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Analysis of USDA Forest Service National BMP Monitoring Results for Fiscal Years 2015 Through 2018:

Wildland Fire Management,
Recreation Management, and
Water Uses 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 wildland fire, recreation, and water uses management protocols. Best management practices were monitored at 998 projects or sites during these two periods: 221 monitored projects involved wildland fire management, 615 involved recreation management, and 162 involved water uses management. Multiple monitoring protocols (forms and instructions) exist for most resource areas 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, while BMP effectiveness is assessed by how well water, aquatic, and riparian resources are protected during project or maintenance activities. This report presents summaries and statistical comparisons of the implementation and effectiveness data, implementation and effectiveness ratings, and composite ratings determined from the combination of those ratings for each protocol. It includes 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 management implications. Overall, 32 percent of the sites evaluated had full BMP implementation, BMPs were fully effective at protecting water resources at 46 percent of the sites, and 33 percent of the sites achieved the best composite rating. 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

Water bar constructed on a Tucker Fire dozer line to divert runoff and prevent erosion, with line of red fire retardant beyond the water bar on the Modoc National Forest, California (left), USDA Forest Service photo by Dave Updike; seeding and erosion matting applied to disturbed soils on the approaches of a snowmobile trail stream ford after the ford was replaced by a bridge on the Green Mountain National Forest, Vermont (middle), USDA Forest Service photo by Nancy Burt; diversion dam pooling stream water and pipe that conveys water from the pool for use at an off-channel site on the El Yunque National Forest, Puerto Rico (right), USDA Forest Service photo by Preston Keres.

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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.



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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 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 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 (App. 1) 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 the third 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 period was the first full monitoring period for National BMP monitoring. The examination presented herein includes sites and projects evaluated using protocols for wildland fire management, recreation management, and water uses management. The other two reports present the results for the aquatic ecosystems management, chemical use management, facilities and nonrecreation special uses management, and minerals management protocols (Edwards et al. 2025a) and rangeland management, road management, and mechanical vegetation 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 separate subsections within the section. For the reader's ease, text versions of protocol monitoring forms from the periods covered in this analysis 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 focusing first on the data from individual or associated questions and exploring relationships between implementation and effectiveness results. Next, implementation and effectiveness ratings (described in the following section) and their association with each other and with individual implementation and effectiveness answers are investigated. Each section concludes with a summary of important findings from the data analyses and considerations for improving BMP implementation and effectiveness in the types of projects, activities, or sites evaluated by the protocol.

¹National 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 2012). The National Core BMPs require development of site-specific prescriptions based on site conditions and local and regional requirements to achieve compliance with established state, tribal, and national water quality goals (FSM 2532.05).

²A 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 of whether site-specific BMP prescriptions were implemented as planned or designed. The effectiveness questions address whether site-specific BMP prescriptions, as implemented, were 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 forest and grassland units; consequently, an extensive number of analyses were completed for each protocol. Although some analyses may be much more useful than others to national forest and grassland resource specialists and managers, particularly as sample sizes increase, the 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 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 used less frequently 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; thus, the 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, temporal trends in implementation, effectiveness, and overall performance (from ratings) also will be examinable. 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 App. 1 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. Because available sample sizes are limited, 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, this 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 was used to define statistical significance because sample sizes are limited, 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, 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 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 because of 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 first component provides an interpretation of BMP planning and design, and the other two provide interpretation of the operational execution. Parallel to implementation questions, key effectiveness questions are assigned to one of several components to address whether BMPs were effective at protecting water quality. 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

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 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 project 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

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 review team completing the evaluation to make observations only at specific areas within the project or site—typically near waterbodies, often within aquatic management zones³ (AMZs) 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 component scores in that evaluation must be *effective*. If any component score 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 because 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

³Aquatic 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.

WILDLAND FIRE MANAGEMENT

Wildland fire management BMPs are used to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from wildland fire management activities whenever possible without compromising the safety of firefighters and the public. Common wildland fire management operations include using prescribed fire, managing wildfire using a wide range of strategies from monitoring to aggressive control and suppression, and rehabilitating fire suppression damage.

In this section, results are described separately by wildland fire protocol: use of prescribed fire (Fire A) and wildfire management actions (Fire B). In the FY15/16 and FY17/18 monitoring periods, completed Fire A and Fire B evaluations were dominated by randomly selected samples (Table 3). Statistical comparisons of the implementation ratings and effectiveness ratings resulting from randomly and nonrandomly selected samples showed no significant associations between the implementation ratings and sample selection (Fig. 1) in either monitoring period (Fire A: $p = 0.16$ FY15/16, $p = 0.25$ FY17/18; Fire B: $p = 0.35$ FY15/16, $p = 0.37$ FY17/18) or between the effectiveness ratings and selection type in FY15/16 for Fire A ($p = 1.00$) or in either monitoring period for Fire B ($p = 0.64$ FY15/16, $p = 1.00$ FY17/18). There was a significant association between effectiveness ratings and selection type in FY17/18 for Fire A ($p = 0.02$) (Fig. 1B). However, the number of nonrandomly selected Fire A

Table 3.—Number of randomly and nonrandomly selected Fire A (Use of Prescribed Fire) and Fire B (Wildfire Management Actions) evaluations, by monitoring period and region (Fire A-Q11b and Fire B-Q11b)

Monitoring period	Region	Fire A random selection	Fire A nonrandom selection	Fire B random selection	Fire B nonrandom selection
FY15/16					
	1	2		2	
	2	5	2	2	
	3	4	5	5	
	4	5	5		
	5	10	1	5	
	6	7	1	7	1
	8	16	4	1	
	9	6	3	3	1
	10				1
	Total	55	21	25	3
	Percent within protocol	72	28	89	11
FY17/18					
	1	1	3		3
	2	4	2	8	1
	3	6	2	1	2
	4	1	3	2	1
	5	14	2	7	
	6	6	1	4	1
	8	22	2	7	
	9	6	3	2	
	10				
	Total	60	18	31	8
	Percent within protocol	77	23	79	21

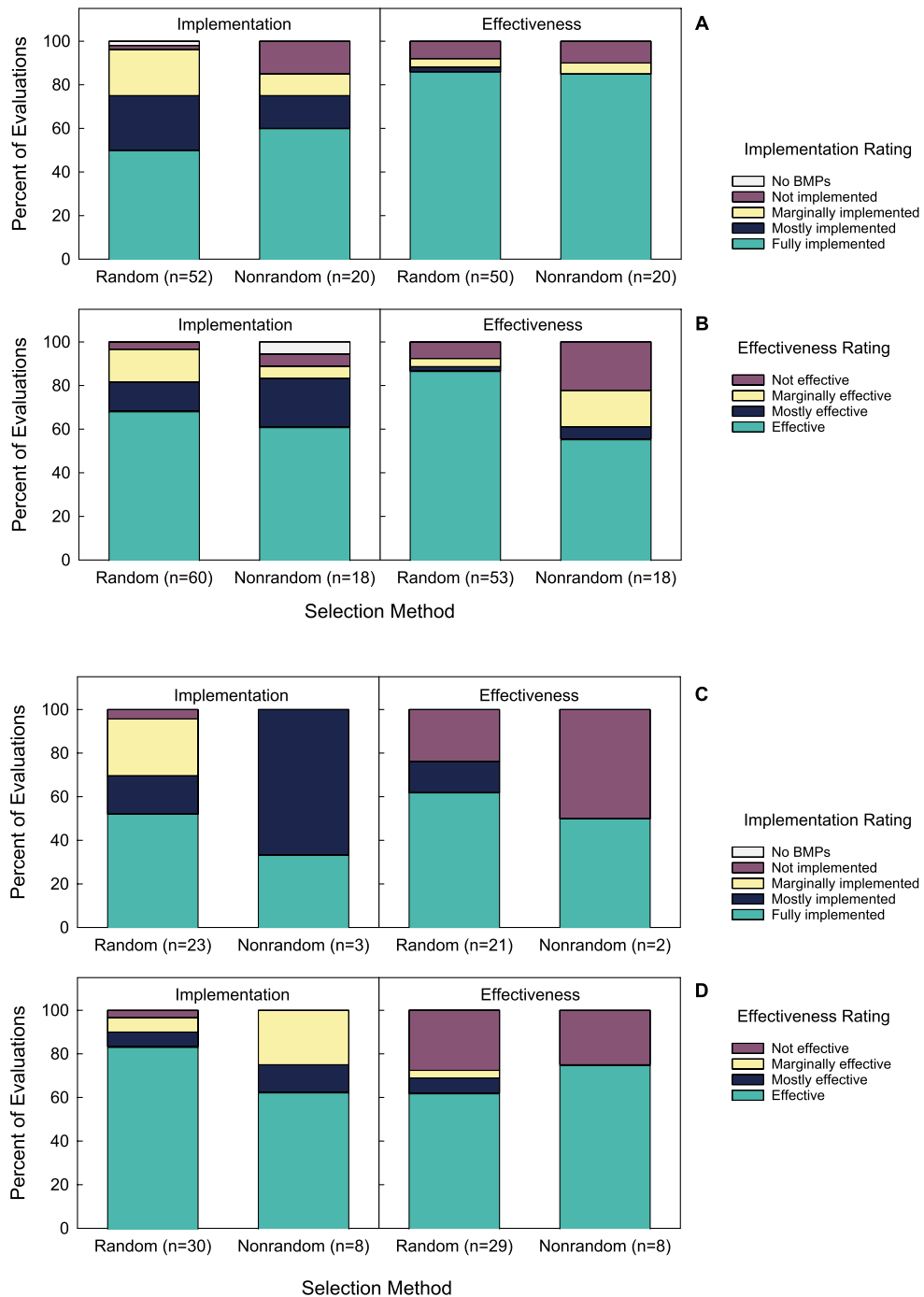


Figure 1.—Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Fire A evaluations completed in FY15/16 (A) and FY17/18 (B) and Fire B evaluations completed in FY15/16 (C) and FY17/18 (D).

samples with poorer effectiveness ratings in FY17/18 is small, and the distribution of ratings for all Fire A samples combined in FY17/18 is very similar to the distribution for all samples in FY15/16. Therefore, all Fire A samples were kept in the dataset, and all samples within each protocol are combined for analysis.

Results for both Fire 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 or sites.
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 back to implementation and sometimes header information to provide context between outcomes and BMP planning and prescription (including operation and maintenance prescriptions) 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 protocol 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 both involve examination of the overall ratings, they are split into individual sections for convenience of the reader. Readers 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. 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.

Wildland Fire A—Use of Prescribed Fire

Wildland Fire A: Header Statistics

Across both monitoring periods, 154 prescribed fire projects (Fire A) were evaluated (Table 4). Every region completed at least two Fire A evaluations in each monitoring period except Region 10 (Alaska; see App. 1 for region delineations). Regions 5 and 8 completed almost half of all evaluations (Table 4). At the end of each monitoring period, about 90 percent of the evaluations had both implementation and effectiveness monitoring completed (Table 4). Implementation and effectiveness monitoring were performed on a single day for all but one evaluation in FY15/16 and four in FY17/18. Only the implementation portion of the evaluation was completed for 12 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

Table 4.—Number of Fire A evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Fire A-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	2			2
	2	7			7
	3	9	1	1	7
	4	10			10
	5	11	2		9
	6	8	1	2	5
	8	20	2		18
	9	9			9
	10				
	All	76	6	3	67
	Percent		8	4	88
FY17/18					
	1	4			4
	2	6	1		5
	3	8			8
	4	4			4
	5	16	3		13
	6	7	1		6
	8	24	1		23
	9	9			9
	10				
	All	78	6	0	72
	Percent		8		92

to be completed prior to effectiveness monitoring, even if both are done on the same day. Therefore, it is possible that at least some of the implementation-only evaluations in FY17/18 that were completed near the end of the monitoring period (i.e., close to September 30, 2018) will have effectiveness evaluations included in the next monitoring period (FY19/20). However, nine of the implementation-only evaluations were done in FY17 or earlier, so it is unlikely that they will be evaluated for effectiveness. Seventy-five percent of evaluated prescribed fire projects were selected randomly (Table 3).

The most common reason for using the Fire A protocol was to meet National BMP targets (selected for all but one evaluation in FY17/18), but the protocol simultaneously met other monitoring needs, most frequently project review (Table 5). Quality assurance was identified as a reason for monitoring in 25 Fire A evaluations (Table 5). For the National BMP program, 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 monitoring effort on that same site . . . [by] different team members than

Table 5.—Number of Fire A evaluations completed in FY15/16 (n=76 evaluations) and FY17/18 (n=78 evaluations), by region and reason for monitoring (Fire A-Q11a). Multiple selections were possible.

Monitoring period	Region	National BMP targets	Land management plan monitoring	Project review	Quality assurance	Other
FY15/16						
	1	2	1	1	1	
	2	7	1	2	1	
	3	9	2	3	2	
	4	10	2	4	3	
	5	11	1		2	
	6	8		5	3	
	8	20	9	4	1	
	9	9	1	2		
	10					
	All	76	17	21	13	0
FY17/18						
	1	4		2	1	
	2	5	1	3	2	
	3	8	1	6	1	
	4	4		1		
	5	16		2	4	1 ^a
	6	7		1		
	8	24	13	4	3	
	9	9	1	1	1	
	10					
	All	77	16	20	12	1

^a Regional target.

the initial 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 monitoring had a duplicate evaluation, 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.

About 70 percent of projects had multiple objectives (Fire A-Q20). In both monitoring periods, the average number of objectives per project was two; in each period, three evaluations had four or five objectives. Fuel reduction and wildlife/habitat improvements were the project objectives identified most frequently (Fig. 2). “Other” objectives included watershed restoration or improvement, range improvement, species-specific regeneration, reintroduction of fire to an ecosystem, and improvements at the wildland-urban interface.

The mean acreage burned per prescribed fire was similar in each monitoring period—899 acres (standard error [se] = 131 acres) in FY15/16 and 847 acres (se = 158 acres) in FY17/18—although the largest prescribed fire in FY17/18 was 8,700 acres compared to 5,277 acres in FY15/16 (Fire A-Q19). Burn unit waterbody transects were most often adjacent to perennial streams or rivers and ephemeral streams in both monitoring periods combined (42 and 34 percent, respectively; Fire A-Q21), followed by intermittent streams (17 percent). The remaining burn units were adjacent to lakes or wetland/wet meadows.

Wildland Fire A: Implementation Results and Their Tie to Header Information

Project planning is assessed using two questions:

- What type of planning document specified BMPs for the project (Fire A-Q22)?
- Were all BMPs from that document included in the project burn plan (Fire A-Q23)?

The types of primary planning documents used are summarized in Table 6. Environmental assessments (EAs) outnumbered other types of planning documents used for prescribed fire projects. Two projects in each monitoring period were completed

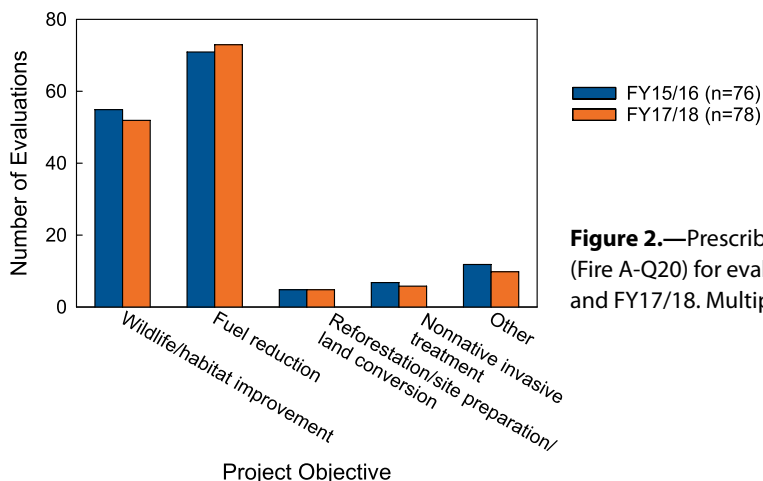


Figure 2.—Prescribed fire project objectives (Fire A-Q20) for evaluations completed in FY15/16 and FY17/18. Multiple objectives could be selected.

Table 6.—Number of Fire A projects evaluated in FY15/16 and FY17/18, by region and type of primary planning document used (Fire A-Q22)

Monitoring period	Region	No planning document	EIS ^a	EA ^b	CE ^c	Other
FY15/16						
	1			1	1	
	2		2	5		
	3		1	6	1	
	4			9	1	
	5			7	4	
	6			5	1	
	8	1		17	1	1
	9		1	3	5	
	10					
	All	1	4	53	14	1
	Percent	1	5	73	19	1
FY17/18						
	1			4		
	2		2	2	2	
	3	1		5	2	
	4		1	2	1	
	5		2	6	8	
	6		1	2	4	
	8			21	2	1
	9		1	6	2	
	10					
	All	1	7	48	21	1
	Percent	1	9	62	27	1

^a Environmental impact statement.

^b Environmental assessment.

^c Categorical exclusion.

without NEPA analysis, but half of those projects used BMPs derived from other sources. The type of primary planning document used was not statistically significantly associated with the type of waterbody adjacent to the burn unit ($p = 0.24$ FY15/16, $p = 0.39$ FY17/18); however, for the two projects without planning documents, the adjacent waterbody was an ephemeral stream. When the size of the prescribed fire was compared among types of planning documents from NEPA analyses (EAs, environmental impact statements [EISs], and categorical exclusions [CEs]), significant differences in project size were not found in FY15/16 ($p = 1.00$, generalized linear mixed model analysis [GLMM] with lognormal distribution and log link function). Mean project areas ranged from about 1,400 acres for those using EISs to 700 acres for those using CEs. A significant difference

in project area burned was found among planning document types in FY17/18 ($p < 0.01$, GLMM with lognormal distribution and identity link function). Projects using EAs were significantly larger than those using CEs and EISs, averaging almost 900 acres compared to 270 acres and 575 acres, respectively.

Table 7 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 and whether all the BMPs in each provision were carried into the project burn plan. A “yes” indicates that at least one BMP in the planning or guidance documents was applicable to the provision and that all BMPs assigned to that provision were included in the written project burn plan. 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 burn plan. “Not applicable” indicates that no BMPs in the planning or guidance documents were applicable to the provision, so there was no obligation to carry them into the burn 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 7 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 burn plan in an average of 78 and 82 percent of evaluations with BMP prescriptions in that provision in FY15/16 and FY17/18, respectively (Table 7). “Revegetation” in FY15/16 and “road closures” in FY17/18 were the provisions for which that value was below 70 percent. On average, specific BMPs were included in three provisions per project in each monitoring period, and GLMM analysis (negative binomial distribution and log link function) found no significant differences ($p = 0.89$ FY15/16, $p = 0.39$ FY17/18) between the number of BMP provisions from planning included in the burn plan and the source of BMPs (i.e., type of NEPA document and guidance documents in the absence of NEPA analysis; the projects with no BMPs [“no planning document” in Table 6] were excluded from this statistical analysis). When the percentage of BMP provisions included in the burn plan was compared by type of planning document, projects using an EIS had the lowest percentage of provisions included in each monitoring period—46 and 74 percent in FY15/16 and FY17/18, respectively—while projects using all other types of NEPA or BMP guidance documents averaged at least 80 percent inclusion. No significant differences were found in the percentage of BMP provisions included by type of planning document ($p = 0.19$ FY15/16, $p = 0.52$ 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 burn plan itself; such BMPs may be associated with standard plan language for the specific type of project or resource. Additional BMPs applicable to six provisions in FY15/16 and four provisions in FY17/18 were identified in the burn plans across all Fire A projects (Table 8). These BMPs were related most frequently to road closures.

Most of the BMPs applicable to the Fire A projects were implemented fully (Table 9). “Applicable” in this context means only the BMPs that were included in the project burn plan. Those that were identified during planning but were not included in the burn plan

Table 7.—Frequencies at which BMPs in provisions were included in the burn plan (Fire A-Q23) for Fire A evaluations completed in FY15/16 (n=72 evaluations) and FY17/18 (n=77 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)
Techniques to control ground cover combustion within AMZ ^d	50	6	15	89	11	60	7	9	90	10
Techniques to control ground cover combustion outside AMZ	57	4	10	93	7	69	3	4	96	4
AMZ prescription	45	11	15	80	20	54	9	13	86	14
Water control structures/features	28	12	30	70	30	38	6	30	86	14
Revegetation	24	14	33	63	37	30	8	36	79	21
Road closures	14	6	48	70	30	14	12	45	54	46
Mean	36	9	25	78	22	44	8	23	82	18

^a Listed provision had at least one BMP from decision document or guidance document included in burn plan.

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

^c Percent calculated from “yes” and “no” counts.

^d Aquatic management zone.

Table 8.—Frequencies at which BMPs to protect water, aquatic, and riparian resources were derived from project burn plan language and not from BMPs in NEPA documents or other BMP guidance documents for Fire A evaluations completed in FY15/16 (n=73 evaluations) and FY17/18 (n=78 evaluations)

Provision	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Techniques to control ground cover combustion within AMZ ^a	1	1	1	1
Techniques to control ground cover combustion outside AMZ	2	3	1	1
AMZ prescription	2	3	1	1
Water control structures/features	2	3		
Revegetation	3	4		
Road closures	5	7	3	4

^a Aquatic management zone.

are not considered applicable (thus values in Tables 7 and 9 differ). As with Table 7, the percentages in Table 9 were calculated only from the “yes” and “no” counts. Techniques to control ground cover combustion both within and outside the aquatic management zone¹ (AMZ) were implemented fully for the highest percentage of projects in each monitoring period. The average number of provisions that were implemented fully did not differ significantly among types of planning documents in either monitoring period ($p = 0.99$ FY15/16, $p = 0.36$ FY17/18; GLMM with negative binomial or Poisson distribution and log link function). For burn projects using planning documents from NEPA analyses, the mean number of provisions implemented fully was three except for those using an EIS in FY17/18, which averaged two. A significant difference was found in the percentage of BMP provisions implemented fully by type of planning document in FY15/16 ($p = 0.04$, Kruskal-Wallis test) but not in FY17/18 ($p = 0.28$). Projects in FY15/16 using EISs averaged 58 percent of BMP provisions implemented fully, while those using EAs and CEs had 91 and 75 percent of provisions implemented fully on average, respectively. Mean percent of provisions implemented fully ranged from 86 to 91 percent for the three NEPA-related document types in FY17/18. Two projects used other BMP guidance documents, and both had all BMP provisions implemented fully.

Burn plan prescriptions typically include watershed protection measures (i.e., for soil and water resources) that are used to determine whether conditions are appropriate to achieve the prescribed fire project objectives (Fire A-Q25). Current weather conditions required to be within a prescribed range are frequent protection measures, although moisture conditions and topography also may be used. The protection measures used in the evaluated Fire A projects are summarized in Figure 3. “Other” types of measures included probability of ignition and conditions related to ground cover or duff. On average, burn plan prescriptions included six and five protection measures in FY15/16

¹Aquatic 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.

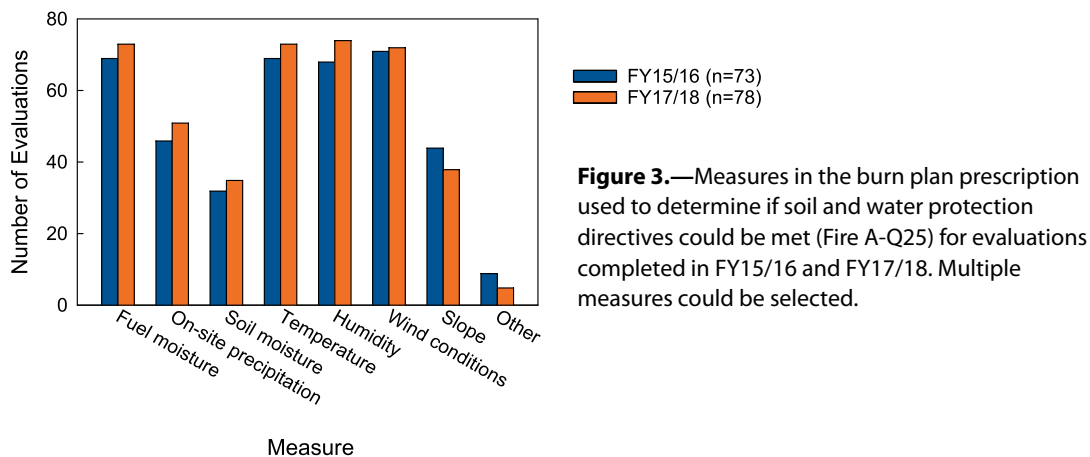
Table 9.—Frequencies at which all BMPs in provisions included in the project burn plan were implemented fully (Fire A-Q24) for Fire A evaluations completed in FY15/16 (n=73 evaluations) and FY17/18 (n=78 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are included.

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)
Techniques to control ground cover combustion within AMZ ^c	50	1	20	98	2	60	1	14	98	2
Techniques to control ground cover combustion outside AMZ	59	0	12	100	0	67	3	6	96	4
AMZ prescription	43	4	22	91	9	51	4	21	93	7
Water control structures/features	22	8	39	73	27	30	5	38	86	14
Revegetation	22	5	40	81	19	24	2	46	92	8
Road closures	17	2	48	89	11	14	3	54	82	18
Mean	36	3	30	89	11	41	3	30	91	9

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

^b Percent calculated from “yes” and “no” counts.

^c Aquatic management zone.



and FY17/18, respectively, although two projects in each monitoring period included one protection measure. Three evaluated prescribed fires—two in FY15/16 and one in FY17/18—did not stay within the ranges of prescribed protection measures (Fire A-Q26). For two of those three burns, ignition was continued with conditions outside the burn plan prescription (Fire A-Q27); however, those two projects included five or six measures in the prescription, and it is unknown which of the measures or how many did not meet prescribed conditions. Soil and water protection were considered in the decision to continue one burn but not the other (Fire A-Q28).

Because prescribed fire projects may involve use of heavy equipment that may have occasional malfunctions or breakages such as hydraulic line breaks or oil leaks, an implementation question (Fire A-Q29) asks 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 would follow that state agency's procedures. One evaluation in FY15/16 indicated that the administrative unit did not have a CERP, and two evaluations (one in each monitoring period) reported a spill or leak that was not addressed following the CERP procedures.

Wildland Fire A: Effectiveness Results and Their Tie to Implementation Results and Header Information

BMP effectiveness is assessed in Fire A projects in four areas: along a waterbody, in the waterbody AMZ, within the burn unit, and on a fire line. Observations from the waterbody, AMZ, and burn unit transects are reported together (Fire A-Q34, Fire A-Q35, Fire A-Q36, Fire A-Q37, and Fire A-Q38). Eighty percent of all evaluated projects had no evidence of erosion, sedimentation, or morphology changes in those three areas; 11 percent had observed evidence outside an AMZ (Table 10). The types of evidence observed (Fire A-Q37) are summarized in Table 11. Sheet erosion was reported for 18 of the 28 evaluations with observed evidence and at all locations; vegetation damage or bare ground was the second most often reported evidence. Two evaluations reported one or two types of evidence that were incompatible with the location where the evidence

Table 10.—Evidence of erosion or sedimentation in the burn unit (Fire A-Q34) for Fire A evaluations completed in FY15/16 (n=70 evaluations) and FY17/18 (n=72 evaluations), by location and distance to nearest waterbody (Fire A-Q36) or number of places evidence observed in a waterbody (Fire A-Q35)

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	58	83							
Outside an AMZ ^a	5	7	1		2	2			
Within an AMZ	5	7	1	2	1	1			
In a waterbody	2	3							2
FY17/18									
No evidence	55	76							
Outside an AMZ	10	14	2			8			
Within an AMZ	4	6	2	1	1				
In a waterbody	3	4					2	1	

^a Aquatic management zone.

was observed; for example, evidence of changes to substrate composition would not be expected when the evidence was observed outside an AMZ (Table 11). Bare soil resulting from the burn was a reported cause of the erosion evidence (Fire A-Q38) for 67, 78, and 80 percent of evaluations with evidence observed outside an AMZ, within an AMZ, or in a waterbody, respectively. One-third of evaluations with evidence outside or within an AMZ identified unstable soils due to slope gradient as a cause, as did 20 percent of evaluations with evidence observed in a waterbody.

In FY15/16, 65 projects had ground cover requirements for burned areas outside the AMZ, 58 projects had cover requirements in the AMZ, and 56 projects had both. For all of those projects, the cover requirements in each location were met. In FY17/18, project objectives included ground cover requirements outside the AMZ and in the AMZ for 69 and 62 projects, respectively, while 58 projects had both. Two projects in FY17/18 did not meet ground cover requirements outside the AMZ, and one project did not meet requirements in the AMZ.

Thirty-six evaluations observed evidence of erosion or sedimentation on or originating from a fire line (Table 12)—seven more than observed evidence in other areas (Table 10)—with evidence observed most often outside an AMZ. Rill erosion was the type of evidence observed most frequently and occurred at all locations (Table 13). Again, two evaluations reported a type of evidence that was incompatible with the location where the evidence was observed. Lack of water control features was identified as a cause of observed erosion or sedimentation on or from fire lines for 16 projects (Table 14). Seven of the 13 “other” causes were described as lack of revegetation or unauthorized use (although unauthorized use is an answer choice in Fire A-Q45).

Table 11.—Types of evidence of erosion or sedimentation observed in the burn unit (Fire A-Q37) for Fire A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Fire A-Q34 (Table 10) is applicable to Fire A-Q37.

Type of evidence	FY15/16 Outside an AMZ ^a (n=5)	FY15/16 Within an AMZ (n=5)	FY15/16 In a waterbody (n=2)	FY17/18 Outside an AMZ (n=10)	FY17/18 Within an AMZ (n=4)	FY17/18 In a waterbody (n=3)
Traceable evidence to the waterbody, but not currently visible in the waterbody		1	1		1	1
Turbidity present						
Evidence of localized sediment deposition in the waterbody		1 ^b	1	1 ^b		3
Changes to substrate composition			1	1 ^b		
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)						
Bank instability		1				
Bank trampling or compaction	1					
Vegetation damage or bare ground	2	2	2	3	4	1
Sheet erosion	4	1	1	8	2	2
Rill erosion	2	2	1	2	1	1
Gully erosion		1	1			1
Headcutting						
Slumping/slips						
Mass wasting						
Sediment plumes or accumulations			2			1
Rutting		2				1
Water quality monitoring results		1				

^a Aquatic management zone.

^b The type of evidence reported is incompatible with the location in which it was observed.

Table 12.—Evidence of erosion or sedimentation on or originating from a fire line (Fire A-Q41) for Fire A evaluations completed in FY15/16 (n=70 evaluations) and FY17/18 (n=71 evaluations), by location and distance to nearest waterbody (Fire A-Q43) or number of places evidence observed in a waterbody (Fire A-Q42)

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	54	77							
Outside an AMZ ^a	5	7			3	2			
Within an AMZ	9	13	2	3	2	2			
In a waterbody	2	3					2		
FY17/18									
No evidence	51	72							
Outside an AMZ	14	20	1	1	1	11			
Within an AMZ	2	3	1	1					
In a waterbody	4	6					3	1	

^a Aquatic management zone.

Table 13.—Types of evidence of erosion or sedimentation observed on or originating from a fire line (Fire A-Q44) for Fire A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Fire A-Q41 (Table 12) is applicable to Fire A-Q44.

Type of evidence	FY15/16 Outside an AMZ ^a (n=5)	FY15/16 Within an AMZ (n=9)	FY15/16 In a waterbody (n=2)	FY17/18 Outside an AMZ (n=14)	FY17/18 Within an AMZ (n=2)	FY17/18 In a waterbody (n=4)
Traceable evidence to the waterbody, but not currently visible in the waterbody		2		2	1	2
Turbidity present				1 ^b		
Evidence of localized sediment deposition in the waterbody		1 ^b	2			2
Changes to substrate composition						1
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)			1			
Bank instability		1	2			2
Bank trampling or compaction						
Vegetation damage or bare ground	3	1		5	1	2
Sheet erosion	3	4		6		1
Rill erosion	5	7		5	1	2
Gully erosion			1	2		1
Headcutting	1					
Slumping/slips						
Mass wasting						
Sediment plumes or accumulations	1		1	4		1
Rutting	1	1	1	2		
Water quality monitoring results		1				

^a Aquatic management zone.

^b The type of evidence reported is incompatible with the location in which it was observed.

Table 14.—Causes of evidence of erosion or sedimentation observed on or originating from a fire line (Fire A-Q45) for Fire A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Fire A-Q41 (Table 12) is applicable to Fire A-Q45.

Cause of evidence	FY15/16 Outside an AMZ ^a (n=5)	FY15/16 Within an AMZ (n=9)	FY15/16 In a waterbody (n=2)	FY17/18 Outside an AMZ (n=14)	FY17/18 Within an AMZ (n=2)	FY17/18 In a waterbody (n=4)
Poorly located fire lines		1	1			
No water control features installed	3	5	1	3	1	3
Improper spacing of water control features	1			5		
Improper construction of water control features	1	1	1	2		1
Improper construction of fire lines		1				
Improper or inadequate maintenance of water control features				1		
Poor erosion control not associated with water control features	2		2	1	1	1
Unauthorized use of fire lines		2	1			
Other	3	2	1	4	1	2

^a Aquatic management zone.

Weather conditions associated with the evaluation (Fire A-Q16) assist in determining if evidence of erosion, sedimentation, or substrate or morphology changes 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. About 25 percent of Fire A effectiveness evaluations in each monitoring period occurred during or just after wet weather conditions. Statistically significant associations were not found between weather conditions (i.e., wet versus dry conditions) and categories of erosion for the burn unit (Fire A-Q34) in either monitoring period ($p = 0.73$ FY15/16, $p = 0.16$ FY17/18) (Fig. 4). Significant associations also were not found between weather conditions and evidence of erosion for fire lines (Fire A-Q41) in either monitoring period ($p = 0.94$ FY15/16, $p = 0.26$ FY17/18) (Fig. 4). However, a higher percentage of evaluations that reported observed evidence occurred in wet conditions compared to those that reported no evidence of erosion.

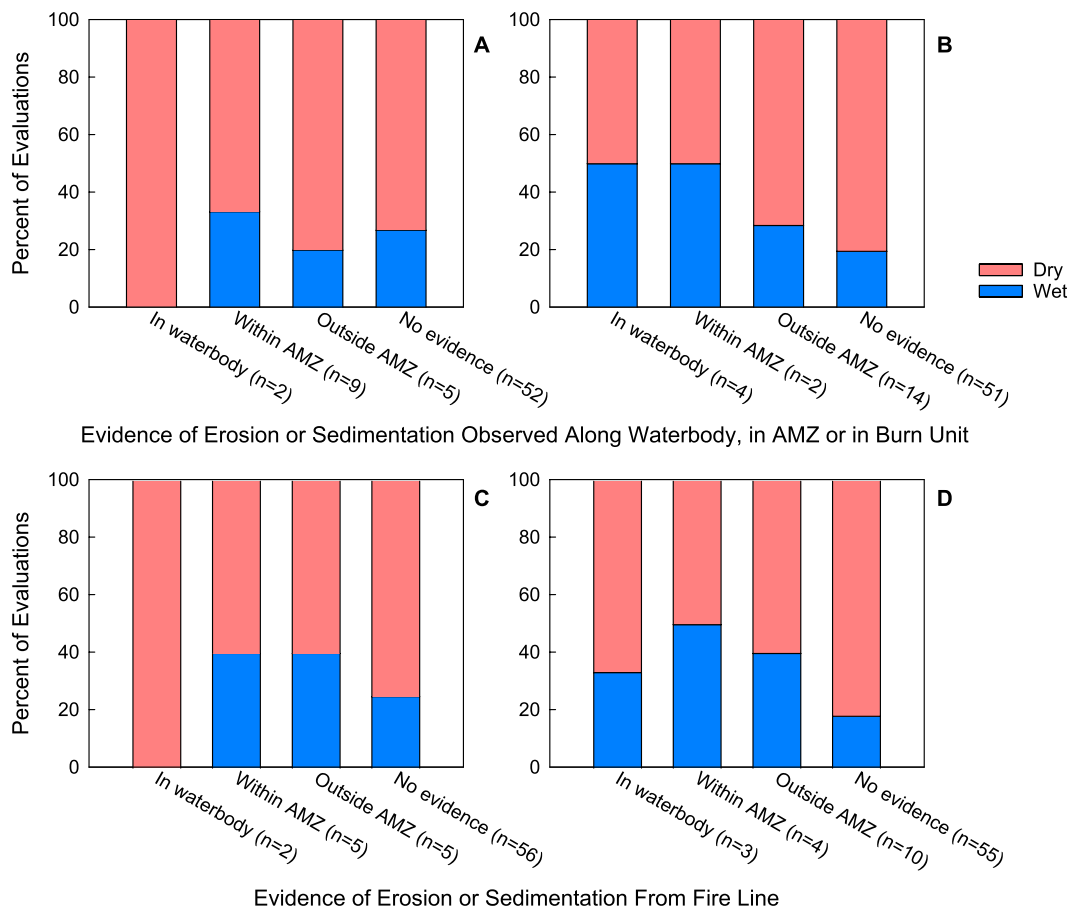


Figure 4.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion observed along waterbody, in AMZ, or in burn unit (Fire A-Q34; A, B) and from fire lines (Fire A-Q41; C, D) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). AMZ = aquatic management zone.

The presence of chemical or fuel spills, leaks, or chemical waste containers is determined during the effectiveness evaluations. Such evidence can include pollutants observed during operations but not reported, pollutants reported but not yet cleaned up, or pollutants not previously observed or known to exist. The results indicate that considerable care was taken to prevent chemical contamination during Fire A projects; no spills or leaks or waste containers were observed in the areas reviewed for pollutants (Fire A-Q46) in FY15/16. One evaluation in FY17/18 observed waste containers outside an AMZ.

Wildland Fire A: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

In FY15/16 and FY17/18, respectively, 52 and 67 percent of projects were rated as *fully implemented*. When the projects rated *mostly implemented* were added to those, the percentages rose to about 74 and 82 percent of the evaluated projects (Fig. 5). For BMP effectiveness, 87 and 81 percent of the projects rated as *effective* or *mostly effective* in FY15/16 and FY17/18, respectively (Fig. 5). One implementation evaluation and one effectiveness evaluation in different monitoring periods lacked responses in the database for questions needed to rate implementation or effectiveness (identified as “incomplete data” in Fig. 5).

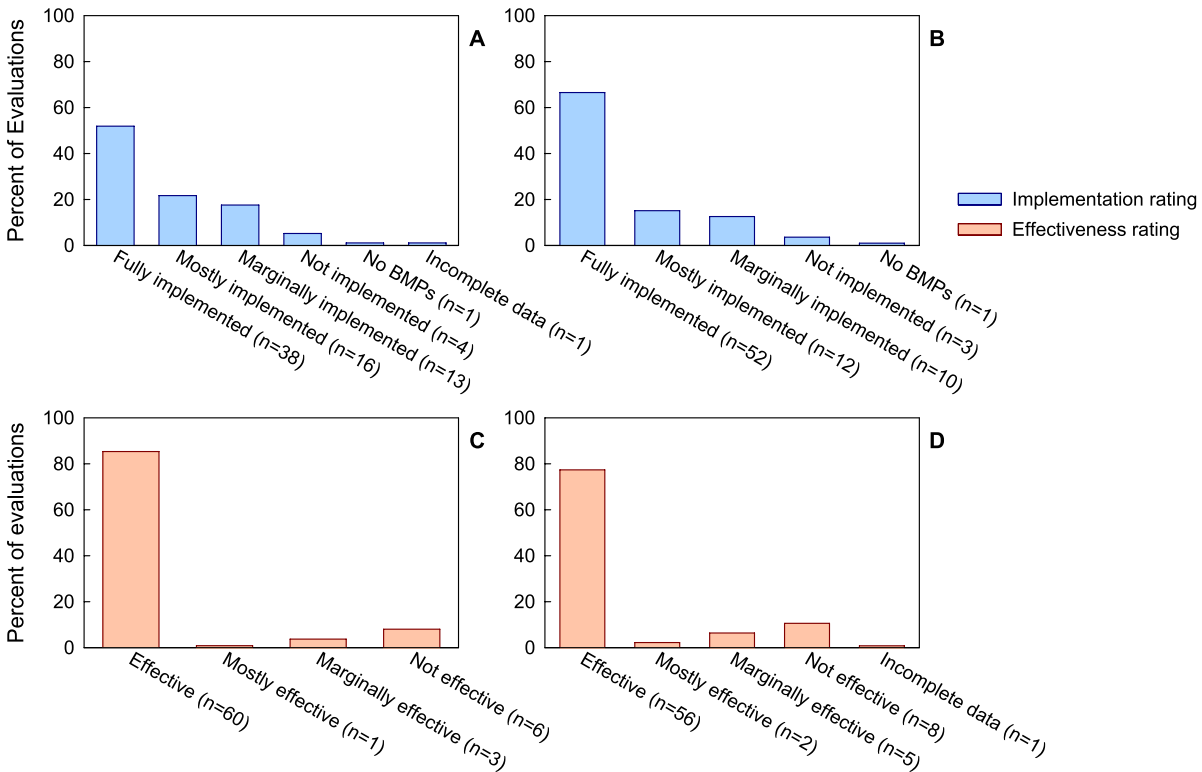


Figure 5.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Fire A evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

Mean area burned by implementation rating ranged from about 630 acres to 1,320 acres in FY15/16 and from 280 acres to 8,700 acres in FY17/18. Significant differences in the size of the area burned were not found among implementation ratings in FY15/16 ($p = 0.37$, GLMM with lognormal distribution and identity link function), but significant differences were found in FY17/18 ($p = 0.05$). However, this significant result is likely attributable to one project with a *no BMPs* implementation rating that was 8,700 acres in size—almost 3,000 acres larger than the next largest prescribed fire in that monitoring period. When that project was excluded from the test, no significant differences in size of the burned area were found among implementation ratings ($p = 0.16$) in FY17/18. Mean area burned for projects rated *mostly effective* and *marginally effective* in each monitoring period were two to three times larger than for projects with other ratings (1,700 to 2,500 acres compared to 700 to 1,300 acres). However, size of the area burned was not significantly different among effectiveness ratings in either monitoring period ($p = 0.61$ FY15/16, $p = 0.24$ FY17/18; GLMM with lognormal distribution and identity link function).

The type of planning document used for preparing Fire A projects was not statistically associated with the implementation ratings ($p = 0.26$) but was associated with the effectiveness ratings ($p = 0.02$) in FY15/16 (Fig. 6). In FY17/18, no significant associations were found for the implementation ratings ($p = 0.84$) or the effectiveness ratings ($p = 0.43$) (Fig. 6). The analysis for implementation excluded projects for which no

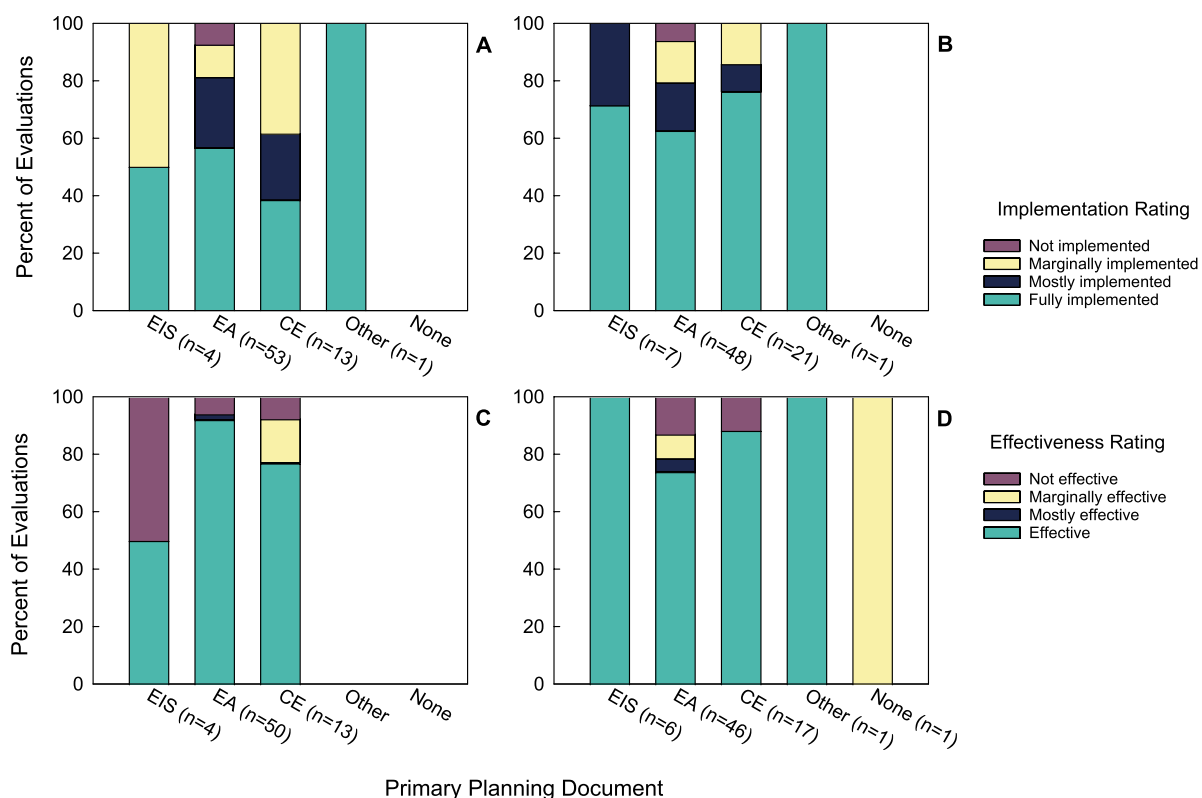


Figure 6.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (Fire A-Q22) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

planning document was employed (i.e., “no planning document” response for Fire A-Q22) because that response results in an implementation rating of *no BMPs*. The results for the effectiveness ratings in FY15/16 suggest that effectiveness was slightly worse for projects planned through an EIS compared to those planned using an EA or a CE. However, the sample size for projects using an EIS is much smaller, so these statistical test results may reflect the greater variation stemming from the sample size differences (Fig. 6).

The number of BMP provisions included in a burn plan (Fire A-Q23) differed little by effectiveness rating in each monitoring period. Mean numbers of BMP provisions in the burn plan in FY15/16 ranged from three for projects rated *effective* to five for those rated *mostly effective*. In FY17/18, projects rated as *marginally effective* averaged five provisions; projects with other ratings averaged three provisions. There were no significant differences in numbers of provisions included among effectiveness ratings in either monitoring period ($p = 0.35$ FY15/16, $p = 0.24$ FY17/18; GLMM with negative binomial distribution and log link function). The number of BMP provisions implemented fully (Fire A-Q24) by effectiveness rating ranged from two to four in each monitoring period, and no significant differences were found in numbers of provisions implemented fully among effectiveness ratings in either monitoring period ($p = 0.60$ FY15/16, $p = 0.14$ FY17/18; GLMM with negative binomial distribution and log link function).

An examination of percentages rather than numbers shows that in FY15/16 the percentages of BMP provisions included in a burn plan varied more by effectiveness rating than did those in FY17/18—67 to 100 percent compared to 62 to 87 percent, respectively. Projects rated *not effective* in FY15/16 and *mostly effective* in FY17/18 had the lowest percentage of BMP provisions from planning included in the burn plan. Percentages of BMP provisions included were not significantly different by effectiveness rating in either monitoring period ($p = 0.51$ FY15/16, $p = 0.75$ FY17/18; Kruskal-Wallis test). The percentage of BMP provisions implemented fully was highest, at 89 percent, for projects rated *effective* in FY15/16 and 100 percent for projects rated *mostly effective* in FY17/18. Projects rated *marginally effective* in FY15/16 and *not effective* in FY17/18 averaged the lowest percentages of provisions implemented fully—58 and 60 percent, respectively. Across effectiveness ratings, there were significant differences in percentage of BMPs implemented fully in each monitoring period ($p = 0.03$ FY15/16, $p = 0.04$ FY17/18; Kruskal-Wallis test).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Fire A-Q16) were not significantly associated with the effectiveness ratings in either monitoring period ($p = 0.50$ FY15/16, $p = 0.27$ FY17/18) (Fig. 7). About three times as many BMP reviews were completed during dry conditions, and the slightly higher percentage of better ratings during dry weather (as in FY17/18) is what might be expected if weather conditions affect the observation of erosion or sedimentation. However, relationships between weather conditions and field observations of erosion, sedimentation, or morphological effects (e.g., Fig. 4) 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.

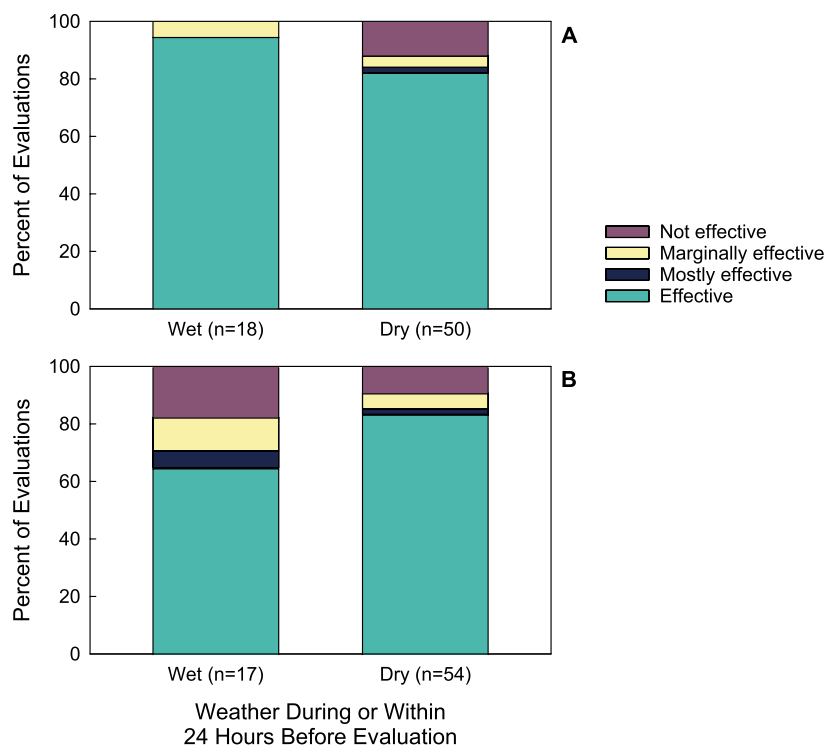


Figure 7.—Distribution of effectiveness ratings by weather conditions (Fire A-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

Two questions that ask whether corrective actions 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; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not having all the BMPs identified during planning included in project burn plans, 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.

In each monitoring period, the number of projects identified as needing actions for implementation and effectiveness was about one-fifth to one-third of projects needing no actions; this held for both corrective actions and adaptive management actions (Figs. 8 and 9). There were significant associations between implementation ratings and corrective action needs ($p < 0.001$ FY15/16, $p < 0.001$ FY17/18); projects for which corrective actions were needed were associated with poorer implementation ratings. The associations between implementation ratings and adaptive management needs also were statistically significant in each monitoring period ($p = 0.01$ FY15/16, $p = 0.04$ FY17/18) (Fig. 8). Effectiveness ratings were significantly associated with whether corrective actions ($p < 0.001$) and adaptive management actions ($p = 0.08$) were needed in FY15/16. The same was true for effectiveness ratings and adaptive management action needs in FY17/18 ($p = 0.02$) (Fig. 9), but there was not a significant association between ratings and corrective action needs ($p = 0.25$). In all cases, 80 percent or more of projects were rated *effective* when no corrective or adaptive management actions were needed; about 50 to 70 percent of projects were rated *effective* when actions were needed.

Some evaluations were 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. The poorer ratings may have resulted from chance occurrence (e.g., an extreme event outside of what could be controlled

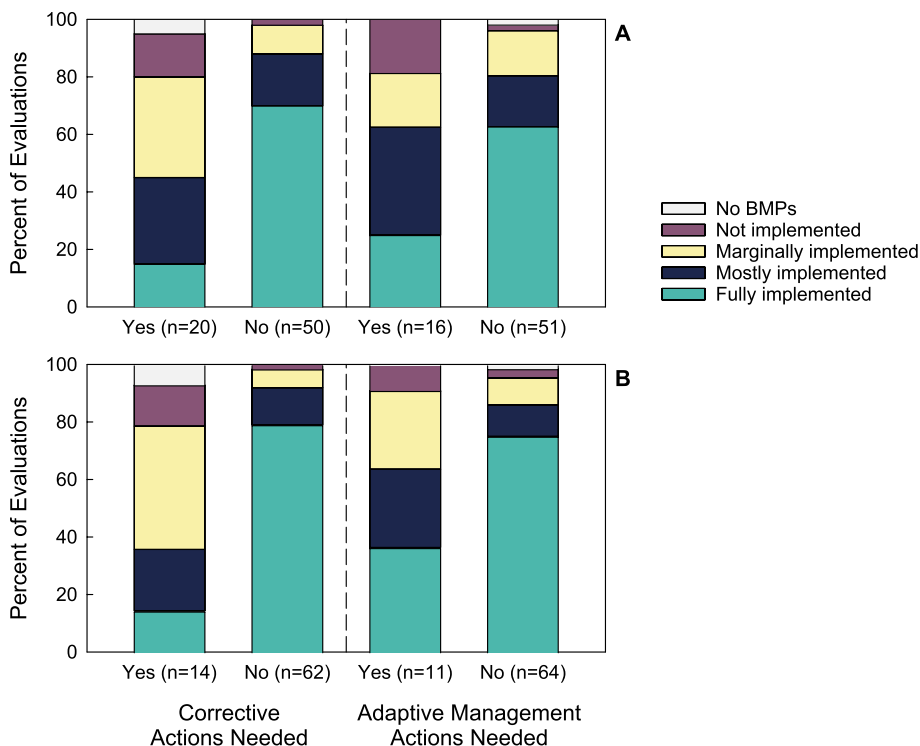


Figure 8.—Distribution of implementation ratings by whether corrective actions (Fire A-Q30) or adaptive management actions (Fire A-Q32) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

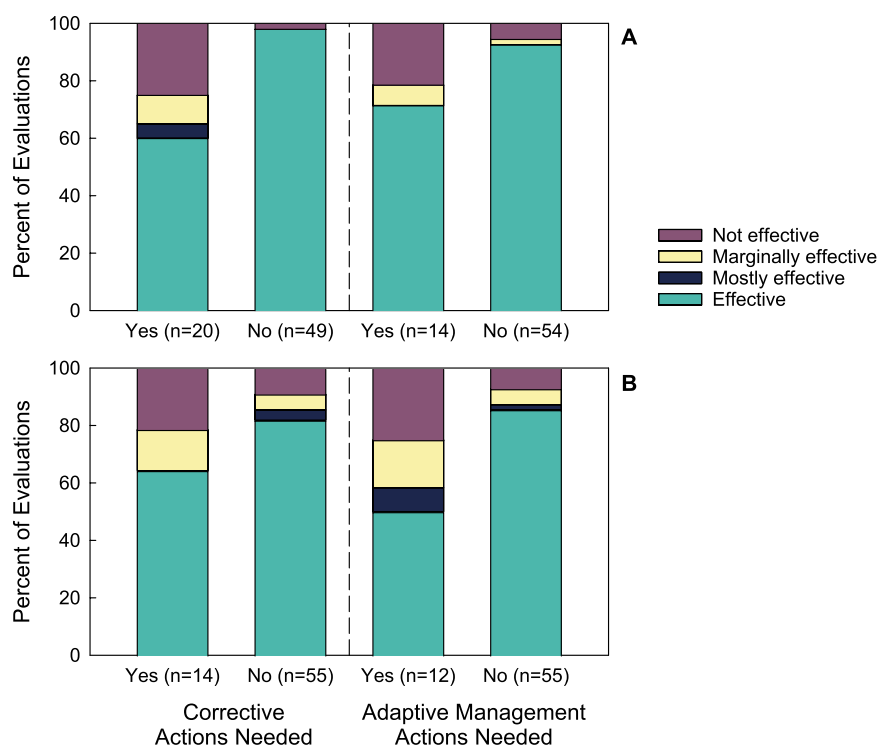


Figure 9.—Distribution of effectiveness ratings by whether corrective actions (Fire A-Q47) or adaptive management actions (Fire A-Q49) were needed to improve project effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

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 that project or 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 otherwise been identified during consideration of Fire A-Q30, Fire A-Q32, Fire A-Q47, and Fire A-Q49.

Composite Ratings

Composite rating results for Fire A projects with complete data (67 in FY15/16 and 71 in FY17/18) that were evaluated for both implementation and effectiveness are given in Table 15. Of the projects evaluated in FY15/16, 70 percent had a composite rating of *excellent*, 16 percent were rated as *good*, and 12 percent were rated as *poor*. In FY17/18, 68 percent of projects had a composite rating of *excellent*, 14 percent of the projects were rated *good*, and 14 percent were rated *poor*. One project had no BMPs prescribed, resulting in a *no plan* composite rating. One project in FY15/16 and two projects in FY17/18 had a composite rating of *fair*.

When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, significant associations were observed in each monitoring period ($p = 0.01$ FY15/16, $p = 0.09$ FY17/18). Better project implementation

Table 15.—Composite rating matrix for Fire A projects evaluated for both implementation and effectiveness in FY15/16 (n=67 evaluations) and FY17/18 (n=71 evaluations). Numbers in cells indicate the number of evaluations 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	34	13	7	4	
	Mostly effective			1		
	Marginally effective			2		
	Not effective	1	2	3		

FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective	39	9	6	2	
	Mostly effective	1	1			
	Marginally effective	2		2		1
	Not effective	4	1	2	1	

Excellent
 Good
 Fair
 Poor
 No plan

generally resulted in better BMP effectiveness. More than half of the projects were rated *fully implemented* and had corresponding BMP effectiveness ratings of either *effective* or *mostly effective* (Table 15). However, *effective* and *not effective* ratings occurred across all levels of project implementation.

Wildland Fire A: Examination of Component and Subcomponent Scores

Overall implementation and effectiveness ratings are determined from component and subcomponent scores. The implementation rating components and their interpretations for the Fire A protocol are given in Table 16, and the effectiveness components for Fire A are described in Table 17. None of the Fire A components have subcomponents.

Table 18 shows how the scores were distributed across the three implementation components. In FY17/18, the distributions of scores within each component were fairly similar to those for FY15/16. One project in FY15/16 had incomplete data for two components. Of the projects for which implementation evaluations were completed in FY15/16 and FY17/18, respectively, 53 and 67 percent were rated as *fully implemented*, which is possible only if all three components scored as *all* (Table 19). Administrative units appear to be more successful at the project oversight component than the planning

Table 16.—Implementation components, scores, and interpretation of each score used for determining the overall implementation ratings for the Fire A protocol

Implementation component	Component score	Score interpretation
Planning	All	All BMPs developed during planning were included in the project burn plan
	Some	Some BMPs developed during planning were included in the project burn plan, but at least one was not
	None	BMPs were developed during planning, but they were not carried into the project burn 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 burn plan were implemented fully
	Some	Some of the BMPs included in the project burn plan were implemented fully, but at least one was not
	None	None of the BMPs included in the project burn plan were implemented fully
Project oversight	All	All necessary corrective actions identified during project implementation were implemented
	Some	Some, but not all, of the necessary corrective actions identified during project implementation were implemented
	None	No necessary corrective actions identified during project implementation were implemented

Table 17.—Effectiveness components, scores, and interpretation of each score used for determining the overall effectiveness ratings for the Fire A protocol

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-burn unit	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-fire line	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

Table 18.—Distribution of implementation component scores by component for Fire 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=73)							
	All	46	63	58	79	71	97
	Some	24	33	13	18		
	None	2	3	1	1	1	1
	No BMPs	1	1				
	Incomplete data ^a			1	1	1	1
FY17/18 (n=78)							
	All	57	73	65	83	77	99
	Some	18	23	11	14	1	1
	None	2	3	2	3		
	No BMPs	1	1				

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

or on-the-ground execution components based upon the results in Tables 18 and 19; all projects with complete data except one in each monitoring period scored *all* for that component.

The planning component considers whether all the BMPs from planning were carried into the project burn plan. A “no” answer for any provision in Table 7 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 burn plan. For the 24 projects in FY15/16 with a planning component score of *some* (Table 18), an average of 46 percent of provisions from planning were not included in the burn plan (Table 7, excluding provisions identified as “not applicable”), with the percentage ranging from 17 to 75 percent. On average, BMPs from planning were included in three of the six possible provisions for those 24 projects. BMPs in the provisions “revegetation” and “water control structures/features” had the greatest frequencies of not being carried from planning into the project burn plan in FY15/16 (Table 7). In FY17/18, 18 projects had planning component scores of *some* due to provisions not being included in the burn plan (Table 18). For those projects, on average 46 percent of provisions from planning were not included. The percentages ranged from 17 to 83 percent. Projects included BMPs from three of the six possible provisions on average, with the provision “road closures” not included in the burn plan most frequently (67 percent of projects).

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 9). This score results from a “no” answer for at least one provision in Table 9 and a “yes” response for at least one other provision. For the 13 projects having a score of *some* for the on-the-ground

Table 19.—Implementation component scores corresponding to the overall implementation ratings for Fire A evaluations with complete data in FY15/16 and FY17/18. See Table 16 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=72)					
	Fully implemented	All	All	All	38
	Mostly implemented	Some	All	All	16
	Marginally implemented	All	Some	All	7
		Some	Some	All	6
	Not implemented	All	None	All	1
		Some	All	None	1
		None	All	All	2
	No BMPs	No BMPs	All	All	1
FY17/18 (n=78)					
	Fully implemented	All	All	All	52
	Mostly implemented	Some	All	All	11
		Some	All	Some	1
	Marginally implemented	All	Some	All	5
		Some	Some	All	5
	Not implemented	Some	None	All	1
		None	All	All	1
		None	None	All	1
	No BMPs	No BMPs	Some	All	1

execution component in FY15/16 (Table 18), the average burn plan had 4 provisions containing at least 1 BMP; in 36 percent of those provisions, at least 1 BMP was not implemented fully. The frequency of BMPs that were not implemented fully ranged from 17 to 67 percent per project. BMPs that were not implemented fully were assigned most commonly to “water control structures/features” and “revegetation” provisions (Table 9). For the 11 projects in FY17/18 with an on-the-ground execution component score of *some* due to BMP provisions not implemented fully, the mean number of provisions included in the burn plan was 5, and 38 percent of provisions per project were not implemented fully. The percentage of provisions not implemented fully ranged from 20 to 80, and BMPs in the provisions “water control structures/features” and “AMZ prescription” were most often not implemented fully.

For most evaluations, the project oversight component scored as *all* (Table 18). One project in FY15/16 that scored as *none* continued ignition when conditions were outside the burn plan prescription (Fire A-Q27), and soil and water protection were not considered in the decision to continue (Fire A-Q28). One project scored as *some* in FY17/18 when ignition was continued outside the burn prescription, but soil and water protection were considered in the decision to continue.

Planning component scores were not significantly associated with the type of primary planning document (Fire A-Q22) used for the 72 projects in FY15/16 and the 77 projects in FY17/18 that employed planning documents (NEPA or other BMP guidance documents) ($p = 0.86$ FY15/16, $p = 0.89$ FY17/18).

The distribution of scores across the three Fire A effectiveness components is summarized in Tables 20 and 21. Across all components, a high percentage of evaluations had scores of *effective* in both monitoring periods (Table 20). The two erosion and sedimentation components had similar numbers of *not effective* scores in each monitoring period. About 82 percent of all projects had overall effectiveness ratings of *effective*, which resulted from each evaluation achieving an *effective* score for all three effectiveness components (Table 21). The *not effective* ratings were due to the erosion and sedimentation component scores (Table 21); 11 projects had a *not effective* score for one erosion and sedimentation component or the other, while 3 projects had that score for both components.

Comparison of the effectiveness component scores to overall implementation ratings (Fig. 10) indicates a significant association between the erosion and sedimentation-burn unit component scores and the implementation ratings in FY15/16 ($p = 0.01$) but not in FY17/18 ($p = 0.79$). A significant association was found between erosion and sedimentation-fire line component scores and ratings in FY17/18 ($p = 0.04$) but not in FY15/16 ($p = 0.11$). In both cases, better project implementation tended to result in better BMP effectiveness. Chemical pollutants component scores and the implementation ratings

Table 20.—Distribution of effectiveness component scores by component for Fire A evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Erosion and sedimentation-burn unit component (number)	Erosion and sedimentation-burn unit component (percent)	Erosion and sedimentation-fire line component (number)	Erosion and sedimentation-fire line component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=70)							
	Effective	64	91	64	91	70	100
	Mostly effective ^a			1	1		
	Moderately effective ^b						
	Marginally effective ^a	2	3	1	1		
	Not effective	4	6	4	6		
FY17/18 (n=72)							
	Effective	65	90	61	85	72	100
	Mostly effective	2	3	1	1		
	Moderately effective						
	Marginally effective			5	7		
	Not effective	5	7	4	6		
	Incomplete data ^c			1	1		

^a Score applies only to erosion and sedimentation components (see Table 17).

^b Score applies only to chemical pollutants component (see Table 17).

^c Some of the questions needed to determine a component score were not answered.

Table 21.—Effectiveness component scores corresponding to the overall effectiveness ratings for Fire A evaluations completed in FY15/16 and FY17/18. See Table 17 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Erosion and sedimentation-burn unit component	Erosion and sedimentation-fire line component	Chemical pollutants component	Number of evaluations
FY15/16 (n=70)					
	Effective	Effective	Effective	Effective	60
	Mostly effective	Effective	Mostly effective	Effective	1
	Marginally effective	Effective	Marginally effective	Effective	1
		Marginally effective	Effective	Effective	2
	Not effective	Effective	Not effective	Effective	2
		Not effective	Effective	Effective	2
		Not effective	Not effective	Effective	2
FY17/18 (n=71)					
	Effective	Effective	Effective	Effective	56
	Mostly effective	Mostly effective	Effective	Effective	2
	Marginally effective	Effective	Marginally effective	Effective	5
	Not effective	Effective	Not effective	Effective	3
		Not effective	Effective	Effective	3
		Not effective	Mostly effective	Effective	1
		Not effective	Not effective	Effective	1

could not be tested in either monitoring period (Fig. 10). The statistical results for most comparisons were probably at least partially affected by the small number of evaluations with effectiveness component scores other than *effective* (Table 20).

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 11. Significant associations did not exist between the effectiveness ratings and the planning component scores in either monitoring period ($p = 0.41$ FY15/16, $p = 0.26$ FY17/18) or between the ratings and project oversight component scores ($p = 1.00$ for both periods). Significant associations were found between the effectiveness ratings and the on-the-ground execution component scores in each monitoring period ($p < 0.01$ FY15/16, $p = 0.04$ FY17/18); when BMPs were implemented fully, better effectiveness ratings were usually achieved.

Planned or implemented BMP provisions (“yes,” “no,” or “not applicable” answers from Table 7 or 9, respectively) that are potentially relevant to effectiveness component scores were examined for statistical associations (Table 22). Because the sample sizes by score within component are highly unequal, with 85 percent or more of component scores being *effective* (Table 20), projects scored as *effective* were compared to all other component scores combined (referred to hereafter as “less than *effective*”). More significant associations were found in FY15/16 between component scores and whether provisions were included in the project burn plan compared to whether BMPs in a provision were implemented fully. Four of the five provisions tested were significantly associated with

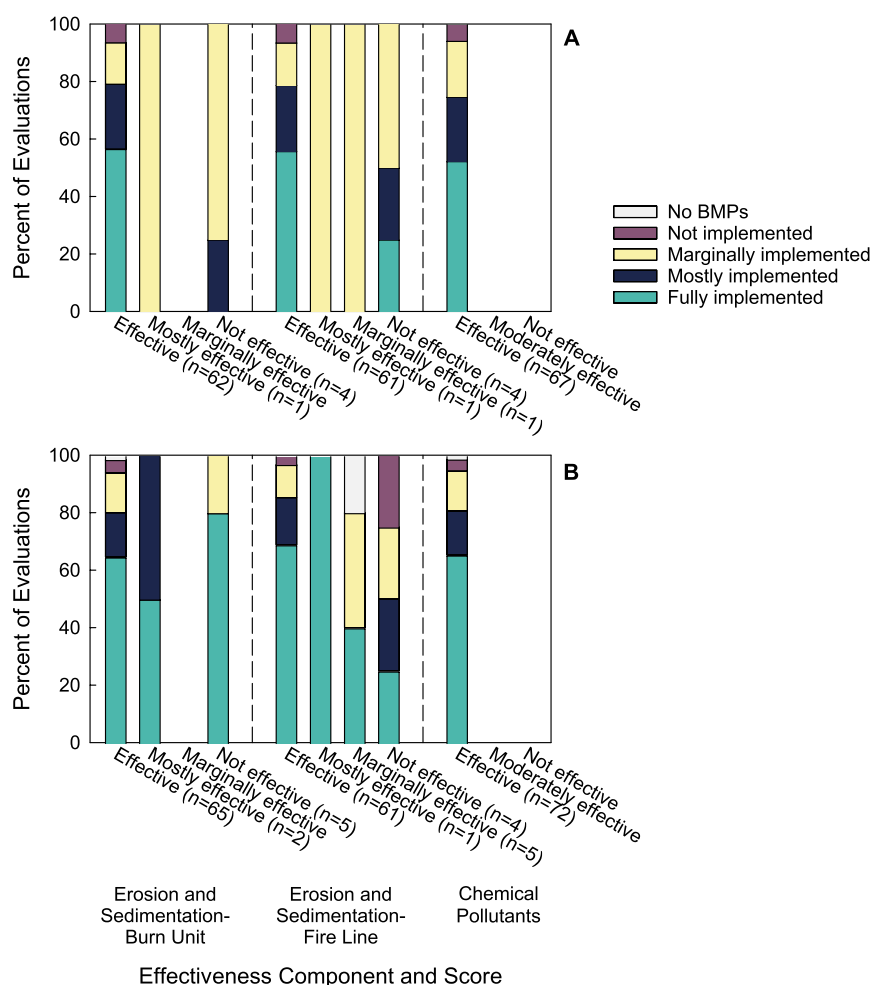


Figure 10.—Distribution of implementation ratings across effectiveness component scores for Fire A evaluations completed in FY15/16 (A) and FY17/18 (B).

planning (“in contract or plan” column in Table 22), while two provisions had significant associations between component scores and on-the-ground execution (“implemented fully” column in Table 22). One provision in FY17/18 had a significant association for execution of BMPs.

When BMPs related to ground cover combustion control, both within and outside the AMZ, were applicable and included in the burn plan, more than 90 percent of evaluations in FY15/16 had erosion and sedimentation-burn unit component scores of *effective*. Forty percent of projects had *less than effective* scores when provisions related to combustion control within the AMZ were applicable but not included in the burn plan, and 50 percent of projects had those component scores when provisions for combustion control outside the AMZ were not included. When BMPs in the ground cover combustion provisions were not applicable to the project, all component scores were *effective*. However, excluding evaluations without applicable BMPs did not change the test of association results.

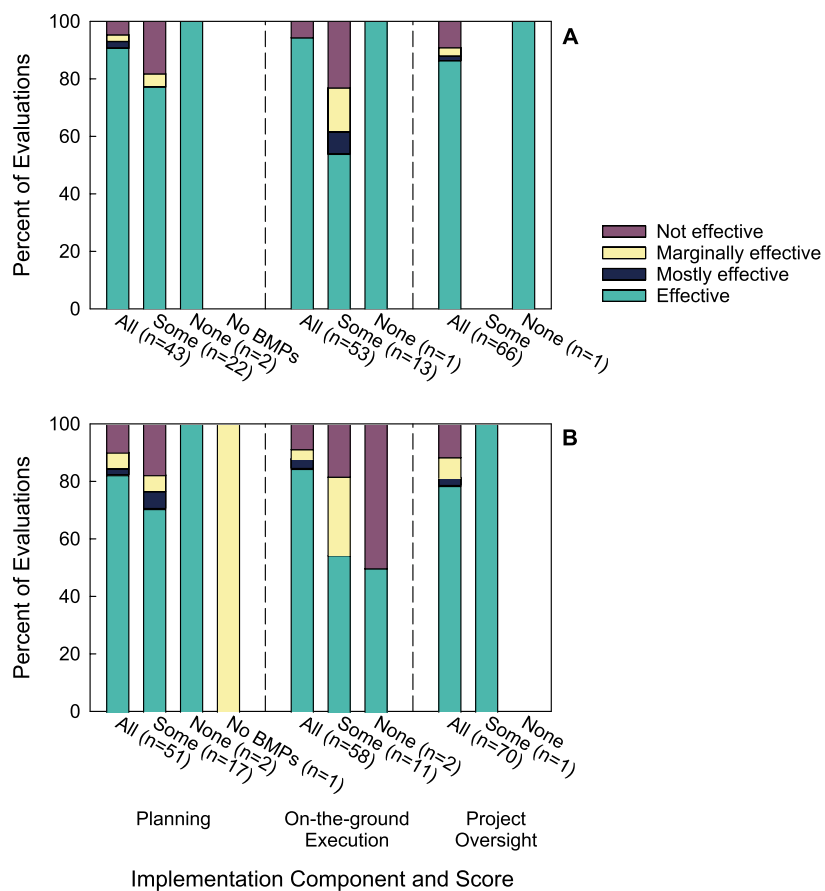


Figure 11.—Distribution of effectiveness ratings across implementation component scores for Fire A evaluations completed in FY15/16 (A) and FY17/18 (B).

Table 22.—Fisher’s exact test probabilities of association between BMP provisions relevant to effectiveness component scores for Fire A 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	FY17/18 In contract or plan p-value	FY17/18 Implemented fully p-value
Erosion and sedimentation-burn unit	Techniques to control ground cover combustion within AMZ ^d	0.06	1.00	0.81	0.12
	Techniques to control ground cover combustion outside AMZ	0.03	1.00	0.54	0.64
	AMZ prescription	0.18	0.03	1.00	0.37
Erosion and sedimentation-fire line	Water control structures/features	0.07	0.02	0.14	<0.01
	Revegetation	0.04	0.13	0.69	0.11

^a See Fire A-Q23.

^b Probability of association; significant at $\alpha=0.10$.

^c See Fire A-Q24.

^d Aquatic management zone.

For the two provisions statistically tested against the erosion and sedimentation-fire line component scores in FY15/16 (Table 22), between 82 and 86 percent of component scores were *effective* when applicable BMPs existed in planning documents whether either provision was included or not included in the burn plan. The significant associations were likely due to component scores of *effective* for every project when each provision had no BMPs applicable to the project and thus no BMPs included in the burn plan. Excluding those evaluations without applicable BMPs from the tests of association resulted in nonsignificant associations for both provisions ($p = 1.00$ for both).

Whether BMPs in the provision “AMZ prescription” were implemented fully in the field was significantly associated with erosion and sedimentation-burn unit component scores in FY15/16 (Table 22). When BMPs were implemented fully, 95 percent of projects scored as *effective* compared to 50 percent of projects having that score when BMPs were not implemented fully. Similar erosion and sedimentation-fire line component score distributions were seen in FY15/16 when BMPs in the provision “water control structures/features” were implemented fully or not; 90 percent of projects scored as *effective* with full implementation, while 62 percent of projects had that score when BMPs were not implemented fully. In FY17/18, the percentage of *effective* scores was 86 percent when BMPs in the “water control structures/features” provision were implemented fully and 20 percent when BMPs in the provision were not implemented fully.

Wildland Fire A: Management Implications for Forest Service Resource Managers

Seventy-nine percent of the prescribed fire projects rated either *fully implemented* or *mostly implemented* for BMP implementation. Five percent of the evaluations were rated *not implemented*. Project planning was a deficiency in about 32 percent of the projects, with 2 projects completed without BMPs prescribed in a planning document or other BMP guidance document. Individual BMP provisions in planning documents were carried into the project burn plan at an average of 80 percent of the time. About 18 percent of the projects had a deficiency in on-the-ground execution; some BMP provisions in the project burn plan were not implemented fully. Individual BMP provisions in the project burn plan were implemented fully at an average of 90 percent of the time. Project oversight was high; of the 154 prescribed fires evaluated, 3 did not stay within the ranges of prescribed protection measures.

For BMP effectiveness, 82 percent of the projects rated *effective* and 2 percent rated *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. There were 22 projects with *marginally effective* or *not effective* ratings. The erosion and sedimentation-burn unit and erosion and sedimentation-fire line components had nearly equal percentages of projects having a score other than *effective* (19 and 22 percent, respectively). When evidence of erosion or sedimentation was observed in the burn unit, it was primarily sheet erosion or vegetation damage or bare ground. The evidence was observed most frequently outside of the waterbody and more than 50 feet from the waterbody. The causes reported most frequently were bare soil from the burn and unstable soil due to slope gradient. When evidence of erosion or

sedimentation was observed from the fire line, it was primarily rill erosion observed more than 50 feet from the waterbody. The causes reported most frequently were lack of or poorly located or constructed water control features on the fire line.

When BMPs were implemented, they were shown to be effective. For sites that were evaluated for both implementation and effectiveness, 91 and 88 percent of the projects with a *fully implemented* or *mostly implemented* rating, respectively, were rated *effective* or *mostly effective*. However, 61 and 86 percent of projects with a *marginally implemented* or *not implemented* rating also were rated *effective* or *mostly effective*, respectively, indicating high effectiveness with poor implementation. Significant associations were found between the on-the-ground execution implementation component scores and effectiveness ratings in both monitoring periods, between implementation ratings and the erosion and sedimentation-burn unit component scores in FY15/16, and between implementation ratings and erosion and sedimentation-fire line component scores in FY17/18, indicating that better implementation ratings led to better effectiveness ratings.

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

- Checking that all BMP provisions in the planning documents are included in the project burn plan. Of the 24 projects with a planning component score of *some*, an average of 46 percent of provisions from planning documents were not included in the burn plan. Projects planned with an EIS had the lowest percentage of BMP provisions in the planning documents included in the project burn plan.
- Checking that all BMP provisions in the project burn plan are implemented fully. A significant association was found between the percentage of BMP provisions implemented fully and the effectiveness rating. The percentage of BMPs implemented fully was 89 percent for projects rated *effective* in FY15/16 and 100 percent for projects rated *mostly effective* in FY17/18. Projects rated *marginally effective* in FY15/16 and *not effective* in FY17/18 had the lowest percentage of BMP provisions implemented fully, at about 60 percent. Projects planned with an EIS had the lowest percentage of BMP provisions in the burn plan implemented fully.
- Where appropriate, including BMP prescriptions for water control features in the project planning documents and in the project burn plan. Rill erosion was the evidence of erosion and sedimentation observed most frequently on the fire lines caused by lack of water control features. Of the evaluated projects, 41 percent did not have BMPs for water control features in the planning documents, and 54 percent did not have those BMPs in the project burn plan.
- Ensuring that BMPs for water control features, when prescribed, are implemented fully. For the projects scored as *some* for the on-the-ground execution component, the BMP provision most frequently reported as not implemented fully was “water control structures/features.” When BMPs related to water control features were implemented fully, about 90 percent of those

projects scored as *effective* for the erosion and sedimentation-fire line component. When those BMPs were not implemented fully, 62 and 20 percent of projects in FY15/16 and FY17/18, respectively, scored as *effective* for the erosion and sedimentation-fire line component.

- Where appropriate, including BMP prescriptions for ground cover combustion control within and outside the AMZ. The evidence of erosion and sedimentation reported most frequently on the burn unit was sheet erosion or vegetation damage or bare ground caused by bare soil resulting from the burn. When those BMPs were included in the burn plan, about 90 percent of projects scored *effective* for the erosion and sedimentation-burn unit component. Nearly half of the projects had an erosion and sedimentation-burn unit component score other than *effective* when those BMPs were not in the burn plan.

Wildland Fire A: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Fire A. Use of Prescribed Fire

(Reference BMPs Fire-1 and Fire-2)

v3.0 February 2016

Header	
Fire A-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Fire A-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Fire A-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Fire A-Q4	Date of current field evaluation:
Fire 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:
Fire 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:
Fire A-Q7	Reviewers and titles:
Fire A-Q8a	Region number:
Fire A-Q8b	State:
Fire A-Q9a	Proclaimed Forest or Grassland number and name:
Fire A-Q9b	Administrative Forest or Grassland number and name:
Fire A-Q10	District number and name:
Fire A-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Fire 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Fire 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: a. Yes b. No 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:
Fire A-Q12	6 th level HUC number and name for the subwatershed containing the burned area being evaluated:
Fire A-Q13	Is the part of the burn unit being evaluated located within a municipal supply watershed? Select one: a. Yes b. No
Fire A-Q14a	Location. UTM Zone: UTM Datum:
Fire A-Q14b	Location. Easting:
Fire A-Q14c	Location. Northing:
Fire A-Q15a	Location. Latitude:
Fire A-Q15b	Location. Longitude:
Fire A-Q15c	Location. Lat/Long Datum:
Fire A-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Fire A-Q17	Name of burn unit:
Fire A-Q18	Date this unit was burned:
Fire A-Q19	Total area burned (ac or ha; specify unit):

continued on next page

Header (continued)	
Fire A-Q20	Objective for burning. Select all that apply: Wildlife/habitat improvement Fuel reduction Reforestation/site preparation/land conversion Treatment of nonnative invasives Other (specify):
Fire A-Q21	Type of waterbody that is adjacent to the burn unit waterbody transect. Select one: Ephemeral stream Intermittent stream Perennial stream/river Pond Lake Wetland/wet meadow Estuary Other (specify):
Implementation	
Fire A-Q22	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: - No planning document containing BMP guidance was used (go to question 24) - Environmental Impact Statement (EIS) (go to question 23) - Environmental Assessment (EA) (go to question 23) - Categorical Exclusion (CE) (go to question 23) - No project-level NEPA, but BMP guidance was provided in other documents (go to question 23)
Fire A-Q23	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 burn 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. - Techniques to control ground cover combustion within AMZ Yes/No/Not applicable - Techniques to control ground cover combustion outside AMZ Yes/No/Not applicable - AMZ prescription Yes/No/Not applicable - Water control structures/features Yes/No/Not applicable - Revegetation Yes/No/Not applicable - Road closures Yes/No/Not applicable - Other (specify): Yes/No/Not applicable

continued on next page

Implementation *(continued)*

Fire A-Q24	Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the burn plan were implemented fully. Select one response in each line. If the provision exists in the burn plan and it was implemented fully, select Yes. If the provision exists in the burn plan but it was not implemented fully, select No. If the provision does not exist in the burn plan, select Not applicable. a. Techniques to control ground cover combustion within AMZ Yes/No/Not applicable b. Techniques to control ground cover combustion outside AMZ Yes/No/Not applicable c. AMZ prescription Yes/No/Not applicable d. Water control structures/features Yes/No/Not applicable e. Revegetation Yes/No/Not applicable f. Road closures Yes/No/Not applicable g. Other provisions specified in question 23g Yes/No/Not applicable h. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Fire A-Q25	How did the burn plan prescription consider if the soil and water protection directives could be met during burning or with burning? Select all that apply: a. Fuel moisture measurements b. On-site precipitation measurements c. Soil moisture measurements d. Temperature measurements e. Humidity measurements f. Wind conditions g. Slope h. Other (specify):
Fire A-Q26	Did the burn stay within the burn plan prescription? Select one: a. Yes (go to question 29) b. No (go to question 27)
Fire A-Q27	Was ignition continued when the burn was outside the burn plan prescription? Select one: a. Yes (go to question 28) b. No (go to question 29)
Fire A-Q28	Were soil and water protection considered in the decision to continue ignition? Select one: a. Yes b. No

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Implementation <i>(continued)</i>	
Fire A-Q29	Were chemical or fuel spills or leaks that occurred in this burn unit during the burn operation handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during the burn operation c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan
Fire A-Q30	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 31) b. No (go to question 32)
Fire A-Q31	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Fire A-Q32	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 33) b. No (go to question 34 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Fire A-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	
Fire A-Q34	Excluding the selected fire line, is there evidence of erosion or sedimentation from the burn? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 39) b. Evidence of erosion or sedimentation outside an AMZ (go to question 36) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 36) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 35)
Fire A-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: a. 1 or 2 b. 3 or 4 c. 5 or more
Fire A-Q36	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet

continued on next page

Effectiveness (continued)	
Fire A-Q37	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: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Surface water or groundwater quality monitoring results r. Other (specify):
Fire A-Q38	What are the causes? Select all that apply: a. Burn resulted in bare soil b. Fire-induced hydrophobic soils c. Unstable soils due to slope gradient within burn area d. Other (specify): e. Unknown
Fire A-Q39	Does ground cover meet project objectives for areas outside the AMZ? Select one: a. Yes b. No c. Not applicable, no project objectives for ground cover outside the AMZ
Fire A-Q40	Does ground cover meet project objectives in the AMZ? Select one: a. Yes b. No c. Not applicable, no project objectives for ground cover in the AMZ
Fire A-Q41	Is there evidence of erosion or sedimentation on or originating from the fire line? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 46) b. Evidence of erosion or sedimentation outside an AMZ (go to question 43) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 43) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 42)
Fire A-Q42	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 44: a. 1 or 2 b. 3 or 4 c. 5 or more

continued on next page

Effectiveness (continued)	
Fire A-Q43	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Fire A-Q44	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 41, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Fire A-Q45	What are the causes? Select all that apply: a. Poorly located fire lines b. No water control features installed c. Improper spacing of water control features d. Improper construction of water control features e. Improper construction of fire lines f. Improper or inadequate maintenance of water control features g. Poor erosion control not associated with water control features (e.g., poor revegetation) h. Unauthorized use of fire line i. Other (specify): j. Unknown
Fire A-Q46	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the burn unit? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Fire A-Q47	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 48) b. No (go to question 49)
Fire A-Q48	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.

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Effectiveness <i>(continued)</i>	
Fire A-Q49	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 50) b. No (go to General Comments)
Fire A-Q50	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	

Wildland Fire B—Wildfire Management Actions

Wildland Fire B: Header Statistics

Twenty-eight and 39 wildfire management actions (Fire B) were evaluated in FY15/16 and FY17/18, respectively. Three western regions (2, 5, and 6) each completed 11 or more wildfire evaluations, and Region 10 completed one (Table 23; see App. 1 for region delineations). Both implementation and effectiveness monitoring were completed for 90 percent of the evaluations (Table 23), and 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 six 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. Therefore, it is possible that the two projects in FY17/18 with implementation-only evaluations near the end of the monitoring period (September 30, 2018) had effectiveness evaluations completed in the next monitoring period (FY19/20). However, the other four implementation-only evaluations were performed in FY15, so it is unlikely that the sites were evaluated for effectiveness.

While the most common reason for using the Fire B protocol was to meet National BMP targets (selected for all evaluations), the protocol simultaneously met other monitoring needs—most frequently project review (Table 24). Quality assurance was identified as a reason for monitoring in 12 Fire B evaluations (Table 24). For the 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 monitoring effort on that same site . . . [by] different team members than the initial 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

Table 23.—Number of Fire B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Fire B-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	2			2
	2	2	1		1
	3	5			5
	4				
	5	5	1		4
	6	8	2		6
	8	1			1
	9	4			4
	10	1			1
	All	28	4		24
	Percent		14		86
FY17/18					
	1	3			3
	2	9	1		8
	3	3			3
	4	3		1	2
	5	7	1		6
	6	5			5
	8	7			7
	9	2			2
	10				
	All	39	2	1	36
	Percent		5	3	92

assurance had a duplicate evaluation, 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.

Fire B evaluations occurred across a wide range of wildfire sizes (i.e., total area burned by the fire). The average area burned for wildfires evaluated in FY15/16 was approximately 25,400 acres and ranged from about 1 acre to 258,000 acres (Fire B-Q19). Evaluated wildfires in FY17/18 averaged approximately 18,300 acres and ranged from 13 acres to 410,200 acres. Regions 5 and 6 had the largest wildfires overall in the dataset and the two largest mean wildfire sizes in each monitoring period. Only Region 9 had mean evaluated wildfire sizes per monitoring period smaller than 1,000 acres: 560 acres in FY15/16 and 74 acres in FY17/18.

Table 24.—Number of Fire B evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (Fire 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				
	3	5	2	2		
	4					
	5	5				
	6	8	1	1	2	
	8	1				
	9	4				
	10	1				
	All	28	3	3	2	0
FY17/18						
	1	3	1	1	2	
	2	9		3	1	
	3	3	1	3	1	
	4	3	1	2	2	
	5	7			1	
	6	5				
	8	7		5	3	
	9	2				
	10					
	All	39	3	14	10	0

Wildland Fire B: Implementation Results and Their Tie to Header Information

Wildfire management actions may include only fire monitoring, only fire suppression, or both at different locations of a wildfire. The implementation portion of a wildfire evaluation assesses the degree to which soil and water protection measures were included in both types of planned management actions, especially those related to fire suppression. Of the 66 wildfires evaluated for implementation, most had soil and water protection measures incorporated into management actions (Table 25). When soil and water protection measures were not included in the delegation of authority (Fire B-Q21), 7 of the 11 evaluations indicated that protection measures were included or considered in some other type of document or that the wildfire was too small to have a delegation of authority. Assignment of at least one soil and water resource advisor to a wildfire (Fire B-Q24) occurred less frequently (58 percent of wildfires). When a wildfire had a resource advisor, their input was included in 68 percent of the wildfire after-action reports (Fire B-Q25) (Table 25).

Table 25.—Implementation metrics used to assess the degree to which soil and water protection measures were included in fire monitoring and fire suppression management actions (Fire B-Q20–Fire B-Q25) for Fire B evaluations completed in FY15/16 (n=28 evaluations) and FY17/18 (n=38 evaluations)

Metric	FY15/16 (number)	FY15/16 (percent ^a)	FY17/18 (number)	FY17/18 (percent)
Potential impacts to watershed conditions and water quality considered				
Yes	22	79	37	97
No	6	21	1	3
Soil and water protection measures from planning included in delegation of authority to IMT ^b or IC ^c				
Yes	20	71	35	92
No	8	29	3	8
IC/IMT had access to information on soil and water protection needs for fire location				
Yes	24	86	38	100
No	4	14	0	
If yes, was soil and water protection information carried into IAP ^d				
Not applicable; IAP not required	3	12	7	18
Yes	15	63	29	76
No	6	25	2	5
Soil and water resource advisor assigned to fire				
Yes	14	50	24	65
No	14	50	13	35
If yes, was input from advisor included in AAR ^e				
Yes	8	57	18	75
No	6	43	6	25

^a Within each metric.

^b Incident management team.

^c Incident commander.

^d Incident action plan.

^e After-action report.

Three wildfires (two in FY15/16 and one in FY17/18) included only fire monitoring management actions. For the remaining wildfires with suppression actions, at least three-quarters in each monitoring period met each metric used to assess planning for soil and water protection (Table 26). Thirty-four wildfires included use of aerial retardants, and water resource protection policies for retardant use were followed for 85 percent of those wildfires. Suppression actions included water use for 44 wildfires, and water-source protection measures were included in 91 percent of incident action plans (IAP) for those fires. (Table 26). Forty-eight wildfires had a suppression rehabilitation plan that had been implemented on all but two wildfires (one in each monitoring period).

Table 26.—Additional implementation metrics used to assess the degree to which soil and water protection measures were included in fire suppression management actions (Fire B-Q26–Fire B-Q30) for Fire B evaluations completed in FY15/16 (n=26 evaluations) and FY17/18 (n=37 evaluations)

Metric	FY15/16 (number)	FY15/16 (percent ^a)	FY17/18 (number)	FY17/18 (percent)
Minimum impact suppression techniques used when appropriate				
Yes	23	88	36	97
No	3	12	1	3
Water resource protection policies followed when aerial retardants used				
Not applicable; no aerial retardant use	9	38	18	49
Yes	13	54	16	43
No	2	8	3	8
Water-source protection included in IAP ^b for water used in suppression				
Not applicable; IAP not required	4	17	6	16
Not applicable; no water use	1	4	6	16
Yes	18	75	22	59
No	1	4	3	8
Soil and water protection considered in tactical firefighting decisions				
Yes	20	83	33	89
No	4	17	4	11
Suppression rehabilitation plan implemented				
No applicable; no rehabilitation plan	5	21	8	22
Yes	18	75	28	76
No	1	4	1	3

^a Within each metric.

^b Incident action plan.

Because wildfire management may involve use of heavy equipment that may have occasional malfunctions or breakages such as hydraulic line breaks or oil leaks, an implementation question (Fire B-Q31) 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 would follow that state agency's procedures. One evaluation in FY15/16 indicated that spills or leaks were not handled according to the CERP (Table 27), and eight evaluations across both monitoring periods indicated that spills or leaks were addressed following the CERP procedures.

Table 27.—Distribution of whether chemical or fuel spills and leaks, if they occurred during the wildfire, were handled according to the unit's contingency and emergency response plan (or its equivalent) (Fire B-Q31) for Fire 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		0	
No spills or leaks	22	85	33	87
Yes; according to contingency and emergency response plan	3	11	5	13
No; not according to contingency and emergency response plan	1	4	0	
All	26		38	

Wildland Fire B: Effectiveness Results and Their Tie to Implementation Results and Header Information

Fire monitoring and fire suppression impacts on water resources are assessed separately during the effectiveness review, and the protocol instructions stipulate that one or the other is reviewed. Four evaluations in FY15/16 and 10 in FY17/18 indicated that management actions for fire monitoring were reviewed (Fire B-Q36). For one fire in FY15/16, the impact of the wildfire was rated as undesirable for both watershed condition and water quality (Fire B-Q37), and based on professional knowledge, the impacts would not have been reduced had suppression activities been used (Fire B-Q38). For the other three wildfires in FY15/16, impacts were rated as limited for watershed condition and water quality; the same was true for 9 of the 10 wildfires assessed for fire monitoring actions in FY17/18. The remaining evaluation reported limited impacts to watershed condition and some impacts to water quality. Statistical tests of association between impacts of the fire monitoring actions and management action planning (i.e., the implementation metrics in Table 25) were not possible because the sample sizes were too small.

In the implementation portion of the review, three evaluations indicated that the wildfires were monitored and that no suppression activities occurred. However, 14 evaluations assessed fire monitoring actions during the effectiveness review. Of those evaluations, all 4 in FY15/16 and 5 of 10 in FY17/18 also answered the questions pertaining to fire suppression management actions in the effectiveness review. These 9 evaluations did not follow the protocol instructions, and therefore their responses for fire suppression actions are not discussed.

Evaluations of the effectiveness of fire suppression or suppression-damage rehabilitation actions were completed for 20 wildfires in FY15/16 and 27 in FY17/18. These include review of the burned area for evidence of erosion or sedimentation and review of waterbodies if aerial fire retardant was used. Suppression activities that are part of an effectiveness evaluation include fire lines constructed mechanically and by hand, safety

zones, base camps and staging areas, drop points, water sources and dipping areas, and back burn areas if those areas were included in the wildfire management actions. At least half of the wildfires evaluated in each monitoring period had no observed evidence of erosion or sedimentation due to suppression or rehabilitation activities (Table 28). When evidence was observed, it was most often in a waterbody. The types of evidence observed are summarized in Table 29. Rill erosion was reported for 9 of the 23 evaluations with observed evidence. Localized sediment deposition in a waterbody was reported for 10 evaluations, but that type of evidence was incompatible with the location of the evidence reported for 4 of those evaluations. Mechanically constructed fire lines were a source of the observed evidence identified most often in each monitoring period (Table 30); 78 percent of evaluations with observed evidence reported that type of fire line as a source. “Other” sources included operations not related to the wildfire, access, and other types of fuel breaks.

The location of observed evidence was not statistically associated with most of the wildfire implementation metrics summarized in Tables 25 and 26, but two comparisons resulted in significant associations. Whether soil and water protection measures were included in the delegation of authority (Fire B-Q21) was associated with observed evidence in FY17/18 ($p = 0.04$); the three evaluations that did not have protection measures included had observed evidence of erosion or sedimentation. When protection measures were included, 50 percent of the evaluations had observed evidence. A significant association also was found between whether a soil and water resource advisor was assigned to the wildfire (Fire B-Q24) and observation of erosion or sedimentation in FY15/16 ($p = 0.08$). When no advisor was assigned, 73 percent of evaluations had observed evidence compared to 22 percent of evaluations having evidence when an advisor was assigned. The sample sizes

Table 28.—Evidence of erosion or sedimentation observed from fire suppression or suppression-damage rehabilitation actions (Fire B-Q39) for Fire B evaluations completed in FY15/16 ($n=20$ evaluations) and FY17/18 ($n=27$ evaluations), by location and distance to nearest waterbody (Fire B-Q41) or number of places evidence observed in a waterbody (Fire B-Q40)

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	10	50							
Outside an AMZ ^a	3	15			2	1			
Within an AMZ	2	10	1	1					
In a waterbody	5	25					2	2	1
FY17/18									
No evidence	14	52							
Outside an AMZ	4	15	1			3			
Within an AMZ	3	11	1	1		1			
In a waterbody	6	22					5		1

^a Aquatic management zone.

Table 29.—Types of evidence of erosion or sedimentation observed from fire suppression or suppression-damage rehabilitation actions (Fire B-Q42) for Fire B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Fire B-Q39 (Table 28) is applicable to Fire B-Q42.

Type of evidence	FY15/16 Outside an AMZ ^a (n=3)	FY15/16 Within an AMZ (n=2)	FY15/16 In a waterbody (n=5)	FY17/18 Outside an AMZ (n=4)	FY17/18 Within an AMZ (n=3)	FY17/18 In a waterbody (n=6)
Traceable evidence to the waterbody, but not currently visible in the waterbody		1	1	1	2	3
Turbidity present						1
Evidence of localized sediment deposition in the waterbody		1 ^b	2	1 ^b	2 ^b	4
Changes to substrate composition			2			1
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)			3			2
Bank instability			2			1
Bank trampling or compaction						2
Vegetation damage or bare ground						
Sheet erosion	1	1	2			1
Rill erosion	1	1	3	2	1	1
Gully erosion					1	
Headcutting						
Slumping/slips						1
Mass wasting						
Sediment plumes or accumulations	1	1	2	1		2
Rutting	1	1	1		1	2
Water quality monitoring results						

^a Aquatic management zone.

^b The type of evidence reported is incompatible with the location in which it was observed.

for these tests were small, however, and more Fire B evaluations are needed to determine the importance of these comparisons between implementation and effectiveness.

Weather conditions associated with the evaluation (Fire B-Q16) assist in determining if evidence of erosion, sedimentation, or substrate or morphology changes 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. About 20 percent of Fire B effectiveness evaluations in FY15/16 and 15 percent in FY17/18 occurred during or just after wet weather conditions. Statistically significant associations were not found between weather conditions (i.e., wet versus dry conditions) and categories of erosion (Fire B-Q39) in either monitoring period ($p = 0.85$ FY15/16, $p = 1.00$ FY17/18) (Fig. 12). The much smaller number of evaluations during wet weather than during dry weather currently limits the usefulness of this comparison.

Table 30.—Sources of evidence of erosion or sedimentation observed from fire suppression or suppression-damage rehabilitation actions (Fire B-Q43) for Fire B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Fire B-Q39 (Table 28) is applicable to Fire B-Q43.

Source of evidence	FY15/16 Outside an AMZ ^a (n=3)	FY15/16 Within an AMZ (n=2)	FY15/16 In a waterbody (n=5)	FY17/18 Outside an AMZ (n=4)	FY17/18 Within an AMZ (n=3)	FY17/18 In a waterbody (n=6)
Hand fire lines				1	2	1
Mechanically constructed fire lines	2	2	4	3	2	5
Safety zones						
Base camps						
Drop points						
Fire camps						
Staging areas						
Water sources					1	
Dipping areas						
Back burn areas				1	1	
Other	1	1	1			3

^a Aquatic management zone.

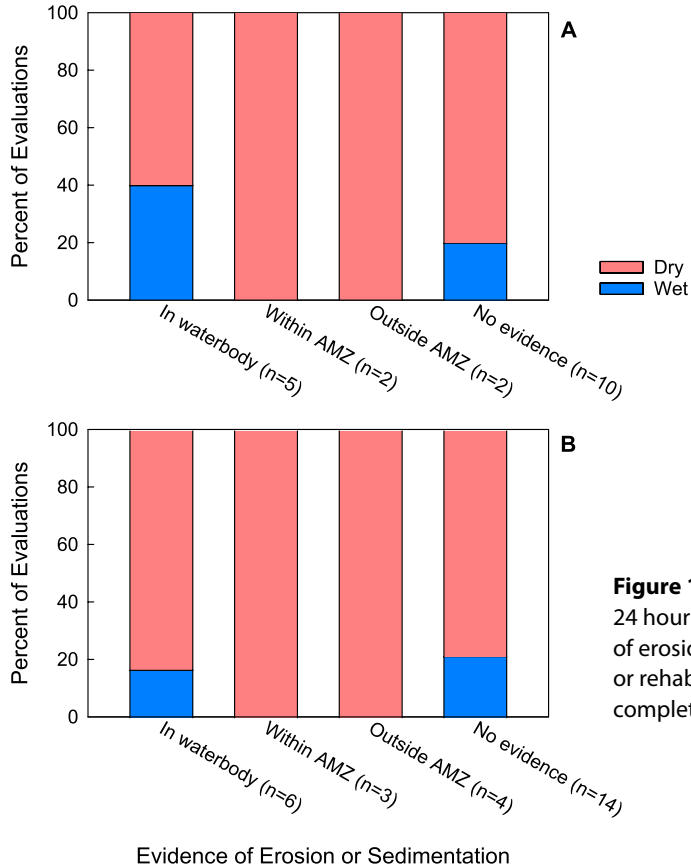


Figure 12.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion or sedimentation from the fire suppression or rehabilitation activities (Fire B-Q39) for evaluations completed in FY15/16 (A) and FY17/18 (B).

Aerial fire retardants were used in 28 of the wildfires evaluated for fire suppression (Table 31). One evaluation in FY15/16 and six evaluations in FY17/18 indicated that retardants entered a waterbody, although they were not supposed to according to policy (Fire B-Q44). For all but one of those wildfires in FY17/18, a wildland fire chemical reporting form (NIFC 9210-18) was completed (Fire B-Q45). Negative effects on water, aquatic, and riparian resources due to the fire retardant (Fire B-Q46) were included in the report for two wildfires in FY17/18; in those cases, the effects were described as “no apparent effects from the misapplication, yet our modeling efforts suggest sublethal effects were likely” and as “no noticeable effects on aquatic life.” Tests of association between whether policies pertaining to aerial retardant use were followed (Fire B-Q27) and whether retardants got into a waterbody (Fire B-Q44) found a significant association in FY17/18 ($p = 0.03$) and a very nearly significant association in FY15/16 ($p = 0.10$). In each monitoring period when policies were not followed (one wildfire in FY15/16 and three in FY17/18), retardants entered a waterbody. Seventy-eight and 67 percent of evaluations in FY15/16 and FY17/18, respectively, indicated that aerial retardant policies were followed and that retardant did not get into a waterbody. Sample sizes within each monitoring period were small, and more evaluations are needed to confirm this association.

Near the end of the effectiveness evaluation, the review team is asked to use professional judgment to assess whether the information on soil and water resource protection measures provided to the incident commander/incident management team (IC/IMT) was effective at reducing suppression and fire impacts (Fire B-Q47). Sixty-one percent of all evaluations found that the information was fully effective at reducing impacts (Table 32).

Table 31.—Distribution of whether aerial fire retardants entered a waterbody (Fire B-Q44) for Fire B evaluations completed in FY15/16 and FY17/18

Aerial retardant entered waterbody	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Not applicable; no retardant use	8	42	10	37
Yes; was allowed	0		1	4
Yes; not supposed to enter	1	5	6	22
No; did not enter	8	42	10	37
Unknown	2	11	0	

Table 32.—Distribution of whether soil and water resource protection information provided to incident commander/incident management team (IC/IMT) was effective in reducing suppression and fire impacts (Fire B-Q47) for Fire B evaluations completed in FY15/16 and FY17/18

Soil and water protection information reduced suppression impacts	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Fully effective	10	53	18	67
Partially effective	7	37	9	33
Not effective	2	11	0	

The two evaluations that determined the information was not effective noted that no resource protection information was provided to the IC/IMT. When responses to Fire B-Q47 were compared to the implementation metrics used to assess planning (see Tables 25 and 26), three significant associations were found in the FY15/16 monitoring period (Fig. 13). Whether soil and water protection measures from planning were included in the delegation of authority (Fire B-Q21) was significantly associated with how effective the information was at reducing impacts ($p = 0.05$). Effectiveness of the information also was associated with whether the IC/IMT had access to information on soil and water protection needs for the fire location (Fire B-Q22) ($p = 0.03$) and whether minimum impact suppression techniques were used when appropriate (Fire B-Q26) ($p = 0.09$). For

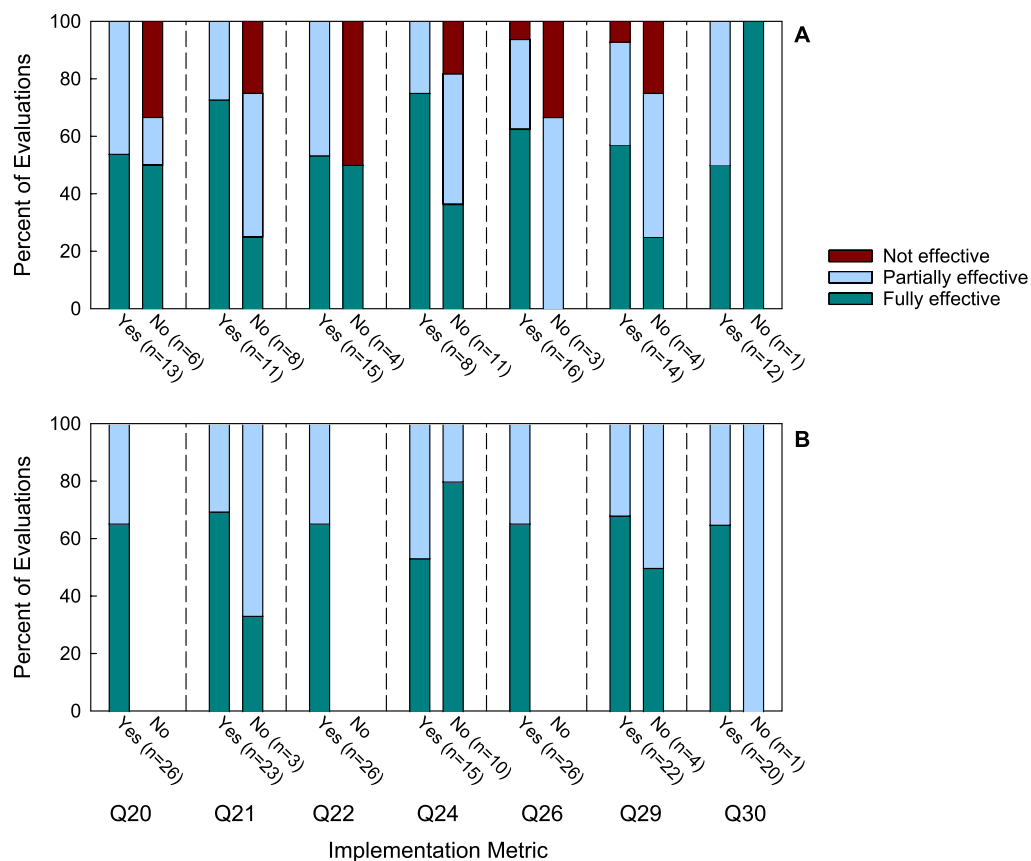


Figure 13.—Effectiveness of information on soil and water resource protection measures at reducing suppression and fire impacts (Fire B-Q47) by implementation metrics used to assess planning for fire suppression management actions for evaluations completed in FY15/16 (A) and FY17/18 (B). Fire B-Q20 asks whether potential impacts to watershed conditions and water quality were considered. Fire B-Q21 asks whether soil and water protection measures from planning were included in the delegation of authority to the incident management team (IMT) or the incident commander (IC). Fire B-Q22 asks whether the IC/IMT had access to information on soil and water protection needs for the fire location. Fire B-Q24 asks whether a soil and water resource advisor was assigned to the fire. Fire B-Q26 asks whether minimum impact suppression techniques were used when appropriate. Fire B-Q29 asks whether soil and water protection were considered in tactical firefighting decisions. Fire B-Q30 asks whether a suppression rehabilitation plan was implemented if applicable.

most metrics, including comparisons with nonsignificant associations, when protection measures were not included or considered, evaluations deemed the information less than fully effective at reducing impacts. No significant associations were found for FY17/18 (Fig. 13).

Wildland Fire B: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

The combination of *fully implemented* and *mostly implemented* ratings included about 68 and 87 percent of the evaluated Fire B sites in FY15/16 and FY17/18, respectively (Fig. 14). Better BMP effectiveness ratings were similarly distributed; about 70 percent of the evaluated sites rated as *effective* or *mostly effective* in each monitoring period (Fig. 14). A larger percentage of sites had *not effective* ratings (about 25 percent in each period) than had *not implemented* ratings (less than 5 percent). One evaluation lacked responses in the database for questions needed to rate implementation, and another lacked responses for both implementation and effectiveness. These are identified as “incomplete data” in Figure 14.

Mean wildfire size (i.e., total area burned, Fire B-Q19) was significantly different by implementation rating in FY15/16 ($p = 0.02$, GLMM with lognormal distribution and identity link function) but not in FY17/18 ($p = 0.75$) (Fig. 15). Larger wildfires tended to

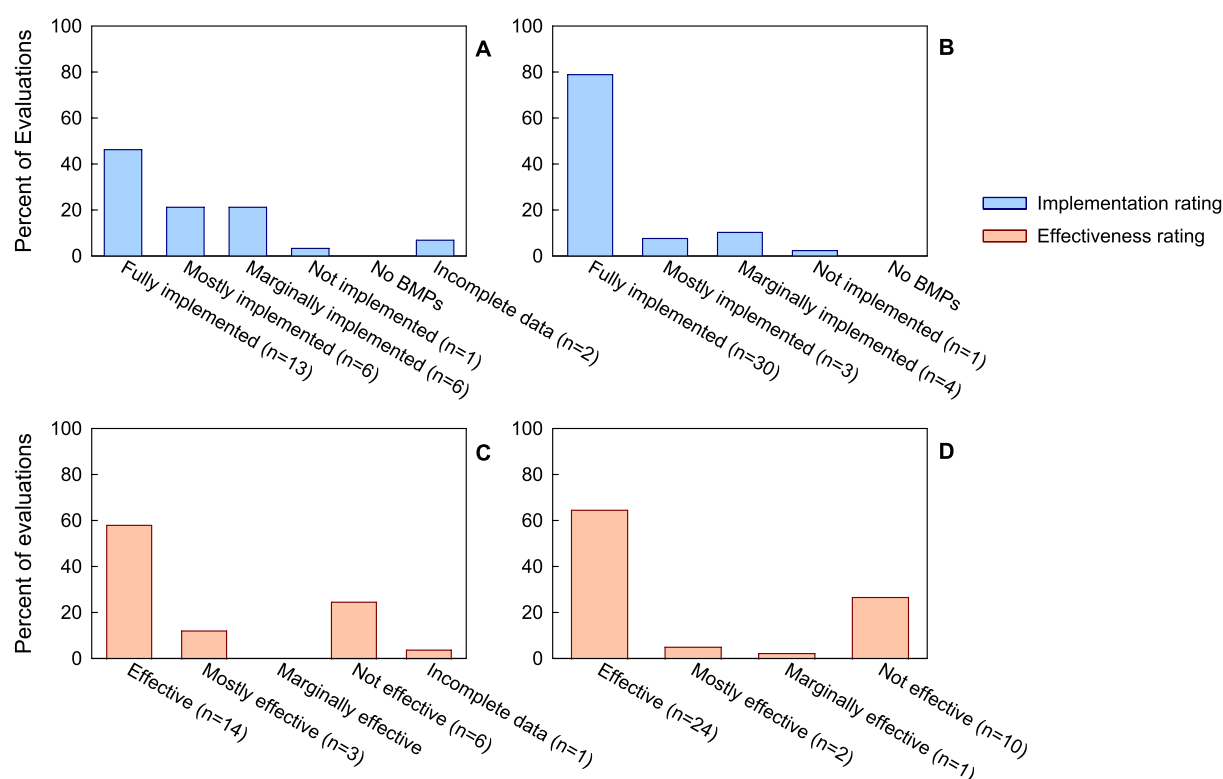


Figure 14.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Fire B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

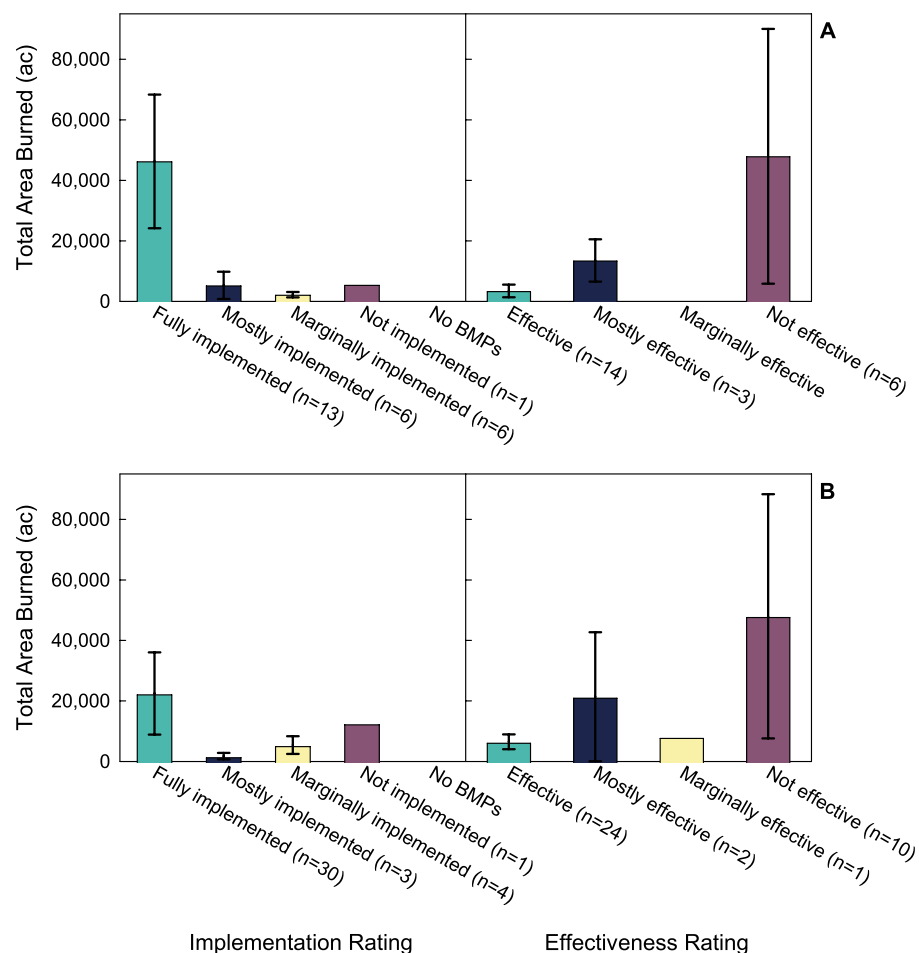


Figure 15.—Mean total area burned (Fire B-Q19; with standard error bars) by implementation (left panels) and effectiveness (right panels) ratings for evaluations completed in FY15/16 (A) and FY17/18 (B).

have better implementation ratings. The opposite occurred for the effectiveness ratings; larger wildfires tended to have poorer ratings (Fig. 15), although no significant differences in wildfire size by effectiveness rating were found in either monitoring period ($p = 0.11$ FY15/16, $p = 0.34$ FY17/18; GLMM with lognormal distribution and identity link function). The tests for wildfire size by ratings were likely affected by the small sample sizes for some ratings (Fig. 15).

Similar to the comparison between individual implementation metrics and responses about whether information on soil and water resources reduced impacts (Fire B-Q47) for wildfires with suppression activities (Fig. 13), the implementation metrics also were tested for associations with the overall effectiveness ratings for all evaluated wildfires. Significant associations were found for two metrics in FY17/18: whether a soil and water resource advisor was assigned to the wildfire (Fire B-Q24) ($p = 0.07$) and whether soil and water protection were considered in tactical firefighting decisions (Fire B-Q29) ($p = 0.09$) (Fig. 16). In both cases, however, effectiveness ratings were better when the implementation metric was deficient.

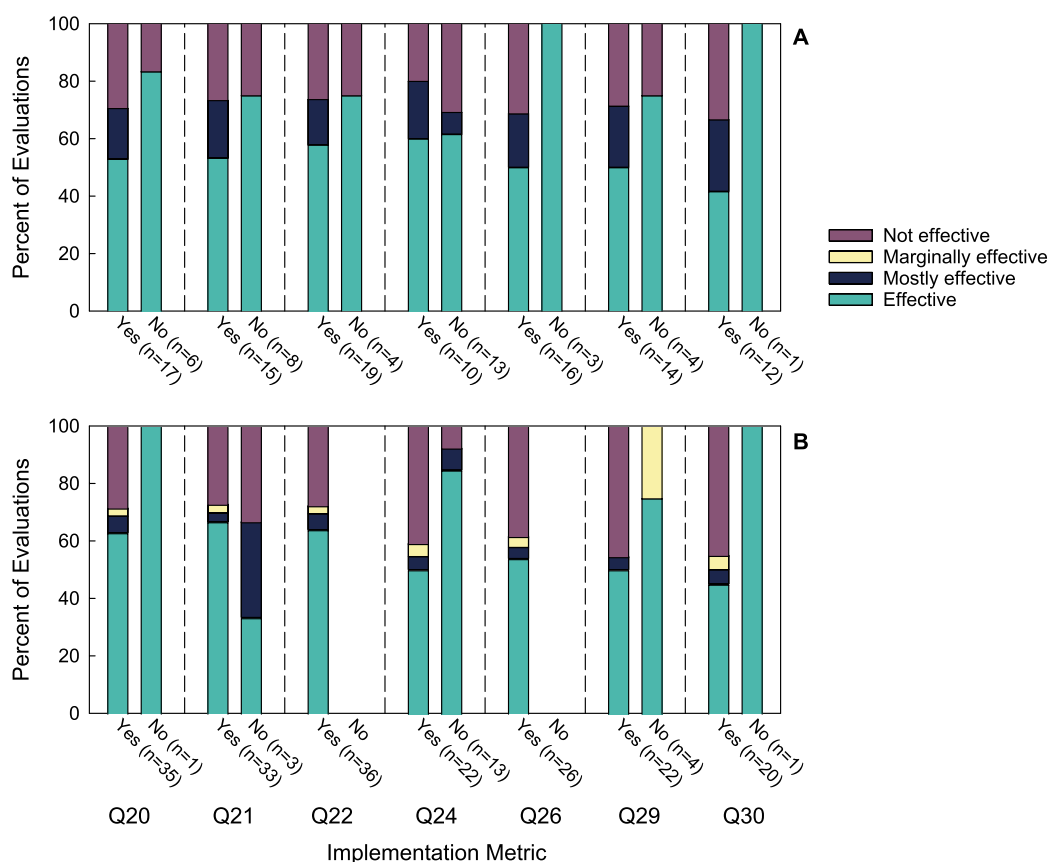


Figure 16.—Effectiveness ratings by implementation metrics used to assess planning for fire management actions for evaluations completed in FY15/16 (A) and FY17/18 (B). Fire B-Q20 asks whether potential impacts to watershed conditions and water quality were considered. Fire B-Q21 asks whether soil and water protection measures from planning were included in the delegation of authority to the incident management team (IMT) or the incident commander (IC). Fire B-Q22 asks whether the IC/IMT had access to information on soil and water protection needs for the fire location. Fire B-Q24 asks whether a soil and water resource advisor was assigned to the fire. Fire B-Q26 asks whether minimum impact suppression techniques were used when appropriate. Fire B-Q29 asks whether soil and water protection were considered in tactical firefighting decisions. Fire B-Q30 asks whether a suppression rehabilitation plan was implemented if applicable.

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Fire B-Q16) were not associated with the effectiveness ratings in either monitoring period ($p = 0.26$ FY15/16, $p = 1.00$ FY17/18) (Fig. 17). More evaluations (78 percent) were completed during dry conditions, and the somewhat higher percentage of better ratings during dry weather in FY15/16 is what might be expected if weather conditions affect the observation of erosion or sedimentation. However, relationships between weather conditions and field observations of erosion, sedimentation, or morphological effects (e.g., Fig. 12) 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.

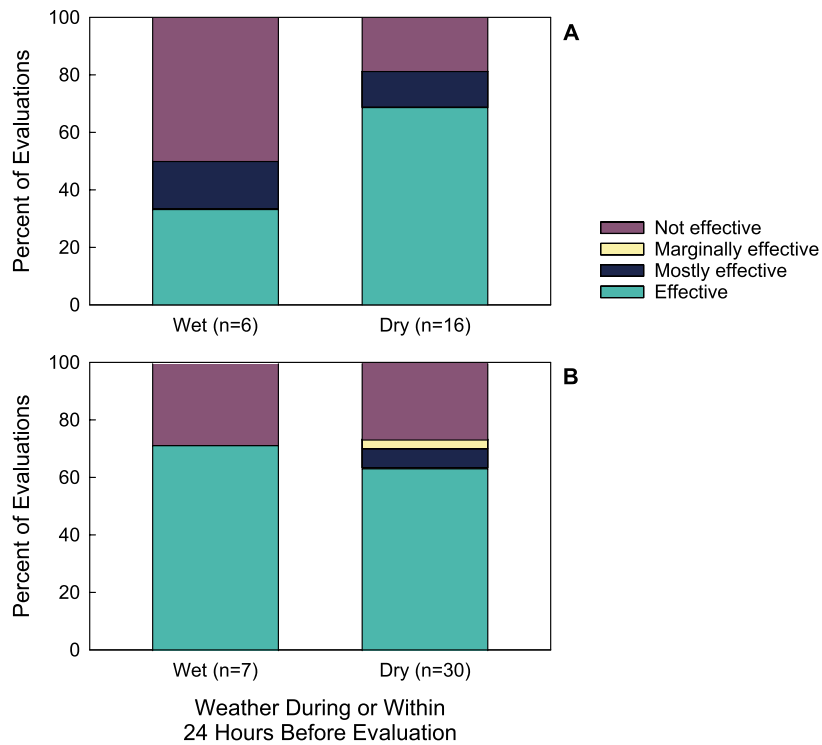


Figure 17.—Distribution of effectiveness ratings by weather conditions (Fire B-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

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

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to the project or site at hand. For example, adaptive management actions for implementation often focus on resolving problems with process, such as repeatedly not having soil and water protection measures carried into the IAP, 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 identified as needing actions for implementation and effectiveness was about one-quarter to one-third of those needing no actions in each monitoring period; this held for both corrective actions and adaptive management actions (Figs. 18 and 19), although higher percentages in FY15/16 indicated that actions were needed to improve effectiveness (Fig. 19). There was not a significant association between implementation ratings and corrective action needs in FY15/16 ($p = 1.00$). In FY17/18, the association was significant ($p = 0.06$); wildfires needing corrective actions were associated with poorer implementation ratings. The associations between implementation ratings and adaptive management needs also were statistically significant in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 0.13$) (Fig. 18). Effectiveness ratings were significantly associated with whether corrective actions ($p < 0.01$) or adaptive management actions ($p = 0.04$) were needed in FY17/18 (Fig. 19). In both cases, almost 80 percent of wildfires were rated *effective* when no corrective or adaptive management actions were needed compared to about 30 percent rated *effective* when actions were needed. Significant associations were not found between ratings and corrective action needs ($p = 0.83$) or adaptive management needs ($p = 0.15$) in FY15/16 (Fig. 19).

