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## Analysis of USDA Forest Service

# National BMP Monitoring Results

## for Fiscal Years 2015 Through 2018:

Aquatic Ecosystems Management,
Chemical Use Management,
Facilities and Nonrecreation Special Uses
Management, and Minerals Management

**Pamela J. Edwards, Frederica Wood, and Joan Y. Carlson**



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## Abstract

The U.S. Department of Agriculture, Forest Service National Best Management Practices (BMP) Program assists in meeting agency Clean Water Act objectives with nationally consistent monitoring. National BMP program monitoring protocols are used to evaluate BMP implementation (including planning) and effectiveness for most types of land-disturbing activities that occur on national forests and grasslands. This report summarizes data from the first two full monitoring periods—federal fiscal years 2015–2016 and 2017–2018—for aquatic ecosystems, chemical uses, facilities and nonrecreation special uses, and minerals management protocols. Best management practices were monitored at 548 projects or sites during these two periods; 203 monitored projects involved aquatic ecosystem management, 114 involved chemical use management, 121 involved facilities and nonrecreation special uses management, and 110 involved minerals management. Multiple monitoring protocols (i.e., forms and instructions) exist for each resource area to cover the many types of sites and projects; consequently, data are primarily analyzed nationally by protocol within a resource area. Assessment of BMP implementation includes planning, on-the-ground execution, and project oversight components. BMP effectiveness is assessed by how well water, aquatic, and riparian resources are protected during project or maintenance activities. In addition to summaries and statistical comparisons of the implementation and effectiveness data, implementation and effectiveness ratings—and composite ratings determined from the combination of those ratings—are presented for each protocol. Overall, 46 percent of the sites evaluated had full BMP implementation, BMPs were fully effective at protecting water resources at 76 percent of the sites, and 54 percent of the sites achieved the best composite rating. This inaugural report includes several analyses to show the wide range of information that can be obtained from monitoring efforts on national forests and grasslands and presents key findings and potential management implications. Results from any monitoring period provide only a snapshot of the planning, implementation, and effectiveness of BMPs but can play a significant role in identifying BMP strengths and adaptive management needs. Future monitoring and reporting can incorporate regional and national trends, allowing for programmatic adaptive management to improve water quality and aquatic health on our national forests and grasslands.

**Keywords:** best management practices, BMP implementation, BMP effectiveness, monitoring protocol, land-disturbing activities, national forests and grasslands

## Cover Photographs

Buckthorn underground gold mine, Okanogan National Forest, Washington (upper left), USDA Forest Service photo; application of herbicide to control yellow star thistle, Eldorado National Forest, California (upper right), USDA Forest Service photo by David Bakke; Bull Mountain pipeline construction, White River National Forest, Colorado (lower left), USDA Forest Service photo by Debra Ryon; installation of log vein structures, Allegheny National Forest, Pennsylvania (lower right), USDA Forest Service photo by Nathan Welker.

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### Authors

**Pamela J. Edwards** is research hydrologist (retired), Timber and Watershed Laboratory, USDA Forest Service, Northern Research Station, 459 Nursery Bottom Road, Parsons, WV 26287.

**Frederica Wood** is natural resources specialist (retired) and volunteer, Timber and Watershed Laboratory, USDA Forest Service, Northern Research Station, 459 Nursery Bottom Road, Parsons, WV 26287.

**Joan Y. Carlson** is national watershed program leader, USDA Forest Service, Washington Office, Natural Resources, Biological and Physical Resources, 201 14th Street SW, Washington, DC 20250, joan.carlson@usda.gov.

# FOREWORD

Securing favorable conditions of water flows was one of three principal reasons given in the Organic Administration Act of 1897 for the establishment of the Nation's national forests. The Forest Service, an agency of the U.S. Department of Agriculture, pursues these conditions through active watershed and forest management strategies developed collaboratively among resource managers, scientists, and the public. Using best management practices (BMPs) for water quality to avoid harm to water resources is foundational to management of national forests and grasslands.

The Forest Service's National BMP program provides nationally consistent, scientifically sound guidance for implementing best management practices and monitoring their effectiveness at protecting water quality across national forests and grasslands. The program is the product of a long-term collaboration between the agency's National Forest System and Research and Development mission areas. For more than 20 years, research scientists have worked with forest and watershed managers and National BMP program staff to provide scientific knowledge and data that have informed program goals and monitoring activities.

From 2019 to 2021, Northern Research Station scientists worked with National BMP program staff to provide an in-depth analysis of BMP implementation and effectiveness data collected across national forests and grasslands. The science team evaluated BMP monitoring data collected from more than 2,600 sites over two monitoring periods (fiscal years 2015 and 2016 and fiscal years 2017 and 2018) to help the National BMP program address key performance questions:

- Is the Forest Service implementing the water resource protections described in the National BMP program guidance?
- Are the water resource protections effective at meeting National BMP program goals?
- What improvements may be needed to improve implementation and effectiveness?

The results of the assessment are presented in three reports that summarize BMP implementation and effectiveness data for projects on national forests and grasslands in each category of activity in the National Core BMPs: Aquatic Ecosystems Management, Chemical Use Management, Facilities and Nonrecreation Special Uses Management, Wildland Fire Management, Minerals Management, Rangeland Management, Recreation Management, Road Management, Mechanical Vegetation Management, and Water Uses Management. Statistical analysis provides key findings that the National BMP program and resource managers on national forests and grasslands can use to inform additional program needs.

Information provided by this assessment will be used by the agency's forest and watershed managers to document compliance with the Federal Clean Water Act, which in turn will strengthen relationships with State and Federal water quality administrators and allow for the continued use of BMPs for control of nonpoint source pollution without additional regulatory requirements. In addition, this information will be used in the agency's land management and project planning processes and decision making to support the use of categorical exclusions and "finding of no significant impacts" for environmental assessments where appropriate.

This long-term effort demonstrates the productive partnership between the Forest Service's National Forest System managers and our Research and Development scientists, who provide the expertise and scientific knowledge used by our land managers to ensure that active management continues to support watershed health and the Nation's safe and clean water supply.



Cynthia West
Director, Northern Research Station
USDA Forest Service, Research and Development
Madison, Wisconsin



Steve Lohr
Director, Natural Resources Staff
USDA Forest Service, National Forest System
Washington, DC

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# INTRODUCTION

National Best Management Practices (BMP) monitoring is part of the U.S. Department of Agriculture, Forest Service National BMP program, which has an overarching objective of protecting water quality and aquatic ecosystem health from the effects of ground-disturbing activities on national forests and grasslands. The Forest Service uses BMPs in an adaptive management framework to achieve compliance with established state and national water quality goals (USDA Forest Service 1990). The purpose of National BMP monitoring is to provide a consistent and credible process to monitor and document Forest Service BMP implementation and effectiveness in a manner that allows data aggregation, analysis, and sharing at local, regional, and national scales. The information gained from BMP monitoring informs management decisions, identifies BMP procedures that may need improvement, and helps to maintain or restore overall watershed condition. National BMP monitoring information is shared with the U.S. Environmental Protection Agency, state water quality regulators, and other partners and stakeholders to document compliance with federal Clean Water Act permit requirements and state nonpoint source programs.

National BMP monitoring consists of 42 different monitoring protocols in 10 resource areas: aquatic ecosystems management, chemical use management, facilities and nonrecreation special uses management, wildland fire management, minerals management, rangeland management, recreation management, road management, mechanical vegetation management, and water uses management. The 42 protocols encompass nearly every major type of ground-disturbing project or activity that occurs on National Forest System (NFS) lands.

Interdisciplinary review teams of resource professionals conduct onsite BMP evaluations utilizing the monitoring protocols to assess BMP implementation and effectiveness. Implementation evaluations assess the extent to which site-specific water resources protection measures were planned and implemented on projects or sites. Implementation monitoring is focused primarily on answering the question of whether site-specific BMP prescriptions developed during planning for the project or activity (including operation and maintenance of existing sites or facilities) were implemented as designed or planned. Effectiveness evaluations determine the extent to which BMPs achieved their water resources protection objectives. In general, effectiveness monitoring is focused on answering the question of whether the site-specific BMP prescriptions, as implemented, were effective at protecting water quality and aquatic health.

Data from completed BMP evaluations are entered into the BMP data management system where they are stored, analyzed, and shared. A scoring rule set, unique to each protocol, is used to assign a rating for BMP implementation, BMP effectiveness, and an overall BMP performance rating for each site or project. Assigning a rating to each evaluation enables tracking of BMP performance over time at multiple scales within the agency.

To achieve the purposes of the National BMP program, a dataset of approximately 1,400 BMP monitoring evaluations per period representatively distributed across all resource areas and all NFS lands (see Appendix) is generated during each 2-year monitoring period. Resulting data are then analyzed to report on the status of Forest Service performance in implementation and effectiveness of the National Core BMPs.[1] Information gained from BMP monitoring is used to improve the National Core BMPs, site-specific BMP prescriptions, and land management activities to better protect water quality on NFS lands and to provide information for programmatic adaptive management at the national and Forest Service region levels.

This document is one of three reports providing a detailed examination of the data from Forest Service BMP monitoring during two 2-year periods coinciding with federal fiscal years (FY)[2]: 2015–2016 (FY15/16) and 2017–2018 (FY17/18). The FY15/16 monitoring period was the first full monitoring period for National BMP monitoring. The examination presented herein includes sites and projects evaluated using protocols for aquatic ecosystems management, chemical use management, facilities and nonrecreation special uses management, and minerals management. The other reports present the results for rangeland management, road management, and mechanical vegetation management protocols (Edwards et al. 2025a) and wildland fire management, recreation management, and water uses management protocols (Edwards et al. 2025b).

Each resource area is examined in its own section, and the findings from each protocol in that resource area are reported in a separate subsection within the section. For the reader's ease, especially those who are not thoroughly familiar with these protocols, text versions of protocol monitoring forms from the periods covered in this analysis for these resource areas are provided within each section. When specific questions on the forms are referenced, the notation Q## preceded by the protocol abbreviation is used to denote the question number in the corresponding form. The review described herein for each monitoring protocol is accomplished by first focusing on the data from individual or associated questions and exploring relationships between implementation and effectiveness results. Second, implementation and effectiveness ratings (described in the following section) and their association with each other as well as with individual implementation and effectiveness answers, are investigated. Finally, each section concludes with a summary of important findings from the data analyses and provide suggestions on how these findings can be used to improve BMP implementation and effectiveness in the types of projects, activities, or sites evaluated by the protocol.

[1]National Core BMPs: The nationally standardized set of general, nonprescriptive BMPs for the broad range of activities that occur on National Forest System lands as specified in the National Core BMP Technical Guide (USDA Forest Service 2012b).

[2]A federal fiscal year (FY) runs from Oct. 1 to Sept. 30 and is denoted by the latter months of the period; for instance, FY 2015 was Oct. 1, 2014, to Sept. 30, 2015. The 2-year monitoring period FY 15/16 was from Oct. 1, 2014, to Sept. 30, 2016.

# METHODS

Each monitoring protocol consists of a monitoring form and instructions. The forms are divided into three primary sections: header, implementation, and effectiveness. The header section collects general descriptive information about the project or site being evaluated. The implementation questions address the overall question: "Were site-specific BMP prescriptions implemented as planned or designed?" The effectiveness questions address the question: "Were the site-specific BMP prescriptions, as implemented, effective at protecting water quality?"

The data queries that serve as the foundation of this report were designed to extract the maximum amount of information that would be useful to national forests and grasslands units; consequently, an extensive number of analyses were completed for each protocol. Some analyses may be much more useful than others to national forest resource specialists and managers, particularly as sample sizes increase, but in-depth analyses are included here to provide insight into the types of queries and information that can be gleaned from monitoring protocols. With continued data collection and consideration of the findings, the number of analyses in future summaries will likely be limited to those that are found to be most useful for local and programmatic adaptive management.

Although there are approximately 1,400 evaluations per 2-year monitoring period, small sample sizes exist for some protocols and analyses because some protocols are more frequently used than others, and because answers are spread across many possible answer choices for individual questions. When sample sizes are small, it is important to interpret the accuracy of results with care; for that reason sample sizes for each of the analyses are presented throughout this report. Confidence in the results of the analyses and value of the findings generally increase as sample sizes increase. With additional data from post-FY17/18 monitoring, temporal trends in implementation, effectiveness, and overall performance (from ratings) also will be examinable in future reports. The number of evaluations per protocol currently limits the ability to do in-depth examinations by Forest Service region (henceforth referred to as region, the administrative divisions of the Forest Service. See the Appendix for a map of the regions); thus, only a few metrics are broken out by those boundaries. Nearly all results—whether presented as count data, percentages, visual comparisons, or statistical test—represent nationally aggregated data.

To meet National BMP monitoring objectives, both implementation and effectiveness monitoring are to be performed for selected sites or projects. However, in some instances only implementation or effectiveness monitoring was completed by the end of the monitoring period. Due to the limited sample sizes currently available, all available data are included in the counts and percentages shown in tables and figures. As more monitoring data become available, restricting all monitoring period analyses (counts, other descriptive statistics, and statistical tests) to evaluations for which both implementation and effectiveness results are available will be more appropriate and in keeping with the intent of the National BMP program.

Data in this report are summarized by monitoring period. Because only the first two monitoring periods are included, it is inappropriate to discuss data trends. Some data are

compared statistically within the monitoring period. In most instances, the comparison was done using the Fisher's exact test of association (McDonald 2014) for comparison of the frequency distribution of two categorical variables (i.e., n-way contingency tables) when sample sizes are small. Generalized linear mixed models (GLMM) with the response variable often having a nonlinear distribution and least-squares means probability of significant difference analysis were appropriate and employed for count data or other noncategorical data (SAS Institute 2013). Nonparametric analysis of variance with Kruskal-Wallis tests were used for percentage data comparisons. For all tests, an alpha level of 0.10 is used to define statistical significance due to limited sample sizes, and test results are reported as p-values. When the Fisher's exact test was not used, the statistical test is reported with the p-values. Although statistical significance provides insight into the patterns of the BMP monitoring data, data comparisons that are suggestive of relationships but not statistically significant also can be informative and useful to NFS management. As such, discussions of findings are not limited to only statistically significant results, particularly within the management implications sections of this report.

## Random Versus Nonrandom Site Selection

The number of evaluations expected to be completed by most individual NFS administrative units was 12 during the FY15/16 monitoring period and 14 during the FY17/18 monitoring period. At least half of the evaluated sites or projects were required to be selected randomly because results from random samples can be assumed to be representative of other similar sites or projects on that unit. Nationally, random sampling would provide unbiased information about the status and trends of BMP implementation and effectiveness. However, nonrandom sampling was permitted to allow units to evaluate sites and projects to address local monitoring needs.

Even with the stipulation that at least half of the evaluation sites or projects be selected randomly, the number of random samples available from these first monitoring periods within each protocol was limited (because there are 42 total protocols). Consequently, to increase the sample sizes in the current analyses, random and nonrandom results were combined if no statistical association existed between both implementation and effectiveness ratings and the sample selection method (ratings are described in greater detail in the next section). Ratings were used because they integrate data from multiple implementation or effectiveness questions; thus, ratings incorporate more information than would be available from responses to any single question.

## Ratings Overview

Implementation ratings indicate the degree of planning and BMP implementation on the ground, while effectiveness ratings provide an interpretation of the magnitude and temporal extent of observed and potential effects to water quality. The implementation and effectiveness sections both follow a decision-tree model format, and some questions do not pertain to every site or project. Even so, all questions that are pertinent to the site or project are expected to be answered for each evaluation. The answers from key questions in each section are used to develop a corresponding rating.

There are five implementation ratings and four effectiveness ratings. The ratings and corresponding interpretations are given in Table 1. Note that although some protocols incorporate existing water quality monitoring data if available, the protocols do not require direct monitoring of water quality; consequently, the effectiveness ratings are not a regulatory assessment of impairment or attainment of beneficial or designated uses.

The ratings are determined from scoring routines developed specifically for each individual protocol. The routines follow the same general template for all protocols, but typically the approach is more similar for implementation than it is for effectiveness simply due to the greater variability in the numbers of effectiveness questions among protocols.

Key implementation questions are assigned to one of three components in the scoring routines: planning, on-the-ground execution, and project oversight. The former component provides an interpretation of BMP planning and design, while the latter two provide interpretation of the operational execution. Analogous to implementation, key effectiveness questions are assigned to one of several components in each protocol scoring routine to address whether BMPs were effective at protecting water quality.

**Table 1.—**Implementation and effectiveness ratings and their meaning

| Protocol section and rating | Rating interpretation |
|---|---|
| Implementation | |
| Fully implemented | Indicates BMP prescriptions were developed for the project or site and fully implemented on the ground |
| Mostly implemented | Indicates a deficiency in project planning or project oversight. Prescribed BMPs were not fully incorporated into project implementing documents, but the BMP prescriptions that were included in the implementing documents were fully implemented on the ground |
| Marginally implemented | Indicates the primary deficiency was in the operational execution of the project due to a lack of full implementation of prescribed BMPs on the ground |
| Not implemented | Indicates BMPs were identified in planning but were either not incorporated in project implementing documents or were not implemented on the ground, or project oversight was lacking |
| No BMPs | Indicates no evidence of BMPs being included during project planning. This rating represents a failure to consider BMPs during the planning process |
| Effectiveness | |
| Effective | Indicates no adverse impacts to water resources from projects or activities were evident |
| Mostly effective | Indicates impacts to water resources were minor and temporary |
| Marginally effective | Indicates impacts to water resources were minor and prolonged, or major and temporary |
| Not effective | Indicates potential for major and prolonged adverse effects to water quality or waterbody condition |

Some components are split further into subcomponents, and those component scores are determined from the subcomponent scoring routines. The specific components, and subcomponents if applicable, differ for each protocol and often are dependent on the types of locations evaluated for a site or project and the pollutants considered. More detail on the components and applicable subcomponents is presented by protocol in the section "Examination of Component and Subcomponent Scores."

Two aspects of the rating scheme are important for interpreting BMP effectiveness findings and effectiveness ratings. First, the protocol instructions direct the interdisciplinary review team completing the evaluation to make observations only at specific areas within the project or site—typically near waterbodies, often within aquatic management zones (AMZs)[3] or within one or more waterbodies. Thus, the monitoring most often occurs at the areas of highest risk to water quality in the event of BMP underperformance or failure. Second, the overall effectiveness rating for a project or site generally is based on the poorest component score. For the overall effectiveness rating to be *effective* (Table 1), all of the component scores in that evaluation must be *effective*. If any of the component scores is *not effective*, the overall effectiveness rating in turn is *not effective*. An overall effectiveness rating of *mostly effective* results when at least one component score is *mostly effective* and none are *marginally effective* or *not effective*. Similarly, a *marginally effective* rating results if a component score is *marginally effective*. Because the overall effectiveness rating is an indicator of the poorest conditions observed at the most sensitive areas at the site, it is not a rating of average condition of the site.

When both an implementation and effectiveness rating are available for a project or site, a composite rating is determined from the combination of the implementation rating and the effectiveness rating (Table 2). More weight is given to the effectiveness rating in determining the composite rating since water quality protection is directly related to the effectiveness rating; however, the *no plan* composite rating results if no BMPs were prescribed in project planning, regardless of the effectiveness rating. When no BMPs were prescribed, water quality and aquatic resource protection are dependent upon chance.

**Table 2.—**Composite ratings are the result of the intersection of the implementation and effectiveness ratings for each project or site where both implementation and effectiveness evaluations have been completed. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| Composite rating | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | Excellent | Excellent | Good | Good | No plan |
| | Mostly effective | Good | Good | Fair | Fair | No plan |
| | Marginally effective | Fair | Fair | Poor | Poor | No plan |
| | Not effective | Poor | Poor | Poor | Poor | No plan |

[3]Aquatic management zones (AMZ) are administratively designated zones adjacent to stream channels and other waterbodies that are delineated for applying special management controls to maintain and improve water quality or other water- and riparian-dependent values.

# AQUATIC ECOSYSTEMS MANAGEMENT

Aquatic ecosystems management BMPs are used to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from construction and maintenance activities in flowing (lotic) and non-flowing (lentic) aquatic ecosystems. Properly functioning streams, lakes, springs, riparian areas, and wetlands are critical in maintaining water quality, water quantity, riparian habitat, aquatic fauna populations and diversity, and downstream beneficial uses. Common management activities in waterbodies include construction of ponds and wetlands, streambank or channel restoration, and aquatic habitat improvement or restoration.

In this section, results are described separately by the aquatic ecosystems (AqEco) protocols: active construction of aquatic ecosystem improvements (AqEco A) and completed aquatic ecosystem improvements (AqEco B). Protocol AqEco A is intended to be used while construction of an aquatic ecosystem improvement project is ongoing. AqEco B is intended to be used within 2 years following completion of a project. In the FY15/16 and FY17/18 monitoring periods, the evaluations for both AqEco A and B are dominated by randomly selected samples (Table 3), but the sample sizes for randomly selected sites for the two protocols are not large, especially considering that they represent agency-wide monitoring. Statistical comparisons of the implementation ratings and effectiveness ratings resulting from randomly and nonrandomly selected samples showed no significant associations between the ratings and sample selection (Fig. 1) in either monitoring period, whether implementation ratings and sample selection type (AqEco A: $p = 0.39$ FY15/16, $p = 0.84$ FY17/18; AqEco B: $p = 0.31$ FY15/16, $p = 0.36$ FY17/18) or effectiveness ratings and selection type (AqEco A: $p = 0.79$ FY15/16, $p = 0.15$ FY17/18; AqEco B: $p = 0.44$ FY15/16, $p = 0.34$ FY17/18). Therefore all samples are combined for analysis.

**Table 3.**—Number of randomly and nonrandomly selected AqEco A (Active Construction of Aquatic Ecosystem Improvements) and AqEco B (Completed Aquatic Ecosystem Improvements) evaluations, by monitoring period and region (AqEco A-Q11b, AqEco B-Q11b)

| Monitoring period | Region | AqEco A random selection | AqEco A nonrandom selection | AqEco B random selection | AqEco B nonrandom selection |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 7 | 1 | 8 | 2 |
| | 2 | 6 | 1 | 4 | 5 |
| | 3 | 1 | 3 | 3 | 3 |
| | 4 | 1 | | | |
| | 5 | 3 | 1 | 4 | 2 |
| | 6 | 8 | | 12 | 3 |
| | 8 | 6 | 2 | 7 | 1 |
| | 9 | 3 | 1 | 7 | |
| | 10 | 1 | | 1 | |
| | Total | 36 | 9 | 46 | 16 |
| | Percent within protocol | 80 | 20 | 74 | 26 |
| FY17/18 | | | | | |
| | 1 | | 1 | 2 | 1 |
| | 2 | 6 | | 7 | 1 |
| | 3 | 1 | | 2 | 2 |
| | 4 | 4 | | | 1 |
| | 5 | 4 | 2 | 8 | 4 |
| | 6 | 10 | 1 | 14 | 2 |
| | 8 | 5 | 1 | 3 | 1 |
| | 9 | 3 | | 5 | 2 |
| | 10 | | | 2 | 1 |
| | Total | 33 | 5 | 43 | 15 |
| | Percent within protocol | 87 | 13 | 74 | 26 |

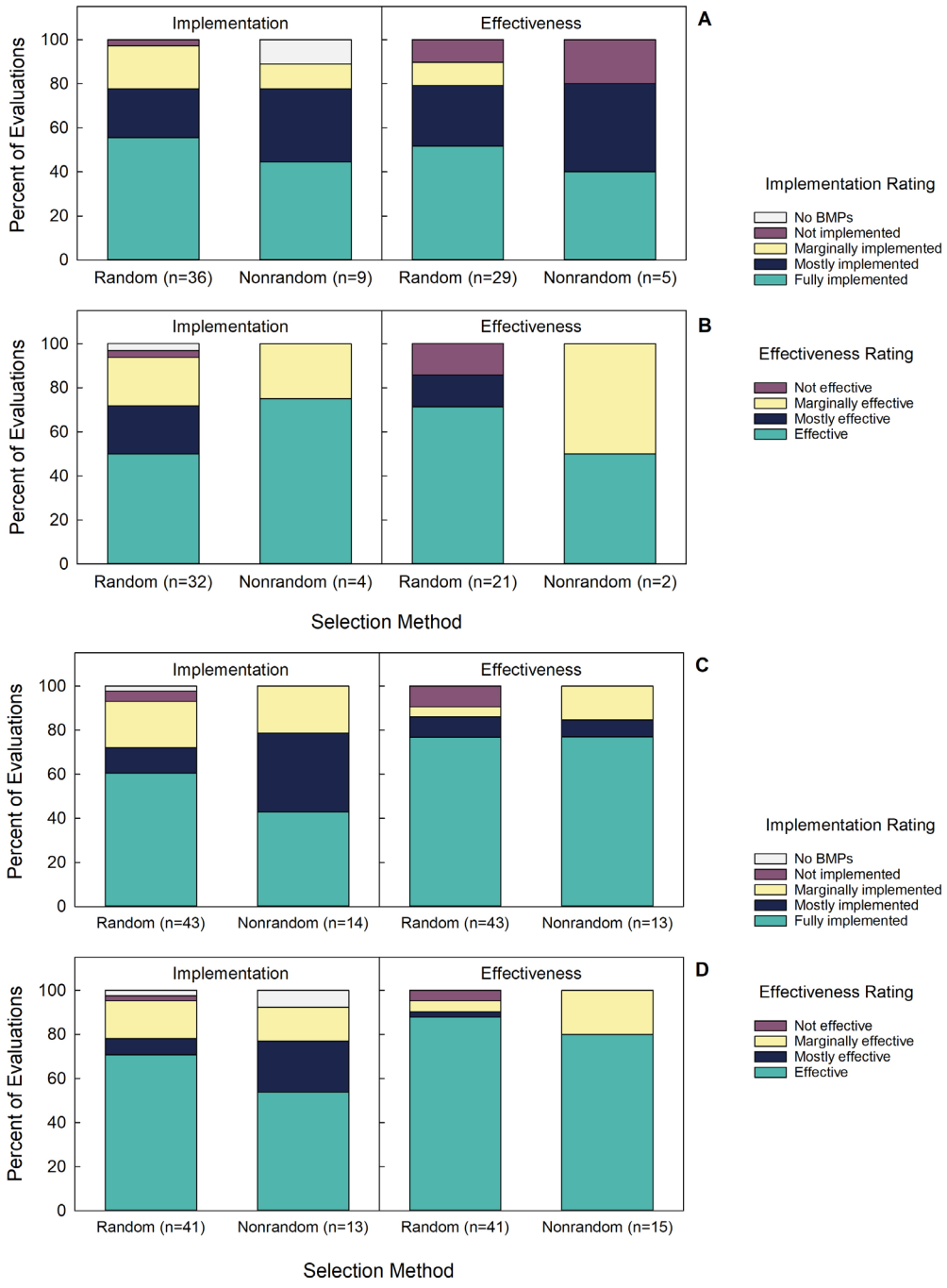



**Figure 1.—**Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for AqEco A evaluations completed in FY15/16 (A) and FY17/18 (B) and AqEco B evaluations completed in FY15/16 (C) and FY17/18 (D).

Results for each of the two AqEco protocols are divided into six sections; each builds on the next in terms of data interpretation. The sections and descriptions are as follows:

1. Header statistics—mostly descriptive statistics from the header section of the evaluation form, including location, composition, and types of projects.
2. Implementation results and their tie to header information—results from the implementation questions with ties to header information when appropriate.
3. Effectiveness results and their tie to implementation results and header information—results from the effectiveness questions with ties to implementation and sometimes header information to provide context between outcomes and BMP planning and prescription and between outcomes and physical site conditions.
4. Ratings and their tie to header, implementation, and effectiveness results—description of the implementation, effectiveness, and composite ratings with ties to individual questions on the respective evaluation form.
5. Component and subcomponent scores—in-depth examination of the component and subcomponent (when applicable) scores and the resulting implementation and effectiveness ratings.

Although the fourth and fifth sections involve examination of the overall ratings, they are split into two individual sections for convenience of the reader. Users who are more interested in the final implementation and effectiveness ratings and their association with individual protocol questions can focus on the fourth section, while those interested in more fully understanding the influence of different components and subcomponents on the scoring routines and the final ratings can focus on the fifth section.

6. Management implications—summary of the important findings in the preceding sections and suggestions for how these findings can be used to improve BMP implementation and effectiveness in the types of projects or activities evaluated by the protocol.

The large number of analyses included in this report provide an in-depth examination into the types of queries and information that can be obtained from monitoring protocol data. Some queries will provide more useful information than others to users. In some cases, small sample sizes within answer choices may limit the usefulness of the corresponding results, although this deficiency will diminish as monitoring continues. The Fisher's exact test of association for categorical data was employed for many analyses because the test remains valid when limited sample sizes occur in at least some answer choices. However, corresponding sample sizes are reported in tables and figures to provide the reader another metric for interpreting the results in addition to the statistical probabilities.

# Aquatic Ecosystems A—Active Construction of Aquatic Ecosystem Improvements

## Aquatic Ecosystems A: Header Statistics

Eighty-three active aquatic ecosystem projects (AqEco A) were evaluated (Table 3). Every region completed at least one AqEco A evaluation in each monitoring period except Region 10 (Alaska), and most completed several (Table 3). Sixty-nine projects were selected randomly (Table 3). While the most common reason for using the AqEco A protocol was to meet National BMP targets (selected for all evaluations), the protocol simultaneously met other monitoring needs, most frequently project review (Table 4).

Quality assurance was identified as a reason for monitoring (AqEco A-Q11a) in 19 AqEco A evaluations (Table 4). For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance had duplicate

**Table 4.—**Number of AqEco A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=38 evaluations), by region and reason for monitoring (AqEco A-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 8 | 3 | 4 | 4 | |
| | 2 | 7 | 1 | 6 | 1 | |
| | 3 | 4 | | 2 | 2 | |
| | 4 | 1 | | | | |
| | 5 | 4 | | | 1 | |
| | 6 | 8 | 1 | 3 | | |
| | 8 | 8 | 1 | 6 | | |
| | 9 | 4 | | | | |
| | 10 | 1 | | | | |
| | All | 45 | 6 | 21 | 8 | 0 |
| FY17/18 | | | | | | |
| | 1 | 1 | | | 1 | |
| | 2 | 6 | | 5 | 1 | |
| | 3 | 1 | | 1 | | |
| | 4 | 4 | 1 | 1 | 1 | |
| | 5 | 6 | | 1 | 1 | |
| | 6 | 11 | | 4 | 3 | 1 |
| | 8 | 6 | 1 | 5 | 2 | |
| | 9 | 3 | 1 | 2 | 2 | |
| | 10 | | | | | |
| | All | 38 | 3 | 19 | 11 | 1 |

evaluations, which is necessary to meet the intent of that type of monitoring. The review teams that selected quality assurance may have used this term to mean something different than the protocol instructions stipulate.

At the end of the FY15/16 monitoring period, almost 80 percent of the evaluations had both implementation and effectiveness monitoring completed (Table 5). In FY17/18, two-thirds had completed both. Implementation and effectiveness monitoring were performed on a single day in both periods for all but two FY17/18 evaluations. Only the implementation portion of the evaluation was completed for the remaining 23 evaluations. Instructions for the monitoring protocols state that both types of monitoring are required at each site or project to fulfill the requirements of the National BMP program (i.e., for meeting National BMP targets), and that implementation monitoring needs to be completed prior to effectiveness monitoring, even if both are done the same day. It is possible that at least some of the project evaluations in FY17/18 for which only implementation was completed were performed near the end of the monitoring period (i.e., close to September 30, 2018), and that the effectiveness evaluations for those will be included in the next monitoring

**Table 5.—**Number of AqEco A evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (AqEco A-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 8 | 4 | | 4 |
| | 2 | 7 | 1 | | 6 |
| | 3 | 4 | 1 | | 3 |
| | 4 | 1 | | | 1 |
| | 5 | 4 | 1 | | 3 |
| | 6 | 8 | 2 | | 6 |
| | 8 | 8 | 1 | | 7 |
| | 9 | 4 | | | 4 |
| | 10 | 1 | | | 1 |
| | All | 45 | 10 | 0 | 35 |
| | Percent | | 22 | | 78 |
| FY17/18 | | | | | |
| | 1 | 1 | 1 | | |
| | 2 | 6 | 4 | | 2 |
| | 3 | 1 | | | 1 |
| | 4 | 4 | 2 | | 2 |
| | 5 | 6 | | | 6 |
| | 6 | 11 | 5 | | 6 |
| | 8 | 6 | | | 6 |
| | 9 | 3 | 1 | | 2 |
| | 10 | | | | |
| | All | 38 | 13 | 0 | 25 |
| | Percent | | 34 | | 66 |

period (FY19/20). However, nine of the implementation-only evaluations were done in FY17, and unless the projects in question have very long durations, it is unlikely that they will be evaluated for effectiveness using AqEco A because such monitoring is performed while projects are active.

Most of the projects involved work in both the floodplain and adjacent waterbody (Table 6). Seventeen percent had only in-waterbody work, and four projects involved floodplain work alone. For four other projects, responses to header and effectiveness questions indicated that work was done in neither the floodplain nor the waterbody or a question was not answered, which would make AqEco A an inappropriate protocol for those activities. However, because responses to project objectives (AqEco A-Q25) and activities (AqEco A-Q27) indicated that work was occurring in the floodplain, these projects were included in the data analyses. For AqEco A projects involving only one type of waterbody, most consisted of improvements in and/or along streams or rivers (Table 7).

**Table 6.—**Number of AqEco A evaluations completed in FY15/16 and FY17/18, by region and location of project improvements (AqEco A-Q19 and AqEco A-Q22)

| Monitoring period | Region | In floodplain only | In waterbody only | In both floodplain and waterbody | In neither floodplain nor waterbody[a] |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 1 | | 6 | 1 |
| | 2 | | | 7 | |
| | 3 | | | 4 | |
| | 4 | | | 1 | |
| | 5 | | 1 | 3 | |
| | 6 | | 3 | 5 | |
| | 8 | | 1 | 7 | |
| | 9 | | | 2 | 2 |
| | 10 | | | 1 | |
| | All | 1 | 5 | 36 | 3 |
| | Percent | 2 | 11 | 80 | 7 |
| FY17/18[b] | | | | | |
| | 1 | | | 1 | |
| | 2 | | | 6 | |
| | 3 | 1 | | | |
| | 4 | 1 | 2 | 1 | |
| | 5 | | 2 | 4 | |
| | 6 | | 2 | 8 | |
| | 8 | 1 | 3 | 2 | |
| | 9 | | | 3 | |
| | 10 | | | | |
| | All | 3 | 9 | 25 | 0 |
| | Percent | 8 | 24 | 68 | |

[a] Responses in the Header section indicated improvements were not located in a floodplain (AqEco A-Q19) and not located within a waterbody (AqEco A-Q22).
[b] One evaluation did not answer AqEco A-Q22.

**Table 7.—**Number of AqEco A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=38 evaluations), by region and waterbody type (AqEco A-Q24). Projects may have involved multiple waterbodies.

| Monitoring period | Region | Stream/ river | Pond | Lake | Wetland | Estuary | Other | Multiple types selected |
|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | |
| | 1 | 8 | 1 | | 1 | | | 1 |
| | 2 | 4 | 1 | 3 | 3 | | | 4 |
| | 3 | 4 | | | | | | |
| | 4 | 1 | | | | | 1 | 1 |
| | 5 | 4 | | | 2 | | | 2 |
| | 6 | 8 | | | 3 | | | 3 |
| | 8 | 8 | | | | | | |
| | 9 | 2 | | | 2 | | | 1 |
| | 10 | 1 | | | | | | |
| | All | 40 | 2 | 3 | 11 | 0 | 1 | 12 |
| FY17/18 | | | | | | | | |
| | 1 | 1 | | | | | | |
| | 2 | 6 | | | 1 | | | 1 |
| | 3 | | | | 1 | | | |
| | 4 | 4 | | | 1 | | | 1 |
| | 5 | 5 | | | 3 | | | 2 |
| | 6 | 10 | | | 1 | 1 | 1 | 2 |
| | 8 | 5 | | | 1 | | | |
| | 9 | 2 | 1 | | 1 | | | 1 |
| | 10 | | | | | | | |
| | All | 33 | 1 | 0 | 9 | 1 | 1 | 7 |

Wetland/wet meadow projects or projects involving multiple types of waterbodies were the next most frequently reviewed. In-channel or in-waterbody structural treatments or excavation (or both) were present at 74 percent of the projects at the time of the evaluation in FY15/16 (Table 8), and mechanical streambank or shoreline treatments were occurring at 70 percent of the projects. Types of features present were similar in FY17/18, with excavation present most frequently at almost 90 percent of projects (Table 8). Across all projects, waterbody disturbance length averaged approximately 1,500 feet in FY15/16 and 2,330 feet in FY17/18 for lotic systems, and waterbody disturbance area averaged 5.1 acres (standard error [se] = 1.9 acres) and 0.5 acre (se = 0.3 acre) for lentic systems in FY15/16 and FY17/18, respectively. Floodplain disturbance averaged 4.2 acres (se = 1.7 acres) and approximately 1,700 feet of length parallel to a waterbody in FY15/16 and 5.3 acres (se = 1.7 acres) and 1,400 feet of length parallel to a waterbody in FY17/18. Most of the projects were performed to achieve multiple in-waterbody and riparian-related objectives (Table 9).

A construction contract was the most common mechanism used to accomplish the AqEco A projects and was used for 30 to 45 percent of the projects (Fig. 2). Force accounts (agency personnel and equipment) were used for about 23 percent of the projects in each monitoring period. "Other" methods were most frequently partnership agreements or agreements with other governmental agencies.

**Table 8.—**Number of AqEco A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=38 evaluations), by region and project features or activities present at time of evaluation (AqEco A-Q27). Projects often had multiple features or activities.

| Monitoring period/ region | Temporary access routes | Excavation | Equipment storage | Revegeta-tion | Physical erosion control measures | Channel realignment | Mechanical treatments[a] | Non-mechanical treatments[a] | In-waterbody structural treatments | Other | Multiple features/ activities selected |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | | | |
| 1 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | | 3 | 2 | 6 |
| 2 | 6 | 7 | 6 | 3 | 4 | 6 | 6 | 2 | 6 | | 7 |
| 3 | 3 | 4 | 4 | 1 | 4 | 4 | 4 | 1 | 4 | | 4 |
| 4 | | | | 1 | | | | | 1 | | 1 |
| 5 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 2 | 4 | 1 | 4 |
| 6 | 5 | 7 | 4 | 3 | 3 | 2 | 6 | 3 | 8 | | 8 |
| 8 | 4 | 7 | 6 | 6 | 6 | 3 | 7 | 5 | 6 | | 7 |
| 9 | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | | 2 |
| 10 | 1 | 1 | | | | | 1 | | 1 | | 1 |
| All | 24 | 34 | 27 | 22 | 24 | 21 | 32 | 14 | 34 | 3 | 40 |
| FY17/18 | | | | | | | | | | | |
| 1 | | 1 | 1 | | 1 | | 1 | | | 1 | 1 |
| 2 | 2 | 6 | 3 | 2 | 3 | 3 | 2 | 1 | 4 | 2 | 6 |
| 3 | | 1 | | 1 | 1 | 1 | | | | | 1 |
| 4 | 2 | 4 | 2 | 3 | 3 | 2 | 2 | 1 | 3 | | 4 |
| 5 | 4 | 3 | 4 | 2 | 3 | 2 | 2 | 2 | 3 | | 5 |
| 6 | 9 | 10 | 5 | 3 | 7 | 3 | 6 | 3 | 7 | 2 | 10 |
| 8 | 4 | 6 | 4 | 4 | 5 | 2 | 4 | | 5 | | 6 |
| 9 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 3 |
| 10 | | | | | | | | | | | |
| All | 23 | 33 | 21 | 16 | 25 | 14 | 18 | 9 | 24 | 6 | 36 |

[a] Streambank or shoreline treatments.

**Table 9.—**Number of AqEco A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=38 evaluations), by region and project objectives (AqEco A-Q25). Projects may have involved multiple objectives.

| Monitoring period/ region | Aquatic habitat improvement | Fish passage improvement | Riparian vegetation restoration | Channel improvement | Bank stabilization | Wetland/ wet meadow construction | Other | Multiple objectives selected |
|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | |
| 1 | 5 | 3 | 5 | 2 | 2 | 3 | 3 | 6 |
| 2 | 7 | 1 | 4 | 3 | 4 | 1 | 4 | 7 |
| 3 | 3 | 1 | | | 1 | | | 1 |
| 4 | 1 | 1 | | 1 | 1 | | 1 | 1 |
| 5 | 3 | 1 | | 3 | 2 | | 1 | 4 |
| 6 | 7 | | 4 | 6 | 5 | 2 | 2 | 7 |
| 8 | 7 | 4 | 7 | 6 | 8 | | | 8 |
| 9 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 2 |
| 10 | 1 | | | | 1 | | | 1 |
| All | 37 | 12 | 21 | 22 | 25 | 8 | 12 | 37 |
| FY17/18 | | | | | | | | |
| 1 | 1 | 1 | | | | | | 1 |
| 2 | 5 | 4 | 2 | 2 | 1 | 1 | 1 | 6 |
| 3 | | | 1 | | | 1 | 1 | 1 |
| 4 | 3 | 1 | 3 | 3 | 3 | | 1 | 3 |
| 5 | 3 | 2 | 1 | 2 | 2 | 1 | | 3 |
| 6 | 10 | 2 | 5 | 5 | 2 | 2 | 4 | 8 |
| 8 | 6 | 4 | 3 | 3 | 2 | 2 | | 5 |
| 9 | 2 | 2 | 1 | 1 | 1 | 1 | | 3 |
| 10 | | | | | | | | |
| All | 30 | 16 | 16 | 16 | 11 | 8 | 7 | 30 |

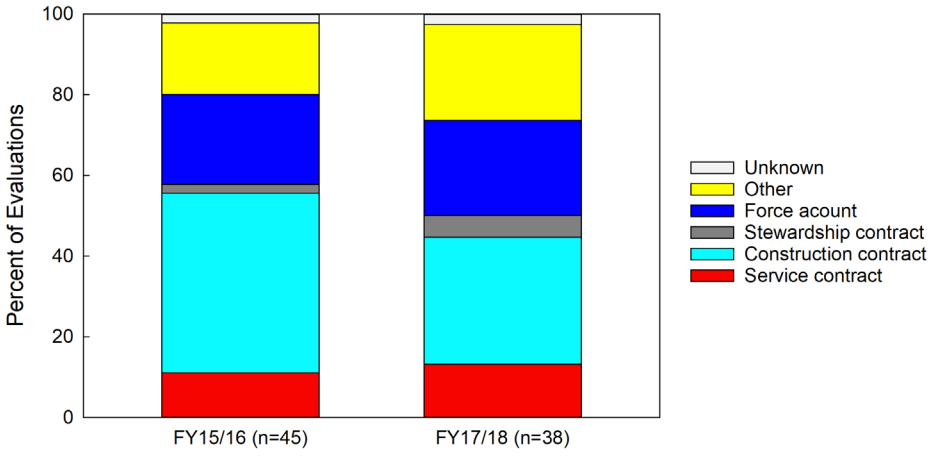



**Figure 2.—**Distribution of methods used to accomplish aquatic improvements (AqEco A-Q26) for evaluations completed in FY15/16 and FY17/18.

## Aquatic Ecosystems A: Implementation Results and Their Tie to Header Information

Project planning is assessed in the protocol using two questions:

- What type of planning document specified BMPs for the project (AqEco A-Q28)?
- Were all BMPs from that document included in the project contract or plan (AqEco A-Q29)?

The types of primary planning documents identified are summarized in Table 10. Categorical exclusions (CEs) outnumbered other types of planning documents used for active aquatic ecosystem improvements (Table 10), indicating those projects were not expected to have significant environmental effects. Six projects were completed without National Environmental Policy Act (NEPA) analysis, but they did employ BMPs derived from other sources.

**Table 10.—**Number of AqEco A evaluations completed in FY15/16 and FY17/18, by region and type of primary planning document used (AqEco A-Q28)

| Monitoring period | Region | No planning document | EIS[a] | EA[b] | CE[c] | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | | | 3 | 3 | 2 |
| | 2 | | | 4 | 3 | |
| | 3 | | | 2 | 2 | |
| | 4 | | | | 1 | |
| | 5 | | | 1 | 3 | |
| | 6 | | 1 | 2 | 5 | |
| | 8 | | | 4 | 4 | |
| | 9 | 1 | | | 3 | |
| | 10 | | | | 1 | |
| | All | 1 | 1 | 16 | 25 | 2 |
| | Percent | 2 | 2 | 36 | 56 | 4 |
| FY17/18 | | | | | | |
| | 1 | | | 1 | | |
| | 2 | | | 1 | 4 | 1 |
| | 3 | | | 1 | | |
| | 4 | | | 1 | 3 | |
| | 5 | | | 2 | 3 | 1 |
| | 6 | | 2 | 5 | 3 | 1 |
| | 8 | | | 2 | 3 | 1 |
| | 9 | 1 | | | 2 | |
| | 10 | | | | | |
| | All | 1 | 2 | 13 | 18 | 4 |
| | Percent | 3 | 5 | 34 | 47 | 11 |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.

No significant relationship existed for the type of planning document used and the location of the project (p = 0.96 FY15/16, p = 0.32 FY17/18) (Fig. 3). For projects with both floodplain and in-waterbody work, 50 percent used a CE and 39 percent used an environmental assessment (EA) in FY15/16, closely following the pattern for all projects combined. Type of planning document used was not significantly related to the method used to accomplish the improvement project (p = 0.20 FY15/16, p = 0.68 FY17/18) (Table 11).

Table 12 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the planning documents or other BMP guidance documents are assigned, along with the information about whether all the BMPs in each provision were then carried into the project contract or plan. A "yes" indicates that there was at least one BMP in the planning or guidance documents applicable to the provision and that all BMPs assigned to that provision were included in the written project contract or plan. Conversely, a "no" indicates that at least one BMP applicable to the provision in the planning or guidance documents was not carried forward into the project contract or plan. "Not applicable" indicates that there were no BMPs in the planning or guidance documents applicable to the provision, so there was no obligation to carry them into the contract or plan. "No" and "not applicable" responses also may indicate that a written contract or plan was not developed (e.g., where projects were developed using force accounts or other means). In the National BMP program, there is no expectation that

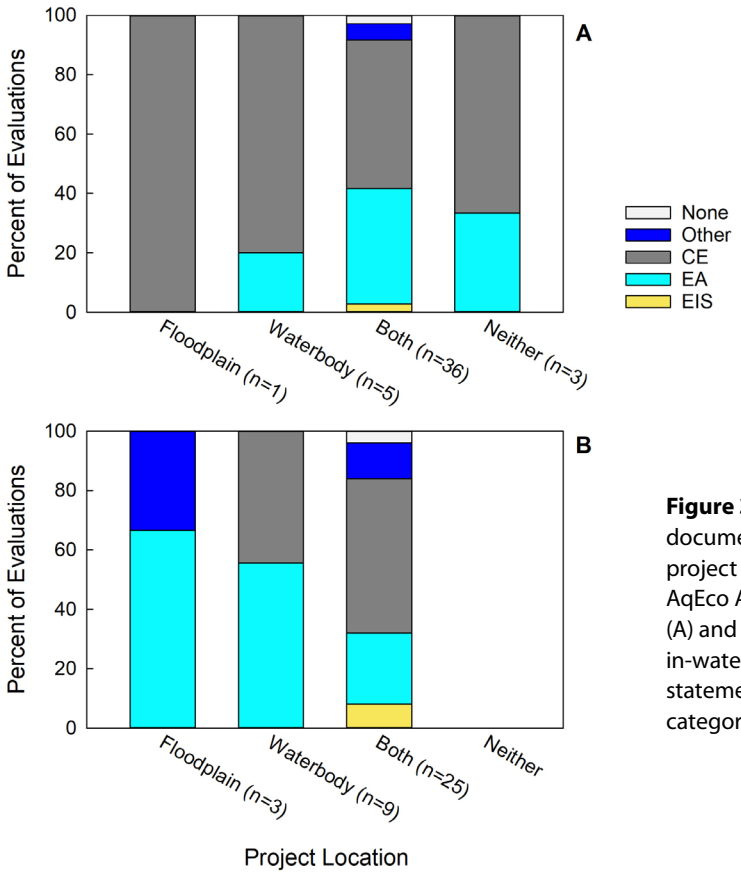



**Figure 3.—**Distribution of primary planning document type (AqEco A-Q28) by location where project activities were conducted (AqEco A-Q19 and AqEco A-Q22) for projects completed in FY15/16 (A) and FY17/18 (B). "Both" includes floodplain and in-waterbody work. EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

**Table 11.—**Number of AqEco A evaluations completed in FY15/16 and FY17/18, by method used to accomplish the project (AqEco A-Q26) and type of primary planning document used (AqEco A-Q28)

| Monitoring period | Method | No planning document | EIS[a] | EA[b] | CE[c] | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | Service contract | | | | 5 | |
| | Construction contract | | | 9 | 10 | 1 |
| | Stewardship contract | | | 1 | | |
| | Force account | 1 | 1 | 2 | 6 | |
| | Other | | | 4 | 3 | 1 |
| | All | 1 | 1 | 16 | 24 | 2 |
| | Percent | 2 | 2 | 36 | 55 | 5 |
| FY17/18 | | | | | | |
| | Service contract | | | 3 | 2 | |
| | Construction contract | | 1 | 3 | 7 | 1 |
| | Stewardship contract | | | 2 | | |
| | Force account | | 1 | 3 | 5 | |
| | Other | 1 | | 2 | 4 | 2 |
| | All | 1 | 2 | 13 | 18 | 3 |
| | Percent | 3 | 5 | 35 | 49 | 8 |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.

every provision has BMPs assigned; consequently, the percentages for "yes" and "no" in the last two columns of each monitoring period of Table 12 are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

When a provision had at least one BMP prescription identified in the planning documents, all of those BMP prescriptions were included in the corresponding plan or contract in an average of 89 and 86 percent of evaluations, with BMP prescriptions in that provision in FY15/16 and FY17/18, respectively (Table 12). "Fencing" in both periods and "temporary vegetative erosion control requirements" in FY17/18 were the only provisions for which that value was below 80 percent. On average, specific BMPs were included in eight provisions per project in each monitoring period, and no significant differences were found ($p = 0.51$ FY15/16, $p = 0.56$ FY17/18; generalized linear mixed model [GLMM] with negative binomial distribution and log link function) between the number of BMP provisions from planning included in the contract or plan and the source of BMPs (i.e., type of NEPA document and guidance documents in the absence of NEPA analysis; the project with no BMPs ["none" in Table 10] was excluded from this statistical analysis). When the percentage of BMP provisions included in the contract or plan was compared by type of planning

**Table 12.—**Frequencies at which BMPs in provisions were included in the project contract or plan (AqEco A-Q29) for AqEco A evaluations completed in FY15/16 (n=44 evaluations) and FY17/18 (n=37 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision[a] to which prescribed BMP is applicable | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[b] (number) | FY15/16 Yes (percent[c]) | FY15/16 No (percent[c]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Timing and scheduling of improvements | 37 | 3 | 4 | 93 | 8 | 36 | 1 | 0 | 97 | 3 |
| Location of access routes for vehicle travel | 30 | 2 | 10 | 94 | 6 | 28 | 3 | 6 | 90 | 10 |
| Construction techniques and treatments for access routes | 26 | 1 | 16 | 96 | 4 | 24 | 3 | 10 | 89 | 11 |
| Placement and storage of excavated materials | 28 | 3 | 11 | 90 | 10 | 27 | 4 | 6 | 87 | 13 |
| Construction methods to reduce disturbance, erosion, or sedimentation | 41 | 2 | 1 | 95 | 5 | 34 | 2 | 1 | 94 | 6 |
| Location and/or limiting the extent of floodplain disturbances | 31 | 5 | 7 | 86 | 14 | 26 | 2 | 9 | 93 | 7 |
| Location and/or limiting the extent of waterbody disturbances | 35 | 5 | 4 | 88 | 13 | 28 | 3 | 6 | 90 | 10 |
| Waterbody stabilization techniques | 30 | 1 | 11 | 97 | 3 | 21 | 3 | 13 | 88 | 13 |
| Dewatering requirements | 20 | 4 | 19 | 83 | 17 | 18 | 2 | 17 | 90 | 10 |
| Temporary vegetative erosion control requirements | 25 | 6 | 12 | 81 | 19 | 17 | 6 | 14 | 74 | 26 |
| Permanent vegetation/cover requirements | 29 | 4 | 10 | 88 | 12 | 21 | 3 | 13 | 88 | 13 |
| Nonvegetative erosion control requirements (permanent or temporary) | 28 | 3 | 10 | 90 | 10 | 25 | 3 | 9 | 89 | 11 |
| Fencing | 9 | 3 | 29 | 75 | 25 | 5 | 5 | 25 | 50 | 50 |
| Mean | 28 | 3 | 11 | 89 | 11 | 24 | 3 | 10 | 86 | 14 |

[a] Listed provision had at least one BMP from decision document or guidance document included in project contract or plan.

[b] Not applicable (NA) because no prescribed BMPs were associated with the provision.

[c] Percent was calculated from "yes" and "no" counts.

document, percentages averaged about 90 percent in both monitoring periods. In FY15/16 the percentages of BMPs included ranged from 77 percent for projects using other BMP guidance documents to 100 percent for the project using an environmental impact statement (EIS). In FY17/18 projects using an EIS had the lowest percentage of provisions included at 70 percent, while projects using all other types of NEPA or BMP guidance documents averaged 90 percent inclusion. No significant differences were found in percentage of BMP provisions included by type of planning document ($p = 0.13$ FY15/16, $p = 0.10$ FY17/18; Kruskal-Wallis test).

It is possible that additional BMPs applicable to the project were not in the planning documents but were in a project contract or plan itself; such BMPs may be associated with standard contract language for the specific type of project or resource. Additional BMPs applicable to eight provisions in FY15/16 and five provisions in FY17/18 were identified in the contracts or plans across all AqEco A projects (Table 13). These BMPs were most frequently related to access routes and excavated materials.

Most of the BMPs applicable to the AqEco A projects were implemented fully (Table 14). Applicable in this context includes only those BMPs that were included in the project contract or plan and those for which implementation was expected to occur. Those that were identified during planning but were not included in the contract or plan or those that have not been implemented yet (i.e., too early in the project for implementation) are

**Table 13.—**Frequencies at which BMPs to protect water, aquatic, and riparian resources were derived from project contract or plan language and not from BMPs in NEPA documents or other BMP guidance documents for AqEco A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=38 evaluations)

| Provision | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Timing and scheduling of improvements | 1 | 2 | | |
| Location of access routes for vehicle travel | 2 | 4 | | |
| Construction techniques and treatments for access routes | 2 | 4 | 5 | 13 |
| Placement and storage of excavated materials | 2 | 4 | 6 | 16 |
| Construction methods to reduce disturbance, erosion, or sedimentation | | | | |
| Location and/or limiting the extent of floodplain disturbances | 1 | 2 | 2 | 5 |
| Location and/or limiting the extent of waterbody disturbances | 2 | 4 | | |
| Waterbody stabilization techniques | | | | |
| Dewatering requirements | 3 | 7 | | |
| Temporary vegetative erosion control requirements | | | | |
| Permanent vegetation/cover requirements | | | 3 | 8 |
| Nonvegetative erosion control requirements (permanent or temporary) | | | | |
| Fencing | 1 | 2 | 1 | 3 |

**Table 14.—**Frequencies at which all BMPs in provisions included in the project contract or plan were implemented fully (AqEco A-Q30) for AqEco A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=38 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a]/too early to implement (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA/too early to implement (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Timing and scheduling of improvements | 35 | 3 | 6 | 92 | 8 | 28 | 0 | 9 | 100 | 0 |
| Location of access routes for vehicle travel | 32 | 0 | 12 | 100 | 0 | 23 | 1 | 13 | 96 | 4 |
| Construction techniques and treatments for access routes | 28 | 0 | 16 | 100 | 0 | 28 | 1 | 8 | 97 | 3 |
| Placement and storage of excavated materials | 28 | 2 | 14 | 93 | 7 | 32 | 1 | 4 | 97 | 3 |
| Construction methods to reduce disturbance, erosion, or sedimentation | 39 | 2 | 4 | 95 | 5 | 25 | 0 | 12 | 100 | 0 |
| Location and/or limiting the extent of floodplain disturbances | 32 | 0 | 12 | 100 | 0 | 28 | 0 | 9 | 100 | 0 |
| Location and/or limiting the extent of waterbody disturbances | 36 | 1 | 8 | 97 | 3 | 21 | 0 | 16 | 100 | 0 |
| Waterbody stabilization techniques | 29 | 1 | 13 | 97 | 3 | 16 | 1 | 20 | 94 | 6 |
| Dewatering requirements | 22 | 1 | 21 | 96 | 4 | 17 | 0 | 20 | 100 | 0 |
| Temporary vegetative erosion control requirements | 19 | 0 | 25 | 100 | 0 | 16 | 1 | 20 | 94 | 6 |
| Permanent vegetation/cover requirements | 25 | 0 | 19 | 100 | 0 | 22 | 2 | 13 | 92 | 8 |
| Nonvegetative erosion control requirements (permanent or temporary) | 24 | 3 | 16 | 89 | 11 | 5 | 1 | 29 | 83 | 17 |
| Fencing | 7 | 3 | 33 | 70 | 30 | 2 | 4 | 22 | 33 | 67 |
| Mean | 27 | 1 | 15 | 95 | 5 | 20 | 1 | 15 | 91 | 9 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.

[b] Percent calculated from "yes" and "no" counts.

not considered applicable (thus values in Tables 12 and 14 differ). As with Table 12, the percentages in Table 14 were calculated only from the "yes" and "no" counts. "Fencing" and "nonvegetative erosion control requirements" in both monitoring periods were the only provisions for which the rates of full implementation were below 92 percent of projects. The average number of provisions that were implemented fully did differ significantly among methods used to accomplish the project in FY15/16 ($p = 0.05$, GLMM with negative binomial distribution and log link function) but not in FY17/18 ($p = 0.77$). Least squares means probability of significant difference comparisons among methods indicated that projects in FY15/16 accomplished with force accounts had significantly fewer provisions implemented fully (mean = 6) than projects using construction contracts or "other" methods (mean = 9) and a stewardship contract (13; n=1). However, no significant differences were found in percentage of BMP provisions implemented fully by method used to accomplish the project in either monitoring period ($p = 0.92$ FY15/16, $p = 0.81$ FY17/18; Kruskal-Wallis test). Projects using force accounts had 82 to 86 percent of BMP provisions implemented fully, while those accomplished by contracts or other methods had 86 to 100 percent of provisions implemented fully on average.

The average number of provisions that were implemented fully did not differ significantly among types of planning documents ($p = 0.11$ FY15/16, $p = 0.72$ FY17/18; GLMM with negative binomial distribution and log link function), although the FY15/16 result was nearly significant at $\alpha = 0.10$. Mean numbers of provisions implemented fully ranged from 7 to 12 and averaged 8 per project. Additionally, no significant differences were found in percentage of BMP provisions implemented fully by type of planning document ($p = 0.18$ FY15/16, $p = 0.16$ FY17/18; Kruskal-Wallis test). Two projects using other guidance documents had 100 percent of BMP provisions in the contract or plan implemented fully, as did all projects using an EIS. Projects with EAs and CEs had 86 to 98 percent of provisions implemented fully, respectively.

Two implementation questions—AqEco A-Q31 and AqEco A-Q32—evaluate whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times when resources were most susceptible to negative effects from the project (Table 15) and whether corrective actions were taken if problems occurred during project implementation (at any time, not just critical times) (Table 16). Critical times include times that work is conducted in the waterbody, periods associated with large or

**Table 15.—**Distribution of whether project inspections or contract administration occurred at critical times (AqEco A-Q31) for AqEco A implementation evaluations completed in FY15/16 and FY17/18

| Project inspections or contract administration occurred at critical times | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No inspections | 2 | 4 | 0 | |
| Not applicable; work avoided critical times | 5 | 11 | 7 | 20 |
| Yes | 38 | 84 | 28 | 80 |
| No | 0 | | 0 | |
| All | 45 | | 35 | |

intense precipitation/runoff events, or other times or locations where the potential for the circumstances to result in water quality impacts is high. Responses indicate that 80 to 84 percent of projects were inspected during critical times (Table 15), and that a total of 97 to 98 percent of projects either had no problems requiring corrective actions or that corrective actions were implemented when needed (Table 16).

Because ground-disturbing activities in aquatic ecosystem projects often involve the use of heavy equipment that may have occasional malfunctions or breakages such as hydraulic line breaks or oil leaks, an implementation question (AqEco A-Q33) considers how chemical spills and leaks were handled. Administrative units in the Forest Service have a contingency and emergency response plan (CERP) or equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in such cases the unit would follow that state agency's procedures. One administrative unit in FY15/16 indicated that it did not have a CERP (Table 17). Ideally, this deficiency would be identified as an implementation adaptive management need (AqEco A-Q37) because the CERP applies broadly to the administrative unit. Of the remaining evaluations, the three in each monitoring period with reported spills or leaks indicated that they were addressed following the CERP procedures (Table 17).

**Table 16.—**Distribution of whether corrective actions (CA) were taken if problems occurred during operations (AqEco A-Q32) for AqEco A implementation evaluations completed in FY15/16 and FY17/18

| Corrective actions during implementation evaluations | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No problems; no CA needed | 28 | 62 | 28 | 78 |
| CA needed but not taken | 1 | 2 | | |
| CA needed and implemented | 16 | 36 | 7 | 19 |
| Unknown | 0 | | 1 | 3 |
| All | 45 | | 36 | |

**Table 17.—**Distribution of whether chemical or fuel spills and leaks, if they occurred during project implementation, were handled according to the unit's contingency and emergency response plan (or its equivalent) (AqEco A-Q33) for AqEco A evaluations completed in FY15/16 and FY17/18

| Chemical or fuel spills and leaks handled according to the unit's contingency and emergency response plan | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No contingency and emergency response plan | 1 | 2 | | |
| No spills or leaks | 41 | 91 | 33 | 92 |
| Yes; according to contingency and emergency response plan | 3 | 7 | 3 | 8 |
| No; not according to contingency and emergency response plan | 0 | | | |
| All | 45 | | 36 | |

## Aquatic Ecosystems A: Effectiveness Results and Their Tie to Implementation Results and Header Information

When in-waterbody work is part of an AqEco A project, four questions about flow control (AqEco A-Q39, AqEco A-Q40, and AqEco A-Q41) and evidence of erosion or sedimentation (AqEco A-Q42) evaluate effectiveness of the implemented BMPs. Additional questions identify sources and causes when evidence of erosion or sedimentation is observed. About half of the AqEco A projects in each monitoring period had some type of dewatering requirement in the contract or plan applicable at the time of the evaluation (Table 14). Overall, when water control of some type was implemented (AqEco A-Q39) (e.g., pumping, timing the project for no-flow conditions, diversion, and so on), water control generally was achieved (Table 18). Twelve percent of the projects in FY15/16 and 5 percent in FY17/18 reported water control described as marginal, and no projects reported poor water control.

Those results align well with the number of projects that reported full implementation for dewatering requirements (Table 14). However, pairing evaluation responses from implementation AqEco A-Q30 (i.e., from Table 14) with those of effectiveness AqEco A-Q39 (Table 18) provides some interesting insights. Table 19 indicates that dewatering was performed for 21 percent of the projects in FY15/16 and 39 percent in FY17/18, even when it was not required in the project plan or contract ("NA" column). Two of the paired implementation and effectiveness evaluations were completed on different days, so the reason for the "not applicable" answers in Table 19 could be due to the implementation evaluation being completed before the water control was needed. One evaluation in each monitoring period answered "yes" for full implementation of the dewatering requirements (AqEco A-Q30) and "control not required" (AqEco A-Q39), which may indicate that the project contract or plan specifically stated that dewatering was not required.

Both water control and lack of water control can influence water quality. Consequently, AqEco A-Q40 and AqEco A-Q41, respectively, investigate whether water control, lack of control, or poorly functioning control affected attainment of turbidity water quality standards or sediment-related water quality standards. More than 65 percent of the

**Table 18.—**Degree of water control observed during effectiveness monitoring for projects that had in-waterbody disturbances (AqEco A-Q39) for AqEco A evaluations completed in FY15/16 and FY17/18

| Water control for projects with in-waterbody disturbances | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Evaluation before control needed | | | | |
| No flow present | 1 | 3 | 5 | 23 |
| Completely controlled | 6 | 18 | 5 | 23 |
| Largely controlled | 11 | 33 | 6 | 27 |
| Marginally controlled | 4 | 12 | 1 | 5 |
| Poorly controlled | | | | |
| Control not required | 11 | 33 | 5 | 23 |

**Table 19.—**Distribution of degree of water control (AqEco A-Q39) by whether implementation provision "dewatering requirements" was implemented fully (AqEco A-Q30i) for AqEco A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Water control and dewatering requirements provision implemented fully | Yes (percent[a]) | No (percent) | NA[b] (percent) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | Evaluation before control needed | | | |
| | No flow present | 3 | | |
| | Completely controlled | 13 | | 6 |
| | Largely controlled | 25 | | 9 |
| | Marginally controlled | 3 | 3 | 6 |
| | Poorly controlled | | | |
| | Control not required | 3 | | 28 |
| FY17/18 | | | | |
| | Evaluation before control needed | | | |
| | No flow present | | | 19 |
| | Completely controlled | 19 | | 5 |
| | Largely controlled | 14 | 5 | 10 |
| | Marginally controlled | | | 5 |
| | Poorly controlled | | | |
| | Control not required | 5 | | 19 |

[a] Within each monitoring period.

[b] Not applicable (NA) because the provision was not in contract or plan or it was too early in project for implementation.

evaluations indicated that neither standard was violated (Table 20), while no turbidity or sediment water quality standard was applicable for 6 to 19 percent of the evaluations.

For most projects involving in-waterbody work, some amount of bank and bed erosion, sedimentation, or changes to waterbody morphology may be expected and even acceptable relative to the beneficial outcomes expected from the completed project. In some situations, changes to waterbody morphology (e.g., altering sinuosity or sloping back the banks) are even desired project objectives. Consequently, project planning often involves some description or discussion of acceptable or expected levels of change.

Of the 33 projects in FY15/16 involving in-waterbody work, nearly half showed no evidence of erosion, sedimentation, or unplanned waterbody morphology changes, and an equal number found that the expected amounts or changes were within those described in planning documents (from AqEco A-Q42; Table 21). Roughly 60 percent of the 21 projects in FY17/18 showed no evidence. Impacts may have not been considered during planning for one project in each monitoring period due to the relatively short length of waterbody involved (Fig. 4). No significant associations were found between the evidence observed relative to that described in planning (Table 21) and the type of planning document (Table 10) used for each project in either monitoring period ($p = 0.67$ FY15/16, $p = 0.12$ FY17/18; includes evaluations completed without planning or BMP guidance documents, "none" in Table 10).

**Table 20.—**Frequency of water quality violations for turbidity and sediment (AqEco A-Q40 and AqEco A-Q41, respectively) attributable to flow diversion, lack of flow diversion, or poorly functioning diversion for AqEco A effectiveness evaluations completed in FY15/16 and FY17/18

| Water quality violations for turbidity and sediment | Violation | FY15/16 (number) | FY15/16 (percent[a]) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|---|
| Turbidity | Not applicable; no standard | 5 | 16 | 1 | 6 |
| | Yes; violation occurred | 1 | 3 | 1 | 6 |
| | No; no violation | 21 | 66 | 13 | 81 |
| | Unknown[b] | 5 | 16 | 1 | 6 |
| | All | 32 | | 16 | |
| Sediment | Not applicable; no standard | 6 | 19 | 1 | 6 |
| | Yes; violation occurred | 1 | 3 | | |
| | No; no violation | 21 | 66 | 13 | 81 |
| | Unknown | 4 | 13 | 2 | 13 |
| | All | 32 | | 16 | |

[a] Within each metric.

[b] Defined as unmeasured, or attainment or violation of the standard could not be determined from the sampling strategy or intensity employed for the project.

**Table 21.—**Presence of bank or shoreline erosion, or changes to waterbody morphology or substrate characteristics relative to that described in planning (AqEco A-Q42) for AqEco A evaluations completed in FY15/16 and FY17/18

| Evidence observed in projects with waterbody disturbance | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No evidence | 15 | 45 | 12 | 57 |
| Evidence present and does not exceed amount described in planning | 15 | 45 | 7 | 33 |
| Evidence present but exceeds amount described in planning | 2 | 6 | 1 | 5 |
| Evidence present but expected amount not described in planning | 1 | 3 | 1 | 5 |

While there were no statistically significant differences in length of disturbance ($p = 0.18$, GLMM with lognormal distribution and identity link function) among the categories of evidence observed in FY15/16, a cursory review of Figure 4 suggests a greater tendency for erosion, sedimentation, or morphology changes to occur and exceed planned or expected values as the length of waterbody disturbance increases. However, the small sample size (n=2) associated with the category of the expected amount exceeding what was planned (i.e., "expected exceeded") means additional data are needed to provide a more robust analysis of this possibility. In FY17/18 a meaningful statistical comparison was not possible due to the two categories with sample sizes of one.

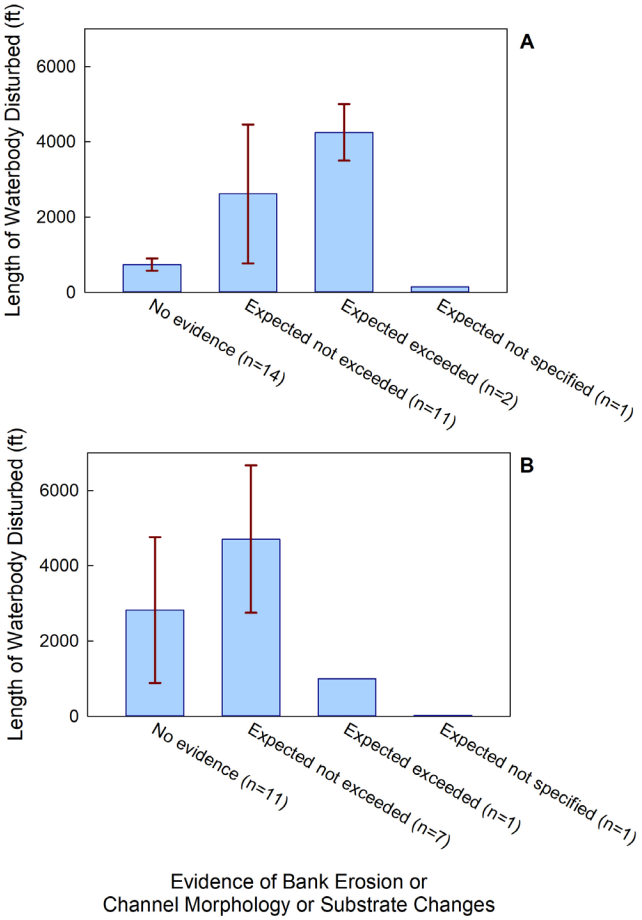



**Figure 4.—**Mean length of waterbody disturbed (with standard error bars) during the project (AqEco A-Q23) associated with each category of disturbance anticipated during planning (AqEco A-Q42; disturbance includes bank erosion, channel morphology changes, or substrate changes) for evaluations completed in FY15/16 (A) and FY17/18 (B).

There were no significant associations between the amount of flow control provided for in-waterbody activities and the presence of expected bank erosion, channel morphology changes, or substrate changes in either monitoring period ($p = 0.23$ FY15/16, $p = 0.47$ FY17/18) (Fig. 5). The combination of "no evidence" and "expected not exceeded" occurred for at least 75 percent of projects for every category of flow control. With complete water control, impacts that exceeded expected levels did occur for one project in FY15/16 (Fig. 5A).

For evaluations that involve floodplain activities, the delivery of sediment to the waterbody is often the greatest concern for water quality. Location of evidence, severity of evidence, and sources and causes of observed evidence are identified in AqEco A-Q44 through AqEco A-Q47, respectively. For these questions, the review team evaluates specific portions of the floodplain area as well as the area immediately adjacent to the associated waterbody. When both evidence of erosion/sediment movement in the floodplain and evidence of sediment delivery to the waterbody exist, only the evidence delivered to the waterbody is reported because that condition directly influences water quality in the waterbody (versus a potential effect from evidence confined within the floodplain).

No evidence of uncontrolled erosion or sedimentation was observed for 86 to 88 percent of the AqEco A projects that had floodplain disturbances as part of the activities

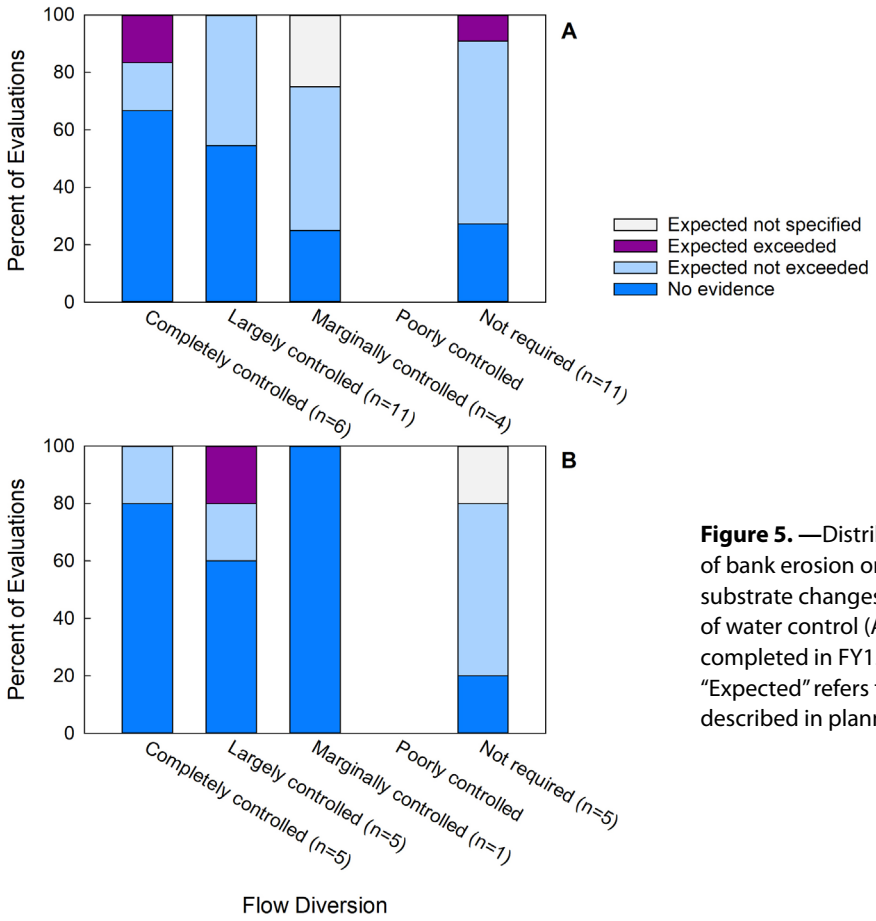



**Figure 5. —**Distribution of categories of evidence of bank erosion or channel morphology or substrate changes (AqEco A-Q42) across levels of water control (AqEco A-Q39) for evaluations completed in FY15/16 (A) and FY17/18 (B). "Expected" refers to amounts or changes described in planning documents.

(Table 22). Many different types of evidence were observed for two projects in FY15/16 where sediment reached the waterbody (Table 23), and for one project in FY17/18 where uncontrolled sediment was confined to the floodplain (Table 23). However, three types of evidence were incompatible with the location where it was observed in FY17/18; for example, evidence of changes to waterbody geometry would not be expected when the evidence was observed within the floodplain. The sources and causes associated with each of the instances of uncontrolled evidence are listed in Table 24. Five of the six evaluations indicated that excavation, storage of excavated materials, or both were sources of uncontrolled erosion or sedimentation. Two of those evaluations reported that all the BMP prescriptions relevant to excavated materials were implemented fully, indicating that the BMP prescriptions may have been inadequate or inappropriate for the conditions present during the project.

Weather conditions associated with the evaluation (AqEco A-Q16) assist in determining if evidence of damage to bank, substrate, or morphology changes for in-water actions, or uncontrolled erosion and sediment transport during floodplain work are masked during dry weather conditions. Wet weather conditions, if found to be important for observing effects, are expected to be most associated with evidence of erosion and sediment transport outside a waterbody because erosion and transport are primarily due to precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. In FY15/16 and FY17/18,

**Table 22.—**Evidence of uncontrolled erosion or sedimentation from floodplain disturbance observed during effectiveness monitoring (AqEco A-Q44) for AqEco A evaluations completed in FY15/16 and FY17/18. If evidence is observed both within the floodplain and in the waterbody, only evidence in the waterbody is reported.

| Evidence observed in evaluations with floodplain disturbance | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No evidence | 24 | 86 | 14 | 88 |
| Within floodplain | 2 | 7 | 1 | 6 |
| In waterbody | 2 | 7 | 1 | 6 |

**Table 23.—**Types of evidence observed when uncontrolled erosion or sedimentation from floodplain disturbance was found in floodplain or waterbody (AqEco A-Q45) for AqEco A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in AqEco A-Q44 (Table 22) is applicable to AqEco A-Q45.

| Type of evidence | FY15/16 Within floodplain (n=2) | FY15/16 In waterbody (n=2) | FY17/18 Within floodplain (n=1) | FY17/18 In waterbody (n=1) |
|---|---|---|---|---|
| Traceable evidence to the waterbody, but not currently visible in the waterbody | | 2 | 1[a] | |
| Turbidity present | | 1 | | |
| Evidence of localized sediment deposition in the waterbody | | 2 | 1[a] | 1 |
| Changes to substrate composition | | 2 | | |
| Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) | | | 1[a] | |
| Bank instability | | 1 | 1 | |
| Bank trampling or compaction | | | | |
| Vegetation damage or bare ground | 1 | 1 | | |
| Sheet erosion | | 2 | | |
| Rill erosion | 1 | 1 | 1 | |
| Gully erosion | | 1 | 1 | |
| Headcutting | | | 1 | |
| Slumping/slips | | | 1 | |
| Mass wasting | | | | |
| Sediment plumes or accumulations | | 1 | | |
| Rutting | | 1 | | |
| Water quality monitoring results | | | | 1 |

[a] The type of evidence reported is incompatible with the location in which it was observed.

**Table 24.—**Sources (AqEco A-Q46) and causes (AqEco A-Q47) of uncontrolled erosion or sedimentation from floodplain disturbance for AqEco A evaluations completed in FY15/16 and FY17/18

| Monitoring period/ evidence observed | Types of evidence observed[a] (number) | Sources of evidence | Causes of evidence |
|---|---|---|---|
| FY15/16 | | | |
| Within floodplain (n=2) | 1 | Reshaping/excavation | Lack of, or insufficient soil cover |
| | 1 | None selected | Other: floodplain scour from rain event |
| In waterbody (n=2) | 8 | Reshaping/excavation<br>Stockpiles or storage areas of excavated materials | Poorly located stockpiles of excavated materials<br>Operations extending outside of designated project boundaries |
| | 7 | Temporary access routes<br>Reshaping/excavation<br>Stockpiles or storage areas of excavated materials | Lack of, or insufficient water control on access routes<br>Improperly designed erosion control treatments<br>Operating outside of allowable soil conditions |
| FY17/18 | | | |
| Within floodplain (n=1) | 8 | Reshaping/excavation | Other: runoff from record winter snowpack |
| In waterbody (n=1) | 2 | Temporary access routes<br>Reshaping/excavation<br>Stockpiles or storage areas of excavated materials | Other: thunderstorm |

[a] From AqEco A-Q45 or Table 23.

14 and 6 AqEco A effectiveness evaluations occurred during or just after wet weather conditions, respectively, while 13 and 10 evaluations occurred during dry conditions in FY15/16 and FY17/18, respectively.

No statistically significant associations were found between weather conditions (i.e., wet versus dry conditions) and categories of erosion for in-waterbody (AqEco A-Q42) or floodplain projects (AqEco A-Q44) in FY15/16 ($p = 0.36$ in-waterbody work, $p = 0.73$ floodplain work) or FY17/18 ($p = 0.81$ in-waterbody work, $p = 0.62$ floodplain work) (Fig. 6). For projects involving in-waterbody work, bank erosion, substrate changes, or morphology changes exceeded those anticipated during planning only for evaluations completed during dry periods (Fig. 6 left panels); however, because there were only three evaluations for which the amount of change exceeded that anticipated or described during planning (Table 21), the result is not particularly informative. Furthermore, waterbody morphology changes typically result from multiple events, and the presence or absence of an individual precipitation/runoff event at or near the time of project review would likely not have much bearing on whether morphological changes were observed (unless it was an extreme event).

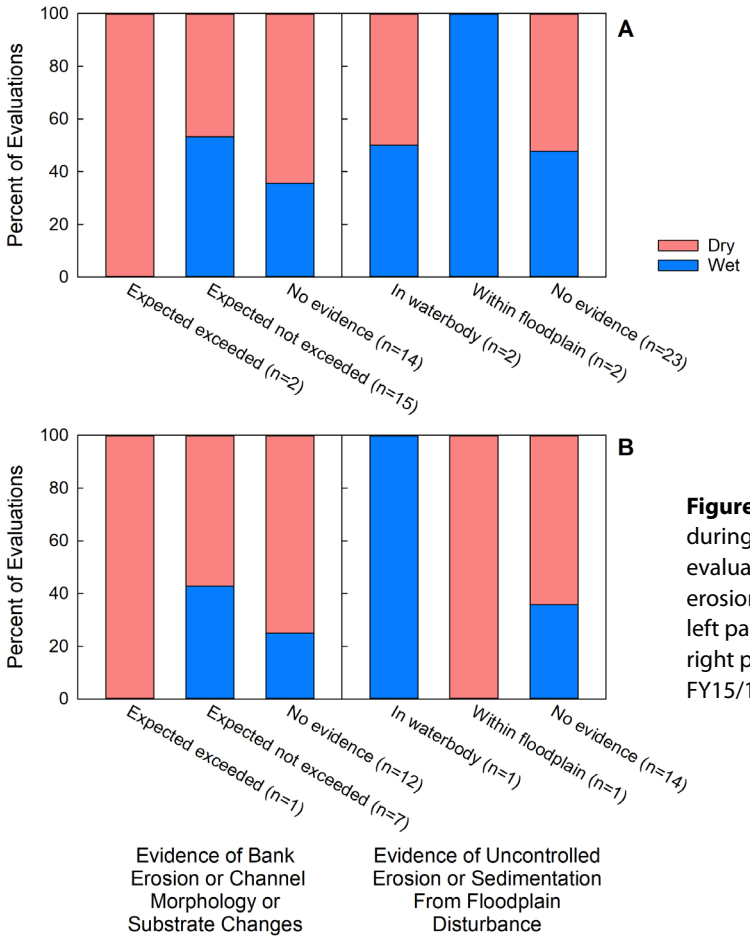



**Figure 6.—** Type of weather conditions during or within 24 hours before effectiveness evaluation (AqEco A-Q16) versus evidence of erosion from in-waterbody work (AqEco A-Q42; left panels) or floodplain work (AqEco A-Q44; right panels) for evaluations completed in FY15/16 (A) and FY17/18 (B).

For projects involving floodplain work, the number of evaluations with observed evidence of uncontrolled erosion or sedimentation was small (Fig. 6 right panels), but four of the six were conducted during or within 24 hours of some type of precipitation event. This finding suggests that uncontrolled erosion or sedimentation during floodplain activities may be easier to distinguish from soil movement by work disturbance if precipitation was recently present to demonstratively show flow paths and similar features. But the small sample size means that far more data are necessary to confirm this suggestion.

In addition to erosion and sedimentation, chemical pollution from equipment use during floodplain and in-waterbody work provides another potential cause of water quality degradation. Such evidence can include pollutants observed during operations but not reported, pollutants not yet cleaned up even if reported, or pollutants not previously observed or known to exist. The results indicate that considerable care was taken to prevent chemical contamination during AqEco A projects. One of the 35 evaluations in FY15/16 and 1 of 25 in FY17/18 reported the presence of any type of chemical pollution; both reported evidence of a spill or leak in the project area (floodplain) (Table 25). Those projects were also 2 of the 6 which had a previously reported chemical or fuel spill or leak that had been handled according to the unit's CERP (Table 17).

Inspections are an important part of projects involving construction or soil disturbance. The AqEco A protocol includes two questions about inspections, one in implementation (AqEco A-Q31) and one in effectiveness (AqEco A-Q49), that are designed to tie together. Respectively, they ask whether inspections were completed during critical times for the project (implementation), and whether lack of inspections during critical times (i.e., if implementation indicated a lack) influenced BMP effectiveness. Table 26 shows the

**Table 25.—**Evidence of chemical or fuel spills, leaks, or waste containers at the time of the effectiveness evaluation (AqEco A-Q48) for AqEco A evaluations completed in FY15/16 (n=35 evaluations) and FY17/18 (n=25 evaluations). Multiple selections were possible.

| Evidence | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| No evidence | 33 | 22 |
| Spills or leaks in area but not reaching a waterbody | 1 | 1 |
| Spills or leaks in a waterbody | | |
| Waste containers in area but not reaching a waterbody | | |
| Waste containers in a waterbody | | |

**Table 26.—**Number and distribution of project inspections or contract administration performed at critical times (AqEco A-Q31) in relationship to problems observed during effectiveness monitoring (AqEco A-Q49) for AqEco A evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (22 and 23 percent of FY15/16 and FY17/18 responses, respectively).

| Monitoring period | Inspections/ administration at critical times (implementation) | Not applicable; inspections at critical times or work avoided critical times (effectiveness) | Yes; lack of administration led to observed problems (effectiveness) | No; lack of administration did not lead to observed problems (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | No inspections | 1 | | |
| | Not applicable; work avoided critical times | 2 | 1 | 1 |
| | Yes; inspections at critical times | 23 | 3 | 1 |
| | No; inspections not at critical times | | | |
| FY17/18 | | | | |
| | No inspections | | | |
| | Not applicable; work avoided critical times | 1 | | 1 |
| | Yes; inspections at critical times | 16 | | 4 |
| | No; inspections not at critical times | | | |

relationship between those two questions for projects in which both implementation and effectiveness evaluations were completed within the two monitoring periods. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Twenty-two percent of the evaluations in FY15/16 and 23 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remainder of the projects, administration was not lacking (Table 26).

## Aquatic Ecosystems A: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

In FY15/16 and FY17/18, 53 and 50 percent of the evaluated AqEco A projects were rated as *fully implemented*, respectively, and the combination of *fully implemented* and *mostly implemented* ratings included about 78 and 68 percent of the projects (Fig. 7A, B). Similarly, BMP effectiveness ratings were generally high, with 77 percent of the projects rated as *effective* or *mostly effective* in FY15/16 (Fig. 7C) and 76 percent in FY17/18 (Fig. 7D). One project in FY15/16 and two in FY17/18 (i.e., for different projects) lacked responses in the database for questions needed to rate implementation or effectiveness or both. These are identified as incomplete data in Figure 7.

AqEco A projects often had multiple features present or activities ongoing (AqEco A-Q27) at the time of the evaluation (Table 8); in each monitoring period, the average project had

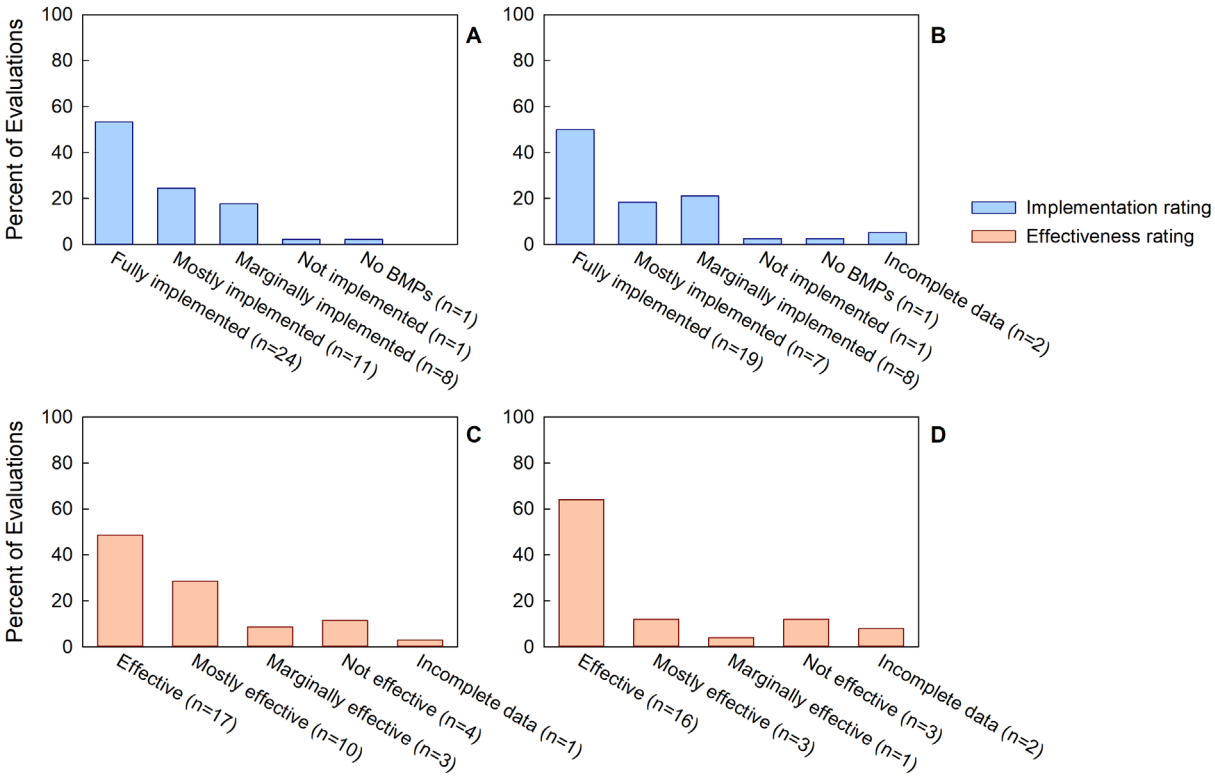



**Figure 7.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for AqEco A evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). "Incomplete data" refers to evaluations where all of the questions needed to determine a rating were not answered.

five features or activities. Project effectiveness ratings were somewhat poorer in FY15/16 for the 11 AqEco A projects that included nonmechanical streambank or shoreline treatments (Fig. 8A). However, this result can be difficult to interpret because the projects with nonmechanical treatments averaged seven features or activities in FY15/16, two more than the average for all projects. To clarify these results, the number of features/activities that were present or ongoing at the time of the evaluation were examined relative to the effectiveness ratings. The effectiveness ratings were significantly different in FY15/16 by the number of features or activities ongoing at the project at the time of the evaluation ($p = 0.01$, GLMM with negative binomial distribution and log link function). Least squares means probability of significant difference tests showed that projects with an *effective* rating averaged significantly fewer features or activities (four) compared to projects rated *mostly effective* ($p < 0.01$), *marginally effective* ($p < 0.01$), or *not effective* ($p < 0.01$) which averaged six, six, and seven features or activities, respectively. In FY17/18 effectiveness ratings were not significantly different by the number of features or activities ongoing during the evaluation ($p = 0.85$), although projects rated *not effective* averaged one more feature per project than those with any other rating (six versus five). From the available

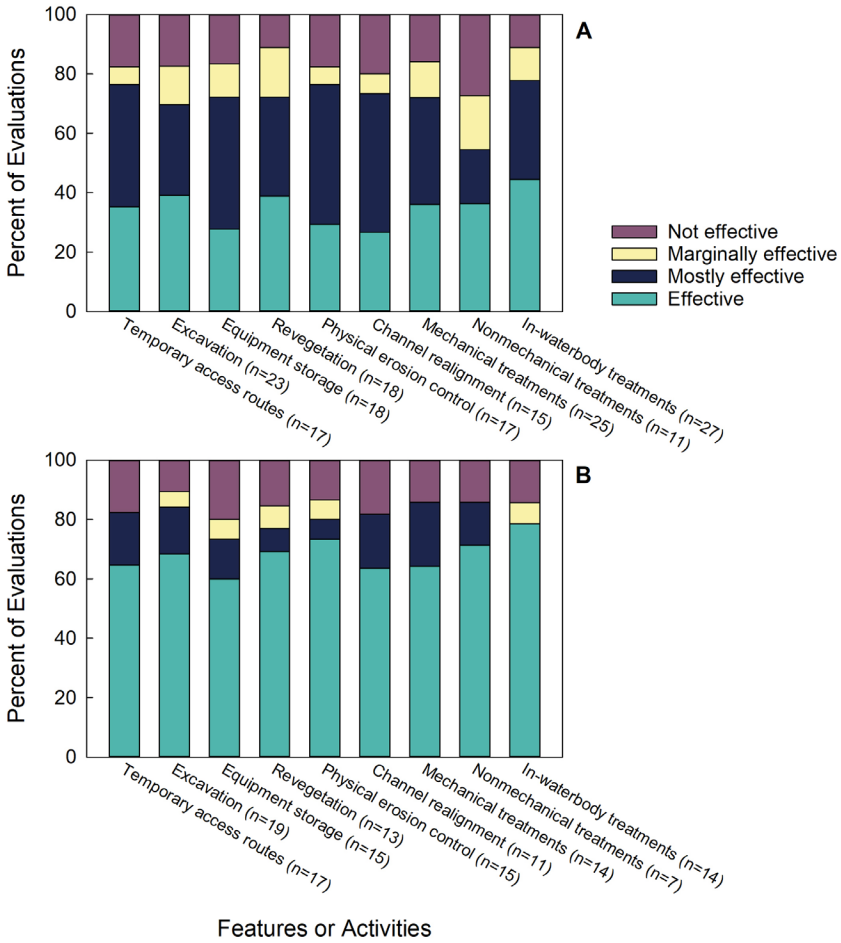



**Figure 8.—**Distribution of effectiveness ratings by project features and activities present during the evaluation (AqEco A-Q27) for evaluations completed in FY15/16 (A) and FY17/18 (B). The mechanical and nonmechanical treatments refer to streambank or shoreline treatments.

data, it is impossible to know whether the projects with more features or activities were more complex and therefore more prone to poorer ratings compared to projects with fewer features or activities. However, these data suggest that phasing the implementation of projects to limit the number of features or activities present (e.g., areas susceptible to pollutant-generating events) at any given time may help improve BMP effectiveness.

Examining the implementation ratings or effectiveness ratings relative to specific project objectives (AqEco A-Q25) is also complicated because most projects were undertaken for multiple objectives (Table 9). For projects in which both implementation and effectiveness were evaluated, the greatest percentages of *not implemented* and *not effective* ratings were associated with projects that included wetland or wet meadow construction in FY15/16 (Fig. 9); however, because there are only five such projects in this dataset, it is too early in National BMP monitoring to determine whether that relationship will be confirmed with larger sample sizes. In both monitoring periods, projects had three objectives on average, and the mean number of objectives ranged from one to four across all implementation ratings and effectiveness ratings. GLMM analyses (negative binomial distribution and log link function) between the implementation rating or effectiveness rating and the number of objectives showed no significant differences in the ratings as the number of objectives changed (implementation: p = 0.39 FY15/16, p = 0.56 FY17/18; effectiveness: p = 0.78 FY15/16, p = 0.33 FY17/18).

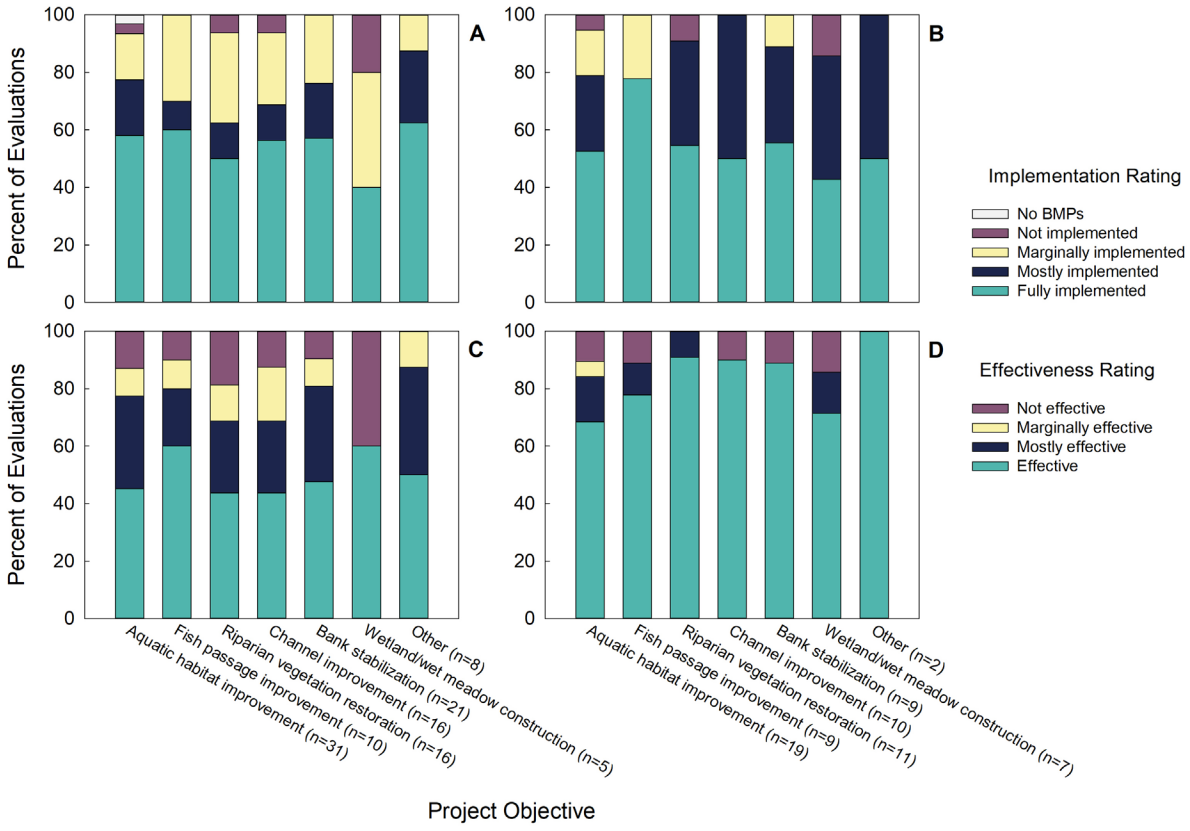



**Figure 9.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by project objective (AqEco A-Q25) for projects evaluated for both implementation and effectiveness in FY15/16 (A, C) and FY17/18 (B, D). Selection of multiple project objectives was permitted.

Several different administrative methods were used to accomplish AqEco A projects (Fig. 2). There was no significant association between the implementation ratings or effectiveness ratings and those methods in either monitoring period (implementation: p = 0.75 FY15/16, p = 0.90 FY17/18; effectiveness: p = 0.26 FY15/16, p = 0.57 FY17/18), but the sample sizes for several were very small (e.g., stewardship contracts; Fig. 10). More AqEco A evaluations will be needed to determine if any of the administrative methods result in better or poorer BMP implementation or effectiveness ratings.

The type of planning document used for preparing AqEco A projects was not statistically associated with either the implementation ratings (p = 0.36) or the effectiveness ratings (p = 0.25) in FY15/16 (Fig. 11A, C). In FY17/18 there was a significant association between the type of planning document and the implementation ratings (p = 0.06) but not for the effectiveness ratings (p = 0.69) (Fig. 11B, D). The analysis for implementation excluded projects for which no planning document was employed (i.e., "no planning document" answer to AqEco A-Q28) because that response can result only in the single implementation rating *no BMPs*. The results for the implementation ratings suggest that implementation is better for projects planned through an EIS compared to those planned using EAs or CEs or other non-NEPA types of planning documents. However, the sample

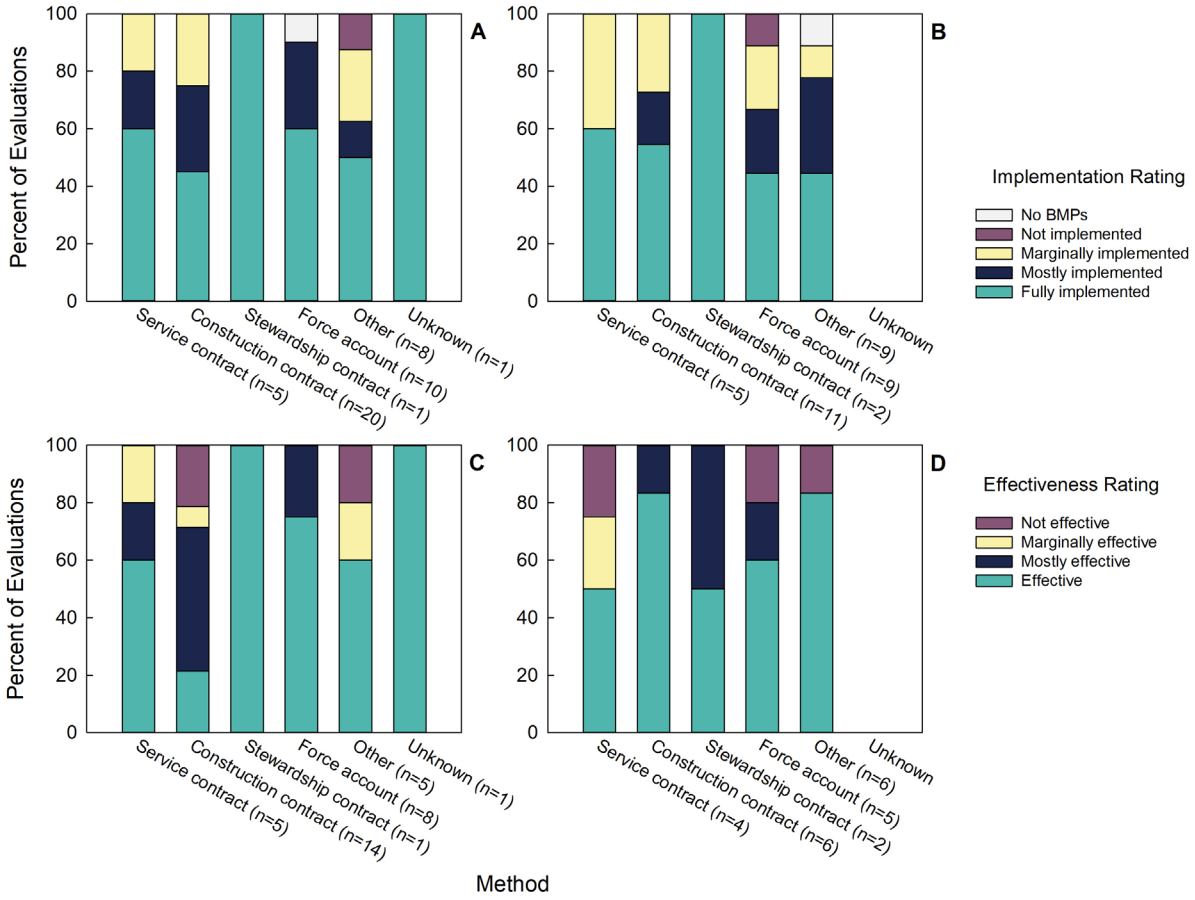



**Figure 10.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by method used to accomplish the project (AqEco A-Q26) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

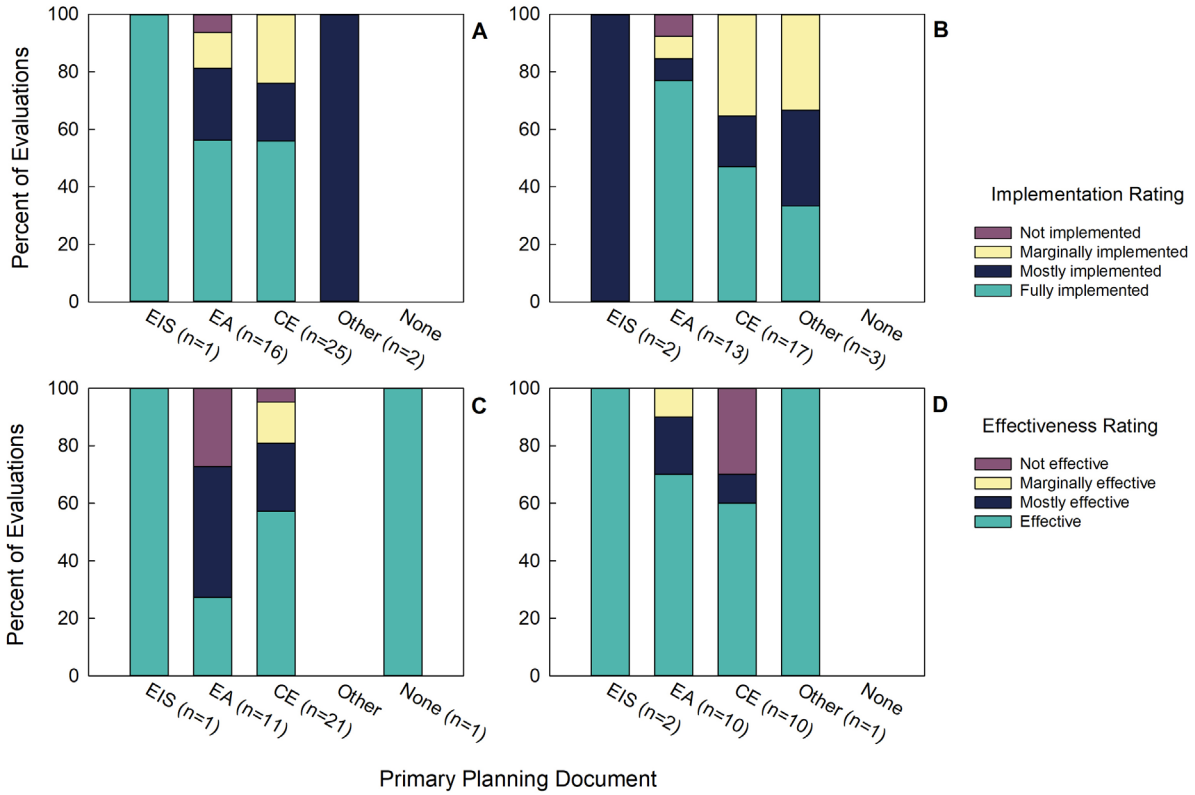



**Figure 11.**—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (AqEco A-Q28) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

sizes for EISs and other types of documents are very small (Fig. 11), so these results may reflect the greater variation within the larger sample sizes for EAs and CEs.

The number of BMP provisions included in a project contract or plan (AqEco A-Q29) was not significantly different by effectiveness rating (p = 0.13 FY15/16, p = 0.89 FY17/18; GLMM with negative binomial distribution and log link function). Mean numbers of BMP provisions in the contract or plan ranged from 6 for projects rated *not effective* to 10 for those rated *mostly effective* in FY15/16. In FY17/18 projects rated as *mostly effective* had the least mean number of provisions at 6 and all other ratings averaged 9 provisions per project. The number of BMP provisions implemented fully (AqEco A-Q30) also was not significantly different by effectiveness rating (p = 0.36 FY15/16, p = 0.18 FY17/18; GLMM with negative binomial distribution and log link function). For both monitoring periods the mean number of provisions implemented fully per project was 8, though the range of means across all effectiveness ratings was larger in FY17/18 (6 to 10) than in FY15/16 (7 to 9).

Examining percentages rather than counts shows that in FY15/16 the percentages of BMP provisions included in a contract or plan varied more by effectiveness rating than did the percentages of BMPs implemented fully. For projects rated *not effective*, an average of 54 percent of BMP provisions from planning were included in the contract or plan, while projects with *effective*, *mostly effective,* and *marginally effective* ratings averaged

89, 99, and 100 percent inclusion, respectively; and percentages of BMP provisions included were significantly different by effectiveness rating ($p = 0.03$, Kruskal-Wallis test). The percentage of BMP provisions implemented fully was highest at 100 percent for projects rated *mostly effective,* while projects rated *effective*, *marginally effective*, and *not effective* averaged 87, 88, and 90 percent of BMP provisions implemented fully, respectively. Across effectiveness ratings there was a significant difference in percentage of BMPs implemented fully in FY15/16 ($p = 0.03$, Kruskal-Wallis test).

Projects rated as *effective* and *marginally effective* in FY17/18 averaged 92 and 100 percent of provisions included in the contract or plan, and 100 percent of provisions implemented fully, though only one project had the *marginally effective* rating. In comparison, projects rated as *mostly effective* and *not effective* had 67 and 82 percent of provisions included in the contract or plan and 64 and 57 percent of provisions implemented fully. Significant differences for percentage of provisions included by effectiveness rating were not found ($p = 0.51$, Kruskal-Wallis test); however, a significant difference for percentages implemented fully did exist in FY17/18 ($p < 0.001$), with projects rated as *mostly effective* or *not effective* having a significantly lower percentage of provisions implemented fully compared to projects rated as *effective*.

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (AqEco A-Q16) were associated with the effectiveness ratings in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 0.85$) (Fig. 12). The numbers of wet-weather and dry-weather evaluations were similar in FY15/16 (Fig. 12A), so the association here is not due to a bias of completing most of the BMP reviews during dry conditions, and the higher percentage of poorer ratings during dry weather is opposite of what might be expected. However, relationships between weather conditions and field observations of erosion/sediment/

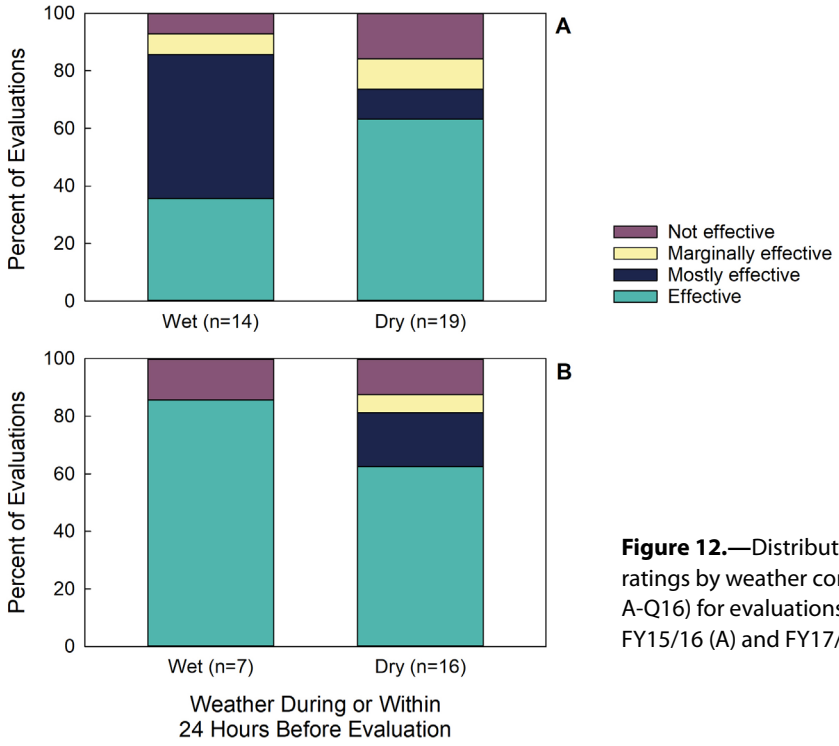



**Figure 12.—**Distribution of effectiveness ratings by weather conditions (AqEco A-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

morphological effects (e.g., Fig. 6) may provide more straightforward information about the influence of weather on site conditions and potential problems than associations between weather and ratings because ratings incorporate responses to multiple questions.

During the implementation portion of the evaluation, review of documents and inquiries with project administrators occur to determine whether corrective actions were taken if problems were experienced (AqEco A-Q32). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. Significant associations were found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings ($p = 0.03$ FY15/16, $p = 0.02$ FY17/18) (Fig. 13). The effectiveness ratings for "needed but not taken" and "needed and implemented" in FY15/16 (Fig. 13) appear to be opposite of what might be expected, but there is a substantial difference in the sample size for the two corrective action categories (Table 16). One evaluation reported that corrective actions were needed but not taken, so a comparison of "none needed" (n=28) and "needed and implemented" (n=16), which have larger sample sizes, is likely more informative. Again, effectiveness ratings are significantly associated with whether corrective actions were needed when only the "none needed" and "needed and implemented" categories of implementation needs are included

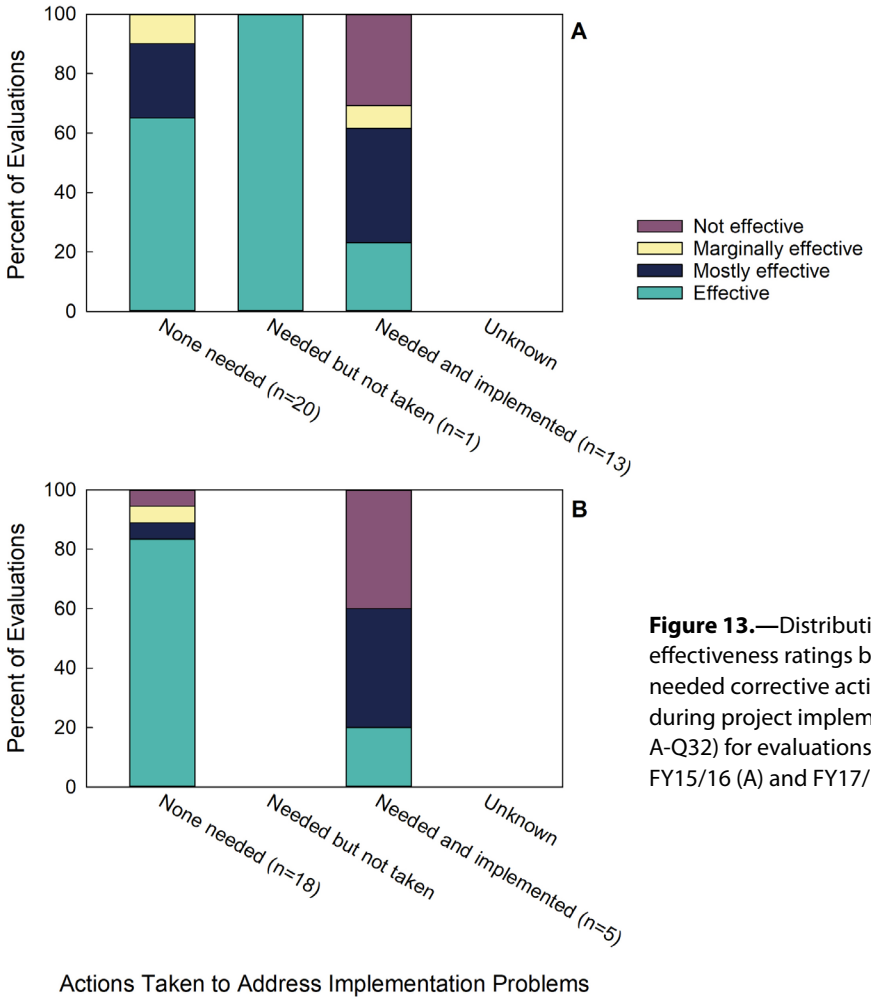



**Figure 13.**—Distribution of effectiveness ratings by whether needed corrective actions were taken during project implementation (AqEco A-Q32) for evaluations completed in FY15/16 (A) and FY17/18 (B).

($p = 0.01$). A higher percentage of poorer effectiveness ratings was associated with projects where corrective actions were identified as being needed and then were implemented in both monitoring periods. These results may appear to negate the reason for taking corrective actions during implementation, but caution is advised. Effectiveness may have already been reduced by the time corrective actions for implementation deficiencies were identified or taken. Effectiveness ratings may have been even poorer had the corrective actions for implementation not been taken. Better effectiveness associated with projects for which there was no need for implementation corrective actions emphasizes the importance of appropriate BMP planning and prescription as well as full implementation to avoid the need for corrective actions and the risk of reducing BMP effectiveness.

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based on what the review team observes and reports during the effectiveness evaluation at the project site.

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site in question. Corrective actions for implementation include actions to improve implementation for the project or site, while corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not including all the BMPs identified during planning in project contracts, while adaptive management actions for effectiveness may involve terminating the prescription of a more conventional BMP that consistently underperforms and replacing it in all future projects with a BMP that has been shown to provide better water quality protection.

The number of projects in FY15/16 that were identified as needing actions for implementation and effectiveness was about one-third projects that needed no actions; this held for both corrective actions and adaptive management actions (Figs. 14A and 15A, respectively). Many fewer evaluations in FY17/18—less than 15 percent in each comparison (Figs. 14B and 15B)—indicated needing actions for both implementation and effectiveness. For implementation, one project in FY15/16 that had a *no BMPs* implementation rating (i.e., no BMP guidance was used in planning) indicated that both corrective actions and adaptive management actions were needed, while one project in FY17/18 with that rating indicated no actions were needed (Fig. 14). There were significant associations between implementation ratings and corrective action needs ($p = 0.01$ FY15/16, $p = 0.04$ FY17/18); projects for which corrective actions were needed were associated with poorer implementation ratings. The associations between implementation ratings and adaptive management needs were not statistically significant ($p = 0.13$ FY15/16, $p = 0.23$ FY17/18) (Fig. 14). The combination of *effective*

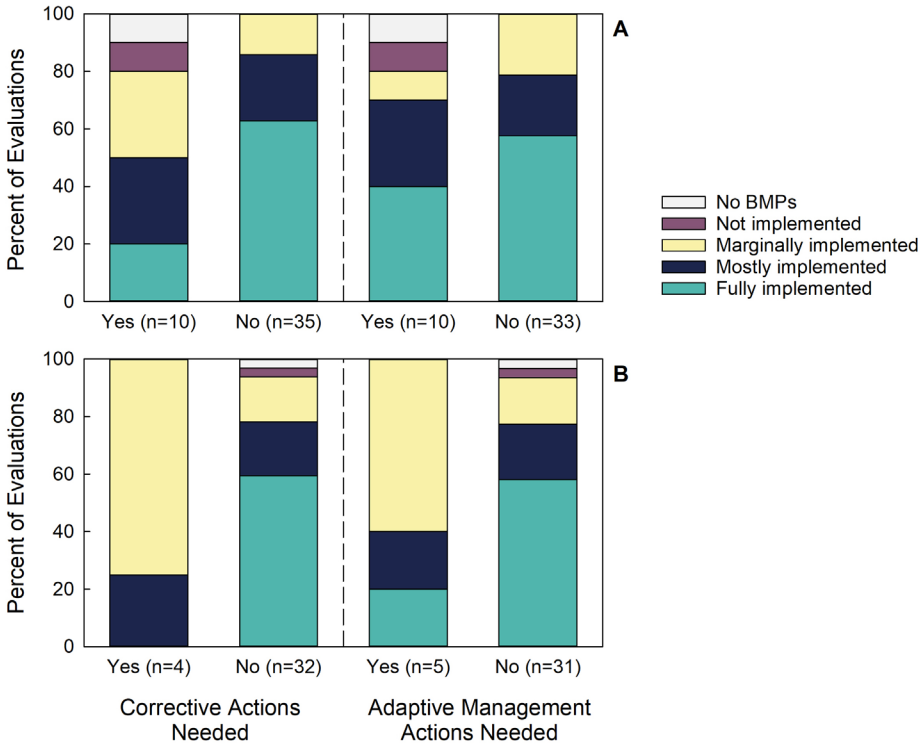



**Figure 14.—**Distribution of implementation ratings by whether corrective actions (AqEco A-Q34) or adaptive management actions (AqEco A-Q36) were needed to improve project implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

and *mostly effective* ratings was similar at about 70 to 80 percent of projects whether effectiveness corrective actions or adaptive management actions were needed or not needed in FY15/16 (Fig. 15A), and there were no significant associations between ratings and whether corrective actions ($p = 0.50$) or adaptive management actions ($p = 0.17$) were needed. The same was true for effectiveness ratings and corrective action needs in FY17/18 ($p = 0.48$) (Fig. 15B), but there was a significant association between ratings and adaptive management needs ($p = 0.02$).

There were evaluations rated as *marginally implemented*, *not implemented, marginally effective*, and *not effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. These poorer ratings may have resulted from chance occurrence (e.g., an extreme event outside of what could be controlled by planning or some type of BMP prescription), but such situations likely would have been applicable to a minority of evaluations. In some instances, the condition that led to an issue may have been unique to the site or been considered insignificant, causing the review team to consider corrective or adaptive management actions unnecessary. It is also possible that the team may have overlooked problems that led to poorer ratings that could have been identified during consideration of AqEco A-Q34, AqEco A-Q36, AqEco A-Q50, and AqEco A-Q52.

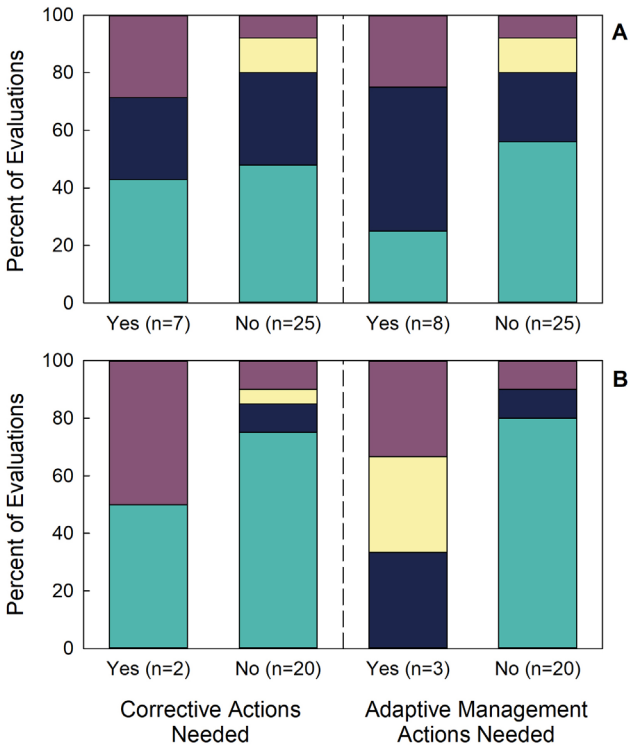



**Figure 15.—**Distribution of effectiveness ratings by whether corrective actions (AqEco A-Q50) or adaptive management actions (AqEco A-Q52) were needed to improve project effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

### Composite Ratings

Composite rating results for AqEco A projects with complete data (34 in FY15/16 and 23 in FY17/18) that were evaluated for both implementation and effectiveness are given in Table 27. In FY15/16, 41 percent of projects had a composite rating of *excellent*, 35 percent were rated as *good*, 3 percent were rated as *fair*, and 18 percent were rated as *poor*. One project had no BMPs prescribed, resulting in a *no plan* composite rating. In FY17/18, 65 percent of projects had a composite rating of *excellent*, and the remainder of the projects were roughly evenly distributed among the composite ratings of *good*, *fair*, and *poor*.

When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, significant associations were observed in both monitoring periods ($p = 0.01$ FY15/16, $p = 0.03$ FY17/18). Better project implementation generally resulted in better BMP effectiveness. About 70 percent of projects in both monitoring periods were rated *fully implemented* and had corresponding BMP effectiveness ratings of either *effective* or *mostly effective* (Table 27). Five of the seven projects that rated as *not effective* had implementation ratings of *marginally implemented* or *not implemented*.

## Aquatic Ecosystems A: Examination of Component and Subcomponent Scores

As noted in the introduction to this report, the overall implementation and effectiveness ratings were determined from component, and sometimes subcomponent, scores. The implementation rating components and their interpretations for the AqEco protocols are given in Table 28. The effectiveness components and subcomponents for AqEco A

**Table 27.—**Composite rating matrix for AqEco A projects evaluated for both implementation and effectiveness in FY15/16 (n=34 evaluations) and FY17/18 (n=23 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 9 | 5 | 2 | | 1 |
| | Mostly effective | 9 | 1 | | | |
| | Marginally effective | 1 | | 2 | | |
| | Not effective | | 1 | 2 | 1 | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 11 | 4 | 1 | | |
| | Mostly effective | 1 | | 1 | 1 | |
| | Marginally effective | 1 | | | | |
| | Not effective | | 1 | 2 | | |

Excellent
Good
Fair
Poor
No plan

are described in Tables 29a and 29b, respectively. AqEco A evaluations may have included floodplain work, in-waterbody work, or both. Consequently, when a project did not include floodplain or in-waterbody work, the missing component was scored *no disturbance* (Table 29a). That score does not influence the final effectiveness rating.

Table 30 shows how the scores were distributed across the three implementation components. In FY15/16 two projects scored as *none* for one component. The project scored as *none* for the project oversight component also scored as *no BMPs* for the planning component, which ultimately resulted in a *no BMPs* implementation rating. In FY17/18 the distributions of scores within each component were very similar to those from FY15/16. In both monitoring periods, more than half of the projects for which implementation evaluations were completed were rated as *fully implemented*, which is possible only if all three components scored as *all* (Table 31). Administrative units appear to be more successful at project oversight than planning or on-the-ground execution, based upon the results in both Tables 30 and 31, which show that the *all* score was achieved more frequently for the project oversight component than it was for either of the other two components.

**Table 28.—**Implementation components, scores, and interpretation of each score. Component scores are used to determine overall implementation ratings for AqEco protocols.

| Implementation component | Component score | Score interpretation |
|---|---|---|
| Planning | All | All BMPs developed during planning were included in the project contract or plan |
| | Some | Some BMPs developed during planning were included in the project contract or plan, but at least one was not |
| | None | BMPs were developed during planning but they were not carried into the project contract or plan **or** documents containing BMPs were referenced during planning but BMPs were not included in the planning documents |
| | No BMPs | No BMPs were considered for the project during planning |
| On-the-ground execution | All | All BMPs included in the project contract or plan were implemented fully |
| | Some | Some of the BMPs included in the project contract or plan were implemented fully, but at least one was not |
| | None | None of the BMPs included in the project contract or plan were implemented fully |
| Project oversight | All | All necessary corrective actions identified during project implementation were implemented |
| | Some | Some, but not all, necessary corrective actions identified during project implementation were implemented |
| | None | No necessary corrective actions identified during project implementation were implemented |

An answer of "no" for any provision in Table 12 accompanied by a "yes" answer for at least one other provision would score as *some* for the planning component, indicating that not all the BMPs from planning were included in the project contract or plan. For the 12 projects in FY15/16 with a planning component score of *some* (Table 30), an average of 25 percent of provisions from planning were not included in the contract or plan (Table 12, excluding provisions identified as "not applicable"), with the percentage ranging from 10 to 45. On average, BMPs from planning were included in 8 of the 13 possible provisions for those 12 projects. BMPs in the provisions "temporary vegetative erosion control requirements," "location and/or limiting the extent of floodplain disturbances," and "location and/or limiting the extent of waterbody disturbances" had the greatest frequencies of not being carried from planning into the project contract or plan (Table 12). Twelve projects in FY17/18 also had planning component scores of *some* (Table 30), and for those projects 22 percent of provisions from planning were not included in the project contract or plan. Projects included BMPs from 9 of the 13 possible provisions on average, with the provisions "fencing" and "temporary vegetative erosion control requirements" not included in the contract or plan most frequently.

**Table 29a.—**Effectiveness components, scores, and interpretation of each score for AqEco A. Component scores are used to determine overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Waterbody disturbance | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| | No disturbance | No waterbody work included in the project; does not affect the effectiveness rating |
| Floodplain disturbance | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| | No disturbance | No floodplain work included in the project; does not affect the effectiveness rating |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

**Table 29b.—**Effectiveness subcomponents, scores, and interpretation of each score for AqEco A. Subcomponent scores are used to determine the waterbody disturbance component score for AqEco A. When waterbody disturbance score is *no disturbance* (see Table 29a), these subcomponents are not relevant.

| Waterbody disturbance subcomponent | Subcomponent score | Score interpretation |
|---|---|---|
| Flow diversion | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| | No flow diversion | No flow present or evaluation done before flow control needed |
| Waterbody erosion | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

**Table 30.—**Distribution of implementation component scores by component for AqEco A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=45) | | | | | | | |
| | All | 31 | 69 | 35 | 78 | 42 | 93 |
| | Some | 12 | 27 | 10 | 22 | 2 | 4 |
| | None | 1 | 2 | | | 1 | 2 |
| | No BMPs | 1 | 2 | | | | |
| FY17/18 (n=38) | | | | | | | |
| | All | 24 | 63 | 28 | 74 | 35 | 92 |
| | Some | 12 | 32 | 10 | 26 | 1 | 3 |
| | None | 1 | 3 | | | | |
| | No BMPs | 1 | 3 | | | | |
| | Incomplete data[a] | | | | | 2 | 5 |

[a] Some of the questions needed to determine a component score were not answered.

**Table 31.—**Implementation component scores corresponding to the overall implementation ratings for AqEco A evaluations with complete data in FY15/16 and FY17/18. See Table 28 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=45) | | | | | |
| | Fully implemented | All | All | All | 24 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 9 |
| | | Some | All | Some | 1 |
| | Marginally implemented | All | Some | All | 6 |
| | | Some | Some | All | 2 |
| | Not implemented | None | Some | All | 1 |
| | No BMPs | No BMPs | Some | None | 1 |
| FY17/18 (n=36) | | | | | |
| | Fully implemented | All | All | All | 19 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 6 |
| | Marginally implemented | All | Some | All | 3 |
| | | Some | Some | All | 5 |
| | Not implemented | None | All | All | 1 |
| | No BMPs | No BMPs | Some | All | 1 |

The *some* score for the on-the-ground execution component indicates that at least one BMP in a provision was not implemented fully in the field (Table 28). This score results from a "no" answer for at least one provision in Table 14 and a "yes" response for at least one other provision. For the 10 projects having a score of *some* for the on-the-ground execution component in FY15/16 (Table 30), the average contract or plan had nine provisions containing at least one BMP, and in 22 percent of those provisions at least one BMP was not implemented fully. The frequency of BMPs that were not implemented fully ranged from 8 to 83 percent per evaluation, although the 83 percent value (five of six provisions) was unusual; excluding the single project with that value reduced the highest percentage of provisions not being implemented fully to 29 percent and the average to 15 percent per evaluation. BMPs that were not implemented fully were most commonly assigned to "nonvegetative erosion control requirements (permanent or temporary)," "timing and scheduling of improvements," and "fencing" provisions (Table 14). For the 10 projects with an on-the-ground execution component score of *some* in FY17/18, the mean number of provisions included in the contract or plan was 11, and 11 percent per project were not implemented fully. The percentage of provisions not implemented fully ranged from 8 to 20 in FY17/18.

For most projects, the project oversight component scored as *all* (Table 30). The two projects in FY15/16 and one project in FY17/18 that scored as *some* lacked inspections during project operations. The project that scored as *none* in FY15/16 corresponded to an evaluation that identified needed corrective actions to address an implementation problem; however, no actions were taken to rectify the observed problem (AqEco A-Q32).

Planning component scores were not significantly associated with the type of primary planning document (AqEco A-Q28) used for the 44 projects in FY15/16 and 37 projects in FY17/18 that employed planning documents (NEPA or other BMP guidance documents) ($p = 0.15$ FY15/16, $p = 0.13$ FY17/18) or with the method used to accomplish the project (AqEco A-Q26) ($p = 0.65$ FY15/18, $p = 0.48$ FY17/18). The on-the-ground execution component scores and project oversight component scores also were not associated with the method used to accomplish the project ($p = 0.78$ and $p = 0.67$, respectively, FY15/16; $p = 0.63$ and $p = 0.69$, respectively, FY17/18).

The distribution of scores across the three effectiveness components is summarized in Tables 32 and 33. For the waterbody disturbance and chemical pollutants components, at least 72 percent of the projects had scores of *effective* or *mostly effective* in both monitoring periods (Table 32). When floodplain disturbance was part of the project, 93 percent of projects in FY15/16 and 82 percent in FY17/18 were scored as *effective* for that component. Thirty-three projects had overall effectiveness ratings of *effective*, which resulted from each project achieving either an *effective* or *no disturbance* score for all three effectiveness components (Table 33). (Recall that *no disturbance* means that the project did not include either floodplain or in-waterbody work.) The 13 *mostly effective* and 4 *marginally effective* ratings were primarily driven by the waterbody disturbance component; the scores for the other two components were *effective* or *no disturbance* for all but one project (Table 33).

**Table 32.—**Distribution of effectiveness component scores by component for AqEco A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Waterbody disturbance component (number) | Waterbody disturbance component (percent) | Floodplain disturbance component (number) | Floodplain disturbance component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=35) | | | | | | | |
| | Effective | 16 | 46 | 26 | 74 | 33 | 94 |
| | Mostly effective[a] | 10 | 29 | | | | |
| | Moderately effective[b] | | | | | 1 | 3 |
| | Marginally effective[a] | 4 | 11 | | | | |
| | Not effective | 3 | 9 | 2 | 6 | | |
| | No disturbance | 2 | 6 | 7 | 20 | | |
| | Incomplete data[c] | | | | | 1 | 3 |
| FY17/18 (n=25) | | | | | | | |
| | Effective | 14 | 56 | 14 | 56 | 22 | 88 |
| | Mostly effective | 4 | 16 | | | | |
| | Moderately effective | | | | | 1 | 4 |
| | Marginally effective | 1 | 4 | 1 | 4 | | |
| | Not effective | 2 | 8 | 1 | 4 | | |
| | No disturbance | 3 | 12 | 8 | 32 | | |
| | Incomplete data | 1 | 4 | 1 | 4 | 2 | 8 |

[a] Score applies only to waterbody disturbance and floodplain disturbance components (see Table 29a).
[b] Score applies only to chemical pollutants component (see Table 29a).
[c] Some of the questions needed to determine a component score were not answered.

The waterbody disturbance component considers both the effectiveness of flow diversion at controlling water as well as evidence of waterbody erosion, sedimentation, or morphology changes that exceeds levels anticipated and described in planning (Table 29b). In-waterbody work was included in 33 projects in FY15/16 and 22 projects in FY17/18 that were evaluated for effectiveness. Two projects had a *not effective* score for the flow diversion subcomponent (Table 34). The evaluation completed in FY15/16 reported water quality violations for both turbidity and sediment (Table 20), while the evaluation in FY17/18 reported a violation for turbidity. Evaluations for the five projects that scored as *marginally effective* for the flow diversion subcomponent (Table 34) all reported that flow was only marginally controlled through the project area (Table 18).

