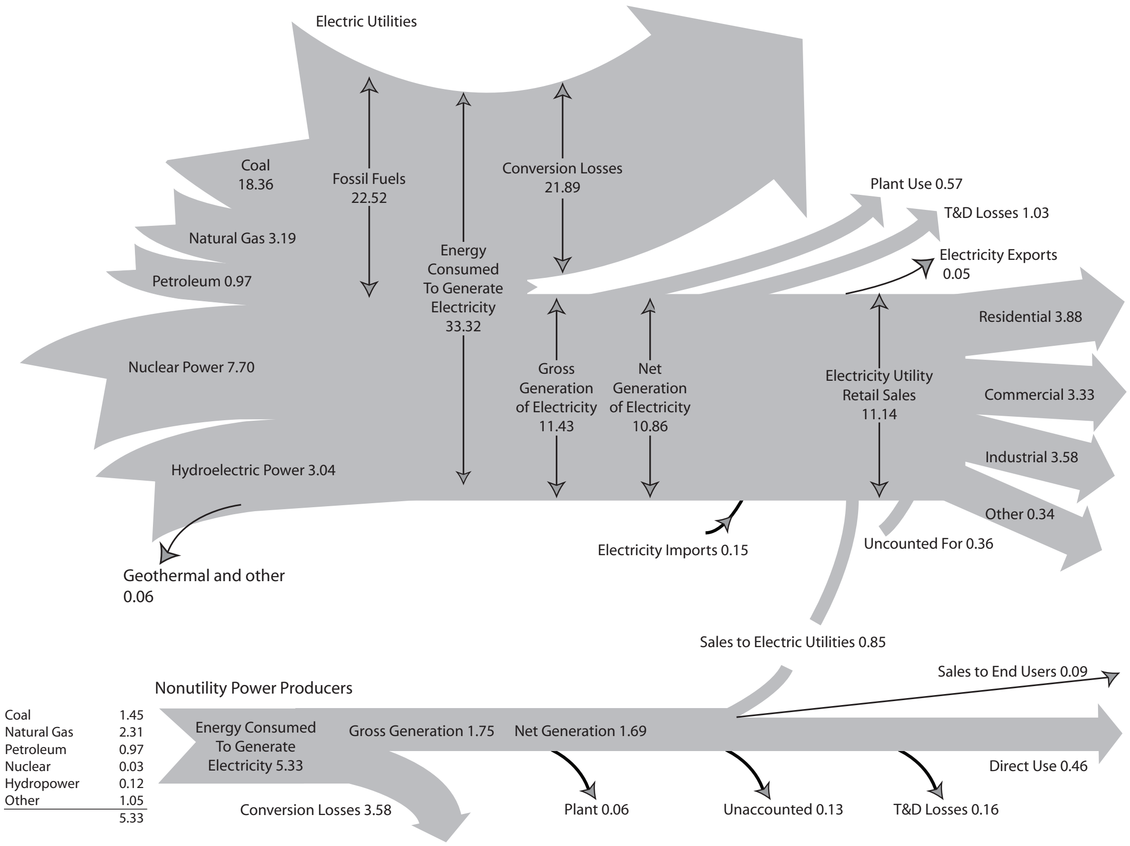

Figure 4.11-2

The federal government consumes 1.5 percent of the nation's energy (Eberhart, 2001). The total Army energy bill for FY00 was over $865 million. Buildings, including industrial and laboratory facilities, accounted for more than 85 percent of these energy costs (exceeding $750 million). While only 22 percent of the total Army energy consumption in FY00, electricity accounted for 60 percent of the Army's total energy cost. In contrast, natural gas was 77 percent of the energy used in FY00 but only 19 percent of the cost. Recent increases in energy costs have created an Army utility budget shortfall of $93 million for FY01, with energy cost increases for FY02-07 estimated to require an additional $218 million. Increased energy costs are non-discretionary; forcing installation commanders to take funds from other accounts to pay for utilities, placing other mission areas at risk (Conrad, 2001).

The following DoD objectives apply to the Energy VEC:

Provide reliable and cost-effective utility services to minimize facility energy consumption, focusing on (a) investments in cost-effective renewable energy sources, (b) energy-efficient construction designs, and (c) aggregating bargaining power among regions and Components to reduce energy costs. This objective focuses on the reduction of standard building energy consumption from 1985 baseline by 30 percent , and the reduction of industrial and laboratory energy consumption from 1990 baseline by 25 percent; by FY 2010.

Reduce consumption of energy as one way to minimize unnecessary life cycle costs, focusing on innovative technologies, state-of-the-art techniques, and alternative sources. This includes active technology development and testing of bio-based lubricants/fuels as alternatives to fossil fuels; and management of the DoD motor vehicle fleet to reduce petroleum fuel consumption through increased fleet fuel efficiency (and increasing the ratio of alternative fueled vehicles in the non-tactical fleet). This objective focuses on reductions in vehicle petroleum consumption from FY 1999 baseline year by 75 percent of ordinary (non-tactical) vehicles by 2005; and use of alternative fuels by 2008.

While the Army energy conservation program (USA, 2000) has been effective in reducing the energy demands on a "per capita" and a "per building" basis; the costs of future energy will become increasingly burdensome, and reduction of these costs (and the consumption that drives it will become an Army management and leadership imperative. The analysis of Army, U.S. and World trends is the subject of continuing Army research (Westervelt and Fournier, 2005); and the primary fuel sources for Army energy are illustrated in the following figure:

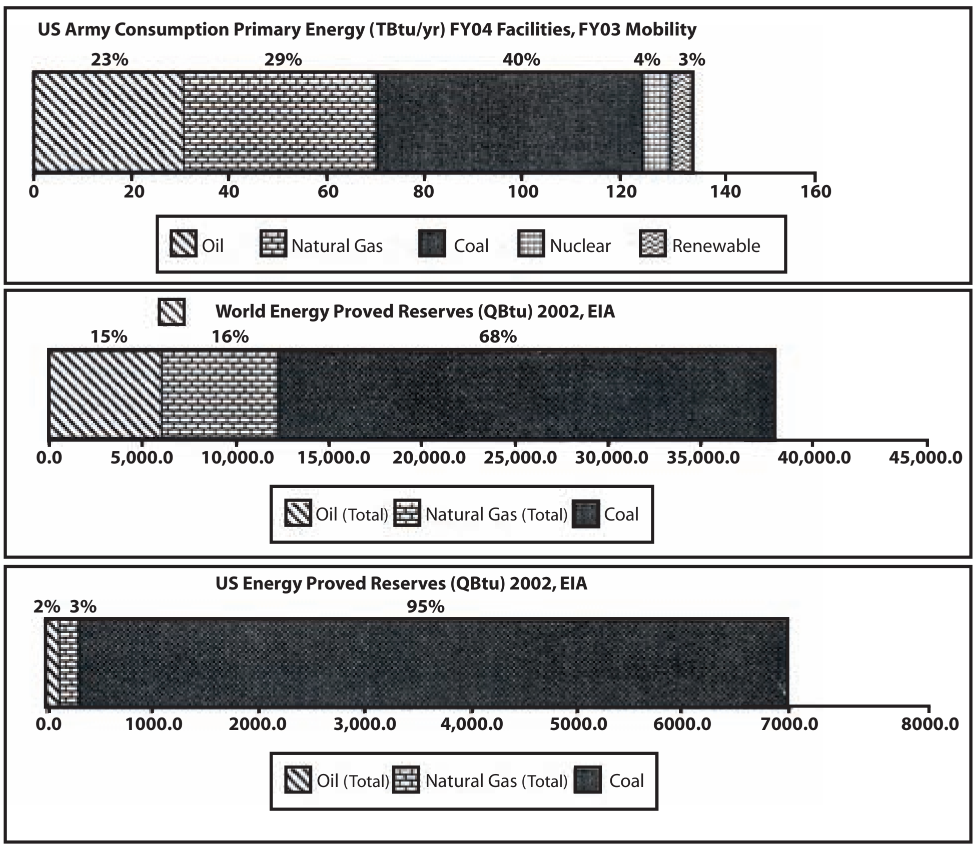

Figure 4.11-3 *Army Energy Consumption in Relation to Resources*

4.11.2 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect effects of a proposed action on energy; and, in addition, they can be used to determine if cumulative effects also need to be considered. These "quick look" questions include:

- Have energy prices in the region been rising?
- Does the proposed action expand installation demands for regional energy? associated with past or on-going activities?
- Is additional cumulative effects analysis needed?

Impact Analysis Level:

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant impacts on the VEC, an EA level of documentation is required. This "hard look" need not be extensive or costly; and can be quite brief as discussed in the "Quick Look' segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis "in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public" (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the "Detailed Analysis", Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

At the EA level, attention must be given to CEQ Steps 1-4 (the scoping steps) and CEQ Steps 6 and 7, describing the affected environment. The findings from these CEQ steps can be documented to serve as a "hard look", if it is determined that an EA is appropriate. However, if significant impacts are identified from consideration of CEQ Steps 1-4, 6 and 7, then an EIS is appropriate. For an EIS, all 11 CEQ steps should be addressed.

CEQ Step 1 – Identify Significant Effects Associated with the Proposed Action and Define the Assessment Goals.

The power infrastructure of both the Army, and the U.S. as a whole, produces impacts across all other VECs. Regardless of the power source (natural gas, coal, or some other fossil fuel, as well as nuclear), and ultimate form of its usage (if converted to electricity); the life cycle process includes extraction, transportation, processing, distribution, use, and waste disposal. The direct and indirect effects cannot always be distinguished from the cumulative effects, as the overall system makes little distinction between an Army use or another use in the community (region).

- Energy Requirements and Sources
- Identify the energy requirements for an installation by type of energy and the type of use.
  - Energy Sources: electricity, natural gas, renewable, etc.
  - Energy Use: Lights/Information Technology, Heat, Industrial, Transportation.
- Show requirements for proposed action using categories above
- Show regional figures derived from utility companies and compare as appropriate the categories of energy used.

As Army energy conservation (USA, 2004) and sustainability (USA, 2006a) initiatives are implemented, energy efficiencies will materialize, and magnitude of direct, indirect, and cumulative effects will decline. While these efficiencies are positive, they are likely inadequate to completely address significant pending economic and environmental issues. In order to stabilize atmospheric carbon and reverse global climate change, fossil energy use must be reduced by some 70%, requiring rapid, radical changes in energy consumption patterns, including the built environment of the extensive Army facility infrastructure (detailed in discussions of the Facility VEC).

The Army may embrace a more sustainable, environmentally-benign energy strategy, including renewable energy sources, averting environmental and resource crises (including costs) in the very near future. Some of this embrace is reflected in the ISP, as indicated by following the energy-related goals and objectives or participating installations. The Army is increasingly including LEED (GBC) considerations into building facilities, and almost all other Army activities now have a sustainability component (USA, 2004), including range facilities (USA, 2006).

The overall environmental consequences associated with "renewable" (wind and solar) energy sources are positive, particularly for such issues such as global warming, ozone depletion, and other issues associated with fossil fuels and their attendant atmospheric pollution. The relative levels of pollution (and natural resource consumption) associated with renewable energies are much less than those associated with traditional fossil fuel sources. While these renewable sources create less pollution during energy production, as nothing is burned; the major positive indirect effects accrue through less demand for fossil fuel extraction, a major worldwide source of resource consumption and pollution.

Overall, the life cycle (indirect) impacts of conservation and renewable sources on most other VECs are negligible; contrasted sharply against the extensive and inclusive effects of the current U.S. energy infrastructure system. The operational impacts of these projects, once they are in place, are mostly positive (beneficial), as in the case of air quality, where the proportion of electricity from fossil fuel generation (and associated pollutants) is reduced; although these positive impacts may be received elsewhere (outside the immediate region). Other O&M impacts, such as avian species mortality may be significant, requiring monitoring and adaptation.

CEQ Step 2 – Establish Geographic Scope of the Analysis.

The geographic scope for Energy effects analysis considerations should include the immediate location of the immediate physical infrastructure, and any location that includes construction of facilities required for the project (generation, transportation, distribution, use, etc.). If the proposed action includes construction or operation of such facilities, their location will delineate the primary impacts area. A larger area will be required if these facilities reach beyond the installation, and included infrastructure components provided by (or shared with) the surrounding community; as this is where some effects will be felt.

Show or discuss the service areas affected by the data contained in "energy requirements and sources "

Taking a broader perspective, the energy infrastructure can become quite extensive, if extraction, central generation, and lengthy transmissions are included due to the addition of additional grid systems to support the project or its alternatives. While the direct and indirect effects of a proposed action may be minor on this expanded region, such consideration can constitute the essence of CEA, as cumulative effects (even at a distant location) can be significant, particularly if resources are constrained or the source of controversy.

CEQ Step 3 – Establish the Time Frame for Analysis.

The timeframe for effects analysis of energy infrastructure is synonymous that of the Socioeconomics VEC, as energy demand is a function of regional economic development. These growth trends are extensively documented by the Department of Commerce Bureau of the Census and Bureau of Economic Analysis (BEA).

The “past” temporal boundary can easily be established through characterization of the ROI at least one, and possible five (depending on conditions), decades in the past. Absent any major growth or prior economic controversies, one decade can be sufficient. However, an ROI that exhibits a long history of economic (or demographic) growth (or fluctuation) requires a longer historical characterization (50 years, or even longer, depending on circumstances). The temporal boundary should reflect the changes in regional population changes as they are associated with the installation. Changes in the regional population may overwhelm the effects of installation population and mission with its energy requirements.

The “future” temporal boundary can be established by evaluating the lifetime of the proposed action, and the lifetime of other accompanying actions in the ROI. The greater timeline of these foreseeable consequences is a reasonable limit for the evaluation of cumulative consequences.

CEQ Step 4–Identify Other Actions Affecting the Resources, Ecosystems, and Human Communities of Concern.

Past and present energy use (consumption) patterns can be obtained from installation sources (DoD, 2004), local energy suppliers, or through coordination with local planning agencies, city Chambers of Commence, local political leaders, and, potentially, any large companies or government agencies that historically influence the local region. Energy suppliers, local planning agencies or political leaders, and large companies or government agencies can also be useful sources for the identification of any future sources of energy demand in the local region.

Emphasis should be placed on the identification of any new major consumers or projects that will increase regional demand. Once those are identified, projected regional population growth should be used to estimate energy demands associated with that growth (using per capita energy demand estimates). These can then be combined to establish total reasonably foreseeable demands.

CEQ Step 5–Characterize the Resources, Ecosystems, and Human Communities Identified During Scoping in Terms of Their Response to Change and Capacity to Withstand Stresses.

While overall energy trends appear initially distressing, conservation and adaptation is already underway in the U.S., as a whole, and the Army, specifically.

U.S. communities are increasingly adapting to energy constraints and costs. The LEED standards (GBC) are becoming increasingly common in residential and commercial construction and renovation projects, large organizations are increasingly adopting sustainability as a business imperative, and individuals are increasingly altering their behaviors to offset their growing energy bills. As a result, energy usage is better managed, a trend likely to continue. Major savings can be obtained in the commercial and business setting from even minor energy management (Romm, 1999). An emerging recognition of such opportunities for cost savings is significantly underway in the private sector (Anderson, 1998), and bodes well for future adaptation to overcome energy (and related) stresses.

CEQ Step 6–Characterize the Stresses Affecting These Resources, Ecosystems, and Human Communities and Their Relation to Regulatory Thresholds.

The environmental impacts of traditional energy consumption (the existing energy infrastructure systems) are extensive and geographically far-reaching, especially when the indirect effects of their life cycle are included. This complex and far-reaching series of direct and indirect impacts is illustrated in the following figure:

As shown, these impacts can be linked to the statutory and regulatory thresholds of all other VECs. All VECs are subject to regulatory control, and energy infrastructure design, construction, operations, and disposal are regulated in the interest of worker safety and public health; and are subject to additional DoD, Army, and other governmental requirements. These impacts are essentially the same as those articulated in the discussion of CEQ Step 6 for the Facility VEC (Section 4.9).

Many of the potential impacts of conservation and renewable sources are relatively minor and can often be eliminated through appropriate site selection and design (incorporating aspects into the design to eliminate conflicts); and the remainder can often be addressed through appropriate mitigations during construction (sound Best Management Practices (BMPs) (USAEC, 2006).

Renewable energy sources do, however, product impacts that, while relatively minor, may be significant. While the objectives of proposed renewable energy projects are environmentally desirable; the decision maker must mediate between the negative environmental effects of traditional energy systems (such as greenhouse gases and global warming) and the often localized effects of renewable systems (such as aesthetics, land utilization, bird mortality, etc.); as well as economic tradeoffs (such as capital investment strategies) and technical issues (reliability, technological uncertainty, etc.).

CEQ Step 7 – Define a Baseline Condition for the Resources, Ecosystems, and Human Communities.

The baseline conditions for energy infrastructures can be readily obtained from installation records and through coordination with local (community) energy provided (either governmental of private sector). Appropriate metrics include the identification of energy sources, the relationship between regional supply and demand, and trends in regional energy costs.

CEQ Step 8 – Identify the Important Cause-and-Effect Relationships between Human Activities and Resources, Ecosystems, and Human Communities.

As discussed in CEQ Step 6, the cause-effect mechanisms are extensive. These can be identified once the energy sources are identified (CEQ Step 6) and affected VECs have been identified. Detailed analysis can then follow the discussions in Step 6 for each of the affected VECs.

CEQ Step 9 – Determine the Magnitude and Significance of Cumulative Effects.

Again, these determinations are specific to each VEC.

CEQ Step 10 – Modify or Add Alternatives to Avoid, Minimize, or Mitigate Significant Effects.

The environmental impacts of traditional energy consumption (the existing energy infrastructure systems) are extensive and geographically far-reaching, especially when the indirect effects of their life cycle are included. As previously discussed, energy consumption and its effects can be reduced through a combination of conservation measures and the adoption of alternate (renewable) energy technologies. In the first case, impacts are avoided, while in the second case, impacts can be minimized or eliminated. Many of the potential impacts (of renewable sources) are relatively minor and can often be eliminated through appropriate site selection (eliminating conflicts altogether) and design (incorporating aspects into the design to eliminate conflicts); and the remainder can often be addressed through appropriate mitigations during construction (sound Best Management Practices (BMPs) (USAEC, 2006) and other mitigations that recognize and respect site characteristics and limitations) and O&M (care in day-to-day operations and adaptive management to account for uncertainties).

While continued Army dependence on fossil fuels will continue, increased Army conservation and use of renewable energy sources can have direct positive (though often minor) impacts in an individual region.

There is a growing realization that sustainable (energy efficient) structures and the alteration of their management can significantly reduce energy demand (at a multi-factor scale (Womack, 1996). These are desirable over the life of a building, and need not cost more (USEPA, 1999). Considerable gains can be achieved through the management of both the efficiency of resource production, and the reduction in demand for the resources.

Given the inefficiencies in the energy infrastructure system, a reduction of 1 BTU in demand can reduce needed generation by 4 BTUs, the “factor four” concept (von Weizacher, et al, 1997).

CEQ Step 11 – Monitor the Effects of the Selected Alternative and Adapt Management.

With energy costs rising and as the strategic (security) implications of the energy “status quo” is recognized; energy use will be closely monitored. These costs are a major portion of any installation budget, and will be the topic of management reviews at both installation and headquarters levels. The cumulative effects of increasingly competitive energy demands will be reflected in the inevitable rising costs that stimulate this constant review and monitoring.

4.12 Land Use

4.12 Land Use

4.12.1 Introduction

Effects on land use have been identified as issues of concern related to modernization of U.S. Army installations particularly installations with training ranges. Effects concerns can derive from additional off-post land requirements for various training missions, on-post changes in land uses resulting from new or modified training policies, additional limitations in on-post access for recreational usage (e.g., hunting and fishing) of installation lands, and conflicts arising from encroachment of developments on adjacent off-post lands. For example, the final Programmatic Environmental Impact Statement (PEIS) for Army Transformation identified five examples of potential contributions to regional effects from various transformations. One example related to the cumulative effects from management of installation lands for multiple uses. Specifically, the example was explained as follows (U.S. Army Corps of Engineers, 2002, p. 4–33):

> "Agencies, such as the U.S. Army, controlling sizable land holdings have employed strategies for management of lands for multiple uses for only a few decades. Such agencies seek to accommodate diverse interests desiring use of the public domain for mineral extraction, timber production, wildlife conservation, aesthetics, recreation, and other purposes. The expected higher tempo of training and robust characteristics of forces needed for interim and future time periods could strain the capacities of present Army land holdings and require the use of additional lands for some types of training. These circumstances could potentially reduce the availability of those other lands for as many uses as they now bear. This might be most noticeable in the amount of acreage available in some locations for recreation, agriculture, and grazing."

Further, the PEIS on Army Transformation also included a discussion of land use and real property effects from systems acquisitions that require reorienting existing ranges and result in concomitant changes in corresponding ranges, safety fans, and buffer zones. Use of training simulators in lieu of real-time training could reduce land usage for training at existing ranges. Other land use changes, either beneficial or adverse, could result from the introduction of new tactical doctrine associated with new systems. Acquisition of additional lands to support various transformation-related training needs could reduce the availability of land to private landowners or controlling governmental agencies. Further, continued public- and private-sector development of lands adjacent to Army installations could result in the persistence of encroachment, and subsequent limitations on, and/or conflicts over, compliance with training requirements (U.S. Army Corps of Engineers, 2002, p. 4–7 to 4–9).

Specific examples of direct, indirect, and detailed cumulative effects on land uses can be found in the following recent installation-specific EISs:

- FEIS for the 2nd Armored Cavalry Regiment transformation and installation mission support, Joint Readiness Training Center and Fort Polk, Louisiana (Tetra Tech, Inc., January, 2004, pp. ES-13, 4-361 to 4-366, and 4-374)

  This FEIS delineated several cumulative land use effects. First, minor to moderate cumulative adverse effects on land use (and land cover) would occur within the five-parish Region of Influence (ROI). These effects would be a result of past and present training actions, past construction of training facilities and infrastructure, and future increased training requirements, timbering, construction projects, and economic development over the next 10 to 20 years. Minor cumulative adverse effects are also anticipated in relation to special use permits for other uses of the Kisatchie National Forest (KNF). Increased requirements for such permits would result from increased non-military uses of the KNF. Finally, long-term minor direct adverse cumulative effects on public access and the quality of recreational experiences would be expected within the ROI. These effects would result from the Army's transformation actions and future training range needs, and the Air Force's Reserve Command training requirements. As a result, reductions in the number of recreational visitor days on military and permitted lands would be expected.

- DEIS for military training activities at Makua Military Reservation (MMR) on Oahu in Hawaii (U.S. Army Corps of Engineers, April, 2004, pp. ES-45 and 5-25 to 5-30)

  This FEIS identified cumulative effects on land use and recreation as issues of concern. The ROI for these effects was identified as the entire island of Oahu. This ROI was chosen since land use policy on Oahu is developed and directed by the city and county of Honolulu. The Oahu Coastal Management Plan was particularly relevant due to the location of MMR on the northwest coast of the island. Historical and existing land use and recreation trends were used as the basis for examining current cumulative effects, and for considering the contributions of future actions. Specific cumulative effects issues included impacts on recreation resources due to training; conflicts with existing or planned land uses; and conflicts or incompatibilities with the objectives, policies, or guidance of state and local plans. Causative factors for these effects include localized noise from training events; reductions in access to coastal resources and beaches during training events; and closure of local nature trails due to wildfires caused by prescribed burns that escaped control, and wildfires initiated by use of rockets and ammunition. Communications with various publics relative to the timing of training exercises should facilitate recreational planning that would decrease unanticipated conflicts with recreational users in the vicinity of MMR.

- FEIS for the transformation of the 2nd Brigade, 25th Infantry Division, to a Stryker Brigade Combat Team in Hawaii (Tetra Tech, Inc., May 2004, pp. E-50 and 56, and 9-21 to 9-25)

  This FEIS identified several cumulative land use and recreation effects. The Stryker Brigade FEIS addresses training on both the islands of Oahu and Hawaii. Significant cumulative effects on land use are anticipated from the acquisition and conversion of agricultural land for military training. An increased potential for wildfires would also be anticipated. Further, cumulative effects on natural resources management would also be anticipated. The ROI was island-wide for the acquisition of land for military use and conversion from agricultural to non-agricultural use. For cumulative effects related to reductions in the amount of land available for hunting, the ROI was also island-wide. Mitigation measures related to recreation will include increased access controls, signage, public notifications, and public hunting check-in stations.

This section is structured as follows around applying the CEQ's 11-step CEA process to the land use VEC. For each step, as appropriate, specific information is included on how the step can be operationalized for the VEC. Further, reference materials and Web sites are noted, as appropriate, along with scientific methods and related tools. Prior to beginning the 11-step process, summary information is included on an overview of installation land use planning. Detailed information is then included on the installation Real Property Master Plan. Finally, subsections are included on real property management and pertinent “quick look” questions.

4.12.2 Encroachment – A Special Issue Related to Land Use

As noted above from the PEIS on Army Transformation, encroachment and associated urban sprawl represent unique issues that can influence land use on Army installations. To illustrate, in testimony before Congress in 2001, Van Antwerp (2001) provided several examples of the influence of urban sprawl, and the associated demands on natural resources, on Army installations. Specifically, the following was noted (Van Antwerp, 2001, p. 5):

> “The Army has seen significant urban growth around several major training facilities. There have been dramatic increases in population in close proximity to Fort Carson, Colorado; Fort Lewis, Washington; Fort Hood, Texas; Fort Benning, Georgia; Fort Bragg, North Carolina; Fort Huachuca, Arizona; and Camp Bullis, Texas. For installations located in arid climates such as Fort Huachuca, growth in nearby communities has resulted in increased competition for water. Urban growth often exacerbates the effects of other encroachment issues such as noise. The Army is aware of noise sensitivities in communities surrounding Fort Drum, NY; Fort Sill, Oklahoma; Fort Bragg, North Carolina; Fort Carson, Colorado; Fort Campbell, Kentucky; Fort Hood, Texas; Fort Lewis, Washington; Fort Riley, Kansas; Fort Stewart, Georgia; and Fort AP Hill, Virginia. There is a particular challenge in managing noise issues related to the Aviation School and its extended flight training areas over and around Fort Rucker, Alabama. As populations around these and other installations continue to grow, the Army expects other encroachment concerns to intensify.”

Encroachment refers to the cumulative result of any and all outside influences that inhibit normal military training and testing (U.S. General Accounting Office, 2002, p. 1). To illustrate, human population growth around military installations is responsible for both past and present encroachment problems, and anticipated further growth is expected to further exacerbate such problems. Eight encroachment issues have been identified by DoD facilities, with three having specific connections to land use. They are: (1) under the authority of the Endangered Species Act, the designation of critical habitat on military lands; (2) the application of various environmental statutes to military munitions, including legacy unexploded ordnance and munitions constituents on training lands; and (3) unplanned or incompatible commercial or residential development (urban growth) around training ranges and installations (U.S. General Accounting Office, 2002, pp. 6-8; Van Antwerp, 2001, pp. 4-7; and Willard, 2002, p. 3). Encroachment-related concerns associated with critical habitat have been noted herein for the VEC on threatened or endangered species. In addition, munitions concerns in relation to impacts on surface water and/or groundwater have been described for the water resources management VEC.

Finally, to address concerns relative to urban sprawl, improving coordination and collaboration efforts related to managing urban growth will be required between military installations and local communities. To illustrate, the U.S. Marine Corps has developed a strategic plan to assist their Community Plans and Liaison Offices in becoming more proactive and effective in such coordination and collaboration efforts (Gardner, Corning, and Scheuer, 2004). Coordination and collaboration will be addressed in a later subsection herein.

4.12.3 Overview of Installation Land Use Planning

The following excerpted paragraphs from the PEIS on Army Transformation provide a useful background for understanding installation land use planning (U.S. Army Corps of Engineers, February, 2002, pp. 3–12 to 3–27). Included is information related to pertinent definitions, land use classifications, and examples of terrain settings.

Land use refers to the planned development of property to achieve its highest and best use and to ensure compatibility among adjacent uses. In the civilian sector, land use plans guide the type and extent of allowable land use in an effort to control and limit growth; maintain and improve social, cultural, and physical amenities; promote a stable economy; preserve agricultural lands; maintain scenic areas; supply adequate housing; ensure the availability of necessary public services and utilities; and protect specially designated or environmentally sensitive areas. These concepts apply, in part, to Army land use planning. Except for economic growth considerations, land use planning at Army installations proceeds toward the same ends. In the Army, land use planning is the mapping and planned allocation of the use of all installation lands based on established land use categories and criteria.

Army land use planning involves identification, evaluation, and implementation phases. In the identification phase, planners establish land use planning objectives and goals and develop a strategy for accomplishing the land use plan. The unique characteristics of each installation require separate formulation of land use objectives and goals. In the evaluation phase planners conduct a functional relationships analysis and actually prepare the land use plan. In the implementation phase, the land use plan is put to work to attain the identified planning objectives and goals. The actual land use planning process, referred to herein as the Real Property Master Plan (RPMP) process, is described in AR 210-20 and will be addressed later.

Army installation land use planning uses 12 general land use classifications. These roughly parallel the types of designations employed by counties and municipalities in the civilian sector. Like designations used in the civilian sector, the Army's land use classifications identify the principal kinds of facilities and activities to be found in particular areas of an installation. For example, Table 4.12-1 lists the Army's 12 land use categories; also shown are facility category groups typically appropriate to each land use category (U.S. Army Corps of Engineers, February, 2002, p. 3-14).

The Army holds real estate in every state. The variety of locations provides the Army with installations having terrain with the characteristics of the key environments of deserts, the arctic, jungles, and mountains. The Army's installations also contain lands that are classifiable as swamp/wetland, forest, open woodland/savanna, grassland prairie, and semiarid shrub/steppe. Because the majority of the Army's lands are dedicated to training and range uses, the array of terrain settings enables Army units to train in a wide variety of environments. Table 4.12-2 lists the terrain settings at a representative selection of Army installations (U.S. Army Corps of Engineers, February 2002, p. 3-16). As can be seen, in many instances, installations have multiple terrain settings within their confines.

Real estate consists of real property, facilities, and infrastructure and includes land and interests in land, leaseholds, standing timber, buildings, improvements, and appurtenances thereto. Facilities are the buildings, structures, and other improvements placed on the land to support the Army's mission. Infrastructure is the combination of supporting systems that enable use of land

and facilities (U.S. Army Corps of Engineers, February 2002, p. 3-15). Facilities, in general, are addressed herein in the facilities VEC, while housing is included in the socioeconomics VEC. Infrastructure includes water, wastewater, and storm water systems that are addressed in the water resources management VEC. Energy systems, another example of infrastructure, are addressed in the energy VEC. Finally, transportation systems are the focus of the transportation VEC.

4.12.4 The Real Property Master Plan

An installation's RPMP, which typically covers a 20-year planning horizon, is focused on the management and development of real property resources. This plan should contain information that is vital for addressing cumulative effects on land use. It analyzes and integrates the plans prepared by the DPW (Directorate of Public Works) and other garrison staff, mission commanders and other tenant activities, higher headquarters, and those of neighboring communities to provide for orderly development, or in some cases, realignment and closure, of real property resources (U.S. Department of the Army, AR 210-20, May 2005, p. 35)*.

Airfield Land Use	Landing and takeoff area, aircraft maintenance, airfield operational and training facilities, and navigational and traffic aids
Maintenance Land Use	Depot maintenance, installation maintenance, Table of Organization and Equipment (TOE) unit maintenance
Industrial Land Use	Production; research, development, and test facilities; potable water supply, treatment, and storage; electric power source, transmission, distribution, substations, and switching stations; heat sources, transmission lines, and distribution lines; sewage and industrial waste treatment and disposal; sewage and industrial waste collection; and parking areas
Supply/Storage Land Use	Installation ammunition storage, depot ammunition storage, cold storage, general-purpose warehouse, controlled-humidity warehouse, flammable materials storehouse, fuel storage, engineer material storage, medical warehouse, unit storage, and salvage and surplus property storage
Administration Land Use	Installation command and control, directorates, tenants, organizational, and special
Training/Ranges Land Use	Training facilities, buildings; training grounds and facilities other than buildings; firing ranges, training; and firing ranges, research, development, testing, and evaluation
Unaccompanied Personnel Housing Land Use	Officer unaccompanied personnel housing, enlisted unaccompanied personnel housing, and visiting officers and soldiers quarters
Family Housing Land Use	Family housing
Community Land Use	Commercial and services
Medical Land Use	Hospital, dental clinic, clinic without beds, electric power source, heat source, parking areas
Outdoor Recreation Land Use	Recreation building, outdoor swimming pool, tennis courts, multiple court areas, baseball field, softball field, football field, and soccer field
Open Space	Unoccupied land, buffer and easement, and greenbelt

***Table 4.12–1**: Army Land Use Classifications*
(U.S. Army Corps of Engineers, February, 2002, p. 3-14)

Fort A.P. Hill, VA:	Forest swamp/wetland
Fort Benning, GA:	Swamp/wetland, forest, open woodland/savanna
Camp Blanding, FL:	Forest, open woodland/savanna
Fort Bliss, TX:	Desert, mountain, semiarid steppe
Fort Bragg, NC:	Forest, open woodland/savanna
Fort Campbell, KY:	Forest, open woodland/savanna
Fort Carson, CO:	Open woodland/savanna, grassland/prairie, semiarid steppe
Fort Chaffee, AR:	Forest, swamp/wetland
Fort Dix, NJ:	Forest, swamp/wetland
Fort Drum, NY:	Swamp/wetland, forest, open woodland/savanna, grass-land/prairie
Fort Hood, TX:	Open woodland/savanna, grassland/prairie, semiarid/steppe
Fort Indiantown Gap, PA:	Forest
Fort Irwin, CA:	Mountain, desert
Fort Knox, KY:	Forest
Fort Lewis and Yakima Training Center, WA:	Swamp/wetland, forest, desert, open woodland/savanna, mountain, grassland/prairie
Fort McClellan, AL:	Forest
Orchard Training Area, ID:	Semiarid steppe
Fort Pickett, VA:	Forest
Fort Polk, LA:	Forest
Fort Riley, KS:	Forest, grassland/prairie
Camp Shelby, MS:	Forest, open woodland/savanna
Fort Sill, OK:	Open woodland/savanna, grassland/prairie
Fort Stewart, GA:	Swamp/wetland, forest, open woodland/savanna
Schofield Barracks and Puhakuloa Training Center, HI:	Mountain, jungle, open woodland/savanna, semiarid steppe
Fort Wainwright, AK:	Mountain, swamp/wetland, arctic, forest, open woodland/savanna

Table 4.12–2: *Terrain Settings At Select Army Installations*
(U.S. Army Corps of Engineers, February, 2002, p. 3-16)

More specifically, "real property" can be defined as (U.S. Army Corps of Engineers, 2002, 3-22):

> "Real property refers to real estate owned by the United States and under the control of the U.S. Army. It includes the land, right, title, and interest therein and improvements thereon. The land includes minerals in their natural state and standing timber; when severed from the land, these become personal property. GSA (General Services Administration) has exempted growing crops from the definition of real estate when the disposal agency designates such crops for disposal by severance and removal from the land. Rights and interest include leaseholds, easements, rights-of-way, water rights, air rights, and rights to lateral and subjacent support. Installed building equipment is considered real estate until severed. Equipment-in-place is considered personal property."

An extended definition of real property is as follows (U.S. Department of the Army, AR 405-80, October 1997, p. 11):

> "Real property refers to: (a) any interest in land, together with the improvements, structures and fixtures, for example, installed equipment, located thereon and appurtenances thereto, under the control of the Army (interest includes leaseholds, easements, rights-of-way, water rights, air rights, and rights of lateral and subjacent support); or (b) improvements of any kind, structures and fixtures, for example, installed equipment, under the control of the Army when designated for disposition with the underlying land; or (c) standing timber and embedded gravel, sand, stone, or underground water under the control of the Army whether designated for disposition by the Army or by severance and removal from the land, excluding timber felled, water stored and gravel, sand or stone excavated by or for the government prior to disposition."

A RPMP is characterized by its multiple purposes. For example, such purposes include, but are not limited to, the following (U.S. Department of the Army, AR 210-20, May 2005, p. 6):

- Establish a vision and future direction for efficiently managing, acquiring, or reducing real property at Army installations in order to support the current mission, transformation, and management processes.
- Establish a mission-oriented installation, which may be in the battle space of the future that can react effectively to contingencies and still present a secure, high-quality environment.
- Provide soldiers, their families, civilians, retirees, and other users of an installation with the highest quality facilities attainable.
- Establish a framework for installation management to review allocation of limited resources that affect, or are affected by, the use of real property assets. This allows the review of alternatives such as privatization, enhanced use leasing, land swaps, or public/private ventures.
- Determine real property deficiencies and identify priorities and potential solutions.
- Coordinate real property master planning activities with local community development.
- Identify sustainability issues, activities, and actions that may have significant mission or environmental impacts.
- Ensure that installations have the carrying capacity to support assigned missions and have the capabilities to accommodate mission expansion or installation reconfiguration/realignments within existing boundaries.
- If required, ensure that garrison commanders are capable of executing well-planned, orderly, base realignment, cleanup, and closure activities to include establishing land use controls.

4.12.4.1 Process for Real Property Master Planning

RPMP comprises a continual, collaborative, and integrated process, primarily performed at the installation level and reflective of mission requirements, yet strongly influenced by the plans, guidance, and initiatives of higher headquarters. The process itself involves collecting, mapping, and evaluating planning information; integrating mission requirements; performing a set of analyses; and conducting extensive coordination, staff reviews, and deliberations. The process itself is depicted in Figure 4.12-1 (U.S. Department of the Army, AR 210-20, May 2005, p. 7). Seven steps are identified along with specific outputs, typical contributing inputs, and resultant components of the RPMP. The garrison commander is the key person in the initiation and completion of the planning process, and in the implementation of its components. In fact, the commander's vision/mission statement should define how the installation's mission will be currently supported and continued into the future.

An important feature of the RPMP process is the development of goals and objectives. Five basic concepts are used in the establishment of an installation's planning goals and objectives; they are (U.S. Army Corps of Engineers, 2002, p. 3-20):

- **Maximize Facilities Utilization.** The Army seeks to arrive at the optimal allocation of existing facilities, utilities, and transportation networks and information systems.
- **Maintain.** The Army seeks to maintain what it owns and to reduce its backlog of maintenance and repair.
- **Meet Regulatory and Environmental Concerns.** The RPMP process aids Army installation commanders in demonstrating leadership and complying with the letter and intent of federal, DoD, and Department of the Army policy guidance documents that govern or influence the practice of planning, including pollution abatement and energy management policies.
- **Renew.** Planning enables the orderly and cost-effective renewal of facilities, including their supporting infrastructure. Renewal may occur through rehabilitation, replacement, or elimination of deficiencies.
- **Provide New Facilities.** This alternative is the last resort for providing facilities. No new construction may be proposed in an RPMP that can be supported by existing underutilized adequate facilities, provided that the use of such facilities does not degrade operational efficiency.