Some evaluations were 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. The poorer ratings may have resulted

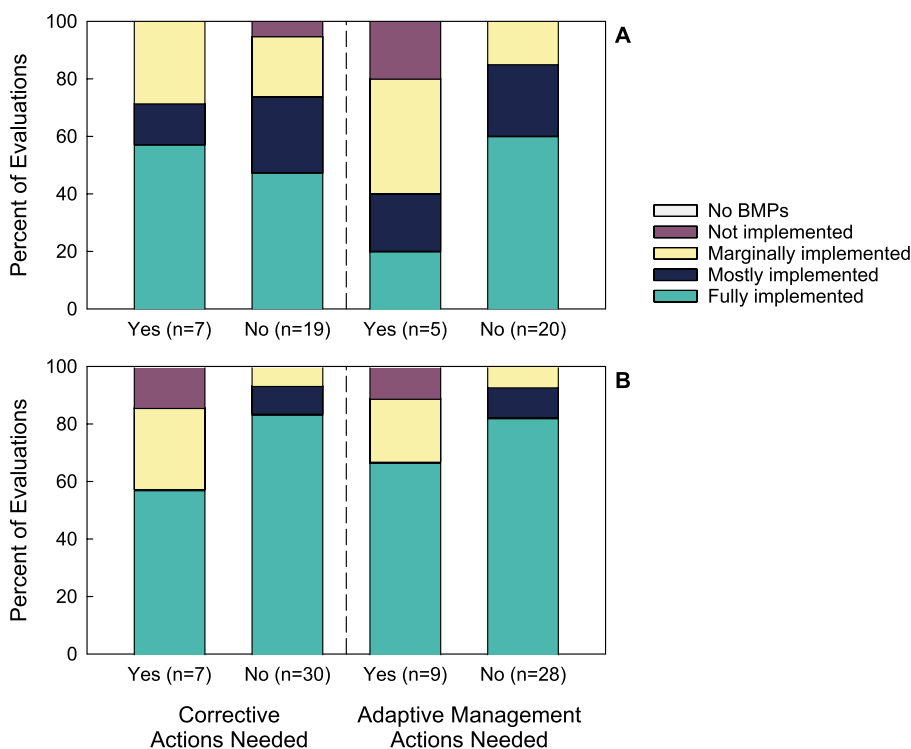


Figure 18.—Distribution of implementation ratings by whether corrective actions (Fire B-Q32) or adaptive management actions (Fire B-Q34) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

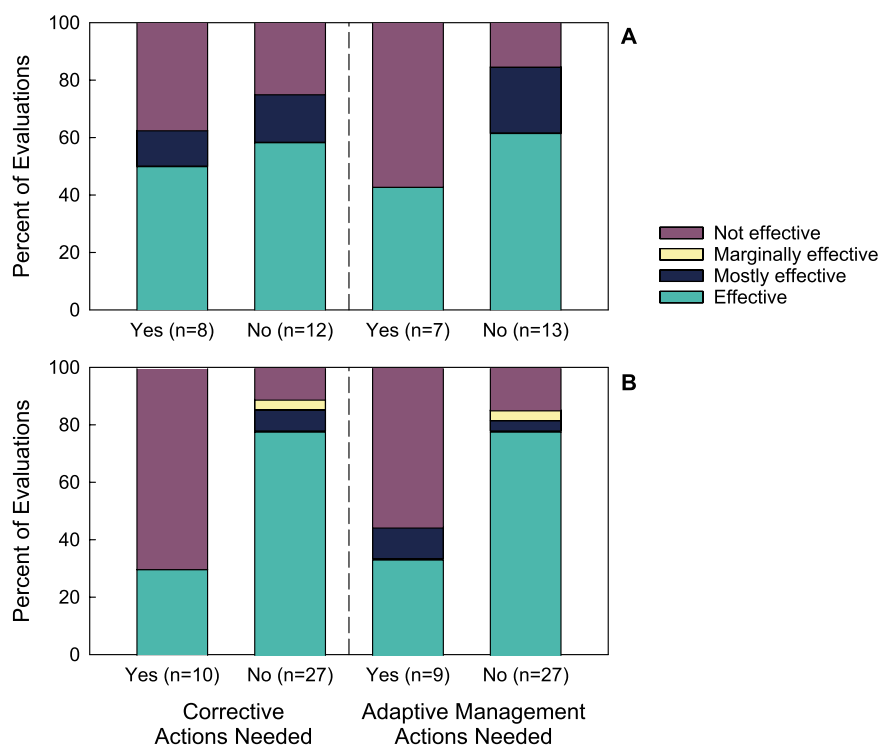


Figure 19.—Distribution of effectiveness ratings by whether corrective actions (Fire B-Q48) or adaptive management actions (Fire B-Q50) were needed to improve effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

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 could have been identified during consideration of Fire B-Q32, Fire B-Q34, Fire B-Q48, and Fire B-Q50.

Composite Ratings

Composite rating results for Fire B sites with complete data (22 in FY15/16 and 36 in FY17/18) that were evaluated for both implementation and effectiveness are given in Table 33. In FY15/16, 36 percent of wildfires evaluated had a composite rating of *excellent*, 32 percent were rated as *good*, and 27 percent were rated as *poor*. In FY17/18, 61 percent of wildfires evaluated had a composite rating of *excellent*, and 31 percent were rated as *poor*.

When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, a significant association was not found in FY15/16 ($p = 0.33$) but the association was significant in FY17/18 ($p = 0.07$). In each period, better project implementation generally tended to result in better BMP effectiveness. However,

Table 33.—Composite rating matrix for Fire B areas evaluated for both implementation and effectiveness in FY15/16 (n=22 evaluations) and FY17/18 (n=36 evaluations). Numbers in cells indicate the number of evaluations 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 ^a
Effectiveness rating	Effective	4	4	5		
	Mostly effective	1	1	1		
	Marginally effective					
	Not effective	4	1		1	

FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective	20	2	1		
	Mostly effective	1	1			
	Marginally effective			1		
	Not effective	8		1	1	

Excellent
 Good
 Fair
 Poor
 No plan

^a *No BMPs* implementation rating and corresponding *no plan* composite rating are not applicable to protocol Fire B.

about 22 percent of projects in each monitoring period were rated either *fully implemented* or *mostly implemented* and had corresponding BMP effectiveness ratings of *not effective* (Table 33).

Wildland Fire B: Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings were determined from component and subcomponent scores. The implementation rating components and their interpretations for the Fire B protocol are given in Table 34. Note that Fire B has just two implementation components—planning and on-the-ground execution—and the on-the-ground execution component is not applicable if only fire monitoring is evaluated. A score of *no fire suppression* for that component does not affect the overall implementation rating. The effectiveness components for Fire B are described in Table 35. For wildfire management actions, either the fire monitoring component or the fire suppression component is scored based on the type of wildfire management evaluated (Fire B-Q36), and the chemical pollutants component applies only to wildfires with fire suppression activities. None of the Fire B components have subcomponents.

Table 36 shows how the scores were distributed across the two implementation components. Two wildfires in FY15/16 had incomplete data for both components. Of the projects for which implementation evaluations were completed in FY15/16 and FY17/18,

Table 34.—Implementation components, scores, and interpretation of each score used for determining the overall implementation ratings for the Fire B protocol

Implementation component	Component score	Score interpretation
Planning	All	All BMPs were made available to the incident commander/incident management team (IC/IMT) at every opportunity
	Some	Some BMPs were made available to the IC/IMT at some opportunities
	None	BMPs were not made available to the IC/IMT
On-the-ground execution	All	All BMPs included in the policy and guidance documents were implemented fully
	Some	Some of the BMPs included in the policy and guidance documents were implemented fully, but at least one was not
	None	None of the BMPs included in the policy and guidance documents were implemented fully
	No fire suppression	Only fire monitoring is evaluated

Table 35.—Effectiveness components, scores, and interpretation of each score used for determining the overall effectiveness ratings for the Fire B protocol

Effectiveness component	Component score	Score interpretation
Fire monitoring	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Fire suppression	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 ^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
	Not applicable	No aerial retardant use

^a Component not applicable to fire monitoring actions.

Table 36.—Distribution of implementation component scores by component for Fire 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)
FY15/16 (n=28)					
	All	15	54	18	64
	Some	10	36	6	21
	None	1	4		
	No fire suppression			2	7
	Incomplete data ^a	2	7	2	7
FY17/18 (n=38)					
	All	32	84	32	84
	Some	5	13	5	13
	None	1	3		
	No fire suppression			1	3

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

respectively, 50 and 79 percent were rated as *fully implemented*, which is possible only if both components scored as *all* or *no fire suppression* (Table 37). Administrative units had slightly higher on-the-ground execution component scores than the planning component scores (Tables 36 and 37); only the planning component had scores of *none*.

The planning component considers the degree to which information on soil and water protection measures is available to the IC/IMT (Fire B-Q22) and whether protection measures are included in the delegation of authority (Fire B-Q21) and IAP (Fire B-Q23 and Fire B-Q28). Forty-seven sites scored as *all* for the planning component (Table 36), indicating that information was available and included in both the delegation of authority and IAP when those plans were applicable to the wildfire. A planning component score of *some* resulted for three evaluations in FY15/16 when soil and water protection measures were not included in either action document and for three other evaluations in FY15/16 when measures were not in the delegation of authority and not accessible to the IC/IMT. For the remaining evaluations in both monitoring periods with a *some* planning component score (Table 36), three did not have soil and water protection measures in the delegation of authority, one did not have information accessible to the IC/IMT, three did not have soil and water protection measures included in the IAP, and two did not have water-source protection measures (for water used in fire suppression) in the IAP. One wildfire in each monitoring period had a planning component score of *none* because soil and water protection measures were not included in the delegation of authority or in the IAP, and water-source protections (Fire B-Q28) also were not included in the IAP.

When only fire monitoring activities occur for a wildfire, the on-the-ground execution component is not applicable and receives a score of *no fire suppression*. As noted earlier, this score does not affect the overall implementation rating. The implementation of fire

Table 37.—Implementation component scores corresponding to the overall implementation ratings for Fire B evaluations with complete data in FY15/16 and FY17/18. See Table 34 for meaning of implementation component descriptors.

Monitoring period	Implementation rating	Planning component	On-the-ground execution component	Number of evaluations
FY15/16 (n=26)				
	Fully implemented	All	All	13
	Mostly implemented	Some	All	5
		Some	No fire suppression	1
	Marginally implemented	All	Some	2
		Some	Some	4
	Not implemented	None	All	1
FY17/18 (n=38)				
	Fully implemented	All	All	30
	Mostly implemented	Some	All	3
	Marginally implemented	All	Some	2
		Some	Some	2
	Not implemented	None	Some	1

suppression planning activities is assessed by whether minimum impact suppression techniques are used when appropriate (Fire B-Q26), whether water protection policies are followed when aerial retardants are used (Fire B-Q27), and whether the suppression rehabilitation plan is implemented if applicable (Fire B-Q30). Twenty-four evaluations had on-the-ground execution component scores of *all* because the three metrics were implemented fully. The remaining evaluations with *all* scores for this component (Table 36) used minimum impact techniques, and either aerial retardants were not used, the wildfire had no rehabilitation plan, or both. For the 11 evaluations with an on-the-ground execution component score of *some* (Table 36), four did not use minimum impact techniques, five did not follow aerial retardant water protection policies, and two did not implement an existing suppression rehabilitation plan.

The distribution of scores across the Fire B effectiveness components is summarized in Tables 38 and 39. Fourteen wildfires were scored for the fire monitoring component, and 47 were scored for the fire suppression and chemical pollutants components; however, aerial retardants were not used for 20 wildfires, resulting in chemical pollutants component scores of *not applicable* (Table 35). Across all components, at least two-thirds of sites had scores of *effective* or *mostly effective* in both monitoring periods (Table 38). Sixty-three percent of wildfires had overall effectiveness ratings of *effective*, which resulted from each site achieving either an *effective* or *not applicable* score for the applicable effectiveness components (Table 39). The *mostly effective* and *not effective* ratings were most often due to the fire suppression component score, although *not effective* scores occurred across all components (Tables 38 and 39).

Table 38.—Distribution of effectiveness component scores by component for Fire B evaluations completed in FY15/16 and FY17/18. Either fire monitoring component or fire suppression component is scored.

Monitoring period	Effectiveness component score	Fire monitoring component (number)	Fire monitoring component (percent)	Fire suppression component (number)	Fire suppression component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=24)							
	Effective	3	75	13	65	8	80
	Mostly effective			2	10	1	10
	Marginally effective						
	Not effective	1	25	5	25		
	Not applicable ^{a,b}					10	-- ^b
	Incomplete data ^c					1	10
FY17/18 (n=37)							
	Effective	9	90	17	63	10	59
	Mostly effective	1	10	1	4	4	24
	Marginally effective			1	4	1	6
	Not effective			8	30	2	12
	Not applicable					10	--

^a Score applies only to chemical pollutants component (see Table 35).

^b Not included in calculation of percentages.

^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. 20) did not find any significant associations in either monitoring period. Evaluations had only two different ratings and two different scores for the fire monitoring component in both periods and the chemical pollutants component in FY15/16, so meaningful comparisons could not be made ($p = 1.00$ for all). In FY15/16, the association between implementation ratings and fire suppression component scores was very nearly significant ($p = 0.10$), although the rating distributions were the opposite of what would be expected; ratings were worse when component scores were better (Fig. 20). Chemical pollutants component scores in FY17/18—although not significantly associated with the implementation ratings ($p = 0.11$)—had somewhat better ratings when scores were better (Fig. 20).

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 21. Significant associations were not found between the effectiveness ratings and either component in FY15/16 (planning: $p = 0.28$, on-the-ground execution: $p = 0.21$). In FY17/18, ratings were significantly associated with scores for both the planning component ($p = 0.05$) and the on-the-ground execution component ($p = 0.01$). For most comparisons, the results were opposite of what would be expected; better implementation had poorer effectiveness ratings. However, when all resource protection measures were implemented fully in FY17/18, better effectiveness ratings were achieved (Fig. 21). When only the on-the-ground execution component

Table 39.—Effectiveness component scores corresponding to the overall effectiveness ratings for Fire B evaluations completed in FY15/16 and FY17/18. Either fire monitoring component or fire suppression component is scored. See Table 35 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Fire monitoring component	Fire suppression component	Chemical pollutants component	Number of evaluations
FY15/16 (n=23)					
	Effective	Effective			3
			Effective	Effective	5
			Effective	Not applicable	6
	Mostly effective		Effective	Mostly effective	1
			Mostly effective	Effective	1
			Mostly effective	Not applicable	1
	Marginally effective				0
	Not effective	Not effective			1
			Not effective	Effective	2
			Not effective	Not applicable	3
FY17/18 (n=37)					
	Effective	Effective			9
			Effective	Effective	6
			Effective	Not applicable	9
	Mostly effective	Mostly effective			1
			Mostly effective	Effective	1
	Marginally effective		Effective	Marginally effective	1
	Not effective		Effective	Not effective	1
			Marginally effective	Not effective	1
			Not effective	Effective	3
			Not effective	Mostly effective	4
			Not effective	Not applicable	1

scores for wildfires that included fire suppression activities were compared to effectiveness ratings, the association in FY15/16 again was nonsignificant ($p = 0.15$), while the association in FY17/18 was again significant ($p = 0.06$).

Wildland Fire B: Management Implications for Forest Service Resource Managers

Eighty-one percent of the wildfire sites rated either *fully implemented* or *mostly implemented* for BMP implementation. Two sites rated *not implemented*. Project planning was a deficiency in about 28 percent of the total sites and was a deficiency in 86 percent of sites that were rated lower than *fully implemented*. Planning deficiencies were spread evenly among the metrics: no soil and water protection measures in the delegation of authority or IAP or no soil and water protection information available to the IC/IMT. About 17 percent of the sites had a deficiency in on-the-ground execution because not all

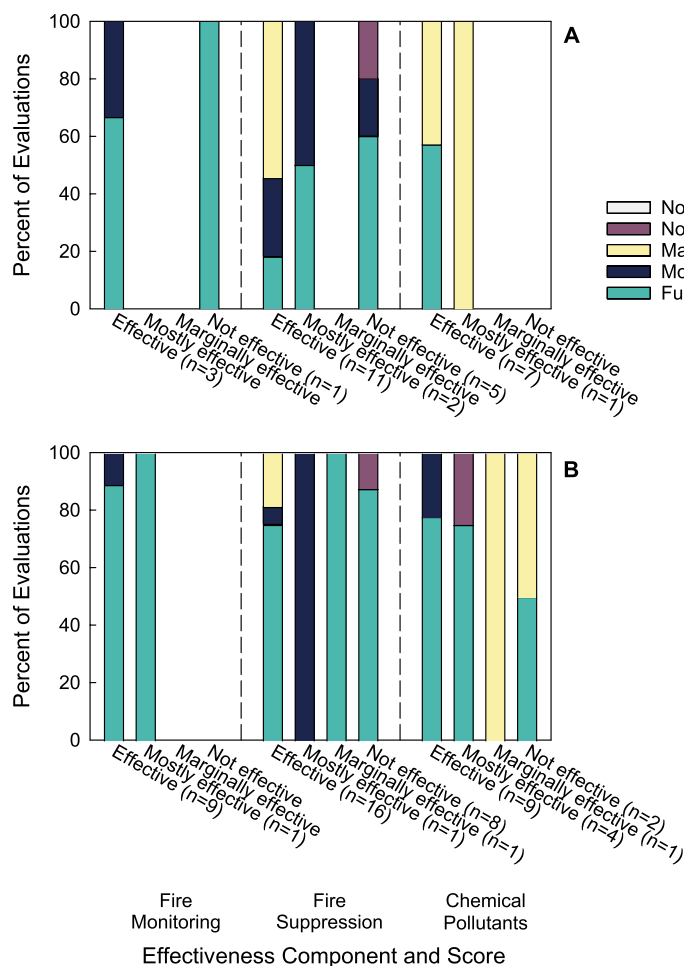


Figure 20.—Distribution of implementation ratings across effectiveness component scores for Fire B evaluations completed in FY15/16 (A) and FY17/18 (B).

soil and water protection policy or guidance was implemented fully. Again, deficiencies were nearly equally spread between the metrics: minimum impact suppression techniques, aerial retardant policy, and implementation of suppression rehabilitation plan. Project oversight is not an implementation component in Fire B.

The Fire B protocol can be used to evaluate effectiveness for either fire monitoring or fire suppression. For BMP effectiveness in fire monitoring projects, 86 percent rated *effective*, indicating that no impacts to water quality were observed. The other fire monitoring projects were rated *not effective*.

Sixty-six percent of fire suppression sites rated *effective* or *mostly effective* for BMP effectiveness, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. One-third of the sites were rated *not effective*, indicating that adverse effects may be major and long term. Most of the *not effective* ratings were due to the fire suppression component. Evidence of erosion or sedimentation related to suppression or rehabilitation activities was observed at nearly half of the

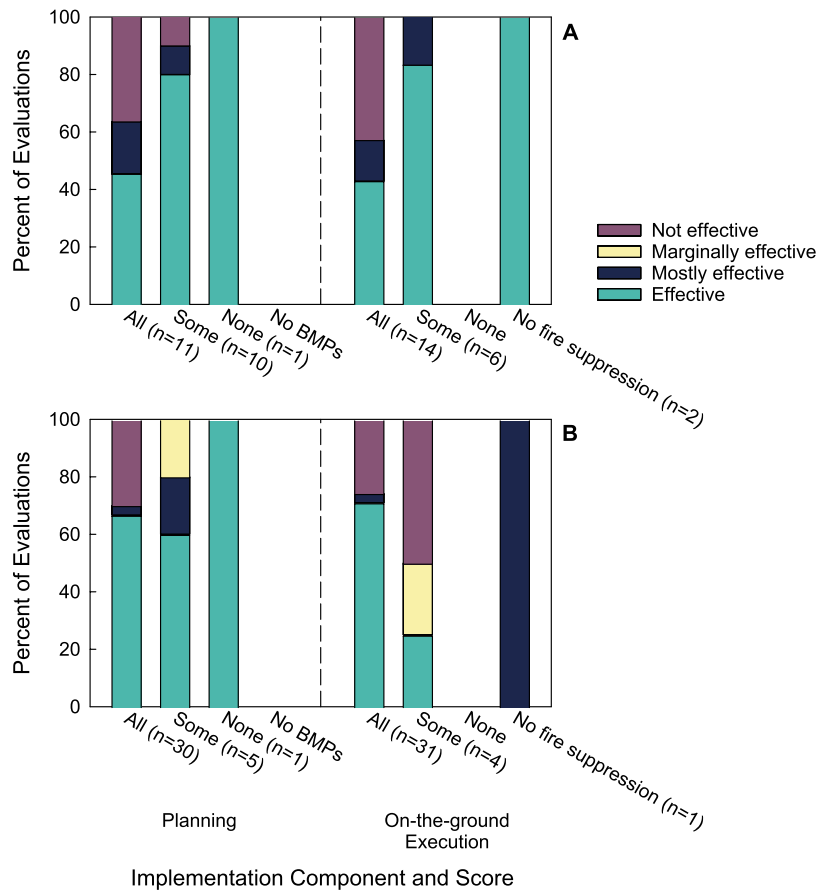


Figure 21.—Distribution of effectiveness ratings across implementation component scores for Fire B evaluations completed in FY15/16 (A) and FY17/18 (B). A *no fire suppression* score for the on-the-ground execution component indicates that only fire monitoring was included in the implementation evaluation.

evaluated sites. When evidence of erosion or sedimentation was observed, it was most frequently rill erosion either in the waterbody or within 10 feet of the waterbody. The most frequently reported source—in 78 percent of the evaluations with observed erosion and sedimentation—was mechanically constructed fire lines.

Although no significant associations between implementation ratings and effectiveness ratings were found, better BMP implementation generally tended to have better effectiveness. For sites in which both implementation and effectiveness evaluations were completed, 68 and 89 percent of the sites with a *fully implemented* or *mostly implemented* rating, respectively, were rated *effective* or *mostly effective*. However, 78 percent of sites with a *marginally implemented* rating also were rated *effective* or *mostly effective*, indicating high effectiveness with poorer implementation ratings. Similarly, 32 and 11 percent of the sites rated *fully implemented* or *mostly implemented*, respectively, were rated *not effective*, indicating poor effectiveness despite better implementation ratings. Yet significant associations were found between the implementation and effectiveness metrics.

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

- Ensuring that soil and water protection measures are included in the delegation of authority or provided to the IC/IMT where appropriate. A significant association was found between soil and water protection measures in the delegation of authority and observed evidence of erosion and sedimentation in the evaluations completed in FY17/18. When protection measures were included, half of those evaluations did not have observed evidence of erosion or sedimentation, but all the evaluations without protection measures included had observed evidence of erosion or sedimentation.
- Assigning at least one soil or water resource advisor to fires when appropriate. When a soil or water resource advisor was assigned, 22 percent of the wildfires had observed evidence of erosion or sedimentation; when an advisor was not assigned, 73 percent of sites had observed evidence of erosion or sedimentation.
- Following established policy for use of aerial retardant, where appropriate, to avoid retardant entering a waterbody. When the established policy was not followed, aerial retardant was reported by 3 (of 4) evaluations to have entered a waterbody. When the policy was followed, 4 (of 21) evaluations reported that retardant entered a waterbody.
- Focusing attention on rehabilitation of mechanically constructed fire lines. Seventy-eight percent of the evaluations with observed erosion and sedimentation reported mechanically constructed fire lines as the cause.

Wildland Fire B: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Fire B. Wildfire Management Actions

(Reference BMPs Fire-1, Fire-3, Fire-4, and WatUses-3)

v3.0 February 2016

Header	
Fire B-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Fire B-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Fire B-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Fire B-Q4	Date of current field evaluation:
Fire 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:
Fire 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:
Fire B-Q7	Reviewers and titles:
Fire B-Q8a	Region number:
Fire B-Q8b	State:
Fire B-Q9a	Proclaimed Forest or Grassland number and name:
Fire B-Q9b	Administrative Forest or Grassland number and name:
Fire B-Q10	District number and name:
Fire B-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Fire 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Fire 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: a. Yes b. No 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:
Fire B-Q12	6 th level HUC number and name for the subwatershed containing the burned area being evaluated:
Fire B-Q13	Did any part of the fire occur within a municipal supply watershed? Select one: a. Yes b. No If Yes, what percentage of the municipal watershed was burned?
Fire B-Q14a	Location. UTM Zone: UTM Datum:
Fire B-Q14b	Location. Easting:
Fire B-Q14c	Location. Northing:
Fire B-Q15a	Location. Latitude:
Fire B-Q15b	Location. Longitude:
Fire B-Q15c	Location. Lat/Long Datum:
Fire B-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Fire B-Q17	Name of wildfire:
Fire B-Q18	Date the fire was controlled:
Fire B-Q19	Total area burned in the fire (ac or ha; specify unit):

continued on next page

Implementation	
Fire B-Q20	Were potential impacts to watershed condition and water quality considered in formulation of wildfire management objectives? Select one: a. Yes b. No
Fire B-Q21	Were soil and water protection measures that are identified in the land management plan, fire management plan, and other pertinent documents included in the Delegation of Authority to the Incident Management Team or Incident Commander? Select one: a. Yes b. No If No, why were they excluded?
Fire B-Q22	Did the Incident Commander/Incident Management Team have access to information about soil and water protection needs in the area where the fire was located? Select one: a. Yes (go to question 23) b. No (go to question 24)
Fire B-Q23	Was the soil and water protection information carried into the Incident Action Plan? Select one: a. Not applicable, the fire type did not require an Incident Action Plan b. Yes c. No
Fire B-Q24	Was at least one soil and water resource advisor assigned to the fire? Select one: a. Yes (go to question 25) b. No (go to question 26)
Fire B-Q25	Was input from the soil and water resource advisor included in the After-Action Report? Select one: a. Yes b. No
Fire B-Q26	Were minimum impact suppression techniques used in the fire area when appropriate? Select one: a. Not applicable, fire monitoring is being evaluated (go to question 31) b. Yes (go to question 27) c. No (go to question 27) If No, explain why they were not used.
Fire B-Q27	Were policies pertaining to the protection of water resources followed when aerial retardants were used? Select one: a. Not applicable, no aerial retardants used b. Yes c. No If No, what policies were not followed?
Fire B-Q28	Was water-source protection included in the Incident Action Plan for water used in fire suppression? Select one: a. Not applicable, the fire type did not require an Incident Action Plan b. Not applicable, water was not used during fire suppression c. Yes d. No

continued on next page

Implementation <i>(continued)</i>	
Fire B-Q29	Were soil and water protection considered in tactical firefighting decisions? Select one: a. Yes b. No
Fire B-Q30	Was the suppression rehabilitation plan implemented? Select one: a. Not applicable, no suppression rehabilitation plan for this fire b. Yes c. No
Fire B-Q31	Were chemical or fuel spills or leaks that occurred during this fire handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during this fire c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan
Fire B-Q32	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 33) b. No (go to question 34)
Fire B-Q33	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Fire B-Q34	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 35) b. No (go to question 36 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Fire B-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	
Fire B-Q36	Are you evaluating fire monitoring? Select one: a. Yes (go to question 37) b. No (go to question 39)
Fire B-Q37	Rate the impact of the fire on watershed condition and water quality. Select one rating on each line: a. Watershed condition: Limited/Some/Undesirable b. Water quality: Limited/Some/Undesirable

continued on next page

Effectiveness (continued)	
Fire B-Q38	Where “Some” impacts or “Undesirable” impacts were reported for watershed condition and/or water quality in question 37, based on professional judgment, would the impact likely have been less if suppression activities had been employed? Select one; after answering go to question 48: a. The impacts to both watershed condition and water quality were limited b. Yes, suppression probably would have resulted in fewer impacts to watershed condition and/or water quality c. No, suppression probably would not have reduced impacts to watershed condition and/or water quality d. Unknown, cannot determine
Fire B-Q39	Is there evidence of erosion or sedimentation from the suppression activities or suppression-damage rehabilitation activities? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 44) b. Evidence of erosion or sedimentation outside an AMZ (go to question 41) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 41) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 40)
Fire B-Q40	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 42: a. 1 or 2 b. 3 or 4 c. 5 or more
Fire B-Q41	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Fire B-Q42	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 39, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

continued on next page

Effectiveness (continued)	
Fire B-Q43	What are the sources? Select all that apply: a. Hand fire lines b. Mechanically constructed fire lines c. Safety zones d. Base camps e. Drop points f. Fire camps g. Staging areas h. Water sources i. Dipping areas j. Back burn areas k. Other (specify):
Fire B-Q44	Did fire retardant get into a waterbody? Select one: a. Not applicable, no retardant used (go to question 47) b. Yes, but retardant was allowed to enter the waterbody in accordance with policy exemptions (go to question 45) c. Yes, even though retardant was not supposed to enter the waterbody (go to question 45) d. No, retardant did not enter the waterbody (go to question 47) e. Unknown (go to question 47)
Fire B-Q45	Was a Wildland Fire Chemical Reporting Form (NIFC 9210-18) completed? Select one: a. Yes (go to question 46) b. No (go to question 47)
Fire B-Q46	Were negative effects of fire retardant on water, aquatic, or riparian resources noted in that report (NIFC 9210-18)? Select one: a. Yes b. No If Yes, describe the effects:
Fire B-Q47	Based on professional judgment, was the information pertaining to protecting soil and water resources that was provided to the Incident Commander/Incident Management Team effective in reducing suppression and fire impacts? Select one, and provide details on the reasons that led you to that response: a. Fully effective b. Partially effective c. Not effective Rationale for this answer:
Fire B-Q48	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 49) b. No (go to question 50)
Fire B-Q49	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Fire B-Q50	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 51) b. No (go to General Comments)
Fire B-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.

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Wildland Fire Management Summary

Wildland fire management protocols were among the most frequently used National BMP monitoring protocols in the FY15/16 and FY17/18 monitoring periods, with a total of 221 evaluations completed (about 8 percent of all evaluations; Table 3). All regions except Region 10 completed at least 11 evaluations using a wildland fire protocol; Region 10 completed 1. Fire A—used to evaluate use of prescribed fire—was used most frequently in Region 8 and Region 5. Fire B—used to evaluate wildfire management actions—was used most frequently in Region 6, Region 5, and Region 2. Seventy-seven percent of the wildland fire evaluations were at randomly selected sites (Table 3).

Overall, seventy-nine percent of the wildland fire evaluations were rated *fully implemented* or *mostly implemented* for BMP implementation. Eleven projects were rated *not implemented* or *no BMPs*. Fire A projects had a lower percentage of *fully implemented* ratings and a higher percentage of evaluations rated *not implemented* or *no BMPs* than Fire B sites. The planning component had the highest percentage of deficiencies in both Fire A and Fire B protocols.

Seventy-seven percent of the wildland fire evaluations rated *effective* or *mostly effective* for BMP effectiveness. Fifteen percent of the projects and sites were rated *not effective*. Seven percent of the projects and sites were rated *mostly effective* or *marginally effective*. Fire A had a higher percentage of projects rated *effective* and a lower percentage rated *not effective* than Fire B. Evidence of erosion and sedimentation, when observed, was primarily rill erosion from fire lines.

For Fire A projects and Fire B sites with complete evaluations of both implementation and effectiveness, better implementation ratings were generally associated with better effectiveness ratings. These findings demonstrate that when BMPs are implemented in prescribed fire projects and at wildfire sites, water quality is protected. In addition, the review teams appear to be recognizing implementation and effectiveness issues while they conduct 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 also are assessed to identify potential issues with application of the National BMP monitoring program. Examination of the data for wildland fire protocols

indicates 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. Nine Fire A and six Fire B evaluations included an implementation review only, with no corresponding effectiveness evaluation in the database. Paired implementation and effectiveness evaluations at the same site are important to determine whether BMPs are effective when implemented correctly.
- Two Fire A and two Fire B evaluations were incomplete in the database. Evaluations with incomplete data in the database cannot be rated.
- Header questions (11a, 11b, and 11c) in both protocols were not answered according to the instructions in many evaluations. These questions are designed to capture information about the reasons for monitoring, whether the projects or sites were selected randomly according to the protocol instructions, and whether the protocol instructions for completing the evaluations were followed. The most common mistake was misunderstanding the intended meaning of quality assurance monitoring.
- Incompatible answers to related questions may adversely affect the overall implementation or effectiveness rating:

Incompatible answers to related questions on the location of erosion and sedimentation evidence observed and the erosion and sediment features observed were found (Fire A-Q34, Fire A-Q37, and Table 11; Fire A-Q41, Fire A-Q44, and Table 13; Fire B-Q39, Fire B-Q42 and Table 29). For example, observed evidence of erosion and sedimentation “within an AMZ” coupled with an observed erosion and sediment feature of “evidence of localized sediment deposition in the waterbody” are incompatible. If localized sediment deposition in a waterbody is observed, the location of the evidence question would be answered “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.

In Fire B, 3 evaluations indicated in the implementation review that the wildfires were monitored and that no suppression activities had occurred. In the effectiveness review, however, 14 evaluations completed the fire monitoring questions, and 9 of the 14 evaluations also completed the fire suppression questions. The protocol instructions direct that effectiveness questions related to either fire monitoring or fire suppression are to be answered in an effectiveness evaluation, but not both. In this analysis, the fire suppression effectiveness data for those 9 evaluations were not included.

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.

RECREATION MANAGEMENT

Recreation management BMPs are used to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from recreation activities. An objective of the Forest Service recreation program is to provide outdoor recreation opportunities in naturally appearing forest and rangeland settings. Recreation activities on National Forest System (NFS) lands take place at developed and undeveloped sites or are dispersed across broad areas.

Recreation results are described separately by protocol: developed recreation sites (Rec A), dispersed recreation areas (Rec B), completed construction or re-routing of motorized or nonmotorized trails (Rec C), motorized or nonmotorized trail operation and maintenance (Rec D), motorized vehicle use areas (Rec E), pack and riding stock use areas (Rec F), active construction or operation and maintenance of watercraft launches (Rec G), completed ski area construction or reconstruction (Rec H), and ski run operation and maintenance (Rec I). The Rec G protocol for watercraft launches evaluates active launch construction in the same manner as completed construction projects (similar to Rec H), and launches at least 1 year old are evaluated for operation and maintenance (similar to Rec I); these two situations are analyzed and presented separately within the Rec G results. The sample sizes for construction are small in each monitoring period, so the analyses for those groups are limited, as they would be if active construction had a stand-alone protocol.

The evaluations for all of the recreation management protocols were dominated by randomly selected samples (Table 40, Fig. 22), but the overall sample sizes for Rec E, Rec F, Rec H, and Rec I were not large, especially considering that these evaluations represent agency-wide monitoring. 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 were completed for the evaluations with sample sizes greater than 10 per monitoring period (i.e., all but Rec E, Rec F, Rec H, and Rec I). These showed few significant associations between the ratings and sample selection technique for implementation or for effectiveness (Table 41). In FY17/18, Rec B effectiveness, Rec D implementation and effectiveness, and Rec G implementation had significant associations (Table 41, Fig. 22). The Rec B effectiveness ratings in FY15/16 and FY17/18 had very similar distributions (Fig. 22C, D); thus the nonrandomly selected Rec B samples for that monitoring period were kept in the dataset for in-depth analysis. The nonrandomly selected Rec D evaluations in FY17/18 had somewhat poorer implementation due to a larger number of no BMPs ratings and poorer effectiveness ratings (Fig. 22H) compared to the randomly selected evaluations in FY17/18 and all evaluations in FY15/16 (Fig. 22G). The nonrandomly selected Rec D evaluations were not kept in the dataset for analysis. A brief summary of those evaluations are provided in Appendix 2. For Rec G implementation in FY17/18 (Fig. 22J), the number of nonrandomly selected evaluations was small and similar numbers of randomly and nonrandomly selected evaluations had better ratings, so all samples were kept in the dataset for analysis.

Table 40.—Number of randomly and nonrandomly selected Recreation Management evaluations in FY15/16 and FY17/18, by region and protocol (Q11b [all Rec protocols]): Rec A (Developed Recreation Sites), Rec B (Dispersed Recreation Areas), Rec C (Completed Construction or Re-routing of Motorized or Nonmotorized Trails), Rec D (Motorized or Nonmotorized Trail Operation and Maintenance), Rec E (Motorized Vehicle Use Areas), Rec F (Pack and Riding Stock Use Areas), Rec G (Active Construction or Operation and Maintenance of Watercraft Launches), Rec H (Completed Ski Area Construction or Reconstruction), and Rec I (Ski Run Operation and Maintenance)

Monitoring period	Region	Rec A random selection	Rec A nonrandom selection	Rec B random selection	Rec B nonrandom selection	Rec C random selection	Rec C nonrandom selection	Rec D random selection	Rec D nonrandom selection	Rec E random selection	Rec E nonrandom selection
FY15/16											
	1	3	2	1			2	1	1		
	2	5	2	5	1	1	2	4	2		
	3	2	1	1			1		2		
	4	2	1	3		2	1	1			
	5	13	3	14	1	2		29	3		
	6	4	1	6	3	2	1	1	1	1	1
	8	6	1		1	3		5	1	1	
	9	15		6	3	6		9	5	1	
	10							1	1		
	Total	50	11	36	9	16	7	51	16	3	1
	Percent within protocol	82	18	80	20	70	30	76	24	75	25
FY17/18											
	1	7	2	2	1	1		2	3		
	2	2	1	7	1	9	3	8	3		
	3	15	3	4	10	2	1	11	7	1	
	4	5	1	5	1		3	2			
	5	16	3	10		3	2	23	4	2	1
	6	9	2	4	2	7	1	9	1		
	8	15	4	3	1	9		10		2	
	9	10	1	3		7	3	11	2		
	10	1		2	2	1	1		1		
	Total	80	17	40	18	39	14	76	21	5	1
	Percent within protocol	82	18	69	31	74	26	78	22	83	17

(continued)

Table 40.—(continued)

Monitoring period	Region	Rec F random selection	Rec F nonrandom selection	Rec G random selection	Rec G nonrandom selection	Rec H random selection	Rec H nonrandom selection	Rec I random selection	Rec I nonrandom selection
FY15/16									
	1	1	1	1	1	1		1	
	2			1		4			
	3	1		4		2			
	4	1		1	1	1		2	1
	5	1						1	
	6			5	2			2	
	8			2					
	9			5	1	1	1		
	10			1	1				
	Total	4	1	20	6	9	1	6	1
	Percent within protocol	80	20	77	23	90	10	86	14
FY17/18									
	1			1	2				
	2	2				3		2	
	3	1		8				1	
	4	2		1	3		1	2	
	5	2		2					
	6	1		4		1	1		
	8			3					
	9	3		6		1		2	
	10	1							
	Total	12	0	25	5	5	2	7	0
	Percent within protocol	100		83	17	71	29	100	

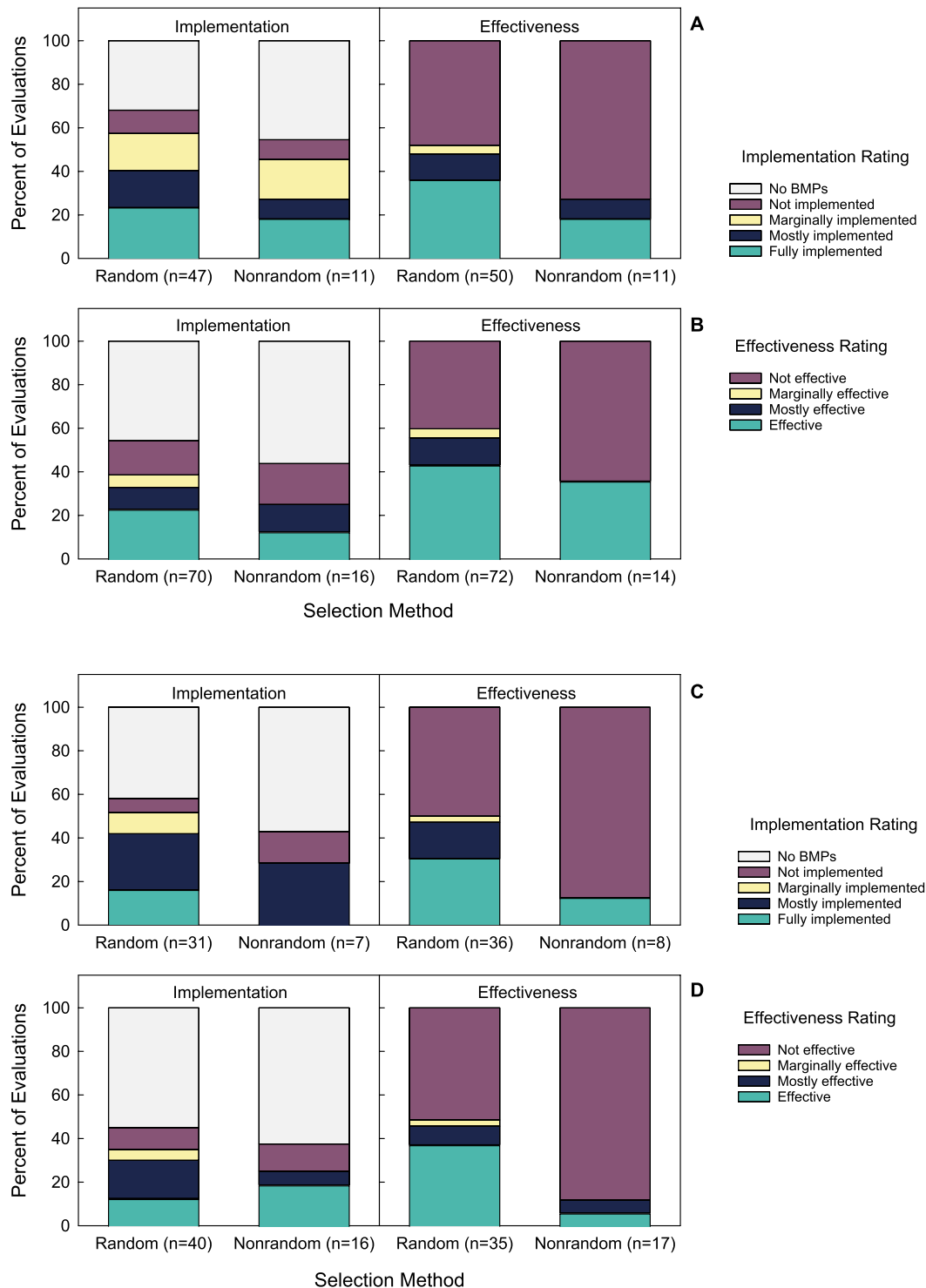


Figure 22.—Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Rec A evaluations completed in FY15/16 (A) and FY17/18 (B) and Rec B evaluations completed in FY15/16 (C) and FY17/18 (D).
(continued on next two pages)

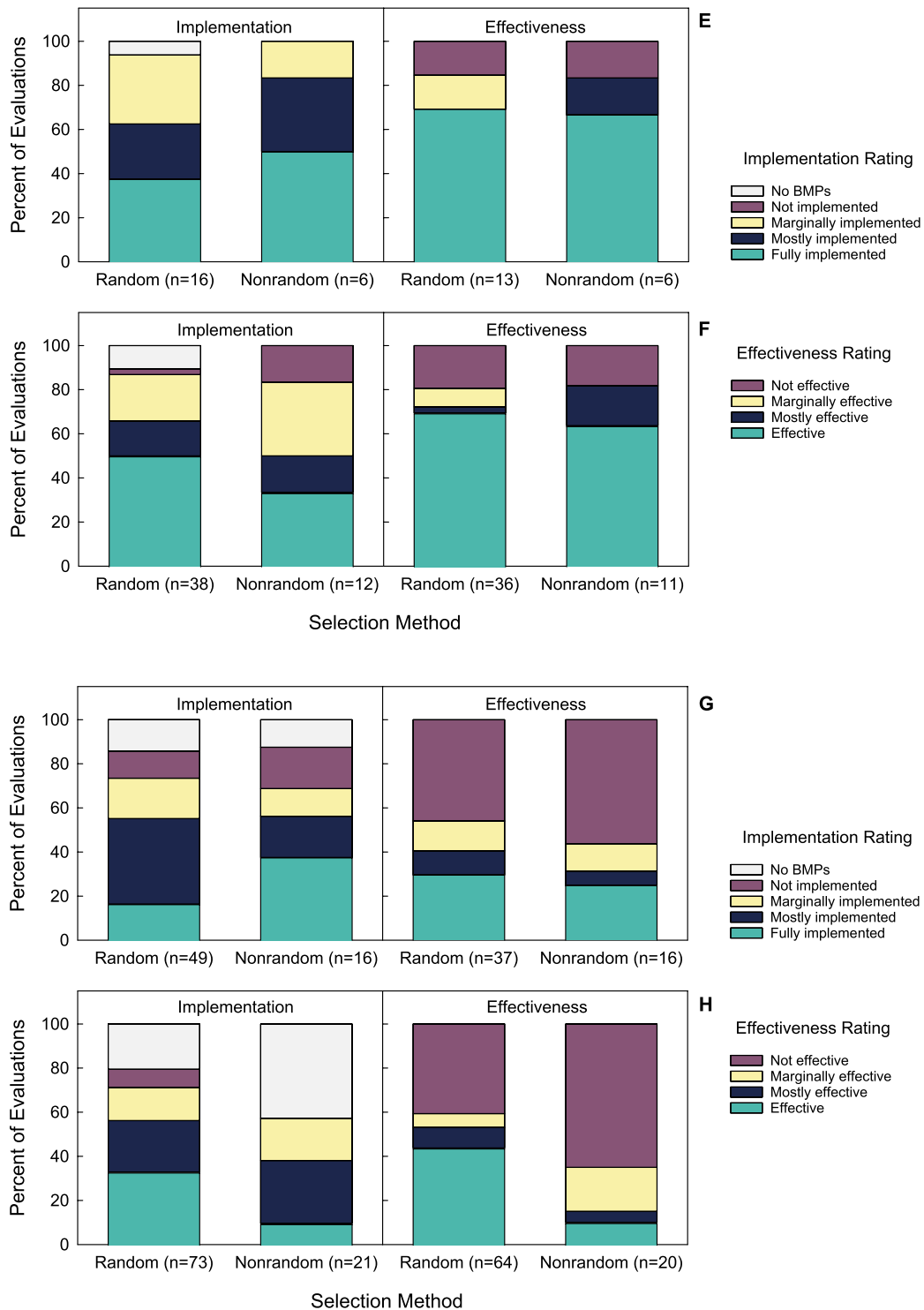


Figure 22.—Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Rec C evaluations completed in FY15/16 (E) and FY17/18 (F) and Rec D evaluations completed in FY15/16 (G) and FY17/18 (H). (continued on next page)

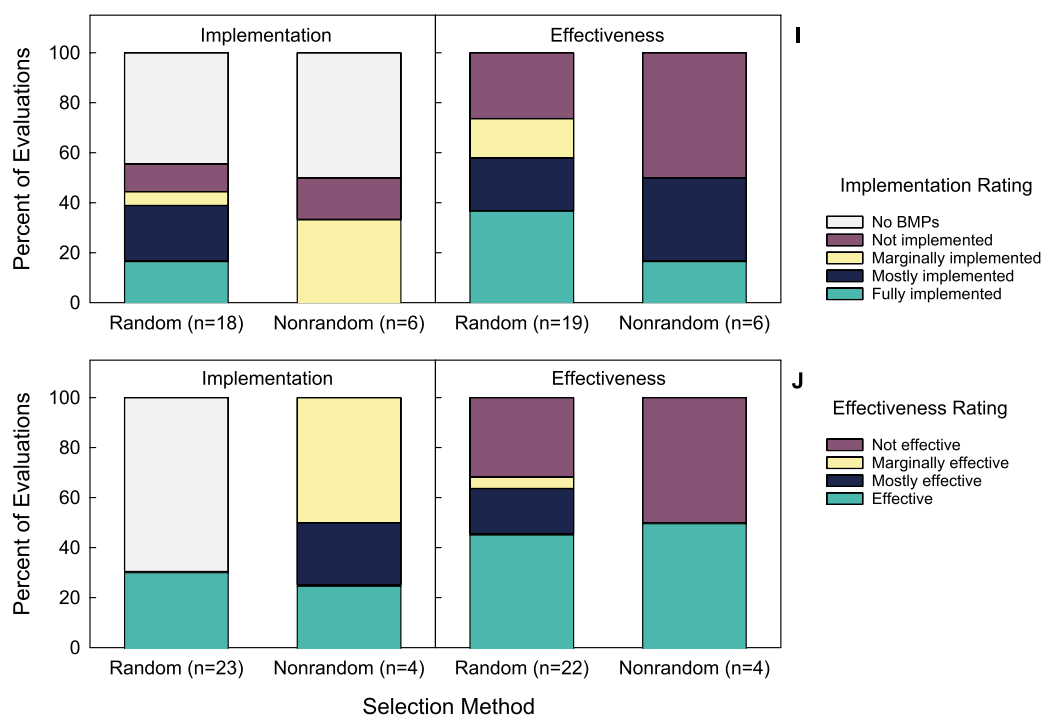


Figure 22.—Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for Rec G evaluations completed in FY15/16 (I) and FY17/18 (J).

Table 41.—Fisher’s exact test probabilities of association between implementation ratings and Recreation Management sample selection method (random or nonrandom) and effectiveness ratings and sample selection method, by Rec protocol and monitoring period. (See also Figure 22 for Rec A through Rec D and Rec G.)

Rec protocol	FY15/16 Implementation p-value ^a	FY15/16 Effectiveness p-value	FY17/18 Implementation p-value	FY17/18 Effectiveness p-value
A	0.94	0.60	0.84	0.32
B	0.80	0.34	0.79	0.03
C	0.89	0.60	0.27	0.37
D	0.34	0.97	0.07	<0.01
E	— ^b	0.50	0.50	1.00
F	1.00	1.00	— ^c	— ^c
G	0.33	0.54	<0.001	1.00
H	0.22	0.25	1.00	0.33
I	1.00	0.50	— ^c	— ^c

^a Probability of association; significant at $\alpha=0.10$.

^b No test because all evaluations had the same rating.

^c No test because all evaluations were selected randomly or nonrandomly.

Results for the Rec A through D and Rec G 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 locations, composition, and types of projects or sites.
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 back to implementation and sometimes header information to provide context between outcomes and BMP planning and prescription (including operation and maintenance prescriptions) 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 protocol 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 both 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.

A less detailed presentation of results is provided for the Rec E, Rec F, Rec H, and Rec I evaluations due to the limited sample sizes. The analyses for those protocols focus primarily on summarizing the descriptive data (header statistics) and providing an overview of the implementation and effectiveness results and the ratings and component scores.

The large number of analyses 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, but 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.

Recreation A—Developed Recreation Sites

Recreation A: Header Statistics

In FY15/16 and FY17/18, 61 and 97 developed recreation sites (Rec A), respectively, were evaluated for implementation, effectiveness, or both (Table 42). All regions except Region 10 (Alaska) completed at least 9 evaluations (see App. 1 for region delineations). Eighty-nine percent of all evaluations had both implementation and effectiveness monitoring completed (Table 42). Implementation and effectiveness monitoring were performed on a single day for all of those evaluations. Only the implementation portion

Table 42.—Number of Rec A evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Rec A-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	5			5
	2	7			7
	3	3			3
	4	3			3
	5	16		2	14
	6	5			5
	8	7		1	6
	9	15			15
	10				
	All	61	0	3	58
	Percent			5	95
FY17/18					
	1	9		1	8
	2	3			3
	3	18		7	11
	4	6		2	4
	5	19			19
	6	11	2		9
	8	19	2		17
	9	11			11
	10	1			1
	All	97	4	10	83
	Percent		4	10	86

of the evaluation was completed for 4 of the remaining 17 evaluations by the end of the monitoring period. 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. One of the evaluations for which only implementation was completed was performed near the end of the FY17/18 monitoring period (i.e., close to September 30, 2018), and the effectiveness evaluation for the site may have been completed in the next monitoring period (FY19/20). The other three implementation-only evaluations were performed in FY17 and earlier, so it is unlikely that they will be evaluated for effectiveness. Of the 158 sites evaluated, 82 percent were selected randomly (Table 40).

Although all Rec A evaluations (except one Region 1 evaluation) in FY15/16 indicated that a reason for monitoring was to meet National BMP targets, the protocol simultaneously met other monitoring needs (Table 43). Quality assurance was identified as a reason for monitoring in 11 Rec A evaluations (Table 43). For National BMP

Table 43.—Number of Rec A evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (Rec 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				1 ^a
	2	7	1	2		
	3	3				
	4	3				
	5	16	1			
	6	5	1	1		
	8	7	1			1
	9	15			1	
	10					
	All	60	4	3	1	2
FY17/18						
	1	9			3	
	2	3	2			
	3	18		2	3	
	4	6	3	1		
	5	19	1	2		
	6	11		1	1	1
	8	19	1	2	3	
	9	11				
	10	1				
	All	97	7	8	10	1

^a Unknown.

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 monitoring effort on that same site . . . [by] different team members than the initial 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 a duplicate evaluation, 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.

Approximately 77 and 84 percent of the recreation sites evaluated in FY15/16 and FY17/18, respectively, were established before approval of the administrative unit’s first land management plan (Rec A-Q18). Newer recreation sites were established between 1992 and 2008. Fifty-one sites in FY15/16 and 84 sites in FY17/18 had not been used for a special event in the 12 months prior to the evaluation (Rec A-Q19). Special events for the remaining 19 sites that answered Rec A-Q19 were most frequently community events (i.e., meetings or programs) or youth educational events, and all occurred at campgrounds or day use areas.

About 20 percent of sites in FY15/16 and 32 percent in FY17/18 normally operated year-round (Rec A-Q20; Fig. 23). Sites that opened in April or May and closed in September, October, or November (5- to 8-month seasons) comprised 55 percent of evaluations in FY15/16 and 45 percent in FY17/18. Twelve evaluations indicated the normal operating season was 1 month long (Fig. 23), which appears to have been an error; based on the types of sites described in the evaluations, it seems likely that the same opening and closing months were selected to indicate the site operated year-round. Concessionaires operated 19 of the 59 sites evaluated in FY15/16 and 22 of 96 sites in FY17/18 (Rec A-Q21). The Forest Service operated 85 percent of the recreation sites that were open year-round. Camping and picnicking were the primary uses (Rec A-Q22) for many developed recreation sites; fishing also was available at more than half the sites in each monitoring period (Fig. 24). “Other” types of primary uses were most often hiking, hunting, and shooting ranges. Multiple uses were reported for 80 percent of sites.

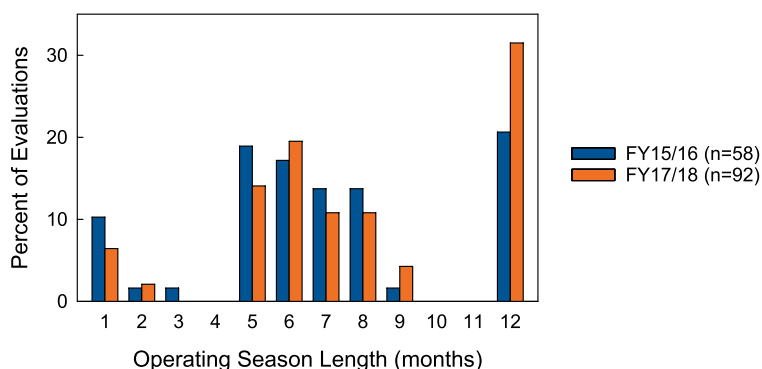


Figure 23.—Distribution of normal operating season length (Rec A-Q20) for evaluations completed in FY15/16 and FY17/18.

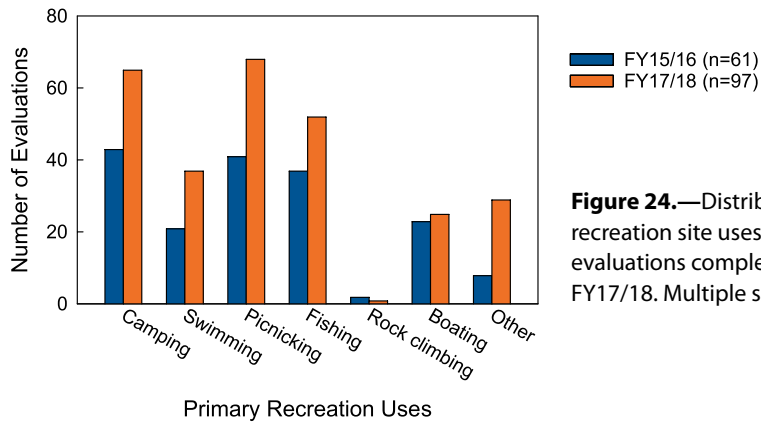


Figure 24.—Distribution of primary recreation site uses (Rec A-Q22) for evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

Of the evaluated recreation sites, 88 percent in FY15/16 and 80 percent in FY17/18 were located at least partially in an aquatic management zone¹ (AMZ) (Rec A-Q24). The remaining sites were about equally either not in an AMZ or the nearest waterbody had no designated AMZ. Recreation sites were most often nearest to perennial streams or rivers (59 and 56 percent in FY15/16 and FY17/18, respectively) or lakes (34 and 27 percent); 20 percent of all evaluations reported more than one type of waterbody (Rec A-Q26). The mean distance to the nearest waterbody (Rec A-Q25) was 72 feet (standard error [se] = 17 feet) for sites evaluated in FY15/16 and 184 feet (se = 110 feet) for those evaluated in FY17/18. Approximately 90 percent of sites had sanitation facilities (Rec A-23); for those sites, availability of facilities was not significantly associated with whether the site was in an AMZ (Rec A-Q24) in either monitoring period ($p = 1.00$ FY15/16, $p = 0.41$ FY17/18).

Recreation A: Implementation Results and Their Tie to Header Information

Twenty-six recreation sites (9 in FY15/16 and 17 in FY17/18) had unresolved maintenance needs that had been identified prior to the evaluation (Rec A-Q27). Whether the recreation site had some type of operation and maintenance (O&M) plan (Rec A-Q28a, Rec A-Q28b versus Rec A-Q28c) was not associated with whether the site had unresolved maintenance needs in either monitoring period ($p = 0.14$ FY15/16, $p = 0.42$ FY17/18), although the majority of recreation sites with unresolved needs had O&M plans: 89 percent in FY15/16 and 65 percent in FY17/18. Of the recreation sites evaluated in FY15/16 and FY17/18, respectively, 55 and 37 percent had 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 44). A location farther from a waterbody did not appear to be the reason for lack of O&M plans or the exclusion of BMPs from those plans (Fig. 25); therefore, it is not surprising that the inclusion or exclusion of BMP provisions in O&M plans, respectively, did not appear to

¹Aquatic 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 44.—Distribution of whether recreation site operation and maintenance (O&M) plan, special use authorization, or other guidance documents contain BMP protection provisions (Rec A-Q28) for Rec A 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	32	55	32	37
No; plan exists but does not have BMP provisions	6	10	14	16
No plan for the recreation site	20	35	41	47

be a function of the proximity of the facility to AMZs (Fig. 26). No significant statistical associations were found between whether recreation site O&M plans had BMPs and the proximity to an AMZ ($p = 0.91$ FY15/16, $p = 0.18$ FY17/18), although sites in AMZs had a slightly higher percentage of plans with BMPs.

Of the recreation sites evaluated for implementation, twice to three times as many were operated by the Forest Service than by concessionaires (Fig. 27). The site operator was significantly associated with whether the site had an O&M plan or other guidance documents with BMPs in each monitoring period ($p < 0.01$ for both). A higher proportion of concessionaire-operated sites had O&M plans, special use authorizations, or other O&M guidance documents with BMPs, particularly in FY15/16 (Fig. 27). Whether the recreation site had sanitation facilities (Rec A-Q23) was not significantly associated with having an O&M plan in FY15/16 ($p = 1.00$). In FY17/18, there was a significant association ($p = 0.07$) between sanitation facilities and an O&M plan; 57 percent of sites had an O&M plan when facilities were present compared to 20 percent with a plan when facilities were not present.

Assessment of operation and maintenance implementation focuses on whether BMPs in O&M guidance documents (O&M plan, special use authorization, and so on) were implemented fully (Rec A-Q29). Table 45 provides a summary of the provisions (i.e., the general category) to which individual BMPs included in the O&M guidance documents are assigned and information about whether all the BMPs from the provisions were implemented fully. A “yes” indicates that at least one BMP in the guidance documents was applicable to the provision and that all BMPs assigned to that provision were implemented fully. A “no” indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. “Not applicable” indicates that no BMPs in the guidance documents were 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 each monitoring period of Table 45 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

Prescribed BMP provisions were implemented fully in an average of 89 percent of evaluations in FY15/16 and 98 percent of evaluations in FY17/18 that had some type of BMP guidance document for operation and maintenance (Table 45). The most common

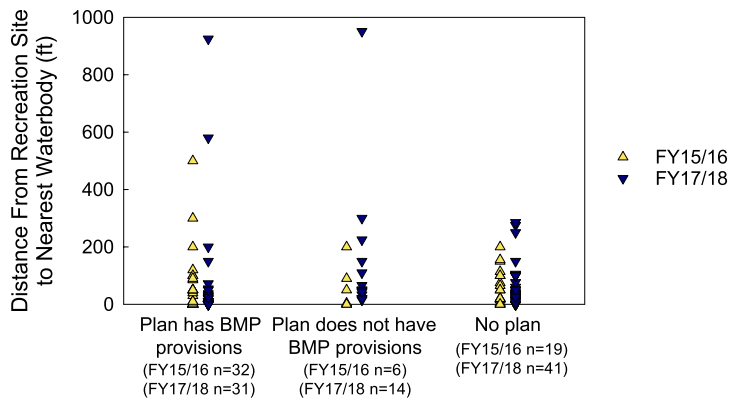


Figure 25.—Distance from recreation site to nearest waterbody (Rec A-Q25) by whether site operation and maintenance plan, special use authorization, or other guidance documents contained BMP provisions (Rec A-Q28) for evaluations completed in FY15/16 and FY17/18.

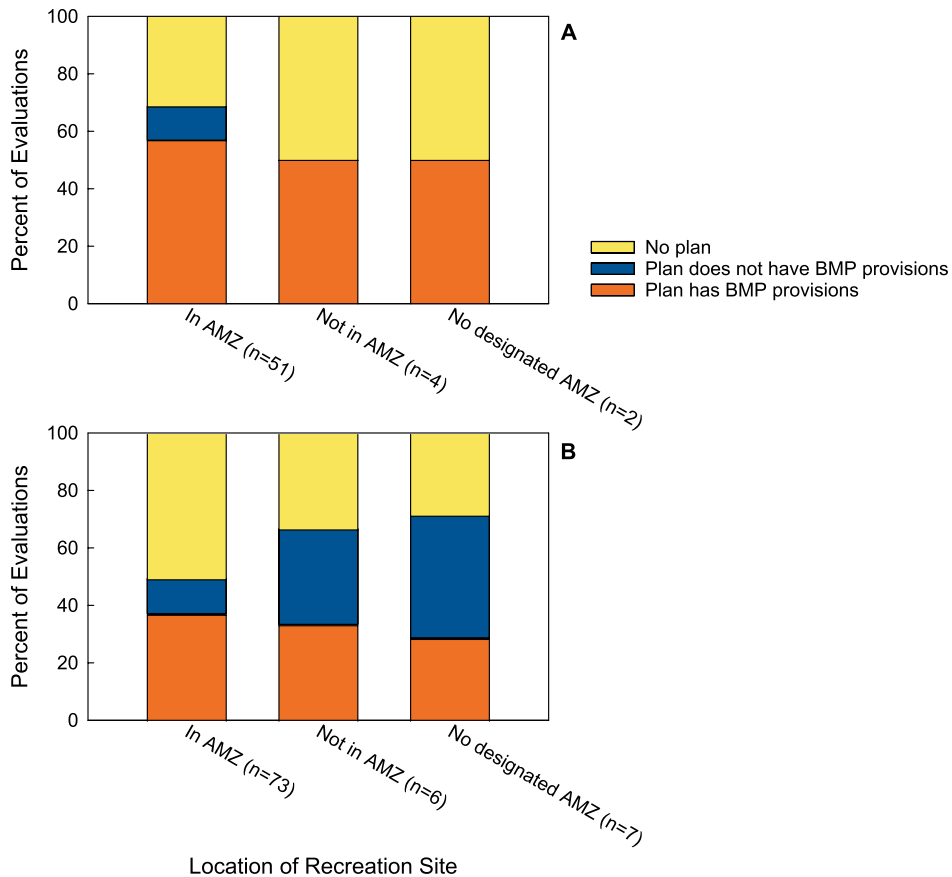


Figure 26.—Distribution of whether recreation site operation and maintenance plan, special use authorization, or other guidance documents contained BMP provisions (Rec A-Q28) by location of site (Rec A-Q24) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

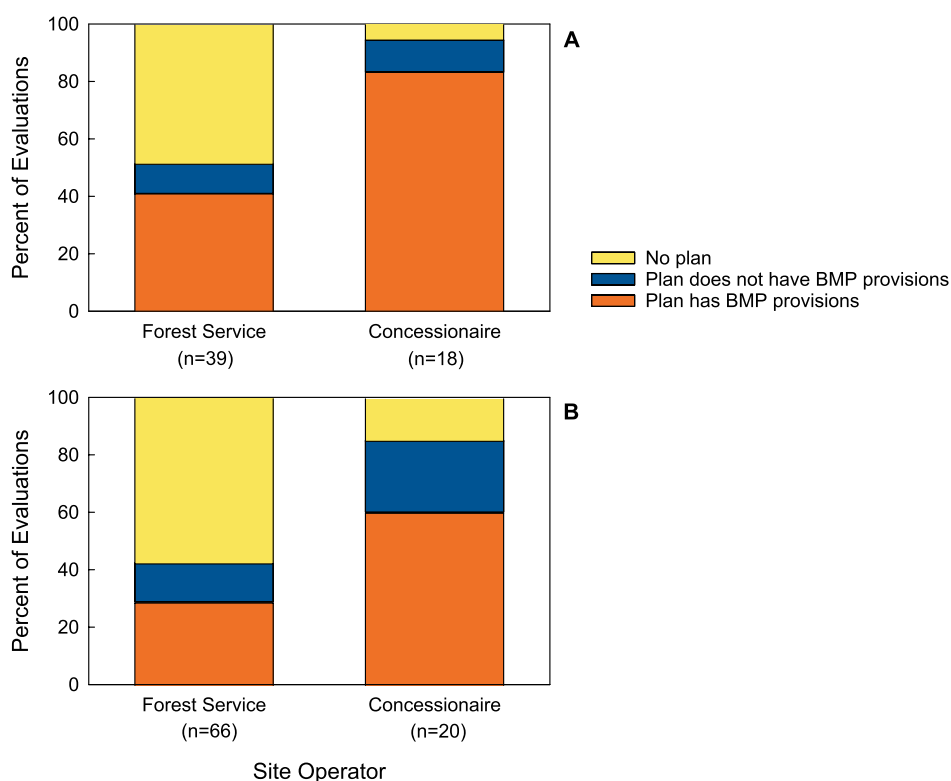


Figure 27.—Distribution of whether recreation site operation and maintenance plan, special use authorization, or other guidance documents contained BMP provisions (Rec A-Q28) by site operator (Rec A-Q21) for evaluations completed in FY15/16 (A) and FY17/18 (B).

types of BMPs prescribed were those associated with trash receptacle and permanent sanitation facility provisions. BMPs associated with cross drainage on trails in both monitoring periods and drainage and stormwater control elsewhere in FY15/16 were most likely not to be implemented fully (Table 45). BMPs in most provisions were implemented fully for 100 percent of recreation sites in FY17/18.

When the numbers and percentages of BMP provisions implemented fully were compared by evaluation, BMPs were included in seven provisions on average, and 93 percent of the BMP provisions were implemented fully per evaluation in FY15/16; in FY17/18, BMPs were included in eight provisions on average, and 98 percent were implemented fully. No significant differences were found in the percentage of BMP provisions implemented fully by site operator in either monitoring period ($p = 0.74$ FY15/16, $p = 0.34$ FY17/18; Kruskal-Wallis test). The percentages of BMPs implemented fully for recreation sites operated by the Forest Service and by concessionaires differed by less than 1 percent in each monitoring period.

Two implementation questions—Rec A-Q30 and Rec A-Q31—evaluate whether site 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

Table 45.—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 (Rec A-Q29) for Rec A evaluations completed in FY15/16 (n=32 evaluations) and FY17/18 (n=32 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)
Locations and spacings of cross drains on trails (e.g., waterbars)	6	1	24	86	14	8	0	21	100	0
Cross drainage control and techniques	7	2	22	78	22	6	1	20	86	14
Trail grades	5	1	25	83	17	11	0	19	100	0
Trail surfacing	6	1	24	86	14	9	0	19	100	0
Trail locations	8	1	22	89	11	11	0	16	100	0
Waterbody crossing techniques	5	3	23	63	37	7	0	21	100	0
Mulching and/or seeding, or other soil cover techniques	11	0	20	100	0	14	1	13	93	7
Campsite locations	14	3	14	82	18	16	1	13	94	6
Campsite surfacing	17	1	14	94	6	8	0	18	100	0
Locations and numbers of trash receptacles	19	1	12	95	5	19	0	7	100	0
Trash receptacle maintenance	23	0	9	100	0	24	0	5	100	0
Permanent sanitation facilities	25	0	7	100	0	29	1	2	97	3
Temporary (portable) sanitation facilities	4	0	27	100	0	1	0	24	100	0
Drainage and stormwater control	10	3	18	77	23	16	0	12	100	0
Maintenance requirements for roads and access routes	18	2	11	90	10	25	0	6	100	0
Maintenance requirements for parking areas	20	2	10	91	9	22	0	9	100	0
Water supply/delivery system maintenance	19	1	11	95	5	12	0	14	100	0
Aquatic invasive species control	9	0	22	100	0	6	0	19	100	0
Mean	13	1	18	89	11	14	0	14	98	2

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

^b Percent calculated from “yes” and “no” counts.

from site conditions (Table 46), and whether corrective actions were taken if problems occurred during the current operating season (at any time, not just critical times) (Table 47). Critical times are periods associated with large or intense precipitation/runoff events or other times when the potential for the site to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted during critical times during the operating season for about 50 percent of the recreation sites in each monitoring period (Table 46). Nearly 80 percent of the sites in each period had no problems requiring corrective actions any time during the operating season (Table 47).

When conditions are present that may negatively impact water, aquatic, or riparian resources, all or part of a developed recreation site may be closed or have use restricted to protect the resources (Rec A-Q32) or have treatments applied to improve conditions (Rec A-Q34). In FY15/16 and FY17/18, respectively, 8 and 20 evaluated recreation sites were closed or had restrictions on use in the 5 years prior to the evaluation (Table 48). An additional 3 sites in FY17/18 indicated that closure or use restrictions were needed but did not occur. The time between when problems were identified and the site was closed or use restricted ranged from 1 day to 6 years, although the time was 6 months or less for more than 70 percent of sites. More than one-third of sites in each monitoring period needed treatments to reduce impacts to water resources and had those treatments applied (Table 48). Treatments were applied 1 day to 12 years after a need was identified; the average was 1.5 years later in FY15/16 and 2.6 years later in FY17/18. In all, 24

Table 46.—Distribution of whether inspections occurred at critical times (Rec A-Q30) for Rec A 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	22	38	30	34
Yes	27	47	49	56
No	9	15	8	9
All	58		87	

Table 47.—Distribution of whether corrective actions (CA) were taken if problems occurred during current operating season (Rec A-Q31) for Rec A 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	46	79	65	76
CA needed but not taken	3	5	4	5
CA needed and implemented	6	10	9	10
Unknown	3	5	8	9
All	58		86	

Table 48.—Distribution of whether recreation site was closed or use was restricted (Rec A-Q32) and whether treatments were applied (Rec A-Q34) during past 5 years to reduce negative impacts to water, aquatic, or riparian resources for Rec A evaluations completed in FY15/16 and FY17/18

Action	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Site closed or use restricted				
Not applicable; no problems warranted closure or use restrictions	50	86	64	74
Needed and closed or use restricted	8	14	20	23
Needed but not closed or use not restricted	0		3	3
Treatments applied				
Not applicable; no problems warranted application of treatments	34	59	50	57
Needed and applied	22	38	30	34
Needed but not applied	2	3	7	8

recreation sites in FY15/16 (41 percent) and 40 sites in FY17/18 (46 percent) had closures or restrictions or had treatments applied or both. The reasons for those actions are summarized in Table 49. Many different “other” reasons were identified, including flooding, wildfire, and infrastructure maintenance or repairs.

Because fuel and other chemicals may be present within or around developed recreation sites, an implementation question (Rec A-Q37) 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 would follow that state agency’s procedures. Four evaluations indicated that the administrative unit did not have a CERP, and four indicated that a spill or leak that required cleanup occurred at a site; CERP procedures were followed at two of those sites.

Recreation A: Effectiveness Results and Their Tie to Implementation Results and Header Information

Developed recreation sites are evaluated for evidence of erosion and sedimentation and trash and waste at two locations: along a waterbody transect and on trails leading from the site to a waterbody. Only the most severe cases of erosion or sedimentation are reported (Rec A-Q42, Rec A-Q51) 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. All occurrences of trash and waste are reported. More than 40 percent of the recreation sites in both monitoring periods had no evidence of erosion, sedimentation, or waterbody morphology changes along the waterbody transect (Rec A-Q42); however, 59 percent of evaluations in FY15/16 and 53 percent in FY17/18 reported some evidence of erosion, sedimentation, or waterbody morphology changes (Table 50). The type of

Table 49.—Reasons recreation site was closed, use was restricted, or treatments were applied (Rec A-Q36) for Rec A evaluations completed in FY15/16 (n=24 evaluations) and FY17/18 (n=40 evaluations). Multiple selections were possible.

Reason for closure, use restriction, or application of treatments	FY15/16 (number)	FY17/18 (number)
Trampled vegetation	6	9
Soil compaction	4	7
Sheet erosion	1	6
Rill erosion	1	7
Gully erosion	0	5
Shoreline/bank erosion	6	11
Road washout	4	5
Campsite washout	4	2
Trail washout	0	2
Water quality in waterbody	1	3
Extreme precipitation/weather events	4	7
Other	7	12

Table 50.—Evidence of erosion or sedimentation observed along waterbody transect (Rec A-Q42) for Rec A evaluations completed in FY15/16 and FY17/18

Evidence observed along waterbody transect	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
No evidence	25	41	43	47
Evidence but not in waterbody	9	15	21	23
Evidence in waterbody	27	44	28	30

evidence observed (Rec A-Q44) relative to the location where the evidence was observed is presented in Table 51. The most common types of evidence observed were damage to vegetation and waterbody banks (Table 51). Three evaluations reported a type of evidence that was inconsistent with the location where evidence was reported in Rec A-Q42 (e.g., changes to waterbody geometry would not be observed outside a waterbody). Numerous sources and causes for the evidence observed were reported (Tables 52 and 53), but most of the sources and many of the “other” causes were related to inappropriate user activities.

A significant association existed between the location where sediment evidence was observed (Rec A-Q42) and the site location relative to an AMZ (Rec A-Q24) in FY15/16 ($p = 0.08$) but not in FY17/18 ($p = 0.14$). In FY15/16, no evidence was observed in the five sites not in an AMZ. Significant differences in the distance between the recreation

Table 51.—Types of evidence of erosion or sedimentation observed along waterbody transect (Rec A-Q44) for Rec A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec A-Q42 (Table 50) is applicable to Rec A-Q44.

Type of evidence	FY15/16 Evidence but not in waterbody (n=9)	FY15/16 Evidence in waterbody (n=27)	FY17/18 Evidence but not in waterbody (n=21)	FY17/18 Evidence in waterbody (n=28)
Traceable evidence to the waterbody, but not currently visible in the waterbody	5	10	5	11
Turbidity present		1		2
Evidence of localized sediment deposition in the waterbody		14	1 ^a	16
Changes to substrate composition		5		7
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)		8	2 ^a	7
Bank instability	3	12	3	17
Bank trampling or compaction	4	19	6	20
Vegetation damage or bare ground	5	19	11	22
Sheet erosion	1	8	8	11
Rill erosion	3	8	6	11
Gully erosion		5	6	3
Headcutting		1	2	4
Slumping/slips	1	5		4
Mass wasting				1
Sediment plumes or accumulations		9	4	5
Rutting	1	3	2	2
Water quality monitoring results				1

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

site and the nearest waterbody (Rec A-Q25) were found between locations where sediment evidence was observed in FY17/18 ($p = 0.03$, generalized linear mixed model [GLMM] with lognormal distribution and identity link function). When evidence was in the waterbody, the sites were less than 30 feet from a waterbody on average, compared to about 90 feet away when evidence was observed outside a waterbody and 100 feet away when no evidence was found (Fig. 28). No significant differences existed in FY15/16 ($p = 0.56$, GLMM with lognormal distribution and identity link function), although the average distances by location of the sediment evidence were similar; sites were about 40 feet away when evidence was observed in a waterbody and about 95 feet away when evidence was outside a waterbody or no evidence was observed. The location where sediment evidence was observed was significantly associated with whether the recreation site had any type of O&M guidance documents containing BMP

Table 52.—Sources of evidence of erosion or sedimentation observed along waterbody transect (Rec A-Q45) for Rec A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec A-Q42 (Table 50) is applicable to Rec A-Q45.

Source of evidence	FY15/16 Evidence but not in waterbody (n=9)	FY15/16 Evidence in waterbody (n=27)	FY17/18 Evidence but not in waterbody (n=21)	FY17/18 Evidence in waterbody (n=28)
Developed camping or day-use site	3	13	5	15
Forest Service-created trail	1	4	5	4
User-created trail	5	20	13	16
Road or parking area	4	3	6	11
Waterbody bank/shoreline	1	15	1	14
Other		1	2	4

Table 53.—Causes of evidence of erosion or sedimentation observed along waterbody transect (Rec A-Q46) for Rec A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec A-Q42 (Table 50) is applicable to Rec A-Q46.

Cause of evidence	FY15/16 Evidence but not in waterbody (n=9)	FY15/16 Evidence in waterbody (n=27)	FY17/18 Evidence but not in waterbody (n=21)	FY17/18 Evidence in waterbody (n=28)
Use is exceeding carrying capacity of the site		4		2
Inappropriate location of campsites		8	1	3
Lack of campsite maintenance		1	1	1
Inappropriate location of trails		7	4	7
Inappropriate trail design		5		2
Lack of trail maintenance				
Insufficient number of trails to the waterbody	1	5	2	2
Too many trails to the waterbody		9	1	6
Watercraft use or wave action		4	1	5
Runoff from open water valves, spigots or other plumbing sources, or plumbing leaks		1		
Runoff from roofs, or roof gutters and downspouts		1	1	2
Runoff from road or parking area	4	6	8	12
Other	7	10	8	17

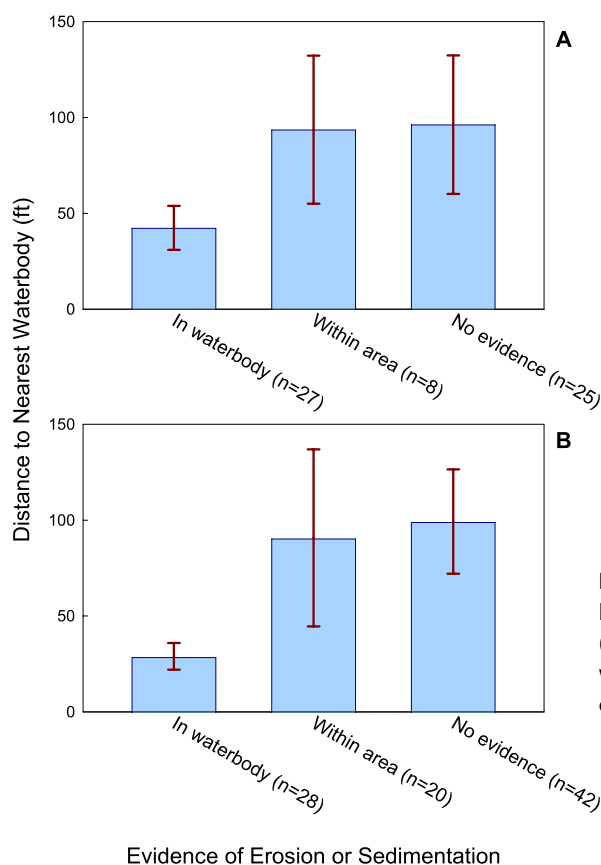


Figure 28.—Mean distance (with standard error bars) between recreation site and nearest waterbody (Rec A-Q25) by evidence of erosion observed along waterbody transect (Rec A-Q42) for evaluations completed in FY15/16 (A) and FY17/18 (B).

provisions (Rec A-Q28) in FY15/16 ($p = 0.04$) but not in FY17/18 ($p = 0.40$) (Fig. 29). In FY15/16, 50 percent of sites that had BMP provisions observed no evidence of erosion or sedimentation; 80 percent of sites that had no O&M plan or other guidance documents had observed evidence.

Trails that connected the developed site to a waterbody were evaluated for evidence of erosion and sedimentation (Rec A-Q51) at 49 recreation sites in FY15/16 and 77 sites in FY17/18; of these, 57 and 48 percent of evaluations, respectively, observed no evidence of erosion or sedimentation on or originating from the trails (Table 54). Evidence was observed within an AMZ or in a waterbody for similar numbers of evaluations in each monitoring period. Vegetation damage or bare ground was the type of evidence observed most frequently (Table 55), followed by bank trampling or compaction. Four evaluations reported a type of evidence that was inconsistent with the location where evidence was reported in Rec A-Q51. User-created trails were a source of observed evidence for 78 percent of all evaluations with evidence (Table 56), and many reported causes were related to trail characteristics (Table 57). Runoff from recreation site infrastructure, such as buildings, roads, and parking areas, also was a frequently identified cause of observed evidence.

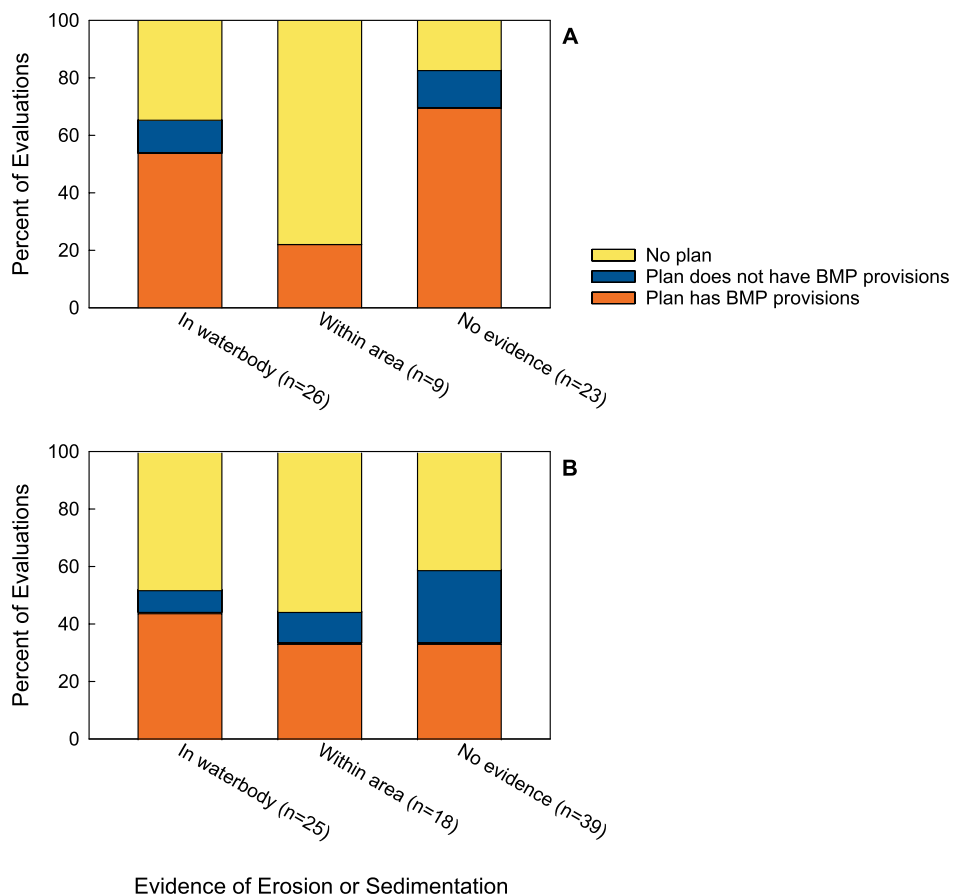


Figure 29.—Distribution of whether recreation site operation and maintenance plan, special use authorization, or other guidance documents contained BMP provisions (Rec A-Q28) by evidence of erosion observed along waterbody transect (Rec A-Q42) for evaluations completed in FY15/16 (A) and FY17/18 (B).

Weather conditions associated with the evaluation (Rec A-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to use of the recreation site and trails 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

No statistically significant associations were found between categories of erosion along the waterbody transect (Rec A-Q42) and weather conditions (i.e., wet versus dry conditions) in either monitoring period ($p = 0.22$ FY15/16, $p = 0.56$ FY17/18) (Fig. 30) or between categories of erosion on or originating from trails (Rec A-Q51) and weather conditions in FY17/18 ($p = 0.86$). There was a significant association between erosion on trails and weather in FY15/16 ($p = 0.03$) (Fig. 30); evidence in a waterbody was observed primarily during dry weather.

Table 54.—Evidence of erosion or sedimentation observed on or originating from trails (Rec A-Q51) for Rec A evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Rec A-Q53) or number of places evidence observed in a waterbody (Rec A-Q52)

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	21	43							
Outside an AMZ ^a	1	2	1						
Within an AMZ	13	27	5	7		1			
In a waterbody	14	29					6	1	7
FY17/18									
No evidence	40	52							
Outside an AMZ	2	3		1					
Within an AMZ	19	25	11	6		2			
In a waterbody	16	21					5	6	5

^a Aquatic management zone.

Trash or domestic animal or human sanitary waste evidence was observed along the waterbody transect (Rec A-Q47) or on or originating from connecting trails (Rec A-Q57) during 77 of the 154 effectiveness evaluations. Forty-seven evaluations observed trash or waste at both locations, 25 evaluations observed trash or waste only along the waterbody transect, and 5 evaluations observed evidence only on or along trails. The types of evidence observed are summarized by the location of the evidence in Table 58. Ninety-three percent of evaluations reported inconsiderate human actions as a cause of the observed evidence along the waterbody transect, and 96 percent reported the same cause for evidence observed on or along trails. Insufficient number of waste receptacles, the second most frequent cause, was reported for 22 percent of evaluations with observed evidence at either location.

During the effectiveness evaluation, the review team is instructed to estimate the percentage of the waterbody transect that has evidence of potential or current impacts to water quality (Rec A-Q50). This estimate includes all evidence of erosion and sedimentation rather than the most severe evidence reported for Rec A-Q42. Waterbody transect lengths averaged 626 feet (se = 66 feet) in FY15/16 and 583 feet (se = 57 feet) in FY17/18 and ranged from 25 feet to 2800 feet for both monitoring periods. About 75 percent of evaluations reported some evidence of erosion (Rec A-Q42), trash or waste (Rec A-Q47), or both in each monitoring period, and those evaluations had mean transect lengths slightly longer than that for all evaluations: 668 feet (se = 77 feet) in FY15/16 and 598 feet (se = 61 feet) in FY17/18. On average, the review team estimated 15 and 14 percent of the waterbody transect in FY15/16 and FY17/18, respectively, had potential or current impacts to water quality.

Table 55.—Types of evidence of erosion or sedimentation observed on or originating from trails (Rec A-Q54) for Rec A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec A-Q51 (Table 54) is applicable to Rec A-Q54.

Type of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=13)	FY15/16 In waterbody (n=14)	FY17/18 Outside an AMZ (n=2)	FY17/18 Within an AMZ (n=19)	FY17/18 In waterbody (n=16)
Traceable evidence to the waterbody, but not currently visible in the waterbody	1	3	7	1	1	9
Turbidity present		1 ^b	1		1 ^b	1
Evidence of localized sediment deposition in the waterbody		1 ^b	8		1 ^b	6
Changes to substrate composition			4		1 ^b	3
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)			5			6
Bank instability		1	7		4	10
Bank trampling or compaction		8	10		8	13
Vegetation damage or bare ground		11	11		11	11
Sheet erosion		2	5	2	3	5
Rill erosion		1	4	1	3	4
Gully erosion			4		3	2
Headcutting			1			2
Slumping/slips		2	1		1	5
Mass wasting				1		
Sediment plumes or accumulations		1	4		1	1
Rutting			2			1
Water quality monitoring results		1				

^a Aquatic management zone.

^b The type of evidence reported is incompatible with the location in which it was observed.

Table 56.—Sources of evidence of erosion or sedimentation observed on or originating from trails (Rec A-Q55) for Rec A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec A-Q51 (Table 54) is applicable to Rec A-Q55.

Source of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=13)	FY15/16 In waterbody (n=14)	FY17/18 Outside an AMZ (n=2)	FY17/18 Within an AMZ (n=19)	FY17/18 In waterbody (n=16)
Developed camping or day-use site		2	7	2	2	7
Forest Service-created trail		6	2	1	5	4
User-created trail		10	13		13	15
Road or parking area	1	1	3	1	2	4
Waterbody bank/shoreline			5		4	8
Other		2				

^a Aquatic management zone.

Table 57.—Causes of evidence of erosion or sedimentation observed on or originating from trails (Rec A-Q56) for Rec A evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec A-Q51 (Table 54) is applicable to Rec A-Q56.

Cause of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=13)	FY15/16 In waterbody (n=14)	FY17/18 Outside an AMZ (n=2)	FY17/18 Within an AMZ (n=19)	FY17/18 In waterbody (n=16)
Use is exceeding carrying capacity of the site			2			
Inappropriate location of campsites			3	1	1	3
Lack of campsite maintenance			1		1	
Inappropriate location of trails		2	5		6	8
Inappropriate trail design		1	4		2	3
Lack of trail maintenance		2			2	
Insufficient number of trails to the AMZ or waterbody		3	3		1	1
Too many trails to the AMZ or waterbody		1	7		3	5
Watercraft use or wave action						
Runoff from open water valves, spigots or other plumbing sources, or plumbing leaks						1
Runoff from roofs, or roof gutters and downspouts	1	2	3	1	3	6
Runoff from road or parking area	1	6		1	6	7
Other			2			

^a Aquatic management zone.

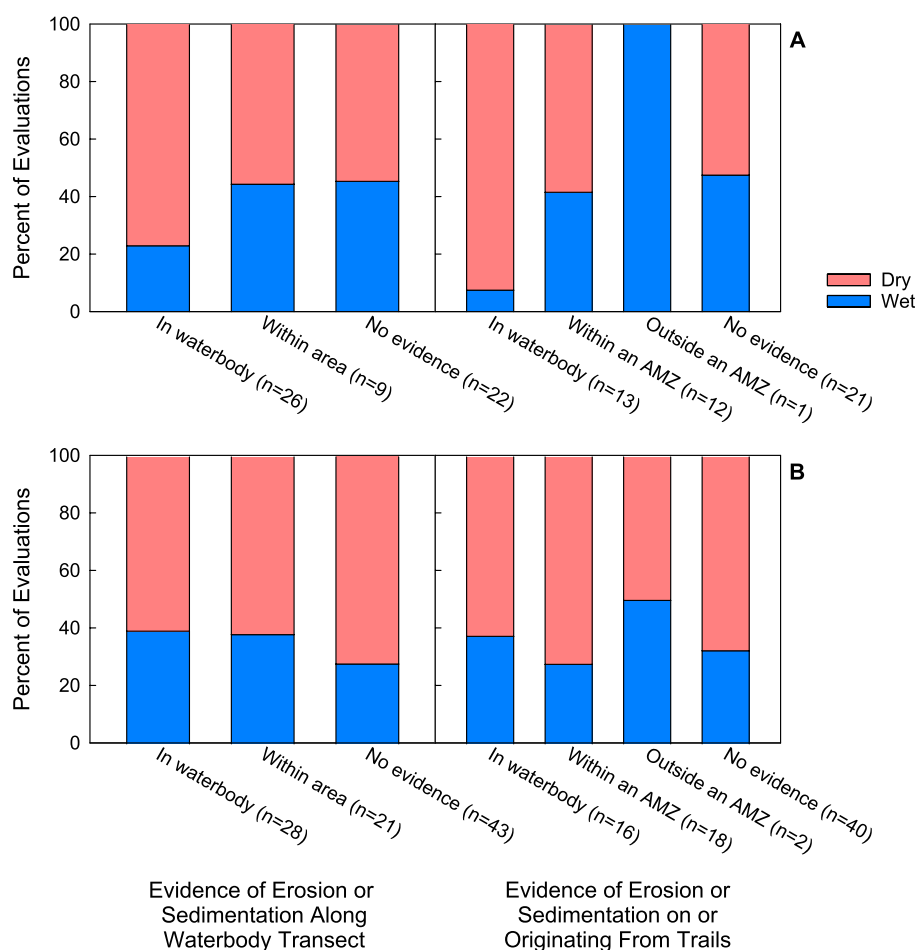


Figure 30.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion along waterbody transect (Rec A-Q42; left panels) and on or originating from trails (Rec A-Q51; right panels) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

Evaluated connecting trails varied by number (Rec A-Q59) and length (Rec A-Q61) and by whether they were created by the Forest Service or users. Approximately 61 percent of trails evaluated in FY15/16 and 69 percent in FY17/18 were created by recreation site users, although the percentage of the evaluated length of these trails was slightly less—59 percent of the total length in FY15/16 and 61 percent in FY17/18—than the evaluated length of trails created by the Forest Service. Mean total trail lengths evaluated were 543 feet (se = 114 feet) in FY15/16 and 512 feet (se = 76 feet) in FY17/18. Similar to the waterbody transect lengths, evaluations that reported observed evidence of erosion or sedimentation, trash or waste, or both on or along trails had mean evaluated trail lengths of 579 feet (se = 138 feet) in FY15/16 and 607 feet (se = 100 feet) in FY17/18.

The presence of chemical spills, leaks, or chemical waste containers is determined during the effectiveness evaluations. Such evidence can include pollutants observed during the operating season but not reported, pollutants not yet cleaned up even if reported,

Table 58.—Evidence of trash or domestic animal or human sanitary waste observed along waterbody transect (Rec A-Q47) and on or originating from trails (Rec A-Q57) for Rec A evaluations completed in FY15/16 (n=61 waterbody transect evaluations and n=49 trail evaluations) and FY17/18 (n=93 waterbody transect evaluations and n=77 trail evaluations). Multiple selections were possible.

Monitoring period	Evidence	Waterbody transect evidence but not in waterbody (number)	Waterbody transect evidence in a waterbody (number)	Trails evidence outside an AMZ ^a (number)	Trails evidence within an AMZ (number)	Trails evidence in a waterbody (number)
FY15/16						
	Trash	24	7	8	15	4
	Domestic animal or human sanitary waste	10	0	2	8	0
FY17/18						
	Trash	35	13	9	20	5
	Domestic animal or human sanitary waste	14	1	3	8	0

^a Aquatic management zone.

or pollutants not previously observed or known to exist. The results indicate that considerable care was taken to prevent chemical contamination at developed recreation sites; spills or leaks were observed outside an AMZ for two evaluations each in FY15/16 and FY17/18 (Rec A-Q63), and one additional evaluation in FY17/18 observed waste containers within an AMZ.

In the Rec A protocol, four sets of paired implementation and effectiveness questions assess unresolved maintenance needs (Rec A-Q27 and Rec A-Q64), inspections (Rec A-Q30 and Rec A-Q65), and site closures (Rec A-Q32 and Rec A-Q66) or treatments (Rec A-Q34 and Rec A-Q66). Respectively, the questions ask whether site administration or lack thereof influenced BMP effectiveness. Only one effectiveness question (Rec A-Q66) assesses the effectiveness of both site closures and treatments, which limits the comparisons to sites that had closures or use restrictions (Rec A-Q32) and to sites that had treatments applied (Rec A-Q34). Tables 59 through 62 show the relationships between the pairs of questions for recreation sites 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 the paired comparisons because some number of incompatible answer choices were selected (shaded cells) based on the protocol instructions. Of the evaluations that followed the protocol instructions (unshaded cells), 17 sites had unresolved maintenance needs, and 59 percent of those sites reported that those needs contributed to observed effectiveness problems (Table 59). Lack of inspections or inspections not conducted at critical times contributed to observed problems for 5 sites (Table 60). Three recreation sites had a closure or use restriction without applied treatments (Table 61), which limited the usefulness of the comparison. For the sites that had needed treatments applied without site closure or use restrictions, the desired results from the treatments were fully or partially achieved (Table 62).

Table 59.—Distribution of whether recreation site had unresolved maintenance needs (Rec A-Q27) in relationship to problems observed during effectiveness monitoring (Rec A-Q64) for Rec A evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (23 and 21 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Site has unresolved maintenance needs (implementation)	Not applicable; no unresolved maintenance needs (effectiveness)	Yes; unresolved maintenance needs led to observed problems (effectiveness)	No; unresolved maintenance needs did not lead to observed problems (effectiveness)
FY15/16				
	Yes	2	3	4
	No	37	4	7
FY17/18				
	Yes	4	7	3
	No	53	1	12

Table 60.—Occurrence of inspections performed at critical times (Rec A-Q30) in relationship to problems observed during effectiveness monitoring (Rec A-Q65) for Rec A evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (28 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 (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	7	2	12
	Yes; inspections at critical times	19	1	5
	No; inspections not at critical times	2	1	5
FY17/18				
	No inspections	6	1	20
	Yes; inspections at critical times	35	3	8
	No; inspections not at critical times	2	1	5

Table 61.—Distribution of whether site was closed or use was restricted (Rec A-Q32) in relationship to whether desired results were achieved by the closure or restrictions^a (Rec A-Q66) for Rec A evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (2 percent of FY17/18 responses).

Monitoring period	Site closed or use restricted (implementation)	Not applicable; no closure or use restrictions (effectiveness)	Desired results fully achieved (effectiveness)	Desired results partially achieved (effectiveness)	No improvement (effectiveness)	Too soon to determine (effectiveness)
FY15/16						
	Not applicable; no closure or use restriction	31				
	Needed and closed or use restricted					
	Needed but not closed or use not restricted					
FY17/18						
	Not applicable; no closure or use restriction	45				
	Needed and closed or use restricted	1	2			
	Needed but not closed or use not restricted					

^a Includes only recreation sites that had closures or use restrictions and no treatments applied.

Table 62.—Distribution of whether site had treatments applied (Rec A-Q34) in relationship to whether desired results were achieved by the treatments^a (Rec A-Q66) for Rec A evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (26 and 8 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Treatments were applied (implementation)	Not applicable; no treatments (effectiveness)	Desired results fully achieved (effectiveness)	Desired results partially achieved (effectiveness)	No improvement (effectiveness)	Too soon to determine (effectiveness)
FY15/16						
	Not applicable; no treatments needed	31				
	Needed and applied	12	2			
	Needed but not applied	1				
FY17/18						
	Not applicable; no treatments needed	45				
	Needed and applied	5	2	3		
	Needed but not applied	4				

^a Includes only recreation sites that had treatments applied and no site closures or use restrictions.

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

In FY15/16 and FY17/18, less than 25 percent of the Rec A sites were rated as *fully implemented*. The combination of sites rated as *not implemented* and *no BMPs* was 45 and 63 percent in FY15/16 and FY17/18, respectively (Fig. 31). More of the Rec A sites were rated as *not effective* than *effective* in each period; the difference in FY17/18 was 2 percent. One evaluation in FY17/18 lacked responses in the database for questions needed to determine both the implementation and effectiveness ratings, and six evaluations lacked responses needed for the effectiveness rating (identified as “incomplete data” in Fig. 31).

The site operator was significantly associated with the implementation ratings in each monitoring period ($p < 0.01$ for both) but was not significantly associated with the effectiveness ratings in either period ($p = 0.51$ FY15/16, $p = 0.58$ FY17/18). Implementation ratings were poorer in FY15/16 but better in FY17/18 for sites operated by the Forest Service versus those operated by concessionaires (Fig. 32). Effectiveness ratings were poor for about 50 percent of sites, regardless of the operator. When comparing ratings by site location relative to an AMZ, there were no significant associations between the implementation ratings and the site locations ($p = 0.98$ FY15/16, $p = 0.40$ FY17/18). There was a significant association for the effectiveness ratings in

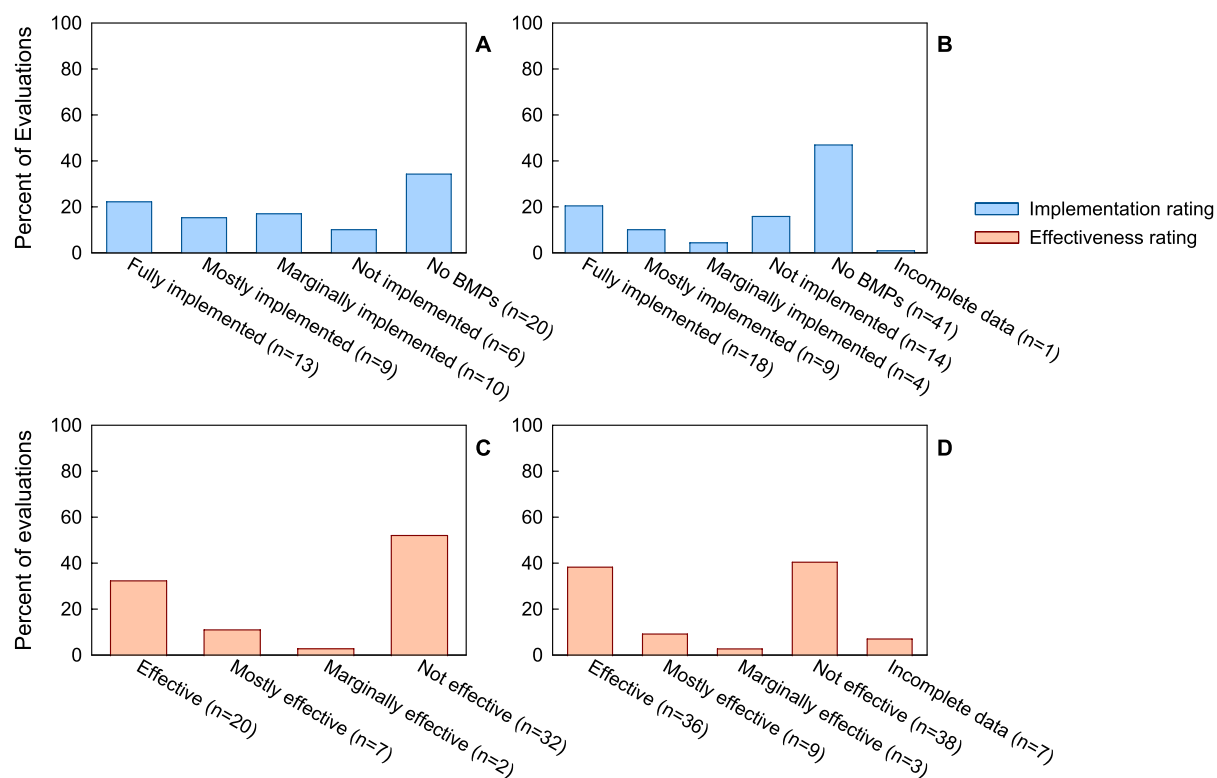


Figure 31.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Rec A evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

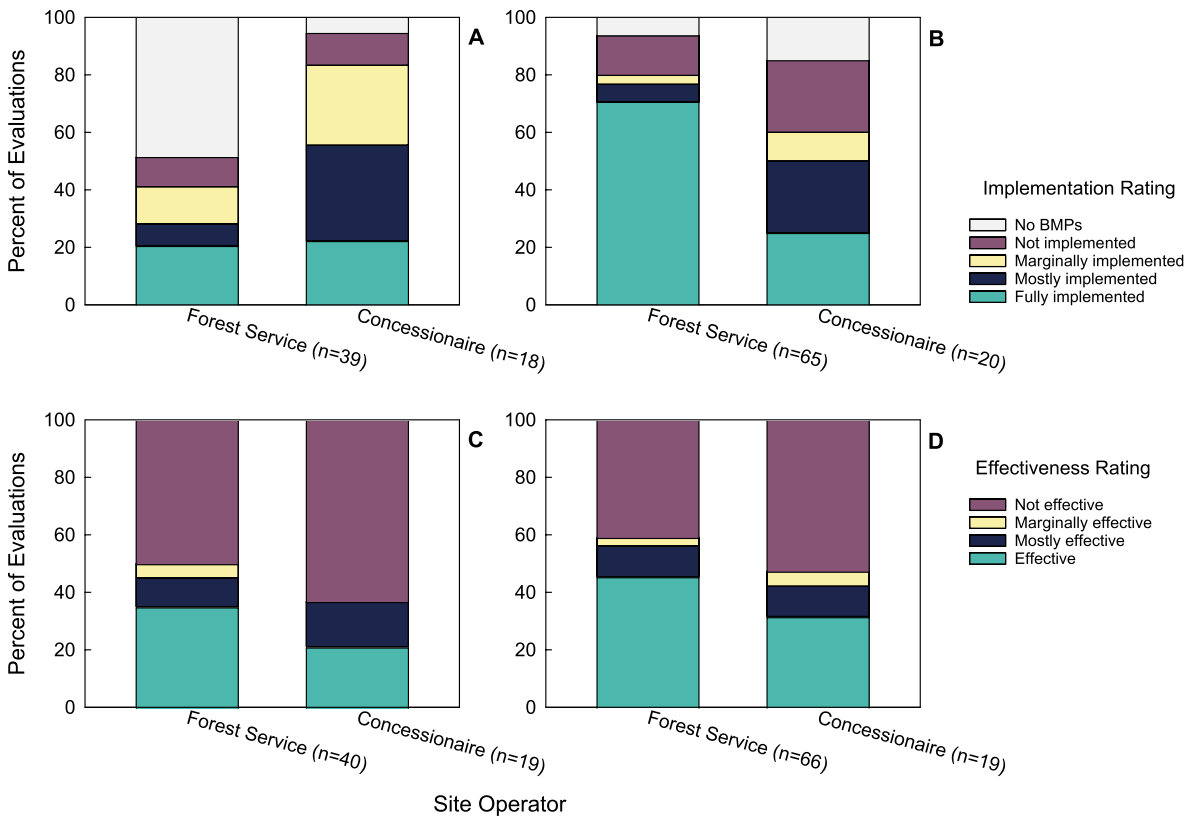


Figure 32.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by recreation site operator (Rec A-Q21) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

FY15/16 ($p = 0.04$) and a very nearly significant association in FY17/18 ($p = 0.10$). Sites not in an AMZ had better effectiveness ratings (Fig. 33).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Rec A-Q16) were not associated with the effectiveness ratings in either monitoring period ($p = 0.21$ FY15/16, $p = 0.17$ FY17/18) (Fig. 34). About half as many evaluations were conducted in wet weather than in dry weather, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential. Relationships between weather conditions and field observations of erosion, sedimentation, or morphological effects (e.g., Fig. 30) 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.

The effectiveness ratings were significantly associated with whether recreation sites had unresolved maintenance needs in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 0.23$). In both periods, 70 percent or more of sites with maintenance needs had the poorest rating (Fig. 35). There were no significant associations between the effectiveness ratings and whether O&M guidance documents existed and included BMPs for the recreation sites ($p = 0.46$ FY15/16, $p = 0.98$ FY17/18) (Fig. 36), an unsurprising result given the percentage of poor effectiveness ratings. The number of BMP provisions implemented

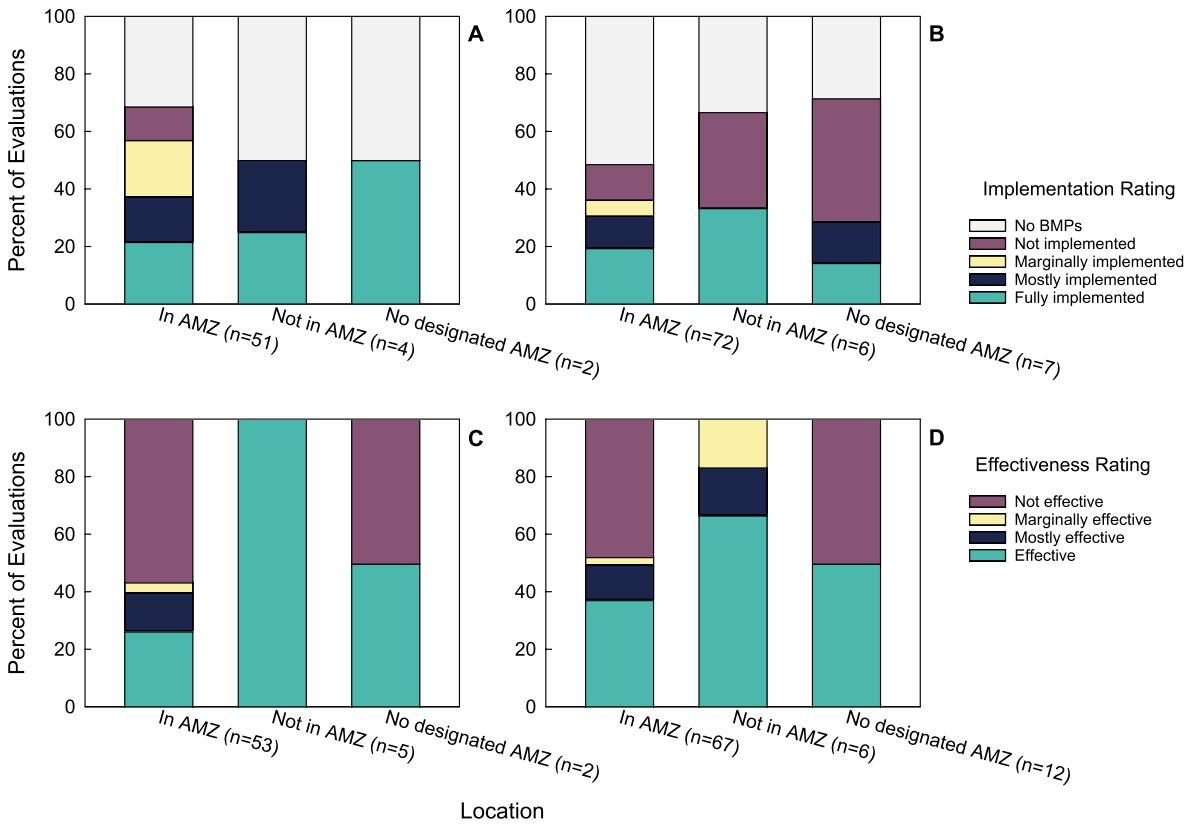


Figure 33.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by recreation site location (Rec A-Q24) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). AMZ = aquatic management zone.

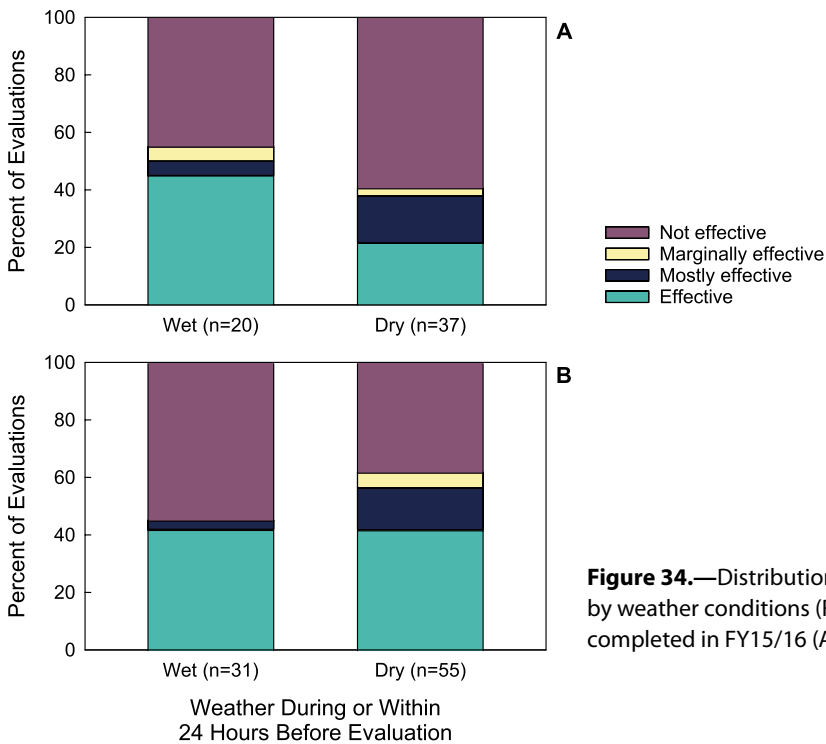


Figure 34.—Distribution of effectiveness ratings by weather conditions (Rec A-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

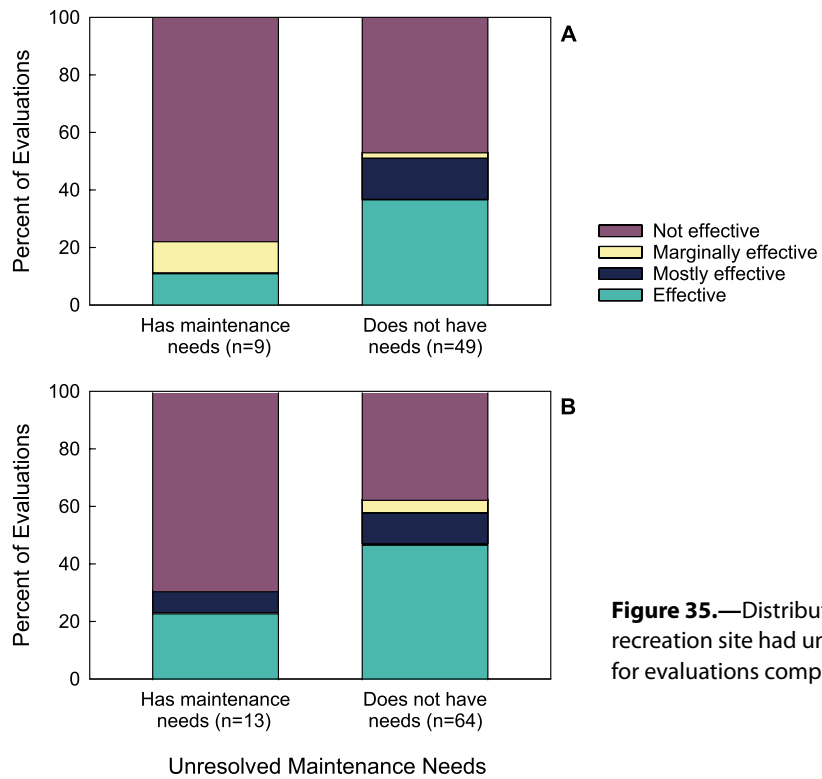


Figure 35.—Distribution of effectiveness ratings by whether recreation site had unresolved maintenance needs (Rec A-Q27) for evaluations completed in FY15/16 (A) and FY17/18 (B).

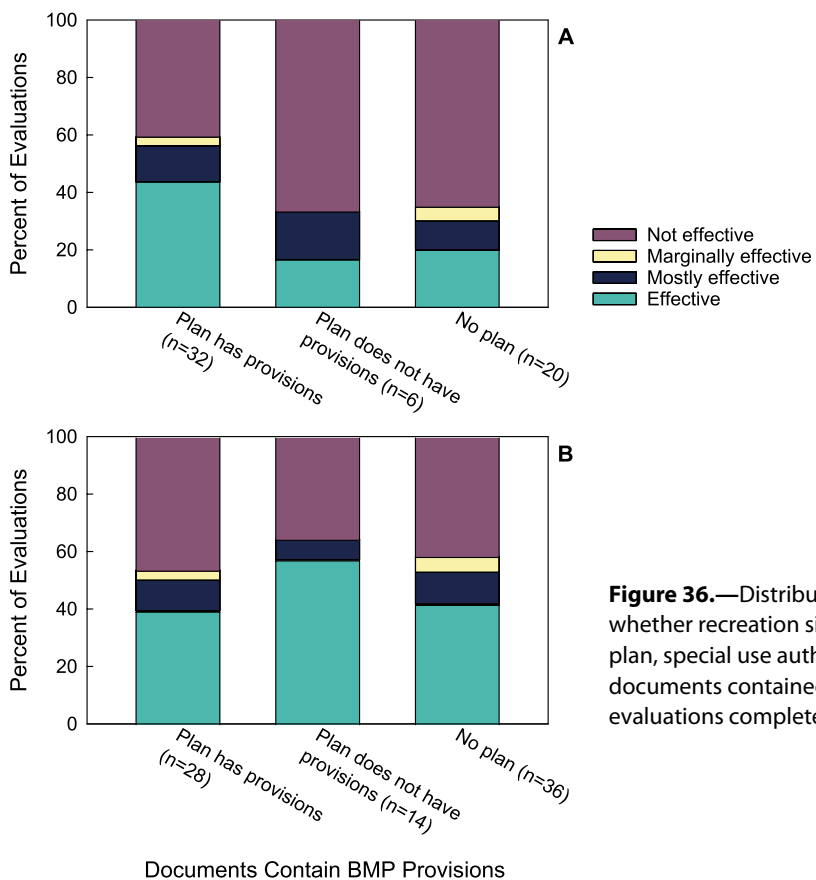


Figure 36.—Distribution of effectiveness ratings by whether recreation site operation and maintenance plan, special use authorization, or other guidance documents contained BMPs (Rec A-Q28) for evaluations completed in FY15/16 (A) and FY17/18 (B).

fully (Rec A-Q29) was not significantly different between the effectiveness ratings in either monitoring period ($p = 0.81$ FY15/16, $p = 0.84$ FY17/18; GLMM with negative binomial distribution and log link function). Evaluations averaged from five to seven provisions implemented fully in FY15/16 and from six to eight in FY17/18 across the effectiveness ratings. Mean percentages of BMPs implemented fully in FY15/16 were more variable across the effectiveness ratings—ranging from 83 to 99 percent—and a significant difference was found ($p = 0.02$, Kruskal-Wallis test). Recreation sites rated *effective* had a significantly higher percentage of BMPs implemented fully compared to those rated *marginally effective* or *not effective*. In FY17/18, the percentages of BMPs implemented fully ranged from 98 to 100 percent, and no significant differences were found ($p = 0.87$, Kruskal-Wallis test).

Of the recreation sites evaluated for effectiveness, 14 percent in FY15/16 and 26 percent in FY17/18 had been closed or had use restrictions. Whether the site was closed was not significantly associated with effectiveness ratings in either monitoring period ($p = 0.58$ FY15/16, $p = 0.25$ FY17/18). When closure was not needed, about 10 percent more evaluations were rated *effective* than when site closure or use restriction was needed. A larger percentage of recreation sites had treatments applied to reduce impacts to water resources (Table 48) than were closed. Whether treatments were applied was not significantly associated with effectiveness ratings in FY15/16 ($p = 0.80$), but a significant association was found in FY17/18 ($p < 0.01$). Ratings were better when treatments were not needed or needed and applied (Fig. 37).

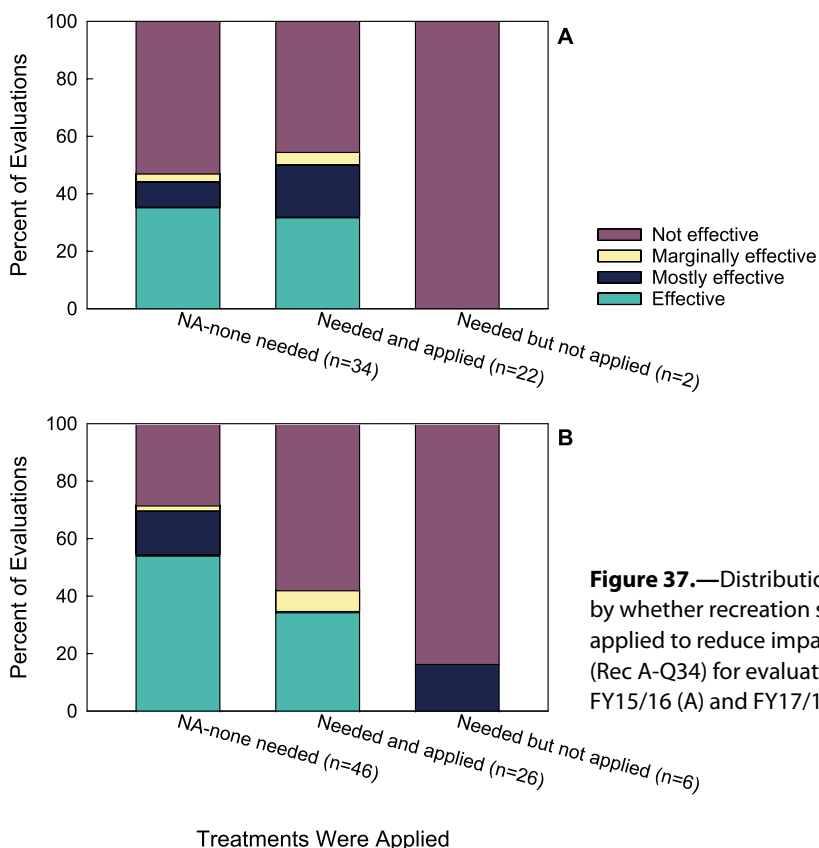


Figure 37.—Distribution of effectiveness ratings by whether recreation site had treatments applied to reduce impacts to water resources (Rec A-Q34) for evaluations completed in FY15/16 (A) and FY17/18 (B). NA = not applicable.