No waterbody erosion was observed for 30 of the 33 projects in FY15/16 and 19 of 22 projects in FY17/18; these projects all received an *effective* score for the waterbody erosion subcomponent (Table 34). Two projects had a *moderately effective* subcomponent score because evidence of waterbody erosion existed, but the expected amount had not been described in planning (Table 21). Three projects had *not effective* waterbody erosion subcomponent scores (Table 34) because the evidence exceeded that described in planning (Table 21).

**Table 33.—**Effectiveness component scores corresponding to the overall effectiveness ratings for AqEco A evaluations with complete data in FY15/16 and FY17/18. See Table 29a for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Waterbody disturbance component | Floodplain disturbance component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=34) | | | | | |
| | Effective | Effective or no disturbance | Effective or no disturbance | Effective | 17 |
| | Mostly effective | Mostly effective | Effective or no disturbance | Effective | 10 |
| | Marginally effective | Marginally effective | Effective or no disturbance | Effective | 3 |
| | Not effective | Marginally effective | Not effective | Effective | 1 |
| | | Not effective[a] | Effective | Effective | 1 |
| | | Not effective[a] | Effective | Moderately effective | 1 |
| | | Not effective[b] | Not effective | Effective | 1 |
| FY17/18 (n=23) | | | | | |
| | Effective | Effective or no disturbance | Effective or no disturbance | Effective | 16 |
| | Mostly effective | Mostly effective | Effective or no disturbance | Effective | 2 |
| | | Mostly effective | Effective or no disturbance | Moderately effective | 1 |
| | Marginally effective | Marginally effective | Effective or no disturbance | Effective | 1 |
| | Not effective | Mostly effective | Not effective | Effective | 1 |
| | | Not effective[c] | Effective | Effective | 1 |
| | | Not effective[a] | Marginally effective | Effective | 1 |

[a] Waterbody erosion subcomponent score for this component was *not effective*.
[b] Flow diversion and waterbody erosion subcomponent scores for this component were *not effective*.
[c] Flow diversion subcomponent score for this component was *not effective*.

Work in the floodplain occurred in 28 projects in FY15/16 and 17 projects in FY17/18, and all but five of those achieved an *effective* score for the floodplain disturbance component (Table 32). The project that had a floodplain disturbance component score of *marginally effective* had evidence of uncontrolled erosion or sedimentation in the floodplain, while the two projects with component scores of *not effective* had evidence reaching a waterbody (Table 22).

One project in each monitoring period had evidence of chemical or fuel spills or leaks observed in the project area (Table 25), resulting in a *moderately effective* score for the chemical pollutants component (Table 32). All other projects had a chemical pollutants component score of *effective*.

**Table 34.—**Distribution of waterbody disturbance subcomponent scores by subcomponent for AqEco A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Subcomponent score | Flow diversion subcomponent (number) | Flow diversion subcomponent (percent) | Waterbody erosion subcomponent (number) | Waterbody erosion subcomponent (percent) |
|---|---|---|---|---|---|
| FY15/16 (n=33) | | | | | |
| | Effective | 17 | 52 | 30 | 91 |
| | Mostly effective[a] | 10 | 30 | | |
| | Moderately effective[b] | | | 1 | 3 |
| | Marginally effective[a] | 4 | 12 | | |
| | Not effective | 1 | 3 | 2 | 6 |
| | No flow diversion | 1 | 3 | | |
| FY17/18 (n=22) | | | | | |
| | Effective | 10 | 45 | 19 | 86 |
| | Mostly effective | 4 | 18 | | |
| | Moderately effective | | | 1 | 5 |
| | Marginally effective | 1 | 5 | | |
| | Not effective | 1 | 5 | 1 | 5 |
| | No flow diversion | 5 | 22 | | |
| | Incomplete data[c] | 1 | 5 | 1 | 5 |

[a] Score applies only to flow diversion subcomponent (see Table 29b).
[b] Score applies only to waterbody erosion subcomponent (see Table 29b).
[c] Some of the questions needed to determine a component score were not answered.

Comparison of the effectiveness component scores to overall implementation ratings (Fig. 16) indicates a significant association between the waterbody disturbance component scores and the implementation ratings in FY15/16 ($p = 0.01$); better implementation ratings were associated with better waterbody disturbance component scores. A significant association also was found in FY17/18 ($p = 0.01$), but the small sample sizes for most component scores limit the meaningfulness of this comparison. Waterbody erosion subcomponent scores also were significantly associated with implementation ratings ($p = 0.03$ FY15/16, $p = 0.04$ FY17/18), but flow diversion subcomponent scores were not ($p = 0.14$ FY15/16, $p = 0.19$ FY17/18) (Fig. 17). No significant associations were found between floodplain disturbance component scores and the implementation ratings in either monitoring period ($p = 0.29$ FY15/16, $p = 0.21$ FY17/18) or between chemical pollutants component scores and the implementation ratings in FY15/16 ($p = 0.24$); however, a significant association was found between chemical pollutants scores and the ratings in FY17/18 ($p = 0.04$) (Fig. 16). The statistical results for most comparisons were probably at least partially affected by the small number of projects with effectiveness component scores other than *effective* (Table 32).

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 18. No significant associations existed between the effectiveness ratings and either the planning component scores ($p = 0.17$ FY15/16,

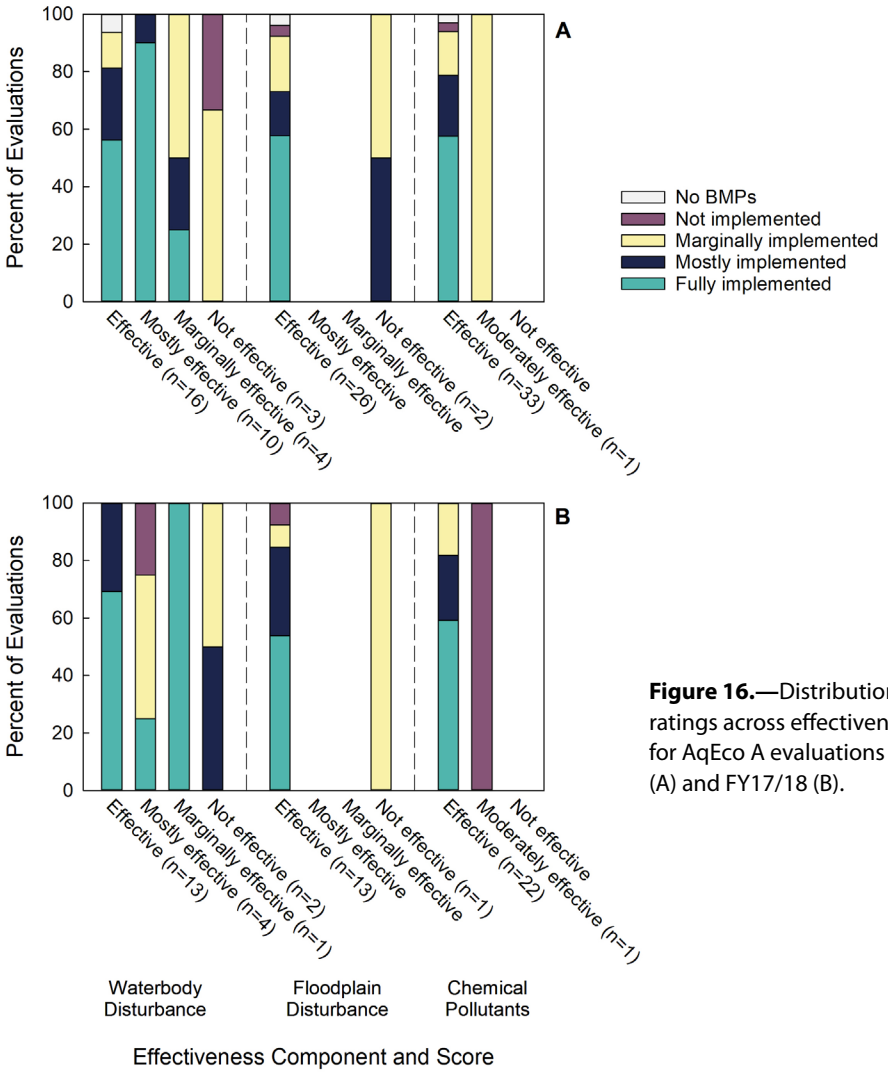



**Figure 16.—**Distribution of implementation ratings across effectiveness component scores for AqEco A evaluations completed in FY15/16 (A) and FY17/18 (B).

p = 0.21 FY17/18) or the project oversight component scores in FY15/16 (p = 1.00), but significant associations between the on-the-ground execution component scores and the overall effectiveness ratings existed for both monitoring periods (p < 0.01 FY15/16, p = 0.07 FY17/18), showing that higher degrees of BMP field implementation generally resulted in better effectiveness ratings. When all the BMPs in the project contract or plan were implemented, approximately 90 percent of the projects had BMP effectiveness ratings of *effective* or *mostly effective* (Fig. 18). When only some of the BMPs in the contract or plan were implemented, 40 to 50 percent of the projects were rated as *not effective* (Fig. 18).

Planned or implemented BMP provisions ("yes," "no," or "not applicable" answers from Table 12 or 14, respectively) that are potentially relevant to effectiveness component scores for floodplain disturbance or to effectiveness subcomponent scores for flow diversion and waterbody erosion were examined for statistical associations (Table 35). For most provisions, no significant associations were found for either monitoring period, but in FY15/16 two provisions were significantly associated with planning ("in contract or plan"

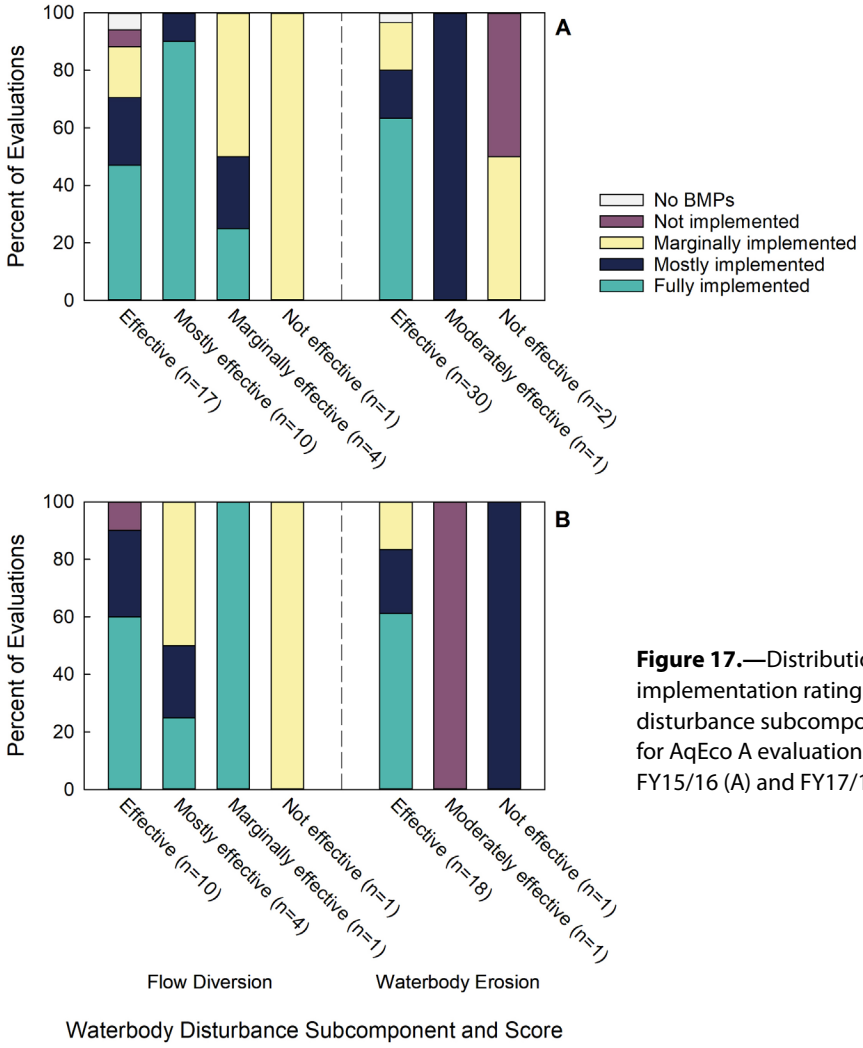



**Figure 17.—**Distribution of the implementation ratings across waterbody disturbance subcomponent scores for AqEco A evaluations completed in FY15/16 (A) and FY17/18 (B).

column in Table 35) and two with on-the-ground execution ("implemented fully" column in Table 35). In FY17/18 two provisions were significantly associated with on-the-ground execution. Both inclusion and execution of BMPs assigned to the provision "construction techniques and treatments for access roads" were significantly associated with the floodplain disturbance component scores in FY1516 (Table 35). All of the projects in FY15/16 with floodplain work that included BMPs for that provision in the contract or plan and implemented those BMPs fully had a floodplain disturbance component score of *effective*. These associations demonstrate the value of including appropriate BMPs for access routes during planning and for ensuring they are implemented fully during the project to control undesirable floodplain disturbances because roads are known to be the most common and often most important source of pollution related to forest management (Megahan and King 2004).

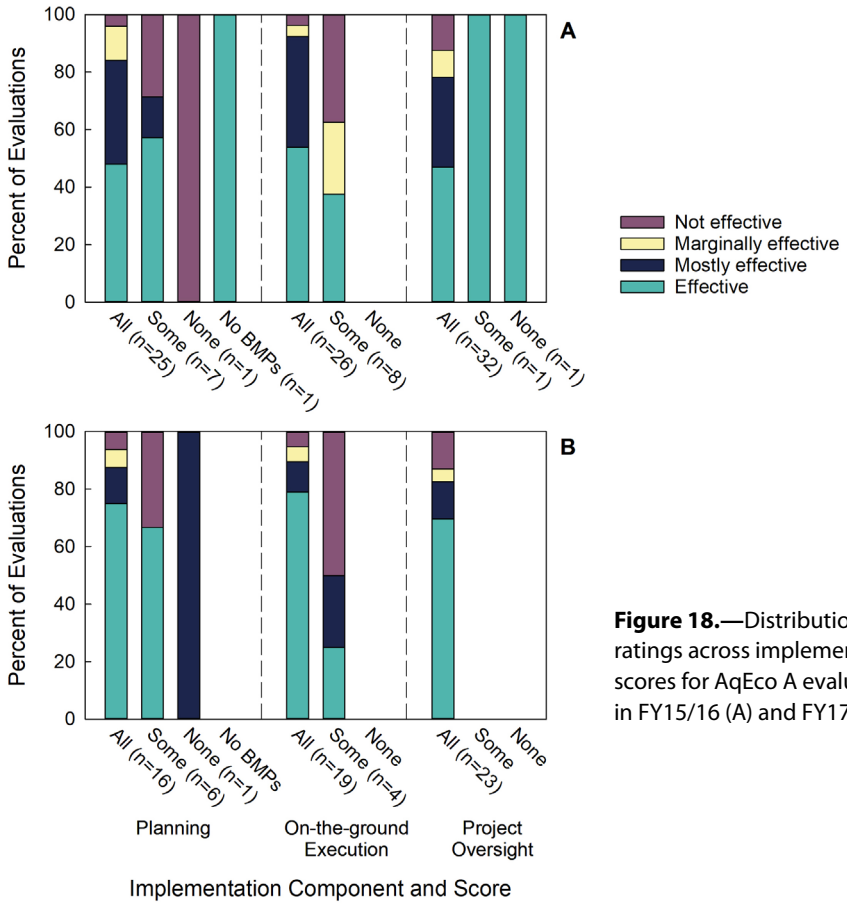



**Figure 18.—**Distribution of effectiveness ratings across implementation component scores for AqEco A evaluations completed in FY15/16 (A) and FY17/18 (B).

There was a strong association ($p < 0.01$; Table 35) in FY15/16 between the waterbody erosion subcomponent scores and inclusion of BMPs assigned to the provision "location and/or limiting the extent of waterbody disturbances" in the contract or plan. The 26 projects that included BMPs in that provision had an *effective* score for waterbody erosion, while two of the three projects that did not include them had scores of *not effective*. The association between flow diversion subcomponent scores and full implementation of BMPs in the provision "dewatering requirements" also was significant ($p = 0.06$) in FY15/16, with 36 percent and 50 percent of projects scored as *effective* or *mostly effective*, respectively, when BMPs in the provision were implemented fully.

In FY17/18 full implementation of BMPs was significantly associated with the floodplain disturbance component scores for the two provisions "location of access routes for vehicle travel" ($p = 0.09$) and "construction methods to reduce disturbance, erosion, or sedimentation" ($p = 0.04$) (Table 35). All projects with full implementation of BMPs in either provision had floodplain disturbance component scores of *effective*, and the one project with less than full implementation of BMPs in the construction methods provision had a component score of *not effective*.

**Table 35.**—Fisher's exact test probabilities of association between BMP provisions relevant to flow diversion and waterbody erosion effectiveness subcomponent scores and floodplain disturbance component scores for AqEco A evaluations completed in FY15/16 and FY17/18

| Subcomponent or component | Provision | FY15/16 In contract or plan[a] p-value[b] | FY15/16 Implemented fully[c] p-value | FY17/18 In contract or plan p-value | FY17/18 Implemented fully p-value |
|---|---|---|---|---|---|
| Flow diversion (subcomponent) | Dewatering requirements | 0.26 | ***0.06*** | 0.26 | 0.16 |
| Waterbody erosion (subcomponent) | Construction methods to reduce disturbance, erosion, or sedimentation | 0.13 | 1.00 | 1.00 | 0.21 |
| | Location and/or limiting the extent of waterbody disturbances | ***<0.01*** | 0.29 | 0.20 | 0.21 |
| | Waterbody stabilization techniques | 0.11 | 1.00 | 0.10 | 0.32 |
| Floodplain disturbance (component) | Timing and scheduling of improvements | 1.00 | 1.00 | 1.00 | 0.26 |
| | Location of access routes for vehicle travel | 1.00 | 1.00 | 0.27 | ***0.09*** |
| | Construction techniques and treatments for access routes | ***0.02*** | ***0.09*** | 1.00 | 0.57 |
| | Construction methods to reduce disturbance, erosion, or sedimentation | 1.00 | 1.00 | 1.00 | ***0.04*** |
| | Location and/or limiting the extent of floodplain disturbances | 0.34 | 0.33 | 0.35 | 0.48 |
| | Temporary vegetative erosion control requirements | 0.51 | 1.00 | 1.00 | 0.57 |
| | Nonvegetative erosion control requirements (temporary or permanent) | 1.00 | 1.00 | 0.54 | 0.66 |

[a] See AqEco A-Q29.
[b] Probability of association; significant at α=0.10.
[c] See AqEco A-Q30.

## Aquatic Ecosystems A: Management Implications for Forest Service Resource Managers

Seventy-three percent of the evaluations for active construction of aquatic ecosystem improvements were rated either *fully implemented* or *mostly implemented*. Project planning was a deficiency in 34 percent of the evaluations, with one project in each monitoring period completed without BMPs prescribed in the planning document. About 24 percent of the evaluations had a deficiency in on-the-ground execution (i.e., some BMP provisions in the project contract or plan were not implemented fully). One evaluation had five of six BMP provisions (83 percent) not implemented fully. The remaining projects with a deficiency (i.e., those having a *some* score) for the on-the-ground execution component had 8 to 29 percent of BMP provisions not implemented fully. Project oversight scores were *all* for 93 percent of the evaluations.

More than 90 percent of the evaluations scored *all* for project oversight. About 80 percent of the projects were rated either *effective* or *mostly effective* for BMP effectiveness, indicating either no impacts to water quality were observed or observed impacts were minor and temporary. In most of the projects that scored *mostly effective* or *marginally*

*effective* in the waterbody disturbance component, the deficiency was in the flow diversion subcomponent. For projects that included floodplain disturbance, BMPs employed were largely effective at controlling erosion, with 86 percent of the projects having no evidence of uncontrolled erosion. One evaluation in each monitoring period observed evidence of a chemical or fuel spill or leak, and those were outside a waterbody.

When BMPs were implemented, they were shown to be effective. For projects with both implementation and effectiveness evaluations, 94 and 83 percent of the projects with a *fully implemented* or *mostly implemented* rating, respectively, were rated *effective* or *mostly effective*. In contrast, 40 percent of projects with a *marginally implemented* rating and 50 percent of projects with a *not implemented* rating were rated *effective* or *mostly effective*. In other words, better implementation ratings resulted in a better effectiveness waterbody disturbance component score, particularly relating to the waterbody erosion subcomponent, and better on-the-ground execution component scores corresponded to better overall effectiveness ratings.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Checking the project contract or plan to ensure that BMP provisions for "fencing," "dewatering requirements," and "temporary vegetative erosion control requirements" are included when prescribed in the project planning documents.
- Conducting post-project inspections to ensure that BMP provisions for "fencing" and "nonvegetative erosion control requirements" in the project contract or plan are implemented as intended.
- Phasing implementation of aquatic ecosystem projects to limit the number of project features or activities active, and potentially susceptible to pollution-generating events, at one time during project implementation. Effectiveness ratings were better for projects that had fewer features active at the time of the evaluation.
- Where appropriate, including BMPs for "dewatering requirements" in the project planning documents and project contract or plan. Better control of water was achieved when prescribed dewatering requirements were implemented fully.
- Where appropriate, including BMPs for "construction techniques and treatments for access routes" for floodplain disturbances and "location and or limiting the extent of waterbody disturbances" for waterbody disturbances. Significant associations were found between implementation of these BMP provisions and the floodplain disturbance component and waterbody erosion subcomponent scores, respectively.
- Where appropriate, including BMPs for excavation and storage of excavated materials in the planning documents and project contract or plan. These areas were most frequently identified as the source of uncontrolled erosion on the floodplain.

## Aquatic Ecosystems A: Best Management Practices Monitoring Form

### Best Management Practices Evaluation

### AqEco A. Active Construction of Aquatic Ecosystem Improvements

(Includes BMPs AqEco-1, AqEco-2, AqEco-3, AqEco-4,
Fac-2, Fac-6, Fac-10, Road-5, Road-9, Road-10, and WatUses 5)

v3.0 February 2016

| Header | |
|---|---|
| AqEco A-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| AqEco A-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| AqEco A-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| AqEco A-Q4 | Date of current field evaluation: |
| AqEco A-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| AqEco A-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| AqEco A-Q7 | Reviewers and titles: |
| AqEco A-Q8a | Region number: |
| AqEco A-Q8b | State: |
| AqEco A-Q9a | Proclaimed Forest or Grassland number and name: |
| AqEco A-Q9b | Administrative Forest or Grassland number and name: |
| AqEco A-Q10 | District number and name: |
| AqEco A-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| AqEco A-Q11b | Was the project/site selected randomly from the population developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| AqEco A-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| AqEco A-Q12 | 6th level HUC number and name for the subwatershed this improvement is in: |
| AqEco A-Q13 | Is any part of the project located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| AqEco A-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| AqEco A-Q14b | Location.<br><br>Easting: |
| AqEco A-Q14c | Location.<br><br>Northing: |
| AqEco A-Q15a | Location.<br><br>Latitude: |
| AqEco A-Q15b | Location.<br><br>Longitude: |
| AqEco A-Q15c | Location.<br><br>Lat/Long Datum: |
| AqEco A-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| AqEco A-Q17 | Name of improvement or construction project: |
| AqEco A-Q18 | Date that ground-disturbing work for the project began: |
| AqEco A-Q19 | Is any of the improvement located on a floodplain? Select one:<br><br>a. Yes (go to question 20)<br>b. No (go to question 22) |
| AqEco A-Q20 | Length of floodplain disturbed by the improvement (ft, m, mi, or km; specify unit): |
| AqEco A-Q21 | Area of floodplain disturbed by improvement (ac or ha; specify unit): |

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| **Header** (*continued*) | |
|---|---|
| AqEco A-Q22 | Is any of the improvement located within a waterbody? Select one:<br><br>a. Yes (go to question 23)<br>b. No (go to question 24) |
| AqEco A-Q23 | If lotic system, provide length of the waterbody disturbed (ft, m, mi, or km; specify unit); if lentic system provide area of waterbody disturbed ($ft^2$, $m^2$, ac, or ha; specify unit): |
| AqEco A-Q24 | Type of waterbody being improved/constructed or type adjacent to the floodplain being improved. Select all that apply:<br><br>Stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| AqEco A-Q25 | Project objectives. Select all that apply:<br><br>Aquatic habitat improvement<br>Fish passage improvement<br>Riparian vegetation restoration<br>Stream/river channel improvement or realignment<br>Bank stabilization<br>Wetland/wet meadow construction<br>Other (specify): |
| AqEco A-Q26 | Method used to accomplish project. Select one:<br><br>Service contract<br>Construction contract<br>Stewardship contract<br>Force account<br>Other (specify): |
| AqEco A-Q27 | Which features or activities exist or are in use at the time of this evaluation? Select all that apply:<br><br>a. Temporary access routes for project implementation<br>b. Excavation<br>c. Equipment storage<br>d. Revegetation<br>e. Physical erosion control measures (e.g., matting, netting, silt fence)<br>f. Channel realignment<br>g. Mechanical streambank or shoreline treatments<br>h. Nonmechanical streambank or shoreline treatments<br>i. In-channel or in-waterbody structural treatments<br>j. Other (specify): |
| **Implementation** | |
| AqEco A-Q28 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 30)<br>b. Environmental Impact Statement (EIS) (go to question 29)<br>c. Environmental Assessment (EA) (go to question 29)<br>d. Categorical Exclusion (CE) (go to question 29)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 29) |

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| **Implementation** (*continued*) | |
|---|---|
| AqEco A-Q29 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract or project plan. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Timing and scheduling of improvements<br>Yes/No/Not applicable<br>b. Location of access routes for vehicle travel<br>Yes/No/Not applicable<br>c. Construction techniques and treatments for access routes<br>Yes/No/Not applicable<br>d. Placement and storage of excavated materials<br>Yes/No/Not applicable<br>e. Construction methods to reduce disturbance, erosion, or sedimentation<br>Yes/No/Not applicable<br>f. Location and/or limiting the extent of floodplain disturbances<br>Yes/No/Not applicable<br>g. Location and/or limiting the extent of waterbody disturbances<br>Yes/No/Not applicable<br>h. Waterbody stabilization techniques<br>Yes/No/Not applicable<br>i. Dewatering requirements<br>Yes/No/Not applicable<br>j. Temporary vegetative erosion control requirements<br>Yes/No/Not applicable<br>k. Permanent vegetation/cover requirements<br>Yes/No/Not applicable<br>l. Non-vegetative erosion control requirements (permanent or temporary)<br>Yes/No/Not applicable<br>m. Fencing<br>Yes/No/Not applicable<br>n. Other (specify):<br>Yes/No/Not applicable |
| AqEco A-Q30 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or project plan were implemented fully. Select one response in each line. If the provision exists in the project contract or plan and it was implemented fully, select Yes. If the provision exists in the project contract or plan but it was not implemented fully, select No. If the provision does not exist in the project contract or plan, or if is too early in the construction period for the provision to have been implemented at the time of evaluation, select Not applicable.<br><br>a. Timing and scheduling of improvements<br>Yes/No/Not applicable<br>b. Location of access routes for vehicle travel<br>Yes/No/Not applicable<br>c. Construction techniques and treatments for access routes<br>Yes/No/Not applicable<br>d. Placement and storage of excavated materials<br>Yes/No/Not applicable<br>e. Construction methods to reduce disturbance, erosion, or sedimentation<br>Yes/No/Not applicable<br>f. Location and/or limiting the extent of floodplain disturbances<br>Yes/No/Not applicable<br>g. Location and/or limiting the extent of waterbody disturbances<br>Yes/No/Not applicable<br>h. Waterbody stabilization techniques<br>Yes/No/Not applicable<br>i. Dewatering requirements<br>Yes/No/Not applicable<br>(*continued* ) |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*AqEco A-Q30 continued*) | j. Temporary vegetative erosion control requirements<br>Yes/No/Not applicable<br>k. Permanent vegetation/cover requirements<br>Yes/No/Not applicable<br>l. Non-vegetative erosion control requirements (permanent or temporary)<br>Yes/No/Not applicable<br>m. Fencing<br>Yes/No/Not applicable<br>n. Other provisions specified in question 29n<br>Yes/No/Not applicable<br>o. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| AqEco A-Q31 | Were project inspections and/or contract administration during operations performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, work was conducted to avoid critical times<br>c. Yes<br>d. No |
| AqEco A-Q32 | If problems occurred during improvement/construction that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| AqEco A-Q33 | Were chemical or fuel spills or leaks that occurred during project activities handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred during construction<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| AqEco A-Q34 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 35)<br>b. No (go to question 36) |
| AqEco A-Q35 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| AqEco A-Q36 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 37)<br>b. No (go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| AqEco A-Q37 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |

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| Effectiveness | |
|---|---|
| AqEco A-Q38 | Are you evaluating construction or improvements within a waterbody? Select one:<br><br>a. Yes (go to question 39)<br>b. No (go to question 43) |
| AqEco A-Q39 | Within the area of disturbance, has water flowing through lotic systems or moving from lentic systems been controlled? Select one:<br><br>a. Evaluation is being done prior to waterbody disturbance and the need for flow control (go to question 42)<br>b. No flow or water present so control or diversion was not needed (go to question 42)<br>c. Flow was completely controlled or diverted around construction or improvement area (go to question 40)<br>d. Flow was largely controlled or diverted, with some seepage present (go to question 40)<br>e. Flow was marginally controlled, with some flow passing through disturbed area (go to question 40)<br>f. Flow was poorly controlled or uncontrolled (go to question 40)<br>g. Flow was not controlled because permit, contract or plan did not require flow control (go to question 40) |
| AqEco A-Q40 | Did flow diversion, lack of flow diversion, or poorly functioning diversion cause a violation of the water quality standard for turbidity? Select one:<br><br>a. Not applicable, no water quality standard for turbidity<br>b. Yes<br>c. No<br>d. Unknown, turbidity not measured |
| AqEco A-Q41 | Did flow diversion, lack of flow diversion, or poorly functioning diversion cause a violation of the water quality standard for sediment? Select one:<br><br>a. Not applicable, no water quality standard for sediment<br>b. Yes<br>c. No<br>d. Unknown, sediment levels not measured |
| AqEco A-Q42 | Is there evidence of bank or shoreline erosion, or changes to waterbody morphology or substrate characteristics that is attributable to the project activities on the banks/shorelines or in the waterbody? Select one:<br><br>a. No evidence of bank/shoreline erosion, or changes to waterbody morphology or substrate characteristics<br>b. Evidence of bank/shoreline erosion, or changes to waterbody morphology or substrate characteristics, and the amount does not exceed that described in project planning<br>c. Evidence of bank/shoreline erosion, or changes to waterbody morphology or substrate characteristics, and the amount exceeds that described in project planning<br>d. Evidence of bank/shoreline erosion, or changes to waterbody morphology or substrate characteristics, but the amount expected was not described in project planning |
| AqEco A-Q43 | Are you evaluating construction, improvements, or soil disturbance in the floodplain? Select one:<br><br>a. Yes (go to question 44)<br>b. No (go to question 48) |

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| **Effectiveness** (*continued*) | |
|---|---|
| AqEco A-Q44 | Is there evidence of uncontrolled erosion or sedimentation originating from the floodplain disturbance? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c.<br><br>a. No evidence of uncontrolled erosion or sedimentation (go to question 48)<br>b. Evidence of uncontrolled erosion or sedimentation within the floodplain, but not reaching a waterbody (go to question 45)<br>c. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 45) |
| AqEco A-Q45 | For all of the occurrences of erosion and sedimentation observed in the area you identified in effectiveness question 44, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| AqEco A-Q46 | What are the sources? Select all that apply:<br><br>a. Reshaping/excavation<br>b. Temporary access routes<br>c. Permanent (pre-disturbance) access routes<br>d. Stockpiles or storage areas of excavated materials<br>e. Sediment trap<br>f. Other (specify): |
| AqEco A-Q47 | What are the causes? Select all that apply:<br><br>a. Overall poor location for project<br>b. Poorly located stockpiles of excavated materials<br>c. Oversteepened slopes<br>d. Lack of, or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, etc.)<br>e. Lack of, or insufficient water control on access routes<br>f. Improperly designed erosion control treatments<br>g. Operating outside of allowable time periods (allowable schedules or weather conditions)<br>h. Operating outside of allowable soil conditions<br>i. Operations extending outside of designated project boundaries<br>j. Soil compaction<br>k. Mechanical additions of soil to the waterbody<br>l. Did not plan for/anticipate effects<br>m. Other (specify):<br>n. Unknown |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| AqEco A-Q48 | What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks in the project area, but outside a waterbody<br>c. Evidence of chemical or fuel spills or leaks in a waterbody<br>d. Evidence of chemical or fuel waste containers in the project area, but outside a waterbody<br>e. Evidence of chemical or fuel waste containers in a waterbody |
| AqEco A-Q49 | If inspections were not conducted at critical times during operations, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times<br>b. Yes<br>c. No |
| AqEco A-Q50 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 51)<br>b. No (go to question 52) |
| AqEco A-Q51 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| AqEco A-Q52 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 53)<br>b. No (go to General Comments) |
| AqEco A-Q53 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Aquatic Ecosystems B—Completed Aquatic Ecosystem Improvements

## Aquatic Ecosystems B: Header Statistics

Sixty-two completed aquatic ecosystem projects (AqEco B) were evaluated in FY15/16 and 58 were evaluated in FY17/18 (Table 36). Region 4 did not complete at least one AqEco B evaluation in FY15/16; most regions completed several in both monitoring periods (Table 36). In each monitoring period, at least half of the evaluations used to meet National BMP targets were required to be selected randomly. For AqEco B, the percentage of random to nonrandom was very similar to that of AqEco A, with 74 percent of the evaluated projects selected randomly in each monitoring period (Table 3). The most common reason for using the AqEco B protocol was to meet National BMP targets and was selected by all but one evaluation in both monitoring periods (Table 36). The protocol simultaneously met other monitoring needs, with project review most frequently selected, including for one project in FY17/18 that did not indicate that meeting National BMP targets was a reason for monitoring.

**Table 36.—**Number of AqEco B evaluations completed in FY15/16 (n=62 evaluations) and FY17/18 (n=58 evaluations), by region and reason for monitoring (AqEco B-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 10 | 3 | 7 | 4 | |
| | 2 | 9 | | 5 | 1 | |
| | 3 | 6 | 1 | 6 | 2 | |
| | 4 | | | | | |
| | 5 | 6 | | 1 | | 1 |
| | 6 | 15 | | 4 | 2 | |
| | 8 | 8 | | 6 | | |
| | 9 | 7 | 1 | 3 | | |
| | 10 | 1 | 1 | 1 | | |
| | All | 62 | 6 | 33 | 9 | 1 |
| FY17/18 | | | | | | |
| | 1 | 3 | | 2 | 1 | |
| | 2 | 8 | 2 | 7 | 2 | 1 |
| | 3 | 4 | | | | |
| | 4 | 1 | 1 | 1 | | |
| | 5 | 11 | | 2 | 2 | |
| | 6 | 16 | | 4 | 3 | |
| | 8 | 4 | | 2 | | |
| | 9 | 7 | | | | |
| | 10 | 3 | 2 | | | |
| | All | 57 | 5 | 18 | 8 | 1 |

Quality assurance was identified as a reason for monitoring (AqEco B-Q11a) in 17 AqEco B evaluations (Table 36). For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance had duplicate evaluations, which is necessary to meet the intent of that type of monitoring. Therefore, the review teams that selected quality assurance appeared to use this term to mean something different than the protocol instructions stipulate.

At the end of the 2-year monitoring periods, 82 and 90 percent of the evaluations had both implementation and effectiveness monitoring completed (Table 37). Implementation and effectiveness monitoring were performed on a single day for all but one evaluation

**Table 37.—**Number of AqEco B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (AqEco B-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 10 | 1 | 3 | 6 |
| | 2 | 9 | 2 | 1 | 6 |
| | 3 | 6 | 2 | | 4 |
| | 4 | 0 | | | |
| | 5 | 6 | | | 6 |
| | 6 | 15 | 1 | 1 | 13 |
| | 8 | 8 | | | 8 |
| | 9 | 7 | | | 7 |
| | 10 | 1 | | | 1 |
| | All | 62 | 6 | 5 | 51 |
| | Percent | | 10 | 8 | 82 |
| FY17/18 | | | | | |
| | 1 | 3 | | | 3 |
| | 2 | 8 | | 1 | 7 |
| | 3 | 4 | | | 4 |
| | 4 | 1 | | | 1 |
| | 5 | 12 | 1 | | 11 |
| | 6 | 16 | 1 | 2 | 13 |
| | 8 | 4 | | | 4 |
| | 9 | 7 | | 1 | 6 |
| | 10 | 3 | | | 3 |
| | All | 58 | 2 | 4 | 52 |
| | Percent | | 3 | 7 | 90 |

completed by a unit in Region 9; for that evaluation, implementation and effectiveness monitoring were completed approximately 6 weeks apart. Eight implementation-only evaluations and nine effectiveness-only evaluations were completed during the two monitoring periods. Both of the FY17/18 implementation-only evaluations were completed later in the period, so it is possible that the corresponding effectiveness evaluations for those projects may be completed in the next monitoring period (FY19/20). The FY15/16 implementation-only evaluations will not have paired effectiveness evaluations that follow the National BMP monitoring protocol instructions because effectiveness evaluations for AqEco B projects needed to be performed within a year of the completion of the project.

Most of the projects involved work in both the floodplain and adjacent waterbody (Table 38). Twenty-two projects had only in-waterbody work, and eight projects involved only floodplain work. Like AqEco A, a few AqEco B evaluations indicated that the work

**Table 38.—**Number of AqEco B evaluations completed in FY15/16 and FY17/18, by region and location of project improvements (AqEco B-Q19 and AqEco B-Q20)

| Monitoring period | Region | In floodplain only | In waterbody only | In both floodplain and waterbody | In neither floodplain nor waterbody[a] |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | | 1 | 9 | |
| | 2 | 1 | | 7 | 1 |
| | 3 | 1 | 1 | 4 | |
| | 4 | | | | |
| | 5 | | 1 | 5 | |
| | 6 | | 2 | 13 | |
| | 8 | | | 6 | 2 |
| | 9 | | 3 | 4 | |
| | 10 | | 1 | | |
| | All | 2 | 9 | 48 | 3 |
| | Percent | 3 | 15 | 77 | 5 |
| FY17/18 | | | | | |
| | 1 | 1 | | 2 | |
| | 2 | 1 | 2 | 5 | |
| | 3 | 1 | | 3 | |
| | 4 | | | 1 | |
| | 5 | 3 | 2 | 7 | |
| | 6 | | 5 | 11 | |
| | 8 | | 2 | 2 | |
| | 9 | | 2 | 5 | |
| | 10 | | | 3 | |
| | All | 6 | 13 | 39 | 0 |
| | Percent | 10 | 22 | 67 | |

[a] Responses in the Header section indicated improvements were not located in a floodplain (AqEco B-Q19) and not located within a waterbody (AqEco B-Q20).

involved neither floodplain nor in-waterbody work (AqEco B-Q19 and AqEco B-Q20, respectively), even though AqEco B is appropriate only for work done within one or both of those areas. However, project objectives (AqEco B-Q23) and features (AqEco B-Q25) indicated work was accomplished in the floodplain for those evaluations.

By far, most of the evaluated AqEco B projects involved improvements in and/or along streams or rivers (Table 39). Wetland/wet meadow projects were the next most frequently reviewed. Across all projects, total waterbody plus floodplain disturbance length averaged approximately 2,940 feet in FY15/16 and 2,570 feet in FY17/18. Multiple features or activities were included in most of the projects reviewed (Table 40). Features included less frequently were equipment storage, channel realignment, nonmechanical bank or shoreline treatments, or other not specified (i.e., "other") in both monitoring periods, and temporary access routes in FY17/18 only. Most of the projects were performed to achieve

**Table 39.—**Number of AqEco B evaluations completed in FY15/16 (n=62 evaluations) and FY17/18 (n=58 evaluations), by region and waterbody type (AqEco B-Q22). Projects may have involved multiple waterbodies.

| Monitoring period | Region | Stream/ river | Pond | Lake | Wetland/ wet meadow | Estuary | Other | Multiple waterbody types selected |
|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | |
| | 1 | 10 | | | | | | |
| | 2 | 9 | | | 3 | | | 3 |
| | 3 | 3 | 1 | | 2 | | 2 | 2 |
| | 4 | | | | | | | |
| | 5 | 6 | | | 3 | | | 3 |
| | 6 | 14 | 2 | 1 | 2 | | | 4 |
| | 8 | 6 | | 1 | 2 | | | 1 |
| | 9 | 5 | | | 1 | | 1 | |
| | 10 | 1 | | | | | | |
| | All | 54 | 3 | 2 | 13 | 0 | 3 | 13 |
| FY17/18 | | | | | | | | |
| | 1 | 3 | | | | | | |
| | 2 | 7 | 1 | | 5 | | | 4 |
| | 3 | 3 | 1 | | 2 | | | 2 |
| | 4 | 1 | | | | | | |
| | 5 | 7 | | 1 | 9 | | | 5 |
| | 6 | 15 | | 1 | 2 | | | 2 |
| | 8 | 3 | | 1 | | | | |
| | 9 | 4 | 1 | 1 | 1 | | 1 | 1 |
| | 10 | 3 | | 1 | | | | 1 |
| | All | 46 | 3 | 5 | 19 | 0 | 1 | 15 |

**Table 40.—**Number in AqEco B evaluations completed in FY15/16 (n=62 evaluations) and FY17/18 (n=58 evaluations), by region and features or activities (AqEco B-Q25) included in project. Projects often had many features or activities.

| Monitoring period/ region | Temporary access routes | Excavation | Equipment storage | Revegeta-tion | Physical erosion control measures | Channel realignment | Mechanical treatments[a] | Non-mechanical treatments[a] | In-waterbody structural treatments | Other | Multiple features selected |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | | | |
| 1 | 6 | 8 | 5 | 8 | 6 | 5 | 7 | 2 | 7 | | 8 |
| 2 | 3 | 5 | | 4 | 4 | 3 | 5 | 5 | 3 | 2 | 7 |
| 3 | 5 | 4 | 2 | 5 | 6 | | 3 | 3 | 5 | 1 | 6 |
| 4 | | | | | | | | | | | |
| 5 | 4 | 4 | 4 | 3 | 2 | 1 | 1 | 1 | 3 | 3 | 5 |
| 6 | 8 | 8 | 5 | 10 | 8 | 1 | 8 | 6 | 14 | 3 | 13 |
| 8 | 4 | 5 | 3 | 6 | 6 | 3 | 4 | 4 | 4 | 1 | 6 |
| 9 | 4 | 6 | 2 | 4 | 3 | 3 | 6 | 2 | 7 | 1 | 7 |
| 10 | | | | | | | | | 1 | 1 | 1 |
| All | 34 | 40 | 21 | 40 | 35 | 16 | 34 | 23 | 44 | 12 | 53 |
| FY17/18 | | | | | | | | | | | |
| 1 | 1 | 2 | 1 | 3 | 3 | 2 | 3 | 2 | 2 | | 3 |
| 2 | 1 | 6 | 4 | 4 | 7 | 2 | 2 | 4 | 5 | 3 | 8 |
| 3 | | 2 | 1 | 4 | 1 | | | 1 | 1 | | 2 |
| 4 | | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | | 1 |
| 5 | 3 | 3 | 3 | 8 | 4 | 1 | 4 | 2 | 6 | 4 | 8 |
| 6 | 9 | 8 | 4 | 9 | 7 | 3 | 7 | 2 | 15 | 3 | 14 |
| 8 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 1 | 3 | | 4 |
| 9 | 2 | 6 | 3 | 5 | 3 | 1 | 4 | | 3 | 1 | 6 |
| 10 | 1 | 1 | 1 | 1 | 1 | | 1 | 2 | 3 | 2 | 3 |
| All | 18 | 32 | 20 | 38 | 30 | 12 | 25 | 14 | 39 | 13 | 49 |

[a] Streambank or shoreline treatments.

multiple objectives, with the most common objective overwhelmingly being aquatic habitat improvement (Table 41). Wetland/wet meadow construction was an objective in just over 10 percent of projects.

Interestingly, the method used to accomplish AqEco B projects was most frequently reported as "other" rather than one of the more traditional methods listed (see AqEco B-Q24) (Fig. 19), and most of the "other" responses involved agreements or partnerships. Six projects that answered "other" indicated that the work was done using Forest Service employees, so presumably that mechanism would have been identified as force account (agency personnel and equipment). Construction contracts in FY15/16 and force accounts in FY17/18 were the next most used instruments for AqEco B projects (Fig. 19).

**Table 41.—**Number of AqEco B evaluations completed in FY15/16 (n=62 evaluations) and FY17/18 (n=58 evaluations), by region and project objectives (AqEco B-Q23). Projects may have involved multiple objectives.

| Monitoring period/ region | Aquatic habitat improvement | Fish passage improvement | Riparian vegetation restoration | Channel improvement | Bank stabilization | Wetland/ wet meadow construction | Other | Multiple objectives selected |
|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | |
| 1 | 6 | 3 | 6 | 5 | 5 | 1 | 3 | 6 |
| 2 | 2 | 3 | 5 | 4 | 3 | 2 | | 4 |
| 3 | 4 | | 4 | 2 | 5 | | 1 | 5 |
| 4 | | | | | | | | |
| 5 | 5 | 2 | 3 | 1 | 3 | 1 | | 5 |
| 6 | 14 | 5 | 8 | 7 | 4 | 1 | 4 | 12 |
| 8 | 7 | 2 | 4 | 4 | 5 | 1 | 1 | 6 |
| 9 | 7 | | 1 | 2 | 3 | 1 | 1 | 5 |
| 10 | 1 | 1 | | 1 | | | 1 | 1 |
| All | 46 | 16 | 31 | 26 | 28 | 7 | 11 | 44 |
| FY17/18 | | | | | | | | |
| 1 | 1 | 1 | 2 | 1 | 2 | | 1 | 2 |
| 2 | 6 | 4 | 4 | 4 | 2 | 3 | | 8 |
| 3 | 3 | | 3 | 1 | 1 | 1 | 1 | 4 |
| 4 | 1 | 1 | 1 | 1 | 1 | | | 1 |
| 5 | 5 | | 8 | 3 | 4 | 1 | 3 | 6 |
| 6 | 14 | 3 | 6 | 7 | 3 | | 1 | 10 |
| 8 | 3 | 1 | 1 | 2 | 3 | | | 3 |
| 9 | 3 | 3 | 2 | 4 | 3 | 1 | 1 | 4 |
| 10 | 3 | 1 | 2 | 1 | 2 | | 1 | 3 |
| All | 39 | 14 | 29 | 24 | 21 | 6 | 8 | 41 |

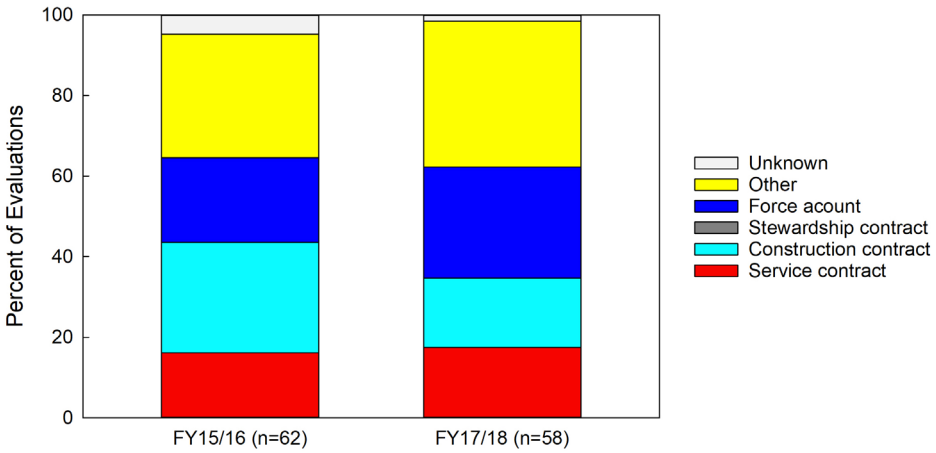



**Figure 19.—**Distribution of methods used to accomplish aquatic improvements (AqEco B-Q24) for evaluations completed in FY15/16 and FY17/18.

## Aquatic Ecosystems B: Implementation Results and Their Tie to Header Information

Project planning is assessed in the protocol using two questions:

- What type of planning document specified BMPs for the project (AqEco B-Q26)?
- Were all BMPs from that document included in the project contract or plan (AqEco B-Q27)?

The types of primary planning documents used are summarized in Table 42. Approximately equal numbers of CEs and EAs were used to complete AqEco B projects in FY15/16, while CEs were used twice as frequently as EAs in FY17/18 (Table 42). The majority of the remaining projects were completed without NEPA analysis, but they did employ BMPs derived from other sources. No significant relationship existed for the type of planning document used and location of the project ($p = 0.11$ FY15/16, $p = 0.16$ FY17/18), although the result in FY15/16 was very nearly significant (Fig. 20). The type of planning document used also was not significantly related to the method used to accomplish the improvement project in either monitoring period ($p = 0.52$ FY15/16, $p = 0.54$ FY17/18) (Table 43).

Table 44 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the planning documents or other BMP guidance documents are assigned, along with the information about whether all the BMPs in each provision were then carried into the project contract or plan. A "yes" indicates that there was at least one BMP in the planning or guidance documents applicable to the provision and all BMPs assigned to that provision were included in the project contract or plan. Conversely, a "no" indicates that at least one BMP applicable to the provision in the planning or guidance documents was not carried forward into the project contract or plan. "Not applicable" indicates that there were no BMPs in the planning or guidance documents applicable to the provision, so there was no obligation to carry them into the contract or plan. In the National BMP program, there is no expectation that every provision has BMPs

**Table 42.—**Number of AqEco B evaluations completed in FY15/16 and FY17/18, by region and type of primary planning document used (AqEco B-Q26)

| Monitoring period | Region | No planning document | EIS[a] | EA[b] | CE[c] | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | | 1 | 4 | 2 | |
| | 2 | 1 | | 1 | 3 | 3 |
| | 3 | | 1 | 1 | 3 | 1 |
| | 4 | | | | | |
| | 5 | | | 4 | 2 | |
| | 6 | | 1 | 3 | 8 | 2 |
| | 8 | | | 5 | | 3 |
| | 9 | | | 1 | 4 | 2 |
| | 10 | | | | | 1 |
| | All | 1 | 3 | 19 | 22 | 12 |
| | Percent | 2 | 5 | 33 | 39 | 21 |
| FY17/18 | | | | | | |
| | 1 | | | | 3 | |
| | 2 | | | 1 | 4 | 2 |
| | 3 | | | | 4 | |
| | 4 | | | 1 | | |
| | 5 | 2 | | 2 | 6 | 2 |
| | 6 | | | 7 | 4 | 3 |
| | 8 | | | | 3 | 1 |
| | 9 | | | 1 | 4 | 1 |
| | 10 | | | 2 | 1 | |
| | All | 2 | 0 | 14 | 29 | 9 |
| | Percent | 4 | | 26 | 54 | 17 |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.

assigned; consequently, the percentages for "yes" and "no" in the last two columns of each monitoring period of Table 44 are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

When a provision had at least one BMP prescription identified in the planning documents, all of those BMP prescriptions were included in the corresponding plan or contract in an average of 88 percent of projects in FY15/16 and 92 percent of projects in FY17/18 (Table 44). "Dewatering requirements," "temporary vegetative erosion control requirements," and "fencing" were the provisions in FY15/16 for which inclusion was below 80 percent, with the first two much closer to 80 percent than "fencing." In FY17/18 "fencing" also had the lowest percentage of inclusion. On average, BMPs were included in eight provisions per project in FY15/16 and seven provisions per project in FY17/18, with

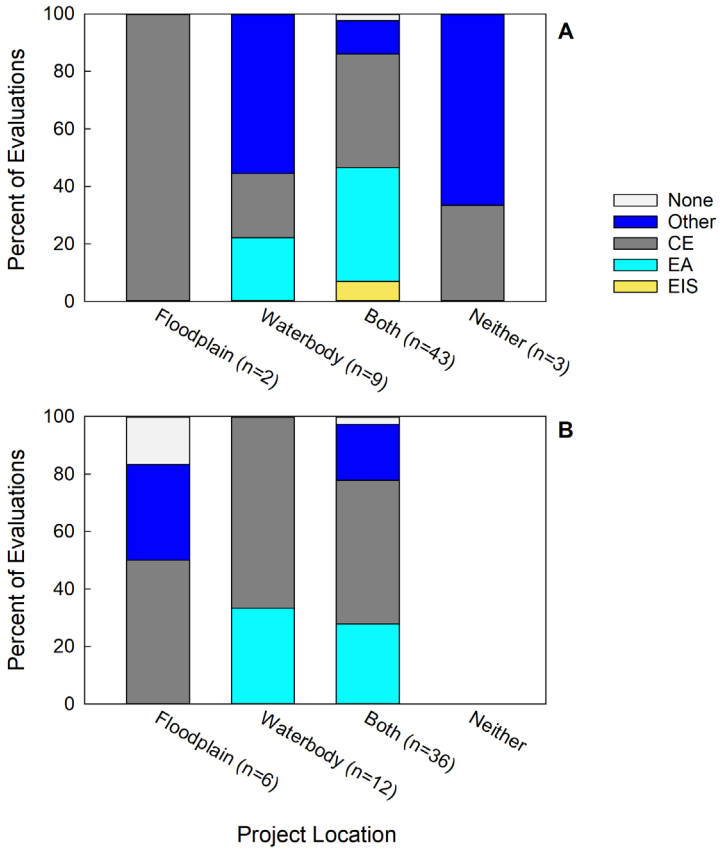



**Figure 20.—**Distribution of primary planning document type (AqEco B-Q26) by location where project activities were conducted (AqEco B-Q19 and AqEco B-Q20) for projects completed in FY15/16 (A) and FY17/18 (B). "Both" includes floodplain and in-waterbody work. EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

one project in each monitoring period including BMPs in all of the provisions and several projects including BMPs in 12 of the 13 provisions. The average number of provisions per project by type of planning document ranged from seven (CEs) to nine (EISs and EAs) in FY15/16 and from seven to eight in FY17/18. GLMM analysis (negative binomial distribution and log link function) found no significant differences ($p = 0.53$ FY15/16, $p = 0.67$ FY17/18) between the number of BMP provisions included and the source of BMPs (i.e., type of NEPA document and guidance documents in the absence of NEPA analysis; projects with no BMPs ["none" in Table 42] were excluded from the statistical analysis). When the percentage of BMP provisions included in the contract or plan was compared by type of planning document, projects in FY15/16 averaged 87 to 93 percent of provisions included. In FY17/18 projects using CEs and EAs averaged 95 and 98 percent of provisions included, while projects using other types of source documents averaged 76 percent of provisions included. No significant differences were found in percentage of BMP provisions included by type of planning document in either monitoring period ($p = 0.71$ FY15/16, $p = 0.42$ FY17/18; Kruskal-Wallis test).

**Table 43.—**Number of AqEco B evaluations completed in FY15/16 and FY17/18, by method used to accomplish the project (AqEco B-Q24) and type of primary planning document used (AqEco B-Q26)

| Monitoring period | Method | No planning document | EIS[a] | EA[b] | CE[c] | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | Service contract | | | 5 | 4 | 1 |
| | Construction contract | | 3 | 4 | 5 | 4 |
| | Stewardship contract | | | | | |
| | Force account | | | 3 | 7 | 2 |
| | Other | 1 | | 7 | 6 | 5 |
| | All | 1 | 3 | 19 | 22 | 12 |
| | Percent | 2 | 5 | 33 | 39 | 21 |
| FY17/18 | | | | | | |
| | Service contract | | | 4 | 6 | |
| | Construction contract | | | 2 | 3 | 3 |
| | Stewardship contract | | | | | |
| | Force account | | | 3 | 10 | 2 |
| | Other | 2 | | 5 | 10 | 4 |
| | All | 2 | | 14 | 29 | 9 |
| | Percent | 4 | | 26 | 54 | 17 |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.

It is possible that additional BMPs applicable to the project were not in the planning documents but were in the project contract or plan; such BMPs may be associated with standard contract language for the specific type of project or resource. Additional BMPs applicable to all provisions were identified in the contracts or plans in FY15/16 and for 8 of 13 provisions in FY17/18 (Table 45). These BMPs were most frequently related to timing and scheduling and access routes.

On average, applicable BMPs were implemented fully for 91 and 93 percent of projects in FY15/16 and FY17/18, respectively (Table 46). Applicable in this context means only those BMPs that were included in the project contract or plan; those that were identified during planning but were not included in the contract or plan are not considered applicable (thus values in Tables 44 and 46 differ). As with the percentages in Table 44, those in Table 46 were calculated only from the "yes" and "no" counts. "Fencing" requirements in both monitoring periods and "dewatering requirements" in FY17/18 were the only provisions for which full implementation occurred in less than 80 percent of projects. Implementation of temporary and permanent vegetative erosion control requirements were just above 80 percent in one or both monitoring periods. The average number of provisions that were implemented fully did differ significantly among methods used to

**Table 44.—**Frequencies at which BMPs in provisions were included in the project contract or plan (AqEco B-Q27) for AqEco B evaluations completed in FY15/16 (n=56 evaluations) and FY17/18 (n=52 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision[a] to which prescribed BMP is applicable | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[b] (number) | FY15/16 Yes (percent[c]) | FY15/16 No (percent[c]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Timing and scheduling of improvements | 48 | 2 | 4 | 96 | 4 | 46 | 1 | 3 | 98 | 2 |
| Location of access routes for vehicle travel | 37 | 1 | 15 | 97 | 3 | 29 | 2 | 19 | 94 | 6 |
| Construction techniques and treatments for access routes | 37 | 3 | 13 | 93 | 8 | 30 | 1 | 19 | 97 | 3 |
| Placement and storage of excavated materials | 31 | 2 | 20 | 94 | 6 | 27 | 1 | 22 | 96 | 4 |
| Construction methods to reduce disturbance, erosion, or sedimentation | 45 | 2 | 7 | 96 | 4 | 43 | 1 | 6 | 98 | 2 |
| Location and/or limiting the extent of floodplain disturbances | 42 | 0 | 13 | 100 | 0 | 35 | 1 | 14 | 97 | 3 |
| Location and/or limiting the extent of waterbody disturbances | 43 | 2 | 8 | 96 | 4 | 38 | 1 | 11 | 97 | 3 |
| Waterbody stabilization techniques | 30 | 5 | 17 | 86 | 14 | 29 | 2 | 19 | 94 | 6 |
| Dewatering requirements | 18 | 5 | 27 | 78 | 22 | 20 | 5 | 25 | 80 | 20 |
| Temporary vegetative erosion control requirements | 21 | 7 | 24 | 75 | 25 | 23 | 0 | 27 | 100 | 0 |
| Permanent vegetation/cover requirements | 37 | 6 | 10 | 86 | 14 | 32 | 2 | 16 | 94 | 6 |
| Nonvegetative erosion control requirements (permanent or temporary) | 32 | 5 | 17 | 86 | 14 | 28 | 2 | 20 | 93 | 7 |
| Fencing | 14 | 10 | 29 | 58 | 42 | 8 | 6 | 36 | 57 | 43 |
| Mean | 33 | 4 | 16 | 88 | 12 | 30 | 2 | 18 | 92 | 8 |

[a] Listed provision had at least one BMP from decision document or guidance document included in project contract or plan.
[b] Not applicable (NA) because no prescribed BMPs were associated with the provision.
[c] Percent calculated from "yes" and "no" counts.

**Table 45.—**Frequencies at which BMPs to protect water, aquatic, and riparian resources were derived from project contract or plan language and not from BMPs in NEPA documents or other BMP guidance documents for AqEco B evaluations completed in FY15/16 (n=57 evaluations) and FY17/18 (n=54 evaluations)

| Provision | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Timing and scheduling of improvements | 3 | 5 | 5 | 9 |
| Location of access routes for vehicle travel | 6 | 11 | | |
| Construction techniques and treatments for access routes | 4 | 7 | | |
| Placement and storage of excavated materials | 4 | 7 | | |
| Construction methods to reduce disturbance, erosion, or sedimentation | 1 | 2 | | |
| Location and/or limiting the extent of floodplain disturbances | 2 | 4 | 2 | 4 |
| Location and/or limiting the extent of waterbody disturbances | 1 | 2 | 2 | 4 |
| Waterbody stabilization techniques | 3 | 5 | 2 | 4 |
| Dewatering requirements | 3 | 5 | 3 | 6 |
| Temporary vegetative erosion control requirements | 1 | 2 | | |
| Permanent vegetation/cover requirements | 4 | 7 | 3 | 6 |
| Nonvegetative erosion control requirements (permanent or temporary) | 3 | 5 | 2 | 4 |
| Fencing | 3 | 5 | 1 | 2 |

accomplish the project in both monitoring periods ($p < 0.01$ FY15/16, $p = 0.06$ FY17/18; GLMM with negative binomial distribution and log link function). Least squares means probability of significant difference tests among methods used in FY15/16 indicated that projects accomplished with construction contracts had significantly more provisions implemented fully than projects accomplished by other methods. In FY17/18 projects using construction contracts again had a higher number of provisions implemented fully compared to projects using service contracts or other methods but not those using force accounts. No significant differences were found in percentage of BMP provisions implemented fully by method used to accomplish the project in FY15/16 ($p = 0.67$, Kruskal-Wallis test). Projects using force accounts had 96 percent of BMP provisions implemented fully, while those accomplished by contracts or other methods had 86 to 93 percent of provisions implemented fully on average. In FY17/18 there was a significant difference in percentage of BMPs implemented fully by method used to accomplish the project ($p = 0.04$, Kruskal-Wallis test); projects using force accounts had 100 percent of BMPs implemented fully, while projects using service and construction contracts had 85 and 95 percent implemented fully, respectively.

The number of provisions that were implemented fully did not differ significantly among types of planning documents in FY15/16 ($p = 0.90$, GLMM with negative binomial distribution and log link function; "none" in Table 42 was excluded from the statistical

**Table 46.—**Frequencies at which all BMPs in provisions included in the project contract or plan were implemented fully (AqEco B-Q28) for AqEco B evaluations completed in in FY15/16 (n=57 evaluations) and FY17/18 (n=54 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a] (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Timing and scheduling of improvements | 49 | 2 | 5 | 96 | 4 | 51 | 0 | 3 | 100 | 0 |
| Location of access routes for vehicle travel | 41 | 2 | 13 | 95 | 5 | 29 | 0 | 24 | 100 | 0 |
| Construction techniques and treatments for access routes | 40 | 1 | 14 | 98 | 2 | 30 | 0 | 23 | 100 | 0 |
| Placement and storage of excavated materials | 35 | 0 | 20 | 100 | 0 | 27 | 0 | 25 | 100 | 0 |
| Construction methods to reduce disturbance, erosion, or sedimentation | 45 | 1 | 9 | 98 | 2 | 41 | 2 | 9 | 95 | 5 |
| Location and/or limiting the extent of floodplain disturbances | 42 | 2 | 13 | 95 | 5 | 36 | 1 | 15 | 97 | 3 |
| Location and/or limiting the extent of waterbody disturbances | 42 | 2 | 12 | 95 | 5 | 40 | 0 | 13 | 100 | 0 |
| Waterbody stabilization techniques | 30 | 3 | 22 | 91 | 9 | 30 | 1 | 21 | 97 | 3 |
| Dewatering requirements | 19 | 2 | 32 | 90 | 10 | 16 | 7 | 29 | 70 | 30 |
| Temporary vegetative erosion control requirements | 18 | 4 | 31 | 82 | 18 | 21 | 1 | 29 | 95 | 5 |
| Permanent vegetation/cover requirements | 34 | 7 | 14 | 83 | 17 | 29 | 6 | 17 | 83 | 17 |
| Nonvegetative erosion control requirements (permanent or temporary) | 32 | 3 | 20 | 91 | 9 | 30 | 0 | 21 | 100 | 0 |
| Fencing | 11 | 6 | 38 | 65 | 35 | 7 | 2 | 42 | 78 | 22 |
| Mean | 34 | 3 | 19 | 91 | 9 | 30 | 2 | 21 | 93 | 7 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.
[b] Percent calculated from "yes" and "no" counts.

analysis because the project had no BMPs) but did differ significantly in FY17/18 ($p = 0.06$). Mean numbers of provisions implemented fully ranged from seven to nine in both monitoring periods for projects with planning documents. For the two projects in FY17/18 without planning documents where BMPs were derived from standard contract or plan language, fewer than two provisions per project were implemented fully, which was significantly lower than all other types of planning documents. However, no significant differences were found in percentage of BMP provisions implemented fully by type of planning document in either monitoring period ($p = 0.29$ FY15/16, $p = 0.15$ FY17/18; Kruskal-Wallis test). Percentages of BMP provisions implemented fully ranged from 89 percent for other types of planning documents to 95 percent for CEs in FY15/16 and from 92 percent for CEs to 100 percent for EAs and projects without planning documents in FY17/18.

Two implementation questions, AqEco B-Q30 and AqEco B-Q31, evaluate whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, if inspections occurred at critical times when resources are most susceptible to negative effects from the project (Table 47) and whether corrective actions were taken if problems occurred during project implementation (at any time, not just critical times) (Table 48). Critical times include times that work is conducted in the waterbody, periods associated with large or intense precipitation/runoff events, or other times or locations that the potential for the circumstances to result in water quality impacts is high. Responses indicate that 77 percent of projects in FY15/16

**Table 47.—**Distribution of whether project inspections or contract administration occurred at critical times (AqEco B-Q30) for AqEco B evaluations completed in FY15/16 and FY17/18

| Project inspections or contract administration occurred at critical times | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No inspections | 0 | | 0 | |
| Not applicable; work avoided critical times | 13 | 23 | 16 | 31 |
| Yes | 44 | 77 | 32 | 67 |
| No | 0 | | 1 | 2 |
| All | 57 | | 52 | |

**Table 48.—**Distribution of whether corrective actions (CA) were taken if problems occurred during operations (AqEco B-Q31) for AqEco B evaluations completed in FY15/16 and FY17/18

| Corrective actions during implementation evaluations | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No problems; no CA needed | 42 | 74 | 42 | 78 |
| CA needed but not taken | 1 | 2 | 0 | |
| CA needed and implemented | 14 | 25 | 10 | 19 |
| Unknown | 0 | | 2 | 4 |
| All | 57 | | 54 | |

and 67 percent in FY17/18 were inspected during critical times. For all but one of the rest of the projects, work was performed to avoid critical times (Table 47). Almost all projects either had no problems requiring corrective actions, or corrective actions were implemented when needed (Table 48).

Because ground-disturbing activities in aquatic ecosystem projects often involve use of heavy equipment that may have occasional malfunctions or breakages such as hydraulic line breaks or oil leaks, an implementation question (AqEco B-Q32) considers how chemical spills and leaks were handled. Administrative units in the Forest Service have a contingency and emergency response plan (CERP) or equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in those cases the unit follows that state agency's procedures. Two evaluations reported that spills or leaks occurred during operations in FY15/16. One indicated the problem was addressed following the CERP procedures, and the other indicated that the CERP requirements were not followed (Table 49). One evaluation in FY17/18 also indicated a spill was not handled according to the unit's CERP procedures. A second evaluation reported the unit did not have a CERP.

## Aquatic Ecosystems B: Effectiveness Results and Their Tie to Implementation Results and Header Information

For projects where in-waterbody work, floodplain work, both in-waterbody and floodplain work, and effectiveness evaluations were performed, about 80 percent in each monitoring period showed no evidence of erosion, sedimentation, or unplanned waterbody morphology changes (AqEco B-Q37) (Table 50). There were no statistical differences in the lengths of waterbody and floodplain disturbances (AqEco B-Q21) across the categories of erosion, sedimentation, and waterbody morphology changes (AqEco B-Q37) ($p = 0.65$ FY15/16, $p = 0.42$ FY17/18; GLMM with lognormal distribution and identity link function) (Fig. 21), even though the mean length for projects in FY15/16 where no evidence was found was more than four times the mean for projects where evidence was found in either the floodplain or in the waterbody (Fig. 21).

**Table 49.—**Distribution of whether chemical or fuel spills and leaks, if they occurred during project implementation, were handled according to the unit's contingency and emergency response plan (or its equivalent) (AqEco B-Q32) for AqEco B evaluations completed in FY15/16 and FY17/18

| Chemical or fuel spills and leaks handled according to the unit's contingency and emergency response plan | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No contingency and emergency response plan | 0 | | 1 | 2 |
| No spills or leaks | 55 | 96 | 52 | 96 |
| Yes; according to contingency and emergency response plan | 1 | 2 | 0 | |
| No; not according to contingency and emergency response plan | 1 | 2 | 1 | 2 |
| All | 57 | | 54 | |

**Table 50.**—Evidence of erosion or sedimentation or unplanned changes to waterbody morphology from project activities observed during effectiveness monitoring (AqEco B-Q37) for AqEco B evaluations completed in FY15/16 and FY17/18. If evidence is observed both within the floodplain and in the waterbody, only evidence in the waterbody is reported.

| Evidence observed | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No evidence | 44 | 79 | 46 | 82 |
| Within floodplain | 5 | 9 | 5 | 9 |
| In waterbody | 7 | 12 | 5 | 9 |

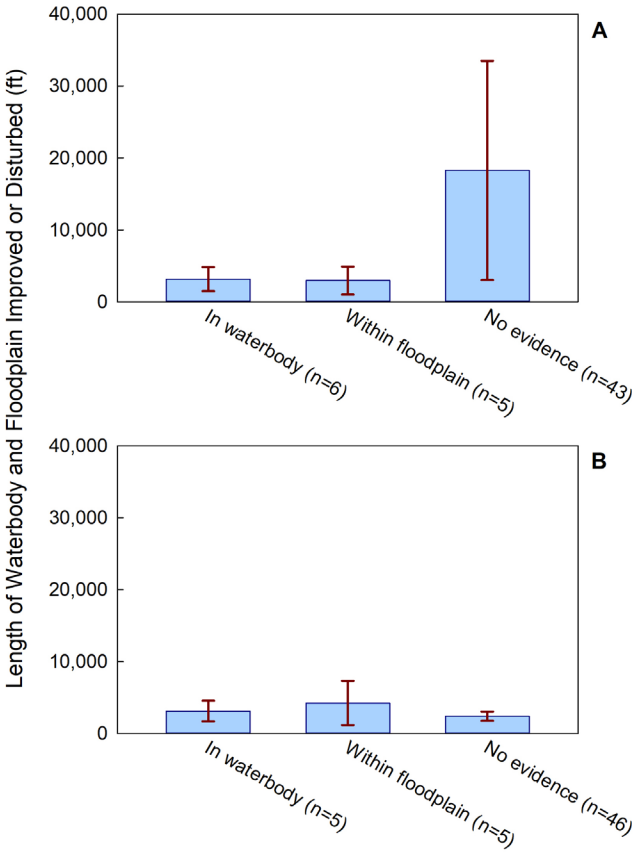



**Figure 21.**—Mean length of waterbody and floodplain disturbed (with standard error bars) during the project (AqEco B-Q21) associated with evidence of disturbance (AqEco B-Q37; disturbance includes erosion, sedimentation, unintended channel morphology changes, or substrate changes) for projects completed in FY15/16 (A) and FY17/18 (B).

Question AqEco B-Q16 characterizes the weather conditions associated with the evaluation to assist in determining whether evidence of damage to bank, substrate, or morphology changes for in-water actions, or uncontrolled erosion and sediment transport during floodplain work are masked during dry weather conditions. Wet weather conditions, if found to be important for observing effects, are expected to be most associated with erosion and sediment transport outside a waterbody, which result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. Eighteen AqEco B evaluations in FY15/16 and 13 in FY17/18 occurred during or just after wet conditions.

Although the number of projects for which no evidence was found is much larger than for the other two categories (Fig. 22), for all categories of evidence, the percentages of effectiveness monitoring done during wet and dry weather was similar in FY15/16 (Fig. 22A). No statistically significant association was found between categories of evidence of erosion and weather conditions (i.e., wet versus dry conditions) in FY15/16 ($p = 0.77$). There was a significant association found in FY17/18 ($p = 0.09$), even though evaluations that observed the most severe evidence (i.e., in the waterbody) all occurred during dry conditions (Fig. 22B). These results in both monitoring periods do not support the supposition that evidence of erosion, sedimentation, or channel morphology changes are easier to identify during wet conditions than during dry conditions.

Vegetation establishment on disturbed soils has long been acknowledged to be a superior erosion control BMP (Edwards et al. 2016), and ground cover standards are often prescribed for projects involving soil disturbance. AqEco B evaluations assess ground

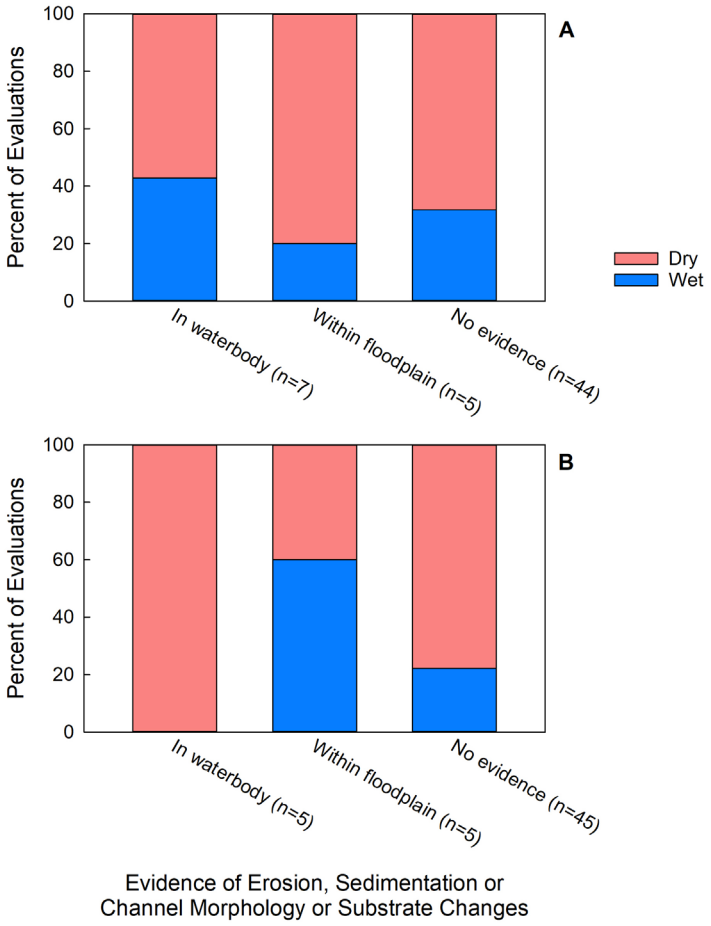



**Figure 22.—**Weather conditions during or within 24 hours before effectiveness evaluation (AqEco B-Q16) versus evidence of erosion, sedimentation, or changes to waterbody morphology (AqEco B-Q37) for projects completed in FY15/16 (A) and FY17/18 (B).

cover separately for waterbody banks or shorelines (AqEco B-Q38; Table 51) and on floodplains (AqEco B-Q39; Table 52). Almost the same number of projects had ground cover standards for banks/shorelines and for floodplains in both monitoring periods (i.e., sum of "yes" and "no" answers in Tables 51 and 52, respectively). When ground cover standards existed, they were met about 85 percent of the time (Tables 51 and 52). Significant associations were found in both monitoring periods between implementation of provisions for permanent vegetation/cover requirements (AqEco B-Q28) and attainment of permanent ground cover standards on both banks/shorelines (AqEco B-Q38) ($p < 0.001$ FY15/16, $p = 0.04$ FY17/18) and on floodplains (AqEco B-Q39) ($p < 0.001$ FY15/16, $p = 0.09$ FY17/18) (Figs. 23 and 24, respectively). Standards were met at much greater percentages when provisions related to permanent ground cover were implemented fully.

**Table 51.—**Distribution of whether project standards for ground cover were met on waterbody banks or shorelines (AqEco B-Q38) for AqEco B evaluations completed in FY15/16 and FY17/18

| Project standards for ground cover were met on waterbody banks or shorelines | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Not applicable; banks or shorelines not part of project | 5 | 9 | 8 | 14 |
| Not applicable; no project standards for ground cover | 9 | 16 | 10 | 18 |
| Yes; standards met | 36 | 64 | 32 | 57 |
| No; standards not met, due to project | 4 | 7 | 3 | 5 |
| No; standards not met, unclear if due to project | 1 | 2 | 1 | 2 |
| No; standards not met, not due to project | 1 | 2 | 2 | 4 |

**Table 52.—**Distribution of whether project standards for ground cover were met on treated floodplains (AqEco B-Q39) for AqEco B evaluations completed in FY15/16 and FY17/18

| Project standards for ground cover were met on treated floodplains | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Not applicable; floodplain treatments not part of project | 9 | 16 | 8 | 14 |
| Not applicable; no project standards for ground cover | 8 | 14 | 13 | 23 |
| Yes; standards met | 34 | 61 | 29 | 52 |
| No; standards not met, due to project | 3 | 5 | 3 | 5 |
| No; standards not met, unclear if due to project | 1 | 2 | 0 | |
| No; standards not met, not due to project | 1 | 2 | 3 | 5 |

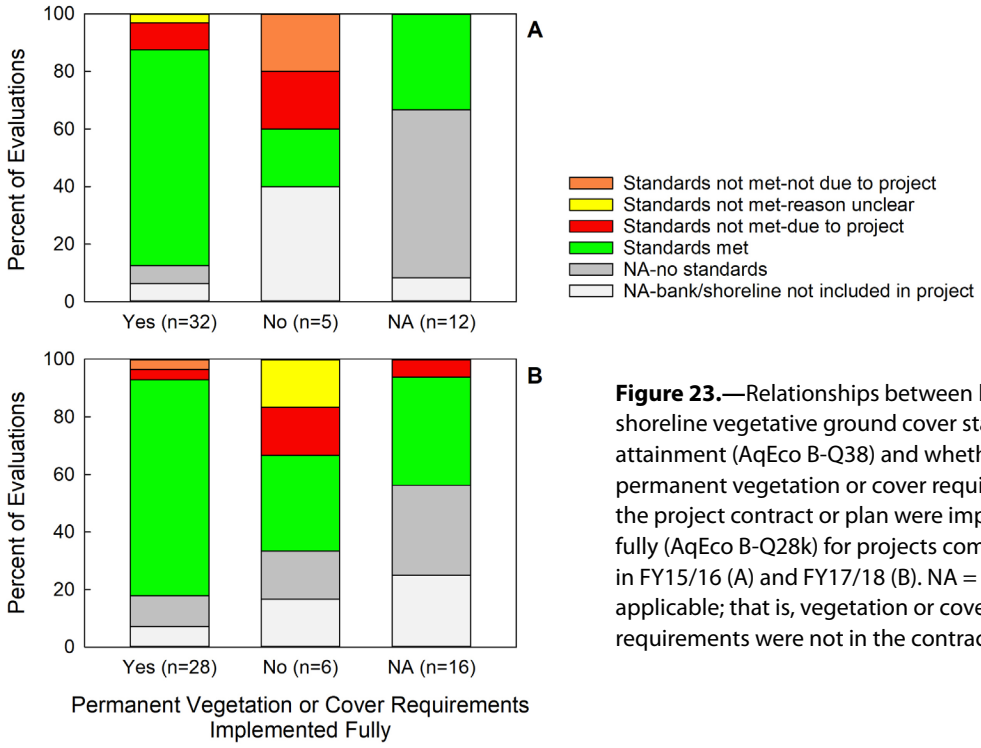



**Figure 23.—**Relationships between bank/shoreline vegetative ground cover standard attainment (AqEco B-Q38) and whether permanent vegetation or cover requirements in the project contract or plan were implemented fully (AqEco B-Q28k) for projects completed in FY15/16 (A) and FY17/18 (B). NA = not applicable; that is, vegetation or cover requirements were not in the contract or plan.

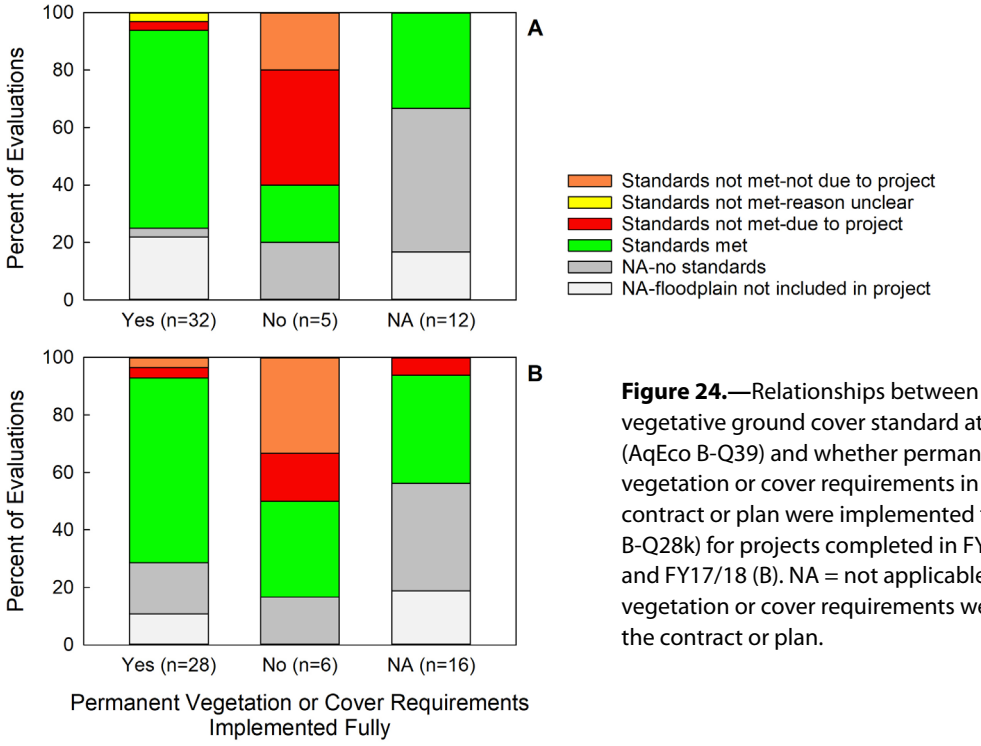



**Figure 24.—**Relationships between floodplain vegetative ground cover standard attainment (AqEco B-Q39) and whether permanent vegetation or cover requirements in the project contract or plan were implemented fully (AqEco B-Q28k) for projects completed in FY15/16 (A) and FY17/18 (B). NA = not applicable; that is, vegetation or cover requirements were not in the contract or plan.

Improvement objectives (AqEco B-Q29) were defined for 53 of the 57 AqEco B projects in FY15/16 and 43 of 54 projects in FY17/18, and most included multiple objectives (Table 41). Whether overall improvement objectives were met was assessed in AqEco B-Q40 during effectiveness monitoring. For AqEco B-Q29, 48 and 41 evaluations had a "yes" answer in FY15/16 and FY17/18, respectively, and they also answered AqEco B-Q40. Because multiple answer choices could be selected for each project (Table 53), determining which individual objectives were met (or not met) is not possible. Therefore, if any of the project objectives were not met, even if others were met, the answer to AqEco B-Q40 would be "no, objectives not met." That answer was given for one project in FY15/16 that included five of the seven objectives and thus accounted for all values in the "no" column of Table 53. Two evaluations in FY17/18 provided contradictory answers in AqEco B-Q29 and AqEco B-Q40—that the project had objectives ("yes" for AqEco B-Q29) and that the project did not have objectives ("not applicable" for AqEco B-Q40). As a result, all evaluations with project objectives in FY17/18 indicated those objectives were met (Table 53).

**Table 53.—**Distribution of project objectives (AqEco B-Q23) by whether project objectives were met (AqEco B-Q40) for projects having improvement objectives specified (AqEco B-Q29 was "yes") for AqEco B evaluations completed in FY15/16 (n=48 evaluations) and FY17/18 (n=41 evaluations). Multiple objectives could be reported for a project.

| Monitoring period | Project objectives | Number of effectiveness evaluations | Yes; objectives met (percent) | No; objectives not met (percent) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | Aquatic habitat improvement | 39 | 97 | 3 |
| | Fish passage improvement | 15 | 100 | |
| | Riparian vegetation restoration | 25 | 96 | 4 |
| | Channel improvement/realignment | 22 | 95 | 5 |
| | Bank stabilization | 23 | 96 | 4 |
| | Wetland/wet meadow construction | 6 | 83 | 17 |
| | Other | 8 | 100 | |
| FY17/18 | | | | |
| | Aquatic habitat improvement | 32 | 100 | |
| | Fish passage improvement | 7 | 100 | |
| | Riparian vegetation restoration | 21 | 100 | |
| | Channel improvement/realignment | 21 | 100 | |
| | Bank stabilization | 18 | 100 | |
| | Wetland/wet meadow construction | 5 | 100 | |
| | Other | 5 | 100 | |

In a similar approach, AqEco B-Q41 asks whether the project design and contract implementation were successful at improving aquatic conditions, floodplain conditions, or both aquatic and floodplain conditions as applicable. Measurable (i.e., quantifiable) or qualitative stated objectives may or may not have been specified in the planning documents or other related documents. If either was specified, it was used to answer AqEco B-Q41; if neither was specified, AqEco B-Q41 was answered based on consensus professional judgment by the review team. Almost 80 percent of the projects in FY15/16 and 62 percent of projects in FY17/18 included either measurable or stated objectives that were met (Table 54).

The presence of chemical spills, leaks, or chemical waste containers is determined during the effectiveness evaluations. All observations of chemical evidence are reported because the proximity to a waterbody is less meaningful for chemical contamination (i.e., waterbodies may be polluted via subsurface leaching of chemicals, even if the chemical evidence is observed in the floodplain). No evidence of chemical or fuel spills, leaks, or chemical containers was observable within or from the areas reviewed for the AqEco B evaluations in either monitoring period (Table 55).

**Table 54.—**Distribution of whether design and contract or plan as implemented were successful in improving aquatic or floodplain conditions (AqEco B-Q41) for AqEco B evaluations completed in FY15/16 and FY17/18

| Design and contract or plan as implemented were successful in improving conditions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Yes; based on measurable objectives | 10 | 18 | 18 | 32 |
| Yes; based on stated objectives | 34 | 61 | 17 | 30 |
| Yes; based on professional judgment | 10 | 18 | 20 | 36 |
| No; based on measurable objectives | 0 | | 0 | |
| No; based on stated objectives | 0 | | 0 | |
| No; based on professional judgment | 2 | 4 | 1 | 2 |

**Table 55.—**Evidence of chemical or fuel spills, leaks, or waste containers at the time of the effectiveness evaluation (AqEco B-Q42) for AqEco B evaluations completed in FY15/16 (n=56 evaluations) and FY17/18 (n=56 evaluations). Multiple selections were possible.

| Evidence | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| No evidence | 56 | 56 |
| Spills or leaks in area but not reaching a waterbody | | |
| Spills or leaks in a waterbody | | |
| Waste containers in area but not reaching a waterbody | | |
| Waste containers in a waterbody | | |

Inspections are an important part of projects involving construction or soil disturbance. The AqEco B protocol includes two questions about inspections, one in implementation (AqEco B-Q30) and one in effectiveness (AqEco B-Q43), that are designed to tie together. Respectively, they ask whether inspections were completed during critical times for the project (implementation), and whether lack of inspections during critical times (i.e., if implementation indicated a lack) influenced BMP effectiveness. Table 56 shows the relationship between those two questions for projects in which both implementation and effectiveness evaluations were completed within each monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Twelve percent of the evaluations in FY15/16 and 18 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remainder of the projects, administration was not lacking, or lack of administration during project implementation did not lead to observed problems in effectiveness (Table 56).

**Table 56.—**Number and distribution of project inspections or contract administration performed at critical times (AqEco B-Q30) in relationship to problems observed during effectiveness monitoring (AqEco B-Q43) for AqEco B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (12 and 18 percent of FY15/16 and FY17/18 responses, respectively).

| Monitoring period | Inspections/ administration at critical times (implementation) | Not applicable; inspections at critical times or work avoided critical times (effectiveness) | Yes; lack of administration led to observed problems (effectiveness) | No; lack of administration did not lead to observed problems (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | No inspections | | | |
| | Not applicable; work avoided critical times | 10 | | 2 |
| | Yes; inspections at critical times | 35 | | 4 |
| | No; inspections not at critical times | | | |
| FY17/18 | | | | |
| | No inspections | | | |
| | Not applicable; work avoided critical times | 11 | | 4 |
| | Yes; inspections at critical times | 28 | | 5 |
| | No; inspections not at critical times | | | 1 |

## Aquatic Ecosystems B: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

Overall, 56 and 67 percent of the projects were rated as *fully implemented*, and the combination of *fully implemented* and *mostly implemented* ratings included 74 and 78 percent of the AqEco B projects in FY15/16 and FY17/18, respectively (Fig. 25A, B). Similarly, BMP effectiveness ratings were generally high: 86 to 88 percent of the projects rated as *effective* or *mostly effective* (Fig. 25C, D).

AqEco B projects often included multiple features or activities (AqEco B-Q25) (Table 40). In FY15/16 the average project had five features or activities, and in FY17/18 the average project had four. Five of the 56 projects in FY15/16 and seven of the 56 projects in FY17/18 evaluated for effectiveness included just one feature or activity. Project

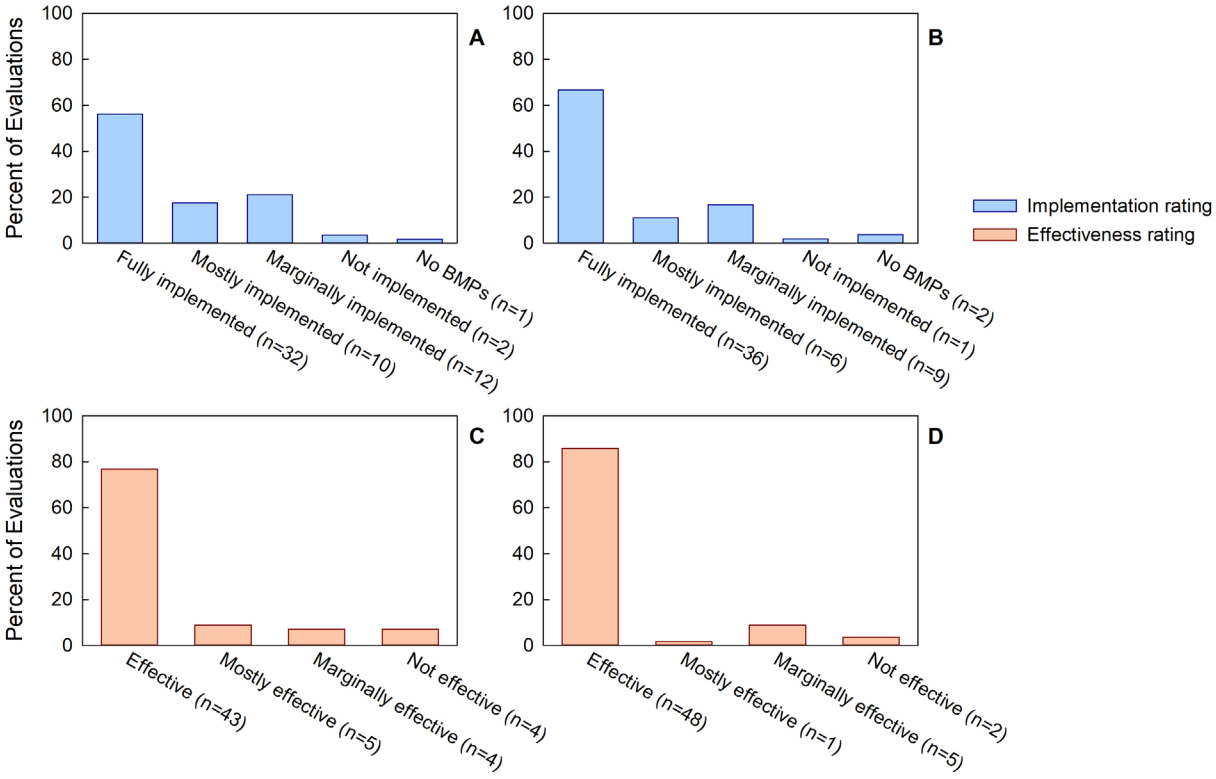



**Figure 25.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for AqEco B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

effectiveness appeared to be slightly poorer when equipment storage was part of the project in FY15/16 (Fig. 26A). However, this result can be difficult to interpret because of the multiple features or activities in most projects, and those involving equipment storage averaged six, one more than the average for all projects. To clarify these results, the number of features or activities that were included in a project were examined statistically in relation to the effectiveness ratings, and no significant differences were found ($p = 0.92$ FY15/16, $p = 0.87$ FY17/18; GLMM with negative binomial distribution and log link function).

The examination of ratings relative to project objectives (AqEco B-Q23) has the same complication because most projects were undertaken for multiple objectives (Table 41). For projects in which both implementation and effectiveness were evaluated, the

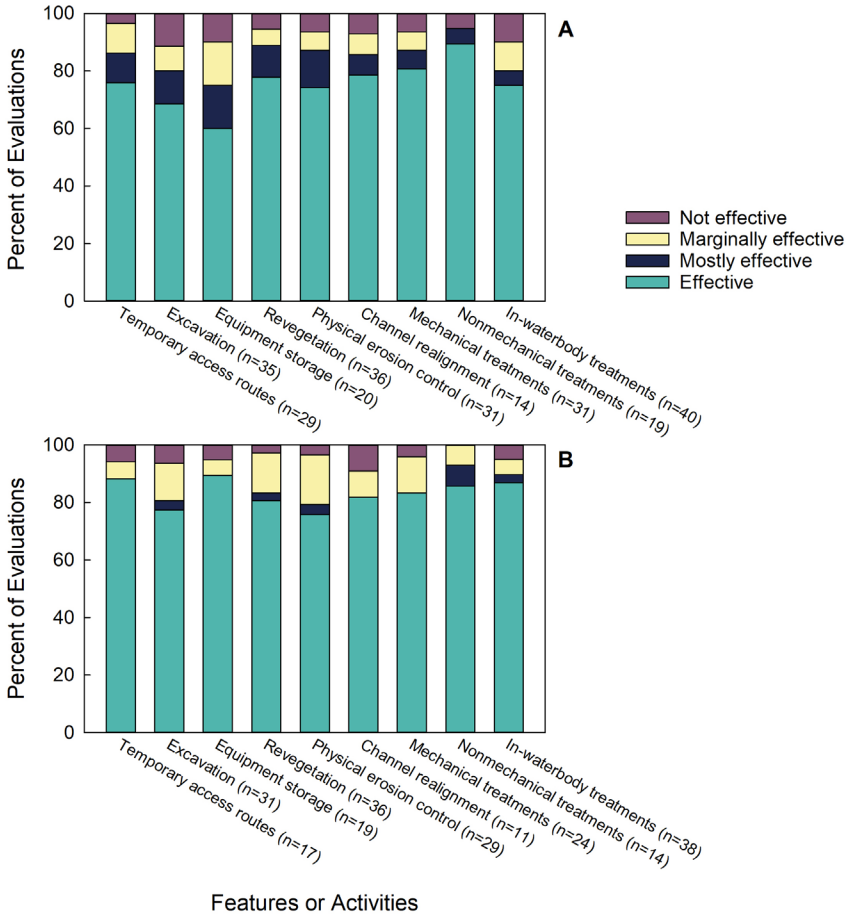



**Figure 26.—**Distribution of effectiveness ratings by features and activities included in the project (AqEco B-Q25) for evaluations completed in FY15/16 (A) and FY17/18 (B). The mechanical and nonmechanical treatments refer to streambank or shoreline treatments.

distributions of implementation and effectiveness ratings were fairly consistent by project objective except for wetland or wet meadow construction projects in FY15/16 (Fig. 27). GLMM analyses (negative binomial or Poisson distribution and log link function) between the implementation rating or effectiveness rating and the number of objectives showed no significant differences in the ratings as the number of objectives changed (implementation: p = 0.56 FY15/16, p = 0.60 FY17/18; effectiveness: p = 0.48 FY15/16, p = 0.79 FY17/18). Several different administrative methods were used to accomplish AqEco B projects (Fig. 28). There were no significant associations between the implementation ratings or effectiveness ratings and those methods in FY15/16 (p = 0.49 and p = 0.96, respectively). In FY17/18 a significant association existed between the implementation ratings and method (p = 0.05) (Fig. 28B) but not between the effectiveness ratings and method (p = 0.70) (Fig. 28D). Projects accomplished using force accounts and other methods (primarily partnerships) had better implementation ratings in FY17/18.

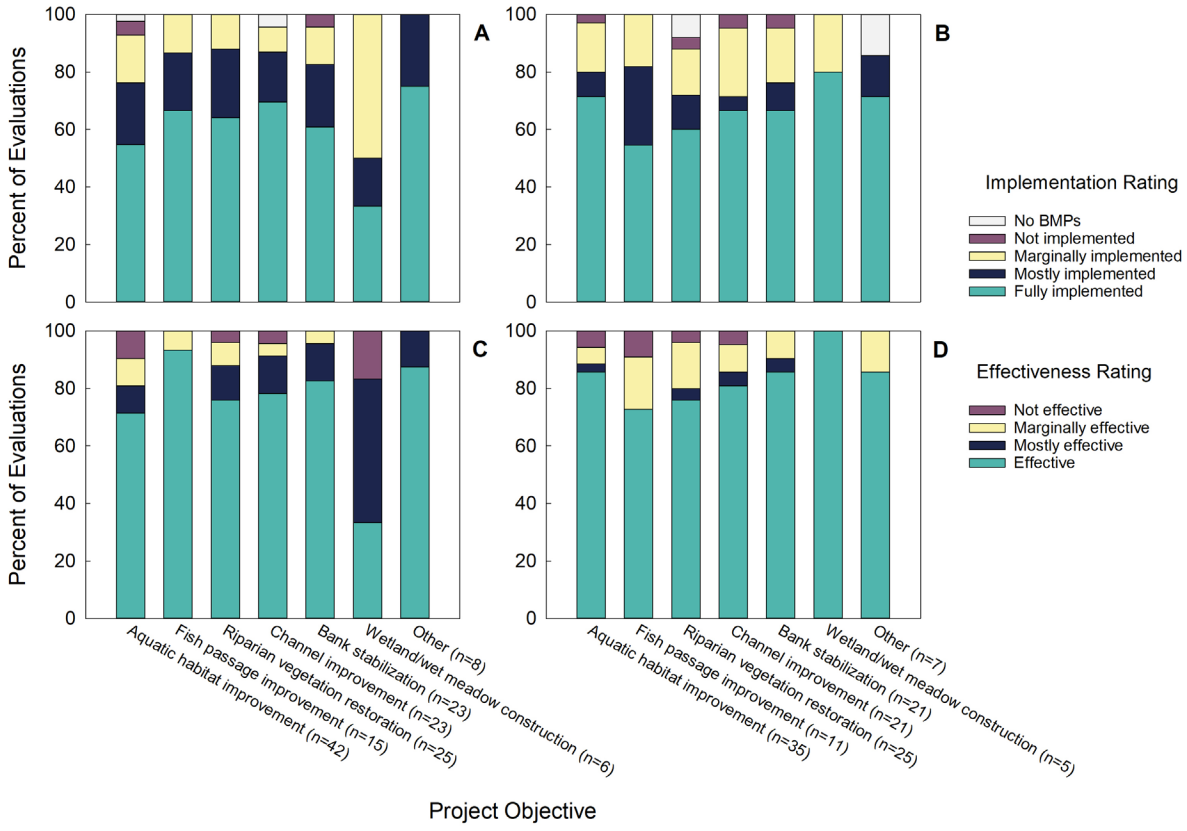



**Figure 27.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by project objective (AqEco B-Q23) for projects evaluated for both implementation and effectiveness in FY15/16 (A, C) and FY17/18 (B, D). Selection of multiple project objectives was permitted.

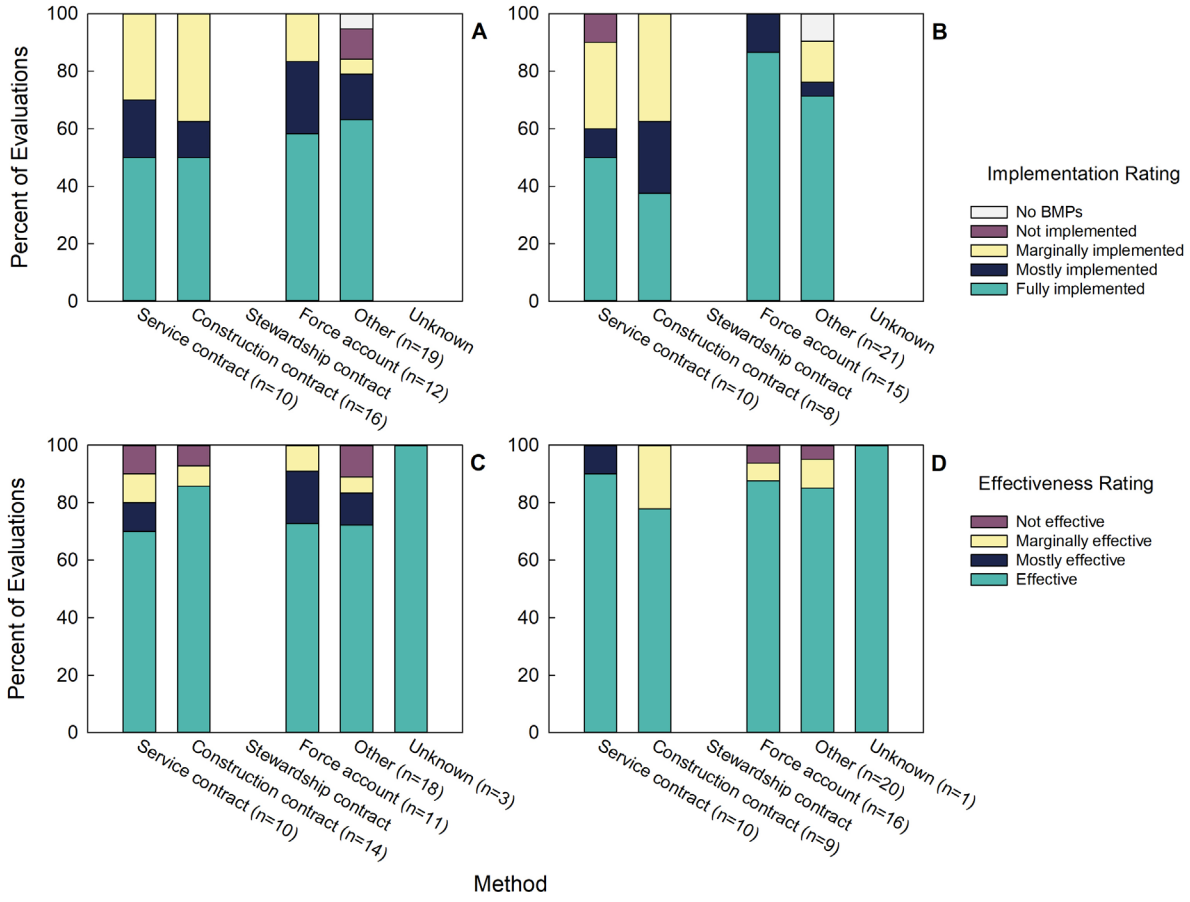



**Figure 28.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by method used to accomplish the project (AqEco B-Q24) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

Distributions of implementation ratings and effectiveness ratings by type of primary planning document are shown in Figure 29. The percentage of projects rated f*ully implemented* or *mostly implemented* combined is similar for most planning document categories in both monitoring periods (Fig. 29A, B), so it is not surprising that the type of planning document used for preparing AqEco B projects was not statistically associated with the implementation ratings ($p = 0.87$ FY15/16, $p = 0.41$ FY17/18). This analysis for implementation excluded projects for which no planning document was employed (i.e., "no planning document" answer choice for AqEco B-Q26 or alternatively "none" for Table 41) because that answer choice can result only in the single implementation rating *no BMPs*. There also were no significant associations between the primary planning document and the effectiveness ratings in either monitoring period ($p = 0.37$ FY15/16, $p = 0.26$ FY17/18) (Fig. 29C, D). But the sample sizes for the EIS and "none" categories are very small, so the statistical test results are probably controlled by the larger sample sizes for EAs, CEs, and other BMP guidance documents.

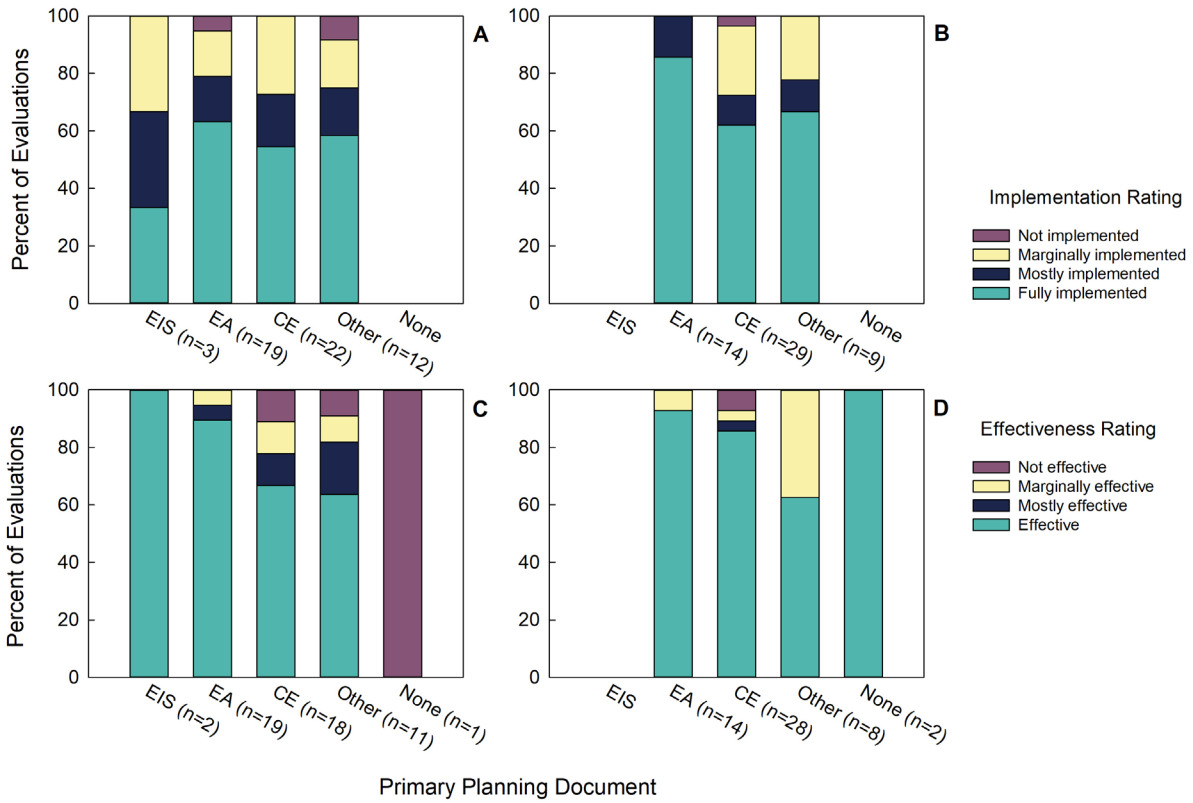



**Figure 29.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (AqEco B-Q26) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

Effectiveness ratings were not significantly associated with either the number of BMP provisions included in a project contract or plan (p = 0.71 FY15/16, p = 0.25 FY17/18; GLMM with negative binomial distribution and log link function) or with the number of BMP provisions implemented fully (p = 0.81 FY15/16, p = 0.41 FY17/18). There were significant differences in the percentages of BMP provisions included by rating in each monitoring period (p = 0.08 FY15/16, p = 0.09 FY17/18; Kruskal-Wallis test), although the test result was likely influenced by the small sample sizes for project ratings other than *effective* (Fig. 25C, D). Projects with ratings other than *marginally effective* in FY15/16 and *mostly effective* in FY17/18 averaged 91 to 98 percent of BMP provisions included, while projects with the other two ratings averaged 67 percent (FY15/16) and 23 percent (FY17/18) inclusion. Significant differences also existed in percentages of BMP provisions implemented fully by effectiveness rating (p = 0.08 FY15/16, p = 0.04 FY17/18; Kruskal-Wallis test). In FY15/16 projects rated *effective* averaged 94 percent of BMP provisions implemented fully, while those rated *mostly effective*, *marginally effective,* and *not effective* averaged 80, 87, and 69 percent, respectively. One project in FY17/18 that was rated *mostly effective* had no BMP provisions implemented fully and likely caused the statistical result; percentages of BMPs implemented fully ranged from 91 to 98 percent for all other effectiveness ratings. Excluding the project rated *mostly effective* resulted in a nonsignificant difference in those percentages (p = 0.35).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (AqEco B-Q16) were not associated with the effectiveness ratings (p = 0.38 FY15/16, p = 0.82 FY17/18) (Fig. 30). The number of evaluations conducted in wet weather was about half or less of that for dry weather; therefore, more evaluations under wet weather conditions are needed to determine if weather conditions are influential. However, relationships between weather conditions and field observations of erosion/sediment/morphological effects (e.g., Fig. 22) may provide more straightforward information about the influence of weather on site conditions and potential problems than associations between weather and ratings because ratings incorporate responses to multiple questions.

During the implementation portion of the evaluation, review of documents and inquiries with project administrators occur to determine whether corrective actions were taken if problems were experienced (AqEco B-Q31). While such actions can protect water quality and be reflected in an improvement in BMP effectiveness, no significant association was found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in either monitoring period (p = 0.12 FY15/16, p = 0.49 FY17/18; Fig. 31).

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based on what the review team observes and reports during the effectiveness evaluation at the project site.

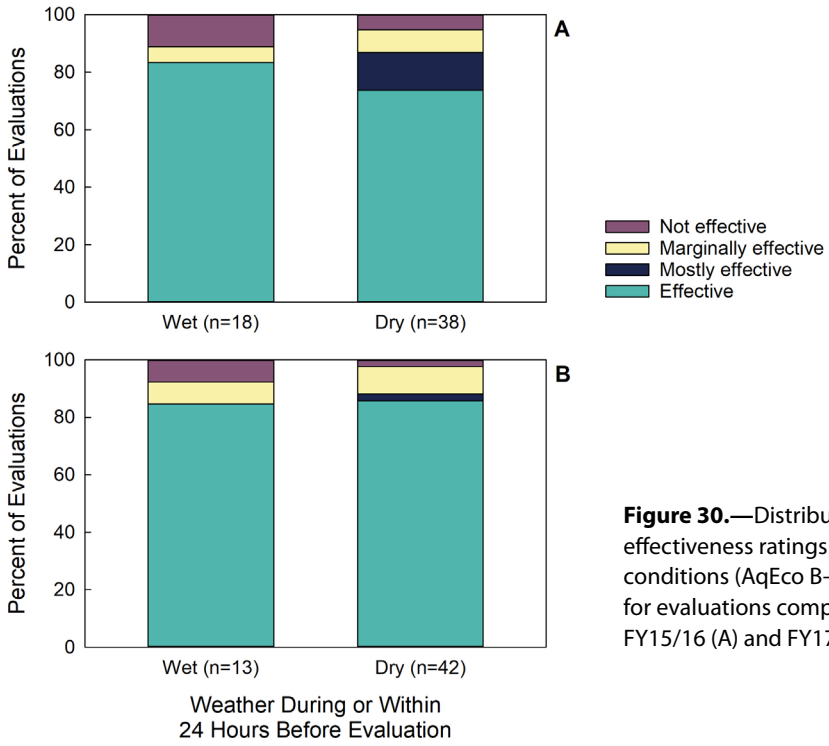



**Figure 30.—**Distribution of effectiveness ratings by weather conditions (AqEco B-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

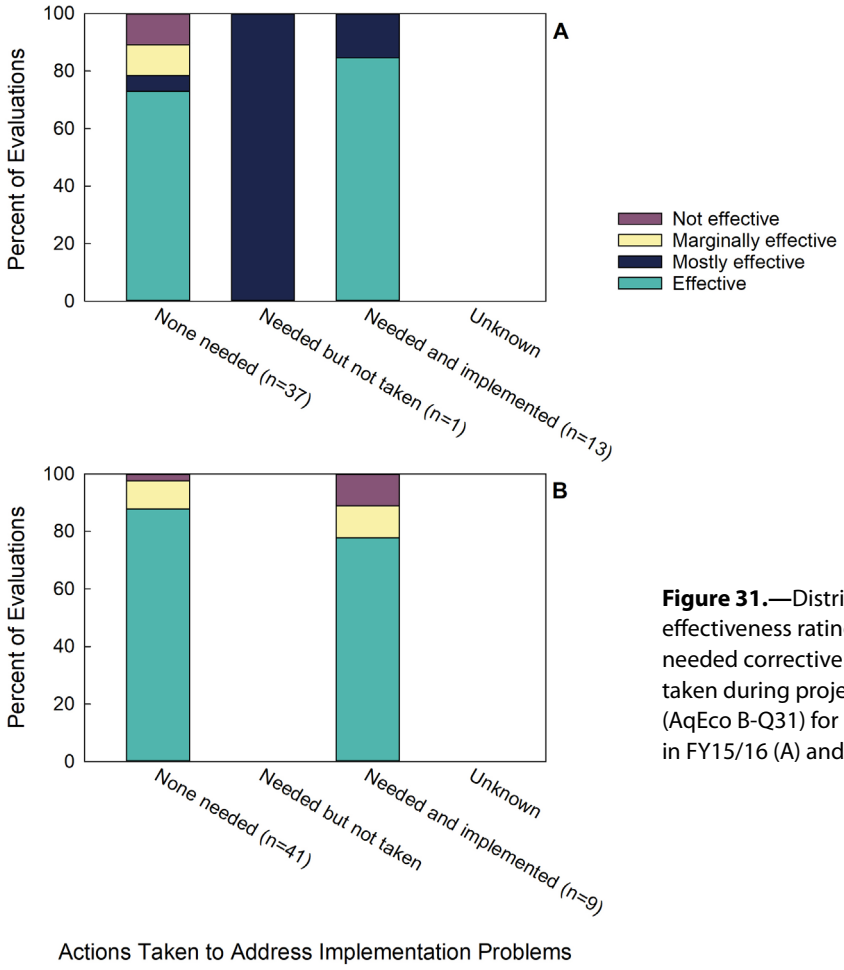



**Figure 31.—**Distribution of effectiveness ratings by whether needed corrective actions were taken during project implementation (AqEco B-Q31) for projects completed in FY15/16 (A) and FY17/18 (B).

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site in question. Corrective actions for implementation include actions to improve implementation for the project or site, while corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not including all the BMPs identified during planning in project contracts, while adaptive management actions for effectiveness may involve terminating the prescription of a more conventional BMP that consistently underperforms and replacing it in all future projects with a BMP that has been shown to provide better water quality protection.

The number projects for which actions were identified as being needed for implementation and effectiveness was about one-quarter to one-third the number for which no actions were needed; this held for both corrective actions and adaptive management actions (Figs. 32 and 33, respectively). One project in FY15/16 and two

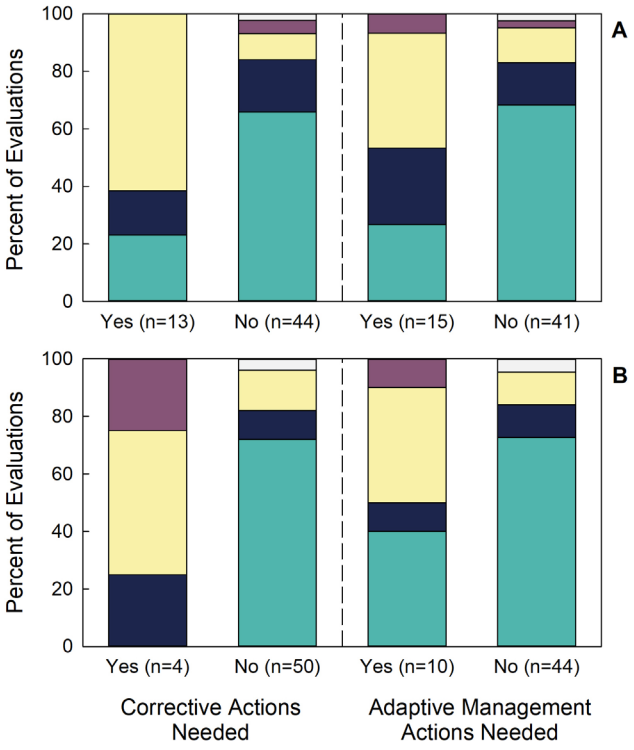



**Figure 32.—**Distribution of implementation ratings by whether corrective actions (AqEco B-Q33) or adaptive management actions (AqEco B-Q35) were needed to improve project implementation for projects completed in FY15/16 (A) and FY17/18 (B).

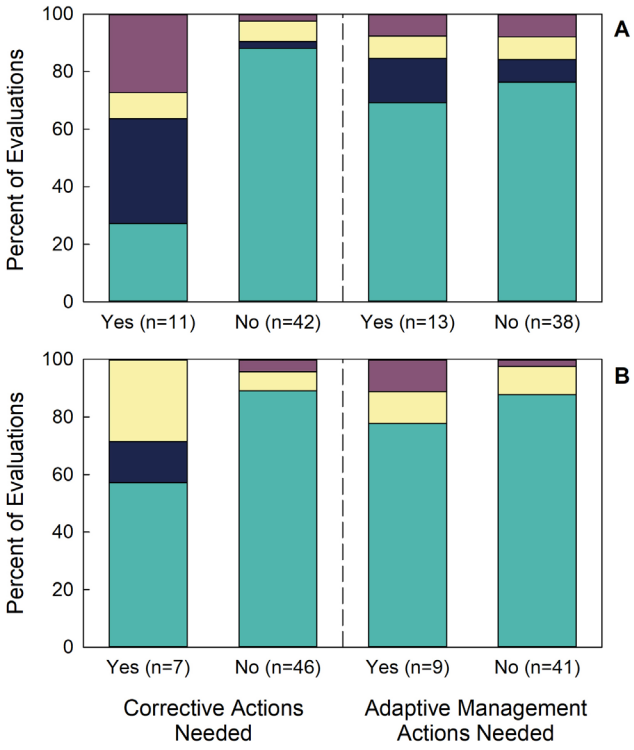



**Figure 33.—**Distribution of effectiveness ratings by whether corrective actions (AqEco B-Q44) or adaptive management actions (AqEco B-Q46) were needed to improve project effectiveness for projects completed in FY15/16 (A) and FY17/18 (B).

projects in FY17/18 had *no BMPs* implementation ratings (i.e., no BMP guidance was used in planning), but no corrective actions or adaptive management actions were noted as being needed (Fig. 32). The lack of BMPs in planning typically would have warranted a "yes" response for at least one of those needs. There were significant associations ($p < 0.01$ FY15/16, $p < 0.01$ FY17/18) between implementation ratings and corrective action needs: projects for which no corrective actions were needed were associated with better implementation ratings. Similar associations existed for adaptive management actions ($p = 0.02$ FY15/16, $p = 0.04$ FY17/18). For effectiveness, there were significant associations between effectiveness ratings and the need for corrective actions ($p < 0.001$ FY15/16, $p = 0.05$ FY17/18) but not between ratings and the need for adaptive management actions ($p = 0.92$ FY15/16, $p = 0.49$ FY17/18). Effectiveness ratings were better when the review team considered corrective actions unnecessary (Fig. 33).

There were evaluations rated as *not implemented*, *marginally implemented*, *not effective*, and *marginally effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. The poorer ratings may have resulted from chance occurrence (e.g., an extreme event outside of what could be controlled by planning or some type of BMP prescription), but such situations likely would have been applicable to a minority of evaluations. In some instances, the condition that led to an issue may have been unique to the site or been considered insignificant, causing the review team to consider corrective or adaptive management actions unnecessary. However, it is possible that the team may have overlooked problems that led to poorer ratings and that could have been identified during consideration of AqEco B-Q33, AqEco B-Q35, AqEco B-Q44, and AqEco B-Q46.

## Composite Ratings

Composite rating results for AqEco B projects evaluated for both implementation and effectiveness (51 in FY15/16 and 52 in FY17/18) are given in Table 57. In FY15/16, 63 percent of projects had a composite rating of *excellent*, 16 percent were rated as *good*, 12 percent were rated as *fair*, and 8 percent were rated as *poor*. In FY17/18, 69 percent of projects had a composite rating of *excellent*, while the percentages for other ratings were similar to those in FY15/16. As noted previously, three projects had no BMPs prescribed, resulting in a *no plan* composite rating (Table 57).

When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, a significant association was observed in each monitoring period ($p = 0.04$ FY15/16, $p = 0.04$ FY17/18). Better project implementation resulted in better BMP effectiveness. More than half of projects (55 and 62 percent in FY15/16 and FY17/18, respectively) were rated *fully implemented* and had corresponding BMP effectiveness ratings of either *effective* or *mostly effective* (Table 57). Ten percent of projects in each monitoring period had better implementation ratings of *fully implemented* or *mostly implemented* but poorer effectiveness ratings of *marginally effective* or *not effective*, indicating that prescribed BMPs did not fully protect water resources.

**Table 57.—**Composite rating matrix for AqEco B projects evaluated for both implementation and effectiveness in FY15/16 (n=51 evaluations) and FY17/18 (n=52 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 26 | 6 | 5 | 1 | |
| | Mostly effective | 2 | | 2 | 1 | |
| | Marginally effective | 1 | 2 | 1 | | |
| | Not effective | 1 | 1 | 1 | | 1 |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 32 | 4 | 6 | | 2 |
| | Mostly effective | | | | 1 | |
| | Marginally effective | 2 | 2 | 1 | | |
| | Not effective | 1 | | 1 | | |

Excellent
Good
Fair
Poor
No plan

## Aquatic Ecosystems B: Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings were determined from component scores. The AqEco B implementation components are the same as those for AqEco A (Table 28). AqEco B effectiveness components and their interpretations are given in Table 58; these effectiveness components have no subcomponents. Table 59 shows how the scores were distributed across the three implementation components. Three projects scored as *none* for one component, and three projects scored as *no BMPs* for the planning component, which ultimately resulted in a *no BMPs* implementation rating. Approximately 56 and 67 percent of the projects for which implementation evaluations were completed in FY15/16 and FY17/18, respectively, were rated as *fully implemented*, which is possible only if all three components scored as *all* (Table 60). Administrative units appear to be more successful at the project oversight component than the planning or on-the-ground execution components, based upon the results in both Tables 59 and 60.

An answer of "no" for any provision in Table 44 accompanied by a "yes" answer for at least one other provision would score as *some* for the planning component, indicating that not all the BMPs from planning were included in the project contract or plan. For the 21 projects in FY15/16 with a score of *some* for the planning component (Table 59), an

**Table 58.—**Effectiveness components, scores, and interpretation of each score for AqEco B. Component scores are used to determine overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Waterbody protection | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Project objectives | Effective | Project objectives met |
| | Moderately effective | Project objectives partially met |
| | Not effective | Project objectives not met |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

**Table 59.—**Distribution of implementation component scores by component for AqEco B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=57) | | | | | | | |
| | All | 34 | 60 | 44 | 77 | 56 | 98 |
| | Some | 21 | 37 | 13 | 23 | | |
| | None | 1 | 2 | | | 1 | 2 |
| | No BMPs | 1 | 2 | | | | |
| FY17/18 (n=54) | | | | | | | |
| | All | 43 | 80 | 44 | 81 | 51 | 94 |
| | Some | 9 | 17 | 9 | 17 | 3 | 6 |
| | None | | | 1 | 2 | | |
| | No BMPs | 2 | 4 | | | | |

**Table 60.—**Implementation component scores corresponding to the overall implementation ratings for AqEco B evaluations with complete data in FY15/16 and FY17/18. See Table 28 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=57) | | | | | |
| | Fully implemented | All | All | All | 32 |
| | Mostly implemented | Some | All | All | 10 |
| | Marginally implemented | All | Some | All | 1 |
| | | Some | Some | All | 11 |
| | Not implemented | All | Some | None | 1 |
| | | None | All | All | 1 |
| | No BMPs | No BMPs | All | All | 1 |
| FY17/18 (n=54) | | | | | |
| | Fully implemented | All | All | All | 36 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 5 |
| | Marginally implemented | All | Some | All | 5 |
| | | All | Some | Some | 1 |
| | | Some | Some | All | 3 |
| | Not implemented | Some | None | Some | 1 |
| | No BMPs | No BMPs | All | All | 2 |

average of 24 percent of BMP provisions from planning were not included in the contract or plan (Table 44, excluding provisions identified as "not applicable"), with the percentage ranging from 8 to 54. On average, BMPs from planning were included in 7 of the 13 possible provisions, and BMPs in the provisions "fencing," "temporary vegetative erosion control requirements," and "permanent vegetation/cover requirements" had the greatest frequencies of not being carried from planning into the project contract or plan for those 21 projects (Table 44). "Fencing" and "dewatering requirements" were the provisions most often not carried into the contract or plan for the nine projects with a planning component score of *some* in FY17/18. Those projects averaged 22 percent of provisions that were not included in the contract or plan though one project had 10 of 13 provisions (77 percent) that were not included. The average percent inclusion without that project is 15 percent. On average the nine projects in FY17/18 with a planning component score of *some* included BMPs in 10 of the 13 possible provisions.

The *some* score for the on-the-ground execution component indicates that at least one BMP in a provision was not implemented fully in the field (Table 28). This results from a "no" answer for at least one provision in Table 46 and a "yes" response for at least one other provision. For the 13 projects in FY15/16 having a score of *some* for the on-the-ground execution component (Table 59), the average contract or plan had 10 provisions

containing at least one BMP, and in 27 percent of those provisions per project at least one BMP was not implemented fully. The frequency of BMP provisions that were not implemented fully ranged from 8 to 54 percent per evaluation. BMPs that were not implemented fully were most commonly assigned to "permanent vegetation/cover requirements" and "fencing" provisions (Table 46) for those 13 projects. In FY17/18, nine projects had *some* scores for the on-the-ground execution component. Of these, on average 16 percent of BMP provisions were not implemented fully per project, with the percentages ranging from 9 to 33 percent. The nine projects averaged BMPs in 11 provisions per project, and the provisions most frequently not implemented fully were "dewatering requirements" and "permanent vegetation/cover requirements."

The project oversight component for most projects scored as *all* (Table 59). The project in FY15/16 that scored as *none* corresponded to an evaluation that indicated corrective actions were needed to address an implementation problem, but the needed actions were not taken to rectify the observed problem (AqEco B-Q31). The three projects in FY17/18 that scored as *some* for the project oversight component had no inspections during project operations.

Planning component scores were not significantly associated with the type of primary planning document (AqEco B-Q26) used for the projects that employed planning documents (NEPA or other BMP guidance documents) in either monitoring period ($p = 0.52$ FY15/16, $p = 1.00$ FY17/18) or with the method used to accomplish the project (AqEco B-Q24) ($p = 0.45$ FY15/16, $p = 0.15$ FY17/18). The on-the-ground execution component scores and project oversight component scores in FY15/16 also were not associated with the method used to accomplish the project ($p = 0.24$ and $p = 1.00$, respectively). On-the-ground execution component scores were significantly associated with the method used in FY17/18 ($p = 0.02$); 100 percent of projects accomplished using force accounts had component scores of *all*, while those using other methods averaged 60 to 86 percent *all* scores. Project oversight component scores in FY17/18 were not associated with the method used to accomplish the project ($p = 0.28$).

Tables 61 and 62 summarize the distribution of scores across the three effectiveness components. For each of the three components, at least 87 percent of the projects in both monitoring periods had scores of *effective* or *mostly effective* (Table 61). Seventy-seven percent of projects in FY15/16 and 86 percent in FY17/18 had an overall effectiveness rating of *effective*, which resulted from each project achieving an *effective* score for all three effectiveness components (Table 62). Of the 15 projects rated as *marginally effective* or *not effective*, the deficiency in 14 projects was in the waterbody protection component. The deficiency in the other project was in the project objectives component (Table 62).

The three effectiveness components were analyzed to determine if associations existed between component scores and the implementation ratings (Fig. 34). A significant association was not found for waterbody protection component scores and implementation ratings in FY15/16 ($p = 0.50$), but a highly significant association was found for the project objectives component scores and implementation ratings ($p < 0.01$). *Fully implemented* and *mostly implemented* ratings occurred only for the *effective* scores for the project objectives component (Fig. 34A), but the other project objective component scores had very small sample sizes. In FY17/18 there was a significant association between

**Table 61.—**Distribution of effectiveness component scores by component for AqEco B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Waterbody protection component (number) | Waterbody protection component (percent) | Project objectives component (number) | Project objectives component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=56) | | | | | | | |
| | Effective | 46 | 82 | 53 | 95 | 56 | 100 |
| | Mostly effective[a] | 3 | 5 | | | | |
| | Moderately effective[b] | | | 2 | 4 | | |
| | Marginally effective[a] | 4 | 7 | | | | |
| | Not effective | 3 | 5 | 1 | 2 | | |
| FY17/18 (n=56) | | | | | | | |
| | Effective | 48 | 86 | 55 | 98 | 56 | 100 |
| | Mostly effective | 1 | 2 | | | | |
| | Moderately effective | | | 1 | 2 | | |
| | Marginally effective | 5 | 9 | | | | |
| | Not effective | 2 | 4 | | | | |

[a] Score applies only to waterbody protection component (see Table 58).

[b] Score applies only to project objectives and chemical pollutants components (see Table 58).

**Table 62.—**Effectiveness component scores corresponding to the overall effectiveness ratings for AqEco B evaluations with complete data in FY15/16 and FY17/18. See Table 58 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Waterbody protection component | Project objectives component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=56) | | | | | |
| | Effective | Effective | Effective | Effective | 43 |
| | Mostly effective | Effective | Moderately effective | Effective | 2 |
| | | Mostly effective | Effective | Effective | 3 |
| | Marginally effective | Marginally effective | Effective | Effective | 4 |
| | Not effective | Effective | Not effective | Effective | 1 |
| | | Not effective | Effective | Effective | 3 |
| FY17/18 (n=56) | | | | | |
| | Effective | Effective | Effective | Effective | 48 |
| | Mostly effective | Mostly effective | Effective | Effective | 1 |
| | Marginally effective | Marginally effective | Effective | Effective | 5 |
| | Not effective | Not effective | Effective | Effective | 2 |

the waterbody protection component scores and implementation ratings (p = 0.04), although the association is not particularly meaningful given the small samples sizes for scores other than *effective* (Fig. 34B). The project objectives component scores and ratings were not significantly associated in FY17/18 (p = 1.00). Tests for association between the chemical pollutants component scores and implementation ratings were not possible because there were no chemical or fuel spills or leaks observed during any of the effectiveness evaluations, and therefore all chemical pollutants component scores were *effective* in both monitoring periods (Fig. 34).

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 35. While the association between project oversight component scores and the effectiveness ratings was not significant in FY15/16 (p = 0.25), the associations between the planning component scores and effectiveness ratings (p = 0.04) and between the on-the-ground execution component scores and effectiveness ratings (p = 0.06) were significant. When all the BMPs from planning were included in the project contract or plan and implemented fully, more than 85 percent of the projects had BMP effectiveness ratings of *effective* or *mostly effective* (Fig. 35A).

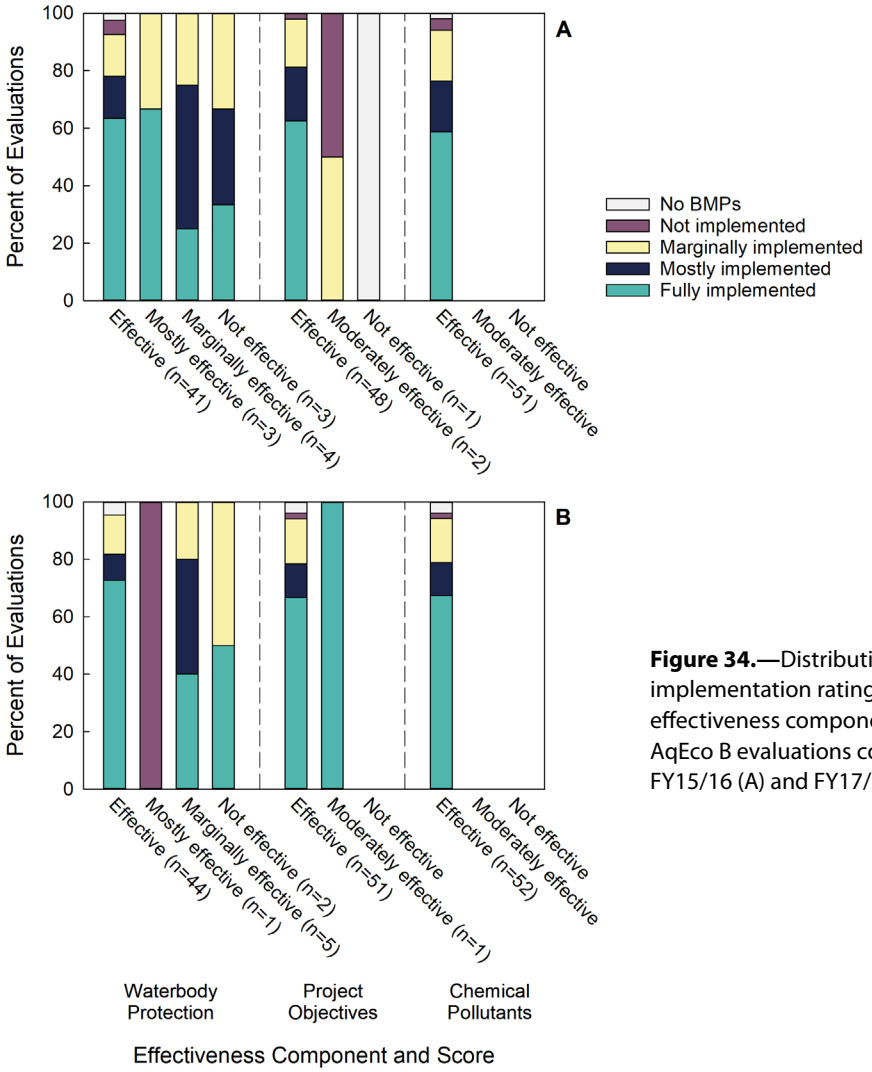



**Figure 34.—**Distribution of implementation ratings across effectiveness component scores for AqEco B evaluations completed in FY15/16 (A) and FY17/18 (B).