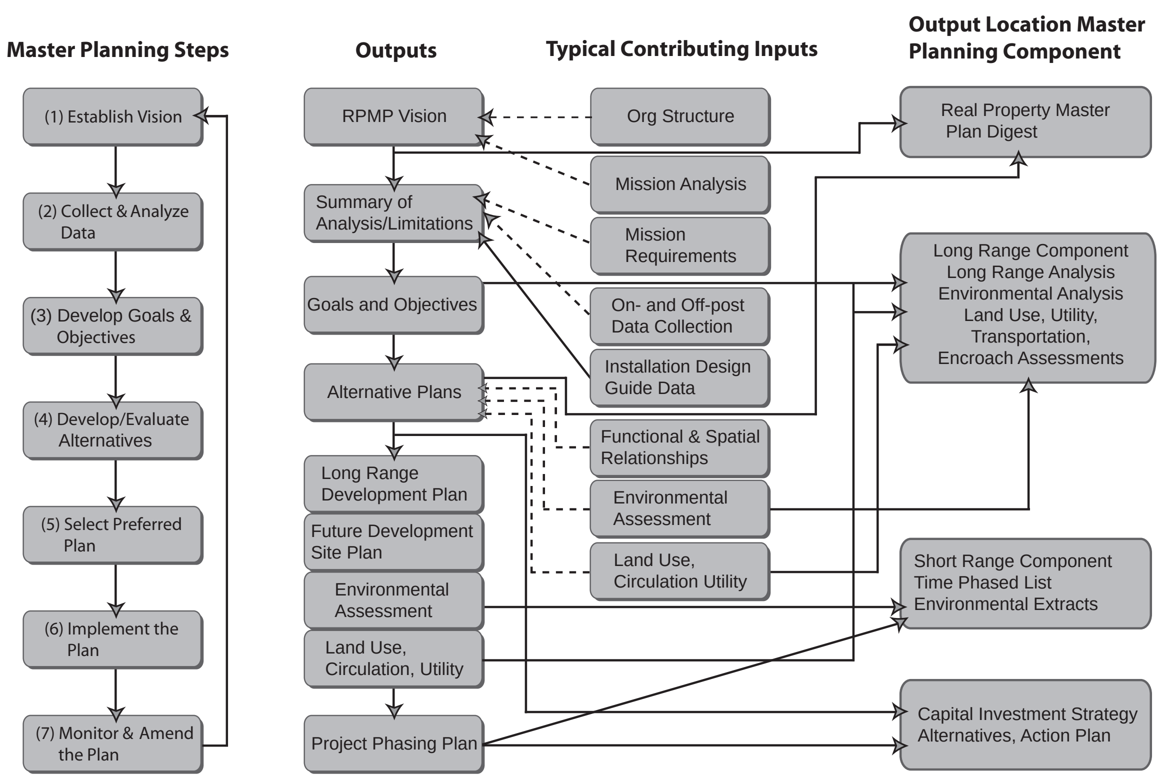

Figure 4.12-1: *Real Property Master Planning Process*
(U.S. Department of the Army, AR 210-20, May, 2005, p. 7)

While not depicted in Figure 4.12-1, it is routinely necessary to consider, approve, and implement changes in the RPMP. Such changes typically result from requests for land-use changes. In this case, a land-use change is a reconfiguration or relocation of an approved land-use zone, or the imposition of certain land-use controls. Land-use controls (LUCs) are defined as follows (U.S. Department of the Army, AR 210-20, May, 2005 pp. 33–34):

> "LUCs are any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health, safety and the environment. Physical mechanisms encompass a variety of engineered remedies to contain or reduce contamination and physical barriers intended to limit access to property, such as fences or signs. Legal mechanisms include restrictive covenants, equitable servitudes, and deed notices. Administrative mechanisms include notices, construction permitting, or land use management systems that may be used to ensure compliance with use restrictions. LUCs are used to mitigate either risks associated with exposure to contamination during or residual to cleanup, instead of eliminating those risks by removing or treating the contaminated media to unrestricted use levels. LUCs may be imposed either during or subsequent to an environmental response conducted under the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA), or corrective action under the Resource Conservation and Recovery Act. The term CERCLA applies to both surplus real property planned for transfer out of federal control and for active installations. LUCs are established through the coordinated efforts of the installation master planner, environmental officer, installation staff judge advocate, and director of plans and training, and approved by the garrison commander and the IMA region directorate. Land use plans will be annotated to reflect the LUCs and new land use if changed. During real property master planning of an Army installation, the real property master planner must consider limitations on potential uses of land associated with environmental contamination and cleanup. RPMP documentation will track LUCs imposed on installation land until it leaves federal ownership."

An installation's Real Property Planning Board (RPPB), while not specifically shown in Figure 4.12-1, provides assistance to the garrison commander in managing, developing, and in some cases realigning, cleaning up, and closing the installation or area facilities and real estate. Examples of the functions of the RPPB include, but are not limited to, the following (U.S. Department of the Army, AR 210-20, May 2005, p. 18):

- Coordination of installation real property master planning with adjacent and nearby installations or jurisdictional planning areas; other activities and land use of the DoD and federal agencies; federally recognized Indian tribes, recognized Alaskan native entities, and native Hawaiian organizations; local agencies and planning commissions of neighboring cities, counties, and states for mutual development concerns, encroachment issues impacting range operations and training, and environmental issues; and nongovernmental groups and associations, Native American tribes, businesses, and concerned individuals.
- Assisting in ensuring that the installation RPMP reflects changes in installation missions and the military community's current or future development plans, with full consideration of, and respect for, regional and local communities.

Specific requirements for intergovernmental coordination are found in Section 2-8 of AR 210-20 (U.S. Department of the Army, May 2005, pp. 10-11). Specific examples include:

- Garrisons will work with local and regional planning agencies to build close and harmonious planning relations. These include host nation (foreign) governments, federal agencies and other DoD departments, federally recognized Indian tribes, federally recognized Alaskan native entities, and native Hawaiian organizations, state and local governments, and nongovernmental organizations. These relations are instrumental to establishing regional compatible land use, influencing surrounding communities and landowners, and demonstrating the garrison commander's commitment to being a good neighbor. RPMPs for installations within the United States will be submitted for intergovernmental review to the agencies, groups, organizations, and persons that are affected by RPMPs, in accordance with the process established by the IMA. Any RPMP will be coordinated with communities surrounding the installation to:

    (1) Minimize impacts of installation operations and development or base realignment actions on those communities.

    (2) Maintain awareness of, and respect for, the future growth patterns and development of the surrounding communities.

    (3) Seek mutual compatible land uses and zoning considerations to maintain the operational capability and future viability of the installation.

- When there is combined interest from local government, the community, and the Army garrison commander in coordinated comprehensive land use planning or where encroachment is or has the potential of becoming a serious impediment to the future viability of the installation, the garrison commander should consider participating in a Joint Land Use Study (JLUS). The JLUS Program is sponsored by the Office of Economic Adjustment and the Office of the Secretary of Defense (OSD). Both the installation and the local communities benefit. Mutual goals can be achieved and not at the expense of any of the parties involved. Participation in this program is voluntary but encouraged. However, where it is in the Army's best interest to protect installation operational areas from encroachment and a JLUS will not work, the garrison commander will consider implementing an Army Compatible Use Buffer (ACUB). An ACUB is a formal agreement between the Army and eligible entities for acquisition by the entities of land or interest in land and/or water rights from willing sellers.

4.12.4.2 Information Needs for Real Property Management Plans

On-post, off-post, and mission requirements information is needed for both the original development and updating of RPMPs. This information is relevant to Steps 1 (identify cumulative effects issues), 4 (identify other actions), and 5 through 7 (describe the affected environment) of the CEQ's 11-step process. Collection and analyses of such information should be both thorough and systematic. Illustrations of such efforts include the following (U.S. Department of the Army, AR 210-20 May, 2005, p. 15):

- On-post data consisting of existing natural and manmade conditions, including potential limitations to future development, should be collected and analyzed. The natural environment, particularly those elements that may create significant limitations on operation or construction of buildings, roadways, utility systems, runways, training ranges, or other facilities, should be evaluated, along with geology, soils, topography, hydrology, vegetation, and wildlife. The human environment, including the historical and archaeological setting, current and forecasted demographics, military community services, outdoor recreation areas, training ranges, and maneuver areas, should also be analyzed. Elements that contribute to safety and health on the installation should be identified, and existing land use patterns should be used to identify spatial relationships and land availability. Finally, land use areas should be categorized.

- Off-post information should be collected and analyzed to identify regional and vicinity conditions that affect the installation. Existing regional and vicinity maps and data should be reviewed for impacts. Regional transportation systems (roads, railroads, commuter mass transit systems, and airports), socioeconomic conditions, demographic patterns, and community land use and planning should also be analyzed. Finally, assessments of community services, land leases/easements, and federal support services should be accomplished.
- Mission requirements information should be assembled and used to establish land and facility support requirements and then compared against on- and off-post data analyses to establish limitations and conditions that directly affect the installation's ability to carry out its missions. Real property inventories or surveys establishing both gross and net square footage of facilities should be collected or conducted. Existing land use and land use restrictions should also be analyzed. Installation-specific and headquarters-driven plans and planning guidance should be assembled and analyzed. This information is integral to an RPMP and provides the basis for identifying future development plans.

A large number of existing plans and information sources are typically available and useful in fulfilling the above requirements. Examples of such available documents at an installation include, but are not limited to, the following (U.S. Department of the Army, AR 210-20, May 2005, p. 15):

- Various HQDA, MACOM, and IMA plans, guidance and initiatives
- Existing conditions maps
- Real property inventory
- Integrated natural resources management plan
- Integrated cultural resource management plan
- Environmental management plans such as the integrated pest management plan and the water resource management plan
- Utility systems studies and plans
- Critical infrastructure protection and force protection plans
- Range Complex Master Plan and Range Development Plan
- MACOM live-fire training investment strategy
- MACOM materiel fielding plan
- Information systems plan and plant-in-place information systems maps
- Regional and community development plans
- Land use control/management/implementation plans

Spatial data are required to conduct various analyses and to serve as a basis for decision making in the real property master planning process. Examples of spatial data themes and representative data layers are shown in Table 4.12-3 (U.S. Department of the Army, AR 210-20, May, 2005, p. 23). It should be noted that several of the themes identify a spatial data boundary that encompasses 20 miles beyond the installation boundary. Further, the themes encompass demographics, political jurisdictions, land usage, biophysical factors, and critical infrastructure such as roads and energy systems.

From an environmental perspective, environmental overlays are used to graphically demarcate all areas in which installation development should be limited or should not occur at all.

Reasons for limitations or non-allowable developments are typically associated with environmentally sensitive areas that are on or near the installation itself. The environmental overlay data must be integrated with the range complex master plan operational overlay; thus these data become part of long range component (LRC) of the RPMP. Typical environmental overlay data layers include, but are not limited to the following (U.S. Department of the Army, AR 210-20, May 2005, p. 16):

- Threatened and endangered species
- Danger zones
- Flood plains
- Wetlands
- Surface and subsurface hazardous material storage or contaminated areas
- Pesticide storage areas
- Pesticide sensitive application facilities and areas
- Former firing ranges and impact areas
- LUCs
- Ammunition and chemical storage areas
- Safety buffers

- Noise contours
- Low altitude aircraft operation corridors
- Quantity safety distances for storage of explosives
- Areas proposed for disposal/deconstruction
- Desirable and undesirable land use features off the installation
- Open/closed landfills
- Cultural resource/archaeological sites

Data for many of the above layers are found in other installation documents such as the ESMC, the Water Resources Management Plan (WRMP), the Installation Compatible Use Zone (ICUZ) report for noise, the INRMP, and the ICRMP.

Data theme	Description	Example layers
Imagery	Multispectral satellite or airborne photography used for general mapping and mapping of land use and land cover within 20 miles of installation boundary	Landsat thematic mapper IKONOS (satellite) SPOT (satellite) Digital ortho photos
Demographics	Human populations and changes to these populations over time within 20 miles and all counties surrounding the installation	Census Bureau and TIGER data sets. Land use change maps Population change maps
Political	All political and jurisdictional data sets within 20 miles and all counties and states surrounding the installation	State and county boundaries Cities and towns
Land use	All factors affecting current and future land use within 20 miles and all counties surrounding the installation	Zoning Land ownership Property lines
Physical setting	Geography, topography, hydrology, and ecological setting of installation and surrounding area within 50 miles and all counties surrounding the installation	Geology Contours and digital elevation maps Rivers, lakes, oceans Current and past land cover and land use
General reference	Information and data required for common referencing and location of features on and surrounding the installation	Benchmarks Ground control points Reference base map
Critical Infrastructure	Features on and around the installation necessary for force protection and emergency response	Medical/hospitals Transportation/roads Buildings Power/energy Real estate Utilities Police/security

***Table 4.12-3**: Typical GIS Data Themes for a RPMP (U.S. Department of the Army, AR 210-20, May, 2005, p. 23)*

4.12.4.3 Evaluation of Alternative Plans within the RPMP

As shown in Figure 4.12-1, the identification and evaluation of alternatives is a central feature of the real property master planning process. The development of alternatives requires the consideration of functional and spatial relationship concepts, tempered by the reality of existing facility locations and the off-post and on-post environment. Alternatives depicting the long-range development of the installation, including arrangement of functional land use areas, circulation, and utility systems, should be developed. More specifically, the following types of alternatives should be considered in the development process (U.S. Department of the Army, AR 210-20, May 2005, pp. 8–9):

- Alternatives will address new mission requirements; improvements to, replacement of, or relocation of existing mission support facilities; and implementation of installation design standards.
- Alternatives must evaluate projects for impacts on conditions, installation support capabilities, and environmental impacts.
- Each alternative may be based on a theme or point of emphasis to allow comparisons and tradeoffs.
- Various alternatives will be defined and evaluated to satisfy deficiencies, eliminate excesses, and satisfy structural and nonstructural needs.
- Nongovernmental construction or shared cost/benefit alternatives, such as privatization, enhanced use leasing, public/private ventures, and so on, should be considered first, before introducing military construction as the solution. Leasing

facilities (off post or brought on post) may be a cost-effective option, particularly for short-term requirements.

Following the systematic evaluation of the developed alternatives, the preferred long-range development plan will be selected from the alternatives. The long-range future development site, land use, circulation, and utility service plan elements of the LRC will be refined to reflect all physical systems that support the installation. The various facility requirements will be translated into building "footprints," utilizing appropriate siting considerations. Short-term stopgaps and recommended long-term solutions will be identified to satisfy land use and real property requirements. These solutions will be reflected in the area development plans of the installation RPMP Digest and the LRC. From the site plan, a project phasing plan will be developed that shows short-range facility requirements (U.S. Department of the Army, AR 210-20, May 2005, p. 9).

4.12.4.4 Components of the RPMP

The RPMP is typically organized into five components – the Real Property Master Plan Digest (RPMPD), the Long Range Component (LRC), the Installation Design Guide (IDG), the Capital Investment Strategy (CIS), and the Short Range Component (SRC). The RPMPD provides the vision, goals, and objectives for the management and development of an installation. It is also an extract of the most important master planning concepts, details, and facts of the installation RPMP. It describes the thrust of an installation's real property development, its constraints and opportunities, and the path to achieving the long-range goals for the community. It is not just a summary of an RPMP but also provides analyses and can serve as a decision-support document (U.S. Department of the Army, AR 210-20, May 2005, p. 12).

The LRC establishes the environmental baseline, basic framework, and specific options for developing and managing real property on the installation. This includes an integrated strategy for infrastructure assurance to support mission requirements and sustainable development. It also provides the basic real property data upon which other business function plans can be built. The documents that comprise the LRC include (U.S. Department of the Army, AR 210-20, May 2005, p. 13):

- Long-range analysis (narrative). The LRC narrative describes current and future real property requirements and conditions. The analysis is based on review of existing real property assets and a determination of required future property requirements to support assigned or potential missions. The analysis will also address installation carrying capacity.
- Environmental quality and natural and cultural resources baseline analysis (narrative and graphics).
- Land use analysis and plan (narrative and graphics). This portion will show the relationships and use of installation land by generalized areas including: family housing, troop housing, range and training, retail, parks and recreation, schools, transportation, industrial, and natural and cultural environmental sites.
- Utilities assessment (narrative and graphics). If a utility system has been privatized, obtain information from the utility provider to include current usage, upgraded and abandoned lines (size and location), and future available capacity.
- Transportation assessment (narrative and graphics). Because transportation systems and traffic patterns are an integral part of both garrison and surrounding community planning efforts, coordinate installation road network changes or new requirements affecting off-post traffic patterns with the Surface Deployment and Distribution Command per AR 55-80.

- Assessment of environmental effects (narrative and graphics). A RPMP is a decision document with potential long-lasting impacts. Therefore, potential environmental impacts of implementing a RPMP must be addressed formally. The assessment will follow the formal NEPA process resulting in an EA or EIS that can then serve as the basis for RPMP projects, garrison operations, or for other installation EAs.
- Assessment of potential encroachment on an installation's boundaries that may impact the future viability of the installation to perform assigned missions. This evaluation may be part of the EA or EIS and must include cross boundary annoyances such as noise and dust. Public safety must also be a consideration.
- Supporting graphics such as a regional plan, land use plan, future development plans (includes buildings and structures, roads, utilities if appropriate, communications, land acquisition, and so on), existing conditions maps (for example, buildings and structure site maps, road network maps, railroad network maps, utilities maps, topographic maps, vegetation maps, airfield map if appropriate, demolition/disposal, installation compatible use, and so on), environmental overlays (includes data and graphics describing environmentally sensitive areas, wetlands, threatened and endangered species habitats, protected natural or cultural features, land use controls, and so on), and a range complex master plan.

As can be inferred from the above listed documents or information comprising the LRC, they all have relevance to an analysis of cumulative effects on land use.

The IDG provides specific guidance on the architectural character of, and exterior and interior design parameters for, the installation. All installation improvements, renovation projects, and new construction will comply with the IDG. The IDG will be prepared in accordance with the Army Installation Design Standards posted on the ACSIM Web site, using the model format provided. The overall purpose of the IDG is to promote visual order, enhance the natural and manmade environments through consistent architectural themes and standards, and improve the functional aspects of the garrison (U.S. Department of the Army, AR 210-20, May 2005, pp. 13–14).

The CIS is the garrison commander's overall strategy for using and investing in real property to support installation missions and Department of the Army objectives. It describes permanent comprehensive/holistic solutions, as well as short-term actions necessary to correct deficiencies, and to meet real property requirements in a manner that assures infrastructure reliability and contributes to sustainable development (U.S. Department of the Army, AR 210-20, May 2005, p. 14).

Finally, the SRC integrates real property master planning into the Army's budgetary and operational planning processes through the current budgetary planning period. More specifically, the SRC should incorporate recommended real property master planning activities into the Army's resource management process (U.S. Department of the Army, AR 210-20, May 2005, p. 14).

4.12.4.5 NEPA Compliance

The development or updating of a RPMP is required to embody the goals and objectives of NEPA with emphasis on environmental awareness, public review of planning proposals that do not compromise security, sustainable design and development, historic sites and buildings, and archaeological and natural resources. A formal EA or EIS, prepared in accordance with NEPA requirements is to be assembled in conjunction with developing a RPMP. All planning proposals that are reflected in the installation RPMP should be analyzed for potential environmental effects. Optimally, planning proposals should be "tiered" to the RPMP NEPA documentation. A RPMP-related EA or EIS could serve as the basis for all subsequent EAs or EISs for the installation (U.S. Department of the Army, AR 210-20, May 2005, p. 10).

4.12.5 Real Property Management

Real property management at an installation may involve land divestment and/or acquisition, land improvements, and the use of various types of "interests" in real estate. Table 4.12-4 contains definitions of key terms related to real property management at installations (after U.S. Army Corps of Engineers, 2002, p. 3-22). While these terms and others are defined in the Excess Lands VEC herein, they are included again for the Land Use VEC to provide contextual information. Examples of various types of interests in real estate (real property), which could be used to acquire land, include the following (U.S. Army Corps of Engineers, 2002, p. 3-25):

Easement	A right to use the land of another for a special purpose.
Excess Real Estate	Any real property under the control of any federal agency that is not needed for the discharge of agency responsibilities
Fee	Real estate for which an owner has all right, title, and interest. A fee estate is without condition, limitation, or restriction. Title to most U.S. real property is held in fee.
Fee Owned	Real property for which the United States has all right, title, and interest, rather than a partial interest.
Improvements	An addition to land amounting to more than repair or replacement and costing labor or capital (e.g., buildings, pavement, pipelines, and other structures more or less permanently attached to the land).
Ingrants	Property acquired for Army use by lease, license, or permit.
Leasehold	An estate in realty held under a lease for a fixed period of time. A lease is a contract for exclusive possession of property for a determinate period. The lessor grants a leasehold in consideration of a return of rent.
License	An authority to do a specified act on the property of another without acquiring any estate or interest in that land.
Nonexcess Property	Property required for an Army mission but proposed for sale to obtain proceeds in an amount sufficient to fund acquisition of replacement land or facilities.
Nonusable Condition	Used to describe a facility as unserviceable because it has deteriorated to the extent that it needs extensive restoration, is a danger to the health and safety of personnel, or might damage equipment
Option	A right to purchase real estate at a specified price during a stipulated period of time.
Permit	A temporary authority given to a government agency to use real property under the jurisdiction of another government agency.
Personal Property	Any property not considered real property.
Public Domain	Land or interest in land owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management, without regard to how the United States acquired ownership, except lands located in the Outer Continental Shelf and lands held for the benefit of Native Americans.
Reassignment	Change of jurisdiction over real estate from one command or agency to another within the Department of the Army
Surplus Real Estate	Any excess real property not required for the needs and discharge of the responsibilities of all federal agencies, as determined by the GSA administrator.
Transfer	Change of jurisdiction over real property from one federal agency or department to another, including military departments and defense agencies.
Withdrawn Public Lands	Public domain held back for the use or benefit of an agency by reservation, withdrawal, or other restriction for a special governmental purpose.

***Table 4.12-4**: Definitions of Terms Related to Real Property Management*

Specific information on the acquisition of real property and interests therein is contained in AR 405-10 (U.S. Department of the Army, 1970, p. 1)*. This AR delineates the authority, policy, responsibility, and procedures associated with such acquisitions and interests. The prerequisites for applying this AR are that the activity to be accommodated is essential to an assigned mission; real property under the control of the Army is inadequate to satisfy the requirement; and no real property under the control of the Navy or Air Force or other federal agency is suitable and available for use by the Army on a permit or joint use basis.

AR 405-80, entitled “Management of Title and Granting Use of Real Property”, sets forth the authority and prescribes policies for management of the title to real property under the jurisdiction or control of the Army, granting the use of that real property to non-Army users, and oversight of unauthorized uses of that real property (U.S. Department of the Army, AR 405-80, October 1997)*.

The policies and procedures for the disposal of military and industrial real estate under the custody and control of the Army worldwide are contained in AR 405-90 (U.S. Department of the Army, 1985, pp. 1-2)*. The identification of excess property at an installation can occur as a result of normal planning and review processes, base reductions and realignments, responses to disposal actions identified under the requirements of EO 12348, the Bureau of Land Management withdrawal review program in certain states (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), and/or determinations associated with Army reserve centers located on other than a U.S. armed forces command installation.

A unique issue related to the disposal of excess property is associated with situations wherein the property is contaminated with explosive hazards, unexploded ordnance, toxic chemicals, or biological, radioactive, or other hazardous substances. Appendix D of AR 405-90 addresses various procedures for determining the nature and extent of actual or suspected contamination, and, if necessary, the proposed method of decontamination.

Three options for disposal of excess property may result from determinations of contamination. They include “no decontamination needed” if the purchaser has operations that will be similar to prior site operations, and the purchaser agrees to conduct its operations in accordance with applicable regulations, or who agrees to perform the necessary decontamination. A second option relates to excessing with restricted use. This option requires MACOM to be accountable and to perform the decontamination and obtain appropriate “statements of clearance” from federal and/or state agencies. The third option is to excess the property with unrestricted usage. Again, the accountable MACOM is to perform the decontamination, obtain appropriate “statements of clearance”, and procure various internal clearances (U.S. Department of the Army, AR 405-90, 1985, p. 12).

4.12.6 “Quick Look” Questions

“Quick look” questions can be used to determine the need to address the direct and indirect effects of a proposed action on land use; in addition, they can be used to determine if cumulative effects also need to be considered. These “quick look” questions include:

- Is the RPMP for the installation more than five to 10 years old and, if so, is the RPMP subject to current updating/modification efforts?
- Are Land Use Controls utilized within the RPMP?
- Is there extensive usage of on-post lands for recreational (e.g., hunting and/or fishing) purposes?
- Has a recent (last five to 10 years) Joint Land Use Study (JLUS) been conducted via a collaborative effort between the installation and nearby towns and cities?
- Is there continuing cooperation and collaboration regarding land usage between the installation and local and regional governmental agencies and other stakeholder groups?
- Are there any historical or current conflicts between the installation and various governmental agencies, and/or stakeholder groups relative to on-post or off-post land usage?

- Is there any evidence of current or anticipated encroachment or urban sprawl that might have implications relative to on-post land usage?
- Will the proposed action(s) require on-post land use classification changes that exceed plus or minus five percent? (See Table 4.12-1 for Army land use classifications).
- Will the proposed action(s) require land acquisitions and/or disposal of excess lands?
- Is there an existing sustainability program for the installation, and does it address sustainability considerations in site selections?
- Does the installation currently have contiguous buffer zones or conservation easements?

If the answers to all of the above questions are "no," then it will probably not be necessary to address the direct, indirect, and cumulative effects of the proposed action. However, if one or more of the above questions has a "yes" or "do not know" answer, then attention will need to be given to all three types of effects. Conversely, a "yes" or "do not know" answer does not automatically trigger an EIS. Consideration should first be given to the preparation of an EA for the proposed action.

At the EA level, attention needs to be given to the four scoping steps (Steps 1-4) described below, and Steps 6 and 7 related to describing the affected environment. Documentation of the findings from these steps could serve as a "hard look" if it is determined that an EA is appropriate. However, if concerns are identified from consideration of Steps 1-4, 6 and 7, then an EIS would be appropriate. For an EIS, all 11 steps described below should be addressed.

4.12.7 Impact Analysis Steps

CEQ Step 1 –Identify the significant land use and public recreation effects issues associated with the proposed action and define the assessment goals.

The first step involves identifying the anticipated land use changes and potential modifications in public access that would be associated with the construction and operation of training range projects or activities, and garrison area projects or activities. The following documents should contain an abundance of information on land usage and on the types and frequencies of public recreational usage of the installation:

- RPMP, and particularly the LRC
- Integrated Natural Resources Management Plan
- Integrated Cultural Resources Management Plan
- Joint Land Use (JLUS)
- Access records related to public recreational usage of installation lands
- Land requirements and training frequencies associated with the proposed action(s); this information should be available from the Description of Proposed Action and Alternatives (DOPAA).

CEQ Step 2–Establish the geographic scope for the analysis.

The geographical boundaries for considering land use effects should include the installation wherein the training range and garrison area is located, as well as 20 miles out from the installation in all directions (the 20-mile boundary was specified in the RPMP). These boundaries should be chosen because they represent typical geographical boundaries used for land use planning at Army installations. Key references that should be reviewed prior to specifically establishing the geographic scope include:

- General information on the location of the physical boundaries of the installation and associated ranges, the boundaries of adjacent easement lands, and land uses and boundaries of adjacent non-Army lands.
- Counties associated with and/or contiguous to the installation, including interstate and international areas as appropriate.
- Geographic boundaries of designated areas of concern in relation to environmental resources and/or the application of LUCs. This information can be obtained via contacts with the DPW, regional or state offices responsible for land use management planning, and federal agencies as appropriate.

CEQ Step 3–Establish the time frame for the analysis.

The temporal boundaries should include consideration of past and future actions that may have influenced land uses within the above-delineated spatial boundaries. However, no specific requirements have been developed for the time period to be encompassed by the retrospective and prospective boundaries. Some practical questions to ask or things to consider in establishing the historical boundary (reference point in time) include:

- When were the installation and associated training ranges established, and when have historical mission changes or modernizations occur? Have range expansions or reductions occurred in the past, and when did they take place?
- When was the first land use inventory and RPMP compiled for the installation and associated range(s)? How frequently has the inventory and RPMP been updated?
- Has a land use and/or public recreational access monitoring program been established for the installation? If so, when did it start and has the program evolved over time relative to land use classifications? Have public access locations been monitored and where the locations of monitoring stations?

Based upon the answers to the above questions, identify the earliest date and use it as the initial historical reference point.

Some practical questions to ask or things to consider relative to a future time horizon include:

- What is the time period required to “modernize” the installation and range(s), and what is the anticipated period of use of the completed modernized range or ranges?
- What are the military construction plans for the installation over the next two, five, and 10 years? It should be noted that the RPMP process uses a 20-year planning horizon.
- Are any major changes in the installation mission anticipated, and if so, when will such changes occur?

Depending upon the answers to the above questions, establish the most distant time as the initial prospective reference point to encompass future actions.

CEQ Step 4–Identify other past, present, and reasonably foreseeable future actions that have affected, or are anticipated to affect, land uses and public recreational access.

The identification of past actions can be aided by the review of historical land use information for the installation. Such reviews can highlight both contributing past actions as well as land usage and quality trends in both garrison areas and training ranges. Several installation-specific plans and reports can be useful in Step 4. For example, the earlier-mentioned RPMP, INRMP, and ICRMP should be reviewed.

Both on-post and off-post past and present actions affecting land use issues could be identified via the use of historical aerial photographs and the delineation of typical land uses associated therewith (these actions can include those by the Army, nearby industrial developments, and urban area growth). In addition, land use plans for federal agencies with land holdings in the study area should be reviewed (e.g., other military services, the U.S. Forest Service, and U.S. Department of Agriculture). Also, any Indian land holdings in the study area should be identified.

Present (current) actions include both on-going past actions and new actions that may be in the construction stage. Information related to these actions can be procured from the range DPW, the planning departments of local towns and cities, and other federal and state planning agencies. These same information sources could be used to identify reasonably foreseeable future actions within the future temporal boundary for the study. The likelihood of future actions and the time period of their potential occurrence should be considered.

Finally, depending on the scope and time of preparation of existing installation documents (e.g., the RPMP), it may be necessary to update these documents. If key documents have never been developed, it may be necessary to conduct such studies for the installation.

CEQ Steps 5-7 – Characterize the land uses and public recreational access identified in scoping in terms of their response to change and capacity to withstand stresses (Step 5); characterize the stresses affecting these land uses and access and their relation to regulatory thresholds (Step 6); and define a baseline condition for the land uses and access (Step 7).

The primary emphases of these three steps are related to historical trends in both on-post and off-post land uses and public access, and the compatibility of these uses with various management policies and goals. Key references that should be reviewed to accomplish these steps include:

- Historical and current reports on installation land use.
- Historical and current land use studies and reports from the state or in-state regional agencies wherein the installation is located.
- Historical and current land use management policies and goals.
- Historical and current tensions and conflicts related to land use and public recreation access.

Numerous sources of both on-post and off-post land use information exist throughout the United States, and three examples will be noted. First, the U.S. Bureau of the Census has, among other products, a population, land use, and emissions data project focused on linking a range of georeferenced demographic and other socioeconomic data products with remote sensing data related to land cover and use (http://sedac.ciesin.org/plue/). Further, the U.S. Geological Survey has Land Use and Land Cover (LULC) data files which describe the vegetation, water, natural surface and "cultural" features on the land surface (U.S. Geological Survey, 2001). These files, which are part of the National Mapping Program, classify the land use and land cover into nine first level and appropriate related second level categories. The first level categories include urban or built-up land, agricultural land, rangeland, forest land, water, wetland, barren land, tundra, and perennial snow and ice (http://edcwww.cr.usgs.gov/glis/hyper/guide/1_250_lulc).

Finally, the U.S. Department of Agriculture conducts its National Resources Inventory every five years (most recent was 2002); the inventory measures the actual use of land rather than population density. From this information, the amount of urbanized land in every county in the contiguous United States can be estimated. This information can be used as an indicator of local encroachment and urban sprawl.

From a programmatic standpoint, Step 7 (Develop a Description of the Historical Baseline Regarding Land Use Issues) could be accomplished using the following approach:

- Describe historical land uses and trends, and public recreational access and trends, in the study area.
- Delineate the history, as appropriate, of land use-related laws, regulations, or ordinances.
- Describe any historical studies of land use issues within the study boundaries. A USGS report on Land Use History of North America could be used; this report can be downloaded from following Web site (http://biology.usgs.gov/luhna/cover.html).
- Summarize and describe historical trends information regarding land use categories and public recreational access information.

Steps 5 and 6 of CEQ's 11-step process (Characterize the Potentially Affected Resources, Ecosystems, and Human Communities in Terms of Their Response to Change and Capacity to Withstand Land Use Issues and Characterize Existing Stresses Affecting Human Communities and Their Relationship to Applicable Regulatory Thresholds) could be accomplished using the following approach:

- Assemble descriptive information related to the effects of land use changes on natural resources and ecosystems, and on the development of human communities.
- Describe the "institutional capacity" of cities and towns in the study area to respond to land use issues.
- Identify public works and infrastructure needs as delineated in planning documents from the cities and towns within the study area.
- Summarize applicable numerical standards, requirements, or policies as contained in federal, state, or local land use-related laws, regulations, or ordinances. Give particular attention to local "smart growth" plans as they relate to the study area.
- Regarding regulatory thresholds and significance determinations, use comparisons to pertinent planning standards, policies, or goals; relative rates of change in the land use categories or other indicator measures; comparisons based on spatial averages across the study area; and comparisons based on temporal averages across the study time period.

CEQ Step 8–Identify the important cause-and-effect relationships between human activities and land usage and recreational access.

The inferred cause-and-effect relationships as noted in Step 8 can be depicted in several ways, including maps showing land uses and areas of conflict, and public recreation areas and areas of current conflict. Network diagrams and connector tables (matrices) could also be developed to depict various actions and types of effects.

CEQ Step 9–Determine the magnitude and significance of cumulative effects on land uses and public recreational areas

Step 9 requires the selection and use of appropriate methodologies (tools) to ascertain the magnitude of cumulative effects on selected indicators of the land use VEC. While a quantitative determination of magnitude is desirable, it may be such that only qualitative (relative) estimates can be developed for some indicators. Further, this step involves the determination of the significance of the cumulative effects in relation to institutional, technical, and public considerations.

Two methodologies for determining the magnitude of land use changes are summarized comparatively in Table 4.12-5. Trends analysis relative to land uses, and historical and predicted future percentage changes in land uses could be used as indicators within both methods. In addition, both methods could be used in a given study; however, the trends analysis approach involving GIS would probably be preferable in most cases.

As noted earlier in relation to the RPMP process, a GIS is an important tool for addressing historical and current land uses and potential land use changes from training activities and infrastructure changes. The GIS tool can be used to quantitatively determine land uses within various categories for historical, current, and future conditions. Both quantitative changes as well as percentage changes can be developed from GIS usage.

In addition, GIS can be used to examine the effects of off-post encroachment on regional land uses and recreational opportunities. Further, as encroachment occurs, the relatively unchanged landscapes on military installations are called upon to support even more protected and endangered species. To illustrate the species connection, the U.S. Navy has used ArcGIS (a specific GIS system) to conduct a critical habitat analysis at a base in the Northwest Region of the United States. The results were used to support endangered species management activities at the base (Spagnuolo, 2002).

Determining the significance of cumulative land use effects can be based on the following considerations:

- Compliance with the land use designations and requirements of the RPMP.
- Consideration of the historical and existing conditions of the installation land uses in relation to anticipated changes in these uses from the proposed action and other reasonably foreseeable future actions.

Method	Advantages	Limitations
Trends analysis of land use categories and other Indicator measures (GIS can be useful tool)	● Provides historical context of changes ● Easy to understand ● Easy to accomplish ● Can be used to identify improving or worsening trends ● Applicable at the programmatic level	● Assumes availability and comparability of historic data for land use categories and indicator measures ● Collection of data can be time consuming ● May not reflect all indicator measures for land use effects ● Predicted trends may not follow historical trends
Review and analysis of historical land use maps and aerial photography	● Provides historical context of changes ● Easy to understand ● Easy to accomplish ● Can be used to identify "stresses" on land use ● Applicable at the programmatic level	● Analysis must be systematic and consistent, thus it can be time consuming ● Collection of maps and photographs can be problematic ● Will not necessarily reflect all identified indicator measures ● Predicted trends may not follow historical trends

Table 4.12-5: *Comparisons of Methodologies for Determining Land Use Impact Magnitude*

Relative to significance determinations, there is growing interest in using "broader scale" considerations of environmental sustainability. Accordingly, two such methodologies are described herein. First, a Resource Capability Model (RCM) has been proposed for the U.S. Air Force for use in assessing the "adequacy" of environmental, airspace, and spectrum resources at their installations (Rowe, et al., 2004). The RCM requires a comparison of resource requirements for the installation against the availability of such resources for airspace, airshed emissions availability, surface and subsurface land access, surface and groundwater access (supply), surface water discharge availability, and frequency spectrum. A resource readiness or adequacy rating is then assigned via use of a consistent protocol. The surface and groundwater resources were described in the Water Resources Management VEC; and airspace resources were addressed in the earlier VEC on airspace.

The RCM includes five defined metrics related to land use and surface land access. They are (Rowe, et al., 2004):

- Land – Current Off-site Compatible Acres – Quantifies compatible and incompatible areas within off-installation or range noise and safety buffers. Evaluates current compatibilities and incompatibilities within operationally required areas.
- Land – Projected Off-site Compatible Acres – Quantifies future compatible and incompatible acres within off-installation or range noise and safety buffers. This metric evaluates projected future compatibilities and incompatibilities within operationally required areas for the time period of five years out.
- Undeveloped Acres – Entire Installation – Quantifies the percentage of undeveloped acres within the installation.

- Land – Developable Acres – Quantifies the degree to which land within the boundaries of the infrastructure asset are available for development, taking composite constraints from encroachment and other factors in account.
- Land – Operational Acreage Adequacy – Quantifies the percentage of the undeveloped acres that are available for development taking into account various composite constraints from encroachment and other factors that would prevent or constrain development of the undeveloped acres.

As noted above, these metrics could be used to assess operational and resource requirements for land.

The land use readiness or adequacy rating includes consideration of both the resource deficiency and opportunity. The following rating scales are used for each metric (Rowe, et al., 2004; and Pease and Cornell, 2004):

- Resource Opportunity (RO) – RO3 – Major opportunities – greater than 140% above the breakpoint of matching resource requirements to availability
- RO2 – Significant opportunities – >120% to 140%
- RO1 – Some opportunities – >110% to 120%
- RR – Adequate (Minor opportunities or deficiencies) – 110% to 90%
- Resource Deficiency (RD) – RD1 – Some deficiencies – <90% to 80%
- RD2 – Significant deficiencies – <80% to 60%
- RD3 – Major deficiencies – <60%

(Note: the above percentages result from the comparison of resource availability to resource requirements, using 100 percent as the baseline for breakpoints)

Secondly, the U. S. Army Engineer Research and Development Center (ERDC – CERL) is developing a Sustainable Installations Regional Resource Assessment (SIRRA) methodology. The methodology incorporates 48 relative regional indicators for ten sustainability issues – air, energy, urban development (land use), threatened and endangered species, location, water, economy, quality of life, infrastructure (transportation), and security (Jenicek, et al., 2004). Of interest herein are the five indicators (or stressors) for urban development (land use) (Fournier, et al., 2002, pp. 30-31):

- Regional Population Density (Pt/Lt) – This indicator provides a measure of the population density of all counties adjacent to the installation. The indicator is found by dividing the total regional population (Pt) by the total regional land area (Lt) of all adjacent counties in square miles. The risk classes are Low (<100 pp/sq mi), Medium (100-250 pp/sq mi), and High (>250 pp/sq mi). A high population density surrounding a military installation is a strong indicator of potential encroachment issues. This can affect the type and intensity of training that can take place on the installation. This indicator calculation is based on data (both county populations and square mileages) accessible through the U.S. Census Bureau.
- Increasing Regional Growth Rate (P90-00/P80-90) – This indicator provides a measure of the rate of change of population growth of all counties adjacent to the installation from the decade of the 1980s to that of the 1990s. The indicator value is found by dividing the regional population growth rate from 1990-2000 (P90-00) by the regional population growth rate from 1980 to 1990 (P80-90). The risk classes are Low (<1), Medium (>1), and High (NA). An increasing rate of regional population

growth is a strong indicator of increased population pressure in the future leading to greater demands for services, access, resources, and land in competition with the military installation. This can affect the type and intensity of training that can take place on the installation. This indicator can be calculated based on information from the U.S. Census Bureau.