During the implementation portion of the evaluation, review of documents and inquiries with site administrators occur to determine whether corrective actions were taken if problems were observed during the operating season (Rec A-Q31). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. Significant associations were not found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in either monitoring period ($p = 0.75$ FY15/16, $p = 0.12$ FY17/18). As with many of the statistical tests between implementation metrics and effectiveness ratings, the high percentage of *not effective* ratings has limited the usefulness of these comparisons (Fig. 38).

Two additional questions that ask whether corrective actions 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.

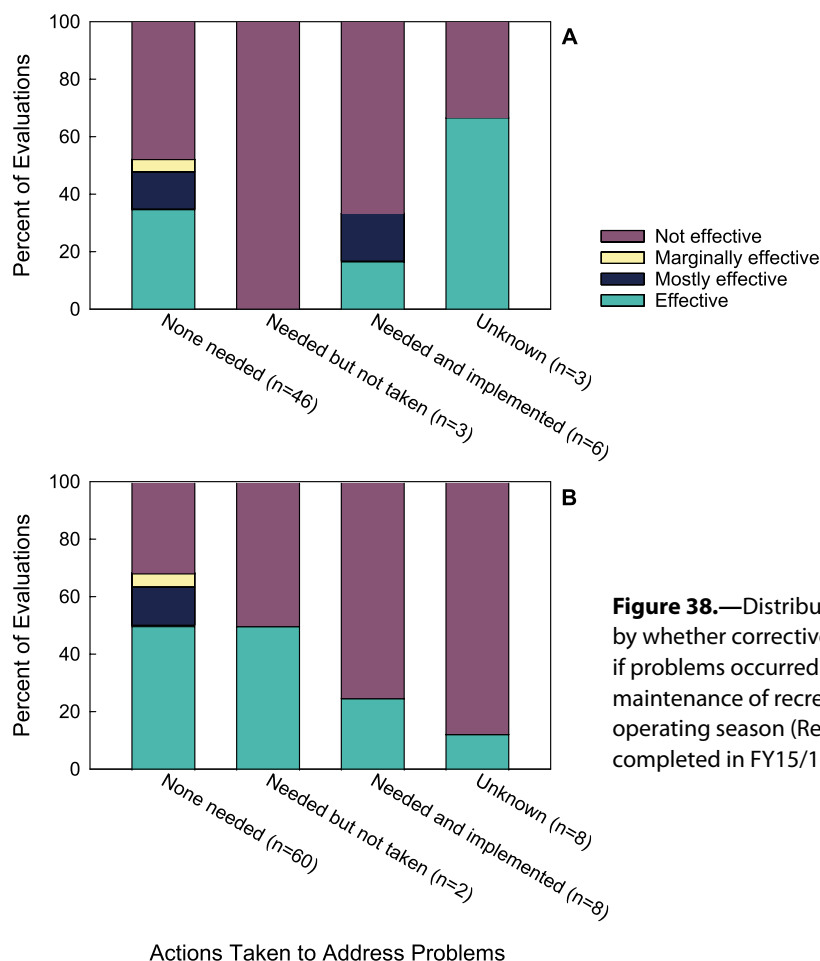


Figure 38.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during operation and maintenance of recreation site during the current operating season (Rec A-Q31) for evaluations completed in FY15/16 (A) and FY17/18 (B).

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 of BMPs applicable to the project or site; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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 facilities every operating season to ensure those standards are met or initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations that identified needed corrective actions or adaptive management actions was about 25 to 50 percent of those that identified no needed actions (Fig. 39). There were no significant associations in FY15/16 among implementation ratings and corrective action needs ($p = 0.38$), but significant associations were found among implementation ratings and adaptive management action needs ($p = 0.09$). This result is not surprising given the poorer implementation ratings when adaptive management actions were needed (Fig. 39). In FY17/18, a significant association existed

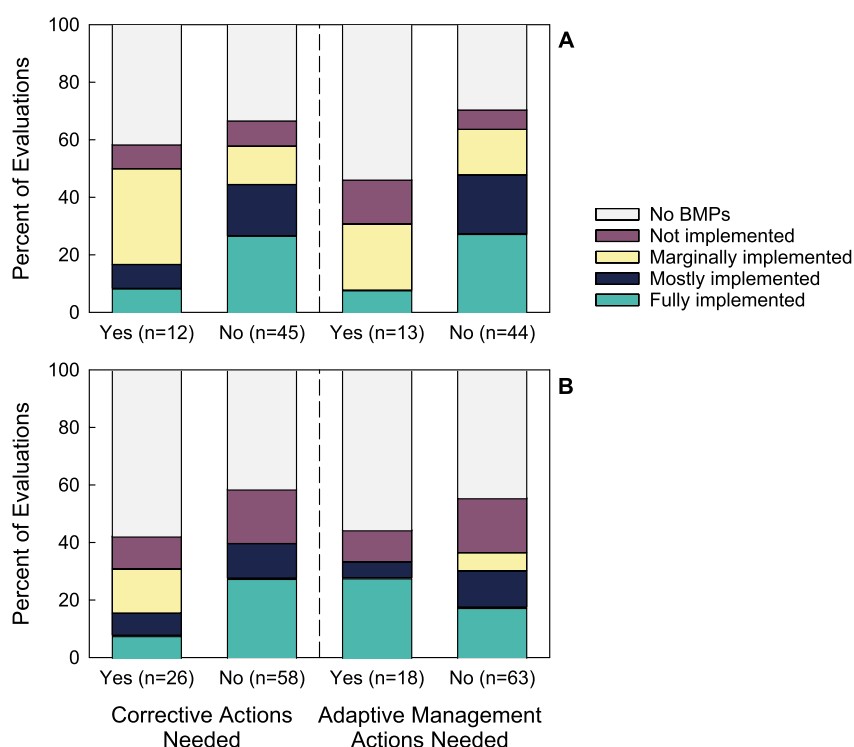


Figure 39.—Distribution of implementation ratings by whether corrective actions (Rec A-Q38) or adaptive management actions (Rec A-Q40) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

between corrective action needs and implementation ratings ($p < 0.01$) (Fig. 39) but not between adaptive management action needs and ratings ($p = 0.62$). By contrast, there were significant associations among effectiveness ratings and whether corrective actions were needed in each monitoring period ($p < 0.001$ FY15/16, $p < 0.01$ FY17/18) and also among effectiveness ratings and whether adaptive management actions were needed in FY17/18 ($p < 0.01$). Better effectiveness ratings are associated with sites for which no corrective actions were identified as being needed as well as with sites that had no adaptive management action needs identified (Fig. 40).

Some evaluations were rated as *not implemented*, *no BMPs*, or *not effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. The individual evaluations reported some type of less-than-optimal performance or condition primarily related to lack of planning or erosion and sedimentation, so the expected response to at least one of those questions would have been that some corrective or adaptive management action was needed. The 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 applied 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

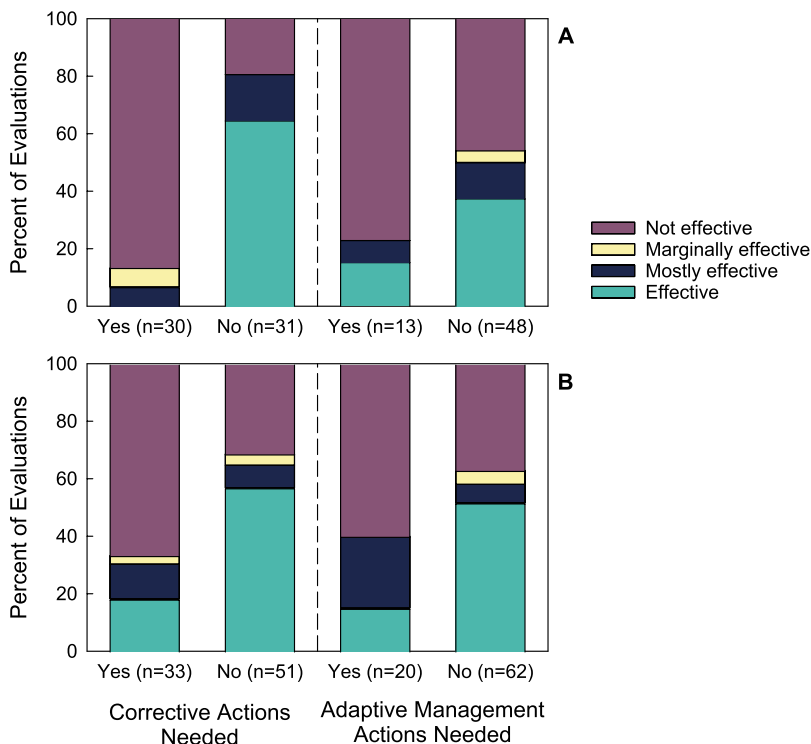


Figure 40.—Distribution of effectiveness ratings by whether corrective actions (Rec A-Q67) or adaptive management actions (Rec A-Q69) were needed to improve effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

adaptive management actions unnecessary. However, it is possible that the team may have overlooked problems that led to poorer ratings that could have been identified during consideration of Rec A-Q38, Rec A-Q40, Rec A-Q67, and Rec A-Q69.

Composite Ratings

Composite rating results for developed recreation sites that were evaluated for both implementation and effectiveness are given in Table 63. In both monitoring periods, 17 percent of sites had a composite rating of *excellent*, 12 percent were rated as *good*, just over 25 percent were rated as *poor*, and 41 percent (56 sites) were rated as *no plan* because no BMPs were prescribed. When the distribution of implementation ratings was statistically compared to the distribution of effectiveness ratings, a significant association between implementation ratings and effectiveness ratings was found in FY15/16 ($p = 0.04$) but not in FY17/18 ($p = 0.98$). For the sites evaluated in FY15/16, better implementation ratings tended to result in better effectiveness ratings. In FY17/18, better implementation occurred across all levels of effectiveness and poor effectiveness occurred across all levels of implementation.

Table 63.—Composite rating matrix for Rec A sites evaluated for both implementation and effectiveness in FY15/16 (n=58 evaluations) and FY17/18 (n=78 evaluations). Numbers in cells indicate the number of evaluations 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	8	5	1	1	4
	Mostly effective	3		1	1	2
	Marginally effective			1		1
	Not effective	2	4	7	4	13

FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective	7	3	1	8	15
	Mostly effective	1	1	1	1	4
	Marginally effective	1				2
	Not effective	8	3	2	5	15

Excellent
 Good
 Fair
 Poor
 No plan

Recreation A: Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings for Rec A were determined from component scores (Tables 64 and 65). When a site evaluation did not include connecting trails between the site and a waterbody, the missing component was scored as *no trails* (Table 65) and did not influence the final effectiveness rating. Table 66 shows the distribution of scores across the three implementation components. Thirty-one of the recreation sites had *all* scores for all three implementation components, which resulted in implementation ratings of *fully implemented* (Table 67). Lack of O&M guidance documents resulted in a *no BMPs* planning component score for 61 sites but also in an *all* score for the on-the-ground execution component (i.e., no O&M documents is equivalent to all provisions being implemented fully). On-the-ground execution is important to the overall implementation rating; the 14 sites rated as *marginally implemented* had *all* scores for the planning component but had prescribed BMPs that were not implemented fully (Table 67).

The project oversight component score for Rec A is based on four metrics: inspections (Rec A-Q30), need for corrective actions (Rec A-Q31), need for site closures or use restrictions (Rec A-Q32), and need for treatments (Rec A-Q34). Lack of inspections or inspections not conducted at critical times resulted in a *some* score for the project oversight component for 64 of the 76 recreation sites with that score (Table 66). Four additional sites lacked inspections and had a deficiency in one or two other metrics, and eight sites had inspections but had a deficiency in another metric—most frequently treatments that were needed but not applied. Two sites scored as *none* for the project oversight component due to deficiencies in the three metrics other than inspections.

Table 64.—Implementation components, scores, and interpretation of each score used for determining overall implementation ratings for Rec A, Rec B, Rec D, Rec E, Rec F, Rec G (operation and maintenance), and Rec I protocols

Implementation component	Component score	Score interpretation
Planning	All	Operation and maintenance (O&M) documents for the site contain BMP provisions
	No BMPs prescribed	O&M documents exist for the site but do not contain BMP provisions
	No O&M	No O&M documents exist for the site
On-the-ground execution	All	All BMPs included in the O&M documents were implemented fully
	Some	Some of the BMPs included in the O&M documents were implemented fully, but at least one was not
	None	None of the BMPs included in the O&M documents were implemented fully
Project oversight	All	All necessary corrective actions identified during implementation were implemented
	Some	Some, but not all, of the necessary corrective actions identified during implementation were implemented
	None	No necessary corrective actions identified during implementation were implemented

Table 65.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for Rec A and Rec B protocols

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-waterbody transect	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-trails	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 trails	No connecting trails from site to a waterbody; does not affect the effectiveness rating
Trash and waste-waterbody transect	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
Trash and waste-trails	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No trails	No connecting trails from site to a waterbody; does not affect the effectiveness rating
Chemical pollutants	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect

The distribution of scores across the five effectiveness components is summarized in Tables 68 and 69. The erosion and sedimentation components had approximately twice as many *not effective* scores compared to the other components in each monitoring period (Table 68). Fifty-six of the evaluations in both monitoring periods had scores of *effective* (or *no trails*) for all five components, resulting in an effectiveness rating of *effective* (Table 69). The *not effective* scores for the erosion and sedimentation-waterbody transect component resulted in an effectiveness rating of *not effective* for 62 of the 70 evaluations with that rating (Table 69) and led to the bimodal distribution of the effectiveness ratings (Fig. 31).

Effectiveness component scores were analyzed to determine whether associations existed between the component scores and the implementation ratings (Fig. 41). A significant association was found for the erosion and sedimentation-waterbody transect component in FY15/16 ($p < 0.01$). All other association test results were not significant (erosion

Table 66.—Distribution of implementation component scores by component for Rec 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=58)							
	All	32	55	48	83	22	38
	Some ^a			10	17	36	62
	None ^a						
	No BMPs prescribed ^b	6	10				
	No O&M ^{b,c}	20	34				
FY17/18 (n=87)							
	All	32	37	83	95	44	51
	Some			4	5	40	46
	None					2	2
	No BMPs prescribed	14	16				
	No O&M	41	47				
	Incomplete data ^d					1	1

^a Score applies only to on-the-ground execution and project oversight components (see Table 64).

^b Score applies only to planning component (see Table 64).

^c Operation and maintenance.

^d Some of the questions needed to determine a component score were not answered.

and sedimentation-waterbody transect: $p = 0.56$ FY17/18; erosion and sedimentation-trails: $p = 0.35$ FY15/16, $p = 0.96$ FY17/18; trash and waste-waterbody transect: $p = 0.38$ FY15/16, $p = 0.33$ FY17/18; trash and waste-trails: $p = 0.58$ FY15/16, $p = 0.15$ FY17/18; chemical pollutants: no test FY15/16, $p = 1.00$ FY17/18). The distributions of the overall effectiveness ratings across the BMP implementation component scores are shown in Figure 42. No significant associations existed in either monitoring period for the planning or on-the-ground execution components (planning: $p = 0.46$ FY15/16, $p = 0.98$ FY17/18; on-the-ground execution: $p = 0.14$ FY15/16, $p = 0.42$ FY17/18). There was a significant association between the effectiveness ratings and the project oversight component scores in FY15/16 ($p = 0.04$) but not in FY17/18 ($p = 0.80$). BMP effectiveness was better in FY15/16 (Fig. 42) when inspections occurred and actions were taken if needed (sites closed or use restricted, treatments applied, or other corrective actions taken).

Table 67.—Implementation component scores corresponding to the overall implementation ratings for Rec A evaluations completed in FY15/16 and FY17/18. See Table 64 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=58)					
	Fully implemented	All	All	All	13
	Mostly implemented	All	All	Some	9
	Marginally implemented	All	Some	All	2
		All	Some	Some	8
	Not implemented	No Rx ^a	All	All	1
		No Rx	All	Some	5
	No BMPs	No O&M ^b	All	All	6
		No O&M	All	Some	14
FY17/18 (n=86)					
	Fully implemented	All	All	All	18
	Mostly implemented	All	All	Some	9
	Marginally implemented	All	Some	All	2
		All	Some	Some	2
	Not implemented	No Rx	All	All	11
		No Rx	All	Some	3
	No BMPs	No O&M	All	All	13
		No O&M	All	Some	26
		No O&M	All	None	2

^a No BMPs prescribed.

^b Operation and maintenance.

Table 68.—Distribution of effectiveness component scores by component for Rec A evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Erosion and sedimentation-waterbody transect component (number)	Erosion and sedimentation-waterbody transect component (percent)	Erosion and sedimentation-trails component (number)	Erosion and sedimentation-trails component (percent)	Trash and waste-waterbody transect component (number)	Trash and waste-waterbody transect component (percent)	Trash and waste-trails component (number)	Trash and waste-trails component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=61)											
	Effective	26	43	23	47	45	74	37	76	61	100
	Mostly effective ^a	6	10	4	8						
	Moderately effective ^b					11	18	7	14		
	Marginally effective ^a	1	2	2	4						
	Not effective	28	46	20	41	5	8	5	10		
	No trails ^c			12	-- ^c			12	--		
FY17/18 (n=93)											
	Effective	50	54	44	55	69	74	63	79	89	96
	Mostly effective	5	5	7	9						
	Moderately effective					13	14	10	13	1	1
	Marginally effective	1	1	3	4						
	Not effective	35	38	22	27	10	11	5	6		
	No trails			13	--			13	--		
	Incomplete data ^d	2	2	4	5	1	1	2	2	3	3

^a Score applies only to all erosion and sedimentation components (see Table 65).

^b Score applies only to all trash and waste and chemical pollutants components (see Table 65).

^c Not included in calculation of percentages.

^d Some of the questions needed to determine a component score were not answered.

Table 69.—Effectiveness component scores corresponding to the overall effectiveness ratings for Rec A evaluations completed in FY15/16 and FY17/18. See Table 65 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Erosion and sedimentation-waterbody transect component	Erosion and sedimentation-trails component	Trash and waste-waterbody transect component	Trash and waste-trails component	Chemical pollutants component	Number of evaluations
FY15/16 (n=61)							
	Effective	Effective	Effective	Effective	Effective	Effective	20
	Mostly effective (n=7)	Effective	Effective	Moderately effective	Moderately effective	Effective	2
		Effective	Mostly effective	Effective	Effective	Effective	1
		Effective	Mostly effective	Effective	Moderately effective	Effective	1
		Mostly effective	Effective or no trails	Effective	Effective or no trails	Effective	2
		Mostly effective	Mostly effective	Moderately effective	Effective	Effective	1
	Marginally effective (n=2)	Marginally effective	Effective	Effective	Effective	Effective	1
		Effective	Marginally effective	Effective	Effective	Effective	1
	Not effective (n=32)	Effective	Not effective	Effective	Effective	Effective	1
		Effective	Not effective	Not effective	Not effective	Effective	1
		Mostly effective	Marginally effective	Not effective	Effective	Effective	1
		Mostly effective	Not effective	Effective	Effective	Effective	1
		Not effective	Effective	Effective	Effective	Effective	4
		Not effective	Effective	Moderately effective	Not effective	Effective	1
		Not effective	No trails	Effective	No trails	Effective	4
		Not effective	Mostly effective	Moderately effective	Not effective	Effective	1
		Not effective	Not effective	Effective	Effective	Effective	9
		Not effective	Not effective	Moderately effective	Effective	Effective	2
		Not effective	Not effective	Moderately effective	Moderately effective	Effective	4
		Not effective	No trails	Not effective	No trails	Effective	1
		Not effective	Not effective	Not effective	Not effective	Effective	2

(continued)

Table 69.—(continued)

Monitoring period	Effectiveness rating	Erosion and sedimentation-waterbody transect component	Erosion and sedimentation-trails component	Trash and waste-waterbody transect component	Trash and waste-trails component	Chemical pollutants component	Number of evaluations
FY17/18 (n=86)							
	Effective	Effective	Effective	Effective	Effective	Effective	36
	Mostly effective (n=9)	Effective	Effective	Effective	Moderately effective	Effective	1
		Effective	Effective or no trails	Moderately effective	Effective or no trails	Effective	3
		Effective	Effective	Moderately effective	Moderately effective	Effective	1
		Effective	Mostly effective	Effective	Effective	Effective	2
		Effective	Mostly effective	Moderately effective	Effective	Effective	1
		Mostly effective	Effective	Effective	Effective	Effective	1
	Marginally effective (n=3)	Effective	Marginally effective	Effective	Effective	Effective	1
		Mostly effective	Marginally effective	Effective	Effective	Effective	1
		Marginally effective	No trails	Effective	No trails	Effective	1
	Not effective (n=38)	Effective	Not effective	Effective	Effective	Effective	2
		Mostly effective	Not effective	Effective	Effective	Effective	2
		Not effective	Effective or no trails	Effective	Effective or no trails	Effective	5
		Not effective	Effective	Moderately effective	Effective	Effective	3
		Not effective	Effective	Moderately effective	Moderately effective	Effective	2
		Not effective	No trails	Not effective	No trails	Effective	1
		Not effective	Effective	Not effective	Moderately effective	Effective	2
		Not effective	Marginally effective	Effective	Effective	Effective	1
		Not effective	Mostly effective	Effective	Moderately effective	Effective	1
		Not effective	Mostly effective	Not effective	Effective	Effective	1
		Not effective	Mostly effective	Not effective	Not effective	Effective	1
		Not effective	Not effective	Effective	Effective	Effective	8
		Not effective	Not effective	Effective	Not effective	Effective	1
		Not effective	Not effective	Moderately effective	Moderately effective	Effective	2
		Not effective	Not effective	Moderately effective	Not effective	Moderately effective	1
		Not effective	Not effective	Not effective	Effective	Effective	2
		Not effective	Not effective	Not effective	Moderately effective	Effective	1
		Not effective	Not effective	Not effective	Not effective	Effective	2

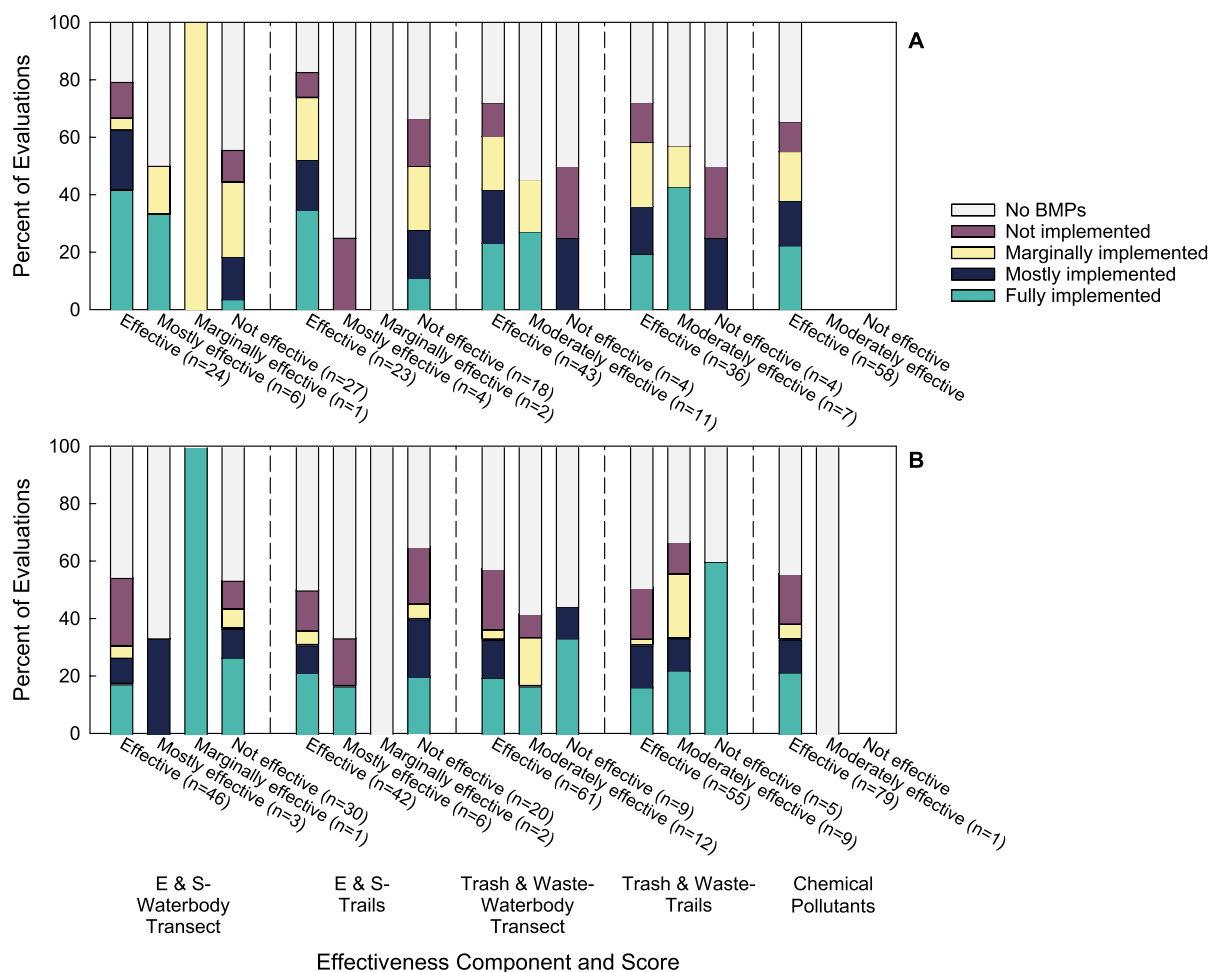


Figure 41.—Distribution of implementation ratings across effectiveness component scores for Rec A evaluations completed in FY15/16 (A) and FY17/18 (B). E & S = erosion and sedimentation.

Recreation A: Management Implications for Forest Service Managers

Thirty-five percent of the developed recreation sites rated either *fully implemented* or *mostly implemented* for BMP implementation, and 56 percent rated either *not implemented* or *no BMPs*. In the context of Rec A, *not implemented* means that an O&M plan or similar documents exist for the site but do not contain BMPs. *No BMPs* means that no O&M plan or other document exists for the site. Project planning was a deficiency at more than half of the sites due to the lack of those documents or lack of BMPs in those documents. Of the three implementation components, the on-the-ground execution component had the highest scores; 90 percent of sites had a score of *all*. When BMPs were prescribed, they were implemented fully at an average rate of 94 percent. Deficiencies in project oversight were found in 54 percent of the evaluations. When a deficiency in project oversight occurred, it was most frequently due to a lack of inspections at critical times; 84 percent of the evaluations scored *some* for the project oversight component for that reason.

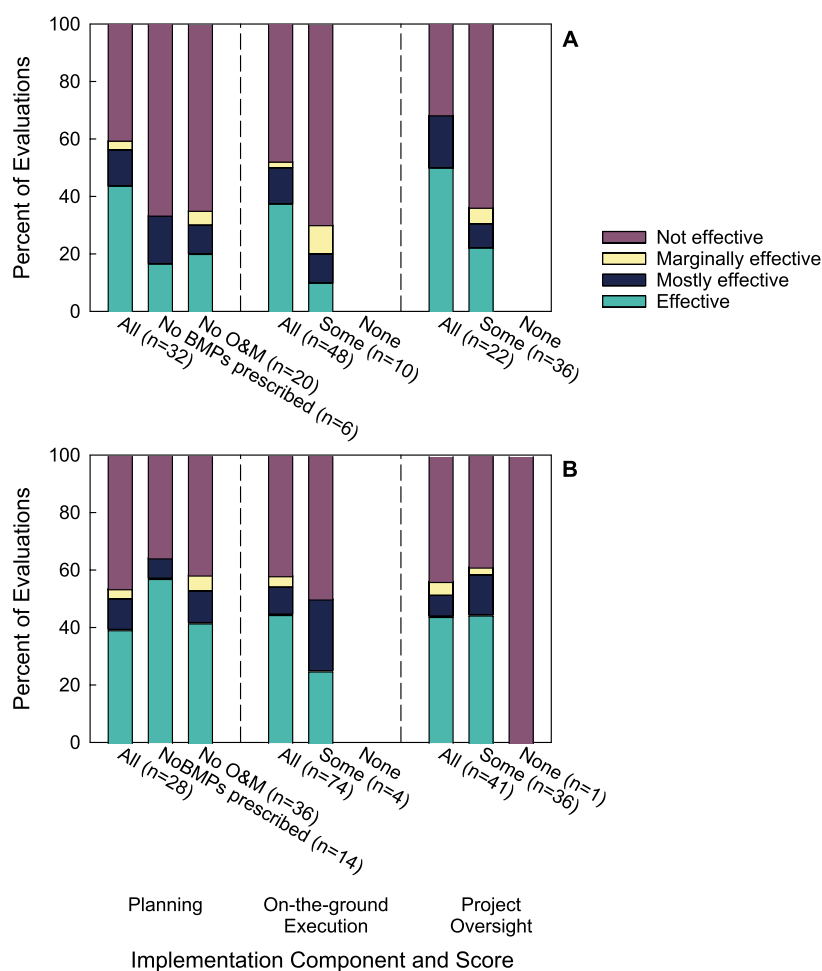


Figure 42.—Distribution of effectiveness ratings across implementation component scores for Rec A evaluations completed in FY15/16 (A) and FY17/18 (B). O&M = operation and maintenance.

For BMP effectiveness, 49 percent of the sites rated *effective* or *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. Forty-eight percent of sites were rated *not effective*, indicating that impacts to water quality were occurring. Of the sites rated *not effective*, 88 percent had a *not effective* score for the erosion and sedimentation-waterbody transect component, and 55 percent had that score for the erosion and sedimentation-trails component. Scores for the trash and waste-waterbody transect and trash and waste-trails components were *not effective* for 17 and 10 percent, respectively, of the sites with a *not effective* rating.

Evidence of erosion or sedimentation was observed along the waterbody transect at 56 percent of the developed recreation sites. When such evidence of erosion or sedimentation was observed, it was primarily vegetation damage or bare ground and bank trampling or compaction. The source reported most frequently was user-created trails, and the causes reported most frequently were inappropriate location of trails and too

many trails. Runoff from a road or parking area was also frequently reported as a cause of erosion or sedimentation along the waterbody transect. At nearly half of the sites with connecting trails, evidence of erosion or sedimentation on or from the connecting trails was found within 50 feet of the waterbody or in the waterbody. The evidence reported was primarily vegetation damage or bare ground and bank trampling or compaction. Seventy-eight percent of the evaluations with erosion and sedimentation along the connecting trails reported a user-created trail as the source. Again, the causes reported most frequently were inappropriate location of trails, too many trails, and runoff from a road or parking area.

Evidence of trash or domestic animal or sanitary waste was observed at 50 percent of the sites. Inconsiderate human action was identified as the cause in more than 90 percent of those evaluations; insufficient number of waste receptacles was reported in 22 percent.

Examination of the Rec A data provides some evidence that better BMP implementation results in better BMP effectiveness at these sites. A significant association was found between the implementation ratings and effectiveness ratings for evaluations completed in FY15/16 but not in FY17/18. In FY15/16, sites with better implementation ratings tended to have better effectiveness ratings. In total, when the implementation rating was *fully implemented* or *mostly implemented*, a greater percentage of sites were rated *effective* or *mostly effective* (61 percent) than *marginally effective* or *not effective* (39 percent). When the implementation rating was *marginally implemented*, *not implemented*, or *no BMPs*, a smaller percentage of those sites were rated *effective* or *mostly effective* (44 percent) than *marginally effective* or *not effective* (56 percent).

A closer look at individual rating components and metrics also provides some evidence that BMP implementation improved effectiveness ratings, particularly for sites evaluated in FY15/16. For example, sites evaluated in that period and rated *effective* had a greater percentage of BMPs implemented fully than sites rated *marginally effective* or *not effective*. A significant association was found between the implementation ratings and the erosion and sedimentation-waterbody transect component scores, in that better implementation resulted in a better effectiveness score. A significant association was also found between the effectiveness ratings and the project oversight component scores—better project oversight resulted in better effectiveness ratings. For sites evaluated in FY17/18, effectiveness ratings were better when treatments were not needed or were needed and applied.

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

- Ensuring that developed recreation sites operated by the Forest Service have O&M plans or similar documents with BMPs. A greater percentage of sites operated by a concessionaire had an O&M plan or similar document with BMPs than did sites operated by the Forest Service. Although no significant association was found between the existence of O&M documents and effectiveness ratings, a significant association was found in FY15/16 between evidence of erosion and sedimentation observed along the waterbody transect and the existence

of O&M documents containing BMPs. Of the sites with O&M documents containing BMPs, 50 percent reported no evidence of erosion or sedimentation; of the sites without O&M documents, 80 percent reported evidence of erosion or sedimentation.

- Locating developed recreation sites outside of the AMZ. Sites located outside of the AMZ had better effectiveness ratings than sites located within the AMZ. This association was significant for sites evaluated in FY15/16 and nearly significant in FY17/18. There was also a significant association for sites evaluated in FY15/16 between the location of the erosion or sedimentation observed along the waterbody transect and the location of the site within the AMZ. No evidence of erosion and sedimentation was observed along the waterbody transect at sites located outside the AMZ. Similarly, for sites evaluated in FY17/18, there were significant differences in the distance between the developed recreation site and the nearest waterbody among the locations of evidence observed along the waterbody transect. For evaluations with evidence of erosion or sedimentation observed in the waterbody, the average distance between the recreation site and the waterbody was less than 30 feet. When no evidence was observed, the average distance was about 100 feet.
- Increasing administration of developed recreation sites. In addition to O&M documents that lacked BMPs, project oversight, including a lack of inspections at critical times, was a deficiency in BMP implementation. For sites evaluated in FY15/16, a significant association was found between better project oversight, including inspections and corrective actions taken when problems were found, and better effectiveness ratings.
- Increasing maintenance of developed recreation sites. Seventy percent of sites with maintenance needs had the poorest effectiveness ratings. A significant association was found between sites with unresolved maintenance needs evaluated in FY15/16 and effectiveness ratings. In addition, the time elapsed between when problems were identified and treatments were applied averaged more than 1 year.
- Reducing the number of user-created trails at developed recreation sites. More than 60 percent of the connecting trails evaluated were user-created. Evidence of erosion and sedimentation observed along the waterbody transect contributed to *not effective* ratings for 88 percent of evaluated sites, and evidence on or from connecting trails contributed to *not effective* ratings for 55 percent of sites. User-created trails were the most frequently reported source of erosion and sedimentation along the waterbody transect and connecting trails. Inappropriate locations and too many trails were among the most frequently reported causes of the erosion and sedimentation observed at these sites.

Recreation A: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Rec A. Developed Recreation Sites

(Reference BMPs Rec-1, Rec-2, Rec-4, and Rec-9)

v3.0 February 2016

Header	
Rec A-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec A-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec A-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec A-Q4	Date of current field evaluation:
Rec 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:
Rec 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:
Rec A-Q7	Reviewers and titles:
Rec A-Q8a	Region number:
Rec A-Q8b	State:
Rec A-Q9a	Proclaimed Forest or Grassland number and name:
Rec A-Q9b	Administrative Forest or Grassland number and name:
Rec A-Q10	District number and name:
Rec A-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec 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: a. Yes b. No 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:
Rec A-Q12	6 th level HUC number and name for the subwatershed this site is in:
Rec A-Q13	Is any part of the site being evaluated located within a municipal supply watershed? Select one: a. Yes b. No
Rec A-Q14a	Location. UTM Zone: UTM Datum:
Rec A-Q14b	Location. Easting:
Rec A-Q14c	Location. Northing:
Rec A-Q15a	Location. Latitude:
Rec A-Q15b	Location. Longitude:
Rec A-Q15c	Location. Lat/Long Datum:
Rec A-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec A-Q17	Name of developed recreation site:
Rec A-Q18	Was this site established prior to the unit's first land management plan? Select one: a. Yes b. No If No, what year was it established?

continued on next page

Header (continued)	
Rec A-Q19	Was this site used for a special event during the past 12 months? Select one: a. Yes b. No If Yes, give name of event and dates of event:
Rec A-Q20	Dates site is normally open for use (month to month):
Rec A-Q21	Who operates this site? Select one: Forest Service Concessionaire
Rec A-Q22	What are the primary recreation uses at this site? Select all that apply: Camping Swimming Picnicking Fishing Rock climbing Boating Other (specify):
Rec A-Q23	Are sanitation facilities available at this site? Select one: a. Yes b. No
Rec A-Q24	Is any part of this site located within an AMZ? Select one: a. Yes b. No c. Waterbody has no designated AMZ
Rec A-Q25	Distance from site to nearest waterbody (ft or m; specify unit):
Rec A-Q26	Type of waterbody adjacent to waterbody transect. Select all that apply: Ephemeral stream Intermittent stream Perennial stream/river Pond Lake Wetland/wet meadow Estuary Other (specify):
Implementation	
Rec A-Q27	Are there any unresolved maintenance needs related to water, aquatic, or riparian resources that were identified for this site prior to this evaluation? Select one: a. Yes b. No If Yes, what needs are unresolved?
Rec A-Q28	Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this site contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 29) b. Plan, SUP, or other O&M guidance documents exist for this site, but they do not contain provisions for water/aquatic/riparian protection (go to question 30) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this site (go to question 30)

continued on next page

Implementation (continued)

Rec A-Q29	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 in the operating season to require implementation, select Not applicable. a. Locations and spacings of cross drains on trails (e.g., waterbars) Yes/No/Not applicable b. Cross drainage control and techniques Yes/No/Not applicable c. Trail grades Yes/No/Not applicable d. Trail surfacing Yes/No/Not applicable e. Trail locations Yes/No/Not applicable f. Waterbody crossing techniques Yes/No/Not applicable g. Mulching and/or seeding, or other soil cover techniques Yes/No/Not applicable h. Campsite locations Yes/No/Not applicable i. Campsite surfacing Yes/No/Not applicable j. Locations and numbers of trash receptacles Yes/No/Not applicable k. Trash receptacle maintenance Yes/No/Not applicable l. Permanent sanitation facilities Yes/No/Not applicable m. Temporary (portable) sanitation facilities Yes/No/Not applicable n. Drainage and stormwater control Yes/No/Not applicable o. Maintenance requirements for roads and access routes Yes/No/Not applicable p. Maintenance requirements for parking areas Yes/No/Not applicable q. Water supply/delivery system maintenance Yes/No/Not applicable r. Aquatic invasive species control Yes/No/Not applicable s. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec A-Q30	Were inspections during this operating season performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No

continued on next page

Implementation (continued)	
Rec A-Q31	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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec A-Q32	Has the recreation site or portions of it been closed, or have restrictions been placed on use during the normal operating season within the past 5 years to protect or restore water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted closure or use restriction (go to question 34) b. Needed and closed or use restricted (go to question 33) c. Needed but not closed or use not restricted (go to question 34)
Rec A-Q33	What length of time passed between when the problem was identified and the closure or use restriction was implemented? (days, weeks, months, or years; specify unit):
Rec A-Q34	Were any treatments applied to this site during the past 5 years to reduce negative impacts to water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted application of treatments (go to question 36) b. Needed and applied (go to question 35) c. Needed but not applied (go to question 36) If applied, describe the treatments:
Rec A-Q35	What length of time passed between when the problem was identified and the treatment was applied? (days, weeks, months, or years; specify unit):
Rec A-Q36	Why was the site closed, use restricted, and/or treatments applied? Select all that apply: a. Not applicable, no closure, use restriction, or treatments applied during the past 5 years b. Trampled vegetation c. Soil compaction d. Sheet erosion e. Rill erosion f. Gully erosion g. Shoreline/bank erosion h. Road washout i. Campsite washout j. Trail washout k. Water quality in waterbody l. Extreme precipitation/weather events m. Other (specify):
Rec A-Q37	Were chemical or fuel spills or leaks, or dumping that occurred at this site during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills, leaks, or dumping occurred during the last 5 years c. Yes, spills, leaks, or dumping were handled/treated according to the contingency and emergency response plan d. No, spills, leaks, or dumping were not handled/treated according to the contingency and emergency response plan

continued on next page

Implementation <i>(continued)</i>	
Rec A-Q38	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 39) b. No (go to question 40)
Rec A-Q39	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec A-Q40	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 41) b. No (go to question 42 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec A-Q41	Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 42 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question.
Effectiveness	
Rec A-Q42	Is there evidence of erosion or sedimentation along the waterbody transect from the use or existence of this developed recreation site? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of erosion or sedimentation (go to question 47) b. Evidence of erosion or sedimentation, but not reaching the waterbody (go to question 44) c. Evidence of sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 43)
Rec A-Q43	How many total places do you observe erosion or sedimentation delivered to/ present in the waterbody and changes to waterbody morphology? Select one: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec A-Q44	For all of the occurrences of erosion and sedimentation in the area you identified in question 42, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

continued on next page

Effectiveness <i>(continued)</i>	
Rec A-Q45	What are the sources? Select all that apply: a. Developed camping or day-use site b. Forest Service-created trail c. User-created trail d. Road or parking area e. Waterbody bank/shoreline f. Other (specify):
Rec A-Q46	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the site b. Inappropriate location of campsites c. Lack of campsite maintenance d. Inappropriate location of trails e. Inappropriate trail design f. Lack of trail maintenance g. Insufficient number of trails to the waterbody h. Too many trails to the waterbody i. Watercraft use or wave action j. Runoff from open water valves, spigots or other plumbing sources, or plumbing leaks k. Runoff from roofs, or roof gutters and downspouts l. Runoff from road or parking area m. Other (specify): n. Unknown
Rec A-Q47	What evidence of trash or domestic animal or human sanitary waste exists along the waterbody transect? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste (go to question 49) b. Evidence of trash within the AMZ (go to question 48) c. Evidence of trash in the waterbody (go to question 48) d. Evidence of domestic animal or human sanitary waste/toilet paper within the AMZ (go to question 48) e. Evidence of domestic animal or human sanitary waste/toilet paper in the waterbody (go to question 48)
Rec A-Q48	What are the causes? Select all that apply: a. Insufficient number of waste receptacles b. Waste receptacles not emptied frequently enough c. Use is exceeding carrying capacity of the site d. Insufficient number of toilet facilities e. Toilet facilities are not functioning properly f. Inconsiderate human actions g. Other (specify):
Rec A-Q49	What is the total length of the waterbody transect? (ft or m; specify unit):
Rec A-Q50	What percentage of the length of the waterbody transect has evidence of potential or current impacts to water quality? (percent):

continued on next page

Effectiveness *(continued)*

Rec A-Q51	Is there evidence of erosion or sedimentation on or originating from the trails that connect the developed site to AMZs or waterbodies? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e. a. Not applicable, no connecting trails (go to question 63) b. No evidence of erosion or sedimentation (go to question 57) c. Evidence of erosion or sedimentation outside an AMZ (go to question 53) d. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 53) e. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 52)
Rec A-Q52	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 54: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec A-Q53	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec A-Q54	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 51, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec A-Q55	What are the sources? Select all that apply: a. Developed camping or day-use site b. Forest Service-created trail c. User-created trail d. Road or parking area e. Waterbody bank/shoreline f. Other (specify):

continued on next page

Effectiveness (continued)	
Rec A-Q56	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the site and/or trails b. Inappropriate location of campsites c. Lack of campsite maintenance d. Inappropriate location of trails e. Inappropriate trail design f. Lack of trail maintenance g. Insufficient number of trails to the AMZ or waterbody h. Too many trails to the AMZ or waterbody i. Runoff from open water valves, spigots or other plumbing sources, or plumbing leaks j. Runoff from roofs, or roof gutters and downspouts k. Runoff from road or parking area l. Other (specify): m. Unknown
Rec A-Q57	What evidence of trash or domestic animal or human sanitary waste exists on or along the trails that connect the developed site to AMZs or waterbodies? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste (go to question 59) b. Evidence of trash outside an AMZ (go to question 58) c. Evidence of trash within an AMZ (go to question 58) d. Evidence of trash in a waterbody (go to question 58) e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ (go to question 58) f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ (go to question 58) g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody (go to question 58)
Rec A-Q58	What are the causes? Select all that apply: a. Insufficient number of waste receptacles b. Waste receptacles not emptied frequently enough c. Use is exceeding carrying capacity of the site and/or trails d. Insufficient number of toilet facilities e. Toilet facilities are not functioning properly f. Inconsiderate human actions g. Other (specify):
Rec A-Q59	How many trails were reviewed in this evaluation?
Rec A-Q60	How many of the trails that were reviewed were user created?
Rec A-Q61	What is the total length of trails evaluated? (ft or m; specify unit):
Rec A-Q62	What is the total length of the user-created trails evaluated? (ft or m; specify unit):
Rec A-Q63	What evidence of chemical or fuel spills or leaks or associated waste containers exists at the site? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody

continued on next page

Effectiveness (continued)	
Rec A-Q64	Did any of the unresolved maintenance needs for this developed recreation site contribute to any observed problems? Select one: a. Not applicable, no unresolved maintenance needs existed for this recreation site b. Yes c. No
Rec A-Q65	If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No
Rec A-Q66	If the site was closed, use was restricted, and/or treatments were applied during the past 5 years to protect or restore water, aquatic, or riparian resources, were the desired results achieved? Select one: a. Not applicable, no site closures, use restrictions, or treatments applied during the past 5 years b. The desired result was fully achieved c. The desired result was partially achieved d. Essentially no improvement to the site was achieved e. Too soon to determine
Rec A-Q67	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 68) b. No (go to question 69)
Rec A-Q68	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec A-Q69	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 70) b. No (go to General Comments)
Rec A-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	

Recreation B—Dispersed Recreation Areas

Recreation B: Header Statistics

In FY15/16 and FY17/18, respectively, 45 and 58 dispersed recreation areas (Rec B) were evaluated for implementation, effectiveness, or both (Table 70). Regions 3, 5, and 6 (see App. 1 for region delineations) completed 55 percent of the evaluations. Eighty-seven percent of all evaluations had both implementation and effectiveness monitoring completed (Table 70). Implementation and effectiveness monitoring were performed on a single day for all paired evaluations. Only the implementation portion of the evaluation was completed for 5 of the remaining 13 evaluations by the end of the period. 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 implementation monitoring needs to be completed prior to

Table 70.—Number of Rec B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Rec B-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	1			1
	2	6		1	5
	3	1			1
	4	3			3
	5	15		2	13
	6	9		3	6
	8	1	1		
	9	9			9
	10				
	All	45	1	6	38
	Percent		2	13	84
FY17/18					
	1	3			3
	2	8	1		7
	3	14	1	2	11
	4	6	1		5
	5	10			10
	6	6	1		5
	8	4			4
	9	3			3
	10	4			4
	All	58	4	2	52
	Percent		7	3	90

effectiveness monitoring, even if both are done the same day. Three of the evaluations for which only implementation was completed were performed near the end of the FY17/18 monitoring period (September 30, 2018); the effectiveness evaluations for these areas may be included in the next monitoring period (FY19/20). The other implementation-only evaluations were performed in FY17 and earlier, so it is unlikely that they were evaluated for effectiveness. Seventy-four percent of the 103 areas evaluated were selected randomly (Table 40).

All but three Rec B evaluations indicated that a reason for monitoring was to meet National BMP targets (Table 71). The protocol simultaneously met other monitoring needs, most often land management plan monitoring. Quality assurance was identified as a reason for monitoring in five Rec B evaluations (Table 71). 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 monitoring effort on that same site . . . [by] different team members than

Table 71.—Number of Rec B evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (Rec B-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	6	1	2		
	3	1			1	
	4	3		2		
	5	15				
	6	9	2			
	8	1	1	1		
	9	8		1		1
	10					
	All	44	4	6	1	1
FY17/18						
	1	3				1
	2	8		1		1
	3	14			2	
	4	6	4	1	1	
	5	10			1	
	6	6	1			2
	8	4	1	1		
	9	3				
	10	2	2			2
	All	56	8	3	4	6

the initial 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 a duplicate evaluation, 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.

The mean size of the dispersed recreation areas (Rec B-Q22) was 18 acres (standard error [se] = 12 acres) in FY15/16 and 13 acres (se = 7 acres) in FY17/18, although 89 and 84 percent of the areas in FY15/16 and FY17/18, respectively, were 5 acres or less. Two recreation areas in each monitoring period were much larger: 195 and 500 acres in FY15/16 and 193 and 350 acres in FY17/18. About 17 percent of recreation areas in FY15/16 and 42 percent in FY17/18 normally operated year-round (Rec B-Q18; Fig. 43). Areas that opened in April, May, or June and closed in October, November, or December (six- to eight-month season) comprised 74 percent of evaluations in FY15/16 and 47 percent in FY17/18. Five evaluations indicated that the normal operating season was 1 month long (Fig. 43), which appears to have been an error; based on the area uses described in the evaluations, it seems likely that the same opening and closing months were selected to indicate the area was open year-round. Three areas in FY15/16 and nine areas in FY17/18 had been used for a special event in the 12 months prior to the evaluation (Rec B-Q19). One dispersed area in each monitoring period was used during a Rainbow Gathering. Camping and hunting were the primary uses (Rec B-Q20) for many evaluated dispersed recreation areas, although picnicking or fishing also occurred in each monitoring period (Fig. 44). “Other” types of primary uses were most often hiking, off-highway vehicle use, and boating. Multiple uses were reported for 89 percent of areas.

Eighty-four percent of recreation areas in FY15/16 and 86 percent in FY17/18 were located at least partially in an aquatic management zone (AMZ) (Rec B-Q23). Ten percent were not located in an AMZ, and 5 percent were located near a waterbody that did not have a designated AMZ. Dispersed recreation areas were most frequently nearest to perennial streams or rivers (64 and 57 percent in FY15/16 and FY17/18, respectively) or lakes (20 and 10 percent); 13 percent of all evaluations reported more than one type of waterbody (Rec B-Q25). The mean distance to the nearest waterbody (Rec B-Q24)

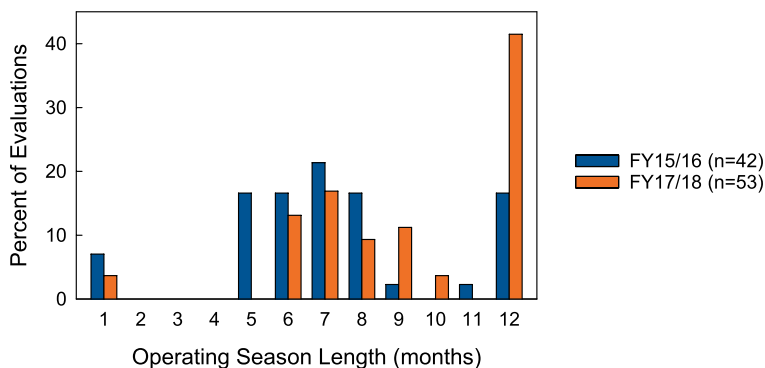


Figure 43.—Distribution of normal operating season length (Rec B-Q18) for evaluations completed in FY15/16 and FY17/18.

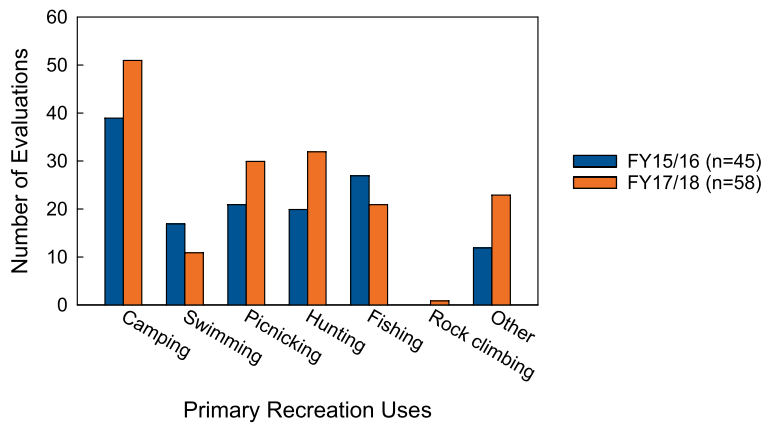


Figure 44.—Distribution of primary dispersed recreation area uses (Rec B-Q20) for evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

was 90 feet ($s = 32$ feet) for areas evaluated in FY15/16 and 110 feet ($se = 32$ feet) for those evaluated in FY17/18. Approximately 20 percent of areas had sanitation facilities (Rec B-Q21); whether areas had facilities was not significantly associated with whether the area was in an AMZ in either monitoring period ($p = 0.29$ FY15/16, $p = 0.45$ FY17/18).

Recreation B: Implementation Results and Their Tie to Header Information

Twenty-seven dispersed recreation areas—11 in FY15/16 and 16 in FY17/18—had unresolved maintenance needs that had been identified prior to the evaluation (Rec B-Q26). Whether the recreation area had some type of operation and maintenance (O&M) plan (Rec B-Q27a, Rec B-Q27b versus Rec B-Q27c) was not associated with whether the site had unresolved maintenance needs in either monitoring period ($p = 0.28$ FY15/16, $p = 0.77$ FY17/18), although the majority of recreation areas with unresolved needs did not have O&M plans (64 and 62 percent in FY15/16 and FY17/18, respectively). Half of the recreation areas evaluated in FY15/16 and 37 percent in FY17/18 had O&M plans or other O&M guidance documents that included at least one BMP provision to help protect water, aquatic, and riparian resources (Table 72). A location farther from a waterbody did not appear to be a reason for the lack of O&M plans or the exclusion of BMPs in those plans (Fig. 45); therefore it is not surprising that the inclusion or exclusion of BMP provisions in O&M plans does not appear to be a function of the proximity of the area to AMZs (Fig. 46). No significant statistical associations were found between whether dispersed recreation area O&M plans or guidance documents had BMPs and the proximity to an AMZ ($p = 0.61$ FY15/16, $p = 0.88$ FY17/18). Whether the recreation area had sanitation facilities (Rec B-Q21) was not significantly associated with having an O&M plan in either monitoring period ($p = 0.12$ FY15/16, $p = 0.81$ FY17/18). However, for areas evaluated in FY15/16, about 30 percent had an O&M plan when facilities were present compared to nearly 60 percent with a plan when facilities were not present, which runs contrary to what might be expected.

Table 72.—Distribution of whether dispersed recreation area operation and maintenance (O&M) plan or other guidance documents contain BMP protection provisions (Rec B-Q27) for Rec B evaluations completed in FY15/16 and FY17/18

O&M plan 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	51	21	37
No; plan exists but does not have BMP provisions	1	3	3	5
No plan for the recreation area	18	46	32	57

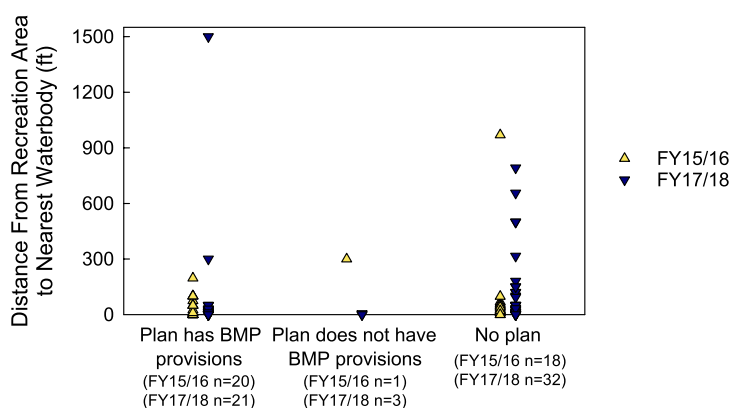


Figure 45.—Distance from dispersed recreation area to nearest waterbody (Rec B-Q24) by whether area operation and maintenance plan or other guidance documents contained BMP provisions (Rec B-Q27) for evaluations completed in FY15/16 and FY17/18.

Assessment of operation and maintenance implementation focuses on whether BMPs in O&M guidance documents (O&M plan, handbooks, and so on) were implemented fully (Rec B-Q28). Table 73 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 the information about whether all the BMPs from the provisions were implemented fully. A “yes” indicates that at least one BMP in the guidance documents was applicable to the provision and that all BMPs assigned to that provision were implemented fully. A “no” indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. “Not applicable” indicates that no BMPs in the guidance documents were 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 each monitoring period of Table 73 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

On average, prescribed BMP provisions were implemented fully in an average of 70 percent of evaluations in FY15/16 and 85 percent of evaluations in FY17/18 that

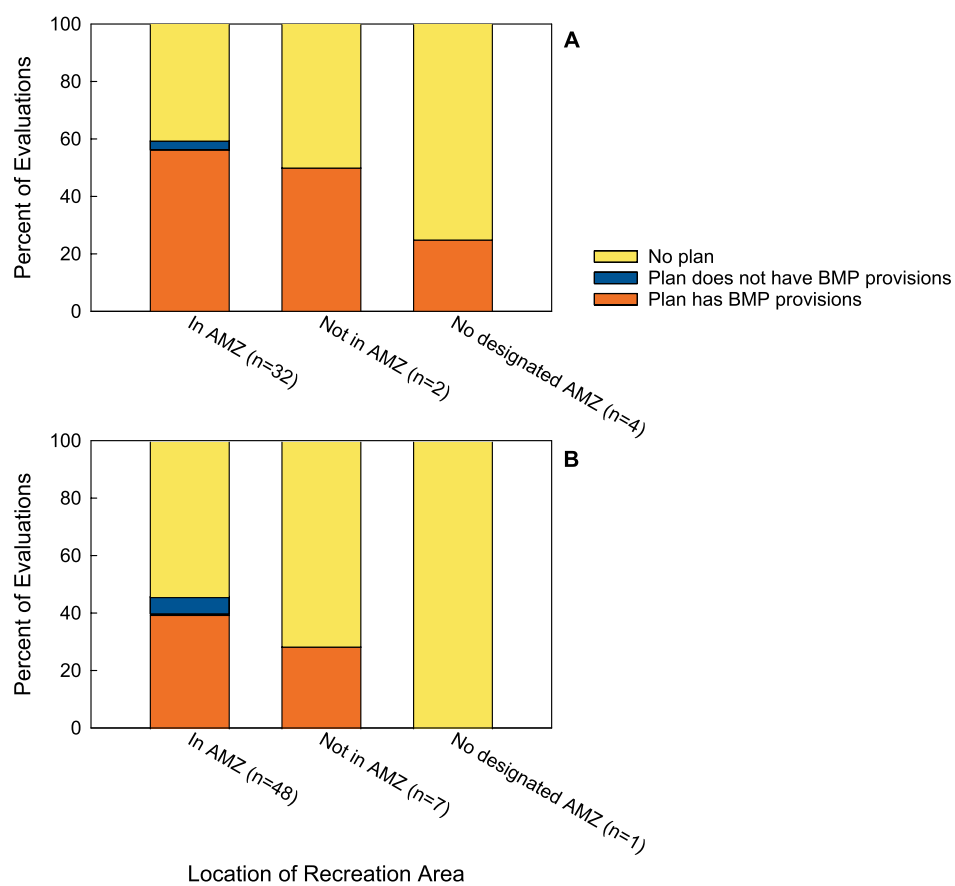


Figure 46.—Distribution of whether dispersed recreation area operation and maintenance plan or other guidance documents contained BMP provisions (Rec B-Q27) by location of area (Rec B-Q23) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

had some type of BMP guidance document for operation and maintenance (Table 73). However, in each monitoring period, BMP provisions were applicable to one-third of evaluations on average. The most common types of BMPs prescribed were those associated with trail cross drain and access provisions. Provisions that were implemented fully for 100 percent of areas in either monitoring period were often applicable to very few of the evaluated dispersed recreation areas (Table 73). When the numbers and percentages of BMP provisions implemented fully were compared by evaluation, BMPs were included in five provisions on average, and 82 percent of the BMP provisions were implemented fully per evaluation in FY15/16; in FY17/18, BMPs were included in four provisions on average, and again 82 percent of provisions were implemented fully.

Two implementation questions—Rec B-Q29 and Rec B-Q30—evaluate whether site 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 74) and whether corrective actions were taken if problems occurred during the current operating season (at any time, not just critical times) (Table 75).

Table 73.—Frequencies at which all BMPs in provisions included in an operation and maintenance (O&M) plan or other O&M guidance documents were implemented fully (Rec B-Q28) for Rec B evaluations completed in FY15/16 (n=20 evaluations) and FY17/18 (n=21 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)
Locations and spacings of cross drains on trails (e.g., waterbars)	8	3	8	73	27	6	0	13	100	0
Cross drain techniques	8	2	10	80	20	6	0	13	100	0
Trail grades	4	2	12	67	33	4	1	13	80	20
Trail surfacing	5	2	11	71	29	4	1	13	80	20
Trail locations	8	2	10	80	20	5	1	12	83	17
Waterbody crossing techniques	5	2	12	71	29	2	1	15	67	33
Mulching and/or seeding, or other soil cover techniques	4	2	14	67	33	5	2	12	71	29
Locations and numbers of trash receptacles	1	1	16	50	50	2	0	16	100	0
Trash receptacle maintenance	3	0	15	100	0	2	0	15	100	0
Permanent sanitation facilities	1	1	16	50	50	3	1	13	75	25
Temporary (portable) sanitation facilities	4	0	14	100	0	4	2	11	67	33
Maintenance requirements for roads and access routes	9	1	9	90	10	9	2	9	82	18
Maintenance requirements for parking areas	6	1	11	86	14	8	2	9	80	20
Water supply/delivery system maintenance	0	1	17	0	100	2	0	15	100	0
Invasive species control	5	2	12	71	29	9	1	8	90	10
Mean	5	1	12	70	30	5	1	12	85	15

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

^b Percent calculated from “yes” and “no” counts.

Table 74.—Distribution of whether inspections occurred at critical times (Rec B-Q29) for Rec 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	15	39	32	57
Yes	16	42	19	34
No	7	18	5	9
All	38		56	

Table 75.—Distribution of whether corrective actions (CA) were taken if problems occurred during current operating season (Rec B-Q30) for Rec 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	22	58	26	46
CA needed but not taken	6	16	12	21
CA needed and implemented	6	16	6	11
Unknown	4	11	12	21
All	38		56	

Critical times are periods associated with large or intense precipitation/runoff events or other times when the potential for the area to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted at critical times during the operating season for 42 percent of the recreation areas in FY15/16 and 34 percent in FY17/18 (Table 74). Somewhat higher percentages of the areas in each period had no problems requiring corrective actions any time during the operating season. Nearly 20 percent in both monitoring periods combined did not take corrective actions when needed (Table 75).

When conditions are present that may negatively impact water, aquatic, or riparian resources, all or part of a dispersed recreation area may be closed or have its use restricted to protect the resources (Rec B-Q31) or have treatments applied to improve conditions (Rec B-Q33). Of the dispersed recreation areas evaluated, 12 in FY15/16 and 10 in FY17/18 were closed or had restrictions on use in the 5 years prior to the evaluation (Table 76). The time between when problems were identified and the area was closed or use restricted ranged from 2 weeks to 15 years in FY15/16 and from 1 day to 6 years in FY17/18. More than one-third of areas in each monitoring period needed treatments to reduce impacts to water resources and had those treatments applied (Table 76). Treatments were applied 1 day to 15 years after a need was identified and averaged 4.6 years in FY15/16 and 2.0 years in FY17/18. In all, 24 dispersed recreation areas in

Table 76.—Distribution of whether dispersed recreation area was closed or use was restricted (Rec B-Q31) and whether treatments were applied (Rec B-Q33) during past 5 years to reduce negative impacts to water, aquatic, or riparian resources for Rec B evaluations completed in FY15/16 and FY17/18

Action	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Site closed or use restricted				
Not applicable; no problems warranted closure or use restrictions	23	61	34	61
Needed and closed or use restricted	12	32	10	18
Needed but not closed or use not restricted	3	8	12	21
Treatments applied				
Not applicable; no problems warranted application of treatments	16	42	26	46
Needed and applied	16	42	20	36
Needed but not applied	6	16	10	18

FY15/16 (63 percent) and 30 areas in FY17/18 (54 percent) had closures or use restrictions or had treatments applied or both. The reasons for those actions are summarized in Table 77. Many “other” reasons were identified, including sanitation and access issues.

Because fuel and other chemicals may be present within or around dispersed recreation areas, an implementation question (Rec B-Q36) 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 would follow that state agency’s procedures. Four evaluations indicated that the administrative unit did not have a CERP. Five evaluations indicated that a spill or leak requiring cleanup occurred at an area; CERP procedures were followed at two areas but not at the other three.

Recreation B: Effectiveness Results and Their Tie to Implementation Results and Header Information

Dispersed recreation areas are evaluated for evidence of erosion and sedimentation and trash and waste at two locations: along a waterbody transect and on trails leading from the area to an AMZ or a waterbody. Only the most severe cases of erosion or sedimentation are reported (Rec B-Q41, Rec B-Q50) 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. All occurrences of trash and waste are reported. Of the recreation areas evaluated in FY15/16 and FY17/18, 45 and 31 percent, respectively, observed no evidence of erosion, sedimentation, or waterbody morphology changes along the waterbody transect (Table 78). No significant associations were found

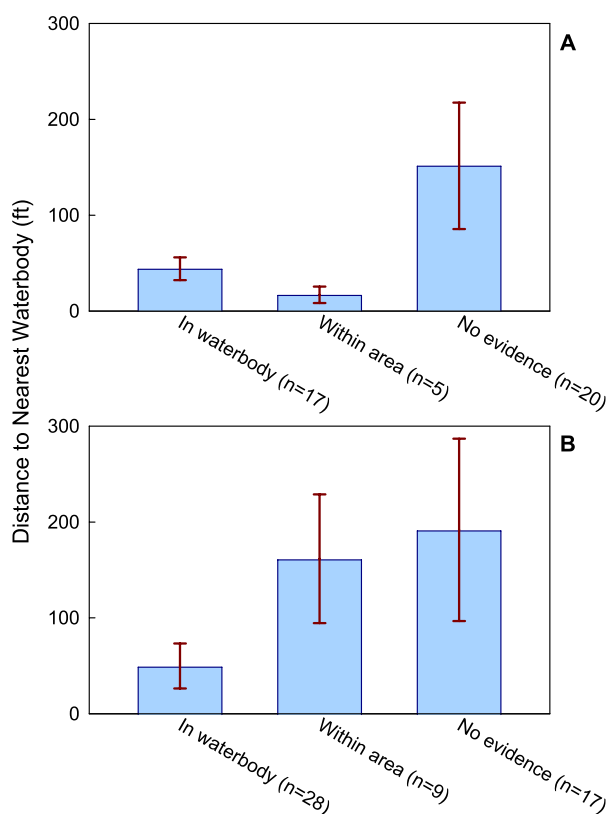
Table 77.—Reasons the dispersed recreation area was closed, use was restricted, or treatments were applied (Rec B-Q35) for Rec B evaluations completed in FY15/16 (n=24 evaluations) and FY17/18 (n=30 evaluations). Multiple selections were possible.

Reason for closure, use restriction, or application of treatments	FY15/16 (number)	FY17/18 (number)
Trampled vegetation	11	15
Soil compaction	10	17
Sheet erosion	7	5
Rill erosion	6	9
Gully erosion	6	4
Shoreline/bank erosion	8	12
Road washout	3	2
Washout in use area	1	3
Water quality in waterbody	7	8
Extreme precipitation/weather event	2	0
Other	8	8

Table 78.—Evidence of erosion or sedimentation observed along waterbody transect (Rec B-Q41) for Rec B evaluations completed in FY15/16 and FY17/18

Evidence observed	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
No evidence	20	45	17	31
Evidence but not in waterbody	7	16	9	17
Evidence in waterbody	17	39	28	52

between the location where sediment evidence was observed (Rec B-Q41) and the site location relative to an AMZ (Rec B-Q23) in either monitoring period ($p = 0.53$ FY15/16, $p = 0.20$ FY17/18). Significant differences in the distance between the recreation area and the nearest waterbody (Rec B-Q25) were found between locations where sediment evidence was observed in each monitoring period ($p = 0.03$ FY15/16, $p = 0.09$ FY17/18; GLMM with lognormal distribution and identity link function). When no evidence was observed in FY15/16, the areas were significantly farther (more than 150 feet) from a waterbody on average, compared to less than 20 feet away when observed evidence had not reached a waterbody and less than 50 feet away when evidence was observed in a waterbody (Fig. 47). In FY17/18, when no evidence was observed, the distance between the areas and the waterbody was 200 feet on average, compared to 160 feet when observed evidence had not reached a waterbody and less than 50 feet when evidence was observed in a waterbody. The location where sediment evidence was observed was not significantly



Evidence of Erosion or Sedimentation

Figure 47.—Mean distance (with standard error bars) between dispersed recreation area and nearest waterbody (Rec B-Q24) by evidence of erosion observed along waterbody transect (Rec B-Q41) for evaluations completed in FY15/16 (A) and FY17/18 (B).

associated with whether the recreation area had any type of O&M guidance documents containing BMP provisions (Rec B-Q27) in either monitoring period ($p = 0.22$ FY15/16, $p = 0.34$ FY17/18) (Fig. 48). However, for areas having BMP provisions, 63 percent of evaluations in FY15/16 and 53 percent in FY17/18 observed no evidence of erosion or sedimentation. For areas that had no O&M plan or other guidance documents, 63 and 75 percent of the areas in FY15/16 and FY17/18, respectively, had observed evidence of erosion and sedimentation.

In FY15/16 and FY17/18, 24 and 37 evaluations, respectively, reported some evidence of erosion, sedimentation, or waterbody morphology changes (Table 78). The types of evidence observed (Rec B-Q43) relative to the location where the evidence was observed is presented in Table 79. The most common types of evidence observed were damage to vegetation and waterbody banks (Table 79). Seven evaluations reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec B-Q41 (e.g., changes to substrate composition would not be observed outside

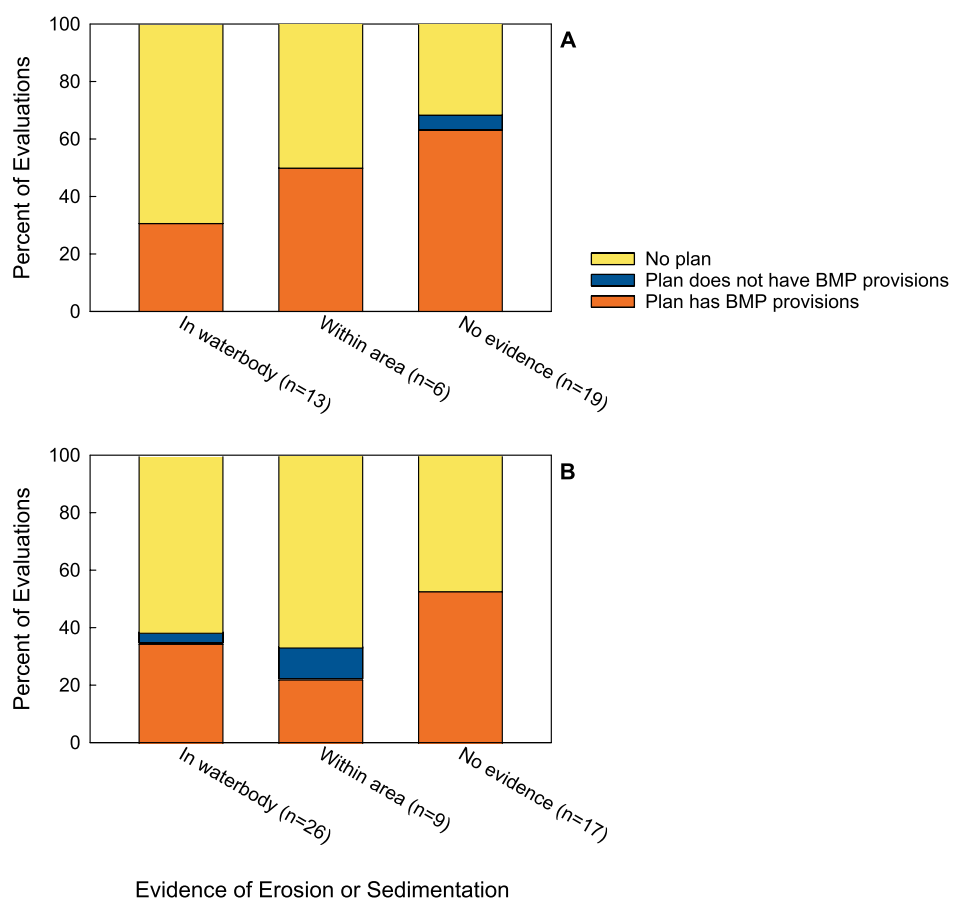


Figure 48.—Distribution of whether dispersed recreation area operation and maintenance plan or other guidance documents contained BMP provisions (Rec B-Q27) by evidence of erosion observed along waterbody transect (Rec B-Q41) for evaluations completed in FY15/16 (A) and FY17/18 (B).

a waterbody). Numerous sources and causes for the evidence observed were reported (Tables 80 and 81); most of the sources were related to inappropriate user activities, and most of the causes were related to the location of the recreation area.

Trails that connected the dispersed recreation area to an AMZ or a waterbody were evaluated for evidence of erosion and sedimentation (Rec B-Q50) at 36 recreation areas in FY15/16 and 36 areas in FY17/18; of these, 39 and 33 percent, respectively, observed no evidence of erosion or sedimentation on or originating from the trails (Table 82). Vegetation damage or bare ground was the type of evidence observed most frequently (Table 83), followed by bank trampling or compaction. Two evaluations reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec B-Q50. User-created trails were a source of observed evidence for 76 percent of all evaluations with evidence (Table 84), and many reported causes were related to trails (Table 85). Overuse of the area also was frequently identified as a cause of observed evidence.

Table 79.—Types of evidence of erosion or sedimentation observed along waterbody transect (Rec B-Q43) for Rec B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec B-Q41 (Table 78) is applicable to Rec B-Q43.

Type of evidence	FY15/16 Evidence but not in waterbody (n=7)	FY15/16 Evidence in waterbody (n=17)	FY17/18 Evidence but not in waterbody (n=9)	FY17/18 Evidence in waterbody (n=28)
Traceable evidence to the waterbody, but not currently visible in the waterbody	4	9	4	13
Turbidity present				2
Evidence of localized sediment deposition in the waterbody	2 ^a	7	2 ^a	19
Changes to substrate composition	2 ^a	3	1 ^a	4
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)	2 ^a	3		13
Bank instability	3	9	2	14
Bank trampling or compaction	4	14	5	22
Vegetation damage or bare ground	6	14	4	24
Sheet erosion	3	7		7
Rill erosion	2	5	3	6
Gully erosion	2	2	2	12
Headcutting		2		5
Slumping/slips	1	2		5
Mass wasting				1
Sediment plumes or accumulations		2		5
Rutting	2	4	1	8
Water quality monitoring results				1

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

Table 80.—Sources of evidence of erosion or sedimentation observed along waterbody transect (Rec B-Q44) for Rec B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec B-Q41 (Table 78) is applicable to Rec B-Q44.

Source of evidence	FY15/16 Evidence but not in waterbody (n=7)	FY15/16 Evidence in waterbody (n=17)	FY17/18 Evidence but not in waterbody (n=9)	FY17/18 Evidence in waterbody (n=28)
Dispersed camping area	5	9	5	22
Forest Service-created trail	1	2	2	3
User-created trail	4	12	3	18
Road or parking area	2	5	4	15
Other	1	2	1	8

Table 81.—Causes of evidence of erosion or sedimentation observed along waterbody transect (Rec B-Q45) for Rec B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec B-Q41 (Table 78) is applicable to Rec B-Q45.

Cause of evidence	FY15/16 Evidence but not in waterbody (n=7)	FY15/16 Evidence in waterbody (n=17)	FY17/18 Evidence but not in waterbody (n=9)	FY17/18 Evidence in waterbody (n=28)
Use is exceeding carrying capacity of the area	2	1	2	8
Inappropriate location of the use area	4	7	3	14
Inappropriate location of trails	1	6	2	7
Inappropriate trail design		4	2	5
Lack of trail maintenance	1	4	2	5
Insufficient number of trails to the waterbody	1		1	2
Too many trails to the waterbody	1	3		4
Watercraft use or wave action		1		2
Runoff from road or parking area	2	6	3	14
Other	2	5	2	8

Table 82.—Evidence of erosion or sedimentation observed on or originating from trails (Rec B-Q50) for Rec B evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Rec B-Q52) or number of places evidence observed in a waterbody (Rec B-Q51)

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	14	39							
Outside an AMZ ^a	1	3	1						
Within an AMZ	9	25	6	2		1			
In a waterbody	12	33					8	1	3
FY17/18									
No evidence	12	33							
Outside an AMZ	0								
Within an AMZ	6	17	5	1					
In a waterbody	18	50					8	7	3

^a Aquatic management zone.

Table 83.—Types of evidence of erosion or sedimentation observed on or originating from trails (Rec B-Q53) for Rec B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec B-Q50 (Table 82) is applicable to Rec B-Q53.

Type of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=9)	FY15/16 In waterbody (n=12)	FY17/18 Within an AMZ (n=6)	FY17/18 In waterbody (n=18)
Traceable evidence to the waterbody, but not currently visible in the waterbody		3	7	2	10
Turbidity present					
Evidence of localized sediment deposition in the waterbody			4	1 ^b	12
Changes to substrate composition		1 ^b	1		5
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)			2		8
Bank instability			5	1	7
Bank trampling or compaction	1	3	6	2	10
Vegetation damage or bare ground	1	8	9	3	14
Sheet erosion	1	4	6		6
Rill erosion		5	3	1	7
Gully erosion	1	1	1	2	8
Headcutting			1		1
Slumping/slips			1		1
Mass wasting					
Sediment plumes or accumulations		1	2		8
Rutting	1	1	5	1	4
Water quality monitoring results					1

^a Aquatic management zone.

^b The type of evidence reported is incompatible with the location in which it was observed.

Table 84.—Sources of evidence of erosion or sedimentation observed on or originating from trails (Rec B-Q54) for Rec B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec B-Q50 (Table 82) is applicable to Rec B-Q54.

Source of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=9)	FY15/16 In waterbody (n=12)	FY17/18 Within an AMZ (n=6)	FY17/18 In waterbody (n=18)
Dispersed camping area		4	6	2	9
Forest Service-created trail	1		3	2	3
User-created trail		7	10	3	15
Road or parking area		3	4	3	8
Other			1		1

^a Aquatic management zone.

Table 85.—Causes of evidence of erosion or sedimentation observed on or originating from trails (Rec B-Q55) for Rec B evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec B-Q50 (Table 82) is applicable to Rec B-Q55.

Cause of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=9)	FY15/16 In waterbody (n=12)	FY17/18 Within an AMZ (n=6)	FY17/18 In waterbody (n=18)
Use is exceeding carrying capacity of the site		1	1	1	8
Inappropriate location of trails			6	1	7
Inappropriate trail design		1	7	2	5
Lack of trail maintenance	1	1	1	2	5
Insufficient number of trails to the AMZ or waterbody		1		1	
Too many trails to the AMZ or waterbody		1	1		4
Other		5	3	1	6

^a Aquatic management zone.

Weather conditions associated with the evaluation (Rec B-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to use of the dispersed recreation area and trails 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

No statistically significant associations were found between categories of erosion along the waterbody transect (Rec B-Q41) and weather conditions (i.e., wet versus dry conditions) in either monitoring period ($p = 0.43$ FY15/16, $p = 0.38$ FY17/18) (Fig. 49) or between categories of erosion on or originating from trails (Rec B-Q50) and weather conditions in either period ($p = 0.49$ FY15/16 $p = 0.86$ FY17/18). For both periods, less than 25 percent of evaluations occurred during wet weather. More evaluations are needed during wet conditions to determine the usefulness of this comparison (Fig. 49).

Of the 98 effectiveness evaluations, 62 reported trash or domestic animal or human sanitary waste evidence observed along the waterbody transect (Rec B-Q46) or on or originating from connecting trails (Rec B-Q56). Thirty-three evaluations observed trash or waste at both locations, 25 evaluations observed trash or waste along the waterbody transect, and 4 evaluations observed evidence on or along trails. The types of evidence observed are summarized by the location of the evidence in Table 86. Ninety-one percent of evaluations reported inconsiderate human actions as a cause of the observed evidence along the waterbody transect; 81 percent reported the same cause for evidence observed on or along trails. Use exceeding the carrying capacity of the area or trails was reported for 21 percent of evaluations with evidence at either location and was the second most frequently reported cause.

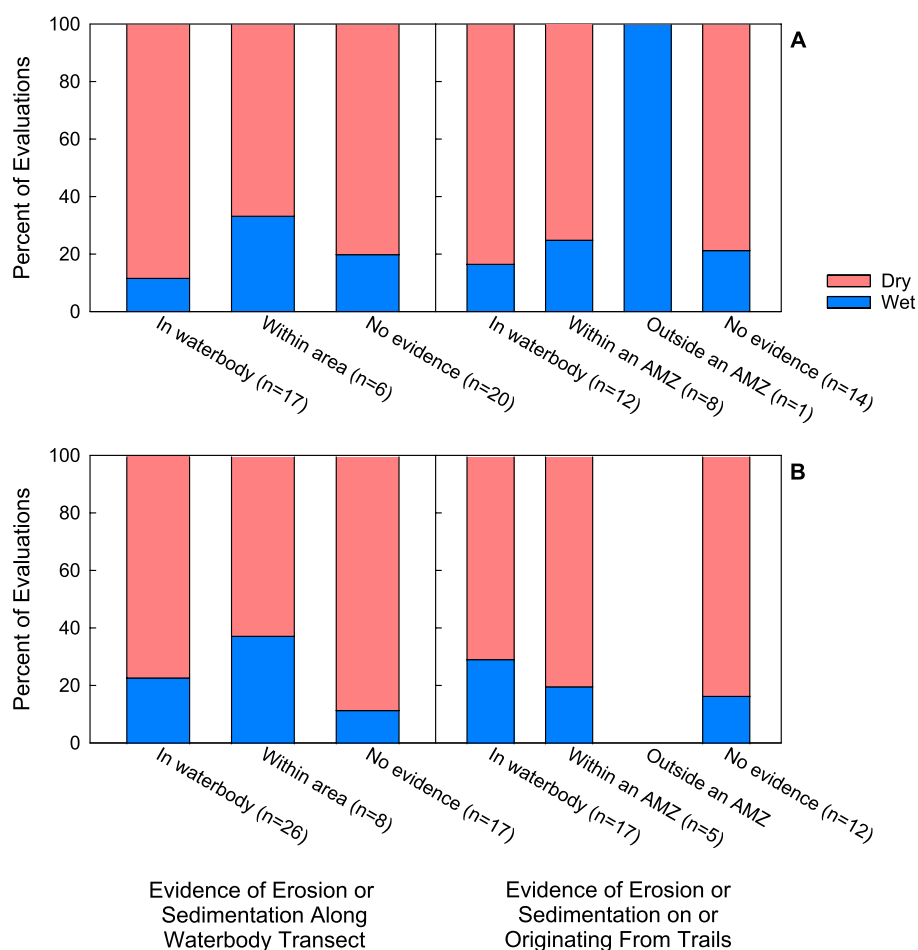


Figure 49.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion along waterbody transect (Rec B-Q41; left panels) and on or originating from trails (Rec B-Q50; right panels) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

During the effectiveness evaluation, the review team is instructed to estimate the percentage of the waterbody transect that has evidence of potential or current impacts to water quality (Rec B-Q49). This estimate includes all evidence of erosion and sedimentation rather than the most severe evidence reported for Rec B-Q41. Waterbody transect lengths averaged 315 feet (se = 66 feet) in FY15/16 and 1,416 feet (se = 829 feet) in FY17/18 and ranged from 10 feet to 8 miles for both monitoring periods. If the dispersed recreation area with the 8-mile-long transect—7 miles longer than any other transect—is excluded, then the mean transect length in FY17/18 was 599 feet (se = 144 feet). About 75 percent of evaluations reported some evidence of erosion (Rec B-Q41), trash and waste (Rec B-Q46), or both in each monitoring period, and those evaluations had mean transect lengths slightly shorter or longer than that for all evaluations: 276 feet (se = 50 feet) in FY15/16 and 710 feet (se = 176 feet) in FY17/18. On average, the review teams estimated that 16 and 29 percent of the waterbody transect in FY15/16 and FY17/18, respectively, had potential or current impacts to water quality.

Table 86.—Evidence of trash or domestic animal or human sanitary waste observed along waterbody transect (Rec B-Q46) and on or originating from trails (Rec B-Q56) for Rec B evaluations completed in FY15/16 (n=44 waterbody transect evaluations and n=54 trail evaluations) and FY17/18 (n=36 waterbody transect evaluations and n=36 trail evaluations). Multiple selections were possible.

Monitoring period	Evidence	Waterbody transect evidence but not in waterbody	Waterbody transect evidence in a waterbody	Trails evidence outside an AMZ ^a	Trails evidence within an AMZ	Trails evidence in a waterbody
FY15/16						
	Trash	22	7	6	14	3
	Domestic animal or human sanitary waste	8	2	1	8	1
FY17/18						
	Trash	25	11	6	11	5
	Domestic animal or human sanitary waste	18	5	6	10	4

^aAquatic management zone.

Evaluated connecting trails varied by number (Rec B-Q58) and length (Rec B-Q60) and by whether they were created by the Forest Service or users. Approximately 67 percent of trails evaluated in FY15/16 and 76 percent in FY17/18 were created by recreation area users, although the percentage of user-created trail length evaluated was slightly different: 62 percent of the total length in FY15/16 and 78 percent in FY17/18. Mean total trail lengths evaluated were 434 feet (se = 185 feet) in FY15/16 and 571 feet (se = 201 feet) in FY17/18. Evaluations that reported observed evidence of erosion or sedimentation, trash or waste, or both on or along trails had shorter mean evaluated trail lengths of 302 feet (se = 130 feet) in FY15/16 and 512 feet (se = 198 feet) in FY17/18.

The presence of chemical spills, leaks, or chemical waste containers is determined during the effectiveness evaluations. Evidence can include pollutants observed during the operating season but not reported, pollutants reported but not yet cleaned up, or pollutants not previously observed or known to exist. Care was taken to prevent chemical contamination at dispersed recreation areas. In FY15/16, one evaluation reported waste containers observed within an AMZ, and one reported waste containers observed in a waterbody. In FY17/18, four evaluations reported observed spills or leaks: one outside an AMZ, one within an AMZ, and two in a waterbody.

In the Rec B protocol, four sets of paired implementation and effectiveness questions assess unresolved maintenance needs (Rec B-Q26 and Rec B-Q63), inspections (Rec B-Q30 and Rec B-Q64), and area closures (Rec B-Q31 and Rec B-Q65) or treatments (Rec B-Q33 and Rec B-Q65). Respectively, the questions ask whether recreation area administration or lack thereof influenced BMP effectiveness. Only one effectiveness question (Rec B-Q65) assesses the effectiveness of both area closures and treatments, which limits the comparisons to areas that had closures or use restrictions (Rec B-Q31) and to areas that had treatments applied (Rec B-Q33). Tables 87 through 90 show the relationships between the pairs of questions for recreation areas in which both

Table 87.—Distribution of whether recreation area has unresolved maintenance needs (Rec B-Q26) in relationship to problems observed during effectiveness monitoring (Rec B-Q63) for Rec B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (18 and 36 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Area has unresolved maintenance needs (implementation)	Not applicable; no unresolved maintenance needs (effectiveness)	Yes; unresolved maintenance needs led to observed problems (effectiveness)	No; unresolved maintenance needs did not lead to observed problems (effectiveness)
FY15/16				
	Yes	1	7	2
	No	22	3	3
FY17/18				
	Yes	5	8	
	No	24	7	6

Table 88.—Occurrence of inspections performed at critical times (Rec B-Q29) in relationship to problems observed during effectiveness monitoring (Rec B-Q64) for Rec B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (38 and 20 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	6	2	7
	Yes; inspections at critical times	11	1	3
	No; inspections not at critical times	4	1	2
FY17/18				
	No inspections	6	9	15
	Yes; inspections at critical times	11	2	2
	No; inspections not at critical times		2	3

Table 89.—Distribution of whether area was closed or use was restricted (Rec B-Q31) in relationship to whether desired results were achieved by the closure or restrictions^a (Rec B-Q65) for Rec B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (6 and 4 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Area closed or use restricted (implementation)	Not applicable; no closure or use restrictions (effectiveness)	Desired results fully achieved (effectiveness)	Desired results partially achieved (effectiveness)	No improvement (effectiveness)	Too soon to determine (effectiveness)
FY15/16						
	Not applicable; no closure or use restriction	14		1		
	Needed and closed or use restricted			1		
	Needed but not closed or use not restricted					
FY17/18						
	Not applicable; no closure or use restriction	24	1			
	Needed and closed or use restricted					
	Needed but not closed or use not restricted					

^a Includes only recreation areas that had closures or use restrictions and no treatments applied.

Table 90.—Distribution of whether area had treatments applied (Rec B-Q33) in relationship to whether desired results were achieved by the treatments^a (Rec B-Q65) for Rec B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (14 and 18 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Treatments were applied (implementation)	Not applicable; no treatments (effectiveness)	Desired results fully achieved (effectiveness)	Desired results partially achieved (effectiveness)	No improvement (effectiveness)	Too soon to determine (effectiveness)
FY15/16						
	Not applicable; no treatments needed	14		1		
	Needed and applied	2	1	2		
	Needed but not applied	2				
FY17/18						
	Not applicable; no treatments needed	24	1			
	Needed and applied	5		2		
	Needed but not applied	1				

^a Includes only recreation areas that had treatments applied and no area closures or use restrictions.

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 the paired comparisons because some incompatible answer choices were selected (shaded cells) based on the protocol instructions. Of the evaluations that followed the protocol instructions (unshaded cells), 17 areas had unresolved maintenance needs, and 88 percent reported that those needs contributed to observed effectiveness problems (Table 87). Lack of inspections or inspections not conducted at critical times contributed to observed problems for 14 of 41 areas (Table 88). One recreation area had a closure or use restriction without applied treatments (Table 89), which limits the usefulness of that comparison. For the areas that had needed treatments applied without area closure or use restrictions, the desired results from the treatments were fully or partially achieved (Table 90).

Recreation B: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

Less than 15 percent of the Rec B areas were rated as *fully implemented* in each monitoring period. The combination of areas rated *not implemented* and *no BMPs* was 51 and 68 percent in FY15/16 and FY17/18, respectively (Fig. 50). Twice as many Rec B areas were rated *not effective* than *effective* in each period. One evaluation in FY15/16 lacked

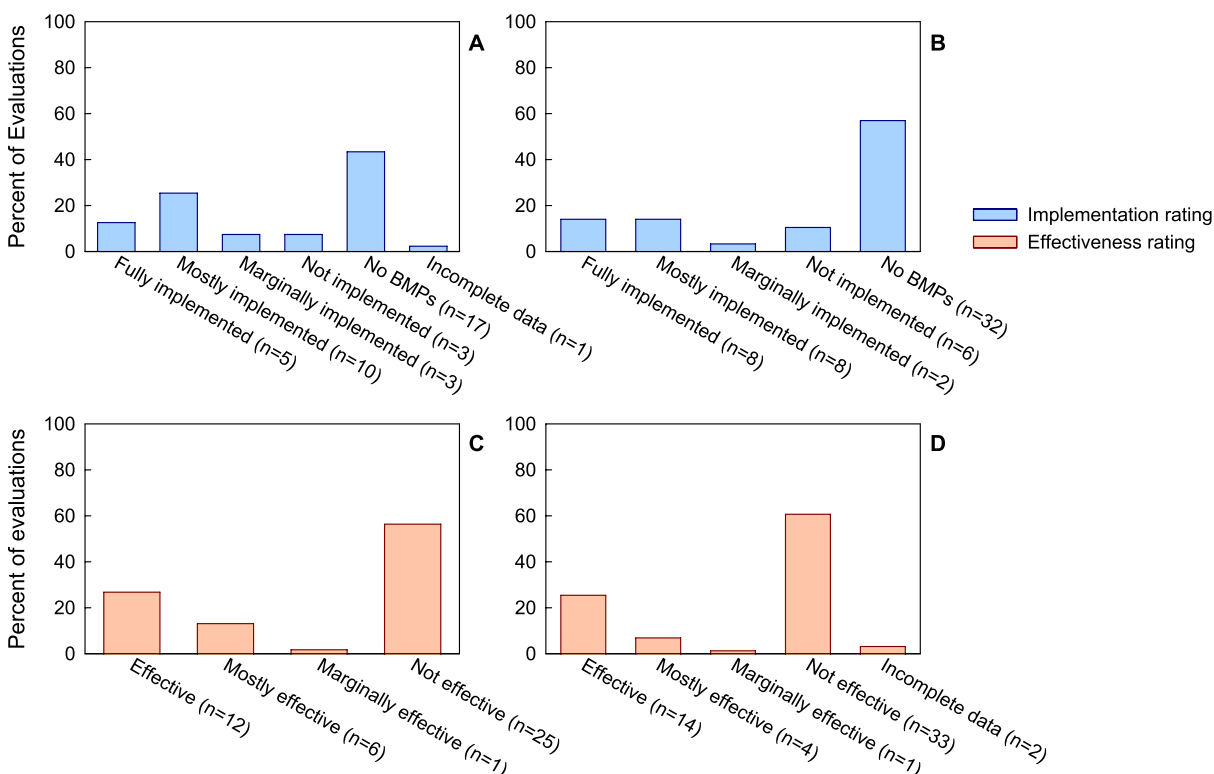


Figure 50.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Rec B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

responses in the database for questions needed to determine the implementation rating, and two evaluations in FY17/18 lacked responses needed for the effectiveness rating (identified as “incomplete data” in Fig. 50).

When comparing ratings by size of the dispersed recreation area, no significant differences in area size by rating category were found for the implementation ratings or effectiveness ratings in either monitoring period (implementation: $p = 0.61$ FY15/16, $p = 0.12$ FY17/18; effectiveness: $p = 0.49$ FY15/16, $p = 0.50$ FY17/18; GLMM with lognormal distribution and identity link function). In FY15/16, recreation areas with *no BMPs* implementation ratings and *not effective* effectiveness ratings had the largest mean size (about 30 acres); in FY17/18, areas with *fully implemented* and *effective* ratings were largest, averaging 30 and 16 acres, respectively. Whether the area was in an AMZ was not significantly associated with the implementation ratings or effectiveness ratings in either monitoring period (implementation: $p = 0.66$ FY15/16, $p = 0.97$ FY17/18; effectiveness: $p = 0.34$ FY15/16, $p = 0.31$ FY17/18). A higher percentage of areas in an AMZ had prescribed BMPs and therefore an implementation rating other than *no BMPs*, but at least half of those areas also were rated *not effective* (Fig. 51).

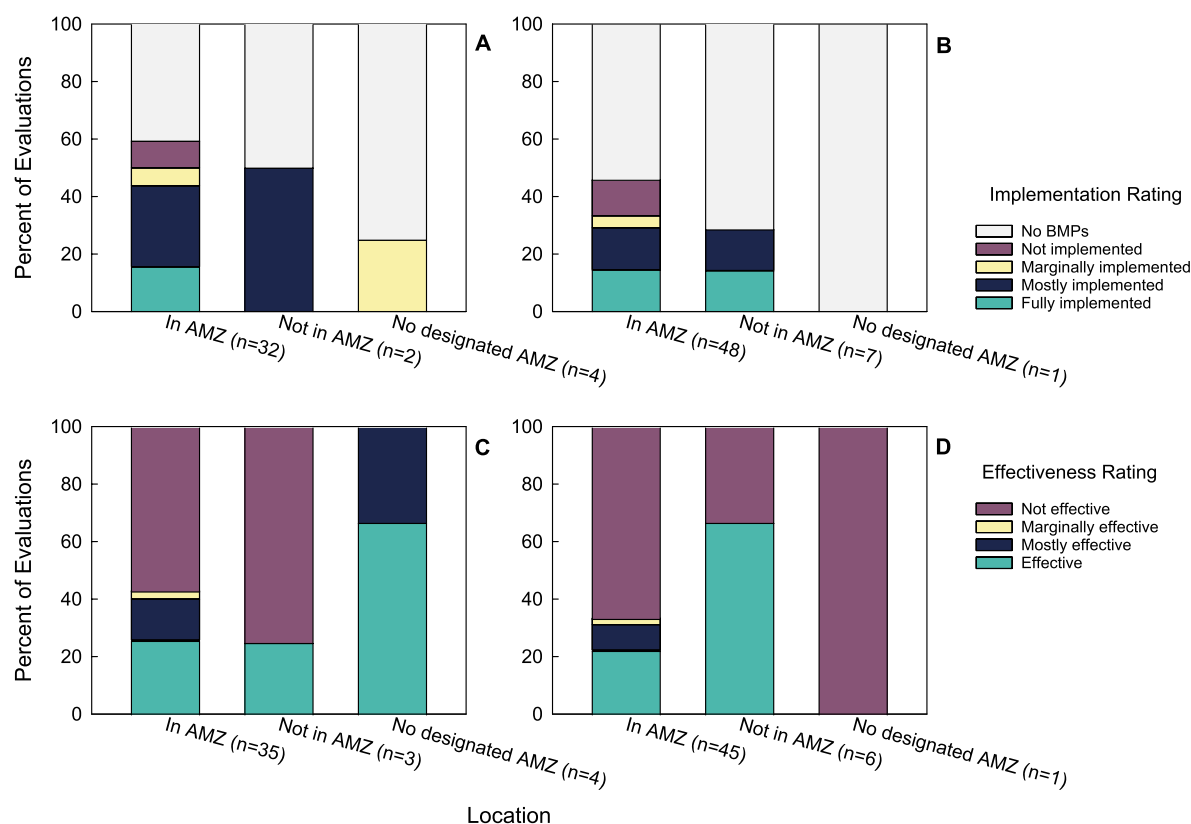


Figure 51.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by recreation area location (Rec B-Q23) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). AMZ = aquatic management zone.

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Rec B-Q16) were not associated with the effectiveness ratings in either monitoring period ($p = 0.78$ FY15/16, $p = 0.89$ FY17/18) (Fig. 52), although ratings were slightly better for evaluations during dry weather. 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. However, relationships between weather conditions and field observations of erosion, sedimentation, or morphological effects (e.g., Fig. 49) 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.

The effectiveness ratings were not significantly associated with whether recreation areas had unresolved maintenance needs in either monitoring period ($p = 0.21$ FY15/16, $p = 0.20$, FY17/18); however, in both periods, 80 percent or more of areas with maintenance needs had the poorest rating (Fig. 53). No significant associations were found between the effectiveness ratings and whether documents pertinent to BMP guidance for the operation and maintenance of the recreation area existed ($p = 0.11$ FY15/16, $p = 0.32$ FY17/18), although areas with prescribed BMPs had slightly better ratings (Fig. 54). The number of BMP provisions implemented fully (Rec B-Q27) was significantly different between effectiveness ratings in FY15/16 ($p = 0.09$ FY15/16, GLMM with negative binomial distribution and log link function) but not in FY17/18 ($p = 0.36$).

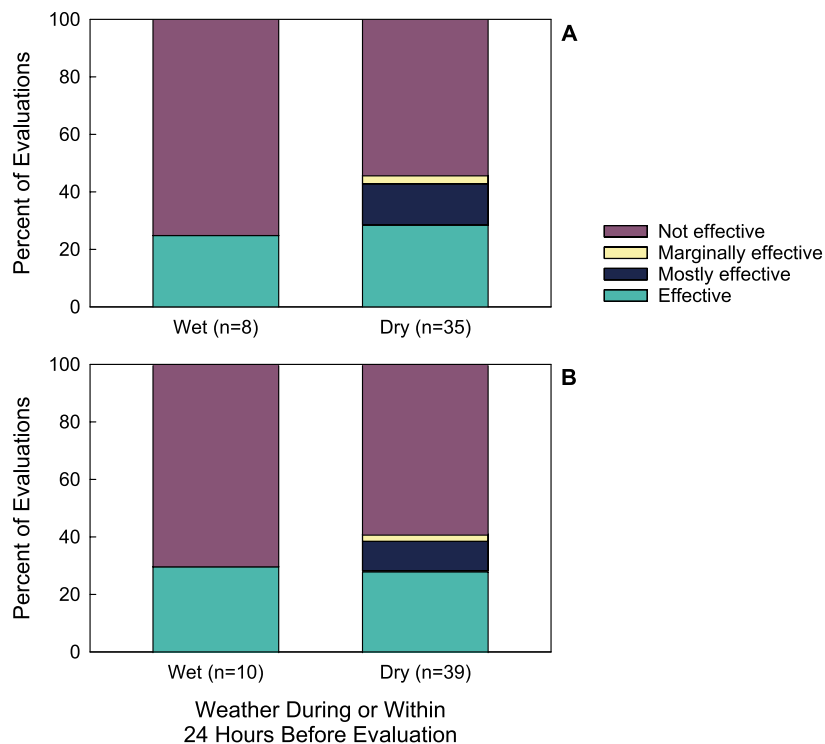


Figure 52.—Distribution of effectiveness ratings by weather conditions (Rec B-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

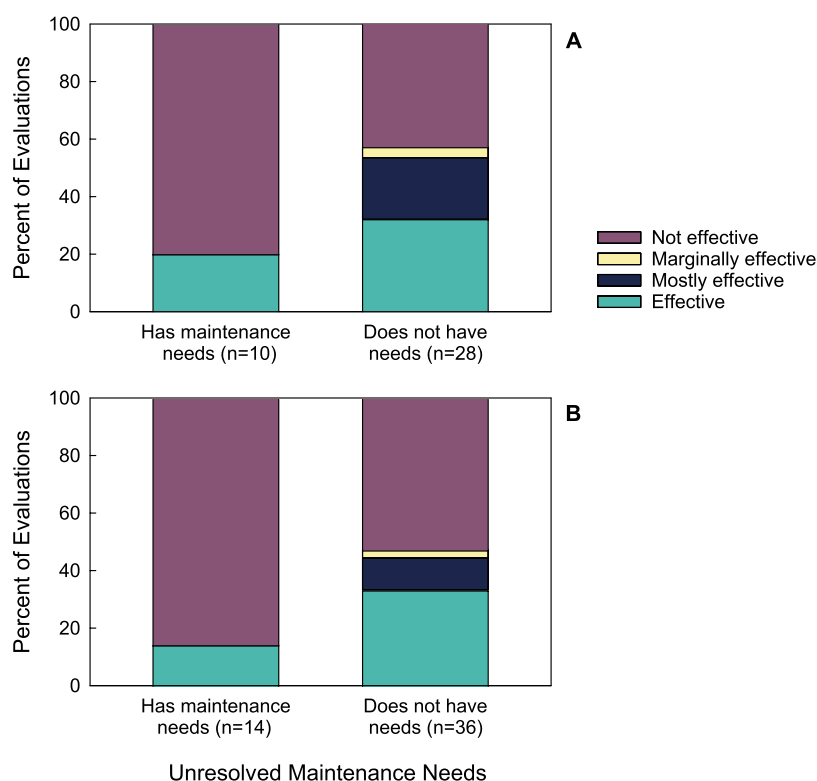
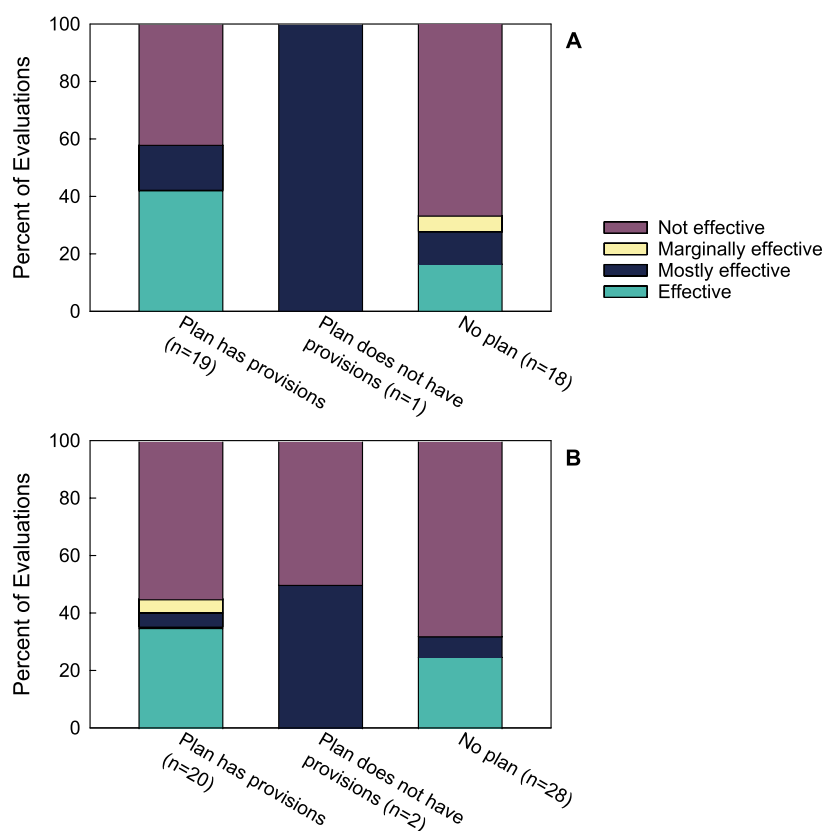


Figure 53.—Distribution of effectiveness ratings by whether recreation area had unresolved maintenance needs (Rec B-Q26) for evaluations completed in FY15/16 (A) and FY17/18 (B).

Recreation areas rated *mostly effective* in FY15/16 averaged one provision implemented fully—significantly fewer than for areas rated *effective* or *not effective* which averaged three and four provisions implemented fully, respectively. In FY17/18, evaluations averaged from two to five provisions implemented fully across all effectiveness ratings. Mean percentages of BMPs implemented fully in FY15/16 were more variable across the effectiveness ratings—ranging from 33 to 76 percent—but a significant difference was not found ($p = 0.45$, Kruskal-Wallis test). Recreation areas rated *mostly effective* had the lowest percentage of BMPs implemented fully in that period. In FY17/18, the percentages of BMPs implemented fully ranged from 61 percent for areas rated *not effective* to 100 percent for all other ratings, and no significant differences were found ($p = 0.16$, Kruskal-Wallis test).

Eleven percent of recreation areas evaluated for effectiveness in FY15/16 and 8 percent in FY17/18 had been closed or had use restrictions within the 5 years prior to the evaluation. Whether the area was closed was significantly associated with effectiveness ratings in FY15/16 ($p = 0.04$) but not in FY17/18 ($p = 0.14$). When closure was not needed, ratings in both periods were somewhat better; about 20 and 10 percent more evaluations in FY15/16 and FY17/18, respectively, were rated *effective* than when area closure or use restriction were needed. A larger percentage of recreation areas had treatments applied to



Documents Contain BMP Provisions

Figure 54.—Distribution of effectiveness ratings by whether recreation area operation and maintenance plan or other guidance documents contained BMPs (Rec B-Q27) for evaluations completed in FY15/16 (A) and FY17/18 (B).

reduce impacts to water resources (Table 76) than were closed. Whether treatments were applied was significantly associated with effectiveness ratings in each monitoring period ($p = 0.01$ FY15/16, $p = 0.09$ FY17/18). Ratings were better when treatments were not needed or needed and applied (Fig. 55).

During the implementation portion of the evaluation, review of documents and inquiries with site administrators occur to determine whether corrective actions were taken if problems were observed during the operating season (Rec B-Q30). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. A significant association was not found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in FY15/16 ($p = 0.34$), but an association was found in FY17/18 ($p < 0.01$). In that monitoring period, the effectiveness ratings were better when corrective actions were not needed (Fig. 56).

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

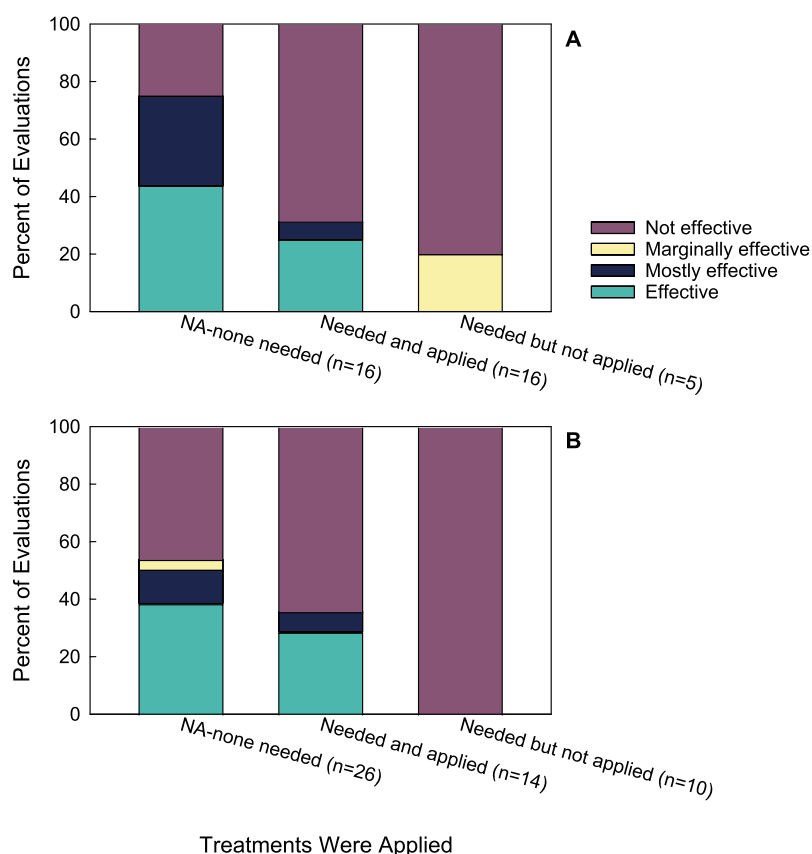


Figure 55.—Distribution of effectiveness ratings by whether recreation area had treatments applied to reduce impacts to water resources (Rec B-Q33) for evaluations completed in FY15/16 (A) and FY17/18 (B). NA = not applicable.

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.

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 of BMPs applicable to the project or site; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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

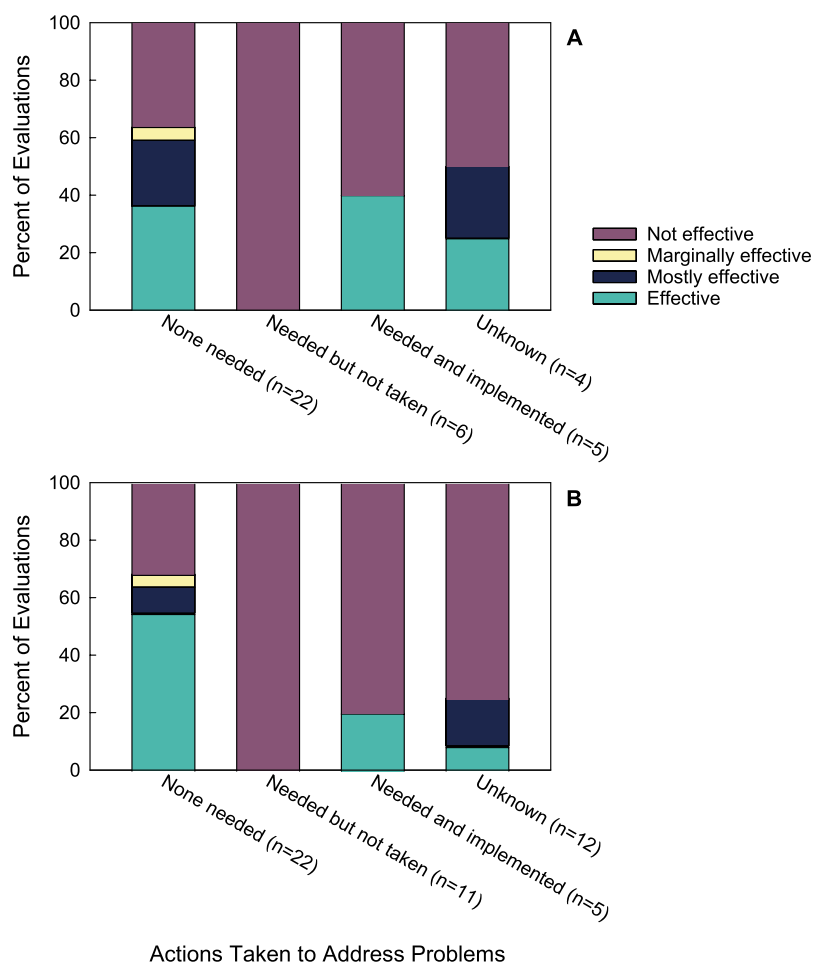


Figure 56.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during operation and maintenance of recreation area during the current operating season (Rec B-Q30) for evaluations completed in FY15/16 (A) and FY17/18 (B).

cover is assessed at recreation areas every operating season to ensure those standards are met or initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations identified as needing implementation corrective actions or adaptive management actions was about half to two-thirds the number needing no actions (Fig. 57). In FY15/16, there was not a significant association between corrective action needs and implementation ratings ($p = 0.38$), but a significant association existed between adaptive management action needs and implementation ratings ($p = 0.05$). Implementation ratings were somewhat poorer when adaptive management actions were needed (Fig. 57). In FY17/18, a significant association existed between corrective action needs and implementation ratings ($p = 0.07$) but not between adaptive management needs and ratings ($p = 0.82$). In contrast, there were significant associations between whether

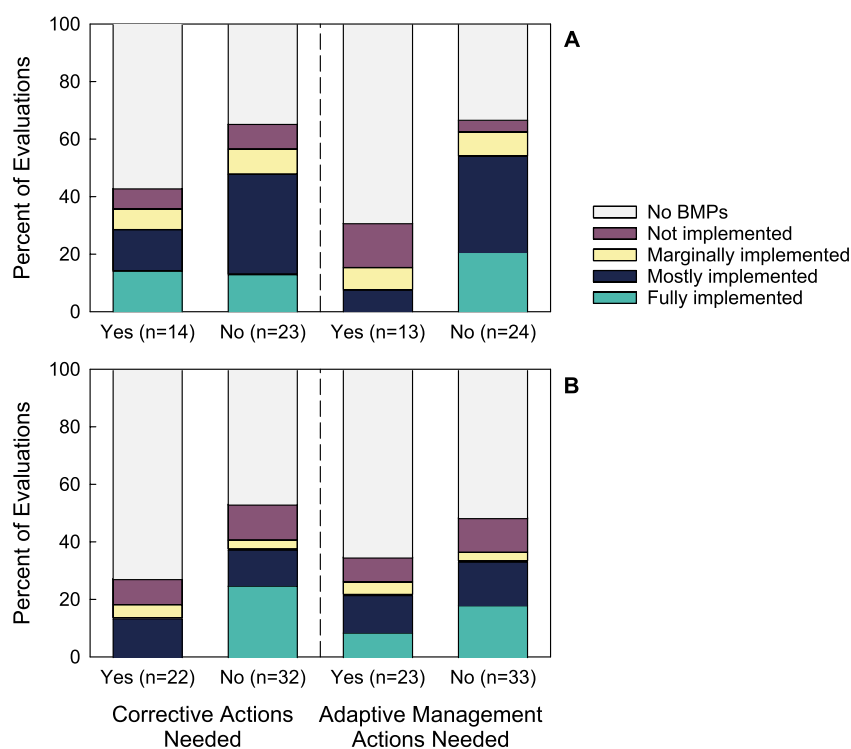


Figure 57.—Distribution of implementation ratings by whether corrective actions (Rec B-Q37) or adaptive management actions (Rec B-Q39) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

corrective actions were needed and effectiveness ratings in each monitoring period ($p < 0.01$ FY15/16, $p < 0.001$ FY17/18) and also between whether adaptive management actions were needed and effectiveness ratings in FY17/18 ($p < 0.001$). Better effectiveness ratings were associated with recreation areas for which no corrective actions were identified as needed as well as with areas that had no adaptive management action needs identified, particularly those in FY17/18 (Fig. 58).

Some evaluations were rated as *not implemented*, *no BMPs*, or *not effective* when no corrective actions or adaptive management actions were identified as needed. This combination of results may seem counterintuitive. The 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 area 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 Rec B-Q37, Rec B-Q39, Rec B-Q66, and Rec B-Q68.

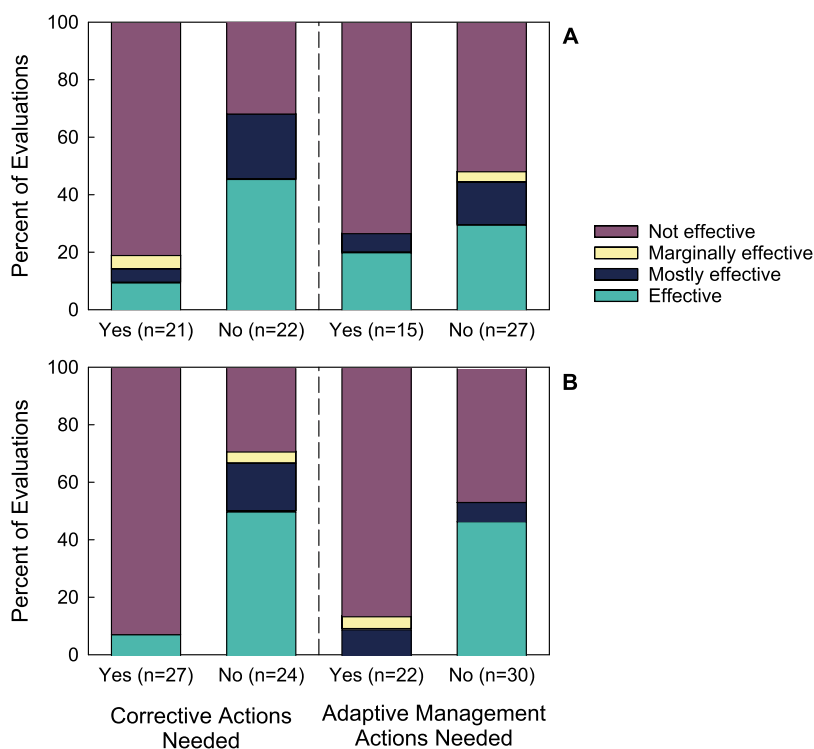


Figure 58.—Distribution of effectiveness ratings by whether corrective actions (Rec B-Q66) or adaptive management actions (Rec B-Q68) were needed to improve effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

Composite Ratings

Composite rating results for Rec B dispersed recreation areas that were evaluated for both implementation and effectiveness are given in Table 91. Sixteen percent of areas had a composite rating of *excellent*, and 5 percent were rated as *good*. About 23 percent of the areas were rated as *poor*, and 52 percent (45 areas) 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, significant associations between implementation ratings and effectiveness ratings were not found in either monitoring period ($p = 0.40$ FY15/16, $p = 0.14$ FY17/18). In both periods, better implementation tended to result in better effectiveness, but poor effectiveness occurred across all levels of implementation.

Recreation B: Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings for Rec B were determined from the component scores (Tables 64 and 65). When a recreation area evaluation did not include connecting trails between the area and a waterbody or AMZ, the missing component was scored as *no trails* (Table 65) and did not influence the final effectiveness rating. Table 92 shows the distribution of scores across the three implementation components. Thirteen

Table 91.—Composite rating matrix for Rec B areas evaluated for both implementation and effectiveness in FY15/16 (n=37 evaluations) and FY17/18 (n=50 evaluations). Numbers in cells indicate the number of evaluations 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	5	1		3
	Mostly effective	1	1		2	2
	Marginally effective					1
	Not effective	2	3	2	1	11

FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective	5	2			7
	Mostly effective	1			1	2
	Marginally effective		1			
	Not effective	2	5	1	4	19

Excellent
Good
Fair
Poor
No plan

recreation areas had *all* scores for all three implementation components, which resulted in implementation ratings of *fully implemented* (Table 93). Lack of O&M guidance documents resulted in a *no BMPs* planning component score for 50 recreation areas but also an *all* score for the on-the-ground execution component (i.e., no O&M documents is equivalent to all provisions being implemented fully; Table 92). The project oversight component is determined from four metrics: inspections (Rec B-Q29), whether corrective actions were taken if needed (Rec B-Q30), whether the area needed to be closed or use restricted (Rec B-Q31), and whether treatments were applied when needed (Rec B-Q33). A score of *none* for the project oversight component indicates deficiencies in the last three metrics, while a *some* score results from a deficiency in one or some other combination of metrics. Forty-three of 58 recreation areas with a *some* score for the project oversight component (Table 92) had that score because areas were not inspected or inspections were not at critical times, and 12 areas had deficiencies in inspections and in one or two other metrics.

The distribution of scores across the five effectiveness components is summarized in Tables 94 and 95. In each monitoring period, the erosion and sedimentation components had higher percentages of *not effective* scores compared to the other components (Table 94). In both monitoring periods combined, 26 evaluations had scores of *effective*

Table 92.—Distribution of implementation component scores by component for Rec 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=39)							
	All	20	51	34	87	12	31
	Some ^a			3	8	23	59
	None ^a			2	5	3	8
	No BMPs prescribed ^b	1	3				
	No O&M ^{b,c}	18	46				
	Incomplete data ^d					1	3
FY17/18 (n=56)							
	All	21	38	51	91	14	25
	Some			2	4	35	63
	None			3	5	7	12
	No BMPs prescribed	3	5				
	No O&M	32	57				

^a Score applies only to on-the-ground execution and project oversight components (see Table 64).

^b Score applies only to planning component (see Table 64).

^c Operation and maintenance.

^d Some of the questions needed to determine a component score were not answered.