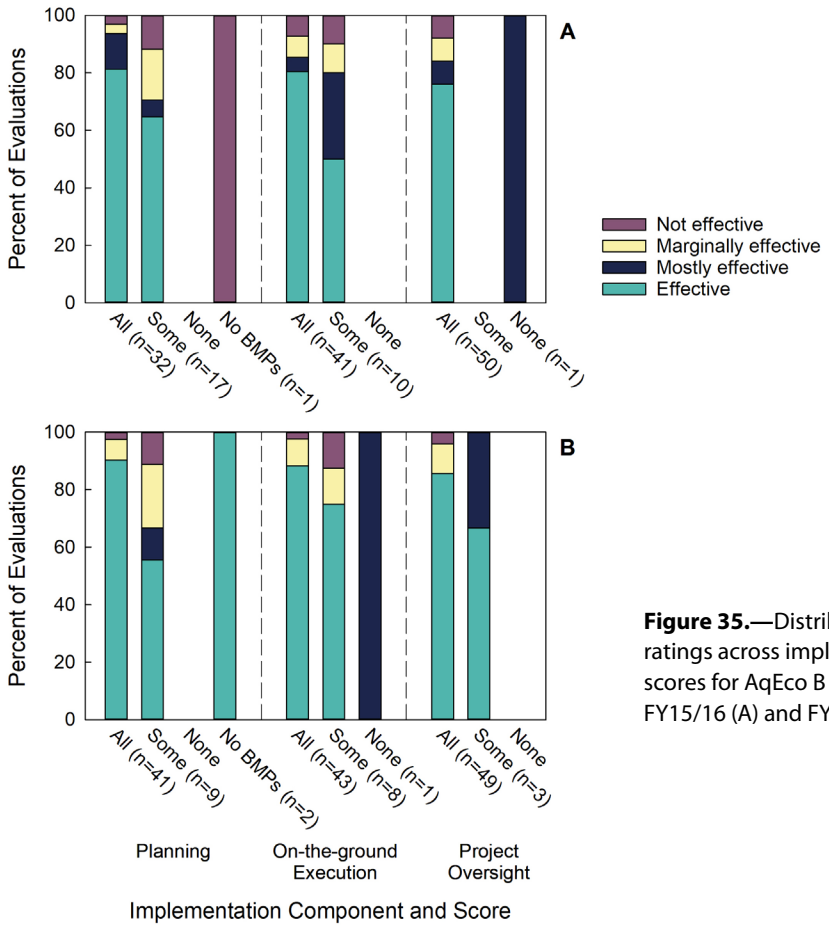



**Figure 35.—**Distribution of effectiveness ratings across implementation component scores for AqEco B evaluations completed in FY15/16 (A) and FY17/18 (B).

In FY17/18 a significant association was found between the on-the-ground execution component scores and effectiveness ratings ($p = 0.03$), and the associations for the other two components were very nearly significant ($p = 0.10$ planning, $p = 0.10$ project oversight). In both monitoring periods, effectiveness ratings were generally better with more complete BMP prescription and implementation (i.e., *all* versus *some* planning component scores and on-the-ground execution component scores).

Planned or implemented BMP provisions ("yes," "no," or "not applicable" answers from Table 44 or 46, respectively) that are potentially relevant to effectiveness component scores for the waterbody protection component were examined for statistical associations (Table 63). For most provisions in FY15/16, no significant associations were found. Two provisions—"location and/or limiting the extent of waterbody disturbance" and "temporary vegetative erosion control requirements"—had significant associations with planning ("in contract or plan" column in Table 63). For projects that included BMPs in those provisions, the projects achieved a waterbody protection component score of *effective* in 75 to 85 percent of the evaluations. Many more associations were found in FY17/18; whether a provision was included in the contract or plan was significantly associated with waterbody protection component scores for seven of the eight provisions tested, and whether a provision was implemented fully was significantly associated with the component scores for half the provisions. For all provisions except "temporary

**Table 63.—**Fisher's exact test probabilities of association between BMP provisions relevant to waterbody protection effectiveness component scores for AqEco B evaluations completed in FY15/16 and FY17/18

| Component | Provision | FY15/16 In contract or plan[a] p-value[b] | FY15/16 Implemented fully[c] p-value[b] | FY17/18 In contract or plan p-value | FY17/18 Implemented fully p-value |
|---|---|---|---|---|---|
| Waterbody protection | Timing and scheduling of improvements | 1.00 | 1.00 | ***0.08*** | 0.10 |
| | Location of access routes | 0.60 | 0.84 | ***0.03*** | 0.74 |
| | Construction methods to reduce disturbance, erosion, or sedimentation | 1.00 | 0.89 | ***0.09*** | ***<0.01*** |
| | Location and/or limiting the extent of floodplain disturbances | 0.34 | 0.69 | ***0.09*** | ***0.09*** |
| | Location and/or limiting the extent of waterbody disturbances | ***0.02*** | 0.37 | ***0.06*** | 0.24 |
| | Temporary vegetative erosion control requirements | ***0.04*** | 0.21 | ***<0.01*** | ***0.02*** |
| | Permanent vegetation/cover requirements | 0.21 | 0.18 | 1.00 | ***0.02*** |
| | Nonvegetative erosion control requirements (temporary or permanent) | 0.11 | 0.52 | ***<0.01*** | 0.11 |

[a] See AqEco B-Q27.
[b] Probability of association; significant at α=0.10.
[c] See AqEco B-Q28.

vegetative erosion control requirements," the sample sizes for projects that did not include a provision in the contract or plan were very small (one or two), and the waterbody protection component scores were always lower than *effective*. In comparison, when those same provisions were included in the contract or plan, an average of 84 percent of projects had component scores of *effective*. Similar results were found for whether the two provisions "construction methods to reduce disturbance, erosion, or sedimentation" and "location and/or limiting the extent of floodplain disturbances" were implemented fully. For the provision "temporary vegetative erosion control requirements," the waterbody protection component scores were more frequently *effective* when the provision was not applicable to the project than when BMPs in that provision were included in the plan and implemented fully.

## Aquatic Ecosystems B: Management Implications for Forest Service Resource Managers

Seventy-six percent of completed aquatic ecosystem improvement construction evaluations were rated *fully implemented* or *mostly implemented*. Project planning was a deficiency in about 30 percent of the projects, but only three projects were completed without BMPs prescribed in the planning document. About 20 percent of the projects had a deficiency in on-the-ground execution, in that some BMP provisions in the project contract or plan were not implemented fully. More than 95 percent of the evaluations scored *all* for project oversight.

Eighty-seven percent of the projects rated either *effective* or *mostly effective* for BMP effectiveness, indicating either no impacts to water quality were observed or observed

impacts were minor and temporary. There were 15 projects with *marginally effective* or *not effective* ratings. In 14 of those projects, the deficiency was in the waterbody protection component, and one project was deficient in the project objectives component. Project objectives were met for 87 percent of the projects, and 97 percent of evaluated projects successfully improved aquatic or floodplain conditions. However, projects in FY15/16 that had an objective of wetland or wet meadow construction appear to have poorer implementation and effectiveness ratings, although the sample size is small (n=5).

When BMPs were implemented, they were shown to be effective. For sites in which both implementation and effectiveness evaluations were completed, 92 and 67 percent of the projects with a *fully implemented* or *mostly implemented* rating, respectively, were rated *effective* or *mostly effective*. The one project rated *no BMPs* in FY15/16 was *not effective*, although the two projects in FY17/18 with that implementation rating were *effective*. However, 80 percent of projects with a *marginally implemented* or *not implemented* rating were rated *effective* or *mostly effective,* indicating high effectiveness with poor implementation. Specifically, better planning component scores and on-the-ground execution component scores corresponded to better effectiveness ratings.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Checking the project plan or contract to ensure that BMP provisions for "fencing," "dewatering requirements," and "temporary vegetative erosion control requirements" are included when prescribed in the project planning documents.
- Considering post-project inspections to ensure that BMP provisions for "fencing" and "temporary and permanent vegetative erosion control" in the project contract or plan are implemented as intended.
- Including BMP provisions for "permanent ground cover" in the project planning documents and project contract or plan for areas that have applicable ground cover standards. Standards were more frequently met when BMP provisions for permanent ground cover were implemented fully.
- Where appropriate, including BMP provisions for "location and/or limiting the extent of waterbody disturbance" and "temporary vegetative erosion control requirements"; projects that had these BMP provisions had high rates of *effective* waterbody protection component scores.
- Focusing on incorporating BMPs from the project planning documents into the project contract or plan and on implementing those BMPs on the ground. Evaluations with better planning component scores and on-the-ground execution component scores corresponded to better overall effectiveness ratings.

Comparing results from these two monitoring periods showed that projects implemented with a construction contract or stewardship contract had a greater percentage of evaluations rated as *marginally implemented* (indicating a potential deficiency in field execution of BMPs) than those implemented by force account or other method. In future monitoring periods, we suggest assessing the data to see if this pattern holds; and if so, investigating potential reasons and corrective actions.

## Aquatic Ecosystems B: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**AqEco B. Completed Aquatic Ecosystem Improvements**

(Includes BMPs AqEco-1, AqEco-2, AqEco-3, and AqEco-4)

v3.0 February 2016

| Header | |
|---|---|
| AqEco B-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| AqEco B-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| AqEco B-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| AqEco B-Q4 | Date of current field evaluation: |
| AqEco B-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| AqEco B-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| AqEco B-Q7 | Reviewers and titles: |
| AqEco B-Q8a | Region number: |
| AqEco B-Q8b | State: |
| AqEco B-Q9a | Proclaimed Forest or Grassland number and name: |
| AqEco B-Q9b | Administrative Forest or Grassland number and name: |
| AqEco B-Q10 | District number and name: |
| AqEco B-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| AqEco B-Q11b | Was the project/site selected randomly from the population developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| AqEco B-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| AqEco B-Q12 | 6th level HUC number and name for the subwatershed this improvement is in: |
| AqEco B-Q13 | Is any part of the improvement located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| AqEco B-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| AqEco B-Q14b | Location.<br><br>Easting: |
| AqEco B-Q14c | Location.<br><br>Northing: |
| AqEco B-Q15a | Location.<br><br>Latitude: |
| AqEco B-Q15b | Location.<br><br>Longitude: |
| AqEco B-Q15c | Location.<br><br>Lat/Long Datum: |
| AqEco B-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| AqEco B-Q17 | Name of improvement project: |
| AqEco B-Q18 | Date project was completed: |
| AqEco B-Q19 | Were any of the improvements or soil-disturbing activities applied to a floodplain? Select one:<br><br>a. Yes<br>b. No |

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| **Header** (*continued*) | |
|---|---|
| AqEco B-Q20 | Were any of the improvements applied to a waterbody? Select one:<br><br>a. Yes<br>b. No |
| AqEco B-Q21 | Total length of waterbody plus floodplain to which improvements and disturbances were applied (ft, m, mi, or km; specify unit): |
| AqEco B-Q22 | Type of waterbody improved or type adjacent to floodplain improvement project. Select all that apply:<br><br>Stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| AqEco B-Q23 | Project objectives. Select all that apply:<br><br>Aquatic habitat improvement<br>Fish passage improvement<br>Riparian vegetation restoration<br>Stream/river channel improvement or realignment<br>Bank stabilization<br>Wetland/wet meadow construction<br>Other (specify): |
| AqEco B-Q24 | Method used to accomplish project. Select one:<br><br>Service contract<br>Construction contract<br>Stewardship contract<br>Force account<br>Other (specify): |
| AqEco B-Q25 | Which features were part of the improvement activities? Select all that apply:<br><br>a. Temporary access routes for project implementation<br>b. Excavation<br>c. Equipment storage<br>d. Revegetation<br>e. Physical erosion control measures (e.g., matting, netting, silt fence)<br>f. Channel realignment<br>g. Mechanical streambank or shoreline treatments<br>h. Nonmechanical streambank or shoreline treatments<br>i. In-channel or in-waterbody structural treatments<br>j. Other (specify): |
| **Implementation** | |
| AqEco B-Q26 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 28)<br>b. Environmental Impact Statement (EIS) (go to question 27)<br>c. Environmental Assessment (EA) (go to question 27)<br>d. Categorical Exclusion (CE) (go to question 27)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 27) |

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| **Implementation** (*continued*) | |
|---|---|
| AqEco B-Q27 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract or project plan. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Timing and scheduling of improvements<br>Yes/No/Not applicable<br>b. Location of access routes<br>Yes/No/Not applicable<br>c. Construction techniques and treatments for access routes<br>Yes/No/Not applicable<br>d. Placement and storage of excavated materials<br>Yes/No/Not applicable<br>e. Construction methods to reduce disturbance, erosion, or sedimentation<br>Yes/No/Not applicable<br>f. Location and/or limiting the extent of floodplain disturbances<br>Yes/No/Not applicable<br>g. Location and/or limiting the extent of waterbody disturbances<br>Yes/No/Not applicable<br>h. Waterbody stabilization techniques<br>Yes/No/Not applicable<br>i. Dewatering requirements<br>Yes/No/Not applicable<br>j. Temporary vegetative erosion control requirements<br>Yes/No/Not applicable<br>k. Permanent vegetation/cover requirements<br>Yes/No/Not applicable<br>l. Non-vegetative erosion control requirements (permanent or temporary)<br>Yes/No/Not applicable<br>m. Fencing<br>Yes/No/Not applicable<br>n. Other (specify):<br>Yes/No/Not applicable |
| AqEco B-Q28 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or project plan were implemented fully. Select one response in each line. If the provision existed in the project contract or plan and it was implemented fully, select Yes. If the provision existed in the project contract or plan but it was not implemented fully, select No. If the provision did not exist in the project contract or plan, select Not applicable.<br><br>a. Timing and scheduling of improvements<br>Yes/No/Not applicable<br>b. Location of access routes<br>Yes/No/Not applicable<br>c. Construction techniques and treatments for access routes<br>Yes/No/Not applicable<br>d. Placement and storage of excavated materials<br>Yes/No/Not applicable<br>e. Construction methods to reduce disturbance, erosion or sedimentation<br>Yes/No/Not applicable<br>f. Location and/or limiting the extent of floodplain disturbances<br>Yes/No/Not applicable<br>g. Location and/or limiting the extent of waterbody disturbances<br>Yes/No/Not applicable<br>h. Waterbody stabilization techniques<br>Yes/No/Not applicable<br>i. Dewatering requirements<br>Yes/No/Not applicable<br>j. Temporary vegetative erosion control requirements<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*AqEco B-Q28 continued*) | k. Permanent vegetation/cover requirements<br>Yes/No/Not applicable<br>l. Non-vegetative erosion control requirements (permanent or temporary)<br>Yes/No/Not applicable<br>m. Fencing<br>Yes/No/Not applicable<br>n. Other provisions specified in question 27n<br>Yes/No/Not applicable<br>o. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| AqEco B-Q29 | Does the project decision document, plan, or other pertinent documentation include improvement objectives? Select one:<br><br>a. Yes<br>b. No<br>If Yes, briefly summarize the project objectives: |
| AqEco B-Q30 | Were project inspections and/or contract administration during operations performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, work was conducted to avoid critical times<br>c. Yes<br>d. No |
| AqEco B-Q31 | If problems occurred during operations that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| AqEco B-Q32 | Were chemical or fuel spills or leaks that occurred during project activities handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred project implementation<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| AqEco B-Q33 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 34)<br>b. No (go to question 35) |
| AqEco B-Q34 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| AqEco B-Q35 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 36)<br>b. No (go to question 37 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |

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| | |
|---|---|
| **Implementation** (*continued*) | |
| AqEco B-Q36 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 37 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| AqEco B-Q37 | Is there evidence of fresh erosion or sedimentation or recent unplanned changes to waterbody morphology that are attributable to the project activities? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c.<br><br>a. No evidence attributable to the project activities<br>b. Evidence of fresh erosion or sedimentation on the floodplain but no deposition in the waterbody<br>c. Evidence of fresh sediment transport to or deposition in the waterbody, or evidence of unplanned changes to waterbody morphology |
| AqEco B-Q38 | Do treated waterbody banks or shorelines within the project area meet project standards for ground cover? Select one:<br><br>a. Not applicable, banks/shorelines were not part of the improvement project<br>b. Not applicable, there are no project standards for bank/shoreline ground cover condition<br>c. Yes, bank/shoreline ground cover condition meets standards<br>d. No, bank/shoreline ground cover condition does not meet standards, and the current condition is attributable to project activities<br>e. No, bank/shoreline ground cover condition does not meet standards, but it is not clear if the current condition is related to project activities<br>f. No, bank/shoreline ground cover condition does not meet standards, but the current condition is not attributable to project activities |
| AqEco B-Q39 | Do treated floodplains within the project area meet project standards for ground cover? Select one:<br><br>a. Not applicable, floodplain treatments were not part of the improvement project<br>b. Not applicable, there are no project standards for floodplain cover condition<br>c. Yes, floodplain cover condition meets standards<br>d. No, floodplain cover condition does not meet standards, and the current condition is attributable to project activities<br>e. No, floodplain cover condition does not meet standards, but it is not clear if the current condition is related to project activities<br>f. No, floodplain cover condition does not meet standards, but the current condition is not attributable to project activities |
| AqEco B-Q40 | Were project objectives (from implementation question 29) met? Select one:<br><br>a. Not applicable, no objectives were specified for this project<br>b. Yes, objectives were met<br>c. No, objectives were not met |
| AqEco B-Q41 | Overall, does it appear that the design and contract or plan, as implemented, were successful in improving aquatic and/or floodplain condition? Select one:<br><br>a. Yes, they were successful, based on attainment of measurable objectives<br>b. Yes, they were successful, based on attainment of stated objectives<br>c. Yes, they were successful, based on professional judgment<br>d. No, they were not successful, based on failure to meet measurable objectives<br>e. No, they were not successful, based on failure to meet stated objectives<br>f. No, they were not successful, based on professional judgment |

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| **Effectiveness** (*continued*) | |
|---|---|
| AqEco B-Q42 | What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks in the project area, but outside a waterbody<br>c. Evidence of chemical or fuel spills or leaks in a waterbody<br>d. Evidence of chemical or fuel waste containers in the project area, but outside a waterbody<br>e. Evidence of chemical or fuel waste containers in a waterbody |
| AqEco B-Q43 | If inspections were not conducted at critical times during operations, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times<br>b. Yes<br>c. No |
| AqEco B-Q44 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 45)<br>b. No (go to question 46) |
| AqEco B-Q45 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| AqEco B-Q46 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 47)<br>b. No (go to General Comments) |
| AqEco B-Q47 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies.<br>Go to General Comments after answering this question. |
| **General Comments** | |
| | |

## Aquatic Ecosystems Summary

AqEco A and AqEco B were among the most frequently used National BMP program monitoring protocols in the FY15/16 and FY17/18 monitoring periods, with a total of 203 evaluations completed (Table 3). Each region completed at least one evaluation using an aquatic ecosystem protocol; Region 6 (50 evaluations) and Region 2 (30 evaluations) completed the most, and Region 4 (6 evaluations) and Region 10 (5 evaluations) completed the fewest. Three-quarters of the projects were randomly selected (Table 3), and there were no differences in either implementation ratings or effectiveness ratings between randomly and nonrandomly selected projects for both AqEco A and AqEco B protocols (Fig. 1). Streams and rivers were the most common waterbodies involved in the reviewed projects, followed by wetlands (Tables 7 and 39). About one-quarter of the projects reviewed involved multiple waterbodies.

Although AqEco A and AqEco B evaluate the same types of projects at different times—during active construction for AqEco A and after project completion for AqEco B—there were some interesting contrasts in the characteristics of the selected projects. The number of projects completed through an EIS or EA planning document was about the same for both AqEco A and AqEco B; however, AqEco A had more projects implemented through a CE (52 percent) and fewer using other BMP source documents (7 percent) than AqEco B (46 and 19 percent, respectively) (Tables 10 and 42). Similarly, the percentages of projects completed using force account and service contract methods were about the same between the two protocols, but AqEco A had a much greater percentage of construction contracts (39 percent) and fewer other methods (17 percent) than AqEco B (23 and 33 percent, respectively) (Tables 11 and 43). The "other" methods for both AqEco A and AqEco B were identified mostly as agreements or partnerships. While the distribution of project locations of in-waterbody work, floodplain work, and both in-waterbody and floodplain was comparable for AqEco A and AqEco B projects (Tables 6 and 38), the area disturbed differed. AqEco A projects reviewed had a greater average length of disturbance—approximately 1,700 linear feet of waterbody and 1,800 linear feet of floodplain (3,500 linear feet total)—compared to AqEco B projects, with just under 2,800 linear feet of combined nonoverlapping in-waterbody and floodplain disturbance.

Overall, the implementation and effectiveness ratings were similar for AqEco A and AqEco B projects. About 75 percent of the projects were rated as *fully implemented* or *mostly implemented* (Tables 31 and 60), indicating that all of the BMP prescriptions in the project contract or plan were implemented fully in the field. Two or three projects for each protocol were rated *no BMPs*, indicating BMPs were not considered in project planning for those projects. Eighty percent of AqEco A and 87 percent of AqEco B projects were rated as *effective* or *mostly effective* (Tables 33 and 62). These ratings indicate that either no impacts to water quality were observed or that observed impacts were minor and temporary. For projects in which both the implementation and effectiveness evaluations were completed, better implementation ratings were associated with better effectiveness ratings ($p = 0.04$ or lower for all comparisons; see "Composite Ratings" discussions, above). These findings demonstrate that when BMPs are implemented in aquatic ecosystem restoration projects, water quality is protected. In addition, the review teams are recognizing implementation and effectiveness issues while conducting the monitoring evaluations. There were significant associations between the implementation and effectiveness ratings and the need for corrective actions or adaptive management actions. Evaluations with better ratings generally did not identify a need for corrective or adaptive management actions.

## Overall Program Observations

In addition to analyzing the monitoring data for insights on BMP implementation and effectiveness, the data are also assessed to identify potential issues with application of the BMP monitoring program. Examination of the data for protocols AqEco A and AqEco B indicate that reading the protocol instructions and completing the monitoring forms more carefully may improve data quality. Specific issues identified are as follows:

- National BMP program direction calls for sites to be evaluated for both BMP implementation and effectiveness, with implementation evaluated first, even if both are evaluated on the same day. About 20 percent of AqEco A and AqEco B evaluations were of implementation only or effectiveness only, with no corresponding effectiveness or implementation evaluation in the database. Although subsequent, corresponding effectiveness evaluations for the completed implementation-only evaluations may occur in a later monitoring period, it's important to note cases where an implementation evaluation did not occur prior to an effectiveness evaluation. Paired implementation and effectiveness evaluations at the same site are important to determine whether BMPs are effective when implemented correctly.
- AqEco A and AqEco B are to be used to evaluate projects implemented in the waterbody, the floodplain, or both. Several evaluations completed for each protocol had answers to header questions that indicated work was done in neither the waterbody nor the floodplain. It was possible to glean from answers to other questions that the AqEco protocols were indeed appropriate to use for these projects and that errors had been made in answering the header questions.
- Three AqEco A evaluations were incomplete in the database. Evaluations with incomplete implementation or effectiveness data in the database cannot be rated.
- In a number of AqEco A and AqEco B evaluations, incorrect answers were provided for header questions 11a, b, and c, which are designed to capture information about the reasons for monitoring and whether the projects or sites were selected randomly according to the protocol instructions and whether the protocol instructions for completing the evaluations were followed. Common mistakes included indicating the purpose of monitoring was for National BMP targets but protocol instructions were not followed, and misunderstanding the intended meaning of quality assurance monitoring.
- Inconsistent answers given for related questions in the implementation sections and effectiveness sections of the protocols can make it difficult to interpret the relationship between BMP implementation and BMP effectiveness. In both protocols, a pair of questions (AqEco A-Q31 and AqEco A-Q49; AqEco B-Q30 and AqEco B-Q43) ask about inspections at critical times (implementation) and a lack of inspections leading to observed problems (effectiveness). In addition, AqEco B has a set of questions regarding ground cover requirements (AqEco B-Q28 in implementation) and attainment of ground cover standards

(AqEco B-Q38 and AqEco B-Q39 in effectiveness). For each of the paired sets of questions, a number of evaluations provided an answer to the effectiveness question that was in direct conflict with the answer given for the implementation question.

As additional data from other protocols are analyzed and more monitoring using the protocols is completed in future monitoring periods, these issues can be tracked. Additional instruction and training can help reduce the likelihood of them recurring.

# CHEMICAL USE MANAGEMENT

Chemical use management BMPs are used to avoid or minimize unacceptable impacts to water quality conditions that may result from application of chemicals to manage biological and physical resources. Chemical treatments are applied to kill, attract, repel, defoliate, stimulate, or retard biologic growth in order to mitigate, control, grow, or kill the intended biota. They also may be applied to ameliorate, neutralize, or stabilize soil or water chemistry. Chemical treatments include application of pesticides, such as insecticides, herbicides, fungicides, nematicides, rodenticides, and piscicides. Chemical treatments also include fertilizers and lime; dyes or other materials used in tracer studies; aggregate additives such as salt, magnesium chloride, and other substances used for dust abatement and roadbed stabilization; and other chemical products that are used to fulfill specific USDA Forest Service management objectives.

Chemical use management results are described separately by protocol: chemical use near waterbodies (Chem A), chemical use in waterbodies (Chem B), and chemical use for dust abatement (Chem C). In the FY15/16 and FY17/18 monitoring periods, the evaluations for Chem A, Chem B, and Chem C are dominated by randomly selected samples (Table 64), but the overall sample sizes for Chem B and Chem C are small. Statistical comparisons of the implementation ratings and effectiveness ratings resulting from randomly and nonrandomly selected samples showed no significant associations between the ratings and sample selection (Fig. 36) for Chem A (implementation: $p = 0.18$ FY15/16, $p = 0.44$ FY17/18; effectiveness: $p = 0.41$ FY15/16, $p = 1.00$ FY17/18); therefore, all samples are combined for analyses. Chem B projects and Chem C sites were all selected randomly (Table 64).

Results for the Chem A evaluations are divided into six sections; each builds on the next in terms of data interpretation. The sections and descriptions are as follows:

1. Header statistics—mostly descriptive statistics from the header section of the evaluation form, including location, composition, and types of projects.
2. Implementation results and their tie to header information—results from the implementation questions with ties to header information when appropriate.
3. Effectiveness results and their tie to implementation results and header information—results from the effectiveness questions with ties to implementation and sometimes header information to provide context between outcomes and BMP planning and prescription and between outcomes and physical site conditions.
4. Ratings and their tie to header, implementation, and effectiveness results—description of the implementation, effectiveness, and composite ratings with ties to individual questions on the respective evaluation form.
5. Component and subcomponent scores—in-depth examination of the component and subcomponent (when applicable) scores and the resulting implementation and effectiveness ratings.

**Table 64.—**Number of randomly and nonrandomly selected Chem A (Chemical Use Near Waterbodies, Chem B (Chemical Use in Waterbodies), and Chem C (Chemical Use for Dust Abatement) evaluations, by monitoring period and region (Chem A-Q11b, Chem B-Q11b, Chem C-Q11b)

| Monitoring period | Region | Chem A random selection | Chem A nonrandom selection | Chem B random selection | Chem B nonrandom selection | Chem C random selection | Chem C nonrandom selection |
|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | |
| | 1 | 2 | 2 | 2 | | | |
| | 2 | 9 | 2 | 2 | | 1 | |
| | 3 | 5 | 1 | | | | |
| | 4 | 2 | | 1 | | | |
| | 5 | 2 | | | | 1 | |
| | 6 | 12 | | 3 | | | |
| | 8 | 7 | | | | | |
| | 9 | 1 | 2 | 1 | | | |
| | 10 | 1 | | 1 | | | |
| | Total | 41 | 7 | 10 | | 2 | |
| | Percent within protocol | 85 | 15 | 100 | 0 | 100 | 0 |
| FY17/18 | | | | | | | |
| | 1 | 2 | | | | 1 | |
| | 2 | 3 | 2 | | | 2 | |
| | 3 | 1 | 3 | | | 1 | |
| | 4 | | 1 | 1 | | 1 | 1 |
| | 5 | 2 | 3 | | | | |
| | 6 | 9 | | 1 | | | |
| | 8 | 10 | | 2 | | | |
| | 9 | 4 | 1 | 1 | | | |
| | 10 | 2 | | | | | |
| | Total | 33 | 10 | 5 | | 5 | 1 |
| | Percent within protocol | 77 | 23 | 100 | 0 | 83 | 17 |

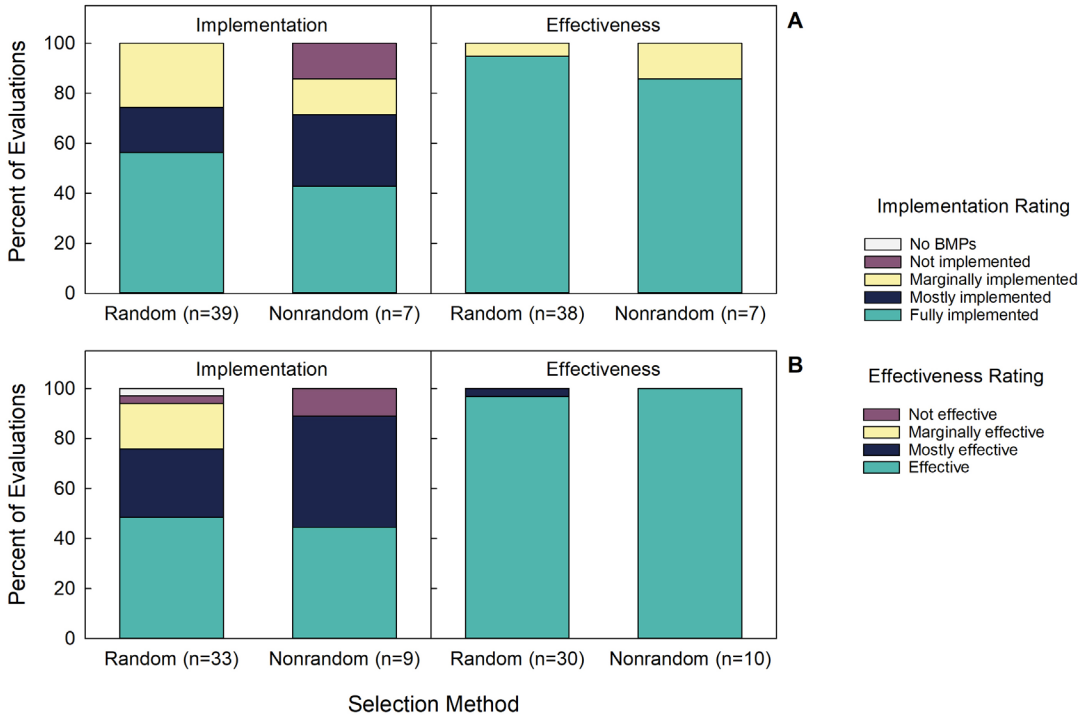



**Figure 36.—**Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Chem A evaluations completed in FY15/16 (A) and FY17/18 (B).

Although the fourth and fifth sections involve examination of the overall ratings, they are split into individual sections for convenience of the reader. Users who are more interested in the final implementation and effectiveness ratings and their association with individual protocol questions can focus on the fourth section, while those interested in more fully understanding the influence of different components and subcomponents on the scoring routines and the final ratings can focus on the fifth section.

6. Management implications—summary of the important findings in the preceding sections and suggestions for how these findings can be used to improve BMP implementation and effectiveness in the types of projects or activities evaluated by the protocol.

The analyses for both Chem B and Chem C are not divided into the six sections used for Chem A because the number of implementation and effectiveness evaluations for each is 10 or fewer in each monitoring period. Instead a much less detailed presentation of results is provided. The analyses in Chem B and Chem C focus primarily on summarizing the descriptive data (i.e., descriptive statistics) and the ratings and component scores.

The large number of analyses included in this report provide an in-depth examination into the types of queries and information that can be obtained from monitoring protocol data. Some queries will provide more useful information than others to users. In some cases, small sample sizes also may limit the usefulness of the corresponding results, though this deficiency will diminish as monitoring continues. The Fisher's exact test of association for

categorical data was employed for many analyses because of the limited sample sizes in at least some answer choices. However, corresponding sample sizes are reported in tables and figures to provide the reader another metric for interpreting the results in addition to the statistical probabilities.

## Chemicals A—Chemical Use Near Waterbodies

### Chemicals A: Header Statistics

Forty-eight Chem A projects were evaluated in FY15/16 and 43 in FY17/18 (Table 65). Every region completed at least one Chem A evaluation, but almost half of the evaluations were completed in Region 2 and Region 6 in FY15/16 and in Region 6 and Region 8 in FY17/18 (see the Appendix for region delineations). For Chem A, 81 percent of the projects evaluated were selected randomly (Table 64). While the most common reason for using the Chem A protocol was to meet National BMP targets, the protocol simultaneously met other monitoring needs, most frequently project review (Table 65).

**Table 65.—**Number of Chem A evaluations completed in FY15/16 (n=48 evaluations) and FY17/18 (n=43 evaluations), by region and reason for monitoring (Chem A-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 4 | | | | |
| | 2 | 11 | 2 | 1 | 2 | |
| | 3 | 6 | | 6 | 1 | |
| | 4 | 2 | 2 | | | |
| | 5 | 2 | 1 | 1 | | |
| | 6 | 12 | 1 | 4 | 2 | 2 |
| | 8 | 7 | | 1 | | |
| | 9 | 3 | 2 | 2 | | |
| | 10 | 1 | | | | |
| | All | 48 | 8 | 15 | 5 | 2 |
| FY17/18 | | | | | | |
| | 1 | 2 | | | | |
| | 2 | 5 | | | | |
| | 3 | 4 | | 1 | | |
| | 4 | 1 | | | | |
| | 5 | 5 | | 1 | 1 | 1 |
| | 6 | 9 | | 1 | 2 | |
| | 8 | 10 | 1 | 1 | 1 | |
| | 9 | 5 | 1 | | | |
| | 10 | 2 | 1 | 1 | | |
| | All | 43 | 3 | 5 | 4 | 1 |

Quality assurance was identified as a reason for monitoring (Chem A-Q11a) in nine Chem A evaluations (Table 65). For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance had duplicate evaluations, which is necessary to meet the intent of that type of monitoring. Therefore, the interdisciplinary review teams that selected quality assurance appeared to use this term to mean something different from what the protocol instructions stipulate.

At the end of the 2-year monitoring period, both implementation and effectiveness monitoring had been completed for 90 and 93 percent of the evaluations in FY15/16 and FY17/18, respectively (Table 66). All but two of the paired evaluations (i.e., both

**Table 66.—**Number of Chem A evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Chem A-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 4 | | | 4 |
| | 2 | 11 | 1 | | 10 |
| | 3 | 6 | | | 6 |
| | 4 | 2 | | | 2 |
| | 5 | 2 | | | 2 |
| | 6 | 12 | 1 | 1 | 10 |
| | 8 | 7 | 1 | 1 | 5 |
| | 9 | 3 | | | 3 |
| | 10 | 1 | | | 1 |
| | All | 48 | 3 | 2 | 43 |
| | Percent | | 6 | 4 | 90 |
| FY17/18 | | | | | |
| | 1 | 2 | | | 2 |
| | 2 | 5 | 2 | | 3 |
| | 3 | 4 | | | 4 |
| | 4 | 1 | | | 1 |
| | 5 | 5 | | | 5 |
| | 6 | 9 | 1 | | 8 |
| | 8 | 10 | | | 10 |
| | 9 | 5 | | | 5 |
| | 10 | 2 | | | 2 |
| | All | 43 | 3 | 0 | 40 |
| | Percent | | 7 | | 93 |

implementation and effectiveness monitoring) were completed on the same day. Two implementation-only evaluations were completed near the end of FY18, so it is possible that the effectiveness evaluations for those projects were completed during the FY19/20 monitoring period. The other four implementation-only evaluations were completed 1 to 3 years before the end of the FY17/18 monitoring period, making it unlikely that effectiveness evaluations were completed for those projects.

Herbicides were by far the most common type of chemical applied (Chem A-Q21), used in 88 percent of projects in FY15/16 and all projects in FY17/18 (Table 67). When projects involved application of multiple chemicals, six projects applied herbicides plus fertilizer and three projects applied herbicides plus an adjuvant. Most of the chemicals were applied as solutions through mechanical means or backpack sprayers (Chem A-Q23); 12 projects used both (Table 68). Nine of the 10 other application methods were described as handheld sprayers or spraying from tanks on trucks or all-terrain vehicles. The intended application target (Chem A-Q24) was most frequently individual organisms—67 percent of projects in FY15/16 and 74 percent in FY17/18—followed by areawide applications for about 21 percent of projects in both monitoring periods; the remainder of projects targeted both.

**Table 67.—**Number of Chem A evaluations completed in FY15/16 (n=48 evaluations) and FY17/8 (n=43 evaluations), by type of chemical applied (Chem A-Q21). Multiple chemicals may be selected.

| Type of chemical applied | FY15/16 | FY17/18 |
|---|---|---|
| Insecticide | 3 | |
| Herbicide | 42 | 43 |
| Fungicide | 1 | |
| Nematicide | | |
| Rodenticide | | |
| Pheromones | | |
| Lime | | |
| Fertilizer | 2 | 4 |
| Other | 1 | 3 |
| Unknown | 1 | |
| Multiple chemicals applied | 2 | 7 |

Treatments associated with Chem A projects are those that are near waterbodies, and treatment locations (completely within, partially within, or adjacent to) are described in relation to the waterbody aquatic management zone[1] (AMZ) (Chem A-Q25). For waterbodies that do not have designated AMZ widths, a 50-foot wide AMZ width is assumed, and the same three location categories exist, with the AMZ referred to as a surrogate AMZ. Most of the chemical treatments for both monitoring periods were completed in or adjacent to designated AMZs, with similar numbers in all three locations (Fig. 37). A small number of treatments were associated with surrogate AMZs. Chem A projects most frequently involved chemical treatments near streams or rivers (Table 69), although one-quarter of projects in FY15/16 involved treatments near wetlands/wet meadows. Ten of the 14 projects in FY15/16 and all the projects in FY17/18 for which multiple waterbody types were selected (Table 69) included ephemeral, intermittent, or perennial channels.

[1]Aquatic management zones (AMZ) are administratively designated zones adjacent to stream channels and other waterbodies that are delineated for applying special management controls to maintain and improve water quality or other water- and riparian-dependent values.

**Table 68.**—Number of Chem A evaluations completed in in FY15/16 (n=48 evaluations) and FY17/8 (n=43 evaluations), by type of application method (Chem A-Q23). Multiple types may be selected.

| Type of application method | FY15/16 | FY17/18 |
|---|---|---|
| Mechanical application of solution | 22 | 15 |
| Backpack sprayer application of solution | 27 | 30 |
| Aerial application of solution | | |
| Mechanical application of solids | 1 | |
| Hand/manual application of solids | 1 | |
| Aerial application of solids | | |
| Mechanical mixing into surface | | |
| Injection | | 5 |
| Paintball equipment | | |
| Other | 5 | 5 |
| Multiple application methods used | 8 | 12 |

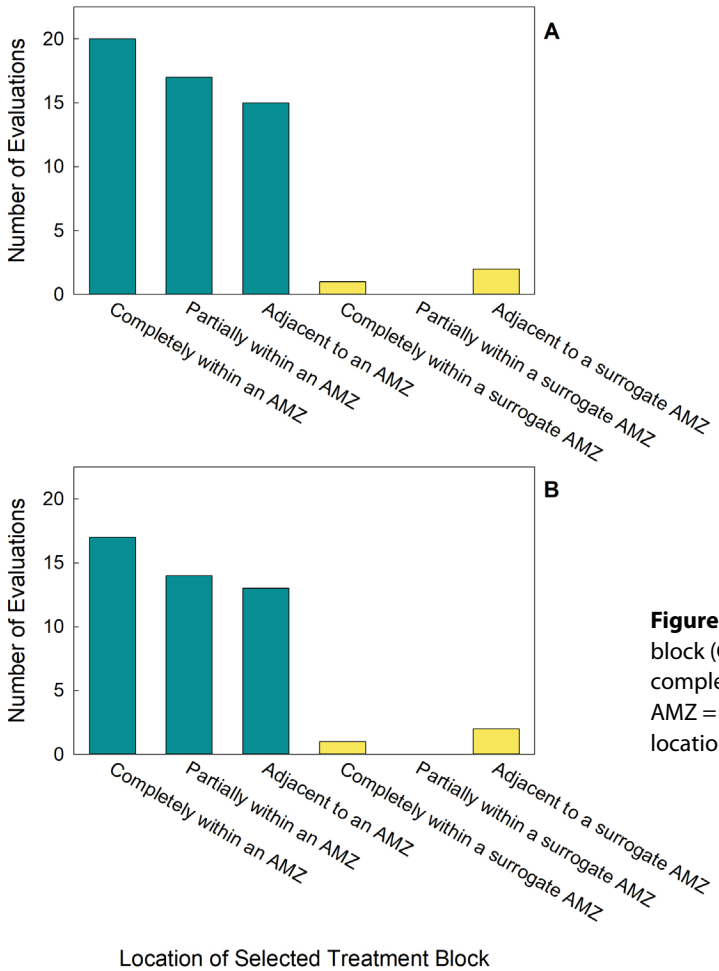



**Figure 37.**—Locations of selected treatment block (Chem A-Q25) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone. Multiple locations could be selected.

**Table 69.—**Number of Chem A evaluations completed in FY15/16 (n=48 evaluations) and FY17/18 (n=43 evaluations), by region and waterbody type adjacent to aquatic management zone (AMZ) or adjacent to treatment area (Chem A-Q26). Projects may have involved multiple waterbodies.

| Monitoring period | Region | Ephemeral stream | Intermittent stream | Perennial stream/ river | Pond | Lake | Wetland/ wet meadow | Estuary | Other[a] | Multiple waterbody types selected |
|---|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | | |
| | 1 | | | 4 | 1 | | 1 | | | 1 |
| | 2 | 1 | 1 | 6 | 2 | 5 | 6 | | | 6 |
| | 3 | 2 | 3 | 2 | | | 1 | | 1 | 1 |
| | 4 | | | 2 | 1 | | | | 1 | 1 |
| | 5 | | 1 | 1 | | | 1 | | | 1 |
| | 6 | | 3 | 8 | 1 | | 2 | | | 2 |
| | 8 | 2 | 4 | 1 | | 1 | | | | 1 |
| | 9 | | 2 | | | | | | 2 | 1 |
| | 10 | | | | | | 1 | | | |
| | All | 5 | 14 | 24 | 5 | 6 | 12 | 0 | 4 | 14 |
| FY17/18 | | | | | | | | | | |
| | 1 | | | 2 | | | 1 | | | 1 |
| | 2 | | 2 | 3 | | | 1 | | | 1 |
| | 3 | 3 | | 1 | | | | | | |
| | 4 | | | 1 | | | | | | |
| | 5 | | 2 | 3 | | | | | | |
| | 6 | 1 | 1 | 8 | | | 2 | | | 3 |
| | 8 | | 4 | 2 | | 4 | | | | |
| | 9 | 1 | 1 | 1 | | | | | 2 | |
| | 10 | | 1 | 1 | | | | | | |
| | All | 5 | 11 | 22 | 0 | 4 | 4 | 0 | 2 | 5 |

[a] Responses were spring, seep, drainageway, and manmade ditch.

## Chemicals A: Implementation Results and Their Tie to Header Information

Most Chem A projects included some type of delineation of treatment area boundaries (Table 70), with at least 35 percent delineated both on project maps as well as on the ground and just over 40 percent delineated only on project maps (Table 70). Nine percent of projects were delineated on neither maps nor the ground.

Project planning is assessed in the protocol using two questions:

- What type of planning document specified BMPs for the project (Chem A-Q28)?
- Were all BMPs from that document included in the project contract or plan (Chem A-Q29)?

**Table 70.—**Number of Chem A implementation evaluations completed in FY15/16 and FY17/18, by region and location of project treatment area boundary delineation (Chem A-Q27). Both project maps and on the ground may be selected.

| Monitoring period | Region | Number of evaluations | Delineated on project maps only | Delineated on ground only | Delineated on maps and on ground | Not delineated |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 4 | | 2 | 1 | 1 |
| | 2 | 11 | 5 | 1 | 4 | 1 |
| | 3 | 6 | 2 | | 2 | 2 |
| | 4 | 2 | 2 | | | |
| | 5 | 2 | | 1 | 1 | |
| | 6 | 11 | 5 | | 4 | 2 |
| | 8 | 6 | 3 | | 3 | |
| | 9 | 3 | 2 | | 1 | |
| | 10 | 1 | | 1 | | |
| | All | 46 | 19 | 5 | 16 | 6 |
| | Percent | | 41 | 11 | 35 | 13 |
| FY17/18 | | | | | | |
| | 1 | 2 | 2 | | | |
| | 2 | 5 | 1 | 3 | 1 | |
| | 3 | 4 | 2 | | 1 | 1 |
| | 4 | 1 | 1 | | | |
| | 5 | 5 | 2 | | 3 | |
| | 6 | 9 | 2 | 4 | 3 | |
| | 8 | 10 | 4 | | 6 | |
| | 9 | 5 | 3 | | 2 | |
| | 10 | 2 | 1 | | | 1 |
| | All | 43 | 18 | 7 | 16 | 2 |
| | Percent | | 42 | 16 | 37 | 5 |

Most of the projects were developed through EAs and EISs (Table 71). Seven projects were completed without NEPA analysis, but they did employ BMPs derived from other sources. The distribution of planning document type used to complete the projects across the various AMZ-related locations is shown in Figure 38. When chemical treatments were within or partially within an AMZ or surrogate AMZ, projects used EISs and EAs a similar percentage of the time in FY15/16 (47 and 42 percent, respectively), while projects in those same areas primarily used EAs in FY17/18 (66 percent).

Table 72 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the planning documents or other BMP guidance documents are assigned, along with the information about whether all the BMPs in each provision were then carried into the project contract or plan. A "yes" indicates that there was at least one BMP in the planning or guidance documents applicable to the provision, and that all

**Table 71.—**Number for Chem A evaluations completed in FY15/16 and FY17/18, by region and type of primary planning document used (Chem A-Q28)

| Monitoring period | Region | No planning document | EIS[a] | EA[b] | CE[c] | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | | 3 | | 1 | |
| | 2 | | 2 | 6 | 1 | 2 |
| | 3 | | 3 | 2 | | 1 |
| | 4 | | | | | 2 |
| | 5 | | | 2 | | |
| | 6 | | 9 | 2 | | |
| | 8 | | | 6 | | |
| | 9 | | | 3 | | |
| | 10 | | | 1 | | |
| | All | 0 | 17 | 22 | 2 | 5 |
| | Percent | | 37 | 48 | 4 | 11 |
| FY17/18 | | | | | | |
| | 1 | | | 2 | | |
| | 2 | 1 | | 2 | | 2 |
| | 3 | | 1 | 3 | | |
| | 4 | | 1 | | | |
| | 5 | | 1 | 4 | | |
| | 6 | | 5 | 4 | | |
| | 8 | | | 10 | | |
| | 9 | | | 5 | | |
| | 10 | | | 2 | | |
| | All | 1 | 8 | 32 | 0 | 2 |
| | Percent | 2 | 19 | 74 | | 5 |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.

BMPs assigned to that provision were included in the project contract or plan. Conversely, a "no" indicates that at least one BMP applicable to the provision in the planning or guidance documents was not carried forward into the project contract or plan. "Not applicable" indicates that there were no BMPs in the planning or guidance documents applicable to the provision, so there was no obligation to carry them into the contract or plan. In the National BMP program, there is no expectation that every provision has BMPs assigned; consequently, the percentages for "yes" and "no" in the last two columns of each monitoring period of Table 72 are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

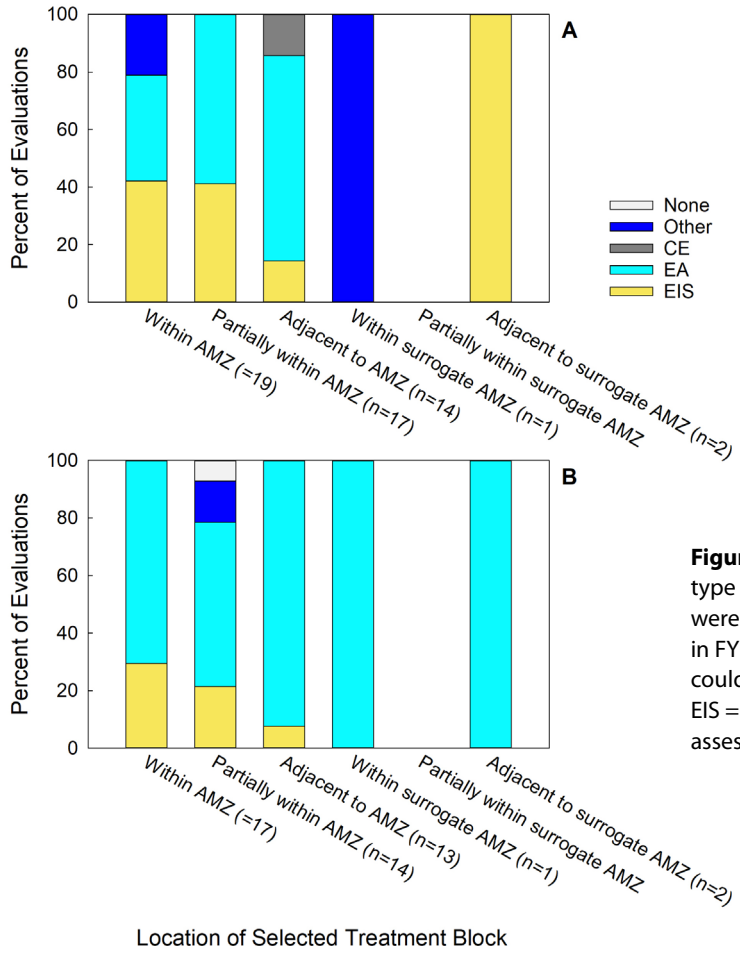



**Figure 38.—**Distribution of primary planning document type (Chem A-Q28) by location where project activities were conducted (Chem A-Q25) for projects completed in FY15/16 (A) and FY17/18 (B). Multiple locations could be selected. AMZ = aquatic management zone. EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

When a provision had at least one BMP prescription identified in the planning documents, all of those BMP prescriptions were included in the corresponding plan or contract in an average of 91 percent of evaluations in FY15/16 and 92 percent of evaluations in FY17/18 with BMP prescriptions in that provision (Table 72). "Soil chemistry" and "required use of GPS flight/application lines" were the two provisions for which that value was below 80 percent of projects in both monitoring periods. On average, specific BMPs were included in 13 provisions per project in FY15/16 and 14 provisions per project in FY17/18, although projects completed using an EIS as the primary planning document averaged BMPs assigned to 15 of the 20 provisions in both monitoring periods. Significantly more BMP provisions ($p = 0.01$, generalized linear mixed model [GLMM] with negative binomial distribution and log link function) were included in projects planned using EISs (15) than for projects planned with CEs or EAs (12 for each) in FY15/16. No significant differences in number of provisions included in the project contract or plan were found by type of planning document in FY17/18 ($p = 0.51$, GLMM with Poisson distribution and log link function). When percentages of provisions included were compared by type of planning document, projects that used documents from NEPA analyses included 91 to 100 percent of provisions in both monitoring periods, while projects using other BMP guidance documents averaged about 80 percent inclusion in both periods. No significant differences were found between the

**Table 72.—**Frequencies at which BMPs in provisions were included in the project contract or plan (Chem A-Q29) for Chem A evaluations completed in FY15/16 (n=46 evaluations) and FY17/18 (n=42 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision[a] to which prescribed BMP is applicable | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[b] (number) | FY15/16 Yes (percent[c]) | FY15/16 No (percent[c]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical/form of chemical selected to reduce unintended consequences | 40 | 2 | 3 | 95 | 5 | 42 | 0 | 0 | 100 | 0 |
| Application technique selected to reduce unintended consequences | 44 | 1 | 1 | 98 | 2 | 42 | 0 | 0 | 100 | 0 |
| Protection measures at waterbody crossings | 25 | 2 | 16 | 93 | 7 | 25 | 2 | 15 | 93 | 7 |
| Limiting areal extent of chemically treated area | 26 | 1 | 15 | 96 | 4 | 30 | 0 | 12 | 100 | 0 |
| Providing untreated buffers between target areas and waterbodies | 29 | 3 | 11 | 91 | 9 | 26 | 3 | 12 | 90 | 10 |
| Temperature conditions | 30 | 4 | 8 | 88 | 12 | 25 | 3 | 13 | 89 | 11 |
| Humidity conditions | 23 | 4 | 15 | 85 | 15 | 24 | 3 | 15 | 89 | 11 |
| Wind speed and/or wind direction | 42 | 0 | 3 | 100 | 0 | 39 | 1 | 2 | 98 | 3 |
| Precipitation conditions | 41 | 1 | 2 | 98 | 2 | 40 | 2 | 0 | 95 | 5 |
| Timing considerations other than weather | 37 | 0 | 5 | 100 | 0 | 35 | 2 | 4 | 95 | 5 |
| Transportation of chemicals to site | 33 | 3 | 6 | 92 | 8 | 39 | 1 | 2 | 98 | 3 |
| Storage of chemicals | 33 | 2 | 8 | 94 | 6 | 32 | 1 | 9 | 97 | 3 |
| Disposal of unused chemicals | 31 | 2 | 10 | 94 | 6 | 34 | 1 | 7 | 97 | 3 |
| Streamflow/runoff levels | 18 | 3 | 21 | 86 | 14 | 29 | 4 | 9 | 88 | 12 |
| Soil chemistry | 15 | 7 | 20 | 68 | 32 | 20 | 7 | 14 | 74 | 26 |
| Soil physical conditions | 25 | 5 | 12 | 83 | 17 | 30 | 4 | 8 | 88 | 12 |
| Infestation levels | 23 | 0 | 20 | 100 | 0 | 23 | 2 | 16 | 92 | 8 |
| Required use of GPS flight/application lines | 6 | 3 | 33 | 67 | 33 | 5 | 2 | 34 | 71 | 29 |
| Calibration of application equipment prior to chemical application | 32 | 1 | 9 | 97 | 3 | 31 | 3 | 7 | 91 | 9 |
| Monitoring | 36 | 1 | 7 | 97 | 3 | 38 | 1 | 2 | 97 | 3 |
| Mean | 29 | 2 | 11 | 91 | 9 | 30 | 2 | 9 | 92 | 8 |

[a] Listed provision had at least one BMP from decision document or guidance document included in project contract or plan.
[b] Not applicable (NA) because no prescribed BMPs were associated with the provision.
[c] Percent was calculated from "yes" and "no" counts.

percentages by type of planning document in either monitoring period (p = 0.87 FY15/16, p = 0.31 FY17/18; Kruskal-Wallis test).

It is possible that additional BMPs applicable to the project were not in the planning documents but were in a project contract or plan; such BMPs may be associated with standard contract language for the specific type of project or resource. Additional BMPs applicable to four provisions in FY15/16 and eight provisions in FY17/18 were identified in the contract or plan for Chem A projects (Table 73). The most frequently added provisions were coincidentally the same provisions—"soil chemistry" and "required use of GPS flight/application lines"—that had the lowest rates of inclusion in contracts or plans when corresponding BMPs were specified in planning documents.

Most of the BMPs applicable to the Chem A projects were implemented fully (Table 74). Applicable in this context includes only those BMPs that were included in the project contract or plan; those that were identified during planning but were not included in the contract or plan are not considered applicable (thus values in Table 72 and Table 74

**Table 73.—**Frequencies at which BMPs to protect water, aquatic, and riparian resources were derived from project contract or plan language and not from BMPs in NEPA documents or other BMP guidance documents for Chem A evaluations completed in FY15/16 (n=46 evaluations) and FY17/18 (n=43 evaluations)

| Provision | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Chemical/form of chemical selected to reduce unintended consequences | | | | |
| Application technique selected to reduce unintended consequences | | | | |
| Protection measures at waterbody crossings | | | 1 | 2 |
| Limiting areal extent of chemically treated area | | | | |
| Providing untreated buffers between target areas and waterbodies | | | 1 | |
| Temperature conditions | | | 1 | |
| Humidity conditions | | | | |
| Wind speed and/or wind direction | | | | |
| Precipitation conditions | | | | |
| Timing considerations other than weather | | | | |
| Transportation of chemicals to site | | | | |
| Storage of chemicals | | | | |
| Disposal of unused chemicals | | | | |
| Streamflow/runoff levels | 1 | 2 | 1 | 2 |
| Soil chemistry | 2 | 4 | 1 | 2 |
| Soil physical conditions | | | 1 | 2 |
| Infestation levels | | | 2 | 5 |
| Required use of GPS flight/application lines | 2 | 4 | 5 | 12 |
| Calibration of application equipment prior to chemical application | | | | |
| Monitoring | 1 | 2 | | |

**Table 74.—**Frequencies at which all BMPs in provisions included in the project contract or plan were implemented fully (Chem A-Q30) for Chem A evaluations completed in FY15/16 (n=46 evaluations) and FY17/18 (n=43 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a] (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical/form of chemical selected to reduce unintended consequences | 40 | 0 | 5 | 100 | 0 | 41 | 1 | 0 | 98 | 2 |
| Application technique selected to reduce unintended consequences | 43 | 0 | 3 | 100 | 0 | 41 | 1 | 0 | 98 | 2 |
| Protection measures at waterbody crossings | 22 | 2 | 19 | 92 | 8 | 25 | 1 | 16 | 96 | 4 |
| Limiting areal extent of chemically treated area | 26 | 0 | 16 | 100 | 0 | 29 | 0 | 13 | 100 | 0 |
| Providing untreated buffers between target areas and waterbodies | 24 | 2 | 17 | 92 | 8 | 26 | 1 | 14 | 96 | 4 |
| Temperature conditions | 27 | 2 | 13 | 93 | 7 | 25 | 1 | 15 | 96 | 4 |
| Humidity conditions | 21 | 2 | 19 | 91 | 9 | 23 | 1 | 18 | 96 | 4 |
| Wind speed and/or wind direction | 38 | 1 | 5 | 97 | 3 | 39 | 0 | 3 | 100 | 0 |
| Precipitation conditions | 39 | 1 | 4 | 98 | 3 | 40 | 0 | 2 | 100 | 0 |
| Timing considerations other than weather | 31 | 1 | 10 | 97 | 3 | 35 | 0 | 7 | 100 | 0 |
| Transportation of chemicals to site | 31 | 1 | 10 | 97 | 3 | 39 | 0 | 3 | 100 | 0 |
| Storage of chemicals | 31 | 2 | 10 | 94 | 6 | 31 | 0 | 10 | 100 | 0 |
| Disposal of unused chemicals | 28 | 1 | 14 | 97 | 3 | 33 | 0 | 9 | 100 | 0 |
| Streamflow/runoff levels | 18 | 1 | 23 | 95 | 5 | 28 | 2 | 12 | 93 | 7 |
| Soil chemistry | 16 | 1 | 25 | 94 | 6 | 20 | 1 | 20 | 95 | 5 |
| Soil physical conditions | 22 | 0 | 20 | 100 | 0 | 29 | 2 | 10 | 94 | 6 |
| Infestation levels | 21 | 0 | 21 | 100 | 0 | 25 | 0 | 17 | 100 | 0 |
| Required use of GPS flight/application lines | 7 | 1 | 34 | 88 | 13 | 10 | 0 | 31 | 100 | 0 |
| Calibration of application equipment prior to chemical application | 30 | 0 | 12 | 100 | 0 | 29 | 1 | 11 | 97 | 3 |
| Monitoring | 36 | 1 | 7 | 97 | 3 | 37 | 1 | 3 | 97 | 3 |
| Mean | 28 | 1 | 14 | 96 | 4 | 30 | 1 | 11 | 98 | 2 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.
[b] Percent calculated from "yes" and "no" counts.

differ). As in Table 72, the percentages in Table 74 were calculated only from the "yes" and "no" counts. "Required use of GPS flight/application lines" was the only provision for which the rates of full implementation were below 92 percent of projects in FY15/16, but at 88 percent was still high. The number of provisions that were implemented fully differed significantly among types of planning documents in FY15/16 ($p < 0.001$, GLMM with negative binomial distribution and log link function), which is not surprising because the number of provisions included differed by type of planning document. The mean numbers of provisions implemented fully were EIS = 15, EA = 11, other guidance documents = 10, CE = 1. All pairwise comparisons were significantly different except EA versus other guidance documents. Only two projects were completed with a CE (Table 71). Of those, one had no BMP provisions implemented fully, and the other had one of two provisions implemented fully. Rerunning the analysis excluding the data from the CEs still showed the number of provisions implemented fully was significantly different among planning documents ($p = 0.04$), but only the pairwise comparison of EIS versus EA remained significantly different ($p = 0.02$). Number of provisions implemented fully was not significantly different by type of planning document in FY17/18 ($p = 0.38$, GLMM with Poisson distribution and log link function); projects using EAs and EISs averaged 14 provisions implemented fully while those using other guidance documents averaged 10. Percentage of provisions implemented fully was not significantly different by type of planning document in either monitoring period ($p = 0.73$ FY15/16, $p = 0.29$ FY17/18; Kruskal-Wallis test). Mean percentages of BMPs implemented fully were 94 to 97 percent for EAs and EISs in both monitoring periods and 80 and 87 percent for other guidance documents in FY15/16 and FY17/18, respectively.

Four Chem A questions (Chem A-Q31, Chem A-Q32, Chem A-Q33, and Chem A-Q34) are used as indicators of appropriate precautions taken for chemical use, and the results for these questions are summarized in Table 75. Proper procedures were followed for most of the four metrics. Lack of inspections during chemical use was the most common shortcoming. Another implementation question (Chem A-Q35) specifically evaluates whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, it asks whether corrective actions were taken if problems occurred during project implementation. In each monitoring period the results were almost identical; about 86 percent of projects had no problems requiring corrective actions, 7 percent had problems requiring corrective actions which were taken, 2 percent had problems requiring corrective actions but no corrections were made, and for 4 percent of the projects the answers to this question were unknown due to insufficient documentation or available information.

Because chemical spills or leaks during transport, handling, mixing, application, or cleanup may occur, an implementation question (Chem A-Q36) assesses how such spills and leaks were handled. Administrative units in the Forest Service have a contingency and emergency response plan (CERP) or equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in those cases the unit would follow that state agency's procedures. Two evaluations indicated spills or leaks were addressed following the CERP procedures while four evaluations indicated cleanup did not follow the unit's CERP (Table 76).

**Table 75.—**Distribution of whether chemical safety procedures were followed for Chem A evaluations completed in FY15/16 (n=46 evaluations) and FY17/18 (n=43 evaluations), by procedure

| Chemical safety procedure | Procedure followed | FY15/16 (number) | FY15/16 (percent[a]) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|---|
| Safety data sheet for each chemical reviewed prior to use (Chem A-Q31) | Yes | 40 | 87 | 39 | 91 |
| | No | 3 | 6 | 0 | |
| | Unknown | 3 | 6 | 4 | 9 |
| Label instructions for each chemical followed (Chem A-Q32) | Yes | 44 | 96 | 40 | 93 |
| | No | 0 | | 2 | 5 |
| | Unknown | 2 | 4 | 1 | 2 |
| Applicator had all required permits, licenses, or certifications at time of application (Chem A-Q33) | NA (none required) | 2 | 4 | 3 | 7 |
| | Yes | 43 | 93 | 40 | 93 |
| | No | 1 | 2 | | |
| Inspections performed during chemical use (Chem A-Q34) | Yes | 35 | 76 | 30 | 70 |
| | No | 11 | 24 | 13 | 30 |

[a] Within each procedure.

**Table 76.—**Distribution of whether chemical or fuel spills and leaks, if they occurred during project implementation, were handled according to the unit's contingency and emergency response plan (or its equivalent) (Chem A-Q36) for Chem A evaluations completed in FY15/16 and FY17/18

| Chemical or fuel spills and leaks handled according to the unit's contingency and emergency response plan | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No contingency and emergency response plan | 0 | | 0 | |
| No spills or leaks | 43 | 94 | 40 | 93 |
| Yes; according to contingency and emergency response plan | 2 | 4 | 0 | |
| No; not according to contingency and emergency response plan | 1 | 2 | 3 | 7 |

## Chemicals A: Effectiveness Results and Their Tie to Implementation Results and Header Information

The effectiveness questions for Chem A focus on whether treatments affected only the target organisms and if the chemicals remained within the intended areas of use, not on the chemical efficacy for the intended use. Both observational evidence and monitoring data, if available, are used in the assessment of effectiveness.

In 5 of 45 evaluations in FY15/16 and 5 of 40 evaluations in FY17/18, observational evidence indicated that the applied chemical moved off target or affected nontarget organisms (Chem A-Q41). For 2 of those evaluations in FY15/16, some observational evidence indicated that the chemical contaminated surface waters (Chem A-Q42). It is

important to understand that contamination in this context means only that the chemical reached a waterbody; it does not imply that concentrations violated water quality standards or that beneficial uses were negatively affected.

Monitoring by some type of sampling to determine if water contamination or aquatic effects occurred from the treatments was performed for 19 projects in FY15/16 and 20 projects in FY17/18 (Chem A-Q43). Most of the monitoring did not involve direct surface water or ground water monitoring (Table 77). The most frequent type of monitoring in Table 77 was "other," which included visual monitoring (n=20), vegetation effects (n=2), and passive water samples (n=1). However, the visual monitoring and vegetation effects monitoring responses for Chem A-Q43 would likely have been more accurately reported in Chem A-Q41 (as observational evidence) rather than in Chem A-Q43 (as monitoring evidence).

One evaluation in FY15/16 and two in FY17/18 for which monitoring was part of the project indicated the existence of evidence that the chemical moved beyond the target area or affected more than the target organism (Chem A-Q44). Two of the three projects reported that monitoring evidence showed that surface water or groundwater was contaminated by the chemical (Chem A-Q45), and the other could not determine whether contamination occurred. For all three projects, the review team determined that the amount of herbicide affecting the surface water quality did not affect beneficial uses of that waterbody (Chem A-Q47).

Numerous causes for off-target movement, nontarget effects, or water contamination (from observational evidence and monitoring evidence) were identified (Table 78). Six evaluations indicated that insufficient care was taken during application. "Other" causes included over spraying, intermixed targets and nontargets, and spraying too close to the AMZ.

**Table 77.—**Types of water quality or aquatic monitoring performed (Chem A-Q43) for Chem A evaluations completed in FY15/16 (n=45 evaluations) and FY17/18 (n=40 evaluations). Multiple types may be selected.

| Type of water quality or aquatic monitoring | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| No monitoring performed | 24 | 16 |
| Surface water samples collected during application and analyzed on site | 2 | 1 |
| Surface water samples collected during application and analyzed off site later | 0 | 0 |
| Groundwater samples collected during application and analyzed on site | 0 | 0 |
| Groundwater samples collected during application and analyzed off site later | 0 | 0 |
| Spray cards | 2 | 6 |
| Other | 15 | 13 |
| Unknown | 2 | 4 |

**Table 78.—**Causes that allowed chemical movement off target or water contamination (Chem A-Q48) for Chem A evaluations completed in FY15/16 (n=5 evaluations) and FY17/18 (n=6 evaluations). Multiple causes may be selected.

| Cause of chemical movement or water contamination | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| Application technique was inappropriate or inadequate for site or conditions | 1 | |
| Insufficient care taken during application to avoid nontarget organisms or water contamination | 3 | 3 |
| Inadequate protection measures at waterbody crossings | 1 | |
| Treated areas were not separated sufficiently from waterbodies | 1 | |
| Wind direction was inappropriate for the chemical used or time of treatment | | 1 |
| Precipitation amount, intensity, and/or duration was inappropriate for the chemical used or time of treatment | 1 | |
| Lack of or improper calibration of application equipment | | 1 |
| SDS[a] information disregarded or not fully followed | 1 | |
| Label instructions disregarded or not fully followed | 1 | |
| Other | 4 | 2 |

[a] Safety data sheet.

There were no significant associations in either monitoring period between whether/where boundaries were delineated and the frequency of observed evidence of off-target movement and affected nontarget organisms (p = 0.46 FY15/16, p = 0.64 FY17/18) or the frequency of monitoring evidence of off-target movement and affected nontarget organisms (p = 0.59 FY15/16, p = 1.00 FY17/18) (Table 79). The lack of association is probably largely attributable to the low frequency of either observational or monitoring evidence of off-target movement or effects ("yes" columns in Table 79).

**Table 79.—**Distribution of whether evidence existed that the chemical moved beyond target area or affected nontarget organisms for Chem A evaluations completed in FY15/16 and FY17/18, by type of evidence and how treatment area boundary was delineated (Chem A-Q27)

| Type of evidence | Treatment area boundary delineation | FY15/16 Yes; evidence existed | FY15/16 No; evidence did not exist | FY17/18 Yes; evidence existed | FY17/18 No; evidence did not exist |
|---|---|---|---|---|---|
| Observed evidence of off-target movement or effects (Chem A-Q41) | On project maps | 1 | 16 | 3 | 14 |
| | On the ground | 0 | 5 | 1 | 4 |
| | On maps and the ground | 3 | 12 | 1 | 15 |
| | Not delineated | 1 | 5 | 0 | 2 |
| Monitoring evidence of off-target movement or effects[a] (Chem A-Q44) | On project maps | 0 | 7 | 1 | 8 |
| | On the ground | 0 | 3 | 0 | 0 |
| | On maps and the ground | 1 | 5 | 0 | 9 |
| | Not delineated | 0 | 1 | 0 | 0 |

[a] Includes only evaluations for which some type of monitoring was performed (see Table 77).

Chemical applications may involve the use of mechanical equipment that requires the use of fuels, lubricants, and similar types of chemicals. Consequently, during effectiveness monitoring, the team reviews the various locations that were part of the evaluation for evidence of chemical (other than the applied chemicals) or fuel spills or leaks. In two effectiveness evaluations in FY15/16, evidence of such spills or leaks was observed outside an AMZ (Table 80) and both corresponded to spills or leaks reported during the implementation reviews that were handled according to the unit CERP (Table 76).

Inspections are an important part of projects involving chemical applications. The Chem A protocol includes two questions about inspections, one in implementation (Chem A-Q34; Table 75) and one in effectiveness (Chem A-Q50), that are designed to tie together. Respectively, they ask whether inspections were completed during the project (implementation) and whether lack of inspections (if applicable) influenced BMP effectiveness. Table 81 shows the relationship between the two questions for projects in

**Table 80.—**Evidence of chemical or fuel spills, leaks or waste containers at the time of the effectiveness evaluation (Chem A-Q49) for Chem A evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

| Evidence | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No evidence | 43 | 96 | 40 | 100 |
| Spills or leaks outside an AMZ[a] | 2 | 4 | | |
| Spills or leaks within an AMZ | | | | |
| Spills or leaks in a waterbody | | | | |
| Waste containers outside an AMZ | | | | |
| Waste containers within an AMZ | | | | |
| Waste containers in a waterbody | | | | |

[a] Aquatic management zone.

**Table 81.—**Number and distribution of project inspections during chemical use (Chem A-Q34) in relationship to problems found by observation or monitoring during effectiveness review (Chem A-Q50) for Chem A evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (28 and 13 percent of FY15/16 and FY17/18 responses, respectively).

| Monitoring period | Inspections during chemical use (implementation) | Not applicable; inspections conducted during application (effectiveness) | Yes; lack of administration contributed to problems found (effectiveness) | No; lack of administration did not contribute to problems found (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | Yes | 21 | | 11 |
| | No | 1 | 1 | 9 |
| FY17/18 | | | | |
| | Yes | 25 | | 3 |
| | No | 2 | | 10 |

which both implementation and effectiveness evaluations were completed within each monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Twenty-eight percent of the evaluations in FY15/16 and 13 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remainder of the projects, one project in FY15/16 lacked inspections, which contributed to problems observed during the effectiveness evaluation of that project (Table 81).

## Chemicals A: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

Overall, 54 and 47 percent of the projects were rated as *fully implemented*, and the combination of *fully implemented* and *mostly implemented* ratings included 74 and 77 percent of the Chem A projects in FY15/16 and FY17/18, respectively (Fig. 39A, B). One evaluation in FY17/18 lacked responses in the database for questions needed to rate implementation and is identified as "incomplete data" in Figure 39B. BMP effectiveness ratings were even better, with 93 and 97 percent of the projects rated as *effective* (Fig. 39C, D). Due to the high percentage of projects with *effective* ratings, statistically significant associations involving effectiveness ratings are not expected.

The distribution of implementation and effectiveness ratings across the three possible locations where chemical treatments occurred is shown in Figure 40. Designated AMZ

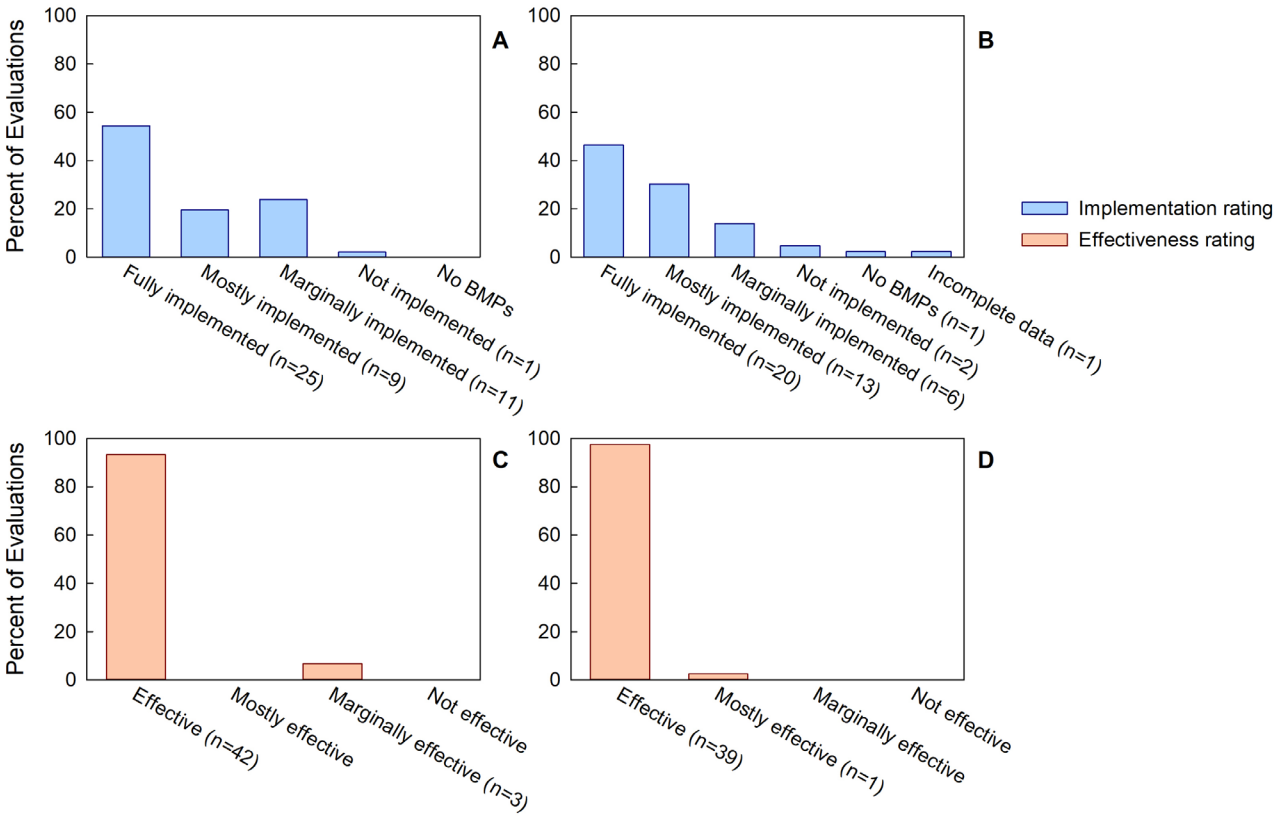



**Figure 39.**—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Chem A evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

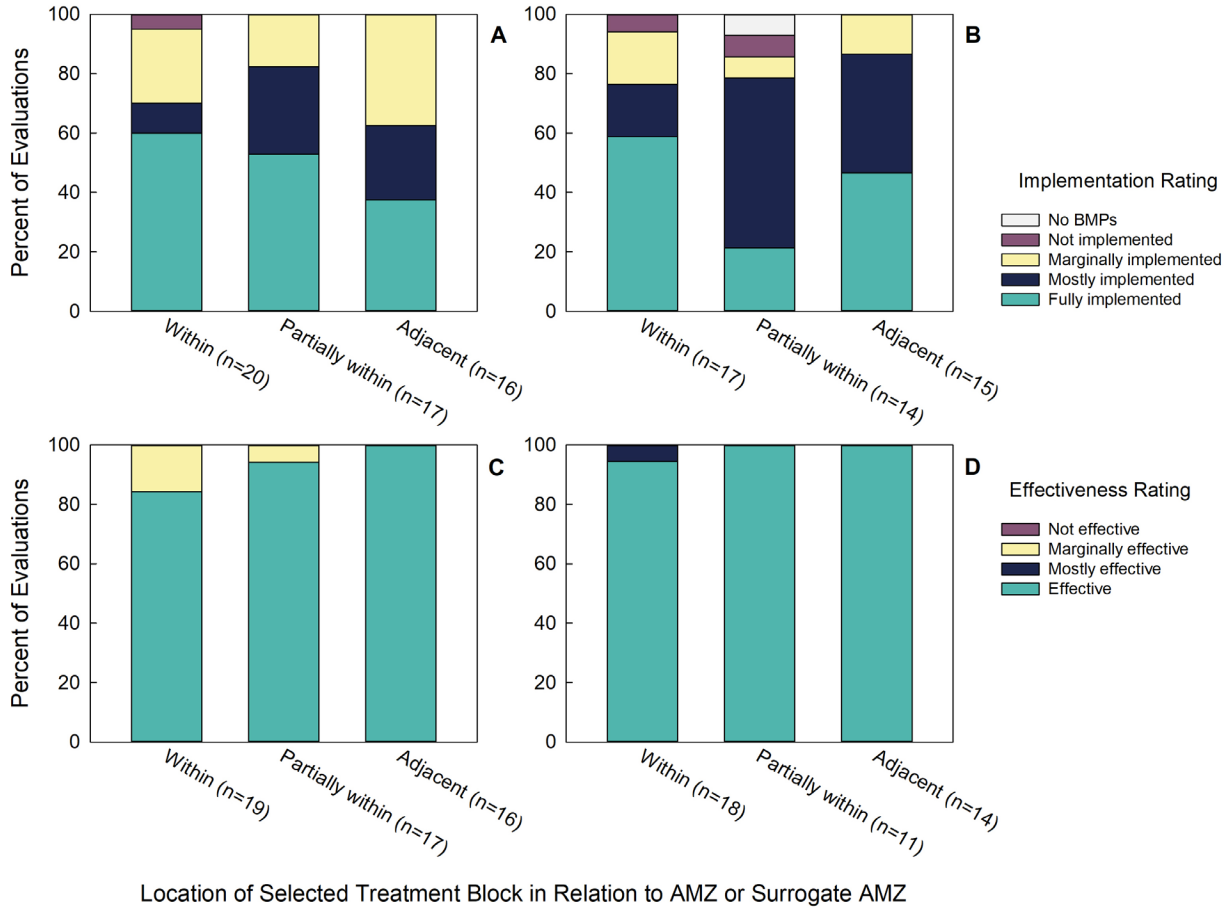



**Figure 40.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by the possible treatment areas (Chem A-Q25) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D); AMZ and surrogate AMZ answers were combined. AMZ = aquatic management zone. Multiple answers were possible.

and surrogate AMZ samples were combined due to the small sample sizes for surrogate AMZs. Because multiple areas could be selected, statistical tests were not possible. Visually, there appears to be a tendency for better BMP implementation ratings closer to a waterbody (i.e., within and partially within the AMZ, Fig. 40A) compared to farther away from a waterbody in FY15/16, although the reverse was more prevalent in FY17/18 (Fig. 40B). Effectiveness was just slightly poorer nearer to a waterbody in both monitoring periods (Fig. 40C, D).

The distribution of implementation and effectiveness ratings across the waterbody types adjacent to the treatment areas or AMZs are shown in Figure 41. Again, because multiple waterbodies could be present in the vicinity of the chemical treatments, no statistical tests of association were performed. The evaluations were relatively well distributed across the possible types of waterbodies, although the majority of those associated with project areas were perennial streams or rivers. Implementation was somewhat poorer for ephemeral streams, which is not entirely surprising because ephemeral streams may not be identified during planning.

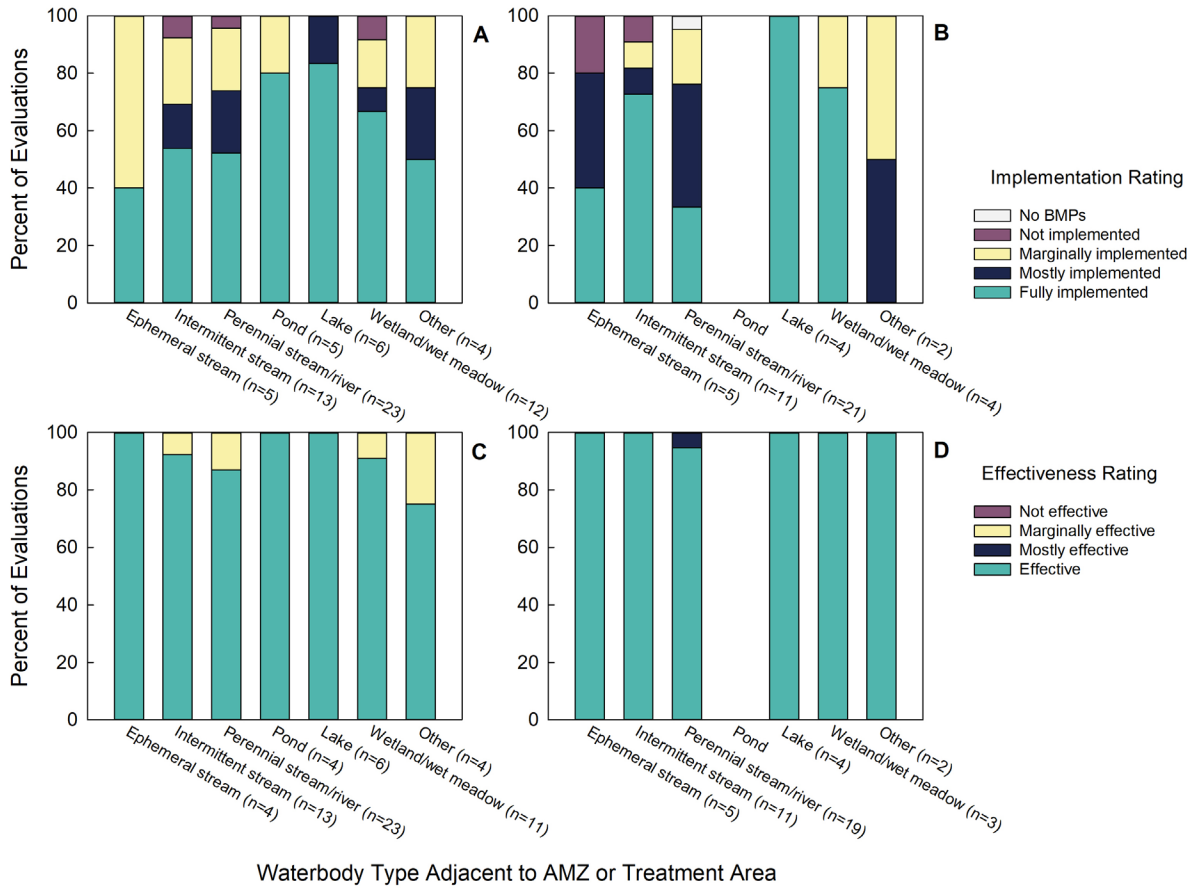



**Figure 41.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by the type of waterbody adjacent to the AMZ or treatment area (Chem A-Q26) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). AMZ = aquatic management zone. Multiple waterbody types per project were possible.

A small number of projects involved both individual and areawide targets (Chem A-Q24), but most chemical treatments were aimed at individual organisms (Fig. 42). Implementation does not appear to be better for any single type of target, although *not implemented* ratings occurred only when chemical treatments targeted individuals. However, because both types could be included in a project, statistical association tests were not performed.

As noted previously (Table 68), most of the chemical applications were as solution, and only two applications were as solids. Implementation ratings appear to be poorer for solid chemicals (Fig. 43), but the differences in sample sizes limit the utility of this comparison. The application methods listed in Table 68 were separated into mechanical and nonmechanical techniques and compared to the distributions of the implementation and effectiveness ratings. Regardless of application type, 70 to 90 percent of the evaluations had ratings of *fully implemented* and *mostly implemented* (Fig. 43).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Chem A-Q16) were not associated with the effectiveness ratings in either monitoring period (p = 1.00 FY15/16 and FY17/18) (Fig. 44). The number of wet weather evaluations

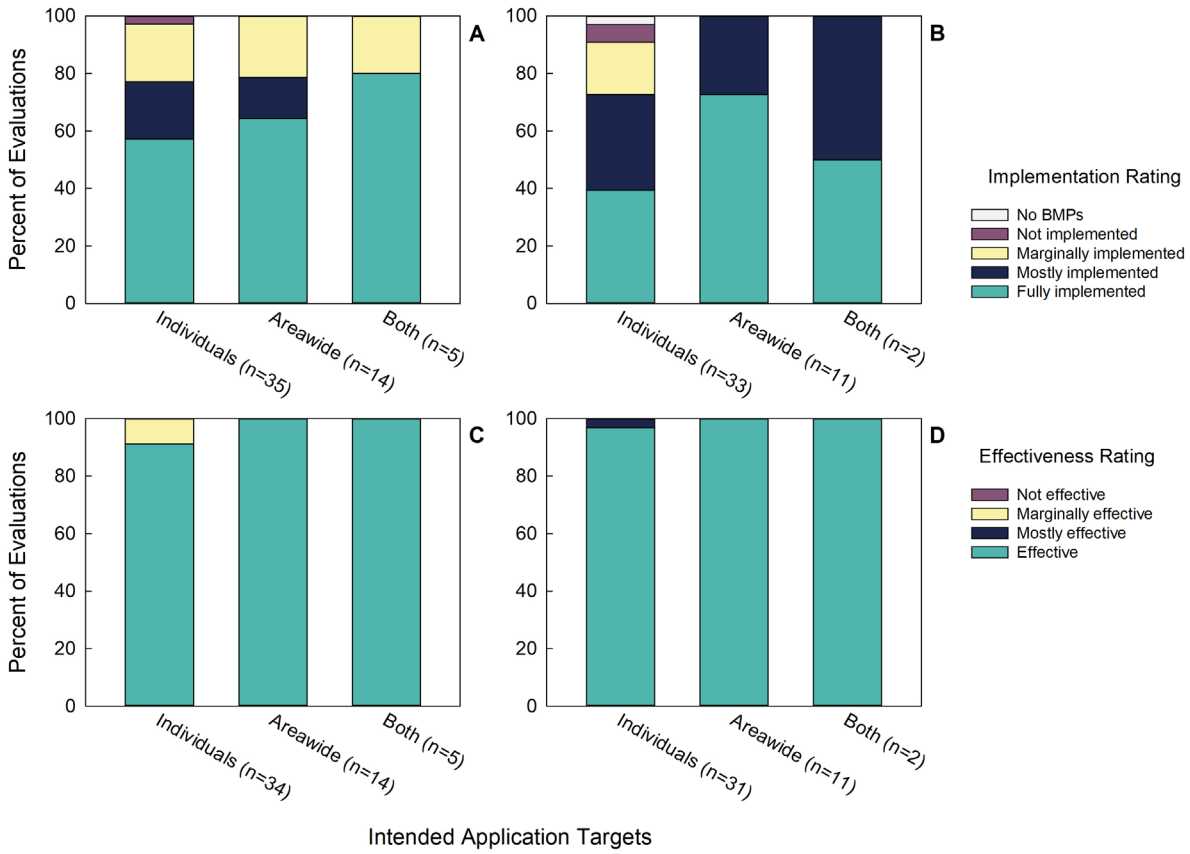



**Figure 42.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by the intended application targets (Chem A-Q24) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). Multiple answers were possible.

was about one-third of those for dry weather, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential. That said, the preponderance of *effective* ratings suggests that factors other than weather control overall effectiveness.

The type of planning document used for preparing Chem A projects (Chem A-Q28) was not statistically associated with the implementation ratings ($p = 0.48$) or the effectiveness ratings ($p = 0.52$) in FY15/16 (Fig. 45A, C) or the effectiveness ratings ($p = 1.00$) in FY17/18. A significant association was found between the type of planning document and implementation ratings in FY17/18 ($p < 0.01$). This result for the implementation ratings appears to indicate that implementation was generally poorer for projects planned through an EIS than other alternatives. However, the smaller sample sizes for projects planned using CEs and other BMP sources (Fig. 45A, B) do not allow a complete examination of the relationship between planning document type and implementation ratings.

The number of BMP provisions included in a project contract or plan (Chem A-Q29) was not significantly different by effectiveness rating ($p = 0.53$ FY15/16, $p = 0.19$ FY17/18; GLMM with negative binomial distribution and log link function), nor was the number of BMP provisions implemented fully (Chem A-Q30) significantly different by rating

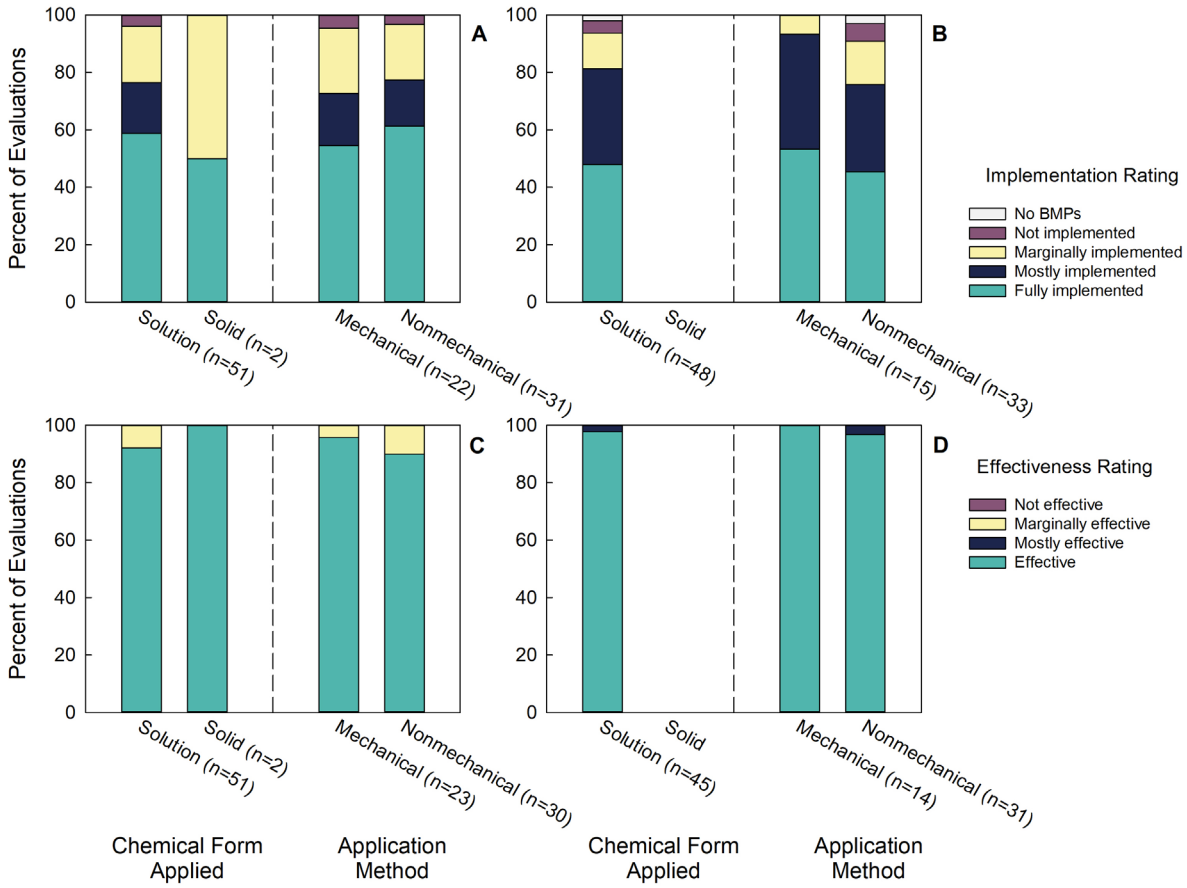



**Figure 43.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for the general types of chemical forms applied and the general application types (Chem A-Q23) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). Multiple chemical forms and application methods were possible for each project.

(p = 0.33 FY15/16, p = 0.24 FY17/18; GLMM with negative binomial distribution and log link function). Projects rated as *effective* averaged 13 and 14 BMP provisions in the contract or plan and 12 and 14 provisions implemented fully in FY15/16 and FY17/18, respectively. Those few projects with less than *effective* ratings (Fig. 45B, D) averaged 3 and 5 fewer provisions included and implemented fully, respectively, in both monitoring periods. When percentages of BMPs implemented were assessed, projects with an *effective* rating averaged 94 percent of BMPs implemented fully in each monitoring period. Those rated *marginally effective* averaged 67 percent of BMPs implemented fully in FY15/16, and one project rated *mostly effective* in FY17/18 had 100 percent full implementation. There was not a significant difference in the percentages by rating in either monitoring period (p = 0.55 FY15/16, p = 0.62 FY17/18; Kruskal-Wallis test).

There was no significant association between effectiveness ratings and whether label instructions were followed in either monitoring period (p = 1.00 FY15/16 and FY17/18) due to the predominance of *effective* ratings (Fig. 46). Similarly, no significant association between effectiveness ratings and the performance of inspections during chemical application could be shown (p = 1.00 FY15/16 and FY17/18) (Fig. 46).

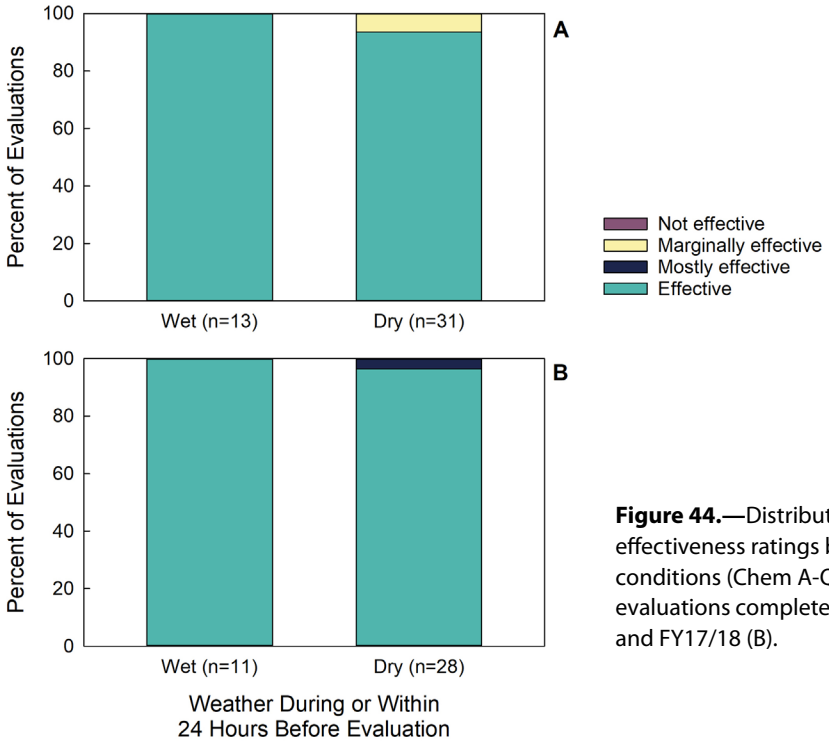



**Figure 44.**—Distribution of effectiveness ratings by weather conditions (Chem A-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

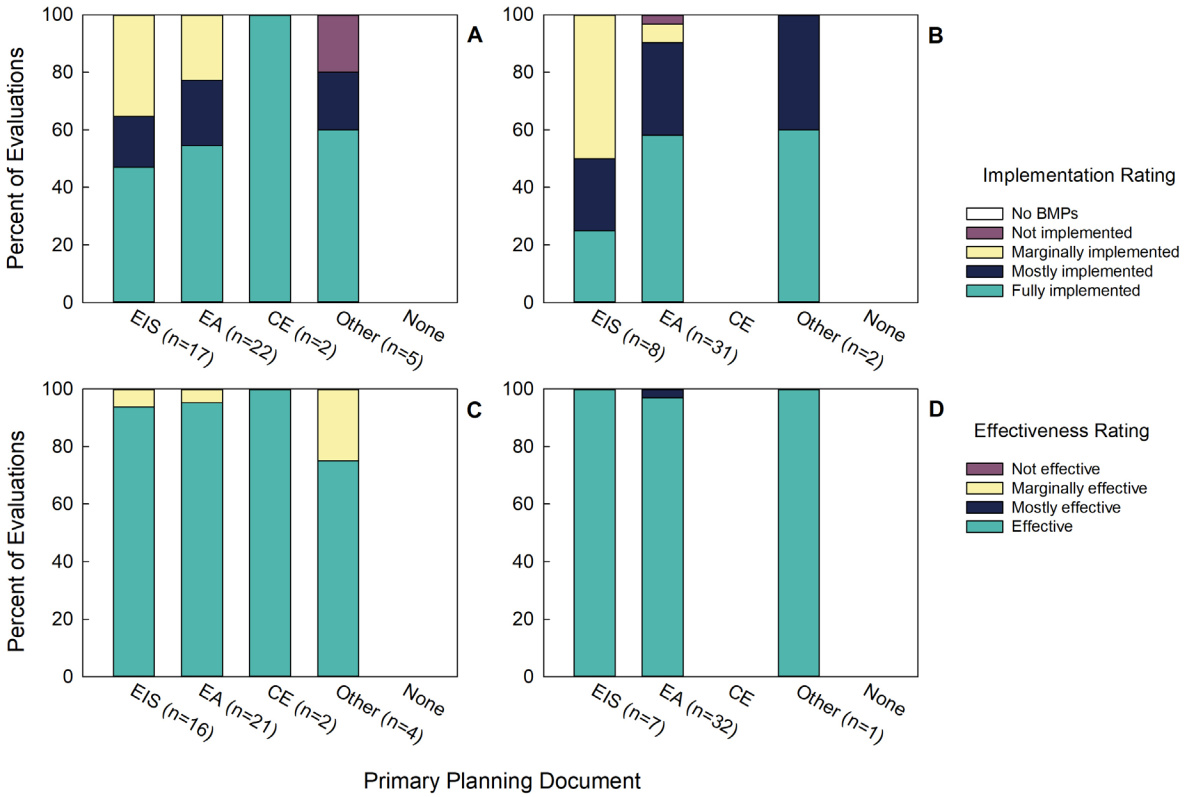



**Figure 45.**—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (Chem A-Q28) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

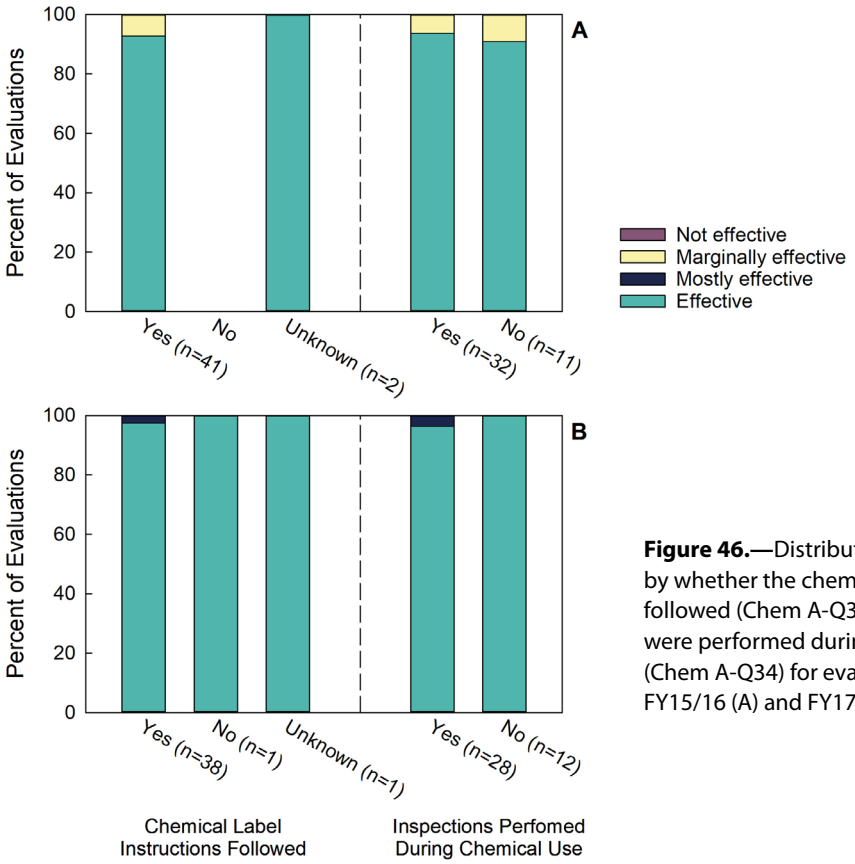



**Figure 46.—**Distributions of effectiveness ratings by whether the chemical label instructions were followed (Chem A-Q32) and whether inspections were performed during chemical treatments (Chem A-Q34) for evaluations completed in FY15/16 (A) and FY17/18 (B).

During the implementation portion of the evaluation, review of documents and inquiries with project administrators occur to determine whether corrective actions were taken during the project if problems were experienced (Chem A-Q35) because such actions can protect water quality and be reflected in an improvement in BMP effectiveness. There was a significant association between whether corrective actions were taken (if problems occurred) and the effectiveness ratings in FY15/16 ($p = 0.10$; this value was considered significant at $\alpha = 0.1$) but not in FY17/18 ($p = 1.00$) (Fig. 47). This association in FY15/16 was due to almost all the Chem A evaluations being rated as *effective* (40 of 43), and one evaluation for which corrective actions were noted as being needed but not taken being rated as *marginally effective*.

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based on what the review team observes and reports during the effectiveness evaluation at the project site.

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site in question. Corrective actions for implementation include actions to improve implementation for the project or site, while

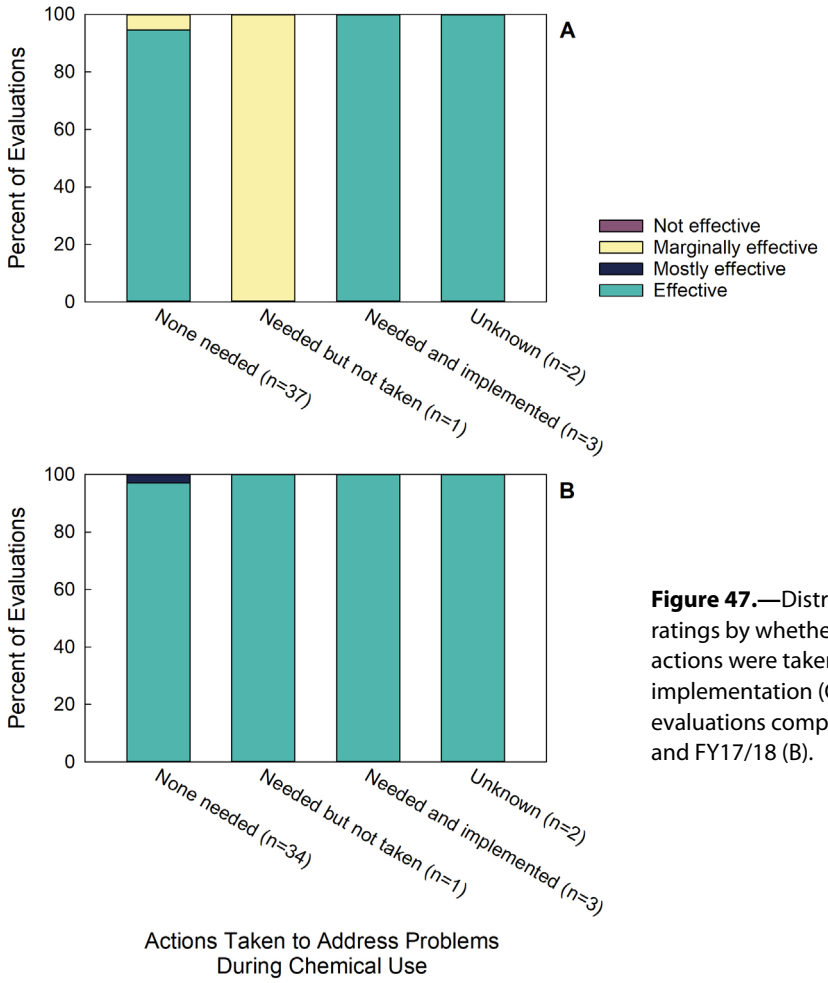



**Figure 47.—**Distribution of effectiveness ratings by whether needed corrective actions were taken during project implementation (ChemA-Q35) for evaluations completed in FY15/16 (A) and FY17/18 (B).

corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not including all the BMPs identified during planning in project contracts, while adaptive management actions for effectiveness may involve terminating the prescription of a more conventional BMP that consistently underperforms and replacing it in all future projects with a BMP that has been shown to provide better water quality protection.

For implementation, 11 and 5 percent of projects identified the need for corrective actions (Chem A-Q37) in FY15/16 and FY17/18, respectively, and 22 and 18 percent identified the need for adaptive management actions (Chem A-Q39) (Fig. 48). There were no significant associations between the implementation ratings and the presence or absence of needs for each type of action in FY15/16 (corrective actions: $p = 0.16$, adaptive management actions: $p = 0.13$) or between ratings and adaptive management needs ($p = 0.27$) in FY17/18. There was a significant association between ratings and corrective action needs in FY17/18

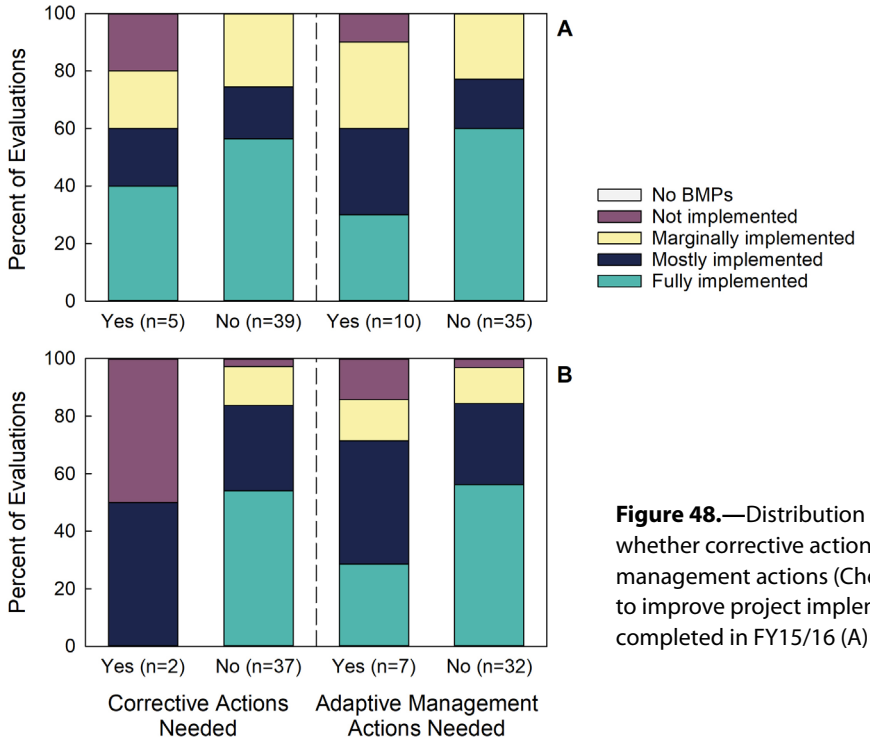



**Figure 48.—**Distribution of implementation ratings by whether corrective actions (Chem A-Q37) or adaptive management actions (Chem A-Q39) were needed to improve project implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

(p = 0.06), but this was likely due to the very unequal sample sizes. For all comparisons, the percentages of *fully implemented* and *mostly implemented* ratings were higher for projects in which no needs were identified compared to those where a need was identified (Fig. 48).

For effectiveness, the numbers of evaluations in which corrective actions or adaptive management actions were identified as being needed were small and occurred at rates comparable to those needed for implementation (Fig. 49). The association between effectiveness ratings and corrective actions was significant (p = 0.04) in FY15/16, with poorer effectiveness being associated with projects that identified the need for corrective actions. No significant association existed between effectiveness ratings and the need for adaptive management actions in FY15/16 (p = 0.47) or between ratings and either corrective action or adaptive management action needs in FY17/18 (p = 1.00 for both).

There were projects rated as *marginally implemented*, *not implemented*, and *marginally effective* that simultaneously indicated no need for corrective actions or adaptive management actions (Figs. 48 and 49). Those individual evaluations reported some type of less-than-optimal performance or condition, so the expected response to at least one of those questions (corrective actions or adaptive management action needs) would have been that some action was needed. No corrective actions may have been applicable for implementation or effectiveness in these situations because the chemical treatments had been completed by the time of the evaluations and there was no way to correct or reverse poor implementation or effectiveness. It is also possible that the situations that led to the *marginally implemented* and *marginally effective* ratings may have been considered insignificant to the extent that neither corrective nor adaptive management actions were considered necessary by the review team. However, it is also possible that the team may

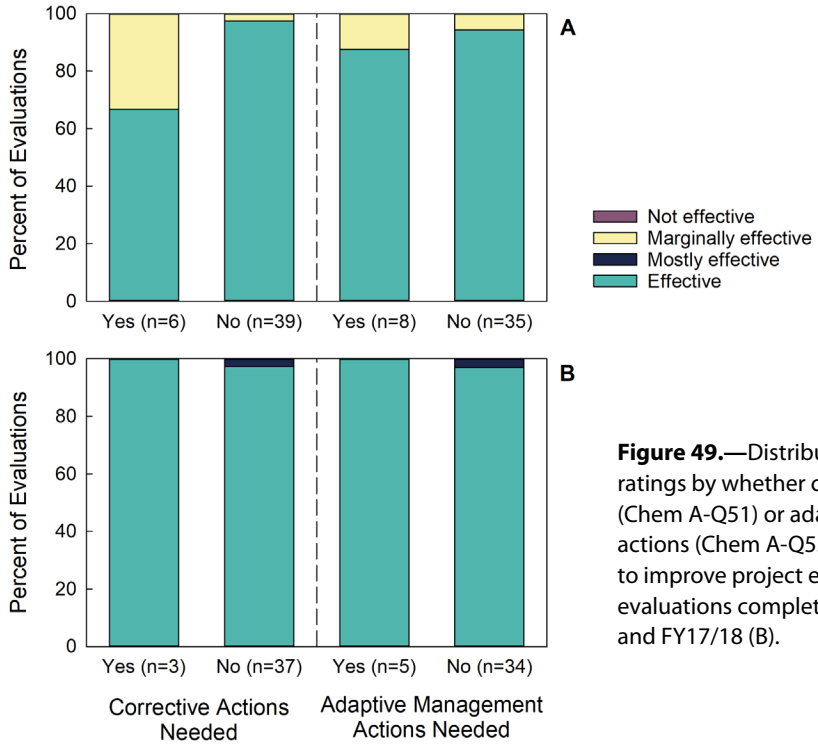



**Figure 49.—**Distribution of effectiveness ratings by whether corrective actions (Chem A-Q51) or adaptive management actions (Chem A-Q53) were needed to improve project effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

have overlooked problems that led to poorer implementation and effectiveness ratings that could have otherwise been identified during consideration of Chem A-Q37, Chem A-Q39, Chem A-Q51, and Chem A-Q53.

### Composite Ratings

Composite rating results for Chem A projects that were evaluated for both implementation and effectiveness are given in Table 82. Approximately 70 percent of projects in FY15/16 and 77 percent in FY17/18 had a composite rating of *excellent*, and one project in FY15/16 had a composite rating of *poor*. When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, a significant association was observed in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 0.49$). Better project implementation resulted in better BMP effectiveness in FY15/16; about 49 percent of the projects were rated as both *fully implemented* and *effective* (Table 82). In FY17/18 BMP effectiveness was high across all levels of project implementation.

## Chemicals A: Examination of Component Scores

The overall implementation and effectiveness ratings were determined from component scores. The implementation rating components and their interpretations for all Chem protocols are given in Table 83. The three Chem A effectiveness components address whether BMPs were effective at protecting water quality (Table 84). The *no monitoring* score for the monitoring evidence component (Table 84) applies when no formal monitoring of chemical dispersal for the project was performed (e.g., monitoring to determine if the application extended beyond the intended area, if nontarget organisms

**Table 82.**—Composite rating matrix for Chem A projects evaluated for both implementation and effectiveness in FY15/16 (n=43 evaluations) and FY17/18 (n=39 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 21 | 9 | 10 | | |
| | Mostly effective | | | | | |
| | Marginally effective | 2 | | | 1 | |
| | Not effective | | | | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 20 | 10 | 6 | 2 | |
| | Mostly effective | | 1 | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

Excellent
Good
Fair
Poor
No plan

**Table 83.**—Implementation components, scores, and interpretation of each score. Component scores are used to determine the overall implementation ratings for all Chem protocols.

| Implementation component | Component score | Score interpretation |
|---|---|---|
| Planning | All | All BMPs developed during planning were included in the project contract or plan |
| | Some | Some BMPs developed during planning were included in the project contract or plan, but at least one was not |
| | None | BMPs were developed during planning but were not carried into the project contract or plan **or** documents containing BMPs were referenced during planning but BMPs were not included in the planning documents |
| | No BMPs | No BMPs were considered for the project during planning |
| On-the-ground execution | All | All BMPs included in the project contract or plan were implemented fully |
| | Some | Some of the BMPs included in the project contract or plan were implemented fully, but at least one was not |
| | None | None of the BMPs included in the project contract or plan were implemented fully |
| Project oversight | All | All necessary corrective actions identified during project implementation were implemented |
| | Some | Some, but not all, necessary corrective actions identified during project implementation were implemented |
| | None | No necessary corrective actions identified during project implementation were implemented |

**Table 84.—**Effectiveness components, scores, and interpretation of each score for Chem A and Chem C. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Observational evidence | Effective | No adverse effect |
| | Moderately effective | Minor adverse effect or potential adverse effect |
| | Not effective | Major adverse effect |
| Monitoring evidence | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| | No monitoring | No monitoring was performed |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

were affected, and so on). Such monitoring is not required for any of the protocols in the National BMP program; consequently, the *no monitoring* component score is treated the same as an *effective* component score in the determination of the final effectiveness rating.

Table 85 shows how the scores were distributed across the three implementation components. Between 70 and 77 percent of the projects received *all* scores for each of the components. One evaluation in FY17/18 could not be scored for two components. Fifty-five percent of the projects in FY15/16 and 48 percent in FY17/18 for which implementation evaluations were completed were rated as *fully implemented*, which is possible only if all three components scored as *all* (Table 86). The evaluation that scored as *none* for the project oversight component in FY15/16 also scored as *none* for the on-the-ground execution component, which resulted in a *not implemented* implementation rating.

An answer of "no" for any provision in Table 72 accompanied by a "yes" answer for at least one other provision would score as *some* for the planning component, indicating that not all the BMPs from planning were included in the project contract or plan. For the 12 projects with a planning component score of *some* in FY15/16 (Table 85), 28 percent of provisions from planning were not included in the contract or plan on average (Table 72, excluding provisions identified as "not applicable"), with the percentage ranging from 6 to 100. One project had BMPs in five provisions from planning documents, and none were included in the contract or plan (i.e., 100 percent not included). If that project is excluded, then the high end of the range was 58 percent, and a mean of 21 percent of provisions were not included per project. On average, BMPs from planning were included in 12 of the 20 possible provisions for those 12 projects. BMPs in the provisions specifically focused on soil characteristics ("soil chemistry" and "soil physical conditions") had the greatest frequencies of not being carried from planning into the project contract or plan

**Table 85.—**Distribution of implementation component scores by component for Chem A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=46) | | | | | | | |
| | All | 34 | 74 | 34 | 74 | 35 | 76 |
| | Some | 12 | 26 | 11 | 24 | 10 | 22 |
| | None | | | 1 | 2 | 1 | 2 |
| | No BMPs | | | | | | |
| FY17/18 (n=43) | | | | | | | |
| | All | 30 | 70 | 33 | 77 | 30 | 70 |
| | Some | 11 | 26 | 7 | 16 | 12 | 28 |
| | None | | | 2 | 5 | 1 | 2 |
| | No BMPs | 1 | 2 | | | | |
| | Incomplete data[a] | 1 | 2 | 1 | 2 | | |

[a] Some of the questions needed to determine a component score were not answered.

in FY15/16 (Table 72). Eleven projects in FY17/18 had a score of *some* for the planning component, and an average of 20 percent of provisions per project were not carried into the contract or plan. The percentages ranged from 6 to 55, and the provisions not included most frequently were again "soil chemistry" and "soil physical conditions" and also "streamflow/runoff levels." Projects with a *some* score for the planning component in FY17/18 averaged BMPs included in 15 of the 20 possible provisions. The planning component score also considers the response to chemical or fuel spills or leaks (Chem A-Q36), but answers to that question did not negatively affect the component score for any Chem A evaluation in either monitoring period.

The *some* score for the on-the-ground execution component in part indicates that at least one BMP in a provision was not implemented fully (Table 83). This results from a "no" answer for at least one provision in Table 74 and a "yes" response for at least one other provision. For 10 of the 11 projects in FY15/16 and 6 of 7 projects in FY17/18 having a score of *some* for the on-the-ground execution component (Table 85), the score was attributable to BMP provisions not implemented fully. The average contract or plan in FY15/16 had 14 provisions containing at least one BMP, and in 19 percent of those provisions at least one BMP was not implemented fully. The frequency of BMPs that were not implemented fully ranged from 6 to 86 percent per evaluation, although the 86 percent value (6 out of 7 provisions) was unusual; excluding that project drops the highest percentage of provisions not being implemented fully to 26 percent and the average to 11 percent per evaluation. In FY17/18 for the 6 projects with on-the-ground execution component scores of *some*, an average of 12 percent of BMP provisions were not implemented fully per project (percentages ranged from 5 to 25). Projects in FY17/18

**Table 86.—**Implementation component scores corresponding to the overall implementation ratings for Chem A evaluations with complete data in FY15/16 and FY17/18. See Table 83 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=46) | | | | | |
| | Fully implemented | All | All | All | 25 |
| | Mostly implemented | All | All | Some | 3 |
| | | Some | All | All | 5 |
| | | Some | All | Some | 1 |
| | Marginally implemented | All | Some | All | 4 |
| | | All | Some | Some | 2 |
| | | Some | Some | All | 1 |
| | | Some | Some | Some | 4 |
| | Not implemented | Some | None | None | 1 |
| FY17/18 (n=42) | | | | | |
| | Fully implemented | All | All | All | 20 |
| | Mostly implemented | All | All | Some | 3 |
| | | Some | All | All | 6 |
| | | Some | All | Some | 4 |
| | Marginally implemented | All | Some | All | 1 |
| | | All | Some | Some | 4 |
| | | Some | Some | All | 1 |
| | Not implemented | All | None | Some | 1 |
| | | All | Some | None | 1 |
| | No BMPs | No BMPs | None | All | 1 |

had BMPs in 16 of the possible 20 provisions on average. Adherence to chemical safety procedures (Chem A-Q32 and Chem A-Q33, Table 75) and response to chemical or fuel spills or leaks (Chem A-Q36, Table 76) also contribute to the on-the-ground execution component score. Two evaluations had all BMP provisions implemented fully, but a reported chemical or fuel spill or leak was not handled according to the unit CERP for a project in FY15/16, and lack of information about chemical safety procedures for a project in FY17/18 resulted in a *some* score for the on-the-ground execution component.

The project oversight component score is primarily a function of the occurrence of inspections during implementation and the actions that result from observed or potential problems. For the 22 projects that had a score of *some* for the project oversight component (Table 85), the deficiency was a lack of inspections during the chemical application. For the two evaluations that had no project oversight (*none* score), the project in FY15/16 also had no BMPs implemented fully (Table 86).

Planning scores were not significantly associated with the type of primary planning document (Chem A-Q28) used for the projects that employed planning documents (NEPA or other BMP guidance documents) in either monitoring period (p = 1.00 FY15/16, p = 0.57 FY17/18).

The distribution of scores across the three effectiveness components is summarized in Tables 87 and 88. The chemical pollutants component scores were all *effective*. (Recall that for Chem A, chemical pollutants refer to fuel and chemical spills and leaks and not pollution caused by the chemical used for target treatment.) For the other two components, there appears to be a fairly wide gap in the score distributions (Table 87). However, this difference is due to 58 and 50 percent of projects having a score of *no monitoring* for the monitoring evidence component in FY15/16 and FY17/18, respectively. By excluding the projects that had no applicable monitoring data available, the percentage of projects in the monitoring evidence component that scored as *effective* is about 95 percent in both monitoring periods (Table 87). Forty-two projects in FY15/16 and 39 projects in FY17/18 had overall effectiveness ratings of *effective* (Table 88). The remaining three projects in FY15/16 had *marginally effective* ratings, which resulted from three different combinations of scores in the three components. One project rated as *mostly effective* in FY17/18 had monitoring evidence that indicated surface water or groundwater contamination had occurred during the project.

**Table 87.—**Distribution of effectiveness component scores by component for Chem A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Observational evidence component (number) | Observational evidence component (percent) | Monitoring evidence component (number) | Monitoring evidence component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=45) | | | | | | | |
| | Effective | 40 | 89 | 18 | 40 | 45 | 100 |
| | Mostly effective[a] | | | | | | |
| | Moderately effective[b] | 3 | 7 | | | | |
| | Marginally effective[a] | | | 1 | 2 | | |
| | Not effective | 2 | 4 | | | | |
| | No monitoring[a] | | | 26 | 58 | | |
| FY17/18 (n=40) | | | | | | | |
| | Effective | 35 | 88 | 19 | 47 | 40 | 100 |
| | Mostly effective | | | 1 | 3 | | |
| | Moderately effective | 5 | 12 | | | | |
| | Marginally effective | | | | | | |
| | Not effective | | | | | | |
| | No monitoring | | | 20 | 50 | | |

[a] Score applies only to monitoring evidence component (see Table 84).
[b] Score applies only to observational evidence and chemical pollutants components (see Table 84).

**Table 88.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Chem A evaluations with complete data in FY15/16 and FY17/18. See Table 84 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Observational evidence component | Monitoring evidence component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=45) | | | | | |
| | Effective | Effective | Effective | Effective | 17 |
| | | Effective | No monitoring | Effective | 22 |
| | | Moderately effective | No monitoring | Effective | 3 |
| | Mostly effective | | | | 0 |
| | Marginally effective | Effective | Marginally effective | Effective | 1 |
| | | Not effective | Effective | Effective | 1 |
| | | Not effective | No monitoring | Effective | 1 |
| | Not effective | | | | 0 |
| FY17/18 (n=40) | | | | | |
| | Effective | Effective | Effective | Effective | 18 |
| | | Effective | No monitoring | Effective | 16 |
| | | Moderately effective | Effective | Effective | 1 |
| | | Moderately effective | No monitoring | Effective | 4 |
| | Mostly effective | Effective | Mostly effective | Effective | 1 |
| | Marginally effective | | | | 0 |
| | Not effective | | | | 0 |

The relationships between the effectiveness component scores and the overall implementation ratings are shown in Figure 50. Because all the chemical pollutants component scores were *effective*, it was not possible to test for an association between the scores and the implementation ratings. No significant associations existed between the other two effectiveness components and the implementation ratings in either monitoring period (observational evidence: $p = 0.12$ FY15/16, $p = 0.13$ FY17/18; monitoring evidence: $p = 1.00$ FY15/16, $p = 0.32$ FY17/18). The p-value for the observational evidence component in FY15/16 is approaching significance, which reflects the visible relationship of better effectiveness with greater BMP implementation. However, the high percentages of *effective* component scores limit the usefulness of this comparison.

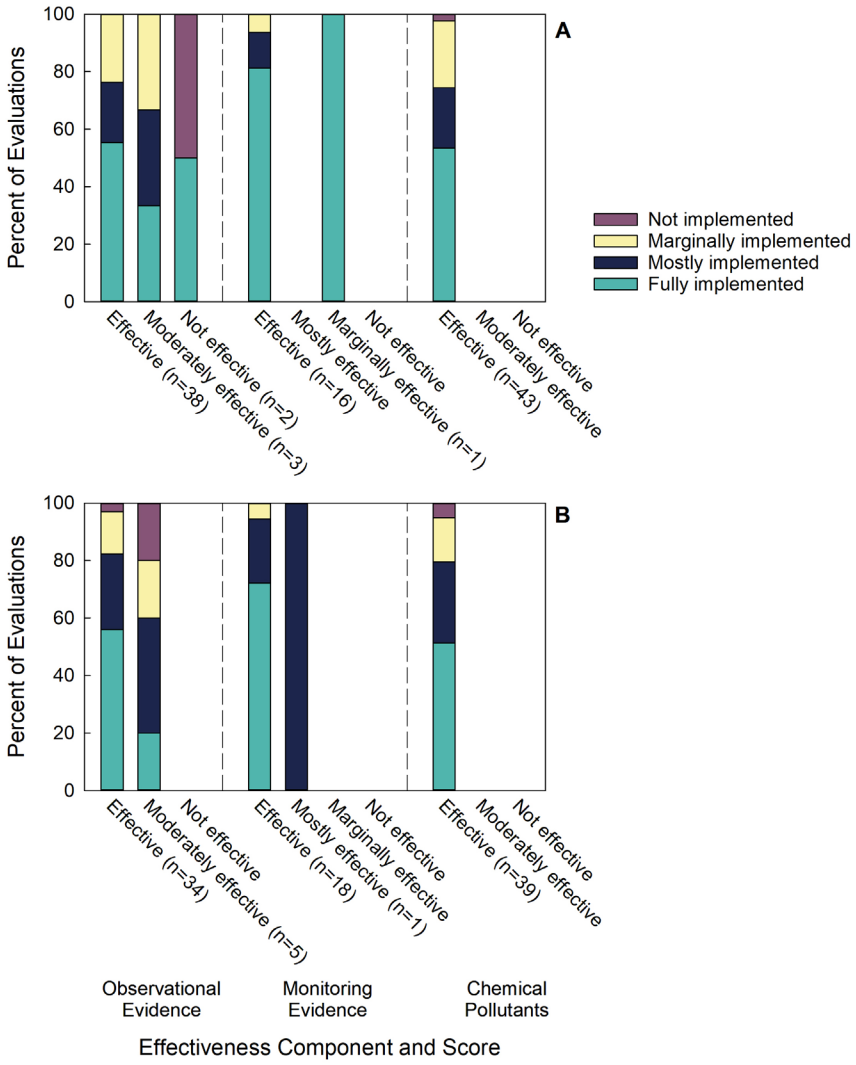



**Figure 50.—**Distribution of implementation ratings across effectiveness component scores for Chem A evaluations completed in FY15/16 (A) and FY17/18 (B).

When effectiveness ratings were compared to implementation component scores, significant associations existed between effectiveness ratings and the on-the-ground execution component scores ($p = 0.08$) and the project oversight component scores ($p = 0.09$) in FY15/16 (Fig. 51A). As BMP implementation and project oversight improved, so did the effectiveness rating. However, the significance of these associations is largely the result of having a single sample comprise the *none* score for those two components (Fig. 51A). No significant associations were found between effectiveness ratings and the planning component scores in either monitoring period ($p = 1.00$ FY15/16, $p = 0.23$ FY17/18) or the between the ratings and the on-the-ground execution component scores ($p = 1.00$) or the project oversight component scores ($p = 1.00$) in FY17/18.

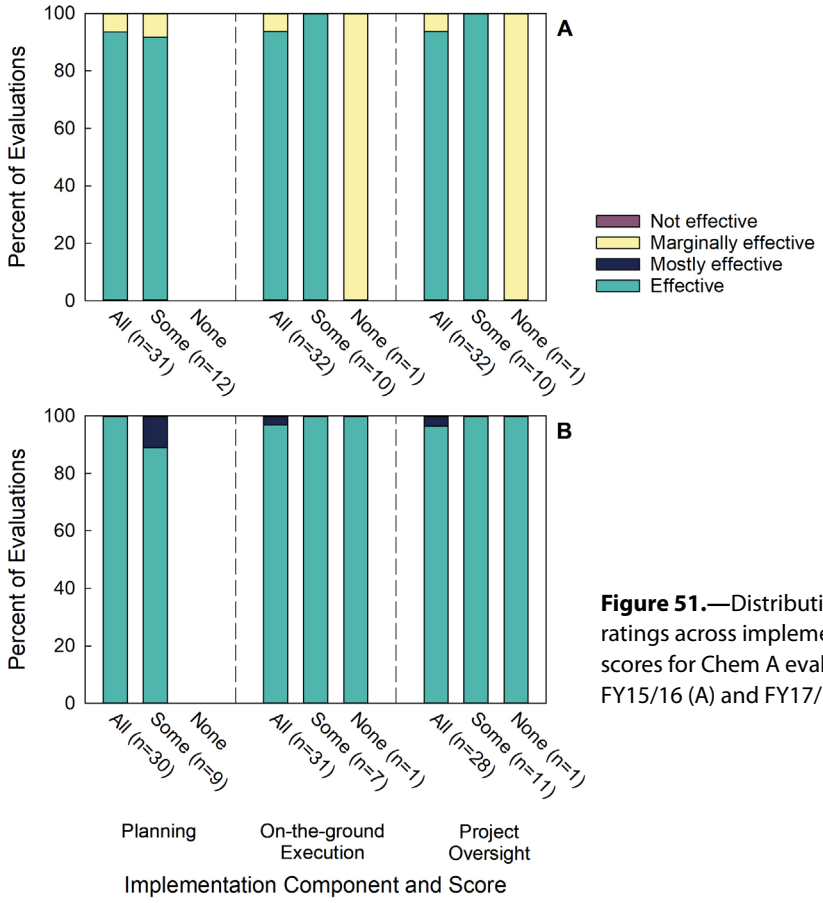



**Figure 51.**—Distribution of effectiveness ratings across implementation component scores for Chem A evaluations completed in FY15/16 (A) and FY17/18 (B).

## Chemicals A: Management Implications for Forest Service Resource Managers

Seventy-five percent of chemical use near waterbodies evaluations were rated either *fully implemented* or *mostly implemented*. Project planning was a deficiency in about 28 percent of the evaluations, but only one project (in FY17/18) was completed without BMPs prescribed in the planning document. About one-quarter of the projects had a deficiency in on-the-ground execution because some BMP provisions in the project contract or plan were not implemented fully or there was a lack of adherence to chemical safety procedures. Three projects (one in FY15/16 and two in FY17/18) were totally lacking in on-the-ground execution and were scored *none* for this component. For the remaining evaluations with a deficiency (i.e., *some* score) for on-the-ground execution, the primary deficiency was implementation of BMPs, with the failure ranging from 5 to 26 percent of BMP provisions not implemented fully. Nearly three-quarters of the projects scored *all* for project oversight. Two projects were totally lacking in project oversight and were scored *none* for this component. The primary deficiency in project oversight was a lack of inspections during the chemical application.

Ninety-five percent of the projects were rated *effective* for BMP effectiveness, indicating no impacts to water quality were observed. For more than half of the projects, the effectiveness rating was based on the observational evidence and chemical pollutants component scores; no other monitoring occurred. For many evaluations that indicated monitoring took place, the most frequent type of monitoring used was visual monitoring. Visual monitoring can be used to inform questions related to the observational evidence component and not questions related to the monitoring evidence component. Two evaluations indicated that observational evidence showed chemical had reached a waterbody, and two evaluations indicated the same using monitoring evidence. The most frequently reported cause of off-target movement, nontarget effects, or water contamination was "insufficient care taken during application."

Nearly three-quarters of the projects had composite ratings of *excellent*, which results from the combination of *fully implemented* or *mostly implemented* and *effective* ratings. The high percentage of projects rated *fully implemented, mostly implemented*, and *effective* reduces the usefulness of investigating relationships between project characteristics and implementation and effectiveness ratings, particularly in FY17/18, when nearly all of the effectiveness evaluations were rated *effective*. However, some relationships investigated were nearly significant in the FY15/16 data and generally showed that effectiveness improved with better BMP implementation. Significant or nearly significant associations were found between implementation ratings and the observational evidence component scores and between effectiveness ratings with both the on-the-ground execution and project oversight component scores. In addition, in both monitoring periods projects rated *effective* had more BMP provisions included in the project contract or plan and more BMP provisions implemented fully than projects with less than *effective* ratings.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Checking the project contract or plan to ensure that BMP provisions for soil properties are included when prescribed in the project planning documents.
- Improving identification of ephemeral streams during project planning and implementation. BMP implementation was slightly poorer in projects that included ephemeral streams.
- Ensuring label directions are followed and that applicators have required permits, licenses, or other certifications. The number of evaluations that indicated these measures were not taken was small; however, as these measures are required by law, compliance is expected to be 100 percent.
- Conducting project inspections while the chemical is being applied to reduce any potential for careless applications.