- Regional Population Growth (P2000/P1990) – This indicator provides a measure (in percent) of the population growth of all counties adjacent to the installation from 1990 to 2000. The indicator value is found by dividing the regional population in 2000 (P2000) by the regional population in 1990 (P1990). The risk classes are Low (<2%), Medium (2 to 7%), and High (>7%). The degree of regional population growth is a strong indicator of demand for services, access, resources, and land in competition with the military installation. This can affect the type and intensity of training that can take place on the installation. This indicator can be calculated based on information from the U.S. Census Bureau.
- Regional Land Urbanization (Lu/Lt) – This indicator provides a measure (in percent) of land urbanization within a 20-mile boundary surrounding the installation. The indicator value is found by dividing the amount of urbanized land (Lu) by the total land area (Lt). The risk classes are Low (<29%), Medium (29 to 35%), and High (>35%). The degree of regional development is a strong indicator of potential encroachment problems that can affect the type and intensity of training that can take place on the installation. This indicator calculation can be performed with Geographical Information Systems (GIS) using the National Land Cover Data available from the U.S. Geological Survey (USGS).
- State Smart Growth Plans – This indicator provides a measure of the presence of smart growth legislation in states in which an installation is located. The risk classes are Low (state has instituted smart growth), Medium (legislation is pending), and High (no legislation). The presence of a state smart growth plan is important because smart growth legislation can decrease the growth of urbanized land surrounding a military installation. This information is available from the American Planning Association.

The SIRRA methodology can be used as an evaluation tool for encroachment concerns at specific Army installations. Further, it can be used relative to the evaluation of the cumulative effects of new training initiatives on land use. The GIS-based SIRRA methodology draws upon data from open, well documented, national level sources, such as the U.S. Geological Survey, Bureau of Census, NatureServe, and the U.S. Environmental Protection Agency. This approach allows the use of national-level data to evaluate regional aspects of an installation’s setting. Such an evaluation provides additional information related to long-term issues that could threaten mission sustainment at a given installation (Jenicek, 2005).

Three additional examples for determining impact significance include the use of regional management goals, evaluation based on Installation Status Reports (ISRs), and the application of sustainability considerations in land use planning. First, regional management goals for land use, and who is responsible, can be used to determine impact significance. For example, regional and local management goals and land use policies and restrictions in federal or state or local laws and regulations related to economic growth and development, and/or environmental protection, should be identified. In addition, management goals and land use policies and restrictions in planning documents or policies prepared by state departments of commerce and/or industrial development, by pertinent councils of government, by federal agencies such as other military services, the Forest Service, Department of Agriculture, and Department of Transportation, and by cities and towns located in the study area should also be identified. Finally, pertinent policies from Executive Orders should also be considered. The key determination is the degree of compatibility between the anticipated on-post land use changes and the pertinent regional management goals.

AR 210-14, titled “The Army Installation Status Report Program,” established the requirement for periodic Installation Status Reports (ISRs) relative to three topical areas – infrastructure, environment, and services (U.S. Department of the Army, AR 210-14, January 2001). The infrastructure portion addresses the adequacy of facilities and utilities systems in five primary areas – mission facilities, mobility facilities, housing, community facilities, and installation support. Qualitative and quantitative evaluations are reflected in Condition Ratings (C-Ratings) that range from C-1 to C-5. A C-1 rating reflects a report element that requires little immediate attention, while a C-5 rating shows that an installation’s status is being degraded or that it is in a nonreportable status (i.e., pending base realignment and closure action). These ratings could be used in determining the potential environmental significance of anticipated land use impacts from various proposed actions.

Finally, the U.S. Army has embraced the concept that the process for development or alteration of the RPMP should incorporate principles of “sustainability” and “sustainable design”. Key definitions of these terms are as follows (U.S. Department of the Army, AR 210-20, May 2005, pp. 35-36)*:

- Sustainable design and development – Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Because many RPMP decisions have long-term impacts, sustainability must be included. The inter-relationship between environments, resources consumed, waste products, and use of facilities and land must be carefully designed and developed to preclude permanent damage to the future environment.
- Sustainment, restoration, and modernization – Applies to all real property regardless of appropriation. In general terms, it replaces real property maintenance, which normally only referred to work performed on real property using operations and maintenance funds. Sustainment maintains facilities in the current condition and includes regularly scheduled adjustments and inspections, preventative maintenance tasks, and emergency response for minor repairs. It also includes major repairs or replacement of facility components that are expected to occur periodically throughout the life cycle of facilities (for example, roofs, heating/cooling systems, and so on). Restoration and modernization improve facilities and are accomplished primarily with military construction (MILCON) but can be done with operations and maintenance funding, depending on the amount of new construction work in the project (note: current work classification and funding constraints still apply). Restoration improves existing facilities to current standards while modernization adapts existing facilities to meet new standards, which support new missions or equipment.

The following principles serve to expand the term sustainable development with specific illustrations associated with installations (U.S. Department of the Army, AR 210-20, May 2005, p. 24).

- Satisfies our needs and desires to improve our built environment while maintaining a balance with natural systems and their limited ability to accommodate that development.
- Strives to create a balance between the natural and built environments to ensure the long-term survival of both.

- Strives for no net loss to nature. Sustainable planning therefore seeks creative ways to interject the values and principles of sustainable development into our decision making process.
- Is an integral part of a garrison commander's installation sustainability program in that it will help to ensure the long-term viability of missions by reducing environmental impacts and managing resources. There are some basic concepts that apply to sustainable planning and should guide the real property master planning process, including: strive to enhance the relationship between the natural and built environments; establish the natural context as the framework for the built environment; endeavor to incorporate human development into the natural context at all scales; in all decisions, reconfirm the relationship of nature to the built environment; and use the continuous and iterative character of the planning process to emphasize sustainable development.

More specifically, Appendix 1 of Chapter 4.12 (associated with the Land Use VEC) includes 37 sustainability-related factors to be considered in developing an installation RPMP (U.S. Department of the Army, AR 210-20, May 2005, pp. 24–26). The 37 factors are grouped into five categories – sustainable sites, water efficiency, energy and atmosphere, materials and resources, and current mission. The listed factors can be used in both developing a RPMP, and as criteria for evaluating the significance of the anticipated impacts associated with various alternatives, including the preferred plan.

CEQ Steps 10 and 11 – Modify or add alternatives to avoid, minimize, or mitigate significant effects on land use (Step10), and monitor the land use effects of the selected alternative and adapt management (Step11).

Mitigation of land use effects may involve installation decisions only, or it could include both installation and off- installation measures, with the latter done in a collaborative manner with the state or regional planning agencies, other state or federal agencies, local towns and cities, and the private sector. Six examples of such mitigation measures are described in the following paragraphs.

The PEIS for Army Transformation identified several examples of mitigation-related actions that could be taken to minimize the effects that transformation might generate. Two of these examples were generally related to land use effects; they were (U.S. Army Corps of Engineers, 2002, pp. 4-34 and 4-35):

(1) Fostering a "Sustainable Environment" Ethic – The Army would continue on its present course to implement sustainability principles on both its ranges and the built environment, and with respect to actions taken that affect natural resources. Development of an Army-wide ethic that fosters considerations of sustainability is presently at an early stage with the initiation of facilities sustainable design and integrated, adaptive management of natural resources on an ecosystem basis.

(2) Using Best Management Practices – Best management practices are various site- and project-specific stratagems that planners, engineers, natural resources managers, and other professionals use to avoid or minimize adverse effects while carrying out projects. Best management practices include such actions as use of erosion control measures during construction, reliance on checklists, adherence to accepted protocols, and oversight of work by trained and experienced supervisors. Consistent use of best management practices reduces the risk of creating situations that might lead to consequences that would be adverse to the environment.

(3) Land Use Controls (LUCs)- At an individual installation level, land use controls (LUCs) represent a third illustration of mitigation measures. Section 4.12.4.1 provides a comprehensive definition, with examples, of various types of LUCs.

(4) Cooperative Agreements- Cooperative agreements with key stakeholders coupled with conservation encumbrances on lands adjacent to Army installations can provide positive benefits relative to encroachment management. This is the fourth mitigation example. To illustrate, in 1995, a Cooperative Agreement (CA) was signed by Fort Bragg (North Carolina), The Nature Conservancy (TNC) and the U.S. Army Environmental Command (USAEC). The CA enabled cost-sharing the acquisition of conservation encumbrances in the vicinity of Fort Bragg. Conservation encumbrances are defined as fee simple land purchases by TNC or the purchase of perpetuity deed restrictions by TNC. All acquisitions were made with willing sellers and based upon fair market value of the acquired land and infrastructure. All acquisitions have provisions for training access to the conserved lands; however, such training must exhibit minimal adverse environmental consequences (U.S. Army Environmental Command, 2005)*. This approach is part of the Private Lands Initiative of the USAEC.

(5) Easement Acquisition- Easement acquisition is another approach for minimizing the effects of encroaching development on training needs at military installations. An example of this approach relates to the acquisition of more than 2100 acres of easements around Luke Air Force Base in Arizona (U.S. Army Corps of Engineers, 2005). The Los Angeles District of the U.S. Army Corps of Engineers is the principal real estate agent for the project. The easement acquisitions will prevent encroaching development in the southern departure corridor from impacting flight training operations involving F-16 fighter planes.

(6) The final example of mitigation measures actually includes a spectrum of possibilities. To illustrate, in February 2003, the inaugural Defense Environmental Forum was held to address mission needs, encroachment, and sustainability issues for training ranges (National Defense Environmental Forum, 2004, pp. 5–10*.) One key issue addressed by the forum was encroachment and uncontrolled urban and suburban development adjacent to military installations. The participants emphasized that a broad coalition of organizations and agencies, in addition to installation personnel, is needed to address these encroachment/sprawl concerns at the local level. One approach for achieving such a coalition was increased emphasis on the JLUS Program, including adoption of results and implementation of recommendations. A second key identified issue was the lack of adequate DoD policy and guidance promoting solutions to the encroachment concerns.

The forum also developed recommendations related to the use of buffer zones, partnering and interagency cooperation, and future attention to encroachment/sprawl. Recommendations related to buffer zones included (National Defense Environmental Forum, 2004, p. 8):

- Pursue efforts to create buffer zones around installations, including adoption of legislation to create tax incentives if parties donate lands for conservation easements.
- Develop a systematic approach for analyzing land use/growth plans to set priorities for buffer land acquisitions and easements.
- Understand the capabilities of the various national, state, and local service providers (private and governmental) and how they are best suited to assist DoD.
- Train base commanders and non-governmental organizations (NGOs) in the use of buffer zone protection tools.
- Share data (for example, GIS data), metrics for measuring priorities, and lists of priority sites for buffer zone protection to identify common objectives.

- Establish reliable funding and funding mechanisms for buffer zone acquisitions and easements.
- Manage not only installation habitats but also habitats within the buffered areas for successful habitat protection; engage local landowners in the solutions to ensure the base is not the only viable place for species habitation.

Recommendations related to partnering and interagency cooperation included (National Defense Environmental Forum, 2004, p. 8):

- Begin efforts typically at the local level, elevating issues only when a solution cannot be reached at the local level or when an issue or solution at the local level has ramifications across DoD.
- Conduct sincere and meaningful ongoing dialogue with a broad range of interested and affected stakeholders.
- At the local level, pursue collaborative discussions to identify solutions with local community groups, local governments in the vicinity of the installation, and nature/land conservancies.
- Work cooperatively with the other federal agencies, such as the FWS and National Marine Fisheries Service, as well as state, tribal, and local governments.
- Designate an installation employee whose sole responsibility is to interface with the local community on a continuing basis.

Recommendations related to future attention to encroachment and urban sprawl included (National Defense Environmental Forum, 2004, p. 9):

- DoD should institute a more systematic approach for quantifying growth/encroachment, implementing buffer zone protection (including developing national guidance), quantifying the problem, and identifying priorities.
- DoD should identify and implement solutions including wider adoption of state laws like those passed in Arizona and California, to address sprawl.

Finally, monitoring of selected indicators of land use effects including cumulative effects, may be necessary. Such monitoring could be introduced as modifications to existing installation monitoring programs, or as a part of a newly implemented EMS. A useful reference for planning and implementing a monitoring program is Marcus (1979)*. It should be noted that such monitoring results could be used within an organized feedback and decision-making system to adapt management activities and thus reduce undesirable land use effects.

4.12.8 Summary

Extensive policy and technical information is available for planning and conducting an assessment of cumulative land use effects along with public recreational access effects, for Army installations and associated training ranges. A key concern is related to the influence of encroachment on installation land uses. The key installation document which is basic to land use considerations is the RPMP. Additional relevant documents include, but are not limited to, the INRMP, ICRMP, ESMC, and ICUZ study. Further, the CEQ's 11-step CEA process can be pragmatically applied to the land use VEC, including appropriate consideration of potential changes in public recreation access. Finally, a variety of mitigation measures could be used by an installation to address concerns related to cumulative land use effects.

Appendix 1 of Chapter 4.12

Sustainability Factors Associated With an Installation RPMP

The following factors should be considered in developing an installation RPMP (U.S. Department of the Army, AR 210-20, May 2005, pp. 24-26).

Sustainable sites

(1) Erosion, sedimentation, and water quality control – Control erosion and pollutants to reduce negative impacts on water and air quality.

(2) Site selection – Avoid development of inappropriate sites and reduce the environmental impact from the location of a building on a site. Select site based on functional adjacencies/relationships and land use compatibility.

(3) Installation/base redevelopment – Channel development to installation/base cantonment areas with existing infrastructure, protecting green fields and preserving habitat and natural resources.

(4) Contaminated site redevelopment – Rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

(5) Alternative transportation – Reduce pollution and land development impacts from automobile use.

(6) Reduced site disturbance – Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity. (For multiple buildings/installations, opportunities exist to mitigate damaged areas in alternative areas/under other projects.)

(7) Storm water management – Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration and reducing contaminants.

(8) Landscape design to reduce heat islands – Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat. (For multiple buildings/installations, strategies for heat island reduction, for example, use of parking garages might be shared among multiple projects/facilities.)

(9) Light pollution reduction – Eliminate light trespass from the building site, improves night sky access, and reduces development impact on nocturnal environments. (For multiple buildings/installations, lighting has safety and force protection implications and sharing of lighting for walkways, and so on, needs to be addressed. In addition, implications for the design of lighting must extend to site/street lighting as well.)

(10) Optimize site features – Optimize utilization of the site's existing natural features and placement of man-made features on the site.

(11) Facility impact – Minimize negative impacts on the site and on neighboring properties and structures; avoid or mitigate excessive noise, shading on green spaces, additional traffic, obscuring significant views, etc.

(12) Site ecology – Identify and mitigate all existing site problems including contamination of soil, water, and air, as well as any negative impacts caused by noise, eyesores, or lack of vegetation, enhancing or creating new site habitat.

Water efficiency

(1) Water efficient landscaping – Limit or eliminate the use of poTable water for landscape irrigation. (For multiple buildings/installations, strategies for water efficient landscaping and/or opportunities for shared rainwater and storm runoff collection to supply irrigation systems need to be addressed.)

(2) Innovative wastewater technologies – Reduce generation of wastewater and poTable water demand, while increasing local aquifer recharge. (For multiple buildings/installations, strategies for Innovative Wastewater Technologies such as shared gray water systems and onsite sewage treatment systems need to be addressed.)

(3) Water use reduction – Maximize water efficiency within buildings to reduce the burden on municipal water supply and waste water systems.

Energy and atmosphere

(1) Fundamental building systems commissioning – Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended and buildings are energy efficient.

(2) Minimum energy performance – Establish the minimum level of energy efficiency for the building and systems. (For multiple buildings/installations, energy performance goals need to be established for the installation and then the individual building's performance can be set. Plans need to accommodate central energy systems.)

(3) Chlorofluorocarbon reduction in heating, ventilation, air conditioning, and refrigeration equipment – Reduce ozone depletion. (For multiple buildings/installations, chlorofluorocarbon reduction goals need to be set for installations.)

(4) Optimize energy performance – Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impacts associated with excessive energy use.

(5) Renewable energy – Encourage and recognize increasing levels of self-supply through renewable technologies to reduce environmental impacts associated with fossil fuel energy use.

(6) Measurement and verification – Provide for the ongoing accountability and optimization of building energy and water consumption performance over time.

(7) Green power – Encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis. (Energy/power strategies/plans should be established at the installation level and effectively integrate existing facilities, purchased power, green power, and distributed generation.)

(8) Distributed generation – Encourage the development and use of distributed generation technologies, which is less polluting than grid-source energy. (Energy/power strate-

gies/plans should be established at the installation level and effectively integrate existing facilities, purchased power, green power, and distributed generation.)

Materials and resources

(1) Storage and collection of recyclables – Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills. (Recyclable strategies need to be determined in accordance with garrison waste management plans and ought to include in addition to recycling centers in facilities, installation-recycling centers. These strategies need to be developed in concert with local municipalities, and where there are no local programs, Army installations might take a lead to see that they are established.)

(2) Building reuse – If building sitings are appropriate for a building reuse, the structures are adaptable for reuse, and reuse is cost effective, the master plan should adopt this alternative. It extends the life cycle of existing building stock, conserves resources, retains cultural resources, reduces waste, and reduces environmental impacts of a construction program.

(3) Construction waste management – Divert construction, demolition, and land clearing debris from landfill disposal. Redirect recyclable material back to the construction or manufacturing process.

(4) Resource reuse – Extend the life cycle of targeted building materials through reuse, reducing environmental impacts of disposal and need for new construction materials. Manage a demolition program through building deconstruction and recycling/sale of reusable materials.

(5) Recycled content – Increase demand for building products that have incorporated recycled content material, reducing the demand on new raw material in the construction or manufacturing process.

(6) Local/regional materials – Increase demand for building products that are manufactured locally, reducing the environmental impacts resulting from transportation.

(7) Rapidly renewable materials – Reduce the use and depletion of finite raw and long cycle renewable materials by replacing them with rapidly renewable materials.

(8) Forest Stewardship Council certified wood – Encourage acquisition of Forest Stewardship Council certified wood-based materials and products.

(9) Holistic delivery of facility – Encourage a facility delivery process that actively engages all stakeholders in the design process to deliver a facility that meets all functional requirements while effectively optimizing tradeoffs among sustainability, first costs, life cycle costs and mission requirements.

Current mission

(1) Operation and maintenance – Encourage the development of a facility delivery process that enhances efficient operation and maintenance of the facility.

(2) Soldier and workforce productivity and retention – Provide a high quality, functional, healthy and safe work environment to promote soldier and workforce productivity and retention.

(3) Future missions

(4) Functional life of facility and supporting systems – Assess the functional life of a facility and it’s supporting systems to optimize the infrastructure investment.

(5) Adaptation, renewal and future uses – Encourage facility design that is responsive to change over time to maximize accommodation of future uses without creating waste and insuring maximum useful life of products.

4.13 Hazardous Materials/ Hazardous Wastes

4.13 Hazardous Materials/ Hazardous Wastes

4.13.1 Introduction

The Hazardous Materials/Hazardous Waste (HM/HW) VEC deals with the use of hazardous substances in households, maintenance of facilities and weapon systems, and training and the generation of hazardous wastes through disposal of unused or contaminated material, air and water pollution control (for example, paint booth filters or wastewater sludge), cleanup of spills, and remediation of historic soil and groundwater contamination. Although household hazardous substance use and hazardous waste generation is typically exempt from regulation, the amounts of products used and waste generated can have significant and measurable impacts to air and water quality and waste management and disposal. Hazardous Materials are defined as any substance with physical properties of ignitability, corrosivity, reactivity, or toxicity that may cause an increase in mortality, a serious irreversible illness, incapacitating reversible illness, or pose a substantial threat to human health or the environment. Hazardous waste is defined as any solid, liquid, contained gaseous, or semi-solid waste, or any combination of wastes that poses a substantial present or potential hazard to human health or the environment.

In general, HM/HW issues are framed by the following:

- Resource Conservation and Recovery Act (RCRA) of 1976, with amendments, establishes guidelines for identifying, transporting, storing and disposing of Hazardous Material and Hazardous Waste. RCRA places “cradle to grave” responsibility for HW on the personnel or units generating the waste. RCRA also covers the laws surrounding the disposal of solid waste, including solid waste management, landfill regulations, recycling, and affirmative procurement.
- Clean Water Act (CWA) of 1972, (33 USC 26 1972, with amendments in 1977) regulates point source discharges into U.S. waters (groundwater, storm water, lakes, rivers, streams, marshes, swamps, wetlands, coastlines, and navigable canals). The law primarily applies to industrial facilities, sewage treatment facilities and ships. Additional requirements for oil and hazardous material spill reporting and waterway cleanups affect military operations, including river crossings and amphibious actions. The CWA requires development of spill prevention plans for sites that store significant quantities of petroleum products. The CWA also regulates storm water runoff from certain industrial sources and requires permits for activities that impact wetlands.
- Safe Drinking Water Act (SDWA) of 1974 regulates the quality of drinking water, including assessing the percentage of pollutants in the water and providing for requirements for analyzing treated water. Additionally, the Army’s program objectives include conserving water resources and providing drinking water that meets regulatory standards.
- Clean Air Act (CAA) of 1970, with amendments, requires the prevention, control, and abatement of air pollution from stationary sources and mobile sources. The CAA implementing regulations concerning emissions do not apply to tactical vehicles, however, increasingly stringent requirements for civilian vehicles do apply to other military vehicles. In addition, many states and localities have implemented more stringent emission requirements, which must be adhered to. The CAA also regulates asbestos removal and disposal as well as controlling air toxic pollutants, acid rain and ozone depleting substances (ODS). Requirements to control fugitive dust and NOx

discharges are also covered by the CAA. Typical Army operations that could have air impacts include open burning, smoke obscurant generation, fugitive dust emissions on tank trails and range roads, engines, boilers, generators, solvent vats, and HVAC systems.

- Toxic Substances Control Act (TSCA) of 1976 (15 USC s/s 2601 et seq) implements restrictions on certain chemical substances, including; CFCs, PCBs, and asbestos. TSCA imposes restrictions to protect human health and environmental exposure to these highly toxic substances, requires chemical testing, and regulates the release of these chemicals into the environment.
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 USC s/s 9601 et seq) regulates past hazardous materials releases into the environment that occurred before 1986. Along with the Superfund Amendments and Reauthorization Act (SARA) of 1986, it established the Superfund program to cleanup hazardous waste sites. DoD's implementing program for Superfund is the Installation Restoration Program (IRP) and is limited to cleanups in the United States, however, international agreements, status of forces agreements and U.S. government policy have been used in the past to conduct cleanup activities overseas, in accordance with DODI 4715.8.
- Federal Facilities Compliance Act (FFCA) of 1992 (7 USC s/s 135.) applies to hazardous and solid waste requirements under RCRA and allows EPA and state agencies to inspect and possibly impose fines on Army installations that violate environmental regulations outlined in RCRA. FFCA also subjects DoD employees at all levels to personal criminal liability for environmental violations, including a maximum fine of up to $250,000 and a jail sentence of up to 15 years.
- Military Munitions Rule (MMR) of 1997 (MMR, 1997) amends RCRA and identifies when a conventional and chemical munition becomes a hazardous waste under RCRA. This rule excludes unused munitions that are repaired, reused, recycled, reclaimed, disassembled, reconfigured, or otherwise subject to material recovery activities. Many states have adopted more stringent military munitions requirements.
- Federal Hazardous Materials Transportation Law (HMT) of 1988 (49 USC s/s 100 et seq). as amended, authorizes the U.S. Department of Transportation (DOT) to issue interstate and intrastate regulations regarding the transportation of hazardous materials. DOT oversight applies to packaging, handling, labeling, marking, placarding, and transporting during operations or deployments that require vehicle movement or convoys on federal and state highways and transportation corridors.

Pursuant to these statutes and subsequent federal and state regulations, Army HM/HW policy is articulated the following Army regulations (ARs):

- AR 200-1 (USA, 1997) describes the Army environmental programs and assigns responsibilities for managing the environmental program.
- AR 200-5 (USA, 1999) describes Army policies, standards, and procedures for pest-control activities and incorporates DoD measures of merit for pest management as in DODI 4150.7.

- AR 420-49 (USA, 2005) prescribes the policy, procedures and methods for authorizing, forecasting, determining and recording training ammunition expenditures and requirements.

Major Executive Orders (EOs) that establish Army behaviors include the following:

- EO 13286 (EOP, 2003), signed on 28 February 2003, amended EO 12580 (Superfund Implementation), delegating CERCLA duties and powers as amended by SARA. It provides for a National Contingency Plan (NCP) to provide national and regional response teams to plan and coordinate HM/HW preparedness and response actions, in accordance with the Homeland Security Act.
- EO 13148 (EOP 2000), signed on 21 April 2000, replaced EO 12856 and challenged federal agencies to promote Greening the Government initiatives through environmental leadership in environmental management. Key elements of EO 13148 include: EMS, Emergency Planning & Community Right to Know Act (EPCRA) and TRI reduction goals, Toxic Chemical Reduction, ODS reductions, and Landscaping initiatives.
- EO 13101 (EOP,1998), signed 14 September 1998, requires federal agencies to incorporate waste prevention and recycling into their daily operations and implement cost effective procurement preference programs for recycled and environmentally preferable products and services.
- EO 12114 (EOP, 1979), signed on 4 January 1979, addresses environmental effects of major federal actions abroad. It establishes procedures for federal agencies in foreign countries and global communities to consider the effects of their actions on the environment. The objective of this program is to provide information to decision makers, increase awareness and interest in environmental concerns and to encourage environmental cooperation with foreign nations.
- Overseas Army operations present unique challenges, as they must comply with environmental guidelines established in that host nation. The Army is committed to comply with such requirements, actively addressing any environmental quality issues with neighboring communities, and by assuring that environmental considerations are an integral part of all Army facility or training decisions. The following sources guide and frame U.S. Army behaviors overseas:
- The Overseas Environmental Baseline Guidance Document (OEBGD) (DoD, 1996) provides “minimum” criteria to protect human health and the envrionment at DOD installations overseas. Its purpose is for use by the DOD designated Executive Agents in development of their country-specific “Final Governing Standards.”
- Final Governing Standards (FGS) (DoD, 1996) are the regulating standards that apply in foreign countries and are include application of host nation laws and OEBGD requirements. DoD assigns service components to be Executive Agents for FGS in applicable host nations, i.e., Army is the Executive Agent for Germany, Belgium and Netherlands. Currently, the FGS in a number of countries is undergoing major revisions due to implementation of regulations associated with the creation of the European Union.

- Host Nation (HN) Laws are laws established in foreign countries and lands that may impact Army operations. HN laws should be considered when planning tactical maneuvers and exercises. In close coordination with the EA, the Army should consult with host nation authorities on environmental issues of concern.
- The Persistent Organic Pollutants (POPs) Treaty was signed by the United States in 2001 and committed the United States to reduce and/or eliminate the production, use and/or release of 12 POPs of global concern. POPs are a set of chemicals that are toxic, persistent and biomagnified as they move through the food chain and include: Aldrin, Hexachlorobenzene, Chlordane, Mirex, DDT, Toxaphene, Dieldrin, PCBs, Endrin, Polychlorinated dibenzo-p-dioxins, Heptachlor, and Polychlorinated dibenzo-p-furans. The United States has taken extreme measures to reduce emissions associated with POPs and none of the pesticide POPs are registered for sale or distribution in the United States. Additionally, the United States has taken a leading role in reducing and eliminating POPs on a global basis, including providing technical and financial assistance for foreign countries. The treaty also restricts the trade and bans the export of POPs.

The Basel Convention (Basel, 1989) for hazardous waste controls the transboundary movements of hazardous waste and disposal, and can limit the HW disposal options available to forces deployed in foreign lands. The U.S. has not implemented the Basel Convention."

The Kyoto Protocol (UN, 2005), which took effect in February 2005, imposes limits and thresholds on emissions of greenhouse gases. Although the United States rejected the Kyoto Protocol in 2001, the United States has since worked with a number of foreign countries to develop and impose additional requirements and initiatives to minimize greenhouse gas emissions.

The Pollution Prevention Act (PPA) of 1990 (42 USC s/s 133 et seq) establishes an ordered set of preferences for hazardous waste management:

(1) Pollution should be prevented or reduced at the source, whenever feasible.

(2) Pollution that cannot be prevented should be recycled in an environmentally safe manner.

(3) Pollution that cannot be prevented or recycled should be treated in an environmentally safe manner.

(4) Disposal or other releases into the environment, should be the last resort.

This is a major departure from traditional environmental legislation; concentrating on source reduction (avoiding the creation of wastes that are difficult or costly to manage). The Army's proactive adherence to these precepts can reduce the risk of exposure to potentially harmful contaminants, pollutants, and hazardous substances; reduce disposal costs; reduce liability; and reduce health and safety risks.

These numerous requirements apply to three major aspects of the Army: (a) Facilities Operation and Management (consisting of real estate, facilities, and infrastructure), (b) Army Acquisition (the development, procurement, and fielding of systems and commodities that support the mission and Army operations), and (c) Training on maneuver and live fire ranges, both on permanent Army installations and overseas.

Facility Operation and Management Issues

Construction- In general, the Army meets facility needs through the use of existing facilities, or the renovation of existing facilities, leasing, or construction of new facilities.

These requirements are closely regulated through Army policies (See Facility VEC), ensuring that such activities are warranted. Many of the required construction and renovation projects have traditionally involved demolition prior to renovation or construction, as well as considerations of underground storage tanks (USTs), lead-based paint (LBP), asbestos, polychlorinated biphenyls (PCBs), and radon. Each construction project may involve some use of hazardous materials or the generation of hazardous wastes.

Facility Operations- In addition to construction or renovation, the day-to-day O&M of built facilities, as well as training activities on the installation, can have potentially significant HM/HW implications. Facilities HM/HW issues include:

Use of existing USTs, including maintenance and replacement

Existing LBP
Existing asbestos
Existing equipment with PCBs
Radon
Renovation of existing facilities, including UST replacement and disposal
LBP removal/disposal
Asbestos disposal
Replacement of PCB-containing equipment
Radon
Demolition of existing facilities
Construction of new facilities
UST disposal
LBP disposal
Asbestos disposal
Disposal of PCB-containing equipment
Installation of new USTs
Radon

All Facility Operations activities, including those that support the installation training mission, often require the local (installation or community) provision of storage and disposal facilities for both hazardous wastes and non-hazardous solid wastes. The installation use, storage, and disposal of construction materials and wastes is controlled by existing comprehensive Army policies, regulations, and guidelines which have, in the past, proven to be adequate to protect human health and the environment. Similarly, community or private solid and hazardous waste facilities are subject to federal, state, and local statutes and regulations.

In addition, to protect habitats and people from inadvertent and potentially harmful releases of hazardous substances, (40 CFR 261) and Spill Prevention, Control, and Countermeasure (SPCC) Plans (40 CFR 112). Also, DoD has developed the Installation Restoration (IR) Program to facilitate investigation and cleanup of contaminated sites associated with military installations (USA, 1975).

Evaluation of HM/HW risks focuses on underground and aboveground storage tanks; transport and use of pesticides and herbicides; fuels; petroleum, oils, and lubricants (POLs); and a variety of other chemicals. Risks extend to generation, storage, transportation, and disposal of hazardous wastes at or near the site of a proposed action, and also can include risks to wildlife species, botanical habitats, soil systems, and water resources. Some special hazards listed here pose risks, but are not regulated as contaminants under the hazardous waste statutes: asbestos, radon, lead-based paint (LBP), polychlorinated biphenyls (PCBs), and unexploded ordnance (UXO).

The goals of the Army HW/HM program are to (a) reduce risk to public health and the environment, (b) prevent pollution, and (c) comply with applicable regulations. Army policies and regulations require that the generation of hazardous or toxic wastes must be avoided, reduced, or eliminated. Regulation of hazardous and toxic materials, and treatment and disposal of hazardous and toxic wastes are designed to protect human health and the environment.

Army policy provides for the removal, repair, or replacement of damaged, leaking, or improperly functioning underground storage tanks (USTs) or associated pollution prevention devices. USTs must include monitoring devices for leak detection and be fitted with cathodic protection, catch basins, and overfill warning devices.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC s/s 136 et seq) requires the registration of pesticides to ensure that, when used according to label directions, they will not present unreasonable risks to human health or the environment. Other federal regulations governing pesticide use and management include:

29 CFR Part 1910, "OSHA Safety and Health Standards"
40 CFR Chapter 1, 3 Subchapter E, "Pesticide Programs"
40 CFR Part 165, "Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticide Containers"
40 CFR Part 171, "Certification of Pesticide Applicators"
DoD sets forth pesticide management policy in:
DoD Directive 4150.7, "Pest Management Program", and
DoD 4160.21-M, "Defense Utilization and Disposal Manual", Chapter 9, "Hazardous Property Management"

Army pesticide management policy is provided in AR 200-1, "Environmental Protection and Enhancement" (USA, 1997), and AR 200-5, "Pest Management" (USA, 1995).

Federal, state, and local regulations, both procedural and substantive, govern the management of lead-based paint (LBP), LBP additives, and LBP hazards. Army policy is to manage LBP in place, unless it presents an imminent health threat, as determined by the installation medical officer or unless operational, economic, or regulatory requirements dictate its removal. Army policy also imposes requirements to reduce the release of lead, lead dust, or LBP into the environment from deteriorating paint surfaces, building maintenance, or other sources on Army installations or on Army-controlled property.

During demolition, maintenance, repair, remediation, or renewal of buildings, asbestos can be released into the air. Asbestos is a friable material; that is, crumbling or breakage of asbestos-containing materials can release asbestos fibers into the air. Asbestos fibers can be released from various building materials, such as pipe and boiler wrap and other insulating materials and acoustic ceiling tiles. NESHAPs (NESHAP, 2006) regulate the demolition and renewal of buildings with asbestos-containing material. The EPA and states have policies that address leaving asbestos in place and thus not disturbing the material if its removal and disturbance would pose a health threat.

The disposal of PCB compounds is regulated under TSCA, which bans the manufacture and distribution of PCBs, except for PCBs in enclosed systems. The EPA regulates the removal and disposal of all sources of PCBs containing 50 ppm or more.

While the effects of radon exposure are uncertain, the effects of radiation can occur at any dose, no matter how small. The Army has implemented a Radon Reduction Program to determine and control the levels of radon exposure of military personnel and their dependents, and has completed the testing of Army facilities as part of this program. In accordance with AR 200-1, the Army maintains and updates records of completed radon assessments; and includes these results with real property and housing data, to notify tenants and transferees of any elevated radon levels. Where elevated levels of radon are encountered, Army facilities managers are to adhere to generally accepted abatement measures.

Army Acquisition Issues

Army systems acquisition activities involve both hazardous materials (selected for use in systems) and hazardous wastes (associated with the manufacture of system components and their ultimate disposal. Along the life cycle (development, testing, production, fielding, and disposal) of weapons systems and equipment, varying quantities of hazardous materials and wastes are used and produced in laboratory, manufacturing, test range, and installation settings. As the Army systems acquisition community adopts pollution prevention and sustainability initiatives, the magnitude and severity of HM/HW issues will be reduced. Weapons and equipment development and testing (as well as training organizations) are benefiting from the use of computer simulation. Where such simulations are feasible, developmental and testing activities can occur without posing HM/HW risks.

DoD and the Army leadership, recognizing the increasingly importance of environmental concerns and the need for more sustainable systems, has integrated pollution prevention and sustainability concepts into the entire design, development, testing and fielding phases of acquisition systems. As the Army undergoes Army Transformation and upgrades the technologies of constituent systems, the following illustrative materials and wastes will be utilized or generated:

weapon combustion products
biological substances
batteries
power cells
fuels
petroleum oils and lubricants
antifreeze
chemical agent resistant coatings

fire suppression materials
munitions
perchlorates
Class I and Class II ODSs
Circuit Card Assemblies (CCAs)
scrap metals
adhesives and sealants
wheeled and tracked vehicles
Cadmium
Hexavalent Chromium
Chemical Biological Radiological Nuclear filters
shipping materials (pallets)
parachutes
solvents
solar panels

As an illustration of the transition in Army acquisition, the program manager for Future Combat Systems (FCS) has prohibited the following materials from use for this project, unless a waiver is granted (FCS, 2003): asbestos containing materials, beryllium, cadmium, hexavalent chromium, hydrazine, lead, mercury, methylene chloride, methyl ethyl ketone, nickel, polychlorinated biphenyls, phenol, tetrachloroethylene, toluene, toluene diisocyanate, trichloroethylene, and xylenes. This prohibition represents a fundamental change in the system development process, from traditional inclusion of hazardous materials, to inclusion only by exception (requiring a petition for a waiver that articulates efforts to substitute non-hazardous materials).

4.13.2 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect effects of a proposed action on hazardous materials/hazardous waste; and, in addition, they can be used to determine if cumulative effects also need to be considered. These "quick look" questions include:

- Will the proposed action occur on an existing installation?
- Are all aspects of the proposed action covered by a Spill Prevention, Control, and Countermeasure Plans (SPCCP)?
- Have project proponents taken steps to eliminate the use and potential release of hazardous materials?
- Are there any existing regional concerns related to chemical contamination of ground or surface waters?
- Are the surrounding counties considered "attainment areas" under provisions of the CAA?
- Is additional cumulative effects analysis needed?

Impact Analysis Level:

If the answers indicate that likely impacts are quite small, or can be mitigated, and will unlikely contribute to significant impacts on the VEC, an EA level of documentation is required. This “hard look” need not be extensive or costly; and can be quite brief as discussed in the “Quick Look’ segment in Section 2.2 (requiring CEQ Steps 1-4, 6 and 7). In some cases, additional analyses may be required to completely answer the questions, and should be documented, again at the EA level of analysis “in proportion to the nature and severity of the issues addressed, and focused on those issues that interest the decision maker and the public” (32 CFR 651).

If the EA level analyses identify any direct or indirect effects that cannot be mitigated, or could contribute to cumulative effects, a more rigorous impact analysis is required, and should be evaluated at an EIS level of analysis as discussed in the “Detailed Analysis”, Section 2.2 (requiring all 11 CEQ steps). The most detailed level of analysis does not automatically trigger the need for an EIS, but the likelihood of significant effects is greatly increased. The eventual need for an EIS is still determined though the EA process, as the significance of potential impact is determined.

At the EA level, attention must be given to CEQ Steps 1-4 (the scoping steps) and CEQ Steps 6 and 7, describing the affected environment. The findings from these CEQ steps can be documented to serve as a “hard look” if it is determined that an EA is appropriate. However, if significant impacts are identified from consideration of CEQ Steps 1-4, 6 and 7, then an EIS is appropriate. For an EIS, all 11 CEQ steps should be addressed.

CEQ Step 1 – Identify Significant Effects Associated with the Proposed Action and Define the Assessment Goals

The effects of HM/HW issues tend to be localized, limited to a small geographic area. They can often become cumulative when the indirect effects of their release and/or transport (via airways, waterways, or groundwater migration). When transport mechanisms become evident, the CEA is best addressed as part of other VECs, such as Water Resources Management or Air Quality, with subsequent potential impacts on other VECs, such as Threatened and Endangered Species and Wetlands.