(or *no trails*) for all five components, resulting in an effectiveness rating of *effective* (Table 95); 14 had a *not effective* score for one component, and 32 areas had a *not effective* score for two components. The *not effective* scores for the erosion and sedimentation-waterbody transect component contributed to a rating of *not effective* for 51 of the 58 evaluations with that rating (Table 95).

Effectiveness component scores were analyzed to determine whether associations existed between the component scores and the implementation ratings (Fig. 59). A significant association was found for the trash and waste-waterbody transect component in FY17/18 ($p = 0.09$). All other association test results were not significant (erosion and sedimentation-waterbody transect: $p = 0.88$ FY15/16, $p = 0.11$ FY17/18; erosion and sedimentation-trails: $p = 0.24$ FY15/16, $p = 0.13$ FY17/18; trash and waste-waterbody transect: $p = 0.97$ FY15/16; trash and waste-trails: $p = 0.57$ FY15/16, $p = 0.50$ FY17/18; chemical pollutants: $p = 0.38$ FY15/16, $p = 0.27$ FY17/18). The large number of evaluations rated *no BMPs* limits the usefulness of the implementation rating comparisons. The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 60. No significant associations existed in either monitoring period for any component (planning: $p = 0.11$ FY15/16, $p = 0.32$ FY17/18; on-the-ground execution: $p = 0.81$ FY15/16, $p = 0.80$ FY17/18; project oversight: $p = 0.71$ FY15/16, $p = 0.22$ FY17/18). However, in most cases effectiveness ratings were better when component scores were *all* (Fig. 60).

Table 93.—Implementation component scores corresponding to the overall implementation ratings for Rec B evaluations completed in FY15/16 and FY17/18. See Table 64 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=38)					
	Fully implemented	All	All	All	5
	Mostly implemented	All	All	Some	10
	Marginally implemented	All	Some	All	2
		All	Some	Some	1
	Not implemented	All	None	All	1
		All	None	Some	1
		No Rx ^a	All	Some	1
	No BMPs	No O&M ^b	All	All	4
		No O&M	All	Some	10
No O&M		All	None	3	
FY17/18 (n=56)					
	Fully implemented	All	All	All	8
	Mostly implemented	All	All	Some	8
	Marginally implemented	All	Some	Some	2
	Not implemented	All	None	Some	1
		All	None	None	2
		No Rx	All	All	2
		No Rx	All	Some	1
	No BMPs	No O&M	All	All	4
		No O&M	All	Some	23
No O&M		All	None	5	

^a No BMPs prescribed.

^b Operation and maintenance.

Recreation B: Management Implications for Forest Service Managers

Thirty-three percent of the dispersed recreation areas rated either *fully implemented* or *mostly implemented* for BMP implementation, and 62 percent rated either *not implemented* or *no BMPs*. *Not implemented* in the context of Rec B means that an O&M plan or a similar document exists for the area but does not contain BMPs. *No BMPs* means no O&M plan or other document exists for the area. Project planning was a deficiency at more than half of the areas due to the lack of those documents or lack of BMPs in those documents. Of the three implementation components, the on-the-ground execution component had the best scores, with 89 percent of the areas scoring *all*; however, five areas had an on-the-ground execution component score of *none*, indicating that none of the prescribed BMPs were implemented fully. When BMPs were prescribed for dispersed

Table 94.—Distribution of effectiveness component scores by component for Rec B evaluations completed in FY15/16 and FY17/18

Monitoring period	Component score	Erosion and sedimentation-waterbody transect component (number)	Erosion and sedimentation-waterbody transect component (percent)	Erosion and sedimentation-trails component (number)	Erosion and sedimentation-trails component (percent)	Trash and waste-waterbody transect component (number)	Trash and waste-waterbody transect component (percent)	Trash and waste-trails component (number)	Trash and waste-trails component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=44)											
	Effective	21	48	16	44	32	73	24	67	42	95
	Mostly effective ^a	1	2	2	6						
	Moderately effective ^b					6	14	8	22	1	2
	Marginally effective ^a	2	5	4	11						
	Not effective	20	45	14	39	6	14	4	11	1	2
	No trails ^c			8	-- ^c			8	--		
FY17/18 (n=54)											
	Effective	18	33	13	36	30	56	22	61	50	93
	Mostly effective	3	6								
	Moderately effective					12	22	6	17	1	2
	Marginally effective			1	3						
	Not effective	33	61	22	61	12	22	6	17	2	4
	No trails			18	--			18	--		
	Incomplete data ^d							2	6	1	2

^a Score applies only to all erosion and sedimentation components (see Table 65).^b Score applies only to all trash and waste and chemical pollutants components (see Table 65).^c Not included in calculation of percentages.^d Some of the questions needed to determine a component score were not answered.

Table 95.—Effectiveness component scores corresponding to the overall effectiveness ratings for Rec B evaluations completed in FY15/16 and FY17/18. See Table 65 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Erosion and sedimentation-waterbody transect component	Erosion and sedimentation-trails component	Trash and waste-waterbody transect component	Trash and waste-trails component	Chemical pollutants component	Number of evaluations
FY15/16 (n=44)							
	Effective	Effective	Effective	Effective	Effective	Effective	12
	Mostly effective (n=6)	Effective	Effective	Effective	Effective	Moderately effective	1
		Effective	Effective	Effective	Moderately effective	Effective	1
		Effective	Effective	Moderately effective	Effective	Effective	1
		Effective	Effective	Moderately effective	Moderately effective	Effective	1
		Effective	Mostly effective	Effective	Moderately effective	Effective	1
		Mostly effective	No trails	Effective	No trails	Effective	1
	Marginally effective	Marginally effective	Effective	Effective	Moderately effective	Effective	1
	Not effective (n=25)	Effective	Effective	Not effective	Not effective	Effective	1
		Effective	Marginally effective	Effective	Effective	Not effective	1
		Effective	Not effective	Effective	Effective	Effective	2
		Marginally effective	Not effective	Effective	Effective	Effective	1
		Not effective	Effective	Effective	Effective	Effective	2
		Not effective	Marginally effective	Effective	Effective	Effective	1
		Not effective	Marginally effective	Effective	Moderately effective	Effective	1
		Not effective	Marginally effective	Not effective	Not effective	Effective	1
		Not effective	Mostly effective	Not effective	Moderately effective	Effective	1
		Not effective	No trails	Moderately effective	No trails	Effective	2
		Not effective	No trails	Not effective	No trails	Effective	1
		Not effective	Not effective	Effective	Effective	Effective	7
		Not effective	Not effective	Moderately effective	Moderately effective	Effective	1
		Not effective	Not effective	Moderately effective	Not effective	Effective	1
		Not effective	Not effective	Not effective	Moderately effective	Effective	1
		Not effective	Not effective	Not effective	Not effective	Effective	1

(continued)

Table 95.—(continued)

Monitoring period	Effectiveness rating	Erosion and sedimentation-waterbody transect component	Erosion and sedimentation-trails component	Trash and waste-waterbody transect component	Trash and waste-trails component	Chemical pollutants component	Number of evaluations
FY17/18 (n=52)							
	Effective	Effective	Effective	Effective	Effective	Effective	14
	Mostly effective (n=4)	Effective	No trails	Moderately effective	No trails	Effective	1
		Mostly effective	Effective	Effective	Effective	Effective	1
		Mostly effective	No trails	Moderately effective	No trails	Effective	2
		Mostly effective	No trails	Moderately effective	No trails	Effective	2
	Marginally effective	Effective	Marginally effective	Effective	Effective	Effective	1
	Not effective (n=33)	Effective	No trails	Not effective	No trails	Not effective	1
		Effective	Not effective	Not effective	Not effective	Effective	1
		Not effective	Effective	Not effective	Not effective	Effective	2
		Not effective	No trails	Effective	No trails	Effective	1
		Not effective	No trails	Moderately effective	No trails	Effective	3
		Not effective	No trails	Moderately effective	No trails	Not effective	1
		Not effective	No trails	Not effective	No trails	Effective	3
		Not effective	Not effective	Effective	Effective	Effective	11
		Not effective	Not effective	Moderately effective	Effective	Effective	1
		Not effective	Not effective	Moderately effective	Moderately effective	Effective	4
		Not effective	Not effective	Not effective	Effective	Moderately effective	1
		Not effective	Not effective	Not effective	Moderately effective	Effective	1
		Not effective	Not effective	Not effective	Not effective	Effective	3

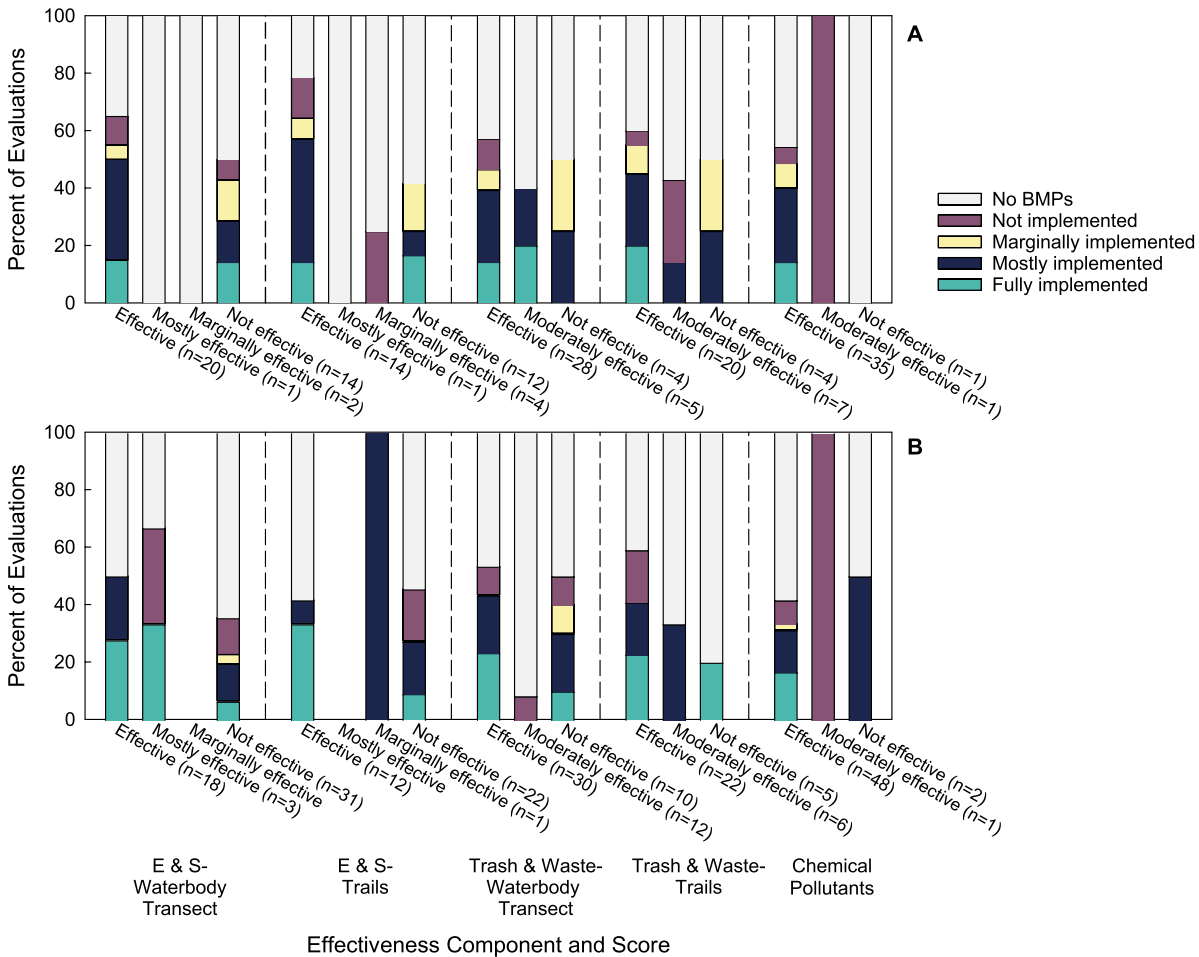


Figure 59.—Distribution of implementation ratings across effectiveness component scores for Rec B evaluations completed in FY15/16 (A) and FY17/18 (B). E & S = erosion and sedimentation.

recreation areas, they were implemented fully at an average rate of 78 percent. Deficiencies in project oversight were found in 73 percent of the evaluations. When a deficiency in project oversight occurred, it was most frequently due to a lack of inspections; 74 percent of the areas that scored *some* for the project oversight component had no inspections or inspections were not at critical times.

For BMP effectiveness, thirty-seven percent of the areas rated *effective* or *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. Sixty percent of the areas were rated *not effective*, indicating that impacts to water quality were occurring. Of the areas rated *not effective*, 88 percent had a *not effective* score for the erosion and sedimentation-waterbody transect component, and 62 percent had that score for the erosion and sedimentation-trails component. Scores for the trash and waste-waterbody transect and trash and waste-trails components were *not effective* for 29 and 17 percent, respectively, of the areas with a *not effective* rating. Seventy-six percent of the dispersed recreation areas rated *not effective* had that score for two or more effectiveness components.

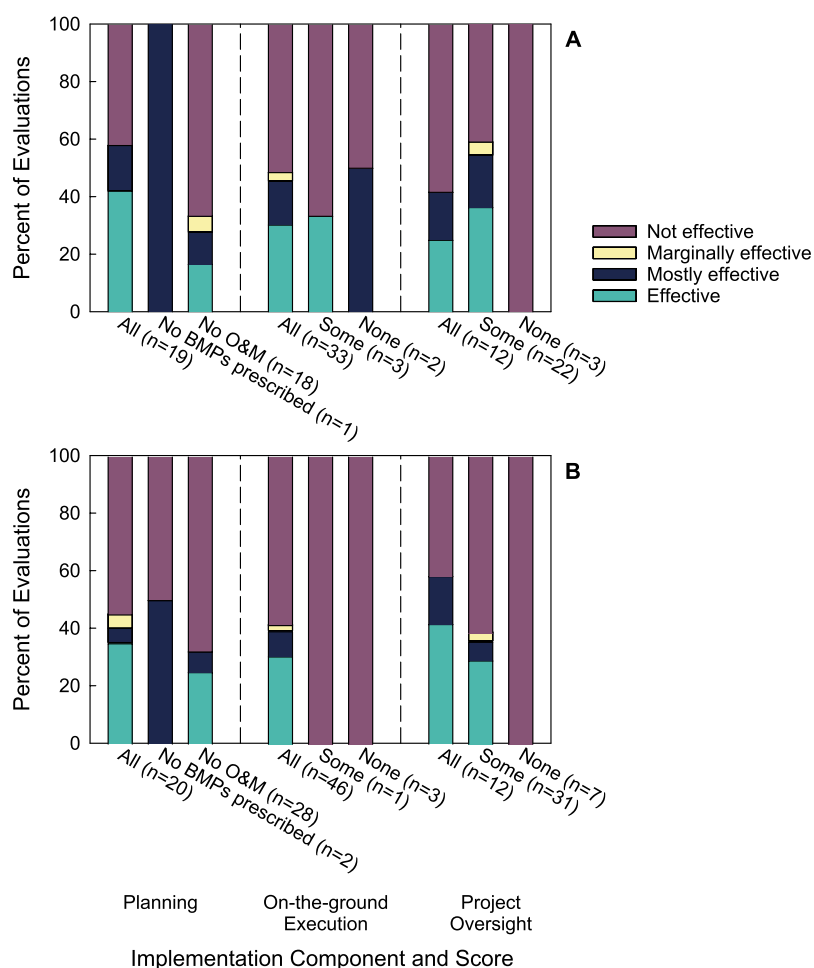


Figure 60.—Distribution of effectiveness ratings across implementation component scores for Rec B evaluations completed in FY15/16 (A) and FY17/18 (B). O&M = operation and maintenance.

Evidence of erosion or sedimentation was observed along the waterbody transect at 62 percent of the dispersed recreation areas. Evidence of erosion or sedimentation was observed in the waterbody in 74 percent of those evaluations. The evidence was primarily vegetation damage or bare ground and bank trampling or compaction. The most frequently reported sources of erosion and sedimentation were dispersed camping areas and user-created trails. The causes reported most frequently were inappropriate location of the use area and runoff from a road or parking area. Evidence of erosion or sedimentation on or from the connecting trails was found within 10 feet of the waterbody or in the waterbody in 58 percent of the areas with connecting trails. The evidence was primarily vegetation damage or bare ground and bank trampling or compaction. Seventy-six percent of the evaluations that observed erosion and sedimentation along the connecting trails reported a user-created trail as the source. The causes reported most frequently were inappropriate location of trails and inappropriate trail design.

Evidence of trash or domestic animal or sanitary waste was observed at 63 percent of the areas. More than 80 percent of those evaluations identified the cause as inconsiderate human actions, and 21 percent reported the cause as use exceeding area capacity.

Examination of the Rec B data provides some evidence that better BMP implementation results in better BMP effectiveness at dispersed recreation areas. No significant association was found between the implementation ratings and effectiveness ratings for evaluations completed in either monitoring period, although better implementation tended to result in better effectiveness ratings. In total, when the implementation rating was *fully implemented* or *mostly implemented*, a greater percentage of those areas were rated *effective* or *mostly effective* (57 percent) than *marginally effective* or *not effective* (43 percent). When no O&M documents existed for the area (i.e., an implementation rating of *no BMPs*), the effectiveness rating was *not effective* for two-thirds of those areas.

The large number of implementation evaluations rated *no BMPs* limits comparison of implementation and effectiveness ratings and component scores. Only one significant association between an effectiveness component and implementation ratings was found: the trash and waste-waterbody transect component in FY17/18. No significant associations between implementation components and effectiveness ratings were found in either monitoring period. In most cases, however, effectiveness was better when the implementation component score was *all*.

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

- Developing O&M plans or similar documents with BMPs for dispersed recreation areas. Of the evaluated areas, 43 percent had an O&M plan or similar document with BMPs. Although no significant association was found between the existence of O&M documents and effectiveness ratings, areas with prescribed BMPs had slightly better ratings. For example, in FY15/16 and 17/18, respectively, 63 and 53 percent of evaluated areas with prescribed BMPs reported no evidence of erosion or sedimentation observed along the waterbody transect, but 63 and 75 percent of areas without O&M documents did report evidence of erosion or sedimentation in that location.
- Locating dispersed recreation areas outside the AMZ. Although no significant association was found between the location of erosion and sedimentation evidence observed along the waterbody transect and the location of the recreation area within or outside the AMZ, significant differences in the distance between the recreation area and the nearest waterbody were found among the locations where evidence of erosion and sedimentation were observed. In FY15/16, the average distance was 150 feet for evaluations that reported no evidence of erosion or sedimentation compared to an average distance of less than 50 feet when erosion and sedimentation evidence was observed. Similarly, for areas evaluated in FY17/18, the average distance between the recreation area and the nearest waterbody was less than 50 feet when evidence of erosion or sedimentation was observed in the waterbody and greater than 150 feet when no evidence or evidence within the area was observed (Fig. 47).

- Increasing administration of dispersed recreation sites. A deficiency identified in BMP implementation was project oversight, which included lack of inspections or lack of inspections at critical times.
- Increasing maintenance of dispersed recreation areas. Although no significant associations were found between effectiveness ratings and areas with unresolved maintenance needs, 80 percent or more of the areas with maintenance needs had the poorest effectiveness ratings in both monitoring periods. In addition, significant associations were found between effectiveness ratings and area closure, use restrictions, or treatments. More recreation areas were rated *effective* when a closure was not needed than when a closure or use restriction was needed. Similarly, effectiveness ratings were better when treatments were not needed or when treatments were needed and applied. In addition, the time between when problems were identified and treatments were applied averaged more than 2 years.
- Reducing the number of user-created trails at dispersed recreation areas. More than two-thirds of the connecting trails evaluated were user-created. Evidence of erosion and sedimentation observed along the waterbody transect contributed to *not effective* ratings for 88 percent of evaluated areas, while evidence on or from connecting trails contributed to *not effective* ratings for 62 percent of areas. The source of erosion and sedimentation along the waterbody transect and the connecting trails reported most frequently was user-created trails. Inappropriate locations and inappropriate design of trails were among the most frequently reported causes of the erosion and sedimentation observed at these areas.

Recreation B: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Rec B. Dispersed Recreation Areas

(Reference BMPs Rec-1, Rec-3, and Rec-4)

v3.0 February 2016

Header	
Rec B-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec B-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec B-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec B-Q4	Date of current field evaluation:
Rec 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:
Rec 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:
Rec B-Q7	Reviewers and titles:
Rec B-Q8a	Region number:
Rec B-Q8b	State:
Rec B-Q9a	Proclaimed Forest or Grassland number and name:
Rec B-Q9b	Administrative Forest or Grassland number and name:
Rec B-Q10	District number and name:
Rec B-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec 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: a. Yes b. No 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:
Rec B-Q12	6 th level HUC number and name for the subwatershed this dispersed recreation area is in:
Rec B-Q13	Is any part of the dispersed recreation area that is being evaluated located within a municipal supply watershed? Select one: a. Yes b. No
Rec B-Q14a	Location. UTM Zone: UTM Datum:
Rec B-Q14b	Location. Easting:
Rec B-Q14c	Location. Northing:
Rec B-Q15a	Location. Latitude:
Rec B-Q15b	Location. Longitude:
Rec B-Q15c	Location. Lat/Long Datum:
Rec B-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec B-Q17	Name of area:
Rec B-Q18	Dates this area is normally available for use (month to month):
Rec B-Q19	Was this area used for a special event during the past 12 months? Select one: a. Yes b. No If Yes, give name of event and dates of event:

continued on next page

Header (continued)	
Rec B-Q20	What are the primary recreation uses at this area? Select all that apply: Camping Swimming Picnicking Hunting Fishing Rock climbing Other (specify):
Rec B-Q21	Are sanitation facilities available at this area? Select one: a. Yes b. No
Rec B-Q22	Approximate size of area (ac, ha, m² or ft²; specify unit):
Rec B-Q23	Is any part of this area located within an AMZ? Select one: a. Yes b. No c. Waterbody has no designated AMZ
Rec B-Q24	Distance from area to nearest waterbody (ft or m; specify unit):
Rec B-Q25	Type of waterbody adjacent to waterbody transect. Select all that apply: Ephemeral stream Intermittent stream Perennial stream/river Pond Lake Wetland/wet meadow Estuary Other (specify):
Implementation	
Rec B-Q26	Are there any unresolved maintenance needs related to water, aquatic, or riparian resources that were identified for this dispersed recreation area prior to this evaluation? Select one: a. Yes b. No If Yes, what needs were unresolved?
Rec B-Q27	Does the operation and maintenance plan or other operation and maintenance guidance documents for this use area contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 28) b. Plan or other O&M guidance documents exist for this area, but they do not contain provisions for water/aquatic/riparian protection (go to question 29) c. No operation and maintenance plan or other O&M guidance documents exist for this area (go to question 29)

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Implementation (continued)

Rec B-Q28	Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the operation and maintenance plan 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 or other guidance documents and it was implemented fully, select Yes. If the provision exists in the operation and maintenance plan or other guidance documents but it was not implemented fully, select No. If the provision does not exist in the operation and maintenance plan or other guidance documents, or it is too early in the operating season to require implementation, select Not applicable. a. Locations and spacings of cross drains on trails (e.g., waterbars) Yes/No/Not applicable b. Cross drain techniques Yes/No/Not applicable c. Trail grades Yes/No/Not applicable d. Trail surfacing Yes/No/Not applicable e. Trail locations Yes/No/Not applicable f. Waterbody crossing techniques Yes/No/Not applicable g. Mulching and/or seeding, or other soil cover techniques Yes/No/Not applicable h. Locations and numbers of trash receptacles Yes/No/Not applicable i. Trash receptacle maintenance Yes/No/Not applicable j. Permanent sanitation facilities Yes/No/Not applicable k. Temporary (portable) sanitation facilities Yes/No/Not applicable l. Maintenance requirements for roads and access routes Yes/No/Not applicable m. Maintenance requirements for parking areas Yes/No/Not applicable n. Water supply/delivery system maintenance Yes/No/Not applicable o. Invasive species control Yes/No/Not applicable p. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec B-Q29	Were inspections during this operating season performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No
Rec B-Q30	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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination

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Implementation <i>(continued)</i>	
Rec B-Q31	Has the dispersed recreation area or portions of it been closed, or have restrictions been placed on use during the past 5 years to protect or restore water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted closure or use restriction (go to question 33) b. Needed and closed or use restricted (go to question 32) c. Needed but not closed or use not restricted (go to question 33)
Rec B-Q32	What length of time passed between when the problem was identified and the closure or use restriction was implemented? (days, weeks, months, or years; specify unit):
Rec B-Q33	Were any treatments applied to this dispersed recreation area during the past 5 years to reduce negative impacts to water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted application of treatments (go to question 35) b. Needed and applied (go to question 34) c. Needed but not applied (go to question 35) If applied, describe the treatments:
Rec B-Q34	What length of time passed between when the problem was identified and the treatment was applied? (days, weeks, months, or years; specify unit):
Rec B-Q35	Why was the area closed, use restricted, and/or treatments applied? Select all that apply: a. Not applicable, no closure, use restriction, or treatments applied during the past 5 years b. Trampled vegetation c. Soil compaction d. Sheet erosion e. Rill erosion f. Gully erosion g. Shoreline/bank erosion h. Road washout i. Washout in use area j. Water quality in waterbody k. Extreme precipitation/weather event l. Other (specify):
Rec B-Q36	Were chemical or fuel spills or leaks, or dumping that occurred at this dispersed area during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills, leaks, or dumping occurred during the last 5 years c. Yes, spills, leaks, or dumping were handled/treated according to the contingency and emergency response plan d. No, spills, leaks, or dumping were not handled/treated according to the contingency and emergency response plan
Rec B-Q37	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39)

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Implementation <i>(continued)</i>	
Rec B-Q38	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec B-Q39	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 40) b. No (go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec B-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.
Effectiveness	
Rec B-Q41	Is there evidence of erosion or sedimentation along the waterbody transect from the use of this dispersed area? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of erosion or sedimentation (go to question 46) b. Evidence of erosion or sedimentation, but not reaching the waterbody (go to question 43) c. Evidence of sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 42)
Rec B-Q42	How many total places do you observe erosion or sedimentation delivered to/present in the waterbody and changes to waterbody morphology? Select one: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec B-Q43	For all of the occurrences of erosion and sedimentation in the area you identified in question 41, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

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Effectiveness (continued)	
Rec B-Q44	What are the sources? Select all that apply: a. Dispersed camping area b. Forest Service-created trail c. User-created trail d. Road or parking area e. Other (specify):
Rec B-Q45	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Inappropriate location of the use area c. Inappropriate location of trails d. Inappropriate trail design e. Lack of trail maintenance f. Insufficient number of trails to the waterbody g. Too many trails to the waterbody h. Watercraft use or wave action i. Runoff from road or parking area j. Other (specify): k. Unknown
Rec B-Q46	What evidence of trash or domestic animal or human sanitary waste exists along the waterbody transect? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste (go to question 48) b. Evidence of trash within the AMZ (go to question 47) c. Evidence of trash in the waterbody (go to question 47) d. Evidence of domestic animal or human sanitary waste/toilet paper within the AMZ (go to question 47) e. Evidence of domestic animal or human sanitary waste/toilet paper in the waterbody (go to question 47)
Rec B-Q47	What are the causes? Select all that apply: a. Insufficient number of waste receptacles b. Waste receptacles not emptied frequently enough c. Use is exceeding carrying capacity of the area d. Insufficient number of toilet facilities e. Toilet facilities are not functioning properly f. Inconsiderate human actions g. Other (specify):
Rec B-Q48	What is the total length of the waterbody transect? (ft or m; specify unit):
Rec B-Q49	What percentage of the length of the waterbody transect has evidence of potential or current impacts to water quality? (percent):
Rec B-Q50	Is there evidence of erosion or sedimentation on or originating from the trails that connect the dispersed area to AMZs or waterbodies? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e. a. Not applicable, no connecting trails (go to question 62) b. No evidence of erosion or sedimentation (go to question 56) c. Evidence of erosion or sedimentation outside an AMZ (go to question 52) d. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 52) e. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 51)

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Effectiveness *(continued)*

Rec B-Q51	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 53: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec B-Q52	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec B-Q53	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 50, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec B-Q54	What are the sources? Select all that apply: a. Dispersed camping area b. Forest Service-created trail c. User-created trail d. Road or parking area e. Other (specify):
Rec B-Q55	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the use area and/or trails b. Inappropriate location of trails c. Inappropriate trail design d. Lack of trail maintenance e. Insufficient number of trails to the waterbody f. Too many trails to the waterbody g. Other (specify):

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Effectiveness (continued)

Rec B-Q56	What evidence of trash or domestic animal or human sanitary waste exists on or along the trails that connect the dispersed area to AMZs or waterbodies? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste (go to question 58) b. Evidence of trash outside an AMZ (go to question 57) c. Evidence of trash within an AMZ (go to question 57) d. Evidence of trash in a waterbody (go to question 57) e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ (go to question 57) f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ (go to question 57) g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody (go to question 57)
Rec B-Q57	What are the causes? Select all that apply: a. Insufficient number of waste receptacles b. Waste receptacles not emptied frequently enough c. Use is exceeding carrying capacity of the area and/or trails d. Insufficient number of toilet facilities e. Toilet facilities are not functioning properly f. Inconsiderate human actions g. Other (specify):
Rec B-Q58	How many trails were reviewed in this evaluation?
Rec B-Q59	How many of the trails that were reviewed were user created?
Rec B-Q60	What is the total length of trails evaluated? (ft or m; specify unit):
Rec B-Q61	What is the total length of user-created trails evaluated? (ft or m; specify unit):
Rec B-Q62	What evidence of chemical or fuel spills or leaks or associated waste containers exists at the area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or associated waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec B-Q63	Did any of the unresolved maintenance needs for this dispersed recreation area contribute to any observed problems? Select one: a. Not applicable, no unresolved maintenance needs existed for this area b. Yes c. No
Rec B-Q64	If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No

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Effectiveness <i>(continued)</i>	
Rec B-Q65	If the area was closed, use was restricted, and/or treatments were applied during the past 5 years to protect or restore water, aquatic, or riparian resources, were the desired results achieved? Select one: a. Not applicable; no area closures, use restrictions, and/or treatments applied during the past 5 years b. The desired result was fully achieved c. The desired result was partially achieved d. Essentially no improvement to the area was achieved e. Too soon to determine
Rec B-Q66	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 67) b. No (go to question 68)
Rec B-Q67	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec B-Q68	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 69) b. No (go to General Comments)
Rec B-Q69	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	

Recreation C—Completed Construction or Re-routing of Motorized or Nonmotorized Trails

Recreation C: Header Statistics

Seventy-six completed trail construction or re-routing projects (Rec C) were evaluated for implementation, effectiveness, or both (Table 96). All regions completed at least two evaluations; Regions 2 and 9 completed 41 percent of all evaluations (see App. 1 for region delineations). At the end of the FY15/16 and FY17/18 monitoring periods, 87 and 89 percent of the evaluations had both implementation and effectiveness monitoring completed, respectively (Table 96). Implementation and effectiveness monitoring were performed on a single day for all but one paired evaluation in FY17/18. Four of the project evaluations for which only implementation was completed (Table 96) were performed in the FY17/18 monitoring period, and the effectiveness evaluation may be included in the next monitoring period (FY19/20). However, the remaining implementation-only evaluations were performed in FY17 or earlier, and effectiveness monitoring did not occur within 12 months of project completion as directed in the protocol instructions, so it is unlikely that these projects were evaluated for effectiveness using Rec C. There was a

Table 96.—Number of Rec C evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Rec C-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	2			2
	2	3	1	1	1
	3	1			1
	4	3			3
	5	2	1		1
	6	3			3
	8	3			3
	9	6			6
	10				
	All	23	2	1	20
	Percent		9	4	87
FY17/18					
	1	1			1
	2	12	1	1	10
	3	3			3
	4	3			3
	5	5	1		4
	6	8	2		6
	8	9			9
	9	10			10
	10	2	1		1
	All	53	5	1	47
	Percent		9	2	89

requirement that at least half of the evaluations used for meeting National BMP targets be selected randomly. For Rec C, 70 percent or more of the projects evaluated in each monitoring period were selected randomly (Table 40).

All Rec C evaluations indicated that a reason for monitoring was to meet National BMP targets, although the protocol simultaneously met other monitoring needs, most frequently project review (Table 97). Quality assurance was identified as a reason for monitoring in 17 Rec C evaluations (Table 97). 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 monitoring effort on that same site . . . [by] different team members than the initial 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

Table 97.—Number of Rec C evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (Rec 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		1	1	
	2	3	1	3	2	2
	3	1		1		
	4	3	1	1		1
	5	2			1	
	6	3		1		
	8	3	1	2		
	9	6	1	3	1	
	10					
	All	23	4	12	5	3
FY17/18						
	1	1				
	2	12	2	11	4	
	3	3		3	3	
	4	3		3		
	5	5		3	1	
	6	8	1	2	1	
	8	9		4	3	
	9	10		3		
	10	2	1	1		
	All	53	4	30	12	0

assurance had a duplicate evaluation, 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.

In FY15/16 and FY17/18, respectively, 43 and 57 percent of the Rec C projects were construction or reconstruction (hereafter referred to as construction). The remainder were trail re-routing projects (Rec C-Q18). Five trails in each monitoring period had been used for a special event in the previous 12 months (Rec C-Q19), and all but one event in FY17/18 involved nonmotorized trail use. The mean length of trail evaluated was 0.66 mile (standard error [se] = 0.21 mile) in FY15/16 and 0.59 mile (se = 0.18 mile) in FY17/18 (Rec C-Q20), although the longest evaluated lengths were 4.6 and 8.2 miles in FY15/16 and FY17/18, respectively. Dominant trail grades (Rec C-Q25) averaged 6.0 percent (se = 0.8 percent) and ranged from flat to 13 percent in FY15/16; the steepest grade evaluated (Rec C-Q26) was 30 percent. In FY17/18, mean dominant grade was 7.3 percent (se = 1.4 percent) and ranged from flat to 45 percent. The steepest grade was 100 percent. Twenty projects (7 in FY15/16 and 13 in FY17/18) had no treated

waterbody crossings in the evaluated trail segment. For the 56 projects with a treated waterbody crossing, 42 had 1 crossing, 11 had 2 crossings, and the others had 3 or 4 crossings (Rec C-Q21). Crossing approaches (Rec C-Q22) ranged from 0 to 1320 feet long and averaged 234 feet (se = 92 feet) in FY15/16. Evaluated approaches were shorter in FY17/18, ranging from 0 to 660 feet and averaging 109 feet (se = 28 feet).

In FY15/16 and FY17/18, respectively, 11 and 39 evaluations reported only nonmotorized uses of trails (Rec C-Q24), 7 and 4 trails reported only motorized uses (Rec C-Q23), and 5 and 7 reported both nonmotorized and motorized uses. Three evaluations in FY17/18 did not answer Rec C-Q23 or Rec C-Q24. Types of motorized and nonmotorized trail uses are summarized in Figure 61. Thirteen trails included multiple motorized uses, compared to 51 trails having multiple nonmotorized uses. When both types of use were permitted, the motorized use reported most frequently was dirt bikes or motorcycles and occurred on 75 percent of those trails.

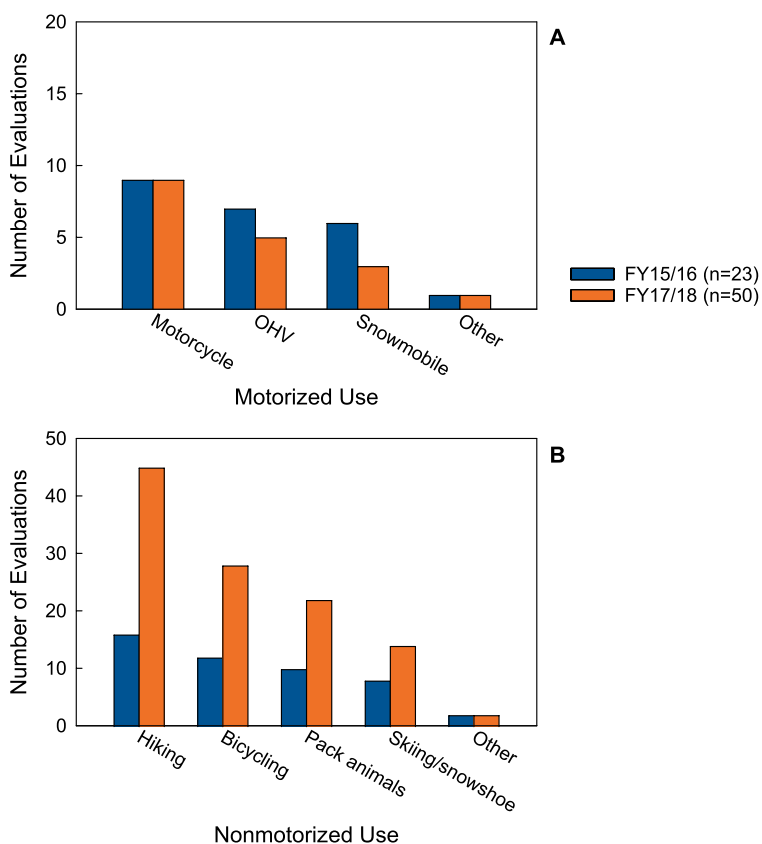


Figure 61.—Distribution of permitted motorized (Rec C-Q23) (A) and nonmotorized (Rec C-Q24) (B) trail uses for evaluations completed in FY15/16 and FY17/18. Multiple selections were possible. OHV = off-highway vehicle.

Recreation C: Implementation Results and Their Tie to Header Information

About 75 percent of the trail projects in each monitoring period indicated that the trail had previously identified unresolved maintenance needs related to water resources (“yes” and “no” answers to Rec C-Q27). Forty-two projects (16 in FY15/16 and 26 in FY17/18) were undertaken to address those needs (Table 98).

Project planning is assessed in the protocol using two questions:

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

The types of primary planning documents used are summarized in Table 99. Categorical exclusions (CEs) outnumbered other types of planning documents used for completed trail projects. The projects that had no BMPs from planning included three construction projects in FY17/18 and one trail re-routing project in each monitoring period. The type of trail project (Rec C-Q18) was not statistically associated with type of planning document used in FY15/16 ($p = 1.00$), but a significant association was found in FY17/18 ($p = 0.07$). In that period, half of the construction projects used planning documents from NEPA or other guidance documents, compared to 42 percent of re-routing projects using those types of documents. Whether the trail had only motorized or nonmotorized uses or had both types of use was not significantly associated with the type of planning document used in either monitoring period ($p = 0.23$ FY15/16, $p = 0.15$ FY17/18), although a larger percentage of trails with only nonmotorized use had planning documents from higher level NEPA analyses, including environmental impact statements (EISs) and environmental assessments (EAs) (Fig. 62). This difference may reflect unequal sample sizes for the trail use categories. Whether the trail had unresolved maintenance needs also was not significantly associated with type of planning document in either monitoring period ($p = 0.19$ FY15/16, $p = 0.11$ FY17/18).

Table 100 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the decision documents or other BMP guidance documents were assigned and whether all the BMPs from the provisions were carried into the project

Table 98.—Distribution of whether project was performed in response to previously identified issues or needs related to water, aquatic, or riparian resources (Rec C-Q27) for Rec C evaluations completed in FY15/16 and FY17/18

Project performed in response to issues or needs	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Not applicable; project is new construction	4	18	10	19
Not applicable; no previous needs identified	1	5	2	4
Yes	16	73	26	50
No	1	5	14	27
All	22		52	

Table 99.—Number of Rec C projects evaluated in FY15/16 and FY17/18, by region and type of primary planning document used (Rec C-Q28)

Monitoring period	Region	No planning document	EIS ^a	EA ^b	CE ^c	Other
FY15/16						
	1				2	
	2	1			1	
	3				1	
	4				1	2
	5			1	1	
	6			1	1	1
	8		1	1	1	
	9				5	1
	10					
	All	1	1	3	13	4
	Percent	5	5	14	59	18
FY17/18						
	1				1	
	2	3		3	2	3
	3			1	1	1
	4			3		
	5			2	3	
	6				5	3
	8		1	2	6	
	9		1	2	5	2
	10	1				1
	All	4	2	13	23	10
	Percent	8	4	25	44	19

^a Environmental impact statement.

^b Environmental assessment.

^c Categorical exclusion.

contract or plan (Rec C-Q29). A “yes” indicates that at least one BMP in the planning or guidance documents was applicable to the provision and that all BMPs assigned to that provision were included in the project contract or plan. 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 no BMPs in the planning or guidance documents were 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 100 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

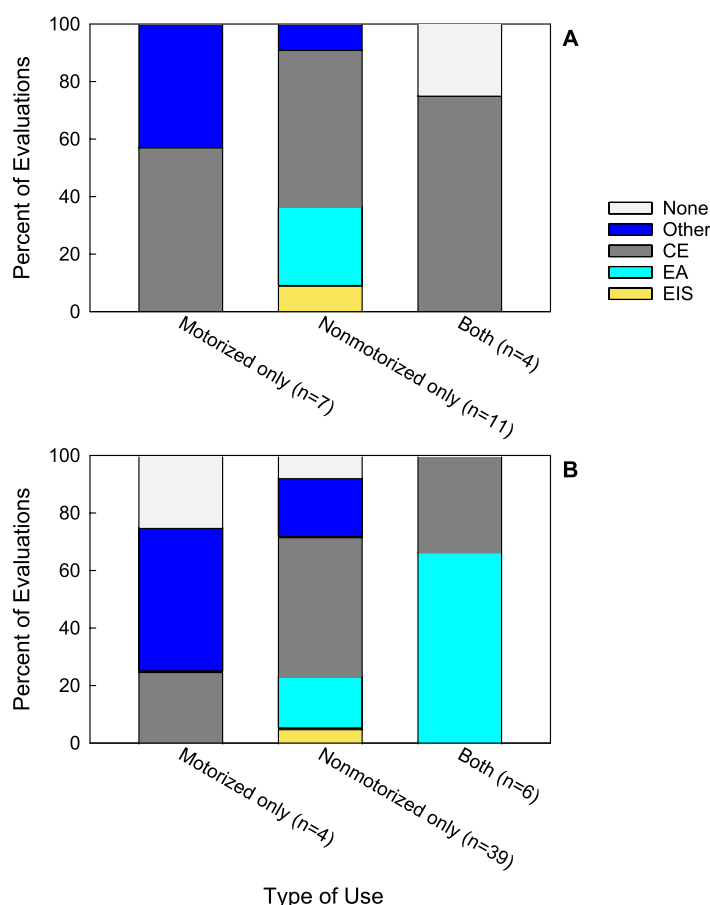


Figure 62.—Distribution of project planning document type used (Rec C-Q28) by type of permitted trail use (Rec C-Q23 and Rec C-Q24) for evaluations completed in FY15/16 (A) and FY17/18 (B). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

When a provision had at least one BMP prescription identified in the planning documents, all those BMP prescriptions were included in the corresponding plan or contract in an average of 86 and 84 percent of evaluations in FY15/16 and FY17/18, respectively (Table 100). On average, prescriptive BMPs were included in four of seven possible provisions per project in each monitoring period. BMPs in the two provisions related to trail cross drains and the “mulching and/or seeding, or other soil cover application” provision were carried from planning into the contract or plan least often. When compared by type of primary planning document, the mean number of provisions included ranged from two (EISs) to five (CEs) in FY15/16, and GLMM analysis (negative binomial distribution and log link function) found no significant differences ($p = 0.60$). In FY17/18, the number of provisions included was four or five per document type, and no significant differences were found ($p = 0.70$, GLMM with negative binomial distribution and log link function). When the percentages of BMP provisions included in the project contract or plan were compared by type of planning document, no significant differences were found in FY15/16 ($p = 0.64$, Kruskal-Wallis test); projects using EAs averaged

Table 100.—Frequencies at which BMPs in provisions were included in the project contract or plan (Rec C-Q29) for Rec C evaluations completed in FY15/16 (n=21 evaluations) and FY17/18 (n=48 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)
Locations and spacings of cross drains (e.g., waterbars)	12	4	5	75	25	23	7	14	77	23
Techniques to construct and install cross drains	13	2	6	87	13	25	5	13	83	17
Trail grades	14	2	5	88	12	30	4	11	88	12
Trail surfacing	11	2	8	85	15	26	6	11	81	19
Waterbody crossing techniques	16	1	4	94	6	34	4	8	89	11
Trail location	18	0	3	100	0	38	1	6	97	3
Mulching and/or seeding, or other soil cover application	9	3	9	75	25	22	9	12	71	29
Mean	13	2	6	86	14	28	5	11	84	16

^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.

82 percent of BMP provisions included, projects using CEs averaged 86 percent inclusion, projects using EISs had 100 percent inclusion, and those using other guidance documents averaged 96 percent inclusion. A significant difference in percent inclusion also was not found in FY17/18 ($p = 0.59$, Kruskal-Wallis test); projects using EAs averaged 84 percent inclusion, projects using CEs averaged 82 percent inclusion, and projects using EISs had all BMP provisions included.

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 seven provisions were identified in the contracts or plans across all Rec C projects (Table 101). These BMPs were related most frequently to soil cover.

All but one provision in FY15/16 and three in FY17/18 had all the applicable BMPs implemented fully for more than 90 percent of the trail projects (Table 102). “Applicable” in this context means only the 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 100 and 102 differ). As with Table 100, the percentages in Table 102 were calculated only from the “yes” and “no” counts. BMPs in the provisions “mulching and/or seeding, or other soil cover application” and “waterbody crossing techniques” were implemented fully least often.

The number of provisions that were implemented fully did not differ significantly among types of planning documents in either monitoring period ($p = 0.70$ FY15/16, $p = 0.65$ FY17/18; GLMM negative binomial distribution and log link function). The mean number of provisions implemented fully ranged from three to seven in FY15/16 and from three to five in FY17/18 by type of planning document. The percentage of provisions implemented fully also was not significantly different by type of planning document in either monitoring period ($p = 0.49$ FY15/16, $p = 0.59$ FY17/18; Kruskal-Wallis test). Mean results for EAs (79 and 74 percent in FY15/16 and FY17/18, respectively) were slightly lower than those for CEs (95 and 85 percent), and EISs (100 percent in each period).

Table 101.—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 Rec C evaluations completed in FY15/16 ($n=22$ evaluations) and FY17/18 ($n=52$ evaluations)

Provision	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Locations and spacings of cross drains (e.g., waterbars)	3	14		
Techniques to construct and install cross drains	3	14		
Trail grades	1	5	1	2
Trail surfacing	3	14	2	4
Waterbody crossing techniques			3	6
Trail location	1	5	2	4
Mulching and/or seeding, or other soil cover application	2	9	4	8

Table 102.—Frequencies at which all BMPs in provisions included in the project contract or plan were implemented fully (Rec C-Q30) for Rec C evaluations completed in FY15/16 (n=22 evaluations) and FY17/18 (n=52 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)
Locations and spacings of cross drains (e.g., waterbars)	14	1	7	93	7	21	2	25	91	9
Techniques to construct and install cross drains	16	0	6	100	0	20	5	22	80	20
Trail grades	14	1	7	93	7	30	1	17	97	3
Trail surfacing	13	1	7	93	7	27	1	19	96	4
Waterbody crossing techniques	14	2	5	88	12	33	4	13	89	11
Trail location	19	0	3	100	0	38	2	7	95	5
Mulching and/or seeding, or other soil cover application	10	1	11	91	9	22	4	21	85	15
Mean	14	1	7	94	6	27	3	18	90	10

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

^b Percent calculated from “yes” and “no” counts.

For some trail construction or re-routing projects, supplemental erosion control (Rec C-Q31) is needed after the contract or plan is closed to address unexpected circumstances or to correct underperforming erosion control measures. This was the case for 9 projects in FY15/16 and 17 projects in FY17/18, but for 1 project in FY15/16 and 3 projects in FY17/18, the evaluations indicated that needed supplemental erosion control was not applied.

Two implementation questions—Rec C-Q32 and Rec C-Q33—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 103), and whether corrective actions were taken if problems occurred during project implementation (at any time, not just critical times) (Table 104). Critical times include times when work is conducted in the waterbody, periods associated with large or intense precipitation/runoff events, or other times or locations when the potential for the circumstances to result in water quality impacts is high. Evaluations indicated that 88 percent of projects were inspected during critical times or work avoided critical times (Table 103) and that 93 percent of projects either had no problems requiring corrective actions or implemented corrective actions when needed (Table 104).

Table 103.—Distribution of whether project inspections or contract administration occurred at critical times (Rec C-Q32) for Rec C 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	9	5	10
Not applicable; work avoided critical times	9	41	21	41
Yes	11	50	23	45
No	0		2	4
All	22		51	

Table 104.—Distribution of whether corrective actions (CA) were taken if problems occurred during project implementation (Rec C-Q33) for Rec C 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	16	73	42	82
CA needed but not taken	1	5	1	2
CA needed and implemented	5	23	5	10
Unknown	0		3	6
All	22		51	

Because ground-disturbing activities on trail projects may involve use of heavy equipment that may have occasional malfunctions or breakages such as hydraulic line breaks or oil leaks, an implementation question (Rec C-Q34) asks 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 would follow that state agency's procedures. None of the projects in FY15/16 had any spills or leaks. In FY17/18, two evaluations indicated that the administrative units did not have a CERP, and one evaluation indicated that a spill or leak was not handled according to the CERP.

Recreation C: Effectiveness Results and Their Tie to Implementation Results and Header Information

Trail construction projects are evaluated for evidence of erosion and sedimentation at two locations—on the trail and at the treated waterbody crossings—if the location was included in the project. Sixty effectiveness evaluations indicated that trail projects included work at one or more waterbody crossings. Nine projects did not include treated crossings. Only the most severe cases of erosion or sedimentation are reported (Rec C-Q39, Rec C-Q47) 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. Trail segments were evaluated for evidence of erosion and sedimentation (Rec C-Q39) at 17 projects in FY15/16 and 47 projects in FY17/18; approximately 60 percent of evaluations observed no evidence of erosion or sedimentation on or originating from the trails (Table 105). When evidence was observed, the waterbody types most frequently affected were intermittent streams and perennial streams or rivers (Rec C-Q42). Rill and sheet erosion were the types of evidence observed most frequently (Table 106), followed by rutting. Three evaluations reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec C-Q39 (e.g., localized sediment deposition in a waterbody would not be observed outside an AMZ). The trail surface was a source of observed evidence for 80 percent of all evaluations (Table 107), and many reported causes were related to water control features and trail location (Table 108). “Other” identified causes of observed evidence included factors related to the old trail and the construction process.

About 70 percent of the trail projects in each monitoring period observed no evidence of erosion, sedimentation, or waterbody morphology changes at treated waterbody crossings and approaches (Rec C-Q47) (Table 109). Perennial streams or rivers and intermittent streams were the types of waterbodies affected most frequently (Rec C-Q48) when evidence was observed, and nearly half of the crossing structures at those waterbodies were bridges (Rec C-Q49). The most common types of evidence observed (Rec C-Q50) were damage to vegetation or bare ground (Table 110). One evaluation reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec C-Q47. Numerous sources and causes for the evidence observed were reported (Tables 111 and 112); many were related to surfacing. Trail steepness and problems with the crossing approaches were “other” causes reported for three evaluations each. Five evaluations in FY17/18 reported that either some of or all the evaluated treated

Table 105.—Evidence of erosion or sedimentation observed on or originating from trails (Rec C-Q39) for Rec C evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Rec C-Q41) or number of places evidence observed in a waterbody (Rec C-Q40)

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	10	59							
Outside an AMZ ^a	1	6				1			
Within an AMZ	5	29	3		1				
In a waterbody	1	6					1		
FY17/18									
No evidence	29	62							
Outside an AMZ	6	13			2	4			
Within an AMZ	9	19	2	4		3			
In a waterbody	3	6					3		

^a Aquatic management zone.

Table 106.—Types of evidence of erosion or sedimentation observed on or originating from trails (Rec C-Q44) for Rec C evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec C-Q39 (Table 105) is applicable to Rec C-Q44.

Type of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=5)	FY15/16 In waterbody (n=1)	FY17/18 Outside an AMZ (n=6)	FY17/18 Within an AMZ (n=9)	FY17/18 In waterbody (n=3)
Traceable evidence to the waterbody, but not currently visible in the waterbody	1	2			1	2
Turbidity present						
Evidence of localized sediment deposition in the waterbody	1 ^b		1		1 ^b	1
Changes to substrate composition					1 ^b	
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)						
Bank instability		1				
Bank trampling or compaction		1			1	
Vegetation damage or bare ground		2			2	
Sheet erosion	1	1		3	3	2
Rill erosion		2	1	4	3	
Gully erosion					1	
Headcutting						
Slumping/slips						
Mass wasting						
Sediment plumes or accumulations		1		1	2	
Rutting		2		1	1	2
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 107.—Sources of evidence of erosion or sedimentation observed on or originating from trails (Rec C-Q45) for Rec C evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec C-Q39 (Table 105) is applicable to Rec C-Q45.

Source of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=5)	FY15/16 In waterbody (n=1)	FY17/18 Outside an AMZ (n=6)	FY17/18 Within an AMZ (n=9)	FY17/18 In waterbody (n=3)
Trail surface in evaluated segment	1	4	1	5	7	2
Trail cut slope in evaluated segment	1	1		1	2	1
Trail fillslope in evaluated segment	1	1		1	3	
Treated trail surface outside evaluated segment		1			1	
Treated trail cut slope outside evaluated segment		1			1	
Treated trail fillslope outside evaluated segment						
Untreated trail surface outside evaluated segment						
Untreated trail cut slope outside evaluated segment						
Untreated trail fillslope outside evaluated segment						
General area off of trail					1	
Other				1	1	

^a Aquatic management zone.

Table 108.—Causes of evidence of erosion or sedimentation observed on or originating from trails (Rec C-Q46) for Rec C evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec C-Q39 (Table 105) is applicable to Rec C-Q46.

Cause of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=5)	FY15/16 In waterbody (n=1)	FY17/18 Outside an AMZ (n=6)	FY17/18 Within an AMZ (n=9)	FY17/18 In waterbody (n=3)
Lack of, or insufficient number of water control features		2		3	1	2
Improper construction of water control features				1	3	
Poor trail location		2	1		2	1
Improper grades on trail		1	1		2	
Inadequate soil cover (mulch, seed, geotextiles, etc.)	1				2	
Mechanical additions/disturbances from the construction or re-routing of the trail segment					2	
Other		2	1	4	5	1

^a Aquatic management zone.

Table 109.—Evidence of erosion or sedimentation observed at treated waterbody crossings and approaches (Rec C-Q47) for Rec C evaluations completed in FY15/16 and FY17/18

Evidence observed	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
No evidence	11	69	32	73
Evidence but not in waterbody	2	12	4	9
Evidence in waterbody	3	19	8	18

Table 110.—Types of evidence of erosion or sedimentation observed at treated waterbody crossings and approaches (Rec C-Q50) for Rec C evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec C-Q47 (Table 109) is applicable to Rec C-Q50.

Type of evidence	FY15/16 Evidence but not in waterbody (n=2)	FY15/16 Evidence in waterbody (n=3)	FY17/18 Evidence but not in waterbody (n=4)	FY17/18 Evidence in waterbody (n=8)
Traceable evidence to the waterbody, but not currently visible in the waterbody		2		4
Turbidity present				
Evidence of localized sediment deposition in the waterbody		1		6
Changes to substrate composition			1 ^a	3
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)		1		3
Bank instability		1		3
Bank trampling or compaction		1		1
Vegetation damage or bare ground	1	1	2	5
Sheet erosion		1	2	3
Rill erosion		2		
Gully erosion				
Headcutting		1		2
Slumping/slips				2
Mass wasting				
Sediment plumes or accumulations			1	1
Rutting	1			1
Water quality monitoring results				

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

Table 111.—Sources of evidence of erosion or sedimentation observed at treated waterbody crossings and approaches (Rec C-Q51) for Rec C evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec C-Q47 (Table 109) is applicable to Rec C-Q51.

Source of evidence	FY15/16 Evidence but not in waterbody (n=2)	FY15/16 Evidence in waterbody (n=3)	FY17/18 Evidence but not in waterbody (n=4)	FY17/18 Evidence in waterbody (n=8)
Waterbody crossing surface		1	1	3
Waterbody crossing fill			1	2
Cut slope in approach		1	1	2
Fillslope in approach		1	1	
Water control feature in crossing or approach	1	1		1
Other	1	1		2

Table 112.—Causes of evidence of erosion or sedimentation observed at treated waterbody crossings and approaches (Rec C-Q52) for Rec C evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec C-Q47 (Table 109) is applicable to Rec C-Q52.

Cause of evidence	FY15/16 Evidence but not in waterbody (n=2)	FY15/16 Evidence in waterbody (n=3)	FY17/18 Evidence but not in waterbody (n=4)	FY17/18 Evidence in waterbody (n=8)
Lack of crossing structure	1			2
Unhardened crossing approaches	1	2	1	4
Poor alignment of waterbody crossing		2		1
Waterbody crossing too narrow				
Waterbody crossing too short				
Inappropriate type of crossing for conditions or traffic levels				1
Other	1	2	4	4

waterbody crossings had diversion potential (Rec C-Q53). Three of those evaluations had no observed evidence of erosion or sedimentation, one had evidence in the crossing area, and one had evidence in a waterbody. On average, 73 percent of treated crossings per evaluation had diversion potential, although two evaluations reported that every crossing had diversion potential. The single longest lengths of the diversion potential ranged from 16 to 100 feet and averaged 60 feet (se = 17 feet).

Weather conditions associated with the evaluation (Rec C-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to trail construction or re-routing 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

For each monitoring period, 40 percent or more of evaluations occurred during wet weather. A statistically significant association was not found between categories of erosion on or originating from trails (Rec C-Q39) and weather conditions (i.e., wet versus dry conditions) in FY15/16 ($p = 0.87$), but a significant association existed in FY17/18 ($p = 0.02$). For the 12 evaluations in FY17/18 with observed evidence within an AMZ or waterbody, 75 percent occurred during wet weather (Fig. 63). Categories of erosion at treated waterbody crossings and approaches (Rec C-Q47) and weather conditions were not significantly associated in either period ($p = 1.00$ FY15/16 $p = 0.52$ FY17/18).

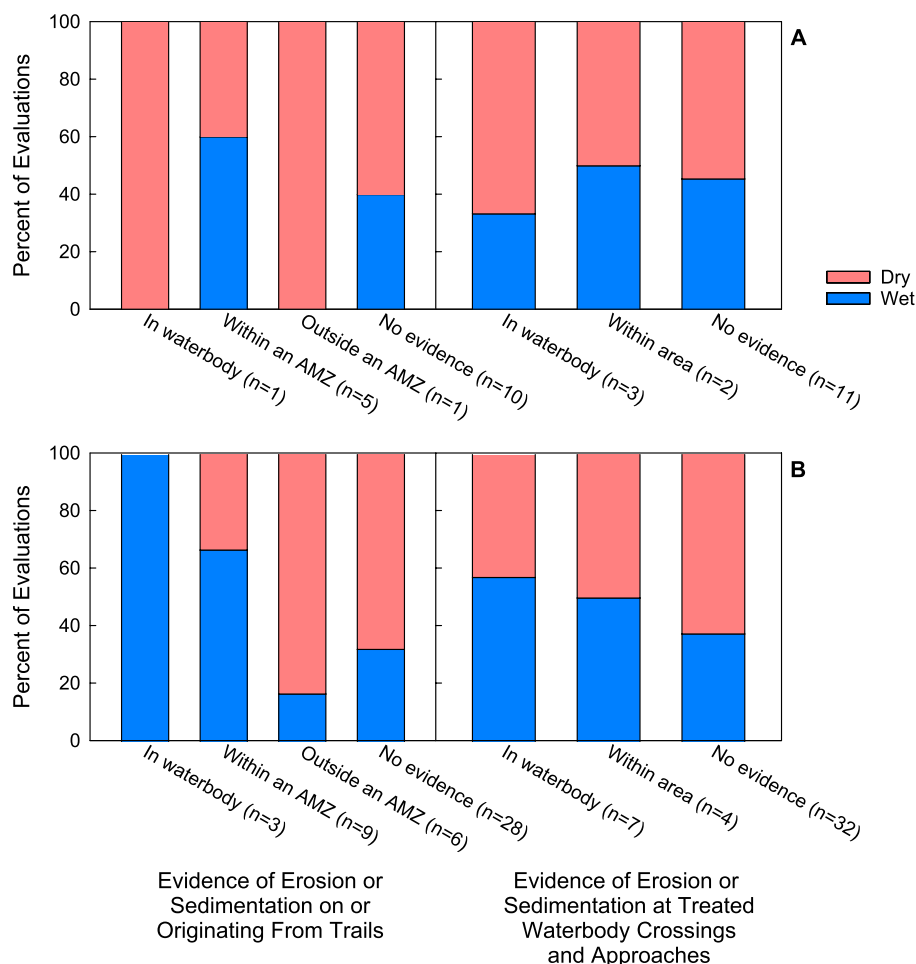


Figure 63.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion on or originating from trails (Rec C-Q39; left panels) and at treated waterbody crossings and approaches (Rec C-Q47; right panels) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

The presence of chemical spills, leaks, or chemical waste containers is determined during the effectiveness evaluations (Rec C-Q54). Such evidence can include pollutants observed during the project but not reported, pollutants reported but not yet cleaned up, or pollutants not previously observed or known to exist. The results indicate that care was taken to prevent chemical contamination during trail construction projects; no evidence of spills, leaks, or waste containers was found during any evaluation.

Inspections are an important part of projects involving construction or soil disturbance. The Rec C protocol includes two questions about inspections, one in implementation (Rec C-Q32) and one in effectiveness (Rec C-Q55), that are designed to tie together. Respectively, the questions ask whether inspections were completed during critical times for the project and whether lack of inspections during critical times influenced BMP effectiveness. Table 113 shows the relationship between those two questions for projects in which both implementation and effectiveness evaluations were completed during each monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Eleven percent of the evaluations in each monitoring period selected incompatible answer choices (shaded cells) based on the protocol instructions. Of the remaining projects that followed the protocol instructions (unshaded cells), one evaluation in FY15/16 and two in FY17/18 indicated that lack of inspections at critical times contributed to problems with effectiveness.

Table 113.—Occurrence of project inspections or contract administration performed at critical times (Rec C-Q32) in relationship to problems observed during effectiveness monitoring (Rec C-Q55) for Rec C evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (11 and 11 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 conducted to avoid 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	1	
	Not applicable; work avoided critical times	6		1
	Yes; inspections at critical times	9		
	No; inspections not at critical times			
FY17/18				
	No inspections	2	1	1
	Not applicable; work avoided critical times	19		1
	Yes; inspections at critical times	17		2
	No; inspections not at critical times		1	1

Recreation C: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

In each monitoring period, 40 percent or more of the Rec C projects were rated as *fully implemented*. In FY5/16 and FY17/18, the combination of projects with *not implemented* and *no BMPs* ratings was 5 and 13 percent, respectively (Fig. 64). In comparison, more than 60 percent of the Rec C projects were rated as *effective*, and 14 and 19 percent in FY15/16 and FY17/18, respectively, were rated as *not effective*. Two implementation evaluations and three effectiveness evaluations lacked responses in the database for questions needed to determine a rating (identified as “incomplete data” in Fig. 64).

Whether the trail project involved construction or re-routing was not significantly associated with the implementation ratings in either monitoring period ($p = 0.50$ FY15/16, $p = 0.85$ FY17/18) (Fig. 65) nor with the effectiveness ratings in FY17/18 ($p = 0.60$). A significant association was found for the effectiveness ratings in FY15/16 ($p = 0.06$); in that monitoring period, trail re-routing projects had better ratings than construction projects (Fig. 65). When comparing ratings by the general type of use allowed, there were no associations between the implementation ratings and the type of use ($p = 0.26$ FY15/16, $p = 0.95$ FY17/18). There was a significant association for the effectiveness ratings in FY15/16 ($p = 0.07$) but not in FY17/18 ($p = 0.35$). For most

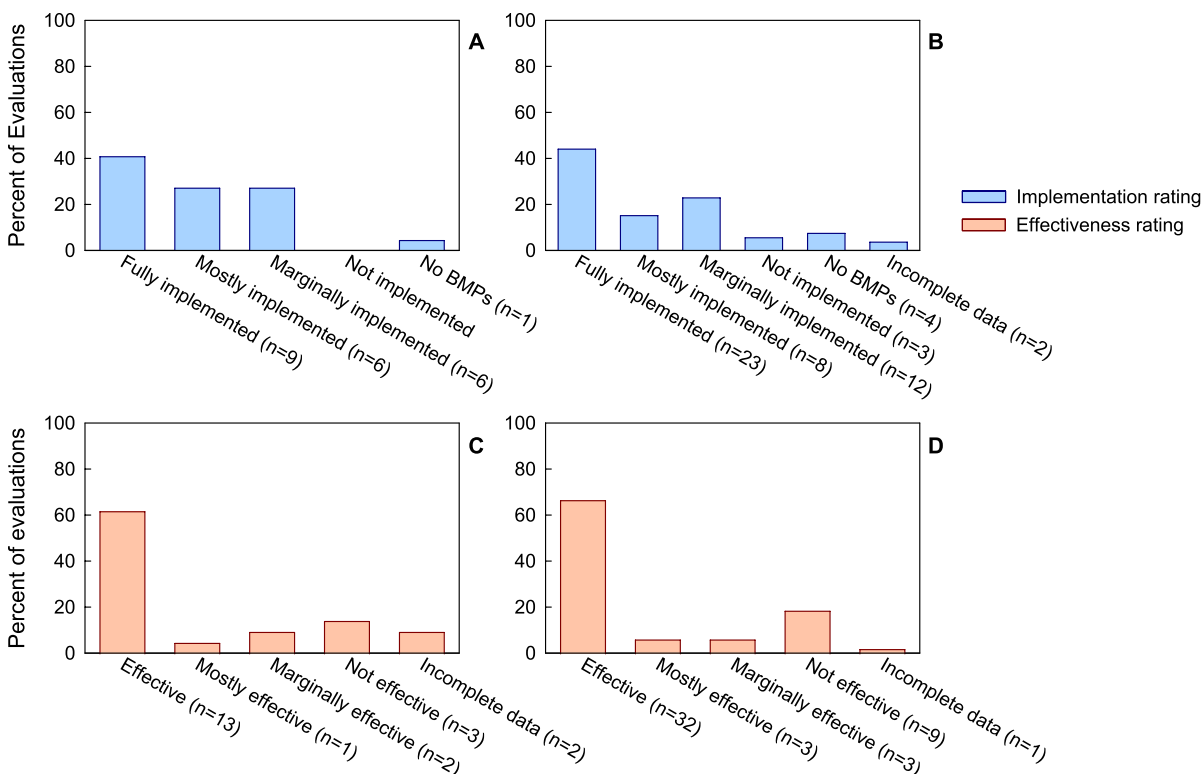


Figure 64.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Rec C evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

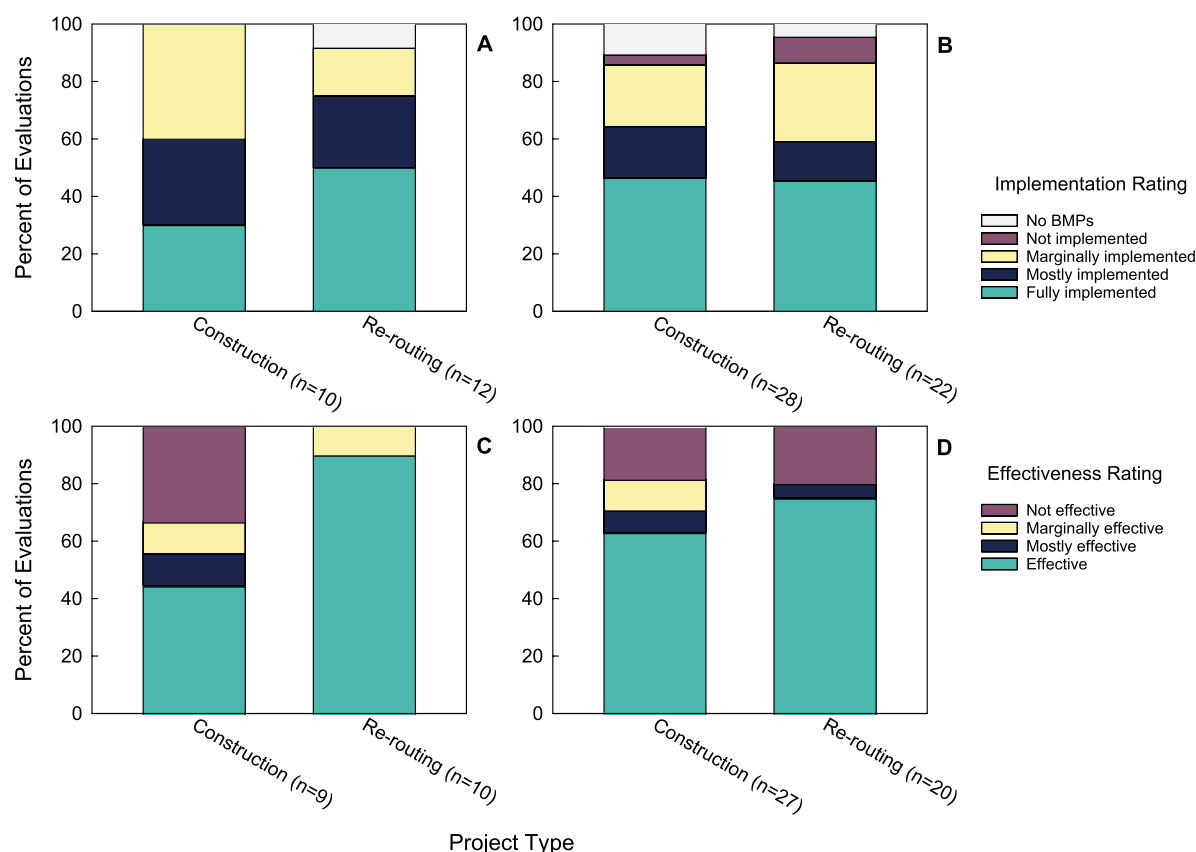


Figure 65.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by type of trail project (Rec C-Q18) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

comparisons, ratings were slightly better when only nonmotorized use was allowed and slightly poorer when both types of use were allowed (Fig. 66). However, more evaluations of mixed-use trails are needed to determine the importance of this result.

Implementation and effectiveness rating distributions across the different primary planning documents are shown in Figure 67. No significant associations existed in either monitoring period between the type of planning document and implementation or effectiveness ratings (implementation: $p = 0.75$ FY15/16, $p = 0.90$ FY17/18; effectiveness: $p = 0.97$ FY15/16, $p = 0.92$ FY17/18). The number of BMP provisions included in a project contract or plan was not significantly different by effectiveness rating in either monitoring period ($p = 0.43$ FY15/16, $p = 0.22$ FY17/18; GLMM with Poisson distribution and log link function). Mean number of provisions included by effectiveness rating in FY15/16 ranged from five for projects rated *effective* to three for projects rated *mostly effective* or *not effective*. In FY17/18, projects rated better than *not effective* averaged four provisions included in the contract or plan, while projects rated *not effective* averaged three provisions. The percentages of BMPs from planning included in the contract or plan averaged 60 to 93 percent inclusion across the effectiveness ratings in FY15/16. The range of percentages was smaller in FY17/18; projects rated *not effective* averaged 71 percent inclusion, and those rated *mostly effective* averaged 93 percent inclusion. However,

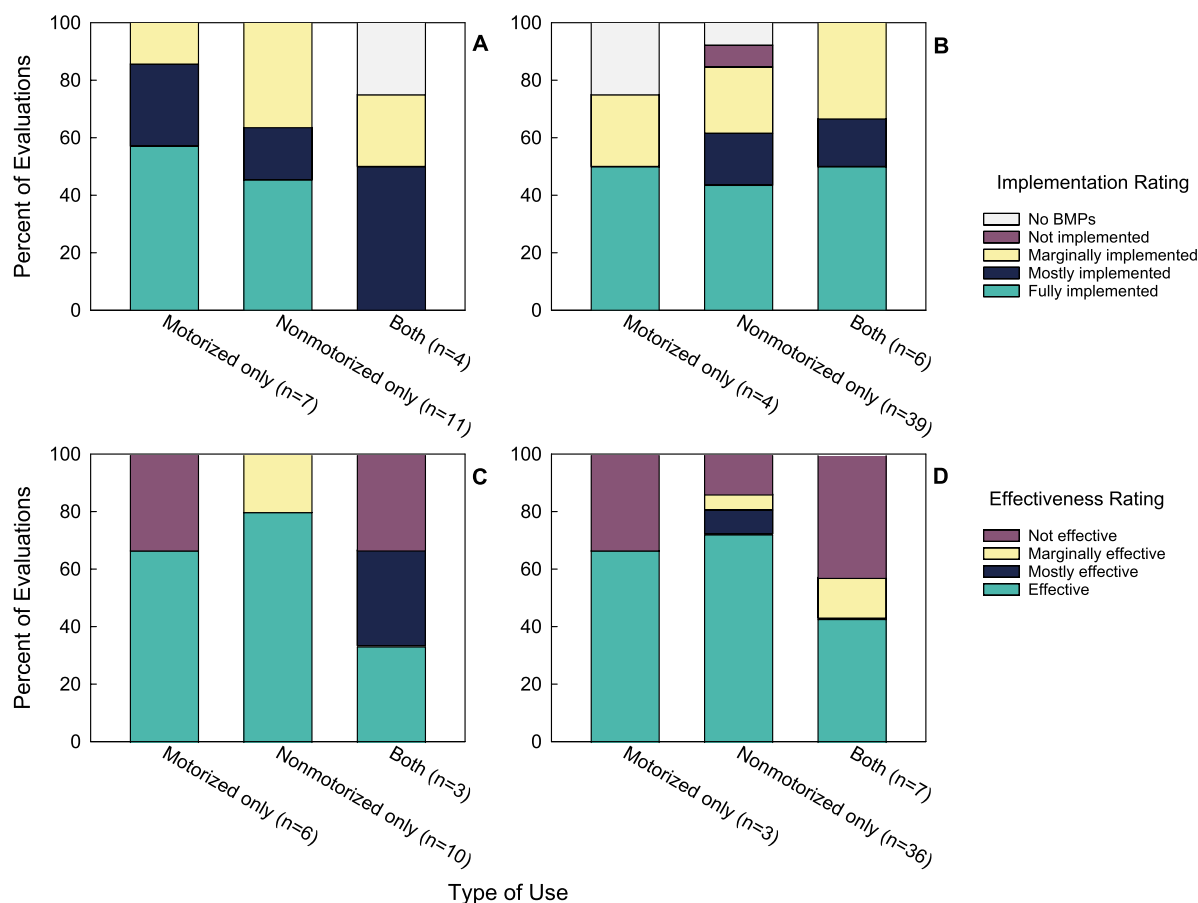


Figure 66.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by general type of permitted trail use (Rec C-Q23 and Rec C-Q24) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

percentages of BMPs included were not significantly different by effectiveness rating in either monitoring period ($p = 0.25$ FY15/16, $p = 0.96$ FY17/18; Kruskal-Wallis test). This result was likely due at least in part to the small number of evaluations with ratings other than *effective* (Fig. 64).

The number of BMP provisions implemented fully was not significantly different by effectiveness rating in either monitoring period ($p = 0.24$ FY15/16, $p = 0.22$ FY17/18; GLMM with Poisson or negative binomial distribution and log link function). Mean numbers of provisions implemented fully ranged from two to five by effectiveness rating in FY15/16 and two to four in FY17/18. When percentages of provisions implemented fully were compared, there was a significant difference in the percentages by rating in FY15/16 ($p = 0.01$, Kruskal-Wallis test) but not in FY17/18 ($p = 0.43$). Projects rated *effective* or *not effective* in FY15/16 averaged 98 and 100 percent of BMPs implemented fully, respectively; those rated *mostly effective* and *marginally effective* averaged 67 and 68 percent, respectively. In FY17/18, mean percentages of provisions implemented fully ranged from 72 percent for projects rated *not effective* to 92 percent for projects rated *mostly effective*.

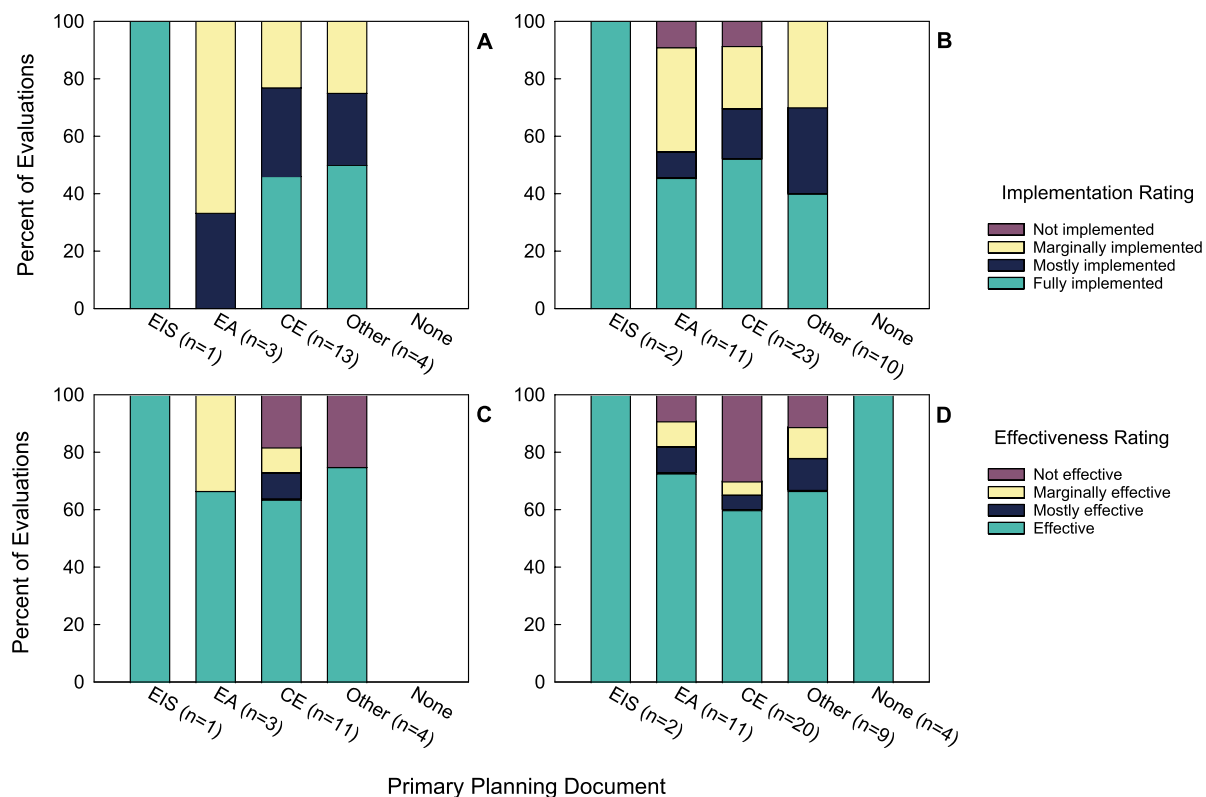


Figure 67.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by primary planning document (Rec C-Q28) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). EIS = environmental impact statement, EA = environmental assessment, CE = categorical exclusion.

More than three-quarters of trail projects in each monitoring period had previously identified issues or needs related to water, aquatic, or riparian resources (Table 98). Whether the project was performed to address those needs (“yes” or “no” answers to Rec C-Q27) was not significantly associated with the effectiveness ratings in either monitoring period ($p = 1.00$ FY15/16, $p = 0.56$ FY17/18). In FY17/18, similar percentages of projects with previously identified needs were rated *effective* (68 percent) and *not effective* (23 percent), both when the project was performed to address those needs and when it was not. There also was not a significant association in either monitoring period between whether supplemental erosion control was applied and the effectiveness ratings ($p = 0.19$ FY15/16, $p = 0.15$ FY17/18). Only three projects did not apply additional erosion control when needed, and, although the sample size is small, two of those projects were rated as *not effective* (Fig. 68).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Rec C-Q16) were not associated with the effectiveness ratings in either monitoring period ($p = 0.66$ FY15/16, $p = 0.24$ FY17/18), although ratings were slightly poorer during wet conditions (Fig. 69). Relationships between weather conditions and field observations of erosion, sediment, or morphological effects (e.g., Fig. 63) 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.

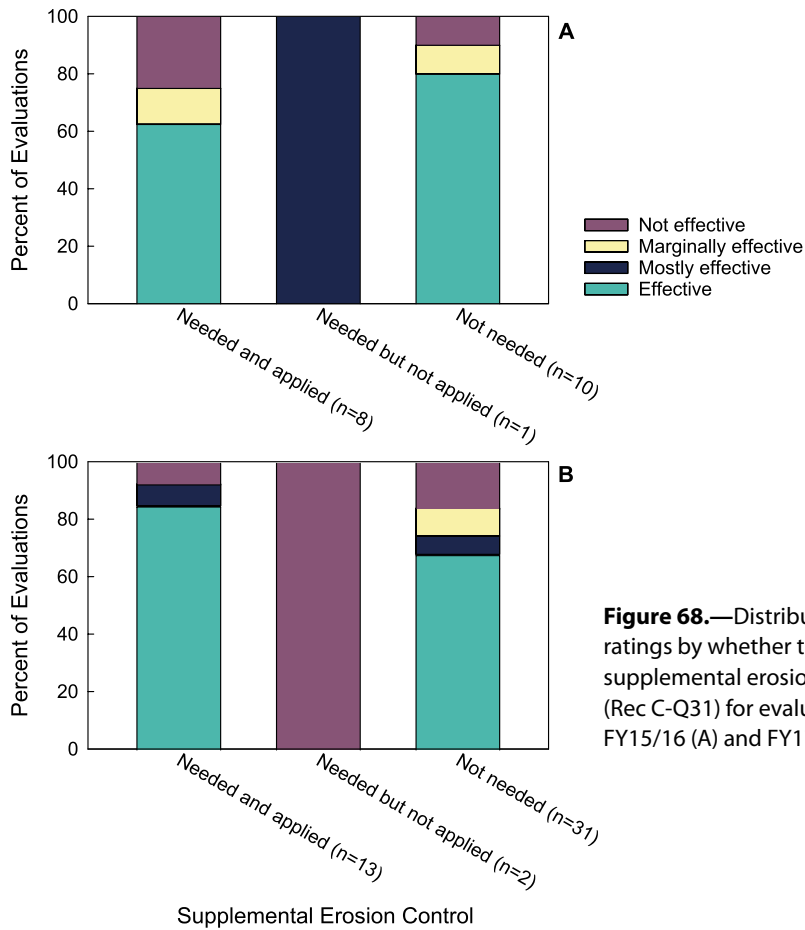


Figure 68.—Distribution of effectiveness ratings by whether trail project had supplemental erosion control applied (Rec C-Q31) for evaluations completed in FY15/16 (A) and FY17/18 (B).

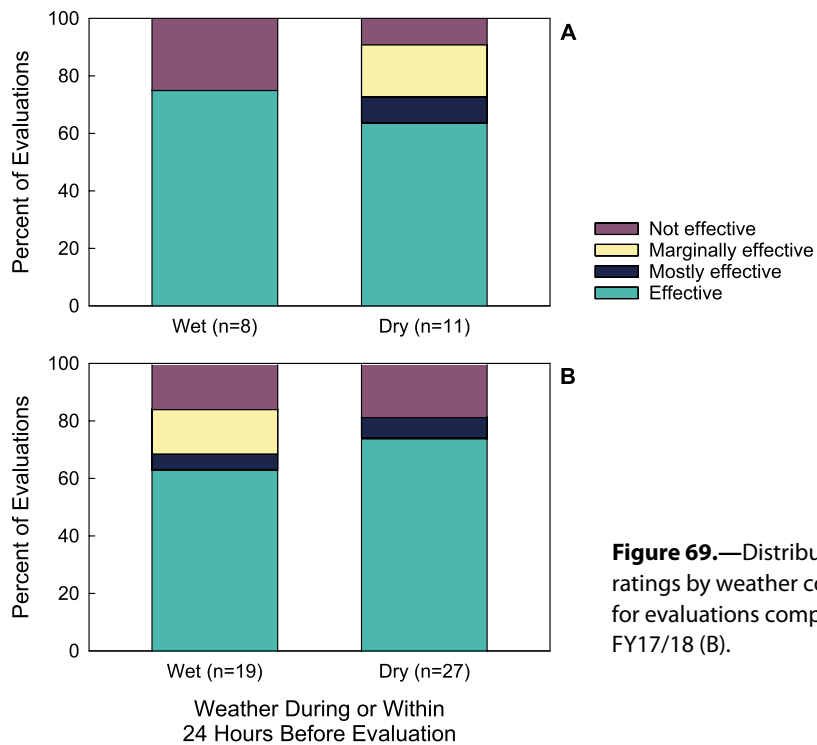


Figure 69.—Distribution of effectiveness ratings by weather conditions (Rec C-Q16) for evaluations completed in FY15/16 (A) and FY17/18 (B).

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 (Rec C-Q33). Such actions can protect water quality and may be reflected in an improvement in BMP effectiveness. A significant association was not found between whether corrective actions were taken and the effectiveness ratings in either monitoring period ($p = 0.49$ FY15/16, $p = 0.54$ FY17/18). Effectiveness ratings were better in FY17/18 when no corrective actions were needed during implementation (Fig. 70). However, the sample sizes for “needed but not taken” and “unknown” were much smaller than for the other two answer choices in each monitoring period, so the usefulness of this comparison is limited.

Two additional questions that ask whether corrective actions 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.

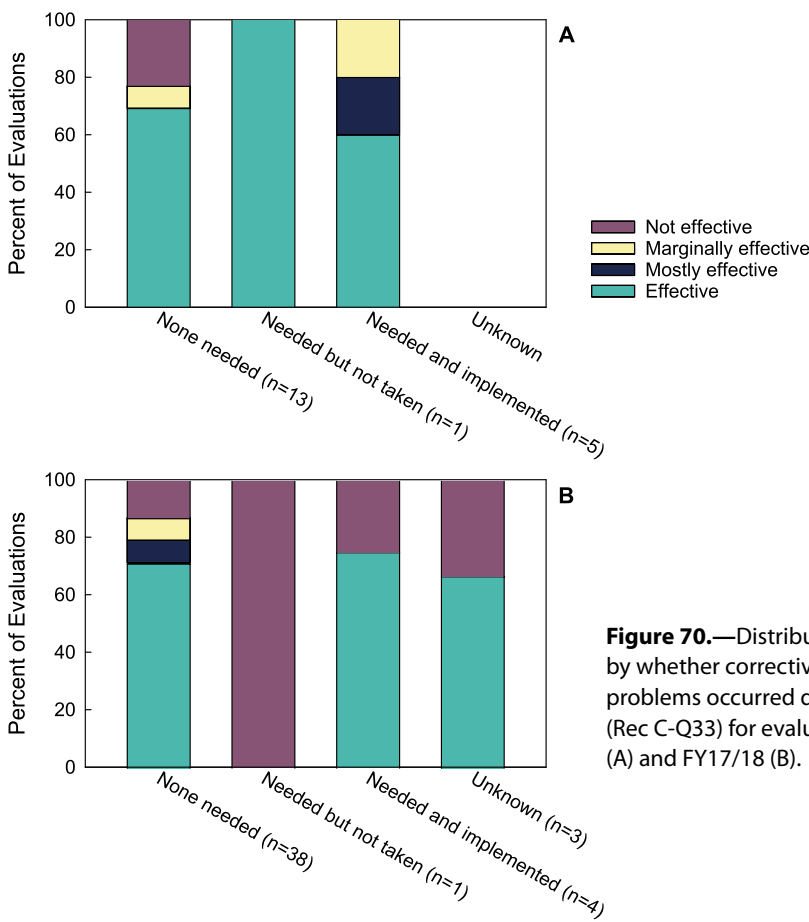


Figure 70.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during the trail project (Rec C-Q33) for evaluations completed in FY15/16 (A) and FY17/18 (B).

Actions Taken to Address Implementation Problems

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

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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 the contract or plan, 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.

For both implementation and effectiveness, the number of projects identified as needing actions was between 25 and 50 percent of those needing no actions; this range held for both corrective actions and adaptive management actions (Figs. 71 and 72). The associations between implementation ratings and corrective action needs were significant in each monitoring period, and the association between implementation ratings and adaptive management needs also was significant in FY17/18 (corrective action needs: $p < 0.001$ FY15/16, $p = 0.04$ FY17/18; adaptive management needs: $p = 0.15$ FY15/16, $p = 0.04$ FY17/18). Poorer implementation ratings were associated with the need for both corrective actions and adaptive management actions (Fig. 71). The associations between effectiveness ratings and the need for corrective or adaptive management actions also were significant in each monitoring period except for adaptive management needs in FY15/16 (corrective action needs: $p < 0.01$ FY15/16, $p < 0.001$ FY17/18; adaptive management needs: $p = 0.10$ FY15/16, $p = 0.01$ FY17/18). The percentage of *not effective* ratings was greater when corrective actions or adaptive management actions were needed, and the sum of *effective* and *mostly effective* ratings for projects not needing corrective or adaptive management actions was 80 percent or more in each monitoring period (Fig. 72).

Some evaluations were rated as *not implemented* or *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 would have been that some corrective or adaptive management action was needed. The 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 this 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 effectiveness ratings that could have otherwise been identified during consideration of Rec C-Q35, Rec C-Q37, Rec C-Q56, and Rec C-Q58.

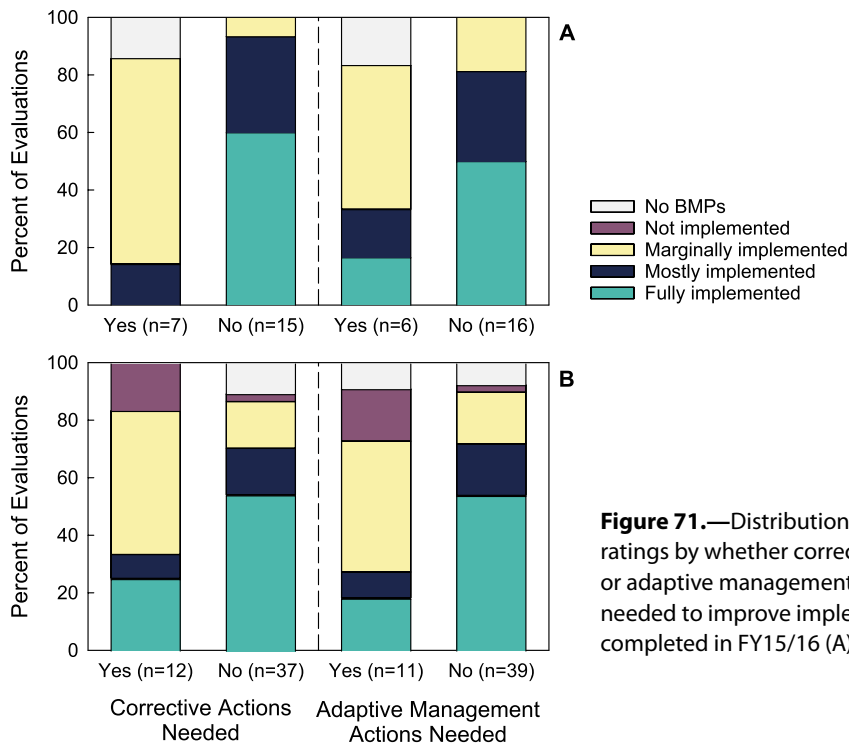


Figure 71.—Distribution of implementation ratings by whether corrective actions (Rec C-Q35) or adaptive management actions (Rec C-Q37) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

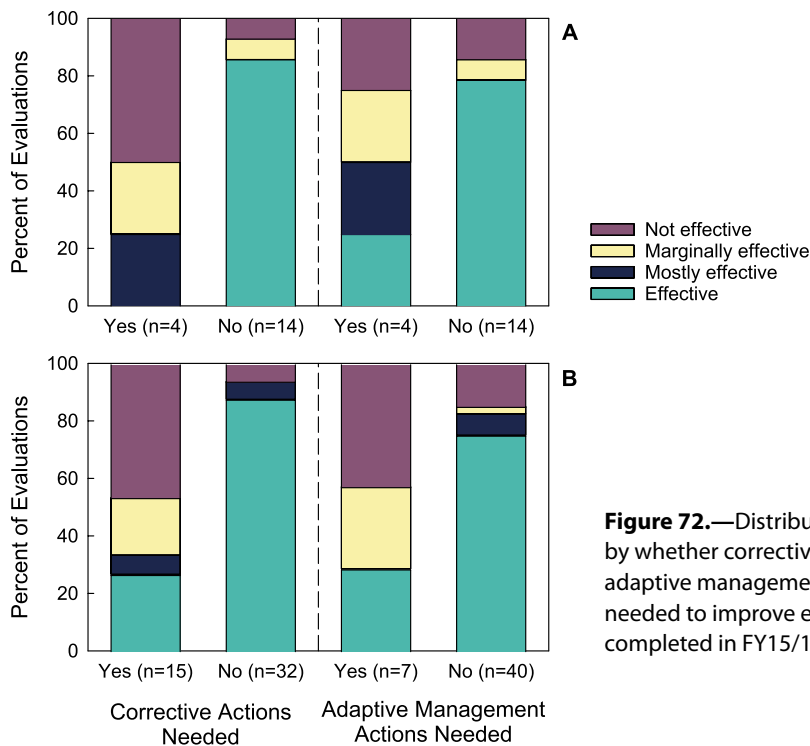


Figure 72.—Distribution of effectiveness ratings by whether corrective actions (Rec C-Q56) or adaptive management actions (Rec C-Q58) were needed to improve effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

Composite Ratings

Composite rating results for Rec C projects with complete data that were evaluated for both implementation and effectiveness are given in Table 114. Forty-nine percent of projects had a composite rating of *excellent*, 17 percent were rated as *good*, about 23 percent were *poor*, and 6 percent had no BMPs prescribed, resulting in a *no plan* composite rating. The implementation and effectiveness ratings were significantly associated in FY15/16 ($p = 0.08$) but not in FY17/18 ($p = 0.54$). The majority of projects with better implementation generally had better effectiveness in FY15/16; in FY17/18, both better and poorer effectiveness ratings occurred across all implementation ratings (Table 114).

Recreation C: Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings for Rec C were determined from component scores (Tables 115 and 116). When a trail project did not include either a trail segment or treated waterbody crossings and approaches, the missing component was scored *no trail* or *no waterbody crossing* (Table 116) and did not influence the final effectiveness rating. Table 117 shows the distribution of scores across the three

Table 114.—Composite rating matrix for Rec C projects evaluated for both implementation and effectiveness in FY15/16 (n=19 evaluations) and FY17/18 (n=46 evaluations). Numbers in cells indicate the number of evaluations 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	7	4	2		
	Mostly effective			1		
	Marginally effective			2		
	Not effective	1	2			

FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective	16	5	6	1	4
	Mostly effective	1	1	1		
	Marginally effective	1		2		
	Not effective	4	1	1	2	

Excellent
 Good
 Fair
 Poor
 No plan

Table 115.—Implementation components, scores, and interpretation of each score used for determining overall implementation ratings for Rec C, Rec G (active construction), and Rec H 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
	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, of the necessary corrective actions identified during project implementation were implemented
	None	No necessary corrective actions identified during project implementation were implemented

Table 116.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec C protocol. If a component is absent (e.g., no trail or no waterbody crossing), the component is not considered in the determination of the evaluation effectiveness rating.

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-trails	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 trail	No trail segment in the project
Erosion and sedimentation-waterbody crossings	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 treated waterbody crossings and approaches
Chemical pollutants	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect

Table 117.—Distribution of implementation component scores by component for Rec 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=22)							
	All	12	55	16	73	19	86
	Some	9	41	6	27	3	14
	None						
	No BMPs	1	5				
FY17/18 (n=52)							
	All	33	63	39	75	42	81
	Some	12	23	12	23	7	13
	None	3	6			1	2
	No BMPs	4	8				
	Incomplete data ^a			1	2	2	4

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

implementation components. Thirty-two of the trail projects had *all* scores for all three implementation components, which resulted in implementation ratings of *fully implemented* (Table 118). Lack of planning documents resulted in a *no BMPs* planning score for five projects (Table 117).

A “no” answer for any provision in Table 100 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 nine projects with a planning component score of *some* in FY15/16 (Table 117), an average of 29 percent of provisions from planning were not included in the project contract or plan (Table 100, excluding provisions identified as “not applicable”), with the percentage ranging from 14 to 71 percent. On average, BMPs from planning were included in four of the seven possible provisions for those nine projects. BMPs in the provisions “locations and spacings of cross drains” and “mulching and/or seeding, or other soil cover application” were most frequently not carried from planning into the project contract or plan (Table 100). Twelve projects in FY17/18 had planning component scores of *some*, and for those projects 32 percent of BMP provisions from planning were not included in the project contract or plan on average. Percentages ranged from 14 to 86 percent, with one project having only one of seven provisions from planning included. All BMPs related to soil cover techniques were not included in the contract or plan for 8 of the 12 projects.

A *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 115). This results from a “no” answer for at least one provision in Table 102 and a “yes” response for at least one other provision. For the 6 projects in FY15/16 and 12 projects in FY17/18 having a score

Table 118.—Implementation component scores corresponding to the overall implementation ratings for Rec C evaluations with complete data in FY15/16 and FY17/18. See Table 115 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=22)					
	Fully implemented	All	All	All	9
	Mostly implemented	All	All	Some	1
		Some	All	All	5
	Marginally implemented	All	Some	All	2
		Some	Some	All	2
		Some	Some	Some	2
	Not implemented				0
	No BMPs	No BMPs	All	All	1
FY17/18 (n=50)					
	Fully implemented	All	All	All	23
	Mostly implemented	All	All	Some	2
		Some	All	All	5
		Some	All	Some	1
	Marginally implemented	All	Some	All	5
		All	Some	Some	1
		Some	Some	All	4
		Some	Some	Some	2
	Not implemented	None	All	All	1
		None	All	Some	1
		None	All	None	1
	No BMPs	No BMPs	All	All	4

of *some* for the on-the-ground execution component (Table 117), the average project contract or plan in each monitoring period had five provisions containing at least one BMP, and in approximately 24 and 30 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 per project ranged from 14 to 50 percent in FY15/16 and from 17 to 71 percent in FY17/18. BMPs that were not implemented fully were assigned most commonly to the “waterbody crossing techniques” provision in FY15/16 and the “techniques to construct and install cross drains” provision in FY17/18 (Table 102).

A *some* score for the project oversight component is due to a deficiency in one or more project implementation metrics. Across both monitoring periods, seven projects lacked inspections during project operations (Rec C-Q32), three projects did not have supplemental erosion control applied when needed (Rec C-Q31), and one project had no corrective actions taken when problems occurred (Rec C-Q33). The project that scored as *none* for the project oversight component in FY17/18 identified needed corrective actions

to address an implementation problem, but no actions were taken to rectify the observed problem and supplemental erosion control was not applied when needed.

Planning component scores were not significantly associated with the type of primary planning document (Rec C-Q28) used for the 21 projects in FY15/16 or the 48 projects in FY17/18 that employed planning documents (NEPA or other BMP guidance documents) ($p = 0.74$ FY15/16, $p = 0.97$ FY17/18). However, some differences did exist; 82 percent of projects using EISs and other BMP guidance documents had planning component scores of *all* compared to 63 percent of projects using EAs and CEs having that score.

The distribution of scores across the three effectiveness components is summarized in Tables 119 and 120. The erosion and sedimentation components had lower percentages of *effective* scores compared to the chemical pollutants component in each monitoring

Table 119.—Distribution of effectiveness component scores by component for Rec C evaluations completed in FY15/16 and FY17/18

Monitoring period	Component score	Erosion and sedimentation-trails component (number)	Erosion and sedimentation-trails component (percent)	Erosion and sedimentation-waterbody crossings component (number)	Erosion and sedimentation-waterbody crossings component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=21)							
	Effective	11	61	12	75	21	100
	Mostly effective ^a	1	6	1	6		
	Moderately effective ^b						
	Marginally effective ^a	2	11				
	Not effective	2	11	2	13		
	No trail ^c	3	-- ^c				
	No waterbody crossing ^c			5	--		
	Incomplete data ^d	2	11	1	6		
FY17/18 (n=48)							
	Effective	40	85	31	70	47	98
	Mostly effective			3	7		
	Moderately effective						
	Marginally effective	2	4	3	7		
	Not effective	5	11	6	14		
	No trail	1	--				
	No waterbody crossing			4	--		
	Incomplete data			1	2	1	2

^a Score applies only to erosion and sedimentation components (see Table 116).

^b Score applies only to chemical pollutants component (see Table 116).

^c Not included in calculation of percentages.

^d Some of the questions needed to determine a component score were not answered.

Table 120.—Effectiveness component scores corresponding to the overall effectiveness ratings for Rec C evaluations with complete data in FY15/16 and FY17/18. See Table 116 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Erosion and sedimentation-trails component	Erosion and sedimentation-waterbody crossings component	Chemical pollutants component	Number of evaluations
FY15/16 (n=19)					
	Effective	Effective or no trail	Effective or no waterbody crossing	Effective	13
	Mostly effective	Mostly effective	Effective	Effective	1
	Marginally effective	Marginally effective	Effective	Effective	1
		Marginally effective	Mostly effective	Effective	1
	Not effective	No trail	Not effective	Effective	1
		Not effective	No waterbody crossing	Effective	1
		Not effective	Not effective	Effective	1
FY17/18 (n=47)					
	Effective	Effective	Effective or no waterbody crossing	Effective	32
	Mostly effective	Effective	Mostly effective	Effective	3
	Marginally effective	Effective	Marginally effective	Effective	1
		Marginally effective	Marginally effective	Effective	2
	Not effective	Effective or no trail	Not effective	Effective	4
		Not effective	Effective or no waterbody crossing	Effective	3
		Not effective	Not effective	Effective	2

period (Table 119). Forty-five evaluations had scores of *effective* (or *no trails* or *no waterbody crossing*) for all three components, resulting in an effectiveness rating of *effective* (Table 120). The *not effective* scores for the erosion and sedimentation-trails component were responsible for an effectiveness rating of *not effective* for 4 of the 12 evaluations with that rating, while that score for the erosion and sedimentation-waterbody crossing component was responsible for a *not effective* rating for 5 of the 12 evaluations (Table 120).

Effectiveness component scores were analyzed to determine whether associations existed between the component scores and the implementation ratings (Fig. 73). Significant associations were found in each monitoring period for the erosion and sedimentation-trails component scores ($p = 0.07$ FY15/16, $p = 0.04$ FY17/18) but not for the erosion and sedimentation-waterbody crossing component scores ($p = 1.00$ FY15/16, $p = 0.58$ FY17/18). For both components, a higher percentage of component scores were *effective* when implementation ratings were *fully implemented*, although the small number of evaluations with effectiveness component scores other than *effective* limits the usefulness of the comparisons. Tests were not possible for the chemical pollutants component because all scores were *effective*.

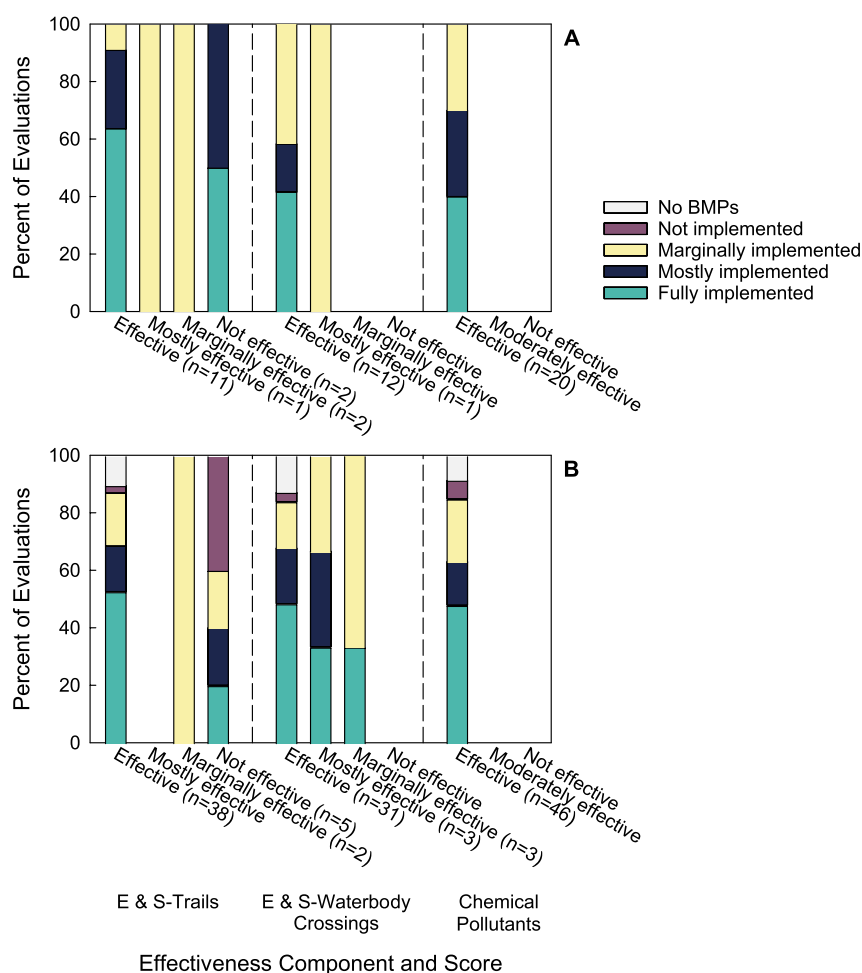


Figure 73.—Distribution of implementation ratings across effectiveness component scores for Rec C evaluations completed in FY15/16 (A) and FY17/18 (B). E & S = erosion and sedimentation.

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 74. No significant associations existed in either monitoring period for the planning component scores ($p = 0.67$ FY15/16, $p = 0.64$ FY17/18). On-the-ground execution component scores were significantly associated with effectiveness ratings in FY15/16 ($p = 0.03$) but not in FY17/18 ($p = 0.21$); project oversight component scores were associated with effectiveness ratings in FY17/18 ($p = 0.09$) but not in FY15/16 ($p = 0.30$). For the planning component in FY15/16, the on-the-ground execution component in both periods, and the project oversight component in FY17/18, effectiveness ratings were better when component scores were *all*; 10 to almost 40 percent more evaluations with *all* scores were rated as *effective* compared to those with *some* scores (Fig. 74).

Planned or implemented BMP provisions (“yes,” “no,” or “not applicable” answers from Table 100 or 102, respectively) that are potentially relevant to effectiveness erosion and sedimentation component scores were examined for statistical associations (Table 121).

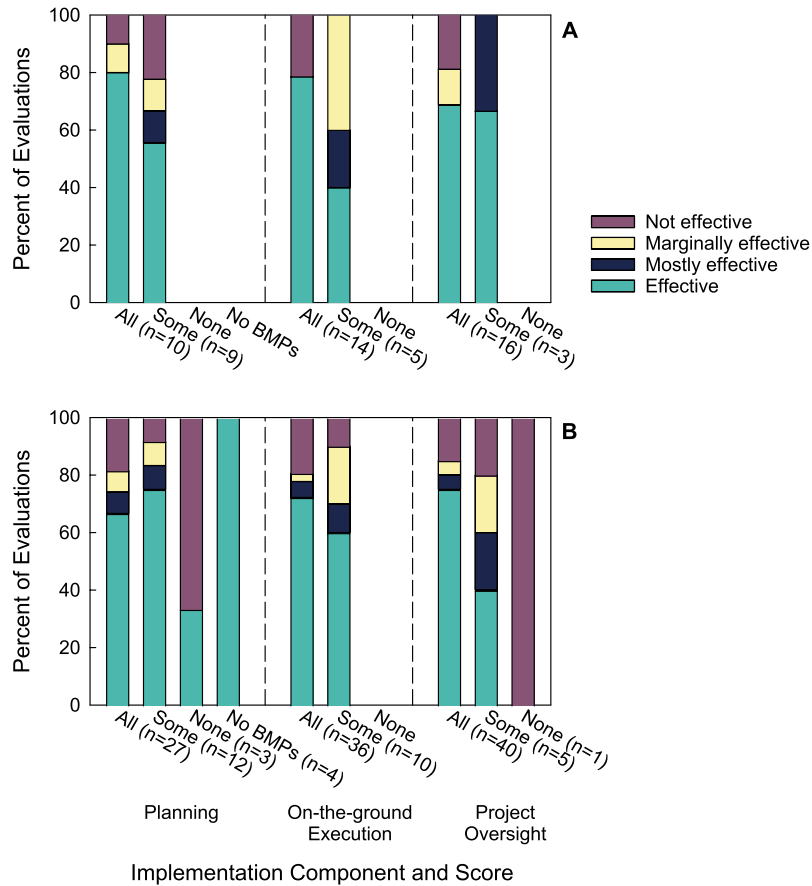


Figure 74.—Distribution of effectiveness ratings across implementation component scores for Rec C evaluations completed in FY15/16 (A) and FY17/18 (B).

Table 121.—Fisher’s exact test probabilities of association between BMP provisions relevant to erosion and sedimentation-trails and erosion and sedimentation-waterbody crossings effectiveness component scores for Rec C 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	FY17/18 In contract or plan p-value	FY17/18 Implemented fully p-value
Erosion and sedimentation-trails	Locations and spacings of cross drains	0.43	0.60	0.16	0.87
	Trail grades	0.01	0.04	0.15	0.45
	Trail surfacing	1.00	0.85	0.04	0.29
	Trail location	0.05	0.05	0.03	0.08
Erosion and sedimentation-waterbody crossings	Waterbody crossing techniques	1.00	0.32	0.10	0.12

^a See Rec C-Q29.

^b Probability of association; significant at $\alpha=0.10$.

^c See Rec C-Q30.

For the provisions relevant to the erosion and sedimentation-trails component, significant associations were found for all but one of the provisions tested: three with planning (“in contract or plan” column in Table 121) and two with on-the-ground execution (“implemented fully” column in Table 121). Both inclusion and execution of BMPs assigned to the provision “trail location” were significantly associated with the component scores in each monitoring period (Table 121). Almost 80 percent of the projects with trail work in FY15/16 and about 90 percent in FY17/18 that included BMPs for that provision in the contract or plan and implemented those BMPs fully had an erosion and sedimentation-trails component score of *effective*. When all trail grade BMPs were included in the project contract or plan, 91 percent of evaluations had component scores of *effective* in FY15/16; one project that did not include all BMPs related to trail grade had a *not effective* component score. BMPs in the trail grade provision were either implemented fully or considered not applicable for projects evaluated in FY15/16; when implemented fully, 90 percent had a component score of *effective*. Similarly, when all BMPs related to trail surfacing were included in the project contract or plan, 88 percent of projects in FY17/18 had erosion and sedimentation-trails component scores of *effective*, compared to 50 percent of projects with that score when those BMPs were not included in the project contract or plan.

There were no significant associations in either monitoring period between the erosion and sedimentation-waterbody crossings component scores and inclusion in the contract or plan or implementation of BMPs assigned to provision “waterbody crossing techniques” (Table 121), but the associations in FY17/18 were very nearly significant; when BMPs in the provision were included, 78 percent of projects had component scores of *effective*, compared to 67 percent of projects that had scores of *not effective* when BMPs from planning were not included in the contract or plan. Eighty percent of projects had erosion and sedimentation-waterbody crossings component scores of *effective* when BMPs in the provision were implemented fully; when BMPs were not implemented fully, 50 percent of projects scored as *effective*, and 50 percent scored as *marginally effective*.

Recreation C: Management Implications for Forest Service Managers

Sixty-three percent of the completed construction or re-routing of motorized or nonmotorized trails projects rated either *fully implemented* or *mostly implemented* for BMP implementation, and 7 percent rated *no BMPs*. *No BMPs* means that no NEPA or other document containing BMPs was used to plan the trail project. Project planning was a deficiency in 39 percent of the projects due to either the lack of those documents or not including all the BMPs in those documents in the project contract or plan. Individual BMP provisions were included in the project contract or plan at an average rate of 85 percent when found in the planning documents. BMPs related to soil cover or location and spacing of cross drains were included least frequently in the project contract or plan when prescribed in the planning documents. One-quarter of the projects scored *some* for the on-the-ground execution component, indicating that not all prescribed BMPs in the project contract or plan were implemented fully. Individual BMP provisions were implemented fully at an average rate of 92 percent when in the project contract or plan. BMPs related to soil cover and waterbody crossings were implemented fully least

frequently when included in the project contract or plan. Of the three implementation components, the project oversight component had the best scores, with 85 percent of the projects having a score of *all*. One project had a project oversight component score of *none*, indicating that corrective actions were not applied when identified and supplemental erosion control was not applied when needed. The other deficiencies in project oversight were due to a lack of inspections or inspections not conducted at critical times.

For BMP effectiveness, 74 percent of the projects rated *effective* or *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. Eighteen percent of the projects were rated *not effective*, indicating that impacts to water quality were occurring. The erosion and sedimentation-trails component had slightly better scores than the erosion and sedimentation-waterbody crossings component; 81 percent of the trails scored *effective* compared to 75 percent of the waterbody crossings, and 8 percent of the trails scored *not effective* compared to 14 percent of the waterbody crossings. For trail projects with effectiveness ratings other than *effective*, the component with the poorest score was nearly evenly split between the erosion and sedimentation-trails and erosion and sedimentation-waterbody crossings components.

Evidence of erosion or sedimentation was observed along the trail at 39 percent of the projects. When evidence was observed, 35 percent of evaluations reported evidence less than 10 feet from the waterbody or in the waterbody. The evidence was primarily sheet or rill erosion. The source of evidence reported most frequently was the trail surface, and the cause reported most frequently was water control features. Evidence of erosion or sedimentation at treated waterbody crossings was observed at 28 percent of the projects with those features. When evidence was observed, 65 percent of those evaluations reported evidence in the waterbody. The evidence was primarily vegetation damage or bare ground, localized sediment deposition in the waterbody, or sheet erosion. The sources reported most frequently were the waterbody crossing surface and the cut slope in the approach. The cause reported most frequently was unhardened crossing approaches.

Implementation ratings were significantly associated with effectiveness ratings at projects evaluated in FY15/16, with better effectiveness results when implementation was better. For projects evaluated in FY17/18, better effectiveness scores occurred across all implementation ratings, so no significant association was found. In total, when the implementation rating was *fully implemented* or *mostly implemented*, a greater percentage of those projects were rated *effective* or *mostly effective* (79 percent) than *marginally effective* or *not effective* (21 percent). Similarly, when the implementation rating was *marginally implemented*, *not implemented*, or *no BMPs*, a greater percentage of those projects were rated *effective* or *mostly effective* than *marginally effective* or *not effective*, but the difference was less (68 percent and 32 percent).

Examination of relationships between implementation and effectiveness ratings and component scores also provide evidence that better BMP implementation leads to better BMP effectiveness on trail construction projects. For example, a greater percentage of projects with a *fully implemented* rating had effectiveness component scores of *effective*. Specific to the erosion and sedimentation-trails component, a significant association was

found between implementation ratings and the scores for this component; better scores were associated with better implementation ratings. Associations between implementation components and effectiveness ratings were more telling. Significant associations were found between the on-the-ground execution component scores and effectiveness ratings for projects evaluated in FY15/16 and between project oversight component scores and effectiveness ratings for projects evaluated in FY17/18. For evaluations that had scores of *all* for the planning component (FY15/16 evaluations), the on-the-ground execution component (both monitoring periods), or the project oversight component (FY17/18 evaluations), effectiveness ratings were better than when scores for those components were *some*.

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

- Checking that all BMP provisions in the planning documents are included in the project contract or plan. Projects rated *not effective* had a smaller number of BMP provisions in the planning documents included in the project contract or plan. For evaluations completed in FY15/16, effectiveness ratings were better when the planning score was *all* than when it was *some*.
- Including BMPs in the provisions “trail grades,” “trail surfacing,” and “trail location” in the project planning documents and in the project contract or plan. A significant association was found between erosion and sedimentation-trail component scores and inclusion of those BMP provisions in the project contract or plan; more than 80 percent of the evaluations with any of those provisions in the project contract or plan had *effective* scores for that component.
- Ensuring that all BMP provisions in the project contract or plan are implemented fully. In both monitoring periods, effectiveness ratings were better when the on-the-ground execution component score was *all* than when that score was *some*.
- Ensuring that BMPs in the provisions “trail location” and “trail grades” are implemented fully. Significant associations were found between those BMP provisions implemented fully and erosion and sedimentation-trails component scores. When trail location BMPs were implemented fully, 90 percent of those projects had an *effective* score for that component.
- If a trail project includes a treated waterbody crossing, ensuring that BMPs in the provision “waterbody crossing techniques” are included in the project contract or plan and implemented fully. Seventy-eight percent of the projects that included those BMPs in the project contract or plan had an erosion and sedimentation-waterbody crossings component score of *effective*, compared to a score of *not effective* for 67 percent of the projects that did not have those BMPs in the project contract or plan. Similarly, when those BMPs were implemented fully, 80 percent of those projects had an erosion and sedimentation-waterbody crossings component score of *effective* compared to a score of *marginally effective* for 50 percent of the projects that did not have those BMPs implemented fully.

- Applying supplemental erosion control on disturbed areas when needed.
Projects where supplemental erosion control was applied when needed had better effectiveness ratings than those where supplemental erosion control was not applied when needed. Although the sample size is small, two of the three projects where supplemental erosion control was not applied when needed had a *not effective* rating.

Recreation C: Best Management Practices Monitoring Form

Best Management Practices Evaluation Rec C. Completed Construction or Re-routing of Motorized or Nonmotorized Trails (Reference BMPs Rec-1, Rec-4, Fac-2, and Fac-6) v3.0 February 2016	
Header	
Rec C-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec C-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec C-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec C-Q4	Date of current field evaluation:
Rec 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:
Rec 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:
Rec C-Q7	Reviewers and titles:
Rec C-Q8a	Region number:
Rec C-Q8b	State:
Rec C-Q9a	Proclaimed Forest or Grassland number and name:
Rec C-Q9b	Administrative Forest or Grassland number and name:
Rec C-Q10	District number and name:
Rec C-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec 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: a. Yes b. No 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:
Rec C-Q12	6 th level HUC number and name for the subwatershed the trail segment is in:
Rec C-Q13	Is the trail segment being evaluated located within a municipal supply watershed? Select one: a. Yes b. No
Rec C-Q14a	Location. UTM Zone: UTM Datum:
Rec C-Q14b	Location. Easting:
Rec C-Q14c	Location. Northing:
Rec C-Q15a	Location. Latitude:
Rec C-Q15b	Location. Longitude:
Rec C-Q15c	Location. Lat/Long Datum:
Rec C-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec C-Q17	Trail number and name:
Rec C-Q18	Identify activity being evaluated. Select one: Construction/Reconstruction Re-routing
Rec C-Q19	Was this trail used for a special event during the past 12 months? Select one: a. Yes b. No If Yes, name event and dates of use:

continued on next page

Header (continued)	
Rec C-Q20	Length of trail being evaluated (ft, m, mi, or km; specify unit):
Rec C-Q21	Number of treated waterbody crossings included in the trail segment:
Rec C-Q22	Lengths of each treated waterbody approach (ft or m; specify unit): Right: Left: Right: Left: Right: Left: Right: Left:
Rec C-Q23	If motorized trail use is permitted, identify types of vehicles permitted. Select all that apply: Dirt bike or motorcycle OHV Snowmobile Other (specify):
Rec C-Q24	If only nonmotorized trail use is permitted, identify types of uses permitted. Select all that apply: Hiking Bicycles Pack animals Skiing/snowshoe Other (specify):
Rec C-Q25	Dominant trail grade in evaluated segment (percent):
Rec C-Q26	Steepest trail grade in evaluated segment (percent):
Implementation	
Rec C-Q27	Was trail or waterbody crossing reconstruction or trail re-routing performed because issues or needs related to protecting water, aquatic, or riparian resources had been identified previously? Select one: a. Not applicable, this trail segment is new construction b. Not applicable, no previous needs identified c. Yes d. No If Yes, what needs were identified?
Rec C-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: a. No planning document containing BMP guidance was used (go to question 30) b. Environmental Impact Statement (EIS) (go to question 29) c. Environmental Assessment (EA) (go to question 29) d. Categorical Exclusion (CE) (go to question 29) e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 29)

continued on next page

Implementation *(continued)*

Rec C-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 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. a. Locations and spacings of cross drains (e.g., waterbars) Yes/No/Not applicable b. Techniques to construct and install cross drains Yes/No/Not applicable c. Trail grades Yes/No/Not applicable d. Trail surfacing Yes/No/Not applicable e. Waterbody crossing techniques Yes/No/Not applicable f. Trail location Yes/No/Not applicable g. Mulching and/or seeding, or other soil cover application Yes/No/Not applicable h. Other (specify): Yes/No/Not applicable
Rec C-Q30	Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the project contract or 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, select Not applicable. a. Locations and spacings of cross drains (e.g., waterbars) Yes/No/Not applicable b. Techniques to construct and install cross drains Yes/No/Not applicable c. Trail grades Yes/No/Not applicable d. Trail surfacing Yes/No/Not applicable e. Waterbody crossing techniques Yes/No/Not applicable f. Trail location Yes/No/Not applicable g. Mulching and/or seeding, or other soil cover application Yes/No/Not applicable h. Other provisions specified in question 29h Yes/No/Not applicable i. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec C-Q31	Was supplemental erosion control applied within the project area? Select one: a. Needed and applied b. Needed but not applied c. Not needed If applied, what supplemental erosion control was used?