## Chemicals A: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Chem A. Chemical Use Near Waterbodies**

(Reference BMPs Chem-1, Chem-2, Chem-3, Chem-5, and Chem-6)

v3.0 February 2016

| Header | |
|---|---|
| Chem A-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Chem A-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Chem A-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Chem A-Q4 | Date of current field evaluation: |
| Chem A-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Chem A-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Chem A-Q7 | Reviewers and titles: |
| Chem A-Q8a | Region number: |
| Chem A-Q8b | State: |
| Chem A-Q9a | Proclaimed Forest or Grassland number and name: |
| Chem A-Q9b | Administrative Forest or Grassland number and name: |
| Chem A-Q10 | District number and name: |
| Chem A-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Chem A-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Chem A-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Chem A-Q12 | 6$^{th}$ level HUC number and name for the subwatershed in which the treatment block being evaluated is located: |
| Chem A-Q13 | Is any part of the block selected for evaluation located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Chem A-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Chem A-Q14b | Location.<br><br>Easting: |
| Chem A-Q14c | Location.<br><br>Northing: |
| Chem A-Q15a | Location.<br><br>Latitude: |
| Chem A-Q15b | Location.<br><br>Longitude: |
| Chem A-Q15c | Location.<br><br>Lat/Long Datum: |
| Chem A-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Chem A-Q17 | Project name or name of area in which chemical was applied: |
| Chem A-Q18 | Dates of chemical use or application: |
| Chem A-Q19 | Total size of the chemically treated area in the project (ft$^2$, m$^2$, ac, or ha; specify unit): |
| Chem A-Q20 | Size of the treatment block being evaluated (ft$^2$, m$^2$, ac, or ha; specify unit): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Chem A-Q21 | What type of chemical was used? Select all that apply:<br><br>Insecticide<br>Herbicide<br>Fungicide<br>Nematicide<br>Rodenticide<br>Pheromones<br>Lime<br>Fertilizer<br>Other (specify): |
| Chem A-Q22 | Provide the common names of the chemicals used: |
| Chem A-Q23 | How was the chemical applied? Select all that apply:<br><br>Mechanical application of solution<br>Mechanical application of solids<br>Mechanical mixing into the surface<br>Backpack sprayer application of solution<br>Hand/manual application of solids<br>Injection<br>Aerial application of solution<br>Aerial application of solids<br>Paintball equipment<br>Other (specify): |
| Chem A-Q24 | Intended application targets. Select all that apply:<br><br>Individuals<br>Area-wide |
| Chem A-Q25 | Describe the location of the selected chemical treatment block. Select all that apply:<br><br>Completely within an AMZ<br>Partially within an AMZ<br>Adjacent to the AMZ<br>Completely within a surrogate AMZ<br>Partially within a surrogate AMZ<br>Adjacent to a surrogate AMZ |
| Chem A-Q26 | To what type of waterbody is the AMZ or treatment adjacent? Select all that apply:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| **Implementation** | |
| Chem A-Q27 | Where were the boundaries of the area to which the chemical was applied delineated? Select all that apply:<br><br>a. On project maps<br>b. On the ground<br>c. Neither on project maps nor on the ground |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Chem A-Q28 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 30)<br>b. Environmental Impact Statement (EIS) (go to question 29)<br>c. Environmental Assessment (EA) (go to question 29)<br>d. Categorical Exclusion (CE) (go to question 29)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 29) |
| Chem A-Q29 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract or project plan. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Chemical or form of chemical selected to reduce unintended consequences<br>Yes/No/Not applicable<br>b. Application technique selected to reduce unintended consequences<br>Yes/No/Not applicable<br>c. Protection measures at waterbody crossings<br>Yes/No/Not applicable<br>d. Limiting the areal extent of chemically treated area<br>Yes/No/Not applicable<br>e. Providing untreated buffers between target areas and waterbodies<br>Yes/No/Not applicable<br>f. Temperature conditions<br>Yes/No/Not applicable<br>g. Humidity conditions<br>Yes/No/Not applicable<br>h. Wind speed and/or wind direction<br>Yes/No/Not applicable<br>i. Precipitation conditions<br>Yes/No/Not applicable<br>j. Timing considerations other than weather and meteorological conditions<br>Yes/No/Not applicable<br>k. Transportation of chemicals to site<br>Yes/No/Not applicable<br>l. Storage of chemicals<br>Yes/No/Not applicable<br>m. Disposal of unused chemicals<br>Yes/No/Not applicable<br>n. Streamflow or runoff levels<br>Yes/No/Not applicable<br>o. Soil chemistry<br>Yes/No/Not applicable<br>p. Soil physical conditions<br>Yes/No/Not applicable<br>q. Infestation levels<br>Yes/No/Not applicable<br>r. Required use of GPS flight/application lines<br>Yes/No/Not applicable<br>s. Calibration of application equipment prior to chemical application<br>Yes/No/Not applicable<br>t. Monitoring<br>Yes/No/Not applicable<br>u. Other (specify):<br>Yes/No/Not applicable |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Chem A-Q30 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or project plan were implemented fully. Select one response in each line. If the provision existed in the project contract or plan and it was implemented fully, select Yes. If the provision existed in the project contract or plan but it was not implemented fully, select No. If the provision did not exist in the project contract or plan, select Not applicable.<br><br>a. Chemical or form of chemical selected to reduce unintended consequences<br>Yes/No/Not applicable<br>b. Application technique selected to reduce unintended consequences<br>Yes/No/Not applicable<br>c. Protection measures at waterbody crossings<br>Yes/No/Not applicable<br>d. Limiting the areal extent of chemically treated area<br>Yes/No/Not applicable<br>e. Providing untreated buffers between target areas and waterbodies<br>Yes/No/Not applicable<br>f. Temperature conditions<br>Yes/No/Not applicable<br>g. Humidity conditions<br>Yes/No/Not applicable<br>h. Wind speed and/or wind direction<br>Yes/No/Not applicable<br>i. Precipitation conditions<br>Yes/No/Not applicable<br>j. Timing considerations other than weather and meteorological conditions<br>Yes/No/Not applicable<br>k. Transportation of chemicals to site<br>Yes/No/Not applicable<br>l. Storage of chemicals<br>Yes/No/Not applicable<br>m. Disposal of unused chemicals<br>Yes/No/Not applicable<br>n. Streamflow or runoff levels<br>Yes/No/Not applicable<br>o. Soil chemistry<br>Yes/No/Not applicable<br>p. Soil physical conditions<br>Yes/No/Not applicable<br>q. Infestation levels<br>Yes/No/Not applicable<br>r. Required use of GPS flight/application lines<br>Yes/No/Not applicable<br>s. Calibration of application equipment prior to chemical application<br>Yes/No/Not applicable<br>t. Monitoring<br>Yes/No/Not applicable<br>u. Other provisions specified in question 29u<br>Yes/No/Not applicable<br>v. Other (specify):<br>Yes/No/Not applicable<br><br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Chem A-Q31 | Was the safety data sheet (SDS) for each chemical reviewed prior to use? Select one:<br><br>a. Yes<br>b. No<br>c. Unknown |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Chem A-Q32 | Were the label instructions for each chemical followed? Select one:<br><br>a. Yes<br>b. No<br>c. Unknown |
| Chem A-Q33 | Did the applicator have all required Federal and State permits, licenses, or other certifications at the time the application was made? Select one:<br><br>a. Not applicable, no permits, licenses, or other certifications required for the chemicals applied<br>b. Yes<br>c. No |
| Chem A-Q34 | Were inspections performed during chemical use to reduce the potential for water contamination? Select one:<br><br>a. Yes<br>b. No |
| Chem A-Q35 | If problems were found during chemical use that led to or probably could have led to unanticipated water contamination, were operations terminated or modified to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Chem A-Q36 | Were spills and leaks that occurred during chemical transportation, mixing, or use handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Chem A-Q37 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 38)<br>b. No (go to question 39) |
| Chem A-Q38 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Chem A-Q39 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 40)<br>b. No (go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Chem A-Q40 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |

*continued on next page*

| Effectiveness | |
|---|---|
| Chem A-Q41 | From observations only (i.e., exclude monitoring results), is there evidence that the chemical applied or residues from the chemical moved beyond the target areas or affected more than the target organisms? Select one:<br><br>a. Yes (go to question 42)<br>b. No (go to question 43) |
| Chem A-Q42 | Where observations indicate that the chemical or its residues moved beyond the target area or affected more than the target organisms, does the evidence indicate that surface water was contaminated? Select one:<br><br>a. Yes<br>b. No<br>If Yes, what is that evidence? |
| Chem A-Q43 | What types of water quality or aquatic monitoring were performed during and/or following the chemical use? Select all that apply:<br><br>a. No monitoring was performed (go to question 48)<br>b. Surface water samples collected and analyzed during application on site (go to question 44)<br>c. Surface water samples collected during application and analyzed off site later (go to question 44)<br>d. Groundwater samples collected, and analyzed during application on site (go to question 44)<br>e. Groundwater samples collected, and analyzed off site later (go to question 44)<br>f. Spray cards (go to question 44)<br>g. Other (specify; go to question 44): |
| Chem A-Q44 | Do monitoring data indicate that the chemical or residues from the chemical moved beyond the chemical target areas or affected more than the target organism? Select one:<br><br>a. Yes (go to question 45)<br>b. No (go to question 48) |
| Chem A-Q45 | Where monitoring results or data indicate that the chemical or its residues moved beyond the chemical target areas or affected more than the target organisms, does the evidence indicate that surface water or groundwater was contaminated? Select one:<br><br>a. Yes (go to question 46)<br>b. No (go to question 48)<br>c. Unknown, cannot determine from available monitoring data (go to question 48)<br>If Yes, provide a brief description of the evidence supporting this answer: |
| Chem A-Q46 | Do monitoring data indicate that water quality standards were violated as a result of the chemical treatment? Select one:<br><br>a. Not applicable, water quality data were not part of the monitored variables<br>b. Yes<br>c. No<br>d. Unknown, cannot determine from the types of water quality monitoring data that are available |
| Chem A-Q47 | Do observations or monitoring data indicate that beneficial uses were negatively affected? Select one:<br><br>a. Yes<br>b. No |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Chem A-Q48 | What are the causes that allowed the chemical to move beyond the target area, to affect nontarget organisms, or to contaminate surface water or groundwater? Select all that apply:<br><br>a. Not applicable, no available evidence to indicate that chemical moved beyond targets or contaminated water<br>b. Chemical selected was inappropriate for site or conditions<br>c. Application technique was inappropriate or inadequate for site or conditions<br>d. Treatment area was not adequately identified<br>e. Chemical applied outside the planned treatment area<br>f. Insufficient care taken during application to avoid nontarget organisms or water contamination<br>g. Inadequate protection measures at waterbody crossings<br>h. Treated areas were not separated sufficiently from waterbodies<br>i. Temperature conditions were inappropriate for the chemical used or time of treatment<br>j. Humidity was inappropriate for the chemical used or time of treatment<br>k. Wind speed was inappropriate for the chemical used or time of treatment<br>l. Wind direction was inappropriate for the chemical used or time of treatment<br>m. Precipitation amount, intensity, and/or duration was inappropriate for the chemical used or time of treatment<br>n. Inappropriate streamflow or runoff conditions during application<br>o. Inappropriate soil physical conditions present at the time of application<br>p. Inappropriate soil chemical conditions present at the time of application<br>q. Lack of, or improper calibration of application equipment<br>r. Insufficient care taken or improper techniques used during transportation of chemical<br>s. Insufficient care taken or improper techniques used for mixing and/or storage of chemical<br>t. Insufficient care taken or improper techniques used for disposal of unused chemical<br>u. SDS information disregarded or not fully followed<br>v. Label instructions disregarded or not fully followed<br>w. Other (specify):<br>x. Unknown |
| Chem A-Q49 | What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody |
| Chem A-Q50 | If inspections were not conducted during chemical use, did the lack of administration contribute to observed problems found by observation or monitoring? Select one:<br><br>a. Not applicable, inspections were conducted during application<br>b. Yes<br>c. No |
| Chem A-Q51 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 52)<br>b. No (go to question 53) |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Chem A-Q52 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Chem A-Q53 | Are any adaptive management actions needed to improve effectiveness?<br>Select one:<br><br>a. Yes (go to question 54)<br>b. No (go to General Comments) |
| Chem A-Q54 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies.<br>Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Chemicals B—Chemical Use in Waterbodies

## Chemicals B: Descriptive Statistics

Chem B evaluations assess chemical treatments applied to one or more waterbodies. All 15 Chem B projects were selected randomly (Table 64). Seven of nine Forest Service regions (see Appendix) completed a Chem B evaluation in the two monitoring periods combined (Table 89). However, one of those evaluations from Region 9 did not complete an effectiveness review for the project (Table 89) during the monitoring period; that project was completed in July 2015, and therefore it is unlikely that the effectiveness evaluation will be completed. The implementation and effectiveness reviews were performed on the same day for seven of the nine evaluations in FY15/16 and for all evaluations in FY17/18. The implementation evaluation for the remaining two, both of which were in Region 6, were completed 3 and 4 days before the effectiveness evaluations.

All Chem B evaluations were noted as being performed to meet National BMP targets (Chem B-Q11a), and ten reported at least one additional reason (Table 90). Quality assurance was selected as a reason for four projects; however, the review teams responsible for those evaluations interpreted quality assurance differently from what is intended within the BMP monitoring (as explained in the instructions for Chem B-Q11a), a misinterpretation made clear by the lack of an independent, duplicate review of the same projects within the BMP database. Two projects employed BMP monitoring to meet monitoring requirements for a state permit (Table 90).

Herbicides and piscicides were the types of chemicals applied to the waterbodies (Table 91). One project in FY15/16 included a chemical referred to as a neutralizing agent along with a piscicide. Chemicals were applied mechanically or manually and most often as a solution (73 percent of projects). The chemicals were applied to waterbodies that were predominately perennial streams, rivers, lakes, and ponds (Table 92), and five projects treated multiple types of waterbodies.

**Table 89.—**Number of Chem B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Chem B-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 2 | | | 2 |
| | 2 | 2 | | | 2 |
| | 3 | | | | |
| | 4 | 1 | | | 1 |
| | 5 | | | | |
| | 6 | 3 | | | 3 |
| | 8 | | | | |
| | 9 | 1 | 1 | | |
| | 10 | 1 | | | 1 |
| | All | 10 | 1 | 0 | 9 |
| | Percent | | 10 | | 90 |
| FY17/18 | | | | | |
| | 1 | | | | |
| | 2 | | | | |
| | 3 | | | | |
| | 4 | 1 | | | 1 |
| | 5 | | | | |
| | 6 | 1 | | | 1 |
| | 8 | 2 | | | 2 |
| | 9 | 1 | | | 1 |
| | 10 | | | | |
| | All | 5 | 0 | 0 | 5 |
| | Percent | | | | 100 |

## Chemicals B: Ratings and Component Scores

Ninety-three percent of the evaluations were rated *fully implemented* or *mostly implemented,* and 93 percent were rated *effective* (Fig. 52). The composite ratings of the 14 projects for which both implementation and effectiveness reviews were completed are shown in Table 93. Except for the one project with an effectiveness rating of *not effective* (Fig. 52C), the composite rating for all other Chem B projects was either *excellent* or *good* in both monitoring periods. The effectiveness rating of *not effective* resulted in an overall composite rating of *poor*, even though the implementation rating for that project was *fully implemented* (Table 93).

The implementation rating components for Chem B and their interpretations are the same as for Chem A (Table 83). The effectiveness components for Chem B are described in Table 94. The planning component (i.e., moving BMPs from planning into the project

**Table 90.—**Number of Chem B evaluations completed in FY15/16 (n=10 evaluations) and FY17/18 (n=5 evaluations), by region and reason for monitoring (Chem B-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 2 | | | | |
| | 2 | 2 | 1 | 2 | | |
| | 3 | | | | | |
| | 4 | 1 | | | | |
| | 5 | | | | | |
| | 6 | 3 | | 1 | | 2[a] |
| | 8 | | | | | |
| | 9 | 1 | | 1 | 1 | |
| | 10 | 1 | | | | |
| | All | 10 | 1 | 4 | 1 | 2 |
| FY17/18 | | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | 1 | 1 | 1 | | |
| | 5 | | | | | |
| | 6 | 1 | | | | |
| | 8 | 2 | 1 | 1 | | |
| | 9 | 1 | 1 | 1 | 2 | |
| | 10 | | | | 1 | |
| | All | 5 | 3 | 3 | 3 | 0 |

[a] State permit.

**Table 91.—**Number of Chem B evaluations completed in FY15/16 (n=10 evaluations) and FY17/18 (n=5 evaluations), by type of chemical applied (Chem B-Q21). Multiple chemical types may be selected.

| Type of chemical applied | FY15/16 | FY17/18 |
|---|---|---|
| Herbicide | 5 | 4 |
| Pesticide | 0 | 0 |
| Piscicide | 5 | 1 |
| Lime | 0 | 0 |
| Fertilizer | 0 | 0 |
| Other (neutralizing agent)[a] | 1 | 0 |

[a] Applied with piscicide.

**Table 92.**—Number of Chem B evaluations completed in FY15/16 (n=10 evaluations) and FY17/18 (n=5 evaluations), by type of waterbody treated (Chem B-Q24). Multiple waterbody types may be selected.

| Type of waterbody treated | FY15/16 | FY17/18 |
|---|---|---|
| Ephemeral stream | 0 | 0 |
| Intermittent stream | 0 | 0 |
| Perennial stream or river | 4 | 2 |
| Pond | 3 | 1 |
| Lake | 2 | 3 |
| Wetland or wet meadow | 2 | 1 |
| Estuary | 0 | 0 |
| Other (slough) | 1 | 0 |

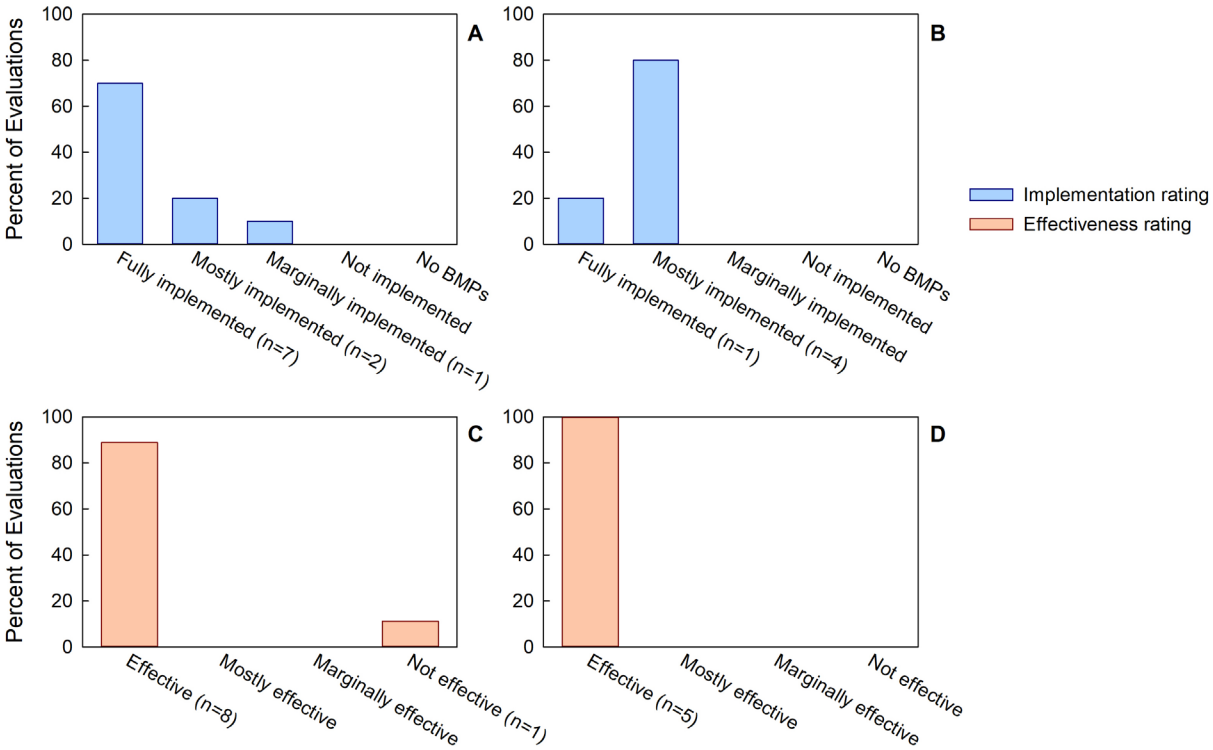



**Figure 52.**—Implementation ratings (A, B) and effectiveness ratings (C, D) for Chem B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

**Table 93.—**Composite rating matrix for Chem B projects evaluated for both implementation and effectiveness in FY15/16 (n=9 evaluations) and FY17/18 (n=5 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 5 | 2 | 1 | | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | 1 | | | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 1 | 4 | | | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

Excellent
Good
Fair
Poor
No plan

**Table 94.—**Effectiveness components, scores, and interpretation of each score for Chem B. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness omponent | Component score | Score interpretation |
|---|---|---|
| Observational and monitoring evidence | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

contact or plan) was the part of implementation with the poorest scores (Tables 95 and 96). Seven evaluations had scores of *some* for the planning component (Table 95), which resulted in implementation ratings of *mostly implemented* (Table 96). For effectiveness, one project had a component score other than *effective* (Table 97); the observational and monitoring evidence component score of *not effective* resulted in an overall effectiveness rating of *not effective* (Table 98). Due to the small sample sizes and limited range of component scores for both implementation and effectiveness evaluations, no tests of associations between implementation component scores and effectiveness ratings or between effectiveness component scores and implementation ratings were completed. However, the results of those respective comparisons are shown in Figures 53 and 54.

**Table 95.—**Distribution of implementation component scores by component for Chem B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=10) | | | | | | | |
| | All | 7 | 70 | 9 | 90 | 10 | 100 |
| | Some | 3 | 30 | 1 | 10 | | |
| | None | | | | | | |
| | No BMPs | | | | | | |
| FY17/18 (n=5) | | | | | | | |
| | All | 1 | 20 | 5 | 100 | 3 | 60 |
| | Some | 4 | 80 | | | 2 | 40 |
| | None | | | | | | |
| | No BMPs | | | | | | |

**Table 96.—**Implementation component scores corresponding to the overall implementation ratings for Chem B evaluations with complete data in FY15/16 and FY17/18. See Table 83 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=10) | | | | | |
| | Fully implemented | All | All | All | 7 |
| | Mostly implemented | Some | All | All | 2 |
| | Marginally implemented | Some | Some | All | 1 |
| | Not implemented | | | | 0 |
| FY17/18 (n=5) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | Some | All | All | 2 |
| | | Some | All | Some | 2 |
| | Marginally implemented | | | | 0 |
| | Not implemented | | | | 0 |

**Table 97.—**Distribution of effectiveness component scores by component for Chem B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Component score | Observational and monitoring evidence component (number) | Observational and monitoring evidence component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|
| FY15/16 (n=9) | | | | | |
| | Effective | 8 | 89 | 9 | 100 |
| | Mostly effective[a] | | | | |
| | Moderately effective[b] | | | | |
| | Marginally effective[a] | | | | |
| | Not effective | 1 | 11 | | |
| FY17/18 (n=5) | | | | | |
| | Effective | 5 | 100 | 5 | 100 |
| | Mostly effective | | | | |
| | Moderately effective | | | | |
| | Marginally effective | | | | |
| | Not effective | | | | |

[a] Score applies only to observational and monitoring evidence component (see Table 94).
[b] Score applies only to chemical pollutants component (see Table 94).

**Table 98.**—Effectiveness component scores corresponding to the overall effectiveness ratings for Chem B evaluations with complete data in FY15/16 and FY17/18. See Table 94 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Observational and monitoring evidence component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|
| FY15/16 (n=9) | | | | |
| | Effective | Effective | Effective | 8 |
| | Mostly effective | | | 0 |
| | Marginally effective | | | 0 |
| | Not effective | Not effective | Effective | 1 |
| FY17/18 (n=5) | | | | |
| | Effective | Effective | Effective | 5 |
| | Mostly effective | | | 0 |
| | Marginally effective | | | 0 |
| | Not effective | | | 0 |

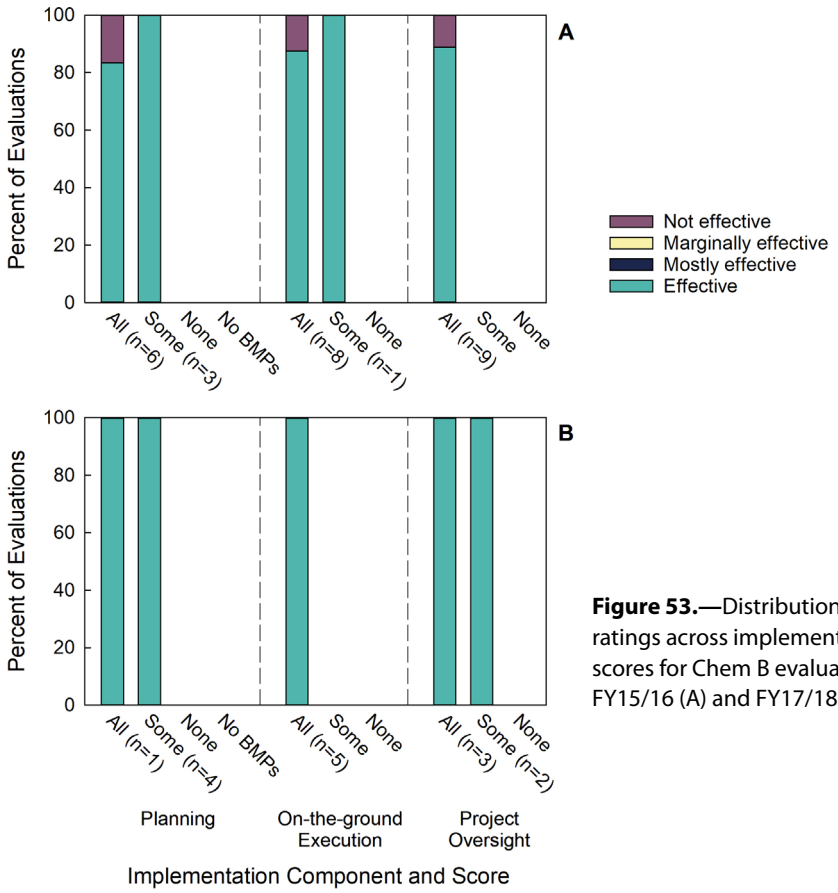



**Figure 53.**—Distribution of effectiveness ratings across implementation component scores for Chem B evaluations completed in FY15/16 (A) and FY17/18 (B).

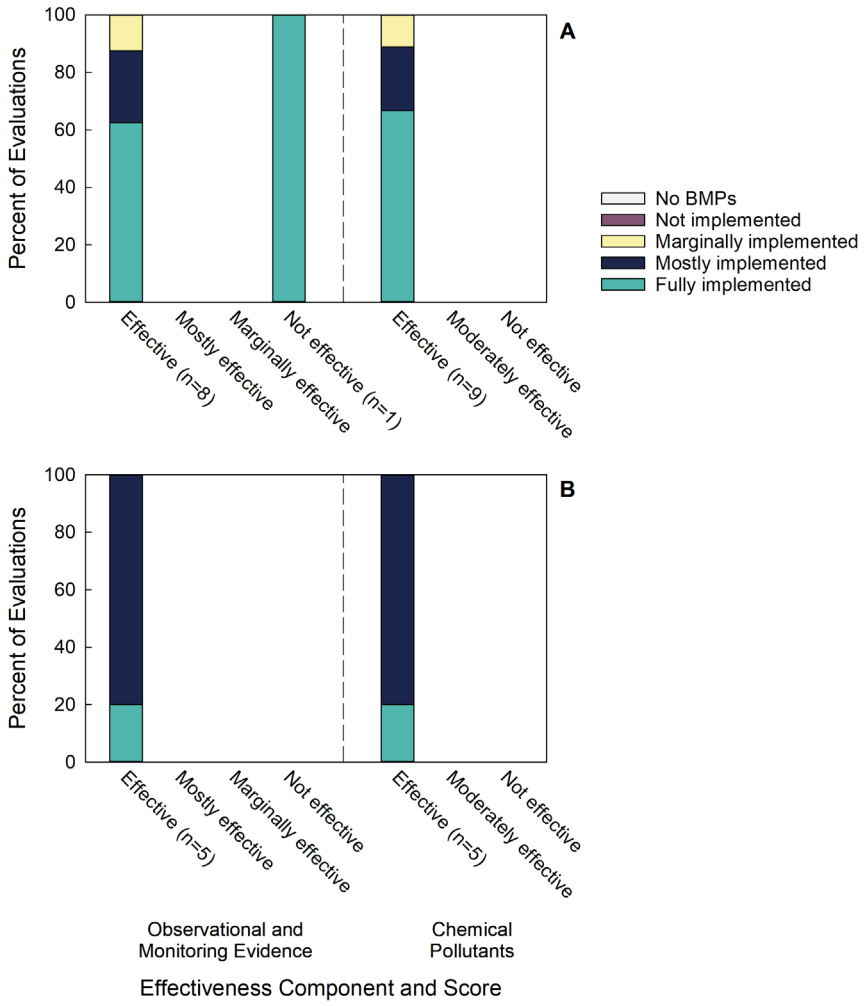



**Figure 54.**—Distribution of implementation ratings across effectiveness component scores for Chem B evaluations completed in FY15/16 (A) and FY17/18 (B).

## Chemicals B: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Chem B. Chemical Use In Waterbodies**

(Reference BMPs Chem-1, Chem-2, Chem-3, Chem-5, and Chem-6)

v3.0 February 2016

| Header | |
|---|---|
| Chem B-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Chem B-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Chem B-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Chem B-Q4 | Date of current field evaluation: |
| Chem B-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Chem B-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Chem B-Q7 | Reviewers and titles: |
| Chem B-Q8a | Region number: |
| Chem B-Q8b | State: |
| Chem B-Q9a | Proclaimed Forest or Grassland number and name: |
| Chem B-Q9b | Administrative Forest or Grassland number and name: |
| Chem B-Q10 | District number and name: |
| Chem B-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Chem B-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Chem B-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Chem B-Q12 | 6th level HUC number and name for the subwatershed in which the treated waterbody is located: |
| Chem B-Q13 | Does the waterbody contribute to a municipal supply water source? Select one:<br><br>a. Yes<br>b. No |
| Chem B-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Chem B-Q14b | Location.<br><br>Easting: |
| Chem B-Q14c | Location.<br><br>Northing: |
| Chem B-Q15a | Location.<br><br>Latitude: |
| Chem B-Q15b | Location.<br><br>Longitude: |
| Chem B-Q15c | Location.<br><br>Lat/Long Datum: |
| Chem B-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Chem B-Q17 | Name or other identifier of the waterbody to which chemicals were applied: |
| Chem B-Q18 | Dates of chemical use or application: |
| Chem B-Q19 | For lotic waterbodies, provide the total length of chemical treatments in the selected waterbody (ft or m, specify unit):<br><br>*or*<br><br>For lentic waterbodies, provide the total area that was chemically treated ($ft^2$, $m^2$, ac, or ha; specify unit): |
| Chem B-Q20 | Waterbody length being evaluated (ft, m, mi, or km; specify unit): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Chem B-Q21 | What chemicals were used? Select all that apply:<br><br>Herbicide<br>Pesticide<br>Piscicide<br>Lime<br>Fertilizer<br>Other (specify): |
| Chem B-Q22 | Provide the common names of the chemicals used: |
| Chem B-Q23 | How was the chemical applied? Select all that apply:<br><br>Mechanical application of solution<br>Mechanical application of solids<br>Manual application of solution<br>Manual application of solids<br>Aerial application of solution<br>Aerial application of solids<br>Other (specify): |
| Chem B-Q24 | To what type of waterbody was the chemical applied? Select all that apply:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| **Implementation** | |
| Chem B-Q25 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 27)<br>b. Environmental Impact Statement (EIS) (go to question 26)<br>c. Environmental Assessment (EA) (go to question 26)<br>d. Categorical Exclusion (CE) (go to question 26)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 26) |
| Chem B-Q26 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract or project plan. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Chemical or form of chemical selected to reduce unintended consequences<br>Yes/No/Not applicable<br>b. Application technique selected to reduce unintended consequences<br>Yes/No/Not applicable<br>c. Limiting the extent of the chemically treated portion of waterbody<br>Yes/No/Not applicable<br>d. Flow, stage, or runoff levels at the time of treatment<br>Yes/No/Not applicable<br>e. Forecast precipitation, flow, stage, or runoff levels expected after treatment<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Chem B-Q26 continued*) | f. Nontarget organism life cycles at the time of treatment<br>Yes/No/Not applicable<br>g. Waterbody chemistry to reduce interferences, etc. of applied chemical<br>Yes/No/Not applicable<br>h. Transportation of chemicals to site<br>Yes/No/Not applicable<br>i. Storage of chemicals<br>Yes/No/Not applicable<br>j. Disposal of unused chemicals<br>Yes/No/Not applicable<br>k. Calibration of application equipment prior to chemical application<br>Yes/No/Not applicable<br>l. Monitoring<br>Yes/No/Not applicable<br>m. Other (specify):<br>Yes/No/Not applicable |
| Chem B-Q27 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or project plan were implemented fully. Select one response in each line. If the provision existed in the project contract or plan and it was implemented fully, select Yes. If the provision existed in the project contract or plan but it was not implemented fully, select No. If the provision did not exist in the project contract or plan, select Not applicable.<br><br>a. Chemical or form of chemical selected to reduce unintended consequences<br>Yes/No/Not applicable<br>b. Application technique selected to reduce unintended consequences<br>Yes/No/Not applicable<br>c. Limiting the extent of the chemically treated portion of waterbody<br>Yes/No/Not applicable<br>d. Flow, stage, or runoff levels at the time of treatment<br>Yes/No/Not applicable<br>e. Forecast precipitation, flow, stage, or runoff levels expected after treatment<br>Yes/No/Not applicable<br>f. Nontarget organism life cycles at the time of treatment<br>Yes/No/Not applicable<br>g. Waterbody chemistry to reduce interferences, etc. of applied chemical<br>Yes/No/Not applicable<br>h. Transportation of chemicals to site<br>Yes/No/Not applicable<br>i. Storage of chemicals<br>Yes/No/Not applicable<br>j. Disposal of unused chemicals<br>Yes/No/Not applicable<br>k. Calibration of application equipment prior to chemical application<br>Yes/No/Not applicable<br>l. Monitoring<br>Yes/No/Not applicable<br>m. Other provisions specified in question 26m<br>Yes/No/Not applicable<br>n. Other (specify):<br>Yes/No/Not applicable<br><br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Chem B-Q28 | Was the safety data sheet (SDS) for each chemical reviewed prior to use? Select one:<br><br>a. Yes<br>b. No<br>c. Unknown |

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| **Implementation** (*continued*) | |
|---|---|
| Chem B-Q29 | Were the label instructions for each chemical followed? Select one:<br><br>a. Yes<br>b. No<br>c. Unknown |
| Chem B-Q30 | Did the applicator have all required Federal and State permits, licenses, or other certifications at the time the chemicals were used? Select one:<br><br>a. Not applicable, no permits, licenses, or other certifications required for the chemicals applied<br>b. Yes<br>c. No |
| Chem B-Q31 | Were inspections performed during chemical use to reduce the potential for unintended consequences to water quality or aquatic health? Select one:<br><br>a. Yes<br>b. No |
| Chem B-Q32 | If problems were found during chemical use that led to or probably could have led to unintended consequences to water quality or aquatic health, were operations terminated or modified to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Chem B-Q33 | Were spills and leaks that occurred during chemical transportation, mixing, or use handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Chem B-Q34 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 35)<br>b. No (go to question 36) |
| Chem B-Q35 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Chem B-Q36 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 37)<br>b. No (go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Chem B-Q37 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |

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| Effectiveness | |
|---|---|
| Chem B-Q38 | From observations only (i.e., exclude monitoring results), is there evidence that unintended consequences to water quality or aquatic health resulted from the chemical use? Select one:<br><br>a. Yes<br>b. No |
| Chem B-Q39 | What types of water quality or aquatic monitoring were performed during and/or following the chemical use? Select all that apply:<br><br>a. No monitoring was performed (go to question 42)<br>b. Surface water samples collected and analyzed during application on site (go to question 40)<br>c. Surface water samples collected during application and analyzed off site later (go to question 40)<br>d. Groundwater samples collected, and analyzed during application on site (go to question 40)<br>e. Groundwater samples collected, and analyzed off site later (go to question 40)<br>f. Monitoring or sampling nontarget organisms during or following application (go to question 40)<br>g. Other (specify; go to question 40): |
| Chem B-Q40 | Do monitoring data indicate that water quality standards were violated as a result of the chemical treatment? Select one:<br><br>a. Not applicable, water quality data were not part of the monitored variables<br>b. Yes<br>c. No<br>d. Unknown, cannot determine from the types of water quality monitoring data that are available |
| Chem B-Q41 | Do monitoring results or data (i.e., exclude observations) indicate that unintended consequences to water quality or aquatic health resulted from the chemical use? Select one; after answering go to question 43:<br><br>a. Yes<br>b. No |
| Chem B-Q42 | Based on professional judgment, did the lack of monitoring contribute to any unintended consequences to water quality or aquatic health? Select one:<br><br>a. Yes<br>b. No |
| Chem B-Q43 | What unintended or unplanned consequences to water quality or aquatic health resulted from chemical use? Select all that apply:<br><br>a. Not applicable, no unintended or unplanned consequences resulted from chemical use (go to question 45)<br>b. Nontarget organisms killed or affected (go to question 44)<br>c. Concentrations of chemicals or residues of chemicals higher than anticipated (go to question 44)<br>d. Water discoloration or turbidity present (go to question 44)<br>e. Reduced or depleted oxygen levels (go to question 44)<br>f. Waterbody substrate negatively affected (go to question 44)<br>g. Other (specify; after answering go to question 44): |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Chem B-Q44 | What are the causes of the unintended or unplanned consequences? Select all that apply:<br><br>a. Chemical concentrations or loads used were too high<br>b. Application technique was inappropriate for site or conditions<br>c. Treatment area was not adequately identified<br>d. Chemical applied beyond planned use area<br>e. Insufficient care taken during application to avoid nontargets or water contamination<br>f. Inappropriate flow, stage, or runoff levels during or immediately following chemical use<br>g. Inappropriate precipitation conditions during or immediately following chemical use<br>h. Nontarget organism life cycle at time of chemical use was not adequately considered<br>i. Background water chemistry at the time of chemical use was not adequately considered<br>j. Insufficient care taken or improper techniques used during transportation of chemical<br>k. Insufficient care taken or improper techniques used during storage of chemical<br>l. Insufficient care taken or improper techniques used during disposal of unused chemical<br>m. SDS information disregarded or not fully followed<br>n. Label instructions disregarded or not fully followed<br>o. Other (specify):<br>p. Unknown |
| Chem B-Q45 | Do observations or monitoring data indicate that beneficial uses were negatively affected? Select one:<br><br>a. Yes<br>b. No |
| Chem B-Q46 | What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside the AMZ<br>c. Evidence of chemical or fuel spills or leaks within the AMZ<br>d. Evidence of chemical or fuel spills or leaks in the waterbody<br>e. Evidence of chemical or fuel waste containers outside the AMZ<br>f. Evidence of chemical or fuel waste containers within the AMZ<br>g. Evidence of chemical or fuel waste containers in the waterbody |
| Chem B-Q47 | If inspections were not conducted during chemical use, did the lack of administration contribute to problems found by observation or monitoring? Select one:<br><br>a. Not applicable, inspections were conducted during chemical use<br>b. Yes<br>c. No |
| Chem B-Q48 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 49)<br>b. No (go to question 50) |
| Chem B-Q49 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |

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| **Effectiveness** (*continued*) | |
|---|---|
| Chem B-Q50 | Are any adaptive management actions needed to improve effectiveness?<br>Select one:<br><br>a. Yes (go to question 51)<br>b. No (go to General Comments) |
| Chem B-Q51 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies.<br>Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Chemicals C—Chemical Use for Dust Abatement

## Chemicals C: Descriptive Statistics

The protocol for assessing BMPs applied to chemical use for dust abatement on unpaved roads (Chem C) is used infrequently on NFS lands, with most use occurring on national forests and grasslands in Regions 1, 2, 3, 4, and 5 (see Appendix). Over the monitoring periods, eight Chem C projects were evaluated (two in FY15/16 and six in FY17/18).

All projects except one in FY17/18 were evaluated for implementation and effectiveness; the other project was evaluated for effectiveness only. Seven of eight projects were selected randomly (Table 64), and all projects indicated a reason for monitoring was to meet National BMP targets. One project in FY15/16 involved the application of a liquid asphalt emulsion to the road surface, while a second project applied a manufactured salt solution (containing magnesium chloride, calcium chloride, and sodium chloride) that was a treated by-product of oil and gas industry-produced water. In FY17/18, four projects applied magnesium chloride, two applied calcium chloride (one with magnesium chloride), and one applied lignin sulfonate. In both FY15/16 and FY17/18, seven projects used surface application of the solution, two projects applied solids to the road surface, and two projects mixed the chemicals into the road surface. Two projects evaluated in FY17/18 reported multiple application methods.

## Chemicals C: Ratings and Component Scores

The implementation and effectiveness rating components for Chem C and their interpretations are the same as for Chem A (Table 83 and Table 84, respectively). No BMPs were developed for two Chem C projects, so those received a *no BMPs* score for the planning component (Table 99). However, both the on-the-ground execution and project oversight components for the projects received *all* scores (Table 100). While it may seem incongruous to have a score of *no BMPs* for the planning component and a score of *all* for the on-the-ground execution component, the combination is possible. The BMPs that were implemented would have had to come from standard contract language rather

**Table 99.—**Distribution of implementation component scores by component for Chem C evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=2) | | | | | | | |
| | All | | | 1 | 50 | 1 | 50 |
| | Some | 1 | 50 | 1 | 50 | 1 | 50 |
| | None | | | | | | |
| | No BMPs | 1 | 50 | | | | |
| FY17/18 (n=5) | | | | | | | |
| | All | 2 | 40 | 3 | 60 | 4 | 80 |
| | Some | 2 | 40 | 2 | 40 | 1 | 20 |
| | None | | | | | | |
| | No BMPs | 1 | 20 | | | | |

**Table 100.—**Implementation component scores corresponding to the overall implementation ratings for Chem C evaluations with complete data in FY15/16 and FY17/18. See Table 83 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=2) | | | | | |
| | Fully implemented | | | | 0 |
| | Mostly implemented | | | | 0 |
| | Marginally implemented | Some | Some | Some | 1 |
| | Not implemented | | | | 0 |
| | No BMPs | No BMPs | All | All | 1 |
| FY17/18 (n=5) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | Some | All | Some | 1 |
| | Marginally implemented | All | Some | All | 1 |
| | | Some | Some | All | 1 |
| | Not implemented | | | | 0 |
| | No BMPs | No BMPs | All | All | 1 |

than from planning. Thus, while applicable BMPs were not included during planning, BMPs in 10 of the 19 possible provisions for the evaluated Chem C projects were available from the standard contract language and implemented fully (*all* score for the on-the-ground execution component) (Table 99). For the effectiveness components, the chemical pollutants component score for every project was *effective*, and the observational evidence component scores were *effective* or *moderately effective* (Table 101). None of the projects in either monitoring period included any type of monitoring. All projects received an effectiveness rating of *effective* (Table 102). The combination of implementation and effectiveness ratings of *marginally implemented* and *effective*, respectively, resulted in three projects receiving a composite rating of *good* (Table 103). The lack of planned BMPs for two projects resulted in a *no plan* composite rating regardless of the effectiveness rating of *effective*.

**Table 101.—**Distribution of effectiveness component scores by component for Chem C evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Observational evidence component (number) | Observational evidence component (percent) | Monitoring evidence component (number) | Monitoring evidence component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=2) | | | | | | | |
| | Effective | 1 | 50 | | | 2 | 100 |
| | Mostly effective[a] | | | | | | |
| | Moderately effective[b] | 1 | 50 | | | | |
| | Marginally effective[a] | | | | | | |
| | Not effective | | | | | | |
| | No monitoring[a] | | | 2 | 100 | | |
| FY17/18 (n=6) | | | | | | | |
| | Effective | 5 | 83 | | | 6 | 100 |
| | Mostly effective | | | | | | |
| | Moderately effective | 1 | 17 | | | | |
| | Marginally effective | | | | | | |
| | Not effective | | | | | | |
| | No monitoring | | | 6 | 100 | | |

[a] Score applies only to monitoring evidence component (see Table 84).
[b] Score applies only to observational evidence and chemical pollutants components (see Table 84).

**Table 102.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Chem C evaluations with complete data in FY15/16 and FY17/18. See Table 84 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Observational evidence component | Monitoring evidence component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=2) | | | | | |
| | Effective | Effective | No monitoring | Effective | 1 |
| | | Moderately effective | No monitoring | Effective | 1 |
| | Mostly effective | | | | 0 |
| | Marginally effective | | | | 0 |
| | Not effective | | | | 0 |
| FY17/18 (n=6) | | | | | |
| | Effective | Effective | No monitoring | Effective | 6 |
| | Mostly effective | | | | 0 |
| | Marginally effective | | | | 0 |
| | Not effective | | | | 0 |

**Table 103.—**Composite rating matrix for Chem C projects evaluated for both implementation and effectiveness in FY15/16 (n=2 evaluations) and FY17/18 (n=5 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | | | 1 | | 1 |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 1 | 1 | 2 | | 1 |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

Excellent
Good
Fair
Poor
No plan

## Chemicals C: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Chem C. Chemical Use for Dust Abatement**

(Reference BMPs Chem-1, Chem-2, Chem-3, Chem-5, and Chem-6)

v3.0 February 2016

| Header | |
|---|---|
| Chem C-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Chem C-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Chem C-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Chem C-Q4 | Date of current field evaluation: |
| Chem C-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Chem C-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Chem C-Q7 | Reviewers and titles: |
| Chem C-Q8a | Region number: |
| Chem C-Q8b | State: |
| Chem C-Q9a | Proclaimed Forest or Grassland number and name: |
| Chem C-Q9b | Administrative Forest or Grassland number and name: |
| Chem C-Q10 | District number and name: |
| Chem C-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Chem C-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Chem C-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Chem C-Q12 | 6th level HUC number and name for the subwatershed in which the evaluated road is located: |
| Chem C-Q13 | Is any part of the treated road segment located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Chem C-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Chem C-Q14b | Location.<br><br>Easting: |
| Chem C-Q14c | Location.<br><br>Northing: |
| Chem C-Q15a | Location.<br><br>Latitude: |
| Chem C-Q15b | Location.<br><br>Longitude: |
| Chem C-Q15c | Location.<br><br>Lat/Long Datum: |
| Chem C-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Chem C-Q17 | Forest Service road on which chemical was applied: |
| Chem C-Q18 | Dates of chemical application: |
| Chem C-Q19 | Total length of this road treated with dust control chemicals (mi or km; specify unit): |
| Chem C-Q20 | Length of segment being evaluated (mi or km; specify unit): |

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| **Header** (*continued*) | |
|---|---|
| Chem C-Q21 | What type of chemical was used? Select all that apply:<br><br>Liquid asphalt<br>Lignin sulfonate<br>Magnesium chloride<br>Calcium chloride<br>Other (specify): |
| Chem C-Q22 | Provide the common names of the chemicals used: |
| Chem C-Q23 | How was the chemical applied? Select all that apply:<br><br>a. Surface application of solution or liquid asphalt<br>b. Surface application of solids<br>c. Chemicals mechanically mixed into roadbed or road surface<br>d. Other (specify): |
| Chem C-Q24 | What type of waterbody is present at the waterbody crossing? Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| **Implementation** | |
| Chem C-Q25 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 27)<br>b. Environmental Impact Statement (EIS) (go to question 26)<br>c. Environmental Assessment (EA) (go to question 26)<br>d. Categorical Exclusion (CE) (go to question 26)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 26) |
| Chem C-Q26 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract or project plan. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Chemical or form of chemical selected to reduce unintended consequences<br>Yes/No/Not applicable<br>b. Application technique selected to reduce unintended consequences<br>Yes/No/Not applicable<br>c. Protection measures at waterbody crossings<br>Yes/No/Not applicable<br>d. Creation of berms or other measures to retain chemicals on road surface<br>Yes/No/Not applicable<br>e. Limiting the length of the chemically treated road<br>Yes/No/Not applicable<br>f. Providing untreated buffers around/near waterbodies<br>Yes/No/Not applicable<br>g. Temperature conditions<br>Yes/No/Not applicable<br>*(continued)* |

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| **Implementation** (*continued*) | |
|---|---|
| (*Chem C-Q26 continued*) | h. Humidity conditions<br>Yes/No/Not applicable<br>i. Wind speed and/or wind direction<br>Yes/No/Not applicable<br>j. Precipitation conditions (type, amount, timing, intensity, etc.)<br>Yes/No/Not applicable<br>k. Timing considerations other than weather and meteorological conditions<br>Yes/No/Not applicable<br>l. Transportation of chemicals to site<br>Yes/No/Not applicable<br>m. Storage of chemicals<br>Yes/No/Not applicable<br>n. Disposal of unused chemicals<br>Yes/No/Not applicable<br>o. Road traffic levels<br>Yes/No/Not applicable<br>p. Road bed and/or road surface texture<br>Yes/No/Not applicable<br>q. Road bed and/or road surface chemical characteristics<br>Yes/No/Not applicable<br>r. Calibration of application equipment prior to chemical application<br>Yes/No/Not applicable<br>s. Monitoring<br>Yes/No/Not applicable<br>t. Other (specify):<br>Yes/No/Not applicable |
| Chem C-Q27 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or project plan were implemented fully. Select one response in each line. If the provision existed in the project contract or plan and it was implemented fully, select Yes. If the provision existed in the project contract or plan but it was not implemented fully, select No. If the provision did not exist in the project contract or plan, select Not applicable.<br><br>a. Chemical or form of chemical selected to reduce unintended consequences<br>Yes/No/Not applicable<br>b. Application technique selected to reduce unintended consequences<br>Yes/No/Not applicable<br>c. Protection measures at waterbody crossings<br>Yes/No/Not applicable<br>d. Creation of berms or other measures to retain chemicals on road surface<br>Yes/No/Not applicable<br>e. Limiting the length of the chemically treated road<br>Yes/No/Not applicable<br>f. Providing untreated buffers around/near waterbodies<br>Yes/No/Not applicable<br>g. Temperature conditions<br>Yes/No/Not applicable<br>h. Humidity conditions<br>Yes/No/Not applicable<br>i. Wind speed and/or wind direction<br>Yes/No/Not applicable<br>j. Precipitation conditions (type, amount, timing, intensity, etc.)<br>Yes/No/Not applicable<br>k. Timing considerations other than weather and meteorological conditions<br>Yes/No/Not applicable<br>l. Transportation of chemicals to site<br>Yes/No/Not applicable<br>m. Storage of chemicals<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Chem C-Q27 continued*) | n. Disposal of unused chemicals<br>Yes/No/Not applicable<br>o. Road traffic levels<br>Yes/No/Not applicable<br>p. Road bed and/or road surface texture<br>Yes/No/Not applicable<br>q. Road bed and/or road surface chemical characteristics<br>Yes/No/Not applicable<br>r. Calibration of application equipment prior to chemical application<br>Yes/No/Not applicable<br>s. Monitoring<br>Yes/No/Not applicable<br>t. Other provisions specified in question 26t<br>Yes/No/Not applicable<br>u. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Chem C-Q28 | Was the safety data sheet (SDS) for each chemical reviewed prior to use? Select one:<br>a. Yes<br>b. No<br>c. Unknown |
| Chem C-Q29 | Were the label instructions for each chemical followed? Select one:<br>a. Yes<br>b. No<br>c. Unknown |
| Chem C-Q30 | Did the applicator have all required Federal and State permits, licenses, or other certifications at the time the application was made? Select one:<br>a. Not applicable, no permits, licenses, or other certifications required for the chemicals applied<br>b. Yes<br>c. No |
| Chem C-Q31 | Were inspections performed during chemical use to reduce the potential for water contamination? Select one:<br>a. Yes<br>b. No |
| Chem C-Q32 | If problems were found during chemical use that led to or probably could have led to unintended consequences to water quality or aquatic health, were operations terminated or modified to reduce or eliminate the problems? Select one:<br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Chem C-Q33 | Were spills and leaks that occurred during chemical transportation, mixing, or use handled/treated according to the contingency and emergency response plan? Select one:<br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |

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| **Implementation** (*continued*) | |
|---|---|
| Chem C-Q34 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 35)<br>b. No (go to question 36) |
| Chem C-Q35 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Chem C-Q36 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 37)<br>b. No (go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Chem C-Q37 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Chem C-Q38 | From observations only (i.e., exclude monitoring results), is there evidence that the chemical applied or residues from the chemical moved off the road? Select one:<br><br>a. Yes (go to question 39)<br>b. No (go to question 40) |
| Chem C-Q39 | Where observations indicate that the chemical or its residues moved off the road, does the evidence indicate that surface water was contaminated? Select one:<br><br>a. Yes<br>b. No<br>If Yes, what is that evidence? |
| Chem C-Q40 | What types of water quality or aquatic monitoring were performed during and/or following the road chemical application? Select all that apply:<br><br>a. No monitoring was performed (go to question 44)<br>b. Runoff from the road surface collected and analyzed during application on site (go to question 41)<br>c. Surface water samples collected and analyzed during application on site (go to question 41)<br>d. Surface water samples collected during application and analyzed off site later (go to question 41)<br>e. Groundwater samples collected, and analyzed during application on site (go to question 41)<br>f. Groundwater samples collected, and analyzed off site later (go to question 41)<br>g. Other (specify; go to question 41): |
| Chem C-Q41 | Do monitoring results or data indicate that the chemical or its residues moved off the road? Select one:<br><br>a. Yes (go to question 42)<br>b. No (go to question 44) |
| Chem C-Q42 | Where monitoring results or data indicate that the chemical or its residues moved off the road, does the evidence indicate that surface water or groundwater was contaminated? Select one:<br><br>a. Yes (go to question 43)<br>b. No (go to question 44)<br>c. Unknown, cannot determine from available monitoring data (go to question 44)<br>If Yes, provide a brief description of the evidence supporting this answer: |

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| **Effectiveness** (*continued*) | |
|---|---|
| Chem C-Q43 | Do monitoring data indicate that water quality standards were violated as a result of the chemical treatment? Select one:<br><br>a. Not applicable, water quality data were not part of the monitored variables<br>b. Yes<br>c. No<br>d. Unknown, cannot determine from the types of water quality monitoring data that are available |
| Chem C-Q44 | Do observations or monitoring data indicate that beneficial uses were negatively affected? Select one:<br><br>a. Yes<br>b. No |
| Chem C-Q45 | What are the causes that allowed the chemical to move off the road or to contaminate surface water or groundwater? Select all that apply:<br><br>a. Not applicable, no available evidence to indicate that chemical moved off the road or contaminated water<br>b. Chemical selected was inappropriate for site or conditions<br>c. Application technique was inappropriate or inadequate for site or conditions<br>d. Treated road length was not adequately identified<br>e. Chemical applied outside the planned treated road length<br>f. Techniques to retain chemical on the road were not installed<br>g. Techniques to retain chemical on the road were installed improperly or inadequately<br>h. Insufficient care taken during application to avoid water contamination<br>i. Inadequate protection measures at waterbody crossings<br>j. Treated road was not separated sufficiently from waterbodies<br>k. Temperature conditions were inappropriate for the chemical used or time of treatment<br>l. Humidity was inappropriate for the chemical used or time of treatment<br>m. Wind speed was inappropriate for the chemical used or time of treatment<br>n. Wind direction was inappropriate for the chemical used or time of treatment<br>o. Precipitation type, amount, intensity, or duration were inappropriate for the chemical used or time of treatment<br>p. Inappropriate road bed or surface texture for chemical used<br>q. Inappropriate road bed or surface chemistry for chemical used<br>r. Lack of, or improper calibration of application equipment<br>s. Inappropriate traffic types or levels allowed following treatment<br>t. Insufficient care taken or improper techniques used during transportation of chemical<br>u. Insufficient care taken or improper techniques used for storage of chemical<br>v. Insufficient care taken or improper techniques used for disposal of unused chemical<br>w. SDS information disregarded or not fully followed<br>x. Label instructions disregarded or not fully followed<br>y. Other (specify):<br>z. Unknown |
| Chem C-Q46 | What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody |

*continued on next page*

| **Effectiveness** *(continued)* | |
|---|---|
| Chem C-Q47 | If inspections were not conducted during chemical use, did the lack of administration contribute to problems found by observation or monitoring? Select one:<br><br>a. Not applicable, inspections were conducted during chemical use<br>b. Yes<br>c. No |
| Chem C-Q48 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 49)<br>b. No (go to question 50) |
| Chem C-Q49 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Chem C-Q50 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 51)<br>b. No (go to General Comments) |
| Chem C-Q51 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

## Chemical Use Summary

Chem A, Chem B, and Chem C were some of the least frequently used National BMP program monitoring protocols in the FY15/16 and FY17/18 monitoring periods with 91, 15, and 8 evaluations completed, respectively (Table 64). Each region completed at least one evaluation using a chemical use protocol. Region 6 (25 evaluations) and Region 2 (21 evaluations) completed the most, and Region 10 (4 evaluations) and Region 4 (7 evaluations) completed the fewest. The small numbers of Chem B and Chem C evaluations completed preclude detailed analysis of these data.

More than 80 percent of the Chem A evaluations were randomly selected (Table 64), and there were no significant differences in either implementation ratings or effectiveness ratings between randomly and nonrandomly selected projects (Fig. 36). An herbicide was applied in 93 percent of the projects evaluated, and most were mechanical or backpack sprayer application of a solution (Tables 67 and 68). Streams and rivers were the most common waterbodies nearest to the reviewed projects followed by wetlands (Table 69). Approximately 20 percent of the projects reviewed involved multiple waterbodies.

For Chem A, approximately 75 percent of the projects were rated as *fully implemented* or *mostly implemented* (Table 86). These ratings indicate that all the BMP prescriptions in the project contract or plan were implemented fully in the field. Three projects were rated *not implemented*, and one project was rated *no BMPs*, indicating BMPs were not considered in project planning for those projects. Ninety-five percent of the projects were rated as *effective* (Tables 88). This rating indicates no impacts to water quality were observed. For projects in which both the implementation and effectiveness evaluations were completed, better implementation ratings were associated with better effectiveness ratings.

Implementation ratings were better for Chem B evaluations completed in FY15/16 and FY17/18 than for Chem C evaluations. One Chem B project was rated something other than *fully implemented* or *mostly implemented* (Table 96), and two Chem C projects were rated either *fully implemented* or *mostly implemented* (Table 100). All Chem B and Chem C projects except one for each protocol rated *effective*. These findings demonstrate that when BMPs are implemented in chemical use projects, water quality is protected.

## Overall Program Observations

In addition to analyzing the monitoring data for insights on BMP implementation and effectiveness, the data are also assessed to identify issues with application of the BMP monitoring program. Examination of the data for protocols Chem A, Chem B, and Chem C indicate that reading the protocol instructions and completing the monitoring forms more carefully may improve data quality. Specific issues identified are as follows:

- National BMP program direction calls for sites to be evaluated for both BMP implementation and effectiveness, with implementation evaluated first, even if both are evaluated on the same day. Several Chem A, Chem B, and Chem C evaluations were of implementation only or effectiveness only, with no corresponding effectiveness or implementation evaluation in the database. While subsequent corresponding effectiveness evaluations for the completed implementation-only evaluations may occur in a later monitoring period, it's important to note cases where an implementation evaluation did not occur prior to an effectiveness-only evaluation. Paired implementation and effectiveness evaluations at the same site are important to determine whether BMPs are effective when implemented correctly.
- One Chem A evaluation was incomplete in the database. Evaluations with incomplete data in the database cannot be rated.
- In a number of Chem A and Chem B evaluations, incorrect answers were provided for header questions 11a, b, and c, which are designed to capture information about the reasons for monitoring and ask whether the projects or sites were selected randomly according to the protocol instructions and whether the protocol instructions for completing the evaluations were followed. Common mistakes were misunderstanding the intended meaning of quality assurance monitoring.

- Inconsistent answers given for related questions in the implementation sections and effectiveness sections of the protocols can make it difficult to interpret the relationship between BMP implementation and BMP effectiveness. In all protocols, a pair of questions (Chem A-Q34 and Chem A-Q50; Chem B-Q31 and Chem B-Q47; Chem C-Q31 and Chem C-Q47) ask about inspections (implementation) and a lack of inspections leading to observed problems (effectiveness). The answers to these questions were not analyzed in detail for Chem B and Chem C but were for Chem A. In 28 and 13 percent of the Chem A evaluations completed in FY15/16 and FY17/18, respectively, the answer to the effectiveness question was in direct conflict with the answer given for the implementation question.

As additional data from other protocols are analyzed and more monitoring using these protocols is completed in future monitoring periods, these issues can be tracked. Additional instruction and training can help reduce the likelihood of them recurring.

# FACILITIES AND NONRECREATION SPECIAL USES MANAGEMENT

Facilities and nonrecreation special uses management BMPs are used to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from construction, use, maintenance, and reclamation of facilities on NFS lands. Facilities include buildings, camps, towers, pipelines, stream gauging stations, water storage facilities, and other permanent or semi-permanent structures and infrastructure associated with facilities administered by the USDA Forest Service. Forest Service facilities typically encountered on NFS lands include fire stations, work centers, permanent field camps, ranger stations, visitor centers, public water systems, and sanitation systems. Other facilities on NFS lands may be operated by third parties through easements or special use authorizations. Examples of third-party facilities include work camps, electronic and communication sites, public water and sanitation systems, power transmission lines, pipelines, research equipment and structures, and access routes to private land inholdings.

Facilities and nonrecreation special uses management results are described separately by protocol: active construction of noncorridor facilities or nonrecreation special uses (Fac A), operation and maintenance of noncorridor facilities or nonrecreation special uses (Fac B), completed construction or operation and maintenance of pipelines, transmission lines, or rights-of-way (Fac C), and completed facility reclamation (Fac D). Because the Fac C protocol is used to evaluate two separate types of non-road corridor facilities (henceforth corridor facilities)—those that are recently constructed (within 2 years of the evaluation) and those that have existed for longer than 2 years—with some unique questions for each type, these two cases are analyzed and presented separately within the Fac C section.

In the FY15/16 and FY17/18 monitoring periods, facilities and nonrecreation special uses management evaluations were dominated by randomly selected samples (Table 104), but the overall sample size for Fac B and Fac C is not large, especially considering that these represent agency-wide monitoring, and the sample sizes for Fac A and Fac D along with the completed corridor construction portion of Fac C (seven evaluations) are very small. Statistical comparisons of the implementation ratings and effectiveness ratings resulting from randomly and nonrandomly selected samples were completed for the protocols with sample sizes >10 in each monitoring period (Fac B and Fac C [corridor operation and maintenance portion only]). Fac B showed no significant associations between the ratings and sample selection technique for implementation and effectiveness in both monitoring periods (implementation: $p = 0.27$ FY15/16, $p = 0.54$ FY17/18; effectiveness: $p = 1.00$ FY15/16, $p = 0.50$ FY17/18) (Fig. 55A, B). Fac C did have a significant association between implementation ratings and sample selection method in FY15/16 ($p < 0.001$) (Fig. 55C) but not for any other test of association (implementation: $p = 0.16$ FY17/18; effectiveness: $p = 1.00$ FY15/16, $p = 0.61$ FY17/18) (Fig. 55C, D). However, all samples for each protocol were combined for analysis because of the small sample sizes.

**Table 104.—**Number of randomly and nonrandomly selected Fac A (Active Construction of Noncorridor Facilities or Nonrecreation Special Uses), Fac B (Operation and Maintenance of Noncorridor Facilities or Nonrecreation Special Uses), Fac C (Completed Construction or Operation and Maintenance of Pipelines, Transmission Lines, or Rights-of-Way), and Fac D (Completed Facility Reclamation) evaluations, by monitoring period and region (Fac A-Q11b, Fac B-Q11b, Fac C-Q11b, Fac D-Q11b)

| Monitoring period | Region | Fac A random selection | Fac A nonrandom selection | Fac B random selection | Fac B nonrandom selection | Fac C[a] random selection | Fac C[a] nonrandom selection | Fac D random selection | Fac D nonrandom selection |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| | 1 | | | 4 | | | | | |
| | 2 | 2 | | 4 | 2 | 1 | | | |
| | 3 | | 1 | 4 | | | 1 | | |
| | 4 | | 1 | 1 | | 1 | 1 | | |
| | 5 | | | 3 | | 2 | 1 | | |
| | 6 | 1 | | 7 | 1 | 2 | | | |
| | 8 | 2 | | 1 | | | 2 | 1 | |
| | 9 | | 1 | 2 | | 6 | 2 | 2 | |
| | 10 | | | 1 | 1 | | | 1 | |
| | Total | 5 | 3 | 27 | 4 | 12 | 7 | 4 | 0 |
| | Percent within protocol | 63 | 37 | 87 | 13 | 63 | 37 | 100 | |
| FY17/18 | | | | | | | | | |
| | 1 | | | | | 1 | | 2 | 1 |
| | 2 | | | 4 | | 2 | | | |
| | 3 | | | 1 | | 1 | | | |
| | 4 | 1 | | 2 | | 1 | 2 | | |
| | 5 | 1 | | 2 | 1 | 3 | | | |
| | 6 | 1 | | 7 | 1 | 5 | | 1 | |
| | 8 | 3 | | | | 1 | 2 | 1 | |
| | 9 | | | | 1 | 2 | 2 | 2 | |
| | 10 | | | 1 | 3 | 1 | | | |
| | Total | 6 | 0 | 17 | 6 | 17 | 6 | 6 | 1 |
| | Percent within protocol | 100 | | 74 | 26 | 74 | 26 | 86 | 14 |

[a] Includes completed construction of corridor facilities evaluations and operation and maintenance of corridor facilities evaluations.

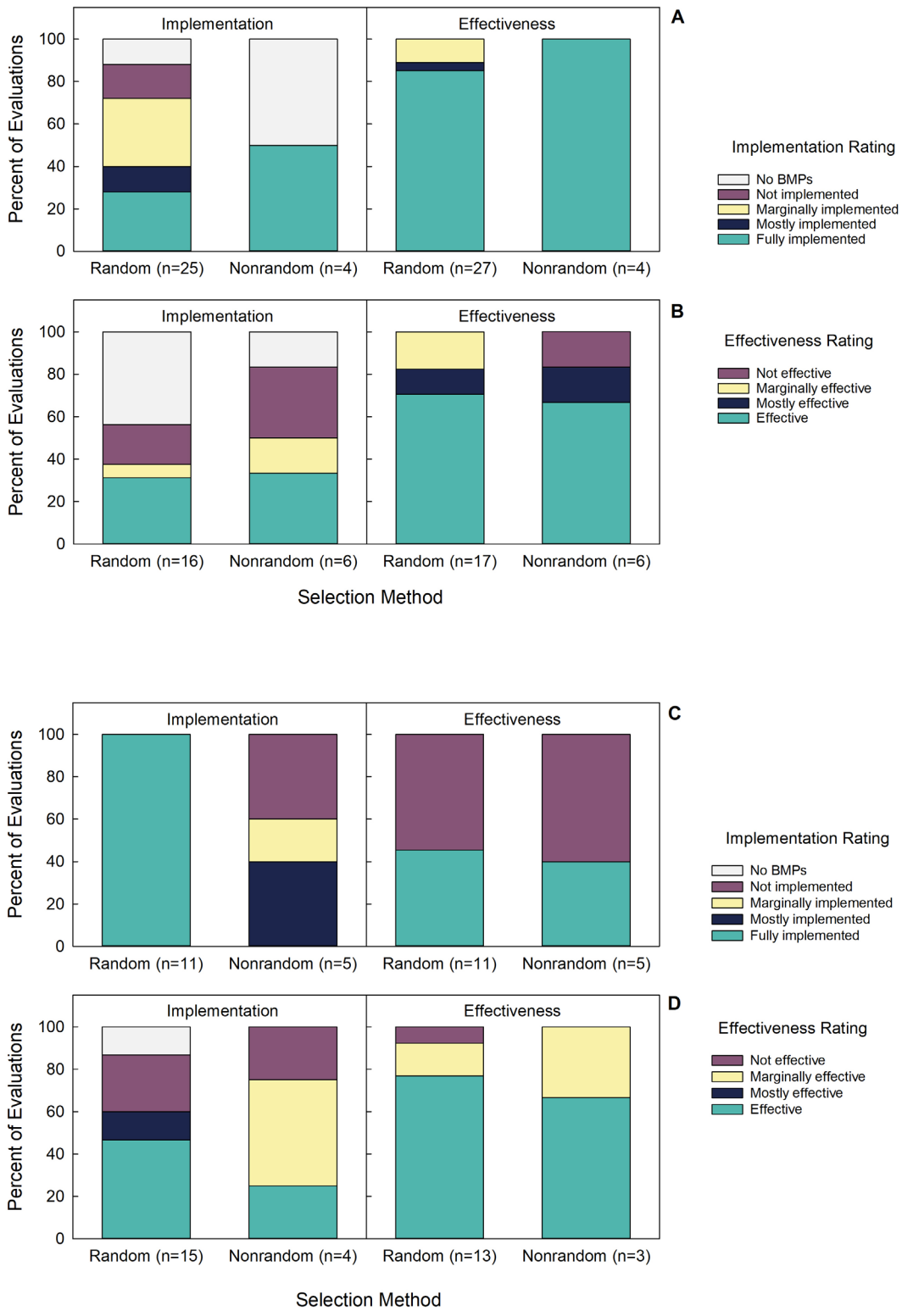



**Figure 55.—**Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Fac B evaluations completed in FY15/16 (A) and FY17/18 (B) and Fac C operation and maintenance evaluations completed in FY15/16 (C) and FY17/18 (D).

Results for Fac B and Fac C operation and maintenance (O&M) of existing corridors are divided into six sections; each builds on the next in terms of data interpretation. The sections and descriptions are as follows:

1. Header statistics—mostly descriptive statistics from the header section of the evaluation form, including location, composition, and types of projects.

2. Implementation results and their tie to header information—results from the implementation questions with ties to header information when appropriate.

3. Effectiveness results and their tie to implementation results and header information—results from the effectiveness questions with ties to implementation and sometimes header information to provide context between outcomes and BMP planning and prescription and between outcomes and physical site conditions.

4. Ratings and their tie to header, implementation, and effectiveness results—description of the implementation, effectiveness, and composite ratings with ties to individual questions on the respective evaluation form.

5. Component and subcomponent scores—in-depth examination of the component and subcomponent (when applicable) scores and the resulting implementation and effectiveness ratings.

Although the fourth and fifth sections involve examination of the overall ratings, they are split into two individual sections for convenience of the reader. Users who are more interested in the final implementation and effectiveness ratings and their association with individual protocol questions can focus on the fourth section, while those interested in more fully understanding the influence of different components and subcomponents on the scoring routines and the final ratings can focus on the fifth section.

6. Management implications—summary of the important findings in the preceding sections and suggestions for how these findings can be used to improve BMP implementation and effectiveness in the types of projects or sites evaluated by the protocol.

The analyses for Fac A, Fac C completed construction of corridors, and Fac D are not divided into the six sections used for Fac B and Fac C O&M because the number of implementation and effectiveness evaluations for each is 10 or fewer in each monitoring period. Instead a much less detailed presentation of results is provided. The analyses in these protocols focus primarily on summarizing the descriptive data (i.e., descriptive statistics) and the ratings and component scores.

The large number of analyses included in this report provide an in-depth examination into the types of queries and information that can be obtained from monitoring protocol data. Some queries will provide more useful information than others to users. In some cases, small sample sizes also may limit the usefulness of the corresponding results, though this deficiency will diminish as monitoring continues. The Fisher's exact test of association for categorical data was employed for many analyses because of the limited sample sizes in at least some answer choices. However, corresponding sample sizes are reported in tables and figures to provide the reader another metric for interpreting the results in addition to the statistical probabilities.

# Facilities A—Active Construction of Noncorridor Facilities or Nonrecreation Special Uses

## Facilities A: Descriptive Statistics

The Fac A protocol evaluates active construction of noncorridor facilities or active construction of nonrecreation special uses (subsequently referred to as facilities). Because facilities construction is not common, the number of evaluations completed during each monitoring period is not very large. All regions except Region 1 and Region 10 (see Appendix) evaluated at least one Fac A project (Table 105). Fourteen Fac A projects were evaluated nationally, with 11 of those selected randomly (Table 104). Three Fac A evaluations did not complete an effectiveness review for the project (Table 105) by the end of the FY17/18 monitoring period. The implementation and effectiveness reviews were performed on the same day for the 11 evaluations for which implementation and effectiveness were both completed.

**Table 105.—**Number of Fac A evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Fac A-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | | | | |
| | 2 | 2 | | | 2 |
| | 3 | 1 | | | 1 |
| | 4 | 1 | 1 | | |
| | 5 | | | | |
| | 6 | 1 | | | 1 |
| | 8 | 2 | 1 | | 1 |
| | 9 | 1 | | | 1 |
| | 10 | | | | |
| | All | 8 | 2 | | 6 |
| | Percent | | 25 | | 75 |
| FY17/18 | | | | | |
| | 1 | | | | |
| | 2 | | | | |
| | 3 | | | | |
| | 4 | 1 | | | 1 |
| | 5 | 1 | | | 1 |
| | 6 | 1 | 1 | | |
| | 8 | 3 | | | 3 |
| | 9 | | | | |
| | 10 | | | | |
| | All | 6 | 1 | | 5 |
| | Percent | | 17 | | 83 |

All Fac A evaluations were performed to meet National BMP targets (Fac A-Q11a) (Table 106). Eight of the facilities were being constructed for use as Forest Service facilities, and six were constructed for operation under special use authorization (Table 107). Lakes were the most common type of waterbody nearest the Fac A projects (Table 108), which is not surprising given that a fishing pier, a dam, and a reservoir were three of the constructed facilities (Table 107). Two of the projects identified ditches as the nearest waterbody. Typically, ditches are not considered waterbodies within the National BMP program, but they may have been considered channel extensions (i.e., directly connected to a receiving waterbody) and therefore considered waterbodies for the evaluation. Six of the facilities were constructed within the waterbody's designated aquatic management zone[1] (AMZ), and six were outside the designated AMZ. Two facilities were constructed where the waterbody had no designated AMZ; one of those waterbodies was a ditch and one was the lake with a fishing pier.

**Table 106.—**Number of Fac A evaluations completed in FY15/16 (n=8 evaluations) and FY17/18 (n=6 evaluations), by reason for monitoring (Fac A-Q11a). Multiple selections were possible.

| Reason for monitoring | FY15/16 | FY17/18 |
|---|---|---|
| National BMP targets | 8 | 6 |
| Land management plan monitoring | 0 | 0 |
| Project review | 3 | 0 |
| Quality assurance | 0 | 0 |
| Other | 0 | 0 |

**Table 107.—**Type of facility constructed (Fac A-Q19) by management type (Fac A-Q17) and region for Fac A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Party responsible for facility management once constructed | Region | Facility type |
|---|---|---|---|
| FY15/16 | | | |
| | Forest Service | 2 | District office addition |
| | | 3 | Fishing pier |
| | | 6 | Visitor center |
| | | 9 | Bison corral |
| | Special use authorization | 2 | University geology camp (use code 432) |
| | | 4 | Dam |
| | | 8 | Reservoir (use codes 915, 922 Communications (use code 818) |
| FY17/18 | | | |
| | Forest Service | 4 | Campground (campsites) |
| | | 8 | Residential Campground (bath house; 2 projects) |
| | Special use authorization | 5 | Water tank |
| | | 6 | Resort |

[1]Aquatic management zones (AMZ) are administratively designated zones adjacent to stream channels and other waterbodies that are delineated for applying special management controls to maintain and improve water quality or other water- and riparian-dependent values.

where the waterbody had no designated AMZ; one of those waterbodies was a ditch and one was the lake with a fishing pier.

**Table 108.**—Number of Fac A evaluations completed in FY15/16 and FY17/18, by waterbody type nearest to the facility being constructed (Fac A-Q22)

| Type of waterbody | FY15/16 | FY17/18 |
|---|---|---|
| Ephemeral stream | | 1 |
| Intermittent stream | 1 | |
| Perennial stream/river | 1 | 1 |
| Lake | 3 | 2 |
| Pond | 1 | |
| Other | 2[a] | 1[b] |

[a] Ditch.
[b] Seep/spring.

## Facilities A: Ratings and Component Scores

The Fac A projects evaluated were fairly evenly distributed across the range of implementation ratings in FY15/16 (Fig. 56A) but not in FY17/18 (Fig. 56B). Distribution of the effectiveness ratings was similar in both monitoring periods (Fig. 56C, D). The composite ratings for the projects for which both implementation and effectiveness reviews were completed are shown in Table 109. Sixty-four percent of the projects had a composite rating of *excellent*. The *good* composite rating in FY15/16 corresponded to the bison corral project that had a *not implemented* rating for implementation. However, the lack of project implementation had little influence on effectiveness given that the project rated as *effective* (Table 109).

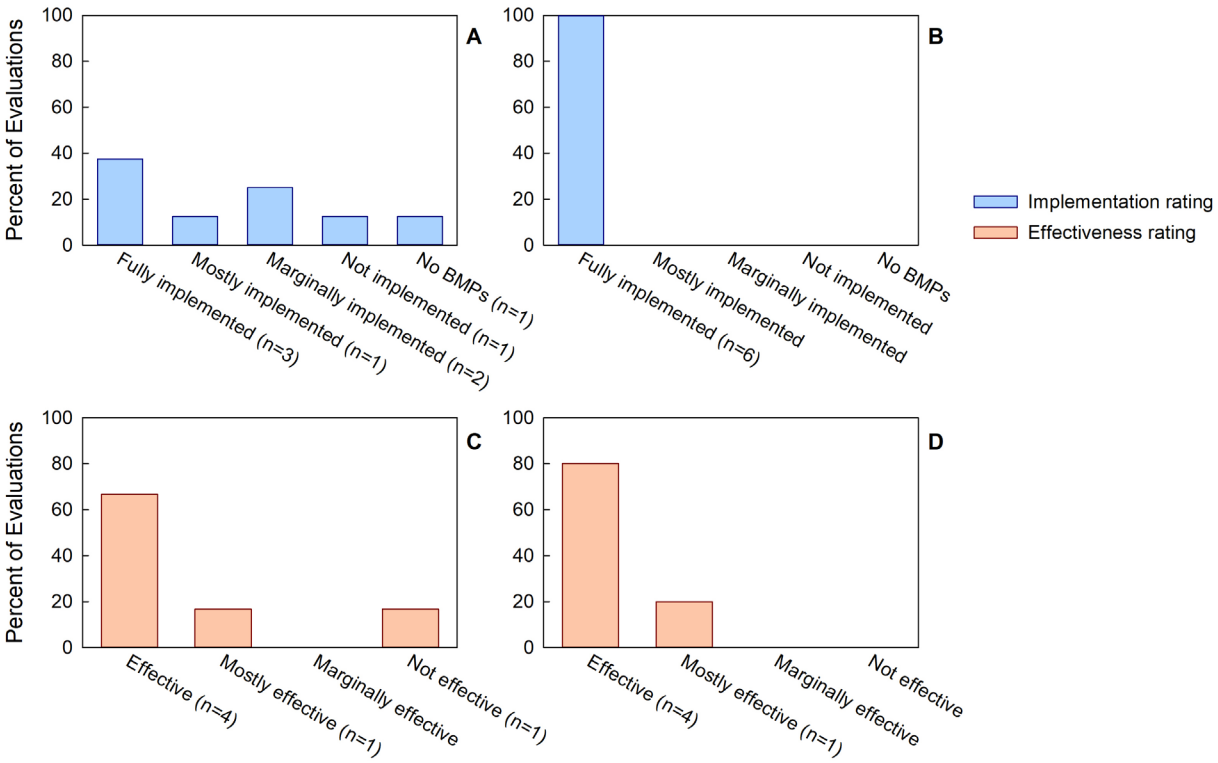



**Figure 56.**—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Fac A evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

**Table 109.—**Composite rating matrix for Fac A projects evaluated for both implementation and effectiveness in FY15/16 (n=6 evaluations) and FY17/18 (n=5 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 2 | 1 | | 1 | |
| | Mostly effective | | | | | 1 |
| | Marginally effective | | | | | |
| | Not effective | | | 1 | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 4 | | | | |
| | Mostly effective | 1 | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

Excellent
Good
Fair
Poor
No plan

The implementation rating components for all Fac protocols are given in Table 110. The effectiveness rating components for Fac A are given in Table 111. No single implementation component had substantially better performance than the others; most of the projects had scores of *all* or *some* for all three components (Table 112). The evaluation with the planning component score of *no BMPs*, which necessarily resulted in an implementation rating of *no BMPs* (Table 113), was the fishing pier construction project.

Analogous to implementation, key effectiveness questions are assigned to one of three components to address whether BMPs were effective at protecting water quality (Table 111). For each component, one project had a component score that was less than effective. One project had a *not effective* erosion and sedimentation component score, which resulted in an overall effectiveness rating of *not effective* (Tables 114 and 115). Due to the small sample sizes and limited range of component scores for both implementation and effectiveness evaluations, no tests of association between implementation component scores and effectiveness ratings or between effectiveness component scores and implementation ratings were performed. However, the results of those respective comparisons are shown in Figures 57 and 58.

**Table 110.—**Implementation components, scores, and interpretation of each score. Component scores are used to determine the overall implementation ratings for all Fac protocols.

| Implementation component | Component score | Score interpretation |
|---|---|---|
| Planning | All | All BMPs developed during planning were included in the project contract or plan |
| | Some | Some BMPs developed during planning were included in the project contract or plan, but at least one was not |
| | None | BMPs were developed during planning but they were not carried into the project contract or plan **or** documents containing BMPs were referenced during planning but BMPs were not included in the planning documents |
| | No BMPs | No BMPs were considered for the project during planning, or no operation and maintenance plan was developed for the project or facility |
| On-the-ground execution | All | All BMPs included in the project contract or plan were implemented fully |
| | Some | Some of the BMPs included in the project contract or plan were implemented fully, but at least one was not |
| | None | None of the BMPs included in the project contract or plan were implemented fully |
| Project oversight | All | All necessary corrective actions identified during project implementation were implemented |
| | Some | Some, but not all, necessary corrective actions identified during project implementation were implemented |
| | None | No necessary corrective actions identified during project implementation were implemented |

**Table 111.—**Effectiveness components, scores, and interpretation of each score for Fac A. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Erosion and sedimentation | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Trash and waste | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

**Table 112.—**Distribution of implementation component scores by component for Fac A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=8) | | | | | | | |
| | All | 6 | 75 | 5 | 62 | 7 | 88 |
| | Some | 1 | 12 | 3 | 38 | | |
| | None | | | | | 1 | 12 |
| | No BMPs | 1 | 12 | | | | |
| FY17/18 (n=6) | | | | | | | |
| | All | 6 | 100 | 6 | 100 | 6 | 100 |
| | Some | | | | | | |
| | None | | | | | | |
| | No BMPs | | | | | | |

**Table 113.—**Implementation component scores corresponding to the overall implementation ratings for Fac A evaluations with complete data in FY15/16 and FY17/18. See Table 110 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=8) | | | | | |
| | Fully implemented | All | All | All | 3 |
| | Mostly implemented | Some | All | All | 1 |
| | Marginally implemented | All | Some | All | 2 |
| | Not implemented | All | All | None | 1 |
| | No BMPs | No BMPs | Some | All | 1 |
| FY17/18 (n=6) | | | | | |
| | Fully implemented | All | All | All | 6 |
| | Mostly implemented | | | | 0 |
| | Marginally implemented | | | | 0 |
| | Not implemented | | | | 0 |
| | No BMPs | | | | 0 |

**Table 114.—**Distribution of effectiveness component scores by component for Fac A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Trash and waste component (number) | Trash and waste component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=6) | | | | | | | |
| | Effective | 5 | 83 | 5 | 83 | 6 | 100 |
| | Mostly effective[a] | | | | | | |
| | Moderately effective[b] | | | 1 | 17 | | |
| | Marginally effective[a] | | | | | | |
| | Not effective | 1 | 17 | | | | |
| FY17/18 (n=5) | | | | | | | |
| | Effective | 5 | 100 | 5 | 100 | 4 | 80 |
| | Mostly effective | | | | | | |
| | Moderately effective | | | | | 1 | 20 |
| | Marginally effective | | | | | | |
| | Not effective | | | | | | |

[a] Score applies only to erosion and sedimentation component (see Table 111).

[b] Score applies only to trash and waste and chemical pollutants components (see Table 111).

**Table 115.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Fac A evaluations with complete data in FY15/16 and FY17/18. See Table 111 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Erosion and sedimentation component | Trash and waste component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=6) | | | | | |
| | Effective | Effective | Effective | Effective | 4 |
| | Mostly effective | Effective | Moderately effective | Effective | 1 |
| | Marginally effective | | | | 0 |
| | Not effective | Not effective | Effective | Effective | 1 |
| FY17/18 (n=5) | | | | | |
| | Effective | Effective | Effective | Effective | 4 |
| | Mostly effective | Effective | Effective | Moderately effective | 1 |
| | Marginally effective | | | | 0 |
| | Not effective | | | | 0 |

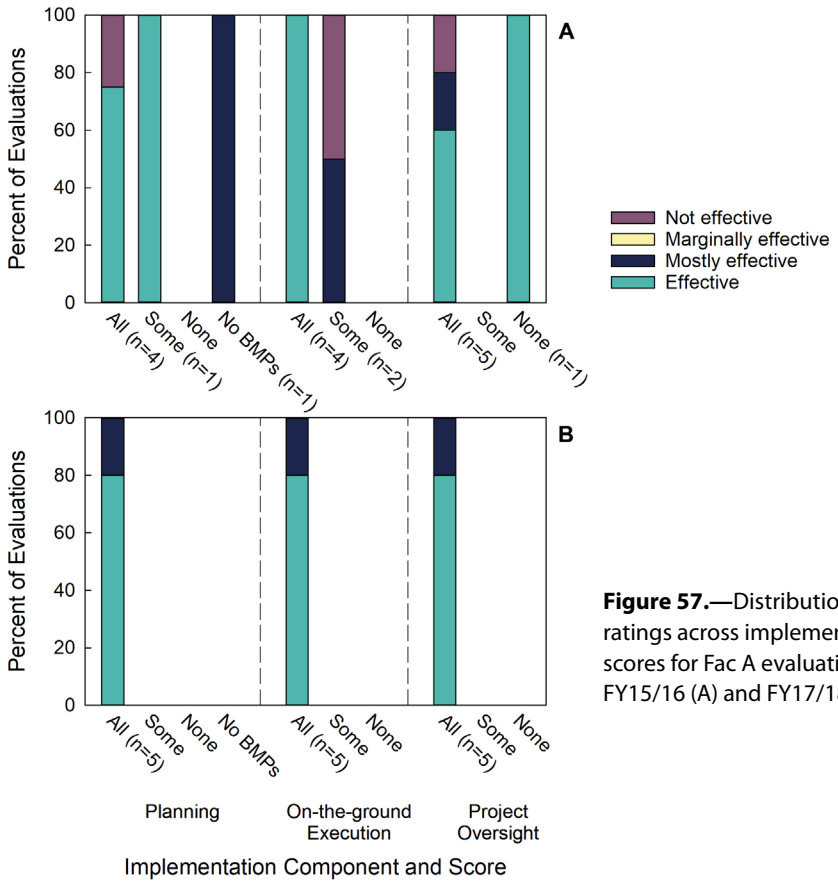



**Figure 57.—**Distribution of effectiveness ratings across implementation component scores for Fac A evaluations completed in FY15/16 (A) and FY17/18 (B).

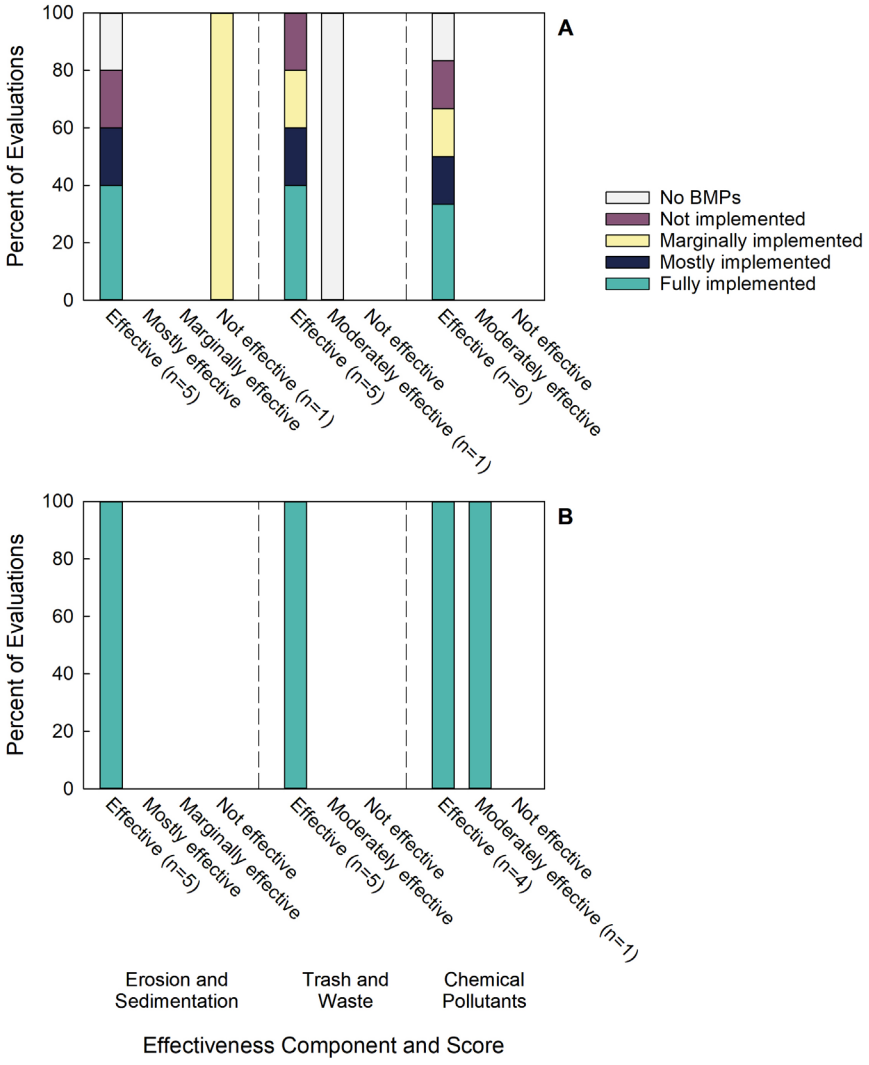



**Figure 58.—**Distribution of implementation ratings across effectiveness component scores for Fac A evaluations completed in FY15/16 (A) and FY17/18 (B).

## Facilities A: Best Management Practices Monitoring Form

### Best Management Practices Evaluation

### Fac A. Active Construction of Non-Corridor Facilities or Non-Recreation Special Uses

(Reference BMPs Fac-1, Fac-2, Fac-3, Fac-4, Fac-5, Fac-6, Fac-8, Road-5, and Road-10)

v3.0 February 2016

| Header | |
|---|---|
| Fac A-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Fac A-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Fac A-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Fac A-Q4 | Date of current field evaluation: |
| Fac A-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac A-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac A-Q7 | Reviewers and titles: |
| Fac A-Q8a | Region number: |
| Fac A-Q8b | State: |
| Fac A-Q9a | Proclaimed Forest or Grassland number and name: |
| Fac A-Q9b | Administrative Forest or Grassland number and name: |
| Fac A-Q10 | District number and name: |
| Fac A-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Fac A-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Fac A-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Fac A-Q12 | 6th level HUC number and name for the subwatershed this facility construction project is in: |
| Fac A-Q13 | Is any part of the construction activities being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Fac A-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Fac A-Q14b | Location.<br><br>Easting: |
| Fac A-Q14c | Location.<br><br>Northing: |
| Fac A-Q15a | Location.<br><br>Latitude: |
| Fac A-Q15b | Location.<br><br>Longitude: |
| Fac A-Q15c | Location.<br><br>Lat/Long Datum: |
| Fac A-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Fac A-Q17 | Type of facility. Select one:<br><br>Forest Service Facility<br>Facility Operated Under Special Use Permit |
| Fac A-Q18 | Name of facility or special use permit: |
| Fac A-Q19 | Type of Forest Service facility being constructed, or special use code for facility: |
| Fac A-Q20 | Date construction began: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Fac A-Q21 | Distance from construction to nearest waterbody (ft, m, mi, or km; specify unit): |
| Fac A-Q22 | Waterbody nearest to the facility being constructed. Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| Fac A-Q23 | Is any part of this site located within an AMZ? Select one:<br><br>a. Yes<br>b. No<br>c. Waterbody has no designated AMZ |
| Fac A-Q24 | Length of the transect around perimeter of the site (ft, m, mi, or km; specify unit): |
| **Implementation** | |
| Fac A-Q25 | Is there an approved erosion control plan for this construction project? Select one:<br><br>a. Yes<br>b. No |
| Fac A-Q26 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 28)<br>b. Environmental Impact Statement (EIS) (go to question 27)<br>c. Environmental Assessment (EA) (go to question 27)<br>d. Categorical Exclusion (CE) (go to question 27)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 27) |
| Fac A-Q27 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract, project plan, or permit. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Stormwater control<br>Yes/No/Not applicable<br>b. Temporary erosion and sediment control<br>Yes/No/Not applicable<br>c. Temporary drainage control<br>Yes/No/Not applicable<br>d. Location of activities (e.g., avoiding waterbodies and sensitive features)<br>Yes/No/Not applicable<br>e. Areal extent of activities/disturbance<br>Yes/No/Not applicable<br>f. Timing and scheduling of activities (e.g., soil wetness)<br>Yes/No/Not applicable<br>g. Temporary access routes, parking areas, and staging areas<br>Yes/No/Not applicable<br>h. Equipment service, storage and maintenance areas<br>Yes/No/Not applicable<br>i. Excavated materials storage<br>Yes/No/Not applicable<br>j. Trash and refuse management<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Fac A-Q27 continued*) | k. Human sanitary waste management<br>Yes/No/Not applicable<br>l. Techniques to prevent or control aquatic invasive species<br>Yes/No/Not applicable<br>m. Other (specify):<br>Yes/No/Not applicable |
| Fac A-Q28 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract, project plan, or permit were implemented fully. Select one response in each line. If the provision exists in the project contract, plan, or permit and it was implemented fully, select Yes. If the provision exists in the project contract, plan, or permit but it was not implemented fully, select No. If the provision does not exist in the project contract, plan, or permit, or if it is too early in the construction period for the provision to have been implemented at the time of evaluation, select Not applicable.<br><br>a. Stormwater control<br>Yes/No/Not applicable<br>b. Temporary erosion and sediment control<br>Yes/No/Not applicable<br>c. Temporary drainage control<br>Yes/No/Not applicable<br>d. Location of activities (e.g., avoiding waterbodies and sensitive features)<br>Yes/No/Not applicable<br>e. Areal extent of activities/disturbance<br>Yes/No/Not applicable<br>f. Timing and scheduling of activities (e.g., soil wetness)<br>Yes/No/Not applicable<br>g. Temporary access routes, parking areas, and staging areas<br>Yes/No/Not applicable<br>h. Equipment service, storage and maintenance areas<br>Yes/No/Not applicable<br>i. Excavated materials storage<br>Yes/No/Not applicable<br>j. Trash and refuse management<br>Yes/No/Not applicable<br>k. Human sanitary waste management<br>Yes/No/Not applicable<br>l. Techniques to prevent or control aquatic invasive species<br>Yes/No/Not applicable<br>m. Other provisions specific in question 27m<br>Yes/No/Not applicable<br>n. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Fac A-Q29 | Were project inspections and/or contract administration during construction activities performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, construction was conducted to avoid critical times<br>c. Yes<br>d. No |
| Fac A-Q30 | If problems occurred during construction that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |

*continued on next page*

| | |
|---|---|
| **Implementation** (*continued*) | |
| Fac A-Q31 | Were chemical or fuel spills or leaks that occurred during project activities handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred during construction<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Fac A-Q32 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 33)<br>b. No (go to question 34) |
| Fac A-Q33 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Fac A-Q34 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 35)<br>b. No (go to question 36 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Fac A-Q35 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 36 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Fac A-Q36 | Is there evidence of uncontrolled erosion or sedimentation on or originating from the construction site? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of uncontrolled erosion or sedimentation (go to question 42)<br>b. Evidence of uncontrolled erosion or sedimentation outside an AMZ (go to question 38)<br>c. Evidence of uncontrolled erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 38)<br>d. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 37) |
| Fac A-Q37 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 39:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Fac A-Q38 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Fac A-Q39 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 36, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Fac A-Q40 | What are the sources? Select all that apply:<br><br>a. Cleared areas<br>b. Excavated areas<br>c. Stockpiles or soil storage areas<br>d. Temporary access routes<br>e. Temporary staging or parking areas<br>f. Equipment service areas<br>g. Other (specify): |
| Fac A-Q41 | What are the causes? Select all that apply:<br><br>a. Inadequate erosion control measures<br>b. Inadequate drainage control measures<br>c. Insufficient maintenance of erosion control measures<br>d. Insufficient maintenance of drainage control measures<br>e. Insufficient control on size of area disturbed<br>f. Work allowed outside of area designated for activity<br>g. Poor location for activity or area<br>h. Poor timing for activity<br>i. Unauthorized use of construction site/disturbed area<br>j. Waterbody, bank, or shoreline destabilization from construction activities<br>k. Other (specify):<br>l. Unknown |
| Fac A-Q42 | What evidence of trash or human sanitary waste exists at the construction site? Select all that apply:<br><br>a. No evidence of trash or human sanitary waste (go to question 44)<br>b. Evidence of trash outside an AMZ (go to question 43)<br>c. Evidence of trash within an AMZ (go to question 43)<br>d. Evidence of trash in a waterbody (go to question 43)<br>e. Evidence of human sanitary waste/toilet paper outside an AMZ (go to question 43)<br>f. Evidence of human sanitary waste/toilet paper within an AMZ (go to question 43)<br>g. Evidence of human sanitary waste/toilet paper in a waterbody (go to question 43) |

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| **Effectiveness** (*continued*) | |
|---|---|
| Fac A-Q43 | What are the causes? Select all that apply:<br><br>a. Insufficient number of trash receptacles<br>b. Trash receptacles not emptied frequently enough<br>c. Inappropriate location of trash receptacles<br>d. Improper design of trash receptacles (e.g., not wildlife-proof)<br>e. No sanitation facilities on site<br>f. Inappropriate location of sanitation facilities<br>g. Insufficient maintenance of sanitation facilities<br>h. Inconsiderate human actions<br>i. Other (specify): |
| Fac A-Q44 | What evidence of chemical or fuel spills or leaks or associated waste containers exists at the construction site? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody |
| Fac A-Q45 | Is there evidence that the construction of the facility contributed to the introduction or spread of aquatic invasive species? Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Fac A-Q46 | If inspections were not conducted at critical times during construction of the facility, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were restricted to avoid critical times<br>b. Yes<br>c. No |
| Fac A-Q47 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 48)<br>b. No (go to question 49) |
| Fac A-Q48 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Fac A-Q49 | Are any adaptive management actions needed to improve effectiveness?<br>Select one:<br><br>a. Yes (go to question 50)<br>b. No (go to General Comments) |
| Fac A-Q50 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies.<br>Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Facilities B—Operation and Maintenance of Noncorridor Facilities or Nonrecreation Special Uses

## Facilities B: Header Statistics

The operation and maintenance of 54 noncorridor or nonrecreation facilities operated under special use authorization (subsequently referred to as facilities) (Fac B) was evaluated (Table 116). Every region completed at least one Fac B evaluation, and most completed multiple evaluations. At the end of both monitoring periods combined, 96 percent of the evaluations had both implementation and effectiveness monitoring completed (Table 116). Implementation and effectiveness monitoring were performed on a single day for all those evaluations. The effectiveness portion of the evaluation was completed without an initial implementation evaluation for two facilities during the FY15/16 monitoring period. Forty-four facilities were selected randomly for evaluation (Table 104).

**Table 116.—**Number of Fac B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Fac B-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 4 | | | 4 |
| | 2 | 6 | | 1 | 5 |
| | 3 | 4 | | | 4 |
| | 4 | 1 | | | 1 |
| | 5 | 3 | | | 3 |
| | 6 | 8 | | 1 | 7 |
| | 8 | 1 | | | 1 |
| | 9 | 2 | | | 2 |
| | 10 | 2 | | | 2 |
| | All | 31 | 0 | 2 | 29 |
| | Percent | | | 6 | 94 |
| FY17/18 | | | | | |
| | 1 | | | | |
| | 2 | 4 | | | 4 |
| | 3 | 1 | | | 1 |
| | 4 | 2 | | | 2 |
| | 5 | 3 | | | 3 |
| | 6 | 8 | | | 8 |
| | 8 | | | | |
| | 9 | 1 | | | 1 |
| | 10 | 4 | | | 4 |
| | All | 23 | 0 | 0 | 23 |
| | Percent | | | | 100 |

Although the most common reason for using the Fac B protocol was to meet National BMP targets, the protocol simultaneously met other monitoring needs, most frequently project review (Table 117). Quality assurance was identified as a reason for monitoring (Fac B-Q11a) in four Fac B evaluations (Table 117). For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance reported duplicate evaluations, which is necessary to meet the intent of that type of monitoring. Therefore, the review teams that selected quality assurance appeared to use this term to mean something different from what the protocol instructions stipulate.

**Table 117.—**Number of Fac B evaluations completed in FY15/16 (n=31 evaluations) and FY17/18 (n=23 evaluations), by region and reason for monitoring (Fac B-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other[a] |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 4 | 1 | 1 | 1 | 1 |
| | 2 | 6 | | | | 1 |
| | 3 | 4 | | 1 | | |
| | 4 | 1 | | | | |
| | 5 | 3 | | | | |
| | 6 | 8 | 2 | 4 | 2 | 1 |
| | 8 | 1 | | | | |
| | 9 | 2 | | | | |
| | 10 | 1 | 1 | | | |
| | All | 30 | 4 | 6 | 3 | 3 |
| FY17/18 | | | | | | |
| | 1 | | | | | |
| | 2 | 4 | | 1 | 1 | |
| | 3 | 1 | | 1 | | |
| | 4 | 2 | | | | |
| | 5 | 3 | | 1 | | |
| | 6 | 8 | | | | |
| | 8 | | | | | |
| | 9 | 1 | | | | |
| | 10 | 4 | | 3 | | |
| | All | 23 | 0 | 6 | 1 | 0 |

[a] Two were BMP training; one was Climate Change Score Card.

A wide variety of facilities were reviewed, but not surprisingly the largest number of facilities operated by the Forest Service were administrative sites (Fig. 59). The nearest waterbody to most of the facilities were perennial streams or rivers (Table 118). The waterbodies specified when the "other" answer choice was selected were unusual compared to answers from other protocols—an aquifer, an irrigation ditch, and a canal inlet—but they reflect the wide variety of facilities that the Forest Service operates directly or oversees through special use authorization (e.g., see Fig. 59). The aquifer was particularly unexpected because groundwater systems usually are not noted as waterbodies in most protocols other than those involving spring-related systems (e.g., water uses management protocols).

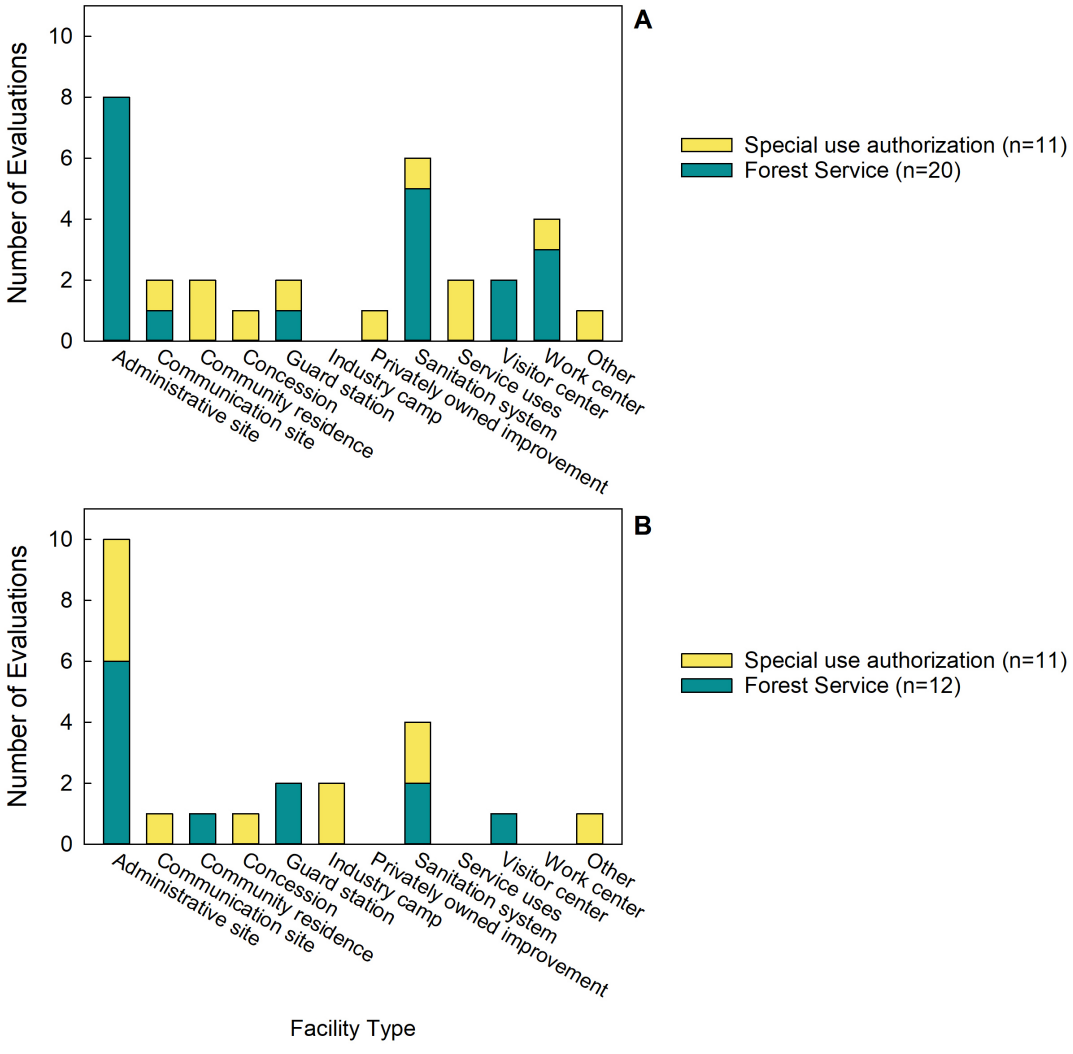



**Figure 59.—**Type of facility (Fac B-Q19) by site operator (Fac B-Q17) for evaluations completed in FY15/16 (A) and FY17/18 (B). Values represented in this figure are based on the total number of evaluations (i.e., effectiveness only plus both implementation and effectiveness).

**Table 118.—**Number of Fac B evaluations completed in FY15/16 and FY17/18, by region and waterbody type closest to facility (Fac B-Q22)

| Monitoring period | Region | Ephemeral stream | Intermittent stream | Perennial stream/river | Pond | Lake | Wetland/wet meadow | Estuary | Other[a] |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| | 1 | | | 3 | | | | | 1 |
| | 2 | | 1 | 4 | | | | | 1 |
| | 3 | 2 | | 2 | | | | | |
| | 4 | | | 1 | | | | | |
| | 5 | | | 2 | 1 | | | | |
| | 6 | | 1 | 3 | | 3 | | | 1 |
| | 8 | | | | | | | | |
| | 9 | | | | | 2 | | | |
| | 10 | | | 1 | | | | 1 | |
| | All | 2 | 2 | 16 | 1 | 5 | 0 | 1 | 3 |
| | Percent | 7 | 7 | 53 | 3 | 17 | | 3 | 10 |
| FY17/18 | | | | | | | | | |
| | 1 | | | | | | | | |
| | 2 | | 2 | 1 | | 1 | | | |
| | 3 | | 1 | | | | | | |
| | 4 | | | 1 | | | 1 | | |
| | 5 | 2 | | | | 1 | | | |
| | 6 | | 1 | 7 | | | | | |
| | 8 | | | | | | | | |
| | 9 | | 1 | | | | | | |
| | 10 | | | 1 | | | | 3 | |
| | All | 2 | 5 | 10 | 0 | 2 | 1 | 3 | 0 |
| | Percent | 9 | 22 | 43 | | 9 | 4 | 13 | |

[a] Specified as an aquifer feeding a water system, an irrigation ditch, and a canal inlet.

At least a portion of most of the evaluated facilities were within a designated aquatic management zone (AMZ) (Table 119). When no designated AMZ exists for a waterbody, a surrogate AMZ distance of 50 feet is assumed, and the review team is instructed to select "waterbody has no designated AMZ" if the area being evaluated is within 50 feet of such a waterbody (Fac B-Q23). Waterbody types with no designated AMZ were a pond, an intermittent stream, an estuary, a wetland, and three perennial streams or rivers.

The intent of the Fac B protocol is to evaluate facilities that are within 300 feet of a waterbody (i.e., an edge of the facility is within 300 feet); however, other facilities may be evaluated if none of the unit facilities are within 300 feet of a waterbody. Forty-five of the selected facilities were within 300 feet of a waterbody, but eight were outside that distance (Table 120). For the evaluations completed in FY15/16, the facility farthest from a waterbody was a communications tower site. In the evaluations completed in FY17/18, a fire station was farthest from a waterbody.

**Table 119.—**Distribution of whether any part of site is located within a designated aquatic management zone (AMZ) (Fac B-Q23) for Fac B evaluations completed in FY15/16 and FY17/18

| Any part of site located within a designated AMZ | FY15/16[a] (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Yes | 18 | 60 | 12 | 52 |
| No | 8 | 27 | 8 | 35 |
| Waterbody has no designated AMZ | 4 | 13 | 3 | 13 |

[a] One evaluation did not answer Fac B-Q23.

**Table 120.—**Distances between edge of evaluated facility and the nearest waterbody (Fac B-Q21) by whether facility was within 300 feet of a waterbody for Fac B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Facility within 300 ft of waterbody | Number of evaluations | Mean distance from nearest waterbody (ft) | Standard error of the mean (ft) | Minimum distance from nearest waterbody (ft) | Maximum distance from nearest waterbody (ft) |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | Yes | 24 | 99 | 18 | 0 | 300 |
| | No | 6 | 5,725 | 4,145 | 528 | 26,400 |
| FY17/18 | | | | | | |
| | Yes | 21 | 93 | 21 | 0 | 300 |
| | No | 2 | 2,142 | 1,817 | 325 | 3,960 |

## Facilities B: Implementation Results and Their Tie to Header Information

Nearly 70 percent of the facilities evaluated in FY15/16 and 52 percent of the facilities evaluated in FY17/18 had operation and maintenance (O&M) plans, special use authorizations, or other O&M guidance documents that provided at least one BMP provision to help protect water, aquatic, and riparian resources (Table 121). Being located farther from a waterbody does not appear to be the explanation for lack of O&M plans or the exclusion of BMPs in those plans (Fig. 60). Therefore, the inclusion or exclusion of BMP provisions in O&M plans does not appear to be related to the proximity of the facility to AMZs (Fig. 61). No significant statistical associations were found between whether facility plans had BMPs and the proximity to an AMZ ($p = 0.66$ FY15/16, $p = 0.85$ FY17/18). Also, neither the constant nor transient presence of water in nearby waterbodies seems to have influenced whether BMPs were included in or left out of operating plans; BMP provisions were both present and absent in plans for facilities near ephemeral and intermittent waterbodies, as well as perennial waterbodies (Fig. 62).

**Table 121.—**Distribution of whether facility operation and maintenance (O&M) plan, special use authorization, or other guidance documents contain BMP protection provisions (Fac B-Q25) for Fac B evaluations completed in FY15/16 and FY17/18

| O&M plan, special use authorization, or other guidance documents contain BMP protection provisions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Yes; plan has BMP provisions | 20 | 69 | 12 | 52 |
| No; plan exists but does not have BMP provisions | 4 | 14 | 3 | 13 |
| No plan for the facility | 5 | 17 | 8 | 35 |

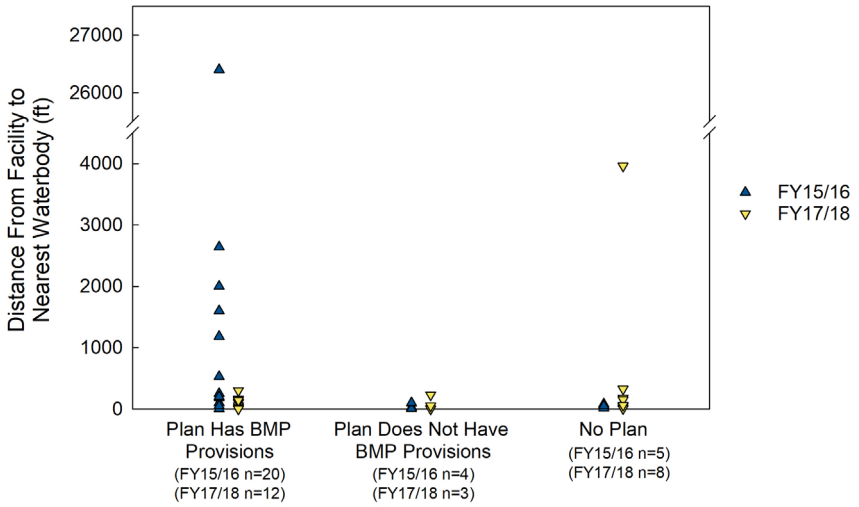



**Figure 60.—**Distance from facility to nearest waterbody (Fac B-Q21) by whether facility operation and maintenance plan contained BMP provisions (Fac B-Q25) for evaluations completed in FY15/16 and FY17/18.

Most evaluated facilities that are operated under special use authorizations had some type of operating plan—likely as a requirement of the authorization—although not all of these included BMP provisions (Fig. 63). As a percentage, facilities administered by the Forest Service were more likely to be lacking operating plans or to be lacking BMPs in operating plans compared to facilities operated under special use authorizations. There was no significant association between the facility plan having BMP provisions and site operator in either monitoring period ($p = 0.18$ FY15/16, $p = 0.20$ FY17/18).

Assessment of operation and maintenance implementation focuses on whether BMPs in O&M guiding documents (O&M plan, special use authorization, land management plan, and so on) were implemented fully (Fac B-Q26). For the facilities with BMPs in guidance documents, Table 122 provides a summary of the provisions (i.e., general category) to

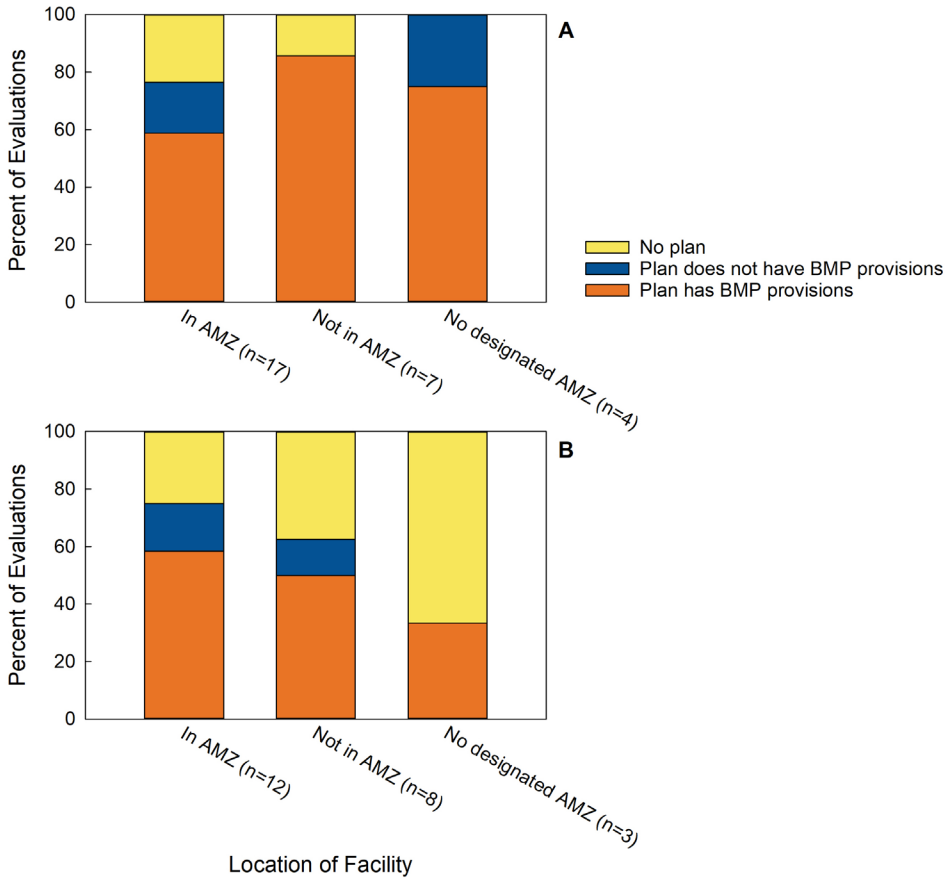



**Figure 61.—**Distribution of whether facility operation and maintenance plan contained BMP provisions (Fac B-Q25) by location of facility relative to an AMZ (Fac B-Q23) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

which individual BMPs included in the O&M guidance documents are assigned along with the information about whether all the BMPs from the provisions were implemented fully. A "yes" indicates that there was at least one BMP in the guidance documents applicable to the provision and that all BMPs assigned to that provision were implemented fully. Conversely, a "no" indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. "Not applicable" indicates that there were no BMPs in the guidance documents applicable to the provision or that applicable BMPs had not been implemented because the situation or timing that would trigger their implementation had not yet occurred. In the National BMP program, there is no expectation that every provision has BMPs assigned; consequently, the percentages for "yes" and "no" in the last two columns of Table 122 for each monitoring period are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

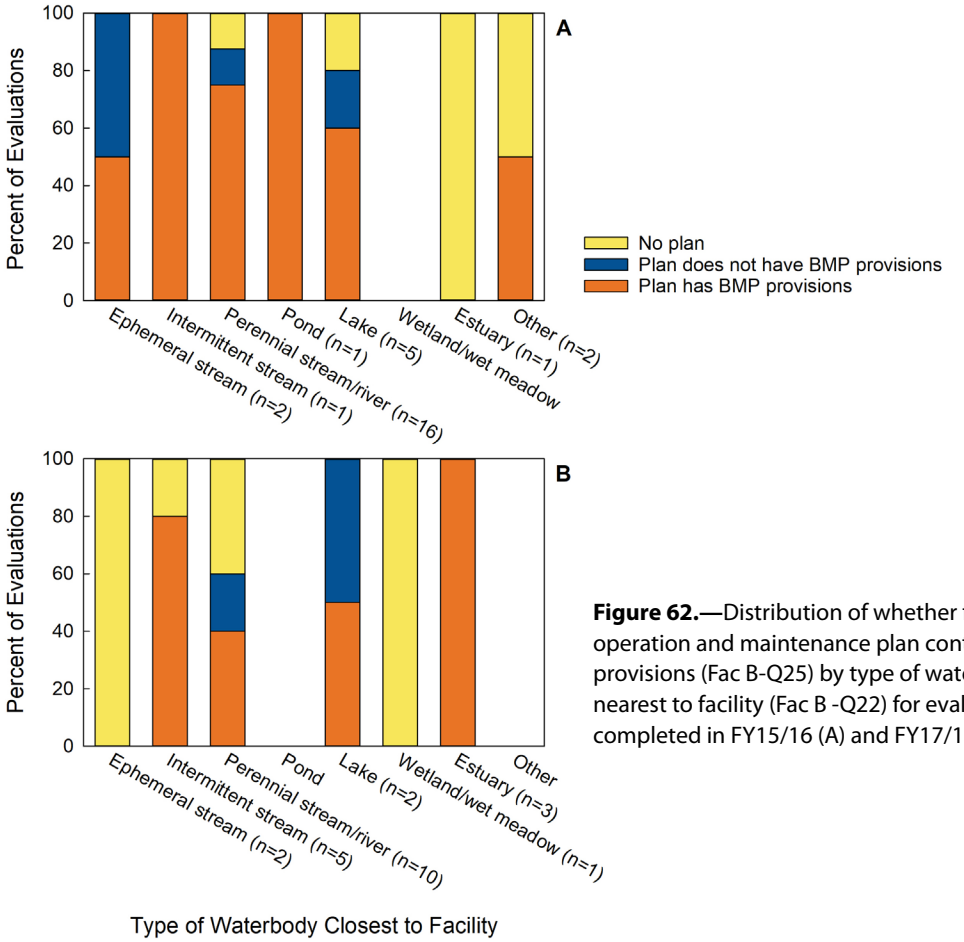



**Figure 62.—**Distribution of whether facility operation and maintenance plan contained BMP provisions (Fac B-Q25) by type of waterbody nearest to facility (Fac B -Q22) for evaluations completed in FY15/16 (A) and FY17/18 (B).

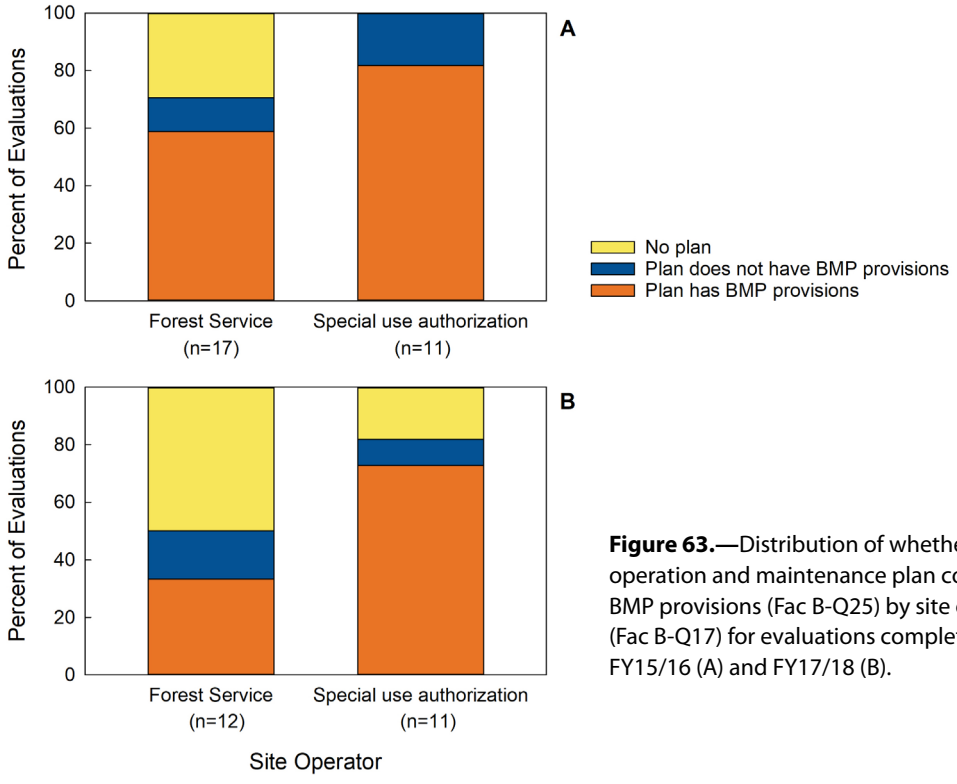



**Figure 63.—**Distribution of whether facility operation and maintenance plan contained BMP provisions (Fac B-Q25) by site operator (Fac B-Q17) for evaluations completed in FY15/16 (A) and FY17/18 (B).

**Table 122.—**Frequencies at which all BMPs in provisions included in an operation and maintenance (O&M) plan, special use authorization, or other O&M guidance documents were implemented fully (Fac B-Q26) for Fac B evaluations completed in FY15/16 (n=20 evaluations) and FY17/18 (n=11 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a]/too early to implement (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA/too early to implement (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Drainage and stormwater control | 13 | 2 | 4 | 87 | 13 | 5 | 0 | 6 | 100 | 0 |
| Ground cover techniques | 13 | 2 | 4 | 87 | 13 | 4 | 0 | 7 | 100 | 0 |
| Other erosion and sediment control | 16 | 1 | 2 | 94 | 6 | 7 | 1 | 3 | 88 | 13 |
| Locations and numbers of trash receptacles | 5 | 3 | 10 | 63 | 38 | 2 | 0 | 9 | 100 | 0 |
| Trash receptacle maintenance | 6 | 2 | 10 | 75 | 25 | 5 | 0 | 6 | 100 | 0 |
| Permanent sanitation facilities | 13 | 2 | 3 | 87 | 13 | 4 | 0 | 7 | 100 | 0 |
| Temporary (portable) sanitation facilities | 5 | 3 | 10 | 63 | 38 | 3 | 0 | 8 | 100 | 0 |
| Road and access routes | 16 | 1 | 3 | 94 | 6 | 4 | 0 | 7 | 100 | 0 |
| Parking areas | 13 | 1 | 4 | 93 | 7 | 3 | 0 | 8 | 100 | 0 |
| Equipment service, storage and maintenance areas | 12 | 0 | 7 | 100 | 0 | 7 | 1 | 3 | 88 | 13 |
| Vehicle wash water collection/disposal | 3 | 2 | 13 | 60 | 40 | 0 | 0 | 11 | NA[c] | NA[c] |
| Water supply/delivery system maintenance | 10 | 1 | 7 | 91 | 9 | 5 | 1 | 5 | 83 | 17 |
| Aquatic invasive species control | 1 | 6 | 11 | 14 | 86 | 7 | 0 | 4 | 100 | 0 |
| Mean | 10 | 2 | 7 | 77 | 23 | 4 | 0 | 6 | 97 | 3 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.
[b] Percent calculated from "yes" and "no" counts.
[c] Not applicable (NA) because percentages could not be calculated (division by zero).

On average, BMPs in each provision were prescribed in 12 evaluations in FY15/16 and 4 evaluations in FY17/18. When prescribed, those BMP provisions were implemented fully in an average of 77 percent of evaluations in FY15/16 and 97 percent of evaluations in FY17/18 that had some type of BMP guidance document for operation and maintenance (Table 122). The most common types of BMPs prescribed were those associated with the "roads and access routes" (FY15/16), "other erosion and sediment control" (FY15/16 and FY17/18), and "equipment service, storage, and maintenance areas" (FY17/18) provisions. BMPs related to "equipment service, storage, and maintenance areas" were most consistently implemented fully in FY15/16, and BMPs associated with "aquatic invasive species control" were least likely to be implemented fully (Table 122). BMPs in many provisions were implemented fully for 100 percent of facilities evaluated in FY17/18.

When the numbers and percentages of BMP provisions implemented fully were compared for each evaluation, BMPs were included in eight provisions on average, and 87 percent of the BMP provisions were implemented fully per evaluation in FY15/16. In FY17/18 BMPs were included in five provisions on average, and 86 percent were implemented fully. Forest Service-administered facilities had a higher mean percentage of BMP provisions implemented fully, at 94 and 95 percent in FY15/16 and FY17/18, respectively, compared to facilities administered by special use authorization, which had 84 and 81 percent implemented fully in FY15/16 and FY17/18, respectively. However, no significant differences were found in percentage of BMP provisions implemented fully by type of facility administration in either monitoring period ($p = 0.23$ FY15/16, $p = 0.82$ FY17/18; Kruskal-Wallis test).

Because many different types of facilities can be evaluated using Fac B, questions inquiring about storage of hazardous materials and hazardous wastes are included. Hazardous materials were stored at 16 facilities in FY15/16 and 8 facilities in FY17/18, and hazardous wastes were stored at 1 facility in each monitoring period (Table 123). During the most recent annual inspection prior to BMP monitoring, some type of storage violation was identified at 31 and 13 percent of facilities holding hazardous materials in FY15/16 and FY17/18, respectively (Table 123). Between the time of the annual inspection and the Fac B evaluation, the violations were addressed at 4 of the facilities. However, at the time of the review additional violations of storage requirements for both hazardous materials and wastes were observed at 7 of 16 facilities evaluated in FY15/16 and 1 of 8 facilities evaluated in FY17/18 (Table 124). Multiple requirements were not being met at the facility in FY15/16 that stored hazardous wastes.

Of the 17 facilities that have access to potable water from springs/spring sources or wells, water sampling was required and accomplished at 16 of those facilities, although the sample results were not available at 2 of the sites (Table 125). Thirty-two facilities had potable water service available, and 27 of those had mechanisms in place to prevent cross connection of contaminated water into the potable water supply (Table 126).

**Table 123.—**Distribution of findings from inspections or audits concerning storage of hazardous materials (Fac B-Q28 and Fac B-Q29) or storage of hazardous wastes (Fac B-Q32 and Fac B-Q33) for Fac B evaluations completed in FY15/16 and FY17/18, by storage type

| Monitoring period | Storage type | Inspection or audit found violations or deficiencies | Number of evaluations | Percent of evaluations | Violations or deficiencies corrected (percent) | Violations or deficiencies not corrected (percent) |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | Hazardous materials (n=16) | Not applicable; no storage during inspection | 0 | | | |
| | | Yes | 5 | 31 | 80 | 20 |
| | | No | 11 | 69 | | |
| | | No inspection | 0 | | | |
| | Hazardous wastes (n=1) | Not applicable; no storage during inspection | 0 | | | |
| | | Yes | 0 | | | |
| | | No | 1 | 100 | | |
| | | No inspection | 0 | | | |
| FY17/18 | | | | | | |
| | Hazardous materials (n=8) | Not applicable; no storage during inspection | 0 | | | |
| | | Yes | 1 | 13 | | 100 |
| | | No | 7 | 87 | | |
| | | No inspection | 0 | | | |
| | Hazardous wastes (n=1) | Not applicable; no storage during inspection | 0 | | | |
| | | Yes | 0 | | | |
| | | No | 1 | 100 | | |
| | | No inspection | 0 | | | |

Two implementation questions—Fac B-Q45 and Fac B-Q46—evaluate whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times during the operating season (when resources were most susceptible to negative effects from site conditions) (Table 127) and whether corrective actions were taken if problems occurred during the current operating season (at any time, not just critical times) (Table 128). Critical times are periods associated with large or intense precipitation/runoff events or other times when potential for the facility to influence water quality (e.g., ground-disturbing activities related to construction or maintenance) is high. Inspections were conducted during critical times within the operating season for about 50 and 70 percent of the facilities in FY15/16 and FY17/18, respectively (Table 127). Nearly 80 percent of the facilities in FY15/16 and 70 percent in FY17/18 had no problems requiring corrective actions any time during the operating season, and another 10 percent in each monitoring period implemented corrective actions when needed (Table 128).

**Table 124.—**Distribution of whether regulations pertaining to hazardous materials storage (Fac B-Q30) or hazardous waste storage (Fac B-Q39) were being followed at the time of the evaluation for Fac B evaluations completed in FY15/16 and FY17/18. See Table 123 for total numbers of facilities with hazardous materials or hazardous waste storage.

| Monitoring period | Regulations | Hazardous materials regulations followed[a] (number) | Hazardous materials regulations not followed[a] (number) | Hazardous wastes regulations followed[a] (number) | Hazardous wastes regulations not followed[a] (number) |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | Storage building requirements | 15 | | | |
| | Physical container requirements | 15 | | | 1 |
| | Container labeling requirements | 14 | 2 | | 1 |
| | Proper storage of materials | 14 | 2 | | |
| | Inventory/recordkeeping requirements | 12 | 3 | | |
| | Facility signage requirements | 15 | 1 | | 1 |
| | Safety data sheet requirements | 14 | 2 | | 1 |
| FY17/18 | | | | | |
| | Storage building requirements | 8 | | 1 | |
| | Physical container requirements | 7 | 1 | 1 | |
| | Container labeling requirements | 7 | 1 | 1 | |
| | Proper storage of materials | 8 | | 1 | |
| | Inventory/recordkeeping requirements | 6 | 1 | 1 | |
| | Facility signage requirements | 7 | | 1 | |
| | Safety data sheet requirements | 7 | | 1 | |

[a] These questions were not answered in all evaluations.

**Table 125.**—Distribution of whether water quality sampling, testing, and recordkeeping requirements were met for spring or surface source and well potable water supplies (Fac B-Q43) for Fac B evaluations completed in FY15/16 and FY17/18

| Water quality sampling, testing, and recordkeeping requirements were met | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Testing not required | 1 | 10 | 0 | |
| Testing required but no samples taken | 0 | | 0 | |
| Yes; sampled and results available | 8 | 80 | 6 | 86 |
| Yes; sampled but results not available | 1 | 10 | 1 | 14 |
| All | 10[a] | | 7[b] | |

[a] 2 spring or surface water sources and 8 wells.

[b] 7 wells.

**Table 126.**—Number of Fac B evaluations completed in FY15/16 and FY17/18, by whether mechanisms were in place to prevent cross connection contamination of potable water (Fac B-Q44)

| Mechanisms were in place to prevent cross connection contamination of potable water | FY15/16 | FY17/18 |
|---|---|---|
| Not applicable (not required) | 2 | 2 |
| Yes | 17 | 10 |
| No | 1 | 0 |
| All | 20 | 12 |

**Table 127.**—Distribution of whether inspections during the operating season occurred at critical times (Fac B-Q45) for Fac B evaluations completed in FY15/16 and FY17/18

| Inspections occurred at critical times | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No inspections | 6 | 21 | 3 | 14 |
| Not applicable; maintenance avoided critical times | 6 | 21 | 3 | 14 |
| Yes | 14 | 48 | 15 | 68 |
| No | 3 | 10 | 1 | 4 |
| All | 29 | | 22 | |

**Table 128.—**Distribution of whether corrective actions (CA) were taken if problems occurred during the operating season (Fac B-Q46) for Fac B evaluations completed in FY15/16 and FY17/18

| Corrective actions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No problems; no CA needed | 23 | 79 | 16 | 70 |
| CA needed but not taken | 1 | 3 | 2 | 22 |
| CA needed and implemented | 3 | 10 | 5 | 9 |
| Unknown | 2 | 7 | 0 | |
| All | 29 | | 23 | |

Because fuel and other chemicals (not necessarily hazardous materials or wastes) may be present within or around facilities, an implementation question (Fac B-Q47) asks how chemical spills and leaks that were reported or observed during the past 5 years were handled. Administrative units in the Forest Service have a contingency and emergency response plan (CERP) or equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in those cases the unit follows that state agency's procedures. Four evaluations indicated that a spill or leak that required cleanup occurred at a facility, and CERP procedures were followed in half of the situations (Table 129).