Prior to any signs of transport, cumulative effects still require some consideration. Even small actions taken over time, can eventually lead to significant deposition and accumulation of HM. In fact, these large and extensive accumulations can become significant issues once transport occurs, and are considerably more difficult to mitigate.

Most Facility HM releases are controlled by their extensive management provisions in the Army (see introduction). As such, any HM contamination results from accidental releases or spills. Such events are inevitable, and are mitigated by the application of SPCCPs, to respond and clean up (remediate) any contamination. These controls have eliminated the likelihood of major contamination from facilities operations that, in the past, have given rise to the extensive and expensive IRP.

The operation of training areas is less controlled. While many training activities are covered by Hazardous Waste Management Plans (HWMPs) and SPCCPs, small releases of contaminants, mainly from propellants and explosives, occur from training activities. These minor releases can constitute cumulative impacts in the form of accumulated contaminants on training facilities (firing ranges). While some training facilities (small arms ranges, etc.) can and are managed to reduce such accumulations, broader scale contamination on larger ranges is still a cumulative issue. Contamination can occur over the life-cycle of a range, and can eventually become a cumulatively significant issue, particularly if/when contaminants reach a “natural pathway” and affect other VECs.

Activities at training ranges are extensively managed (USA, 2004d and USA, 2005), providing some control of the volumes of munitions and systems used. This management is required to insure that training proficiencies are maintained, and that Army fiscal resources are effectively managed. The Army’s increasing use of simulators has also reduced both the costs and the environmental impacts of training activities.

From a regional perspective, these Army contaminants are not cumulative until they migrate and become part of a regional resource issue. These regional issues can be manifested in concerns of groundwater contamination or surface water contamination, or impacts on already contaminated air resources (non-attainment areas), covered in the Water Resources and Air Quality VECs, respectively.

CEQ Step 2–Establish Geographic Scope of the Analysis.

The geographic scope of the HM/HW VEC is initially limited to the area where HM releases (direct affects) occur. This initial scope can then be expanded by following the natural pathways to establish the complete spatial distribution of the pollutants when/if migration occurs. These are further discussed in the sections on the Water Resources and Air Quality VECs.

CEQ Step 3–Establish the Time Frame for Analysis.

The temporal aspects of the HM/HW VEC can be quite extensive, given the often extensive and persistent nature of the pollutants. If the chemical contaminants rapidly degrade in the natural environment, they require time frames that address their likely life in the environment. However, if the contaminants are less biodegradable and more persistent in the environment, the potential threat is greater, and the time line must be adjusted to account for their potential life expectancy.

The outer (future) limits of the temporal boundary are best established by the life of the proposed action. In some cases, this may be one or two years into the future, or may reflect a project that reaches far into the future, such as the upgrade or development of a new range, or Army Transformation.

CEQ Step 4–Identify Other Actions Affecting the Resources, Ecosystems, and Human Communities of Concern.

In the identification of other potential contributors including regional cumulative effects, the process identified in the Water Resources and Air Quality VECs can be used. Cumulative effects on water and air resources can be extensive, with widespread regional implications (recreational resources and facilities, hunting and fishing resources, surface and groundwater drinking supplies, etc.).

On the immediate Army properties, the temporal accumulation of contaminants is the focal point for CEA. As such, other sources of contamination include all previous activities on that land, subject to the temporal considerations discussed in CEQ Step 3. If the activities produced no persistent contaminants, and if the potential life spans have expired, those activities can be noted and deleted from further analyses. If, however, the contaminants likely still exist, those generating activities must be included in the activities used to address cumulative effects.

CEQ Step 5–Characterize the Resources, Ecosystems, and Human Communities Identified During Scoping in Terms of Their Response to Change and Capacity to Withstand Stresses.

HM releases enter the environment immediately. While the consequences and significance of these releases vary based upon the magnitude and setting in which they occur, the actual mechanisms remain the same.

As discussed in CEQ Step 3, final effects analysis is highly dependent of the life span (persistence) of the subject contaminants. At low levels, the environment has a natural ability to assimilate contaminants, but this capacity may be very small for those that are toxic to plants and animals, or humans once they enter any pathways that reach any systems that support human activity. The response of any affected resources, ecosystems, and human communities is entirely dependent upon this assimilative capacity and the characteristics of the contaminant (toxicity, persistence, etc.). The ability to analyze these effects is defined by "fate and transport" models that can be obtained or developed to address unique combinations of the source contaminant and receptor resources, which must account for the cause-effect network that represents the natural pathway. These types of analysis tools are commonly available for the assessment of public health effects, but may be less developed for Army-specific contaminants of specific receptor resources (i.e., endangered species); but adaptation may likely be possible.

CEQ Step 6–Characterize the Stresses Affecting These Resources, Ecosystems, and Human Communities and Their Relation to Regulatory Thresholds.

Once the contributing actions in the region and the contributing Army actions on a given facility have been identified (CEQ Step 4), and the likely environmental responses and transport have been analyzed (CEQ Step 5); likely violations of regulatory thresholds can be ascertained. As previously discussed, many Army activities are regulated at the source, through established acceptable levels of HM release, or by prohibiting any HM release except in cases of accidental release covered by SPCCPs. Given the extensive nature of Army management and regulatory control, these accidental releases pose little risk, and are generally compliant with regulatory provisions.

Less controlled HM contamination, such as that associated with many range activities, is also compliant with established regulatory thresholds, but only as long as the contaminants are immobile in the environment and can biologically degrade before any mobility or accumulation can occur. Regulatory thresholds are often exceeded once the transport of contaminants commences and reaches waterways or sensitive airsheds. When this occurs, the regulatory constraints of the Water Quality and Water Resources VEC's become the critical factor for HM/HW issues, in addition to the regulatory provisions of additional VECs (such as Threatened and Endangered Species and Wetlands), if such indirect effects are evident.

This contamination is the subject of considerable ongoing research, as illustrated by the partial list of relevant references:

Commission on Life Sciences, Toxicity of Military Smokes and Obscurants, Vol. 1, National Academies of Sciences, National Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T.,

"Classification of Wetlands and Deepwater Habitats of the United States," FWS/OBS-79/31, December 1979, U.S. Fish and Wildlife Service, Washington, D.C. (http://wetlands.fws.gov/Pubs_Reports/Class_Manual/class_titlepg.htm).

Commission on Life Sciences, Toxicity of Military Smokes and Obscurants, Vol. 2, National Academies of Sciences, National Academies Press, Washington, D.C., 1999.

Cowherd, C., Gebhart, D., Muleski, G., and Trenholm, A., *"Chemical and Biological Dust Control Technologies for Military Training Ranges,"* Proceedings of the Conference on Sustainable Range Management, New Orleans, Louisiana, January 5-8, 2004, Battelle Press Online Bookstore (http://www.battelle.org/bclscrpt/Bookstore/range04.cfm).

Cover, D. E., Siemann, K., and Ortega, N., *"Investigation of Toxic Air Contaminants Released from Incidental Detonation of Ordnance and Explosives During Prescribed Burning of Vegetation at the Former Fort Ord, California,"* undated.

Getz, Lowell L., et al *"Preliminary Assessment of the Potential Impact of Fog Oil Smoke on Selected Threatened and Endangered Species,"* USACERL Technical Report 96/38, January 1996.

Hayden, T. J., Tazik, D. J., Cassels, D. M., Reinbold, K. A., and Getz, L. L., *"Preliminary Assessment of the Potential Impact of Fog Oil Smoke on Selected Threatened and Endangered Species,"* January 1996, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois.

Mitchell, W. J., *"State of the Science and Research Needs in the Characterization and Minimization of the Emissions from Ordnance Use and Disposal Activities,"* undated, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

Rehm, R., and Rush, T., *"Air Emissions from Range Operations,"* undated, U. S. Army Environmental Command, Aberdeen Proving Ground, Maryland.

Shinn, J. H., Sharmer, L., Novo, M., and Katz, L. F., *"Smokes and Obscurants: A Guidebook of Environment Assessment, vol. 1: Method of Assessment and Appended Data,"* UCRL-21004-VOL-1, September 1987, Lawrence Livermore National Laboratory, Livermore, California.

Shinn, J. H., Sharmer, L., and Novo, M., *"Smokes and Obscurants: A Guidebook of Environment Assessment, vol. 2: A Sample Environmental Assessment,"* UCRL-21004-VOL-2, September 1987, Lawrence Livermore National Laboratory, Livermore, California.

These categorize the types and nature of HM releases associated with these Army activities.

Overall regional HM/HW contamination documentation can be facilitated through the use of some EPA databases and tools:

The Toxic Release Information System (USEPA, 2004): The TRI contains regionally-specific information about more than 650 toxic chemicals that are used, manufactured, treated, transported or released into the environment. TRI can be used for basic facility information and chemical reports, which tabulate air emissions, surface water discharges, releases to land, underground injections, and transfers to off-site locations.

The CERCLA Information System (CERCLIS) (http://www.epa.gov/superfund).

The RCRA Information System (RCRIS) (USEPA): RCRAInfo is a national hazardous waste program management and inventory system regarding hazardous waste handlers. In general, all generators transporters, treaters, storers, and disposers of hazardous wastes are required to provide information about their activities to state environmental agencies. These agencies in turn, pass on the information to regional and national EPA offices. This system is governed by the RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984. The system contains data for specific hazardous waste handlers, and information on treatment, storage, and disposal facilities (i.e., permit/closure status, compliance with federal and state regulations, and cleanup activities) (www.epa.gov/enviro/html/rcris).

Enviromapper (EPA, 2005): Enviromapper provides one-stop access to environmental information; functioning as a tool to map various information, including toxic releases, hazardous wastes, water discharge permits and Superfund sites.

These data sources can identify other major HM/HW activities and current HM/HW issues in the region.

CEQ Step 7–Define a Baseline Condition for the Resources, Ecosystems, and Human Communities.

The baseline conditions for Army facilities can be established through the review of existing installation records, and regional baselines can be established from external governmental and community sources. Most of these records are specified in the CEQ Step 7 discussions for Water Resources, Air Quality, Endangered Species, and Wetlands. These VECs constitute indirect effects from any direct HM releases, but they form the basis for any effects direct, indirect, and cumulative that will become significant.

For some uncontrolled HM releases on training ranges,, baseline conditions should be evaluated and documented. Such efforts can serve as pre-emptive knowledge about the range facility, prior to any formal requirement; which can be stimulated by any controversies that can occur if indirect effects are witnessed in other VECs. While these determinations may not be included in the effects analysis (depending on final conclusions), they may ultimately prove beneficial to Army decision making. If a range has a usage profile that implies likely future issues or controversies, additional cumulative stress may be ill-advised.

CEQ Step 8–Identify the Important Cause-and-Effect Relationships between Human Activities and Resources, Ecosystems, and Human Communities.

The cause-effect relationships associated with HM releases can be shown as follows:

Each of the components of this figure has a separate cause-effect paradigm, detailed in the CEQ Step 8 discussion for each of the appropriate other VECs.

CEQ Step 9–Determine the Magnitude and Significance of Cumulative Effects.

As previously discussed in CEQ Step 6, HM/HW violations are primarily regulated and managed at the source, and any accidental releases are mitigated through response and remediation plans. In such cases, the significance is readily determined by acceptable release standards or by the prohibition of any releases. Accidental releases are also subject to management, response, remediation, and reporting requirements, depending on specific conditions of the event.

The magnitude and significance of indirect effects on other VECs (Air Quality, Water Resources, Threatened and Endangered Species, or Wetlands) can be determined through the CEQ Step 9 sections of those specific VECs.

In reviewing cumulative potential HM contamination of ranges, the relative magnitude can be estimated through some simplified analyses that essentially account for total contaminant release (mass balance) on the range over time, and adjusting to account for persistence or biodegradability in the environment (Szostak and Cleare, 2000).

CEQ Step 10–Modify or Add Alternatives to Avoid, Minimize, or Mitigate Significant Effects.

The current Army mitigation strategy for HM/HW incorporates avoidance and minimization. Past Army experiences have punctuated the fallacy of the uncontrolled use of HMs and the inevitable requirement to manage and fund the disposal of HWs. Past indiscretions created the IRP program, which has been both costly and lengthy, diverting valuable Army economic resources to activities that could be better spent in support of the Army mission. The IRP program resulted from past ill-informed Army decisions.

Recognizing the value of better decisions, Army leadership has historically supported the Pollution Prevention Program (PPP), and many opportunities exist to minimize or reduce HW generation as a result. Many processes can be changed to eliminate or reuse waste streams; remaining waste streams can often be recycled or salvaged for other uses; and hazardous materials can often be replaced by environmentally-benign substitutes. Such PPP innovations are well documented, and can form the basis for mitigations of Army-specific HM/HW threats.

In private industry, the use of specific, often hazardous, chemicals has been dictated by previously formed habits, not firm requirements (McDonough, et al, 2002). Once firm requirements have been documented, and alternatives have been evaluated, many industries have eliminated the use of HMs altogether. This philosophy is growing in the Army acquisition community, as illustrated by the HM provisions of FCS, discussed in the introduction.

Over time, the Army leadership has recognized that unilateral (Army-only) solutions of environmental problems can be costly and ineffective. This was stimulated by concerns over Army practices and their effects on the ability to support the Army mission over the long-term (Eady, et al, 2002 and USA, 2004). This led to the development of the Installation Sustainability Program (ISP) (See Section 1.1 of this guidance manual), and this same leadership has articulated the need for sustainability principles in Army decision making (USA, 2004). This adoption of sustainability can give rise to additional mitigations that involve a “total system” approach to problem solving. Experience over the last few years has indicated that internal installation collaboration can reduce or eliminate the need for HM/HW streams, and the extension of this total system analysis can likewise improve similar HM/HW issues on a regional or community scale.

CEQ Step 11–Monitor the Effects of the Selected Alternative and Adapt Management.

Army HM/HW use and generation is intensively monitored and managed. Pollution prevention and sustainability goals will insure that such efforts continue.

4.14 Traffic and Transportation Systems

4.14 Traffic and Transportation Systems

4.14.1 Introduction

Effects on both on-post and off-post traffic and transportation systems have been identified as issues of concern related to modernization of U.S. Army installations. Transportation systems refer to organized means of moving people and commodities. Principal transportation systems include commercial air carriers, waterway and maritime shipping, railroads, and trucking. Movement of people by privately owned vehicles on a local or regional scale is related to traffic and circulation. In many instances the location and availability of transportation system hubs and their capacities, can affect or be affected by installation activities. The smooth flow of traffic and the adequacy of on-post and off-post road networks to move people efficiently contribute materially to the quality of the human environment in the vicinity of an installation. Installation activities can cause or adversely affect traffic congestion or can occur in locations with an inadequate or only marginally adequate supporting road network (U.S. Army Corps of Engineers, 2002, p. 3-19). Installation streets and roads are typically considered as part of the infrastructure.

The final PEIS for Army Transformation included a discussion of the effects on traffic and transportation from systems acquisition; construction of new buildings, ranges, and other infrastructure; land acquisitions and/or land disposal; training activities; and deployment (U.S. Army Corps of Engineers, February, 2002, pp. 4-8 and 4-9). The anticipated installation-level transportation effects are briefly described as follows:

- Systems acquisition would likely require upgrades to existing ranges or the construction of new ranges at basing facilities. Additional or differently configured maintenance facilities might be required for new weapon systems and vehicles. As a result, new or upgraded on-post roads may be required, and/or increased usage of existing roads might occur.
- Construction of new buildings in garrison areas, new or modified ranges, and new infrastructure systems (such as power grids, surface water collection systems, etc.) would be expected to require new or upgraded on-post roads, and/or increased traffic on existing roads.
- Land acquisitions related to training ranges or other military activities may require new or upgraded on-post roads, and/or increased traffic on existing roads. Land disposal would not necessarily require new transportation infrastructure.
- Training activities could increase in type, size, and frequency at many installations. Such changes could place greater demands on the existing transportation infrastructure, or it could lead to requirements for upgrading on-post highways, streets, and roads. In general, because the Army transformation is moving toward a more mobile force, additional capacity for the transportation infrastructure would be expected.
- Deployments typically involve intense, high focused, time-critical activities. Deployment of forces might require upgrades or new construction of airfields, staging areas at airfields, railheads, or ports, to accommodate all required activities in a timely manner. Further, the capacities of both on-post and off-post roads and highways might be exceeded.

It should also be noted that encroachment or urban sprawl on lands adjacent to installations can contribute to increased usage of existing off-post highways, streets, and roads in the vicinity of the installations. The cumulative effects from existing traffic and anticipated traffic increases due to encroachment, and transformation-related or BRAC-related traffic increases could cause the capacities of portions of the local and/or regional transportation network to be exceeded.

Further, a recent Government Accountability Office (GAO) report highlighted Department of Defense infrastructure needs, including needs related to on-post roads (U.S. Government Accountability Office, 2005). Two examples related to the Army were cited – the needs for road paving at Fort Eustis, Virginia, and for road repairs at Fort Sam Houston, Texas.

Specific examples of effects, primarily cumulative, on traffic and transportation systems can be found in the following recent Army-related EISs:

- FEIS for the 2nd Armored Cavalry Regiment transformation and installation mission support, Joint Readiness Training Center and Fort Polk, Louisiana (Tetra Tech, Inc., January 2004, pp. E-19 and 4-376)

  This FEIS indicated that only negligible to minor cumulative adverse effects on transportation would occur over the 20-year planning horizon. Specifically, cumulative effects on transportation would occur as a result of economic growth (six percent population growth projected) and construction projects in the five-parish region-of-influence (ROI) over the planning horizon. The primary reason that these cumulative effects were deemed as "minor adverse" is that the existing transportation system in the ROI is well below capacity.

- DEIS for military training activities at Makua Military Reservation (MMR) on Oahu in Hawaii (U.S. Army Corps of Engineers, April 2004, pp. ES-41, ES-45, and 5-39 to 5-41)

  This FEIS identified several traffic and transportation-related cumulative effects issues. Specifically, these cumulative effects concerns were noted for Farrington Highway at the primary MMR south access road intersection, for Farrington Highway at the secondary MMR north access road intersection, for Farrington Highway at the Makaha Valley Road intersection, for Farrington Highway at the Town of Wai'anae, and in relation to the local and regional transportation system's consistency with state regulations and policies. The ROI for the traffic and transportation VEC included the roadways/highways from Schofield Barracks to MMR following the route used by training convoys. It was also noted that in addition to MMR training, cumulative traffic volumes are attributable to future development projects, particularly large residential developments in Wai'anae and Ewa.

- FEIS for the transformation of the 2nd Brigade, 25th Infantry Division to a Stryker Brigade Combat Team in Hawaii (Tetra Tech, Inc., May 2004, pp. 9-32 to 9-34)

  This FEIS identified several cumulative traffic issues. The Stryker Brigade FEIS addresses training on both the islands of Oahu and Hawaii, and the ROI was the entirety of each island. Traffic concerns occur on both Oahu and Hawaii, with the major causes being population growth and urban sprawl. Recreational usage of greater portions of both islands by residents and tourists have heightened such traffic concerns, and caused traffic to exceed of the capacities of highways and roads in certain locales.

This section is structured as follows around applying the CEQ's 11-step CEA process to the traffic and transportation system VEC. For each step, as appropriate, specific information is included on how the step can be operationalized for the VEC. Further, reference materials and

Web sites are noted, as appropriate, along with scientific methods and related tools. Prior to beginning the 11-step process, summary information is included on the planning process for public highways and the key federal agency associated therewith. The institutional requirements of the DoD and Army Regulation (AR) 55-80 are then summarized, with many of these requirements forming the basis for compliance with the 11-step process. A special issue relating to the need to jointly address indirect and cumulative effects is then described, and a related detailed appendix on an eight-step process for indirect effects is then presented. Several "quick look" questions precede the actual application of the CEQ's 11-step process.

4.14.2 Transportation Planning and the Key Federal Agency

Land use and transportation (highway) projects are inextricably linked (ICF Consulting, 2005). Accordingly, there are linkages between traffic and transportation system effects associated with modernizing Army installations, and/or with meeting new mission requirements, and/or meeting new mission requirements, and on-post and off-post roads and highways. Thus installation planners may be called upon to interact with local, regional, and state-level transportation planners. In so doing, installation planners may need a broad understanding of off-post transportation and land use planning processes. The following paragraphs contain a brief synopsis of these processes and their associated challenges.

To begin, state transportation agencies are generally charged with improving safety and providing or enabling mobility, but their success requires coordination between those doing system planning and those implementing specific highway projects. With a few exceptions, highway project implementation remains a function of state Departments of Transportation (DOTs). The responsibility for transportation systems, in urban areas with population greater than 200,000 de-centralized to local Metropolitan Planning Organizations (MPOs). MPOs are charged with building regional consensus on invest¬ment priorities for the regional transportation system. State DOTs are then called upon to implement projects from those plans. On roadways within their authority, state DOTs perform the work necessary to take projects from plans to construction, including engineering design, NEPA analysis, fulfillment of federal funding requirements, and federal natural resource agency consultation and permitting requirements. City and county transportation departments perform similar functions on transportation systems under their purview. This division of responsibility between state DOTs and MPOs places state DOTs a step removed from the local context in which projects have been developed (ICF Consulting, 2005, pp. 3-4).

The timing of and responsibility for environmental evaluation in highway decision making can pose additional challenges for addressing related land use impacts. Transportation projects generally proceed to the development stage before federal resource agency expertise and environmental analysis are applied. By then, the range of transportation options has often been narrowed, and significant amounts of technical work invested. Further, just as planning for transportation has been distributed among different agencies, planning for land use has also been divided. Jurisdiction for regulating land use originally lay with the states, but most states have empowered local city and county governments to regulate land use. This deregulation creates numerous decision-making bodies in a region that functions as a single unit, from a variety of social, transportation, and environmental perspectives. Accordingly, effective responses to land use and transportation interactions must address the challenges raised by these contexts and conditions under which transportation planning and project implementation occur (ICF Consulting, 2005, p. 4).

The key federal entity related to environmental impacts associated with transportation is the U.S. Department of Transportation (DOT). Agencies within the DOT having transportation-related environmental responsibilities include the Federal Highway Administration, Federal Railroad Administration, and Federal Aviation Administration. In addition, the Surface Transportation Board has regulatory and NEPA-related responsibilities associated with railroads and waterways (Army Logistics Management College, undated).

4.14.3 DoD Requirements Related to Transportation

Department of Defense (DoD) Directive 4510.11 established broad policies and responsibilities for each of the services relative to conducting transportation engineering; incorporating effective transportation engineering techniques and characteristics into DoD transportation processes, equipment, and facilities; and ensuring that DoD transportation engineering interests and infrastructure concerns are considered in civil transportation programs by federal, state and local governments, and by applicable industry (U.S. Department of Defense, DoD 4510.11, April 2004).

The DoD transportation engineering program is described in AR 55-80 (U.S. Department of the Army, AR 55-80, November 2003*). The regulation itself establishes policies and procedures associated with the multimodal components of transportation, including the use of highways, railroads, and ports for national defense programs. Further, the regulation implements DoD Directive 4510.11. It provides guidance and procedures on obtaining installation transportation engineering studies (evaluations of marine ports, terminals, and other modal facilities) and transportation engineering guidance related to DoD force transportation /deployment (U.S. Department of the Army, AR 55-80, November 2003, p. 1). Further, the Military Traffic Management Command (MTMC) within DoD has major responsibilities across all military services.

Responsibilities of the Secretary of the Army relative to transportation engineering include the following (U.S. Department of the Army, AR 55-80, November 2003, p. 2):

- Ensure that effective, efficient, and safe transportation engineering techniques and standards are incorporated into DoD installation and activity transportation processes, equipment, and facilities.
- Promote the incorporation of appropriate federal standards into the design and construction of DoD component highway facilities as directed by DoD Instruction (DODI) 6055.4.
- Promote the efficient and effective use by the DoD of components of intermodal transportation techniques and containerization through the design and construction of new and modified installation and activity transportation equipment and facilities.
- Provide DoD components with transportation engineering services that identify and evaluate their installation transportation engineering needs on an “as requested” basis, and as resources allow.
- Evaluate the impact of installation and activity infrastructure changes and modifications on the DoD component deployment and mobilization capabilities, on an “as requested” basis.
- Assist the commander, MTMC, in defining the on-installation surface transportation engineering requirements and priorities of the DoD components.

Further, the Secretary of the Army has designated the commander of the MTMC to provide the DoD components with transportation engineering consultation services for their on-installation and other transportation and deployability engineering needs, on an "as requested" basis and as resources allow. These services include, but are not limited to (U.S. Department of the Army, AR 55-80, November 2003, p. 3):

- Roadway traffic engineering, planning, and traffic safety studies.
- Installation facilities engineering, analysis, and mobilization evaluations.
- Marine port and intermodal infrastructure evaluations.
- Other transportation engineering consultations.

The following transportation-related definitions are pertinent in the consideration of direct, indirect, and cumulative effects on roads and highways associated with Army installations (U.S. Department of the Army, AR 55-80, November 2003, pp. 19-20):

- Access road – An existing or proposed public highway from a military installation, defense industry, or activity to suitable transportation facilities. (This may include public highways through military installations when they are dedicated for public use and, by fee simple or easement, are owned, operated, and maintained by civil authorities).
- Defense access road – A road that is improved, in whole or in part, with federal funds provided through the Defense Access Road Program.
- Defense transportation system – That portion of the nation's transportation infrastructure that supports DoD common-user transportation needs across the range of military operations. It consists of those common-user military and commercial assets, services, and systems organic to, contracted for, or controlled by the Department of Defense.
- Intermodal systems – Specialized transportation facilities, assets, and handling procedures designed to create a seamless transportation system by combining multimodal operations and facilities during the shipment of cargo (generally standardized intermodal containers) without the need for separate transfer of cargo between modal facilities.
- Installation road – A road or street within a military installation or in which the DoD has a real estate interest. It is not dedicated to public use and is not eligible for improvement with defense access road funds.
- Maneuver area road – A public road that is usually outside military installation boundaries and is delineated by official departmental orders for field maneuvers or military exercises. Because of the exercises, it is anticipated that the road may be damaged beyond that of normal usage.
- Replacement road – A public road that must be built to replace a public highway or street that has been, or will be, closed to public use because of the construction or expansion of a military installation or defense industry, or because of safety or security requirements of the installation.
- Roads open to public travel – Roads on military installations where dependents, visitors, and other members of the public are permitted to travel. Roads open to public travel may be within installations that require identification checks.

Chapter 3 of AR 55-80 addresses the DoD's Highways for National Defense (HND) Program. As part of the HND Program, installation and activity commanders will identify their peacetime and contingency off-installation public highway needs to state and local highway authorities so appropriate projects and programs can be planned and budgeted. Further, state and local government authorities are expected to develop and maintain public highways to accommodate normal and continuing traffic generated by defense installations or activities the same as for other non-DoD traffic generators (U.S. Department of the Army, AR 55-80, November 2003, p. 4). Key features of the HND Program that are related to cumulative effects concerns include the Defense Access Road (DAR) Program, military use of public roads, transportation-related services provided by the MTMC, and the Highway Safety Program.

The DAR Program is based on the fact that DoD installations and activities can create traffic impacts that require public highway improvements that civil highway authorities cannot anticipate. These impacts can occur so quickly that highway authorities cannot be expected to program improvements in normal civil highway programs in time to meet the DoD requirement. The DAR Program provides the means for DoD to pay a fair share for public highway improvements required as a result of a sudden or unusual defense-generated traffic impact or unique defense public highway requirement (U.S. Department of the Army, AR 55-80, November 2003, p. 6). Examples of DoD/Army actions that may justify DAR assistance include (U.S. Department of the Army, AR 55-80, November 2003, p. 6):

- Establishing a new installation.
- Expanding an installation's workforce or mission that results in a quick, dramatic increase in off-installation traffic volumes that substantially degrade local public roadways.
- Adding a new installation gate or access point that adversely impacts a public highway.
- Assigning a new mission which results in the repetitive movement of overweight/oversized vehicles or equipment over inadequate public roads.
- Expanding the boundaries of an installation such that an existing non-installation public highway must be closed.

Further, installation officials should ensure that off-installation highway impacts are considered when planning installation development since DoD resources could be required if significant impacts, such as cumulative effects, are expected to occur off the installation.

Regarding military use of public roads, the following four bulleted statements provide a synopsis of usage under various conditions (U.S. Department of the Army, AR 55-80, November 2003, pp. 7-8):

- Highways are designed to serve the general motoring public, provide for intrastate and interstate freight movement, and meet the needs of national defense. The DoD, in peacetime, must operate within federal and state highway legal limits and safety regulations, to help ensure that the highways are adequate and available if they are required for a national emergency. Therefore, DoD policy requires movement of extremely oversized, overweight vehicles and cargo by alternate modes (rail and barge) or commercial highway carriers, whenever possible. If not feasible, the DoD must obtain permits from the owning highway authorities for movement of oversized, overweight equipment on public roads as required for other non-DoD highway users. Additionally, DoD must get permission from the owning highway officials for convoy operations on public highways, when required by state or local authorities' conditions (U.S. Department of the Army, AR 55-162, January 1979).

- During an emergency, if following normal written highway permit coordination and approval procedures would adversely delay and cause mission failure, unit commanders can proceed with a movement, after contacting and receiving verbal approval from the appropriate state and local officials. Military officials should follow up with a formal written request for a written permit. Appropriate civil authorities should be advised of the move at the earliest possible time and the coordination completed as soon as the mission allows.
- Maneuver area roads are public roads that have been identified by official military orders to be used by the vehicles of a large military unit (division or equivalent) during field maneuvers or exercises. Because of the number of vehicles involved, road damage may occur beyond that of normal usage. Therefore, MTMC has developed procedures for local highway authorities to get reimbursement for damages, should any occur. The procedures include civil highway authority notification and proper documentation of before and after roadway conditions.
- It is occasionally necessary to move military units over public highways during a national emergency or contingency that requires the rapid deployment of tracked vehicles from installations to their ports of embarkation (POE). There may be insufficient time available to use preferred alternate modes of transportation, such as rail, and still meet time constraints. Also, alternate modes might not be available due to terrorist activity, natural disaster, or other events. Tracked vehicle road marches generally only are feasible for units located within 75 miles of their POE, due to vehicle degradation. The ITOs (Installation Transportation Officers) should determine when future tracked vehicle road marches are probable, and coordinate their plans with state highway authorities. This will ensure the march will minimize any adverse effect the tracked vehicles will have on bridges, pavements, and traffic operations.

As inferred earlier, MTMC, on behalf of the Secretary of the Army, functions as the DoD proponent for overall DoD traffic engineering coordination, technical assistance, and development of installation traffic engineering studies. More specifically, the traffic engineering services available from MTMC include (U.S. Department of the Army, AR 55-80, November 2003, p. 10): geometric design of transportation facilities; analyses of traffic operations and safety concerns; analyses of crash and roadway fatalities; analyses and design of specific gate and entry control facilities to support installation force protection and anti-terrorism projects; selection, placement, and operation of traffic control devices; and guidance in support of installation master/comprehensive planning. Each study involves a review of the installation master/development/ comprehensive plan, collection of data, review of accident and congestion problem locations, analyses of roadway enhancement alternatives, and development of recommended engineering improvements. Traffic engineering guidance normally is in the form of a brief "in and out" visit to the installation, followed immediately by a published report.

In providing these services to installations, the following forms of assistance are available from MTMC (U.S. Department of the Army, AR 55-80, November 2003, p. 11):

- Telephone advice and assistance
- Review of plans, concepts, and proposals
- Reconnaissance study – Reconnaissance studies address problems of limited scope and usually are accomplished by an engineer being on site for two to four days.
- Intermediate study – Intermediate studies address several problems of limited to average scope and usually are accomplished by an engineer being on site for four to seven days.

- Comprehensive study – Comprehensive studies normally analyze the entire installation transportation network and address numerous operational and planning issues. Because of the time and resources required to conduct them, they are usually outsourced to contract firms at installation expense.

- Contracting assistance – This includes professional guidance in contracting for commercial traffic engineering services. MTMC also offers limited contract assistance to installations for investigation of high-frequency crash locations at no expense to the installation, when funds are available.

- Special studies and self-help manuals – These studies and manuals include the development of traffic engineering criteria and standards to serve as practical references in solving common installation traffic engineering problems.

Finally, DoD policies have also been developed for highway safety. Specifically, the following two policies are applicable (U.S. Department of the Army, AR 55-80, November 2003, p. 11):

- Installation commanders will develop and maintain their roadways to nationally accepted standards that provide a safe driving environment for all drivers and passengers.

- Installation commanders will implement a highway safety program in accordance with the Highway Safety Program Guidelines for federally administered areas, as defined in the FHWA's "Highway Safety Grant Management Manual".

In addition, appropriate installations may need to develop and maintain a safety program that includes traffic accident records, accident investigation reports, and a roadway safety program. Each program should be developed based on the size of the installation and the existing and anticipated severity of traffic safety problems. Information from an installation's Traffic Safety Plan (TSP) would be relevant to the conduction of a cumulative effects study for the transportation VEC.

In conclusion, AR 55-80 also includes chapters related to railroads for national defense (Ch. 4), ports for national defense (Ch. 5), and intermodal facilities (Ch. 6). Effects related to these topics are considered to be beyond the scope of this transportation VEC.

4.14.4 Addressing Indirect and Cumulative Effects – A Special Issue

A special NEPA-related issue associated with new or upgraded roads or highways is related to overlaps and confusion over addressing indirect effects and cumulative effects. In response to this issue, EO 13274 was issued on September 18, 2002 (Executive Office of the President, 2002), and a focused work group was formed. The NEPA process requires that direct, indirect, and cumulative effects be considered in agency decision making. Definitions of the latter two terms, as contained in the CEQ's NEPA regulations, are as follows (Council on Environmental Quality, 1979):

- Indirect effects refer to those that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

- Cumulative effects refer to impacts on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

From the above two definitions, it can be observed that the phrase "reasonably foreseeable" appears in both. Further, indirect effects will definitely contribute to cumulative effects, but there can be other contributors such as past, present, or future actions in the study area that have no association with a proposed action involving a new or upgraded highway or highway segment. Useful background information and guidance on indirect and cumulative effects considerations for highway projects can be found in 2003 interim guidance from the FHWA. The guidance is presented in a Web linked question-and-answer format (Federal Highway Administration, 2003).

In addition to NEPA, other federal statutes require the consideration of both indirect and cumulative impacts of highway projects. Examples of these requirements include the Section 404(b1) guidelines of the Clean Water Act, the conformity provisions of the Clean Air Act, the Section 106 regulations of the National Historic Preservation Act, and the Section 7 provisions of the Endangered Species Act.

In response to EO 13274, the FHWA formed a work group to develop a contextual baseline report delineating the concerns and opportunities related to addressing indirect and cumulative effects in NEPA documentation for highway projects. In March 2005, the work group issued their draft report (Indirect and Cumulative Impacts Work Group, 2005, pp. ES-3 to ES-5)*. Key findings as described in this draft report include the following:

- The level of analysis of indirect and cumulative effects in NEPA documents varies widely; reasons basic to these variations include lack of recognition of differences between indirect and cumulative effects, and lack of application of rigorous analysis techniques to estimate these effects.
- Common sources of disagreement often arise between transportation agencies and resource agencies. Examples of such disagreements are related to proper analysis boundaries (spatial and temporal), the level of detail of the analysis, the reasonableness or practicality of obtaining necessary information for the analysis, documentation of significance and related mitigation, and disagreements about causality and the role of transportation agencies in mitigation (compensation) for indirect and cumulative effects.
- One overarching lesson noted by the work group was that there is "no one size fits all approach." This was explained by noting that although transportation agencies ought to strive to have a greater level of consistency in their analyses, experience with indirect and cumulative effects suggests that they should not take a "one size fits all" approach. The unique circumstances of the project, critical resources, and past actions should determine the geographic and temporal boundaries for analysis.
- A second overarching lesson related to the importance of clear documentation of both indirect and cumulative effects. Clear descriptions of these effects, the methodologies and analyses applied, and consideration of mitigation is important to make clear to decision makers, the public and resource agencies that all of these issues have been examined.

The work group also delineated several opportunities for improving coordination and obtaining agreements relative to indirect and cumulative effects. They include (Indirect and Cumulative Impacts Work Group, 2005, pp. ES-7 to ES-8):

- Conduct early coordination to agree on critical issues and analysis boundaries.
- Use analytical tools such as GIS and integrated transportation-land use models to better characterize impacts.
- As appropriate, use expert panels as an aid to organizing input and gaining general consensus on the range of indirect and cumulative effects.
- Consider indirect and cumulative effects at the project development stage rather than near the end of the project planning process.
- Coordinate and develop partnerships, as appropriate, with local governments.
- Consider area-wide, watershed, and ecosystem level approaches for mitigating indirect and cumulative effects.

The work group draft report was developed based on literature reviews, reviews of EISs and associated analyses, and interviews with over 50 practitioners (from the Federal Highway Administration, Federal Transit Administration, Federal Aviation Administration, federal resource agencies, state departments of transportation, metropolitan planning organizations, and consultants). The key sections of the draft report include (Indirect and Cumulative Impacts Work Group, 2005, pp. ES-1 and ES-2):

- Section 2 – requirements for analysis and mitigation of indirect and cumulative impacts. This section includes a summary of laws and regulations that address indirect or cumulative impacts, and a compilation of relevant case law and its implications.
- Section 3 – existing guidance materials and training programs. This section includes an annotated bibliography summarizing guidance documents, a compilation of existing training programs, and a synthesis of viewpoints from practitioners on the value of these resources.
- Section 4 – a summary of the state-of-practice, lessons learned, and opportunities. This section highlights challenges faced, differences of opinion between transportation and resource agencies, effective practices, and opportunities to improve the quality of analysis and develop interagency consensus.
- Section 5 – case studies on notable practices related to indirect and cumulative impacts. This section includes two case studies on planning-level efforts; 15 case studies on notable practices in scoping, analysis, or mitigation; three case studies on ecosystem-level approaches to mitigation; and six case studies on priority projects not elsewhere described. These 26 cases provide practical examples of how to address indirect and cumulative effects across a variety of types of transportation projects.

In addition to the situational baseline report described above, two National Cooperative Highway Research Program (NCHRP) reports have developed an analytical methodology for addressing indirect effects (Louis Berger and Associates, Inc., 1998; and the Louis Berger Group, Inc., 2002). Both reports delineate a common analytical methodology, with the latter one specifically identifying the following 8-step approach (The Louis Berger Group, Inc., 2002, p. 1):

- Step 1 – Scoping: The basic approach, effort required, and geographical boundaries of the indirect effects study are determined in this step.
- Step 2 – Identify the Study Area's Direction and Goals: In this step, information

regarding the study area is compiled with the goal of defining the context for assessment.

- Step 3 – Inventory the Study Area's Notable Features: Additional data on environmental features are gathered and synthesized during this step. The goal is to identify specific environmental issues (or VECs) by which to assess the project.
- Step 4 – Identify Direct and Indirect Impact-Causing Activities of Proposed Action and Alternatives: The component activities of each project alternative are fully described during this step.
- Step 5 – Identify Potentially Significant Indirect Effects for Analysis: Indirect effects associated with project activities and alternatives are cataloged, and potentially significant effects meriting further analysis are identified.
- Step 6 – Analyze Indirect Effects: Qualitative and quantitative techniques are employed to estimate the magnitude of the potentially significant effects identified in Step 5 and describe future conditions with and without the proposed transportation improvement.
- Step 7 – Evaluate Analysis Results: The uncertainty of the results of the indirect effects and analysis is evaluated for its ramification on the overall assessment.
- Step 8 – Assess Consequences and Develop Mitigation: In this step, the consequences of indirect effects are evaluated in the context of the full range of project effects. Strategies are developed to avoid or lessen any effects found to be unacceptable. Effects are reevaluated in the context of those mitigation strategies.