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Implementation <i>(continued)</i>	
Rec C-Q32	Were project inspections and/or contract administration during project implementation performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Not applicable, work was conducted to avoid critical times c. Yes d. No
Rec C-Q33	If problems occurred during project implementation that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec C-Q34	Were chemical or fuel spills or leaks that occurred on this trail during the construction or re-routing project handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during implementation of the project c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan
Rec C-Q35	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 36) b. No (go to question 37)
Rec C-Q36	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec C-Q37	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec C-Q38	Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 39 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question.
Effectiveness	
Rec C-Q39	Excluding treated waterbody crossings and their approaches, is there evidence of erosion or sedimentation on or originating from the trail segment? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e. a. Not applicable, activity involved only a waterbody crossing (go to question 47) b. No evidence of erosion or sedimentation (go to question 47) c. Evidence of erosion or sedimentation outside an AMZ (go to question 41) d. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 41) e. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 40)

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Effectiveness (continued)	
Rec C-Q40	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 42: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec C-Q41	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec C-Q42	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: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec C-Q43	What is the width of the AMZ associated with the waterbody? (ft or m, specify unit):
Rec C-Q44	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 39, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

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Effectiveness *(continued)*

Rec C-Q45	What are the sources? Select all that apply: a. Trail surface in evaluated segment b. Trail cut slope in evaluated segment c. Trail fillslope in evaluated segment d. Treated trail surface outside evaluated segment e. Treated trail cut slope outside evaluated segment f. Treated trail fillslope outside evaluated segment g. Untreated trail surface outside evaluated segment h. Untreated trail cut slope outside evaluated segment i. Untreated trail fillslope outside evaluated segment j. General area off of trail k. Other (specify):
Rec C-Q46	What are the causes? Select all that apply: a. Lack of, or insufficient number of water control features b. Improper construction of water control features c. Poor trail location d. Improper grades on trail e. Inadequate soil cover (mulch, seed, geotextiles, etc.) f. Mechanical additions/disturbances from the construction or re-routing of the trail segment g. Other (specify): h. Unknown
Rec C-Q47	At treated waterbody crossings and their approaches, is there evidence of erosion or sedimentation? Select one; when multiple occurrences would result in different answers, select the most severe occurrence, with severity increasing from c to d. a. Not applicable, no treated waterbody crossings (go to question 54) b. No evidence of erosion or sedimentation (go to question 53) c. Evidence of erosion or sedimentation, but no deposition in a waterbody (go to question 48) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 48)
Rec C-Q48	For all of the treated crossings that your answer to question 47 is applicable, what types of waterbodies were crossed? Select all that apply: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec C-Q49	What types of waterbody crossing structures were employed at the crossings applicable to your answers to question 48? Select all that apply: a. Unhardened ford b. Hardened ford c. Culvert d. Bridge e. Boardwalk f. Other (specify):

continued on next page

Effectiveness *(continued)*

Rec C-Q50	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 47, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec C-Q51	What are the sources? Select all that apply: a. Waterbody crossing surface b. Waterbody crossing fill c. Cut slope in approach d. Fillslope in approach e. Water control feature in crossing or approach f. Other (specify):
Rec C-Q52	What are the causes? Select all that apply: a. Lack of crossing structure b. Unhardened crossing approaches c. Poor alignment of waterbody crossing d. Waterbody crossing too narrow e. Waterbody crossing too short f. Inappropriate type of crossing for conditions or traffic levels g. Other (specify):
Rec C-Q53	Do any of the evaluated waterbody crossings have diversion potential? Select one: a. Yes b. No If Yes, what percentage of waterbody crossings has diversion potential? If Yes, what is the single longest diversion potential length? (ft or m, specify unit):
Rec C-Q54	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or associated waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody

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Effectiveness <i>(continued)</i>	
Rec C-Q55	If inspections were not conducted at critical times during project implementation, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times b. Yes c. No
Rec C-Q56	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 57) b. No (go to question 58)
Rec C-Q57	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec C-Q58	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 59) b. No (go to General Comments)
Rec C-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	

Recreation D—Motorized or Nonmotorized Trail Operation and Maintenance

As discussed in the introduction to Recreation Management, the Rec D evaluations completed in FY17/18 had statistically significant associations between both the implementation ratings and effectiveness ratings and whether trails were selected for evaluation randomly or nonrandomly (Table 41, Fig. 22H). Therefore, only randomly selected trails (127 evaluations) are included in these analyses. The results for nonrandomly selected trails (37 evaluations) are presented more briefly in Appendix 2.

Recreation D: Header Statistics

Operation and maintenance (O&M) of 51 and 76 motorized or nonmotorized trails (Rec D) were evaluated for implementation, effectiveness, or both in FY15/16 and FY17/18, respectively (Table 122). All regions completed at least one evaluation, although Region 5 completed 40 percent of all evaluations (see App. 1 for region delineations). At the end of FY15/16 and FY17/18, respectively, 73 and 86 percent of the evaluations had both implementation and effectiveness monitoring completed (Table 122). Implementation and effectiveness monitoring were performed on a single day for all but one paired evaluation in FY15/16 and eight evaluations in FY17/18. Only

Table 122.—Number of randomly selected Rec D evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Rec D-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	1			1
	2	4			4
	3				
	4	1			1
	5	29	11	2	16
	6	1			1
	8	5	1		4
	9	9			9
	10	1			1
	All	51	12	2	37
	Percent		24	4	73
FY17/18					
	1	2			2
	2	8	3	1	4
	3	11			11
	4	2			2
	5	23	6		17
	6	9	1		8
	8	10			10
	9	11			11
	10				
	All	76	10	1	65
	Percent		13	1	86

the implementation portion of the evaluation was completed for 22 trails, and only the effectiveness portion was completed for three evaluations. Eight of the implementation-only trail evaluations were performed near the end of the FY17/18 monitoring period, and the effectiveness evaluation may be included in the next monitoring period (FY19/20). The remaining 14 implementation-only evaluations were completed in FY17 or earlier, so it is unlikely that they were evaluated for effectiveness using Rec D. There is a requirement that at least half of the evaluations used for meeting National BMP targets be selected randomly. This dataset of randomly selected trails represents 77 percent of all Rec D evaluations (Table 40).

All but three Rec D evaluations indicated that a reason for monitoring was to meet National BMP targets (Table 123). The protocol simultaneously met other monitoring needs, most frequently project review (Table 123). Quality assurance was identified as a reason for monitoring in 32 Rec D evaluations (Table 123). For National BMP

Table 123.—Number of randomly selected Rec D evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (Rec 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	1			
	2	4	1			
	3					
	4	1				
	5	28		2	12	1
	6	1				
	8	5		3		
	9	9	4	2	1	
	10	1	1		1	
	All	50	7	7	14	1
FY17/18						
	1	2				
	2	7	1	2		
	3	11	1	2		
	4	2	1			
	5	22	1	11	13	2
	6	9	1	3	1	1
	8	10		1	3	
	9	11	1	1	1	
	10					
	All	74	6	20	18	3

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 monitoring effort on that same site . . . [by] different team members than the initial 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 a duplicate evaluation, 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.

The mean length of trail evaluated was 0.70 mile (standard error [se] = 0.11 mile) in FY15/16 and 1.16 miles (se = 0.29 mile) in FY17/18 (Rec D-Q18), although the longest evaluated lengths were 3.9 and 12.8 miles in FY15/16 and FY17/18, respectively. Dominant trail grades (Rec D-Q24) averaged 9.3 percent (se = 1.2 percent) and ranged from flat to 50 percent in FY15/16; the steepest grade evaluated (Rec D-Q25) was 95 percent. In FY17/18, mean dominant grade was 7.7 percent (se = 0.8 percent) and

ranged from flat to 45 percent. The steepest grade was 60 percent. Twenty-eight trails had no waterbody crossings in the evaluated trail segment: 11 in FY15/16 and 17 in FY17/18. For the 99 trail evaluations with a waterbody crossing, the number of crossings ranged from 1 (45 evaluations) to 10 in FY15/16 and 18 in FY17/18 (Rec D-Q19). Crossing approaches ranged from 0 to 660 feet long and averaged 134 feet (se = 34 feet) in FY15/16. Evaluated approaches were shorter in FY17/18, averaging 88 feet (se = 25 feet) but also ranged from 0 to 660 feet (Rec D-Q20).

Fourteen trails in each monitoring period had been used for a special event in the previous 12 months (Rec D-Q21); 11 events in FY15/16 and 8 in FY17/18 were dirt bike or motorcycle races. In FY15/16 and FY17/18, respectively, 23 and 19 trails reported only motorized uses (Rec D-Q22), 16 and 40 trails reported only nonmotorized uses (Rec D-Q23), and 11 and 15 reported both motorized and nonmotorized uses. One evaluation in FY15/16 and two in FY17/18 did not answer Rec D-Q22 or Rec D-Q23. Types of motorized and nonmotorized trail uses are summarized in Figure 75. Fifty-six trails included multiple motorized uses, compared to 71 trails having multiple nonmotorized uses. When both types of use were permitted, the motorized use was by dirt bikes or motorcycles most frequently, occurring on 88 percent of mixed-use trails.

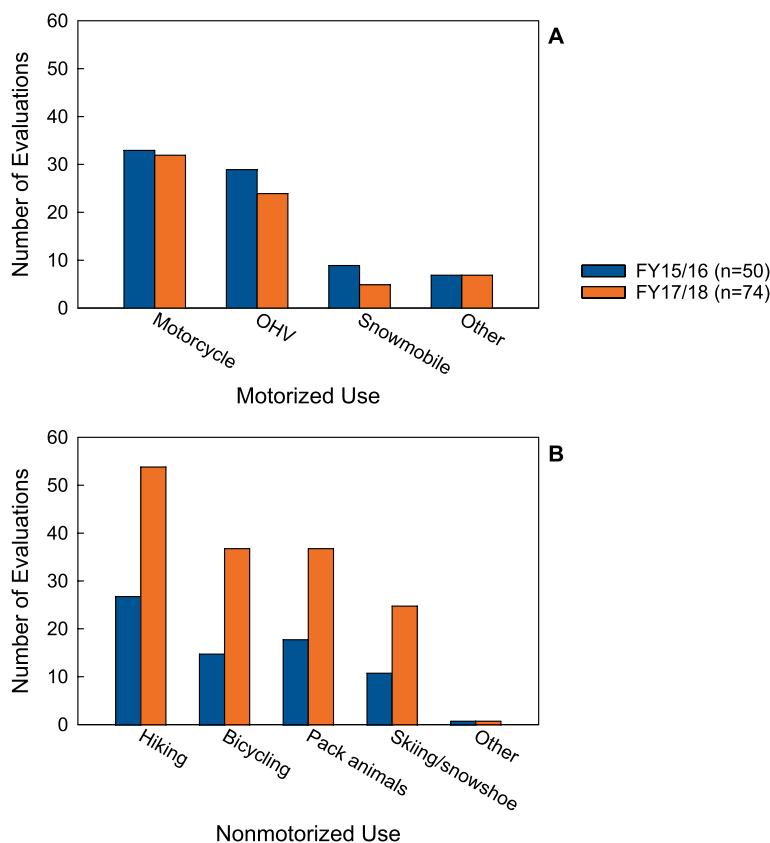


Figure 75.—Distribution of permitted motorized (Rec D-Q22) (A) and nonmotorized (Rec D-Q23) (B) trail uses for randomly selected evaluations completed in FY15/16 and FY17/18. Multiple selections were possible. OHV = off-highway vehicle.

Recreation D: Implementation Results and Their Tie to Header Information

Forty-nine trails (24 in FY15/16 and 25 in FY17/18) had unresolved maintenance needs that had been identified prior to the evaluation (Rec D-Q26). In FY15/16 and FY17/18, respectively, 82 and 72 percent of the trails evaluated had operation and maintenance (O&M) plans or other O&M guidance documents that provided at least one BMP provision to help protect water, aquatic, and riparian resources (Table 124). Whether the trail had some type of O&M plan (Rec D-Q27a, Rec D-Q27b versus Rec D-Q27c) was not associated with whether the trail had unresolved maintenance needs in either monitoring period ($p = 1.00$ FY15/16, $p = 0.39$ FY17/18), although 87 and 84 percent of trails with unresolved needs had O&M plans in FY15/16 and FY17/18, respectively.

Assessment of operation and maintenance implementation focuses on whether BMPs in O&M guidance documents were implemented fully (Rec D-Q28). Table 125 provides a summary of the provisions (i.e., general category) to which individual BMPs included in the O&M guidance documents are assigned and information about whether all the BMPs from the provisions were implemented fully. A “yes” indicates that at least one BMP in the guidance documents was applicable to the provision and that all BMPs assigned to that provision were implemented fully. A “no” indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. “Not applicable” indicates that no BMPs in the guidance documents were 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 each monitoring period of Table 125 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

Prescribed BMP provisions were implemented fully in an average of 88 percent of evaluations in each monitoring period that had some type of BMP guidance document for operation and maintenance (Table 125). The most common types of BMPs prescribed were those associated with trail cross drains in FY15/16 and trail location and grade in FY17/18. BMPs associated with soil cover in FY15/16 and cross drain construction in FY17/18 were least likely to be implemented fully (Table 125). When the numbers and percentages of BMP provisions implemented fully were compared by evaluation, BMPs

Table 124.—Distribution of whether trail operation and maintenance (O&M) plan or other guidance documents contain BMP protection provisions (Rec D-Q27) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18

O&M plan 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	40	82	54	72
No; plan exists but does not have BMP provisions	2	4	4	5
No plan for the trail	7	14	17	23

Table 125.—Frequencies at which all BMPs in provisions included in an operation and maintenance (O&M) plan or other O&M guidance documents were implemented fully (Rec D-Q28) for randomly selected Rec D evaluations completed in FY15/16 (n=40 evaluations) and FY17/18 (n=54 evaluations). Only BMPs that help protect water, aquatic, and riparian resources are applicable.

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)
Cross drain locations and spacings	26	6	6	81	19	36	6	12	86	14
Cross drain construction/types of cross drains	28	4	4	88	12	34	8	10	81	19
Trail grades	27	2	7	93	7	41	2	11	95	5
Trail surfacing	13	2	20	87	13	29	5	20	85	15
Waterbody crossing techniques	24	4	7	86	14	38	7	9	84	16
Trail locations	27	2	8	93	7	41	2	11	95	5
Mulching and/or seeding, or other soil cover techniques	8	4	24	67	33	18	3	33	86	14
Trash management	13	0	21	100	0	16	1	37	94	6
Sanitary waste management	11	0	24	100	0	11	2	41	85	15
Mean	20	3	13	88	12	29	4	20	88	12

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

^b Percent calculated from “yes” and “no” counts.

were included in five provisions on average, and 82 percent of the BMP provisions were implemented fully per evaluation in FY15/16; in FY17/18, BMPs were included in six provisions on average, and 81 percent were implemented fully.

Two implementation questions—Rec D-Q29 and Rec D-Q30—evaluate whether site administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times during the past 12 months when resources were most susceptible to negative effects from site conditions (Table 126) and whether corrective actions were taken if problems occurred during the past 12 months (at any time, not just critical times) (Table 127). Critical times are periods associated with large or intense precipitation/runoff events or other times when the potential for the site to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted during critical times for about 44 percent of the trails in both periods combined (Table 126). About 68 percent of the trails in FY15/16 and 76 percent in FY17/18 either had no problems requiring corrective actions or implemented corrective actions when needed (Table 127).

When conditions are present that may negatively impact water, aquatic, or riparian resources, a trail or a portion of it may be closed or have its use restricted to protect the resources (Rec D-Q31) or have treatments applied to improve conditions (Rec D-Q33).

Table 126.—Distribution of whether inspections occurred at critical times (Rec D-Q29) for randomly selected Rec D 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	18	37	30	40
Yes	15	31	40	53
No	16	33	5	7
All	49		75	

Table 127.—Distribution of whether corrective actions (CA) were taken if problems occurred during past 12 months (Rec D-Q30) for randomly selected Rec 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	13	27	28	37
CA needed but not taken	12	24	11	15
CA needed and implemented	20	41	29	39
Unknown	4	8	7	9
All	49		75	

Of the trails evaluated in FY15/16 and FY17/18, respectively, 18 of 49 and 22 of 75 were closed or had restrictions on use sometime in the 5 years prior to the evaluation. Three evaluations in each monitoring period reported that closure or use restrictions were needed but did not occur. The time between when problems were identified and the trail was closed or use restricted ranged from 1 day to 6 years, although for 80 percent of trails the time was 5 days or less. More than half of the trails in each monitoring period needed treatments to reduce impacts to water resources and had those treatments applied (Table 128). Treatments were applied between 1 day to 10 years after a need was identified and averaged 1 year later in FY15/16 and 10 months later in FY17/18. In all, 33 trails in FY15/16 and 44 trails in FY17/18 had closures or use restrictions or had treatments applied or both. The reasons for those actions (Rec D-Q35) are summarized in Table 129.

Table 128.—Distribution of whether treatments were applied during past 5 years to reduce negative impacts to water, aquatic, or riparian resources (Rec D-Q33) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18

Treatments applied	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Not applicable; no problems warranted application of treatments	12	24	27	37
Needed and applied	30	61	38	52
Needed but not applied	7	14	8	11
All	49		73	

Table 129.—Reasons the trail segment was closed, use was restricted, or treatments were applied (Rec D-Q33) for randomly selected Rec D evaluations completed in FY15/16 (n=33 evaluations) and FY17/18 (n=44 evaluations). Multiple selections were possible.

Reason for closure, use restriction, or application of treatments	FY15/16 (number)	FY17/18 (number)
Trampled vegetation	2	2
Soil compaction		4
Sheet erosion	2	6
Rill erosion	2	6
Gully erosion	4	9
Shoreline/bank erosion	3	3
Trail washout	3	6
Waterbody crossing washout	4	5
Extreme precipitation/weather events	16	21
Other	4	8

Extreme weather was a reason for nearly half of the closures or use restrictions. Several different “other” reasons were identified, including wildfire and unauthorized use.

Because fuel and other chemicals may be present on or near trails, an implementation question (Rec D-Q36) 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 would follow that state agency’s procedures. One evaluation in each monitoring period indicated that the administrative unit did not have a CERP, and four evaluations in both periods combined indicated that a spill or leak requiring cleanup occurred on the trail. Three of those four evaluations reported that cleanup had not followed CERP procedures.

Recreation D: Effectiveness Results and Their Tie to Implementation Results and Header Information

Trail operation and maintenance are evaluated for evidence of erosion and sedimentation at two locations: on the trail and at waterbody crossings in the evaluated trail segment if they exist. Only the most severe cases of erosion or sedimentation are reported (Rec D-Q41, Rec D-Q48) 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. Forty percent or more of evaluated trail segments in each monitoring period observed no evidence of erosion or sedimentation (Rec D-Q41) on or originating from the trails (Table 130). When evidence was observed, the waterbody types affected

Table 130.—Evidence of erosion or sedimentation observed on or originating from trails (Rec D-Q41) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Rec D-Q43) or number of places evidence observed in a waterbody (Rec D-Q42)

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	16	41							
Outside an AMZ ^a	8	21	1		1	5			
Within an AMZ	8	21	3	2	2	1			
In a waterbody	7	18					6		1
FY17/18									
No evidence	31	47							
Outside an AMZ	11	17		1	3	7			
Within an AMZ	11	17	3	7	1				
In a waterbody	13	20					9	2	2

^a Aquatic management zone.

most frequently were intermittent streams and perennial streams or rivers (Rec D-Q44). Vegetation damage or bare ground, rill erosion, sheet erosion, and rutting were the types of evidence observed most often (Table 131). Five evaluations reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec D-Q41 (e.g., turbidity would not be observed outside an AMZ). Many reported causes of the erosion or sedimentation were related to water control features and trail location (Table 132). “Other” identified causes of observed evidence included soil erodibility, trail incision, and unauthorized use.

One trail in FY15/16 and 13 trails in FY17/18 had no waterbody crossings in the evaluated segment. For the remaining trails, about 46 percent in both monitoring periods combined observed no evidence of erosion, sedimentation, or waterbody morphology changes at waterbody crossings and approaches (Rec D-Q48) (Table 133). Perennial streams or rivers and intermittent streams were the types of waterbodies affected most frequently (Rec D-Q49) when evidence was observed, and more than half of the crossing

Table 131.—Types of evidence of erosion or sedimentation observed on or originating from trails (Rec D-Q46) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec D-Q41 (Table 130) is applicable to Rec D-Q46.

Type of evidence	FY15/16 Outside an AMZ ^a (n=8)	FY15/16 Within an AMZ (n=8)	FY15/16 In waterbody (n=7)	FY17/18 Outside an AMZ (n=11)	FY17/18 Within an AMZ (n=11)	FY17/18 In waterbody (n=13)
Traceable evidence to the waterbody, but not currently visible in the waterbody	2	3	5		2	9
Turbidity present	1 ^b					
Evidence of localized sediment deposition in the waterbody	2 ^b	1 ^b	5		1 ^b	10
Changes to substrate composition			2		1 ^b	4
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)			1			3
Bank instability		1	3		2	5
Bank trampling or compaction	1		3		1	3
Vegetation damage or bare ground	2	2	2	5	1	5
Sheet erosion	1	1	2	2	3	7
Rill erosion	1	4	2	4	6	10
Gully erosion	3		2	3	1	6
Headcutting					1	1
Slumping/slips			1	1	1	2
Mass wasting			1			1
Sediment plumes or accumulations	1	2			2	3
Rutting	3	1	1	5	1	5
Water quality monitoring results	1					

^a Aquatic management zone.

^b The type of evidence reported is incompatible with the location in which it was observed.

Table 132.—Causes of evidence of erosion or sedimentation observed on or originating from trails (Rec D-Q47) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec D-Q41 (Table 130) is applicable to Rec D-Q47.

Cause of evidence	FY15/16 Outside an AMZ ^a (n=8)	FY15/16 Within an AMZ (n=8)	FY15/16 In waterbody (n=7)	FY17/18 Outside an AMZ (n=11)	FY17/18 Within an AMZ (n=11)	FY17/18 In waterbody (n=13)
Lack of or insufficient number of water control features	2	4	3	4	3	7
Improper construction of water control features		3		1		2
Improper or inadequate maintenance of water control features or other trail features	5	1	2	2	2	4
Poor trail location	2	1	4	1	3	9
Improper grades on trail	3		3	2	1	3
Other	2	2	4	7	7	1
Unknown					1	

^a Aquatic management zone.

Table 133.—Evidence of erosion or sedimentation observed at waterbody crossings and approaches (Rec D-Q48) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18

Evidence observed	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
No evidence	14	37	27	52
Evidence but not in waterbody	6	16	8	15
Evidence in waterbody	18	47	17	33

structures at those waterbodies were unhardened fords (Rec D-Q50). The types of evidence observed (Rec D-Q51) are summarized in Table 134. Three evaluations reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec D-Q48. Numerous causes for the erosion or sedimentation were reported (Table 135), but many were related to unhardened approaches or poor drainage control. Trail soil properties and problems with unauthorized use were “other” causes reported. Six evaluations in each monitoring period reported that either some or all of the evaluated waterbody crossings had diversion potential for at least one crossing (Rec D-Q53); of those 12 evaluations, 3 had no observed evidence of erosion or sedimentation, 3 had observed evidence in an AMZ, and 6 had evidence in a waterbody. On average, 52 percent of crossings per evaluation in FY15/16 and 68 percent in FY17/18 had diversion potential, although 3 evaluations reported that every crossing had diversion potential. The longest lengths of the diversion potential ranged from 10 to 200 feet and averaged 58 feet (se = 37 feet) in FY15/16; in FY17/18, lengths ranged from 6 to 100 feet and averaged 62 feet (se = 18 feet).

Table 134.—Types of evidence of erosion or sedimentation observed at waterbody crossings and approaches (Rec D-Q51) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec D-Q48 (Table 133) is applicable to Rec D-Q51.

Type of evidence	FY15/16 Evidence but not in waterbody (n=6)	FY15/16 Evidence in waterbody (n=18)	FY17/18 Evidence but not in waterbody (n=8)	FY17/18 Evidence in waterbody (n=17)
Traceable evidence to the waterbody, but not currently visible in the waterbody	1	9	1	5
Turbidity present				1
Evidence of localized sediment deposition in the waterbody		11	1 ^a	14
Changes to substrate composition		6	3 ^a	5
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)		3	1 ^a	8
Bank instability		5		8
Bank trampling or compaction		6	2	5
Vegetation damage or bare ground	1	5	2	8
Sheet erosion		6	1	6
Rill erosion	2	2	2	6
Gully erosion	1	3	2	4
Headcutting		1		1
Slumping/slips		1		1
Mass wasting		1		1
Sediment plumes or accumulations		6	2	4
Rutting	3	3	1	6
Water quality monitoring results				

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

Weather conditions associated with the evaluation (Rec D-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to trail operation and maintenance 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

For each monitoring period, less than 30 percent of evaluations occurred during wet weather. A statistically significant association was not found between categories of erosion on or originating from trails (Rec D-Q39) and weather conditions (i.e., wet versus dry conditions) in either monitoring period ($p = 0.89$ FY15/16, $p = 0.62$ FY17/18). A slightly higher percentage of evaluations with observed evidence in a waterbody occurred during

Table 135.—Causes of evidence of erosion or sedimentation observed at waterbody crossings and approaches (Rec D-Q52) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec D-Q48 (Table 133) is applicable to Rec D-Q52.

Cause of evidence	FY15/16 Evidence but not in waterbody (n=6)	FY15/16 Evidence in waterbody (n=18)	FY17/18 Evidence but not in waterbody (n=8)	FY17/18 Evidence in waterbody (n=17)
Lack of crossing structure		6		6
Unhardened crossing approaches		7	2	10
Poor alignment of waterbody crossing	1	3	1	1
Waterbody crossing too narrow		1		1
Waterbody crossing too short	1	1		1
Inappropriate type of crossing for conditions or traffic levels		2	1	1
Improper or inadequate maintenance of crossings or approaches	1	9		6
Approaches are too long		4		1
Lack of or improper drainage control	3	9	2	7
Other		8	3	6

wet weather (Fig. 76). Categories of erosion at waterbody crossings and approaches (Rec D-Q47) and weather conditions also were not significantly associated in either period ($p = 0.89$ FY15/16, $p = 0.51$ FY17/18).

Trash or domestic animal or human sanitary waste evidence (Rec D-Q54) was observed on or originating from trails—including at waterbody crossings and approaches—during 20 of the 105 effectiveness evaluations. Evidence was observed most often outside an AMZ and least often in a waterbody (Table 136). The presence of chemical spills, leaks, or chemical waste containers (Rec D-Q55) is also determined during the effectiveness evaluations. Such evidence can include pollutants observed but not reported, pollutants reported but not yet cleaned up, or pollutants not previously observed or known to exist. The results indicate that care was taken to prevent chemical contamination along trails; no evidence of spills, leaks, or waste containers was found during any evaluation.

In the Rec D protocol, four sets of paired implementation and effectiveness questions assess unresolved maintenance needs (Rec D-Q26 and Rec D-Q56), inspections (Rec D-Q29 and Rec D-Q57), and site closures (Rec D-Q31 and Rec D-Q58) or treatments (Rec D-Q33 and Rec D-Q58). Respectively, the questions ask whether trail administration or lack thereof influenced BMP effectiveness. Only one effectiveness question (Rec D-Q58) assesses the effectiveness of both site closures and treatments, which limits the comparisons to trails that had closures or use restrictions (Rec D-Q31) and to trails that had treatments applied (Rec D-Q33). Tables 137 through 140 show the relationships between the pairs of questions for trails in which both implementation and

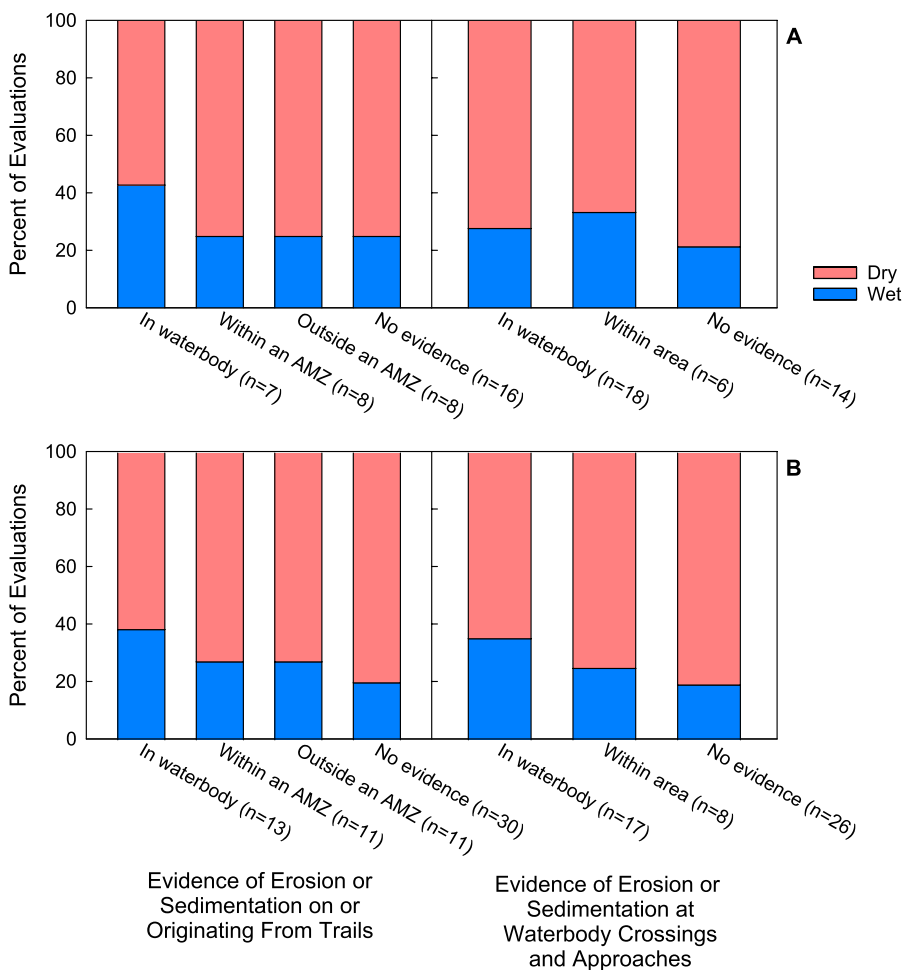


Figure 76.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion on or originating from trails (Rec D-Q41; left panels) and at waterbody crossings and approaches (Rec D-Q48; right panels) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

effectiveness evaluations were completed in each monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of the paired comparisons because some number of incompatible answer choices were selected (shaded cells) based on the protocol instructions for three of the four comparisons. Sixteen trails in FY15/16 and 23 trails in FY17/18 had unresolved maintenance needs, and 62 percent reported that those needs contributed to observed effectiveness problems (Table 137). Lack of inspections or inspections not conducted at critical times contributed to observed problems for five sites (Table 138). Five trails had a closure or use restriction without applied treatments (Table 139), which limits the usefulness of the comparison. For the sites that had needed treatments applied without site closure or use restrictions, the desired results from the treatments were fully or partially achieved when the implementation and effectiveness questions were answered according to the protocol instructions (Table 140).

Table 136.—Evidence of trash or domestic animal or human sanitary waste observed on or along trails, including at waterbody crossings and approaches (Rec D-Q54), for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

Evidence observed	FY15/16 (number)	FY17/18 (number)
No evidence	28	59
Trash outside an AMZ ^a	5	6
Trash within an AMZ	6	3
Trash in a waterbody	0	0
Waste outside an AMZ	2	3
Waste within an AMZ	6	3
Waste in a waterbody	2	0

^a Aquatic management zone.

Table 137.—Distribution of whether trail had unresolved maintenance needs (Rec D-Q26) in relationship to problems observed during effectiveness monitoring (Rec D-Q56) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (24 and 17 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Trail has unresolved maintenance needs (implementation)	Not applicable; no unresolved maintenance needs (effectiveness)	Yes; unresolved maintenance needs led to observed problems (effectiveness)	No; unresolved maintenance needs did not lead to observed problems (effectiveness)
FY15/16				
	Yes	1	12	3
	No	11	4	3
FY17/18				
	Yes	2	12	9
	No	31	2	7

Table 138.—Occurrence of inspections performed at critical times (Rec D-Q29) in relationship to problems observed during effectiveness monitoring (Rec D-Q57) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (20 and 25 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	3	1	9
	Yes; inspections at critical times	8	2	2
	No; inspections not at critical times		3	7
FY17/18				
	No inspections	6	1	20
	Yes; inspections at critical times	23		9
	No; inspections not at critical times	1		4

Table 139.—Distribution of whether trail was closed or use was restricted (Rec D-Q31) in relationship to whether desired results were achieved by the closure or restrictions^a (Rec D-Q58) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18

Monitoring period	Trail closed or use restricted (implementation)	Not applicable; no closure or use restrictions (effectiveness)	Desired results fully achieved (effectiveness)	Desired results partially achieved (effectiveness)	No improvement (effectiveness)	Too soon to determine (effectiveness)
FY15/16						
	Not applicable; no closure or use restriction	11				
	Needed and closed or use restricted		1			
	Needed but not closed or use not restricted					
FY17/18						
	Not applicable; no closure or use restriction	21				
	Needed and closed or use restricted		3	1		
	Needed but not closed or use not restricted					

^a Includes only trails that had closures or use restrictions and no treatments applied.

Table 140.—Distribution of whether trail had treatments applied (Rec D-Q33) in relationship to whether desired results were achieved by the treatments^a (Rec D-Q58) for randomly selected Rec D evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (44 and 30 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Treatments were applied (implementation)	Not applicable; no treatments (effectiveness)	Desired results fully achieved (effectiveness)	Desired results partially achieved (effectiveness)	No improvement (effectiveness)	Too soon to determine (effectiveness)
FY15/16						
	Not applicable; no treatments needed	11				
	Needed and applied	11	1	1		
	Needed but not applied	1				
FY17/18						
	Not applicable; no treatments needed	21				
	Needed and applied	13	4	1		
	Needed but not applied	5				

^a Includes only trails that had treatments applied and no trail closures or use restrictions.

Recreation D: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

About 55 percent of the Rec D trails were rated as *fully implemented* or *mostly implemented* in each monitoring period, and 30 percent were rated as *not implemented* and *no BMPs* (Fig. 77). In comparison, 38 and 52 percent of the trails in FY15/16 and FY17/18, respectively, were rated as *effective* and *mostly effective*, and about 40 percent in each monitoring period were rated as *not effective*. Two implementation evaluations and four effectiveness evaluations lacked responses in the database for questions needed to determine a rating (identified as “incomplete data” in Fig. 77).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Rec D-Q16) were not associated with the effectiveness ratings in either monitoring period ($p = 0.49$ FY15/16, $p = 0.11$ FY17/18), although ratings were slightly poorer for evaluations during wet weather (Fig. 78). About one-third of evaluations were conducted in wet weather, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential. Relationships between weather conditions and field observations of erosion, sedimentation, or morphological effects (e.g., Fig. 76) 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.

The effectiveness ratings were significantly associated with whether trails had unresolved maintenance needs (Rec D-Q26) in FY17/18 ($p = 0.02$) but not in FY15/16 ($p = 0.14$). In both periods, however, 60 percent or more of trails with maintenance needs had the poorest rating (Fig. 79). No significant associations existed between the effectiveness ratings and whether O&M guidance documents—with or without BMPs—existed for the trail ($p = 0.35$ FY15/16, $p = 0.20$ FY17/18) (Fig. 80). This result is not particularly

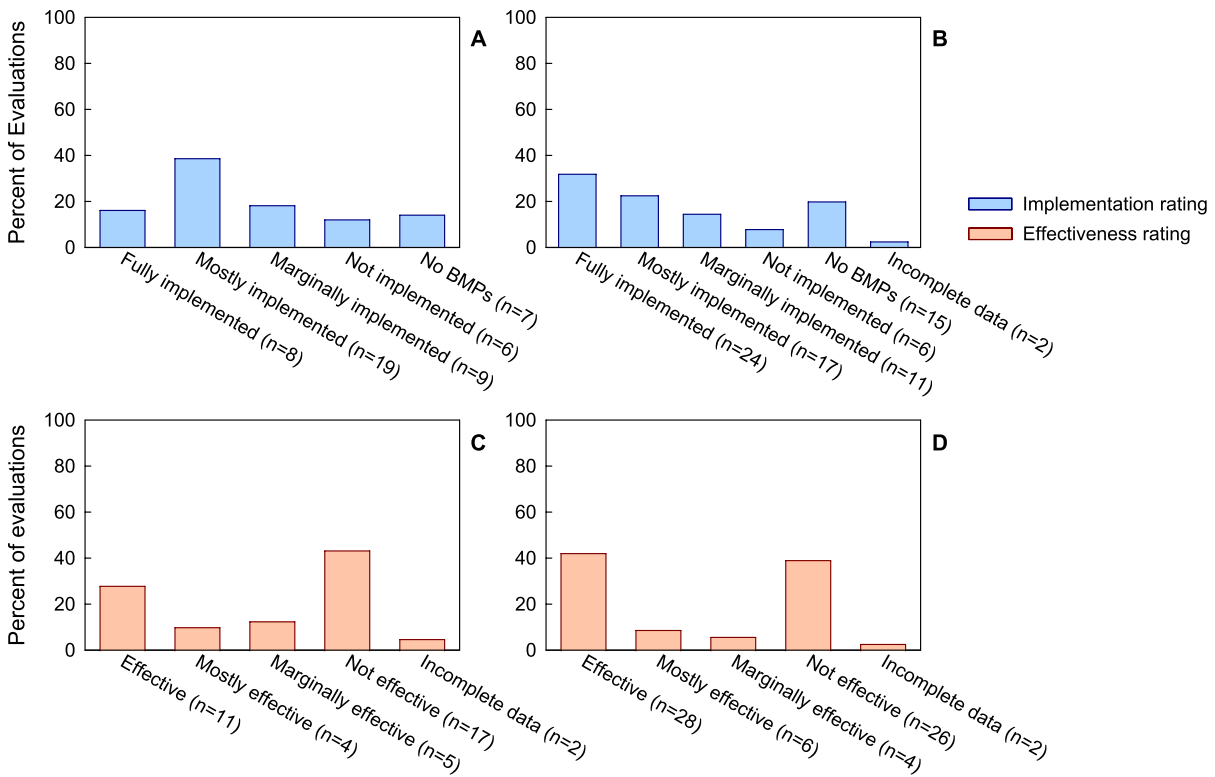


Figure 77.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for randomly selected Rec D evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

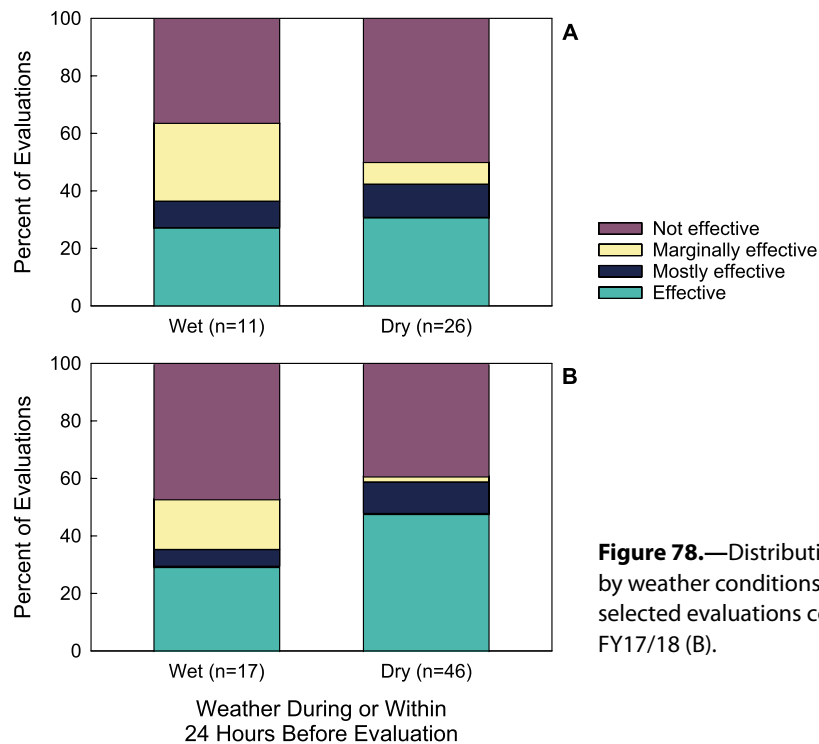


Figure 78.—Distribution of effectiveness ratings by weather conditions (Rec D-Q16) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

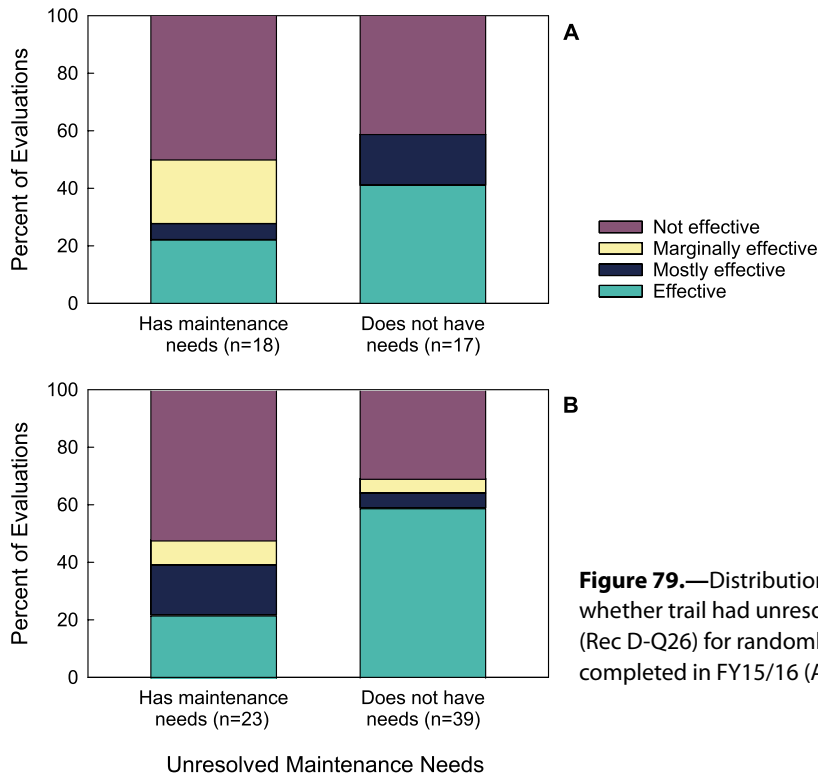


Figure 79.—Distribution of effectiveness ratings by whether trail had unresolved maintenance needs (Rec D-Q26) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

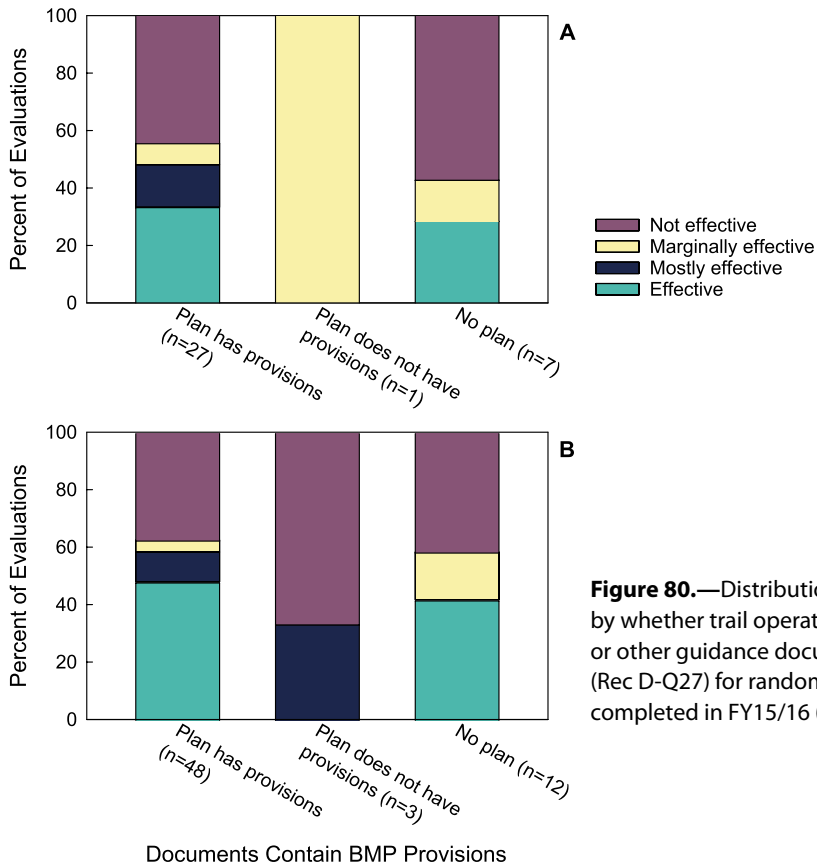


Figure 80.—Distribution of effectiveness ratings by whether trail operation and maintenance plan or other guidance documents contained BMPs (Rec D-Q27) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

surprising given the percentage of poor effectiveness ratings for about half of the evaluated trails. The number of BMP provisions implemented fully (Rec D-Q28) was not significantly different between the effectiveness ratings in FY15/16 ($p = 0.28$, GLMM with negative binomial distribution and log link function), but significant differences were found in FY17/18 ($p = 0.02$). Evaluations averaged from three to eight provisions implemented fully in FY15/16 and from three to seven in FY17/18 across the effectiveness ratings. The range was larger in FY15/16; evaluations with poorer ratings averaged higher numbers of BMPs implemented fully—eight for evaluations rated *marginally effective* and five for those rated *not effective*. In FY17/18, evaluations rated *not effective* had significantly fewer BMP provisions implemented fully (three) compared to evaluations rated *effective* (six) or *mostly effective* (seven). Mean percentages of BMPs implemented fully in FY15/16 were less variable (72 to 100 percent) across the effectiveness ratings, and significant differences were not found ($p = 0.60$, Kruskal-Wallis test). In FY17/18, the percentages of BMPs implemented fully ranged from 57 to 100 percent, and significant differences were found ($p = 0.01$, Kruskal-Wallis test). Trails rated as *effective* had a significantly higher percentage of BMPs implemented fully on average compared to those rated *not effective*: 90 percent versus 57 percent. The much smaller numbers of evaluations with ratings of *mostly effective* and *marginally effective* (Fig. 77) likely affected these statistical tests for differences.

Of the trails evaluated for effectiveness, 17 percent in FY15/16 and 25 percent in FY17/18 had been closed or had use restrictions. Whether the trail was closed was not significantly associated with effectiveness ratings in either monitoring period ($p = 0.61$ FY15/16, $p = 0.14$ FY17/18). When closure was not needed, ratings were slightly worse in FY15/16 but slightly better in FY17/18 than when trail closure or use restrictions were needed. A larger percentage of trails had treatments applied to reduce impacts to water resources (Table 128) than were closed. Whether treatments were applied was not significantly associated with effectiveness ratings in either monitoring period ($p = 1.00$ FY15/16, $p = 0.40$ FY17/18). Ratings were better when treatments were not needed or applied when needed (Fig. 81).

During the implementation portion of the evaluation, review of documents and inquiries with site administrators occur to determine whether corrective actions were taken if problems were observed during the past 12 months (Rec D-Q30). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. Significant associations were not found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in FY15/16 ($p = 0.23$), but a significant association was found in FY17/18 ($p < 0.01$). In that monitoring period, ratings were much better both when corrective actions were not needed and when needed corrections were implemented (Fig. 82).

Two additional questions that ask whether corrective actions 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.

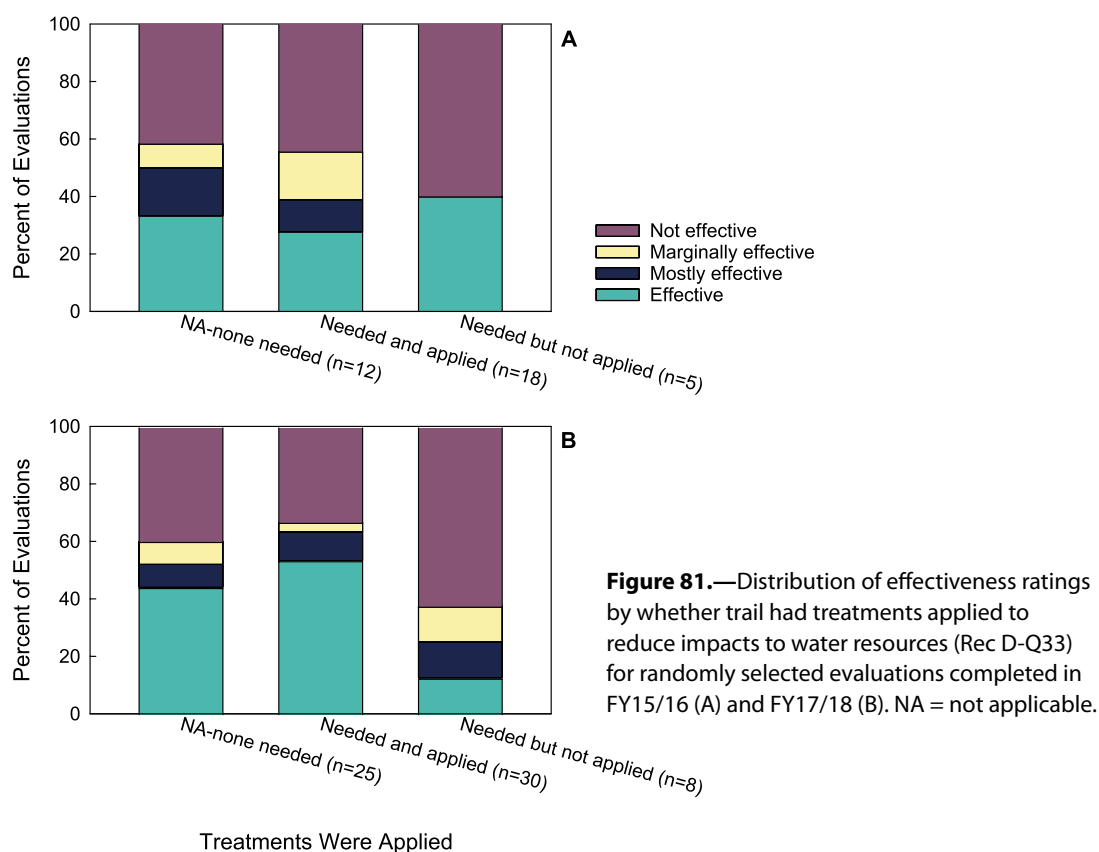


Figure 81.—Distribution of effectiveness ratings by whether trail had treatments applied to reduce impacts to water resources (Rec D-Q33) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B). NA = not applicable.

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 of BMPs applicable to the project or site; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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 sites every operating season to ensure those standards are met or initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations where implementation corrective actions or adaptive management actions were needed was about the same as the number for which no actions were needed in FY15/16 (Fig. 83). There were no significant associations in FY15/16 among implementation ratings and corrective action needs ($p = 0.19$), but there were significant associations among implementation ratings and adaptive management action needs ($p = 0.03$). In FY17/18, one-half to one-third fewer evaluations indicated that actions were needed compared to the number that indicated actions were not needed.

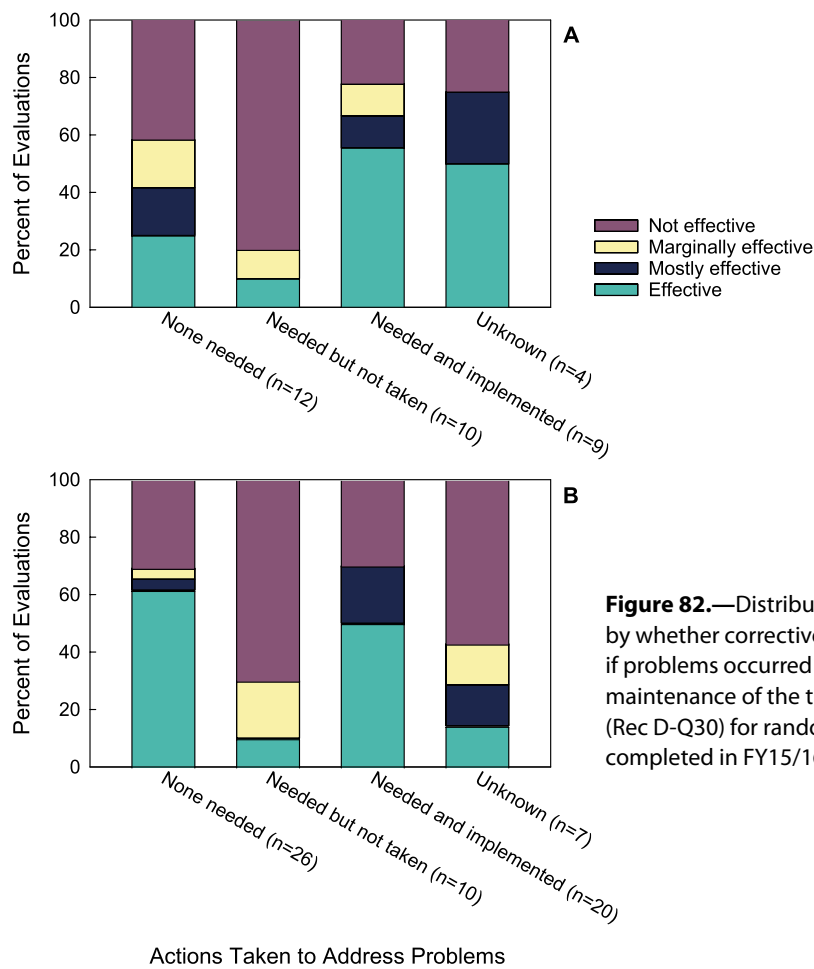


Figure 82.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during operation and maintenance of the trail during the past 12 months (Rec D-Q30) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

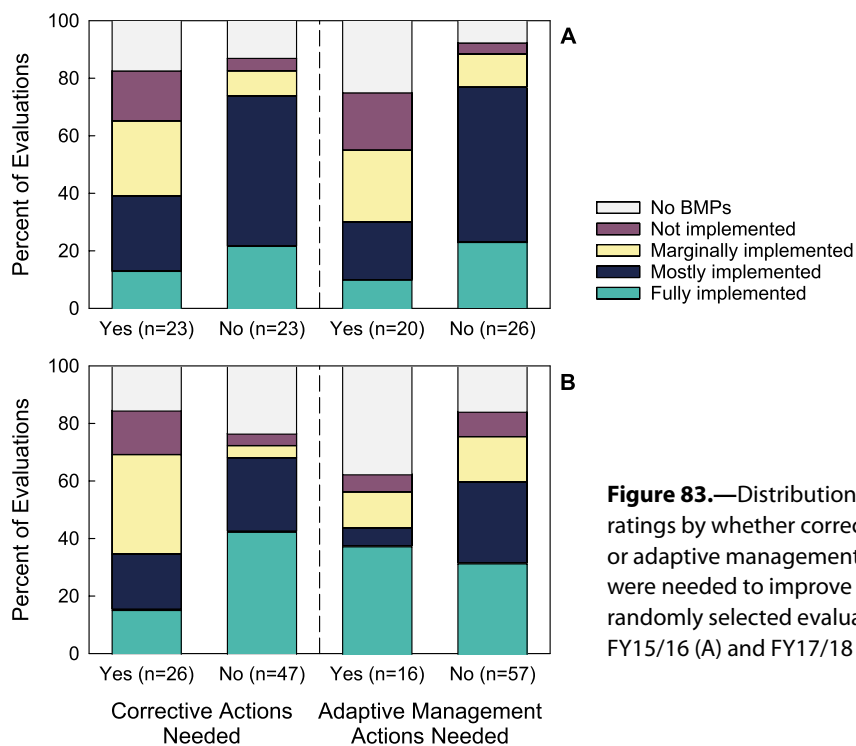


Figure 83.—Distribution of implementation ratings by whether corrective actions (Rec D-Q37) or adaptive management actions (Rec D-Q39) were needed to improve implementation for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

A significant association existed between corrective action needs and implementation ratings ($p < 0.01$) but not between adaptive management needs and ratings ($p = 0.21$). However, in each period, ratings were better when no actions were needed (Fig. 83). By contrast, twice as many evaluations in FY15/16 indicated that effectiveness corrective actions were needed as evaluations that indicated no actions were needed (Fig. 84). There were significant associations among effectiveness ratings and whether corrective actions were needed in both monitoring periods ($p = 0.04$ FY15/16, $p < 0.001$ FY17/18) and among effectiveness ratings and whether adaptive management actions were needed in FY17/18 ($p = 0.07$). Better effectiveness ratings resulted for trails for which no corrective actions were identified as needed; 55 and 71 percent were rated *effective* in FY15/16 and FY17/18, respectively, compared to 60 and 76 percent in those periods rated as *not effective* when corrective actions were needed (Fig. 84). Trails in FY17/18 that had no adaptive management action needs identified also had better effectiveness ratings.

Some evaluations were rated as *not implemented*, *no BMPs*, or *not effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. The 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

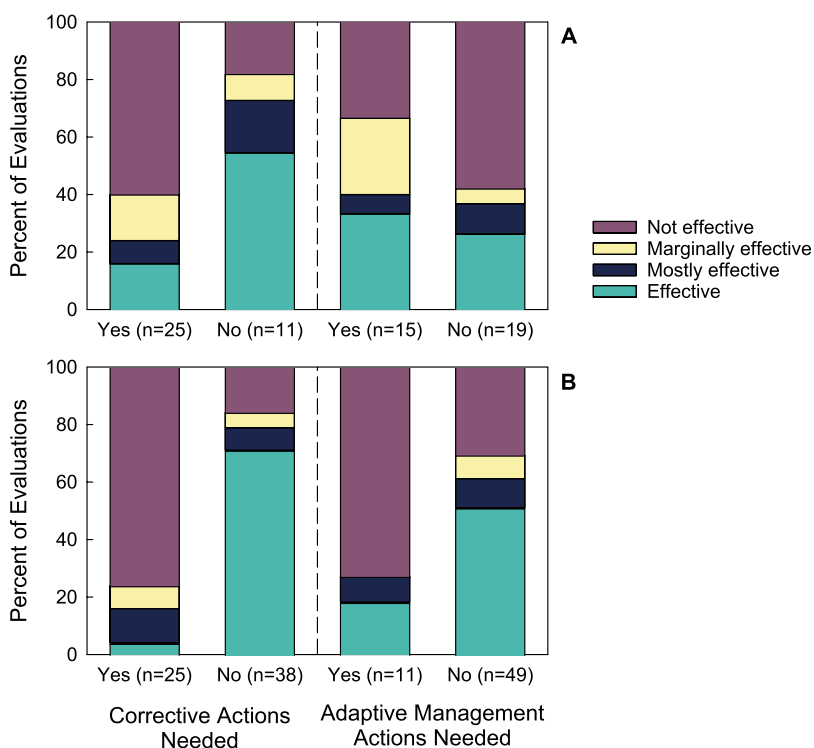


Figure 84.—Distribution of effectiveness ratings by whether corrective actions (Rec D-Q59) or adaptive management actions (Rec D-Q61) were needed to improve effectiveness for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

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 Rec D-Q37, Rec D-Q39, Rec D-Q59, and Rec D-Q61.

Composite Ratings

Composite rating results for Rec D trail operation and maintenance that were evaluated for both implementation and effectiveness are given in Table 141. Twenty-seven percent of trails had a composite rating of *excellent*, 13 percent were rated as *good*, 34 percent were rated as *poor*, and 19 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, a significant association between implementation and effectiveness ratings was not found in FY15/16 ($p = 0.26$) but was found in FY17/18 ($p = 0.03$). For the trails evaluated in FY15/16, better implementation occurred across all levels of effectiveness, and poor effectiveness occurred across all levels of implementation. In FY17/18, better implementation ratings tended to result in better effectiveness ratings (Table 141).

Table 141.—Composite rating matrix for randomly selected Rec D trails evaluated for both implementation and effectiveness in FY15/16 (n=35 evaluations) and FY17/18 (n=63 evaluations). Numbers in cells indicate the number of evaluations 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	3	3	1	2	2
	Mostly effective	2	1	1		
	Marginally effective	1	1		1	1
	Not effective		5	6	1	4

FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective	11	9	3		5
	Mostly effective	4		1	1	
	Marginally effective		2			2
	Not effective	4	5	7	4	5

Excellent

Good

Fair

Poor

No plan

Recreation D: Examination of Component and Subcomponent Scores

The overall implementation ratings for Rec D were determined from component scores described in Table 64. Rec D effectiveness rating components and scores are similar to those for Rec C (Table 116), with the addition of a trash and waste component (Table 142). When a trail evaluation does not include waterbody crossings and approaches, the missing component is scored *no waterbody crossing* (Table 142); that score does not influence the final effectiveness rating. Table 143 shows the distribution of scores across the three implementation components. Thirty-two of the trails had *all* scores for the three implementation components, which resulted in implementation ratings of *fully implemented* (Table 144). Lack of O&M guidance documents resulted in a *no BMPs* planning component score for 24 trails and an *all* score for the on-the-ground execution component because having no O&M documents is equivalent to all provisions being implemented fully (Table 143).

A *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 64). This score results from a “no” answer for at least one provision in Table 125 and a “yes” response for at least one other provision. For the 10 projects in FY15/16 and 11 projects in FY17/18 having a score of *some* for the on-the-ground execution component (Table 143), the O&M plans in FY15/16 averaged seven provisions containing at least one BMP, and in approximately 33 percent of those provisions at least one BMP was not implemented fully. In FY17/18, O&M plans averaged BMPs in five provisions, and 47 percent were not implemented fully. The percentages of BMPs that were not implemented fully per trail ranged from

Table 142.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec D protocol

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-trails	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-waterbody crossings	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 crossings and approaches; does not affect the effectiveness rating
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 143.—Distribution of implementation component scores by component for randomly selected Rec 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=49)							
	All	40	82	36	73	13	27
	Some ^a			10	20	33	67
	None ^a			3	6	3	6
	No BMPs prescribed ^b	2	4				
	No O&M ^{b,c}	7	14				
FY17/18 (n=75)							
	All	54	72	62	83	34	45
	Some			11	15	39	52
	None			2	3		
	No BMPs prescribed	4	5				
	No O&M	17	23				
	Incomplete data ^d					2	3

^a Score applies only to on-the-ground execution and project oversight components (see Table 64)

^b Score applies only to planning component (see Table 64).

^c Operation and maintenance.

^d Some of the questions needed to determine a component score were not answered.

11 to 67 percent per evaluation in FY15/16 and from 17 to 83 percent in FY17/18. Three projects in FY15/16 and two in FY17/18 had a score of *none* for the on-the-ground execution component (Table 143), indicating that none of the BMPs included in the O&M documents were implemented fully in the field (Table 64). This score results from a “no” answer to all applicable provisions in Table 125.

The project oversight component is determined from four metrics: inspections (Rec D-Q29), whether corrective actions were taken if needed (Rec D-Q30), whether the trail needed to be closed or use restricted (Rec D-Q31), and whether treatments were applied when needed (Rec D-Q33). A score of *none* for the project oversight component indicates deficiencies in the last three metrics; a *some* score results from a deficiency in one or some other combination of metrics. Forty-six of 72 trails had a *some* score for the project oversight component (Table 143) because trails were not inspected or inspections were not at critical times. Eighteen trails had deficiencies in inspections and one or two other metrics.

The distribution of scores across the four effectiveness components is summarized in Tables 145 and 146. The erosion and sedimentation components had lower percentages of *effective* scores compared to the other components (Table 145). Thirty-nine of the evaluations in both monitoring periods had scores of *effective* (or *no waterbody crossing*) for all four components, resulting in an effectiveness rating of *effective* (Table 146). Thirty-

Table 144.—Implementation component scores corresponding to the overall implementation ratings for randomly selected Rec D evaluations with complete data in FY15/16 and FY17/18. See Table 64 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=49)					
	Fully implemented	All	All	All	8
	Mostly implemented	All	All	Some	19
	Marginally implemented	All	Some	All	3
		All	Some	Some	6
	Not implemented	All	Some	None	1
		All	None	Some	3
		No Rx ^a	All	All	2
	No BMPs	No O&M ^b	All	Some	5
		No O&M	All	None	2
FY17/18 (n=73)					
	Fully implemented	All	All	All	24
	Mostly implemented	All	All	Some	17
	Marginally implemented	All	Some	All	4
		All	Some	Some	7
	Not implemented	All	None	Some	2
		No Rx	All	Some	4
	No BMPs	No O&M	All	All	6
		No O&M	All	Some	9

^a No BMPs prescribed.

^b Operation and maintenance.

two trails had a *not effective* score for one component, and 10 trails had a *not effective* score for two or three components. The *not effective* scores for the erosion and sedimentation-waterbody crossings component contributed to an effectiveness rating of *not effective* for 29 of the 43 evaluations with that rating (Table 146).

Effectiveness component scores were analyzed to determine whether associations existed between the component scores and the implementation ratings (Fig. 85). Significant associations were found for the erosion and sedimentation-waterbody crossings component ($p = <0.01$) and trash and waste component in FY17/18 ($p = 0.04$). All other association test results were not significant (erosion and sedimentation-trails: $p = 0.47$ FY15/16, $p = 0.31$ FY17/18; erosion and sedimentation-waterbody crossings: $p = 0.22$ FY15/16; trash and waste: $p = 0.58$ FY15/16; chemical pollutants: tests not possible). The large number of evaluations with component scores of *effective* compared to the other possible component scores limits the usefulness of the implementation rating comparisons. The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 86. No significant associations existed

Table 145.—Distribution of effectiveness component scores by component for randomly selected Rec D evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Erosion and sedimentation-trails component (number)	Erosion and sedimentation-trails component (percent)	Erosion and sedimentation-waterbody crossings component (number)	Erosion and sedimentation-waterbody crossings component (percent)	Trash and waste component (number)	Trash and waste component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=39)									
	Effective	22	56	14	37	30	77	38	97
	Mostly effective ^a	3	8	3	8				
	Moderately effective ^b					6	15		
	Marginally effective ^a	5	13	7	18				
	Not effective	8	21	13	34	2	5		
	No waterbody crossing ^c			1	-- ^c				
	Incomplete data ^d	1	3	1	3	1	3	1	3
FY17/18 (n=66)									
	Effective	43	65	29	55	61	92	65	98
	Mostly effective	3	5	2	4				
	Moderately effective					5	8		
	Marginally effective	5	8	4	8				
	Not effective	15	23	17	32				
	No waterbody crossing			13	--				
	Incomplete data			1	2			1	2

^a Score applies only to all erosion and sedimentation components (see Table 142).

^b Score applies only to trash and waste and chemical pollutants components (see Table 142).

^c Not included in calculation of percentages.

^d Some of the questions needed to determine a component score were not answered.

Table 146.—Effectiveness component scores corresponding to the overall effectiveness ratings for randomly selected Rec D evaluations with complete data in FY15/16 and FY17/18. See Table 142 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Erosion and sedimentation-trail component	Erosion and sedimentation-waterbody crossings component	Trash and waste component	Chemical pollutants component	Number of evaluations
FY15/16 (n=37)						
	Effective	Effective	Effective or no waterbody crossing	Effective	Effective	11
	Mostly effective (n=4)	Effective	Effective	Moderately effective	Effective	1
		Effective	Mostly effective	Effective	Effective	3
	Marginally effective (n=5)	Mostly effective	Marginally effective	Effective	Effective	2
		Marginally effective	Marginally effective	Effective	Effective	3
	Not effective (n=17)	Effective	Effective	Not effective	Effective	1
		Effective	Not effective	Effective	Effective	5
		Effective	Not effective	Moderately effective	Effective	1
		Mostly effective	Not effective	Moderately effective	Effective	1
		Marginally effective	Not effective	Effective	Effective	1
		Not effective	Effective	Effective	Effective	1
		Not effective	Effective	Moderately effective	Effective	1
		Not effective	Marginally effective	Effective	Effective	2
		Not effective	Not effective	Effective	Effective	2
		Not effective	Not effective	Moderately effective	Effective	1
	Not effective	Not effective	Not effective	Effective	1	
FY17/18 (n=64)						
	Effective	Effective	Effective or no waterbody crossing	Effective	Effective	28
	Mostly effective (n=6)	Effective	Effective	Moderately effective	Effective	1
		Effective	Mostly effective	Effective	Effective	2
		Mostly effective	Effective or no waterbody crossing	Effective	Effective	3
	Marginally effective (n=4)	Effective	Marginally effective	Effective	Effective	2
		Marginally effective	Effective	Effective	Effective	2
	Not effective (n=26)	Effective	Not effective	Effective	Effective	8
		Marginally effective	Not effective	Effective	Effective	1
		Marginally effective	Not effective	Moderately effective	Effective	2
		Not effective	Effective or no waterbody crossing	Effective	Effective	6
		Not effective	No waterbody crossing	Moderately effective	Effective	1
		Not effective	Marginally effective	Effective	Effective	2
		Not effective	Not effective	Effective	Effective	5
		Not effective	Not effective	Moderately effective	Effective	1

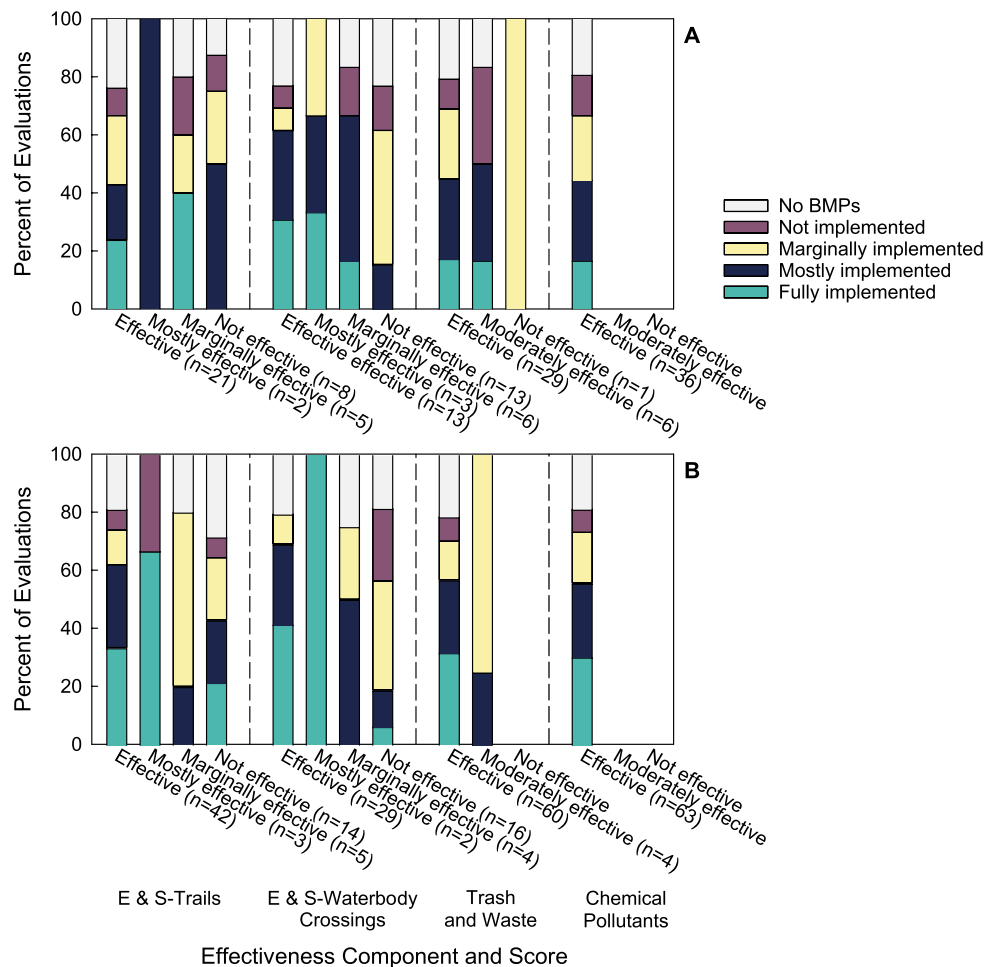


Figure 85.—Distribution of implementation ratings across effectiveness component scores for randomly selected Rec D evaluations completed in FY15/16 (A) and FY17/18 (B). E & S = erosion and sedimentation.

in either monitoring period for any component except the project oversight component in FY17/18 (planning: $p = 0.35$ FY15/16, $p = 0.20$ FY17/18; on-the-ground execution: $p = 0.48$ FY15/16, $p = 0.29$ FY17/18; project oversight: $p = 0.42$ FY15/16, $p < 0.01$ FY17/18). However, effectiveness ratings tended to be better when component scores were better (Fig. 86).

Implemented BMP provisions (“yes,” “no,” or “not applicable” answers from Table 125) that are potentially relevant to effectiveness erosion and sedimentation component scores were examined for statistical associations (Table 147). No significant associations were found for any of the provisions tested in FY15/16, but there were significant associations for every provision tested in FY17/18. For all comparisons in FY17/18, a high percentage of the component scores were *effective* when the provision was implemented fully; a higher percentage of scores were *not effective* when the provision was not implemented fully (Fig. 87). The differences were less in FY15/16, but component scores were slightly better when the provisions related to trail cross drains and waterbody crossing techniques were implemented fully compared to when they were not (Fig. 87).

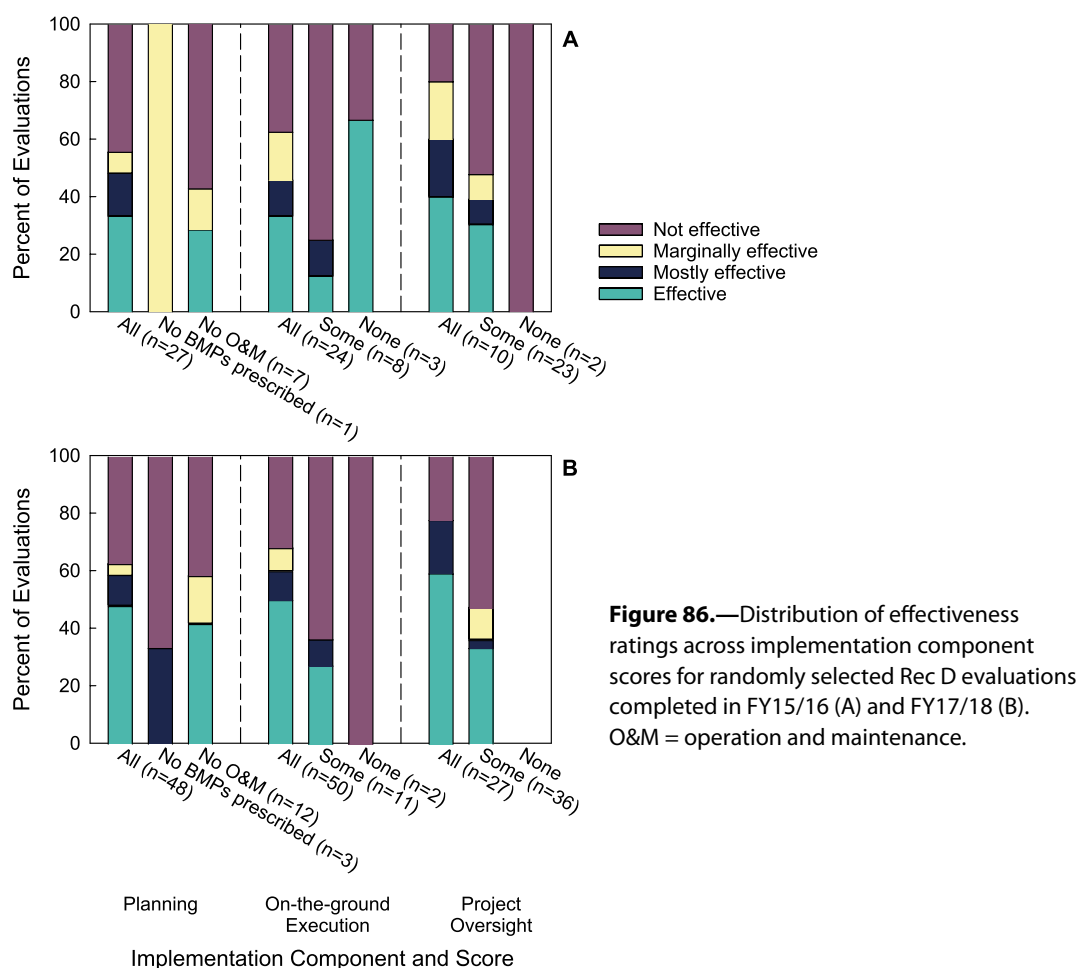


Figure 86.—Distribution of effectiveness ratings across implementation component scores for randomly selected Rec D evaluations completed in FY15/16 (A) and FY17/18 (B). O&M = operation and maintenance.

Table 147.—Fisher's exact test probabilities of association between BMP provisions relevant to erosion and sedimentation-trails and erosion and sedimentation-waterbody crossings effectiveness component scores for randomly selected Rec D evaluations completed in FY15/16 and FY17/18

Component	Provision	FY15/16 Implemented fully ^a p-value ^b	FY17/18 Implemented fully p-value
Erosion and sedimentation-trails	Cross drain locations and spacings	0.76	<0.01
	Cross drain construction/ types of cross drains	0.86	<0.01
	Trail grades	0.77	<0.01
	Trail surfacing	0.72	0.05
	Trail location	1.00	<0.01
Erosion and sedimentation-waterbody crossings	Waterbody crossing techniques	0.31	0.04

^a See Rec D-Q28.

^b Probability of association; significant at $\alpha=0.10$.

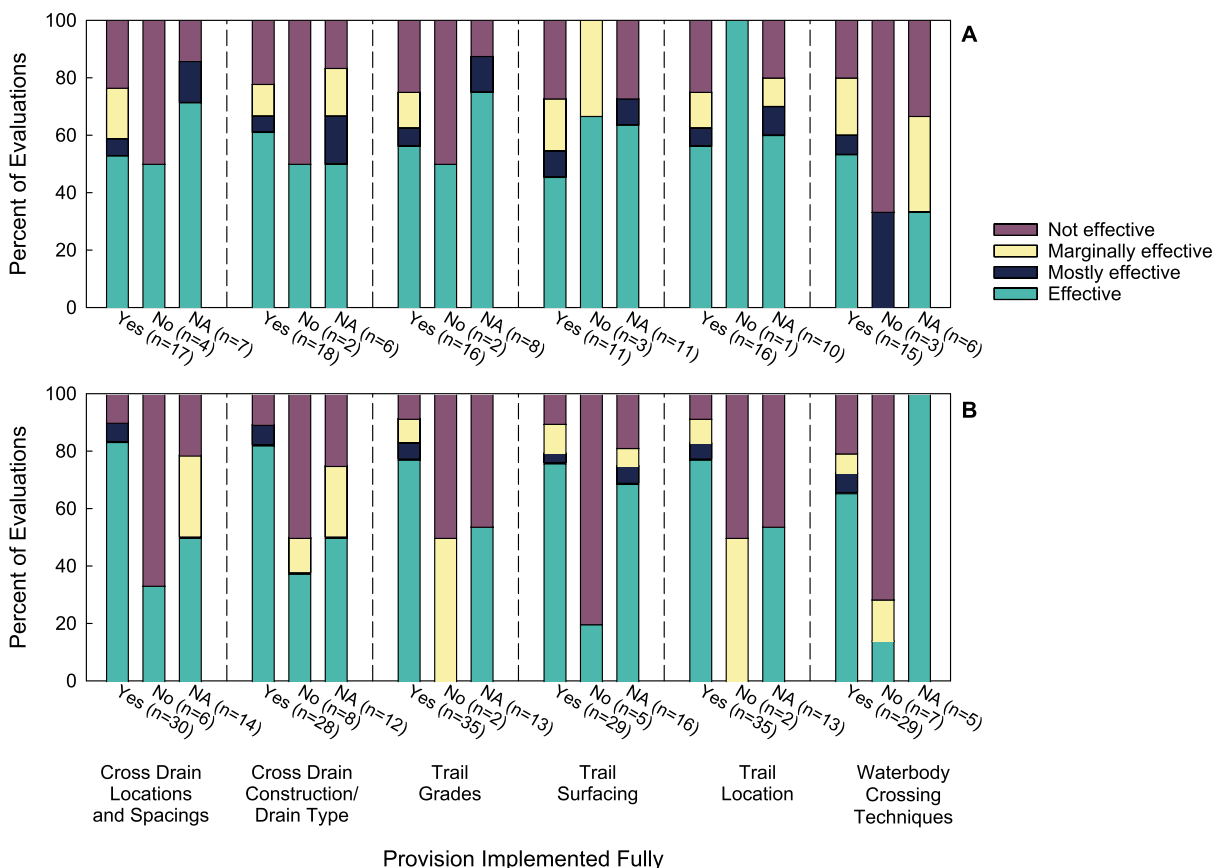


Figure 87.—Distribution of effectiveness erosion and sedimentation-trails component scores by whether BMP provisions for cross drains and trail characteristics were implemented fully (Rec D-Q28) and erosion and sedimentation-waterbody crossings component scores by whether BMP provisions for waterbody crossing techniques were implemented fully (Rec D-Q28) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B). NA = provision was not applicable to the evaluated trail.

Recreation D: Management Implications for Forest Service Managers

Fifty-five percent of the motorized or nonmotorized trail operation and maintenance sites rated either *fully implemented* or *mostly implemented* for BMP implementation, and 29 percent rated either *not implemented* or *no BMPs*. *Not implemented* in the context of Rec D means that an O&M plan or similar documents exist for the site but do not contain BMPs. *No BMPs* means that no O&M plan or other document exists for the site. Project planning was a deficiency at nearly 25 percent of the sites due to the lack of those documents or of BMPs in those documents. The on-the-ground execution component had the highest scores; 79 percent of the sites had a score of *all*. Five sites had a score of *none* for that component, indicating that none of the BMP provisions in the O&M plan or similar documents were implemented fully. When a BMP provision was prescribed for the site, it was implemented fully on average at 88 percent of those sites. BMP provisions for soil cover and cross drains were implemented fully least frequently: 79 and 84 percent, respectively. Deficiencies in project oversight were found in 62 percent of the evaluations.

When a deficiency in project oversight occurred, it was most frequently due to a lack of inspections or lack of inspections at critical times; 89 percent of the sites scored *some* for the project oversight component in part because of a deficiency in inspections.

For BMP effectiveness, 49 percent of the sites rated *effective* or *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. Forty-three percent of the sites were rated *not effective*, indicating that impacts to water quality were occurring. The erosion and sedimentation-trails component had slightly better scores than the erosion and sedimentation-waterbody crossings component—63 and 48 percent, respectively, had an *effective* score for those components, while 22 and 34 percent, respectively, had a *not effective* score for those components. Of the trails with a *not effective* rating, the erosion and sedimentation-waterbody crossings component was scored *not effective* for 67 percent of evaluations, and the erosion and sedimentation-trails component had that score for 53 percent.

Evidence of erosion or sedimentation was observed along the trail at 55 percent of the sites. When evidence was observed, it was in the waterbody in 34 percent of those evaluations. The evidence was primarily rill erosion, although vegetation damage or bare ground, sheet erosion, and rutting were frequently observed. The causes reported most frequently were an insufficient number of water control features and the trail location. Evidence of erosion or sedimentation at treated waterbody crossings was observed at 54 percent of the trails with those features. The crossing type at more than 50 percent of the crossings where evidence was observed were unhardened fords. When evidence was observed, it was in the waterbody in 71 percent of those evaluations. The evidence was primarily localized sediment deposition in the waterbody and vegetation damage or bare ground. The causes reported most frequently were improper drainage control and unhardened crossing approaches.

Implementation ratings were significantly associated with effectiveness ratings at sites evaluated in FY17/18; effectiveness ratings were better when implementation was better. For sites evaluated in FY15/16, better effectiveness ratings occurred across all implementation ratings, so no significant association was found. In total, when the implementation rating was *fully implemented* or *mostly implemented*, a greater percentage of those sites were rated *effective* or *mostly effective* (65 percent) than *marginally effective* or *not effective* (35 percent). When the implementation rating was *marginally implemented*, *not implemented*, or *no BMPs*, a greater percentage of those sites were rated *marginally effective* or *not effective* (66 percent) than *effective* or *mostly effective* (34 percent).

An examination of relationships between implementation or effectiveness ratings and component scores also provides evidence that better BMP implementation leads to better BMP effectiveness in trail operation and maintenance. Significant associations were found for the erosion and sedimentation-waterbody crossings and the trash and waste component scores and implementation ratings for sites evaluated in FY17/18; no other associations between effectiveness component scores and implementation ratings were significant. Effectiveness ratings were better when implementation component scores were *all* compared to other scores, although only the association between the project oversight component scores and effectiveness ratings for sites evaluated in FY17/18 was significant. Looking specifically at BMP provisions related to the erosion and sedimentation-trails

and erosion and sedimentation-waterbody crossings effectiveness components, significant associations were found for sites evaluated in FY17/18 but not in FY15/16. When BMP provisions for cross drains, trail characteristics, and waterbody crossings were implemented fully, a greater percentage of scores for those two components were *effective*; when those BMP provisions were not implemented fully, a greater percentage of the component scores were *not effective*.

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

- Developing O&M plans or similar documents with BMPs for trail operation and maintenance. Nearly one-quarter of the evaluated trails lacked an O&M plan or similar document with BMPs.
- Ensuring that BMPs included in the O&M plan or similar documents are sufficient to protect the resource and implemented fully. Sites rated *not effective* in FY17/18 had only three BMP provisions implemented fully on average, compared to six and seven for sites rated *effective* and *mostly effective*, respectively. Similarly, the percentage of BMP provisions implemented fully was significantly associated with the effectiveness rating in FY17/18. Sites rated *effective* averaged 90 percent of prescribed BMPs implemented fully, compared to 57 percent implemented fully for sites rated *not effective*.
- Including BMPs for cross drain location and construction, trail grades, trail location, and trail surfacing in the O&M plans, as appropriate, and ensuring they are implemented fully. Less evidence of erosion and sedimentation was observed when those BMP provisions were implemented fully.
- Including BMPs for waterbody crossings when those features are present on the trail. Erosion and sedimentation-waterbody crossings component scores were better when waterbody crossing BMPs were implemented fully.
- Reviewing the use of unhardened fords for waterbody crossings. Over half of the waterbody crossings where evidence of erosion and sedimentation was observed were unhardened fords.
- Increasing maintenance of trails. Unresolved maintenance needs were reported to have contributed to effectiveness problems in 62 percent of the trails with maintenance needs. Effectiveness ratings were significantly associated with unresolved maintenance needs for sites evaluated in FY17/18 but not in FY15/16. More than 60 percent of trails with unresolved maintenance needs had effectiveness ratings of *marginally effective* or *not effective*, compared to less than 40 percent of the trails that had no maintenance needs. In addition, for sites evaluated in FY17/18, trails where treatments were applied when needed had better effectiveness ratings than trails where treatments were needed and not applied. Similarly, in both monitoring periods, trails with needed corrective actions that were not applied had worse effectiveness ratings than when identified corrective actions were taken.

Recreation D: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Rec D. Motorized or Nonmotorized Trail Operation and Maintenance

(Reference BMPs Rec-1, Rec-4, and Rec-7)

v3.0 February 2016

Header	
Rec D-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec D-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec D-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec D-Q4	Date of current field evaluation:
Rec 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:
Rec 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:
Rec D-Q7	Reviewers and titles:
Rec D-Q8a	Region number:
Rec D-Q8b	State:
Rec D-Q9a	Proclaimed Forest or Grassland number and name:
Rec D-Q9b	Administrative Forest or Grassland number and name:
Rec D-Q10	District number and name:
Rec D-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)									
Rec 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: a. Yes b. No 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:								
Rec D-Q12	6 th level HUC number and name for the subwatershed this trail segment is in:								
Rec D-Q13	Is the trail segment being evaluated located within a municipal supply watershed? Select one: a. Yes b. No								
Rec D-Q14a	Location. UTM Zone: UTM Datum:								
Rec D-Q14b	Location. Easting:								
Rec D-Q14c	Location. Northing:								
Rec D-Q15a	Location. Latitude:								
Rec D-Q15b	Location. Longitude:								
Rec D-Q15c	Location. Lat/Long Datum:								
Rec D-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown								
Rec D-Q17	Trail number and name:								
Rec D-Q18	Length of trail being evaluated (ft, m, mi, or km; specify unit):								
Rec D-Q19	Number of waterbody crossings present in the trail segment being reviewed:								
Rec D-Q20	Lengths of each waterbody approach (ft or m; specify unit): <table border="0"> <tr> <td>Right:</td> <td>Left:</td> </tr> <tr> <td>Right:</td> <td>Left:</td> </tr> <tr> <td>Right:</td> <td>Left:</td> </tr> <tr> <td>Right:</td> <td>Left:</td> </tr> </table>	Right:	Left:	Right:	Left:	Right:	Left:	Right:	Left:
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Header (continued)	
Rec D-Q21	Was this trail used for a special event during the past 12 months? Select one: a. Yes b. No If Yes, name event and dates of use:
Rec D-Q22	If motorized trail use is permitted, identify types of vehicles permitted. Select all that apply: Dirt bike or motorcycle OHV Snowmobile Other (specify):
Rec D-Q23	If only nonmotorized trail use is permitted, identify types of uses permitted. Select all that apply: Hiking Bicycles Pack animals Skiing/snowshoeing Other (specify):
Rec D-Q24	Dominant trail grade in evaluated segment (percent):
Rec D-Q25	Steepest trail grade in evaluated segment (percent):
Implementation	
Rec D-Q26	Are there any unresolved maintenance needs related to protecting water, aquatic, or riparian resources that were identified for this trail prior to this evaluation? Select one: a. Yes b. No If Yes, what needs are unresolved?
Rec D-Q27	Does the operation and maintenance plan or other operation and maintenance guidance documents for this trail contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 28) b. Plan or other O&M guidance documents exist for this trail, but they do not contain provisions for water/aquatic/riparian protection (go to question 29) c. No operation and maintenance plan or other O&M guidance documents exist for this trail (go to question 29)
Rec D-Q28	Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the operation and maintenance plan or other O&M guidance documents were implemented fully during the past 12 months. Select one response in each line. If the provision exists in the operation and maintenance plan or other guidance documents and it was implemented fully, select Yes. If the provision exists in the operation and maintenance plan or other guidance documents but it was not implemented fully, select No. If the provision does not exist in the operation and maintenance plan 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. a. Cross drain locations and spacings Yes/No/Not applicable b. Cross drain construction/types of cross drains Yes/No/Not applicable c. Trail grades Yes/No/Not applicable (continued)

continued on next page

Implementation <i>(continued)</i>	
(Rec D-Q28 continued)	d. Trail surfacing Yes/No/Not applicable e. Waterbody crossing techniques Yes/No/Not applicable f. Trail location Yes/No/Not applicable g. Mulching and/or seeding, or other soil cover techniques Yes/No/Not applicable h. Trash management Yes/No/Not applicable i. Sanitary waste management Yes/No/Not applicable j. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec D-Q29	Were trail inspections during the past 12 months performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No
Rec D-Q30	If problems occurred on the trail during the past 12 months that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec D-Q31	Has the trail segment been closed, or have restrictions been placed on its use during the past 5 years to protect or restore water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted closure or use restriction (go to question 33) b. Needed and closed or use restricted (go to question 32) c. Needed but not closed or use not restricted (go to question 33)
Rec D-Q32	What length of time passed between when the problem was identified and the closure or use restriction was implemented? (days, weeks, months, or years; specify unit):
Rec D-Q33	Were any treatments applied to the trail segment during the past 5 years to reduce negative impacts to water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted application of treatments (go to question 35) b. Needed and applied (go to question 34) c. Needed but not applied (go to question 35) If applied, describe the treatments:
Rec D-Q34	What length of time passed between when the problem was identified and the treatments were applied? (days, weeks, months, or years; specify unit):

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Implementation <i>(continued)</i>	
Rec D-Q35	Why was the trail segment closed, use restricted, and/or treatments applied? Select all that apply: a. Not applicable, no closure, use restriction, or treatments applied during the past 5 years b. Trampled vegetation c. Soil compaction d. Sheet erosion e. Rill erosion f. Gully erosion g. Shoreline/bank erosion h. Trail washout i. Waterbody crossing washout j. Extreme precipitation/weather events k. Other (specify):
Rec D-Q36	Were chemical or fuel spills or leaks, or dumping that occurred on this trail during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills, leaks, or dumping occurred during the past 5 years c. Yes, spills, leaks, or dumping were handled/treated according to the contingency and emergency response plan d. No, spills, leaks, or dumping were not handled/treated according to the contingency and emergency response plan
Rec D-Q37	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39)
Rec D-Q38	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec D-Q39	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 40) b. No (go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec D-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.
Effectiveness	
Rec D-Q41	Excluding waterbody crossings and their approaches, is there evidence of erosion or sedimentation on or originating from this trail segment? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 48) b. Evidence of erosion or sedimentation outside an AMZ (go to question 43) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 43) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 42)

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Effectiveness *(continued)*

Rec D-Q42	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 44: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec D-Q43	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec D-Q44	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: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec D-Q45	What is the width of the AMZ associated with the waterbody? (ft or m; specify unit):
Rec D-Q46	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 41, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec D-Q47	What are the causes? Select all that apply: a. Lack of, or insufficient number of water control features b. Improper construction of water control features c. Improper or inadequate maintenance of water control features or other trail features d. Poor trail location e. Improper grades on trail f. Other (specify): g. Unknown

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Effectiveness <i>(continued)</i>	
Rec D-Q48	At waterbody crossings and their approaches, is there evidence of erosion or sedimentation? Select one; when multiple occurrences would result in different answers, select the most severe occurrence, with severity increasing from c to d. a. Not applicable, no waterbody crossings present (go to question 54) b. No evidence of erosion or sedimentation (go to question 53) c. Evidence of erosion or sedimentation, but no deposition in a waterbody (go to question 49) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 49)
Rec D-Q49	For all of the crossings that your answer to question 48 is applicable, what types of waterbodies were crossed? Select all that apply: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec D-Q50	What types of waterbody crossing structures were employed for the crossings involved in your answer to question 49? Select all that apply: a. Unhardened ford b. Hardened ford c. Culvert d. Bridge e. Boardwalk f. Other (specify):
Rec D-Q51	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 48, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

continued on next page

Effectiveness *(continued)*

Rec D-Q52	What are the causes? Select all that apply: a. Lack of crossing structure b. Unhardened crossing approaches c. Poor alignment of waterbody crossing d. Waterbody crossing too narrow e. Waterbody crossing too short f. Inappropriate type of crossing for conditions or traffic levels g. Improper or inadequate maintenance of crossings or approaches h. Approaches are too long i. Lack of or improper drainage control j. Other (specify):
Rec D-Q53	Do any of the waterbody crossings in the evaluated trail segment have diversion potential? Select one: a. Yes b. No If Yes, what percentage of waterbody crossings has diversion potential? If Yes, what is the single longest diversion potential length? (ft or m, specify unit):
Rec D-Q54	What evidence of trash or domestic animal or human sanitary waste exists on or along the trail segment, including at waterbody crossings and approaches? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash outside an AMZ c. Evidence of trash within an AMZ d. Evidence of trash in a waterbody e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody
Rec D-Q55	What evidence of chemical or fuel spills or leaks or associated waste containers exists on or along the trail, including at waterbody crossings and approaches? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec D-Q56	Did any of the unresolved maintenance needs for this trail contribute to any observed problems? Select one: a. Not applicable, no unresolved maintenance needs existed for this trail b. Yes c. No
Rec D-Q57	If inspections were not conducted at critical times during the past 12 months, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No

continued on next page

Effectiveness (continued)	
Rec D-Q58	If the trail segment was closed, use was restricted, and/or treatments were applied during the past 5 years to protect or restore water, aquatic, or riparian resources, were the desired results achieved? Select one: a. Not applicable, no trail segment closures, use restrictions, or treatments applied during the past 5 years b. The desired result was fully achieved c. The desired result was partially achieved d. Essentially no improvement to the trail was achieved e. Too soon to determine
Rec D-Q59	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 60) b. No (go to question 61)
Rec D-Q60	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec D-Q61	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 62) b. No (go to General Comments)
Rec D-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	

Recreation E—Motorized Vehicle Use Areas

Recreation E: Descriptive Statistics

Protocol Rec E is used to evaluate BMPs applied to designated motorized vehicle use areas where cross-country travel by off-road motorized vehicles (e.g., off-highway vehicles [OHVs], all-terrain vehicles [ATVs], side-by-sides, motorcycles, dune buggies, off-road 4×4 trucks) and concentrated off-road vehicle use are permitted. Any Forest Service roads or trails used to access a vehicle use area are not included in a Rec E evaluation. The Rec E protocol is used infrequently in the National BMP monitoring program; 10 motorized vehicle use areas were evaluated in the two monitoring periods (four in FY15/16 and six in FY17/18). All of the use areas were selected to meet National BMP targets, and all included evaluation of implementation and effectiveness on the same day. Eighty percent of the areas were selected randomly (Table 40). Six use areas were operated year-round (Rec E-Q18), three were open either 8 or 9 months, and one evaluation did not answer Rec E-Q18. A special event (Rec E-Q19) had been held at four use areas in the 12 months prior to the evaluation. Mean size of the use areas (Rec E-Q20) was approximately 3,800 acres in FY15/16 and 675 acres in FY17/18, with areas ranging from 2 acres to 6,400 acres. One use area evaluated in FY17/18 was 1 year old (Rec E-Q21); the remainder ranged

from 10 to 50 years old. The average period of operation was 28 years for areas evaluated in FY15/16 and 24 years for those evaluated in FY17/18. Staging areas and trails were parts of the use area reported most frequently (Rec E-Q22), occurring at 90 percent of the areas. Eighty percent of areas included sanitation facilities, and half included either improved or unimproved waterbody crossings or both. Hill climbs, mudholes, or both were part of 40 percent of the use areas. None of the evaluated areas had soil monitoring sites or included waterbody or water quality monitoring. One use area included photo points. All the evaluated use areas are operated by the Forest Service (Rec E-Q23).

Of the 10 use areas evaluated, 8 had operation and maintenance (O&M) plans or other guidance documents containing BMP provisions for protecting water, aquatic, and riparian resources (Rec E-Q25). All BMPs in every provision were either implemented fully or not applicable to the use area (Rec E-Q26). BMPs in the provisions “protection measures at crossings,” “protection measures on trails,” and “timing of use” were included in plans or guidance documents for six use areas. BMPs in the provisions “erosion control measures on trails,” “location of trails, disturbed areas and other activities on the area,” and “trash and human waste management” were included for five use areas. On average, four provisions per use area were applicable and implemented fully in FY15/16; in FY17/18, areas averaged six provisions. All of the use areas evaluated in FY15/16 and four of six areas evaluated in FY17/18 had inspections during the current operating season conducted at critical times for addressing water quality issues (Rec E-Q27); two areas in FY17/18 had inspections, but all or some inspections were not at critical times. One evaluation in each monitoring period reported that problems related to water resources had occurred during the operating season (Rec E-Q28) and that corrective actions were implemented to address those problems. The other eight use areas had no problems that needed corrective actions. Nine of 10 evaluations indicated that there had been no chemical or fuel spills, leaks, or dumping (Rec E-Q29) at the use area in the past 5 years; one evaluation did not answer Rec E-Q29.

Three parts of a motorized vehicle use area are evaluated for BMP effectiveness if they exist: a concentrated use area, a trail segment with or without a waterbody crossing, and along a waterbody. The most down slope portion of the use area perimeter also is evaluated for every site. Each part of the use area is evaluated for evidence of erosion and sedimentation, trash and waste, and chemical pollutants. Only the most severe cases of erosion or sedimentation are reported 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. All observations of trash, waste, and chemical pollutants are reported. Because of the limited number of use areas evaluated, results from both monitoring periods are summarized together.

All but one use area included a concentrated use area. Four of the concentrated use areas had evidence of erosion and sedimentation (Rec E-Q34) outside an AMZ, two had evidence in an AMZ, two had evidence in a waterbody, and one evaluation found no evidence. Intermittent streams were affected most often (Rec E-Q37), and sheet erosion and sediment plumes or accumulations were the most frequent types of evidence observed (Rec E-Q39). Trash was observed at three concentrated use areas (Rec E-Q40); the trash was observed two times within an AMZ and two times outside an AMZ. Chemical or fuel waste containers (Rec E-Q41) were observed outside an AMZ at one

concentrated use area. Every use area included trails. Eight of 10 evaluated trail segments included a waterbody crossing. Evidence of erosion or sedimentation on or originating from trails (Rec E-Q45) was observed in a waterbody for four evaluations; three of those also reported evidence in a waterbody at the evaluated crossing (Rec E-Q44). Three evaluations reported no evidence from trails, and three reported no evidence at the evaluated crossing. One of the evaluations with no evidence at the crossing did not answer the erosion and sedimentation questions about the trail. Intermittent streams were the waterbody type affected most frequently (Rec E-Q48), and sediment plumes or accumulations was the type of evidence (Rec E-Q50) observed most often. Two evaluations reported evidence of trash on or along trails within or outside an AMZ (Rec E-Q51). None of the evaluations observed evidence of chemical pollutants on or along trails (Rec E-Q52).

Six use areas had an intermittent stream within or partially within the area, and two areas had perennial streams or rivers (Rec E-Q54). Evidence of sediment deposition, changes to waterbody geometry, and sediment plumes (Rec E-Q58) were observed along the waterbody transect for one intermittent stream. The source of the evidence was a motorized vehicle trail (Rec E-Q59), and the cause was inappropriate location of trails (Rec E-Q60). No evidence of erosion or sedimentation was observed along the other seven waterbodies. One evaluation observed trash in an AMZ (Rec E-Q61). Evidence of chemical pollutants was not observed (Rec E-Q62) from the waterbody transect in any evaluation. Half of the evaluations did not observe evidence of alterations to any waterbody from operation of the use area that exceeded amounts allowed in the O&M documents; for the other half of the evaluations, the O&M documents did not specify allowable waterbody alterations (Rec E-Q63). Every evaluation included a perimeter transect along and down slope of the use area's most down slope boundary. Two evaluations observed evidence of erosion or sedimentation (Rec E-Q64) along that transect (i.e., leaving the use area); the affected waterbody for both was an intermittent stream (Rec E-Q67). Gully erosion, headcutting, and sediment plumes or accumulations (Rec E-Q69) were reported when evidence was observed in an AMZ. When evidence was observed in a waterbody, the types of evidence were changes to waterbody geometry, sheet erosion, and sediment plumes.

Recreation E: Ratings and Component Scores

The implementation rating components and their interpretations for Rec E are given in Table 64. Eight motorized vehicle use areas had planning component scores of *all*, which indicated that BMPs to protect water resources were included in use area O&M plans or guidance documents. One use area was scored as *no BMPs prescribed* due a lack of BMPs in O&M documents, and one area was scored as *no O&M* (Table 64) due to a lack of O&M documents. Every use area scored as *all* for the on-the-ground execution component, either because all applicable BMPs were implemented fully or because none were prescribed (and therefore no BMPs were applicable). Eight of 10 use areas scored as *all* for the project oversight component. Two use areas scored as *some* because all or some inspections did not occur at critical times. The four use areas in FY15/16 and three of the six in FY17/18 had an implementation rating of *fully implemented* due to achieving all scores for each of the three components. The two use areas in FY17/18 with *some* scores

for the project oversight component had implementation ratings of *mostly implemented* (planning component score was *all*) and *not implemented* (planning component score was *no BMPs prescribed*). The one *no O&M* score for the planning component resulted in a *no BMPs* implementation rating.

The effectiveness rating components and their interpretations for Rec E are given in Table 148. One evaluation had a component score lower than *effective* for all of the trash and waste and chemical pollutants components; the trash and waste-concentrated use area (CUA) and trash and waste-trails components had *moderately effective* scores. However, those scores did not determine the overall effectiveness rating for that evaluation, and therefore the remainder of this effectiveness component discussion focuses on the four erosion and sedimentation components. Distributions of the component scores are given in Table 149. In FY15/16, one use area had *effective*, *no CUA*, or *no waterbody* scores for every erosion and sedimentation component and an overall effectiveness rating of *effective*. Two use areas had *mostly effective* scores for the erosion and sedimentation-CUA component, *effective* or *no waterbody* scores for the other three components, and ratings of *mostly effective*. Similarly, one use area in FY17/18 had a *marginally effective* score for the erosion and sedimentation-trails component, *effective* scores for the other three components, and a rating of *marginally effective*. A *not effective* score for any erosion and sedimentation component would result in a *not effective* rating; that combination occurred for four use areas (one in FY15/16 and three in FY17/18). Three of those four use areas had a *not effective* score for only the erosion and sedimentation-trails component, and the other had that score for only the erosion and sedimentation-CUA component. Two evaluations had incomplete data needed to determine a component score—one erosion and sedimentation-trails score and one chemical pollutants-LUA score—and thus the effectiveness rating could not be determined.

Composite ratings for the four use area evaluations in each monitoring period with complete data are given in Table 150. Better implementation during O&M activities tended to have better effectiveness in FY15/16 but not in FY17/18 when poorer effectiveness occurred across all levels of implementation.

Table 148.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec E protocol. If a component is absent (e.g., concentrated use area, trails, or waterbody), the component is not considered in the determination of the evaluation effectiveness rating.

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation- CUA ^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 CUA	No CUA in the use area
Erosion and sedimentation- trails	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 trails	No trails in the use area
Erosion and sedimentation- waterbody	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	No waterbody in the use area
Erosion and sedimentation- LUA ^b	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-CUA	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No CUA	No CUA in the use area
Trash and waste-trails	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No trails	No trails in the use area
Trash and waste- waterbody	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No waterbody	No waterbody in the use area
Trash and waste-LUA	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect

(continued)

Table 148.—(continued)

Effectiveness component	Component score	Score interpretation
Chemical pollutants-CUA	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No CUA	No CUA in the use area
Chemical pollutants-trails	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No trails	No trails in the use area
Chemical pollutants-waterbody	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No waterbody	No waterbody in the use area
Chemical pollutants-LUA	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect

^a Concentrated use area.

^b Leaving use area.

Table 149.—Distribution of erosion and sedimentation effectiveness component scores by component for Rec E evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Erosion and sedimentation-CUA ^a component (number)	Erosion and sedimentation-CUA component (percent)	Erosion and sedimentation-trails component (number)	Erosion and sedimentation-trails component (percent)	Erosion and sedimentation-waterbody component (number)	Erosion and sedimentation-waterbody component (percent)	Erosion and sedimentation-LUA ^b component (number)	Erosion and sedimentation-LUA component (percent)
FY15/16 (n=4)									
	Effective			3	75	2	100	4	100
	Mostly effective	2	67						
	Marginally effective	1	33						
	Not effective			1	25				
	No CUA ^c	1	-- ^c						
	No waterbody ^c					2	--		
FY17/18 (n=6)									
	Effective	3	50	1	17	5	83	4	67
	Mostly effective								
	Marginally effective	1	17	1	17			1	17
	Not effective	2	33	3	50	1	17	1	17
	No CUA								
	No waterbody								
	Incomplete data ^d			1	17				

^a Concentrated use area.

^b Leaving use area.

^c Not included in calculation of percentages.

^d Some of the questions needed to determine a component score were not answered.

Table 150.—Composite rating matrix for Rec E motorized vehicle use areas evaluated for both implementation and effectiveness in FY15/16 (n=4 evaluations) and FY17/18 (n=4 evaluations). Numbers in cells indicate the number of evaluations 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	2				
	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					
	Mostly effective					
	Marginally effective	1				
	Not effective		1		1	1

Excellent

Good

Fair

Poor

No plan

Recreation E: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Rec E. Motorized Vehicle Use Areas

(Reference BMPs Rec-1, Rec-4, Rec-5, Rec-7, Rec-9, and Fac-6)

v3.0 February 2016

Header	
Rec E-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec E-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec E-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec E-Q4	Date of current field evaluation:
Rec E-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:
Rec E-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:
Rec E-Q7	Reviewers and titles:
Rec E-Q8a	Region number:
Rec E-Q8b	State:
Rec E-Q9a	Proclaimed Forest or Grassland number and name:
Rec E-Q9b	Administrative Forest or Grassland number and name:
Rec E-Q10	District number and name:
Rec E-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec E-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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec E-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: a. Yes b. No 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:
Rec E-Q12	6 th level HUC number and name for the subwatershed this use area is located in:
Rec E-Q13	Is any part of the motorized vehicle use area being evaluated located within a municipal supply watershed? Select one: a. Yes b. No
Rec E-Q14a	Location. UTM Zone: UTM Datum:
Rec E-Q14b	Location. Easting:
Rec E-Q14c	Location. Northing:
Rec E-Q15a	Location. Latitude:
Rec E-Q15b	Location. Longitude:
Rec E-Q15c	Location. Lat/Long Datum:
Rec E-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec E-Q17	Name of use area:
Rec E-Q18	Dates use is normally permitted at this use area (month to month):
Rec E-Q19	Was this use area used for a special event during the past 12 months? Select one: a. Yes b. No If Yes, give the name of event and dates of the event:
Rec E-Q20	Approximate size of the use area (ac or ha; specify unit):

continued on next page

Header (continued)	
Rec E-Q21	How long has this motorized vehicle use area been in operation? (months or years; specify unit):
Rec E-Q22	Which elements are parts of the use area? Select all that apply: a. Staging areas b. Equipment service and refueling areas c. Sanitation facilities d. Trails e. Unimproved waterbody crossings f. Improved waterbody crossings g. Hill climbs h. Mud holes i. Soil monitoring sites j. Waterbody or water quality monitoring k. Photo points l. Other (specify):
Rec E-Q23	Who operates this use area? Select one: Forest Service (end header questions) Other (specify; go to question 24):
Rec E-Q24	How is use authorized? Select one: Special use permit Other (specify):
Implementation	
Rec E-Q25	Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this use area contain provisions for protecting water, aquatic, or riparian resources? Select one: a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 26) b. Plan, SUP, or other O&M guidance documents exist for this use area, but they do not contain provisions for water/aquatic/riparian protection (go to question 27) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this use area (go to question 27)
Rec E-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 in the operating season to require implementation, select Not applicable. a. Erosion control measures on trails (includes drainage structures, soil cover, revegetation, etc.) Yes/No/Not applicable b. Protection measures at crossings (armoring, drainage, crossing improvements, etc.) Yes/No/Not applicable c. Protection measures on trails Yes/No/Not applicable d. Location of trails, disturbed areas, and other activities on the area Yes/No/Not applicable (continued)

continued on next page

Implementation (continued)	
(Rec E-Q26 continued)	e. Areal extent of disturbed areas or areal extent of the overall use area Yes/No/Not applicable f. Timing of use Yes/No/Not applicable g. Transport, storage, use, and disposal of fuels, lubricants, hydraulic fluids, etc. Yes/No/Not applicable h. Trash and human sanitary waste management Yes/No/Not applicable i. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec E-Q27	Were inspections during this operating season performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No
Rec E-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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec E-Q29	Were chemical or fuel spills or leaks, or dumping that occurred at this use area during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills, leaks, or dumping occurred during the past 5 years c. Yes, spills, leaks, or dumping were handled/treated according to the contingency and emergency response plan d. No, spills, leaks, or dumping were not handled/treated according to the contingency and emergency response plan
Rec E-Q30	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 31) b. No (go to question 32)
Rec E-Q31	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec E-Q32	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 33) b. No (go to question 34 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec E-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.

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Effectiveness	
Rec E-Q34	Is there evidence of erosion or sedimentation from the selected concentrated use area? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e. a. Not applicable, no concentrated use area (go to question 42) b. No evidence of erosion or sedimentation (go to question 40) c. Evidence of erosion or sedimentation outside an AMZ (go to question 36) d. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 36) e. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 35)
Rec E-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: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec E-Q36	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec E-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: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec E-Q38	What is the width of the AMZ associated with the waterbody? (ft or m, specify unit):
Rec E-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: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

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Effectiveness (continued)	
Rec E-Q40	What evidence of trash or domestic animal or human sanitary waste is visible from the transect around the concentrated use area? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash outside an AMZ c. Evidence of trash within an AMZ d. Evidence of trash in a waterbody e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody
Rec E-Q41	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the concentrated use area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec E-Q42	Are there trails located within the motorized vehicle use area? Select one: a. Yes (go to question 43) b. No (go to question 53)
Rec E-Q43	Is there a waterbody crossing on the trail segment selected for monitoring within the motorized vehicle use area? Select one: a. Yes (go to question 44) b. No (go to question 45)
Rec E-Q44	At the selected waterbody crossing and its approaches, is there evidence of erosion or sedimentation? Select one; when multiple occurrences would yield different answers, select the most severe choice, with severity increasing from b to c. a. No evidence of erosion or sedimentation b. Evidence of erosion or sediment deposition, but no deposition in the waterbody c. Evidence of sediment transport or deposition in a waterbody, or evidence of changes to waterbody morphology
Rec E-Q45	Is there evidence of erosion or sedimentation on or originating from the selected trail segment? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of sediment or erosion (go to question 51) b. Evidence of erosion or sedimentation outside an AMZ (go to question 47) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 47) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 46)
Rec E-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: a. 1 or 2 b. 3 or 4 c. 5 or more

continued on next page

Effectiveness *(continued)*

Rec E-Q47	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec E-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: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec E-Q49	What is the width of the AMZ associated with the waterbody? (ft or m, specify unit):
Rec E-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: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec E-Q51	What evidence of trash or domestic animal or human sanitary waste exists on or along the trail segment being reviewed? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash outside an AMZ c. Evidence of trash within an AMZ d. Evidence of trash in a waterbody e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody

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Effectiveness <i>(continued)</i>	
Rec E-Q52	What evidence of chemical or fuel spills or leaks or associated waste containers exists on or along the trail segment being reviewed? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec E-Q53	Is there a waterbody, and hence a waterbody transect, present within the motor vehicle use area? Select one: a. Yes (go to question 54) b. No (go to question 63)
Rec E-Q54	To what type of waterbody is the waterbody transect adjacent? Select all that apply: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec E-Q55	What is the width of the AMZ associated with the waterbody? (ft or m, specify unit):
Rec E-Q56	Is there evidence of erosion or sedimentation along the waterbody transect from the use or presence of the motorized vehicle use area? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of erosion or sedimentation (go to question 61) b. Evidence of erosion or sedimentation, but not reaching the waterbody (go to question 58) c. Evidence of sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 57)
Rec E-Q57	How many total places do you observe erosion or sedimentation delivered to/present in a waterbody and changes to waterbody morphology? Select one: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec E-Q58	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 56, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion <i>(continued)</i>

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Effectiveness (continued)	
(Rec E-Q58 continued)	k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec E-Q59	What are the sources? Select all that apply: a. Motorized vehicle trail b. Concentrated use area (e.g., hill climbs, mud holes, etc., but excludes trails) c. Staging area d. Equipment refueling and servicing area e. Other (specify):
Rec E-Q60	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the site b. Inappropriate location of trails c. Inappropriate trail design d. Inappropriate location of concentrated use area (e.g., hill climbs, mud holes, etc., excludes trails) e. Inappropriate design of concentrated use area (e.g., hill climbs, mud holes, etc., excludes trails) f. Inappropriate location of staging area g. Inappropriate design of staging area h. Lack of trail maintenance i. Lack of maintenance in concentrated use area (e.g., hill climbs, mud holes, etc., excludes trails) j. Lack of maintenance in staging area k. Other (specify): l. Unknown
Rec E-Q61	What evidence of trash or domestic animal or human sanitary waste exists along the waterbody transect? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash within the AMZ c. Evidence of trash in the waterbody d. Evidence of domestic animal or human sanitary waste/toilet paper within the AMZ e. Evidence of domestic animal or human sanitary waste/toilet paper in the waterbody
Rec E-Q62	What evidence of chemical or fuel spills or leaks or associated waste containers exists on or along the waterbody transect? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks within the AMZ c. Evidence of chemical or fuel spills or leaks in the waterbody d. Evidence of chemical or fuel waste containers within the AMZ e. Evidence of chemical or fuel waste containers in the waterbody
Rec E-Q63	Is there evidence of alterations to any waterbody from the operation of the use area that exceeds the amount allowed in the operation and maintenance plan or SUP? Select one: a. Not applicable, allowable waterbody alterations were not specified in the O&M plan or SUP b. Yes c. No If Yes, briefly describe the alterations:

continued on next page

Effectiveness (*continued*)

Rec E-Q64	Is there evidence of erosion or sedimentation extending out of the motor vehicle use area? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 70) b. Evidence of erosion or sedimentation outside an AMZ (go to question 66) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 66) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 65)
Rec E-Q65	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 67: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec E-Q66	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec E-Q67	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: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
Rec E-Q68	What is the width of the AMZ associated with the waterbody? (ft or m, specify unit):
Rec E-Q69	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 64, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

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Effectiveness <i>(continued)</i>	
Rec E-Q70	What evidence of trash or domestic animal or human sanitary waste is visible from the motorized vehicle use area transect? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash outside an AMZ c. Evidence of trash within an AMZ d. Evidence of trash in a waterbody e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody
Rec E-Q71	What evidence of chemical or fuel spills or leaks or associated waste containers is visible from the motorized vehicle use area transect? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec E-Q72	If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No
Rec E-Q73	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 74) b. No (go to question 75)
Rec E-Q74	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec E-Q75	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 76) b. No (go to General Comments)
Rec E-Q76	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	

Recreation F—Pack and Riding Stock Use Areas

Recreation F: Descriptive Statistics

Pack and riding stock use areas that have stock holding areas (SHAs), developed watering areas, nearby waterbodies, and trails connecting those three areas are evaluated with protocol Rec F. (Rec F is not used to evaluate areas used only for parking, turning, or loading/unloading stock and not for stock holding or watering and system trails used by pack and riding stock that do not connect the areas described in the preceding sentence.) Five stock use areas were evaluated in FY15/16, and 12 areas were evaluated in FY17/18. Every region except Region 8 (see App. 1 for region delineations) evaluated at least one stock use area. Meeting National BMP targets was a reason for monitoring for every evaluation. About one-third of the evaluations indicated that land management plan monitoring also was a reason for monitoring. Implementation and effectiveness monitoring were completed on the same day for all evaluations, and all stock use areas except one were selected randomly (Table 40). On average, the stock use areas were open for 7 months (from late spring or early summer into fall), although four use areas were open year-round (Rec F-Q18). Three stock use areas were managed under a special use authorization (Rec F-Q19). The size of the stock use area ranged from less than 0.2 acre to 18 acres (Rec F-Q20). Two areas were larger than 5 acres; the mean stock use area was 4.7 acres (standard error [se] = 1.3 acres). Required distances between stock holding areas and waterbodies (Rec F-Q21) averaged about 95 feet and ranged from 50 to 300 feet. Twelve of 15 stock use areas had actual distances between holding areas and waterbodies (Rec F-Q22) greater than or equal to the requirement. Two evaluations in FY17/18 did not answer Rec F-Q21. All but two waterbodies were upslope of the use area (Rec F-Q23); the mean average slope between the waterbody and use area was about 7 percent. Average slopes were less than 3 percent for 11 stock use areas and greater than or equal to 25 percent for two areas. The waterbody type nearest to the stock use area (Rec F-Q24) was a perennial stream or river for 10 areas, another type of stream for four areas, and a pond or lake for three areas. Watering sources (Rec F-Q25) were developed sources or troughs most frequently, occurring at five use areas each, followed by natural waterbodies.

Three stock use areas identified unresolved maintenance needs related to water resource protection prior to the evaluation (Rec F-Q26). Eight stock use areas had an operation and maintenance (O&M) plan, special use authorization, or other O&M guidance documents that included BMPs to protect water, aquatic, and riparian resources (Rec F-Q28). Two use areas had documents that did not include BMPs, and seven areas had no O&M plan, authorization, or guidance documents. For the use areas that had prescribed BMPs, those BMPs were most often in the general provisions “locations of the stock holding areas” and “locations of watering areas” (seven and six use areas, respectively) and least often in the provisions “highline use” and “other forms of stock restraint” (two use areas each). When BMPs were applicable to a stock use area, the BMPs were implemented fully for 73 percent of the use areas on average, although BMPs in the two location provisions were implemented fully for every use area when applicable. One stock use area had BMPs not implemented fully in three of five provisions. The other seven stock use areas averaged BMPs in one to three provisions, and 100 percent of applicable BMPs were implemented

fully. Nine evaluations reported that inspections to address water quality issues were performed during critical times during the current operating season (Rec F-Q29), and seven evaluations reported that the stock use area had no inspections. Two stock use areas had problems occur during the operating season, and for both the needed corrective actions were implemented (Rec F-Q30). One use area needed to be closed or have its use restricted (Rec F-Q31), and four use areas—including the one that was closed—needed treatments applied to reduce impacts to water resources (Rec F-Q33) in the 5 years prior to the evaluation. In all cases, the use area was closed and treatments were applied. The evaluations reported between two and five reasons for the closure or needed treatments (Rec F-Q35); the reasons reported most frequently were trampled vegetation, shoreline or bank erosion, and water quality. One administrative unit did not have a contingency and emergency response plan (CERP) for chemical or fuel spills, leaks, or dumping (Rec F-Q36), and one evaluation indicated that a spill, leak, or dumping had occurred during the past 5 years and was cleaned up according to the unit's CERP procedures.

During the effectiveness portion of the monitoring, pack and riding stock use areas are evaluated for evidence of erosion and sedimentation and trash and waste in four locations if they exist within the use area: the stock holding area, on or along trails that connect parts of the use area, at the developed watering source (DWS), and along the nearest waterbody. Only the most severe cases of erosion or sedimentation are reported 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. All occurrences of trash and waste (stock manure and domestic animal and human sanitary waste) are reported. Three evaluations reported evidence of erosion or sedimentation from the use or presence of the stock holding area (Rec F-Q41) outside an AMZ, three reported evidence within an AMZ, and one evaluation reported evidence in a waterbody. The types of evidence observed were most often vegetation damage or bare ground, sheet erosion, and rill erosion (Rec F-Q44). Two evaluations—including the one with evidence in a waterbody—indicated that the cause of the erosion or sedimentation was an inappropriate location for the holding area (Rec F-Q45). Evidence of trash (Rec F-Q46) was observed outside an AMZ during three evaluations. Evidence of stock manure was observed outside and within an AMZ for five and seven holding areas, respectively, and two holding areas observed stock manure evidence in both locations. Improper stock manure disposal was a reported cause of the evidence for four evaluations; the location of the holding area was a cause for three evaluations. Fifteen stock use areas had trails that connected two or more of the evaluated locations, and nine of those use areas had no observed evidence of erosion and sedimentation on or originating from the trails (Rec F-Q48). Four evaluations reported evidence of localized sediment deposition in a waterbody (Rec F-Q51). The type of evidence observed most frequently was sediment plumes or accumulations; however, six evaluations with evidence reported 11 different types of evidence. Four evaluations indicated that the location of user-created trails was a cause of the erosion or sedimentation (Rec F-Q52). Trash or waste on or along trails (Rec F-Q53) was reported in one or more locations for four evaluations. Trash was observed once outside an AMZ, stock manure once outside an AMZ and once within an AMZ, and domestic animal or human sanitary waste was observed once outside and twice within an AMZ; each evaluation reported a different cause (Rec F-Q54). The evidence of erosion, sediment,

trash, and waste was observed on Forest Service trails (Rec F-Q55) in one stock use area, on user-created trails (Rec F-Q56) in five use areas, and on both in one use area. On average, about 530 feet of Forest Service trail was evaluated compared to 460 feet of user-created trail (Rec F-Q57 and Rec F-Q58).