## Facilities B: Effectiveness Results and Their Tie to Implementation Results and Header Information

Only the most severe cases of erosion or sedimentation observed in or around the facility are reported (Fac B-Q52) during the effectiveness review, with severity increasing from outside an AMZ, to inside an AMZ, to delivery to a waterbody or changes to waterbody morphology. No evidence of erosion, sedimentation, or waterbody morphology changes (Fac B-Q52) was observed at about three-quarters of the facilities evaluated (Table 130). No significant associations existed between the location where sediment evidence was observed (Fac B-Q52) and the facility location relative to an AMZ (Fac B-Q23) ($p = 0.61$ FY15/16, $p = 0.16$ FY17/18), between the location where sediment evidence was observed and the distance between the facility and the nearest waterbody (Fac B-Q21) ($p = 0.69$ FY15/16, $p = 0.65$ FY17/18; generalized linear mixed model [GLMM] with lognormal distribution and identity link function), or between the location where sediment evidence was observed and whether the facility had any type of O&M guidance documents containing BMP provisions (Fac B-Q25) in FY15/16 ($p = 0.31$). A significant association was found between the location of the observed sediment evidence and whether the facility plan included BMP provisions in FY17/18 ($p = 0.08$). For facilities having BMP provisions, 11 of 12 evaluations (92 percent) observed no evidence of erosion or sedimentation while 4 of 8 of the facilities that had no O&M plan or other guidance documents had evidence outside or within an AMZ.

**Table 129.—**Distribution of whether chemical or fuel spills and leaks, if they occurred during operations in the past 5 years, were handled according to the unit's contingency and emergency response plan (or its equivalent) (Fac B-Q47) for Fac B evaluations completed in FY15/16 and FY17/18

| Chemical or fuel spills and leaks handled according to the unit's contingency and emergency response plan | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No contingency and emergency response plan | 0 | | 1 | 4 |
| No spills or leaks | 28 | 97 | 19 | 83 |
| Yes; according to contingency and emergency response plan | 1 | 3 | 1 | 4 |
| No; not according to contingency and emergency response plan | 0 | | 2 | 9 |
| All | 29 | | 23 | |

**Table 130.**—Evidence of erosion or sedimentation observed at the facility (Fac B-Q52) for Fac B evaluations completed in FY15/16 and FY17/18, by location, and distance to nearest waterbody (Fac B-Q54) or number of places evidence observed in a waterbody (Fac B-Q53)

| Location of observed evidence | Number of evaluations | Percent of evaluations | Distance to nearest waterbody <10 ft (number) | Distance to nearest waterbody 10–50 ft (number) | Distance to nearest waterbody 50–100 ft (number) | Distance to nearest waterbody >100 ft (number) | Evidence in waterbody 1–2 places (number) | Evidence in waterbody 3–4 places (number) | Evidence in waterbody ≥5 places (number) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| No evidence | 23 | 74 | | | | | | | |
| Outside an AMZ[a] | 5 | 16 | | | 1 | 4 | | | |
| Within an AMZ | 3 | 10 | | 1 | | 2 | | | |
| In a waterbody | 0 | | | | | | | | |
| FY17/18 | | | | | | | | | |
| No evidence | 18 | 78 | | | | | | | |
| Outside an AMZ | 3 | 13 | | | | 3 | | | |
| Within an AMZ | 1 | 4 | 1 | | | | | | |
| In a waterbody | 1 | 4 | | | | | 1 | | |

[a] Aquatic management zone.

Eight evaluations in FY15/16 and five in FY17/18 reported some evidence of erosion, sedimentation, or waterbody morphology changes (Table 130). The types of evidence observed (Fac B-Q55) relative to the location where the evidence was observed are presented in Table 131. The most common type of evidence observed was rill erosion (Table 131). Two evaluations reported one or two types of evidence observed that were inconsistent with the location where evidence was reported in Fac B-Q52; for example, evidence of sediment deposition in a waterbody would not be expected when the evidence was observed outside an AMZ. Numerous causes for the evidence observed were reported (Table 132), but most of the causes were related to runoff and drainage, often from impervious surfaces such as parking areas and roofs.

**Table 131.—**Types of evidence observed when erosion or sedimentation was found at facility (Fac B-Q55) for Fac B evaluations completed in FY15/16. Only evidence present in the location reported in Fac B-Q52 (Table 130) is applicable to Fac B-Q55.

| Type of evidence | FY15/16 Outside an AMZ[a] (n=5) | FY15/16 Within an AMZ (n=3) | FY17/18 Outside an AMZ (n=3) | FY17/18 Within an AMZ (n=1) | FY17/18 In waterbody (n=1) |
|---|---|---|---|---|---|
| Traceable evidence to the waterbody, but not currently visible in the waterbody | 1[b] | | | 1[b] | 1 |
| Turbidity present | | | | | |
| Evidence of localized sediment deposition in the waterbody | 1[b] | | | | |
| Changes to substrate composition | | | | | |
| Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) | | | | | |
| Bank instability | | | | | |
| Bank trampling or compaction | | 1 | | | 1 |
| Vegetation damage or bare ground | | 2 | 1 | | 1 |
| Sheet erosion | 3 | 1 | | | |
| Rill erosion | 4 | 2 | 2 | | |
| Gully erosion | | | | | |
| Headcutting | | | | | |
| Slumping/slips | | | | | |
| Mass wasting | | | | | |
| Sediment plumes or accumulations | 2 | | | | |
| Rutting | | 1 | | | |
| Water quality monitoring results | | | | | |

[a] Aquatic management zone.
[b] The type of evidence reported is incompatible with the location in which it was observed.

Question Fac B-Q16 characterizes the weather conditions associated with the evaluation and assists in determining whether observations of erosion and sedimentation transport or waterbody morphology changes (Fac B-Q52) are masked during dry weather conditions. Wet weather conditions, if found to be important for observing effects, are expected to be most associated with evidence of erosion and sediment transport outside a waterbody because they result primarily from precipitation and runoff, unlike waterbody effects, which may be continually influenced by the presence of flow that obscures any weather-induced conditions. Ten of 51 evaluations were completed during or within 24 hours after precipitation events (Fig. 64), so no conclusions about the relationships between weather conditions and observations of evidence can be made until sample sizes increase.

**Table 132.—**Causes (Fac B-Q56) of observed erosion or sedimentation from facility for Fac B evaluations completed in FY15/16 and FY17/18. The evidence in Table 131 that is inconsistent with the answers to Fac B-Q52 and Fac B-Q55 is excluded from this table (see footnote in Table 131).

| Cause of evidence | FY15/16 Outside an AMZ[a] (n=4) | FY15/16 Within an AMZ (n=3) | FY17/18 Outside an AMZ (n=3) | FY17/18 Within an AMZ | FY17/18 In waterbody (n=1) |
|---|---|---|---|---|---|
| Inadequate control or management of runoff from facility roofs, gutters, and downspouts | | 2 | | | |
| Inadequate control or management of runoff from parking areas or other impervious or compacted surfaces | 3 | 1 | | | 1 |
| Inadequate control or management of runoff from vehicle wash area | | 1 | | | |
| Uncontrolled runoff from temporary (portable) sanitation facilities | | | | | |
| Uncontrolled runoff from permanent sanitation facilities | | | | | 1 |
| Insufficient maintenance of drainage associated with facility | | 1 | | | 1 |
| Use is exceeding carrying capacity of the site | | | | | |
| Inadequate erosion control techniques or structures (excluding soil cover) | 1 | 1 | | | |
| Inadequate soil cover | | 2 | | | |
| Other | 2 | | 3 | | |
| Unknown | | | | | |

[a] Aquatic management zone.

The presence or location of evidence of erosion or sedimentation (Fac B-Q52) for each facility was examined relative to the two BMP provisions in Fac B-Q26 related to erosion control: "ground cover techniques" and "other erosion and sediment control." Whether or not either provision was implemented fully was not significantly associated with evidence of erosion or sedimentation in FY15/16 (ground cover: $p = 0.24$, other erosion control: $p = 0.18$). In FY17/18 a test was not possible for implementation of "ground cover techniques," and implementation of "other erosion and sediment control" was not associated with observed sediment evidence ($p = 0.12$). However, 17 of the 18 facilities (both monitoring periods combined) that had BMPs in the "ground cover techniques" provision had no observed erosion or sediment evidence (Fac B-Q52) when those BMPs were implemented fully. Similarly, 21 of the 23 facilities that had BMPs in the "other erosion and sediment control" provision reported no evidence when those BMPs were implemented fully.

There was little evidence of trash or domestic animal or human sanitary waste (Fac B-Q58) at any of the facilities (Table 133). The trash observed outside and within an AMZ was attributed primarily to inconsiderate human actions. The cause of the trash in the AMZ for one facility in FY15/16 was an old dump site that had not been cleaned up

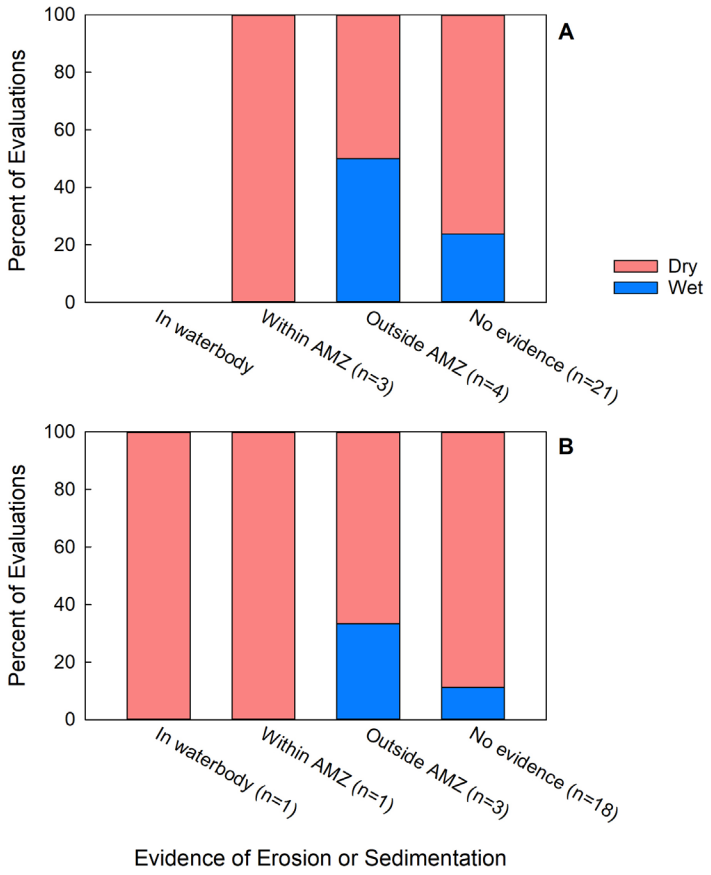



**Figure 64.—**Type of weather conditions during or within 24 hours before effectiveness evaluation (Fac B-Q16) versus evidence of erosion (Fac B-Q52) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

**Table 133.—**Evidence of trash or domestic animal or human sanitary waste at facility (Fac B-Q58) for Fac B evaluations completed in FY15/16 (n=29 evaluations) and FY17/18 (n=23 evaluations). Multiple selections were possible.

| Monitoring period | Evidence | Outside an AMZ[a] (number) | Within an AMZ (number) | In a waterbody (number) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | Trash | 1 | 2 | |
| | Domestic animal or human sanitary waste | 2 | | |
| FY17/18 | | | | |
| | Trash | 6 | 4 | |
| | Domestic animal or human sanitary waste | 1 | | |

[a] Aquatic management zone.

(Fac B-Q59). The cause of the sanitary waste outside the AMZ at two facilities in FY15/16 (Table 133) was attributed to agency stock animals at one facility and cattle grazing at the other. Forty-four of the evaluated facilities had some type of sanitation facilities, and none reported evidence of sewer-related leaks or seepage (Fac B-Q60). All but one of the 26 potable water sources that were required to have water quality sampling met water quality standard requirements (Fac B-Q61). The facility that did not meet the standards was a Forest Service visitor center evaluated in FY17/18; signs were posted indicating that the well water supply was unsafe for consumption.

The presence of chemical spills, leaks, or chemical waste containers is determined during the effectiveness evaluations. Such evidence can include pollutants observed during operations but not reported, pollutants not yet cleaned up even if reported, or pollutants not previously observed or known to exist. Most of the facilities (88 percent) had no chemical spills, leaks, or waste containers present (Table 134). Results from similar questions about hazardous material and waste spills and leaks (Fac B-Q64 and Fac B-Q65, respectively) are given in Table 135 and indicate that the occurrence of spills or leaks of stored materials and wastes is generally infrequent, with 3 of 26 evaluations noting spills or leaks of hazardous materials.

Inspections are an important part of facility operation and maintenance. The Fac B protocol includes two questions about inspections, one in implementation (Fac B-Q45) and one in effectiveness (Fac B-Q67), that are designed to tie together. Respectively, they ask whether inspections were completed during critical times during the operating season and whether lack of inspections during critical times (i.e., if implementation indicated a lack) influenced BMP effectiveness. Table 136 shows the relationship between those two questions for facilities in which both implementation and effectiveness evaluations were completed within each monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison.

**Table 134.—**Evidence of chemical or fuel spills, leaks, or waste containers at the time of the effectiveness evaluation (Fac B-Q58) for Fac B evaluations completed in FY15/16 (n=29 evaluations) and FY17/18 (n=23 evaluations). Multiple selections were possible.

| Evidence | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| No evidence | 27 | 18 |
| Spills or leaks outside an AMZ[a] | 1 | 1 |
| Spills or leaks within an AMZ | | 1 |
| Spills or leaks in a waterbody | | |
| Waste containers outside an AMZ | 3 | |
| Waste containers within an AMZ | | 1 |
| Waste containers in a waterbody | | |

[a] Aquatic management zone.

**Table 135.—**Evidence of hazardous material and hazardous waste spills or leaks during the evaluation (Fac B-Q64 and Fac B-Q65) for Fac B evaluations completed in FY15/16 and FY17/18. Only evaluations that indicated hazardous materials (Fac B-Q27) or hazardous wastes (Fac B-Q31) were stored at the site are included (also see Table 123).

| Evidence | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| No hazardous materials stored at facility | 1[a] | |
| Yes; evidence of hazardous material spill or leak | 1 | 2 |
| No evidence of hazardous material spill or leak | 14 | 6 |
| No hazardous wastes stored at facility | | |
| Yes; evidence of hazardous waste spill or leak | | |
| No evidence of hazardous waste spill or leak | 1 | 1 |

[a] Answer inconsistent with response to implementation Fac B-Q27.

**Table 136.**—Occurrence of facility inspections performed at critical times (Fac B-Q45) in relationship to problems observed during effectiveness monitoring (Fac B-Q67) for Fac B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (36 and 19 percent of FY15/16 and FY17/18 responses, respectively).

| Monitoring period | Inspections at critical times (implementation) | Not applicable; inspections at critical times or work avoided critical times (effectiveness) | Yes; lack of administration led to observed problems (effectiveness) | No; lack of administration did not lead to observed problems (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | No inspections | 2 | | 4 |
| | Not applicable; work avoided critical times | 4 | | 2 |
| | Yes; inspections at critical times | 8 | 1 | 4 |
| | No; inspections not at critical times | 1 | | 2 |
| FY17/18 | | | | |
| | No inspections | | 2 | 1 |
| | Not applicable; work avoided critical times | 2 | | 1 |
| | Yes; inspections at critical times | 11 | | 3 |
| | No; inspections not at critical times | | 1 | |

Thirty-six percent of the evaluations in FY15/16 and 19 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remainder of the projects, administration either was not lacking, or the lack of inspections did not lead to observed problems in FY15/16 (Table 136). Lack of inspections or inspections not at critical times led to observed problems at three facilities (14 percent) evaluated in FY17/18.

## Facilities B: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

Approximately 24 and 30 percent of the evaluated facilities in FY15/16 and FY17/18, respectively, were rated as *fully implemented*, and about 70 percent of the facilities had implementation ratings that were *marginally implemented* or poorer (Fig. 65A, B). Effectiveness ratings were much better than the implementation ratings; 87 and 70 percent of the facilities were rated as *effective* in FY15/16 and FY17/18, respectively (Fig. 65C, D), and one was rated as *not effective* in both monitoring periods.

There were no significant associations among the implementation ratings ($p = 0.26$ FY15/16, $p = 0.61$ FY17/18) or effectiveness ratings ($p = 1.00$ FY15/16, $p = 0.33$ FY17/18) and the entity responsible for administering the facility (Fig. 66). More than 70 percent of implementation ratings were less than *fully implemented*, while effectiveness ratings

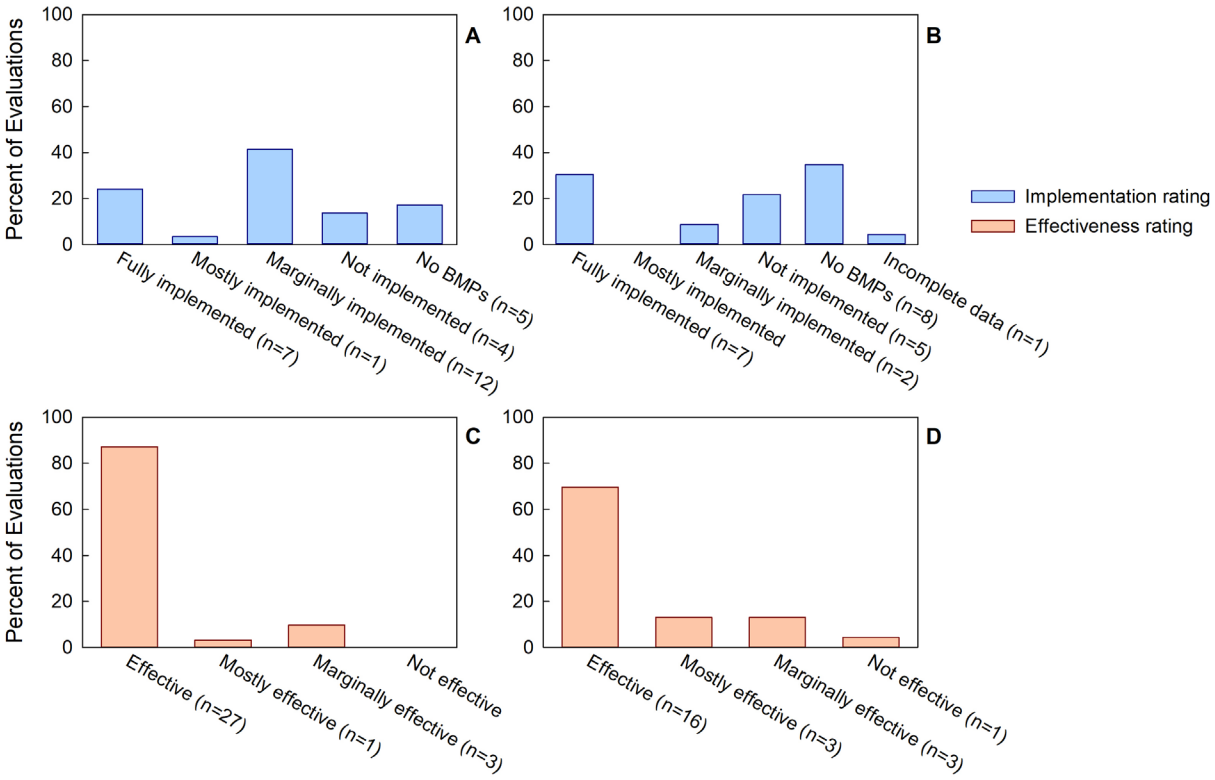



**Figure 65.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Fac B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

were high regardless of the administrator. Similarly, there were no significant associations between the ratings and the facility locations relative to AMZs (implementation: p = 0.69 FY15/16, p = 0.89 FY17/18; effectiveness: p = 0.53 FY15/16, p = 0.49 FY17/18) (Fig. 67).

Almost equal numbers of facilities in each monitoring period had ground cover standards (sum of "yes" and "no" answers in Fig. 68) as those that did not. One facility failed to meet its ground cover standard. No significant associations existed between the ground cover standard categories and the effectiveness ratings (p = 0.26 FY15/16, p = 0.74 FY17/18); however, when compared visually there is some evidence that effectiveness may be somewhat poorer when no ground cover standards exist (Fig. 68).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Fac B-Q16) were not associated with the effectiveness ratings in either monitoring period (p = 0.59 FY15/16, p = 0.28 FY17/18) (Fig. 69). The number of wet weather evaluations was about 15 to 30 percent of that for dry weather, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential. Even so, relationships between weather conditions and field observations of erosion/sediment/morphological effects (e.g., Fig. 64) provide more straightforward information about the influence of weather on site conditions and potential problems than associations between weather and ratings because ratings incorporate responses to multiple questions.

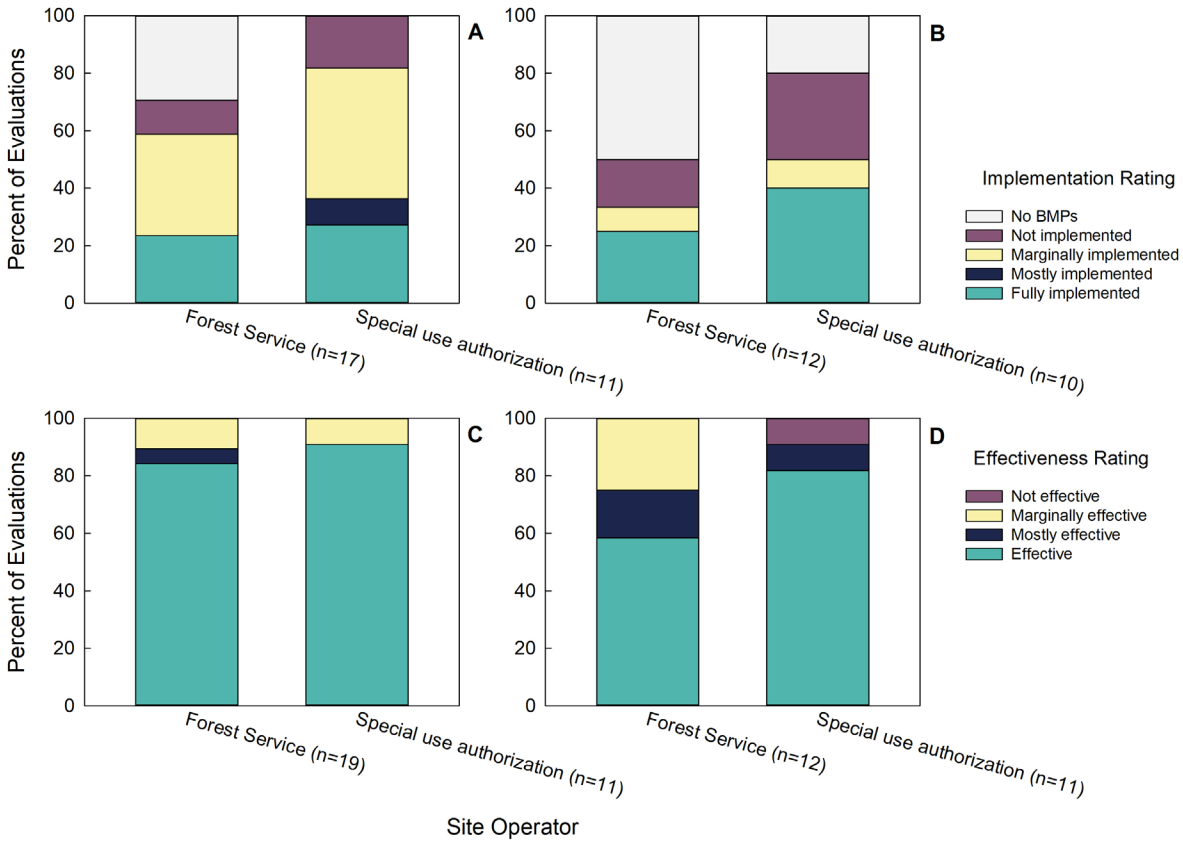



**Figure 66.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by site operator (Fac B-Q17) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

No significant associations were found between the effectiveness ratings and whether documents pertinent to BMP guidance for the operation and maintenance of the facility existed (p = 0.38 FY15/16, p = 0.96 FY17/18) (Fig. 70). This result is not particularly surprising given the overall high effectiveness ratings for most of the evaluated facilities. The number of BMP provisions implemented fully (Fac B-Q30) was significantly associated with the effectiveness ratings in FY15/16 (p = 0.08, GLMM with negative binomial distribution and log link function); evaluations rated *marginally effective* averaged less than half the number of provisions implemented fully compared to those rated *effective* (three versus seven). In FY17/18 the number of provisions implemented fully was not significantly different by rating (p = 0.52). Mean percentages of BMPs implemented fully in each monitoring period were highly variable across the effectiveness ratings, ranging from 67 to 89 percent in FY15/16 and from 50 to 100 percent in FY17/18. However, the percentages were not significantly different by effectiveness rating in either monitoring period (p = 0.46 FY15/16, p = 0.30 FY17/18; Kruskal-Wallis test). Statistical tests for counts and percentages of provisions implemented fully by rating were likely affected by the limited number of facilities with ratings less than *effective* (Fig. 65C, D).

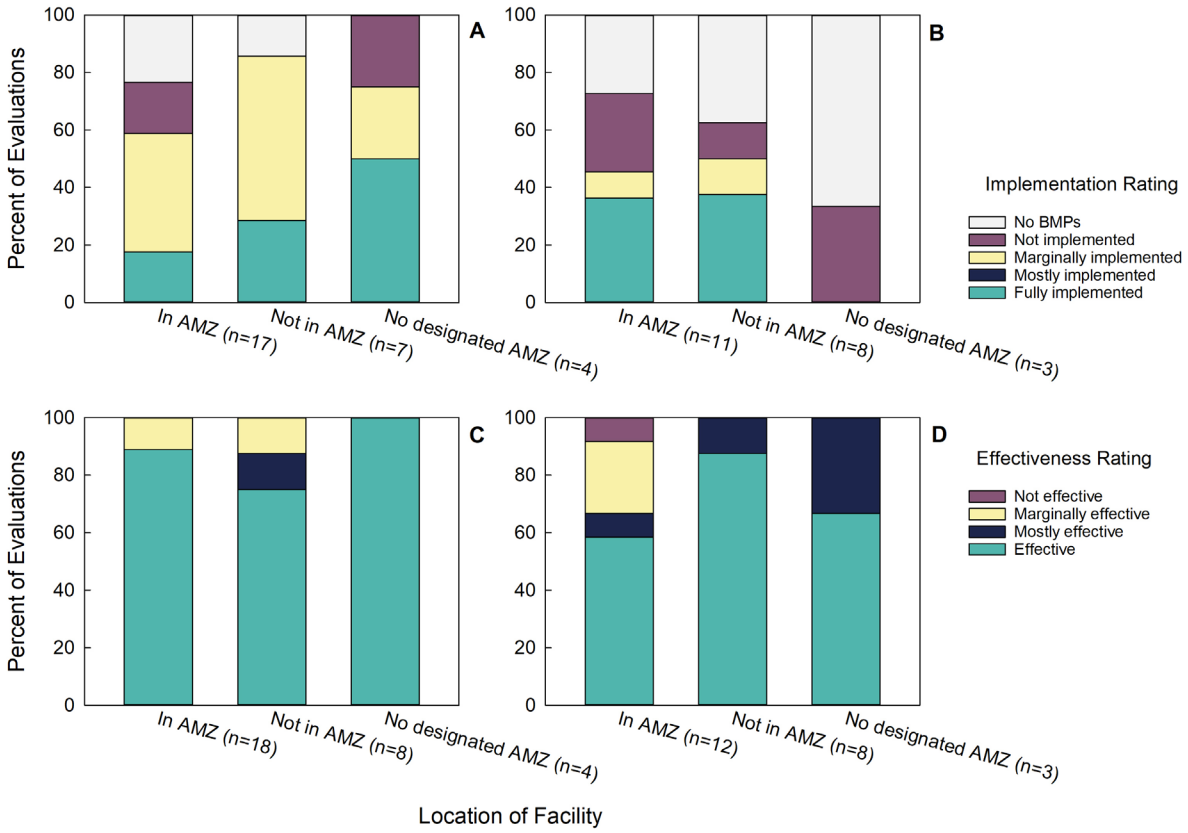



**Figure 67.**—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by facility location relative to an AMZ (Fac B-Q23) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). AMZ = aquatic management zone.

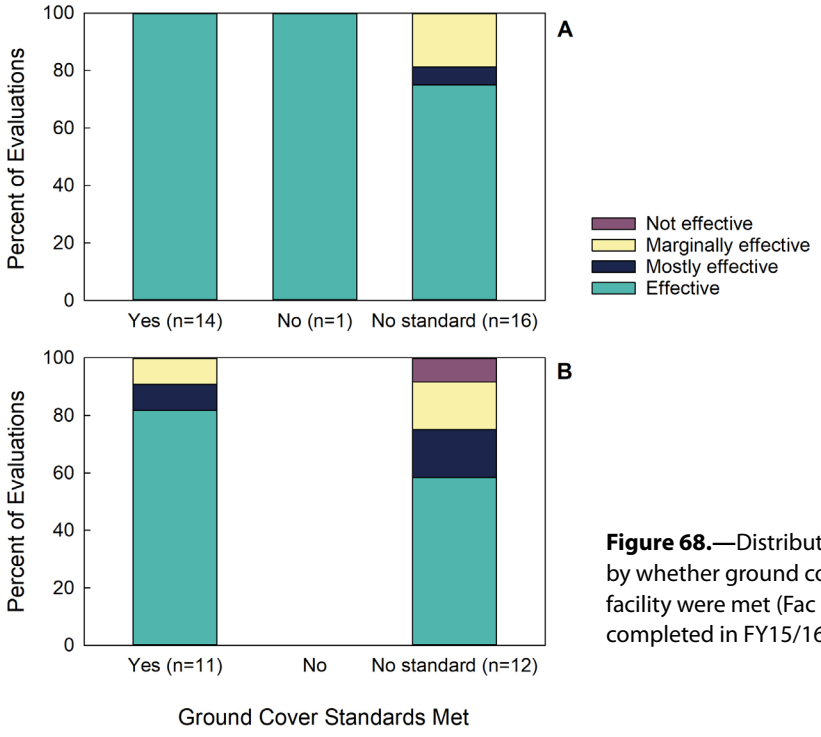



**Figure 68.**—Distribution of effectiveness ratings by whether ground cover standards for the facility were met (Fac B-Q57) for evaluations completed in FY15/16 (A) and FY17/18 (B).

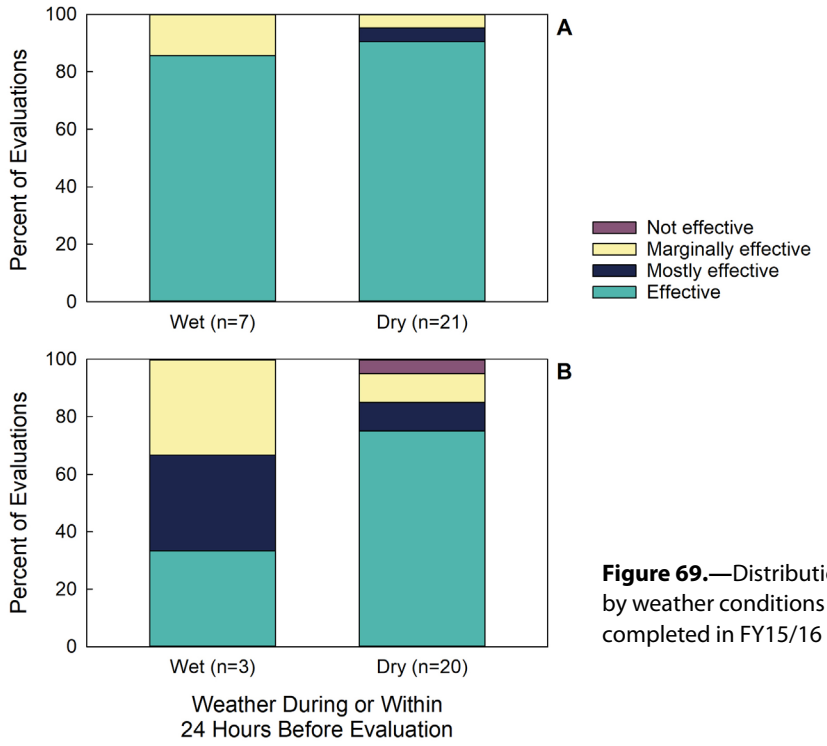



**Figure 69.**—Distribution of effectiveness ratings by weather conditions (Fac B-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

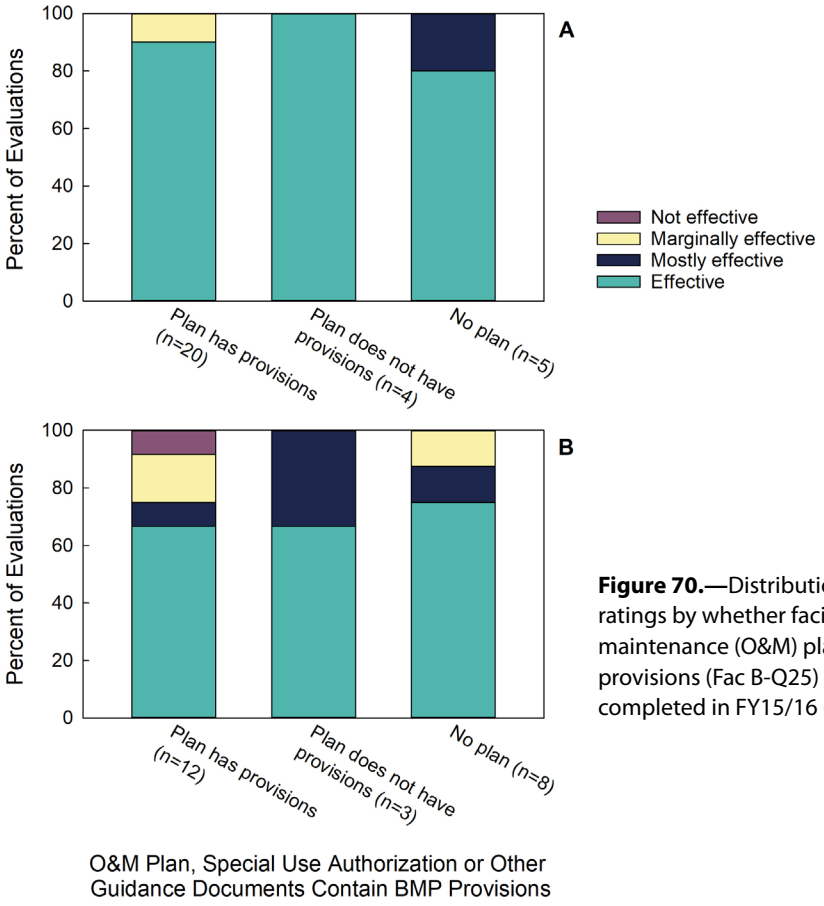



**Figure 70.**—Distribution of effectiveness ratings by whether facility operation and maintenance (O&M) plan contained BMP provisions (Fac B-Q25) for evaluations completed in FY15/16 (A) and FY17/18 (B).

During the implementation portion of the evaluation, review of documents and inquiries with facility administrators occur to determine whether corrective actions were taken if problems were observed during the operating season (Fac B-Q46). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. A significant association was found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in both monitoring periods (p = 0.09 FY15/16, p = 0.06 FY17/18; Fig. 71); however, the associations in Figure 71 are likely due to most corrective action categories having small sample sizes and only one or two effectiveness ratings.

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based on what the review team observes and reports during the effectiveness evaluation at the project or site.

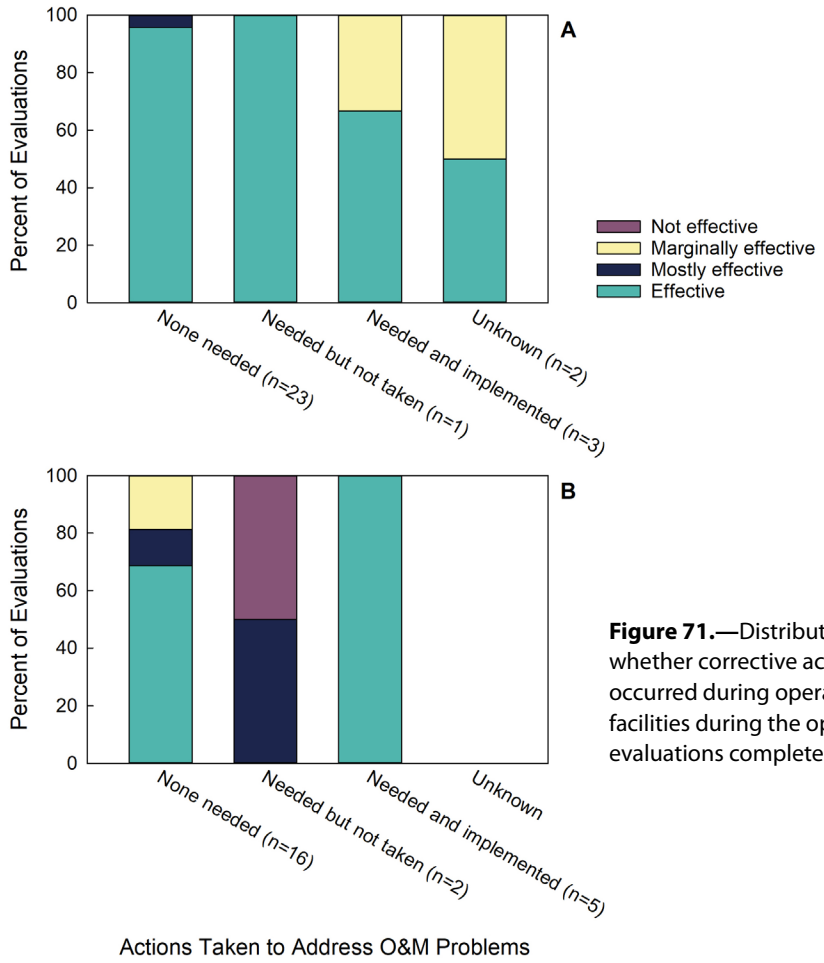



**Figure 71.—**Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during operation and maintenance (O&M) of facilities during the operating season (Fac B-Q46) for evaluations completed in FY15/16 (A) and FY17/18 (B).

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site in question. Corrective actions for implementation include actions to improve implementation for the project or site, while corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as commonly having facilities that lack O&M plans or guidance documents or having plans that lack BMPs, while adaptive management actions for effectiveness may involve making sure that ground cover is assessed at all facilities every operating season and initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations in which the need for corrective actions or adaptive management actions were identified was about one-fifth to one-half the number for which no actions were needed (Figs. 72 and 73). There were no significant associations in FY15/16 among implementation ratings and corrective action needs ($p = 0.12$) or among implementation ratings and adaptive management action needs ($p = 0.90$). This result is not surprising given the similar distribution of poorer implementation ratings across all four bars in Figure 72A. In FY17/18 a significant association did exist between corrective action needs and implementation ratings ($p < 0.01$) (Fig.72B) but not between adaptive management needs and ratings ($p = 0.31$). In contrast, there were significant associations

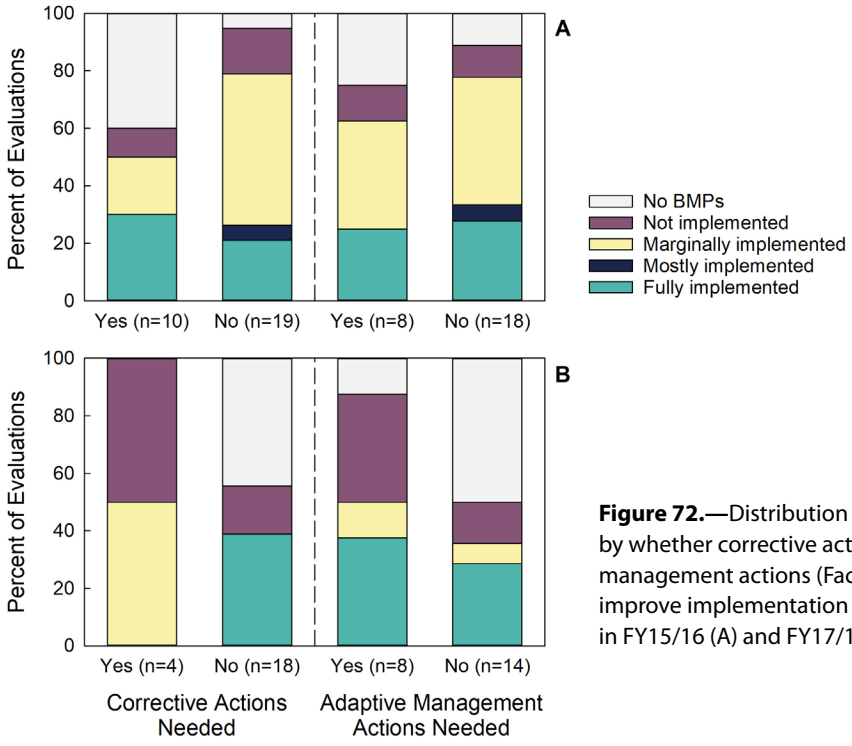



**Figure 72.—**Distribution of implementation ratings by whether corrective actions (Fac B-Q48) or adaptive management actions (Fac B-Q50) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

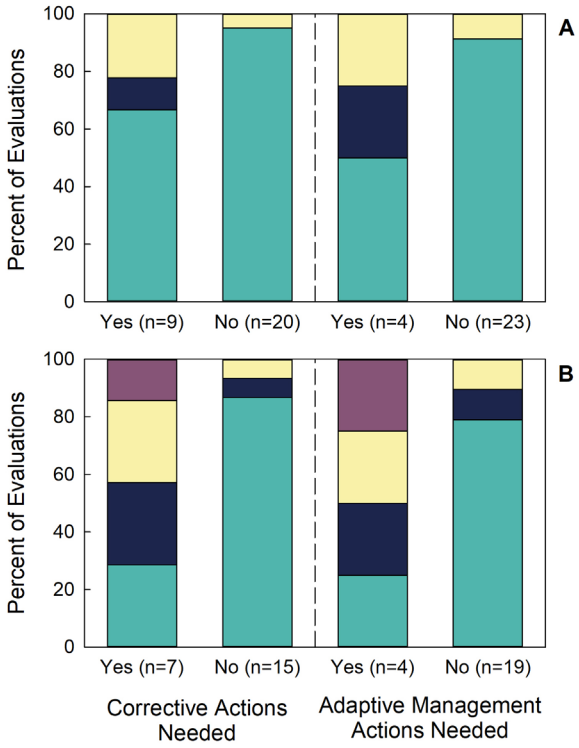



**Figure 73.—**Distribution of effectiveness ratings by whether corrective actions (Fac B-Q68) or adaptive management actions (Fac B-Q70) were needed to improve effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

among effectiveness ratings and whether corrective actions were needed in both monitoring periods ($p = 0.08$ FY15/16, $p = 0.02$ FY17/18) and also among effectiveness ratings and whether adaptive management actions were needed ($p = 0.09$ FY15/16, $p = 0.07$ FY17/18). Better effectiveness ratings are associated with facilities for which no corrective actions were identified as being needed as well as with facilities that had no adaptive management action needs identified (Fig. 73).

There were evaluations rated as *marginally implemented*, *not implemented*, and *marginally effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. Those individual evaluations reported some type of less-than-optimal performance or condition primarily related to lack of planning or erosion and sedimentation; therefore, the expected response to at least one of those questions (corrective actions or adaptive management action needs) would have been that some action was needed. It is possible that those poorer effectiveness ratings resulted from chance occurrence (e.g., an extreme event outside of what could be controlled by planning or some type of BMP prescription), but such situations likely would have been applicable to a minority of evaluations. In some instances, the condition that led to an issue may have been unique to the site or considered insignificant, causing the review team to consider corrective or adaptive management actions unnecessary. However, it is possible that the team may have overlooked problems that led to poorer ratings that could have otherwise been identified during consideration of Fac B-Q48, Fac B-Q50, Fac B-Q68, and Fac B-Q70.

### Composite Ratings

Composite rating results for Fac B facilities that were evaluated for both implementation and effectiveness are given in Table 137. One-quarter of facilities had a composite rating of *excellent* and 35 percent were rated as *good*. Thirteen facilities (25 percent) had no BMPs prescribed, resulting in a *no plan* composite rating. When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, no significant associations between implementation ratings and effectiveness ratings were found in either monitoring period (p = 0.66 FY15/16, p = 0.30 FY17/18). For the facilities evaluated, the consistently high effectiveness ratings do not appear to be dependent on having O&M plans or BMP guidance documents. BMP practices or techniques that protect water, aquatic, and riparian resources may not be documented for facilities, but they may be in use (perhaps as standard operating procedures).

## Facilities B: Examination of Component and Subcomponent Scores

Overall implementation and effectiveness ratings were determined from component, and in some cases, subcomponent scores. The implementation rating components for Fac B are the same as those for Fac A (Table 110). The on-the-ground execution component for Fac B is unique among protocols and has three subcomponents (Table 138). The

**Table 137.—**Composite rating matrix for Fac B sites evaluated for both implementation and effectiveness in FY15/16 (n=29 evaluations) and FY17/18 (n=22 evaluations). Numbers in the cells indicate the number of sites with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 6 | 1 | 11 | 4 | 4 |
| | Mostly effective | | | | | 1 |
| | Marginally effective | 1 | | 1 | | |
| | Not effective | | | | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 6 | | 1 | 2 | 6 |
| | Mostly effective | | | | 2 | 1 |
| | Marginally effective | 1 | | 1 | | 1 |
| | Not effective | | | | 1 | |

Excellent
Good
Fair
Poor
No plan

**Table 138.—**Implementation subcomponents, scores, and interpretation of each score for Fac B. Subcomponent scores are used to determine the on-the-ground execution component score.

| On-the-ground execution subcomponent | Subcomponent score | Score interpretation |
|---|---|---|
| General provisions | All | All BMPs included in the operation and maintenance plan were implemented fully |
| | Some | Some of the BMPs included in the operation and maintenance plan were implemented fully, but at least one was not |
| | None | None of the BMPs included in the operation and maintenance plan were implemented fully |
| Hazardous materials | All | All hazardous materials provisions were implemented |
| | Some | Some hazardous materials provisions were implemented |
| | None | None of hazardous materials provisions were implemented |
| | No hazardous materials | No hazardous materials stored at the site |
| Hazardous wastes | All | All hazardous wastes provisions were implemented |
| | Some | Some hazardous wastes provisions were implemented |
| | None | None of the hazardous wastes provisions were implemented |
| | No hazardous wastes | No hazardous wastes stored at the site |

subcomponents exist because Fac B sites have the potential for hazardous material and hazardous waste storage. When no hazardous materials or hazardous wastes are stored at a site, scores of *no hazardous materials* and *no hazardous wastes* result (Table 138). These two scores have no effect on the subcomponent or component score or the final implementation rating. The effectiveness components for Fac B also are the same as those for Fac A, but the scores within components are slightly different (Table 139).

Table 140 shows how the scores were distributed across the three implementation components. Overall implementation was somewhat poorer for the planning component, with *none* or *no BMPs* for almost all of the component scores. Two facilities in FY17/18 scored as *none* for the project oversight component due to lack of inspections during the operating season and needed corrective actions that were not taken.

The general provisions subcomponent score for 40 of the 52 evaluations was *all* (Table 141). Two evaluations had a subcomponent score of *some* because the facility did not handle a chemical spill or leak according to the unit CERP. Hazardous materials and hazardous wastes subcomponent scores of *some* and *none* resulted from deficiencies in inspections, violations not corrected, and incomplete implementation of storage requirements (Tables 123 and 124).

**Table 139.—**Effectiveness components, scores, and interpretation of each score for Fac B. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Erosion and sedimentation | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Trash and waste | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Chemical pollutants | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |

**Table 140.—**Distribution of implementation component scores by component for Fac B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=29) | | | | | | | |
| | All | 20 | 69 | 15 | 52 | 19 | 66 |
| | Some | | | 14 | 48 | 10 | 34 |
| | None | 4 | 14 | | | | |
| | No BMPs | 5 | 17 | | | | |
| FY17/18 (n=23) | | | | | | | |
| | All | 11 | 48 | 18 | 78 | 17 | 74 |
| | Some | 1 | 4 | 4 | 17 | 3 | 13 |
| | None | 3 | 13 | | | 2 | 9 |
| | No BMPs | 8 | 35 | | | | |
| | Incomplete data[a] | | | 1 | 4 | 1 | 4 |

[a] Some of the questions needed to determine a component score were not answered.

**Table 141.—**Distribution of the on-the-ground execution subcomponent scores by subcomponent for Fac B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Subcomponent score | General provisions subcomponent (number) | General provisions subcomponent (percent) | Hazardous materials subcomponent (number) | Hazardous materials subcomponent (percent) | Hazardous wastes subcomponent (number) | Hazardous wastes subcomponent (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=29) | | | | | | | |
| | All | 22 | 76 | 6 | 21 | | |
| | Some | 7 | 24 | 9 | 31 | | |
| | None | | | 1 | 3 | 1 | 3 |
| | NA[a] | | | 13 | 45 | 28 | 97 |
| FY17/18 (n=23) | | | | | | | |
| | All | 18 | 78 | 7 | 30 | 1 | 4 |
| | Some | 4 | 17 | 1 | 4 | | |
| | None | | | | | | |
| | NA | | | 15 | 65 | 22 | 96 |
| | Incomplete data[b] | 1 | 4 | | | | |

[a] Not applicable (NA); hazardous materials or hazardous wastes not stored at site at time of evaluation. This score does not affect the on-the-ground execution component score.

[b] Some of the questions needed to determine a component score were not answered.

Approximately 27 percent of the facilities were rated as *fully implemented* (Fig. 65; Table 142), which is possible only if all three components score as *all* (Table 142). The on-the-ground execution component score largely dictates the implementation rating when BMPs are included in the O&M guidance documents; if the on-the-ground execution component score is anything other than *all*, the implementation rating cannot be better than *marginally implemented* (Table 142). Of the 14 evaluations with an on-the-ground execution component score of *some* in FY15/16, 7 were solely due to the hazardous materials subcomponent score, and 3 of 4 evaluations with that component score in FY17/18 were solely due to the general provisions subcomponent score.

The distribution of scores across the three effectiveness components is summarized in Tables 143 and 144. For each of the three components, at least 90 percent of the evaluations had scores of *effective* in both monitoring periods (except for the chemical pollutants component in FY17/18) (Table 143). Of the 54 facilities evaluated, 43 had an overall effectiveness rating of *effective*, which is possible only if all three components score as *effective* (Table 144). Six facilities had effectiveness ratings of *marginally effective*; half of these resulted from erosion and sedimentation problems and half from the presence of chemical pollutants (Table 144).

Effectiveness component scores for the erosion and sedimentation, trash and waste, and chemical pollutants components were analyzed to determine whether associations existed between any component and the implementation ratings (Fig. 74). Given that most of

**Table 142.—**Implementation component scores corresponding to the overall implementation ratings for Fac B evaluations with complete data in FY15/16 and FY17/18. See Tables 110 and 138 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=29) | | | | | |
| | Fully implemented | All | All | All | 7 |
| | Mostly implemented | All | All | Some | 1 |
| | Marginally implemented | All | Some | All | 6 |
| | | All | Some | Some | 6 |
| | Not implemented | None | All | All | 3 |
| | | None | All | Some | 1 |
| | No BMPs | No BMPs | All | All | 2 |
| | | No BMPs | All | Some | 1 |
| | | No BMPs | Some | All | 1 |
| | | No BMPs | Some | Some | 1 |
| FY17/18 (n=22) | | | | | |
| | Fully implemented | All | All | All | 7 |
| | Mostly implemented | | | | 0 |
| | Marginally implemented | All | Some | All | 1 |
| | | All | Some | Some | 1 |
| | Not implemented | All | Some | None | 1 |
| | | Some | Some | None | 1 |
| | | None | All | All | 2 |
| | | None | All | Some | 1 |
| | No BMPs | No BMPs | All | All | 7 |
| | | No BMPs | All | Some | 1 |

the component scores were *effective*, significant associations were not expected, and test results supported that expectation (erosion and sedimentation: p = 1.00 FY15/16, p = 0.55 FY17/18; trash and waste: no test FY15/16, p = 0.76 FY17/18; chemical pollutants: p = 0.31 FY15/16, p = 0.17 FY17/18). The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 75. Significant associations were found in FY17/18 for two components—on-the-ground execution and project oversight—while no significant associations were found in FY15/16 (planning: p = 0.38 FY15/16, p = 0.35 FY17/18; on-the-ground execution: p = 1.00 FY15/16, p = 0.08 FY17/18; project oversight: p = 1.00 FY15/16, p = 0.02 FY17/18). Effectiveness ratings were better when the on-the-ground execution and project oversight component scores were *all* for facilities evaluated in FY17/18.

**Table 143.—**Distribution of effectiveness component scores by component for Fac B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Trash and waste component (number) | Trash and waste component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=31) | | | | | | | |
| | Effective | 29 | 94 | 31 | 100 | 29 | 94 |
| | Mostly effective | | | | | 1 | 3 |
| | Marginally effective | 2 | 6 | | | 1 | 3 |
| | Not effective | | | | | | |
| FY17/18 (n=23) | | | | | | | |
| | Effective | 21 | 91 | 21 | 91 | 19 | 83 |
| | Mostly effective | | | 2 | 9 | 1 | 4 |
| | Marginally effective | 1 | 4 | | | 3 | 13 |
| | Not effective | 1 | 4 | | | | |

**Table 144.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Fac B evaluations with complete data in FY15/16 and FY17/18. See Table 139 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Erosion and sedimentation component | Trash and waste component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=31) | | | | | |
| | Effective | Effective | Effective | Effective | 27 |
| | Mostly effective | Effective | Effective | Mostly effective | 1 |
| | Marginally effective | Effective | Effective | Marginally effective | 1 |
| | | Marginally effective | Effective | Effective | 2 |
| | Not effective | | | | 0 |
| FY17/18 (n=23) | | | | | |
| | Effective | Effective | Effective | Effective | 16 |
| | Mostly effective | Effective | Effective | Mostly effective | 1 |
| | | Effective | Mostly effective | Effective | 2 |
| | Marginally effective | Effective | Effective | Marginally effective | 2 |
| | | Marginally effective | Effective | Effective | 1 |
| | Not effective | Not effective | Effective | Marginally effective | 1 |

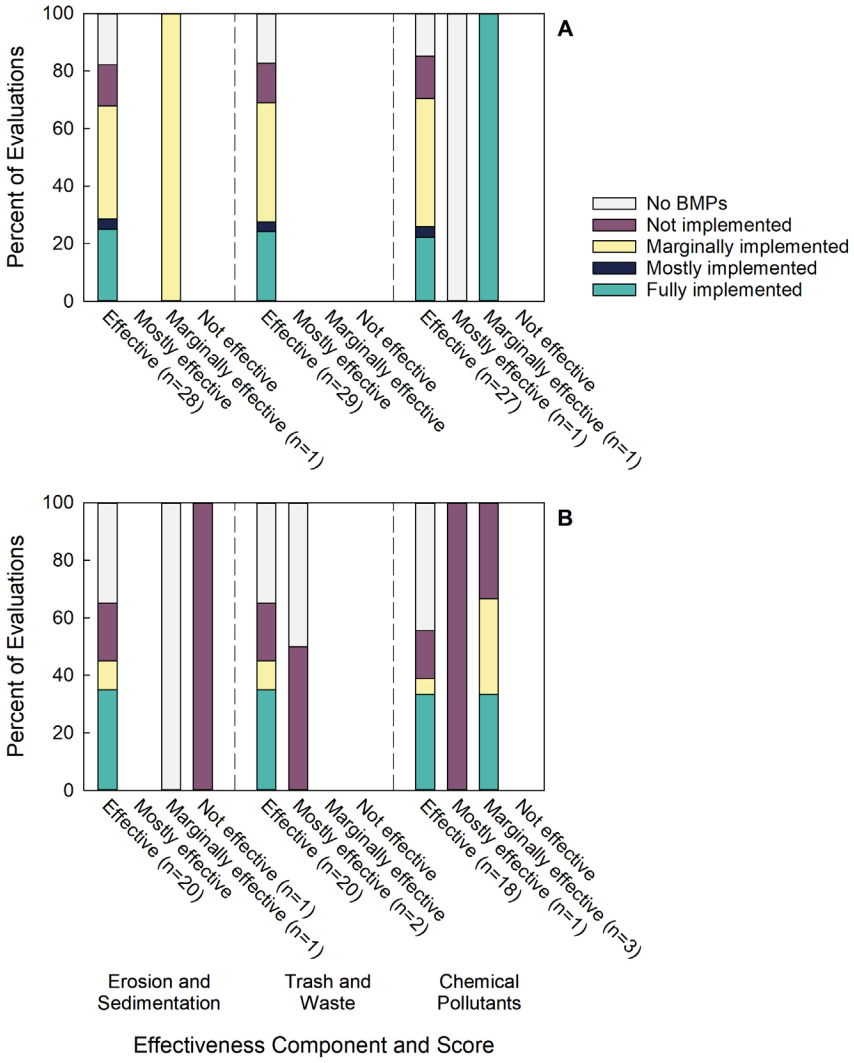



**Figure 74.—**Distribution of implementation ratings across effectiveness component scores for Fac B evaluations completed in FY15/16 (A) and FY17/18 (B).

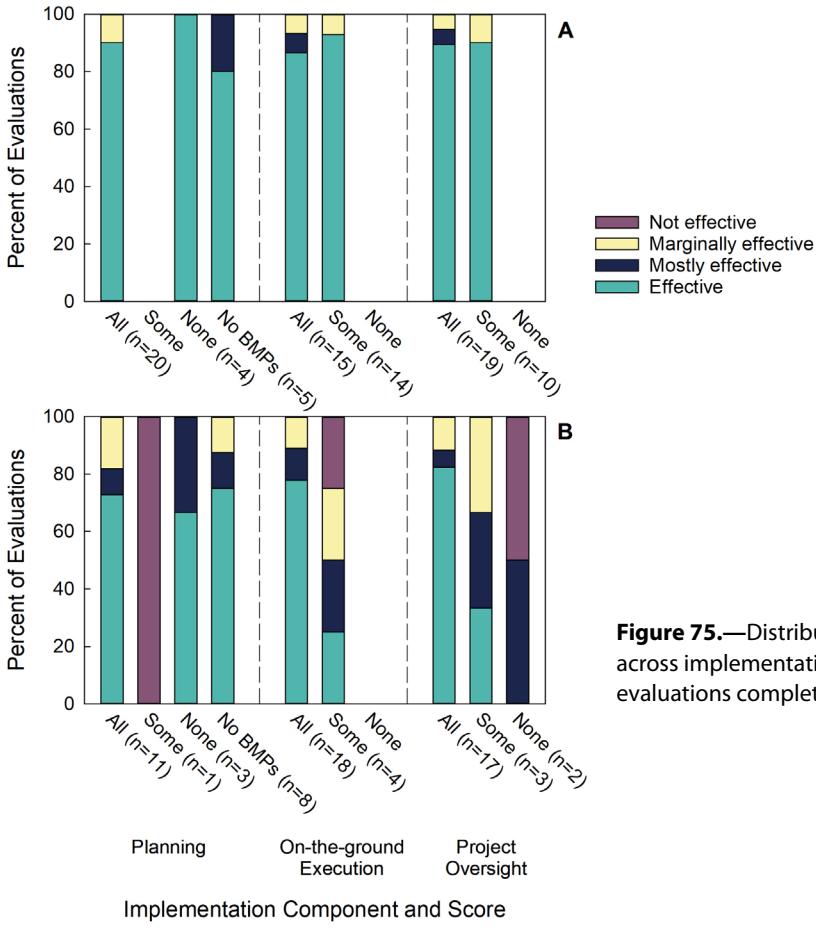



**Figure 75.**—Distribution of effectiveness ratings across implementation component scores for Fac B evaluations completed in FY15/16 (A) and FY17/18 (B).

## Facilities B: Management Implications for Forest Service Resource Managers

Two-thirds of the evaluations for operation and maintenance of noncorridor facilities rated either *marginally implemented, not implemented*, or *no BMPs* for BMP implementation. Project planning was the primary deficiency in implementation; 25 percent of the sites evaluated lacked an operation and maintenance plan or similar guidance documents, and another 13 percent had such documents but BMPs were not included. Facilities operated under a special use authorization were more likely to have an operation and maintenance plan or similar documents with or without BMPs than were Forest Service-administered sites. About one-quarter of the evaluations had a deficiency in on-the-ground execution, mostly related to handling of hazardous materials or chemical leaks or spills. For those facilities that had BMPs in the operation and maintenance plan, BMPs were implemented fully at a higher mean rate at Forest Service-administered sites than at sites operated under a special use authorization. Project oversight was a deficiency at about 29 percent of the facilities, primarily due to a lack of inspections.

Nearly 80 percent of the facilities were rated *effective* for BMP effectiveness, indicating no impacts to water quality were observed. For the few facilities that rated *marginally effective* or *not effective*, the deficiencies were nearly evenly split between the erosion

and sedimentation component and the chemical pollutants component. When evidence of erosion or sedimentation was observed, the evidence was identified as rill erosion or vegetation damage or bare ground greater than 50 feet from a waterbody. The primary cause was runoff and drainage from impervious surfaces like roofs and parking areas. Trash and sanitary waste or chemical and fuel spills or leaks were observed at only a small number of sites.

Although there were no significant associations found between the implementation ratings and effectiveness ratings, a closer look into the data reveals that when BMPs were implemented, they were shown to be effective. For example, for FY15/16 evaluations, the number of BMP provisions implemented fully was significantly associated with effectiveness ratings. Evaluations rated *marginally effective* averaged fewer than half the number of BMP provisions implemented fully than evaluations rated *effective.* Regarding erosion and sedimentation, no evidence of erosion or sedimentation was observed at 92 percent of the facilities with BMP provisions, compared to evidence of erosion or sedimentation observed at half of the sites that lacked an operation and maintenance plan or similar document. More specifically, no erosion or sedimentation was observed at more than 90 percent of the facilities that had BMPs for "ground cover techniques" or "other erosion and sediment control" implemented fully.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Ensuring that Forest Service-administered facilities have an operation and maintenance plan or similar document that contains BMP provisions. Approximately 95 percent of BMP provisions are implemented fully when prescribed at Forest Service facilities.
- Ensuring that operation and maintenance plans or similar documents at facilities operated under a special use authorization have BMP provisions.
- Assessing opportunities for handling and storing hazardous materials and hazardous wastes with greater care. Our assessment suggests that violations of regulations for hazardous materials and hazardous wastes storage are occurring and are not always corrected. Paying particular attention to requirements related to container labeling, inventory and record keeping, and the safety data sheet may help.
- Where appropriate, including BMPs for ground cover and erosion and sediment control in the facility operation and maintenance plan or similar documents. No evidence of erosion or sedimentation was observed when these BMP provisions were implemented fully.
- Establishing specific ground cover standards for the facility. When ground cover standards were prescribed and met, better effectiveness was observed.
- Improving facility administration to ensure facilities are regularly inspected. Lack of administration led to water quality problems at 14 percent of the facilities evaluated in FY17/18.

## Facilities B: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Fac B. Operation and Maintenance of Non-Corridor Facilities or Non-Recreation Special Uses**

(Reference BMPs Fac-1, Fac-3, Fac-4, Fac-5, Fac-6, Fac-7, Fac-8, Road-9, and Road-10)

v3.0 February 2016

| Header | |
|---|---|
| Fac B-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Fac B-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Fac B-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Fac B-Q4 | Date of current field evaluation: |
| Fac B-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac B-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac B-Q7 | Reviewers and titles: |
| Fac B-Q8a | Region number: |
| Fac B-Q8b | State: |
| Fac B-Q9a | Proclaimed Forest or Grassland number and name: |
| Fac B-Q9b | Administrative Forest or Grassland number and name: |
| Fac B-Q10 | District number and name: |
| Fac B-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Fac B-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Fac B-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Fac B-Q12 | 6th level HUC number and name for the subwatershed this facility is in: |
| Fac B-Q13 | Is any part of the facility located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Fac B-Q14b | Location.<br><br>Easting: |
| Fac B-Q14c | Location.<br><br>Northing: |
| Fac B-Q15a | Location.<br><br>Latitude: |
| Fac B-Q15b | Location.<br><br>Longitude: |
| Fac B-Q15c | Location.<br><br>Lat/Long Datum: |
| Fac B-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Fac B-Q17 | Who operates the site? Select one:<br><br>Forest Service<br>Third party under special use permit |
| Fac B-Q18 | Name of facility or special use permit: |
| Fac B-Q19 | Type of Forest Service facility being constructed, or special use code for facility: |
| Fac B-Q20 | Dates site is normally open for use (month to month): |
| Fac B-Q21 | Distance between facility and nearest waterbody (ft, m, mi, or km; specify unit): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Fac B-Q22 | Type of waterbody nearest to the facility. Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| Fac B-Q23 | Is any part of this site located within an AMZ? Select one:<br><br>a. Yes<br>b. No<br>c. Waterbody has no designated AMZ |
| Fac B-Q24 | Length of the transect around perimeter of the site (ft, m, mi, or km; specify unit): |
| **Implementation** | |
| Fac B-Q25 | Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this facility contain provisions for protecting water, aquatic, and riparian resources? Select one:<br><br>a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/ riparian protection (go to question 26)<br>b. Plan, SUP, or other O&M guidance documents exist for this facility, but they do not contain provisions for water/aquatic/riparian protection (go to question 27)<br>c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this facility (go to question 27) |
| Fac B-Q26 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the operation and maintenance plan, SUP, or other O&M guidance documents were implemented fully during this operating season. Select one response in each line. If the provision exists in the operation and maintenance plan, SUP, or other guidance documents and it was implemented fully, select Yes. If the provision exists in the operation and maintenance plan, SUP, or other guidance documents but it was not implemented fully, select No. If the provision does not exist in the operation and maintenance plan, SUP, or other guidance documents, or it is too early for the provision to have been implemented at the time of the evaluation, select Not applicable.<br><br>a. Drainage and stormwater control<br>Yes/No/No applicable<br>b. Ground cover techniques<br>Yes/No/No applicable<br>c. Other erosion and sediment control<br>Yes/No/No applicable<br>d. Locations and numbers of trash receptacles<br>Yes/No/No applicable<br>e Trash receptacle maintenance<br>Yes/No/No applicable<br>f. Permanent sanitation facilities<br>Yes/No/No applicable<br>g. Temporary (portable) sanitation facilities<br>Yes/No/No applicable<br>h. Road and access routes<br>Yes/No/No applicable<br>i. Parking areas<br>Yes/No/No applicable<br>j. Equipment service, storage and maintenance areas<br>Yes/No/No applicable<br>k. Vehicle wash water collection/disposal<br>Yes/No/No applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Fac B-Q26 continued*) | l. Water supply/delivery system maintenance<br>Yes/No/No applicable<br>m. Aquatic invasive species control<br>Yes/No/No applicable<br>n. Other (specify<br>Yes/No/No applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Fac B-Q27 | Are hazardous **materials** stored at this facility? Select one:<br><br>a. Yes (go to question 28)<br>b. No (go to question 31) |
| Fac B-Q28 | During its last annual safety inspection or audit, did this facility receive any violations or Findings-For-Review for deficiencies concerning hazardous materials stored at this facility that could have potentially affected water quality or aquatic health? Select one:<br><br>a. Not applicable, no hazardous materials were stored at this facility during the last inspection or audit (go to question 30)<br>b. Yes (go to question 29)<br>c. No (go to question 30) |
| Fac B-Q29 | Have all of the hazardous material deficiencies that could have potentially affected water quality or aquatic health identified in the last inspection or audit been corrected or addressed? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q30 | Are all regulations pertaining to the topics listed below for hazardous materials storage at this facility being followed at the time of this BMP review? Select one answer in each row:<br><br>a. Storage building requirements<br>Yes/No<br>b. Physical container requirements (container materials, secondary containment, etc.)<br>Yes/No<br>c. Container labeling requirements<br>Yes/No<br>d. Proper storage of materials (separating incompatible materials, etc.)<br>Yes/No<br>e. Inventory/record keeping requirements<br>Yes/No<br>f. Facility signage requirements<br>Yes/No<br>g. Safety Data Sheet requirements<br>Yes/No |
| Fac B-Q31 | Are hazardous **wastes** stored at this facility? Select one:<br><br>a. Yes (go to question 32)<br>b. No (go to question 42) |
| Fac B-Q32 | During its last annual safety inspection or audit, did this facility receive any violations or Findings-For-Review for deficiencies concerning hazardous wastes stored at this facility that could have potentially affected water quality or aquatic health? Select one:<br><br>a. Not applicable, no hazardous wastes were stored at this site during the last inspection or audit (go to question 34)<br>b. Yes (go to question 33)<br>c. No (go to question 34) |

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| **Implementation** (*continued*) | |
|---|---|
| Fac B-Q33 | Have all of the hazardous waste deficiencies that could have potentially affected water quality or aquatic health identified in the last inspection or audit been corrected or addressed? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q34 | Does the facility ***generate no more than*** 100 kg (220.4 pounds) of hazardous waste per month, 1 kg (2.2 pounds) of acute hazardous waste per month, and 100 kg of acute hazardous waste spill clean-up debris per calendar month? Select one:<br><br>a. Yes (go to question 37)<br>b. No (go to question 35) |
| Fac B-Q35 | Does the facility have an EPA identification number identifying it as a small or large quantity generator of hazardous waste? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q36 | Are containers holding hazardous wastes inspected monthly? Select one; after answering go to question 39:<br><br>a. Yes<br>b. No |
| Fac B-Q37 | Does the facility have an EPA identification number identifying it as a conditionally exempt small quantity generator of hazardous wastes? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q38 | Are ***no more than*** 1000 kg of hazardous waste, 1 kg of acute hazardous waste, or 100 kg of acute hazardous waste spill clean-up debris stored at the facility? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q39 | Are all regulations pertaining to the topics listed below for hazardous waste storage being followed for the type of facility corresponding to its EPA identification (conditionally exempt small quantity generator, small quantity generator, or large quantity generator)? Select one answer in each row:<br><br>a. Storage building requirements<br>Yes//No<br>b. Physical container requirements (container materials, secondary containment, etc.)<br>Yes//No<br>c. Container labeling requirements<br>Yes//No<br>d. Proper storage of materials (separating incompatible materials, etc.)<br>Yes//No<br>e. Inventory/record keeping requirements<br>Yes//No<br>f. Facility signage requirements<br>Yes//No<br>g. Safety Data Sheet requirements<br>Yes//No |

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| **Implementation** (*continued*) | |
|---|---|
| Fac B-Q40 | Is hazardous waste disposal accomplished through the use of properly licensed companies? Select one:<br><br>a. Not applicable, hazardous waste disposal has not yet occurred because accumulation has not reached weights requiring disposal (go to question 42)<br>b. Yes (go to question 41)<br>c. No (go to question 41) |
| Fac B-Q41 | Are the manifests for disposal of hazardous wastes from the facility retained for at least the minimum required number of years following disposal? Select one:<br><br>a. Yes<br>b. No |
| Fac B-Q42 | Is potable water supplied to the site? Select one:<br><br>a. Yes, water supplied from city or service-district connections (go to question 44)<br>b. Yes, water is supplied from a spring or surface source (go to question 43)<br>c. Yes, water is supplied from a well (go to question 43)<br>d. No (go to question 45) |
| Fac B-Q43 | Have water quality samples been taken and tested according to the operation and maintenance plan, special use permit, and/or state regulation, and are results recorded and available? Select one:<br><br>a. Water sampling is not required for the source water in plans, permits, or state regulations<br>b. Water sampling is required, but no samples have been taken<br>c. Water samples have been taken and tested, but results are not available<br>d. Water samples have been taken and results are available |
| Fac B-Q44 | Are mechanisms in place to prevent cross connection and contaminated water from entering the public water system? Select one:<br><br>a. Not applicable, state, local, and Forest or Grassland regulations or direction do not require prevention of cross connection<br>b. Yes<br>c. No |
| Fac B-Q45 | Were inspections during this operating season performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, maintenance was conducted to avoid critical times<br>c. Yes<br>d. No |
| Fac B-Q46 | If problems occurred during this operating season that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |

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| **Implementation** (*continued*) | |
|---|---|
| Fac B-Q47 | Were chemical or fuel spills or leaks that occurred at this site during the past 5 years handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred during the past 5 years<br>c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Fac B-Q48 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 49)<br>b. No (go to question 50) |
| Fac B-Q49 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Fac B-Q50 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 51)<br>b. No (go to question 52 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Fac B-Q51 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 52 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Fac B-Q52 | Is there evidence of erosion or sedimentation at the facility? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of erosion or sedimentation (go to question 57)<br>b. Evidence of erosion or sedimentation outside an AMZ (go to question 54)<br>c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 54)<br>d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 53) |
| Fac B-Q53 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 55:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Fac B-Q54 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Fac B-Q55 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 52, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Fac B-Q56 | What are the causes? Select all that apply:<br><br>a. Inadequate control or management of runoff from facility roofs, gutters, and downspouts<br>b. Inadequate control or management of runoff from parking areas or other impervious or compacted surfaces<br>c. Inadequate control or management of runoff from vehicle wash area<br>d. Uncontrolled runoff from temporary (portable) sanitation facilities<br>e. Uncontrolled runoff from permanent sanitation facilities<br>f. Insufficient maintenance of drainage associated with facility<br>g. Use is exceeding carrying capacity of the site<br>h. Inadequate erosion control techniques or structures (excluding soil cover)<br>i. Inadequate soil cover<br>j. Other (specify):<br>k. Unknown |
| Fac B-Q57 | Have ground cover standards for this facility been met? Select one:<br><br>a. Not applicable, no ground cover standards for this facility<br>b. Yes<br>c. No |
| Fac B-Q58 | What evidence of trash or domestic animal or human sanitary waste exists at the facility? Select all that apply:<br><br>a. No evidence of trash or domestic animal or human sanitary waste (go to question 60)<br>b. Evidence of trash outside an AMZ (go to question 59)<br>c. Evidence of trash within an AMZ (go to question 59)<br>d. Evidence of trash in a waterbody (go to question 59)<br>e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ (go to question 59)<br>f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ (go to question 59)<br>g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody (go to question 59) |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Fac B-Q59 | What are the causes? Select all that apply:<br><br>a. Insufficient number of trash receptacles<br>b. Trash receptacles not emptied frequently enough<br>c. Inappropriate location of trash receptacles<br>d. Improper design of trash receptacles (e.g., not wildlife-proof)<br>e. No sanitation facilities on site<br>f. Inappropriate location of sanitation facilities<br>g. Insufficient maintenance of sanitation facilities<br>h. Inconsiderate human actions<br>i. Other (specify): |
| Fac B-Q60 | Is there evidence of leach field seepage or leaks (including overflow) from vault or pit toilets or sewer lines at this facility? Select one:<br><br>a. Not applicable, no sanitation facilities present at the site<br>b. Yes<br>c. No |
| Fac B-Q61 | Do records indicate that potable water meets state or federal water quality standards and are suitable for domestic supply? Select one:<br><br>a. Not applicable, no potable water development for the facility (go to question 63)<br>b. Not applicable, potable water provided by municipal supply (go to question 63)<br>c. Unknown, no water testing performed, or water quality records not available (go to question 62)<br>d. Yes (go to question 63)<br>e. No (go to question 62) |
| Fac B-Q62 | What actions have been taken to alert potential users that the water supply is unsafe or water quality is unknown? Select all that apply:<br><br>a. No actions have been taken<br>b. Water has been made unavailable to users (i.e., valves closed, pump turned off, storage tanks drained, facility locked, area fenced off, etc.)<br>c. Signs have been posted indicating water quality is unsafe for consumption or is unknown<br>d. Signs have been posted indicating how water should be treated to make it potable (e.g., boiling, filtering, treatment tablets, etc.)<br>e. Other (specify): |
| Fac B-Q63 | What evidence of chemical or fuel spills or leaks or associated waste containers exists at the facility? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody |
| Fac B-Q64 | Is there any evidence of spills or leaks of hazardous **materials** stored at the facility? Select one:<br><br>a. Not applicable, no hazardous materials stored at the facility<br>b. Yes<br>c. No |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Fac B-Q65 | Is there evidence of spills or leaks of hazardous **wastes** in this facility's accumulation areas or satellite storage areas? Select one:<br><br>a. Not applicable, no hazardous wastes stored at the facility<br>b. Yes<br>c. No |
| Fac B-Q66 | Is there evidence that operation and maintenance of this facility have contributed to the introduction of or spread of aquatic invasive species? Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Fac B-Q67 | If inspections during this operating season were not conducted at critical times, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were restricted to avoid critical times<br>b. Yes<br>c. No |
| Fac B-Q68 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 69)<br>b. No (go to question 70) |
| Fac B-Q69 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Fac B-Q70 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 71)<br>b. No (go to General Comments) |
| Fac B-Q71 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

## Facilities C—Completed Construction or Operation and Maintenance of Pipelines, Transmission Lines, or Rights-of-Way

As mentioned in the introduction to the facilities protocols, the Fac C protocol can be used to evaluate both completed construction of pipelines, transmission lines, and other non-road rights-of-way as well as the operation and maintenance of such corridors. Three evaluations of newly constructed corridors were completed during the FY15/16 monitoring period and four in FY17/18. They are described briefly and followed by a more in-depth analysis of the evaluations of corridor operation and maintenance.

## Facilities C (Completed Construction): Descriptive Statistics

Six of the seven constructed corridor facilities were buried pipelines; one of them was collocated with an above-ground transmission line. The other corridor project (evaluated in FY17/18) was a buried cable transmission line. Implementation and effectiveness evaluations were completed for six projects on the same day; the seventh, in FY17/18, included implementation only. The corridor construction evaluations all were performed to meet National BMP targets (Fac C-Q11a), and two evaluations also indicated project review was a reason for monitoring. All but one of the corridors (a buried water line) were to be maintained by non-Forest Service entities following construction. Each of the corridor projects had a waterbody crossing in the evaluated segment; three waterbodies crossed were perennial streams or rivers, three were intermittent streams, and one was an ephemeral stream. Three of the projects were accomplished through CEs, two with EAs, and one with an EIS. The contract or plan for the implementation-only evaluation contained BMPs from other guidance documents.

## Facilities C (Completed Construction): Ratings and Component Scores

The implementation rating components for Fac C (both completed construction and operation and maintenance) are the same as those for Fac A (Table 110), and the components have no subcomponents. The effectiveness rating components, their scores, and interpretations for Fac C are given in Table 145. When a project did not include a waterbody crossing, the missing component was scored *no waterbody crossing* (Table 145), which does not influence the final effectiveness rating. Each implementation component had *all* and *some* scores in equal proportions in FY15/16 (Table 146) and better percentages of *all* scores for all components in FY17/18. Four projects received implementation ratings of *fully implemented*, one was *mostly implemented*, and two were *marginally implemented* (Table 147).

The chemical pollutants component scores for effectiveness for all evaluations were *effective* (Table 148), but the waterbody crossing and erosion and sedimentation component scores were not as consistently high. Two projects—one in each monitoring period—had waterbody crossing component scores of *not effective* due to sediment attributable to the existence of the corridor being delivered to the waterbody at the crossing as evidenced by changes to substrate composition and waterbody geometry (Fac C-Q45). Another project in FY15/16 had a *marginally effective* score for the erosion and sedimentation component (Table 148) due to gully and sediment plume evidence observed within an AMZ. The overall effectiveness ratings for the projects are given in Table 149. The composite ratings for the evaluations were *excellent*, *fair*, and *poor* (Table 150). Full implementation of prescribed BMPs did not guarantee complete BMP effectiveness for water resource protection, and when BMPs were not implemented fully and project oversight was less than complete (Table 147), prescribed BMPs were not effective at protecting water resources (Table 150).

**Table 145.—**Effectiveness components, scores, and interpretation of each score for Fac C and Fac D. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Waterbody crossing[a] | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| | No waterbody crossing | No waterbody crossing included in the project; does not affect the effectiveness rating |
| Erosion and sedimentation | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

[a] Waterbody crossing component is excluded in the determination of the overall effectiveness rating for Fac D when the reclaimed facility type is not a corridor.

**Table 146.—**Distribution of implementation component scores by component for Fac C completed construction evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=3) | | | | | | | |
| | All | 2 | 67 | 2 | 67 | 2 | 67 |
| | Some | 1 | 33 | 1 | 33 | 1 | 33 |
| | None | | | | | | |
| | No BMPs | | | | | | |
| FY17/18 (n=4) | | | | | | | |
| | All | 4 | 100 | 3 | 75 | 3 | 75 |
| | Some | | | 1 | 25 | 1 | 25 |
| | None | | | | | | |
| | No BMPs | | | | | | |

**Table 147.—**Implementation component scores corresponding to the overall implementation ratings for Fac C completed construction evaluations with complete data in FY15/16 and FY1718. See Table 110 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=3) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | Some | All | All | 1 |
| | Marginally implemented | All | Some | Some | 1 |
| | Not implemented | | | | 0 |
| | No BMPs | | | | 0 |
| FY17/18 (n=4) | | | | | |
| | Fully implemented | All | All | All | 3 |
| | Mostly implemented | | | | 0 |
| | Marginally implemented | All | Some | Some | 1 |
| | Not implemented | | | | 0 |
| | No BMPs | | | | 0 |

**Table 148.—**Distribution of effectiveness component scores by component for Fac C completed construction evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Waterbody crossing component (number) | Waterbody crossing component (percent) | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=3) | | | | | | | |
| | Effective | 2 | 67 | 1 | 33 | 3 | 100 |
| | Mostly effective[a] | | | 1 | 33 | | |
| | Moderately effective[b] | | | | | | |
| | Marginally effective[a] | | | 1 | 33 | | |
| | Not effective | 1 | 33 | | | | |
| | No waterbody crossing | | | | | | |
| FY17/18 (n=3) | | | | | | | |
| | Effective | 2 | 67 | 2 | 67 | 3 | 100 |
| | Mostly effective | | | | | | |
| | Moderately effective | | | | | | |
| | Marginally effective | | | 1 | 33 | | |
| | Not effective | 1 | 33 | | | | |
| | No waterbody crossing | | | | | | |

[a] Score applies only to waterbody crossing and erosion and sedimentation components (see Table 145).
[b] Score applies only to chemical pollutants components (see Table 145).

**Table 149.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Fac C completed construction evaluations with complete data in FY15/16 and FY17/18. See Table 145 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Waterbody crossing component | Erosion and sedimentation component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=3) | | | | | |
| | Effective | Effective | Effective | Effective | 1 |
| | Mostly effective | | | | 0 |
| | Marginally effective | Effective | Marginally effective | Effective | 1 |
| | Not effective | Not effective | Mostly effective | Effective | 1 |
| FY17/18 (n=3) | | | | | |
| | Effective | Effective | Effective | Effective | 2 |
| | Mostly effective | | | | 0 |
| | Marginally effective | | | | 0 |
| | Not effective | Not effective | Marginally effective | Effective | 1 |

**Table 150.—**Composite rating matrix for Fac C completed construction projects evaluated for both implementation and effectiveness in FY15/16 (n=3 evaluations) and FY17/18 (n=3 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | | 1 | | | |
| | Mostly effective | | | | | |
| | Marginally effective | 1 | | | | |
| | Not effective | | | 1 | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 2 | | | | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | 1 | | |

Excellent
Good
Fair
Poor
No plan

## Facilities C (Operation and Maintenance [O&M]): Header Statistics

The operation and maintenance of 16 corridor facilities (Fac C O&M) were evaluated in FY15/16 and 19 in FY17/18 (Table 151). Every region completed at least one Fac C O&M evaluation, and some completed multiple evaluations. All 16 corridors evaluated for operation and maintenance in FY15/16 had both implementation and effectiveness evaluations completed, while two evaluations in FY17/18 were for implementation only (Table 151). Eleven of 16 corridors evaluated in FY15/16 and 15 of 19 corridors in FY17/18 were selected randomly (Table 104; 4 of the 13 nonrandomly selected projects in Table 104 were construction projects rather than operation and maintenance).

**Table 151.—**Number of Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Fac C-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | | | | |
| | 2 | | | | |
| | 3 | 1 | | | 1 |
| | 4 | 1 | | | 1 |
| | 5 | 2 | | | 2 |
| | 6 | 2 | | | 2 |
| | 8 | 2 | | | 2 |
| | 9 | 8 | | | 8 |
| | 10 | | | | |
| | All | 16 | | | 16 |
| | Percent | | | | 100 |
| FY17/18 | | | | | |
| | 1 | 1 | | | 1 |
| | 2 | 2 | 1 | | 1 |
| | 3 | 1 | | | 1 |
| | 4 | 2 | | | 2 |
| | 5 | 2 | | | 2 |
| | 6 | 5 | | | 5 |
| | 8 | 2 | 1 | | 1 |
| | 9 | 3 | | | 3 |
| | 10 | 1 | | | 1 |
| | All | 19 | 2 | | 17 |
| | Percent | | 11 | | 89 |

Meeting National BMP targets was a reason for every Fac C O&M evaluation; some evaluations were also being performed for other reasons, most commonly project review (Table 152). Quality assurance monitoring was identified as a reason for monitoring (Fac C-Q11a) in three Fac C O&M evaluations. For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance had duplicate evaluations, which is necessary to meet the intent of that type of monitoring. Therefore, the review teams that selected quality assurance appeared to use this term to mean something different from what the protocol instructions stipulate.

**Table 152.—**Number of Fac C operation and maintenance evaluations completed in FY15/16 (n=16 evaluations) and FY17/18 (n=19 evaluations), by region and reason for monitoring (Fac C-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | 1 | | 1 | | |
| | 4 | 1 | 1 | | 1 | |
| | 5 | 2 | | | | |
| | 6 | 2 | | 1 | | |
| | 8 | 2 | | | | |
| | 9 | 8 | | | 1 | |
| | 10 | | | | | |
| | All | 16 | 1 | 2 | 2 | |
| FY17/18 | | | | | | |
| | 1 | 1 | | | | |
| | 2 | 2 | | | | |
| | 3 | 1 | | 1 | | |
| | 4 | 2 | | 2 | | |
| | 5 | 2 | | | | |
| | 6 | 5 | 1 | 1 | | |
| | 8 | 2 | | | 1 | |
| | 9 | 3 | 1 | | | |
| | 10 | 1 | 1 | | | |
| | All | 19 | 3 | 4 | 1 | |

Several types of corridor facilities were evaluated (Table 153). Not surprisingly, given what they are, all of the corridors are operated by entities other than the Forest Service. All but four contained a waterbody crossing (Fac C-Q21), and those that did not were 10 to 200 feet away from the nearest waterbody (Fac C-Q22). Perennial streams or rivers were the most frequently crossed waterbodies (Table 154).

**Table 153.**—Number of Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18, by type of corridor facility (Fac C-Q18)

| Type of corridor | FY15/16 | FY17/18 |
|---|---|---|
| Buried pipeline | 7 | 5 |
| Aboveground pipeline | 1 | 0 |
| Buried power line | 0 | 1 |
| Aboveground transmission line | 6 | 11 |
| Other | 2[a] | 2[b] |

[a] Buried fiber optic communications cable; combined canal and pipeline (above and below ground).
[b] Buried cable.

**Table 154.**—Type of waterbody crossed by corridor facility or nearest to corridor when crossing was not present in evaluated segment (Fac C-Q23) and mean aquatic management zone (AMZ) width (Fac C-Q24) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Type of waterbody | FY15/16 Number of evaluations | FY15/16 Mean AMZ width (ft) | FY17/18 Number of evaluations | FY17/18 Mean AMZ width (ft) |
|---|---|---|---|---|
| Ephemeral stream | 2 | 49 | 2 | 25 |
| Intermittent stream | 0 | | 5 | 96 |
| Perennial stream/river | | | | |
| Crossed | 9 | 181 | 7 | 71 |
| Nearest to corridor | 1 | 300 | 2 | 200 |
| Pond | 0 | | 0 | |
| Lake | 2 | 125 | 0 | |
| Wetland/wet meadow | 2 | 0 | 0 | |
| Estuary | 0 | | 0 | |
| Other | 0 | | 1[a] | 200 |

[a] Perennial stream and wetland.

## Facilities C (O&M): Implementation Results and Their Tie to Header Information

Some type of operation and maintenance documents (O&M plans, special use authorizations, land management plans, and so on) existed for all 16 corridors evaluated in FY15/16 and for 17 of 19 corridors evaluated in FY17/18, but no BMP provisions to help protect water, aquatic, and riparian resources were included in those documents for 5 of the facilities (Table 155). For the corridors with BMPs in guidance documents, Table 156 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the O&M guidance documents are assigned, along with information about whether all the BMPs from the provisions were implemented fully. A "yes" indicates that there was at least one BMP in the guidance documents applicable to the provision and that all BMPs assigned to that provision were implemented fully. Conversely, a "no" indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. "Not applicable" indicates that there were no BMPs in the guidance documents applicable to the provision or that applicable BMPs had not been implemented because the situation or timing that would trigger their implementation had not yet occurred. In the National BMP program, there is no expectation that every provision has BMPs assigned; consequently, the percentages for "yes" and "no" in the last two columns of Table 156 for each monitoring period are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

On average, BMPs in each provision were prescribed in nine evaluations in FY15/16 and seven in FY17/18. When prescribed, the BMP provisions were implemented fully in an average of 91 and 90 percent of the 14 evaluations in each monitoring period that had some type of BMP guidance document for operation and maintenance (Table 156). BMPs were most frequently included in the provision "specificity of corridor inspection frequency" and in two closely related provisions: "erosion control on access routes on corridor" and "drainage features on corridor" (Table 156). When the numbers and percentages of BMP provisions implemented fully were compared for each evaluation, BMPs were included in five and four provisions on average in FY15/16 and FY17/18, respectively, and 95 and 94 percent of the BMP provisions were implemented fully per evaluation, respectively. One evaluation in FY15/16 and two in FY17/18 had BMP provisions that were not implemented fully. Three evaluations indicated that none of the BMP provisions were applicable to the corridor at the time of the review.

**Table 155.—**Distribution of whether facility operation and maintenance (O&M) plan, special use authorization or other O&M guidance documents contain water, aquatic, or riparian resource protection provisions (Fac C-Q35) for Fac C O&M evaluations completed in FY15/16 and FY17/18

| O&M plan, special use authorization, or other guidance documents contain BMP protection provisions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Yes; plan has BMP provisions | 14 | 88 | 14 | 74 |
| No; plan exists but does not have BMP provisions | 2 | 12 | 3 | 16 |
| No plan for the facility | 0 | | 2 | 11 |

**Table 156.—**Frequencies at which all BMPs in provisions included in an operation and maintenance (O&M) plan, special use authorization, or other O&M guidance documents were implemented fully (Fac C-Q36) for Fac C operation and maintenance evaluations completed in FY15/16 (n=14 evaluations) and FY17/18 (n=14 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a]/too early to implement (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA/too early to implement (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Specification of corridor inspection frequency | 10 | 1 | 3 | 91 | 9 | 5 | 1 | 6 | 83 | 17 |
| Erosion control on access routes on corridor | 10 | 0 | 4 | 100 | 0 | 9 | 0 | 4 | 100 | 0 |
| Drainage features on corridor (not on access routes) | 10 | 0 | 4 | 100 | 0 | 7 | 0 | 6 | 100 | 0 |
| Nonvegetative ground cover requirements | 6 | 1 | 7 | 86 | 14 | 4 | 1 | 7 | 80 | 20 |
| Vegetative ground cover requirements | 8 | 0 | 6 | 100 | 0 | 8 | 0 | 5 | 100 | 0 |
| Techniques to prevent or control spread of aquatic invasive species during maintenance | 5 | 1 | 8 | 83 | 17 | 5 | 1 | 6 | 83 | 17 |
| Techniques for corridor maintenance to limit the potential for waterbody contamination | 9 | 0 | 5 | 100 | 0 | 8 | 0 | 5 | 100 | 0 |
| Techniques to limit unauthorized use of corridor | 8 | 1 | 5 | 89 | 11 | 6 | 1 | 6 | 86 | 14 |
| Inspection of corridor to detect leaks from pipelines, transformers, etc. in corridor | 4 | 1 | 9 | 80 | 20 | 5 | 1 | 7 | 83 | 17 |
| Repair of leaks, breaks, etc. of pipelines, transformers, and other corridor structures | 5 | 1 | 8 | 83 | 17 | 4 | 1 | 7 | 80 | 20 |
| Mean | 8 | 1 | 6 | 91 | 9 | 6 | 1 | 6 | 90 | 10 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.

[b] Percent calculated from "yes" and "no" counts.

Two implementation questions—Fac C-Q37 and Fac C-Q38—evaluate whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times when resources were most susceptible to negative effects from site conditions during the past 5 years (Table 157), and whether corrective actions were taken if problems occurred during the past 5 years (at any time, not just critical times) (Table 158). Critical times include periods associated with large or intense precipitation/runoff events or periods of ground-disturbing maintenance. Inspections were conducted during critical times for half of the evaluated corridors in FY15/16 and 37 percent in FY17/18 (Table 157). Of the corridors evaluated in FY15/16 and FY17/18, 63 and 68 percent had no problems requiring corrective actions any time during the 5-year period, respectively, and about 12 percent in each monitoring period had corrective actions implemented when needed (Table 158).

**Table 157.—**Distribution of whether inspections during the past 5 years occurred at critical times (Fac C-Q37) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Inspections during the past 5 years occurred at critical times | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No inspections | 1 | 6 | 2 | 11 |
| Not applicable; maintenance avoided critical times | 4 | 25 | 7 | 37 |
| Yes | 8 | 50 | 7 | 37 |
| No | 3 | 19 | 3 | 16 |
| All | 16 | | 19 | |

**Table 158.—**Distribution of whether corrective actions (CA) were taken if problems occurred during operations in the past 5 years (Fac C-Q38) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Corrective actions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No problems; no CA needed | 10 | 63 | 13 | 68 |
| CA needed but not taken | 0 | | 2 | 11 |
| CA needed and implemented | 2 | 12 | 2 | 11 |
| Unknown | 4 | 25 | 2 | 11 |
| All | 16 | | 19 | |

Because fuel and other chemicals may be used on corridors, especially for maintenance and access, an implementation question (Fac C-Q39) considers how chemical spills and leaks that were reported or observed during the past 5 years were handled. Administrative units in the Forest Service have a contingency and emergency response plan (CERP) or equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in those cases the unit follows that state agency's procedures. One administrative unit indicated that a spill or leak that required cleanup occurred at the evaluated corridor and that CERP procedures were followed (Table 159); another evaluation in FY15/16 did not answer Fac C-Q39.

## Facilities C (O&M): Effectiveness Results and Their Tie to Implementation Results and Header Information

As noted above, 4 of the 33 corridors evaluated for operation and maintenance effectiveness had no waterbody crossing. Of the corridors with crossings, eight and four had evidence of bank or shoreline erosion or waterbody morphology changes at the waterbody crossing attributable to the existence of the corridor in FY15/16 and FY17/18, respectively (Table 160). Ephemeral streams represented only two of the crossings in

**Table 159.—**Distribution of whether chemical or fuel spills and leaks, if they occurred during operations in the past 5 years, were handled according to the unit's contingency and emergency response plan (or its equivalent) (Fac C-Q39) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Chemical or fuel spills and leaks handled according to the unit's contingency and emergency response plan | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No contingency and emergency response plan | 0 | | 0 | |
| No spills or leaks | 14 | 93 | 19 | 100 |
| Yes; according to contingency and emergency response plan | 1 | 7 | 0 | |
| No; not according to contingency and emergency response plan | 0 | | 0 | |
| All | 15 | | 19 | |

**Table 160.—**Evidence of bank or shoreline erosion or morphology or substrate changes within a waterbody crossing attributable to the crossing (Fac C-Q44) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Evidence present within a waterbody crossing | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Not applicable; no waterbody crossing | 1 | 6 | 3 | 18 |
| Yes | 8 | 50 | 4 | 24 |
| No | 7 | 44 | 10 | 59 |

each monitoring period, but three of those four crossings had erosion or morphological changes (Fig. 76A, B); the observed evidence may be due to fewer BMPs being prescribed to nonperennial crossings than perennials because the former do not consistently carry water. The most frequently reported types of evidence were traceable evidence to a waterbody and changes to waterbody morphology (Table 161), although multiple types of evidence (ranging from two to six) were selected for all but one corridor crossing.

Evidence of erosion or sedimentation on or originating from the rest of the evaluated length of the corridor (i.e., excluding the crossing) was observed for 7 of 16 corridors in FY15/16 and 5 of 16 corridors in FY17/18 (Table 162). Only the most severe cases of erosion or sedimentation are reported (Fac C-Q46), with severity increasing from outside an AMZ, to inside an AMZ, to delivery to a waterbody or changes to waterbody morphology. When sediment delivery to a waterbody or waterbody morphology changes occurred, the two waterbody types affected were ephemeral streams and perennial streams or rivers (Fig. 76C, D) (Table 162). The evaluation in FY15/16 that observed evidence less than 10 feet from a waterbody (Table 162) indicated that the waterbody was an ephemeral

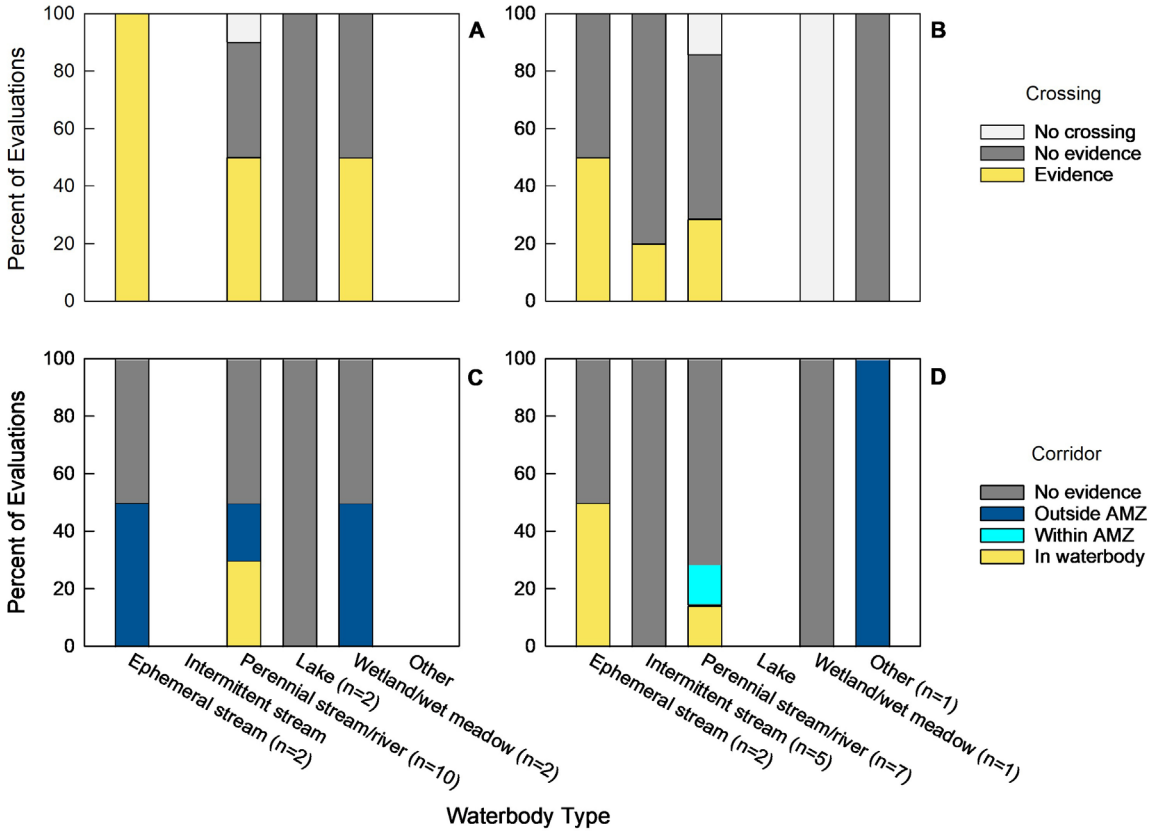



**Figure 76.—**Evidence of erosion or sedimentation or morphology changes at crossings (Fac C-Q44; A, B) and from corridors away from crossings (Fac C-Q46; C, D) by waterbody type (Fac C-Q23) for operation and maintenance evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

**Table 161.—**Types of evidence of bank or shoreline erosion or morphology or substrate changes observed at a waterbody crossing attributable to the existence of the corridor (Fac C-Q45) for Fac C operation and maintenance evaluations completed in FY15/16 (n=8 evaluations) and FY17/18 (n=4 evaluations). Multiple types may be selected.

| Type of evidence | FY15/16 (number) | FY17/18 (number) |
|---|---|---|
| Traceable evidence to the waterbody, but not currently visible in the waterbody | 3 | 2 |
| Turbidity present | 1 | |
| Evidence of localized sediment deposition in the waterbody | 4 | |
| Changes to substrate composition | 4 | |
| Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) | 4 | 1 |
| Bank instability | 3 | 1 |
| Bank trampling or compaction | 1 | |
| Vegetation damage or bare ground | 3 | 1 |
| Sheet erosion | 1 | |
| Rill erosion | 2 | |
| Gully erosion | 1 | |
| Headcutting | 1 | |
| Slumping/slips | | |
| Mass wasting | | |
| Sediment plumes or accumulations | 2 | 1 |
| Rutting | | 1 |
| Water quality monitoring results | | |

**Table 162.—**Evidence of erosion or sedimentation on or originating from corridor segment at areas other than the waterbody crossing (Fac C-Q46) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Fac C-Q48) or number of places evidence observed in a waterbody (Fac C-Q47)

| Location of observed evidence | Number of evaluations | Percent of evaluations | Distance to nearest waterbody <10 ft (number) | Distance to nearest waterbody 10–50 ft (number) | Distance to nearest waterbody 50–100 ft (number) | Distance to nearest waterbody >100 feet (number) | Evidence in waterbody 1–2 places (number) | Evidence in waterbody 3–4 places (number) | Evidence in waterbody ≥5 places (number) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| No evidence | 9 | 56 | | | | | | | |
| Outside an AMZ[a] | 4 | 25 | 1 | 1 | | 2 | | | |
| Within an AMZ | 0 | | | | | | | | |
| In a waterbody | 3 | 19 | | | | | | 3 | |
| FY17/18 | | | | | | | | | |
| No evidence | 11 | 69 | | | | | | | |
| Outside an AMZ | 2 | 13 | | | | 2 | | | |
| Within an AMZ | 1 | 5 | | | 1 | | | | |
| In a waterbody | 2 | 13 | | | | | 1 | 1 | |

[a] Aquatic management zone.

stream with an AMZ width of zero feet. Many different types of evidence were observed (Table 163); the most common evidence was "vegetation damage or bare ground," which was observed at all locations. Not surprisingly, therefore, the single most common cause of erosion and sedimentation was "lack of vegetative soil cover" (Table 164). Three evaluations reported three types of evidence observed that were inconsistent with the location where evidence was reported in Fac C-Q46, such as changes to waterbody geometry outside an AMZ.

Question Fac C-Q16 characterizes the weather conditions associated with the evaluation and assists in determining whether observations of erosion and sedimentation transport or waterbody morphology changes (Fac C-Q46) are masked during dry weather conditions. Wet weather conditions, if found to be important for observing effects, are expected to be most associated with erosion and sediment transport outside a waterbody, which result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

**Table 163.—**Types of evidence of erosion or sedimentation observed from evaluated corridor segment (Fac C-Q49) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Fac C-Q46 (Table 162) is applicable to Fac C-Q49.

| Type of evidence | FY15/16 Outside an AMZ[a] (n=4) | FY15/16 In waterbody (n=3) | FY17/18 Outside an AMZ (n=2) | FY17/18 Within an AMZ (n=1) | FY17/18 In waterbody (n=2) |
|---|---|---|---|---|---|
| Traceable evidence to the waterbody, but not currently visible in the waterbody | 1[b] | 2 | | 1[b] | 1 |
| Turbidity present | | | | | |
| Evidence of localized sediment deposition in the waterbody | 2[b] | 1 | | | |
| Changes to substrate composition | | 1 | | | |
| Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) | 1[b] | 1 | | | |
| Bank instability | | 1 | | | |
| Bank trampling or compaction | | 2 | | | |
| Vegetation damage or bare ground | 4 | 2 | 1 | | 2 |
| Sheet erosion | 2 | 1 | | | 1 |
| Rill erosion | 3 | 1 | 2 | | 1 |
| Gully erosion | | 1 | | | 1 |
| Headcutting | 1 | | | | |
| Slumping/slips | | | | | |
| Mass wasting | | | | | |
| Sediment plumes or accumulations | 2 | | | | 1 |
| Rutting | 2 | | | 1 | |
| Water quality monitoring results | | | | | |

[a] Aquatic management zone.
[b] The type of evidence reported is incompatible with the location in which it was observed.

**Table 164.—**Causes of evidence of erosion or sedimentation observed associated with areas other than the waterbody crossings for the evaluated corridor segment (Fac C-Q50) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18. Multiple answers may be selected.

| Cause of evidence | FY15/16 Outside an AMZ[a] (n=4) | FY15/16 In waterbody (n=3) | FY17/18 Outside an AMZ (n=2) | FY17/18 Within an AMZ (n=1) | FY17/18 In waterbody (n=2) |
|---|---|---|---|---|---|
| Lack of drainage features or structures on access routes on corridor | 1 | 1 | 1 | | 1 |
| Improper or inadequate spacing of drainage structures on access routes on corridor | | 1 | 2 | | |
| Improperly shaped or designed drainage features on access routes on corridor | 2 | 2 | 1 | 1 | |
| Improper or inadequate maintenance of access routes on corridor | 1 | 1 | | | |
| Poor location of access routes on corridor | 1 | | | 1 | |
| Inadequate energy dissipation or armoring of drainage outlets on access routes on corridor | | 1 | | | |
| Unauthorized use of the corridor, or unauthorized use of access routes on corridor | 2 | | | | 1 |
| Lack of any drainage features or structures on corridor (excludes access routes) | | 1 | | | |
| Improper or inadequate spacing of drainage structures on corridor (excludes access routes) | 1 | | | | |
| Improperly shaped or designed drainage features on corridor (excludes access routes) | 1 | | | | |
| Improper or inadequate maintenance of corridor drainage features (excludes access routes) | | | | | |
| Lack of, or improper or inadequate maintenance of corridor (excluding drainage features) | 1 | | | | |
| Inadequate energy dissipation or armoring of outlets for corridor drainage (excludes access routes) | | 1 | | | |
| Lack of vegetative soil cover | 4 | 1 | | | 2 |
| Ineffective non-vegetative soil cover | | | | | |
| Ineffective mechanical/physical soil stabilization | | | | | |
| Poor construction techniques | | | | | 1 |
| Other | | 1 | | 1 | |
| Unknown | 1 | | | | |

[a] Aquatic management zone.

Only four corridor operation and maintenance evaluations—three in FY15/16 and one in FY17/18—were completed during or within 24 hours after precipitation events (Fig. 77), so caution is advised before making conclusions about the relationships between weather conditions and observations of evidence until sample sizes increase. However, no statistically significant associations exist from these data to suggest that erosion evidence is more observable in the presence of recent wet weather (at crossing: p = 1.00 FY15/16 and FY17/18; from corridor: p = 0.74 FY15/16, no test FY17/18).

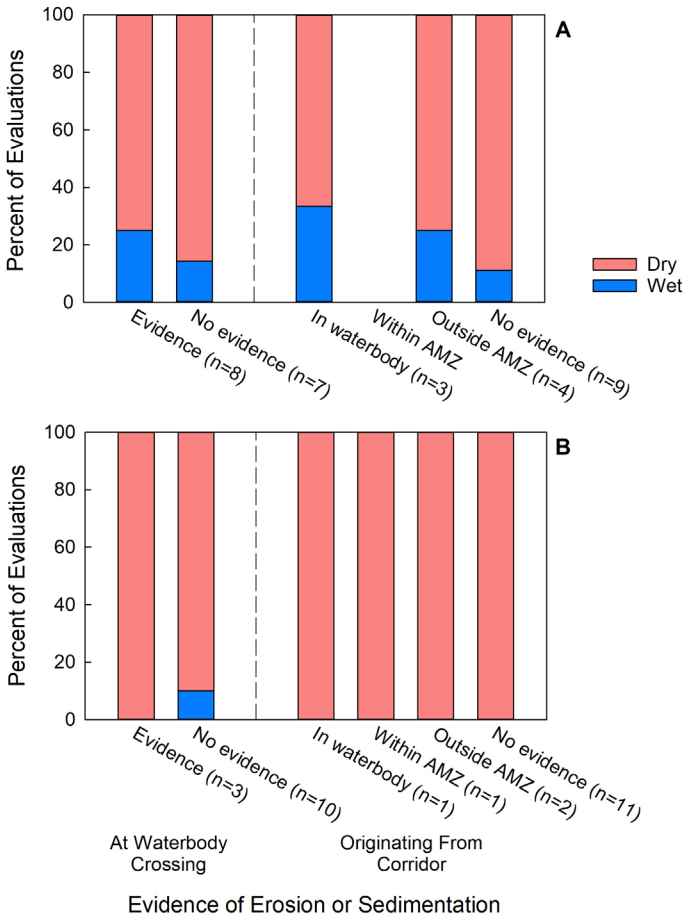



**Figure 77.—**Type of weather conditions during or within 24 hours before effectiveness evaluation (Fac C-Q16) versus evidence of erosion (Fac C-Q44, waterbody crossing; Fac C-Q46, corridor) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

Ground cover standards existed for 11 of the 16 corridors evaluated in FY15/16 and 9 of 16 evaluated in FY17/18 (Table 165); of those 20 corridors, the standards were met for 85 percent. When ground cover standards were compared to whether BMP provisions for "vegetative ground cover requirements" (Table 156) were implemented fully, significant associations did not exist between whether the standard was met and whether applicable BMPs were implemented fully (p = 0.77 FY15/16, p = 0.22 FY17/18). Fifteen evaluations had applicable BMPs in the vegetative requirements provision; all were implemented fully (Fig. 78), and 60 to 70 percent of corridors with applicable BMPs met the ground cover standards for the corridor. The existence (including maintenance) of the corridor was believed to contribute to the introduction or spread of aquatic invasive species (Fac C-Q53) for one corridor evaluated in FY15/16 and none in FY17/18. For that evaluation in FY15/16, the species influenced was purple loosestrife (*Lythrum salicaria*).

**Table 165.**—Distribution of whether ground cover standards were met (Fac C-Q51) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Ground cover standards were met | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Not applicable (no ground cover standards) | 5 | 31 | 7 | 44 |
| Yes | 9 | 56 | 8 | 50 |
| No | 2 | 13 | 1 | 6 |

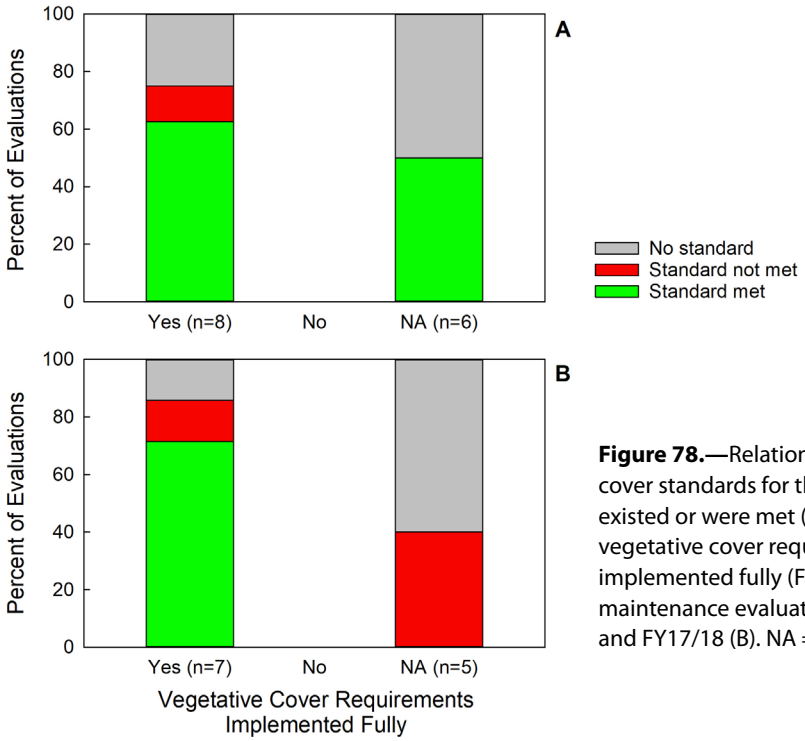



**Figure 78.**—Relationships between whether ground cover standards for the evaluated corridor segment existed or were met (Fac C-Q51) compared to whether vegetative cover requirement provisions were implemented fully (Fac C-Q36e) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B). NA = not applicable.

The presence of chemical or fuel spills, equipment or pipeline leaks, or chemical waste containers is determined during the effectiveness evaluations. Such evidence can include pollutants observed during operations but not reported, pollutants not yet cleaned up even if reported, or pollutants not previously observed or known to exist. No chemical or fuel spills, chemical or fuel leaks, or waste containers were present in either monitoring period.

Inspections are an important part of corridor operation and maintenance. The Fac C O&M protocol includes two questions about inspections, one in implementation (Fac C-Q37) and one in effectiveness (Fac C-Q54), that are designed to tie together. Respectively, they investigate whether inspections were completed during critical times during the past 5 years and whether lack of inspections during critical times (i.e., if implementation indicated a lack) in the past 5 years influenced BMP effectiveness. Table 166 shows the relationship between the two questions for facilities in which both implementation and effectiveness evaluations were completed within a monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Thirty-one percent of the evaluations in FY15/16 and 24 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remainder of the facilities, a lack of inspections led to observed problems for one corridor evaluated in FY17/18 (Table 166).

**Table 166.—**Occurrence of inspections performed at critical times (Fac C-Q37) in relationship to problems observed during effectiveness monitoring (Fac C-Q54) for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (31 and 24 percent of FY15/16 and FY17/18 responses, respectively).

| Monitoring period | Inspections/ administration at critical times (implementation) | Not applicable; inspections at critical times or work avoided critical times (effectiveness) | Yes; lack of administration led to observed problems (effectiveness) | No; lack of administration did not lead to observed problems (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | No inspections | 1 | | |
| | Not applicable; work avoided critical times | 2 | | 2 |
| | Yes; inspections at critical times | 7 | | 1 |
| | No; inspections not at critical times | 1 | | 2 |
| FY17/18 | | | | |
| | No inspections | | | 2 |
| | Not applicable; work avoided critical times | 2 | | 4 |
| | Yes; inspections at critical times | 6 | | |
| | No; inspections not at critical times | | 1 | 2 |

## Facilities C (O&M): Ratings and Their Tie to Header, Implementation, and Effectiveness Results

Eleven of 16 Fac C O&M corridors were rated as *fully implemented* in FY15/16 (Fig. 79A); the remaining corridors were evenly distributed across the other implementation ratings. Effectiveness ratings in FY15/16 were poorer than the implementation ratings; the number of corridors with a *not effective* rating exceeded those with an *effective* rating (Fig. 79C). About 40 percent of corridors in FY17/18 were rated as *fully implemented*, while over 70 percent achieved an effectiveness rating of *effective* (Fig. 79B, D).

Similar numbers of buried and aboveground corridor facilities were evaluated for operation and maintenance (Fig. 80). Significant associations between the implementation ratings and whether the corridor facility was installed above ground or below ground were not found for either monitoring period (p = 1.00 FY15/16, p = 0.79 FY17/18) (Fig. 80A, B). Likewise, no significant associations existed between the effectiveness ratings and the location of corridor infrastructure (p = 1.00 FY15/16, p = 0.70 FY17/18) (Fig. 80C, D). In most cases, however, corridors with buried infrastructure tended to have slightly poorer ratings.

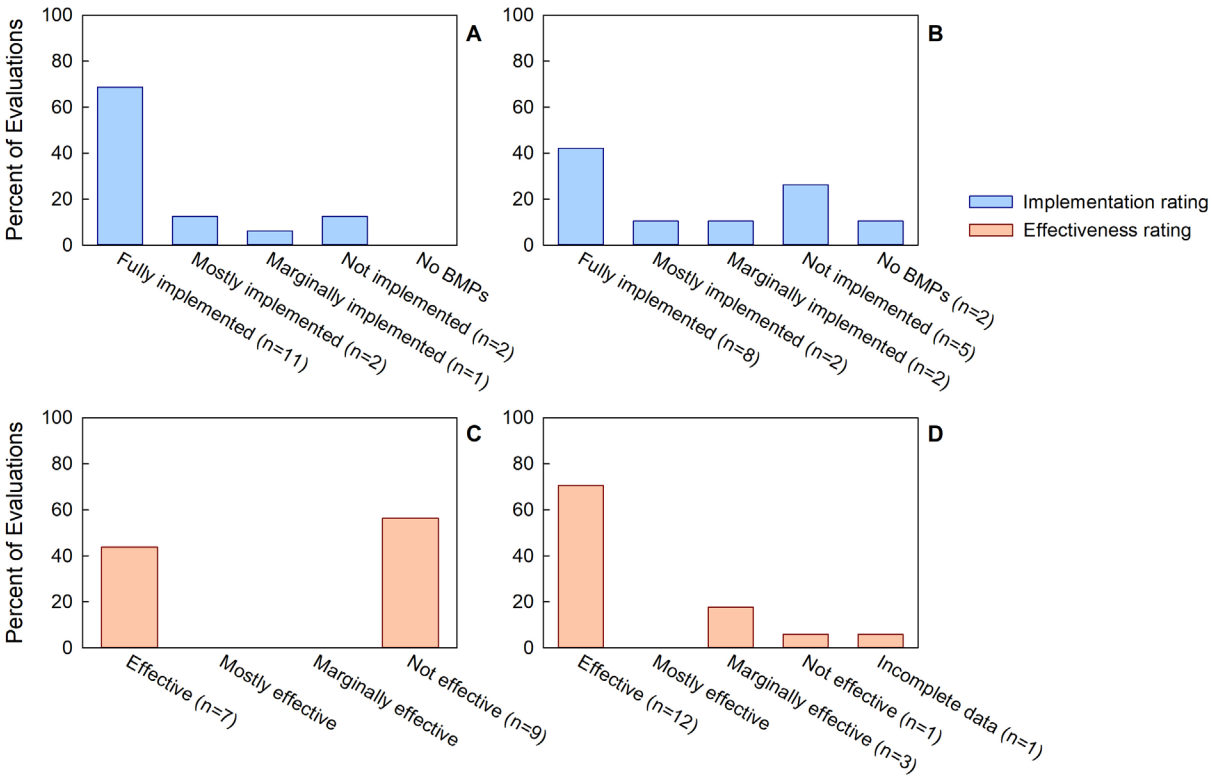



**Figure 79.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Fac C operation and maintenance evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

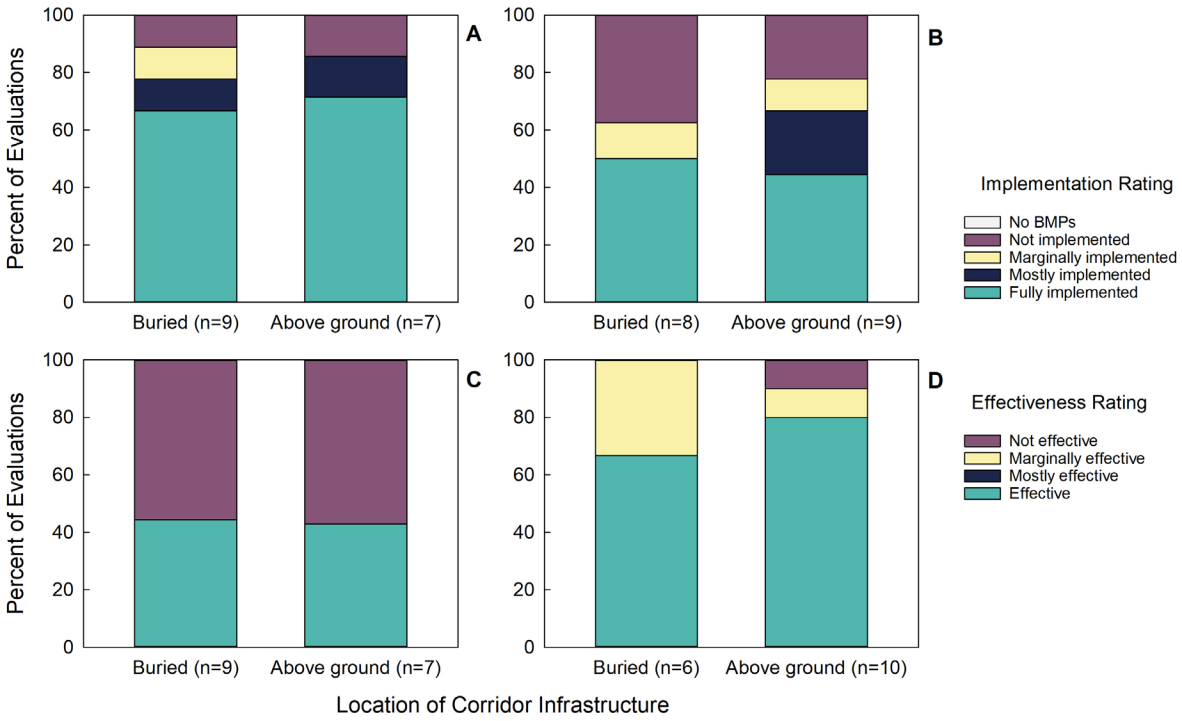



**Figure 80.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by location of corridor infrastructure (Fac C-Q18) for operation and maintenance evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

No significant associations were found between the effectiveness ratings and whether documents pertinent to BMP guidance for the operation and maintenance of the facility exist (p = 1.00 FY15/16, p = 0.73 FY17/18), although the small number of corridors without BMPs limits the usefulness of this comparison (Fig. 81). For the 26 corridors with BMPs, those rated *not effective* in FY15/16 had smaller mean numbers of provisions implemented fully (four) compared to those rated *effective* (seven), but the number of BMP provisions implemented fully (Fac C-Q27) was not significantly different by effectiveness rating (p = 0.23, GLMM with negative binomial distribution and log link function). In FY17/18 the corridor rated *not effective* had BMPs in six provisions implemented fully, while those rated *effective* and *marginally effective* averaged four and three BMP provisions implemented fully; again, no significant differences were found between number of provisions and effectiveness rating (p = 0.59, GLMM with negative binomial distribution and log link function). When the percentages of BMP provisions implemented fully were compared by effectiveness rating, corridors rated *effective* averaged 90 percent of provisions implemented fully, while those rated *not effective* averaged 75 percent implemented fully in FY15/16, although the mean percentages were not significantly different by rating (p = 0.59, Kruskal-Wallis test). The nine corridors rated as *effective* in FY17/18 averaged 81 percent of BMPs implemented fully while the three corridors with other ratings had 100 percent full implementation, and again mean percentages were not significantly different by rating (p = 0.55, Kruskal-Wallis test).

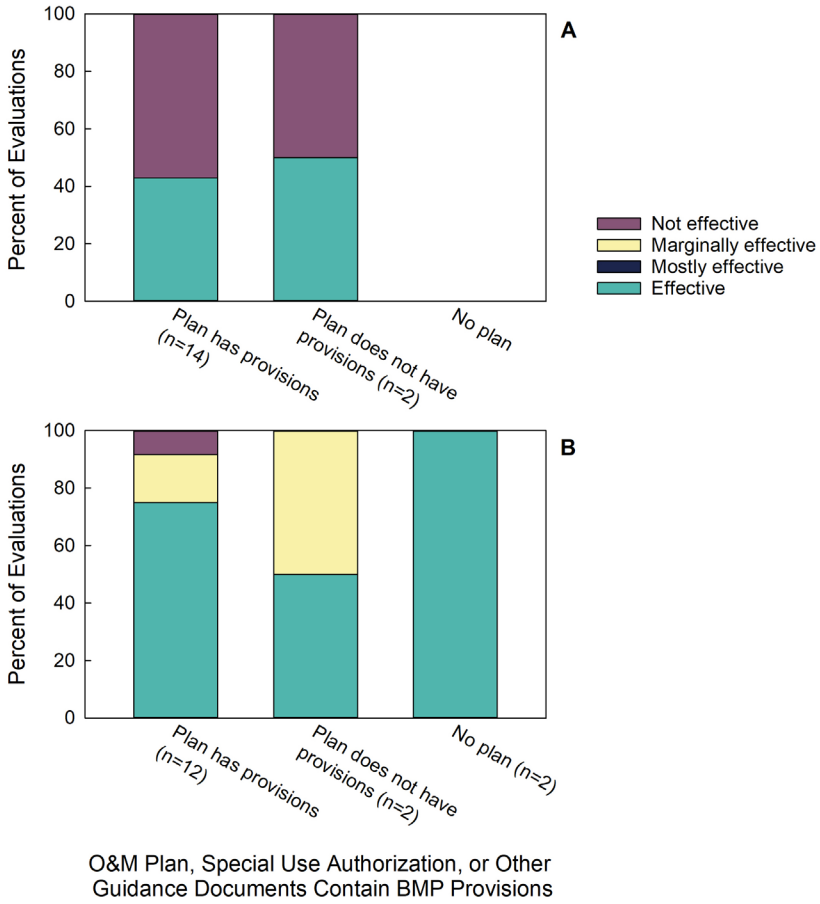



**Figure 81.—**Distribution of effectiveness ratings by whether facility operation and maintenance plan contained BMP provisions (Fac C-Q35) for O&M evaluations completed in FY15/16 (A) and FY17/18 (B).

Almost 70 percent of the corridors in FY15/16 and 56 percent in FY17/18 had ground cover standards (sum of "yes" and "no" answers in Fig. 82), and of those with a standard, more than 80 percent met ground cover requirements in each monitoring period (Fig. 82). Although no significant associations existed between the ground cover standard categories and the effectiveness ratings ($p = 0.17$ FY15/16, $p = 0.17$ FY17/18), the three corridors that did not meet standards and one-third of the corridors that had no ground cover standards were rated as *not effective* (Fig. 82). These results suggest that requirements for ground cover standards may be important BMPs for corridor operation and maintenance.

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Fac C-Q16) were not associated with the effectiveness ratings in FY15/16 ($p = 1.00$) (Fig. 83A). No test was possible in FY17/18. The number of wet weather evaluations was about one-quarter of that for dry weather, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential to ratings. However, relationships between weather conditions and field observations of erosion/sediment/morphological effects (e.g., Fig. 77) may provide more straightforward

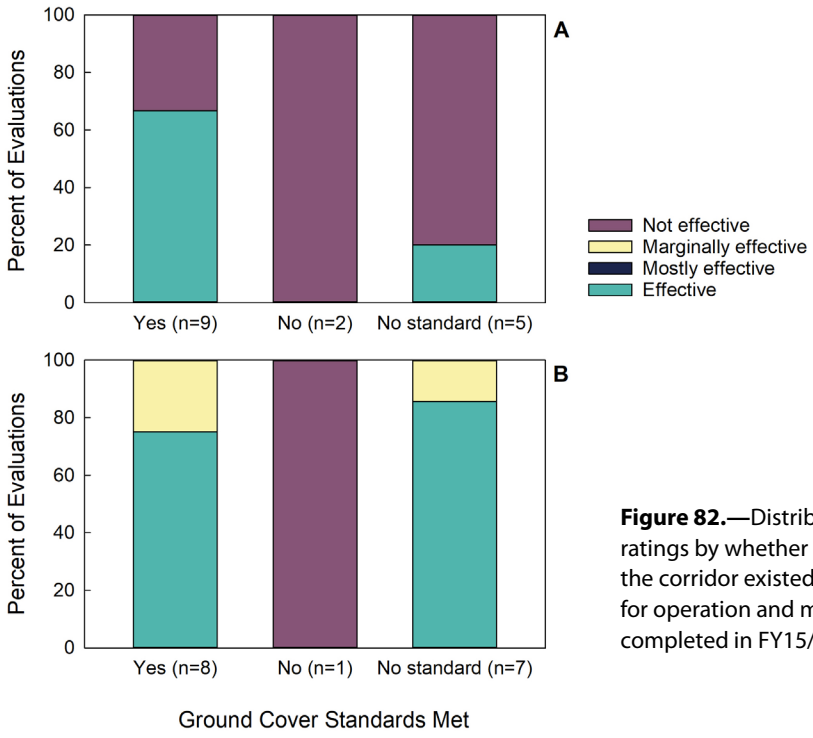



**Figure 82.—**Distribution of effectiveness ratings by whether ground cover standards for the corridor existed or were met (Fac C-Q51) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

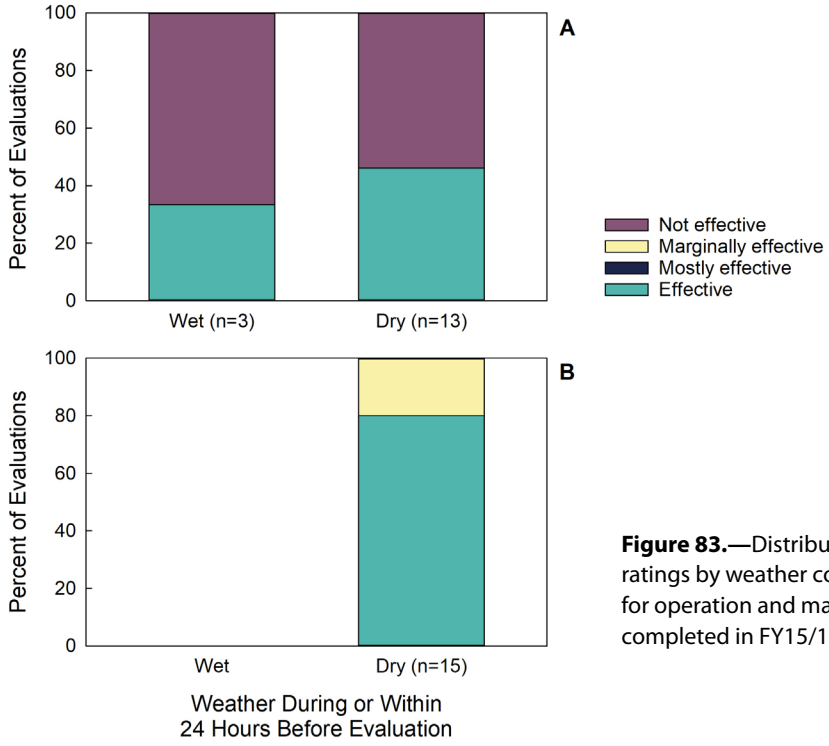



**Figure 83.—**Distribution of effectiveness ratings by weather conditions (Fac C-Q16) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

information about the influence of weather on site conditions and potential problems than associations between weather and ratings because ratings incorporate responses to multiple questions.

During the implementation portion of the evaluation, review of documents and inquiries with the corridor administrator occur to determine whether corrective actions were taken if problems were observed during the past 5 years of operation and maintenance (Fac C-Q54). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. No significant associations were found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in either monitoring period (p = 0.60 FY15/16, p = 0.55 FY17/18) (Fig. 84). Like many of the tests of association with Fac C O&M effectiveness ratings, the results and interpretations are limited by the predominance of one or two effectiveness ratings and the relatively small number of corridors for many answer choices.

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to

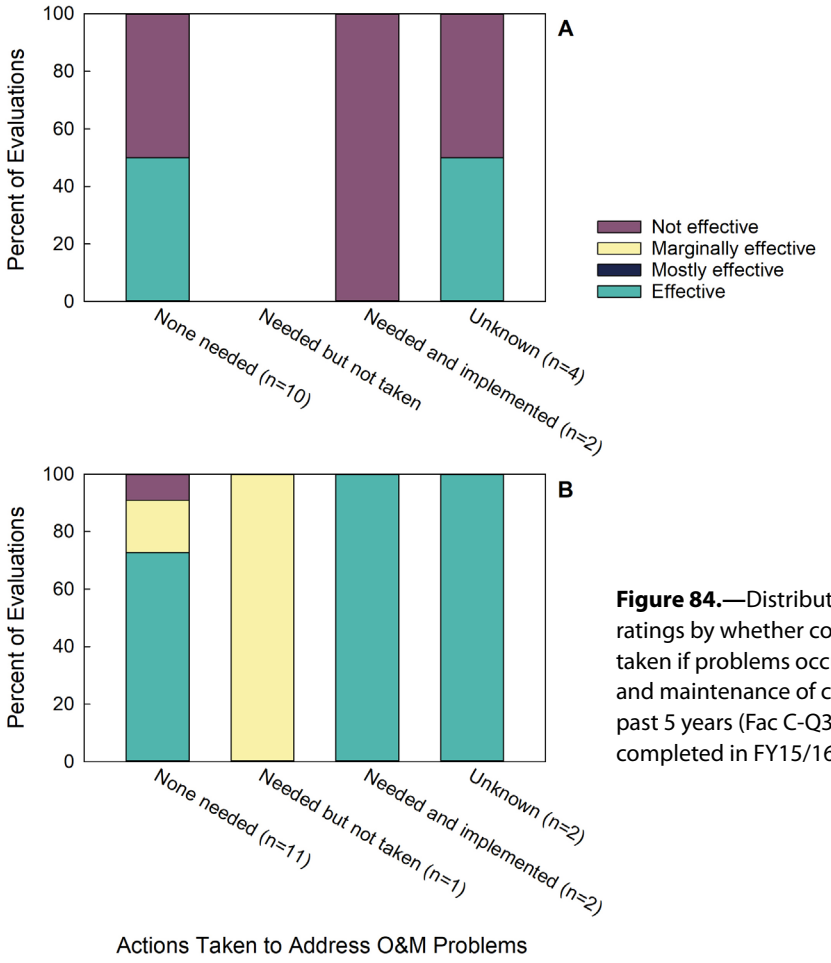



**Figure 84.—**Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during operation and maintenance of corridor facilities during the past 5 years (Fac C-Q38) for O&M evaluations completed in FY15/16 (A) and FY17/18 (B).

these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based on what the team observes and reports during the effectiveness evaluation at the project or site.

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site in question. Corrective actions for implementation are actions that would improve implementation of BMPs applicable to the corridor, while corrective actions for effectiveness are actions that would improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as commonly having corridors that lack O&M plans or similar guidance documents, while adaptive management actions for effectiveness may involve ensuring that ground cover at waterbody crossings is assessed every operating season on all corridors because lack of ground cover at crossings was reported as a cause of erosion on many corridors.