Appendix 1 of Chapter 4.14 to this VEC provides additional details on the above eight steps, how they relate to the CEQ's 11-step CEA process, and how they can be integrated together to plan and conduct a study of the indirect and cumulative effects of a new or upgraded road or highway project, whether on post or off post.

The Departments of Transportation in several states have developed state-specific guidance and related handbooks for addressing the indirect and cumulative effects of transportation projects. For example, North Carolina has applied the 8-step indirect effects analysis (IEA) process described above in their two-volume guidance (The Louis Berger Group, Inc., Vol. I and II, 2001). Volume I contains sections on the background on requirements for assessing indirect and cumulative project impacts, the state-of-such-practice in North Carolina, and NCDOT guidance on indirect and cumulative effects assessment under NEPA and North Carolina's State Environmental Policy Act (The Louis Berger Group, Inc., Vol. I, 2001)*. Volume II, the practitioner's handbook, includes five sections – Section I on how the handbook is organized; Section II on pre-screening projects for applying indirect and cumulative effects analysis; Section III on developing the scope of the indirect and cumulative effects study (includes IEA Steps 1 through 5 as described above); Section IV on the analysis of indirect and cumulative effects (includes IEA Steps 6 and 7 as described above); and Section V on assessing the consequences (includes Step 8 of the IEA process as described above) (The Louis Berger Group, Inc., Vol. II, 2001)*.

For U.S. Army installations in North Carolina, Volumes I and II as described in the above paragraph should be reviewed for specific information and procedural relevance when addressing cumulative effects on the traffic and transportation system VEC. Further, the Departments of Transportation in several other states (e.g., Florida and Maryland) have also developed similar guidance related to indirect and cumulative effects assessment. Accordingly, all installations should ascertain if such state-specific guidance is available, and should review it as appropriate when addressing cumulative effects on this VEC.

The California Department of Transportation (Caltrans), along with the FHWA and the U.S. Environmental Protection Agency, has developed guidance for conducting cumulative effects assessments of surface transportation projects in California (Caltrans, 2005a – 2005e)*. This guidance is focused on cumulative effects rather than indirect effects of highway projects. The guidance is based on an 8-step approach which is consistent with the CEQ's 11-step process for CEA. Summary information on the eight steps, defining study areas for resources, and data gathering for CEA studies, is included in Appendix 2 of Chapter 4.14.

For U.S. Army installations in California, the Caltrans CEA guidance should be reviewed for data sources and procedural relevance when addressing cumulative effects on the traffic and transportation system VEC. Further, the Caltrans guidance, with appropriate agency adaptations, could be useful for installations in any state.

4.14.5 "Quick Look" Questions

"Quick look" questions can be used to determine the need to address the direct and indirect effects of a proposed action on traffic and the transportation system; in addition, they can be used to determine if cumulative effects also need to be considered. These "quick look" questions include:

- Is transportation data and the transportation plan for the installation more than five to 10 years old and, if so, is the plan subject to current updating/modification efforts?
- Is there a transportation improvement program for the installation and, if so, will current and anticipated traffic concerns be resolved upon completion of the plan?
- Has a recent (last five to 10 years) regional transportation study been conducted via a collaborative effort between the installation and nearby towns and cities?
- Are there any historical or current conflicts between the installation and various governmental agencies, and/or stakeholder groups, relative to on-post or off-post traffic-related concerns?
- Is there any evidence of current or anticipated encroachment or rapid urban development that might have implications relative to the traffic and transportation system VEC?
- Will the proposed action(s) over the planning horizon cause increases of more than five percent to on-post and/or off-post traffic levels?

If the answers to all of the above questions are "no," then it will probably not be necessary to address the direct, indirect, and cumulative effects of the proposed action. However, if one or more of the above questions has a "yes" or "do not know" answer, then attention will need to be given to all three types of effects. Conversely, a "yes" or "do not know" answer does not automatically trigger an EIS. Consideration should first be given to the preparation of an EA for the proposed action.

At the EA level, attention needs to be given to the four scoping steps (Steps 1-4) described below, and Steps 6 and 7 related to describing the affected environment. Documentation of the findings from these steps could serve as a "hard look" if it is determined that an EA is appropriate. However, if concerns are identified from consideration of Steps 1-4, 6 and 7, then an EIS would be appropriate. For an EIS, all 11 steps described below should be addressed.

4.14.6 Impact Analysis Steps

CEQ Step 1–Identify the significant traffic and transportation system effects issues associated with the proposed action and define the assessment goals.

The first step involves identifying the anticipated traffic and transportation system changes that would be associated with the construction and operation of training range projects or activities, and cantonment area projects or activities.

The traffic/transportation system-related impacts of the proposed action(s) in the Region-of-Influence (ROI) provide a basis for identifying potential cumulative effects on this VEC. Examples of such impacts include: (1) increases or decreases in local area or regional traffic situations; (2) temporal changes in local area or regional traffic situations (daily, weekly, monthly, and/or seasonally); (3) construction-phase disruptions of existing local area or regional traffic patterns; and (4) increases or decreases in commuting times and congestion in the local area and/or region (Canter, 1996, p. 525).

In order to systematically address these proposed action-related impacts, quantitative information should be aggregated on expected local and regional traffic changes (increases, or decreases) which might occur during construction and conduction of the action. Particular attention should be given to the timing (daily, weekly, monthly, and/or seasonally) of the expected changes. It is anticipated that the proponent for the action would have such information, or, if no such data exists, this information could be developed during discussions with the proponent (Canter, 1996, p. 525).

Several general and specific information sources should be examined relative to information on historical and current traffic and transportation-related conditions. Further, these sources can also be used in conjunction with Steps 5 through 7 below. One possible source is the Integrated Natural Resources Management Plan (INRMP) for the installation. Specifically, in the Facilities section (4.0) of the INRMP, descriptions should be included of the road, railroad, air, and waterway system for transportation within or from the installation. Particular attention needs to be given to roads, trails, and airfields on the installation that will be important to the implementation of, or affected by, the INRMP (U.S. Army Environmental Command, 1997).

Both on-post and off-post transportation infrastructure are vital components of an installation's Real Property Management plan (RPMP) (U.S. Department of the Army, AR 210-20, May 2005). Accordingly, a systematic review of the transportation-related information in the installation's RPMP should be a part of initial efforts to address cumulative effects on the transportation VEC. Detailed information on the process for development of a RPMP, and on the contents thereof, is provided for the Land Use VEC (Section 4.12). Selected transportation-related features incorporated in a RPMP, and which should be reviewed, are as follows:

- Regarding on-post information needs, identify existing natural conditions that may create significant limitations on the construction or use of roadways and runways.
- Regarding off-post information needs, existing regional transportation systems (highways, roads, railroads, commuter mass transit systems, and airports) should be considered in relation to their current usage patterns and capacities.
- Typical GIS data themes for a RPMP should include critical infrastructure, with one data layer being the transportation/roads system encompassing a spatial area of 20 miles beyond the installation boundary. This GIS layer should be studied.

- One of five key components of an installation's RPMP is the Long Range Component (LRC). Documents that should be contained in the LRC include an on-post and off-post transportation system assessment (narrative) and supporting graphics such as road network maps, railroad network maps, and, if appropriate, an airfield map. Familiarity with these documents would provide a basis for addressing cumulative effects on the traffic and transportation system VEC.

In order to identify the potential relevance of cumulative traffic and transportation system effects related to on-post and off-post roads and highways, the assemblage of specific basic data will be required. Table 4.14-1 contains 12 listed data needs for an installation (U.S. Army Environmental Command, 2005, pp. 3-4). As can be seen, a wide range of information/data is specified, with the geographic focus related to on-post, off-post, or both areas. Further, sources for the listed information/data include the installation and transportation agencies associated with MPOs and/or nearby cities and counties. The listed information/data would be relevant for Steps 1 (identify cumulative effects issues), 4 (identify other actions), and 5 through 7 (describe affected environment).

CEQ Step 2 – Establish the geographic scope for the analysis.

The geographical (spatial) boundaries for considering traffic and transportation systems effects should include the installation wherein the training range and cantonment areas are located, as well as at least 20 miles out from the installation in all directions (the 20-mile boundary was specified in the RPMP). These boundaries should be chosen because they represent typical geographical boundaries used for transportation planning at Army installations. Key references that should be reviewed prior to specifically establishing the geographic scope include:

- General information on the location of the physical boundaries of the installation and associated ranges, the boundaries of adjacent easement lands, and the uses and boundaries of adjacent non-Army lands.
- Counties (or parishes) associated with and/or contiguous to the installation, including interstate and international areas as appropriate, and their existing and planned transportation systems.
- Geographic boundaries of designated areas of concern in relation to existing traffic levels and the capacities of the transportation system. This information can be obtained from the DPW, regional, state, or local offices responsible for transportation planning, and federal agencies as appropriate.

Data	Description	Geography	Source		
			Installation	Other Transportation Agencies	
				MPO	City/County
Existing transportation infrastructure	Existing and planned roadways, transit/bus service, pedestrian/bicycle facilities, parking (surface and structure)	On installation and surrounding area	X	X	X
Traffic counts (volumes)	Existing and forecasted (AM and PM Peak Hour)	Roadways on installation and in surrounding area	X	X	X
Level of Service (LOS)	Historic, current and projected LOS for key arterials in and around installation (A, B, …F)	Roadways on installation and in surrounding area	X	X	X
Gate Operations	LOS and carrying capacity of installation gates	Installation	X		
Trip Generation	AM in, AM out, Total AM, PM in, PM out, Total PM	Key areas within installation and the installation itself	X	X	X
Traffic Safety	Incident (traffic accident) data	Roadways on installation and in surrounding area	X	X	X
Demographics/Land Use Data	Historic, current, and projections of population, housing units, households and at-place employment (retail, office, industrial, & other)	On installation and surrounding area; small areas, city/county, metropolitan area	X	X	
Persons per Household	Historic, current and projected	On installation, city/county, metropolitan area		X	X
Land Use Plans	Current land use plans depicting existing conditions and planned land use changes	On installation master plans, city/county comprehensive plans and area plans	X		X
Transportation/Traffic Studies	Studies performed to assess various aspects of transportation system, such as corridor studies	On installation, city/county, metropolitan area	X	X	X
Regional Long Range Plan	Regional long-range transportation plan (approx 25-30 year planning horizon)	Metropolitan area		X	
Regional Transportation Improvement Program (TIP)	Regional 6-year funding programming document identifying major regional transportation projects in next 6 years.	Metropolitan area		X	

Table 4.14-1:*Information/Data Needs Related to Cumulative Effects on Traffic and Transportation System (U.S. Army Environmental Command, 2005, pp. 3-4)*

CEQ Step 3–Establish the time frame for the analysis.

The temporal boundaries should include consideration of past and future actions that may have influenced traffic and the transportation system within the above-delineated spatial boundaries. However, no specific requirements have been developed for the time period to be encompassed by the retrospective and prospective boundaries. Some practical questions to ask or things to consider in establishing the historical boundary (reference point in time) include:

- When were the installation and associated training ranges established, and when have historical mission changes or modernizations occur? Have range expansions or reductions occurred in the past, and when did they take place?

- When was the first transportation inventory and RPMP compiled for the installation and associated range(s)? How frequently has the inventory and RPMP been updated?
- Has a traffic monitoring program been established for the installation and/or regional area? If so, when did it start and has the program evolved over time relative to indicators that have been, or are being, monitored?

Based upon the answers to the above questions, identify the earliest date and use it as the initial historical reference point.

Some practical questions to ask or things to consider relative to a future time horizon include:

- What is the time period required to modernize the installation and range(s), and what is the anticipated period of use of the completed modernized range or ranges?
- What are the military construction plans for the installation over the next two, five, and 10 years? It should be noted that the RPMP process uses a 20-year planning horizon.
- Are any major changes in the installation mission anticipated, and if so, when will such changes occur?

Depending upon the answers to the above questions, establish the most distant time as the initial prospective reference point to encompass future actions.

CEQ Step 4–Identify other past, present, and reasonably foreseeable future actions that have affected, or are anticipated to affect, traffic and transportation systems.

The identification of past actions can be aided by the review of historical land use information for the installation. Such reviews can highlight both contributing past actions as well as traffic levels and trends in both garrison areas and training ranges. Several installation-specific plans and reports can be useful in Step 4. For example, the earlier-mentioned RPMP and INRMP should be reviewed.

Both on-post and off-post past and present actions affecting land use issues and traffic levels could be identified via the use of historical aerial photographs and the delineation of typical land uses and the transportation infrastructure associated therewith (these actions can include those by the Army, nearby industrial developments, and urban area growth). In addition, land use plans and traffic levels for federal agencies with land holdings in the study area should be reviewed (e.g., other military services, the U.S. Forest Service, and U.S. Department of Agriculture). Also, any Indian land holdings in the study area should be identified.

Present (current) actions include both ongoing past actions and new actions that may be in the construction stage. Traffic-related information for these actions can be procured from the range DPW, the planning departments of local towns and cities, and other federal and state planning agencies. These same information sources could be used to identify reasonably foreseeable future actions within the future temporal boundary for the study. The likelihood of future actions and the time period of their potential occurrence should be considered.

Finally, depending on the scope and time of preparation of existing installation documents (e.g., the RPMP), it may be necessary to update these documents. If key transportation infrastructure documents have never been developed, it may be necessary to conduct such studies for the installation.

CEQ Steps 5-7 – Characterize the on-post and off-post transportation infrastructure identified in scoping in terms of its response to change and capacity to withstand stresses (Step 5); characterize the stresses affecting this infrastructure and its relation to regulatory thresholds (Step 6); and define a baseline condition for the traffic levels and transportation infrastructure (Step 7).

The primary emphases of these three steps are related to historical trends in both on-post and off-post traffic levels and the capacities of the existing infrastructure, and the compatibility of these uses with various transportation-related management policies and goals. Key references that should be reviewed to accomplish these steps include:

- Historical and current reports on both the installation and regional roads and highways.
- Historical and current transportation studies and reports from the state or in-state regional agencies wherein the installation is located.
- Historical and current traffic and transportation management policies and goals.
- Historical and current tensions and conflicts related to the local and regional transportation infrastructure.

Key information for describing the historical and current situation related to traffic and the transportation system in the ROI includes the following (U.S. Army Construction Engineering Research Laboratory, Vol. 3, 1989): (1) the type of transportation network, its conditions, and frequency of its use; (2) the type and purpose of traffic using the network; and (3) the character of traffic flow – for example, periods of maximum and minimum use. Further, this information needs to be organized in a manner to display the spatial locations of the infrastructure itself, and the locations of maximum and minimum use.

Another information item is related to the "level of service" (LOS) delineations for the transportation infrastructure in the ROI. The LOS concept was developed by the Transportation Research Board of the National Research Council. The LOS is defined as: a qualitative measure of the effect of a number of factors, which include speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs (Transportation Research Board, 1980, pp. 163-164). In practice, selected specific LOS levels are defined in terms of particular limiting values for a certain number of these factors. LOS levels A through F represent the best through the worst operating conditions, respectively. The specific LOS levels are defined as (Transportation Research Board, 1985 and 2000):

- LOS A – represents virtually free-flow conditions, in which the speed of individual vehicles is controlled only by the driver's desire and by prevailing conditions, not by the presence of interference of other vehicles. Ability to maneuver within the traffic stream is unrestricted.
- LOS B, C, and D – represent increasing levels of flow rate with correspondingly more interference from other vehicles in the traffic stream. Average running speed of the stream remains relatively constant through a portion of this range, but the ability of individual drivers to freely select their speed becomes increasingly restricted as the LOS worsens (goes from B to C to D).
- LOS E – this is representative of operation at or near capacity conditions. Few gaps in traffic are available, the ability to maneuver within the traffic stream is severely limited and speeds are low (in the range of 30 mi/hr). Operations at this level are unstable, and a minor disruption may cause rapid deterioration of flow to LOS F.

- LOS F – represents forced, or breakdown, flow. At this level, stop-and-operations at a given point may vary widely from minute to minute, as will operations in short, adjacent highway segments, as congestion waves propagate through the traffic stream. Operations at this level are highly unstable and unpredictable.

Information related to LOS classifications can be used to ascertain the historical and current conditions of the transportation infrastructure in the ROI. Further, such information can be used in Step 9 for determining the significance of cumulative effects on traffic and transportation systems.

In addition to the LOS system, local roads and streets in the study area may have been classified by local or regional traffic or transportation authorities, or even by the Directorate of Public Works (DPW) if the proposed action is on a military installation (Canter, 1996, p. 526). The delineation of these classifications would also be appropriate for inclusion in conjunction with Steps 5-7 and 9.

Procurement of information on the transportation infrastructure in the ROI can be accomplished by contacts with the engineering staffs of pertinent local and regional agencies, the state DOT, and FHWA. Local agencies could include city planning and/or engineering departments, while regional agencies could include councils of government or designated regional transportation commissions. For larger urban areas, the Metropolitan Planning Organization (MPO) might be the appropriate agency to contact for traffic and transportation-related information.

The DPW at an installation would be the key contact for on-post information related to traffic and the transportation system. Further, careful review of the transportation information in the Real Property Master Plan (RPMP) should also yield pertinent historical and current information.

If the procured information is not current or if some necessary information is non-existent, it may be necessary to conduct installation-specific studies. As described earlier, the MTMC can possibly provide assistance in the conduction of site-specific studies and analyses (U.S. Department of the Army, AR 55-80, November 2003, pp. 10-11).

Some specific information items for describing historical and current conditions relative to traffic volumes is the ADT and the maximum hourly values. Both ADT and maximum hourly values are expressed in numbers of vehicles at specific on-post and off-post locations. Automatic traffic recorders are often used for specified time periods (e.g., a one week period that includes weekdays and a weekend). Resultant data are frequently tabulated for one-hour periods (by direction of travel), and the 24-hour volume or average daily traffic (ADT) is presented for each study area highway (Burchell, et al., 1994, p. 145).

The ADT and maximum hourly values must be considered in relation to the specific capacity and LOS at various locations in the ROI. Capacity is defined as the maximum number of vehicles that can be expected to travel over a given section of roadway, or a specific lane, during a given time period, under prevailing roadway and traffic conditions (Transportation Research Board, 1985 and 2000).

The relationship between the capacity and LOS for a given road segment is related to several factors. For example, the LOS and capacity of a two-lane rural highway is dependent on the type of terrain (level, rolling, or mountainous); the volume of traffic; the composition of traffic (percent trucks, percent recreational vehicles); directional split (percent northbound or eastbound versus southbound or westbound); and the percent of the roadway where no parking is permitted. The use of typical or average factors permits the calculation of the LOS and capacity of a two-lane road expressed as ADT volumes. Table 4.14-2 summarizes the LOS and capacities under a specific set of conditions (Burchell, et al., 1994, p. 146).

Detailed information on capacities and LOS is in the Transportation Research Board's highway capacity manual (Transportation Research Board, 1985). This manual would be useful during the conduction of a cumulative effects study related to local traffic and the transportation system in the ROI.

CEA Step 8–Identify the important cause-and-effect relationships between human activities and traffic and transportation systems.

The inferred cause-and-effect relationships as noted in Step 8 can be depicted in several ways, including maps showing traffic "hot spots" and areas of conflict. Network diagrams and connector tables (matrices) could also be developed to depict various actions and types of effects. Information on several methods and tools for identifying and displaying these cause-effect relationships can be found elsewhere (Louis Berger and Associates, Inc., 1998; The Louis Berger Group, Inc., Vol. I and II, 2001; and The Louis Berger Group, Inc., 2002).

CEA Step 9–Determine the magnitude and significance of cumulative effects on traffic and the transportation system.

Level of Service[1] Expressed as Average Daily Traffic Volumes

Terrain	C	D	E
Level	7,900	13,500	22,900
Rolling	5,200	8,000	14,800
Mountainous	2,400	3,700	8,100

Note:
[1]Assumes that peak-hour traffic = 10%; 60/40 split; 14% trucks; 4% recreational vehicles; 25% no passing (level terrain); 40% no passing (rolling terrain); 60% no passing (mountainous terrain).

Table 4.14-2*: Capacity of Two-Lane Road in Relation to LOS (Burchell, et al., 1994, p. 146)*

The key questions to be addressed relative to determining cumulative effects on local traffic and the transportation system in the ROI are as follows

- How much new traffic will be produced by the site of the proposed action (i.e., the installation) over the planning horizon? Further, what hourly, daily, weekly, and seasonal time patterns will be associated with the new traffic over this period?
- How much new traffic will occur in the ROI over the planning horizon? (This new traffic would be expected to occur from general economic growth and development, and would not be inclusive of the installation-generated new traffic.) Further, what hourly, daily, weekly, and seasonal patterns will be associated with this new traffic over the time period?

The above questions are related to trip generation; detailed information for calculating the anticipated new traffic for various hourly and daily periods can be found in the "trip generation manual" of the Institute of Transportation Engineers (Institute of Transportation Engineers, 1991). This manual contains data on 119 individual land uses grouped into the following categories: ports and terminals, industrial/agricultural, residential, lodging, recreational, institutional, medical, office, retail, and services. Data for military installations is included in the "institutional" category. In lieu of using the manual's national rates, other approaches include the use of local rates based on special studies. Further, multiplier factors could be used on current local and regional traffic to project anticipated future traffic levels. The multiplier factors could be based on assumed or projected economic growth patterns in the ROI.

Additional questions related to cumulative effects in the ROI are as follows:

- Which on-post and off-post roads and highways will be used by the new traffic generated by the installation? Will these usage patterns be expected to change over the planning horizon, and if so, what will the new patterns be?
- What usage patterns of off-post roads and highways in the ROI will be exhibited by new non-installation traffic over the planning horizons? Will these usage patterns be expected to change over the planning horizon, and if so, what will be new patterns be?

The above two questions are related to trip distribution. The four most commonly used methods for estimating trip distribution rely on existing data: origin/destination data; a trip distribution model; and market studies (Burchell, et al., 1994, p. 148). Existing data can provide a sound, cost-effective approach for estimating trip distribution. Most often this information is routinely collected as part of the traffic counting program. Special studies and modeling would be required for the other approaches, and summary information on these "tools" can be found elsewhere (e.g., Burchell, et al., 1994, pp. 155-156; and The Louis Berger Group, Inc., 2002). Again, it is important that the trip distribution information be organized both spatially and temporally.

As answers to the above trip generation and trip distribution questions are generated, and assuming they are determined on a spatial and temporal basis, the following simple calculations could be used to address the direct and indirect effects of the proposed actions, and the cumulative effects at the installation and regional levels.

Percentage changes can be calculated for each pertinent local or regional road or highway, for each proposed action, and for the composite of other actions. For example, assume a local road near the installation has a current ADT of 1,000 vehicles, with the peak-hour traffic being 250 vehicles. Further assume that the action-related construction phase of six months will add 200 (vehicles) to the ADT, with 150 being associated with the peak hour. Also assume that the operational phase for the action will add 80 to the ADT, and that only 10 percent of these vehicles will be associated with the peak hour. The percentage changes for the local road would be calculated as follows:

Construction Phase

(200) (100)

Percent change in ADT = 1,000 = 20%

(150) (100)

Percent change in peak hour = 250 = 60%

Operational Phase

80 (100)

Percent change in ADT = 1,000 = 8.0%

(8) (100)

Percent change in peak hour = 250 = 3.2%

Since the basic output above is the percentage change information in relation to current traffic conditions, the next consideration should be focused upon how to interpret this percentage change information. No transportation criteria or standards provide a delineation of an appropriate interpretation method; however, the absolute changes, the roadway capacity, and the current and resultant changes in LOS should be given consideration in determining the significance of the cumulative effects (Canter, 1996, p. 527).

Additional percentage change calculations could be made for numerous other conditions. They include, but are not limited to, the following:

- The action-generated direct and indirect new traffic at various locations within the ROI and at various future times.
- The action-generated new traffic combined with non-installation related new traffic (cumulative effects) at various locations within the ROI and at various future times. Note: the non-installation related new traffic could be considered as the "future without project condition."

Burchell, et al. (1994, p. 157) suggested that a traffic impact study focused on direct and indirect effects should address the following three key topics and subtopics:

- Existing Conditions
  - Description of roadways in ROI
  - Existing traffic volumes
  - Analysis of present traffic conditions
  - Proposed improvements to existing conditions

- Traffic Projections
  - Background traffic
  - Traffic from approved developments
  - Site (action-generated) trip generation
  - Directional distribution
  - Future volumes without site traffic
  - Future volumes with site traffic

- Future Conditions
  - –Future levels of service without site traffic
  - –Future proposed improvements without site traffic
  - –Future levels of service with site traffic
  - –Future proposed improvements with site traffic

The above topics and subtopics could be modified to address cumulative effects by the inclusion of historical information within the existing condition topic; by incorporating non-approved but reasonably foreseeable future actions within the traffic projections topic; by combining the two "future volumes" topics within the traffic projections topics; and by combining the "without" and "with" conditions within the future conditions topic.

Exhibit	Title	Description
1	Site Location Map	Area map showing adjacent roadways, transit lines, municipal boundaries, site (installation) location.
2	Existing Morning Peak-Hour Traffic	Current morning peak-hour turning volumes for each study intersection. Peak-hour volumes are shown for each permissible movement and are represented by an arrow.
3	Existing Evening Peak-Hour Traffic	Same as above
4	Level of Service for Signalized Intersections	Highway Capacity Manual definitions of levels of service A through F, including the average stopped delay (in seconds).
5	Level of Service for Unsignalized Intersections	Highway Capacity Manual definitions of levels of service A through F, including the average reserve capacity (in vehicles).
6	Existing Morning Peak-Hour Levels of Service	Results of morning peak-capacity analysis should be shown for each separate approach lane to all study intersections. The appropriate level-of-service letter should be presented with either stopped delay or reserve capacity in parentheses adjacent to the respective level of service.
7	Existing Evening Peak-Hours Levels of Service	Same as above.
8	Anticipated Area Development	Map at same scale as Exhibit 1 to illustrate nearby approved developments.
9	Site (installation) Trip Generation	A table showing land use, size of use, peak-hour volumes (in, out, and total) and site totals.
10	Site (installation) Trip Distribution	Illustration showing various arrival/departure percents on the area roadways surrounding the site.
11	Site Peak-Hour(s) Traffic	An exhibit showing the future peak-hour(s) volumes for site traffic only at the study intersections.
12	Future Volumes without Site Traffic	One or more exhibits showing future peak-hour(s) volumes without site traffic at the study intersections.
13	Future Volumes with Site Traffic	One or more exhibits showing future peak-hour(s) volumes with site traffic at the study intersections.
14	Future Peak-Hour(s) Level of Service without Site Traffic	One or more exhibits showing results of capacity analysis for each separate approach lane to all study intersections without site traffic.
15	Future Peak-Hour(s) Level of Service with Site Traffic with improvements	Similar to Exhibit 13, but results assume the completion of proposed roadway and intersection improvements.
16	Level-of-Service Comparison	In the summary of the report, a tabular comparison of the levels of service with respect to existing conditions, future conditions with and without the site, and future conditions with and without improvements.

***Table 4.14-3**: Suggested Exhibits for a Traffic Impact Study (after Burchell, et al., 1994, p. 148)*

Burchell, et al. (1994, p. 158) also suggested a series of exhibits within a traffic impact study focused on direct and indirect effects. The exhibits are listed in Table 4.14-3 (Burchell, et al., 1994, p. 158). Additional exhibits based on the suggestions in the above paragraph could be added to Table 4.14-3; thus making it inclusive of cumulative effects considerations.

Two additional examples for determining impact significance include the use of regional transportation goals and evaluation based on ISRs. First, regional goals for transportation, and who is responsible, can be used to determine impact significance. For example, regional and local transportation goals, policies, and restrictions in federal, state or local laws and regulations related to economic growth and development, and/or environmental protection, should be identified. In addition, transportation goals, policies, and restrictions in planning documents or policies prepared by state DOTs, and/or departments of commerce and/or industrial development, by pertinent councils of government, by federal agencies such as other military services, and by cities and towns located in the study area, should also be identified. Finally, pertinent policies from executive orders should also be considered. The key determination is the degree of compatibility between the anticipated on-post and off-post transportation changes and the pertinent regional transportation goals.

AR 210-14, "The Army Installation Status Report Program," established the requirement for periodic Installation Status Reports (ISRs) relative to three topical areas – infrastructure, environment, and services (U.S. Department of the Army, AR 210-14, January 2001). The infrastructure portion addresses the adequacy of facilities and utilities systems in five primary areas – mission facilities, mobility facilities, housing, community facilities, and installation support. Qualitative and quantitative evaluations are reflected in condition ratings (C-ratings) that range from C-1 to C-5. A C-1 rating reflects a report element that requires little immediate attention, while a C-5 rating shows that an installation's status is being degraded or that it is in a nonreportable status (i.e., pending base realignment and closure action). These ratings could be used to determine the potential environmental significance of anticipated cumulative traffic and transportation impacts from various proposed actions.

Finally, relative to significance determinations, there is growing interest in using "broader scale" considerations of environmental sustainability. To illustrate, the U. S. Army Engineer Research and Development Center (ERDC–CERL) is developing a Sustainable Installations Regional Resource Assessment (SIRRA) methodology. The methodology incorporates 48 relative regional indicators for ten sustainability issues–air, energy, urban development, threatened and endangered species, locational, water, economic, quality of life, infrastructure, and security (Jenicek, et al., 2004). Of interest herein are the following eight indicators (or stressors) for infrastructure involving transportation (Fournier, et al., 2002, pp. 16, and 26-28):

- Proximity to Commercial Airport (PAP)–This indicator provides a measurement of the proximity of the nearest commercial airport. The risk classes are Low (<5 miles), Medium (5 to 25 miles), and High (>25 miles). The proximity of an airport to an installation is an indicator of the ability to strategically mobilize the force. This information was from the Terminal Area Forecast (TAF) System.
- Airport Capacity (AC) – This indicator provides a measurement of the number of operations performed at the commercial airport nearest an installation. The risk classes are Low (<500 operations daily), Medium (500 to 1000 operations daily), and High (>1000 operations daily). The number of operations performed per day is an indicator of the number of potential airborne threats near an installation. This information was from the FAA.
- Proximity to Military Airfield (PAF) – This indicator provides a measurement of the proximity of the nearest military airfield. The risk classes are Low (<5 miles), Medium

(5 to 25 miles), and High (>25 miles). The proximity of a military airfield to an installation is an indicator of the ability to strategically mobilize the force. This information was from the TAF System and installation proximity to Air Force bases.

- Proximity to Rail (PR) – This indicator provides a measurement of the proximity of the nearest rail terminal to an installation. The risk classes are Low (<5 miles), Medium (5 to 10 miles), and High (>10 miles). The proximity of a rail terminal to an installation is a strong indicator of force projection capabilities. This information was from the TAF System.
- Capacity (trains/crossing/day) – This indicator provides a measurement of the number of trains passing through the terminal nearest to the installation per day. The risk classes are Low (<5 trains a day), Medium (5 to 10 trains a day), and High (>10 trains a day). The number of daily trains crossing the terminal nearest an installation is an indicator of potential availability problems and congestion on the rail system. This information was from the Federal Railroad Administration.
- Proximity to Interstate (PI) – This indicator provides a measurement of the distance from the nearest interstate highway to the installation. The risk classes are Low (<25 miles), Medium (25 to 50 miles), and High (>50 miles). The proximity of an interstate to an installation is an indicator of availability of full transportation access. This information was from the Intelligent Road/Rail Information System (IRRIS).
- Congestion (RCI) – This indicator provides a measurement of the congestion of the local road network surrounding an installation. The risk classes are Low (RCI<0.74 miles), Medium (0.74 to1), and High (>1). Road congestion is an indicator of potential problems using the highways near the installation. Road congestion is described by the Roadway Congestion Index (RCI), which is defined as the ratio of traffic volume to road capacity, based on the 2002 Urban Mobility Study published by the Texas Transportation Institute.
- Access (bridging/traffic volume) – This indicator provides a measurement of the congestion of the local road network surrounding an installation. The risk classes are Low (<50,000 vehicles per day), Medium (50,000 to 100,000), and High (>100,000). Road access is defined by annual average daily traffic (AADT), which is a traffic count of the number of vehicles passing through a particular road segment. The majority of state Department of Transportation agencies provide annual traffic reports containing data on AADT, along with road segments and road structures.

The SIRRA methodology can be used as an evaluation tool for encroachment concerns at specific Army installations. Further, it can be used relative to the evaluation of the cumulative effects of new training initiatives on traffic and transportation. The GIS-based SIRRA methodology draws upon data from open, well-documented, national level sources, such as the U.S. Geological Survey, Bureau of Census, NatureServe, and the U.S. Environmental Protection Agency. This approach allows the use of national-level data to evaluate regional aspects of an installation's setting. Such an evaluation provides additional information related to long-term issues that could threaten mission sustainment at a given installation (Jenicek, 2005).

CEA Steps 10 and 11 – Modify or add alternatives to avoid, minimize, or mitigate significant effects on traffic and/or the transportation system (Step 10), and monitor the effects of the selected alternative and adapt management (Step 11).

Mitigation of traffic and transportation effects may involve installation decisions only, or it could include both on- and off-installation measures, with the latter done in a collaborative manner with the state or regional planning agencies, other state or federal agencies, and local towns and cities.

Mitigation measures, in this context, are initiatives that can be taken to minimize the magnitude of the effects in the ROI. The key approach is either to reduce the traffic or to change the timing of the traffic anticipated to be associated with the proposed action. Examples of simple mitigation measures which can be used to reduce the traffic or change the traffic patterns in the study area of a military project or training activity include: (1) the use of car or van pooling or buses from residential areas, for travel to and from military installations, (2) scheduling construction equipment movement during non-peak periods in the local area, (3) scheduling troop movements related to training exercises during non-peak traffic periods in the local area, (4) implementing traffic volume restrictions or controls for certain times of the day, and (5) raising the pertinent LOS category by providing roadway improvements (U.S. Army Construction Engineering Research Laboratory, Vol. 3, 1989).

Additional information related to both technical and policy considerations for mitigation is found in Appendices I and II to this VEC (The Louis Berger Group, Inc. Vol. II, 2001; The Louis Berger Group, Inc., 2002, pp. 94-99; and Caltrans, 2005a, p. 9).

Monitoring of selected indicators of traffic and transportation system capacity in relation to effects may be necessary. Such monitoring could be introduced as modification to existing installation monitoring programs, or as a part of a newly implemented EMS. A useful reference for planning and implementing a monitoring program is Marcus (1979)*. It should be noted that such monitoring results could be used within an organized feedback and decision-making system to adapt management activities and thus reduce undesirable traffic and transportation system effects.

4.14.7 Summary

Extensive policy and technical information is available for planning and conducting an assessment of traffic and transportation system effects for Army installations and associated training ranges. Installation-related documents include on-post transportation plans and the specific transportation contents of the Integrated Natural Resources Management (INRMP) and the RPMP. Off-post information can be procured from local towns and cities, Metropolitan Planning Organizations (MPOs), regional planning agencies, the state Department of Transportation (DOT), and the FHWA. Spatially- and temporally-distributed Average Daily Traffic (ADT) counts and information on the Level of Service (LOS) classifications for the existing infrastructure, is necessary relative to historical, current, and anticipated future conditions. Finally, a variety of mitigation measures could be used by an installation to address concerns related to cumulative effects on this VEC. However, collaborative efforts with other stakeholder groups may be necessary for cumulative effects situations beyond the purview of the installation.

Appendix 1 of Chapter 4.14

Addressing Indirect and Cumulative Effects Associated with Highway Projects

Addressing cumulative effects for proposed new or upgraded highway projects provides numerous challenges for both preparers and reviewers of NEPA documents. Examples of such challenges include, but are not limited to, the following:

- The effects of highway projects on biophysical resources frequently influence social and socio-economic features of the environment, and vice versa. One reason basic to the need to recognize these inter-relationships is associated with the secondary (indirect) effects of highway projects. Such indirect effects can be manifested in economic growth associated with new or refurbished industrial developments, and with new residential and business developments on previously undisturbed lands. Such developmental effects could contribute to encroachment and urban sprawl concerns for areas adjacent to Army installations.
- The transboundary features of highway projects increase the need to address the requirements of different levels of government; further, differences or conflicts can exist in such environmental and natural resources requirements. Accordingly, in a cumulative effects study, there is a need to deal with multiple levels of government.
- Highway projects may traverse through areas characterized by wide variations in human population densities; i.e., from rural to urban areas. Further, due to the variety of land uses such as residential, business, and industry, it may be necessary to cooperate and collaborate with multiple stakeholder groups, including the private sector, in land use planning endeavors.
- Key environmental consequences of new or upgraded highway projects include, but are not limited to, increased noise levels in localized areas, contributions to regional air pollutant emission inventories, and fragmentation or loss of ecological resources such as wetlands, a variety of local habitat types, and critical habitat or protected areas for threatened or endangered species. These typical impacts can be addressed by applying information contained herein from the air quality VEC, noise VEC, threatened and endangered species VEC, and wetlands VEC.
- There are overlaps between the indirect effects of highway projects and reasonably foreseeable future actions that need to be accounted for in CEs studies. Accordingly, a methodology that integrates indirect and cumulative effects is needed.

The methodology described herein can serve as a framework for addressing the indirect and cumulative impacts of new or upgraded highway projects. It is a composite of an eight-step indirect effects analysis procedure contained in a 2002 National Cooperative Highway Research Program (NCHRP) report, and it contains information on how it can be integrated within the CEQ's 11-step CEA process. Prior to describing the 8-step indirect effects procedure, the following definitions are noted from CEQ's regulations related to the National Environmental Policy Act (NEPA) (Council on Environmental Quality, 1979):

- Direct effects are caused by the action and occur at the same time and place. (40 CFR § 1508.8)
- Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population, density or growth rate, and related effects on air and water and other natural systems, including ecosystems. (40 CFR § 1508.8)

- Cumulative impact is the impact on the environment resulting from the incremental impact of the action, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR § 1508.7)

Based on the above definitions and professional practice, the terms "effect" and "impact" can be used synonymously, as can the terms "indirect" and "secondary" impacts (Federal Highway Administration, 2003).

Important concepts related to the above definitions are: (1) indirect effects are connected to or derived from the proposed action and/or associated direct effects; and (2) indirect effects are not synonymous with cumulative effects. Cumulative effects occur from the direct and indirect effects of the proposed action combined with the effects of past, present, and RFFAs not specifically related to the proposed action. The cumulative effects, per se, occur on common resources, ecosystems, and human communities in the identified study area. This point is made as follows in Principle No. 2 of the CEQ's 11-step CEA procedure (Council on Environmental Quality, 1997):

- Cumulative effects are the total effects of all actions taken, including both direct and indirect effects, on a given resource, ecosystem, and human community, no matter who (federal, nonfederal, or private) has taken the actions.