Ten stock use areas included a developed watering source, and eight evaluations indicated that no evidence of erosion or sedimentation from the use or presence of the watering source was observed (Rec F-Q59). Traceable evidence to a waterbody (Rec F-Q62) was found outside an AMZ for one watering source, and sheet and rill erosion were observed within an AMZ for another watering source. Causes of the evidence were reported as an inappropriate design and the location of the watering source (Rec F-Q63). One watering source had evidence of trash or waste (Rec F-Q64); stock manure was observed outside an AMZ, and the cause was improper disposal (Rec F-Q65). Every stock use area evaluation included a waterbody transect adjacent to the nearest waterbody. Two evaluations observed evidence of erosion or sedimentation (Rec F-Q66) in the waterbody at one to two places. Three types of evidence (Rec F-Q68) primarily related to the waterbody bank were reported for one evaluation, and the cause (Rec F-Q70) and source (Rec F-Q69) were the location of a Forest Service trail. Eight types of evidence, including substrate and channel geometry changes, were reported for the other evaluation; the source of erosion and sedimentation was a developed stream ford, and the cause was lack of armoring. Two evaluations observed evidence of trash or waste (Rec F-Q71) along the waterbody transect—trash was found in an AMZ due to improper disposal (Rec F-Q72), and stock manure was observed in the waterbody due to inconsiderate human actions.

Four pairs of implementation and effectiveness questions assess whether problems or issues with administration of the stock use area contributed to problems observed during the effectiveness review. Three use areas had unresolved maintenance needs (Rec F-Q26), and all indicated that those needs contributed to observed problems (Rec F-Q74). Seven use areas had no inspections during the operating season (Rec F-Q29); of those, three indicated that the lack of inspections did not contribute to observed problems (Rec F-Q75). The remaining four evaluations selected an incompatible answer choice for Rec F-Q75 based on the protocol instructions. For the four use areas that had a closure or use restriction (Rec F-Q31), or treatments applied (Rec F-Q33) to address a water resources issue, one evaluation indicated that the desired result was fully achieved (Rec F-Q76), two indicated partial achievement of desired results, and one selected an incompatible answer choice for Rec F-Q76.

Recreation F: Ratings and Component Scores

The implementation rating components and their interpretations for Rec F are given in Table 64. Eight stock use areas had planning component scores of *all*, which indicated that BMPs to protect water resources were included in use area O&M plans or guidance documents. One use area in each monitoring period was scored as *no BMPs prescribed* due a lack of BMPs in O&M documents, and seven areas had no O&M documents and a planning component score of *no O&M* (Table 64). Sixteen of the 17 stock use areas scored as *all* for the on-the-ground execution component (i.e., all applicable BMPs were implemented fully or all BMPs were not applicable). The other use area had a *some* score

for the on-the-ground execution component. Nine stock use areas had an *all* score for the project oversight component, seven scored as *some*, and one area had incomplete data and could not be scored. For the use areas with a project oversight component score of *some*, in all cases the result was due to a lack of inspections. Three stock use areas in FY17/18 had an implementation rating of *fully implemented* due to achieving *all* scores for each of the three components. One use area in FY15/16 and three in FY17/18 had *some* scores for the project oversight component (other component scores were *all*) and implementation ratings of *mostly implemented*. The single use area with an on-the-ground execution component score of *some* also scored as *some* for the project oversight component and had a *marginally implemented* rating. Two use areas had a rating of *not implemented* due to the *no BMPs prescribed* planning component score, although the other two component scores were *all*. Six stock use areas had a rating of *no O&M* for the planning component, resulting in a *no BMPs* implementation rating. One use area could not be rated due to incomplete data.

The effectiveness rating components and their interpretations for Rec F are given in Table 151. Distributions of the erosion and sedimentation component scores are given in Table 152. The trash and waste component scores are given in Table 153. Every stock use area had a chemical pollutants component score of *effective*. Two use areas in FY15/16 and four in FY17/18 had *effective*, *no trails*, or *no DWS* scores for every erosion and sedimentation component and every trash and waste component, and all six had an overall effectiveness rating of *effective*. One use area in FY15/16 had a *mostly effective* score for the erosion and sedimentation-trails component, a *moderately effective* score for the trash and waste-SHA component, *effective* scores for all other components, and a rating of *mostly effective*. One or more trash and waste component scores of *moderately effective* resulted in four stock use areas with ratings of *mostly effective* in FY17/18; all erosion and sedimentation component scores were *effective* or *no DWS* for those areas. One use area in FY17/18 had a *marginally effective* score for the erosion and sedimentation-trails component, *effective* scores for all other components, and a rating of *marginally effective*. A *not effective* score for any component would result in a *not effective* rating; five use areas had that result (two in FY15/16 and three in FY17/18). Three of those five stock use areas had a *not effective* score for one erosion and sedimentation component, and two areas had that score for two erosion and sedimentation components. One of the use areas with two *not effective* erosion and sedimentation component scores also scored as *not effective* for the trash and waste-SHA component.

Composite ratings for the stock use area evaluations in each monitoring period with complete data are given in Table 154. In each monitoring period, all or most stock use areas without O&M guidance documents (*no plan* composite rating) had better effectiveness. When O&M guidance documents existed, poorer implementation during O&M activities tended to have poorer effectiveness in FY15/16. The reverse was true in FY17/18; better implementation occurred across all levels of effectiveness, and better effectiveness occurred across most levels of implementation (Table 154).

Table 151.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec F protocol. If a component is absent (e.g., trails or developed watering source), the component is not considered in the determination of the evaluation effectiveness rating.

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-SHA ^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
Erosion and sedimentation-trails	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 trails	No trails in the use area
Erosion and sedimentation-DWS ^b	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 DWS	No developed watering source in the use area
Erosion and sedimentation-waterbody	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-SHA	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
Trash and waste-trails	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No trails	No trails in the use area
Trash and waste-DWS	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect
	No DWS	No developed watering source in the use area
Trash and waste-waterbody	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

^a Stock holding area.

^b Developed watering source.

Table 152.—Distribution of erosion and sedimentation effectiveness component scores by component for Rec F evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Erosion and sedimentation -SHA ^a component (number)	Erosion and sedimentation -SHA component (percent)	Erosion and sedimentation -trails component (number)	Erosion and sedimentation -trails component (percent)	Erosion and sedimentation -DWS ^b component (number)	Erosion and sedimentation -DWS component (percent)	Erosion and sedimentation -waterbody component (number)	Erosion and sedimentation -waterbody component (percent)
FY15/16 (n=5)									
	Effective	4	80	2	50	4	100	4	80
	Mostly effective			1	25				
	Marginally effective								
	Not effective	1	20	1	25			1	20
	No trails ^c			1	-- ^c				
	No DWS ^c					1	--		
FY17/18 (n=12)									
	Effective	11	92	8	73	5	83	11	92
	Mostly effective					1	17		
	Marginally effective			1	9				
	Not effective	1	8	2	18			1	8
	No trails			1	--				
	No DWS					6	--		

^a Stock holding area.^b Developed watering source.^c Not included in calculation of percentages.

Table 153.—Distribution of trash and waste effectiveness component scores by component for Rec F evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Trash and waste-SHA ^a component (number)	Trash and waste-SHA component (percent)	Trash and waste-trails component (number)	Trash and waste-trails component (percent)	Trash and waste-DWS ^b component (number)	Trash and waste-DWS component (percent)	Trash and waste-waterbody component (number)	Trash and waste-waterbody component (percent)
FY15/16 (n=5)									
	Effective	2	40	4	100	4	100	4	80
	Moderately effective	3	60						
	Not effective							1	20
	No trails ^c			1	-- ^c				
	No DWS ^c					1	--		
FY17/18 (n=12)									
	Effective	8	67	7	64	6	100	12	100
	Moderately effective	3	25	4	36				
	Not effective	1	8						
	No trails			1	--				
	No DWS					6	--		

^a Stock holding area.

^b Developed watering source.

^c Not included in calculation of percentages.

Table 154.—Composite rating matrix for Rec F pack and riding stock use areas evaluated for both implementation and effectiveness in FY15/16 (n=5 evaluations) and FY17/18 (n=11 evaluations). Numbers in cells indicate the number of evaluations 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
	Mostly effective		1			
	Marginally effective					
	Not effective			1	1	

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
	Mostly effective	1	2			1
	Marginally effective		1			
	Not effective	1				1

 Excellent
 Good
 Fair
 Poor
 No plan

Recreation F: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Rec F. Pack and Riding Stock Use Areas

(Reference BMPs Rec-1, Rec-6, and Rec-9)

v3.0 February 2016

Header	
Rec F-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec F-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec F-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec F-Q4	Date of current field evaluation:
Rec F-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:
Rec F-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:
Rec F-Q7	Reviewers and titles:
Rec F-Q8a	Region number:
Rec F-Q8b	State:
Rec F-Q9a	Proclaimed Forest or Grassland number and name:
Rec F-Q9b	Administrative Forest or Grassland number and name:
Rec F-Q10	District number and name:
Rec F-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec F-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: a. Yes b. No If No, describe the procedures used to select the project/site:

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Header (continued)	
Rec F-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: a. Yes b. No 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:
Rec F-Q12	6 th level HUC number and name for the subwatershed this stock use area is in:
Rec F-Q13	Is the pack and riding stock use area located within a municipal supply watershed? Select one: a. Yes b. No
Rec F-Q14a	Location. UTM Zone: UTM Datum:
Rec F-Q14b	Location. Easting:
Rec F-Q14c	Location. Northing:
Rec F-Q15a	Location. Latitude:
Rec F-Q15b	Location. Longitude:
Rec F-Q15c	Location. Lat/Long Datum:
Rec F-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec F-Q17	Name of use area:
Rec F-Q18	Dates use is normally allowed at this use area (month to month):
Rec F-Q19	Is the use area managed under a special use permit? Select one: a. Yes b. No If Yes, who is the permittee?
Rec F-Q20	Approximate size of the use area (ac or ha; specify unit):

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Header <i>(continued)</i>	
Rec F-Q21	Distance required between stock holding area and waterbody (ft or m; specify unit):
Rec F-Q22	Actual distance between the holding area and waterbody (ft or m; specify unit):
Rec F-Q23	Average slope between use area and waterbody (percent). Specify as a positive value when waterbody is upslope of use area or as a negative value when the waterbody is downslope:
Rec F-Q24	Type of waterbody. Select one: Ephemeral stream Intermittent stream Perennial stream/river Pond Lake Wetland/wet meadow Estuary Other (specify):
Rec F-Q25	Type of watering source. Select one: Natural waterbody Developed watering source Pond Trough Other (specify):
Implementation	
Rec F-Q26	Are there any unresolved maintenance needs related to protecting water, aquatic, or riparian resources that were identified for this pack and riding stock use area prior to this evaluation? Select one: a. Yes b. No If Yes, what needs are unresolved?
Rec F-Q27	Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this site contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 28) b. Plan, SUP, or other O&M guidance documents exist for this site, but they do not contain provisions for water/aquatic/riparian protection (go to question 29) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this site (go to question 29)
Rec F-Q28	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 in the operating season to require implementation, select Not applicable. a. Locations of stock holding areas Yes/No/Not applicable b. Locations of watering areas Yes/No/Not applicable c. Highline use Yes/No/Not applicable <i>(continued)</i>

continued on next page

Implementation <i>(continued)</i>	
(Rec F-Q28 continued)	d. Other forms of stock restraint Yes/No/Not applicable e. Manure disposal Yes/No/Not applicable f. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec F-Q29	Were inspections during this operating season performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No
Rec F-Q30	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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec F-Q31	Has the use area or have portions of the use area been closed, or have restrictions been placed on its use during the past 5 years to protect or restore water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted closure or use restriction (go to question 33) b. Needed and closed or use restricted (go to question 32) c. Needed but not closed or use not restricted (go to question 33)
Rec F-Q32	What length of time passed between when the problem was identified and the closure or use restriction was implemented? (days, weeks, months, or years; specify unit):
Rec F-Q33	Were any treatments applied to the pack and riding stock use area during the past 5 years to reduce negative impacts to water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted application of treatments (go to question 35) b. Needed and applied (go to question 34) c. Needed but not applied (go to question 35) If applied, describe the treatments:
Rec F-Q34	What length of time passed between when the problem was identified and the treatments were applied? (days, weeks, months, or years; specify unit):
Rec F-Q35	Why was the use area closed, use restricted, and/or treatments applied? Select all that apply: a. Not applicable, no closure, use restriction, or treatments applied during the past 5 years b. Trampled vegetation c. Soil compaction d. Sheet erosion e. Rill erosion f. Gully erosion g. Shoreline/bank erosion h. Water quality in waterbody (continued)

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Implementation <i>(continued)</i>	
(Rec F-Q35 continued)	i. Water quality in the watering area j. Extreme precipitation/weather event k. Washouts in stock use areas l. Other (specify):
Rec F-Q36	Were chemical or fuel spills or leaks, or dumping that occurred at this use area during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills, leaks, or dumping occurred during the past 5 years c. Yes, spills, leaks, or dumping were handled/treated according to the contingency and emergency response plan d. No, spills, leaks, or dumping were not handled/treated according to the contingency and emergency response plan
Rec F-Q37	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39)
Rec F-Q38	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec F-Q39	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 40) b. No (go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec F-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.
Effectiveness	
Rec F-Q41	Is there evidence of erosion or sedimentation from the use or presence of the stock holding area? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 46) b. Evidence of erosion or sedimentation outside an AMZ (go to question 43) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 43) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 42)
Rec F-Q42	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 44: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec F-Q43	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet

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Effectiveness *(continued)*

Rec F-Q44	For all of the occurrences of erosion/sedimentation observed within the area you identified in question 41, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec F-Q45	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Inappropriate location of stock holding area c. Stock not properly managed d. Improper or inadequate maintenance of the holding area e. Other (specify): f. Unknown
Rec F-Q46	What evidence of trash or domestic animal or human sanitary waste exists from the use or presence of the stock holding area? Select all that apply: a. No evidence (go to question 48) b. Evidence of trash outside an AMZ (go to question 47) c. Evidence of trash within an AMZ (go to question 47) d. Evidence of trash in a waterbody (go to question 47) e. Evidence of stock manure outside an AMZ (go to question 47) f. Evidence of stock manure within an AMZ (go to question 47) g. Evidence of stock manure in a waterbody (go to question 47) h. Evidence of other domestic animal or human sanitary waste/toilet paper outside an AMZ (go to question 47) i. Evidence of other domestic animal or human sanitary waste/toilet paper within an AMZ (go to question 47) j. Evidence of other domestic animal or human sanitary waste/toilet paper in a waterbody (go to question 47)
Rec F-Q47	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Improper stock manure disposal c. Improper trash disposal by site users d. Trash receptacles not emptied or maintained properly e. Lack of human sanitation facilities f. Inconsiderate human actions g. Inappropriate location of stock holding area h. Stock not properly managed i. Other (specify):

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Effectiveness *(continued)*

Rec F-Q48	Is there evidence of erosion or sedimentation on or originating from the trails connecting the holding area, watering source (if present) and the waterbody? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e. a. Not applicable, no connecting trails (go to question 59) b. No evidence of erosion or sedimentation (go to question 53) c. Evidence of erosion or sedimentation outside an AMZ (go to question 50) d. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 50) e. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 49)
Rec F-Q49	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 51: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec F-Q50	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec F-Q51	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 48, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec F-Q52	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Inappropriate location of stock holding area c. Inappropriate location of stock watering area d. Inappropriate location of Forest Service-created trails e. Location of user-created trails f. Lack of trail maintenance g. Stock not properly managed h. Other (specify): i. Unknown

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Effectiveness <i>(continued)</i>	
Rec F-Q53	What evidence of trash or domestic animal or human sanitary waste exists on or along the connecting trails? Select all that apply: a. No evidence (go to question 55) b. Evidence of trash outside an AMZ (go to question 54) c. Evidence of trash within an AMZ (go to question 54) d. Evidence of trash in a waterbody (go to question 54) e. Evidence of stock manure outside an AMZ (go to question 54) f. Evidence of stock manure within an AMZ (go to question 54) g. Evidence of stock manure in a waterbody (go to question 54) h. Evidence of other domestic animal or human sanitary waste/toilet paper outside an AMZ (go to question 54) i. Evidence of other domestic animal or human sanitary waste/toilet paper within an AMZ (go to question 54) j. Evidence of other domestic animal or human sanitary waste/toilet paper in a waterbody (go to question 54)
Rec F-Q54	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Improper disposal of stock manure c. Improper trash disposal by site users d. Trash receptacles not emptied or maintained properly e. Lack of human sanitation facilities f. Inconsiderate human actions g. Inappropriate location of stock holding area h. Inappropriate location of stock watering area i. Inappropriate location of Forest Service-created trails j. Location of user-created trails k. Lack of connecting trail maintenance l. Stock not properly managed m. Other (specify):
Rec F-Q55	Was any of the evidence of erosion, sediment, trash, or sanitary wastes identified in questions 51 and 53 associated with Forest Service-created trails? a. Yes b. No
Rec F-Q56	Was any of the evidence of erosion, sediment, trash, or sanitary wastes identified in questions 51 and 53 associated with user-created trails? a. Yes b. No
Rec F-Q57	What is the total length of Forest Service-created trails evaluated? (ft or m; specify unit):
Rec F-Q58	What is the total length of user-created trails evaluated? (ft or m; specify unit):
Rec F-Q59	Is there evidence of erosion or sedimentation from the use or presence of the developed watering source? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e. a. Pack stock facility does not have a developed watering source (go to question 66) b. No evidence of erosion or sedimentation (go to question 64) c. Evidence of erosion or sedimentation outside an AMZ (go to question 61) d. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 61) e. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 60)

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Effectiveness *(continued)*

Rec F-Q60	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 62: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec F-Q61	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec F-Q62	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 59, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Vegetation damage or bare ground h. Sheet erosion i. Rill erosion j. Gully erosion k. Headcutting l. Slumping/slips m. Mass wasting n. Sediment plumes or accumulations o. Rutting p. Water quality monitoring results q. Other (specify):
Rec F-Q63	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Inappropriate location of water development c. Inappropriate design of water development d. Stock not properly managed e. Improper or inadequate maintenance of the developed watering source f. Other (specify): g. Unknown
Rec F-Q64	What evidence of trash or domestic animal or human sanitary waste exists from the use or presence of the developed watering source? Select all that apply: a. No evidence (go to question 66) b. Evidence of trash outside an AMZ (go to question 65) c. Evidence of trash within an AMZ (go to question 65) d. Evidence of trash in a waterbody (go to question 65) e. Evidence of stock manure outside an AMZ (go to question 65) f. Evidence of stock manure within an AMZ (go to question 65) g. Evidence of stock manure in a waterbody (go to question 65) h. Evidence of other domestic animal or human sanitary waste/toilet paper outside an AMZ (go to question 65) i. Evidence of other domestic animal or human sanitary waste/toilet paper within an AMZ (go to question 65) j. Evidence of other domestic animal or human sanitary waste/toilet paper in a waterbody (go to question 65)

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Effectiveness *(continued)*

Rec F-Q65	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Stock manure disposed of improperly c. Improper trash disposal by site users d. Trash receptacles not emptied or maintained properly e. Lack of human sanitation facilities f. Inconsiderate human actions g. Inappropriate location of water development h. Stock not properly managed i. Other (specify):
Rec F-Q66	Is there evidence of erosion or sedimentation present along the waterbody transect attributable to the use area that was not reported previously for the holding area, connecting trails, and developed watering source? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of erosion or sedimentation (go to question 71) b. Evidence of erosion or sedimentation, but not reaching the waterbody (go to question 68) c. Evidence of erosion or sedimentation in the waterbody, or evidence of changes to waterbody morphology (go to question 67)
Rec F-Q67	How many total places do you observe erosion or sedimentation delivered to/ present in the waterbody and changes to waterbody morphology? Select one: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec F-Q68	For all of the occurrences of erosion and sedimentation observed within the area you identified in question 66, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec F-Q69	What are the sources? Select all that apply: a. Forest Service-created trail b. User-created trail c. Stock holding area d. Stock watering location e. Other (specify):

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Effectiveness *(continued)*

Rec F-Q70	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Inappropriate location of stock holding area c. Inappropriate location of water development d. Inappropriate trail location e. Stock not properly managed f. Other (specify): g. Unknown
Rec F-Q71	What evidence of trash or domestic animal or human sanitary waste exists along the waterbody transect that was not reported previously for the holding area, developed watering source, and connecting trails? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste (go to question 73) b. Evidence of trash within the AMZ (go to question 72) c. Evidence of trash in the waterbody (go to question 72) d. Evidence of stock manure within the AMZ (go to question 72) e. Evidence of stock manure in the waterbody (go to question 72) f. Evidence of other domestic animal or human sanitary waste/toilet paper within the AMZ (go to question 72) g. Evidence of other domestic animal or human sanitary waste/toilet paper in the waterbody (go to question 72)
Rec F-Q72	What are the causes? Select all that apply: a. Use is exceeding carrying capacity of the area b. Improper disposal of stock manure c. Improper trash disposal by site users d. Lack of human sanitation facilities e. Inconsiderate human actions f. Inappropriate location of stock holding area g. Inappropriate location of water development h. Inappropriate trail location i. Stock not properly managed j. Other (specify):
Rec F-Q73	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the pack and riding stock use area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec F-Q74	Did any of the unresolved maintenance needs for this pack and riding stock use area contribute to any observed problems? Select one: a. Not applicable, no unresolved maintenance needs existed for this pack and riding stock use area b. Yes c. No
Rec F-Q75	If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No

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Effectiveness <i>(continued)</i>	
Rec F-Q76	If the stock use area was closed, use was restricted, and/or treatments were applied during the past 5 years to protect or restore water, aquatic, or riparian resources, were the desired results achieved? Select one: a. Not applicable, no site closures, use restrictions, and/or treatments applied during the past 5 years b. The desired result was fully achieved c. The desired result was partially achieved d. Essentially no improvement to the site was achieved e. Too soon to determine
Rec F-Q77	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 78) b. No (go to question 79)
Rec F-Q78	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec F-Q79	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 80) b. No (go to General Comments)
Rec F-Q80	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	

Recreation G—Active Construction or Operation and Maintenance of Watercraft Launches

As discussed in the Recreation Management introduction, the Rec G protocol can be used to evaluate active construction of watercraft launches or the operation and maintenance of such sites. Three evaluations of active construction were completed during the FY15/16 monitoring period and five in FY17/18. These are described briefly and followed by a more detailed analysis of the evaluations of watercraft launch operation and maintenance.

Recreation G (Active Construction): Descriptive Statistics

The eight watercraft launch construction projects were located in six different regions. Three of the projects were in Region 1 (see App. 1 for region delineations). Every project was selected for monitoring to meet National BMP program targets, and all but one project in FY17/18 was selected randomly. All evaluations included both implementation and effectiveness monitoring performed on the same day. When completed, two launches would be open year-round, three launches would have 5- to 7-month operating seasons (Rec G-Q20), and two evaluations did not answer Rec G-Q20. All but one of the new launches were less than 65 feet in length (Rec G-Q22). Six new launches accessed

lakes, and two provided river access (Rec G-Q25). The project contract or plan for four watercraft launches had BMPs included from NEPA-related planning documents, and four had BMPs from other guidance documents (Rec G-Q27). BMPs in the provisions “temporary erosion control” and “surfacing materials” were prescribed and carried into the contract or plan for every project (Rec G-Q28). Every project had all prescribed BMPs implemented fully (Rec G-Q29). Evidence of uncontrolled erosion or sedimentation due to the construction activities was observed at two projects, once in the project area less than 10 feet from the waterbody and once in the waterbody (Rec G-Q42). In both cases, the observed amounts of erosion or sediment deposition were within the amounts described in planning (Rec G-Q46). Trash was observed outside the waterbody at five projects (Rec G-Q52); the causes were inconsiderate human actions and insufficient number of waste receptacles (Rec G-Q53).

Recreation G (Active Construction): Ratings and Component Scores

The implementation rating components for Rec G (active construction) are the same as those for Rec C and Rec H (Table 115). The effectiveness rating components, their scores, and interpretations for Rec G construction projects are given in Table 155. Seven of eight construction projects had implementation ratings of *fully implemented* due to *all* scores for all three components (Table 115). The remaining project had a rating of *mostly implemented* from a *some* score for the planning component due to BMPs in one provision not being carried from planning documents into the project contract or plan. Six projects were scored as *effective* for all three effectiveness components (Table 155), which also resulted in an overall effectiveness rating of *effective*. Two projects in FY15/16 had *marginally effective* scores for the erosion and sedimentation component and *effective* scores for the other two components; those projects were rated as *marginally effective*. The composite ratings for the projects are given in Table 156. Seventy-five percent of projects were rated as *excellent*, and the rest were rated as *fair*.

Table 155.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec G (both active construction and existing launch operation and maintenance) protocol

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 156.—Composite rating matrix for Rec G active construction projects evaluated for both implementation and effectiveness in FY15/16 (n=3 evaluations) and FY17/18 (n=5 evaluations). Numbers in cells indicate the number of evaluations 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	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	5				
	Mostly effective					
	Marginally effective					
	Not effective					

Excellent
 Good
 Fair
 Poor
 No plan

Recreation G (Operation and Maintenance [O&M]): Header Statistics

In FY15/16 and FY17/18, respectively, 23 and 25 watercraft launches were evaluated for operation and maintenance (O&M) activities using the Rec G protocol. All regions completed at least one evaluation (see App. 1 for region delineations). Eighty-eight percent of all evaluations had both implementation and effectiveness monitoring completed (Table 157). Implementation and effectiveness monitoring were performed on a single day for all of those paired evaluations. Only the implementation portion of the evaluation was completed for one of the remaining six evaluations by the end of the period. 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. The evaluation for which only implementation was completed was performed near the end of the FY17/18 monitoring period (i.e., close to September 30, 2018), and the effectiveness evaluation for the site may be included in the next monitoring period (FY19/20). Seventy-nine percent of the 48 launches evaluated for O&M were selected randomly (Table 40).

Table 157.—Number of Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (Rec G-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	1			1
	2	1		1	
	3	4		1	3
	4	2			2
	5				
	6	7			7
	8	1			1
	9	5			5
	10	2			2
	All	23		2	21
	Percent			9	91
FY17/18					
	1	1		1	
	2				
	3	8			8
	4	3			3
	5	1			1
	6	3			3
	8	3	1		2
	9	6		2	4
	10				
	All	25	1	3	21
	Percent		4	12	84

Although all Rec G (O&M) evaluations indicated that a reason for monitoring was to meet National BMP targets, the protocol simultaneously met other monitoring needs (Table 158). Quality assurance was identified as a reason for monitoring in one Rec G evaluation. 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 monitoring effort on that same site . . . [by] different team members than the initial evaluation, with the objective of comparing both sets of results as a check of the repeatability of results.” However, the evaluation that gave quality assurance as a reason for monitoring had no duplicate evaluation, which is necessary to meet the intent of that type of monitoring. The review team that selected quality assurance may have used this term to mean something different than the protocol instructions stipulate.

Table 158.—Number of Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (Rec G-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	1				
	3	4				
	4	2				
	5					
	6	7	2	1		2
	8	1				
	9	5		1	1	
	10	2	2			
	All	23	4	2	1	2
FY17/18						
	1	1				
	2					
	3	8				
	4	3		3		
	5	1				
	6	3				
	8	3		3		
	9	6				
	10					
	All	25	0	6	0	0

About 60 percent of the launches in each monitoring period were open year-round (Rec G-Q20). The mean season length was approximately 6 months in each period for the remaining launches. Thirty-two launches were located on lakes or reservoirs, 15 were on rivers, and 1 of the launches evaluated in Region 10 (Alaska) provided ocean access (Rec G-Q25). Thirteen launches (10 in FY15/16 and 3 in FY17/18) accessed waterbodies that did not allow motorized watercraft (Rec G-Q21 = 0 horsepower). Limits for most motorized watercraft on other waterbodies were 10 horsepower.

The mean launch length above the waterline (Rec G-Q22) in FY15/16 was 154 feet (standard error [se] = 60 feet), and lengths ranged from 0 to 1400 feet. Hydrologically connected approaches to the launch (including parking areas, Rec G-Q23) ranged from 500 square feet to 5 acres in FY15/16 and averaged 0.9 acre (se = 0.3 acre). In FY17/18, the launches were shorter and the approach areas smaller on average: 71 feet long (se = 10 feet) with approaches of 0.6 acre (se = 0.1 acre). Launch lengths ranged from 0 to 190 feet and approach areas ranged from no approach area (four launches) to 2.5 acres in

FY17/18. About half of the launches and approaches in each monitoring period included two or more types of surfacing materials (Rec G-Q24). Gravel was the material used most commonly at launches evaluated in FY15/16, and concrete was more common in FY17/18; each material was used at about 60 percent of launches in the respective period.

Recreation G (O&M): Implementation Results and Their Tie to Header Information

Eleven watercraft launches (five in FY15/16 and six in FY17/18) had unresolved maintenance needs that had been identified prior to the evaluation (Rec G-Q31). Forty-eight percent of the watercraft launches evaluated in FY15/16 had O&M plans, special use authorizations, or other O&M guidance documents; in FY17/18, 27 percent of launches had plans (Table 159). Whether the launch area had some type of O&M plan (Rec G-Q32a, Rec G-Q32b versus Rec G-Q32c) was significantly associated with whether the area had unresolved maintenance needs in FY15/16 ($p = 0.01$) but not in FY17/18 ($p = 0.63$). In FY15/16, half of the launches with O&M plans had unresolved needs, and all of the launches without an O&M plan had no identified needs. In FY17/18, one of six launches with an O&M plan had unresolved maintenance needs.

Assessment of operation and maintenance implementation focuses on whether BMPs in O&M guidance documents (O&M plan, special use authorization, and so on) were implemented fully (Rec G-Q33). Table 160 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 the information about whether all the BMPs from the provisions were implemented fully. A “yes” indicates that at least one BMP in the guidance documents was applicable to the provision and that all BMPs assigned to that provision were implemented fully. A “no” indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. “Not applicable” indicates that no BMPs in the guidance documents were 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 each monitoring period of Table 160 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

Table 159.—Distribution of whether watercraft launch operation and maintenance (O&M) plan, special use authorization, or other guidance documents contain BMP protection provisions (Rec G-Q32) for Rec G operation and maintenance 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	9	43	6	27
No; plan exists but does not have BMP provisions	1	5	0	
No plan for the watercraft launch	11	52	16	73

Table 160.—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 (Rec G-Q33) for Rec G operation and maintenance evaluations completed in FY15/16 (n=9 evaluations) and FY17/18 (n=6 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)
Vegetative erosion control measures adjacent to launch	5	1	3	83	17	3	0	3	100	0
Non-vegetative erosion control measures in launch area	3	1	5	75	25	4	0	2	100	0
Drainage control on approach	2	1	6	67	33	4	0	2	100	0
Launch or approach surfacing requirements	3	0	6	100	0	4	0	2	100	0
Waste and refuse collection and disposal	7	1	1	88	12	5	0	1	100	0
Requirements to control the spread of aquatic nuisance or invasive species	7	0	2	100	0	4	0	2	100	0
Signage requirements to provide information about limiting the spread of aquatic nuisance or invasive species	2	2	5	50	50	2	2	2	50	50
Wake or wave control measures	3	0	6	100	0	5	0	1	100	0
Mean	4	1	4	83	17	4	0	2	94	6

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

^b Percent calculated from “yes” and “no” counts.

Prescribed BMP provisions were implemented fully in an average of 83 percent of evaluations in FY15/16 and 94 percent of evaluations in FY17/18 that had some type of BMP guidance document for operation and maintenance (Table 160). The most common types of BMPs prescribed in both monitoring periods were those in the provision “waste and refuse collection and disposal.” BMPs associated with signage requirements were least likely to be implemented fully in both periods (Table 160). BMPs in all but one provision were implemented fully for 100 percent of launches in FY17/18, although only 6 of 25 launches had BMPs. When the numbers and percentages of BMP provisions implemented fully were compared by evaluation, BMPs were included in five provisions per evaluation on average, and 84 percent of the BMP provisions were implemented fully in FY15/16; in FY17/18, BMPs were included in five provisions on average, and 96 percent were implemented fully.

Two implementation questions—Rec G-Q35 and Rec G-Q36—evaluate whether site 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 161) and whether corrective actions were taken if problems occurred during the current operating season (at any time, not just critical times) (Table 162). Critical times are periods associated with large or intense precipitation/runoff events or other times when the potential for the site to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted during critical times during the operating season for about 40 percent of the watercraft launches in each monitoring period (Table 161). More than 70 percent of the areas in each period had no problems requiring corrective actions any time during the operating season, but nearly 20 percent in each monitoring period could not determine from available documentation whether corrective actions were needed or taken (Table 162).

Because fuel and other chemicals may be present around watercraft launches and their approaches, an implementation question (Rec G-Q34) 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

Table 161.—Distribution of whether inspections occurred at critical times (Rec G-Q35) for Rec G operation and maintenance 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	11	52	7	41
Yes	8	38	7	41
No	2	10	3	18
All	21		17 ^a	

^a Five evaluations selected an incorrect response based on the protocol instructions for operation and maintenance reviews.

Table 162.—Distribution of whether corrective actions (CA) were taken if problems occurred during current operating season (Rec G-Q36) for Rec G 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	15	71	16	73
CA needed but not taken	2	10	0	
CA needed and implemented	0		2	9
Unknown	4	19	4	18
All	21		22	

equivalent, and chemical spills or leaks are cleaned up according to that plan. The CERP may tie 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. Three evaluations in FY15/16 and eight in FY17/18 indicated that the administrative unit did not have a CERP. The remaining evaluations indicated that no spills or leaks that required cleanup had occurred at the watercraft launch.

Recreation G (O&M): Effectiveness Results and Their Tie to Implementation Results and Header Information

Watercraft launches are evaluated for evidence of erosion and sedimentation and trash and waste in the launch area and its approach. Only the most severe cases of erosion or sedimentation are reported (Rec G-Q47) during the effectiveness review, with severity increasing from within the area to delivery to a waterbody or changes to waterbody morphology. All occurrences of trash and waste are reported. No evidence of erosion, sedimentation, or waterbody morphology changes was observed in the launch and approach areas (Rec G-Q47) for 45 and 52 percent of the launch areas evaluated in FY15/16 and FY17/18, respectively (Table 163). Twelve evaluations in FY15/16 and 11 in FY17/18 reported some evidence of erosion, sedimentation, or waterbody morphology changes (Table 163). The type of evidence observed (Rec G-Q50) relative to the location where the evidence was observed is presented in Table 164. The most common types of evidence observed were damage to vegetation and sheet erosion. Two evaluations reported a type of evidence observed that was inconsistent with the location where evidence was reported in Rec G-Q47 (e.g., evidence of sediment deposition in a waterbody was reported outside a waterbody). Numerous causes for the evidence observed were reported (Table 165), but the most common was improper drainage on the approach. "Other" causes reported more than once included issues with drainage ditches and foot traffic. The location where sediment evidence was observed was not significantly associated with whether the watercraft launch had any type of O&M guidance documents containing BMP provisions (Rec G-Q32) in either monitoring period ($p = 0.25$ FY15/16, $p = 1.00$ FY17/18).

Table 163.—Evidence of erosion or sedimentation observed in watercraft launch area or approach (Rec G-Q47) for Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (Rec G-Q49) or number of places evidence observed in a waterbody (Rec G-Q48)

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	10	45							
Within area but not in waterbody	6	27	3	3					
In a waterbody	6	27					3	1	2
FY17/18									
No evidence	12	52							
Within area but not in waterbody	5	22	4	1					
In a waterbody	6	26					4	1	1

Weather conditions associated with the evaluation (Rec G-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to use of the watercraft launch and approach 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions.

No statistically significant associations were found between categories of erosion in the launch area or approach (Rec G-Q47) and weather conditions (i.e., wet versus dry conditions) in either monitoring period ($p = 0.47$ FY15/16, $p = 0.78$ FY17/18) (Fig. 88). For both monitoring periods, nine evaluations (six in FY15/16 and three in FY17/18) occurred during wet weather. More evaluations are needed during those conditions to determine the usefulness of this comparison for watercraft launches (Fig. 88).

Trash or domestic animal or human sanitary waste evidence (Rec G-Q52) was observed in the launch area or approach during 29 of the 47 effectiveness evaluations. The types of evidence observed are summarized by the location of the evidence in Table 166. Eighty-six percent of evaluations reported inconsiderate human actions as a cause of the observed evidence. Livestock grazing was the most frequent “other” cause and was reported as frequently as insufficient number of waste receptacles. Three evaluations in FY15/16 reported evidence of a chemical or fuel spill or leak in the launch area but outside the waterbody (Rec G-Q54); spills or leaks were not observed in any launch areas in FY17/18. Aquatic invasive species were observed in the launch area (Rec G-Q55) during three evaluations in FY15/16 and two in FY17/18. The species observed were zebra mussels (*Dreissena polymorpha*) and several different aquatic and terrestrial plants.

In the Rec G (O&M) protocol, two sets of paired implementation and effectiveness questions assess unresolved maintenance needs (Rec G-Q31 and Rec G-Q56) and

Table 164.—Types of evidence of erosion or sedimentation observed in watercraft launch area or approach (Rec G-Q50) for Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec G-Q47 (Table 163) is applicable to Rec G-Q50.

Type of evidence	FY15/16 Evidence but not in waterbody (n=6)	FY15/16 Evidence in waterbody (n=6)	FY17/18 Evidence but not in waterbody (n=5)	FY17/18 Evidence in waterbody (n=6)
Traceable evidence to the waterbody, but not currently visible in the waterbody	2	3	3	3
Turbidity present				
Evidence of localized sediment deposition in the waterbody	1 ^a	5	1 ^a	5
Changes to substrate composition		2		1
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)		2		2
Bank instability	1	2	1	
Bank trampling or compaction	2	5	1	1
Vegetation damage or bare ground	4	5	2	1
Sheet erosion	2	4	1	3
Rill erosion		4	1	1
Gully erosion		3		3
Headcutting			1	1
Slumping/slips				1
Mass wasting				
Sediment plumes or accumulations		2	1	2
Rutting	2	3	2	
Water quality monitoring results				

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

inspections (Rec G-Q35 and Rec G-Q57). Respectively, the questions ask whether watercraft launch administration or lack thereof influenced BMP effectiveness. Tables 167 and 168 show the relationships between the pairs of questions for launches 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 the paired comparisons because some number of incompatible answer choices were selected (shaded cells) based on the protocol instructions for the comparisons. Five launches in each monitoring period had unresolved maintenance needs, and 60 percent of evaluations reported that those needs contributed to observed effectiveness problems (Table 167). One evaluation in FY17/18 reported that lack of inspections or inspections not conducted at critical times contributed to observed problems for a launch area, but 31 percent of the evaluations in that period had incompatible answer choices (Table 168).

Table 165.—Causes of evidence of erosion or sedimentation observed in watercraft launch area or approach (Rec G-Q51) for Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in Rec G-Q47 (Table 163) is applicable to Rec G-Q51.

Cause of evidence	FY15/16 Evidence but not in waterbody (n=6)	FY15/16 Evidence in waterbody (n=6)	FY17/18 Evidence but not in waterbody (n=5)	FY17/18 Evidence in waterbody (n=6)
Improper drainage on approach	1	3	2	2
Wheel slip on the launch ramp	2			1
Wave action		1	3	
Improper surfacing on watercraft ramp		2	1	1
Inadequate surfacing on approach to watercraft launch	3	2		
Lack of ground cover adjacent to ramp	1	1		2
Lack of or improper maintenance	1	2	1	2
Side slopes of approach or launch area too steep or unstable	1	1	1	
Other	2	2	2	3

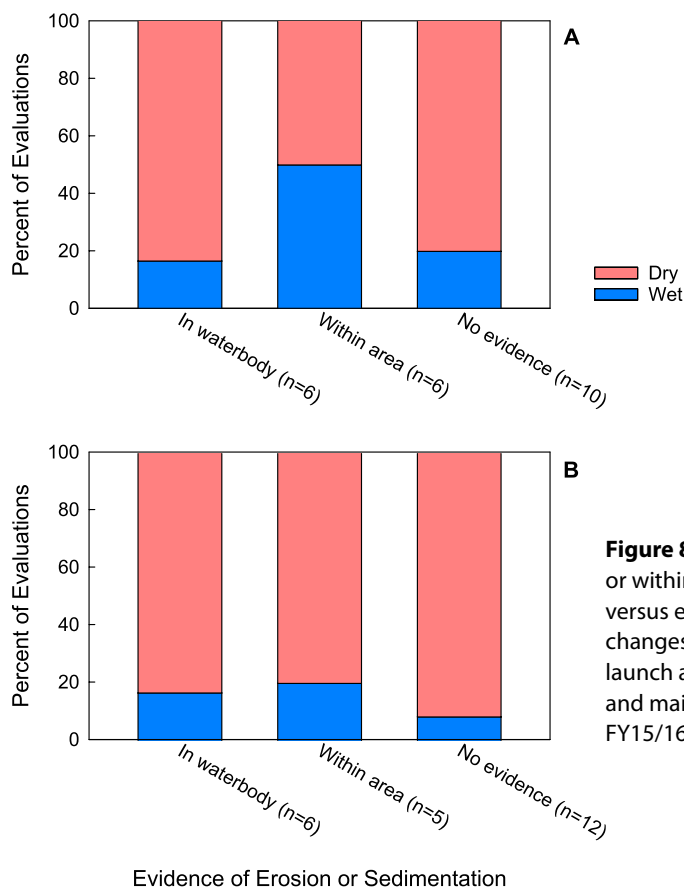


Figure 88.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion, sedimentation, or changes to waterbody morphology in watercraft launch area or approach (Rec G-Q47) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

Table 166.—Evidence of trash or domestic animal or human sanitary waste observed in watercraft launch area and approach (Rec G-Q52) for Rec G operation and maintenance evaluations completed in FY15/16 (n=23 evaluations) and FY17/18 (n=24 evaluations). Multiple selections were possible.

Monitoring period	Evidence	Evidence but not in waterbody (number)	Evidence in a waterbody (number)
FY15/16			
	Trash	8	3
	Domestic animal or human sanitary waste	4	
FY17/18			
	Trash	14	1
	Domestic animal or human sanitary waste	6	1

Table 167.—Distribution of whether watercraft launch area had unresolved maintenance needs (Rec G-Q31) in relationship to problems observed during effectiveness monitoring (Rec G-Q56) for Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (20 and 38 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Area has unresolved maintenance needs (implementation)	Not applicable; no unresolved maintenance needs (effectiveness)	Yes; unresolved maintenance needs led to observed problems (effectiveness)	No; unresolved maintenance needs did not lead to observed problems (effectiveness)
FY15/16				
	Yes	1	3	1
	No	12	1	2
FY17/18				
	Yes	1	3	1
	No	9	2	5

Recreation G (O&M): Ratings and Their Tie to Header, Implementation, and Effectiveness Results

More of the Rec G (O&M) watercraft launches were rated as *no BMPs* in each monitoring period than any other implementation rating (Fig. 89). More of the Rec G (O&M) launches were rated as *not effective* than *effective* in each period, but the differences were small. One evaluation in FY15/16 and three in FY17/18 lacked responses in the database for questions needed to determine the effectiveness ratings (identified as “incomplete data” in Fig. 89).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (Rec G-Q16) were not associated with the effectiveness ratings in either monitoring period ($p = 0.79$ FY15/16, $p = 0.48$ FY17/18) (Fig. 90). The number of wet weather

Table 168.—Occurrence of inspections performed at critical times (Rec G-Q35) in relationship to problems observed during effectiveness monitoring (Rec G-Q57) for Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (30 and 31 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	4		6
	Yes; inspections at critical times	6		2
	No; inspections not at critical times			2
FY17/18				
	No inspections		1	6
	Yes; inspections at critical times	3		4
	No; inspections not at critical times	1		1

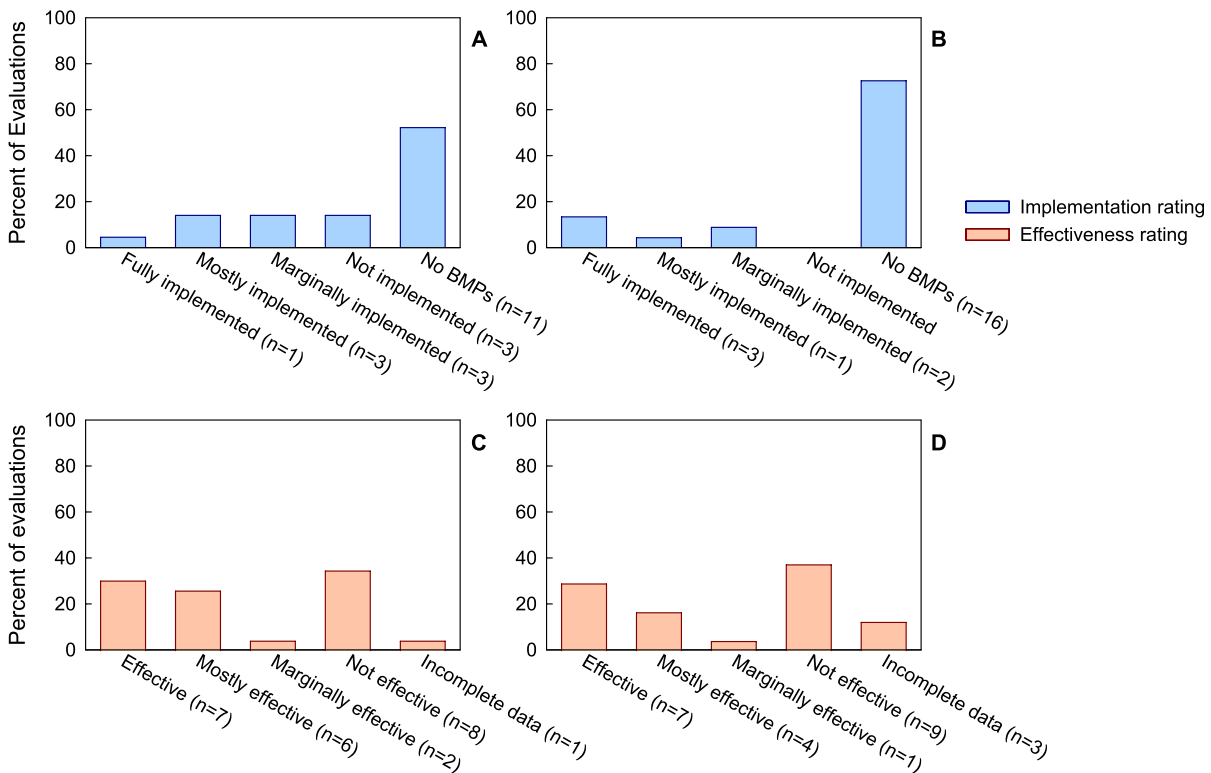


Figure 89.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for Rec G operation and maintenance evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). ‘Incomplete data’ refers to evaluations where all the questions needed to determine a rating were not answered.

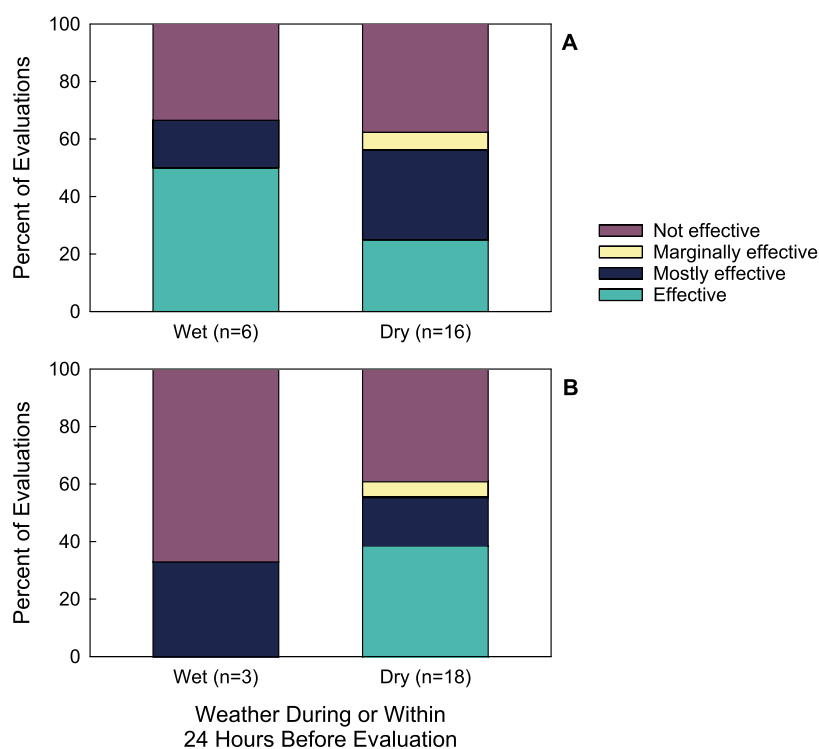


Figure 90.—Distribution of effectiveness ratings by weather conditions (Rec G-Q16) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

evaluations was small compared to the number for dry weather, so 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, sedimentation, or morphological effects (e.g., Fig. 88) 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.

The effectiveness ratings were not significantly associated with whether watercraft launches had unresolved maintenance needs (Rec G-Q31) in either monitoring period ($p = 1.00$ FY15/16, $p = 0.43$ FY17/18) (Fig. 91). Also, no significant associations existed between the effectiveness ratings and whether documents pertinent to BMP guidance for the operation and maintenance of the launch area existed ($p = 0.85$ FY15/16, $p = 0.32$ FY17/18) (Fig. 92). More watercraft launch evaluations are needed to improve the usefulness of these two comparisons.

The number of BMP provisions implemented fully (Rec G-Q33) was not significantly different among the effectiveness ratings in FY15/16 ($p = 0.58$, GLMM with negative binomial distribution and log link function). A test was not possible in FY17/18 due to small sample sizes among ratings. Evaluations averaged from three to four provisions

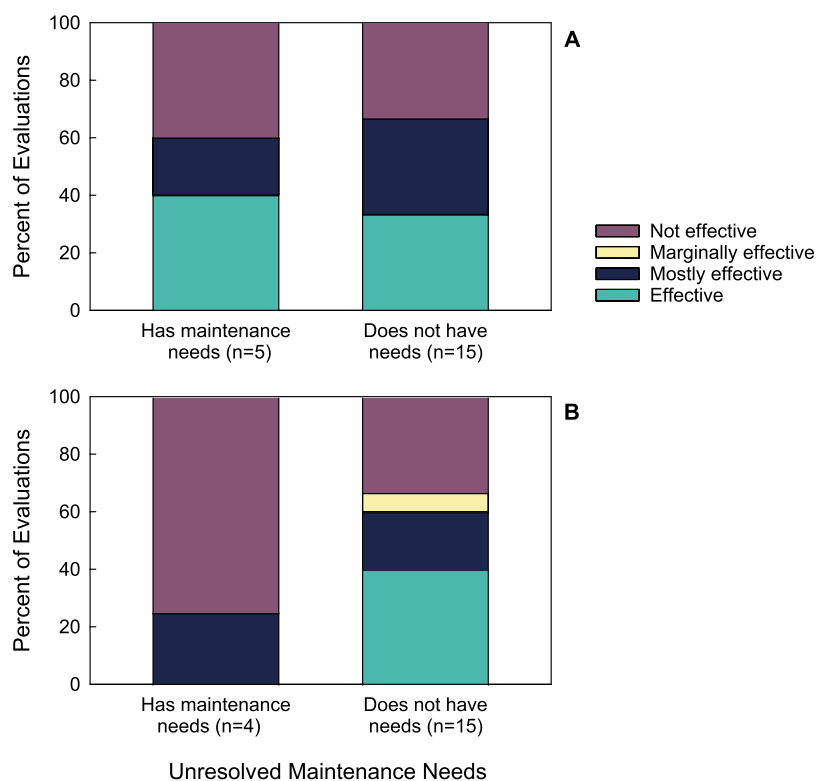


Figure 91.—Distribution of effectiveness ratings by whether watercraft launch had unresolved maintenance needs (Rec G-Q31) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

implemented fully in FY15/16 and either one or seven in FY17/18 across the effectiveness ratings. Mean percentages of BMPs implemented fully in FY15/16 were more variable across the effectiveness ratings, ranging from 68 to 92 percent, although a significant difference was not found ($p = 0.26$, Kruskal-Wallis test). Watercraft launches rated *effective* had a higher percentage of BMPs implemented fully compared to those rated *mostly effective* or *not effective*. In FY17/18, the percentages of BMPs implemented fully ranged from 93 to 100 percent, and no significant differences were found ($p = 0.47$, Kruskal-Wallis test).

During the implementation portion of the evaluation, review of documents and inquiries with site administrators occur to determine whether corrective actions were taken if problems were observed during the operating season (Rec G-Q36). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. Significant associations were not found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in either monitoring period ($p = 0.16$ FY15/16, $p = 0.80$ FY17/18). As with many of the statistical tests between implementation metrics and effectiveness ratings, the unequal sample sizes have limited the usefulness of this comparison (Fig. 93).

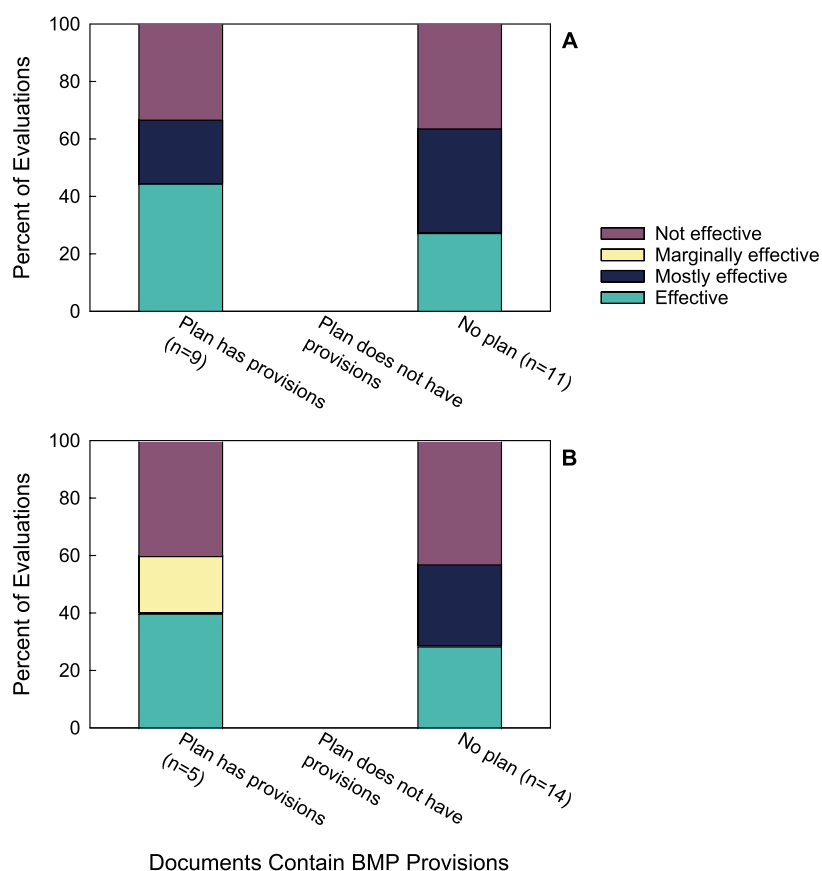


Figure 92.—Distribution of effectiveness ratings by whether watercraft launch operation and maintenance plan, special use authorization, or other guidance documents contained BMPs (Rec G-Q32) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

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.

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 of BMPs applicable to the project or site; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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

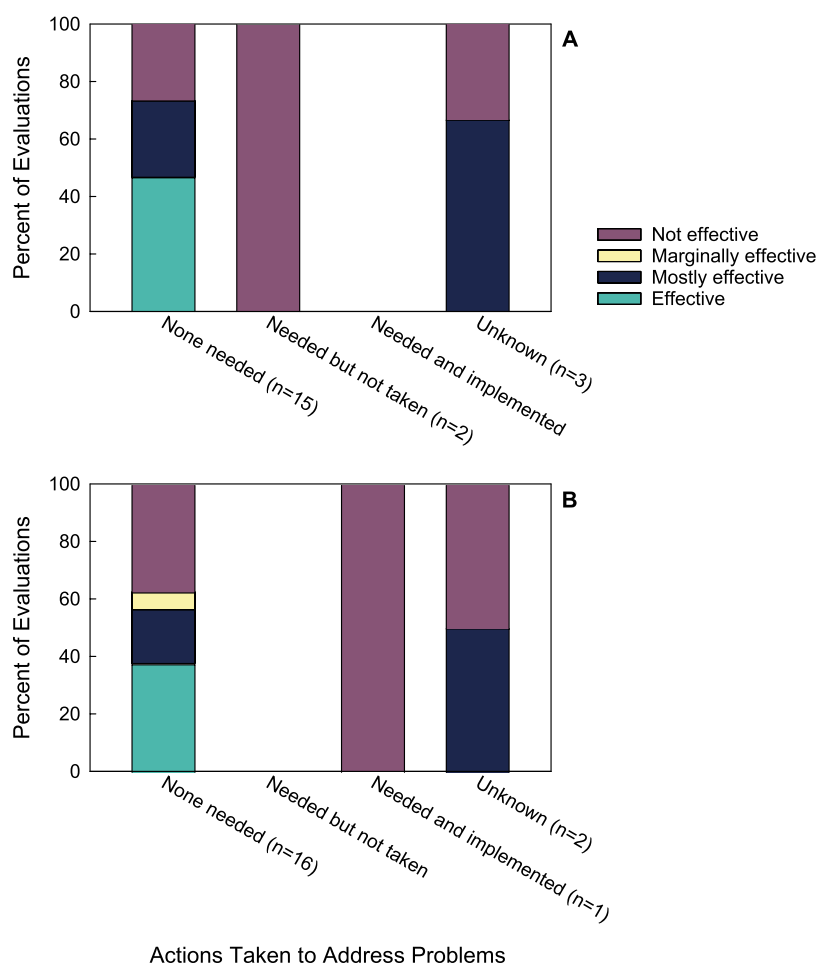


Figure 93.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during the current operating season (Rec G-Q36) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

that lack O&M plans or guidance documents or having plans that lack BMPs, while adaptive management actions for effectiveness may involve assessing ground cover at facilities every operating season to ensure that those standards are met or initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations where implementation or effectiveness corrective actions or adaptive management actions were needed was similar to, although usually less than, the number for which no actions were needed (Figs. 94 and 95). There were no significant associations in either monitoring period among implementation ratings and corrective action needs ($p = 0.11$ FY15/16, $p = 0.25$ FY17/18) or among implementation ratings and adaptive management action needs ($p = 0.43$ FY15/16, $p = 0.47$ FY17/18). This result is not surprising given the much larger percentage of launches in each period that did not have O&M plans or other BMP guidance documents, although implementation ratings were somewhat better when no actions were needed (Fig. 94). A significant association

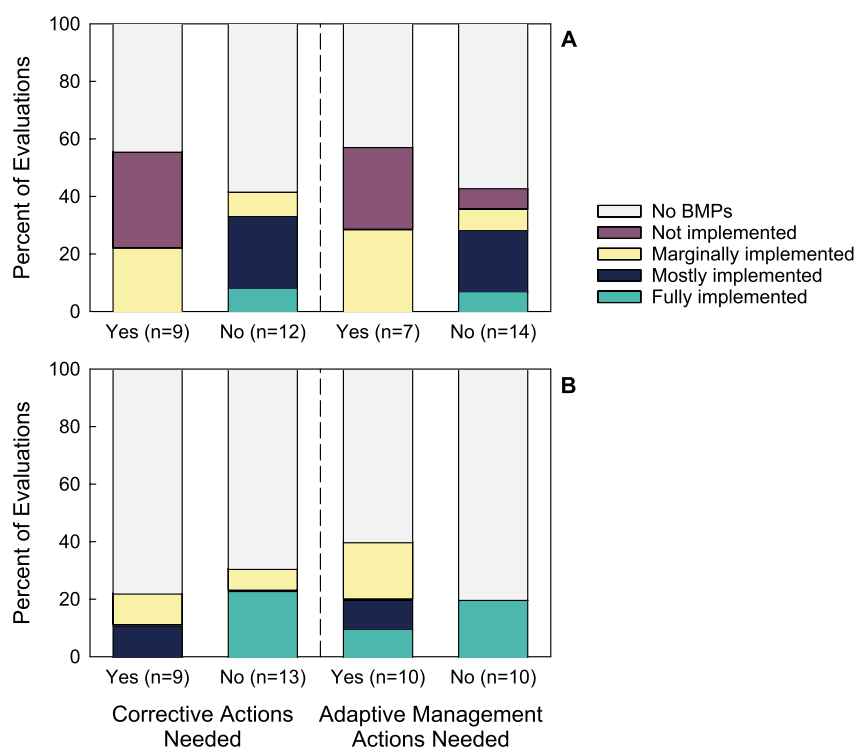


Figure 94.—Distribution of implementation ratings by whether corrective actions (Rec G-Q37) or adaptive management actions (Rec G-Q39) were needed to improve implementation for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

among effectiveness ratings and whether corrective actions were needed existed in FY15/16 ($p < 0.01$) but not in FY17/18 ($p = 0.18$). And no significant associations were found among effectiveness ratings and whether adaptive management actions were needed in either period ($p = 1.00$ FY15/16, $p = 0.56$ FY17/18). However, effectiveness ratings were better for launch areas for which no corrective actions were needed and to a lesser extent for areas that had no adaptive management action needs identified (Fig. 95).

Some evaluations were rated as *not implemented* or *no BMPs* or *not effective* when no corrective actions or adaptive management actions were 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, so the expected response to at least one of those questions would have been that some corrective or adaptive management action was needed. The 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 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 Rec G-Q37, Rec G-Q39, Rec G-Q58, and Rec G-Q60.

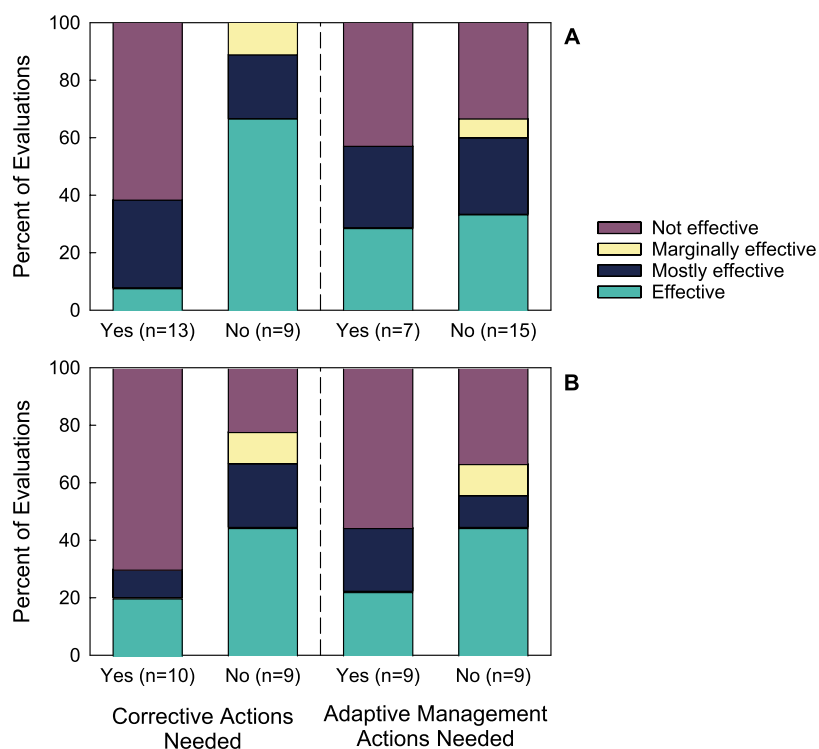


Figure 95.—Distribution of effectiveness ratings by whether corrective actions (Rec G-Q58) or adaptive management actions (Rec G-Q60) were needed to improve effectiveness for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

Composite Ratings

Composite rating results for Rec G (O&M) watercraft launches that were evaluated for both implementation and effectiveness are given in Table 169. Fifteen percent of launches had a composite rating of *excellent* or *good*, 13 percent of the launches were rated as *poor*, and nearly two-thirds 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, significant associations between implementation and effectiveness ratings were not found in either monitoring period ($p = 0.35$ FY15/16, $p = 0.20$ FY17/18). These results are likely due to the lack of BMPs that occurred across all levels of effectiveness; 60 percent of watercraft launches without BMPs had better effectiveness ratings, and the rest had poor effectiveness ratings.

Table 169.—Composite rating matrix for Rec G watercraft launch operation and maintenance evaluated for both implementation and effectiveness in FY15/16 (n=20 evaluations) and FY17/18 (n=19 evaluations). Numbers in cells indicate the number of evaluations 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	1		3
	Mostly effective			2		4
	Marginally effective					
	Not effective		1		2	4

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

 Excellent
 Good
 Fair
 Poor
 No plan

Recreation G (O&M): Examination of Component and Subcomponent Scores

The overall implementation ratings for Rec G (O&M) were determined from component scores given in Table 64. Rec G operation and maintenance effectiveness rating components and scores are the same as those for Rec G active construction (Table 155). Table 170 shows the distribution of scores across the three implementation components. Four of the watercraft launches had *all* scores for all three implementation components, which resulted in implementation ratings of *fully implemented* (Table 171). Lack of O&M guidance documents resulted in a *no* O&M planning component score for 27 launch areas and in an *all* score for the on-the-ground execution component (i.e., no O&M documents is equivalent to all provisions implemented fully; Tables 64 and 171). The project oversight component is determined from two metrics: inspections (Rec G-Q35) and whether corrective actions were taken if needed (Rec G-Q36). A score of *none* for the project oversight component (Table 171) indicates that needed corrective actions were not taken, while a *some* score results from a lack of inspections or inspections not being conducted at critical times.

Table 170.—Distribution of implementation component scores by component for Rec G operation and maintenance (O&M) 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)							
	All	9	43	17	81	8	38
	Some ^a			4	19	11	52
	None ^a					2	10
	No BMPs prescribed ^b	1	5				
	No O&M ^{b,c}	11	52				
FY17/18 (n=22)							
	All	6	27	20	91	12	55
	Some			2	9	10	45
	None						
	No BMPs prescribed						
	No O&M	16	73				
	Incomplete data ^d						

^a Score applies only to on-the-ground execution and project oversight components (see Table 64).

^b Score applies only to planning component (see Table 64).

^c Operation and maintenance.

^d Some of the questions needed to determine a component score were not answered.

The distribution of scores across the three effectiveness components is summarized in Tables 172 and 173. The erosion and sedimentation component had lower percentages of *effective* scores compared to the other components (Table 172). Seven of the evaluations in each monitoring period had scores of *effective* for all components, resulting in an effectiveness rating of *effective* (Table 173). Sixteen watercraft launches had a *not effective* score for one component, and one had a *not effective* score for two components. The *not effective* scores for the erosion and sedimentation component contributed to an effectiveness rating of *not effective* for all but one of the evaluations with that rating (Table 173).

Effectiveness component scores were analyzed to determine whether associations existed between the component scores and the implementation ratings (Fig. 96). No significant associations were found for any component scores in either monitoring period (erosion and sedimentation: $p = 0.29$ FY15/16, $p = 0.33$ FY17/18; trash and waste: $p = 0.92$ FY15/16, $p = 0.23$ FY17/18; chemical pollutants: $p = 0.50$ FY15/16, test not possible FY17/18). The large number of evaluations with ratings of *no BMPs* compared to the other possible component scores limits the usefulness of the implementation rating comparisons, especially in FY17/18. The relationships between the BMP implementation

Table 171.—Implementation component scores corresponding to the overall implementation ratings for Rec G operation and maintenance evaluations completed in FY15/16 and FY17/18. See Table 64 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=21)					
	Fully implemented	All	All	All	1
	Mostly implemented	All	All	Some	3
	Marginally implemented	All	Some	All	1
		All	Some	Some	2
	Not implemented	All	All	None	1
		All	Some	None	1
		No BMPs prescribed	All	Some	1
	No BMPs	No O&M ^a	All	All	6
		No O&M	All	Some	5
FY17/18 (n=22)					
	Fully implemented	All	All	All	3
	Mostly implemented	All	All	Some	1
	Marginally implemented	All	Some	All	1
		All	Some	Some	1
	Not implemented				0
	No BMPs	No O&M	All	All	8
		No O&M	All	Some	8

^a Operation and maintenance.

component scores and the overall effectiveness ratings are shown in Figure 97. Again, no significant associations existed in either monitoring period for any component scores (planning: $p = 0.85$ FY15/16, $p = 0.32$ FY17/18; on-the-ground execution: $p = 0.64$ FY15/16, $p = 1.00$ FY17/18; project oversight: $p = 0.51$ FY15/16, $p = 0.60$ FY17/18). In most cases effectiveness ratings tended to be slightly worse when component scores were better—the opposite of what might be expected (Fig. 97).

Recreation G (O&M): Management Implications for Forest Service Managers

Eighteen percent of the watercraft launch areas evaluated for operation and maintenance rated either *fully implemented* or *mostly implemented* for BMP implementation, and 63 percent rated *no BMPs*. In the context of Rec G, *no BMPs* means that no O&M plan or other document exists for the site. Project planning was a deficiency at 65 percent of the sites due to the lack of those documents or lack of BMPs in those documents. Of the three implementation components, the on-the-ground execution component had

Table 172.—Distribution of effectiveness component scores by component for Rec G operation and maintenance 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=23)							
	Effective	12	52	16	70	20	87
	Mostly effective ^a	1	4				
	Moderately effective ^b			7	30	3	13
	Marginally effective ^a	1	4				
	Not effective	8	35				
	Incomplete data ^c	1	4				
FY17/18 (n=24)							
	Effective	12	50	16	67	23	96
	Mostly effective	1	4				
	Moderately effective			5	21		
	Marginally effective	1	4				
	Not effective	9	38	2	8		
	Incomplete data	1	4	1	4	1	4

^a Score applies only to erosion and sedimentation component (see Table 155).

^b Score applies only to trash and waste and chemical pollutants components (see Table 155).

^c Some of the questions needed to determine a component score were not answered.

the best scores. Eighty-six percent of the sites had a score of *all*; however, sites with a *no O&M* score for the planning component are scored *all* for the on-the-ground execution component by default. If those evaluations are excluded, 60 percent of the sites scored as *all* for the on-the-ground execution component when BMPs were prescribed (i.e., planning component scored as *all*). When BMPs were included in the O&M documents, they were implemented fully at an average rate of 88 percent. Deficiencies in project oversight were found in 53 percent of the evaluations. When a deficiency in project oversight occurred, it was due most frequently to a lack of inspections or inspections at critical times. The project oversight component scored as *none* for two sites where corrective actions were needed but not taken.

For BMP effectiveness, 56 percent of the sites rated *effective* or *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. Forty percent of the launch areas were rated *not effective*, indicating that impacts to water quality were occurring. Of the sites rated *not effective*, 94 percent had a *not effective* score for the erosion and sedimentation component. Of the 10 sites rated *mostly effective*, 8 had a *moderately effective* score for the trash and sanitary waste component driving the overall rating.

Table 173.—Effectiveness component scores corresponding to the overall effectiveness ratings for Rec G operation and maintenance evaluations with complete data in FY15/16 and FY17/18. See Table 155 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=22)					
	Effective	Effective	Effective	Effective	7
	Mostly effective	Effective	Effective	Moderately effective	1
		Effective	Moderately effective	Effective	3
		Effective	Moderately effective	Moderately effective	1
		Mostly effective	Effective	Effective	1
	Marginally effective	Marginally effective	Effective	Effective	1
	Not effective	Not effective	Effective	Effective	4
		Not effective	Effective	Moderately effective	1
		Not effective	Moderately effective	Effective	3
FY17/18 (n=21)					
	Effective	Effective	Effective	Effective	7
	Mostly effective	Effective	Moderately effective	Effective	3
		Mostly effective	Moderately effective	Effective	1
	Marginally effective	Marginally effective	Effective	Effective	1
	Not effective	Effective	Not effective	Effective	1
		Not effective	Effective	Effective	6
		Not effective	Moderately effective	Effective	1
Not effective		Not effective	Effective	1	

Evidence of erosion or sedimentation was observed at 51 percent of the watercraft launch areas evaluated. Evidence of erosion or sedimentation was observed in the waterbody in 52 percent of those evaluations. The evidence was primarily vegetation damage or bare ground or sheet erosion. The causes reported most frequently were inappropriate drainage on the approach and issues with surfacing. Evidence of trash or domestic animal or sanitary waste was observed at 62 percent of the watercraft launch areas; 86 percent of those evaluations identified inconsiderate human actions as the cause.

No significant associations were found between implementation ratings and effectiveness component scores, effectiveness ratings and implementation component scores, or implementation ratings and effectiveness ratings. The large number of evaluations with a *no BMPs* implementation rating across all effectiveness ratings (except *marginally effective*) limits the usefulness of these comparisons. In total, when the implementation rating was *fully implemented* or *mostly implemented*, a greater percentage of evaluations were rated *effective* or *mostly effective* (63 percent) than *marginally effective* or *not effective*

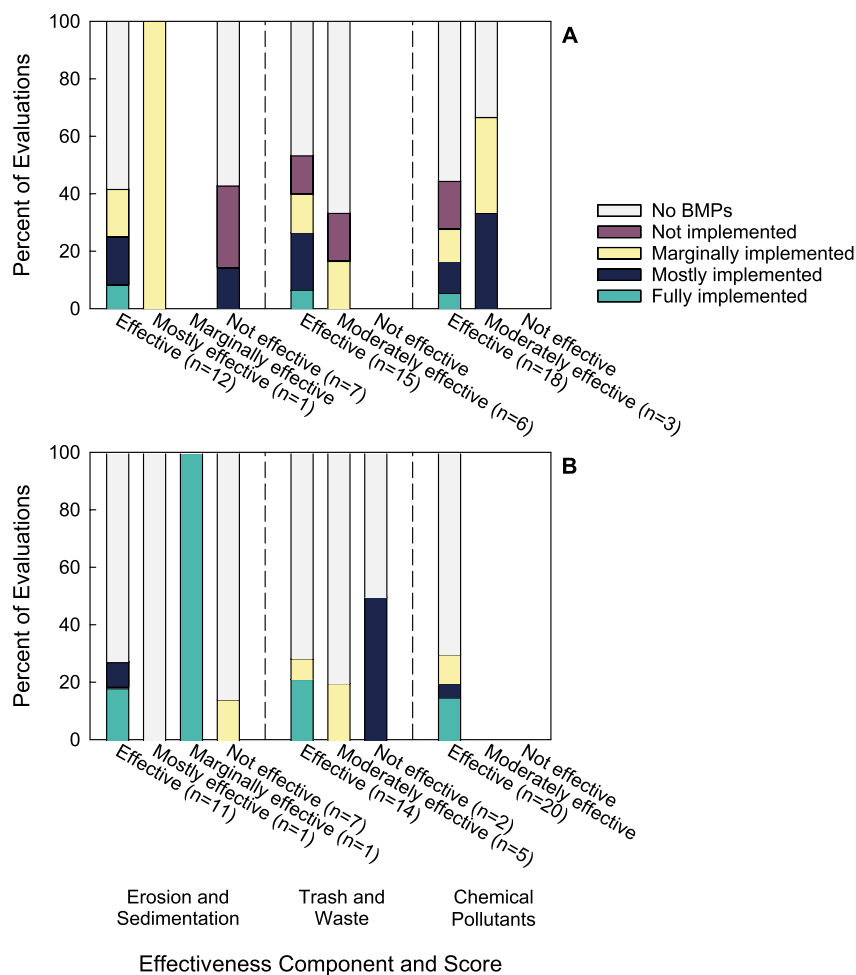


Figure 96.—Distribution of implementation ratings across effectiveness component scores for Rec G operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B).

(37 percent). If the sites rated *no BMPs* are excluded, when the implementation rating was *marginally implemented* or *not implemented*, half of the evaluations were rated *effective* or *mostly effective*, and half were *marginally effective* or *not effective*.

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

- Developing O&M plans or similar documents with BMPs for watercraft launch areas. Thirty-five percent of the evaluated areas had an O&M plan or similar document with BMPs. Although no significant association was found between the existence of O&M documents and effectiveness ratings, when BMPs were prescribed, they were implemented fully at a high rate. Also, for sites evaluated in FY15/16, those rated *effective* had a greater percentage of BMPs implemented fully than those rated *mostly effective* or *not effective*.
- Ensuring that the administrative unit has a contingency and emergency response plan (CERP). Twenty-six percent of the evaluations indicated that

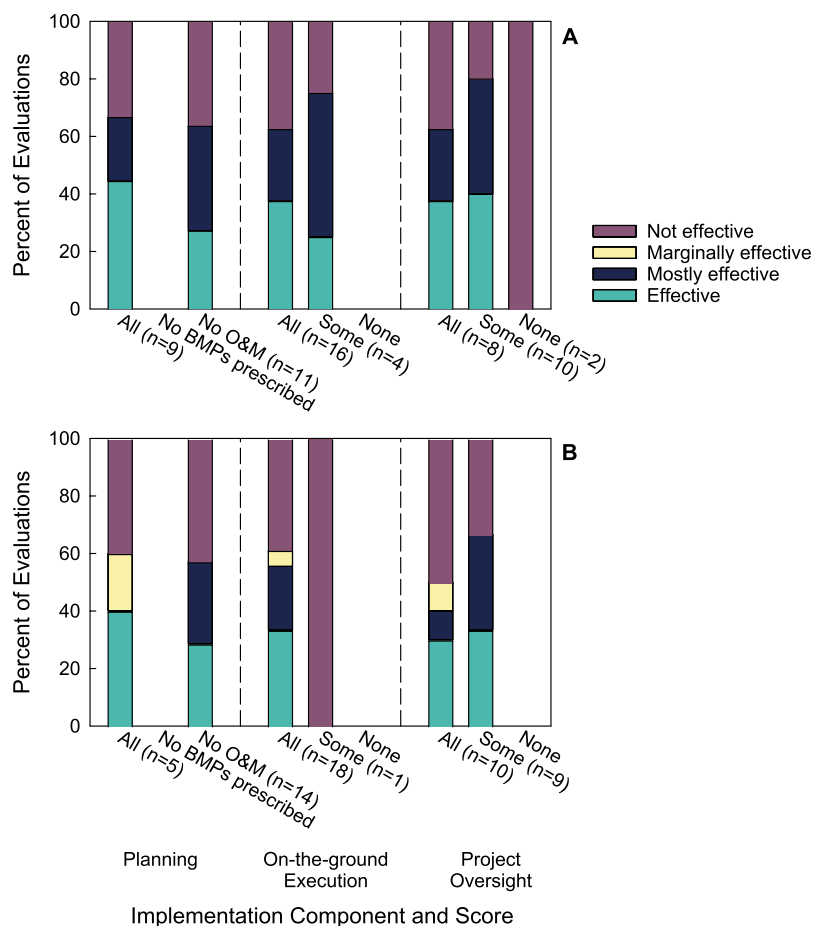


Figure 97.—Distribution of effectiveness ratings across implementation component scores for Rec G operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B). O&M = operation and maintenance.

the administrative unit lacked a CERP or equivalent document. Although no evaluation indicated that a spill or leak requiring cleanup had occurred at the watercraft launch, three evaluations reported evidence of chemicals or fuels outside of the waterbody.

- Increasing administration of watercraft launch areas. Project oversight, including lack of inspections or lack of inspections at critical times, was a deficiency in these evaluations.
- Increasing maintenance of watercraft launch areas. Although no significant associations were found between effectiveness ratings and areas with unresolved maintenance needs, 60 percent of the sites with maintenance needs reported that those needs contributed to effectiveness problems. In addition, effectiveness ratings were better when no corrective actions were needed than when corrective actions were needed and implemented or not taken or when the need for corrective actions was unknown.

Recreation G: Best Management Practices Monitoring Form

Best Management Practices Evaluation Rec G. Active Construction of Watercraft Launches or Operation of Watercraft Launches (Reference BMPs Rec-1, Rec-8, Rec-9, Fac-6, and Road-9) v3.0 February 2016	
Header	
Rec G-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec G-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec G-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec G-Q4	Date of current field evaluation:
Rec G-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:
Rec G-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:
Rec G-Q7	Reviewers and titles:
Rec G-Q8a	Region number:
Rec G-Q8b	State:
Rec G-Q9a	Proclaimed Forest or Grassland number and name:
Rec G-Q9b	Administrative Forest or Grassland number and name:
Rec G-Q10	District number and name:
Rec G-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec G-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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec G-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: a. Yes b. No 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:
Rec G-Q12	6 th level HUC number and name for the subwatershed this watercraft launch is in:
Rec G-Q13	Is the watercraft launch located within a municipal supply watershed? Select one: a. Yes b. No
Rec G-Q14a	Location. UTM Zone: UTM Datum:
Rec G-Q14b	Location. Easting:
Rec G-Q14c	Location. Northing:
Rec G-Q15a	Location. Latitude:
Rec G-Q15b	Location. Longitude:
Rec G-Q15c	Location. Lat/Long Datum:
Rec G-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec G-Q17	Name of site:
Rec G-Q18	What is the evaluation examining? Select one: a. New construction/reconstruction (go to question 19) b. Existing launch (go to question 20)
Rec G-Q19	Date construction or reconstruction began:
Rec G-Q20	Dates this site will be open for use (if new) or dates it is normally open for use (month to month):
Rec G-Q21	What is the horsepower limit for watercraft on this waterbody?

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Header (continued)	
Rec G-Q22	What is the length of the launch ramp above the waterline? (ft or m; specify unit):
Rec G-Q23	Estimated size of the hydrologically connected approach and parking areas (ft ² , m ² , ac, or ha; specify unit):
Rec G-Q24	How are the watercraft launch and approach surfaced or how will they be surfaced? Select all that apply: Native material Gravel Concrete Asphalt Other (specify):
Rec G-Q25	Type of waterbody. Select one: River Pond Lake Reservoir Estuary Other (specify):
Implementation	
Rec G-Q26	What type of watercraft launch activity is being evaluated? Select one: a. Active construction or reconstruction (go to question 27) b. Operation and maintenance of existing launch (go to question 31)
Rec G-Q27	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: a. No planning document containing BMP guidance was used (go to question 29) b. Environmental Impact Statement (EIS) (go to question 28) c. Environmental Assessment (EA) (go to question 28) d. Categorical Exclusion (CE) (go to question 28) e. No project-level NEPA, but guidance was provided in other documents (go to question 28)
Rec G-Q28	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. a. Stormwater control Yes/No/Not applicable b. Temporary erosion control Yes/No/Not applicable c. Temporary drainage control Yes/No/Not applicable d. Areal extent of disturbance Yes/No/Not applicable e. Temporary access routes Yes/No/Not applicable f. Temporary park/staging areas Yes/No/Not applicable g. Excavated material storage/treatment Yes/No/Not applicable h. Surfacing materials Yes/No/Not applicable i. Other (specify): Yes/No/Not applicable

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Implementation (continued)

Rec G-Q29	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. a. Stormwater control Yes/No/Not applicable b. Temporary erosion control Yes/No/Not applicable c. Temporary drainage control Yes/No/Not applicable d. Areal extent of disturbance Yes/No/Not applicable e. Temporary access routes Yes/No/Not applicable f. Temporary park/staging areas Yes/No/Not applicable g. Excavated material storage/treatment Yes/No/Not applicable h. Surfacing materials Yes/No/Not applicable i. Other provisions specified in question 28i Yes/No/Not applicable j. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec G-Q30	Were chemical or fuel spills or leaks that occurred during the construction/reconstruction of this watercraft launch facility handled/treated according to the contingency and emergency response plan? Select one; after answering go to question 35: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during construction or reconstruction c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan
Rec G-Q31	Are there any unresolved maintenance needs related to water, aquatic, and riparian resources that were identified for this watercraft launch facility prior to this evaluation? Select one: a. Yes b. No If Yes, what needs remain unresolved?
Rec G-Q32	Does the operation and maintenance plan, special use permit (SUP), or other O&M guidance documents for this watercraft launch contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 33) b. Plan, SUP, or other O&M guidance documents exist for this site, but they do not contain provisions for water/aquatic/riparian protection (go to question 34) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this site (go to question 34)

continued on next page

Implementation (continued)

Rec G-Q33	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 in the operating season to require implementation, select Not applicable. a. Vegetative erosion control measures adjacent to launch Yes/No/Not applicable b. Non-vegetative erosion control measures in launch area Yes/No/Not applicable c. Drainage control on approach Yes/No/Not applicable d. Launch or approach surfacing requirements Yes/No/Not applicable e. Waste and refuse collection and disposal Yes/No/Not applicable f. Requirements to control the spread of aquatic nuisance or invasive species Yes/No/Not applicable g. Signage requirements to provide information about limiting the spread of aquatic nuisance or invasive species Yes/No/Not applicable h. Wake or wave control measures Yes/No/Not applicable i. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec G-Q34	Were chemical or fuel spills or leaks that occurred at this watercraft launch facility during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during past 5 years c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan
Rec G-Q35	Were inspections and/or contract administration during construction/reconstruction or during this operating season performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Not applicable, work was conducted to avoid critical times c. Yes d. No
Rec G-Q36	If problems occurred during construction/reconstruction or 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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination

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Implementation <i>(continued)</i>	
Rec G-Q37	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39)
Rec G-Q38	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec G-Q39	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 40) b. No (go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec G-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.
Effectiveness	
Rec G-Q41	Are you evaluating active construction/reconstruction of the watercraft launch? Select one: a. Yes (go to question 42) b. No (go to question 47)
Rec G-Q42	Is there evidence of uncontrolled erosion or sedimentation due to the construction/reconstruction activities? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of uncontrolled erosion or sedimentation (go to question 52) b. Evidence of uncontrolled erosion or sedimentation, but no deposition in the waterbody (go to question 44) c. Evidence of uncontrolled sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 43)
Rec G-Q43	How many total places do you observe erosion or sedimentation delivered to/present in the waterbody and changes to waterbody morphology? Select one; after answering go to question 45: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec G-Q44	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet

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Effectiveness *(continued)*

Rec G-Q45	For all of the occurrences of uncontrolled erosion and sedimentation in the area you identified in question 42, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec G-Q46	Are the observed erosion, sediment deposition, and changes to waterbody morphology within the amounts described in project planning? Select one; after answering go to question 52: a. Amounts are within those described in planning b. Amounts exceed those described in planning c. Amounts expected were not described in planning
Rec G-Q47	Is there evidence of erosion or sedimentation in the area of the watercraft launch or its approach? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of erosion or sedimentation (go to question 52) b. Evidence of erosion or sedimentation, but no deposition in the waterbody (go to question 49) c. Evidence of sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 48)
Rec G-Q48	How many total places do you observe erosion or sedimentation delivered to/present in the waterbody and changes to waterbody morphology? Select one; after answering go to question 50: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec G-Q49	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet

continued on next page

Effectiveness *(continued)*

Rec G-Q50	For all of the occurrences of erosion and sedimentation in the area you identified in question 47, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec G-Q51	What are the causes? Select all that apply: a. Improper drainage on approach b. Wheel slip on the launch ramp c. Wave action d. Improper surfacing on watercraft ramp e. Inadequate surfacing on approach to watercraft launch f. Lack of ground cover adjacent to ramp g. Lack of or improper maintenance h. Side slopes of approach or launch area too steep or unstable i. Other (specify): j. Unknown
Rec G-Q52	What evidence of trash or domestic animal or human sanitary waste exists in the watercraft launch area? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste (go to question 54) b. Evidence of trash outside the waterbody (go to question 53) c. Evidence of trash in the waterbody (go to question 53) d. Evidence of domestic animal or human sanitary waste/toilet paper outside the waterbody (go to question 53) e. Evidence of domestic animal or human sanitary waste/toilet paper in the waterbody (go to question 53)
Rec G-Q53	What are the causes? Select all that apply: a. Insufficient number of waste receptacles b. Waste receptacles not emptied frequently enough c. Insufficient number of toilet facilities d. Toilet facilities are not functioning properly e. Inconsiderate human actions f. Use is exceeding carrying capacity g. Other (specify):

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Effectiveness (continued)	
Rec G-Q54	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the watercraft launch area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside the waterbody c. Evidence of chemical or fuel spills or leaks in the waterbody d. Evidence of chemical or fuel waste containers outside the waterbody e. Evidence of chemical or fuel waste containers in the waterbody
Rec G-Q55	Is there evidence of aquatic invasive species present within the watercraft launch area? Select one: a. Yes b. No If Yes, list the aquatic invasive species observed:
Rec G-Q56	Did any of the unresolved maintenance needs for this watercraft launch facility contribute to any observed problems? Select one: a. Not applicable, evaluation was for construction/reconstruction b. Not applicable, no unresolved maintenance needs existed for this watercraft launch area c. Yes d. No
Rec G-Q57	If inspections were not conducted at critical times during construction/ reconstruction or during this operating season, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times b. Yes c. No
Rec G-Q58	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 59) b. No (go to question 60)
Rec G-Q59	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec G-Q60	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 61) b. No (go to General Comments)
Rec G-Q61	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	

Recreation H—Completed Ski Area Construction or Reconstruction

Recreation H: Descriptive Statistics

Seventeen completed ski area construction projects were evaluated (10 in FY15/16 and 7 in FY17/18). In the western United States, five regions completed at least one evaluation; Regions 5 and 10 (California and Alaska, respectively) completed none. Three evaluations were completed in New England. (See App. 1 for region delineations.) Every evaluation indicated that a reason for monitoring was to meet National BMP targets; 8 evaluations also indicated project review as a reason. Fourteen projects were selected randomly (Table 40). Evaluations included implementation and effectiveness monitoring completed on the same day for 15 projects; the other 2 evaluations completed only implementation monitoring.

Construction project evaluations included ski runs, lift towers or supports, lift terminals, and lift lines most frequently (Rec H-Q19). When ski runs, lift lines, or snowmaking systems were reviewed, the evaluated length ranged from 500 feet to just over 3 miles and averaged approximately 0.5 mile (Rec H-Q22). The mean total area reviewed when lift terminals, towers, or pump houses were evaluated was about 5 acres and ranged from 1000 square feet to 26 acres (Rec H-Q23). No water storage construction projects were evaluated. The nearest waterbody to the edge of linear features or perimeter of areal features being evaluated (Rec H-Q24) was 207 feet (standard error [se] = 111 feet) away on average in FY15/16 and 135 feet (se = 81 feet) away in FY17/18. Nine projects included ski runs, and six of those included slope grading during construction (Rec H-Q25). Snow making occurred on five of the nine ski runs (Rec H-Q26). No off-season activities were permitted on two ski runs, two allowed hiking, and two allowed travel on an access road that crossed the ski run (Rec H-Q27).

Every ski area project had a primary planning document from NEPA or other guidance documents that specified BMPs for the project (Rec H-Q28). On average, applicable BMPs from planning were included in the project contract or plan (Rec H-Q29) for 83 and 74 percent of projects evaluated in FY15/16 and FY17/18, respectively. BMPs in the provisions “scheduling/staging/phasing of construction requirements to limit amount of disturbed area” and “topsoil management requirements” were applicable and included in the contract or plan for all projects in FY15/16. In FY17/18, BMPs in the provision “ground cover requirements” were applicable and included in the project or plan for all projects. BMPs in the provisions “maintenance requirements for access routes” in FY15/16 and “slope grade requirements” in FY17/18 were included most frequently in planning documents but not carried into the project contract or plan. On average, projects in FY15/16 had BMPs included in 10 provisions; in FY17/18, projects averaged BMPs in 7 provisions. All applicable BMPs were implemented fully (Rec H-Q30) in an average of 89 percent of projects in FY15/16 and 73 percent of projects in FY17/18. The provisions “location of ski run,” “location of lift line,” and “slope grade requirements” had all applicable BMPs implemented fully in both monitoring periods. Two other provisions in FY15/16 and four in FY17/18 also were implemented fully for all projects. The two provisions related to cross drains were implemented fully least frequently in each monitoring period.

Additional erosion control measures (Rec H-Q31) were needed for 10 projects; for 2 projects, they were not applied. Twelve projects had applicable federal, state, or local permit requirements (Rec H-Q32); 10 of those projects obtained all required permits. Two projects reported that all inspections did not occur during critical times for addressing water quality issues (Rec H-Q33), 12 indicated that inspections were at critical times, and 3 reported that work avoided critical times. Corrective actions were needed to address problems during project implementation (Rec H-Q34) for five projects; of these, one reported that needed actions were not taken. Every administrative unit that conducted a ski area evaluation had a contingency and emergency response plan for handling chemical spills, although no spills or leaks occurred (Rec H-Q35).

BMP effectiveness is evaluated by reviewing the construction area, including a waterbody crossing and approach if it exists, for evidence of erosion, sedimentation, and chemical or fuel spills, leaks, or waste containers. Only the most severe cases of erosion or sedimentation are reported (Rec H-Q40, Rec H-Q47) 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. All occurrences of chemical pollutants are reported (Rec H-Q52). Of the 15 projects evaluated for effectiveness, 9 had no observed evidence of erosion or sedimentation in the construction area, 2 had observed evidence in a waterbody (Rec H-Q40), 1 had evidence in an AMZ, and 3 had evidence outside an AMZ. The types of waterbodies affected or potentially affected were perennial streams or rivers, intermittent streams, and wetlands (Rec H-Q43). The type of evidence observed most often was sheet erosion (Rec H-Q45). The causes reported most frequently were improper construction of water control features, insufficient ground cover, and road-related issues (Rec H-Q46). Nine projects included a waterbody crossing. One evaluation reported evidence of erosion in a waterbody (Rec H-Q47); the crossing structure was a culvert and the intermittent stream crossing had diversion potential (Rec H-Q51), but the length was not reported. Types of evidence included localized sediment deposition and changes to both the substrate composition and waterbody geometry (Rec H-Q50). One evaluation reported evidence in the crossing area (Rec H-Q47); the types of evidence were bank instability and rill erosion. Chemical pollutants were not observed during any effectiveness evaluation (Rec H-Q52). For the two projects that did not have inspections at critical times, one evaluation was implementation only and the other indicated that the lack of inspections contributed to problems observed during the effectiveness review (Rec H-Q53).

Recreation H: Ratings and Component Scores

Thirty-five percent of the Rec H projects in both monitoring periods combined were rated as *fully implemented*, 35 percent were rated as *marginally implemented*, and one project (6 percent) was rated as *not implemented*. For effectiveness, 73 percent of the Rec H projects were rated as *effective*, and two projects (13 percent) were rated as *not effective*. Composite rating results for Rec H projects with complete data that were evaluated for both implementation and effectiveness are given in Table 174. Forty-seven percent of projects had a composite rating of *excellent*, and 33 percent were rated as *good*. The implementation and effectiveness ratings were significantly associated in FY15/16

Table 174.—Composite rating matrix for Rec H projects evaluated for both implementation and effectiveness in FY15/16 (n=9 evaluations) and FY17/18 (n=6 evaluations). Numbers in cells indicate the number of evaluations 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	4		3		
	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	2	1	1		
	Mostly effective			1		
	Marginally effective					
	Not effective				1	

Excellent
 Good
 Fair
 Poor
 No plan

($p = 0.03$) but not in FY17/18 ($p = 0.73$). However, in both periods, full and partial project implementation (i.e., better than a *not implemented* rating) had better BMP effectiveness (Table 174).

The implementation rating components and their interpretations for Rec H are given in Table 115. Nine projects had planning component scores of *all*, which indicated that all BMPs to protect water resources in planning documents were included in the construction project contract or plan. The other eight projects had *some* scores for the planning component; on average, 35 percent of BMPs from planning were not included in the contract or plan. Ten projects scored as *all* for the on-the-ground execution component (i.e., all applicable BMPs were implemented fully), and 14 of 17 projects also had that score for the project oversight component. Thirty-two percent of applicable BMP provisions were not implemented fully on average for projects with *some* scores for the on-the-ground execution component. The two projects that scored as *some* for the project oversight component did not have all or some inspections at critical times, and the one project that scored as *none* for the component needed but did not receive both supplemental erosion control and corrective actions. Six construction projects had an implementation rating of *fully implemented* due to achieving *all* scores for each of the three components. Four projects with *some* scores for the planning component and *all*

scores for the other two components had implementation ratings of *mostly implemented*. An on-the-ground execution component score of *some* resulted in an implementation rating of *marginally implemented* for six projects; of those, three projects also had *some* scores for the planning component, and two of the three had *some* scores for the project oversight component. The one *none* score for the project oversight component resulted in a *not implemented* implementation rating, although the other two component scores were *some*.

The effectiveness rating components and their interpretations for Rec H are given in Table 175. When a project did not include a waterbody crossing and approach, the missing component was scored *no waterbody crossing* (Table 175), which did not influence the final effectiveness rating. All evaluations had a chemical pollutants component score of *effective*. For the erosion and sedimentation-construction and erosion and sedimentation-waterbody crossing components, respectively, 12 of 17 and 7 of 9 evaluations were scored as *effective*. Eleven projects had *effective* or *no waterbody crossing* scores for both erosion and sedimentation components and an overall effectiveness rating of *effective*. One project each had a *mostly effective* score for one of the erosion and sedimentation components and a rating of *mostly effective*. A *not effective* score for either erosion and sedimentation component would result in a *not effective* rating and that occurred for two projects; one had a *not effective* score for only the erosion and sedimentation-construction component, and the other had that score for both erosion and sedimentation components.

Table 175.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec H protocol

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-construction	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-waterbody crossing	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 and approach; does not affect the effectiveness rating
Chemical pollutants	Effective	No adverse effect
	Moderately effective	Potential adverse effect
	Not effective	Major adverse effect

Recreation H: Best Management Practices Monitoring Form

Best Management Practices Evaluation

Rec H. Completed Ski Area Construction or Reconstruction

(Reference BMPs Rec-1, Rec-7, Rec-9, Rec-10, Rec-11, Rec-12, Fac-2, and Fac-6)

v3.0 February 2016

Header	
Rec H-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec H-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec H-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec H-Q4	Date of current field evaluation:
Rec H-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:
Rec H-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:
Rec H-Q7	Reviewers and titles:
Rec H-Q8a	Region number:
Rec H-Q8b	State:
Rec H-Q9a	Proclaimed Forest or Grassland number and name:
Rec H-Q9b	Administrative Forest or Grassland number and name:
Rec H-Q10	District number and name:
Rec H-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec H-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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec H-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: a. Yes b. No 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:
Rec H-Q12	6 th level HUC number and name for the subwatershed this facility is in:
Rec H-Q13	Is any part of the construction/reconstruction project being evaluated located within a municipal supply watershed? Select one: a. Yes b. No
Rec H-Q14a	Location. UTM Zone: UTM Datum:
Rec H-Q14b	Location. Easting:
Rec H-Q14c	Location. Northing:
Rec H-Q15a	Location. Latitude:
Rec H-Q15b	Location. Longitude:
Rec H-Q15c	Location. Lat/Long Datum:
Rec H-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec H-Q17	Name of ski area:
Rec H-Q18	Name of the permit holder who operates the ski area:

continued on next page

Header (continued)	
Rec H-Q19	Type of construction being evaluated. Select all that apply: a. Ski run b. Lift line c. Lift towers or supports d. Lift terminal e. Snowmaking system pipeline f. Snowmaking system pump house g. Snowmaking system water storage facility
Rec H-Q20	Name or identifier of ski run, lift line, and/or snowmaking system being evaluated:
Rec H-Q21	Date construction was completed:
Rec H-Q22	Length of the ski run, lift line, or snowmaking system being evaluated (ft, m, mi, or km; specify unit):
Rec H-Q23	Total area evaluated for the lift terminal, tower/supports, pump house, or water storage facility (ft ² , m ² , ac or ha; specify unit):
Rec H-Q24	What is the shortest distance between the perimeters or edges of the locations being evaluated and the nearest waterbody? (ft or m; specify unit):
Rec H-Q25	If a ski run is being evaluated, was the slope graded during construction? Select one: a. Not applicable, a ski run is not part of the evaluation (end header questions) b. Yes (go to question 26) c. No (go to question 26)
Rec H-Q26	Is snow making applied to this ski run? Select one: a. Yes b. No
Rec H-Q27	What off-season activities are allowed on this ski run? Select all that apply: a. No activities permitted b. Mountain biking c. Hiking d. Grass skiing e. Other (specify):
Implementation	
Rec H-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: a. No planning document containing BMP guidance was used (go to question 30) b. Environmental Impact Statement (EIS) (go to question 29) c. Environmental Assessment (EA) (go to question 29) d. Categorical Exclusion (CE) (go to question 29) e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 29)

continued on next page

Implementation *(continued)*

Rec H-Q29	Indicate if provisions to protect water, aquatic, and riparian resources in the list below from the decision document, ski area Master Development Plan (MDP), 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, ski area MDP, or other BMP guidance documents. a. Location of ski run Yes/No/Not applicable b. Location of lift line Yes/No/Not applicable c. Location of snowmaking system Yes/No/Not applicable d. Scheduling/staging/phasing of construction requirements to limit amount of disturbed area Yes/No/Not applicable e. Cross drain spacing requirements Yes/No/Not applicable f. Cross drain construction or installation requirements Yes/No/Not applicable g. Waterbody crossing construction or installation requirements Yes/No/Not applicable h. Slope grade requirements Yes/No/Not applicable i. Surface treatment requirements (species requirements, amendments, mowing, irrigation) Yes/No/Not applicable j. Ground cover requirements Yes/No/Not applicable k. Maintenance requirements for access routes Yes/No/Not applicable l. Vegetation clearing and slash disposal requirements Yes/No/Not applicable m. Topsoil management requirements Yes/No/Not applicable n. Other (specify): Yes/No/Not applicable
Rec H-Q30	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. a. Location of ski run Yes/No/Not applicable b. Location of lift line Yes/No/Not applicable c. Location of snowmaking system Yes/No/Not applicable d. Scheduling/staging/phasing of construction requirements to limit amount of disturbed area Yes/No/Not applicable e. Cross drain spacing requirements Yes/No/Not applicable f. Cross drain construction or installation requirements Yes/No/Not applicable g. Waterbody construction or installation requirements Yes/No/Not applicable h. Slope grade requirements Yes/No/Not applicable <i>(continued)</i>

continued on next page

Implementation (continued)	
(Rec H-Q30 continued)	i. Surface treatment requirements (species requirements, amendments, mowing, irrigation) Yes/No/Not applicable j. Ground cover requirements Yes/No/Not applicable k. Maintenance requirements for access routes Yes/No/Not applicable l. Vegetation clearing and slash disposal requirements Yes/No/Not applicable m. Topsoil management requirements Yes/No/Not applicable n. Other provisions specified in question 29n Yes/No/Not applicable o. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
Rec H-Q31	Was supplemental erosion control applied within the project area? Select one: a. Needed and applied b. Needed but not applied c. Not needed If applied, what supplemental erosion control was used?
Rec H-Q32	Were all applicable federal, state or local permits (e.g., CWA 402 stormwater, 404 dredge and fill, etc.) pertaining to water quality protection obtained prior to construction/reconstruction? Select one: a. Not applicable, no permits required b. Yes c. No If No, indicate which permits were not obtained:
Rec H-Q33	Were project inspection and/or contract administration during construction/reconstruction performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Not applicable, work was conducted to avoid critical times c. Yes d. No
Rec H-Q34	If problems occurred during construction/reconstruction that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec H-Q35	Were chemical or fuel spills or leaks that occurred during this construction/reconstruction project handled/treated according to the ski area's contingency and emergency response plan? Select one: a. The ski area has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during construction/reconstruction c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan

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Implementation <i>(continued)</i>	
Rec H-Q36	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 37) b. No (go to question 38)
Rec H-Q37	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec H-Q38	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 39) b. No (go to question 40 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec H-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	
Rec H-Q40	Excluding where the ski run/lift line/snowmaking system crosses the waterbody, is there evidence of erosion or sedimentation from the construction/reconstruction project? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 47) b. Evidence of erosion or sedimentation outside an AMZ (go to question 42) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 42) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 41)
Rec H-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 : a. 1 or 2 b. 3 or 4 c. 5 or more
Rec H-Q42	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
Rec H-Q43	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: a. Ephemeral stream b. Intermittent stream c. Perennial stream d. Pond e. Lake f. Wetland or wet meadow g. Other (specify):
Rec H-Q44	What is the width of the AMZ associated with the waterbody? (ft or m; specify unit):

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Effectiveness <i>(continued)</i>	
Rec H-Q45	For all of the occurrences of erosion and sedimentation in the area you identified in question 40, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec H-Q46	What are the causes? Select all that apply: a. Lack of, or insufficient number of water control features b. Improper spacing of water control features c. Improper construction of water control features d. Improper or inadequate maintenance of water control features e. Poor ski run location f. Improper grades on ski run g. Insufficient ground cover h. Road related causes i. Other (specify): j. Unknown
Rec H-Q47	At the waterbody crossing and its approach, is there evidence of erosion or sedimentation attributable to the construction/reconstruction of the crossing? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to d. a. Not applicable, no waterbody crossing on the linear feature, or only a point feature is being evaluated (go to question 52) b. No evidence of erosion or sedimentation (go to question 51) c. Evidence of erosion or sedimentation, but no deposition in the waterbody (go to question 48) d. Evidence of sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 48)
Rec H-Q48	What type of waterbody is crossed by this ski run, lift line, or snowmaking pipeline? Select one: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Wetland or wet meadow e. Other (specify):

continued on next page

Effectiveness (continued)	
Rec H-Q49	What type of waterbody crossing structure is employed at the crossing? Select one: a. None (natural channel) b. Armored channel c. Half culvert cover d. Culvert e. Bridge f. Other (specify):
Rec H-Q50	For all of the occurrences of erosion and sedimentation in the area you identified in question 47, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec H-Q51	Does the waterbody crossing have diversion potential? Select one: a. Yes b. No If Yes, what is the probable length of the diversion potential (ft or m; specify unit):
Rec H-Q52	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec H-Q53	If inspections were not conducted at critical times during the construction/reconstruction, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times b. Yes c. No
Rec H-Q54	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 55) b. No (go to question 56)

continued on next page

Effectiveness <i>(continued)</i>	
Rec H-Q55	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec H-Q56	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 57) b. No (go to General Comments)
Rec H-Q57	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	

Recreation I—Ski Run Operation and Maintenance

Recreation I: Descriptive Statistics

Seven ski runs in each monitoring period were evaluated for operation and maintenance (O&M). All but one of the ski runs were selected randomly. Every region except Regions 8 and 10 completed at least one ski run O&M evaluation (Table 40; see App. 1 for region delineations). Every evaluation was completed to meet National BMP targets, and 13 of the 14 evaluations included both implementation and effectiveness monitoring completed on the same day. The other evaluation included only the implementation portion of the review. Mean ski run length (Rec I-Q20) was 2,628 feet (standard error [se] = 280 feet) and ranged from about 880 feet to 4,000 feet. Portions of nine ski runs were in an aquatic management zone (AMZ), two ski runs were not in an AMZ, and the nearest waterbody to three ski runs had no designated AMZ (Rec I-Q23). On average ski runs were 75 feet (se = 29 feet) from the nearest waterbody (Rec I-Q22), although six ski runs reported a distance of 0 feet to a waterbody. Eight ski runs had snow making applied to the run (Rec I-Q23). Off-season activities (Rec I-Q24) were allowed on 11 ski runs; hiking was allowed on all the ski runs, and mountain biking also was allowed on six ski runs.

Twelve ski runs had operation and maintenance plans or other guidance documents that included BMPs to protect water, aquatic, and riparian resources (Rec I-Q35). Two ski runs had plans that did not contain BMPs. On average, when BMP provisions were applicable, they were implemented fully for 86 percent of evaluations (Rec I-Q36). O&M plans or other documents averaged BMPs in six provisions per ski run, with the provisions “surface treatment” and “location of activities or features” included most frequently and implemented fully (100 percent of evaluations). BMPs related to ground cover requirements were implemented least often (67 percent of evaluations) when applicable. Seven evaluations reported that ski run inspections during the past 12 months were conducted during critical times for addressing water quality issues (Re I-Q27), two ski runs had inspections but not during critical times, and five ski runs were not inspected. Problems requiring corrective actions had not occurred during the past

12 months for nine ski runs (Rec I-Q28). For the remainder, four ski runs had problems; of these, corrective actions were taken on three. Seven of the 14 ski runs had maintenance scheduled during the current operating season, and maintenance had been completed for five runs prior to the evaluation. One ski run had been closed or its use was restricted in the past 5 years (Rec I-Q30), and two others needed treatments to reduce impacts to water resources (Rec I-Q32). Treatments were applied to one ski run but not the other. The reasons for the closure were an extreme weather event and road washout. Grass seeding in an area where snow making equipment was repaired was the treatment applied. One ski area did not have a contingency and emergency response plan (CERP) for chemical spill handling, two areas had spills or leaks in the past 5 years that were handled according to the area CERP, and the other areas had no spills (Rec I-Q35).

BMP effectiveness is evaluated by reviewing a segment of the ski run and a waterbody crossing and approach if it exists in the evaluated segment for evidence of erosion, sedimentation, trash, domestic animal or human waste, and chemical or fuel spills, leaks, or waste containers. Only the most severe cases of erosion or sedimentation are reported (Rec I-Q40, Rec I-Q47) 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. All occurrences of trash, waste, and chemical pollutants are reported (Rec I-Q52 and Rec I-Q53). Thirteen ski runs were evaluated for effectiveness; four had no observed evidence of erosion or sedimentation, four had evidence outside an AMZ, two had evidence within an AMZ, and three had observed evidence in a waterbody. The types of waterbodies affected or potentially affected were ephemeral, intermittent, and perennial streams and one wetland (Rec I-Q43). The types of evidence observed most often were vegetation damage or bare ground and rill erosion (Rec I-Q45). The reported causes of the erosion or sedimentation (Rec I-Q46) were frequently insufficient ground cover and road-related issues. Seven evaluated ski run segments included a waterbody crossing. Evidence of erosion or sedimentation (Rec I-Q47) was observed in a waterbody for two crossings on intermittent streams and in the crossing area for a perennial stream. When evidence was observed in a waterbody, one crossing had no crossing structure, and the other was a constructed berm (Rec I-Q49). The berm stream crossing had diversion potential (Rec I-Q51), and the probable length was 1,000 feet. Types of evidence included traceable and localized sediment deposition, changes to substrate composition and waterbody geometry, bank instability, and rill erosion (Rec I-Q50). Trash or waste was observed during six evaluations. Trash was observed in all three locations (Rec I-Q52), and one evaluation observed domestic animal or human sanitary waste outside and within an AMZ. Chemical or fuel waste containers were observed within an AMZ on one ski run (Rec I-Q53). For the seven ski runs that had no inspections or did not have inspections at critical times (Rec I-Q27), one evaluation was implementation only, four indicated the lack of inspections did not contribute to problems observed during the effectiveness review (Rec I-Q54), and two provided incompatible answer choices for Rec I-Q27 and Rec I-Q54.

Recreation I: Ratings and Component Scores

Of the 14 evaluated Rec I ski runs, 1 ski run in both monitoring periods combined was rated as *fully implemented*. Six were rated as *mostly implemented*. Seven were rated as *effective*. Composite rating results for Rec I sites with complete data that were evaluated

for both implementation and effectiveness are given in Table 176. Forty-two percent of ski runs had a composite rating of *good*, and 25 percent each were rated as *excellent* and *poor*. The implementation and effectiveness ratings were not significantly associated in either period ($p = 1.00$ for both)—better effectiveness occurred at all levels of implementation.

The implementation rating components and their interpretations for Rec I are given in Table 64. Twelve ski runs had planning component scores of *all*, indicating that BMPs to protect water resources were included in the site O&M plan or other guidance documents. Two ski runs had *no BMPs prescribed* scores for the planning component because the site O&M plan or documents did not include BMPs. Nine ski runs scored as *all* for the on-the-ground execution component (i.e., all applicable BMPs were implemented fully), and five ski runs scored as *some* for that component. On average, 25 percent of applicable BMP provisions were not implemented fully for projects with *some* scores for the on-the-ground execution component. Five ski runs scored as *all* for the project oversight component, and nine scored as *some*. Seven of the ski runs that scored as *some* for the project oversight component did not have inspections or all or some inspections at critical times, one ski run needed corrective actions that were not taken, and one ski run did not apply needed treatments. One ski run had an implementation rating of *fully implemented* due to achieving *all* scores for the three components. Six ski runs with *some* scores

Table 176.—Composite rating matrix for Rec I areas evaluated for both implementation and effectiveness in FY15/16 ($n=7$ evaluations) and FY17/18 ($n=5$ evaluations). Numbers in cells indicate the number of evaluations 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	2	
	Mostly effective		1			
	Marginally effective					
	Not effective		1	1		

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

Excellent
 Good
 Fair
 Poor
 No plan

for the project oversight component and *all* scores for the other two components had implementation ratings of *mostly implemented*. An on-the-ground execution component score of *some* resulted in an implementation rating of *marginally implemented* for five ski runs; two of those also had *some* scores for the project oversight component. The two *no BMPs prescribed* scores for the planning component resulted in a *not implemented* implementation rating, although the other two component scores were *all* or *some*.

The effectiveness rating components and their interpretations for Rec I are given in Table 177. When a ski run did not include a waterbody crossing and approach, the missing component was scored *no waterbody crossing* (Table 177) and did not affect the final effectiveness rating. Of the evaluated sites, 9 of 13 and 3 of 7 had a score of *effective* for the erosion and sedimentation-ski run and erosion and sedimentation-waterbody crossing components, respectively. Seven ski runs had *effective* or *no waterbody crossing* scores for all four components and an overall effectiveness rating of *effective*. One ski run had a *mostly effective* score for the erosion and sedimentation-waterbody crossing component, and one ski run had a *moderately effective* score for the chemical pollutants component; the other component scores were *effective*, and the ratings were *mostly effective*. One ski run had a *marginally effective* score for the erosion and sedimentation-ski run component, which resulted in a *marginally effective* rating. A *not effective* score for any component would result in a *not effective* rating, which occurred for two ski runs. However, in both cases three components—both erosion and sedimentation components and the trash and waste component—had *not effective* scores. One ski run had incomplete data for the erosion and sedimentation-ski run component and could not be scored or rated.

Table 177.—Effectiveness components, their scores, and interpretation of each score used for determining overall effectiveness ratings for the Rec I protocol

Effectiveness component	Component score	Score interpretation
Erosion and sedimentation-ski run	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-waterbody crossing	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 and approach; does not affect the effectiveness rating
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

Recreation I: Best Management Practices Monitoring Form

Best Management Practices Evaluation Rec I. Ski Run Operation and Maintenance (Reference BMPs Rec-1, Rec-7, Rec-9, Rec-10, Rec-11, and Rec-12) v3.0 February 2016	
Header	
Rec I-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
Rec I-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
Rec I-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
Rec I-Q4	Date of current field evaluation:
Rec I-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:
Rec I-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:
Rec I-Q7	Reviewers and titles:
Rec I-Q8a	Region number:
Rec I-Q8b	State:
Rec I-Q9a	Proclaimed Forest or Grassland number and name:
Rec I-Q9b	Administrative Forest or Grassland number and name:
Rec I-Q10	District number and name:
Rec I-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
Rec I-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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
Rec I-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: a. Yes b. No 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:
Rec I-Q12	6 th level HUC number and name for the subwatershed this ski run is in:
Rec I-Q13	Is the ski run located within a municipal supply watershed? Select one: a. Yes b. No
Rec I-Q14a	Location. UTM Zone: UTM Datum:
Rec I-Q14b	Location. Easting:
Rec I-Q14c	Location. Northing:
Rec I-Q15a	Location. Latitude:
Rec I-Q15b	Location. Longitude:
Rec I-Q15c	Location. Lat/Long Datum:
Rec I-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
Rec I-Q17	Name of ski area:
Rec I-Q18	Name of ski run being evaluated:
Rec I-Q19	Name of the permit holder who operates the ski area:
Rec I-Q20	Length of the ski run (ft, m, mi, or km; specify unit):
Rec I-Q21	Is any part of the ski run located within an AMZ? Select one: a. Yes b. No c. Waterbody has no designated AMZ

continued on next page

Header (continued)	
Rec I-Q22	What is the shortest distance between the ski run segment being evaluated and the nearest waterbody? (ft or m; specify unit):
Rec I-Q23	Is snow making applied to this ski run? Select one: a. Yes b. No
Rec I-Q24	What off-season activities are allowed on this ski run? Select all that apply: a. No activities permitted b. Mountain biking c. Hiking d. Grass skiing e. Other (specify):
Implementation	
Rec I-Q25	Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this ski area contain provisions for protecting water, aquatic, and riparian resources from the presence or use of the ski runs? Select one: a. Yes, the plan, SUP or other O&M guidance documents contain provisions for water/aquatic/riparian protection associated with the presence or use of the ski runs (go to question 26) b. Plan, SUP, or other O&M guidance documents exist for this ski area, but they do not contain provisions for water/aquatic/riparian protection associated with the presence or use of the ski runs (go to question 27) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this ski area (go to question 27)
Rec I-Q26	Indicate if provisions to protect water, aquatic, and riparian resources from the presence or use of the ski runs 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 12 months. 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, select Not applicable. a. Location of activities or features Yes/No/Not applicable b. Cross drain spacing Yes/No/Not applicable c. Cross drain construction or installation Yes/No/Not applicable d. Cross drain maintenance Yes/No/Not applicable e. Waterbody crossing construction or installation Yes/No/Not applicable f. Waterbody crossing maintenance Yes/No/Not applicable g. Slope grade Yes/No/Not applicable h. Surface treatment (species, amendments, mowing, irrigation) Yes/No/Not applicable i. Ground cover Yes/No/Not applicable j. Road maintenance (only at locations where roads cross ski runs) Yes/No/Not applicable k. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:

continued on next page

Implementation <i>(continued)</i>	
Rec I-Q27	Were inspections during the past 12 months performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No
Rec I-Q28	If problems occurred during the past 12 months that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
Rec I-Q29	Has the current season's scheduled maintenance been completed on this ski run? Select one: a. Yes, maintenance has been completed b. No maintenance is planned c. No, but maintenance is planned this season d. No, but maintenance is in progress
Rec I-Q30	Has the ski run been closed or have restrictions been placed on its use during the past 5 years to protect or restore water, aquatic or riparian resources? Select one: a. Not applicable, no problems warranted closure or use restriction (go to question 32) b. Needed and closed or use restricted (go to question 31) c. Needed but not closed or use not restricted (go to question 32)
Rec I-Q31	What length of time passed between when the problem was identified and the closure or use restriction was implemented? (days, weeks, months or years; specify unit):
Rec I-Q32	Were any treatments applied to this ski run during the past 5 years to reduce negative impacts to water, aquatic, or riparian resources? Select one: a. Not applicable, no problems warranted application of treatments (go to question 34) b. Needed and applied (go to question 33) c. Needed but not applied (go to question 34) If applied, describe the treatments:
Rec I-Q33	What length of time passed between when the problem was identified and the treatment was applied? (days, weeks, months, or years; specify unit):
Rec I-Q34	Why was the ski run closed, use restricted, and/or treatments applied? Select all that apply: a. Not applicable, no closure, use restriction, or treatments applied during the past 5 years b. Lack of adequate ground cover c. Ski run washout d. Sheet erosion e. Rill erosion f. Gully erosion g. Streambank erosion h. Road washout i. Extreme precipitation/weather event j. Other (specify):

continued on next page

Implementation <i>(continued)</i>	
Rec I-Q35	Were chemical or fuel spills or leaks that occurred at this ski area during the past 5 years handled/treated according to the ski area's contingency and emergency response plan? Select one: a. The ski area has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during the past 5 years c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan
Rec I-Q36	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 37) b. No (go to question 38)
Rec I-Q37	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
Rec I-Q38	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 39) b. No (go to question 40 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
Rec I-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	
Rec I-Q40	Excluding the waterbody crossing and its approach, is there evidence of erosion or sedimentation on or originating from this ski run segment? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 47) b. Evidence of erosion or sedimentation outside an AMZ (go to question 42) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 42) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 41)
Rec I-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: a. 1 or 2 b. 3 or 4 c. 5 or more
Rec I-Q42	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet

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Effectiveness <i>(continued)</i>	
Rec I-Q43	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: a. Ephemeral stream b. Intermittent stream c. Perennial stream d. Pond e. Lake f. Wetland or wet meadow g. Other (specify):
Rec I-Q44	What is the width of the AMZ associated with the waterbody? (ft or m; specify unit):
Rec I-Q45	For all of the occurrences of erosion and sedimentation in the area you identified in question 40, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec I-Q46	What are the causes? Select all that apply: a. Lack of, or insufficient number of water control features b. Improper spacing of water control features c. Improper construction of water control features d. Improper or inadequate maintenance of water control features e. Poor ski run location f. Improper grades on ski run g. Insufficient ground cover h. Road related causes i. Other (specify): j. Unknown
Rec I-Q47	At the waterbody crossing and its approach, is there evidence of erosion or sedimentation? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to d. a. Not applicable, no waterbody crossing (go to question 52) b. No evidence of erosion or sedimentation (go to question 51) c. Evidence of erosion or sedimentation, but no deposition in the waterbody (go to question 48) d. Evidence of sediment transport to or deposition in the waterbody, or evidence of changes to waterbody morphology (go to question 48)

continued on next page

Effectiveness *(continued)*

Rec I-Q48	What type of waterbody is crossed by this ski run? Select one: a. Ephemeral stream b. Intermittent stream c. Perennial stream/river d. Wetland or wet meadow e. Other (specify):
Rec I-Q49	What type of waterbody crossing structure exists at the crossing being evaluated? Select one: a. None (natural channel) b. Armored channel c. Half culvert cover d. Culvert e. Bridge f. Other (specify):
Rec I-Q50	For all of the occurrences of erosion and sedimentation in the area you identified in question 47, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
Rec I-Q51	Does the waterbody crossing have diversion potential? Select one: a. Yes b. No If Yes, what is the probable length of the diversion potential (ft or m; specify unit):
Rec I-Q52	What evidence of trash or domestic animal or human sanitary waste exists on or along the ski run segment, including at the waterbody crossing and its approach? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash outside an AMZ c. Evidence of trash within an AMZ d. Evidence of trash in a waterbody e. Evidence of domestic animal or human sanitary waste/toilet paper outside an AMZ f. Evidence of domestic animal or human sanitary waste/toilet paper within an AMZ g. Evidence of domestic animal or human sanitary waste/toilet paper in a waterbody

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Effectiveness <i>(continued)</i>	
Rec I-Q53	What evidence of chemical or fuel spills or leaks or associated waste containers exists on or along the ski run segment, including at the waterbody crossing and its approach? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
Rec I-Q54	If inspections were not conducted at critical times during the past 12 months, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No
Rec I-Q55	If the ski run was closed, use was restricted, and/or treatments were applied during the past 5 years to protect or restore water, aquatic, or riparian resources, were the desired results achieved? Select one: a. Not applicable, no ski run closures, use restrictions and/or treatments applied during the past 5 years b. The desired result was fully achieved c. The desired result was partially achieved d. Essentially no improvement to the ski run was achieved e. Too soon to determine
Rec I-Q56	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 57) b. No (go to question 58)
Rec I-Q57	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
Rec I-Q58	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 59) b. No (go to General Comments)
Rec I-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	

Recreation Management Summary

Recreation management protocols were the National BMP monitoring protocols used most frequently in the FY15/16 and FY17/18 monitoring periods: 615 evaluations were completed (Table 40), making up about 22 percent of all evaluations completed. Recreation management was the National BMP monitoring program focus resource area

for the FY17/18 monitoring period; each administrative unit was required to complete at least one recreation evaluation. Region 5 (135 evaluations) and Region 9 (102 evaluations) completed the most recreation evaluations; excluding Region 10 (13 evaluations), Region 1 (37 evaluations) and Region 4 (43 evaluations) completed the fewest. Of the nine Recreation protocols, A, B, C, and D were used most frequently and accounted for about 81 percent of the recreation evaluations. The Rec D protocol to evaluate operation and maintenance of motorized or nonmotorized trails (164 evaluations) was used the most, followed by Rec A to evaluate operation and maintenance of developed recreation sites (158 evaluations). Seventy-nine percent of the recreation evaluations were at randomly selected sites (Table 40).