For the implementation portion of the review, equal numbers of evaluations in FY15/16 indicated the need for corrective actions versus no need for corrective actions (Fig. 85), while approximately one-third indicated adaptive management actions were needed. In FY17/18, seven of the evaluations indicated that both corrective actions and adaptive management actions were needed. There were no significant associations between

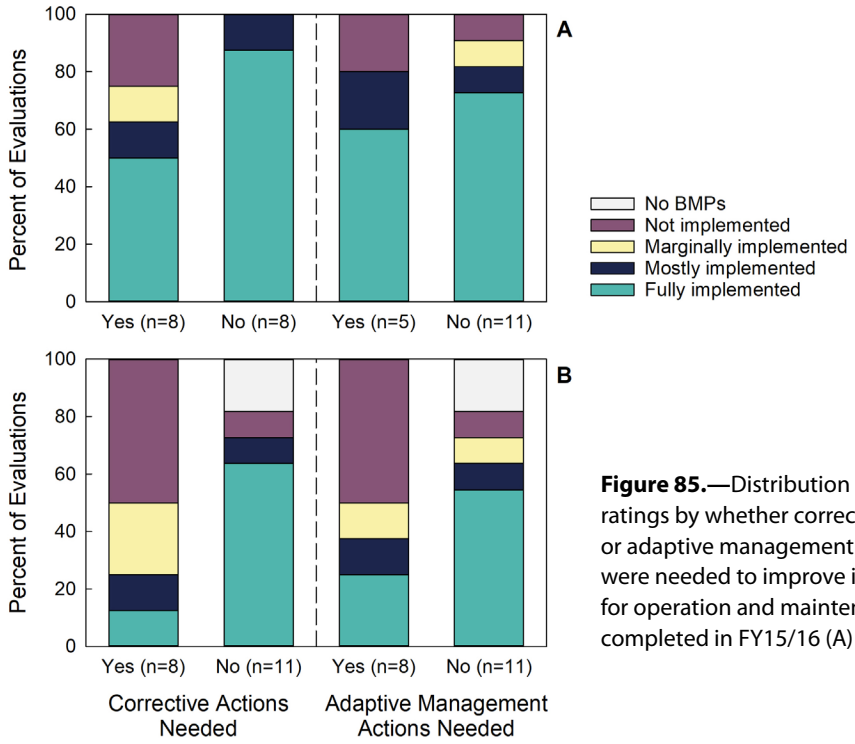



**Figure 85.—**Distribution of implementation ratings by whether corrective actions (Fac C-Q40) or adaptive management actions (Fac C-Q42) were needed to improve implementation for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

implementation ratings and whether corrective actions were needed in FY15/16 (p = 0.43) or between implementation ratings and whether adaptive management actions were needed in either monitoring period (p = 1.00 FY15/16, p = 0.27 FY17/18); however, a significant association was found between ratings and corrective action needs in FY17/18 (p = 0.02). By contrast, three of the four comparisons for effectiveness ratings found significant associations between the ratings and whether actions were needed (corrective actions: p = 0.12 FY15/16, p = 0.03 FY17/18; adaptive management actions: p = 0.08 FY15/16, p = 0.06 FY17/18) (Fig. 86). Better effectiveness ratings are associated with corridors for which no corrective actions were identified as being needed in FY17/18 as well as with corridors that had no adaptive management action needs identified in either monitoring period.

There were evaluations rated as *not implemented* and *not effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. Those individual evaluations reported some type of less-than-optimal performance or condition; therefore, the expected response to at least one of those questions (corrective actions or adaptive management action needs) would have been that some action was needed. These poorer effectiveness

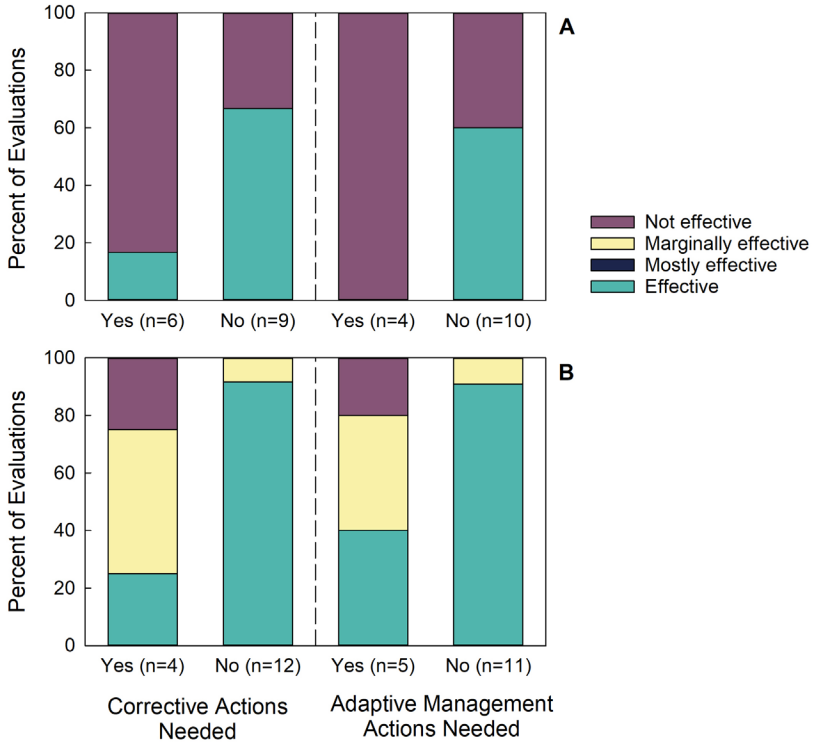



**Figure 86.—**Distribution of effectiveness ratings by whether corrective actions (Fac C-Q55) or adaptive management actions (Fac C-Q57) were needed to improve effectiveness for Fac C operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

ratings may have resulted from chance occurrence (e.g., an extreme event outside of what could be controlled by planning or some type of BMP prescription), but such situations likely would have been applicable to a minority of evaluations. In some instances, the condition that led to an issue may have been unique to this site or considered insignificant, causing the review team to consider corrective or adaptive management actions unnecessary. However, it is possible that the team may have overlooked problems that led to poorer ratings that could have otherwise been identified during consideration of Fac C-Q40, Fac C-Q42, Fac C-Q55, and Fac C-Q57.

## Composite Ratings

Composite rating results for corridors evaluated for both implementation and effectiveness using protocol Fac C (O&M) are given in Table 167. Thirty-one percent of facilities evaluated in FY15/16 had a composite rating of *excellent*, 13 percent were rated as *good*, and 56 percent were rated as *poor*. Sixty-two percent of corridors in FY17/18 had composite ratings of *excellent* or *good*, and 19 percent were rated as *poor*. No significant associations between implementation ratings and effectiveness ratings were found in either monitoring period (p = 0.72 FY15/16, p = 0.22 FY17/18). For the

**Table 167.—**Composite rating matrix for Fac C corridor operation and maintenance evaluated for both implementation and effectiveness in FY15/16 (n=16 evaluations) and FY17/18 (n=16 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 5 | | 1 | 1 | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | 6 | 2 | | 1 | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 6 | 1 | 2 | 1 | 2 |
| | Mostly effective | | | | | |
| | Marginally effective | 1 | | | 2 | |
| | Not effective | | 1 | | | |

Excellent
Good
Fair
Poor
No plan

evaluated corridors, effectiveness does not appear related to factors that control better implementation ratings, such as having O&M plans or BMP guidance documents or even implementing the BMP practices and techniques in those documents. BMP effectiveness was *marginally effective* and *not effective* regardless of the implementation rating for over 40 percent of the corridors. This lack of relationship between implementation and effectiveness does not negate the importance of BMP use on corridors. The sample size involved was small, particularly based on a national scale, and therefore it is too early to make conclusions about the tie between BMP implementation and effectiveness on corridors. In many cases, non-road corridors present some of the most challenging construction and operational situations on NFS lands because they can be quite steep, and their construction often creates soil conditions (e.g., compaction) that are unlike surrounding undisturbed soils. Thus, if effectiveness does not improve as sample sizes increase, development and implementation of BMPs better suited to these challenging conditions will be needed to improve protection of water quality and aquatic resources in the path of corridors.

## Facilities C (O&M): Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings for Fac C O&M were determined from component scores that were described earlier (Tables 110 and 145). Again, when a corridor evaluation did not include a waterbody crossing, the missing component was scored *no waterbody crossing* (Table 145), and that score does not influence the final effectiveness rating. Table 168 shows the distribution of scores across the three

**Table 168.**—Distribution of implementation component scores by component for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=16) | | | | | | | |
| | All | 14 | 87 | 15 | 94 | 12 | 75 |
| | Some[a] | | | 1 | 6 | 4 | 25 |
| | None | 2 | 13 | | | | |
| | No BMPs | | | | | | |
| FY17/18 (n=19) | | | | | | | |
| | All | 14 | 74 | 17 | 89 | 13 | 68 |
| | Some | | | 2 | 11 | 4 | 21 |
| | None | 3 | 16 | | | 2 | 11 |
| | No BMPs | 2 | 11 | | | | |

[a] Score applies only to the on-the-ground execution and project oversight components.

implementation components. Fifty-four percent of the corridors evaluated for operation and maintenance had *all* scores for all three implementation components, which resulted in implementation ratings of *fully implemented* (Table 169). The on-the-ground execution component is very important to the overall implementation rating as can be seen by the three corridors that received a *marginally implemented* rating: even though the planning and project oversight components received *all* or *some* scores, the *marginally implemented* rating resulted because not all the prescribed BMPs were implemented fully (Table 169).

The distribution of scores across the three effectiveness components is summarized in Tables 170 and 171. In FY15/16, 44 percent and 31 percent of the evaluations had *not effective* scores for the waterbody crossing and erosion and sedimentation components, respectively (Table 170). Scores were better for those two components in FY17/18, with only one *not effective* score for the erosion and sedimentation component. Fifty-nine percent of the corridors in both monitoring periods combined had scores of *effective* (or *no waterbody crossing*) for all three components, resulting in an effectiveness rating of *effective* (Table 171). The *not effective* scores for the waterbody crossing and erosion and sedimentation components—primarily in FY15/16—resulted in effectiveness ratings of *not effective* for 10 of the 32 corridors (Table 171) and led to the previously reported bimodal distribution of the effectiveness ratings in FY15/16 (Fig. 79C).

**Table 169.—**Implementation component scores corresponding to the overall implementation ratings for Fac C operation and maintenance evaluations with complete data in FY15/16 and FY17/18. See Table 110 for meaning of implementation component score descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=16) | | | | | |
| | Fully implemented | All | All | All | 11 |
| | Mostly implemented | All | All | Some | 2 |
| | Marginally implemented | All | Some | All | 1 |
| | Not implemented | None | All | Some | 2 |
| | No BMPs | | | | 0 |
| FY17/18 (n=19) | | | | | |
| | Fully implemented | All | All | All | 8 |
| | Mostly implemented | All | All | Some | 2 |
| | Marginally implemented | All | Some | All | 1 |
| | | All | Some | Some | 1 |
| | Not implemented | All | All | None | 2 |
| | | None | All | All | 2 |
| | | None | All | Some | 1 |
| | No BMPs | No BMPs | All | All | 2 |

**Table 170.—**Distribution of effectiveness component scores by component for Fac C operation and maintenance evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Waterbody crossing component (number) | Waterbody crossing component (percent) | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=16) | | | | | | | |
| | Effective | 7 | 44 | 11 | 69 | 16 | 100 |
| | Mostly effective[a] | | | | | | |
| | Moderately effective[b] | | | | | | |
| | Marginally effective[a] | 1 | 6 | | | | |
| | Not effective | 7 | 44 | 5 | 31 | | |
| | No waterbody crossing | 1 | 6 | | | | |
| FY17/18 (n=17) | | | | | | | |
| | Effective | 10 | 59 | 14 | 82 | 17 | 100 |
| | Mostly effective | | | | | | |
| | Moderately effective | | | | | | |
| | Marginally effective | 4 | 24 | 1 | 6 | | |
| | Not effective | | | 1 | 6 | | |
| | No waterbody crossing | 3 | 18 | | | | |
| | Incomplete data[c] | | | 1 | 6 | | |

[a] Score applies only to waterbody crossing and erosion and sedimentation components (see Table 145).
[b] Score applies only to chemical pollutants components (see Table 145).
[c] Some of the questions needed to determine a component score were not answered.

**Table 171.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Fac C operation and maintenance evaluations with complete data in FY15/16 and FY17/18. See Table 145 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Waterbody crossing component | Erosion and sedimentation component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=16) | | | | | |
| | Effective | Effective | Effective | Effective | 7 |
| | Mostly effective | | | | |
| | Marginally effective | | | | |
| | Not effective | No waterbody crossing | Not effective | Effective | 1 |
| | | Marginally effective | Not effective | Effective | 1 |
| | | Not effective | Effective | Effective | 4 |
| | | Not effective | Not effective | Effective | 3 |
| FY17/18 (n=16) | | | | | |
| | Effective | Effective or No waterbody crossing | Effective | Effective | 12 |
| | Mostly effective | | | | 0 |
| | Marginally effective | Marginally effective | Effective | Effective | 2 |
| | | Marginally effective | Marginally effective | Effective | 1 |
| | Not effective | Marginally effective | Not effective | Effective | 1 |

Waterbody crossing and erosion and sedimentation component scores were analyzed to determine if associations existed between either of the component scores and the implementation ratings (Fig. 87). No significant associations were found in either monitoring period (waterbody crossing: p = 0.38 FY15/16, p = 0.27 FY17/18; erosion and sedimentation: p = 1.00 FY15/16, p = 0.30 FY17/18). No association tests were possible for the chemical pollutants component because all corridors scored as *effective* for that component in both monitoring periods (Table 170, Fig. 87). The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 88. No significant associations existed in FY15/16 (planning: p = 1.00, on-the-ground execution: p = 0.44, project oversight: p = 0.58), which was not unexpected given the nearly equal numbers of *effective* and *not effective* ratings (Table 171, Fig. 79B). In FY17/18 there was a significant association between the effectiveness ratings and project oversight component scores (p = 0.06) but not the planning component scores (p = 0.73) or the on-the-ground execution component scores (p = 1.00). BMP effectiveness was better when inspections occurred and corrective actions were taken if needed. Note that

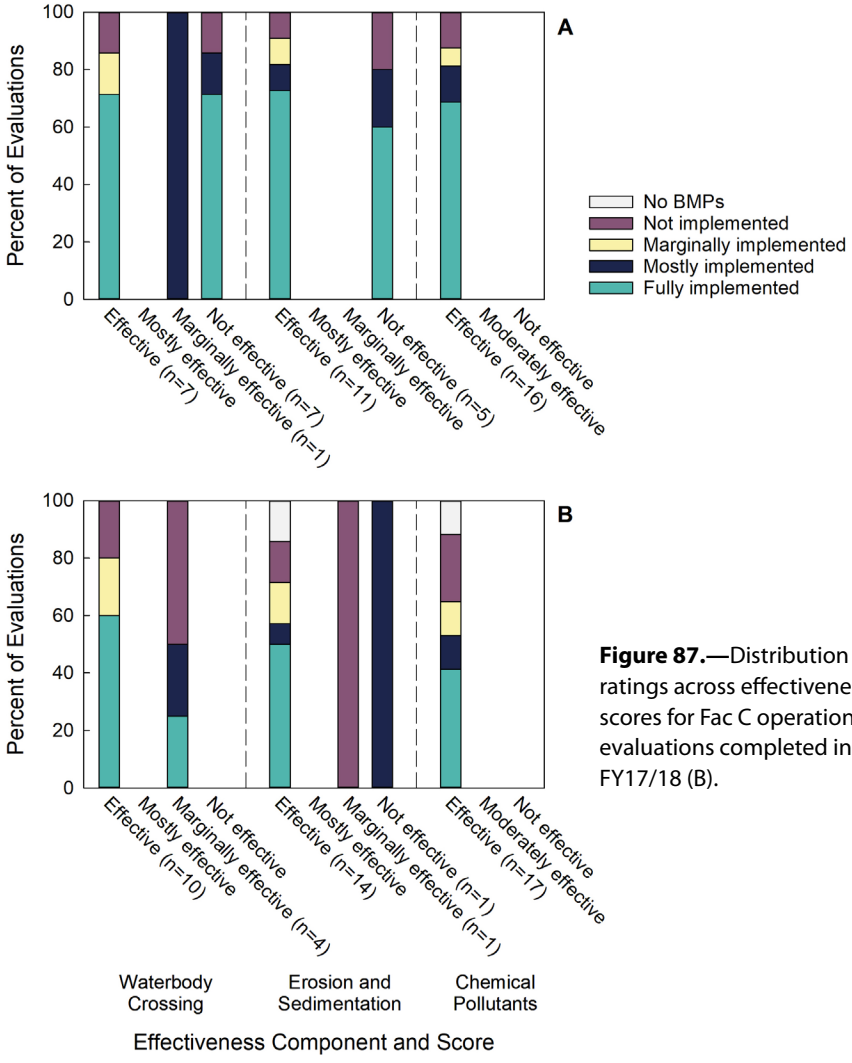



**Figure 87.—**Distribution of implementation ratings across effectiveness component scores for Fac C operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

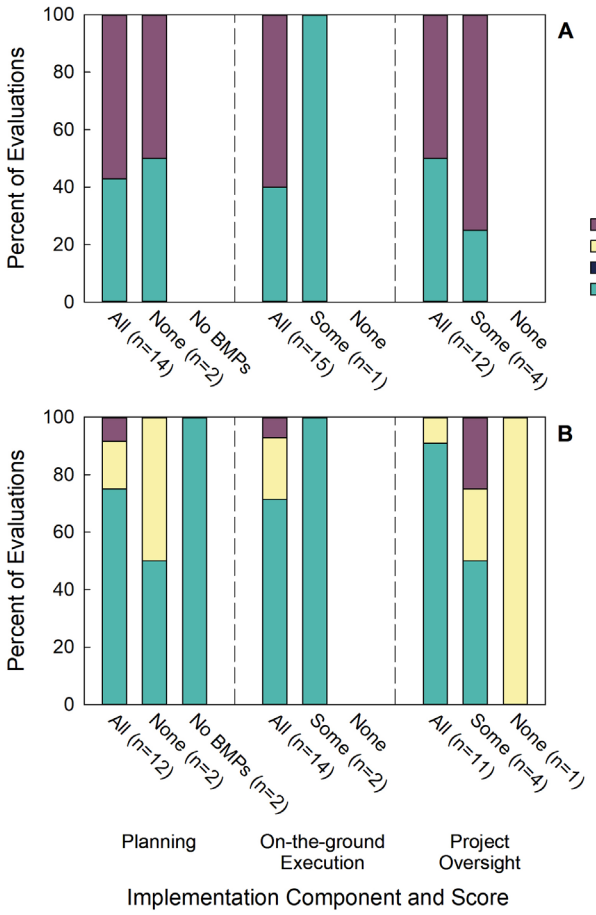



**Figure 88.—**Distribution of effectiveness ratings across implementation component scores for Fac C operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

for all comparisons—implementation and effectiveness—the number of corridors with poorer component scores was often much smaller than the number with better scores (Figs. 87 and 88).

## Facilities C (O&M): Management Implications for Forest Service Resource Managers

BMP implementation in operation and maintenance of corridor facilities evaluated in FY15/16 was found to be better than for corridors evaluated in FY17/18. In FY15/16, fewer than 20 percent of the corridors rated either *marginally implemented*, *not implemented*, or *no BMPs,* while these ratings were given to nearly 50 percent of the implementation evaluations completed in FY17/18. For corridor administration, two of the corridors evaluated lacked an O&M plan or similar guidance documents, and another five had such documents but BMPs were not included. For on-the-ground execution, more than 90 percent of the BMPs were implemented fully when prescribed. Three evaluations noted a deficiency in this implementation component. Project oversight was an observed deficiency in about 29 percent of the evaluations, due primarily to a lack of inspections or lack of inspections at critical times.

Conversely, BMP effectiveness was better at corridors evaluated in FY17/18 than in FY15/16, with 71 and 44 percent of the evaluations rated *effective*, respectively. An *effective*

rating indicates no impacts to water quality were observed. For those corridors rated as *marginally effective* or *not effective*, the deficiencies were mostly erosion at the waterbody crossing (92 percent) and less from the erosion and sedimentation component along the corridor (44 percent). Evidence of erosion was observed at three out of the four waterbody crossings of ephemeral channels; crossings of other waterbody types had a lower percentage of observed erosion. The most common erosion feature at crossings was traceable evidence to a waterbody and changes to waterbody geometry. The most common erosion features on the corridors were rill erosion and vegetation damage or bare ground. The most reported causes of erosion on the corridors were lack of vegetative soil cover and improperly shaped or designed drainage features on access routes.

There were no significant associations found between the implementation ratings and effectiveness ratings, a reflection of the fact that in FY15/16, 69 percent of implementation ratings were *fully implemented* while effectiveness ratings were bimodally distributed (Fig. 79), and in FY17/18 implementation ratings were variable and effectiveness ratings were most often *fully effective* (71 percent). However, a closer look at some BMPs (e.g., ground cover standards) provides evidence that BMPs are more effective when implemented than when they are not. Corridors with either no ground cover standards or ground cover standards that were not met had worse effectiveness ratings than corridors where ground cover standards were met. Of the corridors with no ground cover standards, 33 percent of the evaluations were rated *not effective*, and another 9 percent were rated *marginally effective*. All three corridors where ground cover standards were not met were rated *not effective*, whereas 71 percent of the corridors where ground cover standards were met were rated *effective*.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Ensuring that corridor facilities have an O&M plan or similar document that contains BMP provisions. More than 90 percent of BMP provisions were implemented fully when prescribed.
- Paying special attention to corridor crossings of ephemeral streams. Evidence of erosion was observed at 75 percent of the crossings at ephemeral streams.
- Where appropriate, including BMPs for ground cover and erosion and sediment control in the corridor O&M plans or similar documents. The most frequently reported causes of erosion on the corridors were lack of vegetative ground cover and deficiencies in access route drainage structures.
- Establishing specific ground cover standards for the corridor. When ground cover standards were prescribed and met, better effectiveness was observed.
- Modifying standard BMP prescriptions during the construction of non-road corridors with steep slopes and disturbed (e.g., compacted) soils to increase post-construction BMP effectiveness.
- Identifying opportunities for corrective actions and adaptive management, particularly where BMP implementation may be lacking.

## Facilities C: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Fac C. Completed Construction or Operation and Maintenance of Pipelines, Transmission Lines, or Rights-of-Way**

(Reference BMPs Fac-1, Fac-2, Fac-6, Fac-8, Fac-9, Rec-4, and Road-5)

v3.0 February 2016

| Header | |
|---|---|
| Fac C-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Fac C-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Fac C-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Fac C-Q4 | Date of current field evaluation: |
| Fac C-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac C-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac C-Q7 | Reviewers and titles: |
| Fac C-Q8a | Region number: |
| Fac C-Q8b | State: |
| Fac C-Q9a | Proclaimed Forest or Grassland number and name: |
| Fac C-Q9b | Administrative Forest or Grassland number and name: |
| Fac C-Q10 | District number and name: |
| Fac C-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Fac C-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Fac C-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Fac C-Q12 | 6th level HUC number and name for the subwatershed the corridor segment being evaluated is in: |
| Fac C-Q13 | Is the corridor segment being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Fac C-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Fac C-Q14b | Location.<br><br>Easting: |
| Fac C-Q14c | Location.<br><br>Northing: |
| Fac C-Q15a | Location.<br><br>Latitude: |
| Fac C-Q15b | Location.<br><br>Longitude: |
| Fac C-Q15c | Location.<br><br>Lat/Long Datum: |
| Fac C-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Fac C-Q17 | Forest Service name or identifier for corridor facility: |
| Fac C-Q18 | What type of corridor facility is being evaluated? Select all that apply:<br><br>Buried pipeline<br>Above-ground pipeline<br>Buried power line<br>Above-ground transmission line<br>Other type of non-road right-of-way (specify): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Fac C-Q19 | When was construction of the corridor facility completed; if unknown, when was the original special use permit authorized? |
| Fac C-Q20 | Who is responsible for accomplishing the maintenance? Select one:<br><br>Forest Service personnel<br>Contractor<br>Permittee<br>Other (specify): |
| Fac C-Q21 | Does the corridor segment being evaluated include a waterbody crossing? Select one:<br><br>a. Yes (go to question 23)<br>b. No (go to question 22) |
| Fac C-Q22 | Shortest distance between corridor segment and nearest waterbody (ft, m, mi, or km; specify unit): |
| Fac C-Q23 | What type of waterbody is crossed or is adjacent to the corridor segment? Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| Fac C-Q24 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |
| **Implementation** | |
| Fac C-Q25 | Is the corridor facility less than 2 years old? Select one:<br><br>a. Yes (go to question 26)<br>b. No (go to question 35) |
| Fac C-Q26 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for construction of this corridor? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 28)<br>b. Environmental Impact Statement (EIS) (go to question 27)<br>c. Environmental Assessment (EA) (go to question 27)<br>d. Categorical Exclusion (CE) (go to question 27)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 27) |
| Fac C-Q27 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract, project plan, or permit. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Location/route of corridor<br>Yes/No/Not applicable<br>b. Total length of corridor<br>Yes/No/Not applicable<br>c. Corridor width<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Fac C-Q27 continued*) | d. Other limits on the area of disturbed soil (footings, guy wires, etc.)<br>Yes/No/Not applicable<br>e. Location, design, and construction techniques for corridor access routes<br>Yes/No/Not applicable<br>f. Timing of soil disturbances<br>Yes/No/Not applicable<br>g. Temporary erosion and sediment controls during construction<br>Yes/No/Not applicable<br>h. Permanent erosion and sediment controls following construction<br>Yes/No/Not applicable<br>i. Ground cover requirements<br>Yes/No/Not applicable<br>j. Runoff and drainage controls<br>Yes/No/Not applicable<br>k. Techniques to maintain hill slope stability<br>Yes/No/Not applicable<br>l. Alternative construction techniques and equipment to limit disturbance<br>Yes/No/Not applicable<br>m. Waterbody crossing techniques to limit waterbody disturbance<br>Yes/No/Not applicable<br>n. Control of flow, or water control (e.g., pumping or diversion) during waterbody disturbance<br>Yes/No/Not applicable<br>o. Techniques to prevent or control the spread of aquatic invasive species during construction<br>Yes/No/Not applicable<br>p. Techniques to limit unauthorized use of corridor<br>Yes/No/Not applicable<br>q. Other (specify):<br>Yes/No/Not applicable |
| Fac C-Q28 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract, project plan, or permit were implemented fully. Select one response in each line. If the provision exists in the project contract, plan, or permit and it was implemented fully, select Yes. If the provision exists in the project contract, plan, or permit but it was not implemented fully, select No. If the provision does not exist in the project contract, plan, or permit, select Not applicable.<br><br>a. Location/route of corridor<br>Yes/No/Not applicable<br>b. Total length of corridor<br>Yes/No/Not applicable<br>c. Corridor width<br>Yes/No/Not applicable<br>d. Other limits on the area of disturbed soil (footings, guy wires, etc.)<br>Yes/No/Not applicable<br>e. Location, design, and construction techniques for corridor access routes<br>Yes/No/Not applicable<br>f. Timing of soil disturbances<br>Yes/No/Not applicable<br>g. Temporary erosion and sediment controls during construction<br>Yes/No/Not applicable<br>h. Permanent erosion and sediment controls following construction<br>Yes/No/Not applicable<br>i. Ground cover requirements<br>Yes/No/Not applicable<br>j. Runoff and drainage controls<br>Yes/No/Not applicable<br>k. Techniques to maintain hill slope stability<br>Yes/No/Not applicable<br>l. Alternative construction techniques and equipment to limit disturbance<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Fac C-Q28 continued*) | m. Waterbody crossing techniques to limit waterbody disturbance<br>Yes/No/Not applicable<br>n. Control of flow, or water control (e.g., pumping or diversion) during waterbody disturbance<br>Yes/No/Not applicable<br>o. Techniques to prevent or control the spread of aquatic invasive species during construction<br>Yes/No/Not applicable<br>p. Techniques to limit unauthorized use of corridor<br>Yes/No/Not applicable<br>q. Other provisions specified in question 27q<br>Yes/No/Not applicable<br>r. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient. |
| Fac C-Q29 | Does the corridor have a waterbody crossing that included installation of corridor facility features (pipeline, etc.) through or under the waterbody, or within the waterbody banks? Select one:<br><br>a. Yes (go to question 30)<br>b. No (go to question 31) |
| Fac C-Q30 | What types of erosion control or waterbody stabilizing measures were installed within or around the waterbody crossing during and following active crossing construction to reduce the potential for water contamination or bank, shoreline, or bed damage? Select all that apply:<br><br>a. No erosion control or waterbody stabilizing measures installed<br>b. Straw bales in the waterbody<br>c. Straw bales on the banks or shorelines<br>d. Silt fence on the banks or shorelines<br>e. Wattles, coir dams, filter socks, or other types of sediment barriers or traps on the banks or shorelines<br>f. Riprap or other types of hardening on the banks or shorelines<br>g. Reseeding or other type of revegetation on the banks or shorelines<br>h. Organic mulch applied to the banks or shorelines<br>i. Geotextile ground cover material applied to the banks or shorelines<br>j. Restoration of native waterbody substrate to the bed<br>k. Drilling beneath the waterbody to reduce bed and surface disturbance<br>l. Other (specify): |
| Fac C-Q31 | Was supplemental erosion control applied within the project area? Select one:<br><br>a. Needed and applied<br>b. Needed but not applied<br>c. Not needed<br>If applied, what supplemental erosion control was used? |
| Fac C-Q32 | Were project inspections and/or contract administration during corridor construction performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, work was conducted to avoid critical times<br>c. Yes<br>d. No |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Fac C-Q33 | If problems occurred during corridor construction that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Fac C-Q34 | Were chemical or fuel spills or leaks that occurred during construction activities handled/treated according to the contingency and emergency response plan? Select one; after answering go to question 40:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred during construction<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Fac C-Q35 | Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this corridor contain provisions for protecting water, aquatic, and riparian resources? Select one:<br><br>a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/ riparian protection (go to question 36)<br>b. Plan, SUP, or other O&M guidance documents exist for this corridor, but they do not contain provisions for water/aquatic/riparian protection (go to question 37)<br>c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this corridor (go to question 37) |
| Fac C-Q36 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below, that were included in the operation and maintenance plan, SUP, or other O&M guidance documents, were implemented fully during the past 5 years. Select one response in each line. If the provision exists in the operation and maintenance plan, SUP, or other guidance documents and it was implemented fully, select Yes. If the provision exists in the operation and maintenance plan, SUP, or other guidance documents but it was not implemented fully, select No. If the provision does not exist in the operation and maintenance plan, SUP, or other guidance documents, or if circumstances that would have triggered the need for implementation of the provision have not yet occurred, select Not applicable.<br><br>a. Specification of corridor inspection frequency<br>Yes/No/Not applicable<br>b. Erosion control on access routes on corridor<br>Yes/No/Not applicable<br>c. Drainage features on corridor (not on access routes)<br>Yes/No/Not applicable<br>d. Non-vegetative ground cover requirements<br>Yes/No/Not applicable<br>e. Vegetative ground cover requirements<br>Yes/No/Not applicable<br>f. Techniques to prevent or control spread of aquatic invasive species during maintenance<br>Yes/No/Not applicable<br>g. Techniques for corridor maintenance to limit the potential for waterbody contamination<br>Yes/No/Not applicable<br>h. Techniques to limit unauthorized use of corridor<br>Yes/No/Not applicable<br>i. Inspection of corridor to detect leaks from pipelines, transformers, etc. in corridor<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Fac C-Q36 continued*) | j. Repair of leaks, breaks, etc. of pipelines, transformers, and other corridor structures<br>Yes/No/Not applicable<br>k. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Fac C-Q37 | Were inspections during the past 5 years performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, maintenance was conducted to avoid critical times<br>c. Yes<br>d. No |
| Fac C-Q38 | If problems occurred during corridor operation or maintenance during the past 5 years that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Fac C-Q39 | Were chemical or fuel spills or leaks that occurred on the corridor during the past 5 years (excluding the construction period if it occurred within the past 5 years) handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred during past 5 years<br>c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Fac C-Q40 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 41)<br>b. No (go to question 42) |
| Fac C-Q41 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Fac C-Q42 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 43)<br>b. No (go to question 44 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Fac C-Q43 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 44 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |

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| Effectiveness | |
|---|---|
| Fac C-Q44 | Is there evidence of bank or shoreline erosion, or changes to waterbody morphology or substrate characteristics within the corridor waterbody crossing that is attributable to the existence of the crossing? Select one:<br><br>a. Not applicable, no waterbody crossing in the corridor (go to question 46)<br>b. Yes (go to question 45)<br>c. No (go to question 46) |
| Fac C-Q45 | What evidence of bank or shoreline erosion, or changes to waterbody morphology or substrate characteristics exists within the corridor waterbody crossing that is attributable to the existence of the corridor? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Fac C-Q46 | Is there evidence of erosion or sedimentation on or originating from the evaluated corridor segment at locations other than the banks or shorelines of the waterbody crossing? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of erosion or sedimentation (go to question 51)<br>b. Evidence of erosion or sedimentation outside an AMZ (go to question 48)<br>c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 48)<br>d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 47) |
| Fac C-Q47 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 49:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Fac C-Q48 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

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| **Effectiveness** (*continued*) | |
|---|---|
| Fac C-Q49 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 46, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Fac C-Q50 | What are the causes? Select all that apply:<br><br>a. Lack of drainage features or structures on access routes on corridor<br>b. Improper or inadequate spacing of drainage structures on access routes on corridor<br>c. Improperly shaped or designed drainage features on access routes on corridor<br>d. Improper or inadequate maintenance of access routes on corridor<br>e. Poor location of access routes on corridor<br>f. Inadequate energy dissipation or armoring of drainage outlets on access routes on corridor<br>g. Unauthorized use of the corridor, or unauthorized use of access routes on corridor<br>h. Lack of any drainage features or structures on corridor (excludes access routes)<br>i. Improper or inadequate spacing of drainage structures on corridor (excludes access routes)<br>j. Improperly shaped or designed drainage features on corridor (excludes access routes)<br>k. Improper or inadequate maintenance of corridor drainage features (excludes access routes)<br>l. Lack of, or improper or inadequate maintenance of corridor (excluding drainage features)<br>m. Inadequate energy dissipation or armoring of outlets for corridor drainage (excludes access routes)<br>n. Lack of vegetative soil cover<br>o. Ineffective non-vegetative soil cover<br>p. Ineffective mechanical/physical soil stabilization<br>q. Poor construction techniques<br>r. Other (specify):<br>s. Unknown |
| Fac C-Q51 | Have ground cover standards been met for the segment of corridor being evaluated? Select one:<br><br>a. Not applicable, no ground cover standards for this corridor<br>b. Yes<br>c. No |

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| **Effectiveness** *(continued)* | |
|---|---|
| Fac C-Q52 | What evidence of chemical or fuel spills or leaks or associated waste containers exists on or extends from the corridor segment being reviewed?<br>Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of equipment-associated chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of equipment-associated chemical or fuel spills or leaks within an AMZ<br>d. Evidence of equipment-associated chemical or fuel spills or leaks in a waterbody<br>e. Evidence of pipeline or transmission facility leak outside an AMZ<br>f. Evidence of pipeline or transmission facility leak within an AMZ<br>g. Evidence of pipeline or transmission facility leak in a waterbody<br>h. Evidence of chemical or fuel waste containers outside an AMZ<br>i. Evidence of chemical or fuel waste containers within an AMZ<br>j. Evidence of chemical or fuel waste containers in a waterbody |
| Fac C-Q53 | Is there evidence that the construction, maintenance, or presence of the corridor have contributed to the introduction or spread of aquatic invasive species?<br>Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Fac C-Q54 | If project inspections during construction or during the past 5 years (for operation and maintenance) were not conducted at critical times, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were performed at critical times, or activities were conducted to avoid critical times<br>b. Yes<br>c. No |
| Fac C-Q55 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 56)<br>b. No (go to question 57) |
| Fac C-Q56 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Fac C-Q57 | Are any adaptive management actions needed to improve effectiveness?<br>Select one:<br><br>a. Yes (go to question 58)<br>b. No (go to General Comments) |
| Fac C-Q58 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies.<br>Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Facilities D—Completed Facility Reclamation

## Facilities D: Descriptive Statistics

The Fac D protocol evaluates completed reclamation of facilities (i.e., locations where facilities once existed), including corridor facilities (e.g., pipelines and transmission lines, but excluding roads and trails) and noncorridor facilities (e.g., buildings, impoundments, and towers). The types of facilities that can be evaluated using Fac D are broad. Four reclaimed facilities were evaluated during the FY15/16 monitoring period and seven during FY17/18. Because facilities reclamation is not common, it is not surprising that the number of evaluations is small. Both implementation and effectiveness reviews were completed for each evaluation (Table 172), and implementation and effectiveness for all projects were evaluated on the same day. All Fac D evaluations were performed to meet National BMP targets (Fac D-Q11a), and project review also was selected as a reason for monitoring for most evaluations in FY17/18 (Table 173).

Table 172.—Number of Fac D evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Fac D-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | | | | |
| | 2 | | | | |
| | 3 | | | | |
| | 4 | | | | |
| | 5 | | | | |
| | 6 | | | | |
| | 8 | 1 | | | 1 |
| | 9 | 2 | | | 2 |
| | 10 | 1 | | | 1 |
| | All | 4 | | | 4 |
| | Percent | | 0 | 0 | 100 |
| FY17/18 | | | | | |
| | 1 | 3 | | | 3 |
| | 2 | | | | |
| | 3 | | | | |
| | 4 | | | | |
| | 5 | | | | |
| | 6 | 1 | | | 1 |
| | 8 | 1 | | | 1 |
| | 9 | 2 | | | 2 |
| | 10 | | | | |
| | All | 7 | | | 7 |
| | Percent | | 0 | 0 | 100 |

The types of original facilities that were reclaimed are listed in Table 174. Three of the reclaimed facilities evaluated during FY17/18 were corridor facilities. Four facilities were originally operated through special use authorization, and the others were owned or administered by the Forest Service (Table 174). Three of the reclamation projects were located at least partially within aquatic management zones (AMZs), and the waterbody closest to two other projects had no designated AMZ. The waterbody types nearest to each of the reclamation projects included an ephemeral stream, intermittent streams (4), perennial streams or rivers (3), wetlands or wet meadows (2), and a lake. The mean length of the perimeter (i.e., perimeter transect; Fac D-Q23) around the evaluated reclaimed areas was approximately 670 feet in FY15/16 and 430 feet in FY17/18 (two FY17/18 evaluations did not answer Fac D-Q23), and the average area disturbed by reclamation activities (Fac D-Q24) was approximately 0.4 acre and 0.7 acre in FY15/16 and FY17/18, respectively. All the reclamation projects had planning documents containing BMPs, either EAs (4 projects), CEs (2 projects) or other BMP guidance documents (5 projects).

**Table 173.—**Number of Fac D evaluations completed in FY15/16 (n=4 evaluations) and FY17/18 (n=7 evaluations), by reason for monitoring (Fac D-Q11a). Multiple selections were possible.

| Reason for monitoring | FY15/16 | FY17/18 |
|---|---|---|
| National BMP targets | 4 | 7 |
| Land management plan monitoring | 1 | 1 |
| Project review | 0 | 6 |
| Quality assurance | 0 | 0 |
| Other | 0 | 0 |

**Table 174.—**Type of facility reclaimed (Fac D-Q19) for Fac D evaluations completed in FY15/16 and FY17/18, by region. Unless otherwise noted, all were facilities owned by the Forest Service.

| Monitoring period | Region | Facility type |
|---|---|---|
| FY15/16 | | |
| | 8 | Guard station |
| | 9 | Abandoned army bunkers (five) |
| | | Special use code 111-115 (Privately owned improvements authorized for groups) |
| | 10 | Recreation cabin |
| FY17/18 | | |
| | 1 | Stock dam (corridor) |
| | | Pipeline (Special use) |
| | | Oil storage tank battery (Special use) |
| | 6 | Well house and other infrastructure |
| | 8 | Special use (Electric cooperative project) |
| | 9 | Recreation campground |
| | | Abandoned army bunker |

## Facilities D: Ratings and Component Scores

The overall implementation and effectiveness ratings were determined from component scores. The implementation components and effectiveness components for Fac D are the same as those for Fac C (Tables 110 and 145). Although BMPs were developed for all the projects, for one reclamation project no BMPs were carried into the project contract or plan in FY15/16, which resulted in a planning component score of *none* for that project (Table 175). For the five projects scored as *some* for the planning component, an average of 26 percent of BMP provisions from planning were not included in the project contract or plan. Not all the questions needed to develop a score for the on-the-ground execution component were answered for one evaluation in FY15/16, so it received an incomplete data designation (Table 175), and no implementation rating could be assigned. Two projects scored as *some* for the on-the-ground execution component because all BMPs in one applicable provision

**Table 175.—**Distribution of implementation component scores by component for Fac D evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=4) | | | | | | | |
| | All | 1 | 25 | 3 | 75 | 3 | 75 |
| | Some | 2 | 50 | | | 1 | 25 |
| | None | 1 | 25 | | | | |
| | No BMPs | | | | | | |
| | Incomplete data[a] | | | 1 | 25 | | |
| FY17/18 (n=7) | | | | | | | |
| | All | 4 | 57 | 5 | 71 | 7 | 100 |
| | Some | 3 | 43 | 2 | 29 | | |
| | None | | | | | | |
| | No BMPs | | | | | | |

[a] Some of the questions needed to determine a component score were not answered.

per project were not implemented fully. Five reclamation projects received a *fully implemented* rating by having only *all* component scores (Table 176). The project that had a *none* score for the planning component necessarily received a *not implemented* rating.

Three evaluations in FY17/18 were of reclaimed corridor facilities, and two of those included a waterbody crossing. The effectiveness waterbody crossing component score for both was *effective* (Table 177). The scores for the erosion and sedimentation effectiveness component for all but one project were *effective*, as were all but one of the scores for the chemical pollutants component (Table 177). The corridor reclamation project with the *marginally effective* score for the erosion and sedimentation component had evidence of erosion or sedimentation outside an AMZ that originated from the reclaimed corridor. One project had evidence of a chemical or fuel container in a waterbody, which resulted in the chemical pollutants component score of *not effective* (Table 177). That score also resulted in an effectiveness rating of *not effective* for that project (Table 178). The consistent component scores of *effective* for most of the other projects resulted in ratings of *effective*.

The composite ratings for the projects with complete data were *excellent* (60 percent), *good* (30 percent), and *fair* (10 percent) (Table 179). While BMPs from planning were not carried into the contract or plan for the project in FY15/16 with an implementation rating of *not implemented* (Table 179), the *effective* rating probably is explained by the scope of the project. An area of less than 200 square feet was disturbed during reclamation of a small cabin outside an AMZ (Fac D-Q22) 240 feet from the nearest waterbody (Fac D-Q20).

**Table 176.—**Implementation component scores corresponding to the overall implementation ratings for Fac D evaluations with complete data in FY15/16 and FY17/18. See Table 110 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=3) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | Some | All | All | 1 |
| | Marginally implemented | | | | 0 |
| | Not implemented | None | All | Some | 1 |
| | No BMPs | | | | 0 |
| FY17/18 (n=7) | | | | | |
| | Fully implemented | All | All | All | 4 |
| | Mostly implemented | Some | All | All | 1 |
| | Marginally implemented | Some | Some | All | 2 |
| | Not implemented | | | | 0 |
| | No BMPs | | | | 0 |

**Table 177.—**Distribution of effectiveness component scores by component for Fac D evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Waterbody crossing[a] component (number) | Waterbody crossing[a] component (percent) | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=4) | | | | | | | |
| | Effective | | | 4 | 100 | 3 | 75 |
| | Mostly effective[b] | | | | | | |
| | Moderately effective[c] | | | | | | |
| | Marginally effective[b] | | | | | | |
| | Not effective | | | | | 1 | 25 |
| | No waterbody crossing | | | | | | |
| FY17/18 (n=7) | | | | | | | |
| | Effective | 2 | 67 | 6 | 86 | 7 | 100 |
| | Mostly effective | | | | | | |
| | Moderately effective | | | | | | |
| | Marginally effective | | | 1 | 14 | | |
| | Not effective | | | | | | |
| | No waterbody crossing | 1 | 33 | | | | |

[a] Waterbody crossing component applies only to corridor facility reclamation projects.
[b] Score applies only to erosion and sedimentation component (see Table 145).
[c] Score applies only to chemical pollutants component (see Table 145).

**Table 178.**—Effectiveness component scores corresponding to the overall effectiveness ratings for Fac D evaluations with complete data in FY15/16 and FY17/18. See Table 145 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Waterbody crossing[a] component | Erosion and sedimentation component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=4) | | | | | |
| | Effective | Not applicable | Effective | Effective | 3 |
| | Mostly effective | | | | 0 |
| | Marginally effective | | | | 0 |
| | Not effective | Not applicable | Effective | Not effective | 1 |
| FY17/18 (n=7) | | | | | |
| | Effective | Effective or No waterbody crossing | Effective | Effective | 2 |
| | | Not applicable | Effective | Effective | 4 |
| | Mostly effective | | | | 0 |
| | Marginally effective | Effective | Marginally effective | Effective | 1 |
| | Not effective | | | | 0 |

[a] Waterbody crossing component applies only to corridor facility reclamation projects.

**Table 179.**—Composite rating matrix for Fac D projects evaluated for both implementation and effectiveness in FY15/16 (n=3 evaluations) and FY17/18 (n=7 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 1 | 1 | | 1 | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 3 | 1 | 2 | | |
| | Mostly effective | | | | | |
| | Marginally effective | 1 | | | | |
| | Not effective | | | | | |

Excellent
Good
Fair
Poor
No plan

## Facilities D: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Fac D. Completed Facility Reclamation**

(Reference BMPs Fac-1, Fac-5, Fac-6, Fac-8, Fac-10, and WatUses-6)

v3.0 February 2016

| Header | |
|---|---|
| Fac D-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Fac D-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Fac D-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Fac D-Q4 | Date of current field evaluation: |
| Fac D-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac D-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Fac D-Q7 | Reviewers and titles: |
| Fac D-Q8a | Region number: |
| Fac D-Q8b | State: |
| Fac D-Q9a | Proclaimed Forest or Grassland number and name: |
| Fac D-Q9b | Administrative Forest or Grassland number and name: |
| Fac D-Q10 | District number and name: |
| Fac D-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Fac D-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

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| **Header** (*continued*) | |
|---|---|
| Fac D-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Fac D-Q12 | 6th level HUC number and name for the subwatershed this site is in: |
| Fac D-Q13 | Is any part of the reclamation activities being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Fac D-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Fac D-Q14b | Location.<br><br>Easting: |
| Fac D-Q14c | Location.<br><br>Northing: |
| Fac D-Q15a | Location.<br><br>Latitude: |
| Fac D-Q15b | Location.<br><br>Longitude: |
| Fac D-Q15c | Location.<br><br>Lat/Long Datum: |
| Fac D-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Fac D-Q17 | Name of facility or special use permit prior to reclamation: |
| Fac D-Q18 | When was the reclamation completed? |

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| **Header** (*continued*) | |
|---|---|
| Fac D-Q19 | Type of facility that was reclaimed. Select one:<br><br>Forest Service office building<br>Guard station<br>Fire station<br>Visitor center<br>Other Forest Service facility (specify type):<br>Other type of facility operated by special use permit (specify code):<br>Energy or water pipeline<br>Transmission power line<br>Other type of corridor (specify): |
| Fac D-Q20 | Distance between site and nearest waterbody (ft, m, mi, or km; specify unit): |
| Fac D-Q21 | Type of waterbody nearest to the site. Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| Fac D-Q22 | Is any part of the reclaimed area located within an AMZ? Select one:<br><br>a. Yes<br>b. No<br>c. Waterbody has no designated AMZ |
| Fac D-Q23 | Length of the transect around perimeter of the site (ft, m, mi, or km; specify unit): |
| Fac D-Q24 | Provide an estimate of the total area disturbed by reclamation activities ($ft^2$, $m^2$, ac, or ha; specify unit): |
| **Implementation** | |
| Fac D-Q25 | Was there an approved erosion control plan for this reclamation project? Select one:<br><br>a. Yes<br>b. No |
| Fac D-Q26 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this reclamation project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 28)<br>b. Environmental Impact Statement (EIS) (go to question 27)<br>c. Environmental Assessment (EA) (go to question 27)<br>d. Categorical Exclusion (CE) (go to question 27)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 27) |

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| **Implementation** (*continued*) | |
|---|---|
| Fac D-Q27 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the project contract or project plan. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Timing and scheduling of reclamation operations<br>Yes/No/Not applicable<br>b. Sampling/testing to identify chemicals or hazardous materials (includes fuels, reactive chemicals, other chemicals)<br>Yes/No/Not applicable<br>c. Removal of hazardous materials (includes chemicals, metals, fuels, human waste, etc.)<br>Yes/No/Not applicable<br>d. Installation of water control/drainage measures<br>Yes/No/Not applicable<br>e. Installation of other erosion control<br>Yes/No/Not applicable<br>f. Installation of water diversion and conveyance<br>Yes/No/Not applicable<br>g. Control of aquatic invasive species<br>Yes/No/Not applicable<br>h. Location of activities (e.g., consideration of sensitive features)<br>Yes/No/Not applicable<br>i. Areal extent of activities<br>Yes/No/Not applicable<br>j. Requirements/specifications for facility, material, and equipment removal (includes septic system)<br>Yes/No/Not applicable<br>k. Restoration of contour<br>Yes/No/Not applicable<br>l. Physical stability of project components (design slopes, factor of safety)<br>Yes/No/Not applicable<br>m. Topsoil/growth medium testing and amelioration (includes mulching, fertilizing, liming, inoculation)<br>Yes/No/Not applicable<br>n. Seedbed preparation<br>Yes/No/Not applicable<br>o. Re-establishment of nurse crop or final vegetation communities (includes selecting and obtaining appropriate seed sources)<br>Yes/No/Not applicable<br>p. Installation of non-vegetative soil or ground cover<br>Yes/No/Not applicable<br>q. Re-establishment of stream channels, wetlands, floodplains, streambanks, or shorelines<br>Yes/No/Not applicable<br>r. Re-establishment/rehabilitation of aquatic habitat (includes wood placement and replacement of stream substrate)<br>Yes/No/Not applicable<br>s. Off-site mitigation<br>Yes/No/Not applicable<br>t. Physical restrictions to site by humans, domestic animals, and/or wildlife to protect reclamation (includes fencing, physical blockage of access, etc.)<br>Yes/No/Not applicable<br>u. Monitoring requirements (during or following reclamation)<br>Yes/No/Not applicable<br>v. Operation and/or maintenance requirements for long-term function (e.g., diversions, passive or active water treatment facilities, engineered facilities that remain on site, etc.)<br>Yes/No/Not applicable<br>*(continued)* |

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| **Implementation** (*continued*) | |
|---|---|
| (*Fac D-Q27 continued*) | w. Plugging drill holes or water wells<br>Yes/No/Not applicable<br>x. Plugging pipelines or water lines<br>Yes/No/Not applicable<br>y. Other (specify):<br>Yes/No/Not applicable |
| Fac D-Q28 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or project plan were implemented fully. Select one response in each line. If the provision exists in the project contract or plan and it was implemented fully, select Yes. If the provision exists in the project contract or plan, or permit but it was not implemented fully, select No. If the provision does not exist in the project contract or plan, select Not applicable.<br><br>a. Timing and scheduling of reclamation operations<br>Yes/No/Not applicable<br>b. Sampling/testing to identify chemicals or hazardous materials (includes fuels, reactive chemicals, other chemicals)<br>Yes/No/Not applicable<br>c. Removal of hazardous materials (includes chemicals, metals, fuels, human waste, etc.)<br>Yes/No/Not applicable<br>d. Installation of water control/drainage measures<br>Yes/No/Not applicable<br>e. Installation of other erosion control<br>Yes/No/Not applicable<br>f. Installation of water diversion and conveyance<br>Yes/No/Not applicable<br>g. Control of aquatic invasive species<br>Yes/No/Not applicable<br>h. Location of activities (e.g., consideration of sensitive features)<br>Yes/No/Not applicable<br>i. Areal extent of activities<br>Yes/No/Not applicable<br>j. Requirements/specifications for facility, material, and equipment removal (includes septic system)<br>Yes/No/Not applicable<br>k. Restoration of contour<br>Yes/No/Not applicable<br>l. Physical stability of project components (design slopes, factor of safety)<br>Yes/No/Not applicable<br>m. Topsoil/growth medium testing and amelioration (includes mulching, fertilizing, liming, inoculation)<br>Yes/No/Not applicable<br>n. Seedbed preparation<br>Yes/No/Not applicable<br>o. Re-establishment of nurse crop or final vegetation communities (includes selecting and obtaining appropriate seed sources)<br>Yes/No/Not applicable<br>p. Installation of non-vegetative soil or ground cover<br>Yes/No/Not applicable<br>q. Re-establishment of stream channels, wetlands, floodplains, streambanks, or shorelines<br>Yes/No/Not applicable<br>r. Re-establishment/rehabilitation of aquatic habitat (includes wood placement and replacement of stream substrate)<br>Yes/No/Not applicable<br>s. Off-site mitigation<br>Yes/No/Not applicable<br>t. Physical restrictions to site by humans, domestic animals, and/or wildlife to protect reclamation (includes fencing, physical blockage of access, etc.)<br>Yes/No/Not applicable<br>u. Monitoring requirements (during or following reclamation)<br>Yes/No/Not applicable<br>*(continued)* |

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| **Implementation** (*continued*) | |
|---|---|
| (*Fac D-Q28 continued*)) | v. Operation and/or maintenance requirements for long-term function (e.g., diversions, passive or active water treatment facilities, engineered facilities that remain on site, etc.)<br>Yes/No/Not applicable<br>w. Plugging drill holes or water wells<br>Yes/No/Not applicable<br>x. Plugging pipelines or water lines<br>Yes/No/Not applicable<br>y. Other provisions specified in question 27y<br>Yes/No/Not applicable<br>z. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Fac D-Q29 | Was supplemental erosion control applied within the project area? Select one:<br><br>a. Needed and applied<br>b. Needed but not applied<br>c. Not needed<br>If applied, what supplemental erosion control was used? |
| Fac D-Q30 | Were project inspections and/or contract administration during reclamation performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, reclamation operations were conducted to avoid critical times<br>c. Yes<br>d. No |
| Fac D-Q31 | If problems occurred during reclamation that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Fac D-Q32 | Were chemical or fuel spills or leaks that occurred during reclamation activities handled/treated according to the contingency and emergency response plan? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan<br>b. Not applicable, no spills or leaks occurred during reclamation<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan |
| Fac D-Q33 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 34)<br>b. No (go to question 35) |
| Fac D-Q34 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Fac D-Q35 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 36)<br>b. No (go to question 37 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |

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| | |
|---|---|
| **Implementation** (*continued*) | |
| Fac D-Q36 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 37 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Fac D-Q37 | Are you evaluating reclamation of a corridor?<br><br>a. Yes (go to question 38)<br>b. No (go to question 45) |
| Fac D-Q38 | Is there evidence of bank or shoreline erosion, or changes to waterbody morphology or substrate characteristics within the corridor waterbody crossing that is attributable to the reclamation activities? Select one:<br><br>a. Not applicable, no waterbody crossing in the reclaimed corridor (go to question 40)<br>b. Yes (go to question 39)<br>c. No (go to question 40) |
| Fac D-Q39 | What evidence of bank or shoreline erosion, or changes to waterbody morphology or substrate characteristics exists within the reclaimed corridor waterbody crossing that is attributable to the reclamation activities? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Fac D-Q40 | Is there evidence of erosion or sedimentation on or originating from the reclaimed corridor segment at locations other than the banks or shorelines of the waterbody crossing? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of erosion or sedimentation (go to question 52)<br>b. Evidence of erosion or sedimentation outside an AMZ (go to question 42)<br>c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 42)<br>d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 41) |
| Fac D-Q41 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 43:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |

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| **Effectiveness** (*continued*) | |
|---|---|
| Fac D-Q42 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |
| Fac D-Q43 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 40, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Fac D-Q44 | What are the causes? Select all that apply; after answering go to question 52:<br><br>a. Lack of or insufficient drainage features or structures on reclaimed corridor<br>b. Improper or inadequate spacing of drainage structures on reclaimed corridor<br>c. Improperly shaped or designed drainage features on reclaimed on corridor<br>d. Inadequate energy dissipation or armoring of drainage on reclaimed corridor<br>e. Inadequate or improper maintenance of retained water control features<br>f. Soil compaction<br>g. Lack of or insufficient vegetative soil cover<br>h. Ineffective non-vegetative soil cover<br>i. Ineffective mechanical/physical soil stabilization<br>j. Mechanical additions of sediment to waterbody during reclamation<br>k. Site access to humans was not sufficiently controlled<br>l. Site access to domestic animals or wildlife was not sufficiently controlled<br>m. Reclamation performed outside of allowable time periods<br>n. Reclamation performed outside of allowable soil conditions<br>o. Reclamation performed within the approved operating plan<br>p. Reclamation performed outside of approved operating plan<br>q. Poor reclamation techniques<br>r. Did not anticipate effects<br>s. Other (specify):<br>t. Unknown |
| Fac D-Q45 | Is there evidence of erosion or sedimentation from reclamation? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of erosion or sedimentation (go to question 52)<br>b. Evidence of erosion or sedimentation outside an AMZ (go to question 47)<br>c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 47)<br>d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 46) |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Fac D-Q46 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 48:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Fac D-Q47 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |
| Fac D-Q48 | What type of waterbody has experienced morphological changes, or has received sediment inputs, or will receive inputs if sediment transport or erosion worsens? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Fac D-Q49 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |
| Fac D-Q50 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 45, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |

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| **Effectiveness** (*continued*) | |
|---|---|
| Fac D-Q51 | What are the causes? Select all that apply:<br><br>a. Poor location for activity that was being reclaimed<br>b. Slope shape and/or gradient<br>c. Instability due to inadequate design, construction, or maintenance after restoration<br>d. Lack of, or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, mulch, etc.)<br>e. No water or insufficient number of water control or storage features installed<br>f. Improperly designed water control or storage features<br>g. Improperly constructed water control or storage features<br>h. Inadequate or improper maintenance of water control or storage features<br>i. Reclamation performed outside of allowable time periods<br>j. Reclamation performed outside of allowable soil conditions<br>k. Reclamation performed within the approved operating plan<br>l. Reclamation performed outside of approved operating plan<br>m. Soil compaction<br>n. Mechanical additions of sediment to waterbody during reclamation<br>o. Site access to humans was not sufficiently controlled<br>p. Site access to domestic animals or wildlife was not sufficiently controlled<br>q. Did not anticipate effects<br>r. Other (specify):<br>s. Unknown |
| Fac D-Q52 | Have ground cover standards been met for the reclaimed area? Select one:<br><br>a. Not applicable, no ground cover standards specified for the reclamation project<br>b. Yes<br>c. No |
| Fac D-Q53 | What evidence of chemical or fuel spills or leaks or associated waste containers or other hazardous wastes exists in the reclaimed area? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers, or other hazardous wastes<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody<br>h. Evidence of other hazardous wastes outside an AMZ<br>i. Evidence of other hazardous wastes within an AMZ<br>j. Evidence of other hazardous wastes in a waterbody |
| Fac D-Q54 | Is there evidence that aquatic invasive species have been introduced or their presence was expanded in or along the waterbodies by reclamation activities? Select one:<br><br>a. Yes<br>b. No<br>If Yes, list the invasive species observed: |
| Fac D-Q55 | If project inspections were not conducted at critical times during reclamation, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times<br>b. Yes<br>c. No |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Fac D-Q56 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 57)<br>b. No (go to question 58) |
| Fac D-Q57 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Fac D-Q58 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 59)<br>b. No (go to General Comments) |
| Fac D-Q59 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

## Facilities and Nonrecreation Special Uses Summary

Facilities protocols were some of the least frequently used National BMP monitoring protocols in the FY15/16 and FY17/18 monitoring periods. A total of 120 evaluations completed (Table 104) represents about 4 percent of all evaluations completed in these two monitoring periods. Each region completed at least eight evaluations using a facilities protocol; Region 6 (26 evaluations) and Region 8 (20 evaluations) completed the most, and Region 1, Region 3, and Region 10 completed the fewest (8 evaluations each). The most frequently used facilities protocols were Fac B and Fac C to evaluate operation and maintenance of noncorridor and corridor facilities, respectively. Seventy-four percent of those evaluations were randomly selected (Table 104). Except for Fac C (O&M) implementation evaluations in FY15/16, there were no differences in either implementation ratings or effectiveness ratings between randomly and nonrandomly selected sites for both Fac B and Fac C (O&M) protocols (Fig. 55).

The facilities protocols evaluate a broad range of types of facilities in all phases of construction, operation, and reclamation, which can make it difficult to generalize the results. The projects or sites in the construction or reclamation phase had better implementation ratings than existing sites evaluated for operation and maintenance. About 70 percent of the implementation evaluations completed with protocols Fac A, Fac C (completed construction), and Fac D were rated *fully implemented* or *mostly implemented*, and fewer than 10 percent were rated *not implemented* or *no BMPs*. Conversely, for sites evaluated with protocols Fac B or Fac C (O&M), 37 and 65 percent, respectively, were rated *fully implemented* or *mostly implemented*, and more than 25 percent were rated *not implemented* or *no BMPs*. These findings may reflect the fact that construction projects are generally conducted via contracts that have had a recent

planning effort (e.g., NEPA document), and existing facilities are managed with operation and maintenance documents that may not have been updated recently. Considering BMP effectiveness, more than 82 percent of the effectiveness evaluations of sites involving construction or operation of noncorridor facilities (Fac A and Fac B) and facility reclamation (Fac D) were rated *effective* or *mostly effective*. For corridor facilities evaluated with Fac C, 50 percent and 59 percent of effectiveness evaluations of construction or operation and maintenance, respectively, were rated *effective* or *mostly effective*. As noted in the text, non-road corridors are often constructed in steep difficult terrain, which may be contributing to the poorer effectiveness ratings.

For projects in which both the implementation and effectiveness evaluations were completed, relationships between BMP implementation and BMP effectiveness can be explored. For the facility evaluations completed in FY15/16 and FY17/18, small sample sizes and the generally high effectiveness ratings across all the implementation rating categories can make it difficult to conclude that any relationship between BMP implementation and effectiveness exists at the evaluated sites.

## Overall Program Observations

In addition to analyzing the monitoring data for insights on BMP implementation and effectiveness, the data also are assessed to identify issues with application of the BMP monitoring program. Examination of the data for facilities protocols indicate that reading the protocol instructions and completing the monitoring forms more carefully may improve data quality. Specific issues identified are as follows:

- National BMP program direction calls for sites to be evaluated for both BMP implementation and effectiveness, with implementation evaluated first even if both are evaluated on the same day. A number of Fac A, Fac B, and Fac C evaluations included implementation only or effectiveness only with no corresponding effectiveness or implementation evaluation in the database. While subsequent corresponding effectiveness evaluations for the completed implementation-only evaluations may occur in a later monitoring period, it's important to note cases where an implementation evaluation did not occur prior to an effectiveness-only evaluation. Paired implementation and effectiveness evaluations at the same site are important to determine whether BMPs are effective when implemented correctly.
- Three Fac B, one Fac C and one Fac D evaluations were incomplete in the database. Evaluations with incomplete data in the database cannot be rated.
- Incorrect answers were provided for header questions 11a, b, and c, which are designed to capture information about the reasons for monitoring and ask whether the projects or sites were selected randomly according to the protocol instructions and whether the protocol instructions for completing the evaluations were followed. In several facility evaluations, these questions were not answered according to the instructions. The most common mistake was misunderstanding the intended meaning of quality assurance monitoring.

- Inconsistent answers given for related questions in the implementation sections and effectiveness sections of the protocols can make it difficult to interpret the relationship between BMP implementation and BMP effectiveness. In all protocols, a pair of questions (Fac B-Q45 and Fac B-Q67; Fac C-Q37 and Fac C-Q54) ask about inspections at critical times (implementation) and a lack of inspections leading to observed problems (effectiveness). For each of the paired sets of questions, a number of evaluations provided an answer to the effectiveness question that was in direct conflict with the answer previously given for the implementation question.

As additional data from other protocols are analyzed and more monitoring using these protocols is completed in future monitoring periods, these issues can be tracked. Additional instruction and training can help reduce the likelihood of them recurring.

# MINERALS MANAGEMENT

Minerals management BMPs are used to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from various mineral exploration, development, operation, and reclamation activities. In general, the Forest Service's objective for managing mineral and energy resources on NFS lands is to encourage and facilitate the orderly exploration, development, and production of those resources in a manner that is environmentally sound and integrated with the management of other national forest or grassland resources (USDA Forest Service 2012a). In addition, NFS lands disturbed by mineral activities are to be reclaimed for other productive uses. The extent to which the Forest Service has the authority to regulate mineral operations and require measures to avoid, minimize, mitigate, and reclaim surface disturbance varies with the mineral commodity in question and the status of the land containing the mineral. Thus, various types of written documents specific to the type of mineral and ownership of the mineral rights are used to authorize or approve minerals activity on NFS lands. An authorizing instrument may be a locatable mineral plan of operations, leasable mineral lease, oil and gas surface plan of operations, mineral material contract and pit plan, negotiated operating conditions for a private mineral operation, and so on.

Minerals management results are described separately by protocol: active construction of mineral exploration sites and predevelopment activities (nonplacer mining) (Min A), active nonplacer mineral operations (Min B), placer mining operations (Min C), and reclamation of mineral operations (Min D). The history of the minerals management protocols is somewhat unique to the other protocols. Revisions to the FY15/16 protocols were delayed and became available for use by field units several months into FY15. Consequently, some of the early FY15/16 Min B evaluations (11 implementation and 10 effectiveness evaluations) were completed using the 2013 version of the protocols. The changes consisted primarily of the addition of questions or answer choices within questions to make them more consistent with most other monitoring protocols (i.e., across all resource areas). To glean the maximum amount of information from the data available at this time, evaluations completed using the 2013 protocol versions are included in this report wherever possible. However, the evaluations completed using the 2013 protocol versions are often missing data needed to determine some component scores and final ratings.

The evaluations in FY15/16 for Min B are dominated by randomly selected samples, and Min A, Min C, and Min D have equal or nearly equal numbers of randomly and nonrandomly selected samples (Table 180). At least 70 percent of evaluations for each protocol in FY17/18 were selected randomly. Implementation and effectiveness rating distributions for Min B and Min D—the two protocols with datasets large enough for detailed analysis—are shown by site selection method in Figure 89. Statistical comparisons—Fisher's exact test of association for two categorical variables with $\alpha = 0.10$—of the implementation ratings and effectiveness ratings resulting from randomly and nonrandomly selected samples showed one significant association between the ratings and sample selection for Min B (implementation: $p = 0.46$ FY15/16, $p = 0.06$ FY17/18; effectiveness: $p = 0.64$ FY15/16, $p = 1.00$ FY17/18). In FY17/18 slightly

better implementation ratings occurred for nonrandomly selected projects compared to randomly selected projects (Fig. 89). However, because Min B had only three nonrandomly selected projects during that period, all Min B samples are combined for analysis. No significant associations were found for Min A (implementation: p = 1.00 FY15/16, no test FY17/18; effectiveness: p = 1.00 FY15/16, no test FY17/18), Min C (implementation: p = 1.00 FY15/16, p = 0.45 FY17/18; effectiveness: p = 0.33 FY15/16, p = 0.13 FY17/18), or Min D (implementation: p = 1.00 both periods; effectiveness: p = 1.00 both periods). Min A and Min C summaries and Min D analyses all include both randomly and nonrandomly selected projects or sites.

**Table 180.—**Number of randomly and nonrandomly selected Min A (Active Construction of Mineral Exploration Sites and Predevelopment Activities (Nonplacer Mining)), Min B (Active Nonplacer Mineral Operations), Min C (Placer Mining Operations), and Min D (Reclamation of Mineral Operations) evaluations, by monitoring period and region (Min A-Q11b, Min B-Q11b, Min C-Q11b, Min D-Q11b)

| Monitoring period | Region | Min A random selection | Min A nonrandom selection | Min B random selection | Min B nonrandom selection | Min C random selection | Min C nonrandom selection | Min D random selection | Min D nonrandom selection |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| | 1 | | | 4 | | | 1 | 2 | 2 |
| | 2 | | | 1 | 4 | 1 | | 2 | 1 |
| | 3 | | | 2 | | | 1 | 2 | 1 |
| | 4 | | 1 | 4 | 1 | | | 1 | 1 |
| | 5 | 1 | | 1 | | | | | |
| | 6 | 1 | | 2 | 1 | 2 | 1 | | 2 |
| | 8 | | | 4 | | | | 2 | |
| | 9 | 1 | | 4 | 4 | | | | |
| | 10 | | 1 | 1 | | | | | |
| | Total | 3 | 2 | 23 | 10 | 3 | 3 | 9 | 7 |
| | Percent within protocol | 60 | 40 | 70 | 30 | 50 | 50 | 56 | 44 |
| FY17/18 | | | | | | | | | |
| | 1 | | | | 1 | 1 | | | |
| | 2 | 2 | | 1 | | 2 | | 3 | |
| | 3 | | | 2 | | 1 | | 1 | 2 |
| | 4 | | | 1 | | | 1 | 2 | 1 |
| | 5 | | | | 1 | | | | |
| | 6 | 2 | | | 1 | 5 | | 1 | |
| | 8 | | | 1 | | | | 3 | |
| | 9 | | | 10 | | | | | |
| | 10 | | | | | 1 | 3 | 1 | |
| | Total | 4 | 0 | 15 | 3 | 10 | 4 | 11 | 3 |
| | Percent within protocol | 100 | | 83 | 17 | 71 | 29 | 79 | 21 |

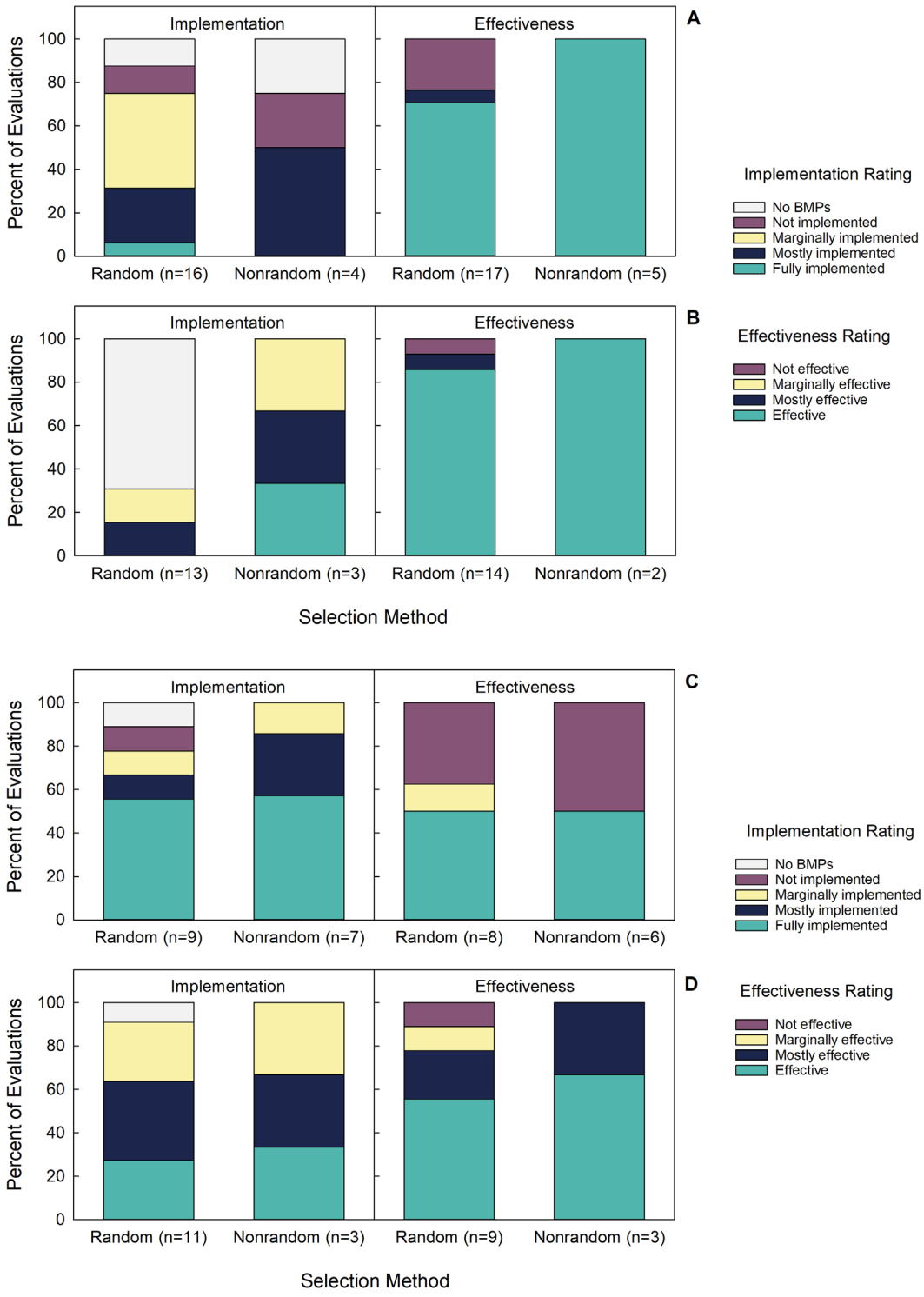



**Figure 89.—**Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Min B evaluations completed in FY15/16 (A) and FY17/18 (B) and Min D evaluations completed in FY15/16 (C) and FY17/18 (D).

Results for the Min B and Min D evaluations are divided into six sections; each builds on the next in terms of data interpretation. The sections and descriptions are as follows:

1. Header statistics—mostly descriptive statistics from the header section of the evaluation form, including location, composition, and types of projects.
2. Implementation results and their tie to header information—results from the implementation questions with ties to header information when appropriate.
3. Effectiveness results and their tie to implementation results and header information—results from the effectiveness questions with ties to implementation and sometimes header information to provide context between outcomes and BMP planning and prescription and between outcomes and physical site conditions.
4. Ratings and their tie to header, implementation, and effectiveness results—description of the implementation, effectiveness, and composite ratings with ties to individual questions on the respective evaluation form.
5. Component and subcomponent scores—in-depth examination of the component and subcomponent (when applicable) scores and the resulting implementation and effectiveness ratings.

Although the fourth and fifth sections involve examination of the overall ratings, they are split into two individual sections for convenience of the reader. Users who are more interested in the final implementation and effectiveness ratings and their association with individual protocol questions can focus on the fourth section, while those interested in more fully understanding the influence of different components and subcomponents on the scoring routines and the final ratings can focus on the fifth section.

6. Management implications—summary of the important findings in the preceding sections and suggestions for how these findings can be used to improve BMP implementation and effectiveness in the types of projects or activities evaluated by the protocol.

Because the number of implementation and effectiveness evaluations is less than 10 in one or both monitoring periods for Min A and Min C, the analyses are not divided into the six sections used for the other Min protocols. Instead a much less detailed presentation of results is provided. The analyses in Min A and Min C focus primarily on summarizing the descriptive data (header information) and the ratings and component scores.

The large number of analyses included in this report provide an in-depth examination into the types of queries and information that can be obtained from monitoring protocol data. Some queries will provide more useful information than others to users. In some cases, small sample sizes within answer choices also may limit the usefulness of the corresponding results, a deficiency that will diminish as monitoring continues. The Fisher's exact test of association for categorical data was used for many analyses because the test remains valid when limited sample sizes occur in at least some answer choices. However, corresponding sample sizes are reported in tables and figures to provide the reader another metric for interpreting the results in addition to the statistical probabilities.

# Minerals A—Active Construction of Mineral Exploration Sites and Predevelopment Activities (Nonplacer Mining)

## Minerals A: Descriptive Statistics

Six Forest Service regions evaluated nine Min A projects in both monitoring periods combined (Table 181). Implementation and effectiveness monitoring were completed for five projects (Table 181), and each had both reviews completed on the same day. Of the evaluated Min A projects, 78 percent were selected randomly (Table 180). All Min A evaluations were noted as being performed to meet National BMP targets (Min A-Q11a), and five reported one additional reason (Table 182). Five evaluations of federally owned minerals and four of nonfederally owned minerals were completed (Table 183); the latter were all locatable or salable minerals or oil/gas operations.

**Table 181.**—Number of Min A evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Min A-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | | | | |
| | 2 | | | | |
| | 3 | | | | |
| | 4 | 1 | | | 1 |
| | 5 | 1 | 1 | | |
| | 6 | 1 | | | 1 |
| | 8 | | | | |
| | 9 | 1 | | | 1 |
| | 10 | 1 | | | 1 |
| | All | 5 | 1 | | 4 |
| | Percent | | 20 | | 80 |
| FY17/18 | | | | | |
| | 1 | | | | |
| | 2 | 2 | 1 | 1 | |
| | 3 | | | | |
| | 4 | | | | |
| | 5 | | | | |
| | 6 | 2 | 1 | | 1 |
| | 8 | | | | |
| | 9 | | | | |
| | 10 | | | | |
| | All | 4 | 2 | 1 | 1 |
| | Percent | | 50 | 25 | 25 |

**Table 182.**—Number of Min A evaluations completed in FY15/16 (n=5 evaluations) and FY17/18 (n=4 evaluations), by reason for monitoring (Min A-Q11a). Multiple selections were possible.

| Reason for monitoring | FY15/16 | FY17/18 |
|---|---|---|
| National BMP targets | 5 | 4 |
| Land management plan monitoring | 2 | 0 |
| Project review | 1 | 2 |
| Quality assurance | 0 | 0 |
| Other | 0 | 0 |

**Table 183.—**Type of mineral operation evaluated (Min A-Q17) for Min A evaluations completed in FY15/16 and FY17/18, by ownership of mineral rights (Min A-Q18)

| Type of operation | FY15/16 Federal ownership | FY15/16 Nonfederal ownership | FY17/18 Federal ownership | FY17/18 Nonfederal ownership |
|---|---|---|---|---|
| Locatable[a] | 1 | 1 | 0 | 1 |
| Salable[b] | 1 | 1 | 1 | 0 |
| Oil/Gas | 0 | 1 | 2 | 0 |
| Geothermal | 0 | 0 | 0 | 0 |
| Solid leasable | 0 | 0 | 0 | 0 |

[a] Includes hardrock minerals mined and processed for metals plus some nonmetallic substances, such as feldspar and gypsum.

[b] Includes common minerals such as sand, gravel, cinders, common building stone, boulders, and flagstone.

The intent of the Min A protocol is to evaluate projects that are within 300 feet of a waterbody (i.e., ground-disturbing activities are within 300 feet); however, other projects may be evaluated if none on the administrative unit are within that distance. Five projects in both periods combined were within 300 feet of a waterbody, with an average distance of approximately 140 feet to a waterbody. The remaining four projects were 500 to 1,600 feet from a waterbody and averaged approximately 800 feet to a waterbody. Six projects were outside an AMZ, and the other three were at least partially within an AMZ. Four of the nearest waterbodies in FY15/16 were perennial streams or rivers, and one was an intermittent stream. Four different waterbody types were adjacent to projects in FY17/18: ephemeral, intermittent and perennial streams, and a pond. The area disturbed at the time of the evaluation was four to eight acres for five projects and one acre or less for three projects.

## Minerals A: Ratings and Component Scores

The overall implementation and effectiveness ratings were determined from component, and sometimes, subcomponent scores. All Min A evaluations were completed using the 2015 version of the protocol and could be scored and rated if the data were complete. The implementation rating components and their interpretations for all Min protocols are given in Table 184. The effectiveness components for Min A are described in Table 185. BMPs were developed for four Min A projects in FY15/16 and three projects in FY17/18, but none were considered during project planning for one project in FY15/16. The latter resulted in a planning component score of *no BMPs* (Table 186). The implementation component that consistently scored best was the on-the-ground execution component, with seven projects having *all* scores (Table 186). The project oversight component score of *none* in FY15/16 (Table 186) was due to needed corrective actions identified during project implementation not being undertaken (Table 184).

**Table 184.—**Implementation components, scores, and interpretation of each score for all Min protocols. Component scores are used to determine the overall implementation ratings.

| Implementation component | Component score | Score interpretation |
|---|---|---|
| Planning | All | All BMPs developed during planning were included in the project authorizing instrument |
| | Some | Some BMPs developed during planning were included in the project authorizing instrument, but at least one was not |
| | None | BMPs were developed during planning but they were not carried into the project authorizing instrument **or** documents containing BMPs were referenced during planning but BMPs were not included in the planning documents |
| | No BMPs | No BMPs were considered for the project during planning |
| On-the-ground execution | All | All BMPs included in the project authorizing instrument were implemented fully |
| | Some | Some of the BMPs included in the project authorizing instrument were implemented fully, but at least one was not |
| | None | None of the BMPs included in the project authorizing instrument were implemented fully |
| Project oversight | All | All necessary corrective actions identified during project implementation were implemented |
| | Some | Some, but not all, necessary corrective actions identified during project implementation were implemented |
| | None | No necessary corrective actions identified during project implementation were implemented |

**Table 185.—**Effectiveness components, scores, and interpretation of each score for Min A and Min B. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Erosion and sedimentation | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Hazardous substances and leachate | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Trash and waste | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |
| Chemical pollutants | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |

**Table 186.—**Distribution of implementation component scores by component for Min A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=5) | | | | | | | |
| | All | 3 | 60 | 4 | 80 | 2 | 40 |
| | Some | 1 | 20 | 1 | 20 | 2 | 40 |
| | None | | | | | 1 | 20 |
| | No BMPs | 1 | 20 | | | | |
| FY17/18 (n=3) | | | | | | | |
| | All | 2 | 67 | 3 | 100 | 2 | 67 |
| | Some | 1 | 33 | | | 1 | 33 |
| | None | | | | | | |
| | No BMPs | | | | | | |

The implementation ratings ranged from *fully implemented* to *no BMPs* (Table 187). The *not implemented* rating was a project for which only a portion of the prescribed BMPs were implemented fully and needed corrective actions were not applied (Table 187). The *all* on-the-ground implementation component score occurred for the evaluation that had a *no BMPs* planning component score (Table 187); that combination is possible only if BMPs that were implemented on the ground were included in standard authorizing instrument language since no BMPs came from planning.

The effectiveness results for Min A were better than the implementation results. One effectiveness evaluation had a component score of *not effective* (Table 188). The erosion and sedimentation component had a *not effective* score because evidence of both uncontrolled erosion or sedimentation and changes to waterbody morphology were observed in a waterbody at five or more places. That component score resulted in an effectiveness rating of *not effective* (Table 189). The composite ratings for the five projects for which both implementation and effectiveness reviews were completed are shown in Table 190.

**Table 187.—**Implementation component scores corresponding to the overall implementation ratings for Min A evaluations with complete data in FY15/16 and FY17/18. See Table 184 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=5) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 1 |
| | Marginally implemented | | | | 0 |
| | Not implemented | All | Some | None | 1 |
| | No BMPs | No BMPs | All | Some | 1 |
| FY17/18 (n=3) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 1 |
| | Marginally implemented | | | | 0 |
| | Not implemented | | | | 0 |
| | No BMPs | | | | 0 |

**Table 188.—**Distribution of effectiveness component scores by component for Min A evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Hazardous materials and leachate component (number) | Hazardous materials and leachate component (percent) | Trash and waste component (number) | Trash and waste component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 (n=4) | | | | | | | | | |
| | Effective | 3 | 75 | 4 | 100 | 4 | 100 | 4 | 100 |
| | Mostly effective[a] | | | | | | | | |
| | Moderately effective[b] | | | | | | | | |
| | Marginally effective[a] | | | | | | | | |
| | Not effective | 1 | 25 | | | | | | |
| FY17/18 (n=2) | | | | | | | | | |
| | Effective | 2 | 100 | 1 | 50 | 1 | 50 | 1 | 50 |
| | Mostly effective | | | | | | | | |
| | Moderately effective | | | | | | | | |
| | Marginally effective | | | | | | | | |
| | Not effective | | | | | | | | |
| | Incomplete data[c] | | | 1 | 50 | 1 | 50 | 1 | 50 |

[a] Score applies only to erosion and sedimentation and hazardous materials and leachate components (see Table 185).

[b] Score applies only to trash and waste and chemical pollutants components (see Table 185).

[c] Some of the questions needed to determine a component score were not answered.

**Table 189.**—Effectiveness component scores corresponding to the overall effectiveness ratings for Min A evaluations with complete data in FY15/16 and FY17/18. See Table 185 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Erosion and sedimentation component | Hazardous materials and leachate component | Trash and waste component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|---|
| FY15/16 (n=4) | | | | | | |
| | Effective | Effective | Effective | Effective | Effective | 3 |
| | Mostly effective | | | | | 0 |
| | Marginally effective | | | | | 0 |
| | Not effective | Not effective | Effective | Effective | Effective | 1 |
| FY17/18 (n=1) | | | | | | |
| | Effective | Effective | Effective | Effective | Effective | 1 |
| | Mostly effective | | | | | 0 |
| | Marginally effective | | | | | 0 |
| | Not effective | | | | | 0 |

**Table 190.**—Composite rating matrix for Min A projects evaluated for both implementation and effectiveness in FY15/16 (n=4 evaluations) and FY17/18 (n=1 evaluation). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 1 | 2 | | | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | 1 | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | | 1 | | | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | | | |

Excellent
Good
Fair
Poor
No plan

## Minerals A: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Min A. Active Construction of Mineral Exploration Sites and Pre-Development Activities (Non-Placer Mining)**

(Reference BMPs Min-1, Min-2, Min-6, Min-7, Fac-2, Fac-3, Fac-4, Fac-5, Fac-6, Road-4, Road-5, Road-9 and Road-10)

v3.0 February 2016

| Header | |
|---|---|
| Min A-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Min A-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Min A-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Min A-Q4 | Date of current field evaluation: |
| Min A-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Min A-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Min A-Q7 | Reviewers and titles: |
| Min A-Q8a | Region number: |
| Min A-Q8b | State: |
| Min A-Q9a | Proclaimed Forest or Grassland number and name: |
| Min A-Q9b | Administrative Forest or Grassland number and name: |
| Min A-Q10 | District number and name: |
| Min A-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Min A-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min A-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Min A-Q12 | 6th level HUC number and name for the subwatershed this mineral construction project is in: |
| Min A-Q13 | Is any part of the area being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Min A-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Min A-Q14b | Location.<br><br>Easting: |
| Min A-Q14c | Location.<br><br>Northing: |
| Min A-Q15a | Location.<br><br>Latitude: |
| Min A-Q15b | Location.<br><br>Longitude: |
| Min A-Q15c | Location.<br><br>Lat/Long Datum: |
| Min A-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Min A-Q17 | Type of mineral operation. Select one:<br><br>Locatable<br>Salable<br>Oil/Gas<br>Geothermal<br>Solid Leasable (Coal, Phosphate, Hard Rock Leasable)<br>Other (specify): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min A-Q18 | Ownership of the mineral rights. Select one:<br><br>Federal<br>Non-federal |
| Min A-Q19 | Name of mineral construction site: |
| Min A-Q20 | Which of these features is currently part of the construction area?<br>Select all that apply:<br><br>a. Testing/Exploration<br>1. Geophysical activities<br>2. Trenching<br>3. Drilling<br>4. Other excavations<br><br>b. Access and Linear Features<br>1. Roads<br>2. Overland vehicle travel<br>3. Waterbody crossings<br>4. Aircraft pads or runways<br>5. Conveyors<br><br>c. Service Areas and Facilities<br>1. Staging areas<br>2. Storage areas<br>3. Parking areas<br>4. Equipment service areas<br>5. Laboratories<br>6. Administrative offices<br>7. Material processing/extraction test areas<br>8. Power generation<br>9. Shafts, milling, or impoundments<br>10. Other support facilities<br><br>d. Exploration or Production of Drill Sites<br>1. Stockpiles<br>2. Drilling circulation pits<br>3. Drill cuttings storage/disposal<br><br>e. Excavation<br>1. Quarry or borrow area<br>2. Underground mine<br>3. Surface mine<br>4. Solution mining wells, pumps, or pipelines<br><br>f. Fresh Water Diversion, Use, and Storage<br>1. Drafting or diversions<br>2. Water production wells<br>3. Ponds, pits, or other storage facilities<br>4. Dewatering<br><br>g. Chemical and Materials Storage<br>1. Oils, fuels, grease, or coolants<br>2. Drilling additives<br>3. Laboratory chemicals<br>4. Mineral processing chemicals<br><br>h. Chemical and Materials Disposal<br>1. Waste oil, fuel, grease, or coolants<br>2. Batteries or tires<br>3. Laboratory waste<br>4. Used mineral processing chemicals<br><br>*(continued)* |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| (*Min A-Q20 continued*) | i. Reactive Materials<br>1. Surface exposures (cuts, pit walls, shafts, adits, etc.)<br>2. Reactive waste rock<br>3. Reactive ores<br>j. Stockpiles<br>1. Topsoil or subsoil<br>2. Non-reactive waste rock<br>3. Non-reactive ore<br>k. Occupancy<br>1. Residences/barracks or security facilities<br>2. Human waste facilities<br>3. Refuse disposal<br>4. Other uses<br>l. Monitoring<br>1. Surface water monitoring<br>2. Groundwater monitoring<br>3. Stability monitoring<br>m. Other (specify): |
| Min A-Q21 | Provide a brief description of the activities ongoing at the time of this review. |
| Min A-Q22 | Approximate size of the area of disturbance (ac or ha; specify unit): |
| Min A-Q23 | Date mineral construction or pre-development activities began: |
| Min A-Q24 | Distance from construction area to nearest waterbody (ft, m, mi, or km; specify unit): |
| Min A-Q25 | Type of waterbody nearest to the mineral site being constructed. Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| Min A-Q26 | Is any part of this site located within an AMZ? Select one:<br><br>a. Yes<br>b. No<br>c. Waterbody has no designated AMZ |
| **Implementation** | |
| Min A-Q27 | Is there an approved erosion control plan for this mineral construction project? Select one:<br><br>a. Yes<br>b. No |
| Min A-Q28 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 30)<br>b. Environmental Impact Statement (EIS) (go to question 29)<br>c. Environmental Assessment (EA) (go to question 29)<br>d. Categorical Exclusion (CE) (go to question 29)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 29) |

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| **Implementation** (*continued*) | |
|---|---|
| Min A-Q29 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the authorizing instrument. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Erosion and sediment control measures (includes soil cover, sediment considerations, etc.)<br>Yes/No/Not applicable<br>b. Storage of topsoil, subsoil, growth media, and waste rock<br>Yes/No/Not applicable<br>c. Limits on vegetation disturbance<br>Yes/No/Not applicable<br>d. Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads)<br>Yes/No/Not applicable<br>e. Controls for limiting the introduction or spread of aquatic invasive species<br>Yes/No/Not applicable<br>f. Location of activities (e.g., avoiding waterbodies or sensitive features)<br>Yes/No/Not applicable<br>g. Areal extent of activities<br>Yes/No/Not applicable<br>h. Timing and scheduling of operations (e.g., soil wetness)<br>Yes/No/Not applicable<br>i. Transport, storage, use, and disposal of chemicals<br>Yes/No/Not applicable<br>j. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc.<br>Yes/No/Not applicable<br>k. Controls for managing drilling fluids, additives, cuttings, and waste<br>Yes/No/Not applicable<br>l. Controls for managing laboratories<br>Yes/No/Not applicable<br>m. Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining)<br>Yes/No/Not applicable<br>n. Provisions concerning consumptive use of water<br>Yes/No/Not applicable<br>o. Storage and disposal of reactive geologic materials<br>Yes/No/Not applicable<br>p. Water diversions, conveyance, and storage of storm water<br>Yes/No/Not applicable<br>q. Equipment service, storage, and maintenance areas<br>Yes/No/Not applicable<br>r. Trash and human sanitary waste management<br>Yes/No/Not applicable<br>s. Groundwater, surface water or stability monitoring<br>Yes/No/Not applicable<br>t. Well and borehole abandonment<br>Yes/No/Not applicable<br>u. Other (specify):<br>Yes/No/Not applicable |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Min A-Q30 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the authorizing instrument were implemented fully. Select one response in each line. If the provision exists in the authorizing instrument and it was implemented fully, select Yes. If the provision exists in the authorizing instrument but it was not implemented fully, select No. If the provision does not exist in the authorizing instrument, or if is too early in the construction period for the provision to have been implemented at the time of evaluation, select Not applicable.<br><br>a. Erosion and sediment control measures (includes soil cover, sediment considerations, etc.)<br>Yes/No/Not applicable<br>b. Storage of topsoil, subsoil, growth media, and waste rock<br>Yes/No/Not applicable<br>c. Limits on vegetation disturbance<br>Yes/No/Not applicable<br>d. Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads)<br>Yes/No/Not applicable<br>e. Controls for limiting the introduction or spread of aquatic invasive species<br>Yes/No/Not applicable<br>f. Location of activities (e.g., avoiding waterbodies or sensitive features)<br>Yes/No/Not applicable<br>g. Areal extent of activities<br>Yes/No/Not applicable<br>h. Timing and scheduling of operations (e.g., soil wetness)<br>Yes/No/Not applicable<br>i. Transport, storage, use, and disposal of chemicals<br>Yes/No/Not applicable<br>j. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc.<br>Yes/No/Not applicable<br>k. Controls for managing drilling fluids, additives, cuttings, and waste<br>Yes/No/Not applicable<br>l. Controls for managing laboratories<br>Yes/No/Not applicable<br>m. Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining)<br>Yes/No/Not applicable<br>n. Provisions concerning consumptive use of water<br>Yes/No/Not applicable<br>o. Storage and disposal of reactive geologic materials<br>Yes/No/Not applicable<br>p. Water diversions, conveyance, and storage of storm water<br>Yes/No/Not applicable<br>q. Equipment service, storage, and maintenance areas<br>Yes/No/Not applicable<br>r. Trash and human sanitary waste management<br>Yes/No/Not applicable<br>s. Groundwater, surface water or stability monitoring<br>Yes/No/Not applicable<br>t. Well and borehole abandonment<br>Yes/No/Not applicable<br>u. Other provisions specified in question 29u<br>Yes/No/Not applicable<br>v. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Min A-Q31 | Were project inspections during construction activities performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, construction activities were conducted to avoid critical times<br>c. Yes<br>d. No |
| Min A-Q32 | If problems occurred during construction activities that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Min A-Q33 | Were chemical or fuel spills or leaks that occurred during construction activities handled/treated according to the spill prevention plan in the authorizing instrument or another agency's requirements? Select one:<br><br>a. There is no spill prevention plan in the authorizing instrument and there are no outside agency requirements that apply<br>b. Not applicable, no spills or leaks occurred during construction activities<br>c. Yes, reported spills or leaks were handled/treated according to the spill prevention plan or other applicable outside agency requirements<br>d. No, spills or leaks were not handled/treated according to the spill prevention plan or other applicable outside agency requirements |
| Min A-Q34 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 35)<br>b. No (go to question 36) |
| Min A-Q35 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Min A-Q36 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 37)<br>b. No (go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Min A-Q37 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 38 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Min A-Q38 | Is there evidence of uncontrolled erosion or sedimentation on or originating from the construction site? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of uncontrolled erosion or sedimentation (go to question 46)<br>b. Evidence of uncontrolled erosion or sedimentation outside an AMZ (go to question 40)<br>c. Evidence of uncontrolled erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 40)<br>d. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 39) |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min A-Q39 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 41:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min A-Q40 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |
| Min A-Q41 | What type of waterbody has experienced morphological changes, or has received sediment inputs, or will receive inputs if sediment transport or erosion worsens? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min A-Q42 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |
| Min A-Q43 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 38, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min A-Q44 | What are the sources? Select all that apply:<br><br>a. Cleared area<br>b. Excavated area<br>c. Stockpiles or soil storage area<br>d. Water facilities (storage areas, drafting facilities, diversions, etc.)<br>e. Equipment service area<br>f. Temporary access route<br>g. Temporary staging or parking area<br>h. Occupancy or administrative area<br>i. Other (specify): |
| Min A-Q45 | What are the causes? Select all that apply:<br><br>a. Poor location for activity or feature<br>b. Slope shape and/or gradient<br>c. Instability due to inadequate design, construction, or maintenance<br>d. Lack of or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, etc.)<br>e. No or insufficient number of erosion control, water control, or water storage features installed<br>f. Improperly designed erosion control, water control, or water or sediment storage features<br>g. Improperly constructed erosion control, water control, or water or sediment storage features<br>h. Inadequate or improper maintenance of erosion control, water control, or water or sediment storage features<br>i. Operating outside of allowable time periods or soil conditions<br>j. Overland vehicle travel<br>k. Soil compaction<br>l. Mechanical additions<br>m. Human error<br>n. Did not anticipate effects<br>o. Other (specify):<br>p. Unknown |
| Min A-Q46 | Is there evidence of hazardous substances or associated leachates on or originating from the construction site? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of hazardous substances or associated leachates (go to question 54)<br>b. Evidence of hazardous substances or associated leachates outside an AMZ (go to question 48)<br>c. Evidence of hazardous substances or associated leachates within an AMZ, but not reaching a waterbody (go to question 48)<br>d. Evidence of hazardous substance or associated leachate transport to or deposition in a waterbody (go to question 47) |
| Min A-Q47 | How many total places do you observe hazardous substances or associated leachates delivered to or present in a waterbody? Select one; after answering go to question 49:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min A-Q48 | What is the shortest distance between the evidence and the nearest waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min A-Q49 | What type of waterbody has been contaminated by hazardous substances or associated leachates or is closest to the evidence in the area you identified in question 46? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min A-Q50 | What is the width of the AMZ associated with the waterbody? (ft or m, specify unit): |
| Min A-Q51 | For all of the occurrences of hazardous substances or associated leachates observed in the area you identified in question 46, what is the evidence? Select all that apply:<br><br>a. Visible leachate or hazardous substances<br>b. Visible precipitate<br>c. Vegetative effects<br>d. Odor<br>e. Aquatic organism effects<br>f. Other organism effects<br>g. Water quality monitoring results<br>h. Other (specify): |
| Min A-Q52 | What are the sources? Select all that apply:<br><br>a. Trenches<br>b. Stockpiles<br>c. Tailings, settling, process, or storage ponds<br>d. Process fluid ponds<br>e. Quarry or borrow area<br>f. Underground, open pit, or strip mine<br>g. Processing/extraction area<br>h. Roads or parking areas<br>i. Storage areas<br>j. Fluid disposal<br>k. Waste rock disposal facility<br>l. Process wastes<br>m. Drilling wastes<br>n. Other (specify): |
| Min A-Q53 | What are the causes? Select all that apply:<br><br>a. Equipment failure<br>b. Lack of facility, or poor location for facility<br>c. Inadequate or improper maintenance<br>d. Poor design<br>e. Human error<br>f. Inadequate characterization of materials that had potential to generate hazardous substances or associated leachates<br>g. Improper construction and/or implementation of facility<br>h. Other (specify):<br>i. Unknown |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min A-Q54 | What evidence of trash or human sanitary waste exists at the construction site? Select all that apply:<br><br>a. No evidence of trash or human sanitary waste (go to question 56)<br>b. Evidence of trash outside an AMZ (go to question 55)<br>c. Evidence of trash within an AMZ (go to question 55)<br>d. Evidence of trash in a waterbody (go to question 55)<br>e. Evidence of human sanitary waste/toilet paper outside an AMZ (go to question 55)<br>f. Evidence of human sanitary waste/toilet paper within an AMZ (go to question 55)<br>g. Evidence of human sanitary waste/toilet paper in a waterbody (go to question 55) |
| Min A-Q55 | What are the causes? Select all that apply:<br><br>a. Insufficient number of trash receptacles<br>b. Trash receptacles not emptied frequently enough<br>c. Inappropriate location of trash receptacles<br>d. Improper design of trash receptacles (e.g., not wildlife-proof)<br>e. No sanitation facilities on site<br>f. Inappropriate location of sanitation facilities<br>g. Insufficient maintenance of sanitation facilities<br>h. Inconsiderate human actions<br>i. Other (specify): |
| Min A-Q56 | What evidence of chemical or fuel spills or leaks or associated containers exists at the construction site? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody |
| Min A-Q57 | Is there evidence that the construction activities contributed to the introduction or spread of aquatic invasive species? Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Min A-Q58 | If inspections were not conducted at critical times during construction activities, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times<br>b. Yes<br>c. No |
| Min A-Q59 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 60)<br>b. No (go to question 61) |
| Min A-Q60 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Min A-Q61 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 62)<br>b. No (go to General Comments) |

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| Effectiveness (*continued*) | |
|---|---|
| Min A-Q62 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Minerals B—Active Nonplacer Mineral Operations

## Minerals B: Header Statistics

Fifty-one active nonplacer mineral operations (Min B) were evaluated (Table 191), and every region completed at least one Min B evaluation. Seventy-five percent of the operations evaluated were selected randomly (Table 180). While the most common reason for using the Min B protocol was to meet National BMP targets, the protocol simultaneously met other monitoring needs, most frequently project review (Table 191).

Quality assurance was identified as a reason for monitoring (Min B-Q11a) in eight Min B evaluations (Table 191). For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance had duplicate evaluations, as would be necessary to meet the intent of that type of monitoring. Therefore, the review teams that selected quality assurance appeared to use this term to mean something different from what the protocol instructions stipulate.

At the end of the FY17/18 monitoring period, all but four evaluations had both implementation and effectiveness monitoring completed (Table 192). Implementation and effectiveness monitoring were performed on a single day for all but two evaluations completed in Region 2 (see the Appendix for region delineations). Only the effectiveness portion of the evaluation was completed for three projects. Instructions for the monitoring protocols state that both types of monitoring are required at each site or project to fulfill the requirements of the National BMP program (i.e., for meeting National BMP targets) and that implementation monitoring needs to be completed prior to effectiveness monitoring, even if both are done the same day. Ten Min B evaluations were completed using the 2013 version of the protocol as was the implementation monitoring for one Region 2 evaluation that had effectiveness monitoring completed later using the 2015 version.

**Table 191.—**Number of Min B evaluations completed in FY15/16 (n=33 evaluations) and FY17/18 (n=18 evaluations), by region and reason for monitoring (Min B-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 4 | | | | |
| | 2 | 5 | | 3 | | |
| | 3 | 2 | | 1 | 1 | |
| | 4 | 5 | | | 1 | |
| | 5 | 1 | | 2 | 1 | 1[a] |
| | 6 | 3 | | 2 | | |
| | 8 | 4 | | | 2 | |
| | 9 | 8 | 1 | | 1 | |
| | 10 | 1 | 1 | | | |
| | All | 33 | 2 | 8 | 6 | 1 |
| FY17/18 | | | | | | |
| | 1 | 1 | | 1 | | |
| | 2 | 1 | | | | |
| | 3 | 2 | | | | |
| | 4 | 1 | | 1 | 1 | |
| | 5 | 1 | | 1 | | |
| | 6 | 1 | | 1 | | |
| | 8 | 1 | | 1 | 1 | |
| | 9 | 10 | | | | |
| | 10 | 0 | | | | |
| | All | 18 | 0 | 5 | 2 | 0 |

[a] Regional minerals administration target.

**Table 192.—**Number of Min B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Min B-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 4 | | | 4 |
| | 2 | 5 | | 1 | 4 |
| | 3 | 2 | | | 2 |
| | 4 | 5 | | | 5 |
| | 5 | 1 | | | 1 |
| | 6 | 3 | | | 3 |
| | 8 | 4 | | | 4 |
| | 9 | 8 | | | 8 |
| | 10 | 1 | | | 1 |
| | All | 33 | 0 | 1 | 32 |
| | Percent | | | 3 | 97 |
| FY17/18 | | | | | |
| | 1 | 1 | | | 1 |
| | 2 | 1 | | | 1 |
| | 3 | 2 | | | 2 |
| | 4 | 1 | 1 | | |
| | 5 | 1 | | | 1 |
| | 6 | 1 | | | 1 |
| | 8 | 1 | | | 1 |
| | 9 | 10 | | 2 | 8 |
| | 10 | 0 | | | |
| | All | 18 | 1 | 2 | 15 |
| | Percent | | 6 | 11 | 83 |

Of the mineral operations, 35 percent involved oil and gas production (Min B-Q17) and 22 percent were identified as "unknown" (Fig. 90A, B; these operations are unknown because the evaluations were completed using the 2013 version of the protocol, which did not inquire about the specific type of operation). In FY15/16 locatable mineral projects averaged the largest area disturbed at just over 11 acres, while salable mineral projects had the smallest mean disturbance of about five acres. When size of area disturbed was compared by operation type, no significant differences were found in FY15/16 ($p = 0.24$, generalized linear mixed model [GLMM] with lognormal distribution and identity link function). A significant difference was found among operation types in FY17/18 ($p = 0.09$, GLMM with lognormal distribution and identity link function). In that period, locatable and solid leasable minerals projects averaged approximately 89 and 20 acres of disturbance, respectively, while all other types of operations averaged 3 acres or less of disturbed area. In every region and monitoring period, most of the minerals were federally owned (Fig. 90C, D).

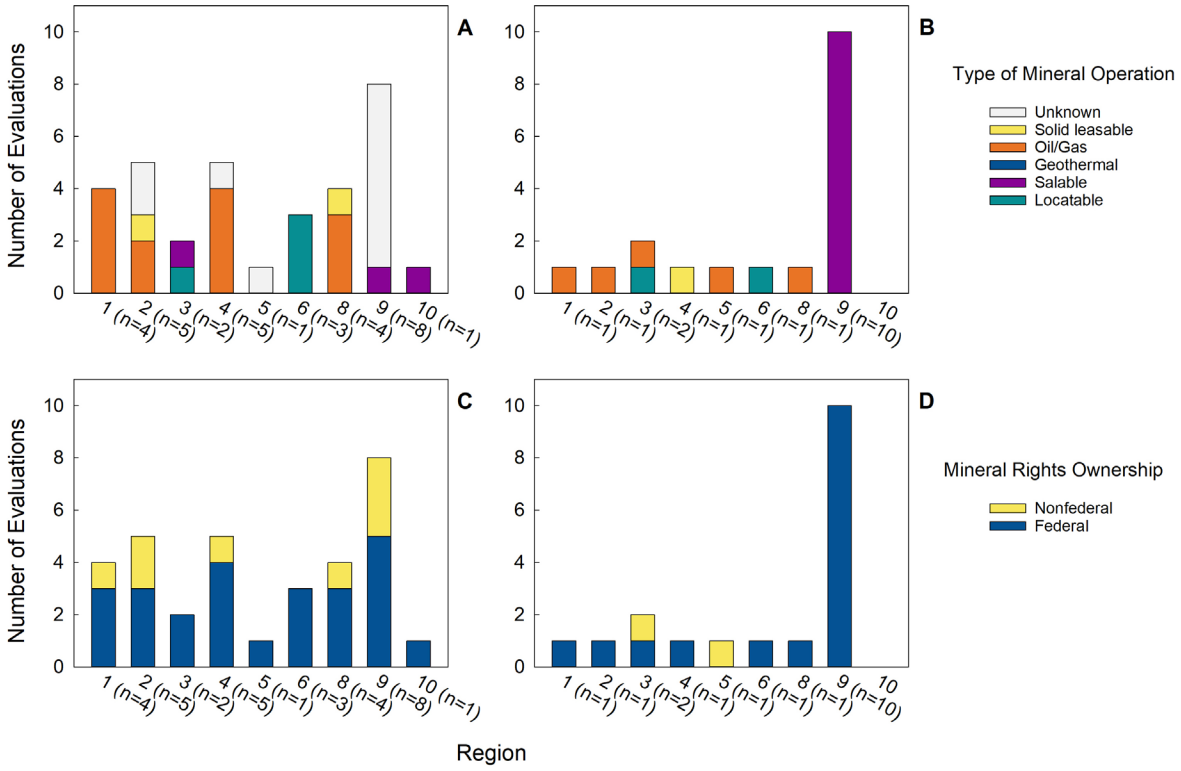



**Figure 90.—**The type of mineral operation (Min B-Q17; A, B) and mineral rights ownership (Min B-Q18; C, D) by region for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). "Unknown" operation type indicates an evaluation was completed using the 2013 version of the protocol.

Because of the wide variety of mineral operations that can be evaluated using Min B, the list of types of features present at the operation at the time of review is long (Min B-Q20). The most frequently identified features in each monitoring period are presented by category in Table 193; ten features were common to both monitoring periods. Not surprisingly given the requirements for minerals operations, the most reported features generally fell under the two categories of access and service areas and facilities, although quarry or borrow areas frequently were present at operations evaluated in FY17/18.

**Table 193.—**Most common features that were part of the mineral operation at the time of the evaluation (Min B-Q20) for Min B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Category | Feature | Percent of evaluations |
|---|---|---|---|
| FY15/16 | | | |
| | Testing/exploration | Drilling | 21 |
| | | Other excavations | 18 |
| | Access and linear features | Roads | 55 |
| | | Overland vehicle travel | 30 |
| | | Waterbody crossings | 18 |
| | Service areas and facilities | Staging areas | 30 |
| | | Storage areas | 42 |
| | | Parking areas | 33 |
| | Drill pads/drilling | Drill holes | 27 |
| | | Equipment | 18 |
| | | Stockpiles | 27 |
| | Excavation/mining methods | Quarry or borrow area | 18 |
| | Ore stockpiles, mine waste facilities | Waste rock | 27 |
| FY17/18 | | | |
| | Testing/exploration | Drilling | 17 |
| | Access and linear features | Roads | 61 |
| | | Overland vehicle travel | 22 |
| | Service areas and facilities | Staging areas | 56 |
| | | Storage areas | 56 |
| | | Parking areas | 44 |
| | | Equipment service areas | 33 |
| | Drill pads/drilling | Drill holes | 17 |
| | | Stockpiles | 22 |
| | Excavation/mining methods | Quarry or borrow area | 67 |
| | | Open pit | 17 |
| | Chemical and materials storage | Oil, fuels, grease, coolants | 22 |
| | Ore stockpiles, mine waste facilities | Waste rock | 17 |

As with Min A projects, the intent of the Min B protocol is to evaluate operations within 300 feet of a waterbody, although operations farther away may be evaluated if none are within 300 feet. Of the 33 operations evaluated in FY15/16 and 18 evaluated in FY17/18, 24 and 13 were within 300 feet of a waterbody, respectively. Rivers and streams, particularly ephemeral streams, comprised most of the waterbodies nearest to the evaluated mineral operations (Min B-Q26) (Table 194). The type of nearest waterbody was unknown for the operations evaluated using the 2013 protocol. The two "other" waterbodies (Table 194) were a pond with an intermittent stream and a wetland forming in a pit. Distances between the operation and nearest waterbody by waterbody type (when the type was reported) are shown in Figure 91. Fifty-one percent of the mineral operations were located completely outside an AMZ (Table 195). The "no designated AMZ" response (Min B-Q27) indicates an operation was located within 50 feet of a waterbody that had no designated AMZ (Table 195).

**Table 194.—**Number of Min B evaluations completed in FY15/16 and FY17/18, by region and type of waterbody nearest to mineral operation (Min B-Q26)

| Monitoring period | Region | Ephemeral stream | Intermittent stream | Perennial stream/river | Pond | Lake | Wetland/ wet meadow | Other | Unknown[a] |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| | 1 | 1 | 1 | 2 | | | | | |
| | 2 | | 1 | 2 | | | | | 2 |
| | 3 | 2 | | | | | | | |
| | 4 | 3 | | | | | | | 2 |
| | 5 | | | | | | | | 1 |
| | 6 | | 2 | | | | | 1 | |
| | 8 | 2 | 1 | | | | | | 1 |
| | 9 | | | | | | | 1 | 7 |
| | 10 | 1 | | | | | | | |
| | All | 9 | 5 | 4 | 0 | 0 | 0 | 2 | 13 |
| | Percent | 27 | 15 | 12 | | | | 6 | 39 |
| FY17/18 | | | | | | | | | |
| | 1 | | 1 | | | | | | |
| | 2 | 1 | | | | | | | |
| | 3 | 1 | 1 | | | | | | |
| | 4 | | | 1 | | | | | |
| | 5 | | 1 | | | | | | |
| | 6 | | 1 | | | | | | |
| | 8 | | 1 | | | | | | |
| | 9 | | | 2 | 5 | 1 | 1 | | 1 |
| | 10 | | | | | | | | |
| | All | 2 | 5 | 3 | 5 | 1 | 1 | 0 | 1 |
| | Percent | 11 | 28 | 17 | 28 | 6 | 6 | | 6 |

[a] Evaluation was completed using the 2013 version of the protocol or Min B-Q26 was not answered.

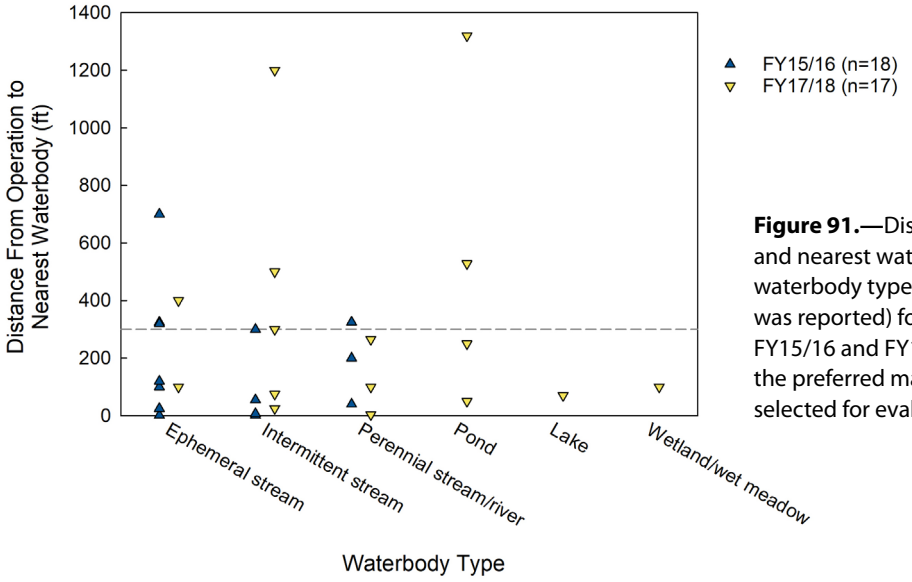



**Figure 91.**—Distance between the operation and nearest waterbody (Min B-Q25) by waterbody type (Min B-Q26, when the type was reported) for evaluations completed in FY15/16 and FY17/18. Dashed line = 300 feet, the preferred maximum distance for operations selected for evaluation by the Min B protocol.

**Table 195.**—Number of Min B evaluations completed in FY15/16 (n=32 evaluations) and FY17/18 (n=17 evaluations), by region and whether any part of mineral operation is in an aquatic management zone (AMZ) (Min B-Q27)

| Monitoring period | Region | Part of operation in an AMZ | Operation not in an AMZ | No designated AMZ for nearest waterbody |
|---|---|---|---|---|
| FY15/16 | | | | |
| | 1 | | | 4 |
| | 2 | 2 | 2 | 1 |
| | 3 | 1 | | 1 |
| | 4 | 2 | 2 | |
| | 5 | | 1 | |
| | 6 | 2 | 1 | |
| | 8 | | 1 | 3 |
| | 9 | 1 | 7 | |
| | 10 | 1 | | |
| | All | 9 | 14 | 9 |
| | Percent | 28 | 44 | 28 |
| FY17/18 | | | | |
| | 1 | | | 1 |
| | 2 | | | 1 |
| | 3 | | 2 | |
| | 4 | 1 | | |
| | 5 | 1 | | |
| | 6 | | 1 | |
| | 8 | | 1 | |
| | 9 | 1 | 8 | |
| | 10 | | | |
| | All | 3 | 12 | 2 |
| | Percent | 18 | 71 | 12 |

## Minerals B: Implementation Results and Their Tie to Header Information

Project planning is assessed in the protocol using two questions:

- What type of planning document specified BMPs for the project (Min B-Q28)?
- Were all BMPs from that document included in the authorizing instrument (Min B-Q29)?

The types of primary planning documents used are summarized in Table 196. Environmental assessments (EAs) outnumbered other types of planning documents used

**Table 196.—**Number of Min B projects evaluated in FY15/16 (n=32 evaluations) and FY17/18 (n=16 evaluations), by region and type of primary planning document used (Min B-Q28)

| Monitoring period | Region | No planning document | EIS[a] | EA[b] | CE[c] | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | | | 3 | 1 | |
| | 2 | 1 | | 1 | 1 | 1 |
| | 3 | | 1 | | | 1 |
| | 4 | | 3 | 1 | 1 | |
| | 5 | | | 1 | | |
| | 6 | 1 | | | 1 | 1 |
| | 8 | 1 | | 2 | | 1 |
| | 9 | 2 | | 6 | | |
| | 10 | | | | 1 | |
| | All | 5 | 4 | 14 | 5 | 4 |
| | Percent | 16 | 12 | 44 | 16 | 12 |
| FY17/18 | | | | | | |
| | 1 | | | | | 1 |
| | 2 | 1 | | | | |
| | 3 | | | 1 | 1 | |
| | 4 | | | 1 | 1 | |
| | 5 | | | 1 | | |
| | 6 | | | 1 | | |
| | 8 | | | | | |
| | 9 | 8 | | | | |
| | 10 | | | | | |
| | All | 9 | 0 | 4 | 2 | 1 |
| | Percent | 56 | | 25 | 13 | 6 |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.

for active nonplacer mineral operations, although almost as many operations had no BMPs developed during planning. Of the 14 projects without BMPs from planning, 8 were sand or gravel pits.

A significant association was found between the type of planning document used (Min B-Q28) and the type of mineral operation (Min B-Q17) in each monitoring period ($p = 0.05$ FY15/16, $p < 0.001$ FY17/18). Oil and gas operations appear to be more associated with more complex environmental analyses (Fig. 92), but it can be difficult to read much into this association when the actual sources of the "other" BMP guidance documents are unknown. Every type of mineral operation evaluated had at least one active project for which no BMPs from planning were included in the authorizing instrument (Fig. 92).

A significant association existed between the type of waterbody nearest to the operation and the type of primary planning document from which BMPs were derived in FY15/16 ($p = 0.02$) but not in FY17/18 ($p = 0.13$). In FY15/16 projects with ephemeral streams

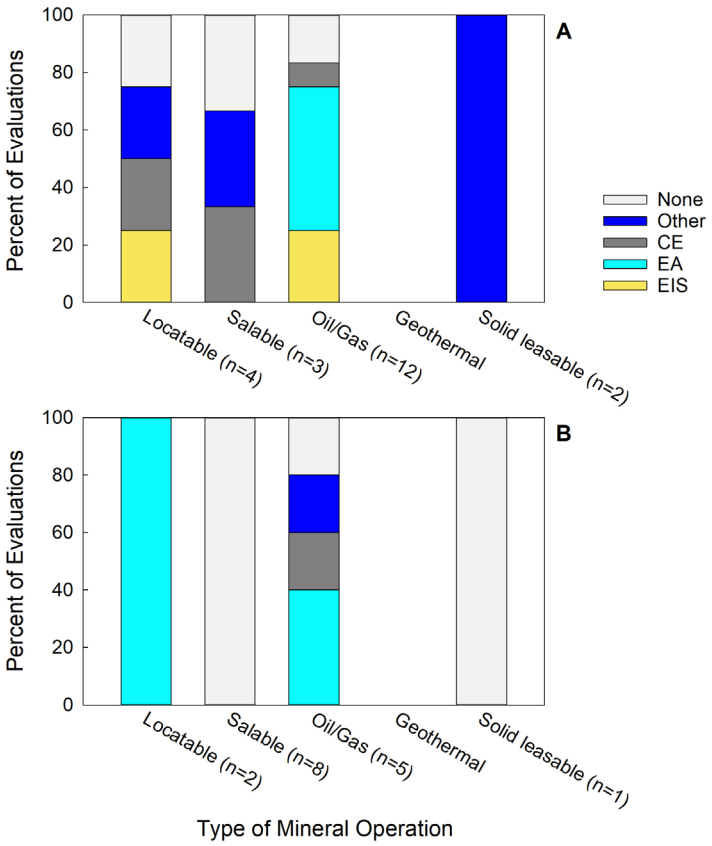



**Figure 92.—**Distribution of primary planning document type (Min B-Q28) by type of mineral operation (Min B-Q17) for evaluations completed in FY15/16 (A) and FY17/18 (B). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

as the nearest waterbody all had BMPs from some type of planning document (Fig. 93). Whether any part of operations was in an AMZ also was significantly associated with the type of primary planning document in FY15/16 ($p = 0.08$) but not in FY17/18 ($p = 0.11$). The association for AMZ location in FY15/16 (Fig. 93) is likely due to a lower percentage of projects in AMZs having planning documents from the NEPA process. However, more evaluations of projects adjacent to lentic waterbodies are needed before meaningful conclusions may be drawn. The size of the area disturbed by the operation (Min B-Q22) was significantly different by type of planning document (Min B-Q28) in FY15/16 ($p = 0.05$, GLMM with lognormal distribution and identity link function) but not in FY17/18 ($p = 0.39$). Projects in FY15/16 using an EIS, EA, CE, or other BMP documents averaged 6.4, 5.8, 5.6, and 4.4 acres of disturbance, respectively, while projects without a primary planning document averaged 3 acres of disturbance. In FY17/18 the mean size of the area disturbed was highly variable across all types of planning documents, ranging from 44 acres for projects planned using an EA to less than 2 acres for projects without planning documents.

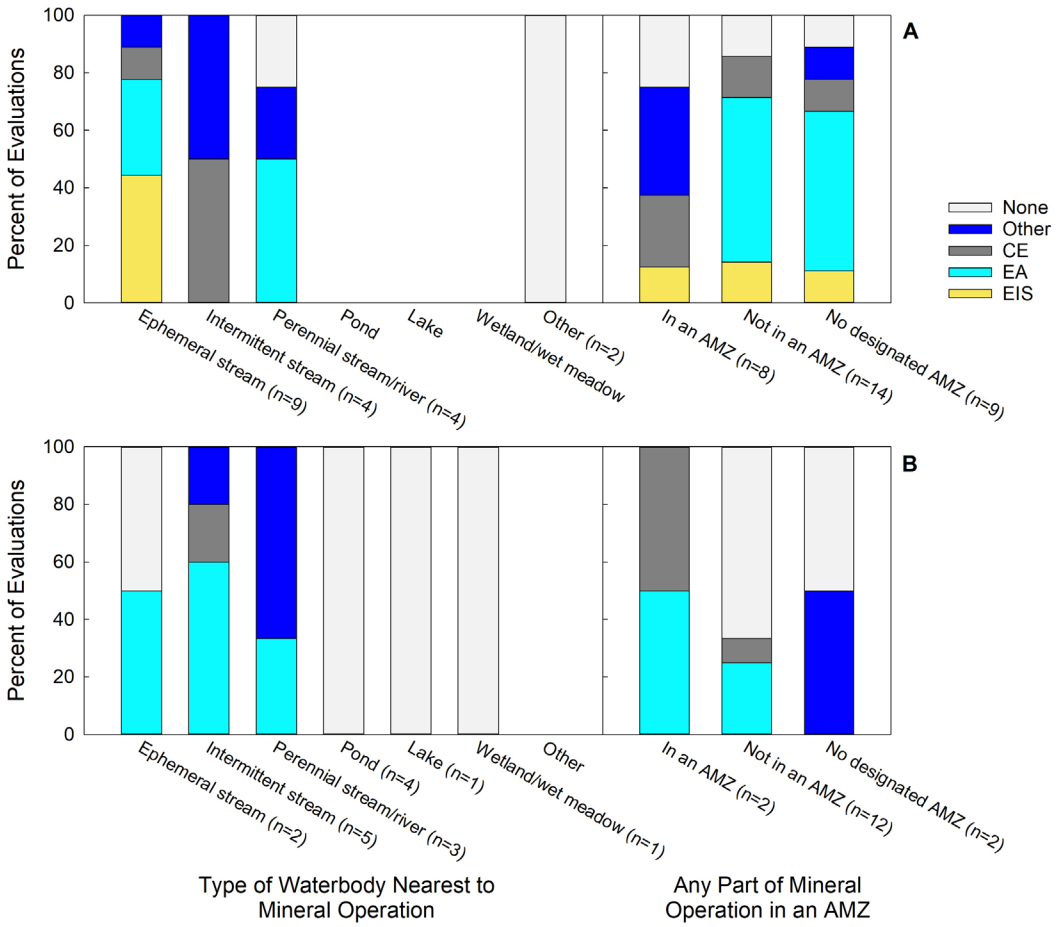



**Figure 93.—**Distribution of primary planning document type (Min B-Q28) by type of waterbody nearest the mineral operation (Min B-Q26) and whether any part of the operation was in an AMZ (Min B-Q27) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone, EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

Table 197 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the planning documents or other BMP guidance documents are assigned, along with the information about whether all the BMPs in each provision were then carried into the authorizing instrument. A "yes" indicates the presence of at least one BMP in the planning or guidance documents applicable to the provision and that all BMPs assigned to that provision were included in the authorizing instrument. Conversely, a "no" indicates that at least one BMP applicable to the provision in the planning or guidance documents was not carried forward into the authorizing instrument. "Not applicable" indicates that there were no BMPs in the planning or guidance documents applicable to the provision, so there was no obligation to carry them into the authorizing instrument. In the National BMP program, there is no expectation that every provision has BMPs assigned; consequently, the percentages for "yes" and "no" in the last two columns of Table 197 for each monitoring period are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

When a provision had at least one BMP prescription identified in the planning documents, all of those BMP prescriptions were included in the authorizing instrument in an average of 69 and 80 percent of evaluations with BMP prescriptions in that provision in FY15/16 and FY17/18, respectively (Table 197). Six provisions in FY15/16 and four provisions in FY17/18 had values at or below 50 percent; controls related to aquatic invasive species, controls for managing laboratories, requirements related to reactive geologic materials, and monitoring requirements were included least frequently in both monitoring periods (Table 197). Prescriptive BMPs were included in 9 and 13 provisions per operation on average in FY15/16 and FY17/18, respectively. Operations in FY15/16 completed using the NEPA process (EIS, EA, or CE planning documents) also averaged BMPs assigned to 9 of the 20 provisions, while operations lacking NEPA analysis but employing other BMP guidance documents had BMPs included in 7 provisions on average. In FY17/18, one project had BMPs from other guidance documents; it had BMPs in 13 provisions. Significantly more BMP provisions ($p = 0.02$, GLMM analysis with negative binomial distribution and log link function) were included in operations in FY15/16 planned using EISs than for operations planned with other types of documents. No significant differences were found in FY17/18 ($p = 0.99$). When the percentages of BMP provisions included in the authorizing instrument were compared by type of planning document, no significant differences were found in either monitoring period ($p = 0.53$ FY15/16, $p = 0.54$ FY17/18; Kruskal-Wallis test). Operations using an EIS averaged 95 percent of BMP provisions included, while operations using EAs, CEs, and other guidance documents averaged 77, 70, and 75 percent inclusion, respectively, in FY15/16. A smaller range of mean percentages of BMP provisions included from planning by type of planning document—87 to 94 percent—was observed for evaluations in FY17/18.

It is possible that additional BMPs applicable to the operation were not in the planning documents but were in the authorizing instrument; such BMPs may be associated with standard authorizing instrument language for the specific type of operation. Additional BMPs applicable to 14 provisions (i.e., those listed in Min B-Q29) in FY15/16 and 5 provisions in FY17/18 were identified in the authorizing instruments across Min B operations (Table 198), with requirements related to fuels and lubricants occurring most frequently.

**Table 197.—**Frequencies at which BMPs in provisions were included in the authorizing instrument (Min B-Q29) for Min B evaluations completed in FY15/16 (n=27 evaluations) and FY17/18 (n=7 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision[a] to which prescribed BMP is applicable | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[b] (number) | FY15/16 Yes (percent[c]) | FY15/16 No (percent[c]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Erosion and sediment control measures (includes soil cover, sediment considerations, etc.) | 24 | 2 | 1 | 92 | 8 | 7 | 0 | 0 | 100 | 0 |
| Storage of topsoil, subsoil, growth media, and waste rock | 19 | 3 | 5 | 86 | 14 | 5 | 1 | 1 | 83 | 17 |
| Limits on vegetation disturbance | 14 | 2 | 2 | 88 | 13 | 6 | 0 | 1 | 100 | 0 |
| Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads) | 14 | 2 | 2 | 88 | 13 | 7 | 0 | 0 | 100 | 0 |
| Controls for limiting the introduction or spread of aquatic invasive species | 5 | 10 | 11 | 33 | 67 | 1 | 1 | 5 | 50 | 50 |
| Location of activities (e.g., avoiding waterbodies or sensitive features) | 22 | 2 | 3 | 92 | 8 | 6 | 1 | 0 | 86 | 14 |
| Areal extent of activities | 20 | 1 | 5 | 95 | 5 | 6 | 0 | 1 | 100 | 0 |
| Timing and scheduling of operations (e.g., soil wetness) | 14 | 6 | 6 | 70 | 30 | 6 | 1 | 0 | 86 | 14 |
| Transport, storage, use, and disposal of chemicals | 18 | 0 | 8 | 100 | 0 | 7 | 0 | 0 | 100 | 0 |
| Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc. | 9 | 9 | 8 | 50 | 50 | 7 | 0 | 0 | 100 | 0 |
| Controls for managing drilling fluids, additives, cuttings, and waste | 10 | 0 | 7 | 100 | 0 | 5 | 0 | 2 | 100 | 0 |
| Controls for managing laboratories | 1 | 2 | 15 | 33 | 67 | 0 | 1 | 6 | 0 | 100 |
| Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining) | 0 | 2 | 15 | 0 | 100 | 3 | 1 | 3 | 75 | 25 |
| Provisions concerning consumptive use of water | 12 | 7 | 7 | 63 | 37 | 3 | 1 | 3 | 75 | 25 |
| Storage and disposal of reactive geologic materials | 1 | 2 | 17 | 33 | 67 | 1 | 1 | 5 | 50 | 50 |
| Water diversions, conveyance, and storage of stormwater | 10 | 4 | 6 | 71 | 29 | 5 | 0 | 2 | 100 | 0 |
| Equipment service, storage, and maintenance areas | 12 | 6 | 8 | 67 | 33 | 6 | 1 | 0 | 86 | 14 |
| Trash and human sanitary waste management | 23 | 2 | 2 | 92 | 8 | 7 | 0 | 0 | 100 | 0 |
| Groundwater, surface water or stability monitoring | 6 | 9 | 8 | 40 | 60 | 1 | 3 | 3 | 25 | 75 |
| Well and borehole abandonment | 7 | 2 | 14 | 78 | 22 | 4 | 1 | 2 | 80 | 20 |
| Mean | 12 | 4 | 8 | 69 | 31 | 5 | 1 | 2 | 80 | 20 |

[a] Listed provision had at least one BMP from decision document or guidance document included in authorizing instrument.

[b] Not applicable (NA) because no prescribed BMPs were associated with the provision.

[c] Percent was calculated from "yes" and "no" counts.

**Table 198.—**Frequencies at which BMPs to protect water, aquatic, and riparian resources were derived from authorizing instrument language and not from BMPs in NEPA documents or other BMP guidance documents for Min B evaluations completed in FY15/16 (n=32 evaluations) and FY17/18 (n=16 evaluations)

| Provision | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Erosion and sediment control measures (includes soil cover, sediment considerations, etc.) | 2 | 6 | | |
| Storage of topsoil, subsoil, growth media, and waste rock | 2 | 6 | | |
| Limits on vegetation disturbance | | | 1 | 6 |
| Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads) | 2 | 6 | 1 | 6 |
| Controls for limiting the introduction or spread of aquatic invasive species | | | | |
| Location of activities (e.g., avoiding waterbodies or sensitive features) | | | 1 | 6 |
| Areal extent of activities | 1 | 3 | | |
| Timing and scheduling of operations (e.g., soil wetness) | 2 | 6 | | |
| Transport, storage, use, and disposal of chemicals | 2 | 6 | | |
| Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc. | 8 | 25 | | |
| Controls for managing drilling fluids, additives, cuttings, and waste | 1 | 3 | 1 | 6 |
| Controls for managing laboratories | | | | |
| Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining) | 1 | 3 | 1 | 6 |
| Provisions concerning consumptive use of water | 3 | 9 | | |
| Storage and disposal of reactive geologic materials | 2 | 6 | | |
| Water diversions, conveyance, and storage of stormwater | 2 | 6 | | |
| Equipment service, storage, and maintenance areas | 1 | 3 | | |
| Trash and human sanitary waste management | | | | |
| Groundwater, surface water or stability monitoring | 3 | 9 | | |
| Well and borehole abandonment | | | | |

An average of 76 percent of the evaluated operations in FY15/16 and 91 percent in FY17/18 had all applicable BMPs implemented fully (Table 199). Applicable in this context includes only those BMPs that were included in the operation authorizing instrument and those for which implementation was expected to have occurred. Those that were identified during planning but were not included in the authorizing instrument or those that have not been implemented yet (i.e., too early in the operation for implementation) are not considered applicable (thus values in Tables 197 and 199 differ). As in Table 197, the percentages in Table 199 were calculated only from the "yes" and "no" counts. Implementation rates ranged from 0 (FY15/16) or 50 (FY17/18) to 100 percent. Six provisions in each monitoring period had BMP implementation rates at or below the

**Table 199.—**Frequencies at which all BMPs in provisions included in the authorizing instrument were implemented fully (Min B-Q30) for Min B evaluations completed in FY15/16 (n=32 evaluations) and FY17/18 (n=16 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a]/too early to implement (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA[a]/too early to implement (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Erosion and sediment control measures (includes soil cover, sediment considerations, etc.) | 21 | 5 | 5 | 81 | 19 | 4 | 3 | 9 | 57 | 43 |
| Storage of topsoil, subsoil, growth media, and waste rock | 18 | 3 | 10 | 86 | 14 | 2 | 2 | 12 | 50 | 50 |
| Limits on vegetation disturbance | 10 | 1 | 9 | 91 | 9 | 6 | 1 | 9 | 86 | 14 |
| Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads) | 14 | 2 | 5 | 88 | 13 | 8 | 0 | 8 | 100 | 0 |
| Controls for limiting the introduction or spread of aquatic invasive species | 1 | 0 | 30 | 100 | 0 | 1 | 0 | 15 | 100 | 0 |
| Location of activities (e.g., avoiding waterbodies or sensitive features) | 21 | 1 | 8 | 95 | 5 | 5 | 2 | 9 | 71 | 29 |
| Areal extent of activities | 18 | 3 | 9 | 86 | 14 | 5 | 1 | 10 | 83 | 17 |
| Timing and scheduling of operations (e.g., soil wetness) | 15 | 1 | 15 | 94 | 6 | 6 | 0 | 10 | 100 | 0 |
| Transport, storage, use, and disposal of chemicals | 18 | 2 | 11 | 90 | 10 | 7 | 0 | 9 | 100 | 0 |
| Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc. | 15 | 2 | 14 | 88 | 12 | 7 | 0 | 9 | 100 | 0 |
| Controls for managing drilling fluids, additives, cuttings, and waste | 10 | 1 | 10 | 91 | 9 | 6 | 0 | 10 | 100 | 0 |
| Controls for managing laboratories | 0 | 1 | 20 | 0 | 100 | 0 | 0 | 16 | NA[c] | NA[c] |
| Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining) | 0 | 1 | 19 | 0 | 100 | 4 | 0 | 12 | 100 | 0 |
| Provisions concerning consumptive use of water | 14 | 1 | 16 | 93 | 7 | 1 | 0 | 15 | 100 | 0 |
| Storage and disposal of reactive geologic materials | 2 | 1 | 20 | 67 | 33 | 0 | 0 | 16 | NA[c] | NA[c] |
| Water diversions, conveyance, and storage of stormwater | 11 | 1 | 12 | 92 | 8 | 5 | 0 | 11 | 100 | 0 |
| Equipment service, storage, and maintenance areas | 11 | 2 | 18 | 85 | 15 | 5 | 0 | 11 | 100 | 0 |
| Trash and human sanitary waste management | 16 | 5 | 10 | 76 | 24 | 6 | 1 | 9 | 86 | 14 |
| Groundwater, surface water or stability monitoring | 6 | 3 | 19 | 67 | 33 | 1 | 0 | 15 | 100 | 0 |
| Well and borehole abandonment | 2 | 2 | 23 | 50 | 50 | 1 | 0 | 15 | 100 | 0 |
| Mean | 11 | 2 | 14 | 76 | 24 | 4 | 1 | 12 | 91 | 9 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.
[b] Percent calculated from "yes" and "no" counts.
[c] Not applicable (NA) because percentages could not be calculated (division by zero).

average (Table 199), and two provisions were either not applicable to any Min B project in FY17/18 or it was too early in the operating season for implementation. Those provisions with lower rates generally also were those which were included less frequently in an operation authorizing instrument (Table 197).