Background Information on NCHRP Reports

Two National Cooperative Highway Research Program (NCHRP) reports describe an eight-step indirect effects analysis procedure for transportation (highway) projects (Louis Berger and Associates, Inc., 1998; and The Louis Berger Group, Inc., 2002). The 1998 report (NCHRP Report 403) provided a research basis for the 2002 report (NCHRP Report 466), and its careful review can be instructive. Some key features and findings of Report 403 that relate to highway project EISs include:

- A comparative review of how indirect effects were addressed in 90 EISs that were prepared from 1989 to 1994. The findings from this review will aid in providing a professional practice basis for highway projects.
- Indirect effects are often controversial in EISs. This was also determined from the review of the 90 EISs. One controversy relates to whether the transportation projects are "growth stimulating" versus "growth serving"; i.e., do the projects promote growth and economic development, or are they responsive to growth that could occur in the absence of the projects?
- Based upon interviews with 57 transportation and environmental regulatory/resource agency personnel (federal and state) involved in preparing EISs, several concerns were identified relative to detailed presentations and assessment of indirect effects. Examples of these concerns related to the speculative nature of predicting growth in specific areas, lack of control and responsibility for zoning and land use regulation, possible requirements to mitigate for projections based on speculations, and fear on the part of transportation agencies to be directly linked to development interests.
- Six case studies associated with how EISs addressed indirect effects were included in Appendix E of Report 403. The common framework for the case studies was the precursor procedure for the eight-step indirect effects analysis procedure in Report 466.

These case studies provide practical examples of how to adapt the procedure and use it as an actual project framework for such analyses.

- Report 466 was written from the perspective of providing practical guidance (e.g., a desk reference) on how to implement the eight-step indirect effects analysis procedure. Further, the report has been used as a manual for professional, short-course training on the subject. Features extracted from this report are described in the following integrated methodology and IEA steps (The Louis Berger Group, Inc., 2002).

The Integrated Methodology

Table I-1 delineates four phases for a highway project associated with an integrated IEA and cumulative effects assessment (CEA) . Scoping represents a continuous process that encompasses identification, prioritization and planning; it is not limited to the conduction of public scoping meetings, although they will be included in the process. Describing the affected environment encompasses larger study areas, the use of indicators, consideration of extended time frames (from the past to the future), and determinations of notable features (or VECs) associated with the affected resources, ecosystems, and human communities. Determining environmental consequences relates to predicting indirect and cumulative effects and determining their significance relative to compliance with regulatory thresholds, compatibility with existing plans and policies, and enhancement of environmental sustainability. Developing appropriate mitigation involves delineating legal and policy requirements of the FHWA for transportation projects, and potential coordination and collaboration with other governmental agencies and private development interests. Five key observations about the Integrated Methodology are:

- IEA is an important part of CEA.
- Information assemblage and analysis is a component of most of the listed IEA and CEA steps; accordingly, these efforts should be jointly planned and conducted for both indirect and cumulative effects.
- Interactions with various stakeholder groups will be involved in all four phases, and particularly in the scoping phase. It is anticipated that stakeholders will provide useful input on numerous topics, including, but not limited to, indirect and cumulative effects concerns, spatial and temporal boundaries for the study, impact prediction tools, and mitigation planning.
- The depth of effort and analysis associated with each IEA and CEA step is expected to vary depending upon the location and specific features of the highway project.
- The listed IEA and CEA steps provide a useful framework for planning the specific work to be done. The steps can be grouped and rearranged, if necessary. Further, additional steps can be added as appropriate. Finally, several steps can be addressed in a simultaneous manner.

Phase	IEA[a]	CEA[b]
Scoping for the IEA-CEA Portion of the EIS	Step 1 Step 2	Step 1 Step 2 Step 3 Step 4
Describing the Affected Environment for the IEA and CEA	Step 3	Step 5 Step 6 Step 7
Determining the Indirect and Cumulative Effects, and Assessment of Their Significance	Step 4 Step 5 Step 6 Step 7	Step 8 Step 9
Developing Appropriate Mitigation	Step 8	Step 10 Step 11
Notes: a -- the numbered steps for the IEA are summarized in this appendix and are based on NCHRP 466 (The Louis Berger Group, Inc., 2002) b -- the numbered steps for the CEA are described in the traffic and transportation VEC and are based on the CEQ procedure (Council on Environmental Quality, 1997)		

***Table 1**: Integrated Indirect Effects Analysis (IEA) and Cumulative Effects Assessment (CEA) Methodology*

Key Features of the IEA Steps

The eight numbered steps listed for IEA in Table I-1 are briefly summarized as follows. The information for these steps is from NCHRP Report 466 (The Louis Berger Group, Inc., 2002). It should be noted that although the following paragraphs mention several figures from the report; the actual figures are not included herein.

Scoping

Step 1 relates to initial scoping for indirect effects analysis. This step involves identifying the need and purpose for the highway project, identifying key resource issues (social, cultural, and natural), and identifying potentially significant issues and effects. This step also involves determining the general indirect effects study approach and level of effort required. As part of this effort, it will be necessary to determine data availability, the applicability of various methods, the features of the project design, and the general transportation needs being addressed. Potential indirect (secondary) effects and possible induced growth shall be identified, and the existing transportation system will be described. The location and extent of the study area will also be described. The area should be based on the governmental and geographic/ecological (watershed and/or habitat) boundaries, the current and potential commuteshed, existing development and/or growth management plans in the general area, and the future time horizon for the study (20 to 25 years is typically used to coincide with the design life of many highway projects). The advice of various stakeholders on these issues should be sought during the scoping process. The product of IEA Step 1 should be a detailed work plan for the IEA portion of the study; the plan should be discussed with the study sponsors. Finally, IEA Step 1 includes components associated with CEA Steps 1 through 3.

Step 2 relates to identifying the study area directions and goals. It involves assembling information about general trends and goals in the study area. Emphasis should be given to social, economic, ecological, and growth-related issues. Community-derived goals of those persons living in the defined study area should be given special attention. Any pertinent reports should also be reviewed. Goals are typically delineated in available plans and policies; and such goals could have been examined in the related planning process. The goals can be used in identifying and evaluating indirect effects. Further, a transportation project may be planned to support an area's economic development goals; thus the project would be expected to promote indirect effects (growth-inducing effects). Finally, evaluation factors for numerous available plans could include age of plan, geographic and topical coverage, plan preparers and level of local participation, and the ascribed importance.

Two specific activities are typically involved in Step 2 – data (or information) collection and public involvement. In addition to the review of land use and related comprehensive plans, data collection can also involve the review of local/regional trend data (census data), and local and regional development regulations and associated policies. Checklists can be used to organize information extracted from various plans and policies; examples include Figures 4-3 and 4-4 on pp. 41 and 42 of NCHRP Report 466. Further, public involvement techniques should be used to update and extend plans and policies into the future time period of analysis. Examples of such techniques include visioning, citizen surveys, focus groups, and collaborative task forces. Representation of the various stakeholder groups needs to be considered. The work products from Step 2 should include summary checklists and a technical memorandum on the process and findings. The report can be used in the EIS. Finally, components of IEA Step 2 are addressed in CEA Steps 1, 6, 7, and 9.

Describing the Affected Environment

Step 3 involves the development of an inventory of notable features in the general area. This step relates to baseline (current) conditions for natural environmental and socioeconomic conditions. Essentially no emphasis is given to historical trends information for the notable features; however, this is done in CEA Step 7. Notable features is a term used to encompass several terms used in related environmental studies; these terms include sensitive species and habitats, VECs, relative uniqueness and recovery time, unusual landscape features, and vulnerable elements of the human population (e.g., elderly, low-income, and minority groups). In essence, notable features represent selected indicators; they are analogous to VECs in the CEA procedure.

The methods used for Step 3 include the assemblage of an inventory of ecosystem conditions (natural environment), an inventory of socioeconomic conditions, and the identification of notable features from the inventories. Numerous information sources are typically available for ecosystem and socioeconomic conditions. Public involvement could be used to aid the process of identifying notable features. Several checklists could be helpful. For example, Figures 5-1 and 5-2, in NCHRP Report 466, are checklists for summarizing ecosystem and socioeconomic conditions, respectively (pp. 47 and 48). Figure 5-3 is a checklist for summarizing notable features (p. 49 of NCHRP Report 466). Finally, Figure 5-4 is a checklist of notable features identified in several federal statutes and executive orders (p. 50 of NCHRP Report 466). At the beginning of the Step 3 activities It would also be useful to review the notable features portions of the statutes in Figure 5-4 (e.g., Clean Air Act, Clean Water Act, and Endangered Species Act), as well as related state statutes and local ordinances,.

The work products from Step 3 should include the identified notable features, maps, and a GIS database. The process used to develop the inventories and the bases for identifying the notable features should be adequately described, including the involvement of various publics in the identification process. Further, the notable features could be grouped into those applicable on a regional (the overall study area) scale and those related to the local scale. Finally, it should be noted that the concepts and focus of IEA Step 3 are similar to the VEC-related emphasis in the CEQ's 11-step CEA procedure. Within the CEA procedure, VECs are generally associated with Steps 1, 5, 6, 7, 8, and 9.

Determining and Assessing Indirect Effects

The focus of Step 4 is on the identification of the impact-causing activities of the proposed action and alternatives. Attention should be given to delineating the construction and operational phase activities of the highway project that will cause indirect effects. This could entail consideration of the activities associated with all alternatives, including the proposed action. Many of the identified activities could also cause direct effects. Recognition of three categories of indirect effects is important to accomplishing Step 4. The categories include encroachment-alteration, access-alteration, and induced growth. NCHRP Reports 403 and 466 differentiate the categories as follows:

- Encroachment-alteration effects arise from direct effects of the project on the biophysical environment; these direct effects are then manifested by various changes in ecosystems that occur later in time or further away in distance. Examples include habitat fragmentation, habitat degradation from pollution, and disruptions of energy flows and nutrient cycling.
- Access-alteration effects include those resulting from changes in traffic patterns and the alteration of accessibility resulting from the project; as a consequence, the location of residential and commercial growth patterns in the study area is influenced, along with the associated impacts on the biophysical environment. Access-alteration effects are specifically related to the inducement of human population growth in the study area.
- Induced growth effects are attributable to the consequences of induced growth itself and are not directly linked to project design features. A recent handbook on integrating land use considerations associated with induced growth into transportation planning is available (ICF Consulting, 2005).

Various checklists have been developed to aid in identifying project activities that can be linked to the categories of indirect effects; e.g., Figure 6-1 in NCHRP Report 466 is a modification of Leopold's original interaction matrix (p. 54). Other example checklists are included in NCHRP Report 403 (pp. 33-34, and 39-40). In addition, the published literature on indirect, secondary effects of highway projects is rapidly increasing. Finally, the work product of Step 4 should be a comprehensive list of impact-causing activities along with general descriptions of their connections to the categories of indirect effects. Accordingly, IEA Step 4 is similar to Steps 1, 4, and 8, in the CEQ's 11-step CEA procedure.

Step 5 involves identifying potentially significant indirect effects that should be subjected to subsequent analyses. This step encompasses the systematic description of indirect effects from the proposed highway project (to be accomplished in more detail than in Step 4), the identification of qualitative and quantitative methods that can be used to facilitate such identifications for the project and its specific locale, and the use of a set of questions to identify and document significant indirect effects for further analysis. Encroachment-alteration effects include both ecological (ecosystem) effects and socioeconomic effects. Figure 7-2 in NCHRP Report 466 displays some possible ecosystem effects from transportation projects (p. 57), while Figure 7-3 does similarly for social and economic consequences (p. 58). Extensive information is available on induced growth and the associated effects. For example, Figure 7-4 in NCHRP Report 466 displays various impacts of highway investments on the typical progress of urbanization (p. 59), and Figure 7-5 illustrates the linkage between transportation access and land use changes (p. 60).

Three types of projects can cause induced growth– projects planned to serve specific land development, projects likely to stimulate complementary land development, and projects likely to influence intraregional location decisions (development shifts). However, it should be noted that the demarcations between these types of projects may overlap; thus a single specific highway project could generate induced growth from serving and stimulating land development and from influencing intraregional location decisions. Associated effects from induced growth typically result from land development. Illustrations of land development effects checklists are shown in Figures 7-7 (pp. 63-64) and 7-8 (p. 65) of NCHRP Report 466.

Five additional methods that could serve as useful tools for supporting cause-effect linkages between highway project activities and indirect effects include matrices, networks, qualitative inference, comparative case analysis, and cartographic techniques such as overlay mapping facilitated by GIS. Such methods can be used singly and in various combinations.

Assessing the significance of the identified effects can be systematized via the use of several basic questions (contained in Figure 7-10 in NCHRP Report 466, p. 67) along with a structured decision tree (displayed in Figure 7-11 on pp. 68-69). Examples of the basic questions include:

- Does the effect conflict with study area needs and goals?
- Does a decision regarding the proposed transportation project represent a decision in principle about a simultaneous or subsequent development action?
- Is the occurrence of the effect predictable?
- Is the effect irreversible or of long duration?
- Can the effect be controlled?
- Is there a great deal of controversy related to the effect?
- Could the effect result in a violation of federal, state, or local law, or other requirements imposed for the protection of the environment?
- Will the effect have a significant impact on public health or safety?

The primary work product from IEA Step 5 is a documented report relating both the process and findings regarding potentially significant indirect effects that should be subject to further analysis. A technical memorandum regarding the findings could be prepared, if appropriate. This memorandum could be included in the EIS. Finally, IEA Step 5 is related to Steps 4, 6, 7, 8, and 9 in the CEQ's 11-step CEA procedure.

Step 6 is focused on a more detailed analysis of potentially significant indirect effects. A variety of qualitative and quantitative tools are available for use, either singly or in combination, for "detailed" analyses. Two basic forecasts will be required– a "no action" forecast that describes future conditions without the proposed highway project; and an "action" forecast that describes future conditions following implementation of the proposed project.

Qualitative forecast tools include literature reviews, comparative case analyses, scenario writing, and input generated by public involvement, one or more expert panels, and/or the Delphi technique. Quantitative forecast tools include trend extrapolation, build-out/carrying-capacity analysis, regression analysis, econometric forecasting techniques, simple gravity models, and cost-benefit analysis. Several more sophisticated tools are broadly categorized as integrated land use and transportation models. For example, NCHRP Report 466 summarizes five such models in terms of their development history, data requirements, advantages, disadvantages, pending revisions, and requirements for implementation. Selection of the forecast tools and models of a specific highway project should be based on input from various stakeholder groups, the availability of input data and information, and professional judgment. Finally, IEA Step 6 is similar to Step 8 in the CEQ's 11-step procedure; the similarity is based on the fact that both steps focus on the use of pertinent tools and methods to address relevant indirect or cumulative effects.

Step 7 highlights the evaluation of the results of the indirect effects analyses. Accordingly, this step is focused on evaluating the assumptions used in Step 6, and the associated uncertainties that could arise from the assumptions. In addition, differences of opinion among stakeholder groups and experts regarding forecasted outcomes, area goals, notable features, significant indirect effects meriting analysis, and utilized methods, should also be summarized for consideration by key decision makers. Pending the results of the evaluations and difference analyses, two tools could be used to gain a further perspective on the results: sensitivity analysis and qualitative risk analysis. One or both tools could be used to further explore the implications of the results.

The expected work product from Step 7 would include summary information on the evaluation of the findings of several earlier steps, particularly Step 6. Such evaluations should be included in the EIS. Finally, IEA Step 7 is primarily related to Step 9 in the CEQ's 11-step procedure.

Developing Appropriate Mitigation

Step 8 entails assessing the consequences and developing appropriate mitigation and enhancement strategies for the significant indirect effects. Stated differently, the objective of this part of the procedure is to assess the consequences of the analyzed indirect effects and develop strategies to address unacceptable effects. Identifying unacceptable indirect effects can be based on considering compliance with the goals (Step 2) and consequences to the notable features (Steps 3, 6, and 7). Additional considerations include the potential or actual scientific or public controversy related to the indirect effects.

Four examples of when mitigation for indirect impacts to notable features need to be considered include (The Louis Berger Group, Inc., 2002, p. 95): (1) the indirect effect could worsen the condition of a notable feature considered sensitive or vulnerable; (2) the indirect effect could interfere with or delay the planned or required improvement of a notable feature; (3) the indirect effect could eliminate a notable feature that is valued or unique, or render the valued or unique feature ordinary; and (4) the indirect effect is otherwise inconsistent with an applicable law.

Mitigation planning for indirect effects will typically involve collaborative efforts with other federal, state, and local agencies. A key issue is to delineate the indirect effects that are within the control of the project proponent agency (e.g., a state transportation agency) and those that are outside the control of that agency. Examples of indirect effects within the control include (The Louis Berger Group Inc., 2002, pp. 95-96): (1) generally, those indirect effects associated with the location of the project and its access provisions; (2) effects related to how the project is constructed (e.g., modification of regime, land transformation and construction, land alteration, resource extraction, etc.); and (3) effects related to how the project right-of-way will be used and maintained (e.g., traffic and traffic-related effects, fertilization, chemical deicing, weed control, pest control, etc.). A flow diagram for decision making related to mitigation is included in Figure 10-1 of NCHRP Report 466 (p. 96).

Examples of mitigation techniques for encroachment-alteration effects include modifications in facility type, facility alignment, facility design features, construction techniques, and facility maintenance. Potential mitigation techniques for induced growth and related effects include access controls (e.g., location of interchanges), designs that are context sensitive, zoning controls and comprehensive land use planning, transfer of development rights, growth management regulation (includes adequate public facilities ordinances, development moratoria, urban growth boundaries, and extraterritorial zoning/annexation), resource management and preservation regulations, land acquisition and conservation easements, incentives for Brownfield/infill development, and development fees and exactions. These types of mitigation techniques should be evaluated, as appropriate, and included in the resultant EIS.

The work product from Step 8 will include a mitigation plan developed from a collaborative process involving other governmental agencies and stakeholders, as appropriate. The plan may need to address technique effectiveness, agency responsibilities, and adaptive management features, as appropriate. Finally, IEA Step 8 encompasses considerations associated with Steps 10 and 11 in the CEQ's 11-step CEA procedure.

Final Comments

It is anticipated that the above-described IEA steps, when used in conjunction with the CEQ's 11-step CEA process, will provide a useful planning framework for addressing the indirect and cumulative effects of a new or upgraded highway project. Further, many unanticipated topics and issues not mentioned herein will probably arise in a given study; however, they can be addressed within the methodology. Accordingly, one feature of the Integrated Methodology is that it provides a focal point for discussions and input that is expected to occur in a planned collaborative process involving various stakeholder groups. Further, as a given highway study progresses, several appropriate means for blending the IEA and CEA steps will probably emerge. Finally, the following observations relate to the IEA and CEA steps:

- The IEA steps are "action-focused", while the CEA steps are "VEC-focused".
- Indirect Effects Analysis is not the same as Cumulative Effects Assessment; however, IEA is an integral part of CEA.
- Grouping indirect and cumulative effects together in an EIS, and then addressing only the indirect effects, does not meet all of the requirements for incorporating CEA in an EIS.
- Cost economics can be realized in a study by jointly planning and conducting the IEA and CEA steps.

Appendix 2 of Chapter 4.14

California Guidance for Preparers of Cumulative Impact Analyses for Surface Transportation Projects

In June 2005, the California Department of Transportation (Caltrans), along with the FHWA and the U.S. Environmental Protection Agency, placed on the Internet several guidance documents for preparers of cumulative impact analyses (Caltrans, 2005a–2005e)*. The guidance relates to surface transportation projects in California; and encompasses both NEPA requirements and those of the California Environmental Quality Act (CEQA). The guidance is presented as five linked online documents as follows (Caltrans, 2005e, p. 2):

- Introduction: Provides background about the guidance, its intended audience and purpose.
- Approach and Guidance: The backbone of the guidance, this report describes an 8-step approach for identifying and assessing cumulative impacts.
- Issue Paper – Data Gathering: This paper presents methods for identifying available data for the cumulative impact analysis, as well as steps to take when data are not available.
- Issue Paper–Data Gathering: This paper presents methods for identifying available data for the cumulative impact analysis, as well as steps to take when data are not available.
- Issue Paper – CEQA Guidelines for Cumulative and Indirect Impacts. Provides a brief primer for Caltrans or other state planners who must analyze cumulative impacts to fulfill only CEQA requirements.

The information contained in the five documents includes definitions of key terms, an eight-step approach for performing the analysis, and examples of best practices and tools. The pragmatic questions addressed in the eight-step approach are as follows (Caltrans, 2005e, p. 3):

- What resources should be included in the analysis? (Refer to Step 1 of the Approach and Guidance.)
- How should a cumulative impact study area be established? (Refer to Step 2 of the Approach and Guidance and the Defining Resource Study Areas issue paper.)
- Is information available to conduct the analysis and make valid conclusions? (Refer to the Data Gathering issue paper, and Steps 3, 4 and 5 of the Approach and Guidance.)
- How can the current health and historical context for each resource be described? (Refer to Step 3 of the Approach and Guidance.)
- What is the best way to identify the “reasonably foreseeable” projects to include in the analysis? (Refer to Step 5 of the Approach and Guidance and the Data Gathering issue paper.)
- What method should be used to perform the analysis? When should quantitative or qualitative analysis techniques be applied? (Refer to Step 6 of the Approach and Guidance.)
- How should conclusions be reported? (Refer to Step 7 of the Approach and Guidance.)
- How should mitigation be addressed? (Refer to Step 8 of the Approach and Guidance.)

Approach and Guidance

No single approach is available for determining the appropriate scope and extent of a cumulative impact analysis. Rather, use of a common framework which can be adapted to meet project-specific and site-specific conditions represents the most reasonable beginning point. In addition, it should be noted that cumulative impact analysis builds upon information associated with the direct and indirect effects of the proposed project. Finally, the following eight steps serve as guidelines for identifying and assessing cumulative effects. The level of detail associated with each step will depend on the type and location of the proposed action. The eight steps are listed as follows along with brief comments as to their relationships to the CEQ's 11-step process (Caltrans, 2005a, p. 2):

- Caltrans Step 1 – Identify the resources to consider in the cumulative impact analysis by gathering input from knowledgeable individuals and reliable information sources. This process is initiated during project scoping and continues throughout the NEPA/CEQA analysis. This step is inferred in CEQ Steps 1 (identify cumulative effects issues) and 5-7 (describe the affected environment).
- Caltrans Step 2 – Define the geographic boundary or Resource Study Area (RSA) for each resource to be addressed in the cumulative impact analysis. This step matches CEQ Step 2 (establish geographic scope).
- Caltrans Step 3 – Describe the current health and the historical context of each resource. This step relates to CEQ Steps 3 (establish time frame for the analysis) and 5-7 (describe the affected environment). It also infers that the past actions identified in CEQ Step 4 need to be considered.
- Caltrans Step 4 – Identify the direct and indirect impacts of the proposed project (action) that might contribute to a cumulative impact on the identified resources. This step is inferred in CEQ Step 1 (identify cumulative effects issues).
- Caltrans Step 5 – Identify the set of other current and reasonably foreseeable future actions or projects and their associated environmental impacts to include in the cumulative impact analysis. This step is related to CEQ Step 4 (identify other past, present, and reasonably foreseeable future actions).
- Caltrans Step 6 – Assess the potential cumulative impacts. This step is related to CEQ Steps 8 (identify cause-effect linkages) and 9 (determine the magnitude of the cumulative effects and assess their significance).
- Caltrans Step 7 – Report the results of the cumulative impact analysis. All 11 steps of the CEQ's process infer this step, but none specifically highlight the preparation of a report.
- Caltrans Step 8 – Assess the need for mitigation and/or recommendations for actions by other agencies to address a cumulative impact. This step is related to CEQ Step 10 (develop mitigation measures and evaluate alternatives); and it also infers CEQ Step 11 (monitor and adapt management).

In summary, as can be seen from the above analyses, the 8-step Caltrans approach either directly or by inference encompasses the 11-step CEQ process. Additional pertinent comments related to the 8-step Caltrans approach include the following (Caltrans, 2005a, pp. 5-9):

- The direct and indirect impacts of the proposed project can be combined with the impacts of other reasonably foreseeable actions (Step 5) in order to perform the cumulative impact analysis (Step 6).
- Regarding Caltrans Step 5, be sure to document the assumptions and methods used to identify projects included in the analysis, the agencies and experts consulted, and

any other research. It may not be necessary to identify the sources consulted in the final document, but it is important to maintain a record of methods, assumptions, and analyses. This is especially important when data is scarce.

- Caltrans Step 6 can be aided by the use of appropriate methods and tools as described in the CEQ's 1997 report on CEA (Council on Environmental Quality, 1997, pp. 49–57).
- The report prepared in conjunction with Caltrans Step 7 should be based upon sound principles of technical writing. Further, analytical methods or processes used in the study should be described. In addition, any assumptions used to conduct the analysis should be specified and explained.

Assessing the need for mitigation (Caltrans Step 8) should be based upon both technical and policy information. To illustrate, the following information from the Caltrans approach and guidance is included (Caltrans, 2005a, p. 9):

"Determining the feasible mitigation measures for a cumulative impact can be difficult. In many cases, a cumulative impact results from the combined actions of numerous agencies and private entities. The requirement to implement a potential mitigation measure to address a cumulative impact is often beyond the jurisdiction of FHWA, Caltrans, or NEPA cooperating agencies. For example, successful mitigation measures for air quality impacts might require numerous local communities to modify their general plans to reduce the amount of planned development and reduce the number of vehicle miles traveled within the geographic study area. Caltrans and FHWA do not have the authority to implement the necessary planning decisions, obtain local legislative approvals, or change the regional distribution of future development. Therefore, disclosure of mitigation for cumulative impacts is not based on or limited to specific mitigation measures that can be implemented by the lead agency.

However, a project may provide opportunities for the project proponent to propose innovative cumulative impacts solutions. Working in collaboration with resource and land use agencies, FHWA and Caltrans have supported and implemented innovative solutions to enhance environmental stewardship and ecosystem sustainability. FHWA's Exemplary Ecosystem Initiatives provide examples of successful ecosystem and habitat conservation strategies. California's Multiple Project Conservation for Species of Concern is another example of innovative collaboration between FHWA, Caltrans and local agencies.

If it was not possible to identify a mitigation measure, the discussion may consist of listing the agencies that have regulatory authority over the resource and recommending actions those agencies could take to influence the sustainability of the resource. By doing so, the needed mitigation would be disclosed to the public and reviewing agencies even though it could not be implemented by the lead agency. Once disclosed, the information could be used to influence future decisions or to help identify opportunities for avoidance and minimization when other projects are proposed."

Defining Resource Study Areas

A Resource Study Area (RSA) is defined as the geographic area within which impacts on a particular resource are analyzed. Accordingly, separate RSAs should be identified for each resource of concern resulting from Caltrans Step 1. Careful thought should be given to identifying the right size for each RSA. For example, if the RSA is too small, the effects being analyzed may be understated. In contrast, if the RSA is too large, the spatial context for considering impact significance may be diluted, and unnecessary efforts may need to be expended in gathering descriptive information for the resource. Accordingly, an "optimally sized RSA is one that is large enough to capture the dynamics of the resource, but small enough to facilitate data gathering" (Caltrans, 2005d, p. 4). Table II-1 lists considerations for defining specific RSAs (Caltrans, 2005d, pp. 3–4).

Data Gathering

When addressing indirect and cumulative effects and cumulative effects of surface transportation projects, it is useful to remember that much of the needed data is already available in existing documents. In fact, the Caltrans issue paper on data gathering includes the following three exhibits (Caltrans, 2005c, pp. 1, and 10–11):

- Exhibit A lists specific agencies and how the data they generate can be used in a cumulative impacts analysis;
- Exhibit B presents various types of data that may be available for a specific resource (VEC) and the source of such data; and
- Exhibit C presents sample questions that can be posed to planning agency staff when requesting data for a cumulative impacts analysis. The usage of these questions can be helpful during the scoping and data gathering efforts for a study.

While existing data is typically extensive, on some occasions it may be a good idea to generate data, using individual and group consultation techniques and direct observation techniques. Such generation of data would typically be limited to circumstances when there is no reliable data available from another source or when there is some indication that the data obtained from a secondary source is not accurate. Table II-2 depicts the types of data generation techniques that are available, and outlines instances in which each technique could be used (Caltrans, 2005c, pp. 8–9).

Resource	Resource Study Area	Discussion
Land Use	Community, metropolitan area, county, sphere of influence	Consult city and county planning agencies and regional councils of government (COGs) for assistance in establishing land use boundaries
Air Quality	Metropolitan area, air basin	In most cases, the air quality study will contain boundaries for this resource
Wetlands and Water Quality	Stream, watershed, river basin, estuary, aquifer, wetlands complexes, or parts thereof	Identify drainage basins or subbasins in which the project is located. Consult the U.S. Army Corps of Engineers, county water agencies and flood control districts for assistance in delineating wetlands and/or water quality boundaries. Consult the State Water Quality Control Board (SWQCB) and the EPA 303(d) TMDL list to identify impaired waters and the reasons why they are impaired.
Plant Species	Watershed, forest, range or ecosystem	Ask botanists specializing in particular species for assistance in defining reasonable RSAs
Animal Species (Resident Wildlife)	Species habitat or ecosystem, subpopulation boundaries	Ask biologists specializing in particular species for assistance in defining reasonable RSAs. Critical habitat designations under the Endangered Species Act and information provided in the Natural Environmental Study (NES) and biological assessment for your project will indicate the range of individual species and populations and provide a general study area.
Animal Species (Migratory Wildlife)	Breeding grounds, migration routes, wintering areas and subpopulation boundaries	Ask biologists specializing in particular migratory species for assistance in defining reasonable RSAs. Information provided in the NES for your project will indicate the range of individual species and populations and provide a general study area.
Fish/Marine Life	Stream, river basin, estuary, or parts thereof; spawning areas and migration routes	Ask biologists specializing in particular species for assistance in defining reasonable RSAs. Information provided in the NES for your project will indicate the range on individual species and populations and provide a general study area.
Cultural Resources	Existing and potential historic districts, traditional cultural properties and known sacred sites, ethnographic and present tribal territory	Project-specific historic and archaeological resource analyses typically define the geographic context for historical resources, which are typically beyond the boundaries of the project footprint. Consult the historic property survey report and cultural resource professionals for assistance in establishing boundaries for cultural resources.
Community	Community, metropolitan area, county, multi-county area, neighborhood, distribution of low-income or minority populations, census tract or subtract	Consult city and county planning agencies and community-bases organization, such as community development organizations and rural development corporations. Analyze U.S. Census data for the distribution of environmental justice populations.
Traffic/Transportation	Transportation network for a city or community, corridor, “commute shed” boundary, or traffic zones	Consult the traffic study. For projects in which travel demand models have been developed, the model will typically define the RSA.

***Table 1**: Considerations Related to Defining RSAs for Specific VECs*
(after Caltrans, 2005d, pp. 3–4)

Data-Generation Technique	Description	When Technique Might be Useful
Interviews	Informal or structured dialogue that follows a script prepared by the interviewer.	Determine past health of resource. Identify potential impacts. Validate data that is dubious or outdated.
Questionnaires	Structured survey instruments that contain questions directed at extracting relevant information.	Validate data (e.g., survey members of a cultural resources organization to validate data contained in outdated directory).
Expert	Groups of experts assembled to address one or more specific issues	Determined health of resource. Assess development trends. Identify potential cumulative or indirect impacts. Validate data.
Delphi technique	Highly structured data gathering technique that involves the use of questionnaires administered to knowledgeable individuals. This technique can be used to identify issues and generate feedback regarding alternative and impacts. This can be an expensive approach, so it is not likely that it will be practical for use on small projects or projects with minor impacts.	Identify potential indirect impacts. Assess development trends.
Brainstorming sessions	Informal sessions involving the free-flowing exchange of ideas and information from knowledgeable individuals.	Determine health of resource. Identify potential impacts.
Field and windshield surveys	Field surveys involve traveling to a site and walking around to observe conditions. Windshield surveys involve driving around and observing conditions from a vehicle.	Validate data. Identify potential impacts.

***Table 2**: Data Generation Techniques and When to Use Them (Caltrans, 2005c, pp. 8–9)*

5.0 Conclusions

5.1.1 – General

As this NEPA Analysis Guidance Manual evolves, it becomes apparent that most tools for Army effects analysis, including CEA, already exist within existing Army plans, policies, procedures, and programs; augmented with similar tools from other agencies. This manual is increasingly a means to linking a variety of tools into a comprehensive framework, one that is continually improved as new tools are found, developed, and refined.

Based upon development this far, and a modest level of testing to date, the following conclusions have been reached:

- CEQ's 11-step CEA process provides a useful framework for addressing overall impact analysis on the selected VECs. Further, for an EA, a subset of the 11 CEQ steps can be used to ensure that a "hard look" has been taken (the subset includes CEQ Steps 1 through 4, 6, and 7). For an EIS, it will be necessary to use all 11 CEQ steps for those VECs containing potentially-significant effects.
- The use of VEC-specific "quick-look questions" can aid in the determination of the necessary level of analysis for a specific study. Answers to the VEC-specific questions can satisfy the "hard look" requirement and thus lead to the determination that no further analysis is necessary. A second possibility is that the answers can highlight the need for more information and further analyses and discussion. The third option is that the answers can point in the direction of an in-depth analysis of direct, indirect, and cumulative effects on the VEC. Accordingly, the quick-look questions provide a useful framework for identifying VEC-specific effects concerns and determining an appropriate level of analysis.
- Numerous existing technical documents and Web sites are available to address effects analysis requirements for each VEC. This technical and procedural wealth is reflected in the approximately 96 bookmarked references and approximately 75 Web links on the accompanying CD. These sources draw from the combined experience of the Army, Navy, Air Force, EPA, FWS, FAA, and ACHP. Given the breadth and depth of this knowledge, this NEPA analysis framework represents an interdisciplinary knowledge base.
- Procedural requirements, based on numerous other laws, must be blended into the CEQ 11-step process for some VECs. Examples include the requirements of the FAA for airspace resources, the ACHP for cultural resources, and the FWS (and NMFS) for TES.
- Existing installation data, as well as data from other federal, state and local organizations can support effects analysis, including CEA. For example, pertinent documents for these VECs include installation air pollutant emissions inventories and regional inventories by county and air quality control region (Section 4.1 – air quality); Restricted Area Annual Utilization Reports (Section 4.2 – airspace resources); installation ICRMPs (Section 4.3 – cultural resources); Installation Compatible Use Zone designations based on installation noise monitoring data (Section 4.4 – noise); sections in the installation INRMP pertaining to land management and erosion control activities performed via the ITAM Program (Section 4.5 – sedimentation/erosion); the installation ESMC, applicable sections of the INRMP, and pertinent Biological Assessments (Section 4.6 – threatened and endangered species); and pertinent sections of the INRMP that summarize wetlands resources on the installation, and information from the National Wetlands Inventory (Section 4.7 – wetlands resources); installation storm water management plans and wastewater management plans (Section 4.8

– water resources management); pertinent sections of the RPMP that highlight various facilities and cantonment areas (Section 4.9 – facilities); installation housing plans and local/regional demographic and economic studies (Section 4.10 – socioeconomics); installation-specific energy conservation and management plans (Section 4.11 – energy); pertinent sections of the RPMP related to installation land uses (Section 4.12 – land use); installation-level solid waste management plans and pollution prevention plans (Section 4.13 – hazardous materials/hazardous wastes); and pertinent sections of the RPMP associated with roads, along with local/regional transportation studies and plans (Section 4.14 – traffic and transportation systems).

- Numerous Army regulations and associated programs directly support NEPA analysis. For example, AR 200-1 describes the policies for the Army air quality, noise, water resources, and hazardous materials/hazardous wastes management programs; thus, they are directly supportive of the direct, indirect, and cumulative for these VECs. Similarly, AR 95-2 addresses Army policy for air traffic control, airspace management, etc., and is thus supportive of the airspace VEC. The cultural resources VEC is supported by AR 200-4; and AR 200-3 influences and guides soil erosion, TES and wetlands management on the installations.
- This manual is a work-in-progress, requiring refinements to apply CEQ's 11 CEA steps to each VEC, as VECs are added, and as experience grows. Further, additional attention must be developed for specific direct, indirect, and effects of Army actions and activities. Better information must be developed on the connections between VECs (for example, the consequences of the air quality VEC on the airspace and TES VECs).

5.1.2 – Use of the NEPA Analysis Guidance in Programmatic Documents

The inclusion of detailed impact analysis, including CEA, in programmatic Army documents will require some caution. In the case of large multi-stage projects in a single location (one type of programmatic treatment), the preceding procedures can be readily applied. In the case of similar (or "like") actions (most applicable to the Army), additional, tiered analyses will be required to adequately address CEA requirements. The CEQ guidelines (CEQ, 1997a) (and this subsequent document) clarify NEPA CEA requirements, encouraging focus on those issues affected by the proposed action, and resource-based analyses (as opposed to activity-based analyses), once an impact is identified on a given VEC. The recommended CEQ methodology then facilitates "back-casting" to identify other past and present projects and actions, and forecasting for future projects and actions, that have affected (or will affect) that valued resource in the affected region. Such analysis is resource-specific and regionally specific; and as such, cannot be fully evaluated at a programmatic level. Although direct and indirect impacts are deemed insignificant, they will require further site-specific evaluation of contributions (even though insignificant) to cumulative impacts on the resources of a specific region. (This concept is at the heart of the cumulative impacts definition.) Specific guidelines are under development by USAEC (Canter, et al, 2005). As a result, individual installations or later project proponents must evaluate the contents of programmatic analyses and documentation to ascertain applicability and ensure that the direct and indirect effects, whether significant or not, do not contribute to significant cumulative effects on a valued regional resource.

6.0 References

6.0 References

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APPENDIX
CONTENTS OF THE REFERENCE CD

NOTES RELATED TO APPENDIX:

- The contents of this Appendix are included on a separate CD titled “U.S. Army NEPA analysis Guidance Manual – 2006 References CD.” The Appendix displays two categories of references – those that are bookmarked files, and those that are Web linked. The included bookmarked references are delineated by the phrase “Click here to view this document,” whereas the Web linked information can be found by clicking on the Web site addresses. It should be noted that the page files within the CD itself are not activated on this copy of the CD Appendix and are indicated as such; however, they are activated on the accompanying 2006 References CD.
- It should be recognized that various Army Regulations and regulations/requirements of the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and other agencies, may vary over time. Deletions or modifications to existing regulations, as well as new regulations, may be issued at any time, thus the user of the 2006 References CD should be aware of such possible changes.
- It should also be recognized that Web sites are frequently moved, deleted, or updated. Therefore, the user of Web links on the 2006 References CD may be routed to new sites, or may need to conduct Internet searching to find updated Web locations.

This CD contains 96 key bookmarked references related to the general topic of effects analysis, including cumulative effects, or to specific processes and methods for addressing cumulative effects (CEs) on 14 valued environmental components (VECs) typically associated with U.S. Army installations and their related training ranges. The 12 bookmarked references related to direct, indirect, and cumulative effects analysis are divided into two categories – laws, regulations, and guidelines documents; and literature review documents and papers. The 84 bookmarked references related to effects on VECs are divided, by VEC, into air quality, air space, cultural resources, energy, facilities, hazardous materials/hazardous wastes, land use, noise, sedimentation/erosion, socioeconomics, threatened or endangered species, traffic and transportation systems, water resources management, and wetlands. The VEC-related sections also include 75 links to Web sites containing regulations, guidance, environmental information, etc. *Left click on one of the categories listed below to begin (not activated here):*

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- Rumrill, J. N., and Canter, L. W., “Cumulative Air Quality Effects Assessment”, Federal Facilities Environmental Journal, Autumn, 2000, pp. 19–38. – This paper presents a CEA methodology that reduces some of the inherent complexities by focusing on the cumulative influence to a single environmental resource, ambient air quality. An eight-step method is presented herein as a tool for the assessment of cumulative air quality effects. Procedures for accomplishment of the more difficult steps, such as the determination of what activities to include in the evaluation and how to determine the significance of a cumulative effect, are also described.