Overall, less than 50 percent of the evaluated sites and projects rated *fully implemented* or *mostly implemented* for BMP implementation. The percentage of *fully implemented* or *mostly implemented* ratings ranged from Rec G (O&M), at about 18 percent, to Rec C, at 63 percent. One-third of all recreation sites or projects were rated *no BMPs*, in most cases indicating that no O&M document existed for the evaluated recreation facility. Rec G (O&M) and Rec B had the greatest percentage of sites rated *no BMPs*, with 63 and 53 percent with those ratings, respectively. The planning component was a deficiency for about 46 percent of the Rec A–D and Rec G (O&M) sites; Rec B and Rec G (O&M) sites had planning deficiencies in more than 50 percent of those evaluations. On-the-ground execution was a deficiency for 15 percent of the Rec A–D and Rec G (O&M) sites; Rec C sites had the greatest percentage, at 25 percent. For project oversight at existing recreation facilities (developed sites, dispersed areas, trails, and watercraft launches), 47 percent or less of the Rec A, Rec B, Rec D, and Rec G (O&M) sites scored *all*. The primary project oversight deficiency was a lack of inspections or lack of inspections at critical times.

BMP effectiveness varied considerably, ranging from 37 percent of the Rec B dispersed recreation areas rated *effective* or *mostly effective* to 74 percent of the Rec C trail projects with those ratings. *Effective* or *mostly effective* ratings indicate that either no impacts to water quality were observed or observed impacts were minor and temporary. Protocols that evaluate existing recreation facilities (Rec A, Rec B, Rec D, and Rec G (O&M)) had the lowest percentages of *effective* or *mostly effective* ratings. Of the effectiveness components, the erosion and sedimentation components generally had poorer scores than the trash and waste components or chemical pollutants component. Evidence of erosion and sedimentation, when observed, was primarily vegetation damage or bare ground, localized sediment deposits, traceable evidence to the waterbody, sheet erosion, or rill erosion. Causes of erosion and sedimentation reported most frequently were related to user-created trails, drainage features, trail location, and trail surface.

For sites or projects in which both the implementation and effectiveness evaluations were completed, better implementation ratings generally were associated with better effectiveness ratings. When associations at the implementation and effectiveness rating level were not significant, examination of implementation and effectiveness components and subcomponents or individual metrics found some significant associations. These findings demonstrate that when BMPs are implemented at recreation sites or projects, water quality is generally protected. In addition, the review teams appear to be recognizing implementation and effectiveness issues while they conduct 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 also are assessed to identify potential issues with application of the National BMP monitoring program. Examination of the data for recreation protocols indicates 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 Rec A, Rec B, Rec C, Rec D, Rec G, Rec H, and Rec I evaluations included implementation only or effectiveness only. Although 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.
- Twelve Rec A and five Rec B evaluations indicated that the normal operating season was 1 month long; however, based on the types of sites, it is more likely that the same opening and closing months were selected to indicate the site operated year-round. The protocol instructions instruct reviews teams to state “January to December” if the site is open year-round.
- Five Rec G (O&M) evaluations completed in FY17/18 selected an incorrect response for Rec G-Q35 (inspections at critical times) based on the protocol instructions for operation and maintenance reviews (Table 161).
- Twenty-nine evaluations (seven Rec A, three Rec B, five Rec C, six Rec D, two Rec E, one Rec F, four Rec G, and one Rec I) were incomplete in the database. Evaluations with incomplete data cannot be rated.
- Header questions (11a, 11b, and 11c) in all protocols were not answered correctly according to the instructions in many evaluations. These questions are designed to capture information about the reasons for monitoring, whether the projects or sites were selected randomly according to the protocol instructions, and whether the protocol instructions for completing the evaluations were followed. The most common mistake was misunderstanding the intended meaning of quality assurance monitoring.
- Incompatible answers to related questions may adversely affect the overall implementation or effectiveness rating. Incompatible answers to related

questions on the location of erosion and sedimentation evidence observed and the erosion and sediment features observed were found (Rec A-Q42, Rec A-Q44, and Table 51; Rec A-Q51, Rec A-Q54 and Table 55; Rec B-Q41, Rec B-Q43, and Table 79; Rec B-Q50, Rec B-Q53, and Table 83; Rec C-Q39, Rec C-Q44, and Table 106; Rec C-Q47, Rec C-Q50, and Table 110; Rec D-Q41, Rec D-Q46, and Table 131; Rec D-Q48, Rec D-Q51, and Table 134; Rec G-Q47, Rec G-Q50 and Table 164). 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.” If localized sediment deposition in a waterbody is observed, the location of the evidence question should be answered “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.

- Inconsistent answers to related questions in the implementation section and effectiveness sections of the protocol make it difficult to interpret the relationship between BMP implementation and BMP effectiveness. Most recreation protocols contain pairs of questions (e.g., Rec A-Q27 and Rec A-Q64, Rec A-Q30 and Rec A-Q65, Rec A-Q32 and Rec A-Q66, Rec A-Q34 and Rec A-Q66; Rec B-Q26 and Rec B-Q63, Rec B-Q30 and Rec B-Q64, Rec B-Q31 and Rec B-Q65, Rec B-Q33 and Rec B-Q65; Rec C-Q32 and Rec C-Q55; Rec D-Q26 and Rec D-Q56, Rec D-Q29 and Rec D-Q57, Rec D-Q31 and Rec D-Q58, Rec D-Q33 and Rec D-Q58; Rec G-Q31 and Rec G-Q56, Rec G-Q35 and Rec G-Q57) regarding project oversight (implementation) and observed problems (effectiveness). In some evaluations, the answer to the effectiveness question conflicted with the answer given for the implementation question.
- A high percentage of evaluations for existing facilities lacked O&M plans or similar documents with BMPs. It was unclear whether units considered Forest Plan Standards and Guidelines as applicable direction for recreation sites and facilities when site-specific documents did not exist.

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.

WATER USES MANAGEMENT

Water uses management BMPs are used to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from development and operation of infrastructure to collect, impound, store, transmit, and distribute water for uses on and off National Forest System (NFS) lands. Water use infrastructure includes wells for public or private water supply or groundwater monitoring; water source developments for Forest Service uses; water diversions and conveyances for uses off NFS lands; and dams and impoundments for water supply storage, flood control, power generation, recreation, and wildlife habitat.

Allocation of water for beneficial use is governed by the states. State laws and programs for water allocation vary widely across the country and include riparian rights systems, administrative permits, and court-adjudicated water rights systems. The Forest Service responsibility when authorizing water use infrastructure projects is to avoid or minimize damage to NFS resources, in compliance with environmental laws and land management plan direction.

Water uses management monitoring results are described separately by protocol: completed construction or operation and maintenance of water wells for monitoring or production (WatUses A), operation and maintenance of spring-source facilities (WatUses B), completed reconstruction/repair or operation and maintenance of water sources (drafting) (WatUses C), active construction of diversions and conveyances (WatUses D), and operation and maintenance of diversions and conveyances (WatUses E). The WatUses A and WatUses C protocols evaluate either completed construction or reconstruction projects (similar to WatUses D) or operation and maintenance of existing wells or water sources without repair activities (similar to WatUses B and WatUses E). These two situations are analyzed and presented separately within the protocol results. The sample sizes for construction are small in each monitoring period, so the analyses for those groups are limited, as they would be if construction or repair had a stand-alone protocol.

The evaluations for the water uses management protocols with larger sample sizes (WatUses A, WatUses B, and WatUses E) were dominated by randomly selected samples (Table 178, Fig. 98). The overall sample sizes for WatUses C reconstruction or repair, WatUses C operation and maintenance, and WatUses D were not large, especially considering that these evaluations represent agency-wide monitoring. Statistical comparisons of the implementation rating and effectiveness rating distributions resulting from randomly and nonrandomly selected samples were performed for the evaluations with sample sizes greater than 10 per monitoring period (Table 178). WatUses A had no significant associations (Fisher's exact test; see methods section in the introduction to this report) between the ratings and sample selection technique for either rating in either monitoring period (implementation: $p = 0.50$ FY15/16, $p = 0.37$ FY17/18; effectiveness: no test FY15/16, $p = 0.15$ FY17/18). WatUses B had multiple significant associations—implementation ratings in both periods ($p = 0.03$ FY15/16, $p = 0.05$ FY17/18) and effectiveness ratings in FY15/16 ($p = 0.05$ FY15/16, $p = 0.63$ FY17/18)—indicating that the rating distributions were different by type of sample selection. In most cases, the

Table 178.—Number of randomly and nonrandomly selected Water Uses Management evaluations in FY15/16 and FY17/18, by region and protocol (Q11b [all WatUses protocols]): WatUses A (Completed Construction or Operation and Maintenance of Water Wells for Monitoring or Production), WatUses B (Operation and Maintenance of Spring-Source Facilities), WatUses C (Completed Reconstruction/Repair or Operation and Maintenance of Water Sources [Drafting]), WatUses D (Active Construction of Diversions and Conveyances), and WatUses E (Operation and Maintenance of Diversions and Conveyances)

Monitoring period	Region	WatUses A random selection	WatUses A nonrandom selection	WatUses B random selection	WatUses B nonrandom selection	WatUses C random selection	WatUses C nonrandom selection	WatUses D random selection	WatUses D nonrandom selection	WatUses E random selection	WatUses E nonrandom selection
FY15/16											
	1	1			2	1				2	
	2	2	2	1	2	1	3	2		5	2
	3	1	1	1	2				2		
	4			4		1	1	2		3	
	5	4	1	4	1	1	2				
	6	2		2	2			1		8	1
	8			3						1	
	9	2									
	10			1				1		1	
	Total	12	4	16	9	4	6	6	2	20	3
	Percent within protocol	75	25	64	36	40	60	75	25	87	13
FY17/18											
	1	2				1	1				
	2			3				1		3	2
	3		3								1
	4	1		3	3					2	3
	5	4		3	2	3	5			1	1
	6	4		8			1	1		12	3
	8										
	9	1									
	10									2	
	Total	12	3	17	5	4	7	2	0	20	10
	Percent within protocol	80	20	77	23	36	64	100		67	33

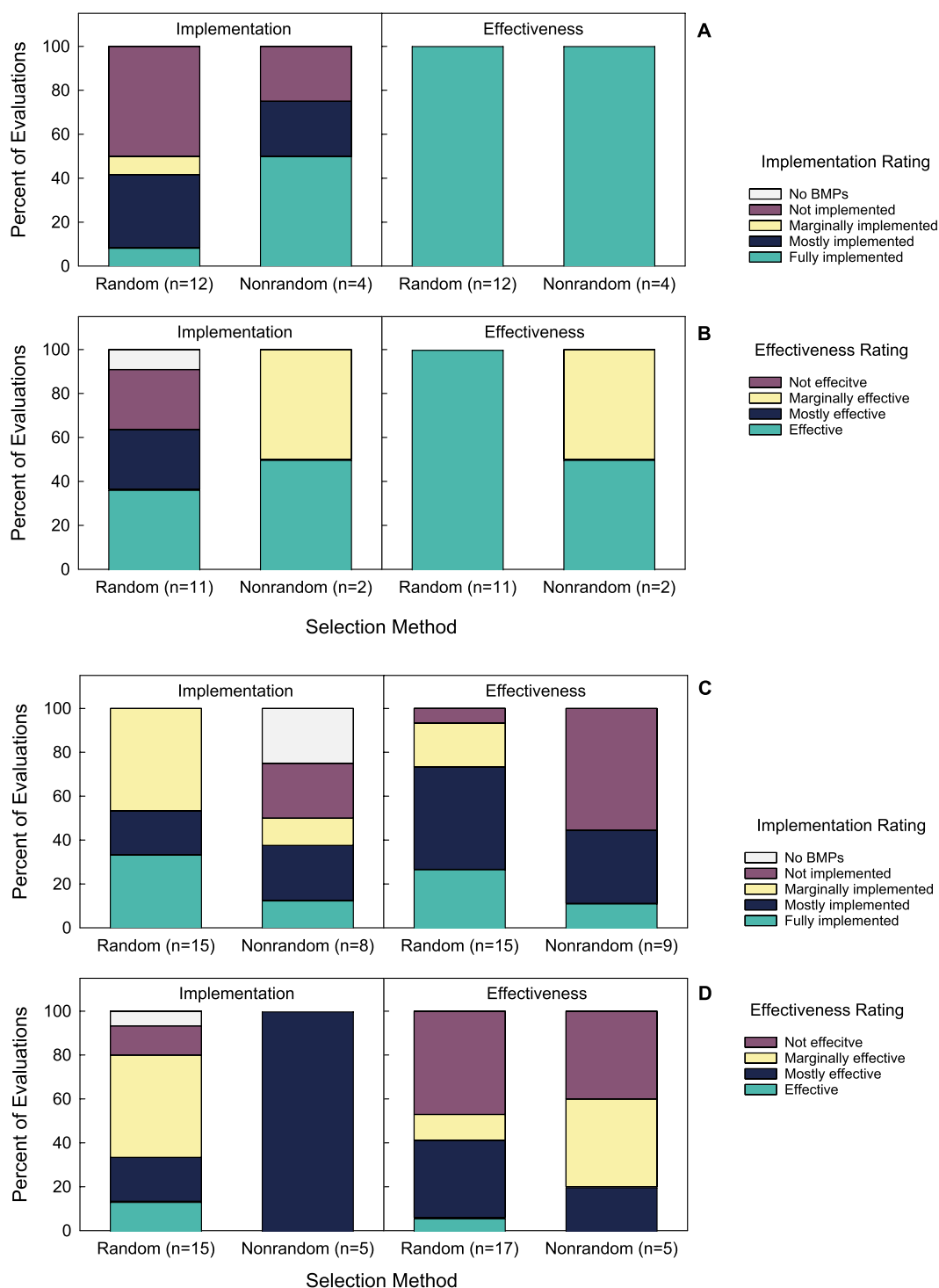


Figure 98.—Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for WatUses A evaluations completed in FY15/16 (A) and FY17/18 (B) and WatUses B evaluations completed in FY15/16 (C) and FY17/18 (D). (continued on next page)

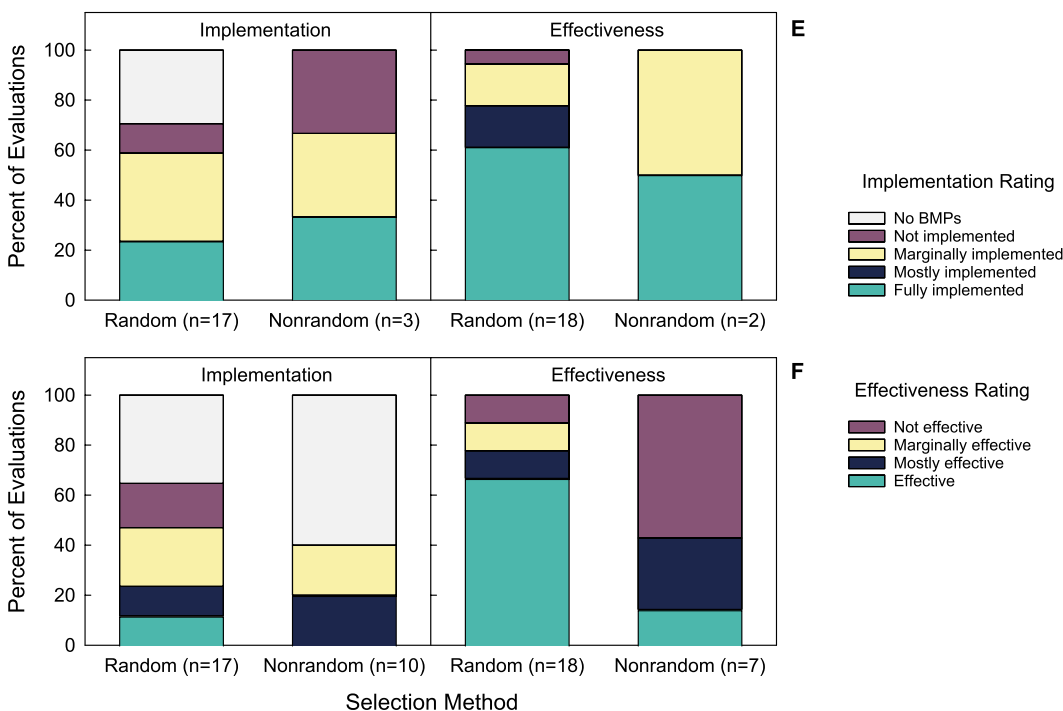


Figure 98.—Distribution of implementation (left panels) and effectiveness (right panels) ratings for randomly and nonrandomly selected samples for WatUses E evaluations completed in FY15/16 (E) and FY17/18 (F).

nonrandomly selected spring-source facilities had poorer ratings compared to randomly selected facilities (Fig. 98C, D). The nonrandomly selected WatUses B evaluations were not included in these analyses. Instead, a summary of those evaluations is provided in Appendix 2. WatUses E had one significant association (implementation: $p = 0.85$ FY15/16, $p = 0.51$ FY17/18; effectiveness: $p = 0.65$ FY15/16, $p = 0.02$ FY17/18): effectiveness ratings with selection method in FY17/18 (Fig. 98F). However, the number of nonrandomly selected evaluations was small and similar distributions of better and poorer effectiveness ratings occurred in both monitoring periods, so all WatUses E samples were included in these analyses.

Results for the WatUses A (operation and maintenance), WatUses B, and WatUses E 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 locations, composition, and types of projects or sites.
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 back to implementation and sometimes header information to provide context between

outcomes and BMP planning and prescription (including operation and maintenance prescriptions) 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 protocol 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 both 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.

A much less detailed presentation of results is provided for the WatUses A (completed construction), WatUses C, and WatUses D evaluations. The analyses for those protocols focus primarily on summarizing the descriptive data (header statistics) and providing an overview of the implementation and effectiveness results and the ratings and component scores.

The large number of analyses 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, but 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.

Water Uses A—Completed Construction or Operation and Maintenance of Water Wells for Monitoring or Production

Water Uses A (Completed Construction): Descriptive Statistics

Seven newly constructed well projects were evaluated (six in FY15/16 and one in FY17/18) in Regions 1, 2, 3, and 5 (see App. 1 for region delineations). A single well was drilled in all the projects. Five projects were selected randomly, and all were evaluated to meet National BMP program targets. Every evaluation included both implementation and effectiveness

monitoring. Two of the new wells had a valid water right, and both were owned by the Forest Service. One well was located in an aquatic management zone¹ (AMZ); the nearest waterbody to another new well did not have a designated AMZ. Five well projects had BMPs in the contract or plan derived from decision documents developed through the NEPA process. Two projects had BMPs from other types of BMP guidance documents. Fifty-three percent of projects had all applicable BMPs from planning included in the contract or plan. BMPs in the general provisions (WatUses A-Q27) “techniques to reduce chance of groundwater contamination from drilling operations” and “limits on the size of the disturbed area” were included in project contracts or plans for five and four projects each, respectively. On average, BMPs from planning were included in 3 of the 10 general provisions per project, but 3 provisions per project also were not included. One project had none of the BMPs from its decision document, a categorical exclusion (CE), included in the contract or plan. For the six projects with applicable BMPs, 81 percent of BMP provisions per project were implemented fully in the field (WatUses A-Q28), and four of the six projects had all applicable BMPs implemented fully. Every construction project met all state and local requirements for casing, grouting, cementing, sealing, apron, and collar. Four of the new wells had limits on withdrawals and a method in place to monitor withdrawals. Inspections were not conducted during one project. None of the projects had problems that required corrective actions, and no chemical or fuel spills or leaks that required cleanup occurred during any project.

Evidence of erosion or sedimentation was not observed in the area evaluated for any well project. Records for the four wells with withdrawal limits indicated that withdrawals stayed within those limits (WatUses A-Q49). No evidence of changes to the extent or species composition of groundwater-dependent vegetation was observed for the seven projects. No records or monitoring data related to groundwater quality existed for any project.

Water Uses A (Completed Construction): Ratings and Component Scores

One WatUses A construction project in both monitoring periods combined was rated as *fully implemented*, four were rated as *mostly implemented*, and two as *marginally implemented*. Every project was rated as *effective*. Composite rating results for WatUses A construction projects with complete data are given in Table 179. No project had a composite rating less than *good* because of the effectiveness ratings.

The implementation rating components and their interpretations for WatUses A (completed construction) are given in Table 180. Two wells had planning component scores of *all*, which indicated that all BMPs from planning documents were included in the project contract or plan. The remaining wells had *some* scores for the planning component because not all BMPs from planning were in the contract or plan. Five well projects scored as *all* for the on-the-ground execution component (i.e., all applicable BMPs were implemented fully), and six well projects scored as *all* for the project oversight

¹Aquatic 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 179.—Composite rating matrix for WatUses A construction projects evaluated for both implementation and effectiveness in FY15/16 (n=6 evaluations) and FY17/18 (n=1 evaluation). Numbers in cells indicate the number of evaluations 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	4	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		
	Mostly effective					
	Marginally effective					
	Not effective					

Excellent
 Good
 Fair
 Poor
 No plan

component. Fifty-seven percent of applicable BMP provisions were not implemented fully, on average, for the two projects with *some* scores for the on-the-ground execution component. One well project scored as *some* for the project oversight component because it did not have inspections. One well project had an implementation rating of *fully implemented* because it had *all* scores for each of the three components. Four well projects with *some* scores for either the planning or project oversight components and *all* scores for the on-the-ground execution component had implementation ratings of *mostly implemented*. Planning and on-the-ground execution component scores of *some* resulted in an implementation rating of *marginally implemented* for two well projects. The effectiveness rating components and their interpretations for WatUses A are given in Table 181. When a well did not have the data needed to assess groundwater-related changes, the waterbody protection component was scored *not applicable* (Table 181), which does not influence the final effectiveness rating. Every evaluation had scores of *effective* for every component and, as noted in the preceding paragraph, an overall effectiveness rating of *effective*.

Table 180.—Implementation components, scores, and interpretation of each score used for determining overall implementation ratings for WatUses A completed construction (portion of WatUses A protocol), WatUses C reconstruction or repair (portion of WatUses C protocol), and WatUses D 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
	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, of the necessary corrective actions identified during project implementation were implemented
	None	No necessary corrective actions identified during project implementation were implemented

Table 181.—Effectiveness components, scores, and interpretation of each score for determining overall effectiveness ratings for WatUses A and WatUses C protocols

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
Waterbody protection (WatUses 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
	Not applicable	No available data; does not affect the effectiveness rating
Waterbody protection (WatUses C)	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

Water Uses A (Operation and Maintenance [O&M]): Header Statistics

Twenty-four wells that were more than 1 year old were evaluated for operation and maintenance. Every region except Regions 8 and 10 evaluated at least one well (Table 182); Regions 5 and 6 evaluated 58 percent of the wells during both monitoring periods. A reason for monitoring was to meet National BMP targets for all but one well, and four evaluations indicated at least one additional reason for monitoring (Table 183). Quality assurance was identified as a reason for monitoring in three WatUses A (O&M) evaluations (Table 183). 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 monitoring effort on that same site . . . [by] different team members than the initial evaluation, with the objective of comparing both sets of results as a check of the repeatability of results.” None of the

Table 182.—Number of WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (WatUses A-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1				
	2	1			1
	3	1			1
	4				
	5	4			4
	6	2			2
	8				
	9	2			2
	10				
	All	10	0	0	10
	Percent				100
FY17/18					
	1	2			2
	2				
	3	2		1	1
	4	1			1
	5	4			4
	6	4		1	3
	8				
	9	1			1
	10				
	All	14	0	2	12
	Percent			14	86

Table 183.—Number of WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (WatUses A-Q11a). Multiple selections were possible.

Monitoring period	Region	National BMP targets	Land management plan monitoring	Project review	Quality assurance	Other
FY15/16						
	1					
	2	1	1	1	1	1
	3	1				
	4					
	5	3				1
	6	2				
	8					
	9	2				
	10					
	All	9	1	1	1	2
FY17/18						
	1	2				
	2					
	3	2			2	
	4	1		1		
	5	4				
	6	4				
	8					
	9	1				
	10					
	All	14	0	1	2	0

evaluations identified as being for quality assurance had a duplicate evaluation, 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. Seventy-nine percent of the wells evaluated for O&M were selected randomly.

Two wells in FY15/16 and seven in FY17/18 had a valid water right (WatUses A-Q17). Of those, one was not owned by the Forest Service, and another had multiple owners that included the Forest Service (WatUses A-Q19). Eight wells were located in an AMZ, four were outside an AMZ, and one was nearest to a waterbody that did not have a designated AMZ (WatUses A-Q21). Nine wells with a known date of construction (WatUses A-Q22) were 20–30 years old at the time of the evaluation, three were less than 5 years old, and two were 55 and 58 years old. The method used to construct the well (WatUses A-Q23) was predominantly by drilling (19 wells). Four evaluations included a nest of wells, and 19 included a single well (WatUses A-Q24).

Water Uses A (O&M): Implementation Results and Their Tie to Header Information

Twenty-two existing wells were evaluated for implementation of BMPs to protect water resources. Metrics used to assess operation and maintenance of water wells include whether state and local requirements for the well apron or collar have been met (WatUses A-Q31) and whether water withdrawals or groundwater levels are monitored when required (WatUses A-Q32 and WatUses A-Q33). Five wells did not have an apron or collar because state or local requirements did not exist (Table 184). All other wells met state or local requirements related to the well collar or apron materials or characteristics. When apron or collar requirements were compared by the age of the well, two of the five wells without those requirements were less than 5 years old; the other three evaluations did not report the well age. Wells with apron or collar requirements averaged about 21 and 34 years old in FY15/16 and FY17/18, respectively. Thirty-six percent of evaluated wells had limits on water withdrawals or requirements related to groundwater levels (Table 184). For the wells with limits or requirements, one well in each monitoring period did not have a method in place to monitor withdrawals or groundwater levels. Whether a well had withdrawal limits or groundwater requirements was not significantly associated with whether the well was in an AMZ ($p = 1.00$ FY15/16, $p = 0.34$ FY17/18); however, 80 percent of wells in FY17/18 with limits or requirements were in an AMZ, and 60 percent of wells that did not have requirements were not in an AMZ.

Two implementation questions—WatUses A-Q34 and WatUses A-Q35—evaluate whether site administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times during the past 5 years when resources were most susceptible to negative effects from site conditions (Table 185) and whether corrective actions were taken if problems occurred during the past 5 years (at any time, not just critical times) (Table 186). Critical times are periods associated with large or intense precipitation/runoff events or other

Table 184.—Distribution of whether well apron or collar requirements were met (WatUses A-Q31) and whether water withdrawal limits existed (WatUses A-Q32), and if limits existed, whether a method was in place to maintain allowable limits (WatUses A-Q33) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18

Metric	Requirement met	FY15/16 (number)	FY15/16 (percent ^a)	FY17/18 (number)	FY17/18 (percent)
Well apron or collar	Not applicable	3	30	2	17
	Yes	7	70	10	83
	No	0		0	
Water withdrawal limits exist	Not applicable; monitoring well	0		2	17
	Yes	3	30	5	42
	No	7	70	5	42
If yes, method in place to maintain limits	Yes	2	67	4	80
	No	1	33	1	20

^a Within each metric.

Table 185.—Distribution of whether inspections occurred at critical times during the past 5 years (WatUses A-Q34) for WatUses A operation and maintenance 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	1	10	1	8
Not applicable; work avoided critical times	1	10	6	50
Yes	7	70	5	42
No	1	10	0	
All	10		12	

Table 186.—Distribution of whether corrective actions (CA) were taken if problems occurred during the past 5 years (WatUses A-Q35) for WatUses A 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	6	60	8	67
CA needed but not taken	1	10	0	
CA needed and implemented	3	30	3	25
Unknown	0		1	8
All	10		12	

times when the potential for the site to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted at critical times during the past 5 years for more than half of the wells in both monitoring periods combined (Table 185). About 90 percent of the wells in each period either had no problems requiring corrective actions any time during the past 5 years or implemented corrective actions when needed (Table 186).

Because fuel and other chemicals may be present within or around well sites, an implementation question (WatUses A-Q36) 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 would follow that state agency's procedures. One evaluation in FY17/18 indicated that the administrative unit did not have a CERP. One evaluation in each monitoring period indicated that a spill or leak that required cleanup occurred at a site; CERP procedures were followed at one site but not at the other.

Water Uses A (O&M): Effectiveness Results and Their Tie to Implementation Results and Header Information

Existing well sites are evaluated for evidence of erosion and sedimentation in the area disturbed by construction and continued use of the well. If that area can no longer be delineated due to the age of the well, an area 30 feet in diameter and centered at the well is evaluated. Only the most severe cases of erosion or sedimentation are reported (WatUses A-Q41) 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. Of the 24 well sites, 20 had no evidence of erosion, sedimentation, or waterbody morphology changes originating from the evaluated area around the well (WatUses A-Q41). Three evaluations in FY15/16 and one in FY17/18 reported some evidence of erosion, sedimentation, or waterbody morphology changes (Table 187). The types of evidence observed (WatUses A-Q46) in FY15/16 were vegetation damage or bare ground, sheet erosion, and sediment plumes. In FY17/18, gully erosion and headcutting were observed. Waterbody types nearest to the observed evidence were an ephemeral stream, an intermittent stream, and two lakes (WatUses A-Q44). Sources of the evidence (WatUses A-Q47) were foot traffic, pump splash, and a storage tank in FY15/16. In FY17/18, multiple sources were observed at the one well with evidence, and all were related to the drill pad. Several causes of the observed evidence (WatUses A-Q48) were reported (Table 188); the majority were related to deficiencies in erosion control.

Weather conditions associated with the evaluation (WatUses A-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to the well site 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 because these result primarily from precipitation and runoff, whereas

Table 187.—Evidence of erosion or sedimentation observed on or originating from well area (WatUses A-Q41) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (WatUses A-Q43) or number of places evidence observed in a waterbody (WatUses A-Q42)

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	7	70							
Outside an AMZ ^a	2	20				2			
Within an AMZ	1	10				1			
In a waterbody	0								
FY17/18									
No evidence	13	93							
Outside an AMZ	1	7				1			
Within an AMZ	0								
In a waterbody	0								

^a Aquatic management zone.

Table 188.—Causes of evidence of erosion or sedimentation observed at well site (WatUses A-Q46) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in WatUses A-Q41 (Table 187) is applicable to WatUses A-Q48.

Cause of evidence	FY15/16 Outside AMZ ^a (n=2)	FY15/16 Within AMZ (n=1)	FY17/18 Outside AMZ (n=1)
Too large of an area disturbed			
Poor location for well or associated disturbance			1
Compacted soil	1		
Overland flow			
Insufficient soil cover (includes vegetation, mulch, rolled erosion control products, etc.)	2	1	1
Lack of or insufficient erosion control features or structures	1		1
Poor drainage control	1		
Oversteepened fillslopes or cut slopes			1
Operating outside of allowable time periods			
Improper or poor disposal of cutting materials			
Unanticipated impacts			

^a Aquatic management zone.

waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. No statistically significant associations were found between categories of erosion at the well site (WatUses A-Q41) and weather conditions (i.e., wet versus dry conditions) in either monitoring period ($p = 1.00$ for both) (Fig. 99). About 20 percent of evaluations occurred during wet conditions, so more evaluations in both wet and dry conditions are needed to determine the usefulness of this comparison for existing wells.

Effects of well water withdrawals are assessed by review of records or monitoring data on withdrawal amounts and groundwater levels and water quality. Evidence of changes, if any, to groundwater-dependent vegetation in the area of the well also are reported. The relationship between whether wells had withdrawal limits or required groundwater levels (WatUses A-Q49) and whether those requirements were met are summarized in Table 189. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of the paired comparison. A number of incompatible answer choices were selected (shaded cells) based on the protocol instructions. Nearly half of the evaluated wells with withdrawal limits or groundwater requirements had no means to assess whether the limits or requirements were met, just over half had no records available to assess whether the well had affected groundwater quality (WatUses A-Q52) (Table 190), and 38 percent had no data or past observations to assess possible changes to groundwater-dependent vegetation (Table 191). When records or data were available, limits or requirements were met, groundwater quality was not affected, and vegetation characteristics (WatUses A-Q50 and WatUses A-Q51) had not changed.

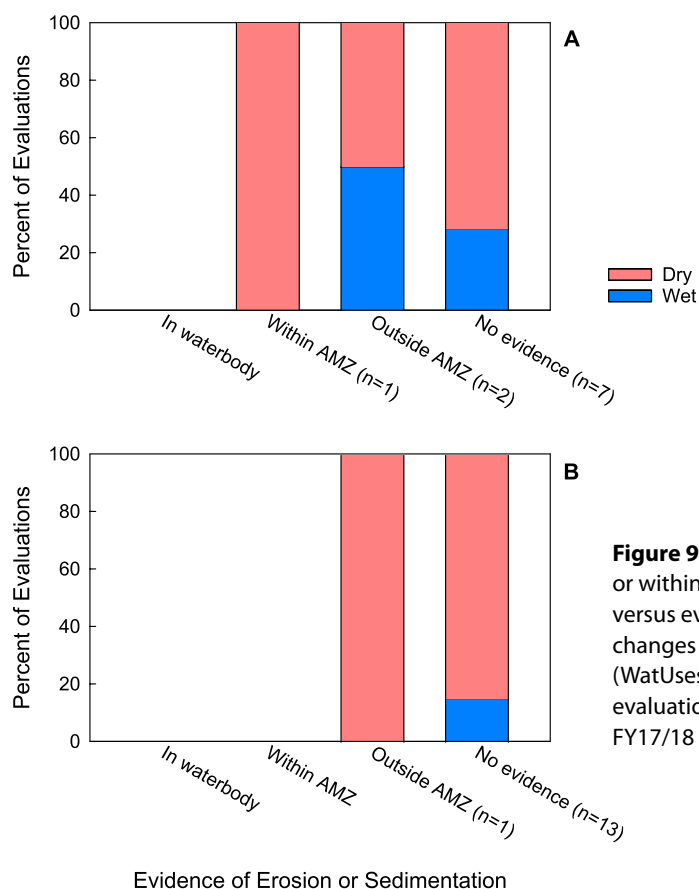


Figure 99.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion, sedimentation or changes to waterbody morphology at well site (WatUses A-Q41) for operation and maintenance evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

Table 189.—Distribution of whether well has water withdrawal limits or groundwater level requirements (WatUses A-Q32) in relationship to whether those limits or requirements were met (WatUses A-Q49) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (14 and 33 percent of FY15/16 and FY17/18 responses, respectively).

Monitoring period	Well has water withdrawal limits or groundwater level requirements (implementation)	Not applicable; monitoring well (effectiveness)	Not applicable; no withdrawal limits (effectiveness)	Yes; limit or requirement met (effectiveness)	No; limit or requirement exceeded (effectiveness)	Unknown if limit or requirement met (effectiveness)
FY15/16						
	Not applicable; monitoring well					
	Yes			2		1
	No		6	1		
FY17/18						
	Not applicable; monitoring well	1	1			
	Yes		1	2		2
	No	1	3	1		

Table 190.—Distribution of whether groundwater quality was altered by presence of the well (WatUses A-Q52) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18

Groundwater quality was altered	FY15/16 (number)	FY15/16 (percent)	FY17/18 (number)	FY17/18 (percent)
Unknown; no records	3	30	9	69
Unknown; sampling planned or record too short to determine	0		1	8
Yes; records indicate a change	0		0	
No; records do not indicate a change	7	70	3	23

Table 191.—Evidence of changes to groundwater-dependent vegetation extent (WatUses A-Q50) or species composition (WatUses A-Q51) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18

Groundwater-dependent vegetation	Evidence	FY15/16 (number)	FY15/16 (percent ^a)	FY17/18 (number)	FY17/18 (percent)
Extent	Increasing extent	0		0	
	Decreasing extent	0		0	
	No change	6	60	7	64
	Unknown	4	40	4	36
Species composition	Increasing numbers of species	0		0	
	Decreasing numbers of species	0		0	
	No change	6	60	7	64
	Unknown	4	40	4	36

^a Within each metric.

The presence of chemical spills, leaks, or chemical waste containers is determined during the effectiveness evaluations (WatUses A-Q54). Such evidence can include pollutants observed but not reported, pollutants reported but not yet cleaned up, or pollutants not previously observed or known to exist. The results indicated considerable care was taken to prevent chemical contamination at well sites; no spills, leaks, or waste containers were observed during any evaluation.

The WatUses A (O&M) protocol includes two questions about inspections, one in implementation (WatUses A-Q34) and one in effectiveness (WatUses A-Q55), that are designed to tie together. Respectively, the questions ask whether well site administration or lack thereof influenced BMP effectiveness. Table 192 shows the relationships between the questions for wells 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 the paired comparisons because a number of incompatible answer choices were selected (shaded cells). Inspections not conducted at critical times did not contribute to observed problems for one well site in FY15/16.

Table 192.—Occurrence of inspections performed at critical times (WatUses A-Q34) in relationship to problems observed during effectiveness monitoring (WatUses A-Q55) for WatUses A operation and maintenance evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (30 and 25 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			1
	Yes; inspections at critical times	6		1
	No; inspections not at critical times			1
FY17/18				
	No inspections	1		
	Not applicable; work avoided critical times	4		2
	Yes; inspections at critical times	5		
	No; inspections not at critical times			

Water Uses A (O&M): Ratings and Their Tie to Header, Implementation, and Effectiveness Results

In both monitoring periods combined, 32 percent of WatUses A (O&M) sites were rated as *fully implemented*, and half were rated as *not implemented* or *no BMPs* (Fig. 100). In comparison, 88 percent of the WatUses A (O&M) sites were rated as *effective*, and none were rated as *not effective*. Two effectiveness evaluations lacked responses in the database for questions needed to determine a rating (identified as “incomplete data” in Fig. 100). Because only one site had an effectiveness rating of less than *effective*, the ratings cannot be statistically tested for associations or differences. For the evaluation rated *marginally effective*, the header, implementation, and effectiveness results are discussed in the following paragraph.

The nest of drilled wells was 33 years old at the time of the evaluation and was located in an AMZ. A valid water right owned by a non-Forest Service entity existed for the well. State and local requirements for the well apron or collar were met. The well had limits on water withdrawals or groundwater level requirements, and a method was in place to ensure the metrics were not exceeded. Inspections were performed at critical times, and no problems occurred that required corrective actions. No chemical or fuel spills or leaks had occurred at the site in the past 5 years. The well had an implementation rating of *fully implemented*, and no corrective or adaptive management actions were needed for the site. Evidence of erosion or sedimentation was observed outside an AMZ and more than 100 feet from an intermittent stream. Types of evidence observed were gully erosion and headcutting from the drill pad area, fillslopes or cut slopes, and access route. The causes reported were insufficient soil cover and erosion control. No chemical or fuel spills,

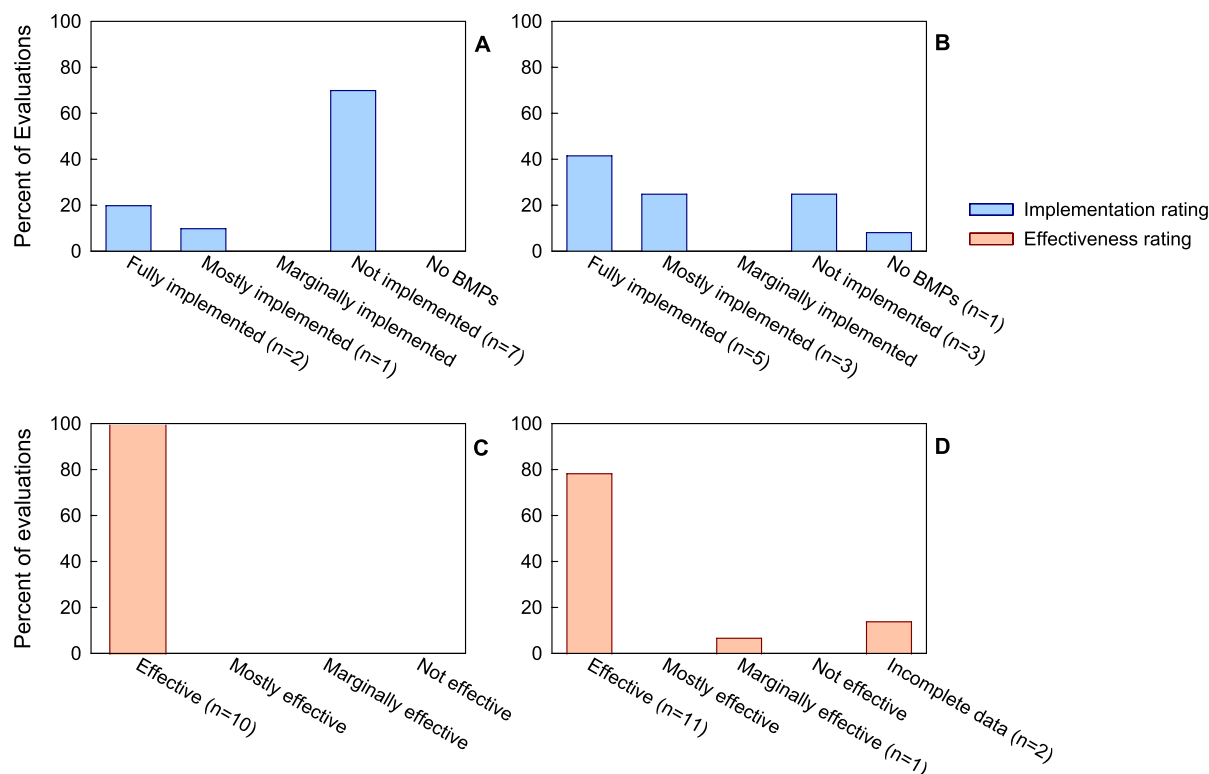


Figure 100.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for WatUses A operation and maintenance evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

leaks, or waste containers were observed during the evaluation. The review team did not identify any needed corrective or adaptive management actions for the site, even though somewhat severe erosion features were observed on and around the drill pad.

Composite Ratings

Composite rating results for WatUses A (O&M) well sites with complete data that were evaluated for both implementation and effectiveness are given in Table 193. Forty-eight percent of wells had a composite rating of *excellent*, and 43 percent were rated as *good*. The implementation and effectiveness ratings were not significantly associated in FY17/18 ($p = 1.00$) and could not be tested in FY15/16. In both periods, better effectiveness ratings occurred across all implementation ratings.

Water Uses A (O&M): Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings were determined from component scores. The implementation rating components and their interpretations for the WatUses A (O&M) protocol are given in Table 194. The effectiveness components and score interpretations are given in Table 181. When a well did not have the data needed to assess groundwater-related changes, the waterbody protection component was scored *not applicable* (Table 181), which did not influence the final effectiveness rating.

Table 193.—Composite rating matrix for WatUses A well site operation and maintenance evaluated for both implementation and effectiveness in FY15/16 (n=10 evaluations) and FY17/18 (n=11 evaluations). Numbers in cells indicate the number of evaluations 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		7	
	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	4	3		2	1
	Mostly effective					
	Marginally effective	1				
	Not effective					

Excellent
 Good
 Fair
 Poor
 No plan

Table 194.—Implementation components, scores, and interpretation of each score used for determining overall implementation ratings for WatUses A operation and maintenance and WatUses B protocols

Implementation component	Component score	Score interpretation
Planning	All	All BMPs applicable to the water source are prescribed
	Some	Some BMPs applicable to the water source are prescribed, but at least one was not
	None	None of the BMPs applicable to the water source are prescribed
	No BMPs	No BMPs are applicable to the water source
On-the-ground execution	All	All BMPs were implemented fully
	Some ^a	Some of the BMPs were implemented fully, but at least one was not
	None	None of the BMPs were implemented fully
Project oversight	All	All necessary corrective actions identified during project implementation were implemented
	Some	Some, but not all, of the necessary corrective actions identified during project implementation were implemented
	None	No necessary corrective actions identified during project implementation were implemented

^a Score not applicable for WatUses A operation and maintenance.

Table 195 shows how the scores were distributed across the three implementation components. Seven well sites had all three components scored as *all* and were rated as *fully implemented* (Table 196). Performance was generally better for the on-the-ground execution component than for the other components in each monitoring period, although the project oversight component scores in FY17/18 also were high (Table 195). Ten evaluations scored as *none* for the planning component, which necessarily resulted in *not implemented* implementation ratings (Table 196).

An *all* score for the planning component indicates that the well had water withdrawal limits or groundwater level requirements and a method to assess them. Four wells had a planning component score of *some* because limits or requirements existed, but an assessment method did not. Ten wells had a score of *none* because limits or requirements did not exist. A *no BMPs* planning component score results when a well is for monitoring only (i.e., no water removals). Scores of *some* and *none* for the project oversight component are due to a deficiency in inspections or corrective actions not being taken when needed.

All three effectiveness components (Table 181) had scores of *effective* for 21 of the 22 wells with complete data. The well rated as *marginally effective* had a *marginally effective* score for the erosion and sedimentation component. Two evaluations lacked data needed to determine the waterbody protection component score; of these, one also lacked data for the chemical pollutants component. Both evaluations could not be scored.

Water Uses A: Management Implications for Forest Service Resource Managers

The WatUses A protocol has separate questions to evaluate completed construction (i.e., completed not more than 12 months before effectiveness monitoring occurs) and operation and maintenance. Seven recently constructed wells were evaluated in FY15/16 and FY17/18. Due to the small sample size, the description and analysis of those results are limited. Seventy-one percent of the recently constructed well projects rated *fully implemented* or *mostly implemented* for BMP implementation. No projects were rated *not implemented* or *no BMPs*. Project planning had more deficiencies compared to on-the-ground execution and project oversight. For BMP effectiveness, 100 percent of the projects rated *effective*, indicating that no impacts to water quality were observed.

Operation and maintenance were evaluated at 24 existing water wells (i.e., at least 1 year old at the time of evaluation). For BMP implementation in those projects, half of the sites rated *fully implemented* or *mostly implemented* and half rated *not implemented* or *no BMPs*. Planning was a deficiency for 63 percent of the sites. The site rated *no BMPs* was a monitoring well. Planning deficiencies included no prescribed water withdrawal limits or groundwater level requirements (*none* score) or no method to measure such prescribed limits or withdrawals (*some* score). There were no deficiencies in on-the-ground execution. Eighty-six percent of the sites scored *all* for the project oversight component. Deficiencies in project oversight included a lack of inspections during critical times and corrective actions not being implemented when the need was identified.

Table 195.—Distribution of implementation component scores by component for WatUses A 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=10)							
	All	2	20	10	100	8	80
	Some ^a	1	10			1	10
	None	7	70			1	10
	No BMPs						
FY17/18 (n=12)							
	All	5	42	12	100	11	92
	Some	3	25			1	8
	None	3	25				
	No BMPs	1	8				

^a Score not applicable to the on-the-ground execution component.

Table 196.—Implementation component scores corresponding to the overall implementation ratings for WatUses A operation and maintenance evaluations with complete data in FY15/16 and FY17/18. See Table 192 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	2
	Mostly implemented	Some	All	Some	1
	Marginally implemented ^a				-- ^a
	Not implemented	None	All	All	6
		None	All	None	1
	No BMPs				0
FY17/18 (n=12)					
	Fully implemented	All	All	All	5
	Mostly implemented	Some	All	All	3
	Marginally implemented				--
	Not implemented	None	All	All	2
		None	All	Some	1
	No BMPs	No BMPs	All	All	1

^a Rating not applicable to WatUses A operation and maintenance.

For BMP effectiveness, ninety-five percent of the sites rated *effective*, indicating that no impacts to water quality were observed. One site was rated *marginally effective* due to somewhat severe erosion features originating from the drill pad area, fillslopes or cut slopes, and access route. In all evaluations with complete data, the scores for the waterbody protection component and the chemical pollutants component were *effective*.

Due to the *effective* ratings across all implementation ratings, no significant association was found between BMP implementation and BMP effectiveness ratings in FY17/18. The relationship could not be tested in FY15/16.

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

- For well construction projects, prescribing appropriate site-specific BMPs in the planning documents and including those BMPs in the project contract or plan. Seventy-one percent of the WatUses A construction projects scored as *some* for the planning component, indicating that not all BMPs in the planning documents were included in the project contract or plan.
- Prescribing water withdrawal limits or groundwater level requirements for water production wells and ensuring that methods are in place to measure those limits or requirements. Planning deficiencies in WatUses A operation and maintenance evaluations were due to a lack of limits or requirements and methods of assessment.
- Periodic monitoring of groundwater quality and groundwater-dependent vegetation communities around wells. Data gathered through such monitoring are useful for judging effectiveness of BMPs related to wells.
- Ensuring that erosion control measures are implemented and maintained on the well pad and access routes. Deficiencies in erosion control were reported as the cause of the observed erosion at the site where evidence of erosion and sedimentation was found.

Water Uses A: Best Management Practices Monitoring Form

Best Management Practices Evaluation WatUses A. Completed Construction or Operation and Maintenance of Water Wells for Monitoring or Production (Reference BMPs WatUses-1, WatUses-2, Fac-2, and Fac-3) v3.0 February 2016	
Header	
WatUses A-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
WatUses A-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
WatUses A-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
WatUses A-Q4	Date of current field evaluation:
WatUses 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:
WatUses 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:
WatUses A-Q7	Reviewers and titles:
WatUses A-Q8a	Region number:
WatUses A-Q8b	State:
WatUses A-Q9a	Proclaimed Forest or Grassland number and name:
WatUses A-Q9b	Administrative Forest or Grassland number and name:
WatUses A-Q10	District number and name:
WatUses A-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
WatUses 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
WatUses 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: a. Yes b. No 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:
WatUses A-Q12	6 th level HUC number and name for the subwatershed this well is located in:
WatUses A-Q13	Is this well located within a municipal supply watershed? Select one: a. Yes b. No
WatUses A-Q14a	Location. UTM Zone: UTM Datum:
WatUses A-Q14b	Location. Easting:
WatUses A-Q14c	Location. Northing:
WatUses A-Q15a	Location. Latitude:
WatUses A-Q15b	Location. Longitude:
WatUses A-Q15c	Location. Lat/Long Datum:
WatUses A-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
WatUses A-Q17	Is there a valid water right for this well? Select one: a. Yes (go to question 18) b. No (go to question 20)
WatUses A-Q18	State water right number for this well:
WatUses A-Q19	Owner of the water right:
WatUses A-Q20	Forest Service name or identifier for the well:

continued on next page

Header (continued)	
WatUses A-Q21	Is the well located in an AMZ? Select one: a. Yes b. No c. Waterbody has no designated AMZ
WatUses A-Q22	Type of well evaluated. Select one: New construction Existing well If existing, what year was the well developed?
WatUses A-Q23	How was the well constructed? Select one: Hand dug Drilled Bored Driven Unknown
WatUses A-Q24	Is a nest of wells or a single well being evaluated? Select one: Nest Single well
Implementation	
WatUses A-Q25	Are you evaluating well construction? Select one: a. Yes (go to question 26) b. No (go to question 31)
WatUses 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: a. No planning document containing BMP guidance was used (go to question 28) b. Environmental Impact Statement (EIS) (go to question 27) c. Environmental Assessment (EA) (go to question 27) d. Categorical Exclusion (CE) (go to question 27) e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 27)
WatUses 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 special use permit for well development. Select one response in each line. Select Not applicable for provisions that were not included in the decision document or other BMP guidance documents. a. Location of well to avoid contamination of groundwater by surface runoff or flood waters Yes/No/Not applicable b. Well construction and sealing techniques to avoid interflow between aquifers Yes/No/Not applicable c. Techniques to reduce chance of groundwater contamination from drilling operations Yes/No/Not applicable d. Timing of soil disturbances Yes/No/Not applicable e. Limits on the size of the disturbed area Yes/No/Not applicable f. Temporary erosion and sediment controls Yes/No/Not applicable (continued)

continued on next page

Implementation (continued)	
(WatUses A-Q27 continued)	g. Permanent erosion and sediment controls Yes/No/Not applicable h. Ground cover requirements Yes/No/Not applicable i. Stormwater runoff and drainage controls Yes/No/Not applicable j. Controls on allowable grades on fillslopes and/or cut slopes Yes/No/Not applicable k. Other (specify): Yes/No/Not applicable
WatUses 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 special use permit for well development 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. a. Location of well to avoid contamination of groundwater by surface runoff or flood waters Yes/No/Not applicable b. Well construction and sealing techniques to avoid interflow between aquifers Yes/No/Not applicable c. Techniques to reduce chance of groundwater contamination from drilling operations Yes/No/Not applicable d. Timing of soil disturbances Yes/No/Not applicable e. Limits on the size of the disturbed area Yes/No/Not applicable f. Temporary erosion and sediment controls Yes/No/Not applicable g. Permanent erosion and sediment controls Yes/No/Not applicable h. Ground cover requirements Yes/No/Not applicable i. Stormwater runoff and drainage controls Yes/No/Not applicable j. Controls on allowable grades on fillslopes and/or cut slopes Yes/No/Not applicable k. Other provisions specified in question 27k Yes/No/Not applicable l. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
WatUses A-Q29	Did casings used to line the well bore hole meet all state and local requirements (material, thickness, etc.)? Select one: a. Not applicable, no casings used (go to question 31) b. Not applicable, no state and local requirements for casings for monitoring wells (go to question 30) c. Not applicable, no state and local requirements for casings for production wells (go to question 30) d. Yes, casings met all state and local requirements (go to question 30) e. No, casings did not meet all state and local requirements (go to question 30)

continued on next page

Implementation (continued)	
WatUses A-Q30	Did grouting, cementing, or sealing (i.e., presence of, quality of, etc.) around casings meet all state and local requirements? Select one: - Not applicable, no state and local requirements for cementing or sealing casings for monitoring wells - Not applicable, no state and local requirements for cementing or sealing casings for production wells - Yes, cementing or sealing met all state and local requirements - No, cementing or sealing did not meet all state and local requirements
WatUses A-Q31	Does the well apron or collar meet all state and local requirements in terms of materials, size, thickness, type, etc.? Select one: - Not applicable, no apron or collar exists because there were no state or local requirements for them at the time of well development, or an apron or collar is not required for this type of well - Yes, an apron or collar exists and meets all state and local requirements - No, an apron or collar exists but it does not meet all state and local requirements
WatUses A-Q32	Are there limits on water withdrawals for this well, or requirements to retain some specified groundwater level? Select one: - Not applicable, well is for monitoring only (go to question 34) - Yes (go to question 33) - No (go to question 34)
WatUses A-Q33	Is there a method in place to ensure that water withdrawals do not exceed allowable limits or required groundwater levels are maintained? Select one: - Yes - No
WatUses A-Q34	Were inspections and/or contract administration during well development (for wells <1 year old) or during the past 5 years (for wells >1 year old) performed at critical times for addressing water quality issues? Select one: - No inspections were performed - Not applicable, work was conducted to avoid critical times - Yes - No
WatUses A-Q35	If problems occurred during well development (for evaluation of construction) or during the past 5 years (for evaluation of O&M of existing wells) that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one: - No problems occurred so no corrective actions were needed - Corrective actions were needed but not taken - Corrective actions were needed and implemented - Unknown, insufficient documentation and information exists to make the determination
WatUses A-Q36	Were chemical or fuel spills or leaks that occurred during well development (for evaluation of construction) or during the past 5 years (for evaluation of O&M of existing wells) handled/treated according to the contingency and emergency response plan? Select one: - The Forest or Grassland has no contingency and emergency response plan - Not applicable, no spills or leaks occurred during development or past 5 years - Yes, spills or leaks were handled/treated according to the contingency and emergency response plan - No, spills or leaks were not handled/treated according to the contingency and emergency response plan

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Implementation <i>(continued)</i>	
WatUses A-Q37	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39)
WatUses A-Q38	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
WatUses A-Q39	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 40) b. No (go to question 41 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
WatUses 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.
Effectiveness	
WatUses A-Q41	Is there evidence of erosion or sedimentation on or originating from the area evaluated for the well? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 49) b. Evidence of erosion or sedimentation outside an AMZ (go to question 43) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 43) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 42)
WatUses A-Q42	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 44: a. 1 or 2 b. 3 or 4 c. 5 or more
WatUses A-Q43	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
WatUses A-Q44	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: a. Ephemeral stream b. Intermittent stream c. Perennial stream or river d. Pond e. Lake f. Wetland or wet meadow g. Estuary h. Other (specify):
WatUses A-Q45	What is the width of the AMZ associated with the waterbody? (ft or m; specify unit):

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Effectiveness *(continued)*

WatUses A-Q46	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 41, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
WatUses A-Q47	What are the sources? Select all that apply: a. Drill cuttings b. General drill pad area c. Fillslopes or cut slopes of drilling pad d. Access route to drill pad e. Other (specify):
WatUses A-Q48	What are the causes? Select all that apply: a. Too large of an area disturbed b. Poor location for well or associated disturbance c. Compacted soil d. Overland flow e. Insufficient soil cover (includes vegetation, mulch, rolled erosion control products, etc.) f. Lack of, or insufficient erosion control features or structures g. Poor drainage control h. Oversteepened fillslopes or cut slopes i. Operating outside of allowable time periods j. Improper or poor disposal of cutting materials k. Unanticipated impacts l. Other (specify): m. Unknown
WatUses A-Q49	Do records indicate that water withdrawals have been within allowable limits or that groundwater levels have remained within required levels? Select one: a. Not applicable, well evaluated is a monitoring well, not a production well (go to question 52) b. Not applicable, no limits on groundwater withdrawals and no required groundwater levels (go to question 50) c. Yes, withdrawals are within allowable limits or required groundwater levels were maintained (go to question 50) d. No, withdrawals have exceeded allowable limits or groundwater levels did not meet requirements during at least one monitoring period (go to question 50) e. Limits on withdrawals or groundwater levels exist, but there is no mechanism in place to tell if those limits have been met (go to question 50)

continued on next page

Effectiveness *(continued)*

WatUses A-Q50	Is there evidence of changes in the extent of groundwater-dependent vegetation associated with this well? Select one: a. Yes, evidence of increasing extent of groundwater-dependent vegetation b. Yes, evidence of decreasing extent of groundwater-dependent vegetation c. No evidence of change d. Unknown, no past data or observations to evaluate changes If Yes, what is the evidence?
WatUses A-Q51	Is there evidence of changes in the species composition of groundwater-dependent vegetation? Select one: a. Yes, evidence of increasing numbers of groundwater-dependent species b. Yes, evidence of decreasing numbers of groundwater-dependent species c. No evidence of change d. Unknown, no past data or observations to evaluate changes If Yes, what is the evidence?
WatUses A-Q52	Do records or monitoring data indicate that groundwater quality was altered by the installation or presence of the production well or monitoring well? Select one: a. Unknown, no records available (go to question 54) b. Unknown, sampling is planned but has yet to be performed, or sampling period has been too short to determine (go to question 54) c. Yes, records indicate a change to groundwater quality due to the well (go to question 53) d. No, records indicate no change to groundwater quality due to the well (go to question 54) If Yes, briefly describe how groundwater quality has been altered:
WatUses A-Q53	What reasons are known or believed to have caused or contributed to the change in groundwater quality? Select all that apply: a. Contamination from casing b. Failure of apron or collar to adequately protect groundwater from contamination by surface runoff c. Lack of cementing or grouting around casing d. Cementing or grout around casing failed or was of poor quality e. Contamination from cementing or grouting materials f. Interflow between different aquifers resulted from bore hole construction g. Other (specify): h. Unknown
WatUses A-Q54	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the evaluated area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody
WatUses A-Q55	If inspections were not conducted at critical times during well development (for evaluation of construction) or during the past 5 years (for evaluation of O&M of existing wells), did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times, or well development activities were conducted to avoid critical times b. Yes c. No

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Effectiveness <i>(continued)</i>	
WatUses A-Q56	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 57) b. No (go to question 58)
WatUses A-Q57	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
WatUses A-Q58	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 59) b. No (go to General Comments)
WatUses A-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	

Water Uses B—Operation and Maintenance of Spring-Source Facilities

Water Uses B: Header Statistics

Thirty-three randomly selected spring-source facilities were evaluated (16 in FY15/16 and 17 in FY17/18 (Table 197). All of the evaluations that included both implementation and effectiveness reviews were completed on the same day. Two evaluations included only an effectiveness review. A reason for monitoring for every facility was to meet National BMP targets, although the evaluations also met other monitoring needs (Table 198). Quality assurance was identified as a reason for monitoring in three randomly selected WatUses B evaluations (Table 198). 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 monitoring effort on that same site . . . [by] different team members than the initial 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 a duplicate evaluation, 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.

Springs were perennial at 28 facilities (14 in each monitoring period) (WatUses B-Q18). Infrastructure present at the facilities (WatUses B-Q19) is summarized in Figure 101. In both monitoring periods combined, nearly 80 percent of facilities included pipes, about 50 percent had spring boxes, and 50 percent had troughs or other use structures. Three types of infrastructure were included at each spring-source facility on average

Table 197.—Number of randomly selected WatUses B evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (WatUses B-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1				
	2	1			1
	3	1			1
	4	4			4
	5	4			4
	6	2			2
	8	3		1	2
	9				
	10	1			1
	All	16	0	1	15
	Percent			6	94
FY17/18					
	1				
	2	3			3
	3				
	4	3			3
	5	3			3
	6	8		1	7
	8				
	9				
	10				
	All	17	0	1	16
	Percent			6	94

in each period. Eleven springs in FY15/16 and 14 in FY17/18 had a valid water right (WatUses B-Q20). Water rights for three springs were owned by an entity other than the Forest Service or another federal government entity. Seven springs served Forest Service facilities, 21 springs served Forest Service natural resource uses, and 19 springs had public or private uses (WatUses B-Q25). Three springs served both Forest Service administrative sites and natural resources, and 13 springs had both Forest Service and public or private uses. Types of uses for the evaluated spring-source facilities (WatUses B-Q26) were most often livestock water or wildlife uses (Fig. 102). “Other” uses included fire suppression, temporary water drafting, a fish hatchery, and municipal uses. Seventeen spring facilities (7 in FY15/16 and 10 in FY17/18) were developed by the Forest Service and did not require an authorization (WatUses B-Q27). The type of authorization for the remaining 15 facilities that answered WatUses B-Q27 was a permit. Authorizations for 11 of the permitted springs were renewable (WatUses B-Q28). Five spring sources were authorized

Table 198.—Number of randomly selected WatUses B evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (WatUses 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	1				
	3	1				
	4	4	1	2	1	
	5	4	1	1		
	6	2	1	1	1	
	8	3	2	1		
	9					
	10	1	1			
	All	16	6	5	2	0
FY17/18						
	1					
	2	3		1		
	3					
	4	3	1	1		
	5	3				
	6	8			1	1 ^a
	8					
	9					
	10					
	All	17	1	2	1	1

^a Water rights and uses (WRU) monitoring.

prior to 1960, and two of the earliest permitted springs (1932 and 1945) had permanent authorizations (WatUses B-Q29). Periods of authorization ranged from 3 years to 79 years when known (WatUses B-Q30). The earliest development of a spring by the Forest Service occurred in 1930, and the latest occurred in 2017 (WatUses B-Q31). Eight of the 13 springs with a known development date were developed in 1980 or later.

Water Uses B: Implementation Results and Their Tie to Header Information

Collection systems fully met design criteria for 16 of the 31 spring-source facilities evaluated for implementation (Table 199). For the three facilities where collection system design criteria were not met, one was missing an overflow device, and two had incorrectly constructed fish screens. Eight collection systems were not completely functional (Table 199): one had very little flow, but the reason was not identifiable; six had needed

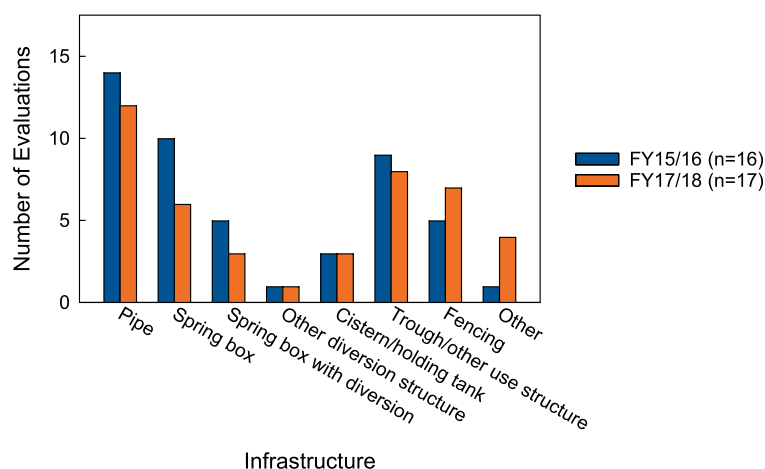


Figure 101.—Distribution of infrastructure present at spring-source facility (WatUses B-Q19) for randomly selected evaluations completed in FY15/16 and FY17/18.

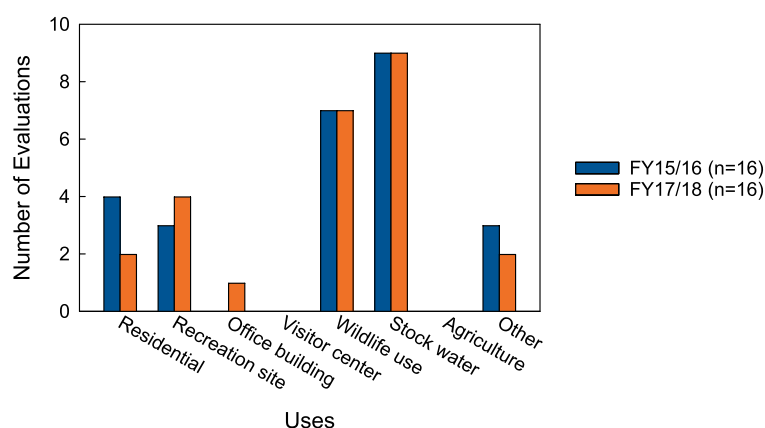


Figure 102.—Distribution of uses provided by spring-source facility (WatUses B-Q26) for randomly selected evaluations completed in FY15/16 and FY17/18.

repairs; and one had not been returned to service after recent repairs. Fifteen of 31 distribution systems fully met design criteria (Table 199). Two of the four facilities that did not meet distribution system design criteria had issues related to uncontrolled flow or overflow. Repairs to the distribution system were needed at five of the nonfunctioning facilities, and one was out of service due to recent repairs.

About two-thirds of the spring-source facilities had O&M plans, special use authorizations, or other O&M guidance documents that included BMPs to help protect water, aquatic, and riparian resources (Table 200). Whether O&M documents existed and included BMPs was statistically significantly associated with whether the spring was perennial in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 1.00$). All 10 facilities with O&M

Table 199.—Distributions of whether the spring-source collection and distribution systems met design criteria (WatUses B-Q32 and WatUses B-Q34) and were functional (WatUses B-Q33 and WatUses B-Q35) for randomly selected WatUses B evaluations in FY15/16 and FY17/18

System	Metric	Response	FY15/16 (number)	FY15/16 (percent ^a)	FY17/18 (number)	FY17/18 (percent)
Collection	Design criteria met	Not applicable; no criteria	2	13	2	12
		Unknown	2	13	6	38
		Yes	11	73	5	31
		No	0		3	19
	System functional	Yes	12	80	11	69
		No	3	20	5	31
Distribution	Design criteria met	Not applicable; no criteria	1	7	5	31
		Unknown	2	13	4	25
		Yes	11	73	4	25
		No	1	7	3	19
	System functional	Yes	13	87	11	69
		No	2	13	5	31

^a Within each metric.

Table 200.—Distribution of whether spring-source facility operation and maintenance (O&M) plan, special use authorization, or other guidance documents contain BMP protection provisions (WatUses B-Q36) for randomly selected WatUses 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	10	67	10	63
No; plan exists but does not have BMP provisions	0		1	6
No plan for the facility	5	33	5	31

documents in FY15/16 were perennial springs. Existence of O&M documents was not significantly associated with whether the spring had a valid water right in either period ($p = 1.00$ FY15/16, $p = 0.43$ FY17/18). However, 70 and 62 percent of springs in FY15/16 and FY17/18, respectively, with a valid water right had O&M guidance documents. Five spring-source facilities in FY15/16 and nine in FY17/18 served only Forest Service uses; of those, 50 percent had O&M guidance documents. When the spring had public or private uses—including those that also had Forest Service uses—76 percent of facilities had O&M documents. Because springs could serve multiple types of users, statistical comparisons were not possible. Whether a spring facility had O&M documents is summarized by type of use provided by the facility in Figure 103. Although the sample sizes are small, every spring that provided water to a recreation site or office building had an O&M plan or other guidance documents containing BMPs. Again, statistical tests were not possible because a spring facility could provide water for multiple uses.

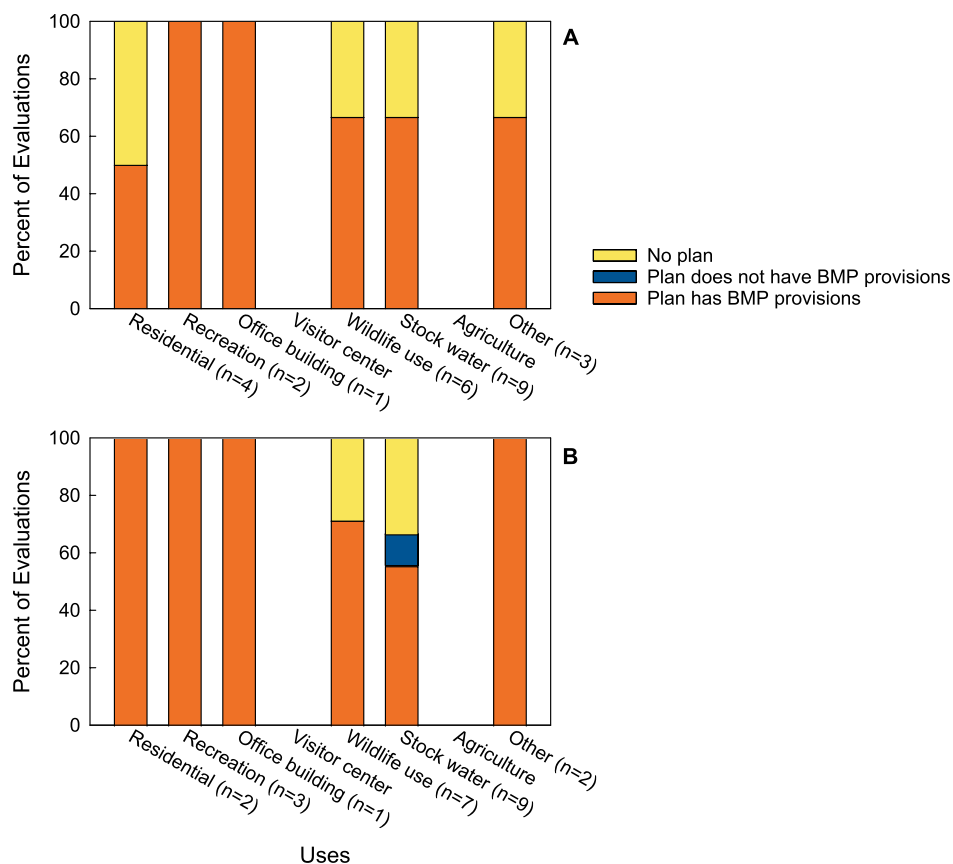


Figure 103.—Distribution of whether spring-source facility operation and maintenance plan, special use authorization, or other guidance documents contained BMP provisions (WatUses B-Q36) by water uses provided by the facility (WatUses B-Q26) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

Assessment of operation and maintenance implementation focuses on whether BMPs in O&M guidance documents (O&M plan, special use authorization, and so on) were implemented fully (WatUses B-Q37). Table 201 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 at least one BMP in the guidance documents was applicable to the provision and that all BMPs assigned to that provision were implemented fully. A “no” indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. “Not applicable” indicates that no BMPs in the guidance documents were 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 each monitoring period of Table 201 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

Table 201.—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 (WatUses B-Q37) for randomly selected WatUses B evaluations completed in FY15/16 (n=10 evaluations) and FY17/18 (n=10 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)
Maintenance of spring	8	1	1	89	11	5	1	4	83	17
Maintenance of collection system	8	1	1	89	11	7	2	1	78	22
Maintenance of distribution system	8	1	1	89	11	6	1	3	86	14
Methods to regulate or control diversion or release of water	5	1	4	83	17	5	0	5	100	0
Control (fencing, etc.) to limit access by animals and/or humans	7	1	2	88	12	5	1	4	83	17
Mean	7	1	2	88	12	6	1	3	86	14

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

^b Percent calculated from “yes” and “no” counts.

In FY15/16 and FY17/18, respectively, prescribed BMP provisions were implemented fully in an average of 88 and 86 percent of evaluations that had some type of BMP guidance document for operation and maintenance (Table 201). The types of BMPs prescribed most commonly were those associated with maintenance, although BMPs associated with collection system maintenance were least likely to be implemented fully (Table 201). When the numbers and percentages of BMP provisions implemented fully were compared by evaluation, BMPs were included in five provisions on average, and 86 percent of the BMP provisions were implemented fully in FY15/16. In FY17/18, BMPs were included in four provisions on average, and 73 percent were implemented fully; however, 7 of 10 evaluations had all provisions implemented fully, and 2 had no provisions implemented fully.

In FY15/16 and FY17/18, respectively, 57 and 38 percent of spring-source facilities had maintenance activities in the year prior to the evaluation (WatUses B-Q38); 29 percent in FY15/16 and half of the facilities in FY17/18 had not had maintenance activities in the past 5 years. Whether the facility had O&M guidance documents containing BMPs was significantly associated with the timing of the most recent maintenance in FY17/18 ($p = 0.06$) and nearly significant in FY15/16 ($p = 0.12$). Seventy-eight percent of spring-source facilities in FY15/16 and 50 percent in FY17/18 that had O&M documents had been maintained within the past year; 80 percent of facilities in both periods combined without O&M documents had not been maintained in the past 5 years.

Water use, capture, and release requirements for a spring-source facility may be specified in the O&M plan, special use authorization, other O&M guidance documents, or the water right. Thirty-nine percent of evaluations indicated that either the facility had no requirements (WatUses B-Q39) or it was unknown whether requirements were being met (Table 202), and 16 percent reported that requirements were not being met. For the evaluations indicating that requirements were met, 21 percent based the assessment on records, 50 percent on field observations, and 29 percent on both records and field observations (Table 202).

Table 202.—Distribution of whether spring-source facility water use, capture, and release requirements were being met (WatUses B-Q39) for randomly selected WatUses B evaluations completed in FY15/16 (n=15 evaluations) and FY17/18 (n=16 evaluations). Multiple selections were possible.

Water use, capture, and release requirements	FY15/16 (number)	FY17/18 (number)
Not applicable; no requirements	3	4
Records indicate requirements are being met	4	3
Records indicate requirements are not being met	1	0
Field evidence or observations indicate requirements are being met	9	2
Field evidence or observations indicate requirements are not being met	0	4
Unknown	1	4

Two implementation questions—WatUses B-Q40 and WatUses B-Q41—evaluate whether site 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 203) and whether corrective actions were taken if problems occurred during the current operating season (at any time, not just critical times) (Table 204). Critical times are periods associated with large or intense precipitation/runoff events or other times when the potential for the site to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted during critical times during the operating season for 45 percent of the spring-source facilities, and 35 percent of facilities had no inspections (Table 203). Fifty-seven percent of the facilities reported no problems requiring corrective actions at any time during the operating season (Table 204).

Because fuel and other chemicals may be present within or around spring-source facilities during maintenance, an implementation question (WatUses B-Q42) 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

Table 203.—Distribution of whether inspections occurred at critical times (WatUses B-Q40) for randomly selected WatUses 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	5	33	6	38
Not applicable; maintenance avoided critical times	3	20	2	12
Yes	7	47	7	44
No	0		1	6
All	15		16	

Table 204.—Distribution of whether corrective actions (CA) were taken if problems occurred during current operating season (WatUses B-Q41) for randomly selected WatUses 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	9	60	8	53
CA needed but not taken	0		2	13
CA needed and implemented	6	40	3	20
Unknown	0		2	13
All	15		15	

material or waste cleanup, and in those cases the unit would follow that state agency's procedures. One evaluation in FY15/16 indicated that the administrative unit did not have a CERP, and one in FY17/18 indicated that a spill or leak requiring cleanup occurred at a site and that CERP procedures were followed.

Water Uses B: Effectiveness Results and Their Tie to Implementation Results and Header Information

Thirty-three spring-source facilities were evaluated for BMP effectiveness (Table 197). Groundwater-related conditions, including levels, vegetation extent, and species composition (WatUses B-Q47, WatUses B-Q48, and WatUses B-Q49); evidence of physical disturbance (WatUses B-Q50); and evidence of pollutants or potential pollutants (WatUses B-Q51, WatUses B-Q52, WatUses B-Q53, and WatUses B-Q54) are assessed during the review.

For each groundwater-related condition, approximately 60 percent of the facilities reported that no changes had occurred (Table 205). However, about 30 percent of evaluations had no past data, observations, or methods to determine change. The remaining evaluations reported in FY15/16 that groundwater-dependent conditions were improving (Table 205) and in FY17/18 that conditions were declining. When groundwater-related conditions were compared to implementation metrics, significant associations were found for 5 of 30 tests. Whether groundwater levels had changed was significantly associated with whether the collection system was functioning in FY17/18 ($p = 0.06$); two facilities reported decreasing groundwater levels and had nonfunctioning collection systems. A significant association between whether changes in the extent of groundwater-dependent vegetation existed and whether the distribution system was

Table 205.—Distribution of groundwater-related change metrics (WatUses B-Q47, WatUses B-Q48, WatUses B-Q49) used to assess spring-source facility operation and maintenance effectiveness for randomly selected WatUses B evaluations completed in FY15/16 and FY17/18

Metric	Evidence of change	FY15/16 (number)	FY15/16 (percent ^a)	FY17/18 (number)	FY17/18 (percent)
Groundwater levels	Yes; increasing levels	1	6	0	
	Yes; decreasing levels	0		2	12
	No evidence of changes	10	63	10	59
	Unknown	5	31	5	29
Groundwater-dependent vegetation extent	Yes; increasing extent	3	19	0	
	Yes; decreasing extent	0		1	6
	No evidence of changes	10	63	10	59
	Unknown	3	19	6	35
Groundwater-dependent vegetation species composition	Yes; increasing number of species	1	6	0	
	Yes; decreasing number of species	0		1	6
	No evidence of changes	10	63	10	59
	Unknown	5	31	6	35

^a Within each metric.

functional was found in FY17/18 ($p = 0.09$), although this result is likely due to 80 percent of nonfunctioning systems not able to determine whether the vegetation extent had changed. Changes in vegetation extent also were associated with whether O&M guidance documents with BMPs existed for a facility in FY17/18 ($p = 0.04$). About 90 percent of facilities with O&M documents had no vegetation changes; 60 percent of facilities without O&M documents could not determine whether changes had occurred. Whether water use requirements were met was significantly associated with both changes in vegetation extent ($p = 0.03$) and changes in vegetation species composition ($p = 0.01$) in FY17/18. For these two comparisons, when changes had not occurred a higher percentage of facilities either had no water use requirements or the requirements had been met. Use requirements were not met for five facilities, and none could determine whether vegetation changes had occurred.

Physical disturbances were observed for 16 of the 33 spring-source facilities. The types of disturbances are summarized in Figure 104. Whether physical disturbances had occurred was significantly associated with whether the facility had O&M guidance documents in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 1.00$). Eighty percent of facilities in FY15/16 with O&M documents reported no physical disturbances; the reverse was true for facilities without O&M documents. Timing of the most recent facility maintenance was not significantly associated with physical disturbances in either monitoring period ($p = 0.12$ FY15/16, $p = 0.62$ FY17/18), although the association was close to significant in FY15/16. In that period, 87 percent of facilities without disturbances had maintenance activities in the past year; 75 percent of facilities with disturbances did not have maintenance in the five years prior to the evaluation.

The spring, source area, distribution facilities, and receiving waterbody (if one exists) are evaluated separately for evidence of pollutants or potential pollutants (i.e., those that are observed in the area reviewed but are not in the water). Each area of the spring-source facility was reviewed for evidence of the same categories of pollutants (Fig. 105).

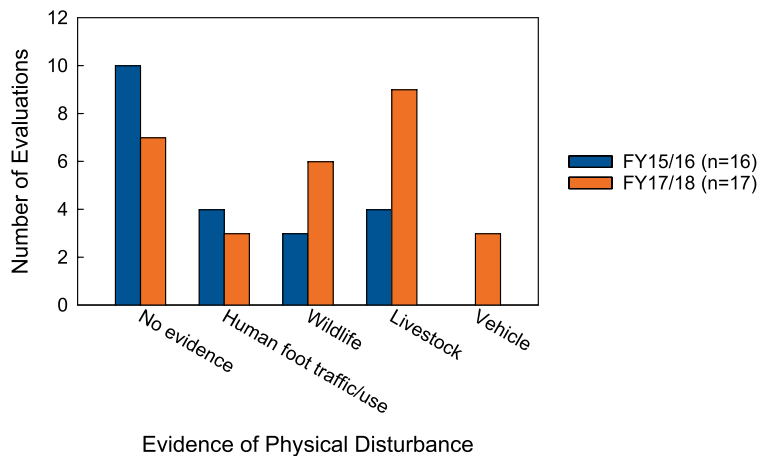


Figure 104.—Distribution of type of evidence of physical disturbance to the spring, source area, distribution facilities, or receiving waters (WatUses B-Q50) for randomly selected evaluations completed in FY15/16 and FY17/18.

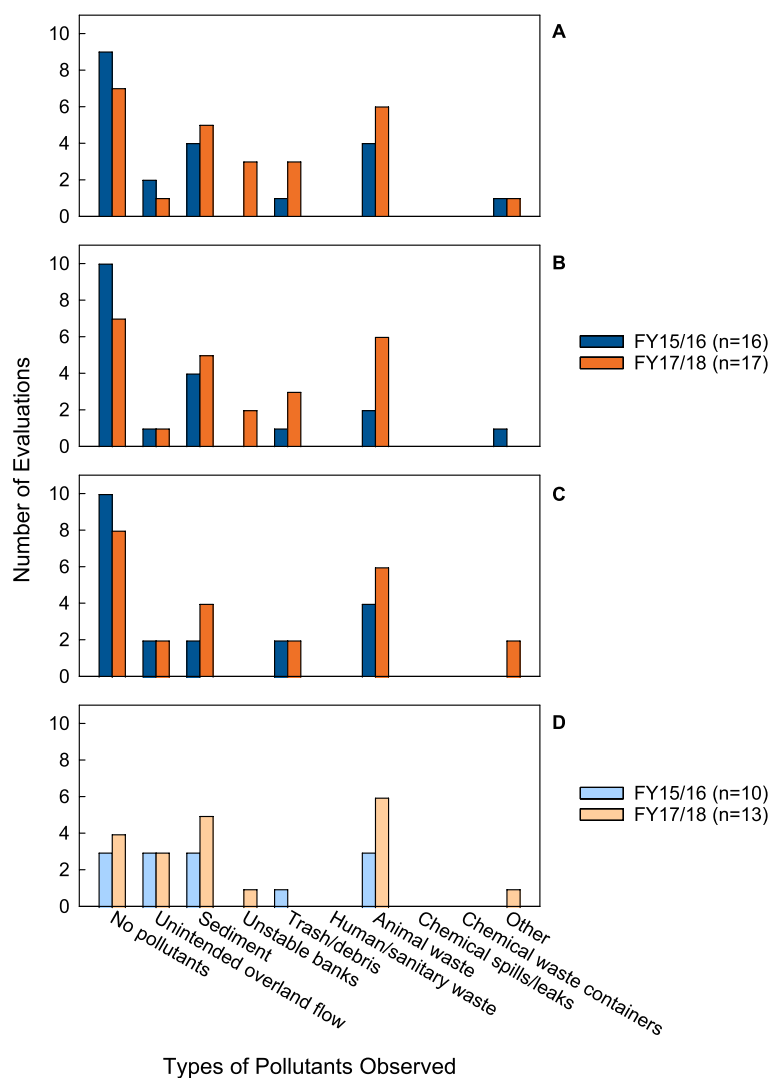


Figure 105.—Distributions of types of pollutants observed at the spring (WatUses B-Q51) (A), source area (WatUses B-Q52) (B), distribution facilities (WatUses B-Q53) (C), and receiving waterbody (WatUses B-Q54) (D) for randomly selected evaluations completed in FY15/16 and FY17/18.

In FY15/16, 55 to 65 percent of evaluations observed no evidence of pollutants in the spring, source area, and distribution facilities. In FY17/18, the percentage ranged from 40 to 50 percent (Fig. 105). Six spring-source facilities in FY15/16 and four in FY17/18 did not have a receiving waterbody. About 30 percent of receiving waterbodies reviewed in each period had no observed evidence of pollutants. In all four areas, animal waste and sediment were the pollutants observed most frequently (Fig. 105). Whether evidence of pollutants was found in an area of the spring-source facility was compared to three implementation metrics—whether the related part of the facility was functioning, whether the facility had O&M guidance documents, and the timing of the most recent maintenance—and one significant association was found (Table 206). However, the relationship between evidence of pollutants in or near the receiving waterbody and

Table 206.—Fisher’s exact test probabilities of association between evidence of pollutants observed at areas of the spring-source facility (WatUses B-Q51 through Q54) and implementation metrics for randomly selected WatUses B evaluations completed in FY15/16 and FY17/18

Area where evidence of pollutants observed	Implementation metric	FY15/16 Implemented fully p-value ^a	FY17/18 Implemented fully p-value
Spring	Collection system functioning	1.00	0.31
	O&M ^b guidance documents exist	1.00	0.20
	Timing of recent maintenance	1.00	0.50
Source area	Collection system functioning	1.00	0.59
	O&M guidance documents exist	1.00	0.74
	Timing of recent maintenance	0.78	0.79
Distribution facility	Distribution system functioning	1.00	0.31
	O&M guidance documents exist	1.00	1.00
	Timing of recent maintenance	0.55	0.62
Receiving waterbody	Distribution system functioning	-- ^c	0.07
	O&M guidance documents exist	0.46	1.00
	Timing of recent maintenance	1.00	1.00

^a Probability of association; significant at $\alpha=0.10$.

^b Operation and maintenance.

^c Test not possible because distribution system was functioning for all facilities.

whether the distribution system was functioning was the opposite of what might be expected. Seven of the eight facilities with observed pollutants had a functioning distribution system, while three of the four facilities with no evidence of pollutants had nonfunctioning distribution systems (primarily broken equipment). These results were likely affected by the small sample sizes in each monitoring period. More evaluations of spring-source facilities are needed to determine the usefulness of these types of comparisons.

During the effectiveness evaluation, an assessment of whether the receiving waterbody (WatUses B-Q55) and the spring (WatUses B-Q57) meet desired conditions is made by the review team; the assessment may be based on established desired conditions or standards or on professional expectations. In addition, the team determines the trend in condition for each area (WatUses B-Q56 and WatUses B-Q58) if information for an assessment is available. In each monitoring period, one evaluation reported that desired conditions for the receiving waterbody had not been met based on established conditions or standards (Table 207). Condition trends for those receiving waterbodies were improving or unknown. For all evaluations, significant associations between whether conditions were met and condition trend were not found in either monitoring period ($p = 0.28$ FY15/16, $p = 1.00$ FY17/18), although this comparison was dominated by evaluations (70 percent) that did not have the information needed to determine a trend (“unknown” response to WatUses B-Q56 or WatUses B-Q58). A summary of desired conditions and trends for the springs are given in Table 208. Seventy-six percent of springs in both periods combined

Table 207.—Distribution of whether receiving waterbody desired conditions or professional expectations have been met (WatUses B-Q55) in relationship to trends in desired conditions (WatUses B-Q56) for randomly selected WatUses B evaluations completed in FY15/16 and FY17/18

Monitoring period	Desired conditions have been met	Trend in desired conditions unknown	Trend in desired conditions declining	Trend in desired conditions unchanging	Trend in desired conditions improving
FY15/16					
	Yes; conditions or standards met	5			2
	No; conditions or standards not met				1
	Yes; professional expectations met	1		1	
	No; professional expectations not met				
FY17/18					
	Yes; conditions or standards met	2		1	
	No; conditions or standards not met	1			
	Yes; professional expectations met	5		2	
	No; professional expectations not met	2			

Table 208.—Distribution of whether spring desired conditions or professional expectations have been met (WatUses B-Q57) in relationship to trends in desired conditions (WatUses B-Q58) for randomly selected WatUses B evaluations completed in FY15/16 and FY17/18

Monitoring period	Desired conditions have been met	Trend in desired conditions unknown	Trend in desired conditions declining	Trend in desired conditions unchanging	Trend in desired conditions improving
FY15/16					
	Yes; conditions or standards met	2		4	3
	No; conditions or standards not met				
	Yes; professional expectations met	2		3	1
	No; professional expectations not met	1			
FY17/18					
	Yes; conditions or standards met	3		3	
	No; conditions or standards not met		1		
	Yes; professional expectations met	1		3	
	No; professional expectations not met	5			1

were meeting desired conditions, and the majority of those assessments were based on established conditions or standards. One spring did not meet desired conditions or standards, and its trend was declining (Table 208). Information was available to determine the trend in condition for 55 percent of the springs. Whether desired conditions for the spring were met and condition trend were not significantly associated in FY15/16 ($p = 0.85$) but were in FY17/18 ($p = 0.03$). In FY17/18, more springs had an unchanging trend when desired conditions were met; when desired conditions were not met, the trend for most springs was unknown (Table 208).

Inspections are an important part of operation and maintenance activities. The WatUses B protocol includes two questions about inspections, one in implementation (WatUses B-Q40) and one in effectiveness (WatUses B-Q59), that are designed to tie together. Respectively, the questions ask whether inspections were completed during critical times for the facility (implementation) 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 two questions for spring-source facilities in which both implementation and effectiveness evaluations were completed for each monitoring period. 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 31 percent in FY17/18 selected incompatible answer choices

Table 209.—Occurrence of inspections performed at critical times during the operating season (WatUses B-Q40) in relationship to problems observed during effectiveness monitoring (WatUses B-Q59) for randomly selected WatUses B evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (27 and 31 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	1	3
	Not applicable; work avoided critical times	2		1
	Yes; inspections at critical times	5		2
	No; inspections not at critical times			
FY17/18				
	No inspections	1	1	4
	Not applicable; work avoided critical times	1		1
	Yes; inspections at critical times	4		3
	No; inspections not at critical times			1

(shaded cells) based on the protocol instructions. For the other spring-source facilities, one evaluation in each monitoring period indicated that the lack of inspections at critical times contributed to problems with effectiveness.

Water Uses B: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

The combination of *fully implemented* and *mostly implemented* ratings included about 53 and 31 percent of the evaluated WatUses B spring-source facilities in FY15/16 and FY17/18, respectively (Fig. 106). BMP effectiveness ratings were higher; 69 and 41 percent of facilities rated as *effective* or *mostly effective* in FY15/16 and FY17/18, respectively (Fig. 106). Nearly half of facilities in FY17/18 were rated as *not effective*. One implementation evaluation and one effectiveness evaluation (for different facilities) lacked responses in the database for questions needed to rate implementation or effectiveness. These are identified as “incomplete data” in Figure 106.

Neither the implementation nor the effectiveness ratings were significantly associated in either monitoring period with whether the spring was perennial (implementation: $p = 0.67$ FY15/16, $p = 0.49$ FY17/18; effectiveness: $p = 0.73$ FY15/16, $p = 0.75$ FY17/18). Similar results were found when ratings were compared by whether the facility had a valid water right and by type of authorization (i.e., Forest Service development not requiring

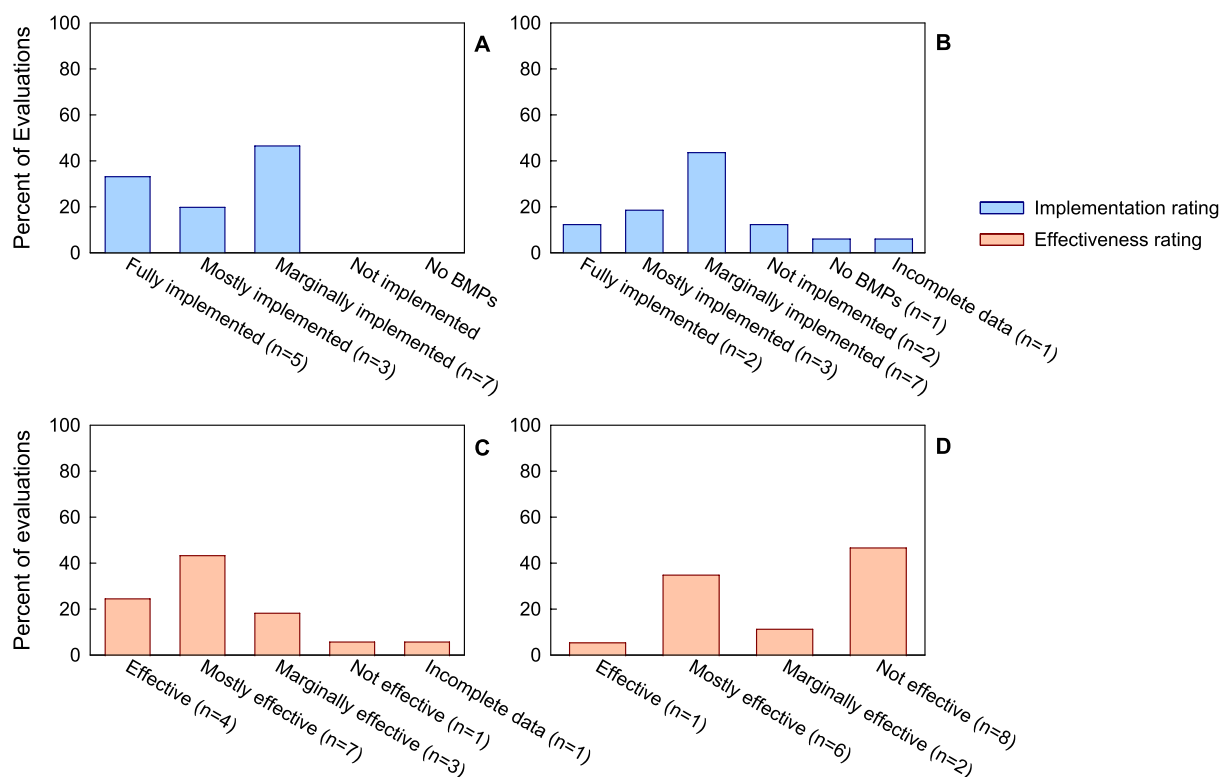


Figure 106.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for randomly selected WatUses B evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

an authorization or permit); only the comparison between implementation ratings and having a valid water right in FY15/16 had a significant association ($p = 0.06$). However, the relationship was the opposite of what might be expected, with a higher percentage of springs with water rights having poorer ratings. Only five springs were not perennial, and six did not have a valid water right; more evaluations of springs in those categories are needed to determine the usefulness of these comparisons.

Tests of association could not be completed for ratings and either the user of the spring-source facility (WatUses B-Q25) or the uses provided by the water supply (WatUses B-Q26) because each facility could have multiple users and multiple uses. However, when implementation and effectiveness ratings are compared visually by user (Fig. 107), facilities that included Forest Service natural resource uses tended to have somewhat poorer ratings in FY17/18. The results were similar—though with larger differences between domestic and resource uses—when general categories of water supply uses were compared visually (Fig. 108).

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (WatUses B-Q16) were associated with the effectiveness ratings in FY15/16 ($p = 0.09$) but not in FY17/18 ($p = 1.00$) (Fig. 109). The number of wet weather evaluations was

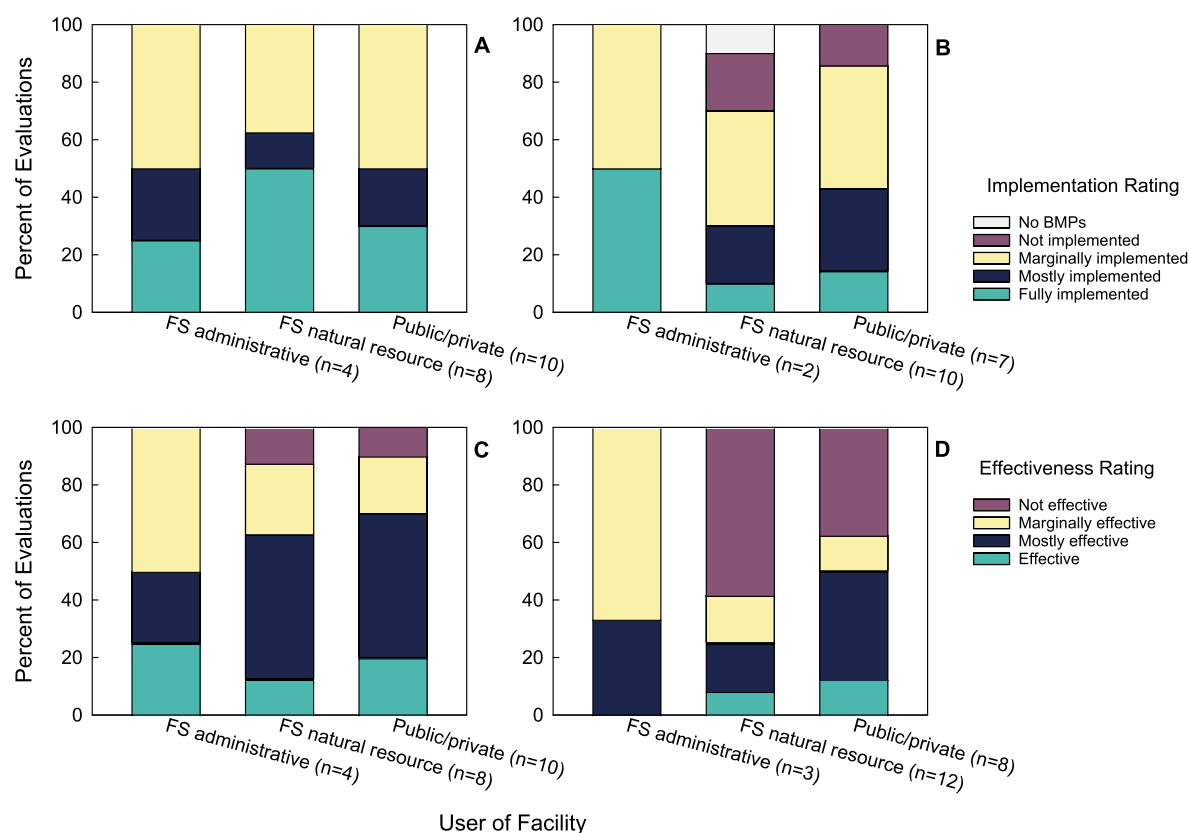


Figure 107.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by user served by facility (WatUses B-Q25) for randomly selected evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). FS = Forest Service.

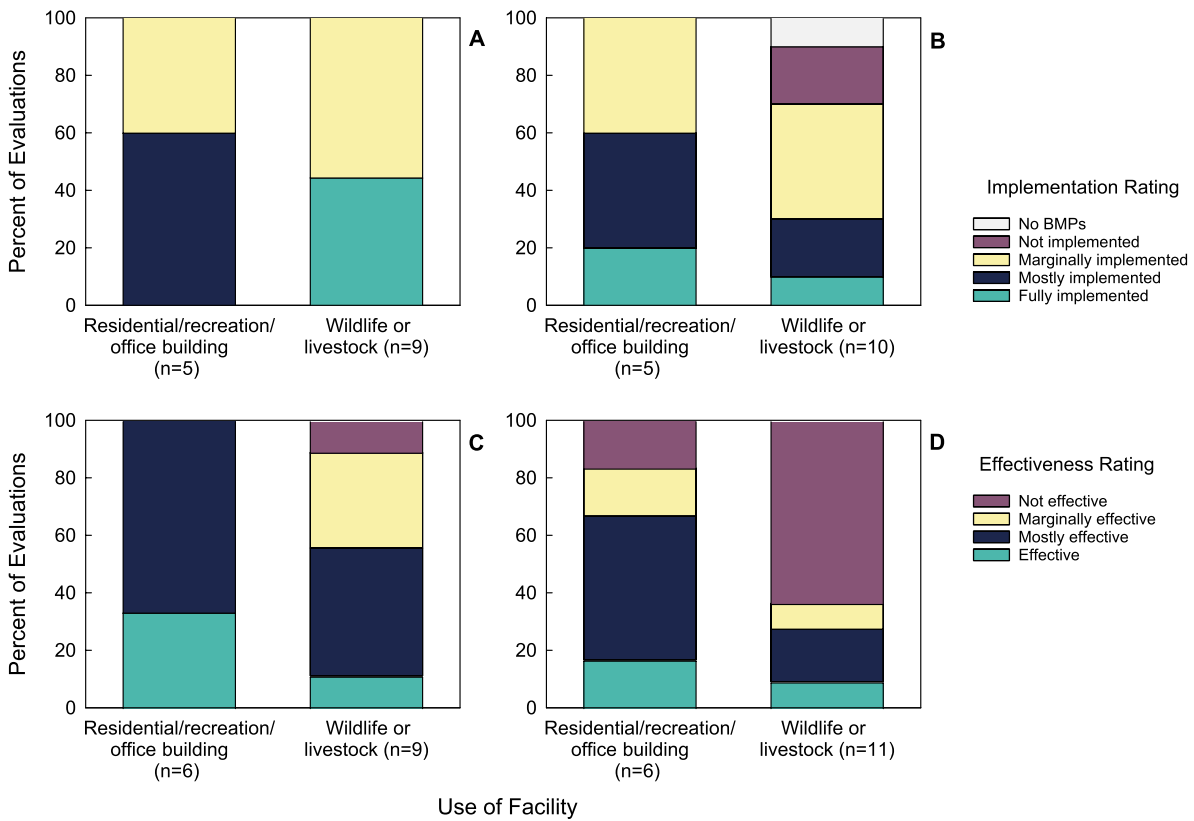


Figure 108.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by general uses provided by facility (WatUses B-Q26) for randomly selected evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

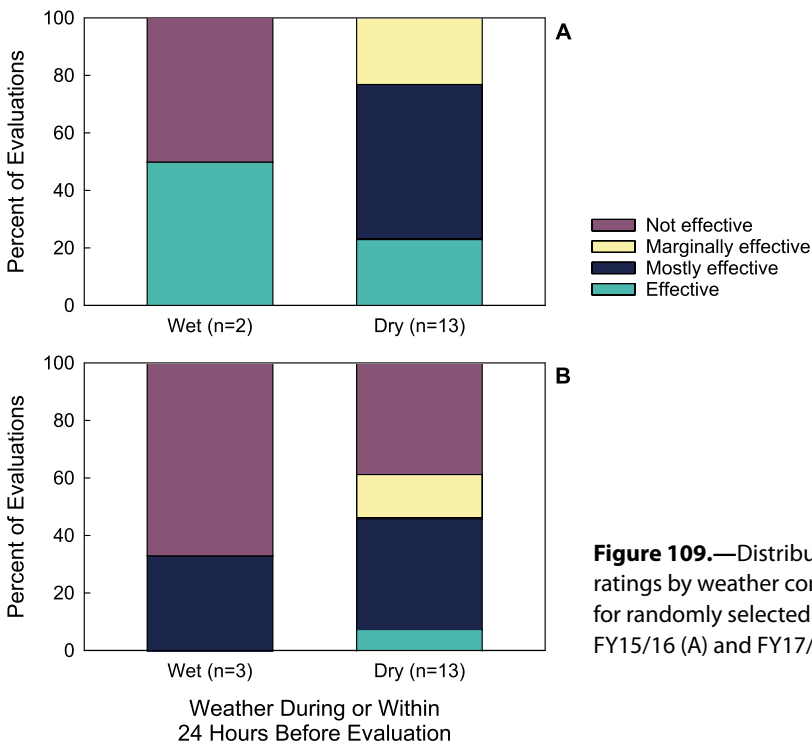


Figure 109.—Distribution of effectiveness ratings by weather conditions (WatUses B-Q16) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

very small, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential. Also, a larger sample of wet weather evaluations would allow tests between weather conditions and evidence of pollutants. Those comparisons 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.

No significant associations existed in either monitoring period between the effectiveness ratings and several implementation metrics: whether the collection system was functioning ($p = 0.74$ FY15/16, $p = 0.68$ FY17/18); whether the distribution system was functioning ($p = 1.00$ FY15/16, $p = 0.68$ FY17/18); whether O&M guidance documents existed and included BMPs for the spring-source facilities ($p = 0.40$ FY15/16, $p = 0.62$ FY17/18); and the timing of the most recent maintenance ($p = 0.89$ FY15/16, $p = 0.29$ FY17/18). These results are not particularly surprising given the small sample sizes for many of the comparisons.

The number of BMP provisions implemented fully (WatUses B-Q29) was not significantly different between the effectiveness ratings in either monitoring period ($p = 0.61$ FY15/16, $p = 0.61$ FY17/18; generalized linear mixed model analysis [GLMM] with negative binomial distribution and log link function). Evaluations averaged from two to four provisions implemented fully in FY15/16 and from two to five in FY17/18 across the effectiveness ratings. Ranges of mean percentages of BMPs implemented fully across the effectiveness ratings were similar in both monitoring periods—from 67 and 60 percent in FY15/16 and FY17/18, respectively, to 100 percent in both periods—and no significant differences were found ($p = 0.48$ FY15/16, $p = 0.76$ FY17/18; Kruskal-Wallis test). Spring-source facilities rated *effective* or *marginally effective* had 95 to 100 percent of BMPs implemented fully compared to those rated *mostly effective* or *not effective* that had 60 to 80 percent of provisions implemented fully.

During the implementation portion of the evaluation, review of documents and inquiries with site administrators occur to determine whether corrective actions were taken if problems were observed during the operating season (WatUses B-Q41). Such actions can protect water quality and be reflected in an improvement in BMP effectiveness. Significant associations were not found between whether corrective actions were taken and the effectiveness ratings in either monitoring period ($p = 0.25$ FY15/16, $p = 0.61$ FY17/18), although ratings were better when actions were not needed or were needed and implemented (Fig. 110). As with many of the statistical tests between implementation metrics and effectiveness ratings, the small sample sizes within categories have limited the usefulness of this comparison (Fig. 110).

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.

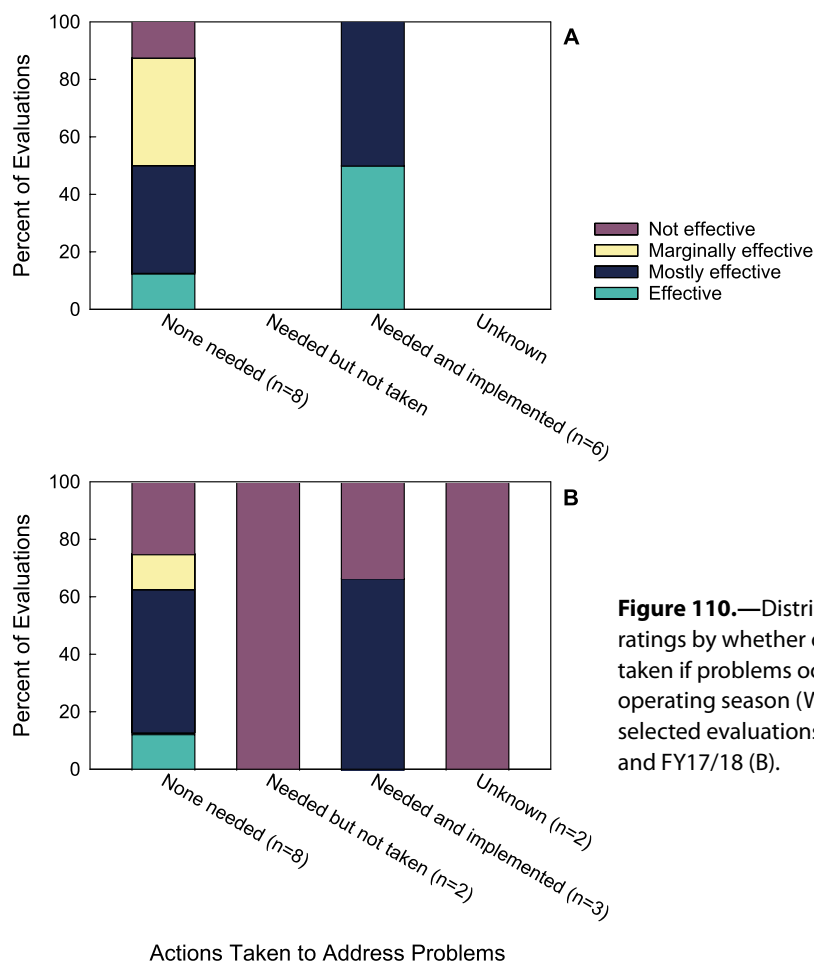


Figure 110.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during the current operating season (WatUses B-Q41) for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

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 of BMPs applicable to the project or site; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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 facilities every operating season to ensure those standards are met or initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations that identified a need for corrective actions or adaptive management actions was somewhat variable but generally less than the number needing no actions (Figs. 111 and 112). Significant associations among implementation ratings and corrective action needs were not found in either monitoring period ($p = 0.15$ FY15/16, $p = 0.76$ FY17/18), and significant associations also were not found among

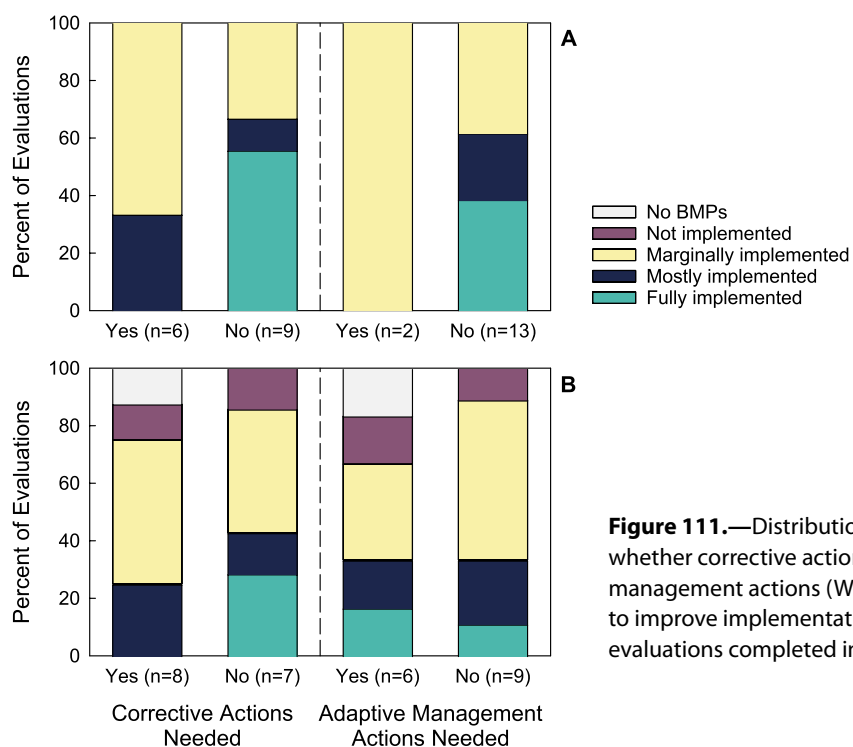


Figure 111.—Distribution of implementation ratings by whether corrective actions (WatUses B-Q43) or adaptive management actions (WatUses B-Q45) were needed to improve implementation for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

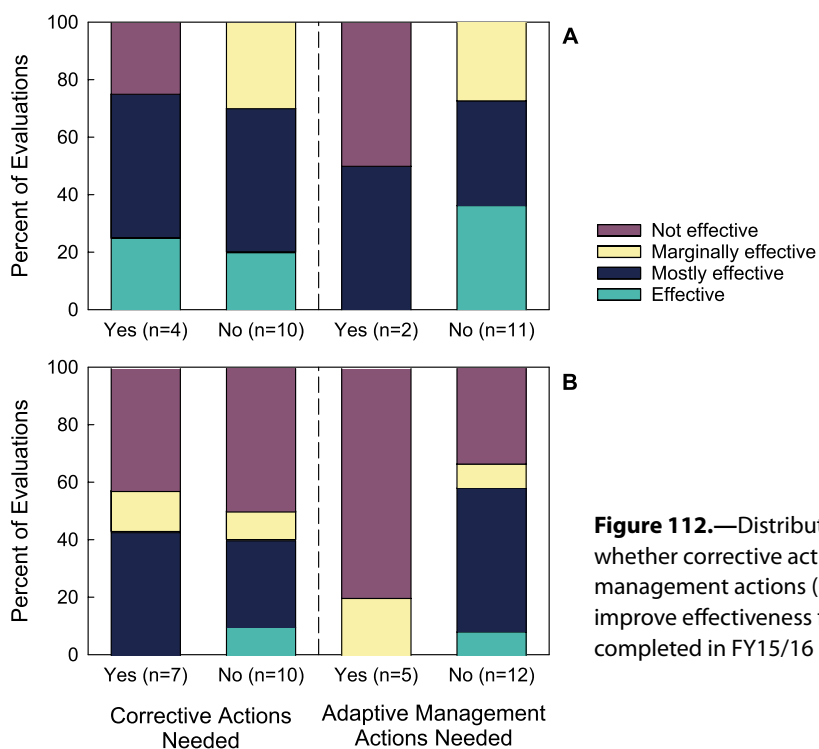


Figure 112.—Distribution of effectiveness ratings by whether corrective actions (WatUses B-Q60) or adaptive management actions (WatUses B-Q62) were needed to improve effectiveness for randomly selected evaluations completed in FY15/16 (A) and FY17/18 (B).

implementation ratings and adaptive management action needs in either period ($p = 0.67$ FY15/16, $p = 0.92$ FY17/18). For most comparisons, however, ratings were poorer when corrective actions or adaptive management actions were needed (Fig. 111). Similarly, there were no significant associations among effectiveness ratings and whether corrective actions were needed in either monitoring period ($p = 0.60$ FY15/16, $p = 1.00$ FY17/18) and not among effectiveness ratings and whether adaptive management actions were needed ($p = 0.19$ FY15/16, $p = 0.14$ FY17/18). Better effectiveness ratings occurred for sites that had no adaptive management action needs identified, but ratings were similar whether or not corrective action needs were identified (Fig. 112).

Some evaluations were rated as *not implemented* and *not effective* in FY17/18 when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. The 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 this 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 WatUses B-Q43, WatUses B-Q45, WatUses B-Q60, and WatUses B-Q62.

Composite Ratings

Composite rating results for randomly selected WatUses B spring-source facilities that were evaluated for both implementation and effectiveness are given in Table 210. Ten percent of facilities had a composite rating of *excellent*, 24 percent were rated as *good*, and 28 percent were rated as *poor*. One facility 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, a significant association between implementation ratings and effectiveness ratings was not found in FY15/16 ($p = 0.54$) but was found in FY17/18 ($p = 0.05$). For the facilities evaluated in FY15/16, better implementation tended to result in better effectiveness, but poorer implementation occurred at all levels of effectiveness. In FY17/18, worse effectiveness occurred across most levels of implementation but more often with worse implementation.

Water Uses B: Examination of Component and Subcomponent Scores

The overall implementation and effectiveness ratings were determined from component scores. The implementation rating components and their interpretations for the WatUses B protocol are given in Table 194. The effectiveness components and score interpretations are given in Table 211. Table 212 shows how the scores were distributed across the three implementation components. Seven facilities had all three components scored as *all* and were rated as *fully implemented* (Table 213). Performance was generally better for the project oversight component than the other components in each monitoring period (Table 212). Two evaluations scored as *none* for the project oversight component, which necessarily resulted in *not implemented* implementation ratings (Table 213).

Table 210.—Composite rating matrix for randomly selected WatUses B spring-source facilities evaluated for both implementation and effectiveness in FY15/16 (n=14 evaluations) and FY17/18 (n=15 evaluations). Numbers in cells indicate the number of evaluations 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		2		
	Mostly effective	1	3	2		
	Marginally effective	2		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		1			
	Mostly effective	1		5		
	Marginally effective	1				
	Not effective		2	2	2	1

Excellent
 Good
 Fair
 Poor
 No plan

Table 211.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the WatUses B protocol

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
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
Waterbody condition	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 212.—Distribution of implementation component scores by component for randomly selected WatUses 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=15)							
	All	7	47	8	53	10	67
	Some	8	53	7	47	5	33
	None						
	No BMPs						
FY17/18 (n=16)							
	All	4	25	5	31	8	50
	Some	11	69	11	69	5	31
	None					2	13
	No BMPs	1	6				
	Incomplete data ^a					1	6

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

An *all* score for the planning component indicates that the spring-source facility had design criteria for the collection and distribution systems; O&M guidance documents that contained BMPs; and water use, capture, and release requirements. Of the facilities that had a planning component score of *some*, five had no design criteria, nine had no O&M documents, and five had no water use requirements. A *no BMPs* planning component score results when a facility has no design criteria, no O&M documents, and no water use requirements.

The on-the-ground execution component assesses whether design criteria have been met, whether BMPs have been implemented fully in the field, and whether water use requirements have been met. Fourteen facilities had an on-the-ground execution component score of *some* because design criteria were not met. Four other facilities also had that component score; of these, two facilities did not have all BMPs implemented fully, and two did not meet water use requirements. Scores of *some* and *none* for the project oversight component result from a deficiency in inspections or corrective actions not being taken when needed.

The score distributions for the three effectiveness components are shown in Table 214. No component had consistently better scores than the other components. Five spring-source facilities had *effective* scores for all three components and an overall effectiveness rating of *effective* (Table 215). About half of facilities in FY15/16 were rated *mostly effective*; in FY17/18, about half were rated *not effective*.

A waterbody protection component score of less than *effective* indicates that changes were observed to groundwater-dependent metrics (water level or vegetation), that physical disturbances at the facility were observed, or both. Two facilities were scored

Table 213.—Implementation component scores corresponding to the overall implementation ratings for randomly selected WatUses B evaluations with complete data in FY15/16 and FY17/18. See Table 194 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=15)					
	Fully implemented	All	All	All	5
	Mostly implemented	Some	All	All	1
		Some	All	Some	2
	Marginally implemented	All	Some	All	2
		Some	Some	All	2
		Some	Some	Some	3
	Not implemented				0
	No BMPs				0
FY17/18 (n=15)					
	Fully implemented	All	All	All	2
	Mostly implemented	All	All	Some	1
		Some	All	All	1
		Some	All	Some	1
	Marginally implemented	Some	Some	All	5
		Some	Some	Some	2
	Not implemented	All	Some	None	1
		Some	Some	None	1
	No BMPs	No BMPs	Some	Some	1

Table 214.—Distribution of effectiveness component scores by component for randomly selected WatUses B evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Waterbody protection component (number)	Waterbody protection component (percent)	Pollutants component (number)	Pollutants component (percent)	Waterbody condition component (number)	Waterbody condition component (percent)
FY15/16 (n=16)							
	Effective	10	63	10	63	8	50
	Mostly effective	3	19	4	25	6	38
	Marginally effective	2	12	1	6		
	Not effective	1	6			1	6
	Incomplete data ^a			1	6	1	6
FY17/18 (n=17)							
	Effective	7	41	9	53	3	18
	Mostly effective	1	6	4	24	7	41
	Marginally effective	5	29	3	18	1	6
	Not effective	4	24	1	6	6	35

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

Table 215.—Effectiveness component scores corresponding to the overall effectiveness ratings for randomly selected WatUses B evaluations with complete data in FY15/16 and FY17/18. See Table 211 for meaning of effectiveness component descriptors.