The number of provisions that were implemented fully differed significantly among types of planning documents in FY15/16 ($p = 0.07$, GLMM with negative binomial distribution and log link function) but not in FY17/18 ($p = 0.97$, GLMM with lognormal distribution and identity link function). Operations in FY15/16 using an EIS averaged 12 provisions implemented fully compared to operations using any other type of BMP document, which averaged four or five provisions; operations that included no BMPs from planning documents averaged three BMP provisions implemented fully. However, for the operations without BMPs from planning, three had no applicable BMPs, and the other two operations had seven and eight BMP provisions implemented fully. Operations using planning documents in FY17/18 averaged 10 to 12 BMP provisions implemented fully. Although those without planning documents averaged just one BMP provision implemented fully, eight of those operations had no applicable BMPs, and one had nine BMP provisions implemented fully. Percentages of provisions implemented fully were not significantly different by type of planning document in FY15/16 ($p = 0.58$, Kruskal-Wallis test), although mean results for other guidance documents, CEs, and operations without planning documents (63, 72, and 40 percent, respectively) were lower than those for EISs and EAs, at 89 and 82 percent, respectively. A significant difference in percentages was found in FY17/18 ($p = 0.02$, Kruskal-Wallis test); the low mean number of BMP provisions implemented fully for operations without planning documents resulted in 11 percent of provisions implemented fully, compared to 75 to 100 percent full implementation for operations with BMPs from planning documents.

Mineral operations often involve the use of petroleum and other chemicals for a variety of purposes. Due to the size of the operations, these materials and their wastes may be stored on site. About one-third of evaluations indicated that materials were stored on site, and 27 percent indicated that wastes were stored on site (Table 200). One evaluation

**Table 200.—**Distribution of whether petroleum or chemical materials or wastes were stored at site at the time of the evaluation (Min B-Q31 and Min B-Q35, respectively), and if so, was the site inspected in last 12 months and were problems found (Min B-Q32 and Min B-Q36, respectively, for materials and wastes) for Min B evaluations completed in FY15/16 (n=21 evaluations) and FY17/18 (n=16 evaluations)

| Monitoring period | Type of petroleum or chemical storage | Stored at site (number) | Not stored at site (number) | Inspected within last 12 months and problems identified (number) | Inspected within last 12 months; no problems found (number) | No inspection within last 12 months (number) |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | Materials | 7 | 14 | 1 | 4 | 2 |
| | Wastes | 8 | 13 | 0 | 6 | 2 |
| FY17/18 | | | | | | |
| | Materials | 5 | 11 | 1 | 3 | 1 |
| | Wastes | 2 | 14 | 1 | 1 | 0 |

in each monitoring period identified problems during inspections in the previous 12 months for stored materials. At the time of the evaluation in FY15/16, the deficiencies had not been corrected. At the time of the evaluation in FY17/18, the deficiencies related to petroleum or chemical materials as well as wastes had been corrected. A greater number of deficiencies in material and waste storage requirements were identified during the BMP evaluation than during the prior inspections for operations in FY15/16 (Table 201); many of these were related to paperwork requirements.

Two implementation questions—Min B-Q39 and Min B-Q40—evaluate whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical

**Table 201.—**Distribution of whether regulations pertaining to petroleum or chemical materials (Min B-Q34) or wastes (Min B-Q38) storage were being followed at time of the evaluation for Min B evaluations completed in FY15/16 and FY17/18. See Table 200 for numbers of evaluations that stored petroleum or chemical materials or wastes.

| Monitoring period | Regulation | Hazardous materials regulations followed (number) | Hazardous materials regulations not followed (number) | Hazardous wastes regulations followed (number) | Hazardous wastes regulations not followed (number) |
|---|---|---|---|---|---|
| FY15/16[a] | | | | | |
| | Storage building requirements | 7 | 0 | 7 | 0 |
| | Physical container requirements (e.g., container composition, secondary containment, etc.) | 6 | 1 | 7 | 1 |
| | Container labeling requirements | 7 | 0 | 8 | 0 |
| | Proper storage of materials (e.g., separating incompatible materials, etc.) | 6 | 1 | 7 | 0 |
| | Inventory/record keeping requirements | 5 | 2 | 6 | 1 |
| | Mineral authorization (or HazMat plan) requirements | 5 | 2 | 6 | 1 |
| | Safety Data Sheet requirements | 5 | 2 | 6 | 1 |
| | Spill prevention plan | 6 | 1 | 8 | 0 |
| FY17/18 | | | | | |
| | Storage building requirements | 5 | 0 | 2 | 0 |
| | Physical container requirements (e.g., container composition, secondary containment, etc.) | 5 | 0 | 2 | 0 |
| | Container labeling requirements | 5 | 0 | 2 | 0 |
| | Proper storage of materials (e.g., separating incompatible materials, etc.) | 5 | 0 | 2 | 0 |
| | Inventory/record keeping requirements | 5 | 0 | 2 | 0 |
| | Mineral authorization (or HazMat plan) requirements | 4 | 1 | 2 | 0 |
| | Safety Data Sheet requirements | 5 | 0 | 2 | 0 |
| | Spill prevention plan | 4 | 1 | 2 | 0 |

[a] One evaluation in FY15/16 did not answer all questions related to hazardous waste requirements.

times during the operating season when resources are most susceptible to negative effects from the operations (Table 202) and whether corrective actions were taken if problems occurred during the operating season (at any time, not just critical times; if operations are year-round, the operating season is the preceding 12 months) (Table 203). Critical times include times that work is conducted in or near a waterbody, periods associated with large or intense precipitation/runoff events, or other times or locations that potential for the circumstances to result in water quality impacts is high. Responses indicate that 57 percent of operations in FY15/16 and 31 percent in FY17/18 were inspected during critical times within the operating season (Table 202). Despite the relatively large number of operations lacking inspections or lacking inspections during critical times, nearly 75 percent of the evaluations reported that no problems were encountered that affected or potentially affected water, aquatic, or riparian resources during the operating season (Table 203).

An implementation question (Min B-Q41) in the 2015 version of the Min B protocol asks how chemical spills and leaks that occurred during the past 5 years of operations were handled; this question was not included in the 2013 version of the protocol used for 11 implementation evaluations. Mineral operations are expected to have a spill prevention plan in the authorizing instrument or other outside agency requirements that specifies how chemical spills or leaks are cleaned up. The plan may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in those cases the unit

**Table 202.—**Distribution of whether inspections during the operating season occurred at critical times (Min B-Q39) for Min B evaluations completed in FY15/16 and FY17/18

| Inspections during operating season occurred at critical times | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No inspections | 8 | 27 | 10 | 63 |
| Yes | 17 | 57 | 5 | 31 |
| No | 5 | 16 | 1 | 6 |
| All | 30 | | 16 | |

**Table 203.—**Distribution of whether corrective actions (CA) were taken if problems occurred during operating season (Min B-Q40) for Min B evaluations completed in FY15/16 and FY17/18

| Corrective actions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No problems; no CA needed | 23 | 72 | 12 | 75 |
| CA needed but not taken | 4 | 13 | 0 | |
| CA needed and implemented | 3 | 9 | 2 | 12 |
| Unknown | 2 | 6 | 2 | 12 |
| All | 32 | | 16 | |

follows that state agency's procedures. Five evaluations indicated the operation did not have a spill prevention plan (Table 204). Of the remaining evaluations, five reported that spills or leaks occurred, one of which was not handled according to the spill plan (Table 204).

## Minerals B: Effectiveness Results and Their Tie to Implementation Results and Header Information

Of the 33 active nonplacer mineral operations evaluated in FY15/16, 19 (58 percent) had no evidence of uncontrolled erosion, sedimentation, or waterbody morphology changes (Table 205), and 16 of 17 operations evaluated in FY17/18 had no evidence. Only the

**Table 204.**—Distribution of whether chemical or fuel spills and leaks, if they occurred during operations in the past 5 years, were handled according to the spill prevention plan (or its equivalent) (Min B-Q41) for Min B evaluations completed in FY15/16 (n=20 evaluations; this question was not included in the 2013 protocol) and FY17/18 (n=16 evaluations)

| Chemical or fuel spills and leaks handled according to the spill prevention plan | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No spill prevention plan | 4 | 20 | 1 | 6 |
| No spills or leaks | 12 | 60 | 14 | 88 |
| Yes; according to spill prevention plan | 3 | 15 | 1 | 6 |
| No; not according to spill prevention plan | 1 | 5 | | |
| All | 20 | | 16 | |

**Table 205.**—Evidence of uncontrolled erosion or sedimentation from the mineral operation (Min B-Q46) for Min B evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Min B-Q48) or number of places evidence observed in a waterbody (Min B-Q47)

| Location of observed evidence | Number of evaluations | Percent of evaluations | Distance to nearest waterbody <10 ft (number) | Distance to nearest waterbody 10–50 ft (number) | Distance to nearest waterbody 50–100 ft (number) | Distance to nearest waterbody >100 feet (number) | Evidence in waterbody 1–2 places (number) | Evidence in waterbody 3–4 places (number) | Evidence in waterbody ≥5 places (number) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| No evidence | 19 | 58 | | | | | | | |
| Outside an AMZ[a] [b] | 9 | 27 | | 2 | 2 | 4 | | | |
| Within an AMZ | 1 | 3 | 1 | | | | | | |
| In a waterbody | 4 | 12 | | | | | 2 | 1 | 1 |
| FY17/18 | | | | | | | | | |
| No evidence | 16 | 94 | | | | | | | |
| Outside an AMZ | 0 | | | | | | | | |
| Within an AMZ | 0 | | | | | | | | |
| In a waterbody | 1 | 6 | | | | | 1 | | |

[a] Aquatic management zone.

[b] One evaluation with evidence observed outside an AMZ did not answer the distance question.

most severe cases of erosion or sedimentation are reported (Min B-Q46), with severity increasing from outside an AMZ, to inside an AMZ, to delivery to a waterbody or changes to waterbody morphology. When observed uncontrolled erosion or sedimentation (Min B-Q46) was summarized by the type of waterbody that was affected by or potentially would be affected by it (Min B-Q49), five types of waterbodies had evidence observed in a waterbody (Fig. 94), and four of those five evaluations reported evidence in two or more waterbodies. Because multiple waterbody types could be selected as affected or potentially affected, a statistical comparison was not possible.

Fifteen evaluations reported some evidence of erosion, sedimentation, or waterbody morphology changes (Table 205). The types of evidence observed (Min B-Q51) relative to the location where the evidence was observed are presented in Table 206. Many more types of evidence were reported for impacts to a waterbody than within an AMZ or outside an AMZ. Of the types of evidence listed, most were observed between one and three times (over all evaluations), although rill erosion was observed six times outside an AMZ and 11 times across all evaluations (Table 206). Two evaluations reported a

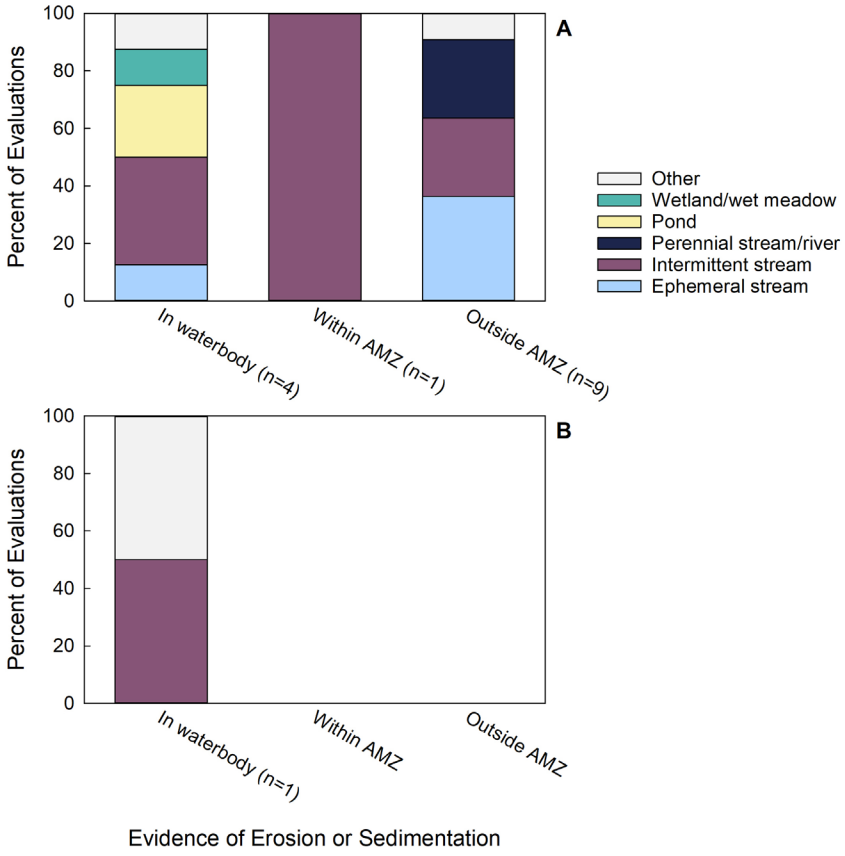



**Figure 94.—**Distribution of waterbody type (Min B-Q49) closest to evidence of erosion or sedimentation (Min B-Q46) for evaluations completed in FY15/16 (A) and FY17/18 (B).

**Table 206.—**Types of evidence of uncontrolled erosion or sedimentation observed from mineral operation (Min B-Q51) for Min B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Min B-Q46 (Table 205) is applicable to Min B-Q51.

| Type of evidence | FY15/16 In a waterbody (n=4) | FY15/16 Within an AMZ[a] (n=1) | FY15/16 Outside an AMZ (n=9) | FY17/18 In a waterbody (n=1) |
|---|---|---|---|---|
| Traceable evidence to the waterbody, but not currently visible in the waterbody | 2 | | | |
| Turbidity present | | | | 1 |
| Evidence of localized sediment deposition in the waterbody | 3 | 1[b] | | 1 |
| Changes to substrate composition | 2 | | 1[b] | 1 |
| Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) | 2 | | | 1 |
| Bank instability | | 1 | | |
| Bank trampling or compaction | | 1 | | 1 |
| Vegetation damage or bare ground | 3 | 1 | 2 | 1 |
| Sheet erosion | 2 | 1 | 1 | 1 |
| Rill erosion | 3 | 1 | 6 | 1 |
| Gully erosion | | | | |
| Headcutting | | | | |
| Slumping/slips | 1 | | | |
| Mass wasting | 1 | | | |
| Sediment plumes or accumulations | 3 | | 2 | 1 |
| Rutting | 2 | | 1 | |
| Water quality monitoring results | | | | |

[a] Aquatic management zone.
[b] The type of evidence reported is incompatible with the location in which it was observed.

type of evidence that was inconsistent with the location where evidence was reported in Min B-Q46; for example, these evaluations reported changes to substrate composition outside an AMZ.

Most evaluations reported multiple sources of erosion or sedimentation, with a higher mean number of 3.5 sources when evidence was present in a waterbody (Table 207). Given that oil and gas operations were the most common type of operation evaluated using protocol Min B (Fig. 90), it is not surprising that drill pad areas were one of the most common sources noted (although cleared areas and excavated areas were reported as frequently). Numerous causes for the observed evidence were reported (Table 208). Similar to the sources, the average number of causes per evaluation in FY15/16 was greater for evidence in a waterbody than for evidence outside the waterbody. The most reported cause for uncontrolled erosion and sedimentation was "no or insufficient number of erosion control, water control, or water or sediment storage features installed."

**Table 207.—**Sources of evidence of uncontrolled erosion or sedimentation observed from mineral operation (Min B-Q52) for Min B evaluations completed in FY15/16 and FY17/18

| Source of evidence | FY15/16 In a waterbody (n=4) | FY15/16 Within an AMZ[a] (n=1) | FY15/16 Outside an AMZ (n=9) | FY17/18 In a waterbody (n=1) |
|---|---|---|---|---|
| Cleared areas | 2 | 1 | 2 | 1 |
| Excavated areas | 3 | | 2 | 1 |
| Stockpiles or soil storage areas | 2 | | 2 | 1 |
| Water diversions | 1 | | 1 | 1 |
| Water conveyance facility | 1 | | | |
| Water storage pond or facility | | | 1 | 1 |
| Tailings, settling, process or storage ponds | | | | |
| Equipment service areas | | | | |
| Drill pad area | | | 6 | |
| Exploration area | 1 | | | 1 |
| Quarry or borrow area | 2 | | | |
| Access route | 1 | | 3 | |
| Staging area | | | | |
| Parking area | | | 1 | 1 |
| Storage area | 1 | | 1 | |
| Occupancy or administrative area | | | | |
| Other | | 1 | | 1 |
| Mean number of sources per evaluation[b] | 3.5 | | 2 | |

[a] Aquatic management zone.
[b] When number of evaluations is greater than one.

Question Min B-Q16 characterizes the weather conditions associated with the evaluation and assists in determining whether observations of erosion and sedimentation transport or waterbody morphology changes (Min B-Q52) are masked during dry weather conditions. Wet weather conditions, if found to be important for observing effects, are expected to be most associated with erosion and sediment transport outside a waterbody, which result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

Evaluations completed during or within 24 hours after precipitation events comprise one-third of evaluations in FY15/16 and about half in FY17/18, so caution is advised before making conclusions about the relationships between weather conditions and observations of evidence until sample sizes increase. Based on the available data, however, no statistically significant association existed in either monitoring period ($p = 0.80$ FY15/16, $p = 0.47$ FY17/18) to suggest that evidence is more likely to be observed due to the presence of current or recent wet weather (Fig. 95).

**Table 208.—**Causes of evidence of uncontrolled erosion or sedimentation observed from mineral operation (Min B-Q53) for Min B evaluations completed in FY15/16 and FY17/18

| Cause of evidence | FY15/16 In a waterbody (n=4) | FY15/16 Within an AMZ[a] (n=1) | FY15/16 Outside an AMZ (n=9) | FY17/18 In a waterbody (n=1) |
|---|---|---|---|---|
| Poor location for activity or feature | 1 | | | 1 |
| Slope shape and/or gradient | 1 | | 3 | |
| Instability due to inadequate design, construction, or maintenance | 2 | | 3 | |
| Lack of or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, etc.) | 2 | | 1 | |
| No or insufficient number of erosion control, water control, or water or sediment storage features installed | 3 | | 4 | |
| Improperly designed erosion control, water control, or water or sediment storage features | 2 | | 2 | |
| Improperly constructed erosion control, water control, or water or sediment storage features | 1 | | | |
| Inadequate or improper maintenance of erosion control, water control, or water or sediment storage features | 1 | | 2 | |
| Operating outside allowable time periods or soil conditions | | | | |
| Overland vehicle travel | 1 | | | |
| Soil compaction | | | | |
| Mechanical additions | | | | |
| Human error | | | | |
| Did not anticipate effects | | | 1 | |
| Other | 1 | 1 | 1 | |
| Unknown | | | 1 | |
| Mean number of causes per evaluation[b] | 4 | | 2 | |

[a] Aquatic management zone.
[b] When number of evaluations is greater than one.

Hazardous substances are used as a part of some types of mineral operations for extraction and processing; therefore, concerns about them exist with active mineral operations. One evaluation observed evidence of leaks, spills, or leachates from those types of chemicals; the evidence was documented more than 100 feet from the nearest waterbody. Trash was more of a problem, observed within an AMZ at two operations and outside an AMZ at 14 operations, with the cause reported as inconsiderate human actions in most cases. No evidence of human sanitary waste was observed.

The presence of chemical or fuel spills, leaks, or chemical waste containers from heavy equipment use also is determined during the effectiveness evaluations (Min B-Q64). Such evidence can include pollutants observed during operations but not reported, pollutants not yet cleaned up even if reported, or pollutants not previously observed or known

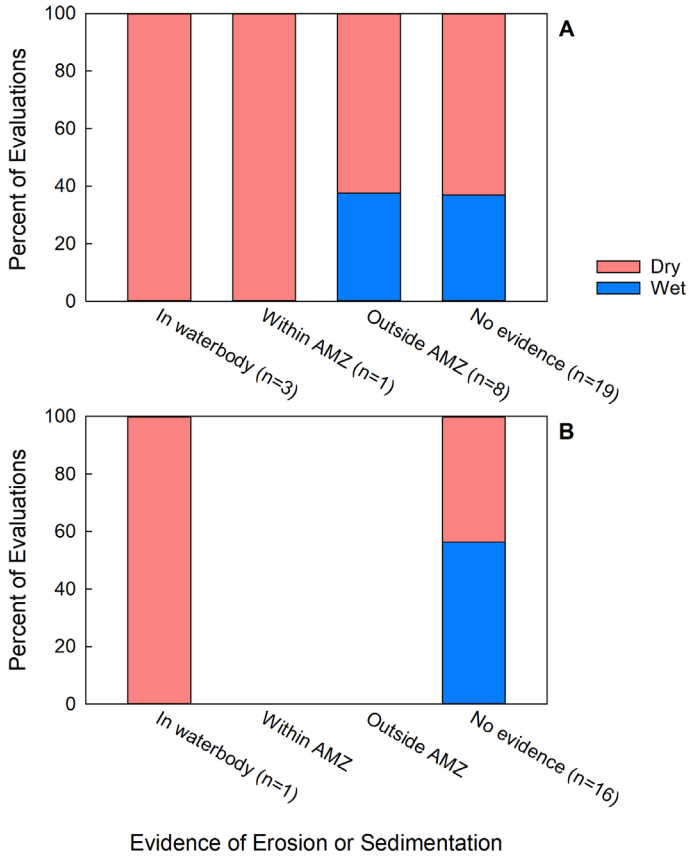



**Figure 95.—**Type of weather conditions during or within 24 hours before effectiveness evaluation (Min B-Q16) versus evidence of erosion or sedimentation (Min B-Q46) for evaluations completed in FY15/16 (A) and FY17/18 (B).

to exist. Unlike the effectiveness evaluations for erosion/sedimentation or hazardous chemicals and associated leachates, all observations of chemical or fuel spills and leaks are reported. Of the 44 evaluations that answered Min B-Q64, 37 reported no chemical or fuel spills, leaks, or waste containers were present. For the seven operations that reported spills or leaks observed outside an AMZ during the effectiveness evaluations, three had reported during the implementation evaluation that no spills or leaks had occurred.

One out of 50 operations was reported to be responsible for the introduction or spread of aquatic invasive species. Two species, *Phragmites australis* (common reed) and *Phalaris arundinace* (reed canarygrass), were identified as being introduced or spread by a salable mineral operation that had no BMPs developed during planning.

Inspections are an important part of active mineral operations. The Min B protocol includes two questions about inspections, one in implementation (Min B-Q39) and one in effectiveness (Min B-Q66), that are designed to tie together. Respectively, they investigate whether inspections were completed during critical times during the operating season and whether lack of inspections during critical times (i.e., if implementation indicated a lack) influenced BMP effectiveness. Table 209 shows the relationship between those

**Table 209.**—Occurrence of inspections during the operating season performed at critical times (Min B-Q39) in relationship to problems observed during effectiveness monitoring (Min B-Q66) for Min B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (27 and 8 percent of FY15/16 and FY17/18 responses, respectively).

| Monitoring period | Inspections/ administration at critical times (implementation) | Not applicable; inspections at critical times (effectiveness) | Yes; lack of administration led to observed problems (effectiveness) | No; lack of administration did not lead to observed problems (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | No inspections | 1 | | 3 |
| | Yes; inspections at critical times | 11 | | 6 |
| | No; inspections not at critical times | | 1 | 4 |
| FY17/18 | | | | |
| | No inspections | 1 | | 8 |
| | Yes; inspections at critical times | 4 | | |
| | No; inspections not at critical times | | | |

two questions for active nonplacer mineral operations in which both implementation and effectiveness evaluations were completed within the monitoring periods. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Twenty-seven percent of the evaluations in FY15/16 and 8 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the rest of the operations, the lack of inspections at critical times led to observed problems for one operation in FY15/16.

## Minerals B: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

One evaluation in FY15/16 and one in FY17/18 were rated as *fully implemented* (Fig. 96A, B). The most frequently occurring implementation ratings were *marginally implemented* in FY15/16 at 33 percent and *no BMPs* in FY17/18 at 56 percent. By comparison, effectiveness ratings for Min B were much better, with 74 percent of evaluated projects in FY15/16 and 82 percent in FY17/18 receiving an *effective* rating (Fig. 96C, D). The incomplete data in Figure 96 result from missing responses to at least one question in the implementation or effectiveness sections of Min B; these were evaluations completed using the 2015 version of the protocol. Evaluations completed using the 2013 version were not included in the FY15/16 ratings summary.

Min B evaluations included several types of mineral operations (Fig. 90), with most being oil/gas extraction. The type of operation was not significantly associated with the implementation ratings in FY15/16 ($p = 0.55$) but was in FY17/18 ($p < 0.001$); however,

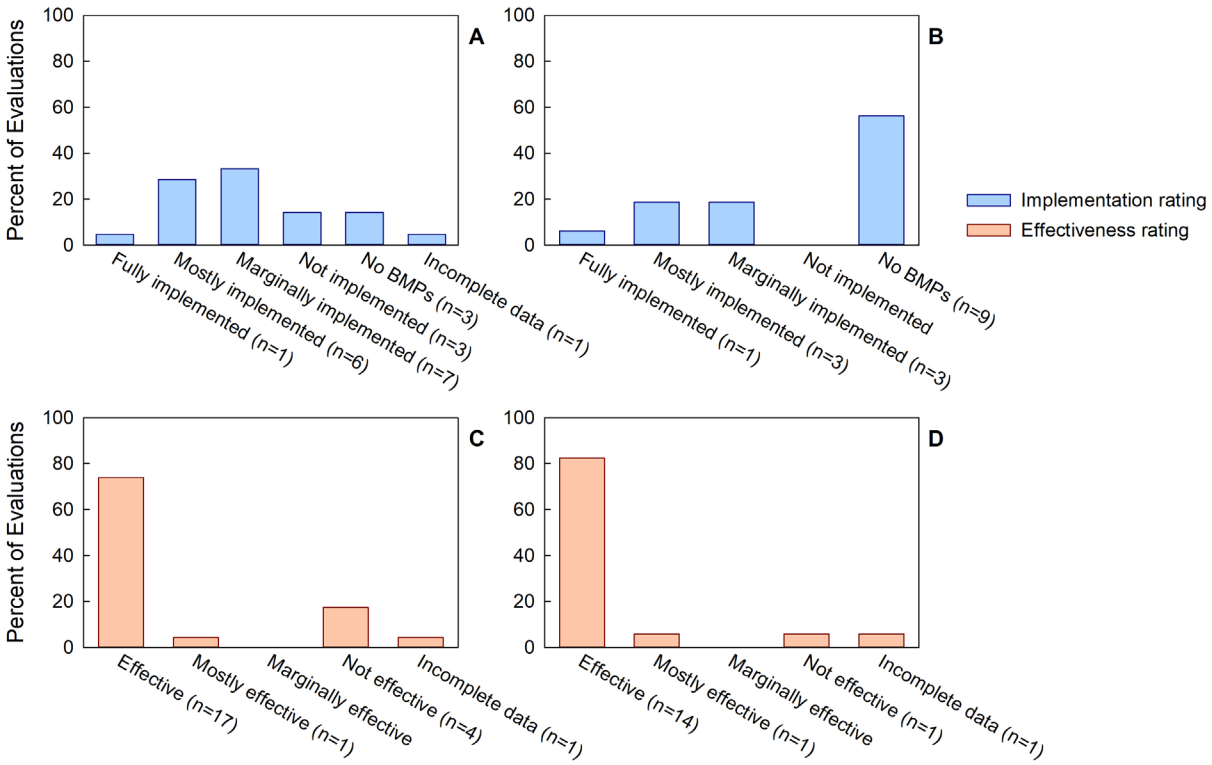



**Figure 96.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Min B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). "Incomplete data" refers to evaluations where all of the questions needed to determine a rating were not answered.

the significant association likely resulted from all eight salable mineral operations not having any BMPs from planning documents and thus a *no BMPs* rating (Fig. 97B). The effectiveness ratings were close to statistically significant in FY15/16 (p = 0.11), with the results suggesting that effectiveness is better for oil and gas operations (Fig. 97C). However, in FY17/18 those operations had slightly poorer effectiveness ratings, and there was not a significant association (p = 0.62). Larger sample sizes are needed, particularly for non-oil and gas operations, to improve the usefulness of comparisons among types of mineral operations.

The number of evaluations was relatively equal across the different primary planning documents, although the number was small for each type (Fig. 98). No significant association existed between planning document type and implementation ratings in either monitoring period (p = 0.51 FY15/16, p = 1.00 FY17/18) (Fig. 98A, B). In contrast, the association between planning document type and effectiveness ratings was significant in FY15/16 (p = 0.05) but not in FY17/18 (p = 0.31) (Fig. 98C, D). Projects planned through formal NEPA analyses in FY15/16 resulted in better effectiveness outcomes than those in which BMPs were derived from other sources or for which no planning documents containing BMP prescriptions were used. However, the same relationship was not observed in FY17/18, where two-thirds of operations had no BMPs from planning.

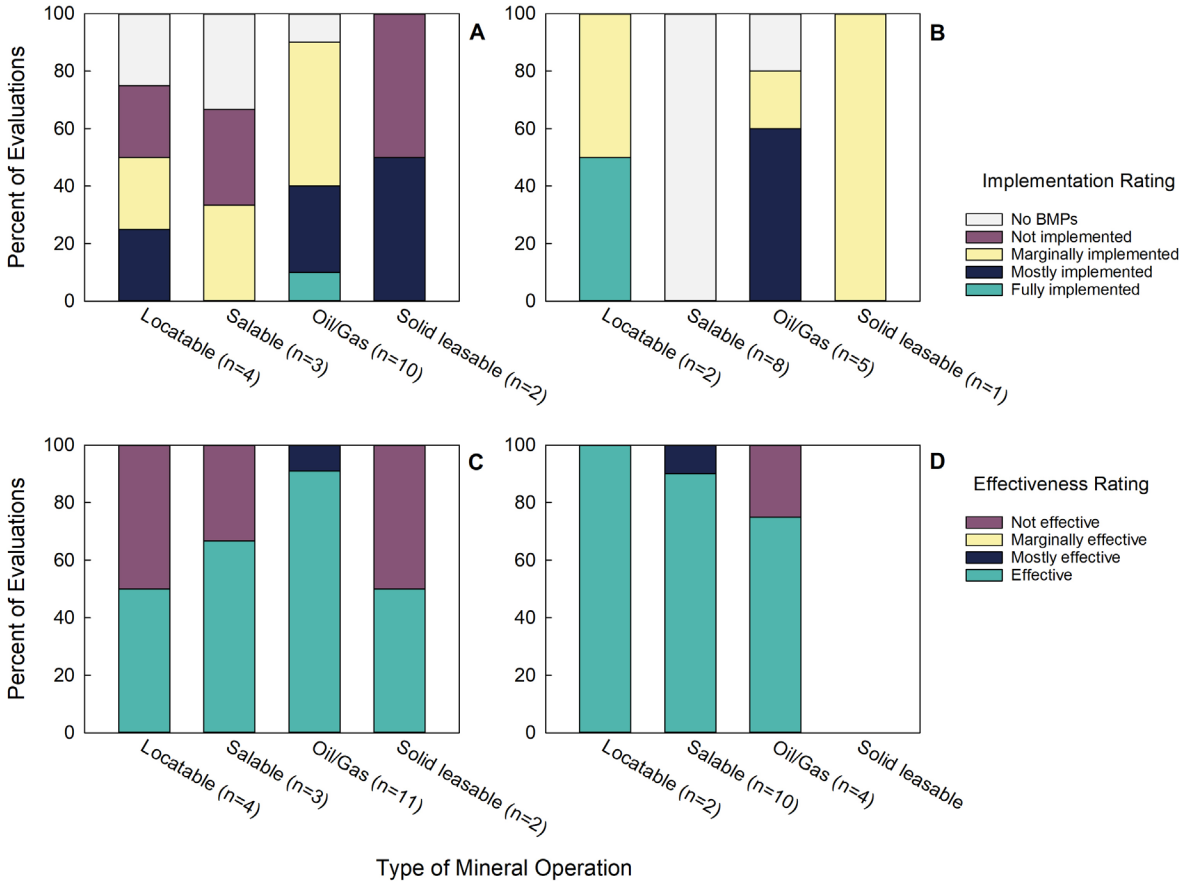



**Figure 97.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by type of mineral operation (Min B-Q17) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

The numbers of BMP provisions included in an authorizing instrument were not significantly different by effectiveness rating in either monitoring period (p = 0.21 FY15/16, p = 0.79 FY17/18; GLMM with negative binomial distribution and log link function). Mean number of provisions included per evaluation ranged from 5 to 15 across the ratings in FY15/16 and from 13 to 15 in FY17/18. For operations rated *not effective* in FY15/16, an average of 62 percent of BMPs from planning were included in the authorizing instrument, while projects with *effective* and *mostly effective* ratings averaged 83 and 100 percent inclusion, respectively; the range of percentages included in FY17/18 was 85 to 100 percent. Percentages of BMPs included also were not significantly different by effectiveness rating in either monitoring period (p = 0.57 FY15/16, p = 0.64 FY17/18; Kruskal-Wallis test).

The numbers of BMP provisions implemented fully were significantly different by rating in FY15/16 ($p < 0.001$, GLMM with Poisson distribution and log link function) but not in FY17/18 (p = 0.47). Evaluations in FY15/16 averaged two BMP provisions implemented fully for operations rated *not effective* and 8 and 15 for operations rated *effective* and *mostly effective*, respectively. However, these results likely were affected by the small

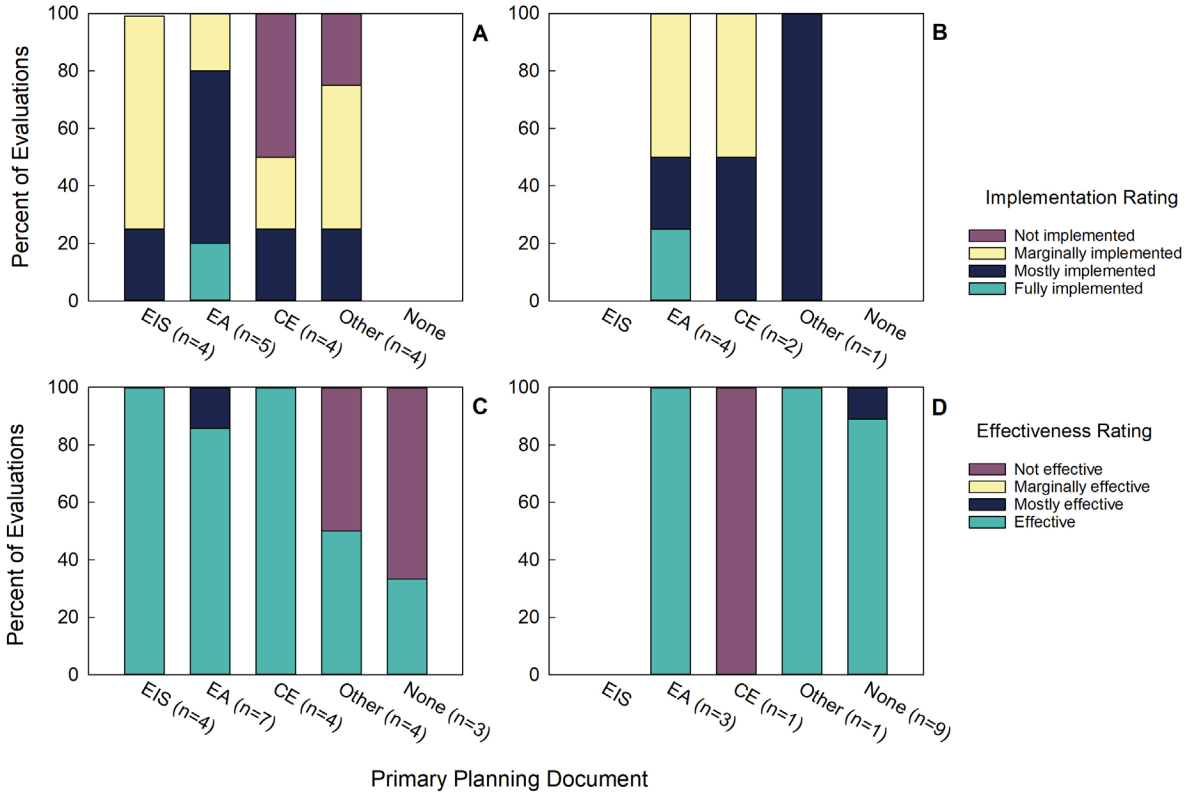



**Figure 98.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (Min B-Q28) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

number of evaluations in each comparison (2 to 4) that had ratings other than *effective*. Operations rated *effective* and *mostly effective* in FY15/16 averaged 74 and 100 percent of BMPs implemented fully, respectively, while those rated *not effective* averaged 19 percent. In FY17/18 operations rated *effective* averaged 40 percent of BMPs implemented fully, while one operation rated *mostly effective* had no BMPs implemented fully and the operation rated *not effective* had all BMPs implemented fully. There was a significant difference in the percentages implemented fully by rating in FY15/16 ($p = 0.05$, Kruskal-Wallis test) but not in FY17/18 ($p = 0.34$, Kruskal-Wallis test), although the test results again were likely influenced by the small sample numbers for ratings other than *effective* (Fig. 96C, D).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Min B-Q16) were significantly associated with the effectiveness ratings in FY15/16 ($p = 0.09$) (Fig. 99). The numbers of wet-weather and dry-weather evaluations were equal, and every evaluation in wet weather was rated *effective*. The sample sizes were similar in FY17/18, but a significant association was not found ($p = 0.17$). However, relationships between weather conditions and field observations of erosion/sediment/morphological effects (e.g., Fig. 95) may provide more straightforward information about the influence of weather on site conditions and potential problems than associations between weather and ratings because ratings incorporate responses to multiple questions.

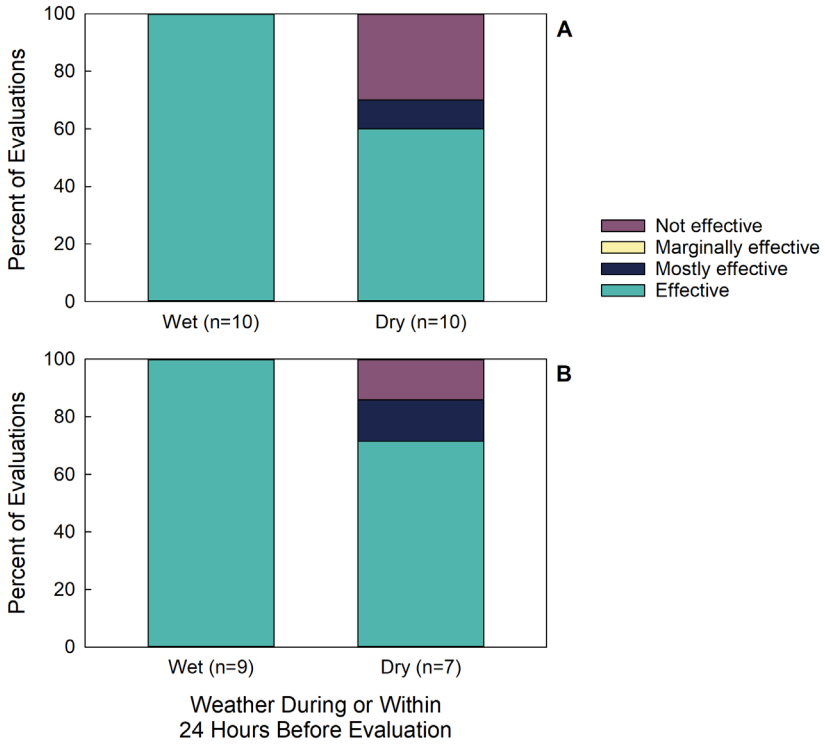



**Figure 99.—**Distribution of effectiveness ratings by weather conditions (Min B-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

During the implementation portion of the evaluation, review of documents and inquiries with project administrators occur to determine whether corrective actions were taken if problems were experienced (Min B-Q40). Such actions can protect water quality and may be reflected in BMP effectiveness. A significant association was found between whether corrective actions were taken and the effectiveness ratings in FY15/16 ($p = 0.09$), but a significant association was not found in FY17/18 ($p = 1.00$). Effectiveness ratings in FY15/16 were not fully achieved when corrective actions were needed but not undertaken; however, the sample sizes are small for all the Min B-Q40 response categories (Fig. 100). More Min B evaluations are needed to determine whether this relationship is meaningful.

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based on what the review team observes and reports during the effectiveness evaluation at the operation.

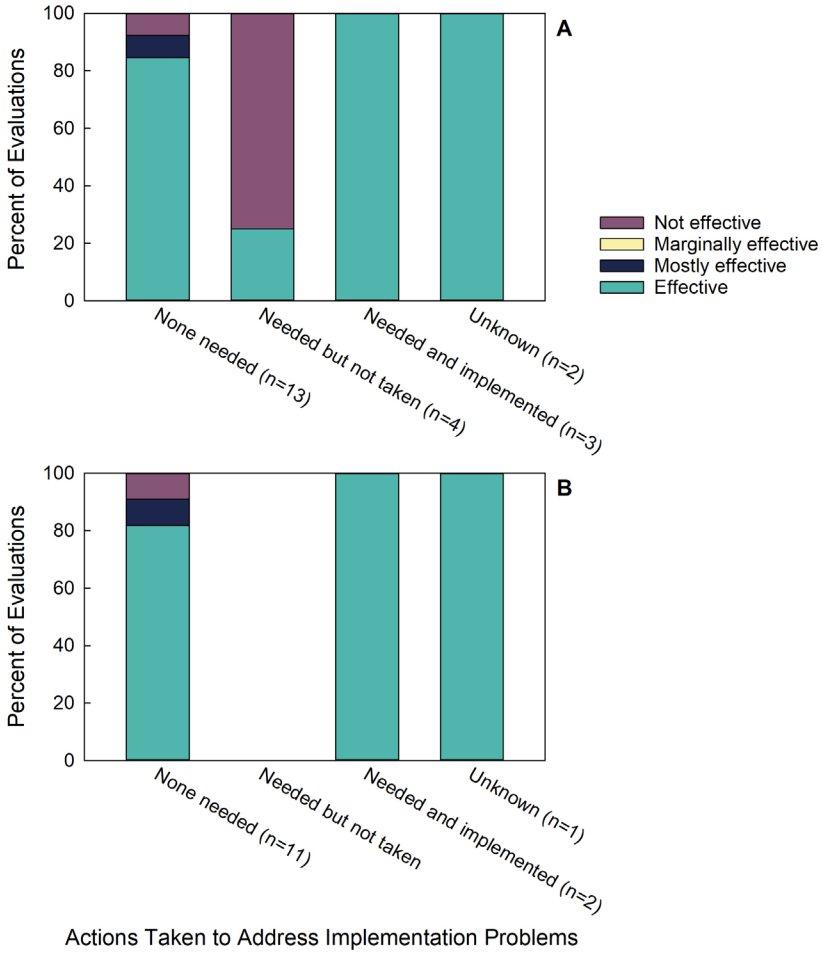



**Figure 100.**—Distribution of effectiveness ratings by whether needed corrective actions were taken during the operating season (Min B-Q40) for evaluations completed in FY15/16 (A) and FY17/18 (B).

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site in question. Corrective actions for implementation include actions that would improve implementation for the mineral operation, while corrective actions for effectiveness are those things that would directly improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not including all the BMPs identified during planning in authorizing instruments, while adaptive management actions for effectiveness may involve terminating the prescription of a BMP that consistently underperforms and replacing it in future, similar operations or situations with a BMP that has been shown to provide better water quality protection.

The number of operations in FY15/16 for which corrective actions were identified as being needed for implementation and effectiveness was equal to or nearly equal to the number for which no actions were needed (Figs. 101 and 102), but very few evaluations in FY17/18 indicated corrective actions were needed. Similarly, the number of evaluations noting the need for adaptive management actions was much smaller than those for which no actions were needed for implementation or effectiveness in both periods (Figs. 101 and 102). The associations between implementation ratings and corrective action responses were significant in both monitoring periods ($p = 0.01$ FY15/16, $p < 0.01$ FY17/18) as was the association between implementation ratings and adaptive management needs in FY17/18 ($p < 0.01$); implementation ratings were not significantly associated with adaptive management needs in FY15/16 ($p = 0.41$). Effectiveness ratings and corrective action responses were significantly associated in FY15/16 ($p = 0.06$) but not in FY17/18 ($p = 1.00$), and the associations for adaptive management needs were not statistically significant for effectiveness in either monitoring period ($p = 1.00$ FY15/16, $p = 0.13$ FY17/18). In most cases, ratings were better when no actions were needed (Figs. 101 and 102). However, the much smaller sample sizes for "yes" responses (i.e., actions needed) compared to the "no" responses for most comparisons limits the utility of these comparisons.

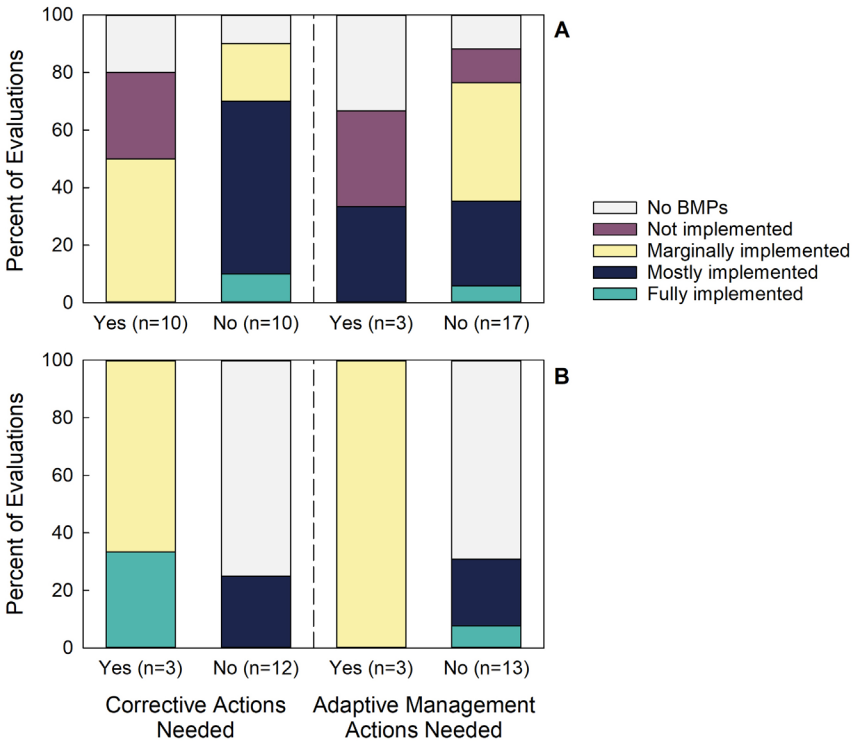



**Figure 101.—**Distribution of implementation ratings by whether corrective actions (Min B-Q42) or adaptive management actions (Min B-Q44) were needed to improve project implementation for Min B evaluations completed in FY15/16 (A) and FY17/18 (B).

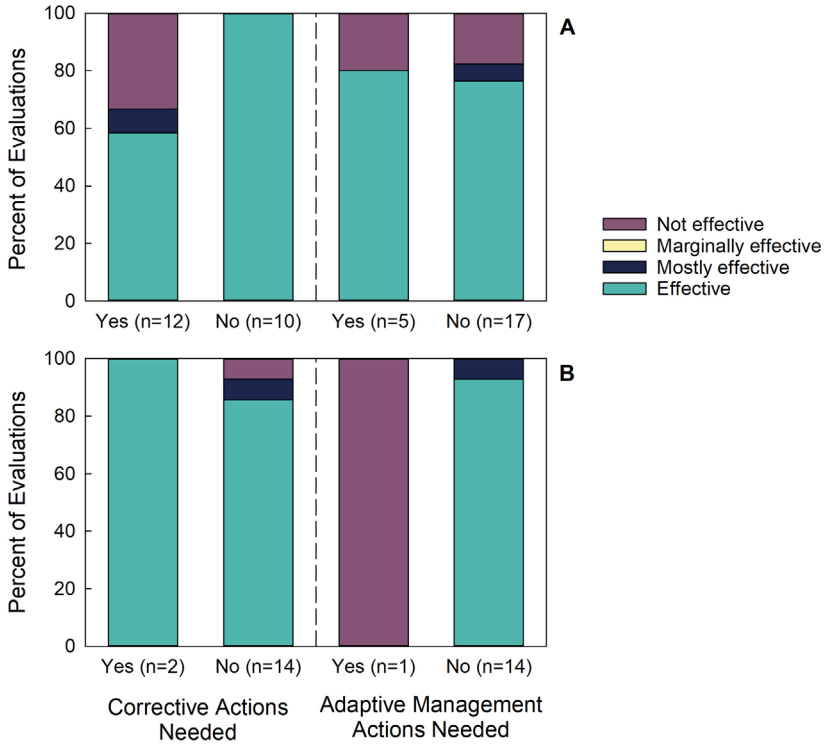



**Figure 102.—**Distribution of effectiveness ratings by whether corrective actions (Min B-Q67) or adaptive management actions (Min B-Q69) were needed to improve project effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

## Composite Ratings

Composite rating results for Min B operations with complete data for which both implementation and effectiveness were evaluated using the 2015 version of the protocol are given in Table 210. Twenty-six percent of operations had a composite rating of *excellent*, 29 percent were rated as *good*, 9 percent were rated as *poor*, and 35 percent had no BMPs prescribed, resulting in a *no plan* composite rating. The implementation ratings were significantly associated with the effectiveness ratings in FY15/16 ($p = 0.03$), but it can be difficult to interpret the importance of this relationship. Poorer effectiveness was associated with poorer implementation in some cases, but better effectiveness occurred even when implementation was not fully achieved (i.e., across all five implementation ratings, including *no BMPs*). In FY17/18 a significant association between ratings was not found ($p = 0.60$); again, the majority of operations in this comparison (86 percent) achieved *effective* ratings across most implementation ratings.

**Table 210.**—Composite rating matrix for Min B operations evaluated for both implementation and effectiveness in FY15/16 (n=20 evaluations) and FY17/18 (n=14 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | | 6 | 6 | 2 | 1 |
| | Mostly effective | 1 | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | 1 | 1 | 2 |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 1 | 2 | 1 | | 8 |
| | Mostly effective | | | | | 1 |
| | Marginally effective | | | | | |
| | Not effective | | 1 | | | |

Excellent
Good
Fair
Poor
No plan

## Minerals B: Examination of Component Scores

The overall implementation and effectiveness ratings were determined from component scores. The implementation and effectiveness rating components for Min B are the same as those for Min A (Tables 184 and 185). Table 211 shows how the scores were distributed across the three implementation components. Similar percentages of operations scored as *all* and *some* for all three components in FY15/16, while the on-the-ground execution component had a much higher percentage of *all* scores in FY17/18. The *no BMPs* scores for the planning component (Table 211) necessarily resulted in *no BMPs* implementation ratings for 12 evaluations (Table 212). One operation in each monitoring period was rated as *fully implemented*, having achieved an *all* score for every component.

An answer of "no" for any provision in Table 197 accompanied by a "yes" answer for at least one other provision would score as *some* for the planning component, indicating that not all the BMPs from planning were included in the operation authorizing instrument. For the nine operations in FY15/16 and the three in FY17/18 with a planning component score of *some* (Table 211), 11 were due to not all BMPs being included in the authorizing instrument, and one was due to the lack of a spill prevention plan. When the *some* component score was from BMPs not being included, an average of 42 percent of provisions from planning were not included in the authorizing instrument in FY15/16

**Table 211.—**Distribution of implementation component scores by component for Min B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=21[a]) | | | | | | | |
| | All | 8 | 38 | 10 | 48 | 8 | 38 |
| | Some | 9 | 43 | 9 | 43 | 9 | 43 |
| | None | | | 1 | 5 | 4 | 19 |
| | No BMPs | 3 | 14 | | | | |
| | Incomplete data[b] | 1 | 5 | 1 | 5 | | |
| FY17/18 (n=16) | | | | | | | |
| | All | 4 | 25 | 13 | 81 | 5 | 31 |
| | Some | 3 | 19 | 3 | 19 | 11 | 69 |
| | None | | | | | | |
| | No BMPs | 9 | 56 | | | | |

[a] 11 evaluations were completed using the 2013 version of the protocol and could not be scored.
[b] Some of the questions needed to determine a component score were not answered.

(Table 197, excluding provisions identified as "not applicable"), with the percentage ranging from 8 to 77 percent. On average, BMPs from planning were included in 9 of the 20 possible provisions for those 9 operations in FY15/16. One operation had BMPs included in two provisions, while two other operations had them in three provisions. The three projects with a *some* score for the planning component in FY17/18 averaged 23 percent of BMP provisions from planning not included in the authorizing instrument. Those operations had BMPs from planning included in 13 provisions on average.

The *some* score for the on-the-ground execution component may indicate that at least one BMP in a provision was not implemented fully in the field (Table 184); this results from a "no" answer for at least one provision in Table 199 and a "yes" response for at least one other provision. For the seven operations having a score of *some* for the on-the-ground execution component (Table 211) for this reason in FY15/16, the average authorizing instrument had 10 provisions containing at least one BMP, and in approximately 33 percent of those provisions at least one BMP was not implemented fully. The frequency of BMPs that were not implemented fully ranged from 7 to 100 percent per evaluation. If the evaluation with no BMPs implemented fully was excluded, then 20 percent of BMP provisions were not implemented fully on average, and the highest percentage was 33 for the remaining six evaluations. Two other operations in FY15/16 scored as *some* for the on-the-ground execution component; one had no BMPs implemented fully but all requirements related to chemicals and fuels were met, and the other had some regulations related to chemical and fuel materials storage not being followed (Min B-Q34). Three evaluations in FY17/18 had on-the-ground execution component scores of *some* due to less than full BMP implementation. Those operations also had BMPs in 10 provisions on

**Table 212.—**Implementation component scores corresponding to the overall implementation ratings for Min B evaluations with complete data in FY15/16 and FY17/18. See Table 184 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=20) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | All | All | Some | 3 |
| | | Some | All | All | 3 |
| | Marginally implemented | All | Some | All | 1 |
| | | All | Some | Some | 3 |
| | | Some | Some | All | 2 |
| | | Some | Some | Some | 1 |
| | Not implemented | Some | Some | None | 2 |
| | | Some | None | Some | 1 |
| | No BMPs | No BMPs | All | Some | 1 |
| | | No BMPs | All | None | 2 |
| FY17/18 (n=16) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | Some | All | All | 3 |
| | Marginally implemented | All | Some | All | 1 |
| | | All | Some | Some | 2 |
| | Not implemented | | | | 0 |
| | No BMPs | No BMPs | All | Some | 9 |

average, and 33 percent of provisions per operation did not have all BMPs implemented fully; the percentages ranged from 15 to 50 percent.

Most evaluations scored as *all* or *some* for the project oversight component (Table 211). The four projects in FY15/16 that scored as *none* identified needed corrective actions to address an implementation problem; however, no actions were taken to rectify the observed problem (Min B-Q40).

Planning component scores were not significantly associated with the type of primary planning document (Min B-Q28) used for the 17 evaluations in FY15/16 and 7 evaluations in FY17/18 where the comparison could be made ($p = 0.41$ FY15/16, $p = 0.66$ FY17/18). In both monitoring periods, however, operations with a more complex level of NEPA analysis had a higher percentage of *all* planning component scores, with EISs, EAs, CEs, and other BMP guidance documents averaging 75, 67, 37 and 12 percent, respectively.

The distribution of scores across the four effectiveness components is summarized in Tables 213 and 214. For each of the four components, at least 74 percent of the evaluations

**Table 213.—**Distribution of effectiveness component scores by component for Min B evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Hazardous materials and leachate component (number) | Hazardous materials and leachate component (percent) | Trash and waste component (number) | Trash and waste component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 (n=23[a]) | | | | | | | | | |
| | Effective | 17 | 74 | 22 | 96 | 21 | 92 | 22 | 96 |
| | Mostly effective[b] | 1 | 4 | | | | | | |
| | Moderately effective[c] | | | | | 1 | 4 | | |
| | Marginally effective[b] | | | | | | | | |
| | Not effective | 5 | 22 | | | | | | |
| | Incomplete data[d] | | | 1 | 4 | 1 | 4 | 1 | 4 |
| FY17/18 (n=17) | | | | | | | | | |
| | Effective | 16 | 94 | 17 | 100 | 15 | 88 | 16 | 94 |
| | Mostly effective | | | | | | | | |
| | Moderately effective | | | | | 1 | 6 | | |
| | Marginally effective | | | | | | | | |
| | Not effective | 1 | 6 | | | | | | |
| | Incomplete data | | | | | 1 | 6 | 1 | 6 |

[a] 10 evaluations were completed using the 2013 version of the protocol and could not be scored.
[b] Score applies only to erosion and sedimentation and hazardous substances and leachate components (see Table 185).
[c] Score applies only to trash and waste and chemical pollutants components (see Table 185).
[d] Some of the questions needed to determine a component score were not answered.

**Table 214.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Min B evaluations with complete data in FY15/16 and FY17/18. See Table 185 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Erosion and sedimentation component | Hazardous materials and leachate component | Trash and waste component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|---|
| FY15/16 (n=22) | | | | | | |
| | Effective | Effective | Effective | Effective | Effective | 17 |
| | Mostly effective | Mostly effective | Effective | Effective | Effective | 1 |
| | Marginally effective | | | | | 0 |
| | Not effective | Not effective | Effective | Effective | Effective | 3 |
| | | Not effective | Effective | Moderately effective | Effective | 1 |
| FY17/18 (n=16) | | | | | | |
| | Effective | Effective | Effective | Effective | Effective | 14 |
| | Mostly effective | Effective | Effective | Moderately effective | Effective | 1 |
| | Marginally effective | | | | | 0 |
| | Not effective | Not effective | Effective | Effective | Effective | 1 |

had scores of *effective* (Table 213). Eighty-two percent of projects had overall effectiveness ratings of *effective*, which resulted from each evaluation achieving an *effective* score for all components (Table 214). The evaluations with ratings other than *effective* were most often the result of the erosion and sedimentation component score; four of five operations with a *not effective* score for that component had evidence of erosion or sedimentation observed in a waterbody.

Comparison of the effectiveness component scores to overall implementation ratings (Fig. 103) indicates a significant association between the erosion and sedimentation component scores and the implementation ratings in FY15/16 ($p = 0.03$) but not in FY17/18 ($p = 0.40$). Although the overall implementation ratings were not particularly noteworthy (Fig. 96), somewhat better implementation ratings were associated with better erosion and sedimentation component scores in FY15/16 (Fig. 103). No significant associations were found between trash and waste component scores and the implementation ratings in either monitoring period ($p = 0.35$ FY15/16, $p = 1.00$ FY17/18), and no tests of statistical associations were possible for the hazardous substance and leachate component scores or chemical pollutants component scores and the implementation ratings.

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 104. No significant associations existed between the effectiveness ratings and the on-the-ground execution component scores in either monitoring period ($p = 1.00$ for both). There were significant associations in FY15/16 between the effectiveness ratings and the planning component scores ($p = 0.09$) and between the effectiveness ratings and the project oversight component scores ($p < 0.01$);

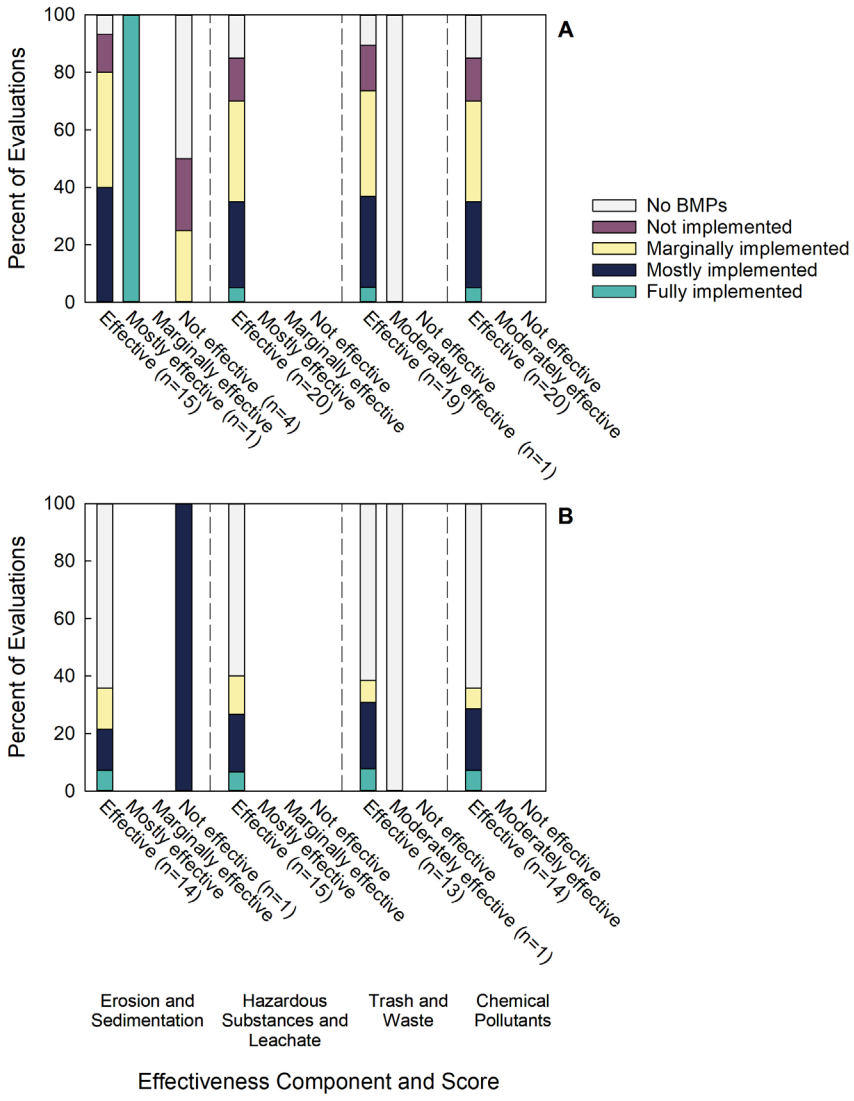



**Figure 103.—**Distribution of implementation ratings across effectiveness component scores for Min B evaluations completed in FY15/16 (A) and FY17/18 (B).

for both, better component scores were associated with better effectiveness ratings. When BMPs were not included from planning or corrective actions were not taken when needed, there was a greater tendency to have erosion and sedimentation problems (Table 213), which resulted in ratings of *not effective* in FY15/16 (Fig. 104). No significant associations were found in FY17/18 between planning component scores ($p = 0.60$) or project oversight component scores ($p = 0.51$) and the effectiveness ratings.

The Min B dataset is not yet large enough to meaningfully assess possible associations between effectiveness component scores and implementation of individual BMP provisions relevant to those components. For example, whether relevant individual

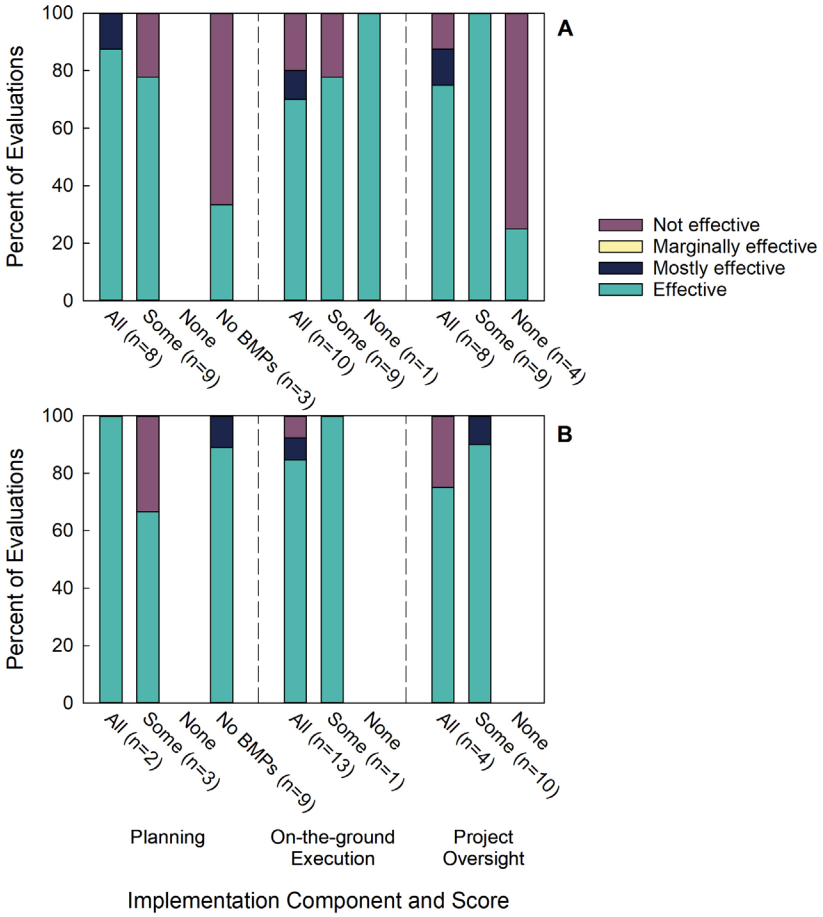



**Figure 104.**—Distribution of effectiveness ratings across implementation component scores for Min B evaluations completed in FY15/16 (A) and FY17/18 (B).

BMP provisions (e.g., erosion and sediment control measures or storage of topsoil; see Table 199) are implemented fully could be tested for statistical associations with the erosion and sedimentation component scores. Such analyses completed for other resource protocols with larger sample sizes have shown some informative results; see "Aquatic Ecosystems A: Examination of Component and Subcomponent Scores," "Aquatic Ecosystems B: Examination of Component and Subcomponent Scores," and Tables 35 and 63 in this report.

## Minerals B: Management Implications for Forest Service Resource Managers

Sixty-nine percent of the active nonplacer mineral operations rated either *marginally implemented*, *not implemented*, or *no BMPs* for BMP implementation. Two operations—one in each monitoring period—were rated *fully implemented*. Most deficiencies were in the planning and project oversight components. For the planning component, the operations were evenly split across the *all*, *some,* and *no BMPs* scores, with 32 percent of the operations in each score. For the project oversight component, more than half the

operations were scored *some*, and 11 percent were scored *none*. The operations with *some* scores were primarily due to lack of inspections during critical periods, and those with *none* scores were due to corrective actions identified during project implementation not being taken. About two-thirds of the mineral operations scored *all* for the on-the-ground execution component, and one scored *none*.

Eighty-two percent of the operations were rated *effective* for BMP effectiveness, indicating no impacts to water quality were observed. For the few operations that were rated *not effective*, the deficiencies were in the erosion and sedimentation component. When evidence of erosion or sedimentation was observed, the types were rill erosion and vegetation damage or bare ground. The primary cause was a lack of or insufficient erosion control on excavated areas or drill pads. Trash and sanitary waste were observed at a small number of sites.

Due to the high percentage of effectiveness ratings across all categories of implementation ratings, the relationship between BMP implementation and effectiveness in this dataset is inconsistent. Implementation ratings were significantly associated with the effectiveness ratings in FY15/16 but not in FY17/18. A closer look into the data, however, suggests that when BMPs were implemented, they were effective. For example, for FY15/16 evaluations, the percentage of BMP provisions included in the authorizing instrument and percentage of BMP provisions in the authorizing instrument implemented fully were significantly associated with effectiveness ratings. Operations rated *not effective* averaged 62 percent of the BMP provisions in the planning documents included in the authorizing instrument compared to 83 and 100 percent, respectively, for operations rated *effective* or *mostly effective*. Similarly, for BMP provisions implemented fully, mineral operations rated *not effective* averaged 19 percent compared to 74 and 100 percent, respectively, for operations rated *effective* or *mostly effective*. Regarding erosion and sedimentation, there was a significant association between the implementation rating and the erosion and sedimentation score; operations with better implementation ratings, and in particular, the planning and project oversight component scores, had a better erosion and sedimentation component score.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Ensuring that BMPs are considered during planning of mineral operations (29 percent of the evaluations did not use planning documents that contained BMPs).
- Ensuring that BMP prescriptions included in planning documents are carried over into the authorizing instrument. Percent inclusion for a BMP provision averaged 69 and 80 percent of evaluations with BMP prescriptions in that provision in FY15/16 and FY17/18, respectively.
- Identifying opportunities to improve project oversight, such as inspecting mineral operation sites during critical periods and ensuring that water quality problems identified during project implementation are corrected. Of the

operations where corrective actions were needed but not taken, 75 percent were rated *not effective*. Conversely, all the operations where corrective actions were needed and implemented were rated *effective*.

- Paying greater attention to implementation of BMP provisions related to storage of topsoil, subsoil, growth media, and waste rock and to maintenance of erosion and stormwater controls. When included in the authorizing instrument, these BMP provisions were implemented fully in less than 85 percent of the evaluations.
- Paying greater attention to implementation of BMP provisions related to erosion and sediment control measures. Evidence of uncontrolled erosion and sedimentation was observed at 30 percent of all mineral operations evaluated in FY15/16 and FY17/18. The most frequently reported cause of uncontrolled erosion and sedimentation was "no or insufficient number of erosion control, water control, or water or sediment storage features installed."
- Assessing trash management. Evidence of trash was observed at 32 percent of all mineral operations evaluated in FY15/16 and FY17/18. The most frequently reported cause of trash was "inconsiderate human actions."

## Minerals B: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Min B. Active Non-Placer Mineral Operations**

(Reference BMPs Min-1, Min-3, Min-5, Min-6, Min-7, Fac-2, Fac-3, Fac-4, Fac-5, Fac-6, Road-4, Road-5, Road-9 and Road-10)

v3.0 February 2016

| Header | |
|---|---|
| Min B-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Min B-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Min B-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Min B-Q4 | Date of current field evaluation: |
| Min B-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Min B-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Min B-Q7 | Reviewers and titles: |
| Min B-Q8a | Region number: |
| Min B-Q8b | State: |
| Min B-Q9a | Proclaimed Forest or Grassland number and name: |
| Min B-Q9b | Administrative Forest or Grassland number and name: |
| Min B-Q10 | District number and name: |
| Min B-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Min B-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min B-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Min B-Q12 | 6th level HUC number and name for the subwatershed this mineral operation is in: |
| Min B-Q13 | Is any part of the mineral operation being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Min B-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Min B-Q14b | Location.<br><br>Easting: |
| Min B-Q14c | Location.<br><br>Northing: |
| Min B-Q15a | Location.<br><br>Latitude: |
| Min B-Q15b | Location.<br><br>Longitude: |
| Min B-Q15c | Location.<br><br>Lat/Long Datum: |
| Min B-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Min B-Q17 | Type of mineral operation. Select one:<br><br>Locatable<br>Salable<br>Oil/Gas<br>Geothermal<br>Solid Leasable (Coal, Phosphate, Hard Rock Leasable)<br>Other (specify): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min B-Q18 | Ownership of the mineral rights. Select one:<br><br>Federal<br>Non-federal |
| Min B-Q19 | Name of mineral operation: |
| Min B-Q20 | Which of these features is currently part of the operation?<br>Select all that apply:<br><br>a. Testing/Exploration<br>1. Geophysical activities<br>2. Trenching<br>3. Drilling<br>4. Other excavations<br><br>b. Access and Linear Features<br>1. Roads<br>2. Overland vehicle travel<br>3. Waterbody crossings<br>4. Aircraft pads or runways<br>5. Conveyors<br><br>c. Service Areas and Facilities<br>1. Staging areas<br>2. Storage areas<br>3. Parking areas<br>4. Equipment service areas<br>5. Laboratories<br>6. Administrative offices<br>7. Material processing/extraction test areas<br>8. Power generation<br>9. Shafts, milling, or impoundments<br>10. Other support facilities<br><br>d. Drill Pads/Drilling<br>1. Drill holes<br>2. Injection wells<br>3. Hydraulic fracturing<br>4. Equipment<br>5. Stockpiles<br>6. Reserve pits<br>7. Drilling circulation pits<br>8. Drill cuttings storage/disposal<br><br>e. Excavation/Mining Methods<br>1. Quarry or borrow area<br>2. Underground mine<br>3. Open pit<br>4. Strip mine<br>5. Blasting<br>6. In-situ/solution mining<br>7. Heap or dump leaching<br>8. Wells, pumps, or pipelines for mining solutions<br>9. Solvent extraction/electrowining<br>10. Milling/floatation/concentrating<br><br>f. Fresh Water Diversion, Use, and Storage<br>1. Drafting or diversions<br>2. Conveyance facilities<br>3. Water production wells<br>4. Ponds, pits, or other storage facilities<br>5. Reclaimed wells<br>6. Return water<br>7. Mine dewatering<br><br>*(continued)* |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| (*Min B-Q20 continued*) | g. Process Water Treatment, Storage, Disposal<br>1. Tailings pond<br>2. Settling ponds<br>3. Leach solution ponds<br>4. Process water storage<br>5. Slime ponds<br>6. Water treatment (chemical)<br>7. Water treatment (passive)<br>h. Chemical and Materials Storage<br>1. Drilling additives<br>2. Blasting agents<br>3. Oils, fuels, grease, coolants<br>4. Pesticides or herbicides<br>5. Laboratory chemicals<br>6. Mineral processing chemicals<br>i. Chemical and Materials Waste Holding<br>1. Oils, fuels, grease, coolants<br>2. Batteries or tires<br>3. Paint<br>4. Cleaning solvents<br>5. Laboratory wastes<br>6. Used mineral processing chemicals<br>j. Reactive Materials<br>1. Surface exposures (cuts, workings, pit walls, etc.)<br>2. Mining waste<br>3. Process waste<br>k. Ore Stockpiles, Mine Waste Facilities<br>1. Ore stockpiles<br>2. Waste rock<br>3. Mine waste repositories<br>4. Tailing piles<br>l. Occupancy<br>1. Residences/barracks or security facilities<br>2. Human waste facilities<br>3. Refuse disposal<br>4. Other uses<br>m. Monitoring<br>1. Surface water monitoring<br>2. Groundwater monitoring<br>3. Stability monitoring<br>4. Process monitoring (e.g., freeboard, leak detection, facility upsets, rates and volume limits, etc.)<br>5. Maintenance of erosion and stormwater controls<br>6. Water consumption<br>n. Other (specify): |
| Min B-Q21 | Provide a brief description of the activities ongoing at the time of this review. |
| Min B-Q22 | Approximate size of the area disturbed by the operation (ac or ha; specify unit): |
| Min B-Q23 | How long has the operation been active (specify in years): |
| Min B-Q24 | Normal operation season (specify month to month): |
| Min B-Q25 | Distance from mineral operation to nearest waterbody (ft, m, mi, or km; specify unit): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min B-Q26 | Type of waterbody nearest to the mineral operation. Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland/wet meadow<br>Estuary<br>Other (specify): |
| Min B-Q27 | Is any part of this site located within an AMZ? Select one:<br><br>a. Yes<br>b. No<br>c. Waterbody has no designated AMZ |
| **Implementation** | |
| Min B-Q28 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 30)<br>b. Environmental Impact Statement (EIS) (go to question 29)<br>c. Environmental Assessment (EA) (go to question 29)<br>d. Categorical Exclusion (CE) (go to question 29)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 29) |
| Min B-Q29 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the authorizing instrument. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Erosion and sediment control measures (includes soil cover, sediment considerations, etc.)<br>Yes/No/Not applicable<br>b. Storage of topsoil, subsoil, growth media, and waste rock<br>Yes/No/Not applicable<br>c. Limits on vegetation disturbance<br>Yes/No/Not applicable<br>d. Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads)<br>Yes/No/Not applicable<br>e. Controls for limiting the introduction or spread of aquatic invasive species<br>Yes/No/Not applicable<br>f. Location of activities (e.g., avoiding waterbodies or sensitive features)<br>Yes/No/Not applicable<br>g. Areal extent of activities<br>Yes/No/Not applicable<br>h. Timing and scheduling of operations (e.g., soil wetness)<br>Yes/No/Not applicable<br>i. Transport, storage, use, and disposal of chemicals<br>Yes/No/Not applicable<br>j. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc.<br>Yes/No/Not applicable<br>k. Controls for managing drilling fluids, additives, cuttings, and waste<br>Yes/No/Not applicable<br>l. Controls for managing laboratories<br>Yes/No/Not applicable<br>*(continued)* |

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| **Implementation** (*continued*) | |
|---|---|
| (*Min B-Q29 continued*) | m. Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining)<br>Yes/No/Not applicable<br>n. Provisions concerning consumptive use of water<br>Yes/No/Not applicable<br>o. Storage and disposal of reactive geologic materials<br>Yes/No/Not applicable<br>p. Water diversions, conveyance, and storage of storm water<br>Yes/No/Not applicable<br>q. Equipment service, storage, and maintenance areas<br>Yes/No/Not applicable<br>r. Trash and human sanitary waste management<br>Yes/No/Not applicable<br>s. Groundwater, surface water or stability monitoring<br>Yes/No/Not applicable<br>t. Well and borehole abandonment<br>Yes/No/Not applicable<br>u. Other (specify):<br>Yes/No/Not applicable |
| Min B-Q30 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the authorizing instrument were implemented fully this operating season. Select one response in each line. If the provision exists in the authorizing instrument and it was implemented fully, select Yes. If the provision exists in the authorizing instrument but it was not implemented fully, select No. If the provision does not exist in the authorizing instrument, or if is too early in the operating season for the provision to have been implemented at the time of evaluation, select Not applicable.<br><br>a. Erosion and sediment control measures (includes soil cover, sediment considerations, etc.)<br>Yes/No/Not applicable<br>b. Storage of topsoil, subsoil, growth media, and waste rock<br>Yes/No/Not applicable<br>c. Limits on vegetation disturbance<br>Yes/No/Not applicable<br>d. Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads)<br>Yes/No/Not applicable<br>e. Controls for limiting the introduction or spread of aquatic invasive species<br>Yes/No/Not applicable<br>f. Location of activities (e.g., avoiding waterbodies or sensitive features)<br>Yes/No/Not applicable<br>g. Areal extent of activities<br>Yes/No/Not applicable<br>h. Timing and scheduling of operations (e.g., soil wetness)<br>Yes/No/Not applicable<br>i. Transport, storage, use, and disposal of chemicals<br>Yes/No/Not applicable<br>j. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc.<br>Yes/No/Not applicable<br>k. Controls for managing drilling fluids, additives, cuttings, and waste<br>Yes/No/Not applicable<br>l. Controls for managing laboratories<br>Yes/No/Not applicable<br>m. Controls for managing (use, storage, transport, and disposal) mineral processing test materials (includes leaching, milling, process ponds, process plants, and solution mining)<br>Yes/No/Not applicable<br>n. Provisions concerning consumptive use of water<br>Yes/No/Not applicable<br>*(continued)* |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Min B-Q30 continued*) | o. Storage and disposal of reactive geologic materials<br>Yes/No/Not applicable<br>p. Water diversions, conveyance, and storage of storm water<br>Yes/No/Not applicable<br>q. Equipment service, storage, and maintenance areas<br>Yes/No/Not applicable<br>r. Trash and human sanitary waste management<br>Yes/No/Not applicable<br>s. Groundwater, surface water or stability monitoring<br>Yes/No/Not applicable<br>t. Well and borehole abandonment<br>Yes/No/Not applicable<br>u. Other provisions specified in question 29u:<br>Yes/No/Not applicable<br>v. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Min B-Q31 | Are petroleum or chemical **materials** stored at this mineral operation? Select one:<br><br>a. Yes (go to question 32)<br>b. No (go to question 35) |
| Min B-Q32 | Within the last 12 months, has the site been inspected by a governmental agency from which reports, violations, or similar instructions have been issued to correct problems concerning the storage, handling, or use of petroleum or chemical materials? Select one:<br><br>a. The site has been inspected by a governmental agency and problems were identified (go to question 33)<br>b. The site has been inspected by a governmental agency but problems were not found (go to question 34)<br>c. The site has not been inspected by a governmental agency within the past 12 months for these issues (go to question 34) |
| Min B-Q33 | Have all of the petroleum or chemical material deficiencies that could have potentially affected water quality or aquatic health identified by government agency inspections in the past 12 months been corrected or addressed fully? Select one:<br><br>a. Yes, deficiencies have been corrected or addressed fully<br>b. No, deficiencies have not been corrected or addressed fully |
| Min B-Q34 | Are all regulations pertaining to the topics below for petroleum or chemical materials storage at this mineral operation being followed at the time of this review? Select one answer in each row:<br><br>a. Storage building requirements<br>Yes/No<br>b. Physical container requirements (e.g., container composition, secondary containment, etc.)<br>Yes/No<br>c. Container labeling requirements<br>Yes/No<br>d. Proper storage of materials (e.g., separating incompatible materials, etc.)<br>Yes/No<br>e. Inventory/record keeping requirements<br>Yes/No<br>f. Mineral authorization (or HazMat plan) requirements<br>Yes/No<br>g. Safety Data Sheet requirements<br>Yes/No<br>h. Spill prevention plan<br>Yes/No |

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| **Implementation** (*continued*) | |
|---|---|
| Min B-Q35 | Are petroleum or chemical **wastes** stored at this mineral operation? Select one:<br><br>a. Yes (go to question 36)<br>b. No (go to question 39) |
| Min B-Q36 | Within the last 12 months, has the site been inspected by a governmental agency from which reports, violations, or similar instructions have been issued to correct problems concerning the storage, handling, discharge, or disposal of petroleum or chemical wastes? Select one:<br><br>a. The site has been inspected by a governmental agency and problems were identified (go to question 37)<br>b. The site has been inspected by a governmental agency but problems were not found (go to question 38)<br>c. The site has not been inspected by a governmental agency within the past 12 months for these issues (go to question 38) |
| Min B-Q37 | Have all of the petroleum or chemical waste deficiencies that could have potentially affected water quality or aquatic health identified by government agency inspections in the past 12 months been corrected or addressed fully? Select one:<br><br>a. Yes, deficiencies have been corrected or addressed fully<br>b. No, deficiencies have not been corrected or addressed fully |
| Min B-Q38 | Are all regulations pertaining to the topics below for petroleum or chemical waste storage at this mineral operation being followed at the time of this review? Select one answer in each row:<br><br>a. Storage building requirements<br>Yes/No<br>b. Physical container requirements (e.g., container composition, secondary containment, etc.)<br>Yes/No<br>c. Container labeling requirements<br>Yes/No<br>d. Proper storage of materials (e.g., separating incompatible materials, etc.)<br>Yes/No<br>e. Inventory/record keeping requirements<br>Yes/No<br>f. Mineral authorization (or HazMat plan) requirements<br>Yes/No<br>g. Safety Data Sheet requirements<br>Yes/No<br>h. Spill prevention plan<br>Yes/No |
| Min B-Q39 | Were project inspections during this operating season performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Yes<br>c. No |
| Min B-Q40 | If problems occurred during this operating season that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |

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| **Implementation** (*continued*) | |
|---|---|
| Min B-Q41 | Were chemical or fuel spills or leaks that occurred during operations at the site during the past 5 years handled/treated according to the spill prevention plan in the authorizing instrument or another agency's requirements? Select one:<br><br>a. There is no spill prevention plan in the authorizing instrument and there are no outside agency requirements that apply<br>b. Not applicable, no spills or leaks occurred during operations<br>c. Yes, reported spills or leaks were handled/treated according to the spill prevention plan or other applicable outside agency requirements<br>d. No, spills or leaks were not handled/treated according to the spill prevention plan or other applicable outside agency requirements |
| Min B-Q42 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 43)<br>b. No (go to question 44) |
| Min B-Q43 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Min B-Q44 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 45)<br>b. No (go to question 46 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Min B-Q45 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 46 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Min B-Q46 | Is there evidence of uncontrolled erosion or sedimentation from the mineral operations? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of uncontrolled erosion or sedimentation (go to question 54)<br>b. Evidence of uncontrolled erosion or sedimentation outside an AMZ (go to question 48)<br>c. Evidence of uncontrolled erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 48)<br>d. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 47) |
| Min B-Q47 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 49:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min B-Q48 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

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| **Effectiveness** (*continued*) | |
|---|---|
| Min B-Q49 | What type of waterbody has experienced morphological changes, or has received sediment inputs, or will receive inputs if sediment transport or erosion worsens? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min B-Q50 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |
| Min B-Q51 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 46, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Min B-Q52 | What are the sources? Select all that apply:<br><br>a. Cleared areas<br>b. Excavated areas<br>c. Stockpiles or soil storage areas<br>d. Water diversions<br>e. Water conveyance facility<br>f. Water storage pond or facility<br>g. Tailings, settling, process or storage ponds<br>h. Equipment service areas<br>i. Drill pad area<br>j. Exploration area<br>k. Quarry or borrow area<br>l. Access route<br>m. Staging area<br>n. Parking area<br>o. Storage area<br>p. Occupancy or administrative area<br>q. Other (specify): |

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| **Effectiveness** (*continued*) | |
|---|---|
| Min B-Q53 | What are the causes? Select all that apply:<br><br>a. Poor location for activity or feature<br>b. Slope shape and/or gradient<br>c. Instability due to inadequate design, construction, or maintenance<br>d. Lack of or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, etc.)<br>e. No or insufficient number of erosion control, water control, or water or sediment storage features installed<br>f. Improperly designed erosion control, water control, or water or sediment storage features<br>g. Improperly constructed erosion control, water control, or water or sediment storage features<br>h. Inadequate or improper maintenance of erosion control, water control, or water or sediment storage features<br>i. Operating outside of allowable time periods or soil conditions<br>j. Overland vehicle travel<br>k. Soil compaction<br>l. Mechanical additions<br>m. Human error<br>n. Did not anticipate effects<br>o. Other (specify):<br>p. Unknown |
| Min B-Q54 | Is there evidence of hazardous substances or associated leachates on or originating from the mineral operation site? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of hazardous substances or associated leachates (go to question 62)<br>b. Evidence of hazardous substances or associated leachates outside an AMZ (go to question 56)<br>c. Evidence of hazardous substances or associated leachates within an AMZ, but not reaching a waterbody (go to question 56)<br>d. Evidence of hazardous substance or associated leachate transport to or deposition in a waterbody (go to question 55) |
| Min B-Q55 | How many total places do you observe hazardous substances or associated leachates delivered to or present in a waterbody? Select one; after answering go to question 57:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min B-Q56 | What is the shortest distance between the evidence and the nearest waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

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| **Effectiveness** (*continued*) | |
|---|---|
| Min B-Q57 | What type of waterbody has been contaminated by hazardous substances or associated leachates or is closest to the evidence in the area you identified in question 54? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min B-Q58 | What is the width of the AMZ associated with the waterbody? (ft or m, specify unit): |
| Min B-Q59 | For all of the occurrences of hazardous substances or associated leachates observed in the area you identified in question 54, what is the evidence? Select all that apply:<br><br>a. Visible leachate or hazardous substances<br>b. Visible precipitate<br>c. Vegetative effects<br>d. Odor<br>e. Aquatic organism effects<br>f. Other organism effects<br>g. Water quality monitoring results<br>h. Other (specify): |
| Min B-Q60 | What are the sources? Select all that apply:<br><br>a. Trenches<br>b. Stockpiles<br>c. Tailings, settling, process, or storage ponds<br>d. Process fluid ponds<br>e. Quarry or borrow area<br>f. Underground, open pit, or strip mine<br>g. Processing/extraction area<br>h. Roads or parking areas<br>i. Storage areas<br>j. Fluid disposal<br>k. Waste rock disposal facility<br>l. Process wastes<br>m. Drilling wastes<br>n. Other (specify): |
| Min B-Q61 | What are the causes? Select all that apply:<br><br>a. Equipment failure<br>b. Lack of facility, or poor location for facility<br>c. Inadequate or improper maintenance<br>d. Poor design<br>e. Human error<br>f. Inadequate characterization of materials that had potential to generate hazardous substances or associated leachates<br>g. Improper construction and/or implementation of facility<br>h. Other (specify):<br>i. Unknown |

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| **Effectiveness** (*continued*) | |
|---|---|
| Min B-Q62 | What evidence of trash or human sanitary waste exists at the mineral operation site? Select all that apply:<br><br>a. No evidence of trash or human sanitary waste (go to question 64)<br>b. Evidence of trash outside an AMZ (go to question 63)<br>c. Evidence of trash within an AMZ (go to question 63)<br>d. Evidence of trash in a waterbody (go to question 63)<br>e. Evidence of human sanitary waste/toilet paper outside an AMZ (go to question 63)<br>f. Evidence of human sanitary waste/toilet paper within an AMZ (go to question 63)<br>g. Evidence of human sanitary waste/toilet paper in a waterbody (go to question 63) |
| Min B-Q63 | What are the causes? Select all that apply:<br><br>a. Insufficient number of trash receptacles<br>b. Trash receptacles not emptied frequently enough<br>c. Inappropriate location of trash receptacles<br>d. Improper design of trash receptacles (e.g., not wildlife-proof)<br>e. No sanitation facilities on site<br>f. Inappropriate location of sanitation facilities<br>g. Insufficient maintenance of sanitation facilities<br>h. Inconsiderate human actions<br>i. Other (specify): |
| Min B-Q64 | What evidence of chemical or fuel spills or leaks or associated containers exists at the mineral operation site? Select all that apply:<br><br>a. No evidence of chemical or fuel spills, leaks, or waste containers<br>b. Evidence of chemical or fuel spills or leaks outside an AMZ<br>c. Evidence of chemical or fuel spills or leaks within an AMZ<br>d. Evidence of chemical or fuel spills or leaks in a waterbody<br>e. Evidence of chemical or fuel waste containers outside an AMZ<br>f. Evidence of chemical or fuel waste containers within an AMZ<br>g. Evidence of chemical or fuel waste containers in a waterbody |
| Min B-Q65 | Is there evidence that the mineral operation has contributed to the introduction or spread of aquatic invasive species? Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Min B-Q66 | If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times<br>b. Yes<br>c. No |
| Min B-Q67 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 68)<br>b. No (go to question 69) |
| Min B-Q68 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Min B-Q69 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 70)<br>b. No (go to General Comments) |

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| Effectiveness (*continued*) | |
|---|---|
| Min B-Q70 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Minerals C—Placer Mining Operations

## Minerals C: Descriptive Statistics

Six Min C evaluations were completed during the FY15/16 monitoring period, with two evaluations by Region 6 completed using the 2013 version of the protocol. Fourteen evaluations were completed in FY17/18. Sixty-five percent of the Min C evaluations were selected randomly (Table 180). All regions in the western United States except Region 5 (see Appendix) completed at least one Min C evaluation (Table 215). One evaluation in FY15/16 included only implementation monitoring, and all other evaluations included both implementation and effectiveness monitoring (Table 215). All Min C evaluations were performed to meet National BMP targets (Min C-Q11a). Many reported at least one additional reason, most frequently project review (Table 216).

The area disturbed by placer mining and processing activities at the time of the evaluations (Min C-Q18) averaged 13.7 acres (standard error [se] = 13.3 acres) and 1.7 acres (se = 0.8 acre) in FY15/16 and FY17/18, respectively, and ranged from less than 0.1 acre to 80 acres; 17 of the 20 sites had disturbed areas of 2 acres or smaller. The mean area disturbed by support activities (Min C-Q19) was 0.3 acre (se = 0.1 acre) in FY15/16 and 1.0 acre (se = 0.2 acre) in FY17/18. A large difference existed among the operations in the length of time they were active (Min C-Q20), ranging from 4 months to 20 years (mean = 5.9 years, se = 3.0 years) in FY15/16 and 4 months to 55 years (mean = 11.5 years, se = 3.8 years) in FY17/18. Sixteen placer mining operations had federally owned mineral rights, and four operations had nonfederally owned mineral rights (Min C-Q23). In both monitoring periods, the most frequently identified activities ongoing at the operation (Min C-Q21) were use of roads and parking areas, at 80 percent or more of sites. Wash plants also were operating at two-thirds of the sites evaluated in FY15/16 and half the sites evaluated in FY17/18.

All but one of the Min C operations in FY15/16 and all operations in FY17/18 had BMPs from planning documents—either from NEPA or other guidance documents—included in the Approved Plan of Operations (APO) or negotiated terms. When BMPs were applicable to operations for protecting water, aquatic, and riparian resources, they were carried from planning into the APO or negotiated terms for 53 and 85 percent of operations on average in FY15/16 and FY17/18, respectively. Applicable BMPs in the APO or negotiated terms were implemented fully for 92 percent of operations in FY15/16

**Table 215.—**Number of Min C evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Min C-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 1 | | | 1 |
| | 2 | 1 | | | 1 |
| | 3 | 1 | 1 | | |
| | 4 | | | | |
| | 5 | | | | |
| | 6 | 3 | | | 3 |
| | 8 | | | | |
| | 9 | | | | |
| | 10 | | | | |
| | All | 6 | 1 | | 5 |
| | Percent | | 17 | | 83 |
| FY17/18 | | | | | |
| | 1 | 1 | | | 1 |
| | 2 | 2 | | | 2 |
| | 3 | 1 | | | 1 |
| | 4 | 1 | | | 1 |
| | 5 | | | | |
| | 6 | 5 | | | 5 |
| | 8 | | | | |
| | 9 | | | | |
| | 10 | 4 | | | 4 |
| | All | 14 | | | 14 |
| | Percent | | | | 100 |

**Table 216.—**Number of Min C evaluations completed in FY15/16 (n=6 evaluations) and FY17/18 (n=14 evaluations), by reason for monitoring (Min C-Q11a). Multiple selections were possible.

| Reason for monitoring | FY15/16 | FY17/18 |
|---|---|---|
| National BMP targets | 6 | 14 |
| Land management plan monitoring | 1 | 3 |
| Project review | 2 | 4 |
| Quality assurance | 0 | 2 |
| Other | 0 | 2 |

and 80 percent in FY17/18 on average. Note that for Min C, BMPs may be considered not applicable if it is too early in the operating season for implementation of those BMPs. Overall, seven operations (35 percent) did not have inspections or inspections were not at critical times for protecting water resources (Min C-Q27). One evaluation indicated that corrective actions were needed to address problems during the operating season but that those actions were not taken. Five evaluations reported that corrective actions were taken when problems occurred. Chemical spills and leaks had not occurred during the past 5 years at any Min C operation.

Evidence of uncontrolled erosion, sedimentation, or waterbody morphology changes from project activities outside the mined waterbody was observed at 7 of the 19 operations evaluated for BMP effectiveness. Five evaluations observed evidence within an AMZ less than 50 feet from a waterbody, and two evaluations observed evidence in a waterbody. The most common type of evidence observed was vegetation damage or bare ground. Ten operations had specifications for allowable waterbody alterations in the APO or negotiated terms, and for three of those operations the allowable amounts were exceeded.

## Minerals C: Ratings and Component Scores

Thirty-three percent of the operations in FY15/16 and 71 percent in FY17/18 were rated as *fully implemented* or *mostly implemented* (Fig. 105A, B). One operation had a *no BMPs* rating. Effectiveness ratings for Min C in FY17/18 were very similar to the implementation

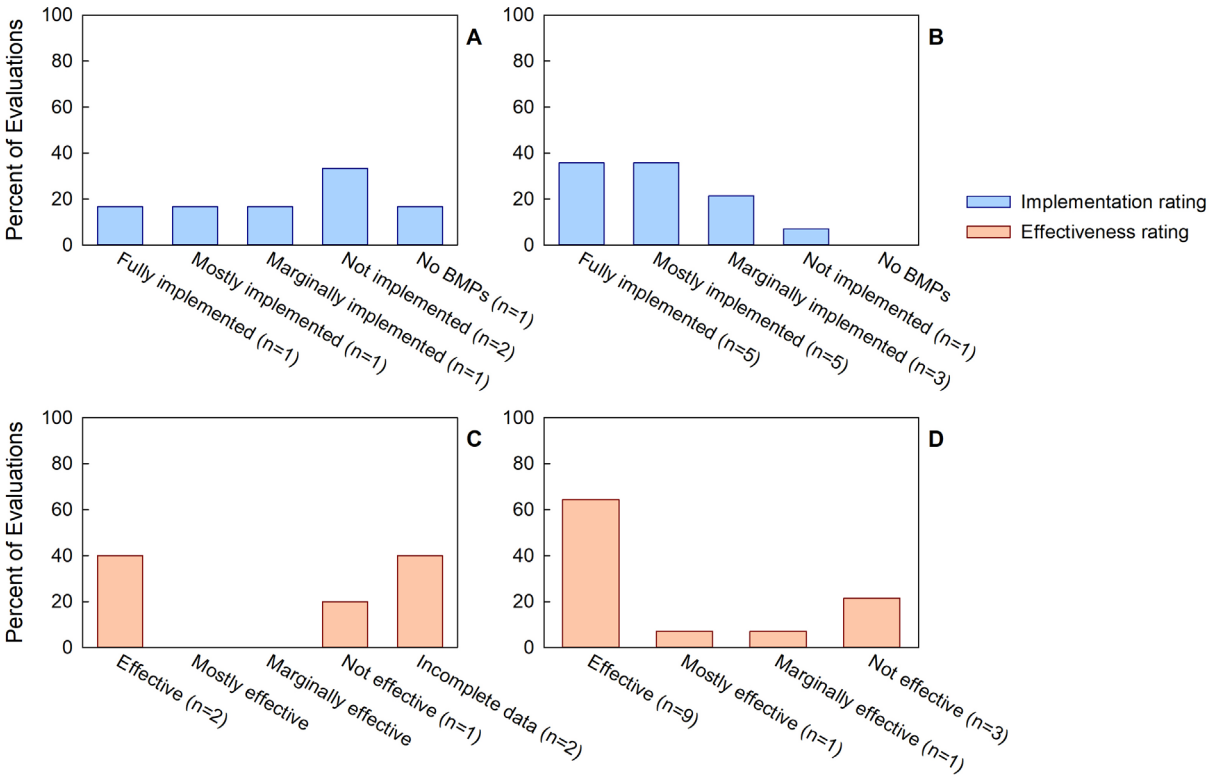



**Figure 105.**—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Min C evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). "Incomplete data" refers to evaluations where all of the questions needed to determine a rating were not answered.

ratings, with 71 percent of evaluated operations receiving an *effective* or *mostly effective* rating (Fig. 105C, D) compared to 40 percent in FY15/16. Evaluations completed using the 2013 version of the protocol were included in the FY15/16 ratings summary for Min C. Thus, only three evaluations in FY15/16 could be rated for effectiveness because of incomplete data.

Composite ratings could be determined for 17 Min C operations (3 in FY15/16 and 14 in FY17/18) (Table 217). Of these, 47 percent of operations had composite ratings of *excellent*, and 24 percent were rated as *poor*. In FY17/18, 64 percent of operations were rated *fully implemented* or *mostly implemented* and also *effective* or *mostly effective* (Table 217), indicating that better implementation resulted in better BMP effectiveness for the larger sample of placer mining operations evaluated during that monitoring period.

**Table 217.—**Composite rating matrix for Min C operations evaluated for both implementation and effectiveness in FY15/16 (n=3 evaluations) and FY17/18 (n=14 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 1 | | | 1 | |
| | Mostly effective | | | | | |
| | Marginally effective | | | | | |
| | Not effective | | | 1 | | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 5 | 3 | | 1 | |
| | Mostly effective | | 1 | | | |
| | Marginally effective | | 1 | | | |
| | Not effective | | | 3 | | |

Excellent
Good
Fair
Poor
No plan

The implementation rating components and their interpretations for Min C are the same as for the other Min protocols (Table 184). The Min C effectiveness components and their interpretations are given in Table 218. Table 219 shows how the scores were distributed across the three implementation components. One operation did not carry the BMPs from planning into the APO or negotiated terms, which resulted in a planning component score of *none*. One project had a *none* score for the on-the-ground execution component because none of the BMPs in the APO or negotiated terms were implemented fully. The

**Table 218.—**Effectiveness components, scores, and interpretation of each score for Min C. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Erosion and sedimentation | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Trash and waste | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |
| Chemical pollutants | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |

**Table 219.—**Distribution of implementation component scores by component for Min C evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=6) | | | | | | | |
| | All | 2 | 33 | 4 | 67 | 3 | 50 |
| | Some | 2 | 33 | 2 | 33 | 1 | 17 |
| | None | 1 | 17 | | | 2 | 33 |
| | No BMPs | 1 | 17 | | | | |
| FY17/18 (n=14) | | | | | | | |
| | All | 10 | 71 | 10 | 71 | 8 | 57 |
| | Some | 4 | 29 | 3 | 21 | 6 | 43 |
| | None | | | 1 | 7 | | |
| | No BMPs | | | | | | |

two *none* scores for the project oversight component resulted from needed corrective actions not being undertaken during operations. Thirty percent of the operations achieved an implementation rating of *fully implemented*, and 15 percent were rated as *not implemented* (Table 220). One operation in FY15/16 had the unusual combination of a *none* score for the planning component and an *all* score for the on-the-ground execution component, which is possible only if BMPs that were implemented on the ground were included in standard APO or negotiated terms language rather than from planning documents.

The distribution of effectiveness component scores is shown in Table 221. Two evaluations in FY15/16 had incomplete data for the trash and waste component, and therefore an effectiveness rating could not be determined (Table 222). The remaining trash and waste component scores and chemical pollutants component scores were *all*. Thus the effectiveness ratings were driven by the erosion and sedimentation component scores for all 17 Min C operations that could be rated (Table 222).

**Table 220.—**Implementation component scores corresponding to the overall implementation ratings for Min C evaluations with complete data in FY15/16 and FY17/18. See Table 184 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=6) | | | | | |
| | Fully implemented | All | All | All | 1 |
| | Mostly implemented | All | All | Some | 1 |
| | Marginally implemented | Some | Some | All | 1 |
| | Not implemented | Some | All | None | 1 |
| | | None | All | All | 1 |
| | No BMPs | No BMPs | Some | None | 1 |
| FY17/18 (n=14) | | | | | |
| | Fully implemented | All | All | All | 5 |
| | Mostly implemented | All | All | Some | 3 |
| | | Some | All | All | 1 |
| | | Some | All | Some | 1 |
| | Marginally implemented | All | Some | All | 1 |
| | | Some | Some | Some | 2 |
| | Not implemented | All | None | All | 1 |

**Table 221.—**Distribution of effectiveness component scores by component for Min C evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Trash and waste component (number) | Trash and waste component (percent) | Chemical pollutants component (number) | Chemical pollutants component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=5) | | | | | | | |
| | Effective | 3 | 60 | 3 | 60 | 5 | 100 |
| | Mostly effective[a] | 1 | 20 | | | | |
| | Moderately effective[b] | | | | | | |
| | Marginally effective[a] | | | | | | |
| | Not effective | 1 | 20 | | | | |
| | Incomplete data[c] | | | 2 | 40 | | |
| FY17/18 (n=14) | | | | | | | |
| | Effective | 9 | 64 | 14 | 100 | 14 | 100 |
| | Mostly effective | 1 | 7 | | | | |
| | Moderately effective | | | | | | |
| | Marginally effective | 1 | 7 | | | | |
| | Not effective | 3 | 21 | | | | |

[a] Score applies only to erosion and sedimentation component (see Table 218).
[b] Score applies only to trash and waste and chemical pollutants components (see Table 218).
[c] 2013 version of the Min C protocol.

**Table 222.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Min C evaluations with complete data in FY15/16 and FY17/18. See Table 218 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Erosion and sedimentation component | Trash and waste component | Chemical pollutants component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=3) | | | | | |
| | Effective | Effective | Effective | Effective | 2 |
| | Mostly effective | | | | 0 |
| | Marginally effective | | | | 0 |
| | Not effective | Not effective | Effective | Effective | 1 |
| FY17/18 (n=14) | | | | | |
| | Effective | Effective | Effective | Effective | 9 |
| | Mostly effective | Mostly effective | Effective | Effective | 1 |
| | Marginally effective | Marginally effective | Effective | Effective | 1 |
| | Not effective | Not effective | Effective | Effective | 3 |

## Minerals C: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Min C. Placer Mining Operations**

(Reference BMPs Min-1, Min-3, Min-4, Min-5, Min-6, Fac-3, Fac-4, Fac-5, Fac-6, Road-4, Road-5, Road-9, and Road 10)

v3.0 February 2016

| Header | |
|---|---|
| Min C-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Min C-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Min C-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Min C-Q4 | Date of current field evaluation: |
| Min C-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Min C-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Min C-Q7 | Reviewers and titles: |
| Min C-Q8a | Region number: |
| Min C-Q8b | State: |
| Min C-Q9a | Proclaimed Forest or Grassland number and name: |
| Min C-Q9b | Administrative Forest or Grassland number and name: |
| Min C-Q10 | District number and name: |
| Min C-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Min C-Q11b | Was the project/site selected randomly from the population developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min C-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Min C-Q12 | 6th level HUC number and name for the subwatershed this operation is in: |
| Min C-Q13 | Is the area being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Min C-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Min C-Q14b | Location.<br><br>Easting: |
| Min C-Q14c | Location.<br><br>Northing: |
| Min C-Q15a | Location.<br><br>Latitude: |
| Min C-Q15b | Location.<br><br>Longitude: |
| Min C-Q15c | Location.<br><br>Lat/Long Datum: |
| Min C-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Min C-Q17 | Name of operation or mining claim: |
| Min C-Q18 | Approximate size of area disturbed by the placer mining operation and processing activities (ac or ha; specify unit): |
| Min C-Q19 | Approximate size of support areas (e.g., parking, storage, occupancy, etc.) disturbed by operation (ac or ha; specify units): |
| Min C-Q20 | How long has the operation been active? (months or years; specify units) |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min C-Q21 | Which of these elements currently is an active part of the operation? Select all that apply:<br><br>a. Testing/Mining<br>1. Suction dredging<br>2. Sand or gravel mining (includes excavations, test pits, and drill holes in unconsolidated deposits)<br>3. Wash plants<br>4. Spray bars<br>5. Settling/process ponds<br>6. Processing stockpiles<br>7. Soil/overburden stockpiles<br>8. Stormwater run-on/runoff controls<br>9 Other processing<br><br>b. Access and Linear Features<br>1. Roads<br>2. Waterbody crossings<br>3. Overland vehicle travel<br>4. Aircraft pads or runways<br>5. Conveyors<br><br>c. Service Areas and Facilities<br>1. Storage areas<br>2. Parking areas<br>3. Equipment service areas<br>4. Laboratories<br>5. Administrative offices<br>6 Power generation<br>7. Water wells<br>8. Water diversions and conveyances<br>9. Other support facilities<br><br>d. Chemicals and Materials<br>1. Oils, fuels, grease, coolants<br>2. Laboratory chemicals<br>3. Pesticides or herbicides<br>4. Tires<br>5. Batteries<br>6. Other chemicals or materials<br><br>e. Occupancy<br>1. Residences/barracks or security facilities<br>2. Human waste facilities<br>3. Refuse disposal<br>4. Other uses<br><br>f. Monitoring<br>1. Surface water monitoring<br>2. Waterbody bed/bank or morphological monitoring<br>3. Discharge monitoring<br>4. Stability monitoring<br>5. Maintenance of erosion and stormwater controls<br>6. Water consumption<br><br>g. Other (specify): |
| Min C-Q22 | Provide a brief description of the activities ongoing at the time of this review. |
| Min C-Q23 | Ownership of the mineral rights. Select one:<br><br>Federal<br>Non-federal |

*continued on next page*

| Implementation | |
|---|---|
| Min C-Q24 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 26)<br>b. Environmental Impact Statement (EIS) (go to question 25)<br>c. Environmental Assessment (EA) (go to question 25)<br>d. Categorical Exclusion (CE) (go to question 25)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 25) |
| Min C-Q25 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the Approved Plan of Operations or in the negotiated terms for private mineral operations. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Erosion and sediment control measures not on access routes (includes soil cover, revegetation, structural controls, etc.)<br>Yes/No/Not applicable<br>b. Limits on vegetative disturbance<br>Yes/No/Not applicable<br>c. Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads)<br>Yes/No/Not applicable<br>d. Controls for limiting the introduction or spread of aquatic invasive species<br>Yes/No/Not applicable<br>e. Location of activities (e.g., avoiding sensitive features)<br>Yes/No/Not applicable<br>f. Areal extent of activities<br>Yes/No/Not applicable<br>g. Timing and scheduling of operations (e.g., soil wetness)<br>Yes/No/Not applicable<br>h. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, and other chemicals needed for mechanized equipment<br>Yes/No/Not applicable<br>i. Transport, storage, use, and disposal of other chemicals<br>Yes/No/Not applicable<br>j. Process waste (storage, use, disposal)<br>Yes/No/Not applicable<br>k. Location of access routes<br>Yes/No/Not applicable<br>l. Construction requirements for access routes<br>Yes/No/Not applicable<br>m. Erosion and sediment control measures on access routes<br>Yes/No/Not applicable<br>n. Other stormwater controls<br>Yes/No/Not applicable<br>o. Equipment service, storage, and maintenance areas<br>Yes/No/Not applicable<br>p. Trash and human sanitary waste management<br>Yes/No/Not applicable<br>q. Water supply (use and limits)<br>Yes/No/Not applicable<br>r. Well and borehole abandonment<br>Yes/No/Not applicable<br>s. Other (specify):<br>Yes/No/Not applicable |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Min C-Q26 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the Approved Plan of Operations or in the negotiated terms for private mineral operations were fully implemented this operating season. Select one response in each line. If the provision exists in the Approved Plan of Operations or in the negotiated terms for private mineral operations and it was implemented fully, select Yes. If the provision exists in the Approved Plan of Operations or in the negotiated terms for private mineral operations but it was not implemented fully, select No. If the provision does not exist in the Approved Plan of Operations or in the negotiated terms for private mineral operations, or if is too early in the operation for the provision to have been implemented at the time of evaluation, select Not applicable.<br><br>a. Erosion and sediment control measures not on access routes (includes soil cover, revegetation, structural controls, etc.)<br>Yes/No/Not applicable<br>b. Limits on vegetative disturbance<br>Yes/No/Not applicable<br>c. Maintenance of erosion and stormwater controls (includes run-on/runoff controls, flood protection, stream crossings, and roads)<br>Yes/No/Not applicable<br>d. Controls for limiting the introduction or spread of aquatic invasive species<br>Yes/No/Not applicable<br>e. Location of activities (e.g., avoiding sensitive features)<br>Yes/No/Not applicable<br>f. Areal extent of activities<br>Yes/No/Not applicable<br>g. Timing and scheduling of operations (e.g., soil wetness)<br>Yes/No/Not applicable<br>h. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, and other chemicals needed for mechanized equipment<br>Yes/No/Not applicable<br>i. Transport, storage, use, and disposal of other chemicals<br>Yes/No/Not applicable<br>j. Process waste (storage, use, disposal)<br>Yes/No/Not applicable<br>k. Location of access routes<br>Yes/No/Not applicable<br>l. Construction requirements for access routes<br>Yes/No/Not applicable<br>m. Erosion and sediment control measures on access routes<br>Yes/No/Not applicable<br>n. Other stormwater controls<br>Yes/No/Not applicable<br>o. Equipment service, storage, and maintenance areas<br>Yes/No/Not applicable<br>p. Trash and human sanitary waste management<br>Yes/No/Not applicable<br>q. Water supply (use and limits)<br>Yes/No/Not applicable<br>r. Well and borehole abandonment<br>Yes/No/Not applicable<br>s. Other provisions specified in question 25s<br>Yes/No/Not applicable<br>t. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Min C-Q27 | Were inspections during this operating season performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Yes<br>c. No |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| Min C-Q28 | If problems occurred during this operating season that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |
| Min C-Q29 | Were chemical or fuel spills or leaks that occurred at this site in the past 5 years handled/treated according to the spill prevention plan in the Approved Plan of Operations or the negotiated terms for private mineral operations or another agency's requirements? Select one:<br><br>a. There is no spill prevention plan in the Approved Plan of Operations or negotiated terms and there are no outside agency requirements that apply<br>b. Not applicable, no spills or leaks occurred during placer mining operations<br>c. Yes, reported spills or leaks were handled/treated according to the spill prevention plan or other applicable outside agency requirements<br>d. No, spills or leaks were not handled/treated according to the spill prevention plan or other applicable outside agency requirements |
| Min C-Q30 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 31)<br>b. No (go to question 32) |
| Min C-Q31 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Min C-Q32 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 33)<br>b. No (go to question 34 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Min C-Q33 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 34 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Min C-Q34 | Is there evidence of uncontrolled erosion or sedimentation attributable to operation activities that occurred or are occurring outside the waterbody? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of uncontrolled erosion or sedimentation (go to question 42)<br>b. Evidence of uncontrolled erosion or sedimentation outside an AMZ (go to question 36)<br>c. Evidence of uncontrolled erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 36)<br>d. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 35) |
| Min C-Q35 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one; after answering go to question 37:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min C-Q36 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |
| Min C-Q37 | What type of waterbody has experienced morphological changes, or has received sediment inputs, or will receive inputs if sediment transport or erosion worsens? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min C-Q38 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |
| Min C-Q39 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 34, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Min C-Q40 | What are the sources? Select all that apply:<br><br>a. Equipment service areas<br>b. Processing/extraction area<br>c. Access roads<br>d. Overland vehicle travel<br>e. Waterbody crossings<br>f. Staging areas<br>g. Parking areas<br>h. Storage areas<br>i. Occupancy or administrative area<br>j. Stormwater or sediment control features<br>k. Stockpiles<br>l. Transportation/conveyors<br>m. Other (specify): |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min C-Q41 | What are the causes? Select all that apply:<br><br>a. Poor location for activity<br>b. Lack of or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, etc.)<br>c. No or insufficient number of erosion control structures installed<br>d. Improperly designed erosion control structures<br>e. Improperly constructed erosion control or storage structures<br>f. Inadequate or improper operation or maintenance of erosion control structures<br>g. Operating outside of allowable time periods<br>h. Soil compaction<br>i. Other (specify):<br>j. Unknown |
| Min C-Q42 | Is there evidence of fuels or chemicals from the operation? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of fuels or chemicals (go to question 48)<br>b. Evidence of fuels or chemicals outside an AMZ (go to question 44)<br>c. Evidence of fuels or chemicals within an AMZ, but not reaching a waterbody (go to question 44)<br>d. Evidence of fuel or chemical transport to or deposition in a waterbody (go to question 43) |
| Min C-Q43 | How many total places do you observe fuels or chemicals delivered to or present in a waterbody? Select one; after answering go to question 45:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min C-Q44 | What is the shortest distance between the evidence and the nearest waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |
| Min C-Q45 | For all of the occurrences of fuels or chemicals observed in the area you identified in question 42, what is the evidence? Select all that apply:<br><br>a. Hydrocarbon or chemicals are visible<br>b. Free product actively leaking or being discharged<br>c. Soil stains<br>d. Vegetative effects<br>e. Odor<br>f. Aquatic organism effects<br>g. Other organism effects<br>h. Water quality monitoring results<br>i. Other (specify): |
| Min C-Q46 | What are the sources? Select all that apply:<br><br>a. Equipment or vehicles<br>b. Equipment service areas<br>c. Fuel or chemical storage areas<br>d. Occupancy or administrative areas<br>e. Access routes constructed/used for operations<br>f. Other (specify): |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min C-Q47 | What are the causes? Select all that apply:<br><br>a. Equipment or vehicle failure<br>b. Poor location for activity or feature<br>c. Poor operations or maintenance<br>d. Poor design<br>e. Human error<br>f. Inadequate spill response or clean-up<br>g. Other (specify):<br>h. Unknown |
| Min C-Q48 | Is there evidence of trash or human sanitary waste disposal problems from the operation? Select all that apply:<br><br>a. No evidence of trash or human sanitary waste (go to question 51)<br>b. Evidence of trash outside an AMZ (go to question 49)<br>c. Evidence of trash within an AMZ, but not reaching a waterbody (go to question 49)<br>d. Evidence of trash in a waterbody (go to question 49)<br>e. Evidence of human sanitary waste outside an AMZ (go to question 49)<br>f. Evidence of human sanitary waste within an AMZ, but not reaching a waterbody (go to question 49)<br>g. Evidence of human sanitary waste in a waterbody (go to question 49) |
| Min C-Q49 | For all of the occurrences of trash or human sanitary waste observed in the area you identified in question 48, what is the evidence? Select all that apply:<br><br>a. Visible human excrement/toilet paper<br>b. Trash or food wastes<br>c. Visible evidence of soaps<br>d. Odor<br>e. Flies or other insects<br>f. Burn piles or barrels<br>g. Water quality monitoring results<br>h. Other (specify): |
| Min C-Q50 | What are the causes? Select all that apply:<br><br>a. Waste receptacles are not appropriate<br>b. Waste disposal does not follow the Approved Plan of Operations or negotiated terms<br>c. Waste receptacles are not emptied frequently enough<br>d. Use is exceeding carrying capacity of the occupied site footprint<br>e. Toilet facilities are not present<br>f. Toilet facilities are not properly located<br>g. Toilet facilities are not functioning properly<br>h. Inconsiderate human actions<br>i. Other (specify): |
| Min C-Q51 | Is there evidence of waterbody alterations from the operation that exceeded the amount allowed in the Approved Plan of Operations or the negotiated terms? Select one:<br><br>a. Not applicable, allowable waterbody alterations not specified (go to question 53)<br>b. Yes, waterbody alterations exceed the amount allowed in the Plan or terms (go to question 52)<br>c. No, waterbody alterations do not exceed the amount allowed in the Plan or terms (go to question 53) |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min C-Q52 | What are the causes? Select all that apply:<br><br>a. Operations outside area allowed in Approved Plan of Operations or negotiated terms<br>b. Operations exceeded other limits defined in the Approved Plan of Operations or negotiated terms<br>c. Operations performed with oversized equipment<br>d. Undercutting of the waterbody bank<br>e. Improperly designed access roads<br>f. Improperly constructed access roads<br>g. Lack of appropriate waterbody crossings<br>h. Other (specify):<br>i. Unknown |
| Min C-Q53 | Is there evidence that the placer mining operation contributed to the introduction or spread of aquatic invasive species? Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Min C-Q54 | If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times<br>b. Yes<br>c. No |
| Min C-Q55 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 56)<br>b. No (go to question 57) |
| Min C-Q56 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Min C-Q57 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 58)<br>b. No (go to General Comments) |
| Min C-Q58 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies. Go to General Comments after answering this question. |
| **General Comments** | |
| | |

# Minerals D—Reclamation of Mineral Operations

## Minerals D: Header Statistics

Thirty mineral reclamation projects (Min D) were evaluated in the two monitoring periods. Region 5 and Region 9 (see Appendix) were the only regions that did not complete at least one Min D evaluation in either monitoring period (Table 223). Twenty of the projects evaluated were selected randomly (Table 180). While the most common reason for using the Min D protocol was to meet National BMP targets (Min D-Q11a) with all evaluations noting that reason, the protocol simultaneously met other monitoring needs, most frequently project review (Table 223).

Quality assurance was identified as a reason for monitoring (Min D-Q11a) in eight Min D evaluations (Table 223). For National BMP monitoring, quality assurance monitoring is defined in the protocol instructions provided for reviewers as "replicated BMP monitoring performed on a site or project soon after an initial or follow-up monitoring effort on that

**Table 223.—**Number of Min D evaluations completed in FY15/16 (n=16 evaluations) and FY17/18 (n=14 evaluations), by region and reason for monitoring (Min D-Q11a). Multiple selections were possible.

| Monitoring period | Region | National BMP targets | Land management plan monitoring | Project review | Quality assurance | Other |
|---|---|---|---|---|---|---|
| FY15/16 | | | | | | |
| | 1 | 1 | | | | |
| | 2 | 3 | | | | |
| | 3 | 3 | | 3 | | |
| | 4 | 2 | | 1 | 1 | |
| | 5 | | | | | |
| | 6 | 2 | | 2 | 1 | |
| | 8 | 2 | | | 1 | |
| | 9 | | | | | |
| | 10 | | | | | |
| | All | 16 | 0 | 6 | 3 | 0 |
| FY17/18 | | | | | | |
| | 1 | | | | | |
| | 2 | 3 | 1 | 3 | 2 | 2[a] |
| | 3 | 3 | | | | |
| | 4 | 3 | | 2 | 1 | |
| | 5 | | | | | |
| | 6 | 1 | | 1 | 1 | |
| | 8 | 3 | | 1 | 1 | |
| | 9 | | | | | |
| | 10 | 1 | | | | |
| | All | 14 | 1 | 7 | 5 | 2 |

[a] Regional Minerals inspection.

same site . . . [by] different team members than the initial or follow-up evaluation, with the objective of comparing both sets of results as a check of the repeatability of results." None of the evaluations identified as being for quality assurance had duplicate evaluations, however, which is necessary to meet the intent of that type of monitoring. Therefore, the review teams that selected quality assurance appeared to use this term to mean something different from what the protocol instructions stipulate.

At the end of the FY17/18 monitoring period, all but three evaluations had both implementation and effectiveness monitoring completed (Table 224). Implementation and effectiveness monitoring were performed on a single day for all those evaluations. Only the implementation portion of the evaluation was completed for the remaining projects, and it is unlikely that effectiveness will be evaluated on at least two of those projects given that the protocol instructions to complete both parts of the evaluation within 12 months of project completion were not followed. On average, the Min D evaluations in FY15/16 occurred 7 months after the reclamation project was completed. The reported times

**Table 224.—**Number of Min D evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Min D-Q1)

| Monitoring period | Region | Total | Implementation only | Effectiveness only | Both implementation and effectiveness |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 4 | | | 4 |
| | 2 | 3 | | | 3 |
| | 3 | 3 | | | 3 |
| | 4 | 2 | | | 2 |
| | 5 | | | | |
| | 6 | 2 | 1 | | 1 |
| | 8 | 2 | | | 2 |
| | 9 | | | | |
| | 10 | | | | |
| | All | 16 | 1 | | 15 |
| | Percent | | 6 | | 94 |
| FY17/18 | | | | | |
| | 1 | | | | |
| | 2 | 3 | 1 | | 2 |
| | 3 | 3 | | | 3 |
| | 4 | 3 | 1 | | 2 |
| | 5 | | | | |
| | 6 | 1 | | | 1 |
| | 8 | 3 | | | 3 |
| | 9 | | | | |
| | 10 | 1 | | | 1 |
| | All | 14 | 2 | | 12 |
| | Percent | | 14 | | 86 |

between project completion and the BMP evaluation were highly variable in FY17/18, ranging from 1 day to 20 years. When the longest time of 20 years was excluded, the average for the monitoring period was 16 months, which is still longer than the timing given in the protocol instructions.

There are a wide variety of reclaimed mineral operations that can be evaluated using protocol Min D (Min D-Q24). Ten projects evaluated fell into the "surface uses-other" category (Fig. 106), and six were oil and gas or geothermal production sites. The "other" type of operations included underground adits (mine access) and a buried production pipeline. Seventy-three percent of the reclaimed sites included federally owned mineral rights (Table 225). Bond release criteria (i.e., standards that must be met before a bond may be released) were developed (Min D-Q23) for 6 of 16 projects in FY15/16 and 7 of 14 in FY17/18. Oil and gas or geothermal production reclamation projects most frequently had bond release criteria developed (17 percent of projects), while reclamation of other surface uses most often did not (27 percent of projects).

Rivers or streams comprised most of the waterbodies nearest to the reclamation operations, with ephemeral, intermittent, and perennial channels being approximately equally represented across both monitoring periods (Table 226). Similar numbers of

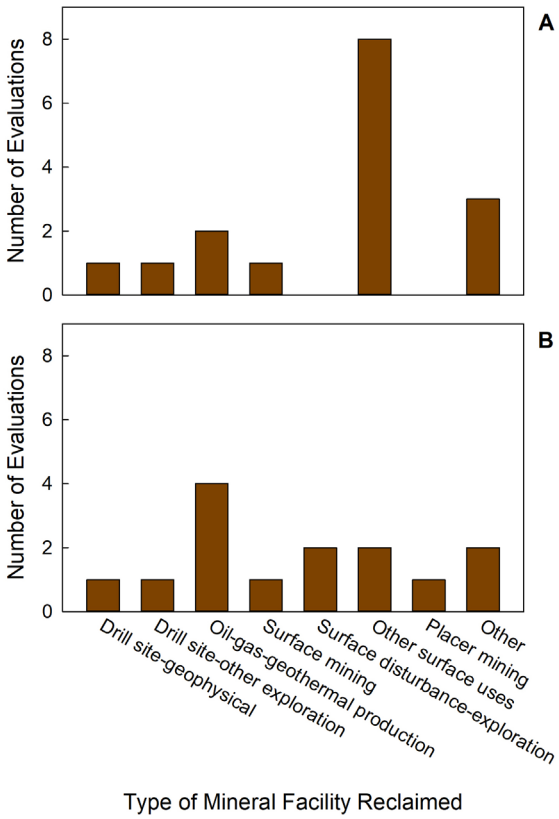



**Figure 106.—**The types of mineral facilities reclaimed (Min D-Q24) for evaluations completed in (A) FY15/16 and (B) FY17/18.

**Table 225.—**Number of Min D evaluations completed in FY15/16 and FY17/18, by region and ownership of mineral rights (Min D-Q25)

| Region | FY15/16 Federal ownership | FY15/16 Nonfederal ownership | FY17/18 Federal ownership | FY17/18 Nonfederal ownership |
|---|---|---|---|---|
| 1 | 3 | 1 | | |
| 2 | 3 | | 3 | |
| 3 | | 3 | 2 | 1 |
| 4 | 2 | | 3 | |
| 5 | | | | |
| 6 | | 2 | 1 | |
| 8 | 2 | | 2 | 1 |
| 9 | | | | |
| 10 | | | 1 | |
| All | 10 | 6 | 12 | 2 |
| Percent within monitoring period | 62 | 38 | 86 | 14 |

**Table 226.—**Number of Min D evaluations completed in FY15/16 and FY17/18, by region, type of waterbody nearest to project (Min D-Q20), and whether any part of reclamation activity was in an aquatic management zone (AMZ) (Min D-Q18)

| Monitoring period | Region | Ephemeral stream | Intermittent stream | Perennial stream/river | Wetland/ wet meadow | Activity in an AMZ | Activity not in an AMZ | No designated AMZ for nearest waterbody |
|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | |
| | 1 | 2 | 1 | 1 | | 1 | 1 | 2 |
| | 2 | | 2 | 1 | | 1 | 1 | 1 |
| | 3 | | 2 | 1 | | 2 | 1 | |
| | 4 | 2 | | | | | 1 | 1 |
| | 5 | | | | | | | |
| | 6 | | 1 | | 1 | 2 | | |
| | 8 | 1 | | 1 | | | 1 | 1 |
| | 9 | | | | | | | |
| | 10 | | | | | | | |
| | All | 5 | 6 | 4 | 1 | 6 | 5 | 5 |
| | Percent | 31[a] | 38[a] | 25[a] | 6[a] | 38[b] | 31[b] | 31[b] |
| FY17/18 | | | | | | | | |
| | 1 | | | | | | | |
| | 2 | 1 | 1 | | 1 | 2 | 1 | |
| | 3 | 3 | | | | | 2 | 1 |
| | 4 | 1 | | 2 | | 2 | 1 | |
| | 5 | | | | | | | |
| | 6 | | | 1 | | 1 | | |
| | 8 | | 1 | 2 | | 2 | 1 | |
| | 9 | | | | | | | |
| | 10 | | | 1 | | | 1 | |
| | All | 5 | 2 | 6 | 1 | 7 | 6 | 1 |
| | Percent | 36[a] | 14[a] | 43[a] | 7[a] | 50[b] | 43[b] | 7[b] |

[a] Percent within waterbody type.
[b] Percent within reclamation activity relative to an AMZ.

projects in FY15/16 were located completely outside an aquatic management zone (AMZ), at least partially within an AMZ, or within 50 feet of a waterbody that had no designated AMZ (which corresponds to the "no designated AMZ" column in Table 226); one project in FY17/18 had no designated AMZ. The total area disturbed by reclamation activities averaged 6.2 acres (se = 2.0 acres) for all projects in FY15/16; however, one exploration drill site covered 30 acres. The mean project area in FY17/18 was 3.4 acres (se = 1.5 acres) and ranged from 0.75 acre to 20 acres for the surface mine reclamation. However, the project area was not significantly different by type of facility reclaimed in either monitoring period (p = 0.38 FY15/16, p = 0.41 FY17/18; generalized linear mixed model [GLMM] with lognormal distribution and identity link function).

## Minerals D: Implementation Results and Their Tie to Header Information

Of the reclamation projects completed, 19 were done by the operator of the mineral operation, and the remaining 11 were accomplished by the Forest Service (Table 227). Of those 11, the bond that was available for reclamation was insufficient to complete all needed reclamation activities for six projects (Table 227). Off-site mitigation (Min D-Q28) was not included in the authorizing instrument for 24 of the operations, while off-site mitigation requirements had been initiated at the time of the evaluation for five of the six other projects. Mitigations most frequently were described as sediment retention or settling ponds.

**Table 227.—**Distribution of entity accomplishing reclamation (Min D-Q26) and bond sufficiency for Forest Service projects (Min D-Q27) for Min D evaluations completed in FY15/16 and FY17/18

| Monitoring period | Region | Reclamation accomplished by operator | Reclamation accomplished by Forest Service | Bond sufficient for Forest Service projects[a] | Bond not sufficient for Forest Service projects[a] |
|---|---|---|---|---|---|
| FY15/16 | | | | | |
| | 1 | 3 | 1 | | 1 |
| | 2 | 1 | 2 | 2 | |
| | 3 | | 3 | 2 | 1 |
| | 4 | 2 | | | |
| | 5 | | | | |
| | 6 | 2 | | | |
| | 8 | 1 | 1 | | 1 |
| | 9 | | | | |
| | 10 | | | | |
| | All | 9 | 7 | 4 | 3 |
| | Percent | 56 | 44 | 57 | 43 |
| FY17/18 | | | | | |
| | 1 | | | | |
| | 2 | 2 | 1 | | 1 |
| | 3 | 2 | 1 | | |
| | 4 | 3 | | | |
| | 5 | | | | |
| | 6 | 1 | | | |
| | 8 | 1 | 2 | | 2 |
| | 9 | | | | |
| | 10 | 1 | | | |
| | All | 10 | 4 | 0 | 3 |
| | Percent | 71 | 29 | | 100 |

[a] Applies only to reclamation projects accomplished by the Forest Service; one evaluation in FY17/18 did not answer Min D-Q27.

Erosion control plans, which typically provide BMP prescriptions, are not a requirement for mineral reclamation, but some units develop them either as standalone documents or as part of a larger document such as the reclamation plan. Two-thirds of the projects had an erosion control plan that was applicable to reclamation activities (Table 228). The existence of an erosion control plan was not associated with the location of the reclaimed area relative to an AMZ (Fig. 107) in either monitoring period (p = 0.79 FY15/16, p = 1.00 FY17/18). By contrast, erosion control plans were statistically associated with the entity accomplishing the project (Min D-Q26) in FY15/16 (p = 0.09), with all Forest Service projects having an erosion control plan (Fig. 108). In FY17/18 there was not a significant association (p = 0.58); however, three of four projects accomplished by the Forest Service had erosion control plans (Fig. 108).