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- Rumrill, J. N., and Canter, L. W., “Cumulative Air Quality Effects Assessment – A Case Study”, presented at the 19th Annual Meeting of the International Association for Impact Assessment, June 15–19, 1999, Glasgow, Scotland. – This case study describes an application of the 8-step Cumulative Air Quality Effects Assessment (CAQEA) method for a strategic planning effort at a U.S. Air Force Base in the southwestern section of the USA.

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- Szostak, R., and Cleare, K., “Emissions Related to Munitions Firing: A Case Study of Nitrogen Oxides, Volatile Organic Compounds, and Energetic Residue from Detonable Munitions”, Federal Facilities Environmental Journal, Autumn, 2000, pp. 87-104 – This is a case study wherein measurements were made of air pollutant emissions from munitions firing.

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- Polyak, L. M., and Webber, L. L., “Technical Guide for Compliance with the General Conformity Rule”, August, 2002, U.S. Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, Maryland. – This guidebook, which is structured around several questions, provides useful information on the applicability of the USEPA’s General Conformity Rule to U.S. Army Installations.

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- U.S. Navy, “Clean Air Act General Conformity Guidance”, Appendix F, October, 2002. – This guidance was developed to assist the U.S. Navy in implementing the U.S. EPA’s General Conformity Rule. Detailed information is included on demonstrating conformity, determining emissions for conformity purposes, and the use of mitigation measures, as appropriate.

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- U.S. Department of Energy, "Clean Air Act General Conformity Requirements and the National Environmental Policy Act Process", April, 2000, Washington, D.C. – This comprehensive guidance includes three parts, with the first addressing coordination of the conformity and NEPA processes. The second part provides details on conformity requirements and the process, and the third part identifies related references.

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- Marcus, L. G., "A Methodology for Post-EIS (Environmental Impact Statement) Monitoring", USGS Circular 782, 1979, U.S. Geological Survey, Washington, D.C. – This report describes a comprehensive process for planning and implementing an environmental monitoring program as a follow-on to an EIS. Further, a case study that applies the process is included.

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- U.S. Environmental Protection Agency, "MOBILE6 Vehicle Emission Modeling Software", 2005 – This software can be used for addressing mobile source emissions at Army installations
  http://www.epa.gov/otaq/m6.htm
- U.S. Environmental Protection Agency, "Official Release of the MOBILE6 Motor Vehicle Emission Factor Model", Federal Register, Vol. 67, No. 19, January 29, 2002, pp. 4254–4257 – Describes the features and potential uses of the MOBILE6 model.
  http://www.epa.gov/fedrgstr/EPA-AIR/2002/January/Day-29/a2125.htm
- U.S. Environmental Protection Agency, "NONROAD Model (nonroad engines, equipment, and vehicles)", 2005 – This model can be used for determining emissions from construction equipment, marine vessels, etc.
  http://www.epa.gov/otaq/nonrdmdl.htm
- Federal Aviation Administration, "Emissions and Dispersion Modeling System", October, 2004 – Can be used for determining aircraft emissions and their dispersion.
  http://www.faa.gov/about/office_org/headquarters_offices/aep/models/edms_model/
- U.S. Environmental Protection Agency, "AirCHIEF CD-ROM, Version 11 (April 2004 – Released June 2004) – In addition to emission factors for numerous source categories, there are many related documents on inventories and methods associated therewith that can be found on this Web site or in AP-42.
  http://www.abuse.com/environment/EPA_Home/Technology_Transfer_Network/Software_Tools/Air_CHIEF_CD_ROM_/index.html
- U.S. Environmental Protection Agency, "About the National Emission Inventory Database", 2005 – This database includes inventory information on sources of criteria air pollutants and their precursors, and hazardous air pollutants.
  http://www.epa.gov/air/data/neidb.html
- U.S. Environmental Protection Agency, "AirData: Access to Air Pollution Data", 2005 – This database includes monitoring system results in terms of ambient concentrations of criteria and hazardous air pollutants.http://www.epa.gov/air/data/
- U.S. Environmental Protection Agency, "National Ambient Air Quality Standards (NAAQS)", 2005 – Information is included on the standards and the scientific and technical bases for the standards.http://www.epa.gov/air/criteria.html

- U.S. Environmental Protection Agency, “About AQS Hazardous Air Pollutants”, 2005 – Fundamental information on HAPs is provided, along with information on the availability of ambient monitoring data. http://www.epa.gov/air/data/help/haqshaps.html
- U.S. Environmental Protection Agency, “Determining Conformity of Federal Actions to State or Federal Implementation Plans”, CFR Title 40, Ch. 1, Part 93, 2001, Washington, D.C. – This is a copy of the specific conformity regulations derived from requirements of the Clean Air Act. http://www.access.gpo.gov/nara/cfr/waisidx_01/40cfr93_01.html
- U.S. Environmental Protection Agency, “Technology Transfer Network Support Center for Regulatory Air Models”, 2005 – This is an overview site which addresses the various features of the Support Center. http://www.epa.gov/ttn/scram/
- U.S. Environmental Protection Agency, “Technology Transfer Network Support Center for Regulatory Atmospheric Modeling – Air Quality Models”, 2005 – This Web site includes summary information and refers to support documents on several preferred/recommended models for specific uses.http://www.epa.gov/scram001/aqm/index.htm
- U.S. Environmental Protection Agency, “Technology Transfer Network Support Center for Regulatory Atmospheric Modeling – Modeling Guidance and Support”, 2005 – This Web site provides information on modeling guidance and on the USEPA’s model clearinghouse.http://www.epa.gov/scram001/guidanceindex.htm
- U.S. Environmental Protection Agency, “Guideline on Air Quality Models”, 40 CFR Part 51, Appendix W, July 1, 2003 – This guideline, which is included in the Code of Federal Regulations, includes comparative information on the features, data requirements, and outputs of models approved for usage by the USEPA. http://www.epa.gov/scram001/guidance/guide/appw_03.pdf
- U.S. Environmental Protection Agency, “SCREEN3 Model Software”, undated – This is a single source Gaussian plume model that provides maximum ground-level concentrations for point, area, flare, and volume sources. It is a screening version of the more sophisticated Industrial Source Complex 3 (ISC3) model. http://www.epa.gov/scram001/models/screen/screen3.zip
- U.S. Environmental Protection Agency, “SCREEN3 User’s Guide”, EPA-454/B-95-004, September, 1995, Research Triangle Park, North Carolina – This guide provides a description of fundamental assumptions, information needs, and outputs from the use of the SCREEN3 model. Example practice problems are also included. http://www.epa.gov/scram001/userg/screen/screen3d.pdf

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Addressing Effects on Air Space

- U.S. Department of the Army, “Cultural Resources Management”, AR 200-4, October 1, 1998, Washington, D.C. – This Army Regulation contains policies and procedures related to cultural resources compliance requirements, pertinent Federal laws, and the development of ICRMPs. An ICRMP represents a fundamental reference document when addressing cumulative effects on cultural resources at an installation.

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- U.S. Department of the Air Force, “Range Planning and Operations”, Vol. 1, Air Force Instruction 13-212, August 7, 2001, Washington, D.C. – This AFI provides guidance for the planning, operations, management, safety, equipment, facilities and security of Air Force ranges.

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- U.S. Department of the Air Force, “Air Force Airspace Management”, Air Force Instruction 13-201, September 20, 2001, and Washington, D.C. – This AFI provides guidance and procedures for developing and processing special use airspace. It also stresses the importance of community relations and various reports required for airspace management. Such reports could also be used as informational sources for the NEPA process.

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- Marcus, L. G., “A Methodology for Post-EIS (Environmental Impact Statement) Monitoring”, USGS Circular 782, 1979, U.S. Geological Survey, Washington, D.C. – This report describes a comprehensive process for planning and implementing an environmental monitoring program as a follow-on to an EIS. Further, a case study that applies the process is included.

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Addressing Effects on Cultural Resources

- U.S. Department of the Army, “Cultural Resources Management”, AR 200-4, October 1, 1998, Washington, D.C. – This Army Regulation contains policies and procedures related to cultural resources compliance requirements, pertinent Federal laws, and the development of Integrated Cultural Resources Management Plans (ICRMPs). An ICRMP represents a fundamental reference document when addressing cumulative effects on cultural resources at an installation.

Click here to view this document (not activated here)

- U.S. Department of the Army, “Cultural Resources Management”, Pamphlet 200-4, October 1, 1998, Washington, D.C. – This Pamphlet is a support document to AR 200-4. It includes detailed information on cultural resources management planning, specific laws and requirements, and pertinent procedures and standards of practice.

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- U.S. Department of the Army, “Fort Bliss Integrated Cultural Resources Management Plan,” August, 2000, Fort Bliss, Texas – This is an example of an ICRMP for an installation. It contains policies, procedures, and standard operating procedures (SOPs) utilized for cultural resources management at Fort Bliss.

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- U.S. Department of the Army, “Fort Leonard Wood Integrated Cultural Resources Management Plan – FY 2002 to 2006”, September, 2003, Fort Leonard Wood, Missouri – This is an example of an ICRMP for an installation. It contains historical context information, summaries of cultural resources, and policies, procedures, and SOPs for cultural resources management.

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- U.S. Army Historic Preservation Program – Contains broad information related to meeting historic preservation review responsibilities. http://www.achp.gov/army.html
- Advisory Council on Historic Preservation, "Amendments to the Army Alternate Procedures" – Describes procedures related to meeting historic preservation review responsibilities under the National Historic Preservation Act. http://www.achp.gov/AAPfinal-4-16-04.pdf
- U.S. Army Environmental Command, "Cultural Resources – Laws and Regulations" – Contains nine pertinent statutes, 19 federal regulations and guidelines, and 5 executive orders. http://aec.army.mil/usaec/cultural/laws.html
- U.S. Department of Defense, "Legacy Resource Management Program." http://www.dodlegacy.org/legacy/index.htm
- U.S. Army Environmental Command, "Cultural Resources" – Description of a variety of documents, tools, and information related to the Cultural Resources Management Program. http://aec.army.mil/usaec/cultural/index.html
- U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory, "Cultural Resources Risk Assessment" – Describes program and available products and publications. http://www.cecer.army.mil/td/tips/indexAREA.cfm?AREA=9&TECHNAME=

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Addressing Effects on Energy

- U.S. Department of the Army, "Army Energy Program", AR 11-27, February 3, 1997 – This AR updates policies, procedures, and responsibilities for the Army Energy Program (AEP). The AEP objectives are to ensure the availability and supply of energy in accordance with mission, readiness, and "quality of life" priorities; to participate in the national effort to conserve energy and water resources; to attain established energy and water conservation goals; and to participate in related research and development efforts. In addition, Energy Resources Management Plans (ERMPs) for MACOMS and installations are also addressed.

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- U.S. Congress, "Energy Policy Act of 1992", HR 776, 1992, Washington, D.C. – This broad act includes selected titles on energy efficiency; natural gas; alternative fuels-general; availability and use of replacement fuels, alternative fuels, and alternative fueled private vehicles; electric motor vehicles; electricity; renewable energy; coal; general provisions – reduction of oil vulnerability; and energy and environment (including improved energy efficiency). https://energy.navy.mil/publications/law_us/92epact/hr776toc.htm
- Executive Office of the President, "Executive Order 13123 – Greening the Government Through Energy Efficient Management", June 3, 1999, Washington, D.C. – This EO indicates that the Federal Government, as the Nation's largest energy consumer, shall significantly improve its energy management and thus save costs and reduce emissions that contribute to air pollution and global climate change. Goals are established in several areas, including energy efficiency improvement, fuel usage, and water conservation. The use of various tools (methods) such as life-cycle cost analysis, facility energy audits, and energy management strategies and tools is also stressed.

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- U.S. Department of the Army, "Army Energy Strategy for Installations", July 8, 2005, Washington, D.C. – This document addresses five major initiatives related to the energy strategy. They include eliminating energy waste in existing facilities, increasing energy efficiency in renovation and new construction, reducing dependence on fossil fuels, conserving water resources, and improving energy security.

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- U.S. Department of Defense, "Design: Energy Conservation", Unified Facilities Criteria (UFC) 3-400-01, July 5, 2002, Washington, D.C. – This document establishes minimum standards and policy for energy and water conservation in new construction and renovation of existing DoD facilities. Included in the document are mandatory energy and water conservation criteria, sustainable design and development, examples of energy and water conservation measures, functional requirements, and energy and economic analysis calculation methods.

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- U.S. Department of the Army, "Army Energy and Water Management Program", November, 2005 – This Web site includes information on the progress of the Army relative to meeting key energy goals. Some files on this Web site are not available for public viewing, thus an Army Knowledge Online (AKO) account is necessary to view this information. http://army-energy.hqda.pentagon.mil/
- U.S. Department of the Army, "Installation Management Agency (IMA) Southeast Region Energy Program – Long-Range Energy Management Plans", November, 2005 – This Web site includes a template of the generic contents for a long-range energy management plan for an installation. The long-range plans for 14 installations in the Southeast Region are also included. The installations include the Anniston and Blue Grass Air Depots; Forts Benning, Bragg, Buchanan, Campbell, Gordon, Jackson, Knox, McPherson/Gillen, Rucker, and Stewart; Redstone Arsenal; and Sunny Point MOT. The template and the plans on this Web site are not available for public viewing, thus an Army Knowledge Online (AKO) account is necessary to view this information. http://www.pnl.gov/ima-seroenergy/contracting/lr_energy_mgmt_plans.stm
- U.S. Department of the Army, "Western Power Grid Peak Demand and Energy Reduction Program – Army", November, 2005 – This Web site includes a final summary report developed from eight assessment reports at selected Army installations on the western power grid. The installations include Forts Carson, Drum, Huachuca, and Shafter; the Presidio of Monterey; Schofield Barracks; Sierra Army Depot; and the Parks Reserve Forces Training Area. During these studies emphasis was given to identifying specific installation projects that are cost effective and that achieve the greatest reductions in energy consumption and demand. The reports on this Web site are not available for public viewing, thus an Army Knowledge Online (AKO) account is necessary to view this information. http://army-energy.hqda.pentagon.mil/programs/grid.asp

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Addressing Effects on Facilities

- U.S. Department of the Army, "The Army Sustainable Range Program", AR 350-19, August 30, 2005, Washington, D.C. – This AR defines responsibilities and prescribes policies for implementing the Sustainable Range Program (SRP) on Army controlled training ranges and lands both inside and outside the continental United States. The SRP goal is to maximize the capability, availability, and accessibility of ranges and training lands to support doctrinal requirements, mobilization, and deployments under normal and surge conditions. The term “accessibility” refers to the environmental compliance and management functions and the continuous access to the land for realistic military training and testing. Key components of the SRP at an installation include a Range Complex Master Plan (RCMP), a Range Development Plan (RDP), and the Integrated Training Area Management (ITAM) program. Relative to integrated planning, an installation will be responsible for ensuring that required management plans at the installation or responsible activity level include planning for sustainable range use, and they are to be reviewed or updated at least every 5 years. Additionally, installation planning, at a minimum, must address long-term sustainable use, hydrology and hydrogeology, management procedures, record keeping standards, monitoring, public outreach and public participation programs, and necessary technology requirements to ensure sustainable range management, and integration with other installation planning processes and resources.

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- Engineer Research and Development Center – U.S. Army Corps of Engineers, “SIRRA – Sustainable Installations Regional Resource Assessment”, March, 2006, Construction Engineering Research Laboratory, Champaign, Illinois – SIRRA (Version 1a) is a web-based analysis tool that provides a first level screening relative to answering four types of questions related to sustainability using spatially related national data sets. These questions include: (1) what are important across the fenceline sustainability issues for an installation; (2) how can unit transformation and stationing requirements be best met on existing or new DoD installations; (3) how does sustainability compare across a range of installations, for example, in the context of realignment of forces; and (4) what is the regional context of an installation for one or a group of sustainability indicators. The SIRRA methodology characterizes the region surrounding a military installation based on an evaluation of ten themes: air, energy, urban development, threatened and endangered species, location, water, economy, quality of life, infrastructure, and security. The methodology also provides resource assessment ratings for 48 individual regional indicators. SIRRA relies on existing national data sets primarily from federal or other national organizations that manage or collect the data. The ratings have been mapped into GIS coverages for individual indicators coded as red, amber, or green. Military installations are placed geographically in a location and the GIS data is applied to evaluate regional aspects of the installation setting. It is important to note that the ratings are related to data from the counties and watersheds that installations lie within, and not the installations themselves. This informative Web site contains descriptive information on SIRRA and the 48 indicators. Further indicator maps and tabular data are also included.
  https://ff.cecer.army.mil/ff/sirra.do
- Center for Ecological Management of Military Lands (CEMML), “Applications of Bailey’s Ecoregions to Military Lands”, Colorado State University, Fort Collins, Colorado, March, 2006 – This document (Web site) describes a study on using Bailey’s ecoregion framework to enhance understanding of the ecological attributes of Army lands, and to then apply this understanding in the environmental management of such lands. Both data and maps are included in the document.
  http://www.cemml.colostate.edu/bailey_ecoregion.htm
- U.S. Army Corps of Engineers, “Method to Estimate Vegetative Cover on Army Training Lands”, Public Works Technical Bulletin 200-1-37, October 25, 2005,

Washington, D.C.–This bulletin describes a method for estimating percent ground cover and environmental damage caused by off-road vehicle traffic at U.S. Army installations. The method is based on the analysis of time-referenced digital photographs at various locations. It was field tested at Fort Hood and Fort Benning via the use of a commercially available software program called Assess.

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Addressing Effects on Hazardous Materials / Hazardous Wastes

The contents herein are divided into three topics–hazardous materials management, pollution prevention, and hazardous and solid waste management.

Hazardous Materials Management

- U.S. Department of the Army, "Environmental Protection and Enhancement", AR 200-1, Chapter 4–Hazardous Materials Management, February 21, 1997, Washington, D.C., pp. 13–16–This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to several VECs addressed herein. Chapter 4 contains summary information on the Army's scope and policy related to identifying and managing hazardous materials. Examples of program requirements include inventory development and updating, spill reporting, PCB management, storage tank systems management, lead hazard management, and compliance with the Emergency Planning and Community Right-to-know Act.

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- U.S. Department of the Army, "Environmental Protection and Enhancement", Pamphlet 200-1, Chapter 4–Hazardous Materials Management, January 17, 2002, Washington, D.C., pp. 17–24–Chapter 4 of this pamphlet contains detailed information related to an installation's Hazardous Material Management Program (HMMP). In addition, detailed information is also included on PCB management; storage tank systems management, testing, and information needs; lead hazard management, including lead-based paint; and reporting requirements related to the Emergency Planning and Community Right-to-Know Act.

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- U.S. Department of the Army, "Storage and Handling of Hazardous Materials", TM 38-410, January 13, 1999, Washington, D.C.–This TM establishes uniform procedures for the receipt, storage, and handling of hazardous materials and wastes by DoD components, installations, and activities.
  http://www.dlaps.hq.dla.mil/i414511.pdf
- U.S. Department of the Army, "Pest Management", AR 200-5, October 29, 1999, Washington, D.C,–This AR describes the Army's Pest Management Program which implements DoD policies to protect health, property, and natural resources from damage by insects, weeds, and other species in ways that promote training and readiness with minimum risks to the environment.
  http://www.dscp.dla.mil/subs/pestmgmt/instruct/r200_5.pdf

- U.S. Department of the Army, “Hazardous Materials Information Resource System”, AR 700-141, May 28, 2004, Washington, D.C, – This AR sets forth policies and responsibilities for Army input to and use of the DoD’s Hazardous Materials Information Resource System (HMIRS). It applies to all hazardous materials (HAZMAT) managed, procured, used, or manufactured by the Army. http://www.army.mil/usapa/epubs/pdf/r700_141.pdf
- U.S. Department of the Army, “Environmental Information Technology Management”, 2005 – This Web site includes information on DoD’s Hazardous Substance Management System (HSMS). Among the various data within HSMS is an inventory of all hazardous products, materials and chemicals on one or more installation or bases. This information can be used to meet various reporting requirements. HSMS has been deployed at over 180 DoD installations. https://www.asaie.army.mil/Public/ESOH/1eitm.html
- U.S. Department of the Army, “Chemical Accident or Incident Response and Assistance (CAIRA) Operations”, DA Pamphlet 50-6, May 17, 1991 – This pamphlet provides a comprehensive reference that can be used in preparing for, responding to, and recovering from a chemical accident/incident (CAI) involving surety or nonsurety materiel. https://134.11.61.26/ArchivePub/Publications/DA/DA%20Pam/DA%20Pam%2050-6%2019910517.pdf
- U.S. Department of the Army, “The Army Chemical Agent Safety Program”, AR 385-61, October 12, 2001, Washington, D.C. – This AR prescribes safety and health policy, responsibilities, and procedures for operations involving chemical agents and weapons systems. http://www.army.mil/usapa/epubs/pdf/r385_61.pdf

Pollution Prevention

- U.S. Department of the Army, “Environmental Protection and Enhancement”, AR 200-1, Chapter 10 – Pollution Prevention, February 21, 1997, Washington, D.C., pp. 24–25 – This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to several of the VECs addressed herein. Chapter 10 addresses the scope and policy of the Army’s Pollution Prevention Program, including the development of an installation Pollution Prevention Plan.

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- U.S. Department of the Army, “Environmental Protection and Enhancement”, Pamphlet 200-1, Chapter 10 – Pollution Prevention, January 17, 2002, Washington, D.C., pp. 44–48 – Chapter 10 of this pamphlet contains detailed information on the Army’s Pollution Prevention Program, including delineating the baseline year and pollutants, establishing a tracking system, conducting pollution prevention opportunity assessments (PPOAs), and defining pollution reduction goals. The contents of a Pollution Prevention Plan (P2 Plan) are specified; and possible sources of technical assistance are listed.

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- Executive Order of the President, “Executive Order 13101 – Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition”, September 14, 1998, Washington, D.C. – This EO requires that the head of each executive agency shall incorporate waste prevention and recycling in the agency's daily operations, and shall seek to increase and expand markets for recovered materials as well as the agency's use of such materials.

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- U.S. Army Environmental Command, "Guidance for Developing Army Pollution Prevention Plans", June, 2001, Aberdeen Proving Ground, Maryland – This document includes detailed guidance related to the elements necessary to develop an installation-level Pollution Prevention Plan. Topical outlines for 14 chapters are included along with the titles of 13 appendices containing supporting information and materials.

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- U.S. Environmental Protection Agency, "EPA Federal Facility Pollution Prevention Planning Guide", EPA 300-B-94-012, November, 1994, Washington, D.C. – This guide provides summary information on the requirements of federal and state laws and EOs related to multimedia pollution prevention. Seven steps associated with the development of a Pollution Prevention Plan are described. The steps include – develop pollution prevention goals, obtain management commitment, establish a pollution prevention team, develop a baseline, conduct a P2 opportunity assessment, develop criteria and rank activities and opportunities, and conduct a management review.

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- U.S. Navy, "Joint Service Pollution Prevention Technical Library", 2005 – This comprehensive Web site includes over 15 P2 opportunity topics, over 10 general information sources, specific P2 resources from various branches of DoD, and selected information on the relationship between P2 and installation sustainability issues. http://p2library.nfesc.navy.mil/
- U.S. Environmental Protection Agency, "Pollution Prevention at Fort Riley", 2005 – This Web site summarizes the features of a successful P2 Program at Fort Riley. Examples of installation projects that have reduced hazardous wastes, process changes and source reduction projects resulting in pollution prevention, and projects that have minimized solid waste generation are described. http://www.epa.gov/region7/p2/trandall.htm

Hazardous and Solid Waste Management

- U.S. Department of the Army, "Environmental Protection and Enhancement", AR 200-1, Chapter 5 – Hazardous and Solid Waste Management, February 21, 1997, Washington, D.C., pp. 16-19 – This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to several of the VECs addressed herein. Chapter 5 addresses the scope and policy of the Army's Hazardous and Solid Waste Management Program. Compliance with the Resource Conservation and Recovery Act (RCRA) is described along with the need for inventories of hazardous waste, permits for various on-post hazardous waste facilities, administrative requirements for the disposal of hazardous waste, and waste minimization planning. Integrated Solid Waste Management Plans for installations are also described.

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- U.S. Department of the Army, “Environmental Protection and Enhancement”, Pamphlet 200-1, Chapter 5 – Hazardous and Solid Waste Management, January 17, 2002, Washington, D.C., pp. 24-31 – Chapter 5 of this pamphlet contains detailed information related to hazardous waste management, including planning considerations, installation inventories, necessary permits, transportation, disposal, and a Resource Conservation and Recovery Act (RCRA) Biennial Report. Special wastes such as military munitions, chemical warfare agents, pesticides, medical supplies, and low-level and mixed radioactive wastes are also addressed. Solid waste management requirements as contained within RCRA are summarized. Such requirements are related to source reduction, recycling, disposal on lands, and management of construction and demolition wastes.

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- U.S. Environmental Protection Agency, “Guidelines for the Thermal Processing of Solid Wastes”, 40 Code of Federal Regulations Part 240, 2005, Washington, D.C. – Contained in this part are definitions, design procedures, and operational measures associated with solid waste incineration.
  http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr240_05.html
- U.S. Environmental Protection Agency, “Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste”, 40 Code of Federal Regulations Part 243, 2005, Washington, D.C. – Contained in this part are definitions, design procedures, and operational measures associated with storage and collection of various types of solid waste.
  http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr243_05.html
- U.S. Environmental Protection Agency, “Source Separation for Materials Recovery Guidelines”, 40 Code of Federal Regulations Part 246, 2005, Washington, D.C. – Contained in this part are definitions, and recommended procedures for paper recovery; newsprint recovery; glass, can, and mixed paper separation; and corrugated container recovery. In addition, information on market studies is included.
  http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr246_05.html
- U.S. Environmental Protection Agency, “Criteria for Municipal Solid Waste Landfills”, 40 Code of Federal Regulations Part 258, 2005, Washington, D.C. – Contained in this part are definitions, siting considerations, design procedures, and operational and monitoring measures associated with municipal solid waste landfills.
  http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr258_05.html
- U.S. Environmental Protection Agency, “Standards Applicable to Generators of Hazardous Wastes”, 40 Code of Federal Regulations Part 262, 2005, Washington, D.C. – Contained in this part are definitions, and general requirements related to packaging, recordkeeping, and reporting of hazardous waste.
  http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr262_05.html
- U.S. Environmental Protection Agency, “Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities”, 40 Code of Federal Regulations Part 264, 2005, Washington, D.C. – Contained in this part are definitions, siting considerations, design procedures, and operational and monitoring measures associated with treatment, storage, and disposal facilities.
  http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr264_05.html

- U.S. Army Center for Health Promotion and Preventive Medicine, “Guide for Developing Integrated Solid Waste Management Plans at Army Installations”, TG 197, December, 1999, Aberdeen Proving Ground, Maryland – This guide begins with summary information on applicable regulations. Specific sections are also included on waste characterization and generation, source reduction, recycling, composting, solid waste management facilities (landfills, incinerators, transfer stations, and recycling), recordkeeping, and factors affecting installation decision-making.

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- U.S. Department of the Army, “Sanitary Landfill”, TM 5-814-5, January 15, 1994, Washington, D.C. – This TM establishes the minimum design requirements for sanitary landfills, provides engineering criteria for construction, and includes recommended practices for planning and feasibility studies.

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Addressing Effects on Land Use

- Fournier, D. F., Deal, B. M., Jenicek, E. M., and Sagert, A. J., “Sustainable Installation Risk Assessment and Stationing Implications”, ERDC/CERL SR-02-12, September, 2002, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois – This report describes 48 relative regional indicators related to installation sustainability. Five indicators (or stressors) are related to land use (urban development) – regional population density, increasing regional growth rate, regional population growth, regional land urbanization, and state smart growth plans. Risk classifications are used for the five indicators.

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- Marcus, L. G., “A Methodology for Post-EIS (Environmental Impact Statement) Monitoring”, USGS Circular 782, 1979, U.S. Geological Survey, Washington, D.C. – This report describes a comprehensive process for planning and implementing an environmental monitoring program as a follow-on to an EIS. Further, a case study that applies the process is included.

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- National Defense Environmental Forum, “Balancing Mission Needs and Environmental Stewardship to Sustain the Training and Testing Landscape – A Summary of the Inaugural Meeting of the Defense Environmental Forum – February 4-5, 2003”, April, 2004, National Defense University Press, Washington, D.C. – This report summarizes the results of a Forum to address mission needs, encroachment, and sustainability issues for training ranges. Recommendations are included on the use of buffer zones, partnering and interagency cooperation, and measures related to encroachment/sprawl.

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- U.S. Army Environmental Command, “Private Lands Initiative – Addressing Encroachment with Cooperative Agreements and Conservation”, 2005, Aberdeen, Maryland – This report summarizes examples of the Army’s use of cooperative agreements and conservation encumbrances to address encroachment concerns at installations. These innovative approaches are part of the Army’s public lands initiative.

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- U.S. Department of the Army, "Acquisition of Real Property and Interests Therein", AR 405-10, May 14, 1970, Washington, D.C. – This AR delineates the authority, policy, responsibility, and procedures associated with the acquisition of real property and interests therein.

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- U.S. Department of the Army, "Disposal of Real Estate", AR 405-90, May 10, 1985, Washington, D.C. – This AR incorporates the policies and procedures for the disposal of military and industrial real estate under the custody and control of the Army worldwide. The disposal of contaminated excess property, including the conduction of appropriate surveys and implementation of clean-up measures, is also addressed.

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- U.S. Department of the Army, "Management of Title and Granting Use of Real Property", AR 405-80, October 10, 1997, Washington, D.C. – This AR delineates the authorities and describes policies for the management of title to real property under the jurisdiction or control of the Army, granting the use of that real property to non-Army uses, and the conduction of oversight activities related to unauthorized uses of such real property.

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- U.S. Department of the Army, "Real Property Master Planning for Army Installations", AR 210-20, May 16, 2005, Washington, D.C. – This AR describes the land use planning process for Army installations. The central feature is the development and periodic updating of an installation's Real Property Master Plan (RPMP). The AR includes numerous definitions, highlights the establishment of planning goals and objectives, delineates potential land use control measures, and stresses the importance of intergovernmental coordination. Information needs are also stressed along with the evaluation of alternative plans.

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Addressing Effects on Noise

- U.S. Department of the Army, "Environmental Protection and Enhancement", AR 200-1, February 21, 1997, Washington, D.C. – This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to threatened or endangered species. Chapter 7 summarizes the Army's Noise Management Program, including its basic policy, requirements, and related programs and issues.

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- U.S. Army Center for Health Promotion and Preventive Medicine, "Tri-Services Community and Environmental Noise Primer", 2005, Aberdeen Proving Ground, Maryland. – This tri-services (Army, Navy, and Air Force) primer summarizes key noise issues at military installations, and the importance of local community involvement in addressing such concerns. The use of effective communication principles is also stressed along with the management of noise complaints received at installations.

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- U.S. Army Center for Health Promotion and Preventive Medicine “International Bibliography on Noise”, 2005, Aberdeen Proving Ground, Maryland. – This extensive bibliography includes over 5000 citations with an abstract for each. The references are categorized into those related to health effects, animal effects, structural effects, and noise modeling. The entire database can be searched by authors and key words. The IBON CD can be downloaded from the following site.
  http://chppm-www.apgea.army.mil/dehe/morenoise/ibon.aspx

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Addressing Effects on Sedimentation/Erosion

- U.S. Department of the Army, “Integrated Training Area Management (ITAM)”, AR 350-4, May 8, 1998, Washington, D.C. – This AR includes information on policy and procedures related to the ITAM Program. The Program is focused on applying procedures to achieve optimum, sustainable use of training lands by implementing a uniform land management program that includes inventorying and monitoring land conditions, integrating training requirements with training land carrying capacity, educating land users to minimize adverse impacts, and providing for training land rehabilitation and maintenance.

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- National Institute for Land Management and Training, “Guidelines for Preparing an ITAM Five-year Plan, Version 7.1” (draft report submitted to U.S. Army Environmental Command, Aberdeen Proving Ground, Maryland), August 8, 2002, Kansas State University, Manhattan, Kansas. – The ITAM 5-year plan for an installation can be used to identify program requirements. Included is a descriptive outline of an 8-chapter 5-year plan. Detailed information on work categories related to ITAMs is also included.

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- U.S. Department of the Army, “Environmental Protection and Enhancement”, AR 200-1, February 21, 1997, Washington, D.C. – This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to wetlands and/or threatened or endangered species. Chapter 15 contains brief information about the ITAM Program.

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- U.S. Department of the Army, “Integrated Training Area Management Procedural Manual”, Implementing Draft, August, 1999, Washington, D.C. – This manual includes sections on overall ITAM Program management; installation-level program management; program components such as land condition trend analysis, training requirements integration, land rehabilitation and maintenance, and environmental awareness; and decision support and information management systems. Several supporting appendices are also included.

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- Anderson, A. B., Sekscienski, S., Sydelko, P., Winters, L., Brown, M., Colosky, C., Shirnia, T., and Weith, G., "U.S. Army Training and Testing Area Carrying Capacity (ATTACC) – Handbook for Installations", Version 1.1, March, 1999, U.S. Army Environmental Command, Aberdeen Proving Ground, Maryland. – ATTACC refers to a methodology and integrated decision support system for estimating the costs of using land at Army installations for training purposes. This handbook indicates how installation-level personnel can use the ATTACC methodology. Sections are included on an overview of the concepts, determining training load, estimating land conditions and determining land maintenance requirements, and using the methodology to support land management at an installation.

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- Sullivan, P. M., and Anderson, A. B., "A Methodology for Estimating Army Training and Testing Area Carrying Capacity (ATTACC) Vehicle Severity Factors and Local Condition Factors", ERDC TR-00-2, June, 2000, U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory, Champaign, Illinois. – This report addresses improvements in the ATTACC methodology based on improving the estimations of vehicle severity factors and the local condition factor. The vehicle severity factors module was validated at Fort Hood, Texas.

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- Reid, L. M., "Research and Cumulative Watershed Effects", General Technical Report PSW-GTR-141, March, 1993, U.S. Forest Service, Pacific Southwest Research Station, Albany, California. – This research report summarizes information on changes in watershed and ecosystem functions and processes that can arise from multiple land-use activities. Consideration of these changes from a holistic perspective provides the basis for analyses of cumulative watershed effects (CWEs). The land-use activities that are addressed include roads, impoundments and water development, timber management, grazing, mining, agriculture, urbanization, flood control and navigation, and recreation and fishing. Finally, eight methods for evaluating potential CWEs are described, including three procedures for calculating values or indices, several analytical procedures, and a checklist of issues for consideration. Several CWE research needs are also articulated.

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- Bern, C., Brozka, R., Doe, W., Easter, M., Jones, D., Senseman, G., and Sprouse, W., "Ecological Monitoring on Army Lands – Land Condition Trend Analysis II – Technical Reference Manual", June, 1999, Center for Ecological Management of Military Lands (CEMML), Colorado State University, Fort Collins, Colorado. – This manual focuses on the inventorying and monitoring of vegetation and biotic communities, soil, and wildlife, and the evaluation of changes or trends in these resources conditions resulting from Army activities. A total of 11 chapters are included; they range from sampling fundamentals to identification of attributes for measurement to data storage, retrieval, analysis, and interpretation.
  http://www.cemml.colostate.edu/files/trmexecsum.pdf

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- Clark Atlanta University, “Economic Impact Forecast System”, March, 2006 – This Web site provides overview information on the EIFS; it is an economic modeling and information system that can be used by military planners and analysts in the conduction of regional economic impact analyses. The central feature of EIFS is an analytical process for estimating the magnitude and significance of potential socioeconomic effects of proposed military activities and/or base realignment and closure decisions for installations. Online registration is required to gain access to this secured Web site.

  http://eifs.cau.edu/about.asp

- Bragdon, K., and Webster, R., “Economic Impact Forecast System (EIFS) – Version 6 – User Manual”, draft, August 15, 2001, U.S. Army Environmental Policy Institute, Atlanta, Georgia – This 2001 draft version of the User Manual is updated from the original mid-1970s version of EIFS. The Manual includes six chapters and two appendices. Chapter 1 has introductory information on EIFS, while Chapter 2 is focused on input needs for the model. Input needs are identified for both the project (proposed action and alternatives) and affected region of influence (ROI). Because Version 6 is web-based, Chapter 3 provides descriptive information on entering the input data and processing the associated economic outputs. Chapter 4 addresses two approaches for determining the significance of the outputs (impacts) – namely, use of a Rational Threshold Value (RTV) for the area, and use of technique named Forecast of Significance of Impacts (FSI). The foundation theory and assumptions of EIFS and the associated Automated Input-Output Multiplier Systems (AIMS) is summarized in Chapter 5. Additional information on AIMS is in Chapter 6. Appendix A includes more details on the basic economic theory underlying the EIFS model. Finally, Appendix B contains summary information on two other classes of techniques used to conduct regional economic impact studies; namely, input-output analyses and econometric modeling.

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- U.S. Bureau of Census, “Home Page”, March, 2006 – This Web site includes summary data and information from the most recent national census conducted in 2000. Examples of such data include spatially-linked census findings on total populations, minority populations, annual incomes, housing, and many others. These data are fundamental to describing the affected socioeconomic environment and forecasting changes to various demographic and economic indicators. http://www.census.gov/

- Council on Environmental Quality, “Environmental Justice – Guidance Under the National Environmental Policy Act”, December 10, 1997, Washington, D.C. – This report addresses the requirements of the 1994 Executive Order (EO 12898) entitled “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations”. Further, principles for considering environmental justice (EJ) in NEPA analyses are also stated along with specific guidance as to how to consider EJ in the following phases of the NEPA process – scoping, public participation, determining the affected environment, analysis, alternatives, record of decision, and mitigation.

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- U.S. Environmental Protection Agency, “Environmental Justice – Policies and Guidance”, March, 2006 – This Web site contains links to EO 12898 on environmental justice (EJ), CEQ’s 1997 EJ guidance under NEPA (see above-listed bookmarked document on this CD), and several EPA reports on guidance and tools for addressing EJ. Examples of these EPA reports include the 1998 final guidance for incorporating EJ concerns in EPA's NEPA compliance analyses, the EJ Smart Enforcement Assessment Tool (EJSEAT), and a toolkit for assessing potential allegations of environmental injustice (EJ Toolkit).

http://www.epa.gov/compliance/resources/policies/ej/index.html

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Addressing Effects on Threatened or Endangered Species

- U.S. Department of the Army, "Environmental Protection and Enhancement", AR 200-1, February 21, 1997, Washington, D.C. – This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to threatened or endangered species.

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- U.S. Department of the Army, "Natural Resources – Land, Forest, and Wildlife Management", AR 200-3, February 28, 1995, Washington, D.C. – This Army Regulation summarizes current policies, procedures and standards for the conservation, management, and restoration of land associated with military missions. Of particular relevance are sections or chapters addressing wetlands, Integrated Training Area Management (ITAM), Integrated Natural Resources Management Plans (INRMPs), Endangered Species Act requirements, and Endangered Species Management Plans (ESMPs).

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- U.S. Fish and Wildlife Service and National Marine Fisheries Service, "Endangered Species Consultation Handbook", March, 1998, Washington, D.C. – This Handbook summarizes basic policies, procedures, and regulations associated with compliance with the Endangered Species Act.

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- U.S. Army Environmental Command, "Guidelines to Prepare Integrated Natural Resources Management Plans for Army Installations and Activities", April, 1997, Aberdeen Proving Ground, Maryland – These guidelines describe the INRMP preparation process and standardization, and the major chapter outline for INRMPs.

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- U.S. Department of the Army, "Fort Bliss Integrated Natural Resources Management Plan", November, 2001, Fort Bliss, Texas – This example INRMP contains information which could be used in addressing cumulative effects on several natural resources, including soils, threatened or endangered species, water resources, and biological resources.

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- U.S. Army Environmental Command, "Installation Summaries from the FY 2004 Survey of Threatened and Endangered Species on Army Lands", April, 2005, Aberdeen Proving Ground, Maryland – This report summarizes October, 2004, data on 177 federally threatened or endangered species on 100 installations and 251 species-at-risk on or adjacent to 72 installations. The report provides a useful beginning point for addressing cumulative effects on threatened and endangered species at an installation.

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- U.S. Department of the Army, "Multi-species Endangered Species Management Plan – Fort Stewart, Georgia", July 9, 2001, Fort Stewart, Georgia – This ESMP contains information on three threatened and two endangered species found at Fort Stewart. Included information addresses species descriptions and habitat requirements, conservation goals, and management prescriptions and actions. Accordingly, the ESMP should be utilized when addressing cumulative effects on these federally-listed species..

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- Hayden, T. J., Cornelius, J. D., Weinberg, H. J., Jette, L. L., and Melton, R. H., "Endangered Species Management Plan for Fort Hood, Texas; FY01-05", ERDC/CERL TR-01-26, March, 2001, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois. – This report provides a comprehensive plan for maintaining and enhancing populations and habitats for two endangered bird species (golden-checked warbler, and black-capped vireo), one plant species of concern (Croton alabamensis), and cave-adapted fauna. The objectives of the ESMP for all species are described along with actions for their conservation.

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- U.S. Fish and Wildlife Service, "Recovery Criteria and Estimates of Time for Recovery Actions for the Sonoran Pronghorn: A Supplement and Amendment to the Final Revised Sonoran Pronghorn Recovery Plan", January, 2002, Region 2, Albuquerque, New Mexico – This report provides an example of a recovery plan which contains several types of information that would be useful in systematically addressing cumulative effects on the species. Examples of such information include criteria for listing the species, and for evaluation and recovery of the species.

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- U.S. Fish and Wildlife Service, "The Endangered Species Program", Washington, D.C. – This searchable Web site includes the Threatened and Endangered Species System (TESS); TESS can be queried for scientific data and details for listed species, Federal Register documents related to listings, and species recovery plans, if available.

  http://www.fws.gov/endangered/

- U.S. Army Environmental Command, "Army Guidance and Regulations – Natural Resources", Aberdeen Proving Ground, Maryland – This Web site includes copies of the Endangered Species Act, Sikes Act, and Migratory Bird Treaty Act; and Army guidance related to forestry management, fire policy, and wildland fire management.

  http://aec.army.mil/usaec/natural/natural01.html

- U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory, "Threatened and Endangered Species", Champaign, Illinois – This Web site describes CERL's research program on threatened or endangered species. Also included are abstracts and links to reports from 36 research studies.

  http://www.cecer.army.mil/td/tips/indexAREA.cfm?AREA=10&TECHNAME=

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Addressing Effects on Traffic and Transportation Systems

- Caltrans, "Guidance for Preparers of Cumulative Impact Analysis – Approach and Guidance", June, 2005a, Sacramento, California. – This site describes a California-specific eight-step approach for addressing cumulative effects.

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- Caltrans, "Guidance for Preparers of Cumulative Impact Analysis – CEQA Guidelines for Cumulative and Indirect Impacts", June, 2005b, Sacramento, California. – This site summarizes the cumulative effects requirements of the California Environmental Quality Act.

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- Caltrans, "Guidance for Preparers of Cumulative Impact Analysis – Data Gathering Issue Paper", June, 2005c, Sacramento, California. – This site highlights federal, state, and local information services.

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- Caltrans, "Guidance for Preparers of Cumulative Impact Analysis – Defining Resource Study Areas", June, 2005d, Sacramento, California. – This site includes factors to consider in delineating the spatial boundaries for resources to be addressed in a cumulative effects study.

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- Caltrans, "Guidance for Preparers of Cumulative Impact Analysis – Introduction", June, 2005e, Sacramento, California. – This site provides overview information on the Caltrans guidelines.

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- Federal Highway Administration, "Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process", January 31, 2003 – This Guidance includes definitions and 12 questions and answers related to addressing indirect and cumulative impacts in NEPA documentation. http://environment.fhwa.dot.gov/guidebook/qaimpact.asp
- Fournier, D.F., Deal, B.M., Jenicek, E.M., and Sagert, A.J., "Sustainable Installation Risk Assessment and Stationing Implications", ERDC/CERL SR-02-12, September, 2002, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois – This report describes 48 relative regional indicators related to installation sustainability. There are eight indicators (stressors) related to transportation infrastructure; they include proximity to commercial airport, airport capacity, proximity to military airfield, proximity to rail, rail capacity (trains/crossing/day), proximity to interstate, congestion of the local road network, and road access. Risk classifications are assigned for each of these indicators.

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- Indirect and Cumulative Impacts Work Group, "Draft Baseline Report Related to Executive Order 13274", March 15, 2005, Federal Highway Administration, Washington, D.C. – This report summarizes the results of a Work Group study of "barriers" to the inclusion of indirect and cumulative effects in highway EISs, as well as "opportunities" for improving such inclusions. State of practice information is included along with 26 case studies.

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- Marcus, L. G., “A Methodology for Post-EIS (Environmental Impact Statement) Monitoring”, USGS Circular 782, 1979, U.S. Geological Survey, Washington, D.C. – This report describes a comprehensive process for planning and implementing an environmental monitoring program as a follow-on to an EIS. Further, a case study that applies the process is included.

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- The Louis Berger Group, Inc., “Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina – Volume I: Guidance Policy Report”, November, 2001, prepared for the State of North Carolina Department of Transportation/Department of Environment and Natural Resources, Raleigh, North Carolina – This report summarizes requirements for assessing ICIs for highway projects, the state-of-practice in North Carolina, and an 8-step approach.

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- The Louis Berger Group, Inc., “Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina – Volume II: Practioners Handbook”, November, 2001, prepared for the State of North Carolina Department of Transportation/Department of Environment and Natural Resources, Raleigh, North Carolina – This handbook describes the systematic application of an 8-step process for addressing ICIs in highway EISs.

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- U.S. Department of the Army, “DoD Transportation Engineering Program”, AR 55-80, November 17, 2003, Washington, D.C. – This AR describes the overall transportation engineering program of DoD. It contains policies and procedures associated with the multimodal components of transportation, including the use of highways, railroads, and ports for national defense programs. In addition, it provides guidance and procedures on obtaining installation transportation engineering studies (evaluations of marine ports, terminals, and other modal facilities) and transportation engineering guidance related to DoD force transportation /deployment. Further, the responsibilities of the Military Traffic Management Command (MTMC) within DoD are delineated.

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Addressing Effects on Water Resources Management

- Euphrat, F.D., and Warkentin, B.P., “A Watershed Assessment Primer”, EPA 910/B-94/005, December, 1994, U.S. Environmental Protection, Region 10, Seattle, Washington – This report describes four inventory methods for characterizing the current conditions of a watershed. One method involves the collection and analysis of strategically located water samples. Another method involves measurements of physical and biological characteristics of stream channels. Watershed features such as land uses and habitats comprise the third method. The fourth integrates selected features of the first three methods.

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- Executive Office of the President, “Executive Order 11988 – Floodplain Management”, May 24, 1977, Washington, D.C. – This EO requires federal agencies, in carrying out their normal responsibilities, to reduce the risk of flood loss, to minimize the negative impacts of flooding, and to restore and preserve the natural and beneficial values served by floodplains.

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- Executive Office of the President, “Executive Order 11990 – Protection of Wetlands”, May 24, 1977, Washington, D.C. – This EO focuses on the need to avoid long and short term adverse impacts on wetlands. Agencies are required to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the beneficial values of wetlands.

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- Executive Office of the President, “Executive Order 12902 – Energy Efficiency and Water Conservation at Federal Facilities”, March 8, 1994, Washington, D.C.— This EO addresses various measures for improving energy efficiency and accomplishing water conservation at federal facilities.
  https://www.denix.osd.mil/denix/Public/Legislation/EO/note32.html
- Fournier, D.F., Deal, B.M., Jenicek, E.M., and Sagert, A.J., “Sustainable Installation Risk Assessment and Stationing Implications”, ERDC/CERL SR-02-12, September, 2002, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois – This report describes 48 relative regional indicators related to installation sustainability. Three indicators (or stressors) are related to water – a water vulnerability index, a water quality index, and the presence of a “sole source/primary aquifer” at the installation. Risk classifications are used for the three indicators.

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• Marcus, L. G., “A Methodology for Post-EIS (Environmental Impact Statement) Monitoring”, USGS Circular 782, 1979, U.S. Geological Survey, Washington, D.C. – This report describes a comprehensive process for planning and implementing an environmental monitoring program as a follow-on to an EIS. Further, a case study that applies the process is included.

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- Reid, L. M., “Research and Cumulative Watershed Effects”, General Technical Report PSW-GTR-141, March, 1993, U.S. Forest Service, Pacific Southwest Research Station, Albany, California. – This research report summarizes information on changes in watershed and ecosystem functions and processes that can arise from multiple land-use activities. Consideration of these changes from a holistic perspective provides the basis for analyses of cumulative watershed effects (CWEs). The land-use activities that are addressed include roads, impoundments and water development, timber management, grazing, mining, agriculture, urbanization, flood control and navigation, and recreation and fishing. Finally, eight methods for evaluating potential CWEs are described, including three procedures for calculating values or indices, several analytical procedures, and a checklist of issues for consideration. Several CWE research needs are also articulated.

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- The Federal Interagency Stream Restoration Working Group, "Stream Corridor Restoration – Principles, Processes, and Practices", October, 1998 (revised 8-2001), Natural Resources Conservation Service, U.S. Department of Agriculture, Washington, D.C. – This handbook contains basic information on stream processes and their relationships to water quality and aquatic ecology. Also included is information for planning and implementing a stream corridor restoration program.
  http://www.nrcs.usda.gov/technical/stream_restoration/

- U.S. Air Force, "Installation Stormwater Program Management Guide", May, 1997, Air Force Center for Environmental Excellence, Brooks AFB, Texas – This report includes sections on the regulatory background and framework for storm water management, practical considerations in program management, and technical issues associated with implementation.

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- U.S. Army Center for Health Promotion and Preventive Medicine, in collaboration with the U.S. Geological Survey, "User's Guide for Source Water Assessment and Protection at U.S. Army Installations", 1998, report submitted to U.S. Army Environmental Command, Aberdeen Proving Ground, Maryland – This user's guide provides detailed information on five steps – delineate the protection area, identify potential contamination sources, rank each potential contaminant source, develop protection strategies, and contingency planning.

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- U.S. Army Environmental Command, "Guidelines to Prepare Integrated Natural Resources Management Plans for Army Installations and Activities", April, 1997, Aberdeen Proving Ground, Maryland – These guidelines describe the INRMP preparation process and standardization, and the major chapter outline for INRMPs.

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- U.S. Department of the Army, "Environmental Protection and Enhancement", AR 200-1, Chapter 2 – Water Resources Management Programs, February 21, 1997, Washington, D.C., pp. 8-11 – This Army Regulation summarizes policies and requirements related to a broad range of programs or issues, including water resources management, oil and hazardous substances spills, hazardous materials management, hazardous and solid waste management, air quality, noise, and pollution prevention. Many of the addressed topics have implications related to wetlands and/or threatened or endangered species. Chapter 2 contains a concise summary of the Clean Water Act and Safe Drinking Water Act and their associated compliance requirements for the U.S. Army.

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- U.S. Department of the Army, "Environmental Protection and Enhancement", Pamphlet 200-1, Chapter 2 – Water Resources Management Programs, January 17, 2002, Washington, D.C., pp. 1-10 – Chapter 2 of this pamphlet contains detailed information related to the requirements of the Clean Water Act and Safe Drinking Water Act at Army installations.

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- U.S. Department of the Army, "Tactical Land-Based Water Resources Management", AR 700-136, May 10, 2005, Washington, D.C. – This AR addresses the management of water resources in support of tactical operations. Topics addressed include water requirements; water standards; and water treatment, storage, and distribution.

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- U.S. Department of the Army, “Utility Services”, AR 420-49, Chapter 4 – Water Supply and Wastewater, April 28, 1997, Washington, D.C., pp. 4–7 – This AR delineates the topical requirements of a Water Resources Management Plan for an installation. This Plan should be part of the Installation Utilities Management Plan.

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- U.S. Environmental Protection Agency, “Clean Water Act”, 2005 – This is a comprehensive Web site that addresses the various titles and requirements of the Clean Water Act. http://www.epa.gov/region5/water/cwa.htm
- U.S. Environmental Protection Agency, “Criteria and Standards for the National Pollutant Discharge Elimination System”, 40 Code of Federal Regulations Part 125, 2005, Washington, D.C. – Contained herein are the 40 CFR Part 125 criteria and standards for the NPDES program. http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr125_05.html
- U.S. Environmental Protection Agency, “Current National Recommended Water Quality Criteria”, 2005 – The current recommended water quality criteria for waterbodies in the United States are contained on this Web site. http://www.epa.gov/waterscience/criteria/wqcriteria.html
- U.S. Environmental Protection Agency, “Industrial Water Pollution Controls – Effluent Guidelines”, 2005 – Effluent guidelines related to numerous types of industrial wastewaters are contained on this Web site. http://www.epa.gov/ost/guide/
- U.S. Environmental Protection Agency, “Managing Your Environmental Responsibilities: A Planning Guide for Construction and Development”, EPA/305-B-04-003, April, 2005, Office of Enforcement and Compliance Assurance, Washington, D.C. —This report serves as a planning guide for construction-related permits and other environmental requirements that must be addressed during the development planning process. For example, specific information is included on stormwater permits and Section 404 permits, and on various other requirements related to hazardous and non-hazardous solid wastes, air quality, and ESA/NEPA/NHPA laws.

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- U.S. Environmental Protection Agency, “National Pollutant Discharge Elimination System (NPDES) Permitting Program”, 2005 – This Web site includes comprehensive information on the NPDES permit program. http://www.epa.gov/npdes/
- U.S. Environmental Protection Agency, “Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices”, EPA 832-R-92-005, 1992, Washington, D.C. – This report addresses the requirements for, and contents of, stormwater pollution prevention plans for construction phase activities.

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- U.S. Environmental Protection Agency, “National Pollutant Discharge Elimination System (NPDES) – Stormwater Program”, 2005 – This Web site contains information on the stormwater permit program within the NPDES program. http://cfpub.epa.gov/npdes/home.cfm?program_id=6
- U.S. Environmental Protection Agency, “National Primary Drinking Water

Regulations", 40 Code of Federal Regulations Part 141, 2005, Washington, D.C. – Contained herein are the 40 CFR Part 141 primary drinking water regulations promulgated under the Safe Drinking Water Act.
http://www.access.gpo.gov/nara/cfr/waisidx_04/40cfr141_04.html

- U.S. Environmental Protection Agency, "National Secondary Drinking Water Regulations", 40 Code of Federal Regulations Part 143, 2004, Washington, D.C. – Contained herein are the 40 CFR Part 143 secondary drinking water regulations promulgated under the Safe Drinking Water Act.
http://www.access.gpo.gov/nara/cfr/waisidx_04/40cfr143_04.html
- U.S. Environmental Protection Agency, "Source Water Assessment Program", 2005 – This Web site includes detailed information related to source water assessments as promulgated under the Safe Drinking Water Act.
http://www.epa.gov/safewater/protect/swap.html
- U.S. Environmental Protection Agency, "Water Quality Models", 2005 – This Web site summarizes key information on selected surface water quality models. Examples of EPA-supported models on this Web site include BASINS, AQUATOX, CORMIX, WASP, and QUAL2K.
http://www.epa.gov/waterscience/wqm/
- U.S. Navy, "Navy Conservation Guide for Shore Activities", undated, Washington, D.C. – This guide includes information on conducting a water usage audit, as well as identifying and evaluating a variety of conservation measures.
https://energy.navy.mil/publications/waterguide/wguide.html

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Addressing Effects on Wetlands

- U.S. Environmental Protection Agency, "Considering Ecological Processes in Environmental Impact Assessments", July, 1999, Washington, D.C. – This guidance provides information on the fundamentals of 10 topics and related processes that can be used to incorporate ecological considerations into the preparation and review of NEPA documents.

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- U.S. Department of the Army, "Natural Resources – Land, Forest, and Wildlife Management", AR 200-3, February 28, 1995, Washington, D.C. – This Army Regulation summarizes current policies, procedures and standards for the conservation, management, and restoration of land associated with military missions. Of particular relevance are sections or chapters addressing wetlands, Integrated Training Area Management (ITAM), Integrated Natural Resources Management Plans (INRMPs), Endangered Species Act requirements, and Endangered Species Management Plans (ESMPs).

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- U.S. Army Environmental Command, "Guidelines to Prepare Integrated Natural Resources Management Plans for Army Installations and Activities", April, 1997, Aberdeen Proving Ground, Maryland. – These guidelines describe the INRMP preparation process and standardization, and the major chapter outline for INRMPs.

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- U.S. Department of the Army, “Fort Bliss Integrated Natural Resources Management Plan”, November, 2001, Fort Bliss, Texas. – This example INRMP contains information which could be used in addressing cumulative effects on several natural resources, including soils, threatened or endangered species, water resources, and biological resources.

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- Executive Office of the President, “Executive Order 11990 – Protection of Wetlands”, May 24, 1977, Washington, D.C. – This EO focuses on the need to avoid long and short term adverse impacts on wetlands. Agencies are required to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the beneficial values of wetlands.

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- Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T., “Classification of Wetlands and Deepwater Habitats of the United States”, FWS/OBS-79/31, December, 1979, U.S. Fish and Wildlife Service, Washington, D.C. – An hierarchical classification scheme for wetlands is described based on five systems, 10 sub-systems, and multiple classes. Appendices are also included on the scientific and common names of plants and animals.

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- U.S. Army Corps of Engineers, “Corps of Engineers Wetlands Delineation Manual”, Technical Report Y-97-1, January, 1987 (updated to 1997), Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. – This report describes a multiparameter approach for identifying and delineating wetlands. Indicators for three broad parameters (hydrophobic vegetation, hydric soils, and wetland hydrology) are listed and described.

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- Dahl, T. E., “Status and Trends of Wetlands in the Conterminous United States, 1986 to 1997”, 2000, U.S. Fish and Wildlife Service, Washington, D.C. – This report contains trends information on the national status of wetland resources, and on the causes of wetland losses in recent years. Attention is given to intertidal estuarine and marine wetlands along with freshwater wetlands.

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- U.S. Fish and Wildlife Service, “National Wetlands Inventory: A Strategy for the 21st Century”, January, 2002, Washington, D.C. – Three program goals for the future of the National Wetlands Inventory are described; they include strategic mapping, trend and change analyses of wetlands and other aquatic habitats, and identifying and assessing threats to aquatic habitats at risk.

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- Dahl, T.E., “Wetlands Losses in the United States 1780s to 1980s”, 1990, U.S. Fish and Wildlife Service, Washington, D.C. – This report documents historical wetland losses from colonial times through the 1980s. The methods used to compile the report are also described.

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- Reid, L. M., “Research and Cumulative Watershed Effects”, General Technical Report PSW-GTR-141, March, 1993, U.S. Forest Service, Pacific Southwest Research Station, Albany, California. – This research report summarizes information on changes in watershed and ecosystem functions and processes that can arise from multiple land-use activities. Consideration of these changes from a holistic perspective provides the basis for analyses of cumulative watershed effects (CWEs). The land-use activities that are addressed include roads, impoundments and water development, timber management, grazing, mining, agriculture, urbanization, flood control and navigation, and recreation and fishing. Finally, eight methods for evaluating potential CWEs are described, including three procedures for calculating values or indices, several analytical procedures, and a checklist of issues for consideration. Several CWE research needs are also articulated.

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- Southerland, M., “Habitat Evaluation: Guidance for the Review of Environmental Impact Assessment Documents”, January, 1993, U.S. Environmental Protection Agency, Washington, D.C. – This report includes descriptive information on the impacts of numerous types of projects and activities on several habitat types, including wetlands. Regional concerns related to habitat type are summarized. The original intent of this report was to provide a guide to reviewers of EISs; however, it can also be used to plan and develop EISs.

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- Fennessy, M.S., Jacobs, A.D., and Kentula, M. E., “Review of Rapid Methods for Assessing Wetland Condition”, EPA/620/R-04/009, March, 2004, U.S. Environmental Protection Agency, Corvallis, Oregon. – A comparative review and analysis of 16 rapid assessment methods for wetlands is summarized in this report. It might be appropriate to review these methods if the selection of a rapid method is required as part of a cumulative effects study on wetlands.

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- Vestal, B., Rieser, A., Ludwig, M., Kurland, J., Collins, C., and Ortiz, J., “Methodologies and Mechanisms for Management of Cumulative Coastal Environmental Impacts, Part I – Synthesis, with Annotated Bibliography, and Part II – Development and Application of a Cumulative Impacts Assessment Protocol”, NOAA Coastal Ocean Program, Decision Analysis Series No. 6, September, 1995, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, Part 1 pp. 13-14, 33-36, 39-48, A-28, and A-42, and Part II pp. 5-6, 9-10, 32-35. – This extensive report includes two parts. Part I contains a thorough review of published literature on cumulative effects fundamentals and related issues. Several methodologies for assessment and management of cumulative effects are also reviewed along with selected institutional programs and key legal issues. Part II contains a cumulative impact assessment protocol based on either a key indicator species approach or a habitat-based landscape approach. Seven brief case studies involving usage of the protocol are also included.

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- U.S. Department of the Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Department of Agriculture Natural Resources Conservation Service, and National Oceanic and Atmospheric Administration (NOAA), “Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks”, Federal Register, Vol. 60, No. 228, November 28, 1995, pp. 58605-58614.–This multi-agency policy-oriented document for wetland mitigation banks includes sections on policy considerations; planning considerations; establishment of mitigation banks; criteria for use of a mitigation bank; long-term management, monitoring, and remediation; and other considerations.

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- U.S. Department of the Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Department of Agriculture Natural Resources Conservation Service, National Oceanic and Atmospheric Administration (NOAA) Fisheries, and U.S. Department of Transportation, "Federal Guidance on the Use of Off-Site and Out-of-Kind Compensatory Mitigation Under Section 404 of the Clean Water Act", draft, April 7, 2004, Washington, D.C.–This multi-agency policy-oriented draft document contains guidance on the use of off-site and out-of-kind compensatory mitigation. It also addresses recommendations from a National Research Council (2001) study of the issues.

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- Marcus, L. G., "A Methodology for Post-EIS (Environmental Impact Statement) Monitoring", USGS Circular 782, 1979, U.S. Geological Survey, Washington, D.C.–This report describes a comprehensive process for planning and implementing an environmental monitoring program as a follow-on to an EIS. Further, a case study that applies the process is included.

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- U.S. Environmental Protection Agency, "Wetlands–Laws", 2005.–This Web site contains links to key text sections or the entirety of the Clean Water Act (CWA); NEPA; Rivers and Harbors Appropriation Act of 1899; Federal Agriculture Improvement and Reform Act of 1996; Endangered Species Act ; Transportation Equity Act for the 21st Century; Coastal Wetlands Planning, Protection, and Restoration Act; and North American Wetlands Conservation Act. http://www.epa.gov/owow/wetlands/laws/
- U.S. Environmental Protection Agency, "Wetlands–Regulations", 2005.–This Web site includes CWA Sec. 404 regulations as promulgated by the USEPA and the U.S. Army Corps of Engineers. http://www.epa.gov/owow/wetlands/regs/
- U.S. Environmental Protection Agency, "Wetlands–Policy and Technical Guidance Documents", 2005.–This Web site includes numerous documents relating to a variety of topics; examples include geographic jurisdiction, dredged material management, mitigation banking, in-lieu fees, and Corps regulatory guidance letters. http://www.epa.gov/owow/wetlands/guidance/
- U.S. Fish and Wildlife Service, "National Wetlands Inventory", 2005.–This Web site includes status maps of wetlands as contained in the National Wetlands Inventory. http://www.fws.gov/nwi/
- Natural Resources Conservation Service, "National Resources Inventory", 2005.–This Web site includes annual natural resources inventories on non-federal lands; wetlands estimates are available at the national and regional scales. http://www.nrcs.usda.gov/technical/nri/
- Tiner, R. W., Bergquist, H. C., DeAlessio, G. P., and Starr, M. J., "Geographically Isolated Wetlands: A Preliminary Assessment of the Characteristics and Status in Selected Areas of the United States", June, 2002, U.S. Fish and Wildlife Service,

Northeast Region, Hadley, Massachusetts. – This report addresses wetlands that are completely surrounded by upland, with no apparent surface water outlet. Examples include prairie potholes, playas, desert springs and their wetlands, etc. http://www.fws.gov/nwi/Pubs_Reports/isolated/report.htm

- U.S. Fish and Wildlife Service, "National Wetlands Inventory – Publications", 2005. – Numerous national, regional, state, and local reports are contained on this Web site. http://www.fws.gov/nwi/Pubs_Reports/publi.htm
- U.S. Fish and Wildlife Service, "National Wetlands Inventory – List of Selected Wetlands Publications", updated November, 2003. – An extensive list of reports, articles, and books related to wetlands is on this Web site. Many of the publications are available upon request. http://www.fws.gov/nwi/Pubs_Reports/publi.htm
- U.S. Environmental Protection Agency, "Wetlands – Wetlands and Watersheds", 2005. --- this Web site includes pertinent factsheets; reports related to wetlands and nonpoint sources of pollution, wetlands and urban stormwater, floodplain protection, and wetland restoration and creation. http://www.epa.gov/owow/wetlands/watersheds/
- O'Neil, J., "Ecosystem Management and Restoration Information System", Version 1.0, February, 2001, Engineer Research and Development Center, Vicksburg, Mississippi. – This Web site includes extensive information on habitat evaluation methods along with about 150 Habitat Suitability Index models developed by the U.S. Fish and Wildlife Service for various indicator species; some of these species are associated with wetlands habitat. http://el.erdc.usace.army.mil/emrrp/emris/
- U.S. Environmental Protection Agency, "Wetlands – Monitoring and Assessment", 2005. – This Web site includes informational sections on monitoring for biological integrity, the Corps' hydrogeomorphic approach for assessing wetland functions, and other related monitoring and reporting references. http://www.epa.gov/owow/wetlands/monitor/

A

AADT- Annual average Daily Traffic
AAP- Army Alternate Procedures
AC- Airport Capacity
ACSIM- Assistant Chief of Staff for Installation Management
ACUBs- Army Compatible Use Buffers
ADT- Average Daily Traffic
AEC- Army Environmental Command
AEM- adaptive environmental management
AEP- Army Energy Program
AEPI- Army Environmental Policy Institute
AGL- Above Ground Level
AIMS- Automated Input-Output Multiplier System
AIRFA- American Indian Religious Freedom Act
AKO- Army Knowledge Online
ALMC- Army Logistics Management College
ANSI- American National Standards Institute
APE- Area of Potential Effect
APZ- Accident Potential Zone
AQCR- Air Quality Control Region
AQS- Air Quality System
AR- Army Regulation
ARPA- Archaeological Resources Protection Act
ASA- I&E- Assistant Secretary of the Army for Installations and Environment
ASEL- A-weighted Sound Exposure Level
ATC- Air Traffic Control
ATTACC- Army Training and Testing Area Carrying Capacity
AUSA- Association of the U.S. Army

B

BASINS- Better Assessment Science Integrating Point and Nonpoint Sources
BCT- Brigade Combat Team
BEA- Bureau of Economic Analysis
BISON- Biota Information System of New Mexico
BLM- Bureau of Land Management
BMGR- Barry M. Goldwater Range

BMP- Best Management Practices
BR- Bureau of Reclamation
BRAC- Base Realignment and Closure

C

CA- Cooperative Agreement
CAA- Clean Air Act
CAB- Combat Aviation Brigade
CAI- chemical accident/incident
CAIRA- Chemical Accident or Incident Response and Assistance
CAQEA- Cumulative Air Quality Effects Assessment
CBP- County Business Pattern
CCA- Circuit Card Assembly
CE- Cumulative Effects
CEA- cumulative effects analysis
CEMML- Center for Ecological Management of Military Lands
CEQ- Council on Environmental Quality
CEQA- California Environmental Quality Act
CERCLA- Comprehensive Environmental Response, Compensation, and Liabilities Act
CERL- Construction Engineering Research Laboratory
CERLIS- CERCLA Information System
CFAs- Controlled Firing Areas
CFR- Code of Federal Regulations
CIS- Capital Investment Strategy
CMSA- Consolidated Metropolitan Statistical Area
CO- Carbon Monoxide
CORMIX- Cornell Mixing Zone Expert System
CPI- Consumer Price Index
C-Rating- Condition Rating
CSEL- C-weighted Sound Exposure Level
CWA- Clean Water Act
CWE- Cumulative Watershed Effect
CWP- Center for Watershed Protection
CX- Categorical Exclusion

D

DA PAM¬¬- Depart of the Army Pamphlet
DAR- Defense Access Road
dB- decibel
dBA- decibels, A-weighted
dBC- decibels, C-weighted
DEIS- Draft Environmental Impact Statement
DENWG- Defense Environmental Noise Working Group
DNL- Day-night Level
DoD- Department of Defense
DODI- DoD Instruction
DOE- Department of Energy
DOPAA- Description of Proposed Action and Alternatives
DOT- U.S. Department of Transportation
DOT- Department of Transportation
DPW-Directorate of Public Works
DRID- Defense Reform Initiative Directive

E

EA- Environmental Assessment
EBS- Environmental Baseline Survey
EDMS- Emissions and Dispersion Modeling System
EDYS- Ecological Dynamics Simulation
EIFS- Economic Impact Forecast System
EIS- Environmental Impact Statement
EJ- Environmental Justice
EJSEAT- Environmental Justice Smart Enforcement Assessment Tool
EMRIS- Ecosystem Management and Restoration Information System
EMS- Environmental Management System
EO- Executive Order
EPA- Environmental Protection Agency
EPAS- Environmental Performance Assessment System
EPCRA- Emergency Planning & Community Right to Know Act
ERDC-CERL- U. S. Army Engineer Research and Development Center – Construction Engineering Research Laboratory
ERDC- Engineer Research and Development Center

ERMP- Energy Resources Management Plan
ESA- Endangered Species Act
ESMC- Endangered Species Management Component
ESMP- Endangered Species Management Plan
ESOH- Environmental, Safety, and Occupational Health

F

FAA- Federal Aviation Administration
FCG- Facility Category Groups
FCS- Future Combat Systems
FEIS- Final Environmental Impact Statement
FFCA- Federal Facilities Compliance Act
FGS- Final Governing Standards
FHWA- Federal Highway Administration
FIFRA- Federal Insecticide, Fungicide, and Rodenticide Act
FLW- Fort Leonard Wood
FONSI- Finding of No Significant Impact
FOSL- Finding of Suitability to Lease
FOST- Finding of Suitability to Transfer
FOTW- Federally-owned Treatment Works
FPMR- Federal Property Management Regulations
FSI- Finding of Significant Impacts
FSI- Forecast of Significance of Impacts

G

GAO- Government Accountability Office
GBC- Green Building Council
GIS- Geographical Information System
GSA- General Services Administration
GUI- Graphical User Interface

H

HA- Hydrogeomorphic Approach
HABS- Historic American Buildings Survey
HAER- Historic American Engineering Record
HALS- Historic American Landscape Survey

HAPS- Hazardous Air Pollutants
HAZMAT- hazardous materials
HCI- Habitat Suitability Index
HCP- Habitat Conservation Plan
HM- Hazardous Materials
HMIRS- Hazardous Materials Information Resource System
HMMP- Hazardous Material Management Program
HMT- Federal Hazardous Materials Transportation Law
HN- Host Nation
HND- Highways for National Defense
HPC- Historic Properties Component
HQDA- Headquarters Department of the Army
HSMS- Hazardous Substance Management System
HW- Hazardous Waste
HWMP- Hazardous Waste Management Plan
Hz- Hertz

I

I&E- Installations and the Environment
IAIA- International Association for Impact Assessment
IBI- indices of biotic integrity
IBON- International Bibliography on Noise
ICRMP- Integrated Cultural Resources Management Plan
ICUZ- Installation Compatible Use Zone
IDG- Installation Design Guide
IEA- indirect effects analysis
IFR- instrument-flight-rules
IGPBS- Integrated Global Presence and Basing Study
IMA- Installation Management Agency
INRMP- Integrated Natural Resources Management Plan (INRMP)
I-O- input-output
IR- Installation Restoration
IRP- Installation Restoration Program
IRRIS- Intelligent Road/Rail Information System
ISC3- Industrial Source Complex 3
ISP- Installation Sustainability Program

ISR- Installation Status Report
ITAM- Integrated Training Area Management
ITO- Installation Transportation Officer
IUMP- Installation Utilities Management Plan
IWG- Interagency Working Group
IWR- Institute for Water Resources

J

JLUS- Joint Land Use Study
JRTC- Joint Readiness Training Center

K

KNF- Kisatchie National Forest

L

LBP- Lead-based Paint
LEED- Leadership in Energy and Environmental Design
LOA- Letters of Agreement
LOP- Letters of Procedure
LOS- Level of Service
LRC- Long Range Component
LUC- Land Use Control
LULC- Land Use and Land Cover
LUPZ- Land Use Planning Zone

M

MACOM- Major Commands
MC- Mobilization Component
MCA- Military Construction-Army
MCD- Minor Civil Division
MCL- Maximum Contaminant Levels
MILCON- Military Construction
MMR- Makua Military Reservation
MMR- Military Munitions Rule
MOA- Military Operations Area
MPO- Metropolitan Planning Organization

mpss- meters per second squared
MSA- Metropolitan Statistical Area
MSL- Mean Sea Level
MSW- Municipal Solid Waste
MTMC- Military Traffic Management Command
MTR- Military Training Route
MUAV- Medium Unmanned Aerial Vehicle

N

NAAQS- National Ambient Air Quality Standards
NAGPRA- Native American Graves Protection and Repatriation Act
NASMOD- Naval Aviation Simulation Model
NCHRP- National Cooperative Highway Research Program
NCP- National Contingency Plan
NEI- National Emission Inventory
NEPA- National Environmental Policy Act
NGOs- Non-Governmental Organizations
NHPA- National Historic Preservation Act
NLR- Noise Level Reduction
NMANG- New Mexico Air National Guard
NMFS- National Marine Fisheries Service
NMTRI- New Mexico Training Range Initiative
NOAA- National Oceanic and Atmospheric Administration
NOVs- Notices of Violations
NOx- Nitrogen Oxides
NPAA- Noise Pollution and Abatement Act
NPDES- National Pollutant Discharge Elimination System
NRC- National Research Council
NRHP- National Register of Historic Places
NU- Northwestern University
NWR- National Wildlife Refuge

O

O&M- Operation and Maintenance
OASA- Office of the Secretary of the Army
ODS- ozone depleting substances

OEBGD- Overseas Environmental Baseline Guidance Document
ONMP- Operational Noise Management Program
OSD- Office of the Secretary of Defense

P

P2 Plan- Pollution Prevention Plan
PAF- Proximity to Military Airfield
PAP- proximity to Commercial Airport
PCB- Polychlorinated Biphenyl
PCBs- asbestos, polychlorinated biphenyls
PEIS- Programmatic Environmental Impact Statement
PI- Proximity to Interstate
PM- Preventive Maintenance
PMSA- Primary Metropolitan Statistical Area
POE- ports of embarkation
POL- petroleum, oils, and lubricants
POP- Persistent Organic Pollutant
POTW- Publicly Owned Treatment Works
POV- Privately-owned Vehicles
PPA- Pollution Prevention Act
PPOA- Pollution Prevention Opportunity Assessments
PPP- Pollution Prevention Program
PPRF- past, present and reasonably foreseeable
PR- Proximity to Rail
PSD- Prevention of Significant Deterioration
PVA- population viability analysis
PWS- public water supply

Q

QOL- Quality of Life

R

RAG- red/amber/ green
RAS- Regional Accounting System
RCI- Roadway Congestion Index
RCM- Resource Capability Model

RCMP- Range Complex Master Plan
RCRA- Resource Conservation and Recovery Act
RCRIS- RCRA Information System
RCW- Red-cockaded Woodpecker
RD- Resource Deficiency
RDF- Refuse-Derived Fuel
RDP- Range Development Plan
REC- Record of Environmental Consideration
RFFA- reasonably foreseeable future actions
RGL- Regulatory Guidance Letter
rms- root mean square
RMTK- Range Manager's Tool Kit
RNM- Rotocraft Noise Model
RO- Resource Opportunity
ROA- Report of Availability
ROI- Region of Influence
RONIP- Range Operators' Noise Impact Predictor
RPMP- Real Property Management plan
RPMPD- Real Property Master Plan Digest
RPPB- Real Property Planning Board
RPV- remotely piloted vehicle
RSA- Resource Study Area
RTV- Rational Threshold Value

S

SARA- Superfund Amendments and Reauthorization Act
SBCT- Stryker Brigade Combat Team
SDWA- Safe Drinking Water Act
SDZs- safety danger zones
SEA- Strategic Environmental Assessment
SEIS- Supplemental EIS
SERDP- Strategic Environmental Resources and Development Program
SERM- Sustainability Encroachment and Room to Maneuver
SHPO- State Historic Preservation Office
SIP- State Implementation Plan
SIRRA- Sustainable Installations Regional Resource Assessment

SOPs- Standard Operating Procedures
SOx- Sulphur Oxides
SPCC- Spill Prevention, Control, and Countermeasure
SPCCPs- Spill Prevention, Control, and Countermeasure Plans
SRC- Short-Range Component
SRP- Sustainable Range Programs
SSAs- Sole-Source Aquifer
STC- Sound Transmission Class
SUA- Special Use Airspace
SUAV- Small Unmanned Aerial Vehicle
SWAP- Source Water Assessment and Protection

T

TABS- Total Army Basing Study
TAF- Terminal Area Forecast
TC- Training Circular
TES- Threatened and Endangered Species
TESS- Threatened and Endangered Species System
TMDL- Total Maximum Daily Load
TMs- Technical Manuals
TNC- The Nature Conservancy
TNM- Traffic Noise Model
TOC- Table of Contents
TRB- Transportation Research Board
TRI- Toxic Release Inventory
TSB- tabulation of existing and required facilities
TSCA- Toxic Substances Control Act
TSP- Traffic Safety Plan
TUAV- Tactical Unmanned Aerial Vehicle

U

UA- Units of Action
UAV- Unmanned Aerial Vehicle
UFC- Unified Facilities Criteria
USA- United States Army
USACE- US Army Corps of Engineers

USACERL- U.S. Army Construction Engineering Research Lab
USACHPPM- U.S. Army Center for Health Promotion and Preventative Medicine
USC- United Stated Code
USDA- U.S. Department of Agriculture
USFS- U.S. Forest Service
USFW- US Fish and Wildlife Service
USGS- U.S. Geological Survey
USLE- Universal Soil Loss Equation
USN- United States Navy
USTs- Underground Storage Tanks
UXO- Unexploded Ordnance

V

VECs- Valued Environmental Components
VFR- Visual Flight Rules
VOC- Volatile Organic Compound

W

WAM- Workplan Analysis Module
WARM- Waste Reduction Model
WASP- Water Quality Analysis Simulation Program
WEQ- Wind Erosion Equation
WET- wetland evaluation technique
WHP- Wellhead Protection
WQ- Water Quality Index
WRMP- Water Resources Management Plan
WV- Water Vulnerability Index

Y

YTRC- Yuma Training Range Complex

Numerical Acronyms

27 FW- 27th Fighter Wing