**Table 228.—**Number of Min D projects evaluated in FY15/16 and FY17/18, by region, type of primary planning document used (Min D-Q30), and whether project had an erosion control plan (Min D-Q29)

| Monitoring period | Region | No planning document | EIS[a] | EA[b] | CE[c] | Other | Erosion control plan | No erosion control plan |
|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | |
| | 1 | | | 1 | 2 | 1 | 4 | |
| | 2 | | | | | 3 | 2 | 1 |
| | 3 | | | 1 | | 2 | 3 | |
| | 4 | 1 | | 1 | | | | 2 |
| | 5 | | | | | | | |
| | 6 | | 1 | | | 1 | 1 | 1 |
| | 8 | | | 1 | 1 | | 2 | |
| | 9 | | | | | | | |
| | 10 | | | | | | | |
| | All | 1 | 1 | 4 | 3 | 7 | 12 | 4 |
| | Percent | 6[d] | 6[d] | 24[d] | 19[d] | 44[d] | 75[e] | 25[e] |
| FY17/18 | | | | | | | | |
| | 1 | | | | | | | |
| | 2 | | | | 1 | 2 | 3 | |
| | 3 | | | | 3 | | 2 | 1 |
| | 4 | | | | 2 | 1 | 1 | 2 |
| | 5 | | | | | | | |
| | 6 | 1 | | | | | | 1 |
| | 8 | | | 1 | | 2 | 2 | 1 |
| | 9 | | | | | | | |
| | 10 | | | | 1 | | | 1 |
| | All | 1 | 0 | 1 | 7 | 5 | 8 | 6 |
| | Percent | 7[d] | | 7[d] | 50[d] | 36[d] | 57[e] | 43[e] |

[a] Environmental impact statement.
[b] Environmental assessment.
[c] Categorical exclusion.
[d] Percent within type of primary planning document.
[e] Percent within whether project had an erosion control plan.

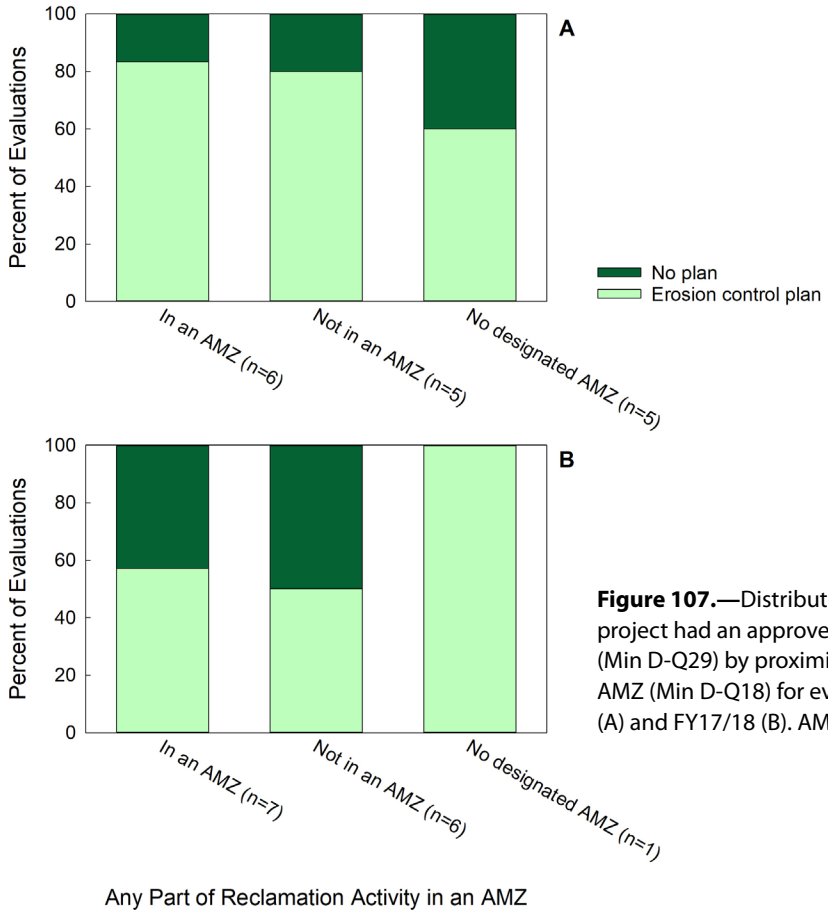



**Figure 107.—**Distribution of whether reclamation project had an approved erosion control plan (Min D-Q29) by proximity of reclamation activity to an AMZ (Min D-Q18) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

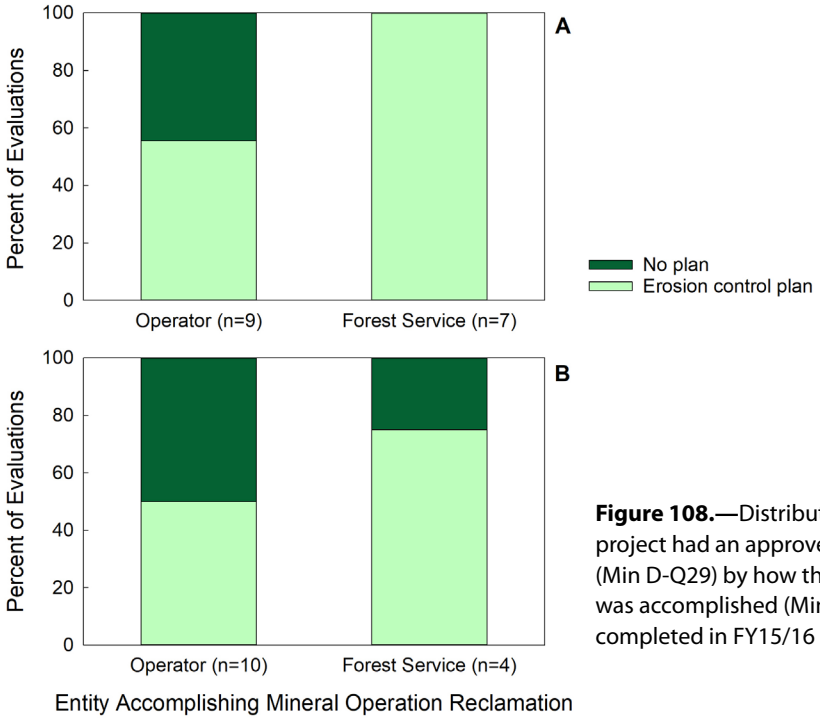



**Figure 108.—**Distribution of whether reclamation project had an approved erosion control plan (Min D-Q29) by how the reclamation operation was accomplished (Min D-Q26) for evaluations completed in FY15/16 (A) and FY17/18 (B).

Project planning is assessed in the protocol using two questions:

- What type of planning document specified BMPs for the project (Min D-Q30)?
- Were all BMPs from that document included in the authorizing instrument (Min D-Q31)?

The types of primary planning documents used are summarized in Table 228. Non-NEPA types of documents ("other" in Table 228) were the most common sources of BMPs for reclamation projects and may have included erosion control plans. One reclamation project in each monitoring period had no source of BMPs during planning. The size of the area disturbed by the operation (Min D-Q21) was not significantly different by type of planning document in FY15/16 ($p = 0.17$, GLMM with lognormal distribution and identity link function). Projects using an EA had the largest average disturbed area at 8.4 acres, and the one project with an EIS had 0.3 acre of disturbance. Significant differences were found in FY17/18 ($p = 0.06$); projects using other BMP guidance documents had significantly less area disturbed (0.8 acre) compared to projects using EAs (10 acres) or CEs (4.6 acres). Significant associations between the entity responsible for accomplishing the reclamation and the type of planning document used were not found in either monitoring period ($p = 0.20$ FY15/16, $p = 0.41$ FY17/18), but the two reclamation projects that had no planning documents from which to derive BMPs (Table 228) were operator-administered (Fig. 109).

Table 229 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the planning documents or other BMP guidance documents are assigned, along with the information about whether all the BMPs in each provision were then carried into the authorizing instrument. A "yes" indicates that there was at least

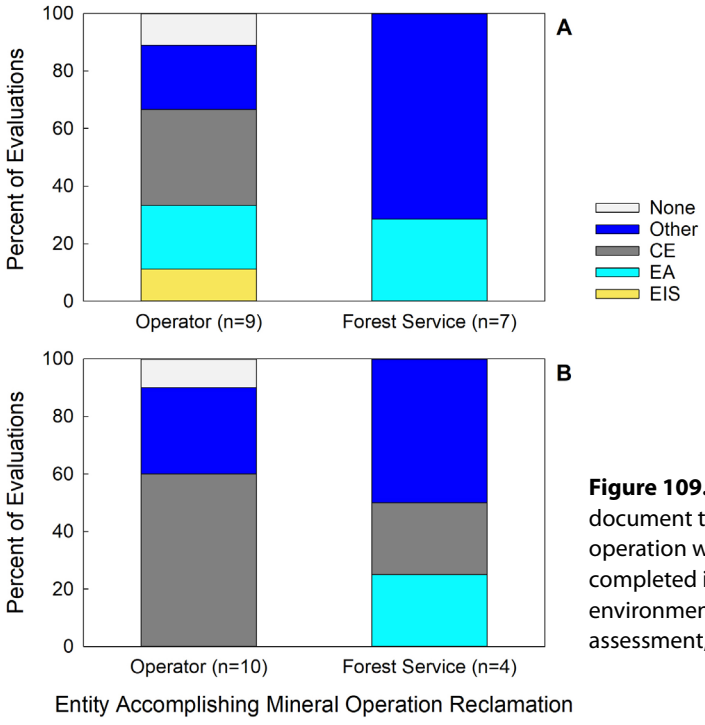



**Figure 109.**—Distribution of primary planning document type (Min D-Q30) by how the reclamation operation was accomplished (Min D-Q26) for evaluations completed in FY15/16 (A) and FY17/18 (B). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

**Table 229.—**Frequencies at which BMPs in provisions were included in the authorizing instrument (Min D-Q31) for Min D evaluations completed in FY15/16 (n=15 evaluations) and FY17/18 (n=13 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision[a] to which prescribed BMP is applicable | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[b] (number) | FY15/16 Yes (percent[c]) | FY15/16 No (percent[c]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Timing and scheduling of reclamation operations | 13 | 0 | 2 | 100 | 0 | 12 | 0 | 1 | 100 | 0 |
| Sampling/testing to identify chemicals or hazardous materials or wastes | 10 | 1 | 3 | 91 | 9 | 6 | 1 | 6 | 86 | 14 |
| Isolation, neutralization, removal, or treatment of hazardous materials or wastes | 10 | 1 | 3 | 91 | 9 | 6 | 1 | 6 | 86 | 14 |
| Sampling/testing to identify reactive geologic materials or wastes | 9 | 0 | 5 | 100 | 0 | 4 | 1 | 8 | 80 | 20 |
| Isolation, neutralization, removal, or treatment of reactive geologic materials or wastes | 9 | 0 | 5 | 100 | 0 | 3 | 2 | 8 | 60 | 40 |
| Water control/drainage measures | 13 | 0 | 2 | 100 | 0 | 12 | 0 | 1 | 100 | 0 |
| Other erosion control | 15 | 0 | 0 | 100 | 0 | 12 | 0 | 1 | 100 | 0 |
| Installation of water diversion and conveyance | 11 | 0 | 4 | 100 | 0 | 8 | 0 | 5 | 100 | 0 |
| Control of aquatic or wetland invasive species | 7 | 1 | 7 | 88 | 13 | 3 | 2 | 8 | 60 | 40 |
| Location of activities | 10 | 3 | 2 | 77 | 23 | 9 | 0 | 4 | 100 | 0 |
| Areal extent of activities | 10 | 1 | 3 | 91 | 9 | 11 | 0 | 2 | 100 | 0 |
| Requirements/specifications for facility, equipment, and non-hazardous material removal | 12 | 1 | 1 | 92 | 8 | 8 | 1 | 4 | 89 | 11 |
| Restoration of contour | 12 | 0 | 2 | 100 | 0 | 8 | 1 | 4 | 89 | 11 |
| Physical stability of project components | 12 | 1 | 1 | 92 | 8 | 7 | 2 | 4 | 78 | 22 |
| Topsoil/growth medium testing and preparation | 8 | 1 | 5 | 89 | 11 | 3 | 3 | 7 | 50 | 50 |
| Placement of topsoil or growth medium | 10 | 0 | 4 | 100 | 0 | 7 | 1 | 5 | 88 | 13 |
| Seedbed preparation | 10 | 1 | 3 | 91 | 9 | 6 | 1 | 6 | 86 | 14 |
| Application of nonvegetative ground cover | 11 | 1 | 2 | 92 | 8 | 6 | 2 | 5 | 75 | 25 |
| Re-establishment of nurse crop or final vegetation communities | 11 | 1 | 2 | 92 | 8 | 8 | 1 | 4 | 89 | 11 |
| Re-establishment of stream channels, wetlands, floodplains, streambanks, or shorelines | 5 | 2 | 7 | 71 | 29 | 3 | 0 | 10 | 100 | 0 |
| Re-establishment/rehabilitation of aquatic habitat | 3 | 3 | 8 | 50 | 50 | 1 | 1 | 11 | 50 | 50 |
| Off-site mitigation | 2 | 1 | 11 | 67 | 33 | 3 | 3 | 7 | 50 | 50 |
| Reclamation protection | 12 | 1 | 1 | 92 | 8 | 7 | 4 | 2 | 64 | 36 |
| Monitoring requirements | 12 | 0 | 2 | 100 | 0 | 12 | 0 | 1 | 100 | 0 |
| Operation and/or maintenance requirements for long-term function | 10 | 1 | 3 | 91 | 9 | 7 | 2 | 4 | 78 | 22 |
| Well and borehole abandonment | 4 | 2 | 8 | 67 | 33 | 6 | 1 | 6 | 86 | 14 |
| Mean | 10 | 1 | 4 | 89 | 11 | 7 | 1 | 5 | 82 | 18 |

[a] Listed provision had at least one BMP from decision document or guidance document included in authorizing instrument.

[b] Not applicable (NA) because no prescribed BMPs were associated with the provision.

[c] Percent was calculated from "yes" and "no" counts.

one BMP in the planning or guidance documents applicable to the provision and all BMPs assigned to that provision were included in the authorizing instrument. A "no" indicates that at least one BMP applicable to the provision in the planning or guidance documents was not carried forward into the authorizing instrument. "Not applicable" indicates that there were no BMPs in the planning or guidance documents applicable to the provision, so there was no obligation to carry them into the authorizing instrument. In the National BMP program, there is no expectation that every provision has BMPs assigned; consequently, the percentages for "yes" and "no" in the last two columns of Table 229 for each monitoring period are calculated using only their corresponding counts (i.e., "not applicable" counts are ignored).

When a provision had at least one BMP prescription identified in the planning documents, all of those BMP prescriptions were included in the authorizing instrument in an average of 89 and 82 percent of projects with BMP prescriptions in that provision in FY15/16 and FY17/18, respectively (Table 229). The provision "re-establishment/ rehabilitation of aquatic habitat" had the lowest rate of planned BMPs included in the authorizing instrument at 50 percent of projects in both monitoring periods, although BMPs in the provisions "topsoil/growth medium testing and preparation" and "off-site mitigation" also were included for half of the projects in FY17/18. Prescriptive BMPs were included in 17 provisions per project on average in FY15/16. The two projects planned using other BMP guidance documents had the highest number of provisions with BMPs at 24. Mean number of provisions from planning included in the authorizing instrument ranged from 13 for projects using an EA to 22 for the one project using an EIS. The project using an EA in FY17/18 had BMPs in 17 provisions, while projects using EAs, CEs, and other sources averaged BMPs in 13 provisions. GLMM analysis (negative binomial distribution and log link function) found no significant differences in either monitoring period ($p = 0.23$ FY15/16, $p = 0.78$ FY17/18) between the number of BMP provisions from planning included in the authorizing instrument and the source of BMPs (i.e., type of NEPA document or guidance documents in the absence of NEPA analysis; the projects with no BMPs ["none" in Table 228] were excluded from the statistical analysis). When the percentage of BMP provisions included in the authorizing instrument was compared by type of planning document, projects in FY15/16 using EISs, EAs, and CEs had 100 percent of BMP provisions included; those using other guidance documents averaged 85 percent of provisions included. In FY17/18 projects using EAs also had 100 percent of BMP provisions included, and projects using other guidance documents again had the lowest inclusion at 80 percent. No significant differences were found in percentage of BMP provisions included by type of planning document in either monitoring period ($p = 0.13$ FY15/16, $p = 0.57$ FY17/18; Kruskal-Wallis test).

It is possible that additional BMPs applicable to the projects were not in the planning documents but were in the authorizing instrument; such BMPs may be associated with standard authorizing instrument language used for mineral reclamation. Additional BMPs applicable to five provisions (i.e., those listed in Min D-Q31) in FY15/16 and eight provisions in FY17/18 were identified in the authorizing instruments for the evaluated Min D projects (Table 230).

Almost all of the BMPs applicable to the Min D projects were implemented fully (Table 231). Applicable in this context includes only those BMPs that were included in the

**Table 230.—**Frequencies at which BMPs to protect water, aquatic, and riparian resources were derived from authorizing instrument language and not from BMPs in NEPA documents or other BMP guidance documents for Min D evaluations completed in FY15/16 (n=16 evaluations) and FY17/18 (n=14 evaluations)

| Provision | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Timing and scheduling of reclamation operations | | | | |
| Sampling/testing to identify chemicals or hazardous materials or wastes | | | | |
| Isolation, neutralization, removal, or treatment of hazardous materials or wastes | | | | |
| Sampling/testing to identify reactive geologic materials or wastes | | | | |
| Isolation, neutralization, removal, or treatment of reactive geologic materials or wastes | | | | |
| Water control/drainage measures | | | 1 | 6 |
| Other erosion control | | | 1 | 6 |
| Installation of water diversion and conveyance | | | 1 | 6 |
| Control of aquatic or wetland invasive species | | | | |
| Location of activities | | | 1 | 6 |
| Areal extent of activities | | | 1 | 6 |
| Requirements/specifications for facility, equipment, and non-hazardous material removal | | | | |
| Restoration of contour | 1 | 6 | | |
| Physical stability of project components | | | 1 | 6 |
| Topsoil/growth medium testing and preparation | | | | |
| Placement of topsoil or growth medium | 1 | 6 | | |
| Seedbed preparation | | | | |
| Application of nonvegetative ground cover | | | | |
| Re-establishment of nurse crop or final vegetation communities | 2 | 13 | | |
| Re-establishment of stream channels, wetlands, floodplains, streambanks, or shorelines | | | | |
| Re-establishment/rehabilitation of aquatic habitat | 1 | 6 | 1 | 6 |
| Off-site mitigation | | | | |
| Reclamation protection | | | 2 | 13 |
| Monitoring requirements | | | | |
| Operation and/or maintenance requirements for long-term function | | | | |
| Well and borehole abandonment | 1 | 6 | | |

authorizing instrument. Those that were identified during planning but were not included in the authorizing instrument are not considered applicable (thus values in Tables 229 and 231 differ). As with Table 229, the percentages in Table 231 were calculated only from the "yes" and "no" counts. Implementation rates in FY15/16 ranged from 83 to 100 percent of projects, although only three provisions had BMP implementation rates below 90 percent (Table 231). In FY17/18 BMP implementation rates were not as high; 89 percent of projects implemented BMPs fully on average, and BMPs in six provisions were implemented fully in 80 percent or fewer projects.

**Table 231.—**Frequencies at which all BMPs in provisions included in the authorizing instrument were implemented fully (Min D-Q32) for Min D evaluations completed in FY15/16 (n=16 evaluations) and FY17/18 (n=14 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

| Provision implemented fully | FY15/16 Yes (number) | FY15/16 No (number) | FY15/16 NA[a] (number) | FY15/16 Yes (percent[b]) | FY15/16 No (percent[b]) | FY17/18 Yes (number) | FY17/18 No (number) | FY17/18 NA (number) | FY17/18 Yes (percent) | FY17/18 No (percent) |
|---|---|---|---|---|---|---|---|---|---|---|
| Timing and scheduling of reclamation operations | 13 | 0 | 2 | 100 | 0 | 12 | 0 | 1 | 100 | 0 |
| Sampling/testing to identify chemicals or hazardous materials or wastes | 10 | 0 | 5 | 100 | 0 | 5 | 0 | 8 | 100 | 0 |
| Isolation, neutralization, removal, or treatment of hazardous materials or wastes | 9 | 0 | 6 | 100 | 0 | 5 | 0 | 8 | 100 | 0 |
| Sampling/testing to identify reactive geologic materials or wastes | 9 | 0 | 6 | 100 | 0 | 3 | 0 | 10 | 100 | 0 |
| Isolation, neutralization, removal, or treatment of reactive geologic materials or wastes | 8 | 1 | 6 | 89 | 11 | 1 | 1 | 11 | 50 | 50 |
| Water control/drainage measures | 12 | 1 | 3 | 92 | 8 | 13 | 0 | 1 | 100 | 0 |
| Other erosion control | 14 | 1 | 1 | 93 | 7 | 12 | 1 | 1 | 92 | 8 |
| Installation of water diversion and conveyance | 11 | 0 | 5 | 100 | 0 | 9 | 0 | 4 | 100 | 0 |
| Control of aquatic or wetland invasive species | 7 | 0 | 9 | 100 | 0 | 1 | 2 | 10 | 33 | 67 |
| Location of activities | 10 | 0 | 6 | 100 | 0 | 10 | 0 | 3 | 100 | 0 |
| Areal extent of activities | 10 | 0 | 5 | 100 | 0 | 11 | 1 | 1 | 92 | 8 |
| Requirements/specifications for facility, equipment, and non-hazardous material removal | 12 | 0 | 3 | 100 | 0 | 6 | 0 | 7 | 100 | 0 |
| Restoration of contour | 12 | 1 | 2 | 92 | 8 | 7 | 0 | 6 | 100 | 0 |
| Physical stability of project components | 10 | 2 | 3 | 83 | 17 | 7 | 1 | 5 | 88 | 13 |
| Topsoil/growth medium testing and preparation | 8 | 0 | 7 | 100 | 0 | 2 | 1 | 10 | 67 | 33 |
| Placement of topsoil or growth medium | 10 | 1 | 4 | 91 | 9 | 5 | 1 | 7 | 83 | 17 |
| Seedbed preparation | 10 | 0 | 5 | 100 | 0 | 4 | 1 | 8 | 80 | 20 |
| Application of nonvegetative ground cover | 11 | 0 | 4 | 100 | 0 | 4 | 1 | 8 | 80 | 20 |
| Re-establishment of nurse crop or final vegetation communities | 11 | 2 | 2 | 85 | 15 | 6 | 1 | 6 | 86 | 14 |
| Re-establishment of stream channels, wetlands, floodplains, streambanks, or shorelines | 5 | 0 | 10 | 100 | 0 | 3 | 0 | 10 | 100 | 0 |
| Re-establishment/rehabilitation of aquatic habitat | 4 | 0 | 11 | 100 | 0 | 2 | 0 | 11 | 100 | 0 |
| Off-site mitigation | 1 | 0 | 14 | 100 | 0 | 3 | 0 | 10 | 100 | 0 |
| Reclamation protection | 12 | 0 | 3 | 100 | 0 | 7 | 2 | 4 | 78 | 22 |
| Monitoring requirements | 12 | 0 | 3 | 100 | 0 | 11 | 1 | 1 | 92 | 8 |
| Operation and/or maintenance requirements for long-term function | 10 | 0 | 5 | 100 | 0 | 5 | 1 | 7 | 83 | 17 |
| Well and borehole abandonment | 5 | 0 | 10 | 100 | 0 | 6 | 0 | 7 | 100 | 0 |
| Mean | 9 | 0 | 5 | 97 | 3 | 6 | 1 | 6 | 89 | 11 |

[a] Not applicable (NA) because no prescribed BMPs were associated with the provision.

[b] Percent was calculated from "yes" and "no" counts.

The average number of provisions that were implemented fully differed significantly among types of planning documents in FY15/16 but not in FY17/18 ($p = 0.06$ FY15/16, $p = 0.14$ FY17/18; GLMM with negative binomial distribution and log link function). In FY15/16 the project without BMPs from planning had BMPs in two provisions implemented fully, and the project using an EIS had BMPs in 22 provisions implemented fully. The range among types of planning documents in FY17/18 was less, with 2 to 15 BMP provisions having full implementation. No significant differences were found in the percentage of BMP provisions implemented fully by type of planning document in either monitoring period ($p = 0.23$ FY15/16, $p = 0.66$ FY17/18; Kruskal-Wallis test). Projects in FY15/16 using an EIS or CEs had 100 percent of BMP provisions in the authorizing instrument implemented fully, while projects using EAs or other guidance documents had 98 and 94 percent of provisions implemented fully, respectively, and the project without BMPs from planning had 67 percent. Percentages of full implementation ranged from 88 to 100 percent in FY17/18; the project without BMPs from planning had BMPs from standard authorizing instrument language in two provisions, and both were implemented fully.

Two implementation questions—Min D-Q33 and Min D-Q34—evaluate whether project administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times when resources are most susceptible to negative effects from the project (Table 232), and whether corrective actions were taken if problems occurred during reclamation (at any time, not just critical times) (Table 233). Critical times include times that work is conducted in a waterbody, periods associated with large or intense precipitation/runoff events, or other times or locations that the potential for the circumstances to result in water quality impacts is high. In both periods combined, 60 percent of projects were inspected during critical times, and for another 23 percent of projects work was performed to avoid critical times (Table 232). Ninety percent of reclamation projects in both monitoring periods either had no problems requiring corrective actions, or corrective actions were implemented when needed (Table 233).

Because reclamation projects involve use of heavy equipment that may have occasional malfunctions or breakages such as hydraulic line breaks or oil leaks, an implementation question (Min D-Q35) considers how chemical or fuel spills and leaks were handled.

**Table 232.—**Distribution of whether project inspections or contract administration occurred at critical times (Min D-Q33) for Min D evaluations completed in FY15/16 and FY17/18

| Project inspections or contract administration occurred at critical times | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No inspections | 1 | 6 | 1 | 7 |
| Not applicable; work avoided critical times | 6 | 38 | 1 | 7 |
| Yes | 8 | 50 | 10 | 71 |
| No | 1 | 6 | 2 | 14 |
| All | 16 | | 14 | |

Administrative units in the Forest Service have a contingency and emergency response plan (CERP) or equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tier to another plan, such as a state agency plan for hazardous material or waste cleanup, and in those cases the unit follows that state agency's procedures. Three evaluations in FY15/16 and one in FY17/18 reported spills or leaks had occurred during reclamation activities and all were addressed following the CERP procedures.

## Minerals D: Effectiveness Results and Their Tie to Implementation Results and Header Information

Twenty-seven reclaimed sites were evaluated for effectiveness. Of these, 12 projects had no evidence of erosion, sedimentation, or waterbody morphology changes (Table 234).

**Table 233.**—Distribution of whether corrective actions (CA) were taken if problems occurred during reclamation activities (Min D-Q34) for Min D evaluations completed in FY15/16 and FY17/18

| Corrective actions | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| No problems; no CA needed | 10 | 63 | 12 | 86 |
| CA needed but not taken | 1 | 6 | | |
| CA needed and implemented | 3 | 19 | 2 | 14 |
| Unknown | 2 | 12 | | |
| All | 16 | | 14 | |

**Table 234.**—Evidence of erosion or sedimentation from reclaimed area (Min D-Q40) for Min D evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Min D-Q42) or number of places evidence observed in a waterbody (Min D-Q41)

| Location of observed evidence | Number of evaluations | Percent of evaluations | Distance to nearest waterbody <10 ft (number) | Distance to nearest waterbody 10–50 ft (number) | Distance to nearest waterbody 50–100 ft (number) | Distance to nearest waterbody >100 feet (number) | Evidence in waterbody 1–2 places (number) | Evidence in waterbody 3–4 places (number) | Evidence in waterbody ≥5 places (number) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 | | | | | | | | | |
| No evidence | 6 | 40 | | | | | | | |
| Outside an AMZ[a] | 3 | 20 | | | | 3 | | | |
| Within an AMZ | 1 | 7 | 1 | | | | | | |
| In a waterbody | 5 | 33 | | | | | 2 | | 3 |
| FY17/18 | | | | | | | | | |
| No evidence | 6 | 50 | | | | | | | |
| Outside an AMZ | 4 | 33 | | 1 | | 3 | | | |
| Within an AMZ | 1 | 8 | | | | 1 | | | |
| In a waterbody | 1 | 8 | | | | | 1 | | |

[a] Aquatic management zone.

There were nearly as many reclaimed sites in FY15/16 with evidence of sedimentation in a waterbody or waterbody morphology changes as there were those with no evidence. In FY17/18, one project reported evidence in a waterbody (Table 234).

The types of evidence of erosion, sedimentation, or waterbody morphology changes observed (Min D-Q45) relative to the location where they were observed are presented in Table 235. More types of evidence were reported in FY15/16 for impacts to a waterbody compared to other locations. One evaluation reported two types of evidence that were incompatible with the location where evidence was reported in Min D-Q40 (e.g., changes to substrate composition would not be expected within an AMZ). Many different causes of the erosion or sedimentation (Min D-Q46) were reported, with slope shape or gradient reported most often (Table 236). Ten of the 13 evaluations reported multiple causes.

Ground cover standards existed for 13 reclamation projects in FY15/16 and 11 projects in FY17/18 (Min D-Q47) and those standards were met for 7 and 9 sites. No associations existed between whether standards were attained and whether or where evidence of erosion or sedimentation was observed in either monitoring period

**Table 235.—**Types of evidence of erosion or sedimentation observed from mineral reclamation (Min D-Q45) for Min D evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Min D-Q40 (Table 234) is applicable to Min D-Q45.

| Type of evidence | FY15/16 In waterbody (n=5) | FY15/16 Within AMZ[a] (n=1) | FY15/16 Outside AMZ (n=3) | FY17/18 In waterbody (n=1) | FY17/18 Within AMZ (n=1) | FY17/18 Outside AMZ (n=4) |
|---|---|---|---|---|---|---|
| Traceable evidence to the waterbody, but not currently visible in the waterbody | 2 | | | | | |
| Turbidity present | | | | 1 | | |
| Evidence of localized sediment deposition in the waterbody | 3 | 1[b] | | 1 | | |
| Changes to substrate composition | 1 | 1[b] | | 1 | | |
| Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) | 2 | | | | | |
| Bank instability | 3 | 1 | | | | |
| Bank trampling or compaction | | 1 | | | | |
| Vegetation damage or bare ground | 2 | | 1 | | | 1 |
| Sheet erosion | 2 | | 1 | | | 3 |
| Rill erosion | 4 | 1 | 1 | | | 3 |
| Gully erosion | | | 1 | | 1 | |
| Headcutting | | | | | 1 | |
| Slumping/slips | | 1 | | | | |
| Mass wasting | | | | | | |
| Sediment plumes or accumulations | 1 | | | 1 | | |
| Rutting | | | | | | |
| Water quality monitoring results | | | | | | |

[a] Aquatic management zone.
[b] The type of evidence reported is incompatible with the location in which it was observed.

**Table 236.—**Causes of evidence of erosion or sedimentation observed from reclaimed area (Min D-Q46) for Min D evaluations completed in FY15/16 and FY17/18

| Cause of evidence | FY15/16 In waterbody (n=5) | FY15/16 Within AMZ[a] (n=1) | FY15/16 Outside AMZ (n=1[b]) | FY17/18 In waterbody (n=1) | FY17/18 Within AMZ (n=1) | FY17/18 Outside AMZ (n=4) |
|---|---|---|---|---|---|---|
| Poor location for activity that was being reclaimed | | | | | | 1 |
| Slope shape and/or gradient | 4 | | | | | 2 |
| Instability due to inadequate design, construction, or maintenance after restoration | 1 | | | | | |
| Lack of or insufficient soil cover | | 1 | 1 | | | 3 |
| No or insufficient number of erosion control, water control, or water or sediment storage features installed | 3 | | 1 | | | 1 |
| Improperly designed erosion control, water control, or water or sediment storage features | 1 | | | | | |
| Improperly constructed erosion control, water control, or water or sediment storage features | 2 | | | | | |
| Inadequate or improper maintenance of erosion control, water control, or water or sediment storage features | | | | 1 | | |
| Reclamation performed outside allowable time periods | | | | | | |
| Reclamation performed outside allowable soil conditions | | | | | | |
| Reclamation performed within authorizing instrument requirements | 2 | | | | | |
| Reclamation performed outside authorizing instrument requirements | 1 | | | | | |
| Soil compaction | | 1 | | | | 2 |
| Mechanical additions of sediment to waterbody during reclamation | | | | | | |
| Site access by humans was not sufficiently controlled | | | | | | 1 |
| Site access by domestic animals or wildlife was not sufficiently controlled | | 1 | | | | |
| Unanticipated effects | 2 | | | | 1 | 1 |
| Other | | 1 | | | | |
| Unknown | | | | | | |
| Mean number of causes per evaluation[c] | 3 | | | | | 3 |

[a] Aquatic management zone.

[b] Min D-Q46 was not answered in two "outside AMZ" evaluations in FY15/16.

[c] When number of evaluations is greater than one.

(p = 0.30 FY15/16, p = 1.00 FY17/18). There also were no significant associations between whether ground cover provisions were implemented fully (Min D-Q32.s, "re-establishment of nurse crop or final vegetation communities") and whether ground cover standards were met (p = 1.00 FY15/16, p = 0.20 FY17/18).

Question Min D-Q16 characterizes the weather conditions associated with the evaluation and assists in determining whether observations of erosion and sedimentation transport or waterbody morphology changes (Min D-Q40) are masked during dry weather conditions. Wet weather conditions, if found to be important for observing effects, are expected to be most associated with erosion and sediment transport outside a waterbody because they result primarily due to precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. Two of the 15 BMP effectiveness evaluations in FY15/16 and 4 of 12 in FY17/18 were completed during or within 24 hours after precipitation events (Fig. 110), and no significant associations were found between weather conditions and evidence of erosion or sedimentation in either monitoring period (p = 0.26 FY15/16, p = 0.66 FY17/18). However, sample sizes are small and more evaluations in wet weather are needed to improve the usefulness of this comparison.

The areas disturbed by reclamation ranged from about 0.1 acre to 30 acres in size. The average size of the area disturbed by location where erosion/sedimentation evidence was observed ranged from about 4.4 to 9 acres in FY15/16, and there were no significant

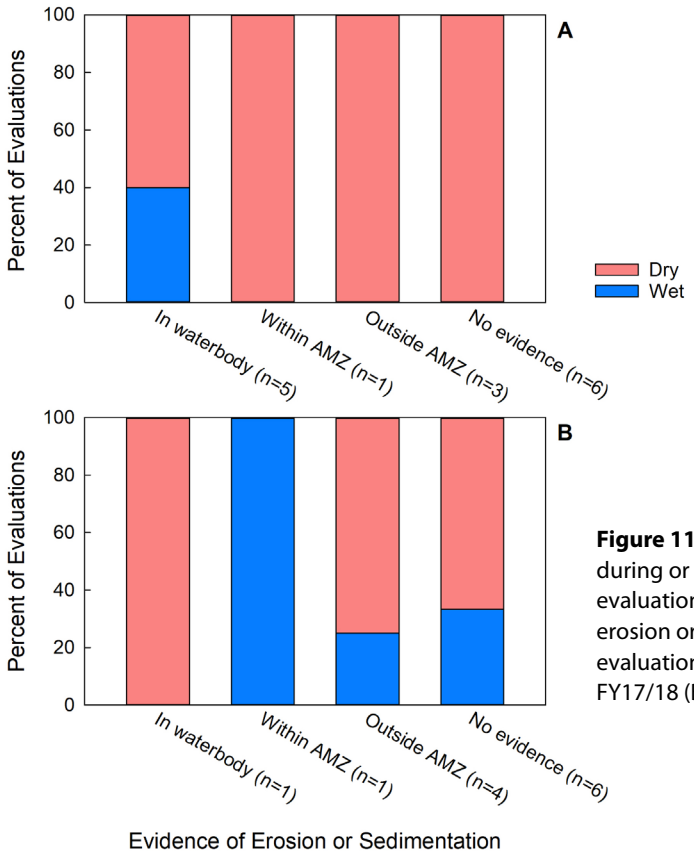



**Figure 110.—**Type of weather conditions during or within 24 hours before effectiveness evaluation (Min D-Q16) versus evidence of erosion or sedimentation (Min D-Q40) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

differences in the size of the disturbed areas among the locations of the evidence ($p = 0.79$, GLMM with lognormal distribution and identity link function) (Fig. 111A). In FY17/18 mean disturbed areas ranged from 0.5 acre to 10 acres, and a significant difference in size of area disturbed among locations of observed evidence was found ($p < 0.001$, GLMM with normal distribution and identity link function) (Fig. 111A). When distance to the nearest waterbody was compared by the location of observed evidence, there were significant differences in the distance among the locations in FY15/16 ($p < 0.01$, GLMM with normal distribution and identity link function) (Fig. 111B). Distance to the nearest waterbody was not significantly different by location of observed evidence in FY17/18 ($p = 0.68$, GLMM with lognormal distribution and identity link function) (Fig. 111B). Disturbed areas for two projects in FY17/18 were 900 feet and 1 mile from the nearest waterbody (3.5 and 20 times farther than the next longest distance of 260 feet). When the GLMM analysis was rerun with those two projects excluded, again no significant differences were found for distance to waterbody by location of evidence ($p = 0.62$). Figure 111B illustrates that erosion, sedimentation, and waterbody morphology changes can be controlled or their impacts reduced even for projects near waterbodies.

Hazardous substances or chemical leachates are used in or are by-products of some types of mineral operations, and therefore concerns exist about such residues as well as fuel leaks or spills from heavy equipment use during reclamation activities. One of the 15 reclaimed sites in FY15/16 and 2 of 12 sites in FY17/18 had evidence of residual contamination. One evaluation in each monitoring period found evidence present in a waterbody (Min D-Q48), and the other evaluation in FY17/18 had evidence outside an AMZ. Types of evidence in a waterbody included results from water quality monitoring,

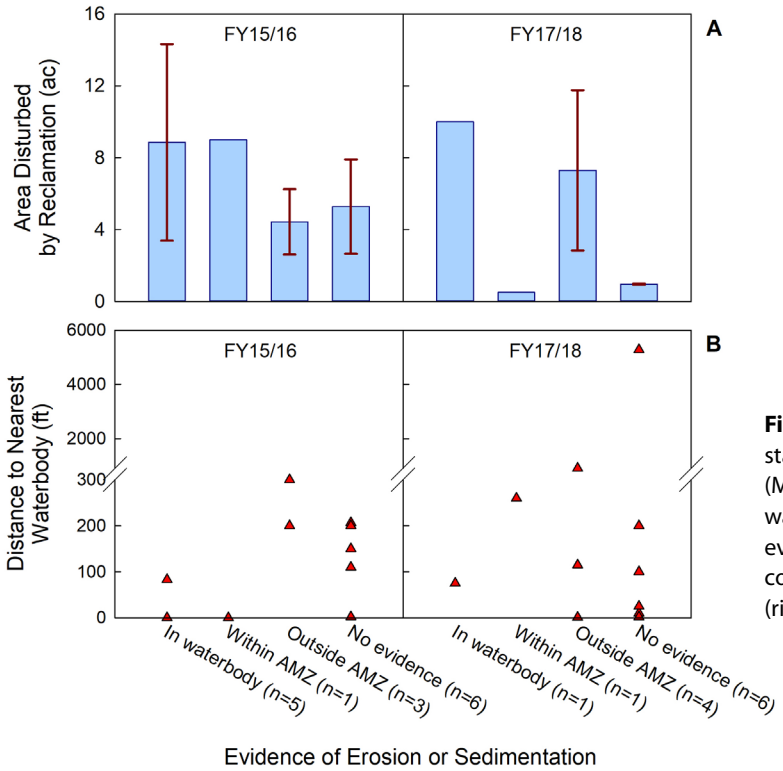



**Figure 111.—** Mean area disturbed (with standard error bars) during the project (Min D-Q21; A) and distances to nearest waterbody (Min D-Q19; B) for each category of evidence observed (Min D-Q40) for evaluations completed in FY15/16 (left panels) and FY17/18 (right panels).

visible leachate and precipitate, and odor (Min D-Q53), while evidence outside an AMZ included visible hydrocarbons or chemicals and precipitates. The causes of the contamination in waterbodies (Min D-Q54) were reported as "inadequate collection, control, or treatment of runoff or drainage" and "inadequate or improper maintenance of water control or storage features," while human error or carelessness was the cause reported for the evidence outside an AMZ. The presence of improperly disposed of trash (Min D-Q55) was reported for one reclaimed site in FY15/16 (within an AMZ) and two sites in FY17/18 (outside an AMZ). No evidence of human sanitary waste was observed at any of the reclaimed sites.

Of the 27 projects evaluated, 10 involved some type of reclamation of the waterbody from disturbances that occurred during mineral exploration or extraction operations (Table 237). Full waterbody recovery was achieved for one site, but at four sites waterbody recovery was not achieved. "Improper design or implementation of reclamation projects" was noted as a cause for three of four sites with incomplete waterbody recovery, and one of those sites also noted "connection of groundwater not repaired or restored" as a cause. The fourth site reported excessive acid mine drainage as the cause.

None of the evaluations in FY15/16 reported the introduction or spread of aquatic invasive species (Min D-Q60) resulting from the reclamation activities; however, one evaluation in FY17/18 reported that Canada thistle (*Cirsium arvense*) was introduced or spread into the reclaimed project area. Beneficial uses in the waterbodies associated with the reclaimed areas were not impacted by invasive species, erosion, sedimentation, waterbody changes, chemicals, hazardous substances or associated leachates, fuels, trash, or sanitary wastes for most projects (Min D-Q61). The exception in FY15/16 was the site in which hazardous chemicals or leachates were observed delivered to a waterbody even after reclamation. In this situation, "partial body contact and livestock use standards" were the beneficial uses affected. Beneficial uses were impacted at two sites evaluated in FY17/18. At one site, sediment and chemical contamination were observed in a waterbody and affected recreation, aquatic habitat, and water quality. At the other site, wildlife uses were affected. Not surprisingly, the site impacted in FY15/16 also was the project in the monitoring period for which reclamation was identified as not being effective at meeting water quality standards (Min D-Q62) for pH and metals. One project in FY17/18 also reported that standards for pH and possibly heavy metals were not met. Seven projects in FY15/16 and 10 projects in FY17/18 documented that reclamation was effective at

**Table 237.—**Evidence that waterbody reclamation has not resulted in full recovery (Min D-Q58) for Min D evaluations completed in FY15/16 and FY17/18

| Evidence | FY15/16 (number) | FY15/16 (percent) | FY17/18 (number) | FY17/18 (percent) |
|---|---|---|---|---|
| Not applicable; no waterbody alteration | 7 | 47 | 10 | 83 |
| Did not result in full recovery | 2 | 13 | 2 | 17 |
| Too soon to tell | 5 | 33 | | |
| Did result in full recovery | 1 | 7 | | |
| All | 15 | | 12 | |

achieving water quality standards, and another eight indicated that achievement of water quality standards was unknown (i.e., water quality parameters are not measured as a part of reclamation activities).

Thirteen projects in FY15/16 and eight in FY17/18 did not include off-site mitigation (Min D-Q28). Of the two projects that had those plans in FY15/16, mitigation had not yet begun for one, and for the other it was too early following mitigation efforts to determine whether the objectives had been met (Min D-Q63). Four projects in FY17/18 reported that off-site mitigation had been started or completed (Min D-Q28). For two projects, mitigation objectives were met, and for one project, mitigation objectives were not met. The evaluation for the other project indicated mitigation was not planned (Min D-Q63), which contradicted the response given for Min D-Q28.

Inspections are an important part of mineral reclamation projects. The Min D protocol includes two questions about inspections, one in implementation (Min D-Q33) and one in effectiveness (Min D-Q64), that are designed to tie together. Respectively, they ask whether inspections were completed at critical times during reclamation activities and whether lack of inspections during critical times (i.e., if implementation indicated a lack) influenced BMP effectiveness. Table 238 shows the relationship between those two questions for mineral reclamation projects in which both implementation and effectiveness evaluations were completed within each monitoring period (although two effectiveness evaluations in FY15/16 did not answer Min D-Q64). A lack of

**Table 238.—**Occurrence of project inspections or contract administration performed at critical times (Min D-Q33) in relationship to problems observed during effectiveness monitoring (Min D-Q64) for Min D evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (38 percent of FY15/16 responses).

| Monitoring period | Inspections/ administration at critical times (implementation) | Not applicable; inspections at critical times or work avoided critical times (effectiveness) | Yes; lack of administration led to observed problems (effectiveness) | No; lack of administration did not lead to observed problems (effectiveness) |
|---|---|---|---|---|
| FY15/16 | | | | |
| | No inspections | 1 | | |
| | Not applicable; work avoided critical times | 3 | 1 | 1 |
| | Yes; inspections at critical times | 4 | | 2 |
| | No; inspections not at critical times | | | 1 |
| FY17/18 | | | | |
| | No inspections | | | 1 |
| | Not applicable; work avoided critical times | 1 | | |
| | Yes; inspections at critical times | 8 | | |
| | No; inspections not at critical times | | | 2 |

attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Thirty-eight percent of the evaluations in FY15/16 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remainder of the projects in FY15/16 and all the projects in FY17/18 that followed the protocol instructions, administration was not lacking, or the lack of inspections did not lead to observed problems (Table 238).

## Minerals D: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

In FY15/16, 56 percent of the Min D projects were rated as *fully implemented* and 19 percent were rated as *mostly implemented* (Fig. 112A), while 64 percent of projects had those ratings in FY17/18 (Fig. 112B). Effectiveness ratings for Min D were generally poorer than the implementation ratings in FY15/16 but better than the implementation ratings in FY17/18. The number of *not effective* ratings was nearly equal to the number of *effective* ratings in FY15/16 (Fig. 112C). In FY17/18, 17 percent of projects were rated less than *mostly effective* (Fig. 112D).

Min D evaluations involved reclamation of several types of mineral operations, with most being surface mining or other surface use or disturbance (Fig. 113). The effectiveness ratings in FY15/16 were borderline in statistical significance relative to their association with the type of mineral operation ($p = 0.10$), suggesting that effectiveness is poorer for

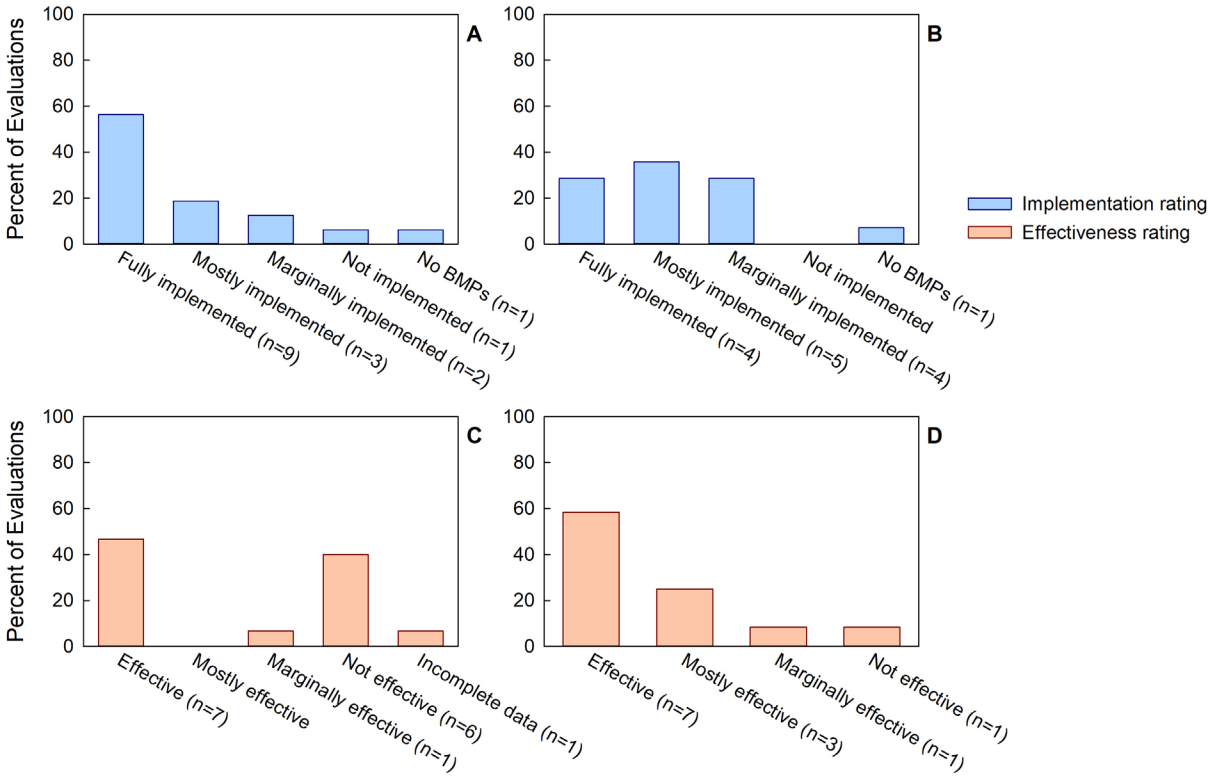



**Figure 112.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Min D evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). "Incomplete data" refers to evaluations where all of the questions needed to determine a rating were not answered.

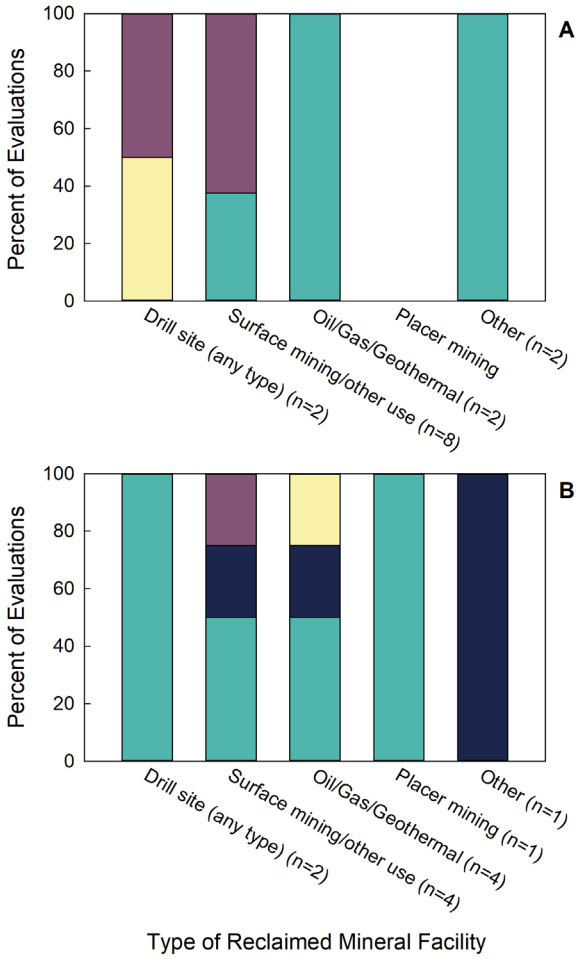



**Figure 113.—**Distribution of effectiveness ratings by type of mineral facility that was reclaimed (Min D-Q24) for evaluations completed in FY15/16 (A) and FY17/18 (B).

reclamation of drill sites and surface use sites (Fig. 113A). There was not a significant association in FY17/18 (p = 0.94), and only one surface use site was rated *not effective*. Larger sample sizes are needed, particularly for sites that did not involve surface mining or other surface uses, to meaningfully compare types of reclaimed mineral facilities. The number of reclamation projects accomplished by mineral operators was slightly higher than the number completed by the Forest Service (Fig. 114). However, the distributions of implementation ratings and effectiveness ratings were similar across both entities except for the effectiveness ratings in FY17/18 (Fig. 114D). Neither the associations between the entity accomplishing reclamation and the implementation rating nor between the entity and the effectiveness rating were significant in either monitoring period (implementation: p = 0.60 FY15/16, p = 1.00 FY17/18; effectiveness: p = 1.00 FY15/16, p = 0.55 FY17/18).

A significant association was found between the locations of the reclamation activities relative to an AMZ and the effectiveness ratings in FY15/16 (p = 0.08) but not in FY17/18 (p = 0.36). One of the five reclamation projects in FY15/16 that extended into an AMZ and two projects near waterbodies with no designated AMZ had ratings of *effective* (Fig. 115). The type of waterbody adjacent to the reclaimed site (and therefore permanency of surface water) does not appear to have an influence on the effectiveness

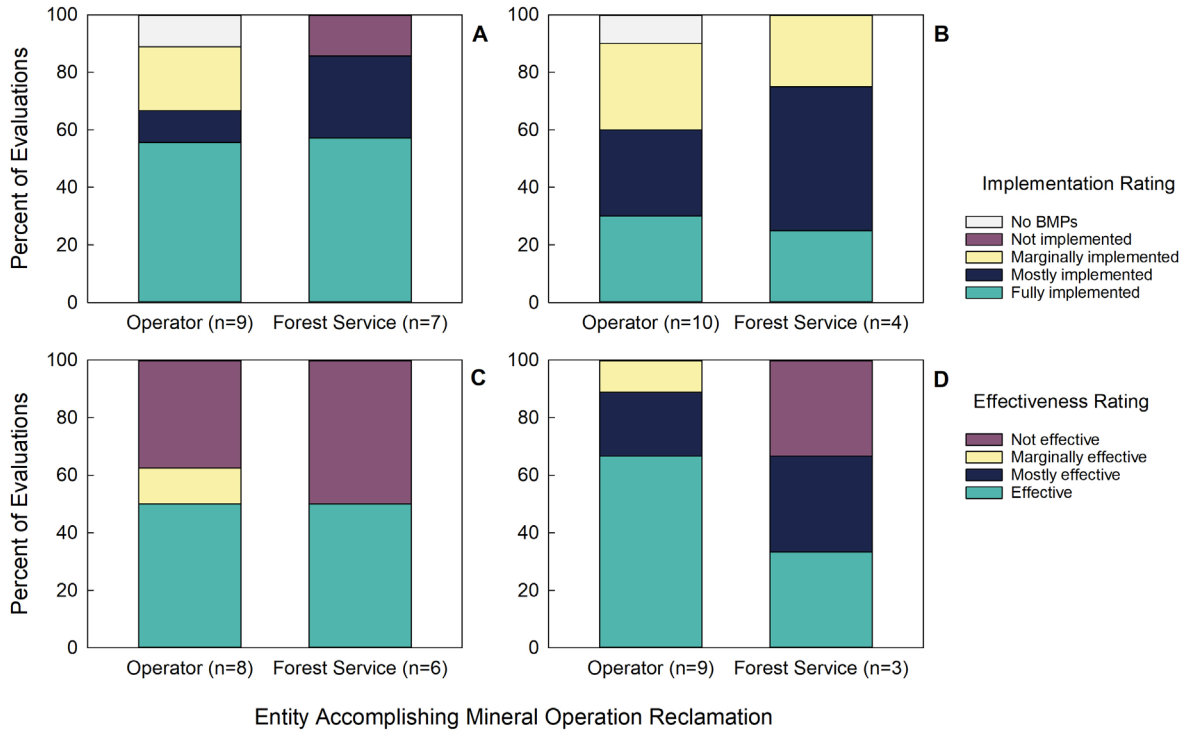



**Figure 114.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by how the reclamation project was accomplished (Min D-Q26) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

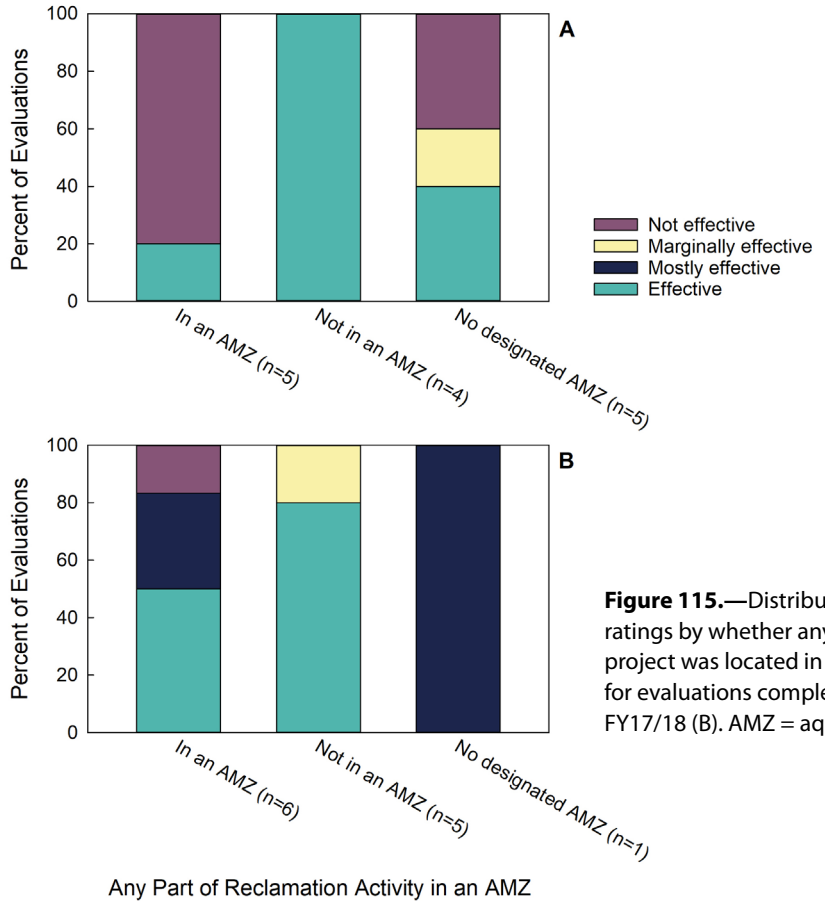



**Figure 115.—**Distribution of effectiveness ratings by whether any part of the reclamation project was located in an AMZ (Min D-Q18) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

rating (Fig. 116). Intermittent streams had poorer effectiveness ratings, but no significant associations were found between the ratings and the type of waterbody in either monitoring period (p = 0.22 FY15/16, p = 0.23 FY17/18).

Environmental analyses were completed for more than half of the reclamation projects, with about an equal number of projects accomplished using BMPs obtained from other documents (Fig. 117, Table 228). The project planned using an EIS had only an implementation evaluation of the site. Significant associations did not exist between the type of planning documents and implementation ratings in either monitoring period (p = 0.97 FY15/16, p = 1.00 FY17/18) (Figs. 117A, B). In contrast, the association between planning document type and effectiveness ratings was significant in FY15/16 (p = 0.07) but not in FY17/18 (p = 0.16) (Figs. 117C, D). Effectiveness ratings in FY15/16 generally were somewhat poorer for projects planned without formal NEPA analysis compared to those that were.

The number of BMP provisions included in an authorizing instrument were significantly different by effectiveness ratings in FY15/16 (p = 0.07, GLMM with negative binomial distribution and log link function). The single project rated *marginally effective* had 5 provisions included in an authorizing instrument, and those rated *effective* or *not effective* both averaged 17 provisions included. Mean numbers of BMP provisions

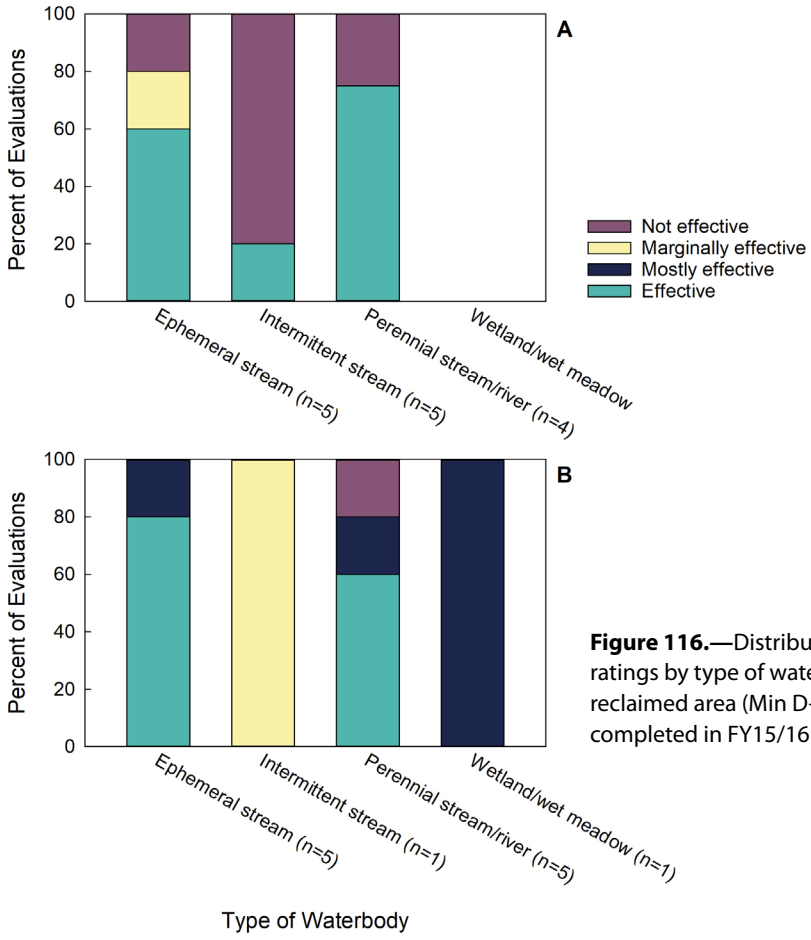



**Figure 116.—**Distribution of effectiveness ratings by type of waterbody nearest to reclaimed area (Min D-Q20) for evaluations completed in FY15/16 (A) and FY17/18 (B).

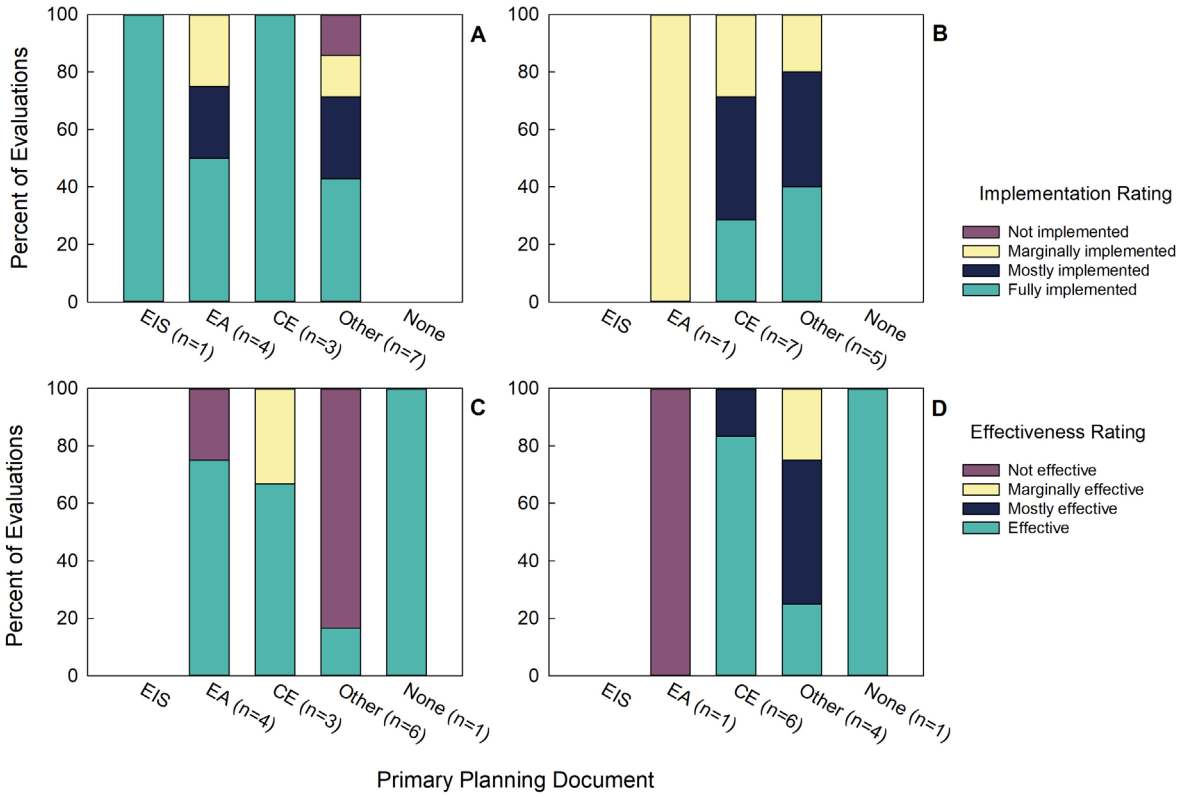



**Figure 117.—**Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (Min D-Q30) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

included in the authorizing instrument were less variable by rating in FY17/18—ranging from 9 for the project rated *marginally effective* to 17 for the project rated *not effective*—and no significant differences were found among ratings (p = 0.50, GLMM with negative binomial distribution and log link function). Reclamation projects in FY15/16 with an *effective* or *marginally effective* rating averaged 100 percent of BMPs included while those rated *not effective* averaged 88 percent, and there was not a significant difference in the percentages by rating (p = 0.13, Kruskal-Wallis test). Percentages of BMP provisions included by effectiveness rating in FY17/18 followed the pattern of numbers of provisions included in FY17/18, with the project rated *marginally effective* having the lowest rate at 41 percent and the project rated *not effective* having all BMP provisions included in the authorizing instrument. Again, there was not a significant different in percentages among ratings (p = 0.26, Kruskal-Wallis test).

When numbers of BMP provisions implemented fully were compared among effectiveness ratings, no significant differences were found in either monitoring period (p = 0.19 FY15/16, p = 0.37 FY17/18; GLMM with negative binomial distribution and log link function). Projects rated *marginally effective* had the lowest number of provisions implemented fully in both periods, with 5 in FY15/16 and 9 in FY17/18. For projects rated *not effective,* 16 and 15 provisions were implemented fully on average in FY15/16 and FY17/18, respectively. No significant differences in percentages of provisions with full

implementation existed among effectiveness ratings (p = 0.45 FY15/16, p = 0.38 FY17/18; Kruskal-Wallis test). The range of BMP provisions implemented fully was similar in both monitoring periods, with 92 to 100 percent of provisions with full implementation in FY15/16 and 86 to 100 percent in FY17/18.

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Min D-Q16) were not associated with the effectiveness ratings in either monitoring period (p = 0.31 FY15/16, p = 0.19 FY17/18). The number of wet-weather evaluations was small (Fig. 118); therefore, the lack of association here may be due to a bias of completing most of the BMP reviews during dry conditions. However, relationships between weather conditions and field observations of erosion/sediment/morphological effects (e.g., Fig. 110) may provide more straightforward information about the influence of weather on site conditions and potential problems than associations between weather and ratings because ratings incorporate responses to multiple questions.

During the implementation portion of the evaluation, review of documents and inquiries with project administrators occur to determine whether corrective actions were taken if problems were experienced (Min D-Q34). Such actions can protect water quality and may be reflected in BMP effectiveness. No significant association was found between whether corrective actions were taken and the effectiveness ratings in either monitoring period (p = 0.49 FY15/16, p = 1.00 FY17/18). The effectiveness ratings in Figure 119 for "needed and implemented" and "needed but not taken" were mostly *not effective*, but

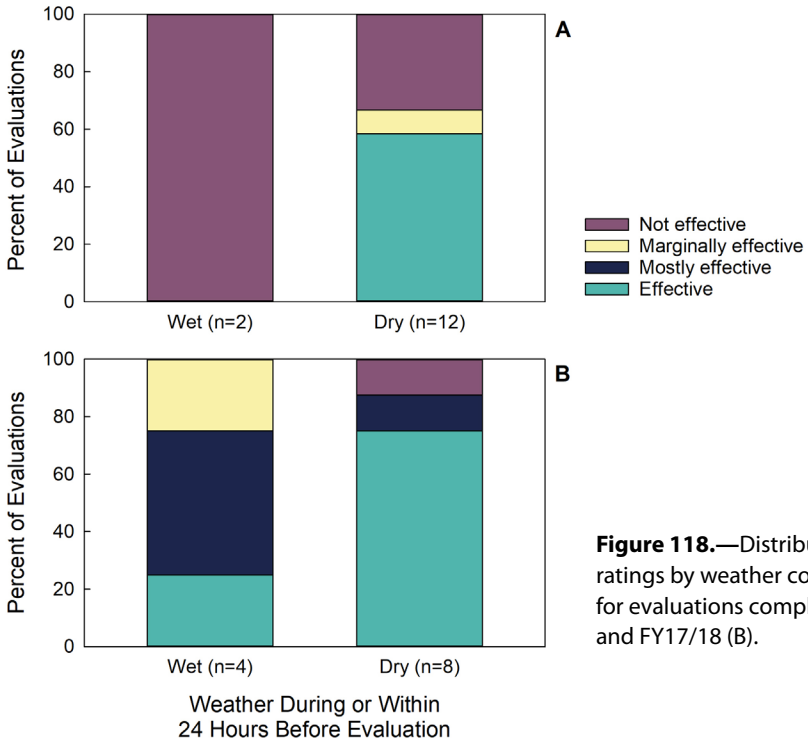



**Figure 118.—**Distribution of effectiveness ratings by weather conditions (Min D-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

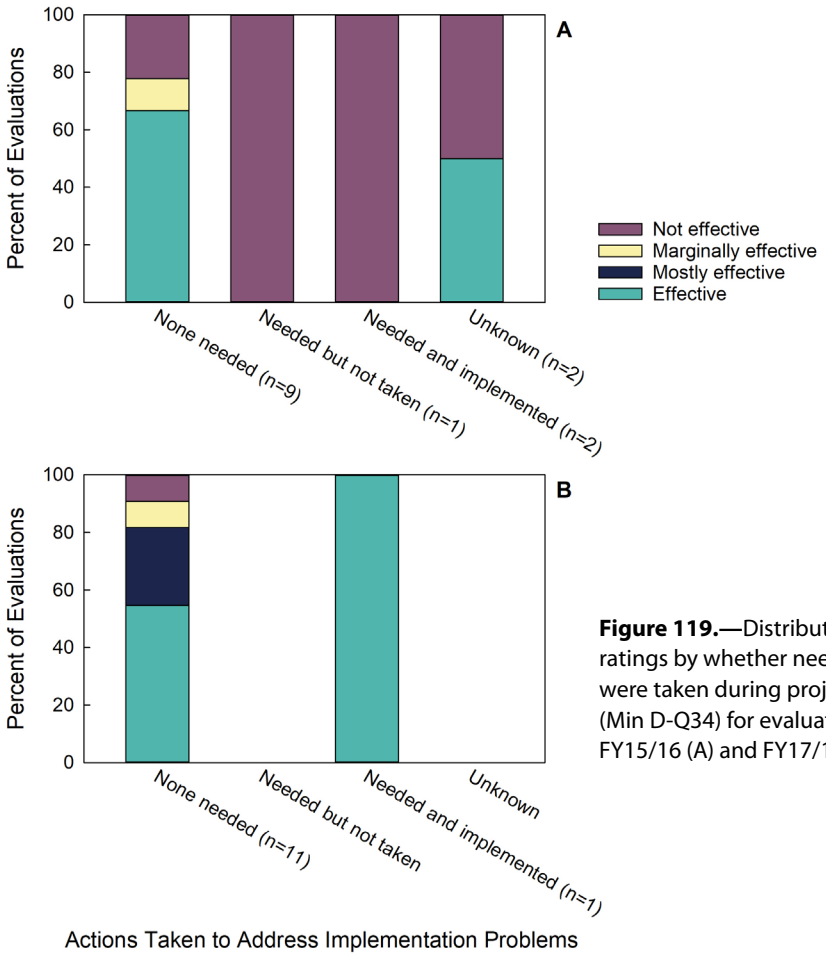



**Figure 119.—**Distribution of effectiveness ratings by whether needed corrective actions were taken during project implementation (Min D-Q34) for evaluations completed in FY15/16 (A) and FY17/18 (B).

the sample sizes for each were small, and therefore it can be difficult to garner much useful information from these results. There is some suggestion from the 20 evaluations with "none needed" responses that if problems do not develop, the potential for BMP effectiveness is greater (i.e., more *effective* ratings).

Two additional questions that ask whether corrective actions are needed or adaptive management actions are needed are included at the end of the implementation and effectiveness sections in every monitoring protocol. For implementation, the answers to these questions are based on the review of office documents as well as what the review team observes and reports from the field portion of the implementation review. For effectiveness, the answers to these questions are based upon what the team observes and reports during the effectiveness evaluation at the reclaimed site.

For all protocols, corrective actions for implementation and effectiveness refer to actions needed specifically for the project or site being evaluated. Corrective actions for implementation include actions to improve implementation for the reclamation, while corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, adaptive management actions often result from recurring deficiencies or problems and typically apply more broadly than to just the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not including all the BMPs identified during planning in authorizing instruments, while adaptive management actions for effectiveness may involve terminating the prescription of a BMP that consistently underperforms and replacing it in future, similar reclamation situations with a BMP that has been shown to provide better water quality protection.

In FY15/16, 25 percent of the Min D evaluations noted that corrective actions were needed for implementation, and about 20 percent noted that adaptive management actions were needed (Fig. 120A). In FY17/18, 30 percent indicated actions were needed (Fig. 120B). Neither the associations between corrective action needs and implementation ratings nor between adaptive management needs and implementation ratings were statistically significant in either monitoring period (corrective actions: $p = 0.31$ FY15/16, $p = 0.24$ FY17/18; adaptive management: $p = 0.45$ FY15/16, $p = 1.00$ FY17/18). When compared visually, for all comparisons ratings were slightly better when no actions were needed.

There were no significant associations between effectiveness ratings and whether corrective actions were needed in either monitoring period ($p = 0.16$ FY15/16, $p = 0.47$ FY17/18), although effectiveness ratings tended to be better when no corrective actions were needed (Fig. 121). The sample sizes for effectiveness corrective action needs, while small overall, were nearly equal in both monitoring periods, thereby suggesting that better BMP effectiveness is achieved with properly functioning BMPs. The effectiveness ratings

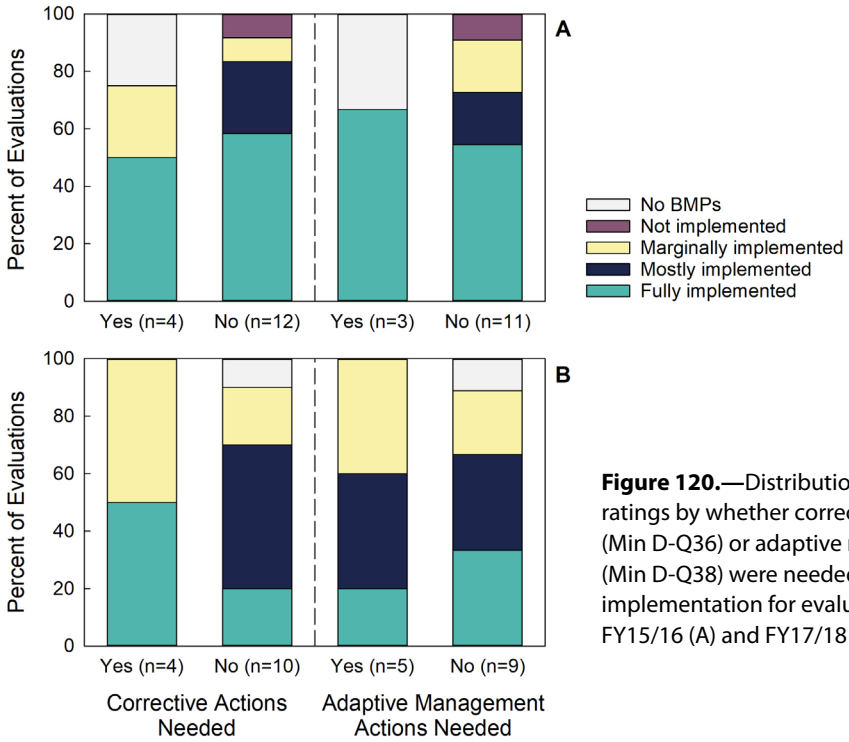



**Figure 120.**—Distribution of implementation ratings by whether corrective actions (Min D-Q36) or adaptive management actions (Min D-Q38) were needed to improve project implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

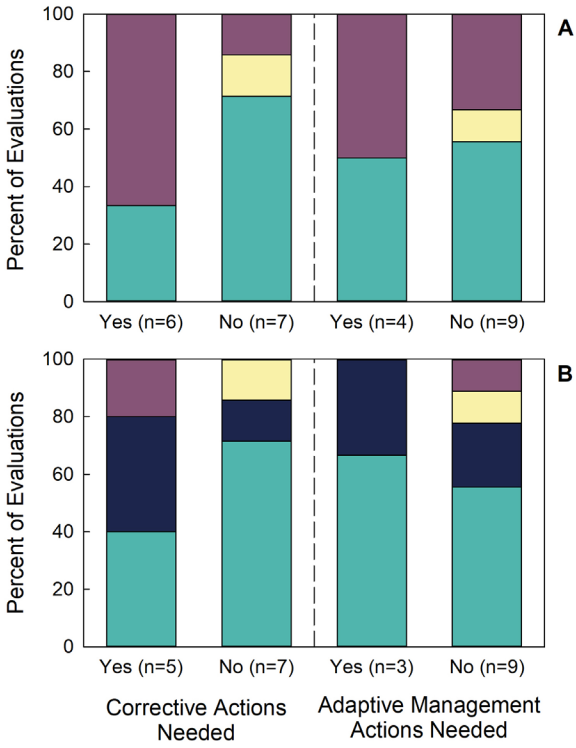



**Figure 121.—**Distribution of effectiveness ratings by whether corrective actions (Min D-Q65) or adaptive management actions (Min D-Q67) were needed to improve project effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

distributions relative to adaptive management needs were similar on a percentage basis in FY15/16 (Fig. 121) but less so in FY17/18, and there were no significant associations between the ratings and the need for adaptive management in either monitoring period ($p = 1.00$ for both periods).

There were reclamation evaluations rated as *not implemented* and *not effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. Those individual evaluations reported some type of less-than-optimal performance or condition, so the expected response to at least one of those questions (corrective actions or adaptive management action needs) would have been that some action was needed. These poorer effectiveness ratings may have resulted from chance occurrence (e.g., an extreme event outside of what could be controlled by planning or some type of BMP prescription), but such situations likely would have been applicable to a minority of evaluations. In some instances, the condition that led to an issue may have been unique to the site or considered insignificant, causing the review team to consider adaptive management actions unnecessary. However, it is possible that the team may have overlooked problems that led to poorer ratings that could have otherwise been identified during consideration of Min D-Q36, Min D-Q38, Min D-Q65, and Min D-Q67.

## Composite Ratings

Composite rating results for Min D projects with complete data that were evaluated for both implementation and effectiveness are given in Table 239. Forty-two percent of projects had a composite rating of *excellent* and 27 percent had a composite rating of

**Table 239.—**Composite rating matrix for Min D reclamation projects evaluated for both implementation and effectiveness in FY15/16 (n=14 evaluations) and FY17/18 (n=12 evaluations). Numbers in the cells indicate the number of projects with that composite rating. Composite ratings are excellent, good, fair, poor, and no plan, which results when no BMPs were prescribed (i.e., *no BMPs* implementation rating), regardless of the effectiveness rating.

| FY15/16 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 5 | 1 | | | 1 |
| | Mostly effective | | | | | |
| | Marginally effective | 1 | | | | |
| | Not effective | 2 | 1 | 2 | 1 | |

| FY17/18 Composite rating (number of evaluations) | | Implementation rating | | | | |
|---|---|---|---|---|---|---|
| | | Fully implemented | Mostly implemented | Marginally implemented | Not implemented | No BMPs |
| Effectiveness rating | Effective | 3 | 2 | 1 | | 1 |
| | Mostly effective | 1 | | 2 | | |
| | Marginally effective | | 1 | | | |
| | Not effective | | | 1 | | |

Excellent
Good
Fair
Poor
No plan

*poor.* Interestingly, the *poor* composite ratings in FY15/16 were driven by the effectiveness ratings of *not effective* across the entire range of implementation ratings (excluding the *no BMPs* implementation rating). This distribution explains why there was no significant association between the implementation and effectiveness ratings in FY15/16 ($p = 0.65$). Implementation and effectiveness ratings also were not significantly associated in FY17/18 ($p = 0.75$), likely because incomplete implementation resulted in poorer effectiveness for only two evaluations (Table 239).

## Minerals D: Examination of Component Scores

The overall implementation and effectiveness ratings were determined from component scores. The implementation rating components and their interpretations for Min D are the same as for the other Min protocols (Table 184). The Min D effectiveness components and their interpretations are given in Table 240. Table 241 shows how the scores were distributed across the three implementation components. Planning was the least successful component (i.e., lowest percentage of *all* scores) in both monitoring periods, and the reclamation projects with a *no BMPs* score for the planning component (Table 241) necessarily resulted in *no BMPs* implementation ratings (Table 242). Forty-three percent of the reclamation projects rated as *fully implemented*, which is possible

**Table 240.**—Effectiveness components, scores, and interpretation of each score for Min D. Component scores are used to determine the overall effectiveness ratings.

| Effectiveness component | Component score | Score interpretation |
|---|---|---|
| Erosion and sedimentation | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Chemical pollutants and hazardous substances and leachate | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |
| Trash and waste | Effective | No adverse effect |
| | Moderately effective | Potential adverse effect |
| | Not effective | Major adverse effect |
| Waterbody protection | Effective | No adverse effect |
| | Mostly effective | Minor adverse effect |
| | Marginally effective | Minor adverse effect but potentially could be major |
| | Not effective | Major adverse effect |

**Table 241.**—Distribution of implementation component scores by component for Min D evaluations completed in FY15/16 and FY17/18

| Monitoring period | Implementation component score | Planning component (number) | Planning component (percent) | On-the-ground execution component (number) | On-the-ground execution component (percent) | Project oversight component (number) | Project oversight component (percent) |
|---|---|---|---|---|---|---|---|
| FY15/16 (n=16) | | | | | | | |
| | All | 11 | 69 | 12 | 75 | 13 | 81 |
| | Some | 4 | 25 | 4 | 25 | 2 | 13 |
| | None | | | | | 1 | 6 |
| | No BMPs | 1 | 6 | | | | |
| FY17/18 (n=14) | | | | | | | |
| | All | 6 | 43 | 10 | 71 | 11 | 79 |
| | Some | 7 | 50 | 4 | 29 | 3 | 21 |
| | None | | | | | | |
| | No BMPs | 1 | 7 | | | | |

**Table 242.—**Implementation component scores corresponding to the overall implementation ratings for Min D evaluations with complete data in FY15/16 and FY17/18. See Table 184 for meaning of implementation component descriptors.

| Monitoring period | Implementation rating | Planning component | On-the-ground execution component | Project oversight component | Number of evaluations |
|---|---|---|---|---|---|
| FY15/16 (n=16) | | | | | |
| | Fully implemented | All | All | All | 9 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 2 |
| | Marginally implemented | All | Some | Some | 1 |
| | | Some | Some | All | 1 |
| | Not implemented | Some | Some | None | 1 |
| | No BMPs | No BMPs | Some | All | 1 |
| FY17/18 (n=14) | | | | | |
| | Fully implemented | All | All | All | 4 |
| | Mostly implemented | All | All | Some | 1 |
| | | Some | All | All | 4 |
| | Marginally implemented | All | Some | All | 1 |
| | | Some | Some | All | 1 |
| | | Some | Some | Some | 2 |
| | Not implemented | | | | 0 |
| | No BMPs | No BMPs | All | All | 1 |

only if all three components scored as *all* (Table 242). One project in both monitoring periods was rated *not implemented*, and that rating was due to a deficiency in the project oversight component.

An answer of "no" for any provision in Table 229 accompanied by a "yes" answer for at least one other provision scores as *some* for the planning component, indicating that not all the BMPs from planning were included in the reclamation project authorizing instrument. Four evaluations in FY15/16 and seven in FY17/18 had a planning component score of *some* (Table 241). For those evaluations, an average of 25 and 20 percent of provisions from planning were not included in the authorizing instrument in FY15/16 and FY17/18, respectively (Table 229, excluding provisions identified as "not applicable"), with the percentage ranging from 5 to 35 percent in FY15/16 and 5 to 59 percent in FY17/18. On average, BMPs from planning were included in 17 of the 26 possible provisions in FY15/16 and 15 provisions in FY17/18. BMPs in the provisions "location of activities" and "re-establishment/rehabilitation of aquatic habitat" (Table 229) were most often not carried from planning into the authorizing instrument for the four projects in FY15/16. Provisions not included in FY17/18 were most frequently "reclamation protection," "off-site mitigation," and "topsoil/growth medium testing and preparation."

The *some* score for the on-the-ground execution component indicates that at least one BMP in a provision was not implemented fully in the field (Table 184). This results from a "no" answer for at least one provision in Table 231 and a "yes" response for at least one other provision. For the four reclamation projects in each monitoring period having a score of *some* for the on-the-ground execution component (Table 241), the authorizing instrument averaged 13 provisions containing at least one BMP in FY15/16 and 16 provisions in FY17/18, and in 20 and 24 percent of those provisions at least one BMP was not implemented fully in FY15/16 and FY17/18, respectively. The percentages of BMPs that were not implemented fully ranged from 8 to 33 percent per evaluation in FY15/16 and 12 to 42 percent in FY17/18 when the on-the-ground execution score was *some*. BMPs that were not implemented fully were most commonly assigned to the provisions "physical stability of project components" and "re-establishment of nurse crop or final vegetation communities" (Table 231) for the four projects in FY15/16 and to the provisions "control of aquatic or wetland invasive species" and "reclamation protection" for the four projects in FY17/18.

All but one project scored as *all* or *some* for the project oversight component (Table 241). The project in FY15/16 that scored as *none* reported that corrective actions were needed to address an implementation problem but that no actions were taken to rectify the observed problem (Min D-Q34).

Planning component scores were not significantly associated with the type of primary planning document (Min D-Q30) used for the 28 projects that employed planning documents (NEPA or other BMP guidance documents) ($p = 0.14$ FY15/16, $p = 1.00$ FY17/18) or with how the project was accomplished (Min D-Q26) ($p = 1.00$ FY15/16, $p = 0.48$ FY17/18). The on-the-ground execution component scores and the project oversight component scores also were not associated with how the project was accomplished in either monitoring period (on-the-ground execution: $p = 0.58$ FY15/16, $p = 1.00$ FY17/18; project oversight: $p = 0.70$ FY15/16, $p = 1.00$ FY17/18).

The distribution of scores across the four effectiveness components is summarized in Tables 243 and 244. The erosion and sedimentation component in FY15/16 had poorer scores than any component in either monitoring period, with fewer than half of the evaluations scored as *effective* (Table 243). Erosion and sedimentation component scores were not significantly associated with whether a project had an erosion control plan in either monitoring period ($p = 0.48$ FY15/16, $p = 1.00$ FY17/18). However, three of four projects without a plan in FY15/16 had *not effective* scores, while 6 of 10 projects with an erosion control plan scored as *effective* for the erosion and sedimentation component. In FY17/18, 10 of 12 projects had component scores of *effective*, with half having an erosion control plan and half not. Fifty-four percent of the reclamation projects had overall effectiveness ratings of *effective*, which resulted from each project achieving an *effective* score for all the effectiveness components (Table 244). The seven *not effective* ratings were primarily driven by the *not effective* scores for the erosion and sedimentation component, although two evaluations also had that score for one or two other components (Table 244). The trash and waste component scores were *effective* for every evaluation (Tables 243 and 244).

**Table 243.—**Distribution of effectiveness component scores by component for Min D evaluations completed in FY15/16 and FY17/18

| Monitoring period | Effectiveness component score | Erosion and sedimentation component (number) | Erosion and sedimentation component (percent) | Chemical pollutants and hazardous substances and leachate component (number) | Chemical pollutants and hazardous substances and leachate component (percent) | Trash and waste component (number) | Trash and waste component (percent) | Waterbody protection component (number) | Waterbody protection component (percent) |
|---|---|---|---|---|---|---|---|---|---|
| FY15/16 (n=15) | | | | | | | | | |
| | Effective | 7 | 47 | 14 | 93 | 15 | 100 | 13 | 87 |
| | Mostly effective[a] | | | | | | | 1 | 7 |
| | Moderately effective[b] | | | | | | | | |
| | Marginally effective[a] | 1 | 7 | | | | | | |
| | Not effective | 6 | 40 | 1 | 7 | | | 1 | 7 |
| | Incomplete data[c] | 1 | 7 | | | | | | |
| FY17/18 (n=12) | | | | | | | | | |
| | Effective | 10 | 83 | 11 | 92 | 12 | 100 | 8 | 67 |
| | Mostly effective | | | 1 | 8 | | | 3 | 25 |
| | Moderately effective | | | | | | | | |
| | Marginally effective | 1 | 8 | | | | | | |
| | Not effective | 1 | 8 | | | | | 1 | 8 |

[a] Score applies only to erosion and sedimentation, chemical pollutants and hazardous substances and leachate, and waterbody protection components (see Table 240).

[b] Score applies only to trash and waste component (see Table 240).

[c] Some of the questions needed to determine a component score were not answered.

**Table 244.—**Effectiveness component scores corresponding to the overall effectiveness ratings for Min D evaluations with complete data in FY15/16 and FY17/18. See Table 240 for meaning of effectiveness component scores.

| Monitoring period | Effectiveness rating | Erosion and sedimentation component | Chemical pollutants and hazardous substances and leachate component | Trash and waste component | Waterbody protection component | Number of evaluations |
|---|---|---|---|---|---|---|
| FY15/16 (n=14) | | | | | | |
| | Effective | Effective | Effective | Effective | Effective | 7 |
| | Mostly effective | | | | | 0 |
| | Marginally effective | Marginally effective | Effective | Effective | Effective | 1 |
| | Not effective | Not effective | Effective | Effective | Effective | 4 |
| | | Not effective | Effective | Effective | Mostly effective | 1 |
| | | Not effective | Not effective | Effective | Not effective | 1 |
| FY17/18 (n=12) | | | | | | |
| | Effective | Effective | Effective | Effective | Effective | 7 |
| | Mostly effective | Effective | Effective | Effective | Mostly effective | 3 |
| | Marginally effective | Marginally effective | Effective | Effective | Effective | 1 |
| | Not effective | Not effective | Mostly effective | Effective | Not effective | 1 |

Comparison of the effectiveness component scores to overall implementation ratings (Fig. 122) resulted in no significant associations in either monitoring period between any of the three components that could be tested (erosion and sedimentation: p = 0.65 FY15/16, p = 0.76 FY17/18; chemical pollutants: p = 0.13 FY15/16, p = 1.00 FY17/18; waterbody protection: p = 0.11 FY15/16, p = 0.59 FY17/18); no association tests could be made with the trash and waste component. When compared visually, projects with better implementation ratings tended to have better effectiveness component scores (Fig. 122), although the sample sizes are small for component scores other than *effective*. Similarly, no significant associations between the implementation component scores and overall effectiveness ratings were found (planning: p = 0.26 FY15/16, p = 0.77 FY17/18; on-the-ground execution: p = 0.48 FY15/16, p = 0.19 FY17/18; project oversight: p = 0.77 FY15/16, p = 1.00 FY17/18). Visually, effectiveness ratings were better when implementation component scores were better for some components in some monitoring periods (Fig. 123). However, these results further support the composite rating results (Table 239), where 15 percent of projects with better implementation (*fully implemented* or *mostly implemented*) reported poorer BMP effectiveness (*marginally effective* or *not effective*).

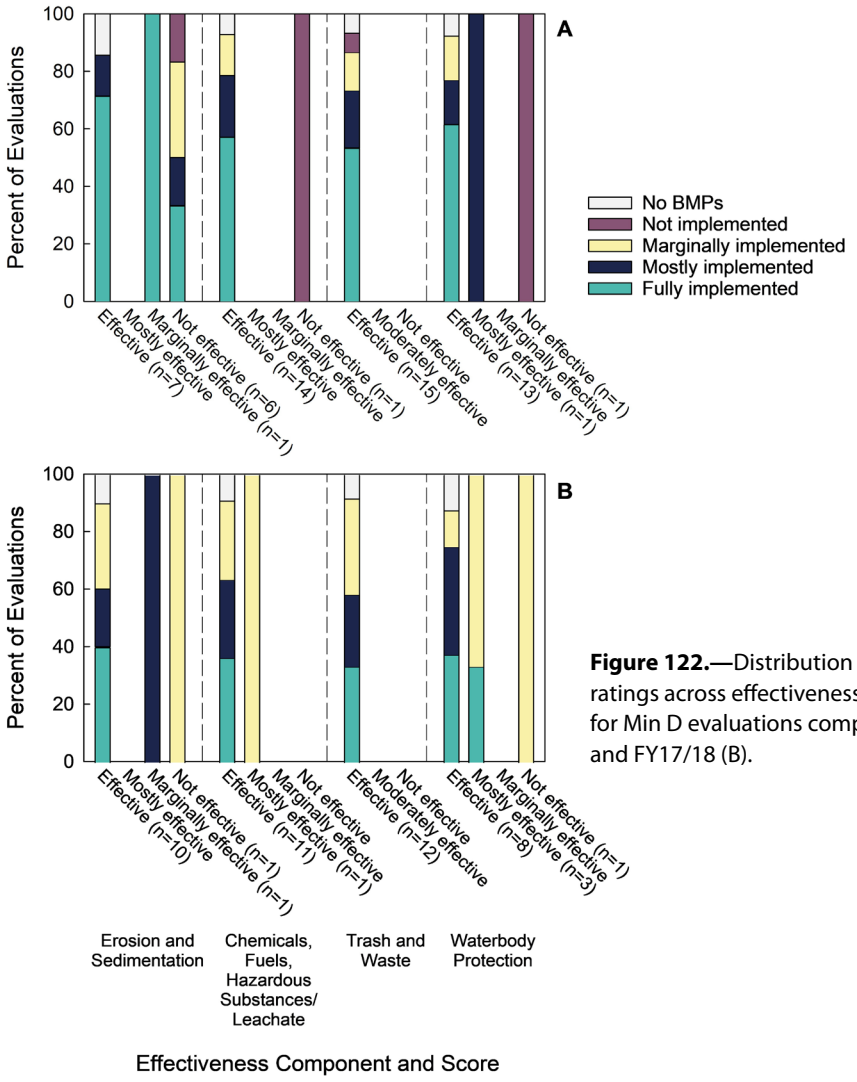



**Figure 122.—**Distribution of implementation ratings across effectiveness component scores for Min D evaluations completed in FY15/16 (A) and FY17/18 (B).

## Minerals D: Management Implications for Forest Service Resource Managers

Seventy percent of the mineral operation reclamation projects rated either *fully implemented* or *mostly implemented* for BMP implementation. Implementation ratings were better in the FY15/16 monitoring period than in FY17/18. Project planning was the primary deficiency in implementation, with 57 percent of the projects scoring *all* for the planning component. The most common planning documents were "other" (40 percent) and CEs (33 percent). About one-quarter of the evaluations had a deficiency in on-the-ground execution, with only some of the BMPs in the authorizing instrument implemented fully. Eighty percent of the projects scored *all* for project oversight.

Sixty-five percent of the projects were rated *effective* or *mostly effective*, indicating no impacts to water quality were observed or observed impacts were minor and temporary. Effectiveness ratings were better in the FY17/18 monitoring period than in FY15/16. Seven of the projects (27 percent) were rated *not effective*, due primarily to the erosion and sedimentation component. When evidence of erosion or sedimentation was

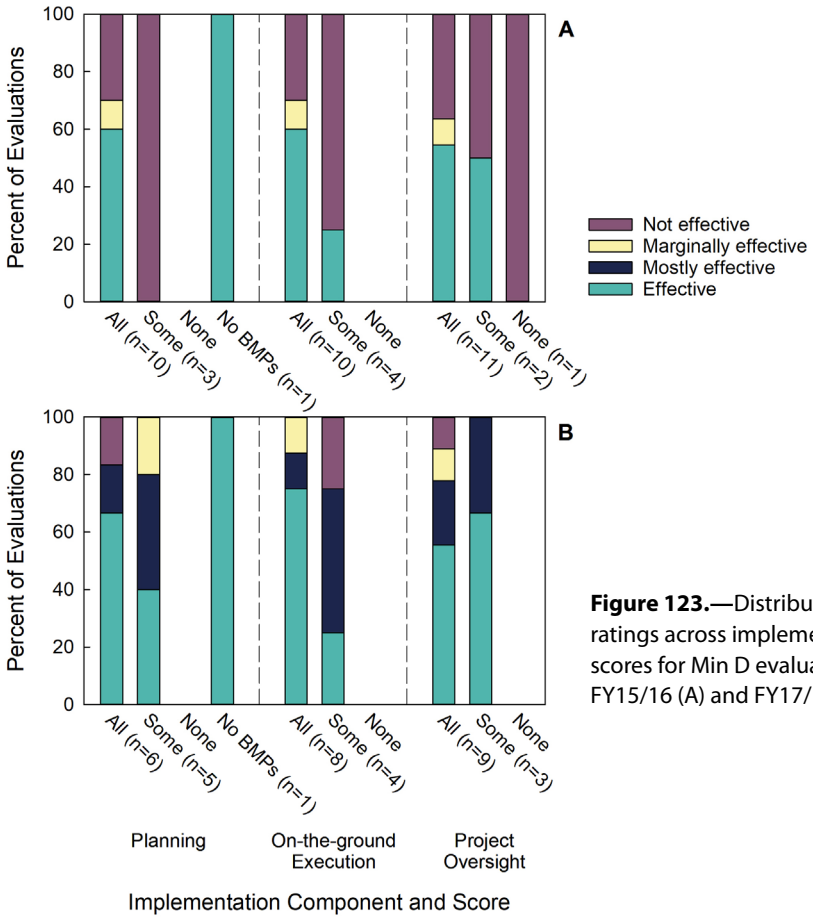



**Figure 123.**—Distribution of effectiveness ratings across implementation component scores for Min D evaluations completed in FY15/16 (A) and FY17/18 (B).

observed, it was rill erosion or sheet erosion due to the slope shape or gradient of the project site, lack of or insufficient ground cover, or lack of or insufficient number of erosion control structures. The waterbody protection component was a deficiency for six projects. In projects that involved waterbody alteration as a part of the restoration activities, 40 percent of those evaluations reported that the restoration did not result in full recovery of the waterbody. The cause reported most frequently was improper design or implementation of the reclamation project. Evidence of chemicals, hazardous materials, or fuels was observed at two sites. No evidence of trash or sanitary waste was reported for any site.

Due to the small sample size, there were no significant associations found between the implementation ratings and effectiveness ratings. However, there are indications in the data that BMPs were effective when implemented. For example, Figures 122 and 123 display the implementation ratings across the effectiveness components and the effectiveness ratings across the implementation components. Visually it appears from the figures that better implementation scores or ratings result in better effectiveness scores or ratings. In another example, most of the projects evaluated had an erosion control plan even though they are not required to have one. In FY15/16, three of the four projects that did not have an erosion control plan scored *not effective* for the erosion and sedimentation

component (which ultimately resulted in a *not effective* rating for the project), whereas 6 of the 10 projects that did have an erosion control plan scored *effective* for the erosion and sedimentation component.

Approximately two-thirds of the reclamation projects were accomplished by the mineral operator and the other third by the Forest Service. Who accomplished the reclamation did not seem to matter; the distribution of implementation ratings and effectiveness ratings was similar for those two groups. Another interesting observation in the data, as noted previously, is that most projects were completed with the BMPs coming from either a non-NEPA planning document ("other") or a CE. The effectiveness ratings for projects completed with a CE were much better than if the planning document was not a NEPA document; 88 percent of the CE projects were rated *effective* or *mostly effective*, and 60 percent of the "other" projects were rated *not effective*.

Efforts to improve BMP implementation and effectiveness might consider the following:

- Encouraging private operators to develop an erosion control plan for any reclamation project. Ninety percent of the projects completed by the Forest Service had an erosion control plan, while nearly half (48 percent) of the private operator projects did not. Projects with an erosion control plan scored better for the erosion and sedimentation effectiveness component than those without.
- Ensuring that all BMP prescriptions in the planning documents are included in the authorizing instrument. Between 20 and 25 percent of the BMP provisions in planning documents were not completely included in the authorizing instrument.
- When a reclamation project involves alterations to a waterbody, ensuring that the activities in the waterbody are properly designed and implemented. Most of the projects in which the waterbody alterations did not result in full recovery were due to improper design or implementation of the reclamation projects.
- When conducting mineral operations, minimizing the size of disturbed area and maximizing the distance between the disturbance and the waterbody to the extent practicable. Data from FY17/18 showed that when evidence of erosion or sedimentation was observed in the waterbody, the area of disturbance was significantly larger than for those projects in which no evidence of erosion was observed or the observed evidence was within the AMZ. Data from FY15/16 showed a significant relationship between distance to a waterbody and the location of evidence of erosion and sedimentation. The larger the distance between the disturbance and the waterbody, the less evidence of erosion was observed closer to the waterbody. Similarly, reclamation projects that were not within the AMZ had better effectiveness ratings.
- Assessing the bond amounts for reclamation projects to be conducted by the Forest Service. In more than half of the projects accomplished by the Forest Service, the bond available for reclamation was insufficient to complete the restoration.

## Minerals D: Best Management Practices Monitoring Form

**Best Management Practices Evaluation**

**Min D. Reclamation of Mineral Operations**

(Reference BMPs Min-1, Min-8, Fac-6, Fac-10, and Road-6)

v3.0 February 2016

| Header | |
|---|---|
| Min D-Q1 | Type of review being performed. Select one:<br><br>Implementation<br>Effectiveness<br>Both Implementation and Effectiveness<br>Follow-up Implementation<br>Follow-up Effectiveness<br>Follow-up Implementation and Effectiveness |
| Min D-Q2 | If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site? |
| Min D-Q3 | If current review is a follow-up evaluation, what was the date of the most recent evaluation? |
| Min D-Q4 | Date of current field evaluation: |
| Min D-Q5 | If this is a follow-up evaluation, describe all of the corrective actions that were applied to protect or improve water quality since the initial evaluation: |
| Min D-Q6 | If this is a follow-up evaluation, describe all of the adaptive management actions that were applied to protect or improve water quality since the initial evaluation: |
| Min D-Q7 | Reviewers and titles: |
| Min D-Q8a | Region number: |
| Min D-Q8b | State: |
| Min D-Q9a | Proclaimed Forest or Grassland number and name: |
| Min D-Q9b | Administrative Forest or Grassland number and name: |
| Min D-Q10 | District number and name: |
| Min D-Q11a | Reason for monitoring. Select all that apply:<br><br>National BMP Targets<br>Land Management Plan Monitoring<br>Project Review<br>Quality Assurance<br>Other (specify): |
| Min D-Q11b | Was the project/site selected randomly from the pool developed using the National BMP Monitoring Program instructions that correspond to this form? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures used to select the project/site: |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min D-Q11c | Will the project/site be evaluated using the procedures described in the National BMP Monitoring Program instructions that correspond to this form (e.g., evaluating the appropriate areas or transects, etc.)? Select one:<br><br>a. Yes<br>b. No<br>If No, describe the procedures that will be used to evaluate the project/site or how they will differ from the procedures in the instructions: |
| Min D-Q12 | 6th level HUC number and name for the subwatershed the reclamation project is in: |
| Min D-Q13 | Is any part of the area being evaluated located within a municipal supply watershed? Select one:<br><br>a. Yes<br>b. No |
| Min D-Q14a | Location.<br><br>UTM Zone:<br>UTM Datum: |
| Min D-Q14b | Location.<br><br>Easting: |
| Min D-Q14c | Location.<br><br>Northing: |
| Min D-Q15a | Location.<br><br>Latitude: |
| Min D-Q15b | Location.<br><br>Longitude: |
| Min D-Q15c | Location.<br><br>Lat/Long Datum: |
| Min D-Q16 | Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply:<br><br>Rain<br>Snow<br>Snowpack on the ground<br>Melting snow<br>Hail/sleet<br>Freezing rain/freezing fog<br>Other (specify):<br>Unknown |
| Min D-Q17 | Name of mineral operation being reclaimed: |
| Min D-Q18 | Is any part of the reclamation activity located within an AMZ? Select one:<br><br>a. Yes<br>b. No<br>c. Waterbody has no designated AMZ |
| Min D-Q19 | Distance between reclaimed area and nearest waterbody (ft, m, mi, km; specify unit): |

*continued on next page*

| **Header** (*continued*) | |
|---|---|
| Min D-Q20 | Type of waterbody nearest to reclaimed area. Select one:<br><br>Ephemeral stream<br>Intermittent stream<br>Perennial stream/river<br>Pond<br>Lake<br>Wetland or wet meadow<br>Estuary<br>Other (specify): |
| Min D-Q21 | Approximate total size of area disturbed by reclamation activities (ac or ha; specify unit): |
| Min D-Q22 | How long ago was reclamation completed, or how long ago was the most recent phase completed? (months or years; specify units): |
| Min D-Q23 | Were bond-release criteria developed for this reclamation operation? Select one:<br><br>a. Yes<br>b. No |
| Min D-Q24 | Type of facility that was reclaimed. Select one:<br><br>a. Drilling sites for geophysical exploration purposes, including shot holes<br>b. Exploration drill sites (for hard rock mineral, solid leasable minerals [coal, phosphate, etc.], oil/gas, or geothermal resources)<br>c. Production locations for oil, gas, or geothermal<br>d. Surface mining operation<br>e. Surface disturbance related to other exploration method (e.g., trenching and bulk sampling)<br>f. Other surface uses related to mines, including shafts, ventilation facilities, milling, ore and stockpiles, impoundments, etc.<br>g. Placer mining<br>h. Other (specify): |
| Min D-Q25 | Ownership of the mineral rights. Select one:<br><br>Federal<br>Non-federal |
| **Implementation** | |
| Min D-Q26 | How has reclamation been accomplished? Select one:<br><br>a. By the operator, as required by the authorizing instrument (go to question 28)<br>b. By the Forest Service with a bond (go to question 27) |
| Min D-Q27 | Was the bond sufficient to cover costs of reclamation? Select one:<br><br>a. Yes<br>b. No |
| Min D-Q28 | Is there off-site mitigation for this operation? Select one:<br><br>a. Yes, and it has been started or completed<br>b. Yes, but it has not yet been started<br>c. No, off-site mitigation was not planned for this project<br>If Yes, what is the planned or completed mitigation, and where is it located or where is it planned to be located? |
| Min D-Q29 | Was there an approved erosion control plan for this reclamation project? Select one:<br><br>a. Yes<br>b. No |

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| **Implementation** (*continued*) | |
|---|---|
| Min D-Q30 | What was the primary planning document used to specify the BMPs to be implemented to protect water, aquatic, and riparian resources for this project? Select one:<br><br>a. No planning document containing BMP guidance was used (go to question 32)<br>b. Environmental Impact Statement (EIS) (go to question 31)<br>c. Environmental Assessment (EA) (go to question 31)<br>d. Categorical Exclusion (CE) (go to question 31)<br>e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 31) |
| Min D-Q31 | Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document or other BMP guidance documents were included in the authorizing instrument. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents.<br><br>a. Timing and scheduling of reclamation operations<br>Yes/No/Not applicable<br>b. Sampling/testing to identify chemicals or hazardous materials or wastes (includes fuels, reactive chemicals, other chemicals)<br>Yes/No/Not applicable<br>c. Isolation, neutralization, removal, or treatment of hazardous materials or wastes (includes chemicals, metals, fuels, pit fluids, etc.)<br>Yes/No/Not applicable<br>d. Sampling/testing to identify reactive geologic materials or wastes (includes tailings, waste rock or development of rock stockpiles, process pond sediment and sludge)<br>Yes/No/Not applicable<br>e. Isolation, neutralization, removal, or treatment of reactive geologic materials or wastes (includes tailings, waste rock or development rock stockpiles, process pond sediment and sludge)<br>Yes/No/Not applicable<br>f. Water control/drainage measures<br>Yes/No/Not applicable<br>g. Other erosion control<br>Yes/No/Not applicable<br>h. Installation of water diversion and conveyance<br>Yes/No/Not applicable<br>i. Control of aquatic or wetland invasive species<br>Yes/No/Not applicable<br>j. Location of activities (e.g., avoiding waterbodies or sensitive features)<br>Yes/No/Not applicable<br>k. Areal extent of activities<br>Yes/No/Not applicable<br>l. Requirements/specifications for facility, equipment, and non-hazardous material removal (includes septic system and human waste)<br>Yes/No/Not applicable<br>m. Restoration of contour<br>Yes/No/Not applicable<br>n. Physical stability of project components (design slopes, factor of safety, landslide control measures)<br>Yes/No/Not applicable<br>o. Topsoil/growth medium testing and preparation (includes organic material, fertilizer, lime, and inoculation amendments)<br>Yes/No/Not applicable<br>p. Placement of topsoil or growth medium<br>Yes/No/Not applicable<br>q. Seedbed preparation<br>Yes/No/Not applicable<br>r. Application of non-vegetative ground cover (e.g., mulch, geotextiles, etc.)<br>Yes/No/Not applicable<br>(*continued*) |

*continued on next page*

| **Implementation** (*continued*) | |
|---|---|
| (*Min D-Q31 continued*) | s. Re-establishment of nurse crop or final vegetation communities (includes selecting and obtaining appropriate seed sources)<br>Yes/No/Not applicable<br>t. Re-establishment of stream channels, wetlands, floodplains, stream banks, or shorelines<br>Yes/No/Not applicable<br>u. Re-establishment/rehabilitation of aquatic habitat (includes wood placement)<br>Yes/No/Not applicable<br>v. Off-site mitigation<br>Yes/No/Not applicable<br>w. Reclamation protection (includes fencing, keeping animals out of the area, physical blockage of reclaimed access routes, etc.)<br>Yes/No/Not applicable<br>x. Monitoring requirements (during or following reclamation)<br>Yes/No/Not applicable<br>y. Operation and/or maintenance requirements for long-term function (e.g., diversions, passive or active water treatment facilities, engineered facilities that remain on site, roads, gates, fences, etc.)<br>Yes/No/Not applicable<br>z. Well and borehole abandonment<br>Yes/No/Not applicable<br>aa. Other (specify):<br>Yes/No/Not applicable |
| Min D-Q32 | Indicate if provisions to protect water, aquatic, and riparian resources during reclamation in the list below that were included in the authorizing instrument were implemented fully. Select one response in each line. If the provision exists in the authorizing instrument and it was implemented fully, select Yes. If the provision exists in the authorizing instrument but it was not implemented fully, select No. If the provision does not exist in the authorizing instrument, select Not applicable.<br><br>a. Timing and scheduling of reclamation operations<br>Yes/No/Not applicable<br>b. Sampling/testing to identify chemicals or hazardous materials or wastes (includes fuels, reactive chemicals, other chemicals)<br>Yes/No/Not applicable<br>c. Isolation, neutralization, removal, or treatment of hazardous materials or wastes (includes chemicals, metals, fuels, pit fluids, etc.)<br>Yes/No/Not applicable<br>d. Sampling/testing to identify reactive geologic materials or wastes (includes tailings, waste rock or development of rock stockpiles, process pond sediment and sludge)<br>Yes/No/Not applicable<br>e. Isolation, neutralization, removal, or treatment of reactive geologic materials or wastes (includes tailings, waste rock or development rock stockpiles, process pond sediment and sludge)<br>Yes/No/Not applicable<br>f. Water control/drainage measures<br>Yes/No/Not applicable<br>g. Other erosion control<br>Yes/No/Not applicable<br>h. Installation of water diversion and conveyance<br>Yes/No/Not applicable<br>i. Control of aquatic or wetland invasive species<br>Yes/No/Not applicable<br>j. Location of activities (e.g., avoiding waterbodies or sensitive features)<br>Yes/No/Not applicable<br>k. Areal extent of activities<br>Yes/No/Not applicable<br>l. Requirements/specifications for facility, equipment, and non-hazardous material removal (includes septic system and human waste)<br>Yes/No/Not applicable<br>(*continued*) |

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| **Implementation** (*continued*) | |
|---|---|
| (*Min D-Q32 continued*) | m. Restoration of contour<br>Yes/No/Not applicable<br>n. Physical stability of project components (design slopes, factor of safety, landslide control measures)<br>Yes/No/Not applicable<br>o. Topsoil/growth medium testing and preparation (includes organic material, fertilizer, lime, and inoculation amendments)<br>Yes/No/Not applicable<br>p. Placement of topsoil or growth medium<br>Yes/No/Not applicable<br>q. Seedbed preparation<br>Yes/No/Not applicable<br>r. Application of non-vegetative ground cover (e.g., mulch, geotextiles, etc.)<br>Yes/No/Not applicable<br>s. Re-establishment of nurse crop or final vegetation communities (includes selecting and obtaining appropriate seed sources)<br>Yes/No/Not applicable<br>t. Re-establishment of stream channels, wetlands, floodplains, stream banks, or shorelines<br>Yes/No/Not applicable<br>u. Re-establishment/rehabilitation of aquatic habitat (includes wood placement)<br>Yes/No/Not applicable<br>v. Off-site mitigation<br>Yes/No/Not applicable<br>w. Reclamation protection (includes fencing, keeping animals out of the area, physical blockage of reclaimed access routes, etc.)<br>Yes/No/Not applicable<br>x. Monitoring requirements (during or following reclamation)<br>Yes/No/Not applicable<br>y. Operation and/or maintenance requirements for long-term function (e.g., diversions, passive or active water treatment facilities, engineered facilities that remain on site, roads, gates, fences, etc.)<br>Yes/No/Not applicable<br>z. Well and borehole abandonment<br>Yes/No/Not applicable<br>aa. Other provisions specified in question 31aa<br>Yes/No/Not applicable<br>bb. Other (specify):<br>Yes/No/Not applicable<br>For any provisions you answered No, briefly explain how implementation is deficient: |
| Min D-Q33 | Were project inspections during reclamation performed at critical times for addressing water quality issues? Select one:<br><br>a. No inspections were performed<br>b. Not applicable, reclamation operations were conducted to avoid critical times<br>c. Yes<br>d. No |
| Min D-Q34 | If problems occurred during reclamation that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one:<br><br>a. No problems occurred so no corrective actions were needed<br>b. Corrective actions were needed but not taken<br>c. Corrective actions were needed and implemented<br>d. Unknown, insufficient documentation and information exists to make the determination |

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| **Implementation** (*continued*) | |
|---|---|
| Min D-Q35 | Were chemical or fuel spills or leaks that occurred during reclamation activities handled/treated according to the contingency and emergency response plan or another agency's requirements? Select one:<br><br>a. The Forest or Grassland has no contingency and emergency response plan and there are no outside agency requirements that apply<br>b. Not applicable, no spills or leaks occurred during reclamation<br>c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan or other applicable outside agency requirements<br>d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan or other applicable outside agency requirements |
| Min D-Q36 | Are any corrective actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 37)<br>b. No (go to question 38) |
| Min D-Q37 | Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies. |
| Min D-Q38 | Are any adaptive management actions needed to improve implementation? Select one:<br><br>a. Yes (go to question 39)<br>b. No (go to question 40 if effectiveness is to be evaluated at this time; otherwise go to General Comments) |
| Min D-Q39 | Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 40 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question. |
| **Effectiveness** | |
| Min D-Q40 | Is there evidence of erosion or sedimentation from reclamation activities or reclaimed areas? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of erosion or sedimentation (go to question 47)<br>b. Evidence of erosion or sedimentation outside an AMZ (go to question 42)<br>c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 42)<br>d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 41) |
| Min D-Q41 | How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and unplanned changes to waterbody morphology? Select one; after answering go to question 43:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min D-Q42 | What is the shortest distance between the evidence and the waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min D-Q43 | What type of waterbody has experienced unplanned morphological changes, or has received sediment inputs, or will receive inputs if sediment transport or erosion worsens? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min D-Q44 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |
| Min D-Q45 | For all of the occurrences of erosion and sedimentation observed in the area you identified in question 40, what is the evidence? Select all that apply:<br><br>a. Traceable evidence to the waterbody, but not currently visible in the waterbody<br>b. Turbidity present<br>c. Evidence of localized sediment deposition in the waterbody<br>d. Changes to substrate composition<br>e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)<br>f. Bank instability<br>g. Bank trampling or compaction<br>h. Vegetation damage or bare ground<br>i. Sheet erosion<br>j. Rill erosion<br>k. Gully erosion<br>l. Headcutting<br>m. Slumping/slips<br>n. Mass wasting<br>o. Sediment plumes or accumulations<br>p. Rutting<br>q. Water quality monitoring results<br>r. Other (specify): |
| Min D-Q46 | What are the causes? Select all that apply:<br><br>a. Poor location for activity that was being reclaimed<br>b. Slope shape and/or gradient<br>c. Instability due to inadequate design, construction, or maintenance after restoration<br>d. Lack of or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, mulch, etc.)<br>e. No or insufficient number of erosion control, water control, or water or sediment storage features installed<br>f. Improperly designed erosion control, water control, or water or sediment storage features<br>g. Improperly constructed erosion control, water control, or water or sediment storage features<br>h. Inadequate or improper maintenance of erosion control, water control, or water or sediment storage features<br>i. Reclamation performed outside allowable time periods<br>j. Reclamation performed outside allowable soil conditions<br>k. Reclamation performed within authorizing instrument requirements<br>l. Reclamation performed outside authorizing instrument requirements<br>m. Soil compaction<br>n. Mechanical additions of sediment to waterbody during reclamation<br>o. Site access by humans was not sufficiently controlled<br>(*continued*) |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| (*Min D-Q46 continued*) | p. Site access by domestic animals or wildlife was not sufficiently controlled<br>q. Did not anticipate effects<br>r. Other (specify):<br>s. Unknown |
| Min D-Q47 | Have ground cover standards been met for the reclaimed area being evaluated? Select one:<br><br>a. Not applicable, no ground cover standards specified for the reclamation project<br>b. Yes<br>c. No |
| Min D-Q48 | Is there evidence of chemicals, hazardous substances or associated leachates, or fuels from reclamation activities or in reclaimed areas? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d.<br><br>a. No evidence of chemicals, hazardous substances or associated leachates, or fuels (go to question 55)<br>b. Evidence of chemicals, hazardous substances or associated leachates, or fuels outside an AMZ (go to question 50)<br>c. Evidence of chemicals, hazardous substances or associated leachates, or fuels within an AMZ, but not reaching a waterbody (go to question 50)<br>d. Evidence of chemical, hazardous substance or associated leachate, or fuel transport to or deposition in a waterbody (go to question 49) |
| Min D-Q49 | How many total places do you observe chemicals, hazardous substances or associated leachates, or fuels delivered to or present in a waterbody? Select one; after answering go to question 51:<br><br>a. 1 or 2<br>b. 3 or 4<br>c. 5 or more |
| Min D-Q50 | What is the shortest distance between the evidence and the nearest waterbody? Select one:<br><br>a. ≤10 feet<br>b. >10 to 50 feet<br>c. >50 to 100 feet<br>d. >100 feet |
| Min D-Q51 | What type of waterbody has been contaminated by chemicals, hazardous substances or associated leachates, or fuels or is closest to the evidence in the area you identified in question 48? Select all that apply:<br><br>a. Ephemeral stream<br>b. Intermittent stream<br>c. Perennial stream/river<br>d. Pond<br>e. Lake<br>f. Wetland or wet meadow<br>g. Estuary<br>h. Groundwater<br>i. Other (specify): |
| Min D-Q52 | What is the width of the AMZ associated with the waterbody? (ft or m; specify unit): |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min D-Q53 | For all of the occurrences of chemicals, hazardous substances or associated leachates, or fuels observed in the area you identified in question 48, what is the evidence? Select all that apply:<br><br>a. Hydrocarbons, chemicals, or hazardous substances are visible<br>b. Visible leachate<br>c. Visible precipitate<br>d. Waste containers<br>e. Vegetative effects<br>f. Odor<br>g. Aquatic organism effects<br>h. Other organism effects<br>i. Water quality monitoring results<br>j. Other (specify): |
| Min D-Q54 | What are the causes? Select all that apply:<br><br>a. Equipment or vehicle failure<br>b. Poorly located equipment fueling, maintenance, or storage<br>c. Inadequate provisions for fueling or servicing equipment<br>d. Inadequate or improperly designed storage areas (includes secondary containment)<br>e. Improperly designed reclamation for storage or disposal areas<br>f. Improper reclamation of storage or disposal areas<br>g. Poorly located storage or disposal areas<br>h. Human error or carelessness<br>i. Inadequate spill response or clean-up<br>j. Inadequate sampling or treatment of exploration or operation sources<br>k. Inadequate characterization of materials or locations that had potential to generate hazardous substances or leachate<br>l. Inadequate collection, control, or treatment of runoff or drainage<br>m. Improperly constructed water control or storage features<br>n. Inadequate or improper maintenance of water control or storage features<br>o. Did not anticipate effects<br>p. Other (specify):<br>q. Unknown |
| Min D-Q55 | Is there evidence of trash or human sanitary waste disposal problems from reclamation or in the reclaimed areas? Select all that apply:<br><br>a. No evidence of trash or human sanitary waste (go to question 58)<br>b. Evidence of trash outside an AMZ (go to question 56)<br>c. Evidence of trash within an AMZ, but not reaching a waterbody (go to question 56)<br>d. Evidence of trash in a waterbody (go to question 56)<br>e. Evidence of human sanitary waste outside an AMZ (go to question 56)<br>f. Evidence of human sanitary waste within an AMZ, but not reaching a waterbody (go to question 56)<br>g. Evidence of human sanitary waste in a waterbody (go to question 56) |
| Min D-Q56 | For all of the occurrences of trash or human sanitary waste observed in the area you identified in question 55, what is the evidence? Select all that apply:<br><br>a. Visible human excrement/toilet paper<br>b. Trash or food wastes<br>c. Visible evidence of soap<br>d. Odor<br>e. Flies or other insects<br>f. Water quality monitoring results<br>g. Other (specify): |

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| **Effectiveness** (*continued*) | |
|---|---|
| Min D-Q57 | What are the causes? Select all that apply:<br><br>a. Trash receptacles not supplied or not maintained properly during reclamation activities<br>b. Toilet facilities not supplied or not maintained properly during reclamation activities<br>c. Trash receptacles not reclaimed properly<br>d. Toilet facilities not reclaimed properly<br>e. Inconsiderate human actions<br>f. Ineffective reclamation of human waste accumulation areas<br>g. Ineffective reclamation of waste treatment facilities<br>h. Other (specify):<br>i. Unknown |
| Min D-Q58 | Where a waterbody was altered by mining exploration or extraction operations, is there evidence that waterbody reclamation has not resulted in full recovery? Select one:<br><br>a. Not applicable, no waterbody alteration by mining exploration or extraction operations (go to question 60)<br>b. Yes, there is evidence that waterbody reclamation did not result in full recovery (go to question 59)<br>c. Too soon to tell (go to question 60)<br>d. No, waterbody reclamation resulted in full recovery (go to question 60) |
| Min D-Q59 | What are the causes of inadequate reclamation of the waterbody? Select all that apply:<br><br>a. Reclamation not undertaken<br>b. Undercutting of the waterbody bank not adequately repaired<br>c. Waterbody excavation not reclaimed<br>d. Waterbody disposal of materials not properly treated<br>e. Connection to groundwater not repaired or restored<br>f. Improperly reclaimed access roads that included waterbody crossings<br>g. Improper design or implementation of reclamation projects<br>h. Lack of appropriate waterbody identification/designation<br>i. Other (specify): |
| Min D-Q60 | Is there evidence that the reclamation activities contributed to the introduction or spread of aquatic invasive species? Select one:<br><br>a. Yes<br>b. No<br>If Yes, provide the names of the aquatic invasive species observed: |
| Min D-Q61 | Are any beneficial uses in any waterbodies in the areas that you evaluated for reclamation activities being impacted by erosion and sedimentation, chemicals, hazardous substances or associated leachates, fuels, trash or human sanitary waste, or aquatic invasive species? Select one:<br><br>a. Yes, beneficial uses are being impacted<br>b. No, beneficial uses are not being impacted<br>If Yes, what beneficial uses are being impacted? |
| Min D-Q62 | Is reclamation effective at meeting water quality standards? Select one:<br><br>a. Yes<br>b. No<br>c. Unknown<br>If No, what water quality standards are not being met? |

*continued on next page*

| **Effectiveness** (*continued*) | |
|---|---|
| Min D-Q63 | Did off-site mitigation meet objectives? Select one:<br><br>a. Not applicable, no off-site mitigation for this operation<br>b. Not applicable, off-site mitigation has not yet begun<br>c. Too soon to tell<br>d. Yes<br>e. No<br>If No, describe the objectives that are not being met, and the actions being taken to meet objectives: |
| Min D-Q64 | If inspections were not conducted at critical times during reclamation, did the lack of administration contribute to observed problems? Select one:<br><br>a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times<br>b. Yes<br>c. No |
| Min D-Q65 | Are any corrective actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 66)<br>b. No (go to question 67) |
| Min D-Q66 | Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies. |
| Min D-Q67 | Are any adaptive management actions needed to improve effectiveness? Select one:<br><br>a. Yes (go to question 68)<br>b. No (go to General Comments) |
| Min D-Q68 | Provide information about adaptive management actions needed to improve effectiveness, and reference the question number to which each action applies.<br>Go to General Comments after answering this question. |
| **General Comments** | |
| | |

## Minerals Summary

Minerals management protocols were some of the least frequently used National BMP monitoring protocols in the FY15/16 and FY17/18 monitoring periods. A total of 110 evaluations were completed (Table 180), making up approximately 4 percent of all evaluations completed in these two monitoring periods. Most regions completed at least 10 evaluations using a minerals protocol; Region 9 (19 evaluations) and Region 6 (18 evaluations) completed the most. Region 10 and Region 5 completed fewer than 10, with 7 and 3 evaluations, respectively. The most frequently used minerals protocols were Min B (51 evaluations) and Min D (30 evaluations). In total, 71 percent of the mineral sites evaluated were randomly selected (Table 180). Except for Min B implementation evaluations in FY17/18, there were no differences in either implementation ratings or effectiveness ratings between randomly and nonrandomly selected sites for Min B and Min D protocols (Fig. 89).

The minerals protocols evaluate a broad range of types of mineral operations in all phases of construction, operation, and reclamation, which can make it difficult to generalize the results. Of the implementation evaluations completed with protocols Min A, Min C, and Min D, 60 to 75 percent were rated *fully implemented* or *mostly implemented*, but one-third of the evaluated Min B operations had those ratings. Few deficiencies were found in on-the-ground execution, as all BMP provisions included in the authorizing instrument were implemented fully at 79 percent of all minerals sites evaluated. Many deficiencies were found in the planning component for Min B evaluations, with nearly 33 percent of those sites rated *no BMPs*, an indication that BMPs were not considered during project planning. The planning component also was a deficiency for Min C and Min D sites, and project oversight was the primary implementation deficiency for Min A projects.

Looking at BMP effectiveness, more than 80 percent of the Min A and Min B sites evaluated for effectiveness were rated *effective,* 65 percent of the Min C operations were rated *effective*, and 54 percent of the Min D projects were rated *effective*. Generally, effectiveness was either fully achieved (*effective* rating) or totally lacking (*not effective* rating); only 9 of the 86 sites evaluated for effectiveness (10 percent) were rated *mostly effective* or *marginally effective*. The erosion and sedimentation component was the most common effectiveness deficiency observed across the four minerals protocols. Evidence of trash and sanitary waste or chemical pollutants was observed at very few of the minerals sites evaluated.

For projects in which both the implementation and effectiveness evaluations were completed, relationships between BMP implementation and BMP effectiveness can be explored. For the minerals evaluations completed in FY15/16 and FY17/18, small sample sizes and the generally high effectiveness ratings across all of the implementation rating categories can make it difficult to conclude that any relationship between BMP implementation and effectiveness exists at the evaluated sites. However, closer examination of subsets of the data indicate that better BMP implementation can result in better effectiveness at minerals sites. For example, Min B operations evaluated in FY15/16 show a significant association between implementation ratings and effectiveness ratings.

## Overall Program Observations

In addition to analyzing the monitoring data for insights on BMP implementation and effectiveness, the data also are assessed to identify issues with application of the BMP monitoring program. Examination of the data for minerals protocols indicate that reading the protocol instructions and completing the monitoring forms more carefully may improve results. Specific issues identified include the following:

- National BMP program direction calls for sites to be evaluated for both BMP implementation and effectiveness, with implementation evaluated first even if both are evaluated on the same day. Three Min B, one Min C, and three Min D evaluations were of implementation only or effectiveness only. Even though subsequent corresponding effectiveness evaluations for the completed implementation-only evaluations may occur in a later monitoring period, it is

important to note cases where an implementation evaluation did not occur prior to an effectiveness-only evaluation. Paired implementation and effectiveness evaluations at the same site are important to determine whether BMPs are effective when implemented correctly.

- One Min A, two Min B, two Min C, and one Min D evaluations were incomplete in the database. Evaluations with incomplete data in the database cannot be rated.
- Incorrect answers were provided for header questions 11a, b, and c, which are designed to capture information about the reasons for monitoring and ask whether the projects or sites were selected randomly according to the protocol instructions and whether the protocol instructions for completing the evaluations were followed. In several Min B, Min C, and Min D evaluations, these questions were not answered according to the instructions. The most common mistake was misunderstanding the intended meaning of quality assurance monitoring.
- Inconsistent answers given for related questions in the implementation sections and effectiveness sections of the protocols can make it difficult to interpret the relationship between BMP implementation and BMP effectiveness. In all protocols, a pair of questions (Min B-Q39 and Min B-Q66; Min D-Q33 and Min D-Q64) ask about inspections at critical times (implementation) and a lack of inspections leading to observed problems (effectiveness). For each of the paired sets of questions, a number of evaluations provided an answer to the effectiveness question that was in direct conflict with the answer given for the implementation question.
- Incompatible answers to the questions on location of erosion and sedimentation evidence observed and the erosion and sediment features observed (Min B-Q46, Min B-Q51, Table 206; Min D-Q40, Min D-Q45, Table 235). For example, observed evidence of erosion and sedimentation "within an AMZ" was coupled with an observed erosion and sediment feature of "evidence of localized sediment deposition in the waterbody." However, if localized sediment deposition in a waterbody is observed, the answer to the location of the evidence question would be "in a waterbody," not "within an AMZ." Incompatible combinations of answers selected for these questions can result in an incorrect score for the erosion and sedimentation component of the effectiveness rating and may adversely affect the ultimate effectiveness rating assigned to the evaluation.

As additional data from other protocols are analyzed, and more monitoring using these protocols is completed in future monitoring periods, these issues can be tracked. Additional instruction and training can help reduce the likelihood of them recurring.

# METRIC EQUIVALENTS

| When you know | Multiply by | To convert to |
|---|---|---|
| acres | 0.4047 | hectares |
| feet | 0.305 | meters |
| miles | 1.609 | kilometers |

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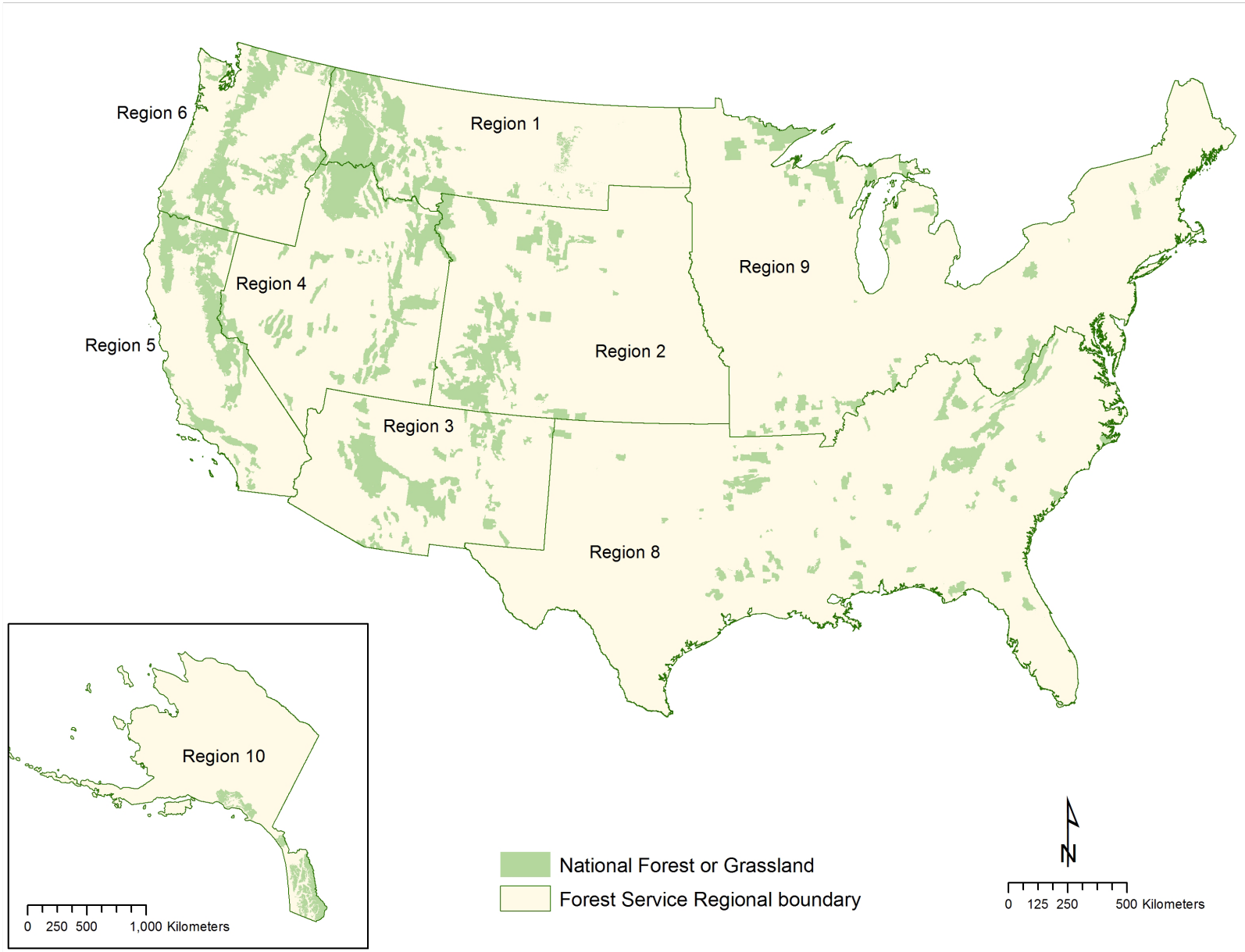
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# APPENDIX: Map of USDA Forest Service Regions



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