Monitoring period	Effectiveness rating	Waterbody protection component	Pollutants component	Waterbody condition component	Number of evaluations
FY15/16 (n=15)					
	Effective	Effective	Effective	Effective	4
	Mostly effective	Effective	Effective	Mostly effective	3
		Effective	Mostly effective	Effective	1
		Mostly effective	Effective	Effective	1
		Mostly effective	Effective	Mostly effective	1
		Mostly effective	Mostly effective	Mostly effective	1
	Marginally effective	Effective	Marginally effective	Effective	1
		Marginally effective	Effective	Effective	1
		Marginally effective	Mostly effective	Mostly effective	1
	Not effective	Effective	Mostly effective	Not effective	1
FY17/18 (n=17)					
	Effective	Effective	Effective	Effective	1
	Mostly effective	Effective	Effective	Mostly effective	5
		Mostly effective	Effective	Effective	1
	Marginally effective	Marginally effective	Marginally effective	Effective	1
		Marginally effective	Mostly effective	Mostly effective	1
	Not effective	Effective	Effective	Not effective	1
		Marginally effective	Mostly effective	Not effective	3
		Not effective	Effective	Not effective	1
		Not effective	Marginally effective	Marginally effective	1
		Not effective	Marginally effective	Not effective	1
		Not effective	Not effective	Mostly effective	1

as *mostly effective* for the waterbody protection component due to changes in one or more groundwater-dependent metrics, and two had that score due to minor physical disturbances. Two or more types of physical disturbances at seven facilities that did not have changes in the groundwater-related metrics resulted in *marginally effective* component scores. The pollutants component scores reflect the location and severity of chemical, sediment, trash, or waste evidence observed at the facility. Fifty-eight percent of facilities had no evidence of pollutants and scored as *effective* (Table 214). One facility scored as *not effective* because three or four types of pollutants were observed at each area of the facility reviewed. When desired conditions for the spring and receiving waterbody are being met and trends in conditions are not declining, the waterbody condition component score is *effective*; one-third of facilities had that score (Table 214). Waterbody condition component scores of less than *effective* were due to deficiencies in the spring desired condition and trend (13 facilities), deficiencies in the receiving waterbody desired

condition and trend (4 facilities), and deficiencies in both the spring and receiving waterbody desired conditions and trends (4 facilities).

Comparison of the effectiveness component scores to overall implementation ratings found no significant associations between component scores and the implementation ratings in either monitoring period (waterbody protection: $p = 1.00$ FY15/16, $p = 0.14$ FY17/18; pollutants: $p = 0.89$ FY15/16, $p = 0.14$ FY17/18; waterbody condition: $p = 0.16$ FY15/16, $p = 0.57$ FY17/18). When compared visually, only the waterbody condition component scores were somewhat better with better implementation ratings (Fig. 113). The statistical results for some comparisons were likely affected by the small number of evaluations with effectiveness component scores other than *effective* (Table 214).

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 114. Again, no significant associations were found between the effectiveness ratings and the scores for the three components in either monitoring period (planning: $p = 0.18$ FY15/16, $p = 0.60$ FY17/18; on-the-ground

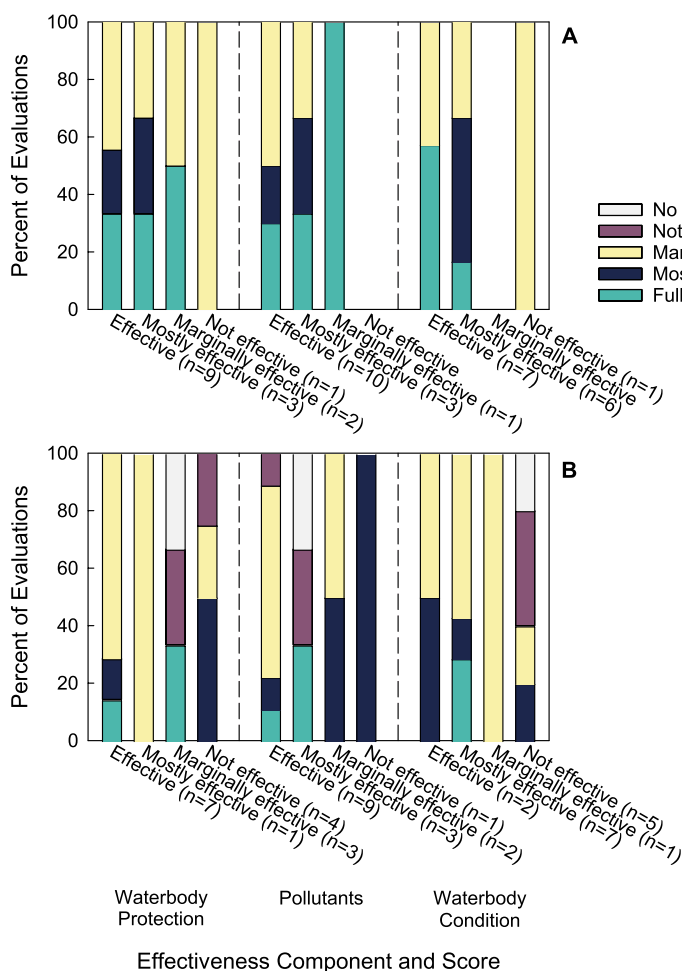


Figure 113.—Distribution of implementation ratings across effectiveness component scores for randomly selected WatUses B evaluations completed in FY15/16 (A) and FY17/18 (B).

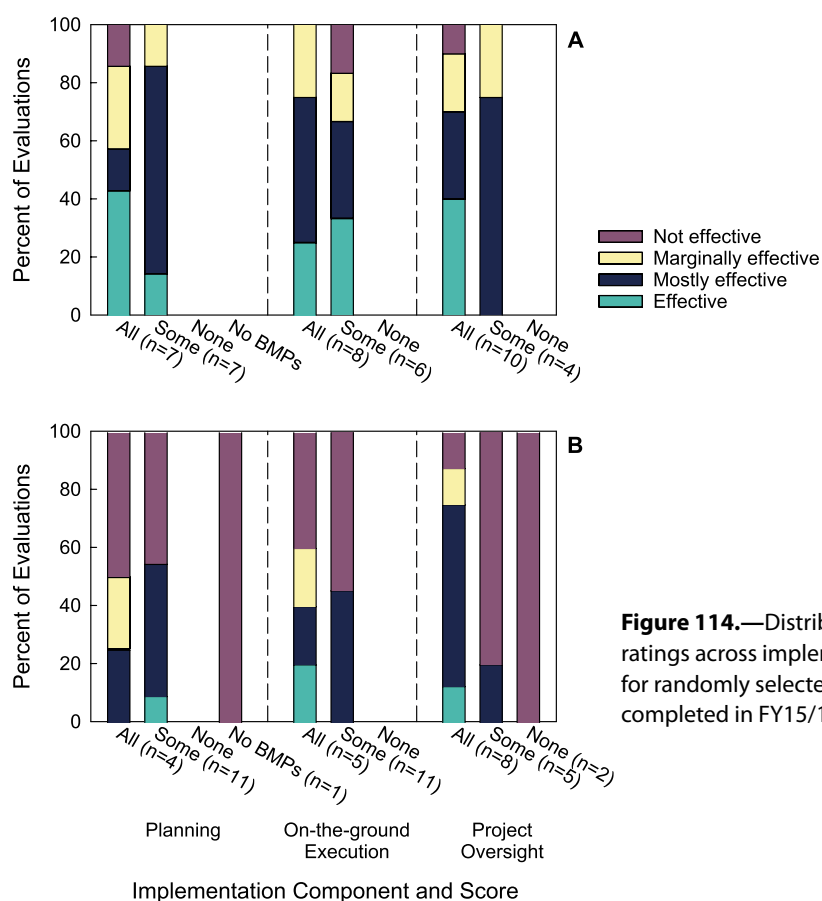


Figure 114.—Distribution of effectiveness ratings across implementation component scores for randomly selected WatUses B evaluations completed in FY15/16 (A) and FY17/18 (B).

execution: $p = 0.88$ FY15/16, $p = 0.24$ FY17/18; project oversight: $p = 0.40$ FY15/16, $p = 0.11$ FY17/18). The association between ratings and project oversight component scores in FY17/18 was very nearly significant; in that period, effectiveness ratings were better when component scores were *all* (Fig. 114).

Water Uses B: Management Implications for Forest Service Resource Managers

Forty-three percent of the spring-source facilities evaluated for operation and maintenance rated either *fully implemented* or *mostly implemented* for BMP implementation, and 47 percent rated *marginally implemented*. One spring facility was rated *no BMPs*. Project planning was a deficiency at 64 percent of the facilities. Planning deficiencies were predominantly a lack of operation and maintenance documents. Five sites had no design criteria for the spring facility, and five lacked water use requirements. Deficiencies in on-the-ground execution occurred for more than half of the facilities, mostly because the design criteria were not met. Project oversight generally was better than the other two components; 60 percent of the facilities scored *all* for this component. Deficiencies in project oversight included a lack of inspections and corrective actions not implemented when the need was identified.

For BMP effectiveness, 57 percent of the spring source facilities rated *effective* or *mostly effective* (indicating that either no impacts to water quality were observed or observed impacts were minor and temporary), and more than 25 percent of sites rated *not effective*. Of the three effectiveness components, the pollutants component had a higher percentage of *effective* scores at 59 percent of facilities; observed pollutants were most frequently animal waste or sediment. The waterbody condition component had the lowest percentage of *effective* scores (34 percent of facilities) and the highest percentage of *not effective* scores (22 percent).

Most of the waterbody condition deficiencies were due to deficiencies in condition of the spring. Most of the *marginally effective* scores for the waterbody protection component were due to physical disturbance at the spring. When the overall effectiveness rating was something other than *effective*, the waterbody condition component most frequently had the lowest score.

No significant association was found between BMP implementation and BMP effectiveness at the rating or component score levels. However, for 57 and 67 percent of facilities rated *fully implemented* or *mostly implemented*, respectively, the effectiveness ratings at those sites were either *effective* or *mostly effective*. All the sites rated *not implemented* or *no BMPs* were rated *marginally effective* or *not effective*.

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

- Applying the design criteria when constructing collection and distribution systems. Forty-eight percent of the collection systems and 52 percent of the distribution systems did not meet design criteria.
- Developing a written operation and maintenance (O&M) plan for the spring facility. Most of the spring facilities with an O&M plan had received maintenance within the 5 years prior to the evaluation; 80 percent of spring facilities without an O&M plan had not. Spring facilities with an O&M plan were more likely to have no evidence of physical disturbance than facilities without an O&M plan. In FY17/18, a significant association was found between facilities with an O&M plan and change in extent of groundwater dependent vegetation; 90 percent of facilities with an O&M plan did not have a change in extent of vegetation.
- Ensuring that spring facilities are maintained regularly. The association between the timing of the most recent maintenance and physical disturbance was nearly significant. For evaluations completed in FY15/16, 87 percent of spring facilities without evidence of physical disturbance had been maintained within the previous year; 75 percent of spring facilities with evidence of physical disturbance had not been maintained in the previous 5 years.
- Taking corrective actions when problems that may affect water quality are identified. The effectiveness ratings were better at spring facilities where corrective actions were not needed or were taken when needed. The two sites needing corrective actions that were not taken were rated *not effective*.

- Protecting the spring source from livestock, wildlife, and human foot traffic. Evidence of those types of disturbance were reported at 39, 27, and 21 percent of the springs evaluated, respectively. The pollutants observed most frequently in the spring and source area were animal waste and sediment.
- Carrying out periodic monitoring of the spring, source area, and receiving waters for condition, vegetation community, and water levels. This information is useful for assessing the effectiveness of BMPs.
- Giving comparable levels of attention to springs developed for wildlife or livestock uses and those developed for residential or recreational uses. Implementation and effectiveness ratings were generally poorer for spring facilities developed for wildlife or livestock.

Water Uses B: Best Management Practices Monitoring Form

Best Management Practices Evaluation WatUses B. Operation and Maintenance of Spring Source Facilities (Reference BMPs WatUses-1, WatUses-3, and Fac-3) v3.0 February 2016	
Header	
WatUses B-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
WatUses B-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
WatUses B-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
WatUses B-Q4	Date of current field evaluation:
WatUses 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:
WatUses 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:
WatUses B-Q7	Reviewers and titles:
WatUses B-Q8a	Region number:
WatUses B-Q8b	State:
WatUses B-Q9a	Proclaimed Forest or Grassland number and name:
WatUses B-Q9b	Administrative Forest or Grassland number and name:
WatUses B-Q10	District number and name:
WatUses B-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
WatUses 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
WatUses 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: a. Yes b. No 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:
WatUses B-Q12	6 th level HUC number and name for the subwatershed this spring is located in:
WatUses B-Q13	Is the spring located within a municipal supply watershed? Select one: a. Yes b. No
WatUses B-Q14a	Location. UTM Zone: UTM Datum:
WatUses B-Q14b	Location. Easting:
WatUses B-Q14c	Location. Northing:
WatUses B-Q15a	Location. Latitude:
WatUses B-Q15b	Location. Longitude:
WatUses B-Q15c	Location. Lat/Long Datum:
WatUses B-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
WatUses B-Q17	Name of waterbody to which the spring drains:
WatUses B-Q18	Is the spring perennial? Select one: a. Yes b. No

continued on next page

Header <i>(continued)</i>	
WatUses B-Q19	Type of infrastructure present. Select all that apply: Pipe Spring box Spring box with diversion Other diversion structure Cistern/holding tank Trough or other use structure Fencing Other (specify):
WatUses B-Q20	Is there a valid water right for this spring development? Select one: a. Yes (go to question 21) b. No (go to question 24)
WatUses B-Q21	State water right number for this spring:
WatUses B-Q22	Permitted periods of water use and amounts for each period (cfs, acre-ft, or gal/min; specify units):
WatUses B-Q23	Owner of the water right:
WatUses B-Q24	Forest Service name or identifier for this spring:
WatUses B-Q25	User served by this water facility. Select all that apply: a. Forest Service administrative (facility) use b. Forest Service natural resource use c. Public or private use
WatUses B-Q26	Uses provided by this water supply. Select all that apply: Residential Recreation site or campground Office building Visitor center Wildlife use Stock water Agriculture Other (specify):
WatUses B-Q27	What is the authorization for the spring? Select one: a. Not applicable, Forest Service development (go to question 31) b. Permit (go to question 28) c. Easement (go to question 28) d. Assertion (go to question 28) e. Lease (go to question 28) f. No current/valid authorization (go to question 31)
WatUses B-Q28	Is the authorization renewable? Select one: a. Yes b. No
WatUses B-Q29	What year was the spring authorized?
WatUses B-Q30	What year does the current authorization expire? (end header questions):
WatUses B-Q31	What year was the spring developed?

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Implementation	
WatUses B-Q32	Does the collection system fully meet design criteria? Select one: a. Not applicable, no design criteria for collection system b. Unknown, information about design criteria could not be located c. Yes d. No If No, what design criteria are not met:
WatUses B-Q33	Is the collection system functional? Select one: a. Yes b. No If No, identify needed repairs:
WatUses B-Q34	Does the distribution system fully meet design criteria? Select one: a. Not applicable, no design criteria for distribution system b. Unknown, information about design criteria could not be located c. Yes d. No If No, what design criteria are not met:
WatUses B-Q35	Is the distribution system functional? Select one: a. Yes b. No If No, identify needed repairs:
WatUses B-Q36	Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this spring contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 37) b. Plan, SUP, or other O&M guidance documents exist for this spring, but they do not contain provisions for water/aquatic/riparian protection (go to question 38) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this spring (go to question 38)
WatUses B-Q37	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 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 in the operating season to require implementation, select Not applicable. a. Maintenance of spring Yes/No/Not applicable b. Maintenance of collection system Yes/No/Not applicable c. Maintenance of distribution system Yes/No/Not applicable d. Methods to regulate or control diversion or release of water Yes/No/Not applicable e. Control (fencing, etc.) to limit access by animals and/or humans Yes/No/Not applicable f. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:

continued on next page

Implementation <i>(continued)</i>	
WatUses B-Q38	When did the most recent maintenance of the facility occur? Select one: a. Observable evidence or records indicate maintenance has occurred within the past year b. Observable evidence or records indicate that maintenance occurred 1–5 years ago c. Observable evidence or records indicate no maintenance has occurred within the past 5 years
WatUses B-Q39	Are the water use, capture, and release requirements that are specified in the operation and maintenance plan, SUP, other O&M guidance documents, or in the water right for this spring being met? Select all that apply: a. Not applicable, no use, capture and release requirements for this spring b. Records indicate all of the use, capture, and release requirements are being met c. Records indicate not all of the use, capture, or release requirements are being met d. Evidence or observation today indicates all of the use, capture, and release requirements are being met e. Evidence or observation today indicates not all of the use, capture, or release requirements are being met f. Unknown, no way to tell
WatUses B-Q40	Were inspections during this operating season performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Not applicable, maintenance was conducted to avoid critical times c. Yes d. No
WatUses B-Q41	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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
WatUses B-Q42	Were chemical or fuel spills or leaks, or dumping that occurred at this spring facility during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills, leaks, or dumping occurred during the past 5 years c. Yes, spills, leaks, or dumping were handled/treated according to the contingency and emergency response plan d. No, spills, leaks, or dumping were not handled/treated according to the contingency and emergency response plan
WatUses B-Q43	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 44) b. No (go to question 45)
WatUses B-Q44	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.

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Implementation <i>(continued)</i>	
WatUses B-Q45	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 46) b. No (go to question 47 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
WatUses B-Q46	Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 47 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question.
Effectiveness	
WatUses B-Q47	Is there evidence of changes to groundwater levels (beyond normal seasonal and annual variations) at the source, spring, or spring distribution facilities? Select one: a. Yes, evidence of increasing groundwater levels b. Yes, evidence of decreasing groundwater levels c. No evidence of change d. Unknown, no past data, observations, or methods to determine change If Yes, describe the evidence:
WatUses B-Q48	Is there evidence of changes in the extent of groundwater-dependent vegetation associated with this spring? Select one: a. Yes, evidence of increasing extent of groundwater-dependent vegetation b. Yes, evidence of decreasing extent of groundwater-dependent vegetation c. No evidence of change d. Unknown, no past data or observations to determine change If Yes, describe the evidence:
WatUses B-Q49	Is there evidence of changes in the species composition of groundwater-dependent vegetation? Select one: a. Yes, evidence of increasing numbers of groundwater-dependent species b. Yes, evidence of decreasing numbers of groundwater-dependent species c. No evidence of change d. Unknown, no past data or observations to determine change If Yes, describe the evidence:
WatUses B-Q50	Is there evidence of physical disturbance to the spring, source area, distribution facilities, or receiving water? Select all that apply: a. No evidence of physical disturbance b. Yes, due to human foot traffic/use c. Yes, due to wildlife d. Yes, due to livestock e. Yes, due to vehicles
WatUses B-Q51	Which types of pollutants or potential pollutants exist for the spring? Select all that apply: a. No pollutants or potential pollutants b. Unintended overland flow c. Sediment (erosion or deposition) d. Unstable banks e. Trash/debris f. Human sanitary waste g. Animal waste h. Chemical or fuel spills or leaks i. Chemical or fuel waste containers j. Other (specify):

continued on next page

Effectiveness *(continued)*

WatUses B-Q52	Which types of pollutants exist in the source area? Select all that apply: a. No pollutants b. Unintended overland flow c. Sediment (erosion or deposition) d. Unstable banks e. Trash/debris f. Human sanitary waste g. Animal waste h. Chemical or fuel spills or leaks i. Chemical or fuel waste containers j. Other (specify):
WatUses B-Q53	Which types of pollutants or potential pollutants exist for the distribution facilities? Select all that apply: a. No pollutants or potential pollutants b. Unintended overland flow c. Sediment (erosion or deposition) d. Unstable banks e. Trash/debris f. Human sanitary waste g. Animal waste h. Chemical or fuel spills or leaks i. Chemical or fuel waste containers j. Other (specify):
WatUses B-Q54	Which types of pollutants or potential pollutants exist for the receiving waterbody? Select all that apply: a. Not applicable, no receiving waterbody (go to question 57 for this answer choice only) b. No pollutants or potential pollutants c. Unintended overland flow d. Sediment (erosion or deposition) e. Unstable banks f. Trash/debris g. Human sanitary waste h. Animal waste i. Chemical or fuel spills or leaks j. Chemical or fuel waste containers k. Other (specify):
WatUses B-Q55	Does the condition of the receiving waterbody meet desired conditions? Select one: a. Yes, meets established desired conditions or standards b. No, does not meet desired conditions or standards c. Desired conditions not formally established, but conditions meet professional expectations (explain reasons for this answer): d. Desired conditions not formally established, but conditions do not meet professional expectations (explain reasons for this answer):
WatUses B-Q56	Based on past and current records, observations, and evaluations, what is the trend in the receiving waterbody's condition? Select one: a. Unknown, no past information, or information is insufficient to assess trend b. Condition is declining (explain reasons for this answer): c. Condition is unchanging (explain reasons for this answer): d. Condition is improving (explain reasons for this answer):

continued on next page

Effectiveness <i>(continued)</i>	
WatUses B-Q57	Does the spring meet desired conditions? Select one: a. Yes, meets established desired conditions or standards b. No, does not meet desired conditions or standards c. Desired condition not formally established, but conditions meet professional expectations (explain reasons for this answer): d. Desired condition not formally established, but conditions do not meet professional expectations (explain reasons for this answer):
WatUses B-Q58	Based on past and current records, observations, and evaluations, what is the trend in the spring's condition? Select one: a. Unknown, no past information available, or information is insufficient to assess trend b. Condition is declining (explain reasons for this answer): c. Condition is unchanging (explain reasons for this answer): d. Condition is improving (explain reasons for this answer):
WatUses B-Q59	If inspections were not conducted at critical times during this operating season, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No
WatUses B-Q60	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 61) b. No (go to question 62)
WatUses B-Q61	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
WatUses B-Q62	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 63) b. No (go to General Comments)
WatUses B-Q63	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	

Water Uses C—Completed Reconstruction/Repair or Operation and Maintenance of Water Sources (Drafting)

Eight reconstruction or repair projects of water sources used for drafting were evaluated (four in each monitoring period). Twelve water sources were evaluated for operation and maintenance activities (five in FY15/16 and seven in FY17/18). One evaluation did not indicate whether reconstruction or repair (henceforth referred to as construction) or operation and maintenance was being evaluated and had no responses in the database

for the implementation portion of the review even though “both implementation and effectiveness” was selected as the type of evaluation (WatUses C-Q1); the data from that evaluation are excluded from the WatUses C analyses.

Water Uses C (Reconstruction/Repair [Construction]): Descriptive Statistics

Seven of the eight WatUses C (construction) evaluations included both implementation and effectiveness monitoring completed on the same day. The other evaluation was an implementation-only review completed near the end of the FY17/18 monitoring period, and it is possible that the effectiveness review occurred in the FY19/20 monitoring period. Regions 2 and 5 completed three evaluations each, and Regions 1 and 4 completed one evaluation each (see App. 1 for region delineations). Every evaluation indicated that a reason for monitoring was to meet National BMP targets. Project review also was a reason for three evaluations. Three construction projects were selected randomly; this low number is not surprising given the likelihood that the number of projects available was limited. The most common types of infrastructure present (WatUses C-Q19) at the project sites were native surface approaches and dams; each was reported in five evaluations. Uses of the water sources (WatUses C-Q20) were many, with none reported more often than any other. “Other” uses included livestock watering, irrigation, and drinking water. For most sites, the construction project had been completed 1 year before the evaluation.

BMPs derived from a NEPA process decision document were included in the contract or plan for six projects: four decision documents were categorical exclusions (CEs), one was an environmental assessment (EA), and one was an environmental impact statement (EIS) (WatUses C-Q24). When a BMP provision was applicable to a project, those BMPs from planning were included in the contract or plan for 62 percent of projects on average (WatUses C-Q25). BMPs in the provisions “streambank or waterbody protection” and “location” were applicable and included most frequently. Applicable BMP provisions were implemented fully in the field (WatUses C-Q26) in an average of 70 percent of projects. The mean number of BMP provisions applicable to a project (including projects without planning documents where BMPs were derived from standard contract or plan language) was five, and on average 81 percent were implemented fully. BMPs in the two provisions listed above were applicable to seven projects and implemented fully for six projects. Half of the water source projects had inspections at critical times, two had inspections but not at critical times, and one had no inspections (WatUses C-Q30). One project needed corrective actions, and those actions were implemented (WatUses C-Q31). That project also had a chemical spill or leak that was handled according to the administrative unit contingency and emergency response plan cleanup procedures (WatUses C-Q32).

Seven water source construction projects were evaluated for effectiveness. Two projects had no evidence of erosion or sedimentation at the site (WatUses C-Q37), two had evidence observed in an aquatic management zone (AMZ) 10 feet or less from the nearest waterbody, and three projects observed evidence at one or two places in the waterbody. When evidence was in the waterbody, nine different types of evidence were reported, including morphological changes, bank damage, and headcutting (WatUses C-Q42). Every waterbody affected or potentially affected was a perennial stream or river (WatUses C-Q40). Five different sources, including four “other” sources (WatUses C-Q43),

and seven causes (WatUses C-Q44) were reported for the erosion or sedimentation. Five evaluations reported that adequate flows were present to maintain aquatic species habitat or communities during drafting (WatUses C-Q45), and two evaluations indicated that flow may have been partially limiting. No chemical or fuel spills, leaks, or waste containers were observed in any project area during the effectiveness reviews (WatUses C-Q46). For the two projects that did not have inspections during critical times (as reported during the implementation review), both reported that the lack of administration did not contribute to problems observed during the effectiveness evaluation (WatUses C-Q47).

Water Uses C (Construction): Ratings and Component Scores

Two WatUses C construction projects in both monitoring periods combined were rated as *fully implemented*, one was rated as *mostly implemented*, and three as *marginally implemented*. The two projects that did not have BMPs from planning documents were rated as *no BMPs*. For the effectiveness portion, two projects were rated as *effective*, two were rated as *marginally effective*, and three as *not effective*. Composite rating results for WatUses C construction projects with complete data are given in Table 216. More than half of the projects had a composite rating of *poor* because of the effectiveness ratings.

Table 216.—Composite rating matrix for WatUses C reconstruction or repair projects evaluated for both implementation and effectiveness in FY15/16 (n=4 evaluations) and FY17/18 (n=3 evaluation). Numbers in cells indicate the number of evaluations 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			2		
	Not effective					1

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					
	Not effective	1		1		

- Excellent
- Good
- Fair
- Poor
- No plan

The implementation rating components and their interpretations for WatUses C (construction) are given in Table 180. Three projects had planning component scores of *all*, indicating that all BMPs from planning documents were included in the project contract or plan. Three projects had *some* scores for the planning component because not all BMPs from planning were included in the contract or plan. Five projects scored as *all* for the on-the-ground execution component (i.e., all applicable BMPs were implemented fully), and five projects scored as *all* for the project oversight component. Forty-four percent of applicable BMP provisions were not implemented fully on average for the three projects with *some* scores for the on-the-ground execution component. Three projects scored as *some* for the project oversight component because inspections were not at critical times or did not occur. Two water source construction projects had an implementation rating of *fully implemented* resulting from *all* scores for each of the three components. One project with *some* scores for the planning and project oversight components and an *all* score for the on-the-ground execution component had an implementation rating of *mostly implemented*. On-the-ground execution component scores of *some* resulted in an implementation rating of *marginally implemented* for three projects.

The effectiveness rating components and their interpretations for WatUses C (construction) are given in Table 181. All seven projects evaluated for effectiveness had a score of *effective* for the chemical pollutants component. The erosion and sedimentation component scores were *effective* or *marginally effective* for two projects each and *not effective* for three projects. Five projects had waterbody protection component scores of *effective*, and two had scores of *moderately effective*. Two projects had *effective* scores for all three components and effectiveness ratings of *effective*. For the other projects, the effectiveness rating was due to—and thus the same as—the erosion and sedimentation component scores of either *marginally effective* or *not effective*.

Water Uses C (Operation and Maintenance [O&M]): Descriptive Statistics

Twelve water sources for drafting were evaluated for operation and maintenance (five in FY15/16 and seven in FY17/18). Evaluations were completed in Regions 1, 4, 5, and 6; Region 5 completed two-thirds of all evaluations (see App. 1 for region delineations). Meeting National BMP program targets was a reason for monitoring for every evaluation. Four of the water sources were selected randomly. All evaluations included implementation and effectiveness reviews completed on the same day. Infrastructure present at the water sources (WatUses C-Q19) is summarized in Table 217; “other” infrastructure included a campground, a bridge, and a bridge asphalt drafting pad. Six water sources provided a single use, and the six other sources provided multiple uses (WatUses C-Q20). Road-related uses were reported most often for both monitoring periods combined (Fig. 115); the two “other” uses were related to recreation. Development dates (WatUses C-Q21) for the water sources ranged from 1949 to 2015, although dates were unknown for half the sites. Seven water sources had been reconstructed or repaired (WatUses C-Q22) from 1 year to 20 years prior to the evaluation; for the other sites, the year was unknown or no work had occurred.

Table 217.—Infrastructure present at the water sources (WatUses C-Q19) for WatUses C operation and maintenance evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

Infrastructure	FY15/16 (number)	FY17/18 (number)
Natural surface approach	3	2
Surfaced approach	2	4
Turnaround	1	1
Bump log or barrier		3
Pond or other storage	1	3
Dam or other diversion structure	1	2
Return flow structures		
Other	3	1

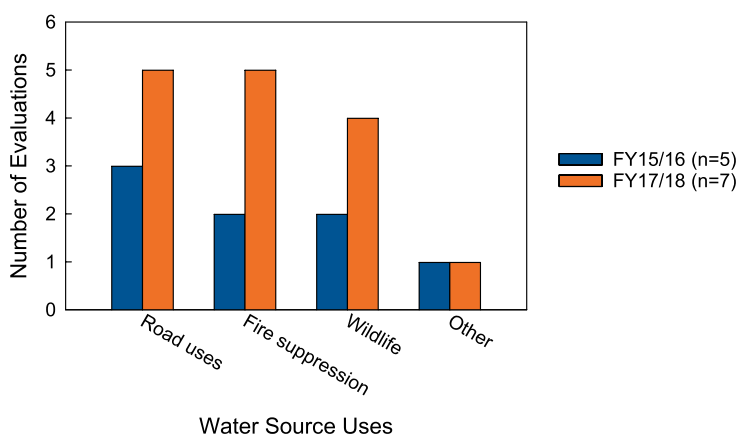


Figure 115.—Distribution of uses provided by water source (WatUses C-Q20) for operation and maintenance evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

All the water sources evaluated in FY15/16 and six of seven evaluated in FY17/18 had an operation and maintenance (O&M) plan or other O&M guidance documents that contained BMPs for protecting water, aquatic, and riparian resources (WatUses C-Q27). Sites averaged BMPs in three provisions in FY15/16 and six provisions in FY17/18 (WatUses C-Q28). Applicable BMP provisions were implemented fully for 100 percent of evaluations in FY15/16. In FY17/18, applicable BMP provisions were implemented fully for 95 percent of evaluations on average. Three evaluations had BMPs not implemented fully in one provision; those provisions were the most often applicable: “location,” “streambank or waterbody protection,” and “flow requirements, or restriction or limitations on water use.” Two water sources had maintenance in the year prior to the evaluation (WatUses C-Q29), four sites had maintenance 1 to 5 years prior, five sites had

maintenance more than 5 years prior, and one site had no maintenance. Inspections were at critical times during the past 5 years of O&M (WatUses C-Q30) for three water sources in FY15/16, O&M activities avoided critical times for two and one sites in FY15/16 and FY17/18, respectively, and six sites in FY17/18 either had no inspections (five sites) or had inspections not at critical times (one site). Three evaluations in each monitoring period indicated that no problems requiring corrective actions had occurred at the water source (WatUses C-Q31). One site in each period needed corrective actions; needed actions were implemented for the site evaluated in FY15/16 but not for the site evaluated in FY17/18. At four sites, the review teams could not determine whether corrective actions had been needed or taken. None of the evaluations indicated that the administrative unit was lacking a contingency and emergency response plan (CERP) for handling chemical spills (WatUses C-Q32). A chemical spill had occurred in the past 5 years at one site evaluated in FY15/16, and the spill cleanup was handled according to the CERP.

No evidence of erosion or sedimentation (WatUses C-Q37) was observed at any of the five sites in FY15/16 and at four of the sites in FY17/18. The other three sites evaluated in FY17/18 observed evidence in the waterbody at one or two places. The types of evidence reported most frequently (WatUses C-Q42) were sediment deposition in the waterbody and rill erosion. A source of the evidence reported by the three evaluations with observed evidence was the approach or turnaround (WatUses C-Q43); one site also reported the waterbody banks as a source. The causes of the erosion reported by the three evaluations were poor facility design and inadequate or improper surface treatments (WatUses C-Q44); two sites also reported lack of maintenance and inadequate drainage treatment as causes.

Nine of the 12 evaluated water sources (three in FY15/16 and six in FY17/18) had adequate flows present to maintain aquatic species or communities during drafting (WatUses C-Q45). One site in each period indicated that flows were partially limiting to aquatic species, and one site in FY15/16 had limited flows such that water drafting would affect aquatic species. Evidence of chemical or fuel spills or leaks (WatUses C-Q46) was observed during two evaluations in FY15/16, although only one reported a spill or leak during the implementation review. Evidence was outside the aquatic management zone (AMZ) at one site and within the AMZ at the other.

Two questions about inspections, one in implementation (WatUses C-Q30) and one in effectiveness (WatUses C-Q47), are designed to tie together. Respectively, the questions ask whether inspections were completed during critical times for the water source and whether lack of inspections during critical times influenced BMP effectiveness. Table 218 shows the relationship between those two questions for sites in which both implementation and effectiveness evaluations were completed. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Sixty percent of the evaluations in FY15/16 and 29 percent in FY17/18 selected incompatible answer choices (shaded cells) based on the protocol instructions. For the remaining sites, three evaluations in FY17/18 indicated that a deficiency in inspections contributed to problems with effectiveness.

Table 218.—Occurrence of site inspections performed at critical times (WatUses C-Q30) in relationship to problems observed during effectiveness monitoring (WatUses C-Q47) for WatUses C operation and maintenance evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (60 and 29 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	1		1
	Yes; inspections at critical times	1	1	1
	No; inspections not at critical times			
FY17/18				
	No inspections		1	
	Not applicable; work avoided critical times	1		
	Yes; inspections at critical times			
	No; inspections not at critical times	2	2	1

Water Uses C (O&M): Ratings and Component Scores

All five water sources in FY15/16 were rated as *fully implemented*. In FY17/18, one site was rated as *fully implemented*, two were rated *mostly implemented*, two were *marginally implemented*, one was rated *not implemented*, and one site did not have O&M guidance documents and received a *no BMPs* implementation rating. For the effectiveness reviews, half of all sites in both periods combined were rated as *effective*, two were rated *mostly effective*, one was rated *marginally effective*, and three sites were rated *not effective*. Every evaluation had complete data, and composite ratings could be determined (Table 219). Forty-two percent of water sources had composite ratings of *excellent*, and one-third were rated as *poor*.

The implementation rating components and their interpretations for WatUses C (O&M) are given in Table 220. Every water source in FY15/16 had an *all* score for all three components; in FY17/18, one water source had an *all* score for all three components. Four additional sites in FY17/18 scored as *all* for the on-the-ground execution component (i.e., all applicable BMPs were implemented fully). Two sites scored as *some*, with 58 percent of applicable BMP provisions not implemented fully on average. Five water sources scored as *some* for the project oversight component in FY17/18 because inspections were not at critical times or inspections did not occur. One site scored as *none* due to a lack in inspections and corrective actions not taken when needed. Two water sources with *some*

Table 219.—Composite rating matrix for WatUses C water source operation and maintenance evaluated for both implementation and effectiveness in FY15/16 (n=5 evaluations) and FY17/18 (n=7 evaluation). Numbers in cells indicate the number of evaluations 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				
	Mostly effective	2				
	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	2			1
	Mostly effective					
	Marginally effective				1	
	Not effective			2		

Excellent
 Good
 Fair
 Poor
 No plan

Table 220.—Implementation components, scores, and interpretation of each score used for determining overall implementation ratings for WatUses C operation and maintenance (O&M) and WatUses E protocols

Implementation component	Component score	Score interpretation
Planning	All	Operation and maintenance (O&M) documents for the site contain BMP provisions
	No BMPs prescribed	O&M documents exist for the site but do not contain BMP provisions
	No O&M	No O&M documents exist for the site
On-the-ground execution	All	All BMPs included in the O&M documents were implemented fully
	Some	Some of the BMPs included in the O&M documents were implemented fully, but at least one was not
	None	None of the BMPs included in the O&M documents were implemented fully
Project oversight	All	All necessary corrective actions identified during implementation were implemented
	Some	Some, but not all, of the necessary corrective actions identified during implementation were implemented
	None	No necessary corrective actions identified during implementation were implemented

scores for the project oversight component and *all* scores for the other components had implementation ratings of *mostly implemented*. On-the-ground execution component scores of *some* resulted in an implementation rating of *marginally implemented* for two projects. The *none* score for the project oversight component resulted in a *not implemented* rating.

The effectiveness rating components and their interpretations for WatUses C (O&M) are given in Table 181. All sites except one had a score of *effective* for the chemical pollutants component. The erosion and sedimentation component scores were *effective* for nine sites (including every site in FY15/16), *marginally effective* for one site, and *not effective* for two sites. Two evaluations had waterbody protection component scores of *moderately effective*, and one scored as *not effective*; the remaining water sources had waterbody protection component scores of *effective*. Six sites had *effective* scores for all three components and effectiveness ratings of *effective*. In FY15/16, two sites had either a waterbody protection or chemical pollutants component score of *moderately effective* and a rating of *mostly effective*, and one site had a *not effective* waterbody protection component score that resulted in a *not effective* rating. For three sites in FY17/18, the effectiveness rating was solely due to—and thus the same as—the erosion and sedimentation component scores of either *marginally effective* or *not effective*.

Water Uses C: Best Management Practices Monitoring Form

Best Management Practices Evaluation

WatUses C. Completed Reconstruction/Repair or Operation and Maintenance of Water Sources (Drafting)

(Reference BMPs WatUses-3, Fac-2, Fire-3, AqEco-2, AqEco-3, and AqEco-4)

v3.0 February 2016

Header	
WatUses C-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
WatUses C-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
WatUses C-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
WatUses C-Q4	Date of current field evaluation:
WatUses 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:
WatUses 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:
WatUses C-Q7	Reviewers and titles:
WatUses C-Q8a	Region number:
WatUses C-Q8b	State:
WatUses C-Q9a	Proclaimed Forest or Grassland number and name:
WatUses C-Q9b	Administrative Forest or Grassland number and name:
WatUses C-Q10	District number and name:
WatUses C-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
WatUses 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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
WatUses 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: a. Yes b. No 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:
WatUses C-Q12	6 th level HUC number and name for the subwatershed this water source is located in:
WatUses C-Q13	Is the water source located within a municipal supply watershed? Select one: a. Yes b. No
WatUses C-Q14a	Location. UTM Zone: UTM Datum:
WatUses C-Q14b	Location. Easting:
WatUses C-Q14c	Location. Northing:
WatUses C-Q15a	Location. Latitude:
WatUses C-Q15b	Location. Longitude:
WatUses C-Q15c	Location. Lat/Long Datum:
WatUses C-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
WatUses C-Q17	Road number associated with accessing the drafting site:
WatUses C-Q18a	Name of waterbody which feeds or serves as the water source:
WatUses C-Q18b	Unique site name for this drafting site (only required if multiple drafting sites occur on this waterbody):

continued on next page

Header (continued)	
WatUses C-Q19	Type of infrastructure present. Select all that apply: Natural surface approach Surfaced approach Turn around Bump log or barrier Pond or other storage Dam or other diversion structure Return flow structures Other (specify):
WatUses C-Q20	Uses provided by this water-source facility. Select all that apply: Road uses Fire suppression Wildlife Other (specify):
WatUses C-Q21	What year was the source developed?
WatUses C-Q22	What year was the source last reconstructed/repared?
Implementation	
WatUses C-Q23	Are you evaluating either reconstruction or repair of a drafting facility? Select one: a. Yes (go to question 24) b. No (go to question 27)
WatUses 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: a. No planning document containing BMP guidance was used (go to question 26) b. Environmental Impact Statement (EIS) (go to question 25) c. Environmental Assessment (EA) (go to question 25) d. Categorical Exclusion (CE) (go to question 25) e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 25)
WatUses 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 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. a. Location (e.g., avoiding sensitive features) Yes/No/Not applicable b. Approach and/or turn around surfacing Yes/No/Not applicable c. Approach and/or turn around drainage Yes/No/Not applicable d. Barriers Yes/No/Not applicable e. Water storage/holding facility Yes/No/Not applicable f. Diversion/inlet structure Yes/No/Not applicable g. Streambank or waterbody protection Yes/No/Not applicable h. Characterization of reactive materials Yes/No/Not applicable i. Size limits on drafting area or associated facilities Yes/No/Not applicable (continued)

continued on next page

Implementation (continued)

(WatUses C-Q25 continued)	j. Flow requirements, or restrictions or limitations on water use Yes/No/Not applicable k. Facility maintenance requirements Yes/No/Not applicable l. Other (specify): Yes/No/Not applicable
WatUses C-Q26	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, select Not applicable. After answering, go to question 29. a. Location (e.g., avoiding sensitive features) Yes/No/Not applicable b. Approach and/or turn around surfacing Yes/No/Not applicable c. Approach and/or turn around drainage Yes/No/Not applicable d. Barriers Yes/No/Not applicable e. Water storage/holding facility Yes/No/Not applicable f. Diversion/inlet structure Yes/No/Not applicable g. Streambank or waterbody protection Yes/No/Not applicable h. Characterization of reactive materials Yes/No/Not applicable i. Size limits on drafting area or associated facilities Yes/No/Not applicable j. Flow requirements, or restrictions or limitations on water use Yes/No/Not applicable k. Facility maintenance requirements Yes/No/Not applicable l. Other provisions specified in question 25l Yes/No/Not applicable m. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
WatUses C-Q27	Does the operation and maintenance plan or other operation and maintenance guidance documents for this water source facility contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 28) b. Plan or O&M guidance documents exist for this water source, but it does not contain provisions for water/aquatic/riparian protection (go to question 29) c. No operation and maintenance plan or other O&M guidance documents exist for this water source (go to question 29)

continued on next page

Implementation *(continued)*

WatUses C-Q28	Indicate if provisions to protect water, aquatic, and riparian resources in the list below that were included in the operation and maintenance plan or other O&M guidance documents for this water source were implemented fully during the past 5 years. Select one response in each line. If the provision exists in the operation and maintenance plan or other O&M guidance documents and it was implemented fully, select Yes. If the provision exists in the operation and maintenance plan or other O&M guidance documents but it was not implemented fully, select No. If the provision does not exist in operation and maintenance plan or other O&M guidance documents, select Not applicable. a. Location (e.g., avoiding sensitive features) Yes/No/Not applicable b. Approach and/or turn around surfacing Yes/No/Not applicable c. Approach and/or turn around drainage Yes/No/Not applicable d. Barriers Yes/No/Not applicable e. Water storage/holding facility Yes/No/Not applicable f. Diversion/inlet structure Yes/No/Not applicable g. Streambank or waterbody protection Yes/No/Not applicable h. Characterization of reactive materials Yes/No/Not applicable i. Size limits on drafting area or associated facilities Yes/No/Not applicable j. Flow requirements, or restrictions or limitations on water use Yes/No/Not applicable k. Facility maintenance requirements Yes/No/Not applicable l. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
WatUses C-Q29	When did the most recent maintenance of the water-source facility occur? Select one: a. Not applicable, reconstruction or repair occurred within the past year b. Observable evidence or records indicate maintenance has occurred within the past year c. Observable evidence or records indicate that maintenance occurred 1–5 years ago d. Observable evidence or records indicate no maintenance has occurred during the past 5 years
WatUses C-Q30	Were inspections during reconstruction/repair or during the past 5 years of operation and maintenance performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Not applicable, work was conducted to avoid critical times c. Yes d. No

continued on next page

Implementation <i>(continued)</i>	
WatUses C-Q31	If problems occurred during reconstruction/repair or during the past 5 years of operation and maintenance that affected or potentially may have affected water, aquatic, or riparian resources, were corrective actions taken to reduce or eliminate the problems? Select one: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
WatUses C-Q32	Were chemical or fuel spills or leaks that occurred during reconstruction/repair or during the past 5 years of operation and maintenance handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred at this water source facility c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan
WatUses C-Q33	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 34) b. No (go to question 35)
WatUses C-Q34	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
WatUses C-Q35	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 36) b. No (go to question 37 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
WatUses C-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	
WatUses C-Q37	Is there evidence of erosion or sedimentation resulting from or attributable to drafting or the drafting facilities? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of erosion or sedimentation (go to question 45) b. Evidence erosion or sedimentation outside an AMZ (go to question 39) c. Evidence erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 39) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 38)
WatUses C-Q38	How many total places do you observe erosion or sedimentation delivered to/present in the waterbody and changes to waterbody morphology? Select one; after answering go to question 40: a. 1 or 2 b. 3 or 4 c. 5 or more

continued on next page

Effectiveness *(continued)*

WatUses C-Q39 What is the shortest distance between the evidence and the waterbody? Select one:

- a. ≤10 feet
- b. >10 to 50 feet
- c. >50 to 100 feet
- d. >100 feet

WatUses C-Q40 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:

- a. Ephemeral stream
- b. Intermittent stream
- c. Perennial stream or river
- d. Pond
- e. Lake
- f. Wetland or wet meadow
- g. Estuary
- h. Other (specify):

WatUses C-Q41 What is the width of the AMZ associated with the waterbody? (ft or m; specify unit):

WatUses C-Q42 For all of the occurrences of erosion and sedimentation observed in the area you identified in question 37, what is the evidence? Select all that apply:

- a. Traceable evidence to the waterbody, but not currently visible in the waterbody
- b. Turbidity present
- c. Evidence of localized sediment deposition in the waterbody
- d. Changes to substrate composition
- e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)
- f. Bank instability
- g. Bank trampling or compaction
- h. Vegetation damage or bare ground
- i. Sheet erosion
- j. Rill erosion
- k. Gully erosion
- l. Headcutting
- m. Slumping/slips
- n. Mass wasting
- o. Sediment plumes or accumulations
- p. Rutting
- q. Water quality monitoring results
- r. Other (specify):

WatUses C-Q43 What are the sources? Select all that apply:

- a. Approach or turn around
- b. Waterbody banks
- c. Other (specify):

WatUses C-Q44 What are the causes? Select all that apply:

- a. Poor facility design
- b. Lack of facility maintenance
- c. Inadequate treatment of drainage
- d. Inadequate or improper surface treatment of approach or turnaround
- e. Other (specify):
- f. Unknown

continued on next page

Effectiveness <i>(continued)</i>	
WatUses C-Q45	Is there adequate flow to maintain aquatic communities during drafting? Select one: a. Adequate flows are present to maintain aquatic species habitat or communities during drafting b. Flow may be partially limiting to aquatic species habitat or communities during drafting c. Flows are limited; water drafting will affect aquatic species habitat or communities d. Unknown
WatUses C-Q46	What evidence of chemical or fuel spills or leaks or associated waste containers exists on the approach, in the turn-around area, or at any other water-source facility feature? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside the AMZ c. Evidence of chemical or fuel spills or leaks within the AMZ d. Evidence of chemical or fuel spills or leaks in the waterbody e. Evidence of chemical or fuel waste containers outside the AMZ f. Evidence of chemical or fuel waste containers within the AMZ g. Evidence of chemical or fuel waste containers in the waterbody
WatUses C-Q47	If inspections were not conducted at critical times during reconstruction/repair or during the past 5 years of operation and maintenance, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No
WatUses C-Q48	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 49) b. No (go to question 50)
WatUses C-Q49	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
WatUses C-Q50	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 51) b. No (go to General Comments)
WatUses 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	

Water Uses D—Active Construction of Diversions and Conveyances

Water Uses D: Descriptive Statistics

Ten evaluations of active construction of diversions and conveyances were completed (eight in FY15/16 and two in FY17/18). The evaluations were completed in Regions 2, 3, 4, 6, and 10 (see App. 1 for region delineations). Eight projects were reviewed for implementation and effectiveness on the same day. Two projects in FY15/16 completed only the implementation portion of the evaluation. Eighty percent of projects were selected randomly (Table 178). All projects indicated that a reason for monitoring was to meet National BMP targets (Table 221). Three evaluations also selected quality assurance as a reason for monitoring. 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 monitoring effort on that same site . . . [by] different team members than the initial 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 a duplicate evaluation, 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.

Seven of the diversions had a valid water right, and three did not (WatUses D-Q17). One water right was owned by the Forest Service (WatUses D-Q19). Three facilities will provide water to Forest Service administrative uses, and seven facilities will provide water for public or private uses when completed (WatUses D-Q21). Five of the facilities were authorized by permit, one was authorized by an easement, and three had no current or valid authorization (WatUses D-Q22). Intended and beneficial uses of the diversion and conveyance facility are summarized in Figure 116. “Other” intended uses included wetland creation, fish rearing, and snowmaking, while “other” beneficial uses were related to agriculture. Seven projects involved perennial streams or rivers, and one project each involved an intermittent stream, a perennial spring, and groundwater (WatUses D-Q25). Between one and five activities were ongoing at the time of the project evaluation (WatUses D-Q28), with conveyance construction and/or temporary erosion control occurring at half of the sites (Table 222).

Table 221.—Number of WatUses D evaluations completed in FY15/16 and FY17/18, by reason for monitoring (WatUses D-Q11a). Multiple selections were possible.

Reason for monitoring	FY15/16 (number)	FY17/18 (number)
National BMP targets	8	2
Land management plan monitoring	1	1
Project review	4	2
Quality assurance	2	1
Other (proposed water rights transfer)	1	

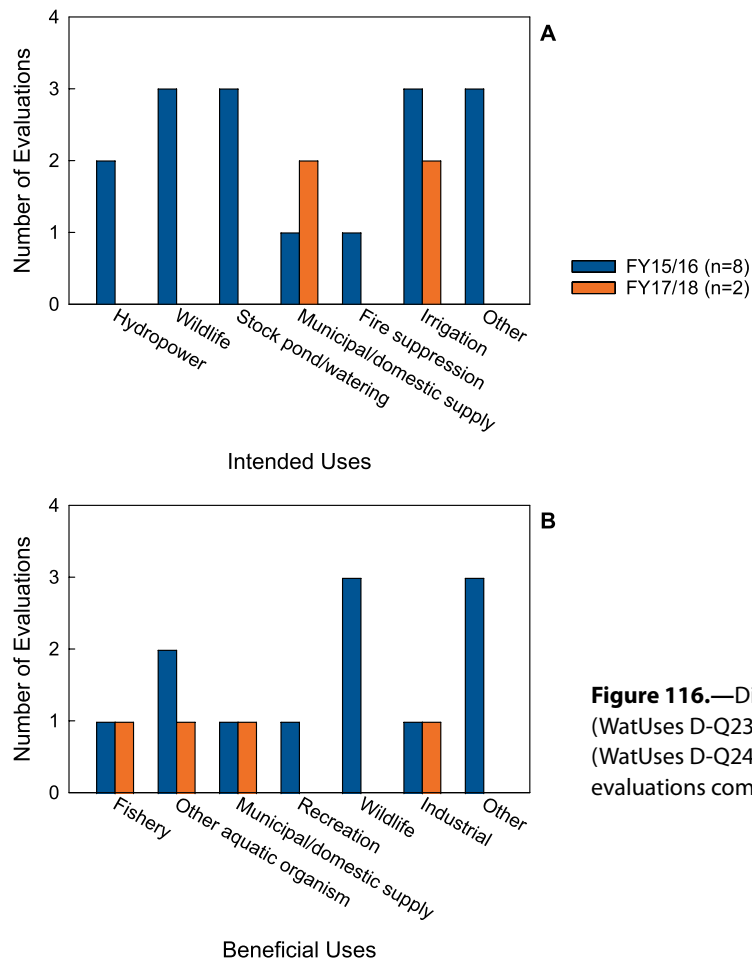


Figure 116.—Distributions of intended uses (WatUses D-Q23) (A) and beneficial uses (WatUses D-Q24) (B) of the diversion water for evaluations completed in FY15/16 and FY17/18.

Table 222.—Project activities ongoing at the time of the evaluation (WatUses D-Q28) for WatUses D evaluations completed in FY15/16 and FY17/18. Multiple selections were possible.

Activity	FY15/16 (number)	FY17/18 (number)
Diversion excavation	1	
Conveyance excavation	4	
Dewatering or diversion process	2	1
Diversion structure construction	3	1
Conveyance construction	4	1
Temporary erosion control	4	1
Final erosion control	3	1
Other	3	

Six construction projects in FY15/16 and both projects in FY17/18 had BMPs from planning documents included in the project contract or plan. Three projects used categorical exclusions (CEs), three used environmental assessments (EAs), and two used other BMP guidance documents (WatUses D-Q29). When a provision had at least one BMP prescription identified in the planning documents, all of those BMP prescriptions were included in the project contract or plan in an average of 75 percent of evaluations with BMP prescriptions in that provision in both monitoring periods combined (WatUses D-Q30). When applicable to the project, BMPs related to access route location, excavated materials, and construction methods were each included in the contract or plan for all projects (i.e., 100 percent inclusion). When a provision had at least one BMP prescription identified in the project contract or plan, all of those BMP prescriptions were implemented fully (WatUses D-Q31) in an average of 56 percent of evaluations with BMP prescriptions in that provision. BMPs related to access route location and dewatering were implemented fully most frequently; BMPs related to access construction methods and temporary erosion control (vegetative and non-vegetative) were implemented fully least frequently. On a per project basis, projects averaged BMPs in seven provisions, and 65 percent were implemented fully in FY15/16. Projects in FY17/18 averaged one more provision and 83 percent full implementation. One project in FY15/16 did not have inspections at critical times, and three indicated that work avoided critical times (WatUses D-Q32). Six sites reported that no problems needing corrective actions (WatUses D-Q33) occurred during project implementation, three sites reported needed corrective actions that were implemented, and one could not determine whether corrective actions were needed. Eight projects had no chemical or fuel spills or leaks, one project had a spill or leak that was handled according to the administrative unit contingency and emergency response plan (CERP) cleanup procedures, and one evaluation indicated that the administrative unit did not have a CERP (WatUses D-Q34).

The effectiveness review for active construction of diversions and conveyances includes an assessment of flow diversion (if water control is part of the project) and whether uncontrolled erosion or sedimentation resulted from the project either in or outside the diversion-source waterbody. Of the eight projects evaluated for effectiveness, all but one required flow diversion (WatUses D-Q39). Water was completely or largely controlled for five projects. Two projects did not use water control because there was no flow during the project. No water quality violations resulted from flow diversion for the four projects that measured turbidity (WatUses D-Q40) or sediment (WatUses D-Q41). Construction activities did not contribute to uncontrolled erosion or sedimentation in the diversion-source waterbody (WatUses D-Q42) during five projects. Evidence of uncontrolled erosion or sedimentation was observed at three projects. For two of these projects, the observed amounts exceeded those described in project planning; for the other project, expected amounts were not described in planning documents. Evidence of uncontrolled erosion or sedimentation from construction was observed outside the diversion-source waterbody (WatUses D-Q43) for four projects. One project had evidence within an AMZ that included headcutting and slumps (WatUses D-Q46). Three projects reported evidence in a waterbody: vegetation damage or bare ground, bank damage, sheet or rill erosion, and sediment deposition. The source of the evidence (WatUses D-Q47) in an AMZ was lateral ditches, and the causes (WatUses D-Q48) were insufficient soil cover and erosion control features. Fillslopes were a source for every project with evidence in a waterbody;

access routes and the general project area also were sources for two projects each. One to three causes were reported per project; insufficient soil cover, insufficient erosion control features, and operations exceeding planned waterbody disturbance each were reported as a cause for two projects. None of the evaluations observed evidence of chemical or fuel spills, leaks, or waste containers in the project areas reviewed.

Water Uses D: Ratings and Component Scores

Two diversion and conveyance construction projects in FY15/16 were rated as *fully implemented*. The two projects that had no BMPs from planning were rated as *no BMPs*. The other projects in FY15/16 and both projects in FY17/18 had *marginally implemented* ratings. The effectiveness ratings were *effective* for two projects (one in each monitoring period), *mostly effective* for one project in FY17/18, *marginally effective* for one project in FY15/16, and *not effective* for four projects in FY15/16. Composite ratings for the evaluations that included both implementation and effectiveness are given in Table 223. Five of the eight composite ratings were either *fair* or *poor*. When implementation ratings were compared to effectiveness ratings for FY15/16, a significant association was not found ($p = 0.20$). Better implementation did not consistently result in better effectiveness, but projects with poorer implementation had poor effectiveness. A test was not possible for FY17/18.

Table 223.—Composite rating matrix for WatUses D projects evaluated for both implementation and effectiveness in FY15/16 (n=6 evaluations) and FY17/18 (n=2 evaluations). Numbers in cells indicate the number of evaluations 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			3		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			1		
	Marginally effective					
	Not effective					

Excellent
 Good
 Fair
 Poor
 No plan

The implementation rating components and their interpretations for WatUses D are given in Table 180. Five projects had all BMPs from planning included in the project contract or plan and a planning component score of *all*. Three projects reported that all BMPs from planning were not included and had a planning component score of *some*. Two projects had no BMPs from planning and *no BMPs* component scores. On-the-ground execution component scores are based on whether applicable BMPs, including those from standard contract or plan language rather than planning documents, are implemented fully in the field. Three projects had all BMPs implemented fully and a component score of *all*. Forty-four and 17 percent of BMP provisions were not implemented fully on average for the four and two projects in FY15/16 and FY17/18, respectively, with *some* scores for the on-the-ground execution component. One evaluation in FY15/16 without BMPs from planning did not follow the protocol instructions for BMP implementation and had an on-the-ground execution component score of *none*. This project had a project oversight component score of *some* (the only project with a score less than *all*) due to a lack of inspections during critical times. Two projects had *all* scores for the three implementation components and ratings of *fully implemented*. On-the-ground execution component scores of *some* resulted in *marginally implemented* ratings for six projects; half of those projects were scored as *all* and half as *some* for the planning component.

The effectiveness rating components and their interpretations for WatUses D are given in Table 224. If flow diversion was not part of the construction project, that component is scored as *no flow diversion* and does not influence the final effectiveness rating. Seven of the eight projects evaluated for effectiveness had flow diversion component scores of *effective* or *no flow diversion*, indicating that water was controlled when needed and water quality was not affected by flow diversion. The other project had a flow diversion component score of *mostly effective*. Erosion and sedimentation component scores

Table 224.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the WatUses D protocol

Effectiveness component	Component 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 diversion; 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

were poorer, with four projects scored as *not effective* due to evidence of uncontrolled erosion or sedimentation exceeding that described in planning documents or due to evidence observed in a waterbody. Three projects had scores of *effective*, and one had a score of *marginally effective* for the erosion and sedimentation component. Every project scored as *effective* for the chemical pollutants component. One evaluation had an overall effectiveness rating of *mostly effective* due to a flow diversion component score of *mostly effective*; the other two component scores were *effective*. All other effectiveness ratings were due to and the same as the erosion and sedimentation component score because the other two component scores were either *effective* or *no flow diversion*.

Water Uses D: Best Management Practices Monitoring Form

Best Management Practices Evaluation

WatUses D. Active Construction of Diversions and Conveyances

(Reference BMPs WatUses-1, WatUses-4, Range-3, AqEco-2, AqEco-4, and Fac-2)

v3.0 February 2016

Header	
WatUses D-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
WatUses D-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
WatUses D-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
WatUses D-Q4	Date of current field evaluation:
WatUses 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:
WatUses 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:
WatUses D-Q7	Reviewers and titles:
WatUses D-Q8a	Region number:
WatUses D-Q8b	State:
WatUses D-Q9a	Proclaimed Forest or Grassland number and name:
WatUses D-Q9b	Administrative Forest or Grassland number and name:
WatUses D-Q10	District number and name:
WatUses D-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
WatUses D-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: a. Yes b. No If No, describe the procedures used to select the project/site:

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Header (continued)	
WatUses 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: a. Yes b. No 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:
WatUses D-Q12	6 th level HUC number and name of the subwatershed at the point of diversion:
WatUses D-Q13	Are the diversion and conveyance located within a municipal supply watershed? Select one: a. Yes b. No
WatUses D-Q14a	Location. UTM Zone: UTM Datum:
WatUses D-Q14b	Location. Easting:
WatUses D-Q14c	Location. Northing:
WatUses D-Q15a	Location. Latitude:
WatUses D-Q15b	Location. Longitude:
WatUses D-Q15c	Location. Lat/Long Datum:
WatUses D-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
WatUses D-Q17	Is there a valid water right for this diversion? Select one: a. Yes (go to question 18) b. No (go to question 20)
WatUses D-Q18	State water right number for this diversion and conveyance system:
WatUses D-Q19	Owner of water right:
WatUses D-Q20	Forest Service name or identifier for this diversion and conveyance system:

continued on next page

Header (continued)	
WatUses D-Q21	Use served by this water facility. Select all that apply: a. Forest Service administrative use b. Public or private use
WatUses D-Q22	What is the authorization for the water facility? Select one: a. Permit b. Easement c. Assertion d. Lease e. No current/valid authorization
WatUses D-Q23	Intended uses of the diverted water. Select all that apply: Hydropower Wildlife Stock pond/watering Municipal/domestic water supply Fire suppression water source Irrigation Other (specify):
WatUses D-Q24	Beneficial uses of the diversion-source water. Select all that apply: Fishery Other aquatic organisms Municipal/domestic water supply Recreation Wildlife Industrial Other (specify):
WatUses D-Q25	Type of waterbody. Select one: Perennial stream/river Pond Lake Other (specify):
WatUses D-Q26	When did construction begin?
WatUses D-Q27	Percentage of construction that has been completed:
WatUses D-Q28	Activities currently ongoing. Select all that apply: a. Diversion excavation b. Conveyance excavation c. Dewatering or diversion process d. Diversion structure construction e. Conveyance construction f. Temporary erosion control g. Final erosion control h. Other (specify):
Implementation	
WatUses D-Q29	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: a. No planning document containing BMP guidance was used (go to question 31) b. Environmental Impact Statement (EIS) (go to question 30) c. Environmental Assessment (EA) (go to question 30) d. Categorical Exclusion (CE) (go to question 30) e. No project-level NEPA, but BMP guidance was provided in other documents (go to question 30)

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Implementation *(continued)*

WatUses D-Q30

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.

- a. Timing or scheduling of improvements
Yes/No/Not applicable
- b. Location of access routes for vehicle travel
Yes/No/Not applicable
- c. Construction techniques for access routes
Yes/No/Not applicable
- d. Placement and storage of excavated materials
Yes/No/Not applicable
- e. Construction methods to reduce disturbance, erosion, or sedimentation
Yes/No/Not applicable
- f. Location of waterbody disturbance and/or limits on the extent of
waterbody disturbance
Yes/No/Not applicable
- g. Channel stabilization techniques
Yes/No/Not applicable
- h. Dewatering requirements
Yes/No/Not applicable
- i. Temporary vegetative erosion control requirements
Yes/No/Not applicable
- j. Temporary non-vegetative soil cover requirements
Yes/No/Not applicable
- k. Permanent revegetation establishment requirements
Yes/No/Not applicable
- l. Permanent non-vegetative soil cover requirements
Yes/No/Not applicable
- m. Non-vegetative erosion control structures or features
Yes/No/Not applicable
- n. Other (specify):
Yes/No/Not applicable

WatUses D-Q31

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 it is too early in the construction period for the provision to have been implemented at the time of evaluation, select Not applicable.

- a. Timing or scheduling of improvements
Yes/No/Not applicable
- b. Location of access routes for vehicle travel
Yes/No/Not applicable
- c. Construction techniques for access routes
Yes/No/Not applicable
- d. Placement and storage of excavated materials
Yes/No/Not applicable
- e. Construction methods to reduce disturbance, erosion, or sedimentation
Yes/No/Not applicable
- f. Location of waterbody disturbance and/or limits on the extent of
waterbody disturbance
Yes/No/Not applicable
- g. Channel stabilization techniques
Yes/No/Not applicable
- h. Dewatering requirements
Yes/No/Not applicable

*(continued)**continued on next page*

Implementation <i>(continued)</i>	
(WatUses D-Q31 continued)	i. Temporary vegetative erosion control requirements Yes/No/Not applicable j. Temporary non-vegetative soil cover requirements Yes/No/Not applicable k. Permanent revegetation establishment requirements Yes/No/Not applicable l. Permanent non-vegetative soil cover requirements Yes/No/Not applicable m. Non-vegetative erosion control structures or features Yes/No/Not applicable n. Other provisions specified in question 30n Yes/No/Not applicable o. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
WatUses D-Q32	Were project inspections and/or contract administration during construction performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Not applicable, work was conducted to avoid critical times c. Yes d. No
WatUses D-Q33	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: a. No corrective actions necessary b. Corrective actions were needed, but not taken c. Correction actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the determination
WatUses D-Q34	Were chemical or fuel spills or leaks that occurred during construction handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during construction c. Yes, reported spills or leaks were handled/treated according to the contingency and emergency response plan d. No, reported spills or leaks were not handled/treated according to the contingency and emergency response plan
WatUses D-Q35	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 36) b. No (go to question 37)
WatUses D-Q36	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
WatUses D-Q37	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 38) b. No (go to question 39 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
WatUses D-Q38	Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 39 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question.

continued on next page

Effectiveness	
WatUses D-Q39	Has water flowing through the area of disturbance been controlled? Select one: a. Evaluation is being done prior to waterbody disturbance and the need for flow control (go to question 43) b. No flow in the channel so control or diversion was not needed (go to question 42) c. Flow was completely controlled or diverted around site (go to question 40) d. Flow was largely controlled or diverted, with some seepage present (go to question 40) e. Flow was marginally controlled, with some streamflow passing through disturbed area (go to question 40) f. Flow was poorly controlled or uncontrolled (go to question 40) g. Flow was not controlled because permit, contract or plan did not require flow control (go to question 40)
WatUses D-Q40	Did flow diversion, lack of flow diversion, or poorly functioning diversion cause a violation of the water quality standard for turbidity? Select one: a. Not applicable, no water quality standard for turbidity b. Yes c. No d. Unknown, turbidity not measured
WatUses D-Q41	Did flow diversion, lack of flow diversion, or poorly functioning diversion cause a violation of the water quality standard for sediment? Select one: a. Not applicable, no water quality standard for sediment b. Yes c. No d. Unknown, sediment not measured
WatUses D-Q42	Is there evidence of uncontrolled erosion or sediment in the diversion-source waterbody attributable to construction activities in the waterbody? Select one: a. No evidence of uncontrolled erosion or sedimentation b. Evidence of uncontrolled erosion or sedimentation or changes in waterbody morphology, and the amount does not exceed that described in project planning c. Evidence of uncontrolled erosion or sedimentation or changes in waterbody morphology, but the amount expected was not described in project planning d. Evidence of uncontrolled erosion or sedimentation or changes in waterbody morphology, and the amount exceeds that described in project planning
WatUses D-Q43	Is there evidence of uncontrolled erosion or sedimentation from construction activities outside the diversion-source waterbody? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to c. a. No evidence of uncontrolled erosion or sedimentation (go to question 49) b. Evidence of uncontrolled erosion or sedimentation, but not reaching a waterbody (go to question 45) c. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 44)
WatUses D-Q44	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 46: a. 1 or 2 b. 3 or 4 c. 5 or more

continued on next page

Effectiveness *(continued)*

WatUses D-Q45 What is the shortest distance between the evidence and the waterbody? Select one:

- a. ≤10 feet
- b. >10 to 50 feet
- c. >50 to 100 feet
- d. >100 feet

WatUses D-Q46 For all of the occurrences of erosion and sedimentation observed in the area you identified in question 43, what is the evidence? Select all that apply:

- a. Traceable evidence to the waterbody, but not currently visible in the waterbody
- b. Turbidity present
- c. Evidence of localized sediment deposition in the waterbody
- d. Changes to substrate composition
- e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)
- f. Bank instability
- g. Bank trampling or compaction
- h. Vegetation damage or bare ground
- i. Sheet erosion
- j. Rill erosion
- k. Gully erosion
- l. Headcutting
- m. Slumping/slips
- n. Mass wasting
- o. Sediment plumes or accumulations
- p. Rutting
- q. Water quality monitoring results
- r. Other (specify):

WatUses D-Q47 What are the sources? Select all that apply:

- a. Soil stockpiles
- b. Access route
- c. Parking/staging area
- d. Cut slopes
- e. Fillslopes
- f. General project area
- g. Other (specify):

WatUses D-Q48 What are the causes? Select all that apply:

- a. Overall poor location for project
- b. Poorly located stockpiles of excavated materials
- c. Lack of or insufficient soil cover (includes geotextiles, gravel, rock/riprap, vegetation, etc.)
- d. Lack of or insufficient water control on access routes
- e. Lack of or insufficient erosion control features or structures (silt fence, straw bales, etc.)
- f. Improperly designed erosion control treatments or structures
- g. Operating outside of allowable time periods (allowable schedules or weather conditions)
- h. Operating outside of allowable soil conditions
- i. Operations extending outside of designated project boundaries
- j. Operations exceeding planned waterbody disturbance
- k. Soil compaction
- l. Mechanical additions of soil to the waterbody
- m. Other (specify):
- n. Unknown

continued on next page

Effectiveness <i>(continued)</i>	
WatUses D-Q49	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the project area? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside the conveyance or waterbody c. Evidence of chemical or fuel spills or leaks in the conveyance or waterbody d. Evidence of chemical or fuel waste containers outside the conveyance or waterbody e. Evidence of chemical or fuel waste containers in the conveyance or waterbody
WatUses D-Q50	If inspections were not conducted at critical times during operations, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times, or activities were conducted to avoid critical times b. Yes c. No
WatUses D-Q51	Are any corrective management actions needed to improve effectiveness? Select one: a. Yes (go to question 52) b. No (go to question 53)
WatUses D-Q52	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
WatUses D-Q53	Are any adaptive actions needed to improve effectiveness? Select one: a. Yes (go to question 54) b. No (go to General Comments)
WatUses D-Q54	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	

Water Uses E—Operation and Maintenance of Diversions and Conveyances

Water Uses E: Header Statistics

The operation and maintenance of 23 and 30 diversion and conveyance facilities were evaluated in FY15/16 and FY17/18, respectively (Table 225). Every region except Region 9 completed at least one WatUses E evaluation, although nearly half of all the evaluations occurred in Region 6 (see App. 1 for region delineations). At the end of the monitoring periods, 89 percent of the evaluations had both implementation and effectiveness monitoring completed (Table 225). Implementation and effectiveness monitoring were performed on a single day for all of those evaluations. One implementation-only evaluation was completed in early FY17, and it is unlikely to be evaluated for effectiveness.

Table 225.—Number of WatUses E evaluations completed in FY15/16 and FY17/18, by region and type of evaluation (WatUses E-Q1)

Monitoring period	Region	Total	Implementation only	Effectiveness only	Both implementation and effectiveness
FY15/16					
	1	2			2
	2	7			7
	3				
	4	3		1	2
	5				
	6	9		2	7
	8	1			1
	9				
	10	1			1
	All	23	0	3	20
	Percent			13	87
FY17/18					
	1				
	2	5	1	1	3
	3	1			1
	4	5			5
	5	2			2
	6	15		1	14
	8				
	9				
	10	2			2
	All	30	1	2	27
	Percent		3	7	90

Five effectiveness-only evaluations did not follow National BMP program protocol instructions that implementation monitoring needs to occur prior to effectiveness monitoring, even when both are done the same day. Seventy-five percent of the facilities were selected randomly (Table 178).

While the most common reason for using the WatUses E protocol was to meet National BMP targets, the protocol simultaneously met other monitoring needs, most frequently project review (Table 226). Quality assurance was identified as a reason for monitoring in four WatUses E 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 monitoring effort on that same site . . . [by] different team members than the initial 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 a duplicate evaluation, which is

Table 226.—Number of WatUses E evaluations completed in FY15/16 and FY17/18, by region and reason for monitoring (WatUses E-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	7		1		2
	3					
	4	3	1	1		1
	5					
	6	9	4	2	2	3
	8	1		1		
	9					
	10	1				
	All	23	5	5	2	6
FY17/18						
	1					
	2	4		2		
	3	1				
	4	5		2	2	
	5	2	1	1		
	6	15		1		2
	8					
	9					
	10	2				
	All	29	1	6	2	2

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.

Ninety-two percent of the diversion and conveyance facilities had a valid water right (WatUses E-Q17). The water right for 6 facilities was owned by the Forest Service or another federal government entity; for 14 facilities, the water right was owned by state, local, or tribal entities (WatUses E-Q20). In FY15/16, 21 of 23 facilities served public or private uses (WatUses E-Q22), and 2 served Forest Service administrative uses. In FY17/18, 2 facilities served Forest Service uses, 26 served public or private uses, and 2 served both types of uses. Facilities were most often authorized by permit (31 percent of facilities in FY15/16 and 35 percent in FY17/18), followed by easements (WatUses E-Q23). One diversion and conveyance facility in FY15/16 and seven in FY17/18 had no current or valid authorization. The earliest known authorization dates were 1866 for a facility evaluated in FY15/16 and 1893 for one evaluated in FY17/18 (WatUses E-Q24), although

most facilities in each monitoring period were authorized since 1980 (Fig. 117). Of the 41 facilities with an authorization, the authorization was renewable for 33 facilities (WatUses E-Q25).

The types of infrastructure present at the diversion and conveyance facilities are summarized in Figure 118. Eighty-five percent of facilities included a diversion, and 60 percent had a head gate. Conveyances most often included pipelines followed by earthen ditches. Debris screens were reported frequently as an “other” type of infrastructure. Thirty-five facilities, 14 in FY15/16 and 21 in FY17/18, had aquatic organisms of interest in the diversion-source waterbody (WatUses E-Q28). Thirty-three waterbodies had one or more fish species of interest, including various trout, salmon, and chub species. Five waterbodies had amphibians or crustaceans of interest.

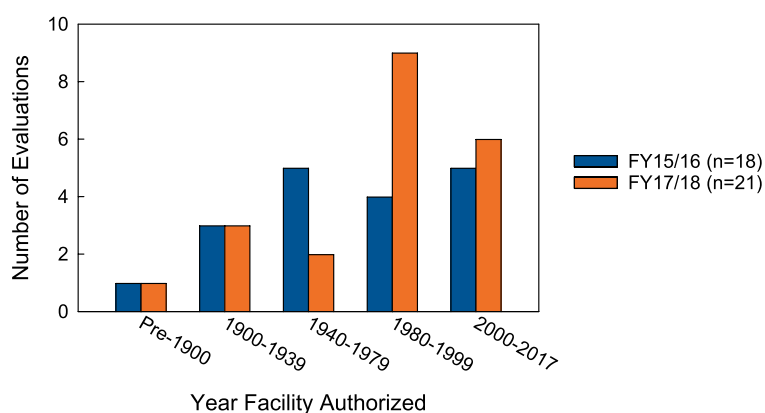


Figure 117.—Distribution of when the diversion and conveyance facilities with valid authorizations were first authorized if known (WatUses E-Q24) for evaluations completed in FY15/16 and FY17/18.

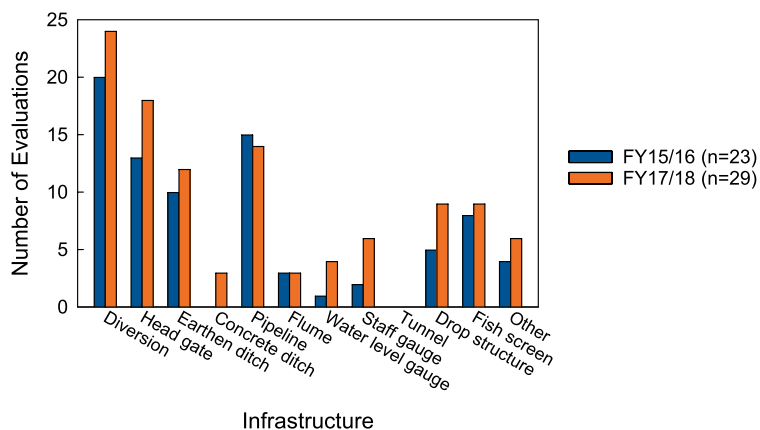


Figure 118.—Distribution of infrastructure present at the diversion and conveyance facilities (WatUses E-Q27) for evaluations completed in FY15/16 and FY17/18.

Irrigation was an intended use (WatUses E-Q30) of the water for 58 percent of the diversion and conveyance facilities (Fig. 119A); 34 percent had municipal or domestic water supply as an intended use. Number of intended uses per facility ranged from one to three. The number of beneficial uses (WatUses E-Q31) ranged from one to five in FY15/16 and from one to six in FY17/18. Facilities averaged three beneficial uses in each monitoring period, distributed fairly evenly across most of the uses (Fig. 119B).

Water Uses E: Implementation Results and Their Tie to Header Information

Fourteen diversion and conveyance facilities in each monitoring period had an operation and maintenance (O&M) plan, special use authorization, or other O&M guidance documents that contained BMP provisions for protecting water, aquatic, or riparian resources (Table 227). Whether the facility had O&M guidance documents was not significantly associated with whether the facility had a valid water right in either monitoring period ($p = 1.00$ FY15/16, $p = 0.63$ FY17/18) or whether the diversion-source waterbody contained aquatic organisms of interest ($p = 1.00$ FY15/16, $p = 0.84$ FY17/18). For facilities with a known authorization date (WatUses E-Q24), the period when authorized (see Fig. 117 for periods) was not significantly associated with whether the

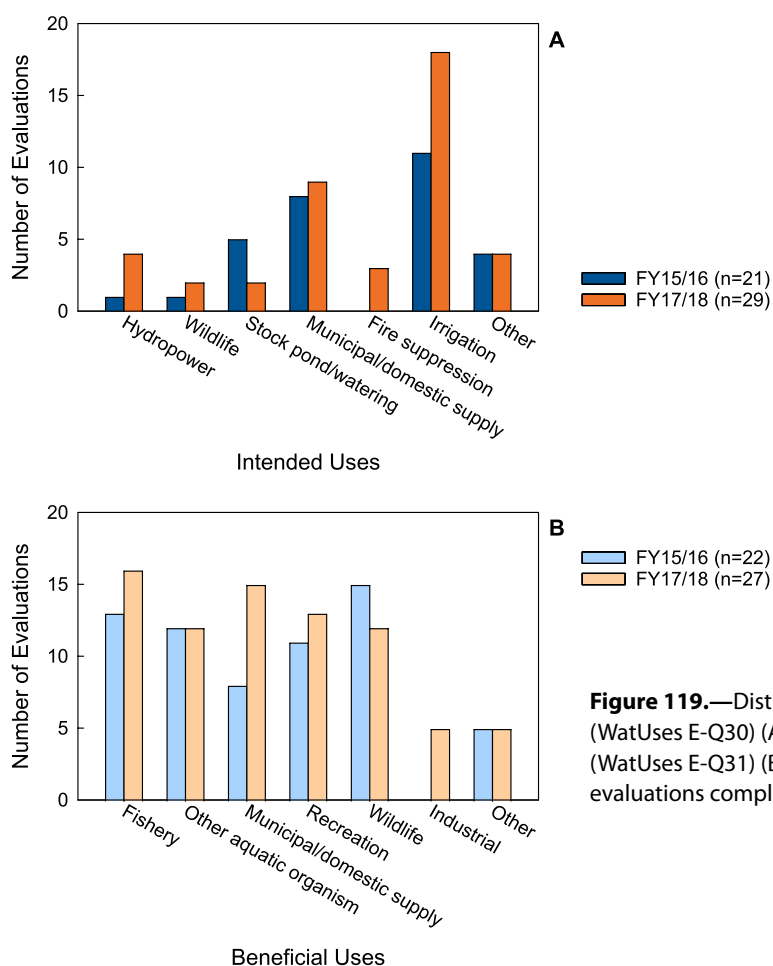


Figure 119.—Distributions of intended uses (WatUses E-Q30) (A) and beneficial uses (WatUses E-Q31) (B) of the diversion water for evaluations completed in FY15/16 and FY17/18.

Table 227.—Distribution of whether diversion and conveyance facility operation and maintenance (O&M) plan, special use authorization, or other O&M guidance documents contain BMP protection provisions (WatUses E-Q32) for WatUses E 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	70	14	50
No; plan exists but does not have BMP provisions	1	5	2	7
No plan for the facility	5	25	12	43

facility had O&M documents with BMPs in either monitoring period ($p = 0.31$ FY15/16, $p = 0.44$ FY17/18). However, in FY15/16 and FY17/18, respectively, 88 and 73 percent of facilities authorized since 1980 had O&M documents compared to 67 and 40 percent of facilities authorized earlier than 1980 having O&M documents. Whether facilities had O&M guidance documents with BMPs varied more by intended use of the diversion water than by beneficial use, although the sample sizes for some uses were small (Fig. 120). For both monitoring periods combined, 68 percent of facilities using diversion water for municipal or domestic water supply had O&M guidance documents; 54 percent of facilities had such documents when water was used for wildlife.

Assessment of O&M implementation focuses on whether applicable BMPs in O&M guidance documents (O&M plan, special use authorization, and so on) were implemented fully (WatUses E-Q33). Table 228 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 the information about whether all the BMPs from the provisions were implemented fully. A “yes” indicates that at least one BMP in the guidance documents was applicable to the provision and that all BMPs assigned to that provision were implemented fully. A “no” indicates that at least one BMP applicable to the provision in the guidance documents was not implemented fully. “Not applicable” indicates that no BMPs in the guidance documents were applicable to the provision. 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 228 are calculated using only their corresponding counts (i.e., “not applicable” counts are ignored).

On average, prescribed BMP provisions were implemented fully in an average of 89 percent of evaluations in FY15/16 and 73 percent of evaluations in FY17/18 that had some type of BMP guidance document for operation and maintenance (Table 228). The types of BMPs prescribed most commonly were those in the provisions “erosion control” and “maintenance of facilities.” When the numbers and percentages of BMP provisions implemented fully were compared by evaluation, BMPs were included in five provisions on average in each monitoring period, and 84 and 80 percent of the BMP provisions were implemented fully per evaluation in FY15/16 and FY17/18, respectively.

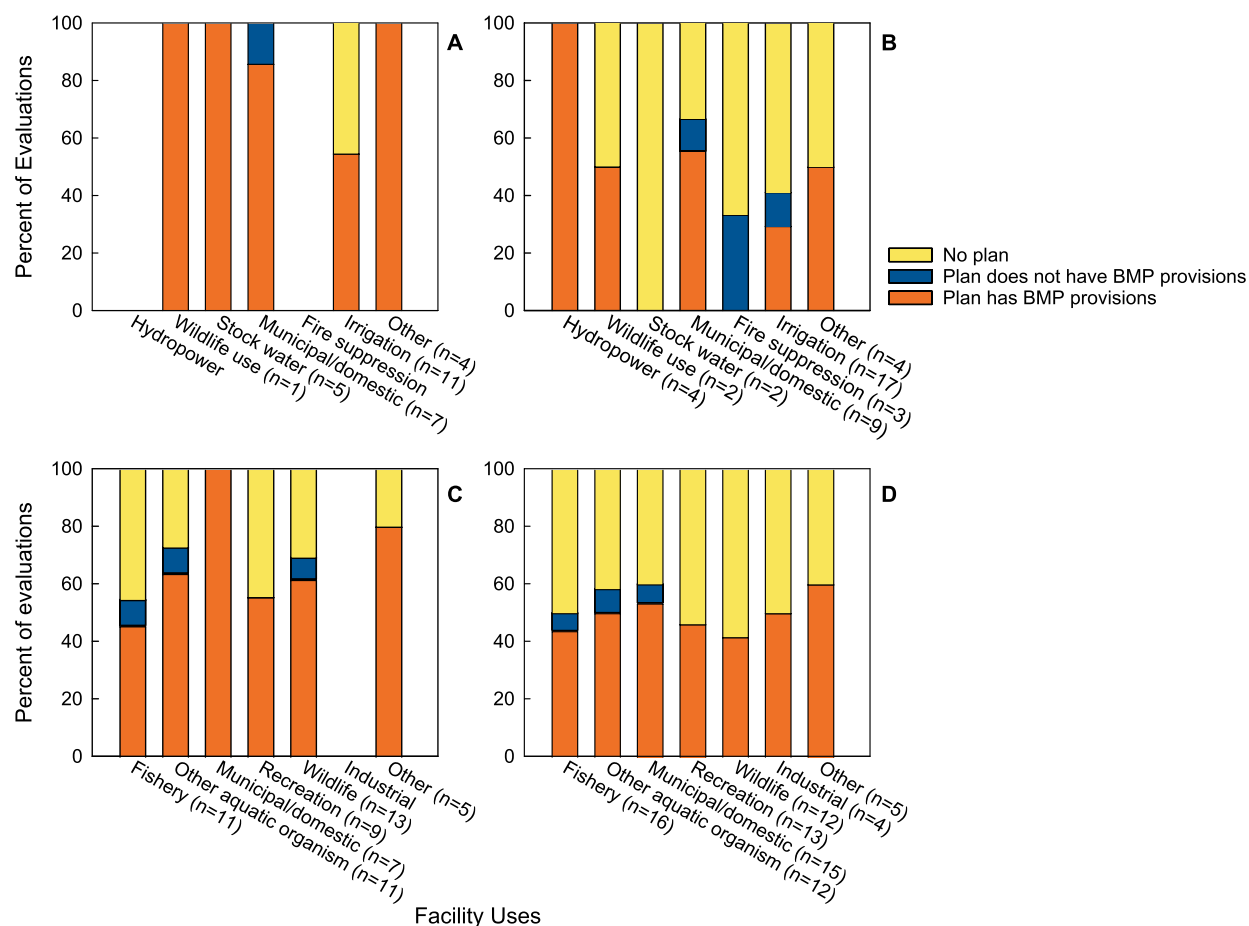


Figure 120.—Distribution of whether diversion and conveyance facility operation and maintenance plan, special use authorization, or other guidance documents contained BMP provisions (WatUses E-Q32) by intended uses (WatUses E-Q30; A, B) and beneficial uses (WatUses E-Q31; C, D) of the diversion water for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

Fifty and 63 percent of diversion and conveyance facilities in FY15/16 and FY17/18, respectively, had maintenance activities in the year prior to the evaluation (WatUses E-Q34). Ten percent of the facilities in FY15/16 and 11 percent in FY17/18 did not have maintenance activities in the 5 years prior to the evaluation. Whether the facility had O&M guidance documents containing BMPs was significantly associated with the timing of the most recent maintenance in FY15/16 ($p < 0.001$) but not in FY17/18 ($p = 0.38$). Seventy-one percent of facilities in FY15/16 and 79 percent in FY17/18 that had O&M documents had been maintained within the past year. In comparison, 69 percent of facilities in both periods combined without O&M documents had been maintained more than 1 year prior to the evaluation.

One evaluation in each monitoring period reported that some part of the facility was constructed from potentially toxic materials (WatUses E-Q35). In both cases, the materials were pressure-treated wood. Nine facilities in FY15/16 and seven in FY17/18 had one or more structures (diversion, head gate, or conveyance) that were not operating as intended (WatUses E-Q36); most often the structure was the conveyance (Table 229).

Table 228.—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 (WatUses E-Q33) for WatUses E 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 (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)
Erosion control (vegetation, structures, etc.)	13	1	0	93	7	8	2	4	80	20
Locations of disposal of materials, including sediment, vegetation and debris	5	0	7	100	0	4	2	8	67	33
Streamflow/volume control requirements	5	3	6	62	38	7	3	4	70	30
Aquatic passage requirements	5	1	6	83	17	3	1	10	75	25
Prevent/minimize loss or entrainment of target organisms	5	1	6	83	17	6	2	6	75	25
Aquatic/riparian invasive species control	5	1	6	83	17	4	2	8	67	33
Trash management	8	1	3	89	11	5	3	6	62	38
Human sanitary waste management	4	0	8	100	0	6	1	7	86	14
Domestic animal waste management	3	0	10	100	0	2	2	10	50	50
Maintenance of facilities (frequency, types of actions, etc.)	9	0	3	100	0	10	0	4	100	0
Mean	6	1	6	89	11	6	2	7	73	27

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

^b Percent calculated from “yes” and “no” counts.

Table 229.—Distribution of structure operating conditions (WatUses E-Q36) for WatUses E evaluations completed in FY15/16 (n=20 evaluations) and FY17/18 (n=28 evaluations). Multiple selections were possible.

Structure	FY15/16 (number)	FY17/18 (number)
Diversion not operating as intended	4	5
Head gate not operating as intended	4	1
Conveyance not operating as intended	6	4
All structures operating as intended	12	19

Two evaluations reported problems with all three structures, and four evaluations reported problems with two structures. When structures were not operating as intended, physical failure was a cause (WatUses E-Q37) reported for seven facilities. Clogging by sediment or bedload was a cause reported for six facilities. When the timing of the most recent facility maintenance was compared to whether any structure was not operating as intended, a significant association was not found in FY15/16 ($p = 0.82$), but one was found in FY17/18 ($p = 0.02$). In that monitoring period, when all structures were problem-free, 70 percent of the facilities had been maintained in the past year. When at least one structure had a problem, 43 percent of the facilities had last been maintained more than 5 years prior to the evaluation.

Water flow was present in the conveyance (WatUses E-Q38) for about 70 percent of facilities in each monitoring period (Table 230). When water flow was not present, eight evaluations determined the most recent flow occurrence based on field observations, two evaluations used inspection reports, and three evaluations used both (WatUses E-Q39). Water conveyance was by ditch (WatUses E-Q40) for 15 facilities in FY15/16 and 13 in FY17/18. Four of those facilities (three in FY15/16 and one in FY17/18) reported that adequate freeboard was not being maintained to reduce the potential for ditch failure or resource damage. Evidence of seeps or leaks that could contribute to failure or resource damage (WatUses E-Q41) was observed below the conveyance system at four facilities in FY15/16 and six in FY17/18.

Two implementation questions—WatUses E-Q42 and WatUses E-Q43—evaluate whether site administration was adequate for protecting water, aquatic, and riparian resources. Paraphrased, the questions ask, respectively, whether inspections occurred at critical times during the past 5 years when resources were most susceptible to negative effects from site conditions (Table 231) and whether corrective actions were taken if problems occurred during the past 5 years (at any time, not just critical times) (Table 232). Critical times are periods associated with large or intense precipitation/runoff events or other times when the potential for the site to influence water quality is high (e.g., ground-disturbing activities related to construction or maintenance). Inspections were conducted during critical times during the past 5 years for 56 percent of the diversion and conveyance facilities in both monitoring periods combined, and 35 percent of all facilities had no inspections (Table 231). Most of the facilities in FY15/16 had no problems requiring

Table 230.—Most recent occurrence of water flow in the conveyance (WatUses E-Q38) for WatUses E evaluations completed in FY15/16 and FY17/18

Most recent occurrence of water flow	FY15/16 (number)	FY17/18 (number)
Present during evaluation	14	20
Within past year	4	4
1–5 years ago	0	1
5–10 years ago	1	2
More than 10 years ago	1	1

Table 231.—Distribution of whether inspections occurred at critical times (WatUses E-Q42) for WatUses E 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	5	25	12	43
Yes	13	65	14	50
No	2	10	2	7
All	20		28	

Table 232.—Distribution of whether corrective actions (CA) were taken if problems occurred during current operating season (WatUses E-Q43) for WatUses E 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	11	55	9	32
CA needed but not taken	3	15	3	11
CA needed and implemented	4	20	8	29
Unknown	2	10	8	29
All	20		28	

corrective actions any time in the 5 years prior to the evaluation. In FY17/18, nearly one-third of the evaluations could not determine whether problems or corrective actions had occurred at the facilities (Table 232).

Because fuel and other chemicals may be present within or around diversion and conveyance facilities during maintenance, an implementation question (WatUses E-Q44) 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 would follow that state agency's procedures. One evaluation in FY15/16 and three in FY17/18 indicated that the administrative unit (i.e., four different units) did not have a CERP, and two evaluations in FY15/16 indicated that a spill or leak requiring cleanup had occurred during the past 5 years and that CERP procedures were followed.

Water Uses E: Effectiveness Results and Their Tie to Implementation Results and Header Information

Assessment of the effectiveness of BMPs for operation and maintenance of diversion and conveyance facilities includes reviewing requirements for aquatic organism passage, non-entrainment requirements for aquatic organisms of interest (AOI), flow requirements, evidence of erosion and sedimentation (if any) in the area of the facility, and presence of aquatic invasive species. Whether requirements for aquatic organism passage and non-entrainment of AOI were met at the facilities are summarized in Table 233. About 60 percent of diversion and conveyance facilities in each monitoring period had no aquatic organism passage requirements or no means to determine whether requirements were being met (WatUses E-Q49). For the 28 facilities that made a determination, requirements were not met for one facility (using two means of determination) in FY15/16 and five facilities in FY17/18. "Other means" often were field evaluations during the BMP review. Forty-five percent of the facilities had no AOI or no means to determine whether AOI non-entrainment requirements were being met (WatUses E-Q50) (Table 233). Entrained AOI were observed during the BMP review for 28 percent of the conveyance systems with non-entrainment requirements. Based on means other than the current BMP review, non-entrainment requirements were not met for one conveyance system (using two means of determination) in FY15/16 and two systems in FY17/18.

Thirty-five percent of diversion and conveyance facilities in both monitoring periods combined had no flow requirements for the diversion source water (WatUses E-Q51), and 25 percent had no means to determine whether flow requirements were being met (Table 234). Flow requirements were not met at two facilities in FY15/16 and one facility in FY17/18. Two of the three evaluations based the determination on both periodic inspections and other means. For the 15 facilities in FY15/16 and 19 in FY17/18 with source-water flow requirements (Table 234), about 60 percent of the evaluations in each monitoring period indicated that the flow requirements were effective for meeting beneficial uses (WatUses E-Q52), while 33 and 37 percent of evaluations in FY15/16 and FY17/18, respectively, indicated that a determination could not be made. One evaluation in FY15/16 indicated that the flow requirements were not effective, and one evaluation in FY17/18 did not answer WatUses E-Q52.

Table 233.—Distribution of whether requirements were met and basis for determination for aquatic passage (WatUses E-Q49) and non-entrainment of aquatic organisms of interest (AOI) (WatUses E-Q50) for WatUses E evaluations completed in FY15/16 (n=23 evaluations) and FY17/18 (n=29 evaluations). Multiple selections within each metric were possible.

Metric	Basis	Requirements	FY15/16 (number)	FY17/18 (number)
Aquatic passage requirements met	Not applicable; no requirements		12	12
	No means to determine		2 ^a	3
	Measurements or monitoring	Met	3	3
		Not met	0	2
	Periodic inspections	Met	3	6
		Not met	1 ^b	1
	Other means	Met	5	4
		Not met	1 ^b	2
AOI non-entrainment requirements	Not applicable; no AOI		7	5
	No means to determine		2	10
	Current review	AOI not entrained	7	6
		AOI entrained	3	2
	Measurements or monitoring	Met	1	3
		Not met	0	1
	Periodic inspections	Met	2	2
		Not met	1 ^b	0
	Other means	Met	3	3
		Not met	1 ^b	1

^a One evaluation selected additional incompatible answer choices.

^b Two bases reported by one evaluation.

Table 234.—Distribution of whether flow requirements were met and basis for determination (WatUses E-Q51) for WatUses E evaluations completed in FY15/16 (n=23 evaluations) and FY17/18 (n=29 evaluations). Multiple selections were possible.

Basis	Requirements	FY15/16 (number)	FY17/18 (number)
Not applicable; no requirements		8	10
No means to determine		5	8 ^a
Measurements or monitoring	Met	4	5
	Not met	0	0
Periodic inspections	Met	4	4
	Not met	2	1
Other means	Met	2	2
	Not met	1	1

^a One evaluation selected additional incompatible answer choices.

Evidence of erosion or sedimentation due to conveyance failures was observed at 10 facilities in FY15/16 and 6 facilities in FY17/18 (WatUses E-Q53). Nearly 70 percent of the reported evidence was either in a waterbody or less than 10 feet from a waterbody (Table 235). For conveyance failures, only the most severe cases of erosion or sedimentation are reported 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. The types of evidence observed (WatUses E-Q56) are summarized in Table 236. Most evaluations reported multiple types of evidence; traceable evidence to a waterbody was observed most frequently. Three evaluations reported one or more types of evidence that were incompatible with the location where the evidence was observed (e.g., turbidity would not be reported for evidence outside an AMZ).

Seven facilities in FY15/16 and four in FY17/18 observed evidence of active ditch bank erosion that was not due to conveyance failures (Table 237). For three facilities, the erosion threatened to cause or had caused ditch instability. One evaluation reported evidence of erosion or sedimentation in the source waterbody downstream of the diversion that exceeded allowable amounts described in O&M documents (Table 237). None of the evaluations reported evidence in the receiving waterbody downstream of the conveyance return. Twenty-seven facilities had sediment removed during maintenance of the diversion or conveyance (WatUses E-Q60). Three evaluations reported uncontrolled erosion from the removed sediment, with evidence observed either in a waterbody or less than 10 feet from a waterbody (Table 238). Every evaluation indicated vegetation damage or bare ground as a type of observed evidence (WatUses E-Q63) (Table 239).

Table 235. Evidence of erosion or sedimentation observed from conveyance failures (WatUses E-Q53) for WatUses E evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (WatUses E-Q55) or number of places evidence observed in a waterbody (WatUses E-Q54)

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	13	57							
Outside an AMZ ^a	1	4				1			
Within an AMZ	7	30	4	1		2			
In a waterbody	2	9					2		
FY17/18									
No evidence	23	79							
Outside an AMZ	0								
Within an AMZ	3	10	2		1				
In a waterbody	3	10					2	1	

^a Aquatic management zone.

Table 236.—Types of evidence of erosion or sedimentation observed from conveyance failures (WatUses E-Q56) for WatUses E evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in WatUses E-Q53 (Table 235) is applicable to WatUses E-Q56.

Type of evidence	FY15/16 Outside an AMZ ^a (n=1)	FY15/16 Within an AMZ (n=7)	FY15/16 In waterbody (n=2)	FY17/18 Within an AMZ (n=3)	FY17/18 In waterbody (n=3)
Traceable evidence to the waterbody, but not currently visible in the waterbody	1	5		1	2
Turbidity present	1 ^b				
Evidence of localized sediment deposition in the waterbody	1 ^b	1 ^b		1 ^b	1
Changes to substrate composition		1 ^b			1
Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.)		1 ^b	1	1	2
Bank instability		1	1	1	1
Bank trampling or compaction		2			1
Vegetation damage or bare ground		2		1	2
Sheet erosion					
Rill erosion		1			
Gully erosion		1		2	
Headcutting		2			
Slumping/slips		1		1	
Mass wasting		1			
Sediment plumes or accumulations					
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.

Weather conditions associated with the evaluation (WatUses E-Q16) assist in determining if evidence of erosion and sediment transport or morphology changes due to the diversion and conveyance facility 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 because these result primarily from precipitation and runoff, whereas waterbody effects may be continually influenced by the presence of flow that obscures any weather-induced conditions. No statistically significant associations were found between categories of erosion due to conveyance failures (WatUses E-Q53) and weather conditions (i.e., wet versus dry conditions) in either monitoring period ($p = 0.69$ FY15/16, $p = 0.72$ FY17/18) (Fig. 121) or between categories of erosion from sediment removals during maintenance (WatUses E-Q60) and weather conditions in FY17/18 ($p = 0.63$). About 15 percent of all evaluations occurred during wet weather. More evaluations are needed during wet conditions to determine the usefulness of this comparison.

Table 237.—Evidence of active ditch bank erosion (WatUses E-Q57) or of erosion or sedimentation observed in the source waterbody downstream of the diversion (WatUses E-Q58) or in the receiving waterbody downstream of the conveyance return (WatUses E-Q59) for WatUses E evaluations completed in FY15/16 and FY17/18

Location	Evidence of erosion or sedimentation	FY15/16 (number)	FY17/18 (number)
Ditch bank	Not applicable; conveyance not a ditch	10	13
	Not applicable; conveyance a hardened ditch	0	0
	No evidence	5	12
	Evidence present; does not exceed amounts allowed in O&M ^a documents	1	2
	Evidence present; O&M documents do not include allowable amounts	3	1
	Evidence present; exceeds amounts allowed in O&M documents	1	0
	Evidence present; threatens or has resulted in ditch instability	2	1
Source waterbody downstream of diversion	No evidence	18	27
	Evidence present; does not exceed amounts allowed in O&M documents	0	0
	Evidence present; O&M documents do not include allowable amounts	3	2
	Evidence present; exceeds amounts allowed in O&M documents	1	0
Receiving waterbody downstream of conveyance return	No evidence	19	27
	Evidence present; does not exceed amounts allowed in O&M documents	1	0
	Evidence present; O&M documents do not include allowable amounts	1	0
	Evidence present; exceeds amounts allowed in O&M documents	0	0

^a Operation and maintenance.

Table 238.—Evidence of uncontrolled erosion observed from sediment removed during maintenance of diversion or conveyance system (WatUses E-Q60) for WatUses E evaluations completed in FY15/16 and FY17/18, by location and distance to nearest waterbody (WatUses E-Q62) or number of places evidence observed in a waterbody (WatUses E-Q61)

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 sediment removal	10	48							
No evidence	11	52							
Outside an AMZ ^a	0								
Within an AMZ	0								
In a waterbody	0								
FY17/18									
No sediment removal	12	43							
No evidence	13	46							
Outside an AMZ	0								
Within an AMZ	1	4	1						
In a waterbody	2	7					2		

^a Aquatic management zone.

Table 239.—Types of evidence of uncontrolled erosion observed from sediment removed during maintenance activities (WatUses E-Q63) for WatUses E evaluations completed in FY15/16 and FY17/18. Only evidence present in the location reported in WatUses E-Q60 (Table 238) is applicable to WatUses E-Q63.

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

^a Aquatic management zone.

When the diversion and conveyance facilities were reviewed for evidence of trash or domestic animal or human sanitary waste (WatUses E-Q64), one evaluation in FY15/16 reported some type of waste in the source waterbody. In FY17/18, three evaluations observed trash in the source waterbody, and two evaluations observed trash in the conveyance. A chemical or fuel spill or leak (WatUses E-Q65) was observed outside an AMZ at one facility in FY15/16 (the same facility that reported a spill or leak during the implementation review that had been cleaned up following the unit CERP procedures). No spill or leak evidence was observed at any facility in FY17/18. Two evaluations in FY15/16 observed evidence that the facility had introduced or increased the presence of aquatic invasive species in or along the waterbody (WatUses E-Q66). The species observed were brook trout (*Salvelinus fontinalis*) and Canada thistle (*Cirsium arvense*).

Inspections are an important part of operation and maintenance activities. The WatUses E protocol includes two questions about inspections, one in implementation (WatUses E-Q42) and one in effectiveness (WatUses E-Q67), that are designed to tie together. Respectively, the questions ask whether inspections were completed during critical times for the facility and whether a lack of inspections during critical times

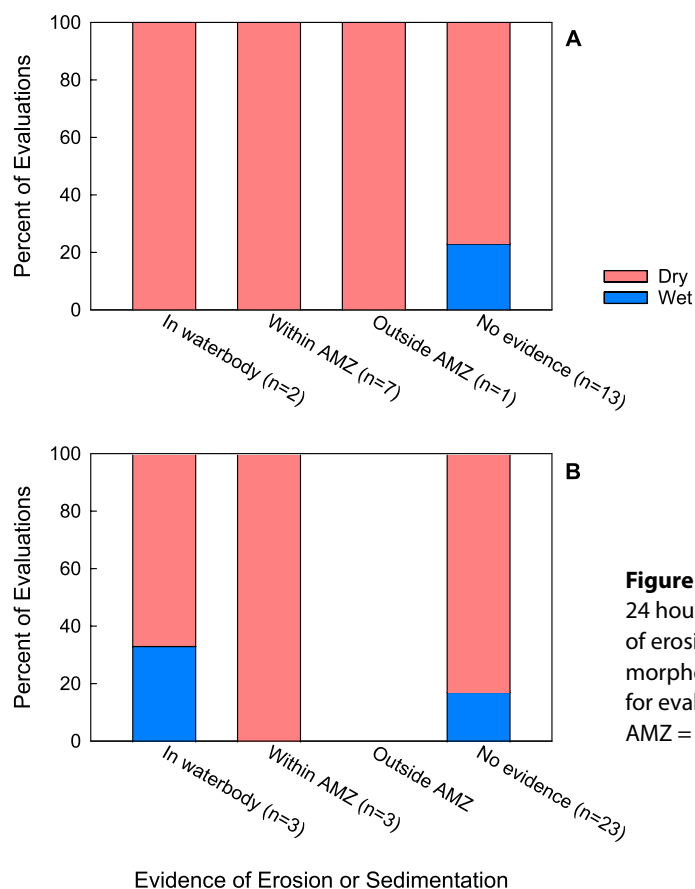


Figure 121.—Type of weather conditions during or within 24 hours before effectiveness evaluation versus evidence of erosion, sedimentation, or changes to waterbody morphology due to conveyance failures (WatUses E-Q53) for evaluations completed in FY15/16 (A) and FY17/18 (B). AMZ = aquatic management zone.

influenced BMP effectiveness. Table 240 shows the relationship between those two questions for diversion and conveyance facilities for which both implementation and effectiveness evaluations were completed in each monitoring period. A lack of attention to the protocol instructions relative to these questions has affected the usefulness of this comparison. Thirty 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 remaining the facilities, three evaluations in FY15/16 indicated that a lack of inspections at critical times contributed to problems with effectiveness.

Water Uses E: Ratings and Their Tie to Header, Implementation, and Effectiveness Results

Twenty-five and 21 percent of the evaluated WatUses E diversion and conveyance facilities in FY15/16 and FY17/18, respectively, were rated *fully implemented* or *mostly implemented* (Fig. 122). Forty percent of the facilities in FY15/16 and 54 percent in FY17/18 were rated as *not implemented* or *no BMPs*. Effectiveness ratings were better—65 and 59 percent of the facilities were rated as *effective* or *mostly effective* in FY15/16 and FY17/18, respectively (Fig. 122). Seven effectiveness evaluations lacked responses in the database for questions needed to rate effectiveness, and one of those evaluations also lacked responses needed to rate implementation. These are identified as “incomplete data” in Figure 122.

Table 240.—Occurrence of inspections performed at critical times during the past 5 years (WatUses E-Q42) in relationship to problems observed during effectiveness monitoring (WatUses E-Q67) for WatUses E evaluations completed in FY15/16 and FY17/18. Shaded cells indicate incompatible combinations of answer choices (30 and 19 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		2	3
	Yes; inspections at critical times	7	1	5
	No; inspections not at critical times		1	1
FY17/18				
	No inspections	2		10
	Yes; inspections at critical times	11		2
	No; inspections not at critical times	1		1

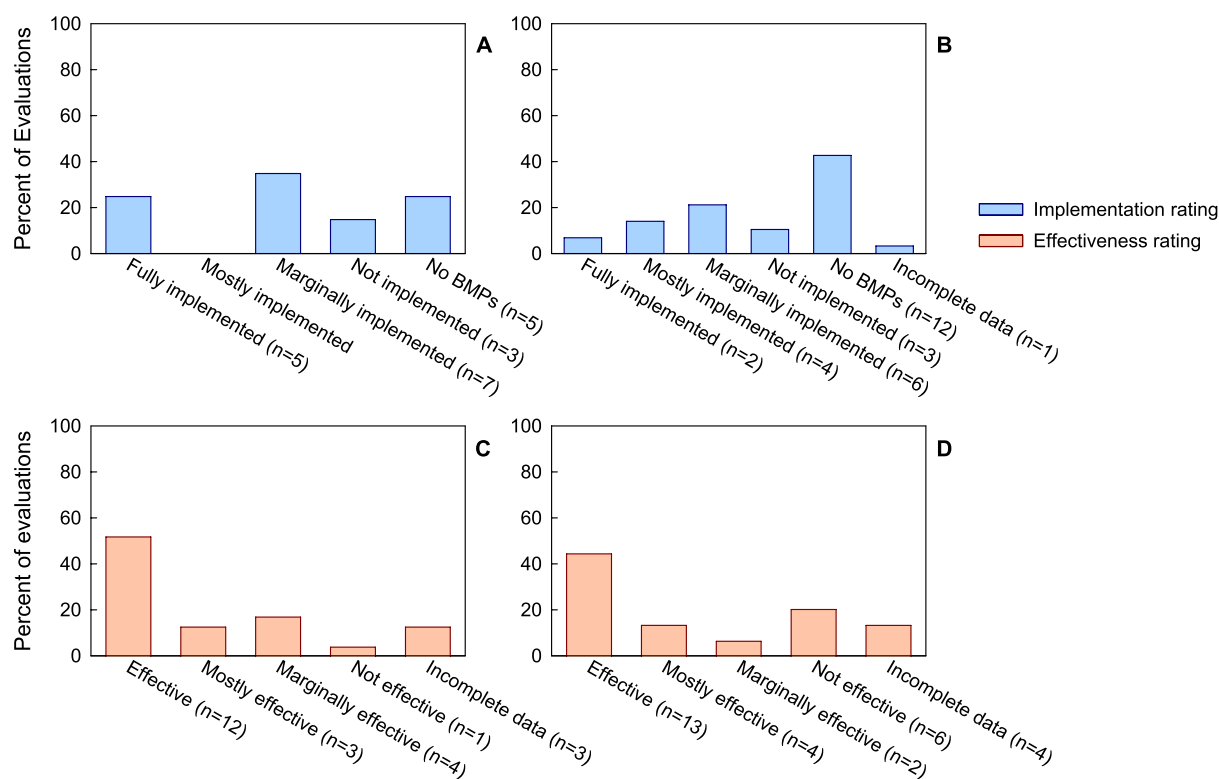


Figure 122.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) for WatUses E evaluations completed in FY15/16 (A, C) and FY17/18 (B, D). “Incomplete data” refers to evaluations where all the questions needed to determine a rating were not answered.

Neither the implementation nor the effectiveness ratings were significantly associated in either monitoring period with whether the diversion had a valid water right (implementation: $p = 1.00$ FY15/16, $p = 0.37$ FY17/18; effectiveness: no test FY15/16, $p = 0.30$ FY17/18). When ratings were compared by type of authorization, significant associations were found for implementation ratings in each monitoring period ($p = 0.03$, FY15/16, $p = 0.06$ FY17/18) but not for effectiveness ratings ($p = 0.17$ FY15/16, $p = 0.73$ FY17/18). Implementation ratings were somewhat better in both periods for facilities authorized by permit (Fig. 123); the same was true for effectiveness ratings in FY15/16 but not in FY17/18. Whether the diversion-source waterbody contained AOI was not significantly associated with implementation or effectiveness ratings in either monitoring period (implementation: $p = 0.36$ FY15/16, $p = 0.31$ FY17/18; effectiveness: $p = 0.22$ FY15/16, $p = 0.16$ FY17/18). However, when compared visually, both the implementation and effectiveness ratings were somewhat poorer when AOI were present in the diversion-source waterbody (Fig. 124). More evaluations of diversion and conveyance facilities without AOI are needed to determine the importance of this comparison.

Weather conditions (i.e., wet versus dry) during and the 24 hours before the evaluations (WatUses E-Q16) were not associated with the effectiveness ratings in FY15/16 ($p = 0.40$) but were in FY17/18 ($p = 0.06$). Ratings were somewhat better for evaluations during dry weather in FY17/18 (Fig. 125). The number of wet weather evaluations was small

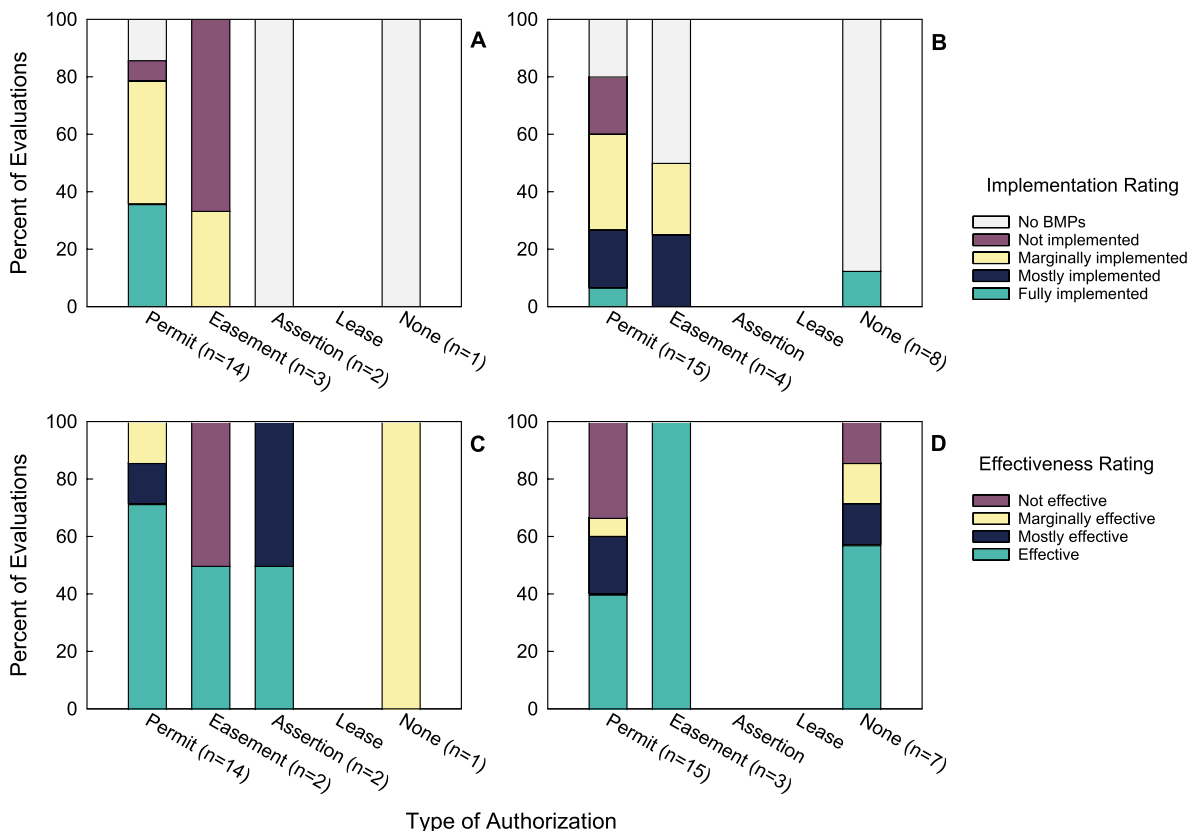


Figure 123.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by type of authorization (WatUses E-Q23) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

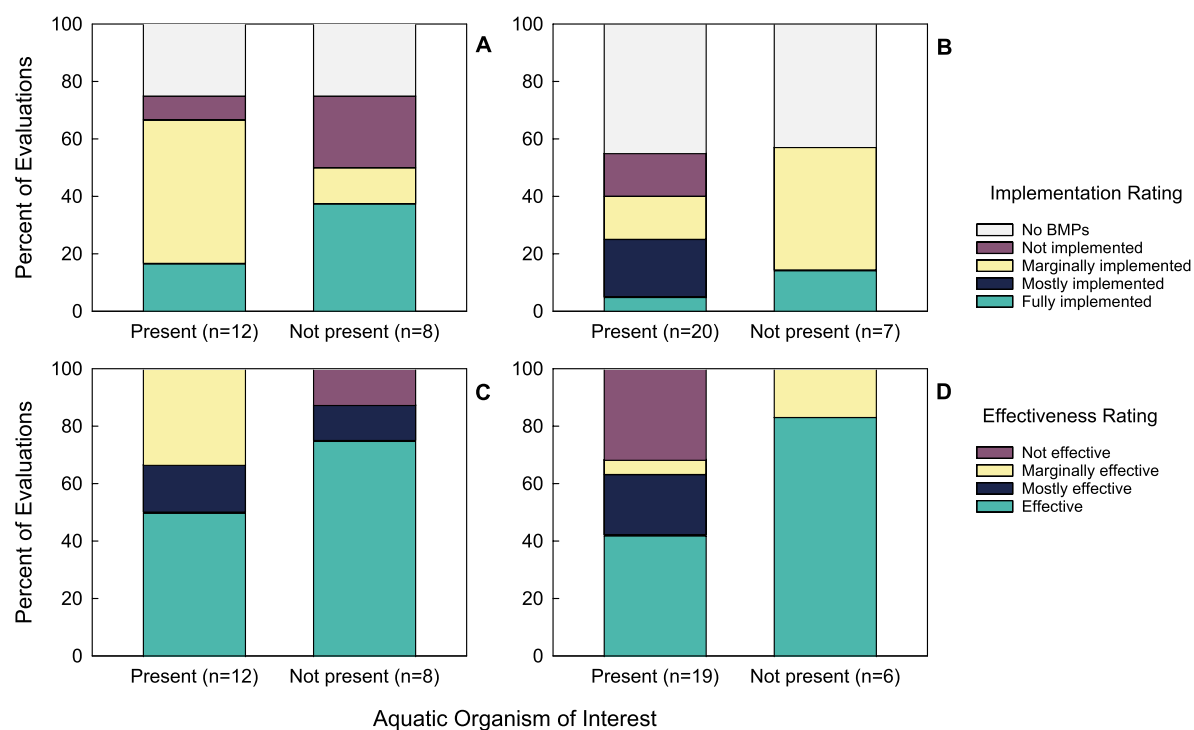


Figure 124.—Distribution of implementation ratings (A, B) and effectiveness ratings (C, D) by whether aquatic organisms of interest were present in the diversion-source waterbody (WatUses E-Q28) for evaluations completed in FY15/16 (A, C) and FY17/18 (B, D).

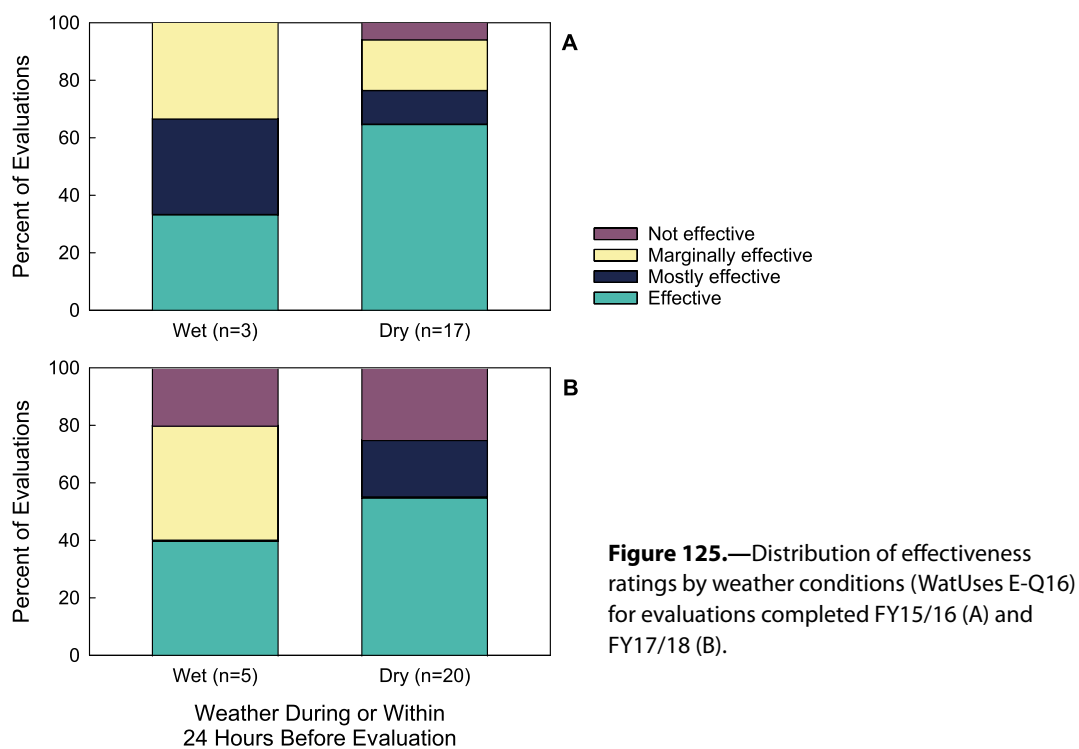


Figure 125.—Distribution of effectiveness ratings by weather conditions (WatUses E-Q16) for evaluations completed FY15/16 (A) and FY17/18 (B).

compared to the number during dry weather, so more evaluations under wet weather conditions are needed to determine if weather conditions are influential. As sample sizes increase, the relationships between weather conditions and field observations of erosion, sediment, or morphological effects (e.g., Fig. 121) 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.

A significant association was not found between the effectiveness ratings and whether O&M guidance documents existed and included BMPs for the facility in FY15/16 ($p = 0.20$) but was found in FY17/18 ($p = 0.09$). The latter result is primarily due to the *mostly effective* ratings for the two facilities with O&M documents that did not include BMPs (Fig. 126). The number of BMP provisions implemented fully (WatUses E-Q33) was not significantly different between the effectiveness ratings in either monitoring period ($p = 0.38$ FY15/16, $p = 0.48$ FY17/18; GLMM with negative binomial distribution and log link function). Evaluations averaged from one to six provisions implemented fully across the effectiveness ratings in FY15/16 and from zero to five in FY17/18. Mean percentages of BMPs implemented fully in FY15/16 ranged from 75 to 100 percent across effectiveness ratings, and a significant difference was not found ($p = 0.45$, Kruskal-Wallis test). In FY17/18, significant differences in the percentage of BMPs implemented fully were found across ratings ($p = 0.09$, Kruskal-Wallis test). However, the result in this

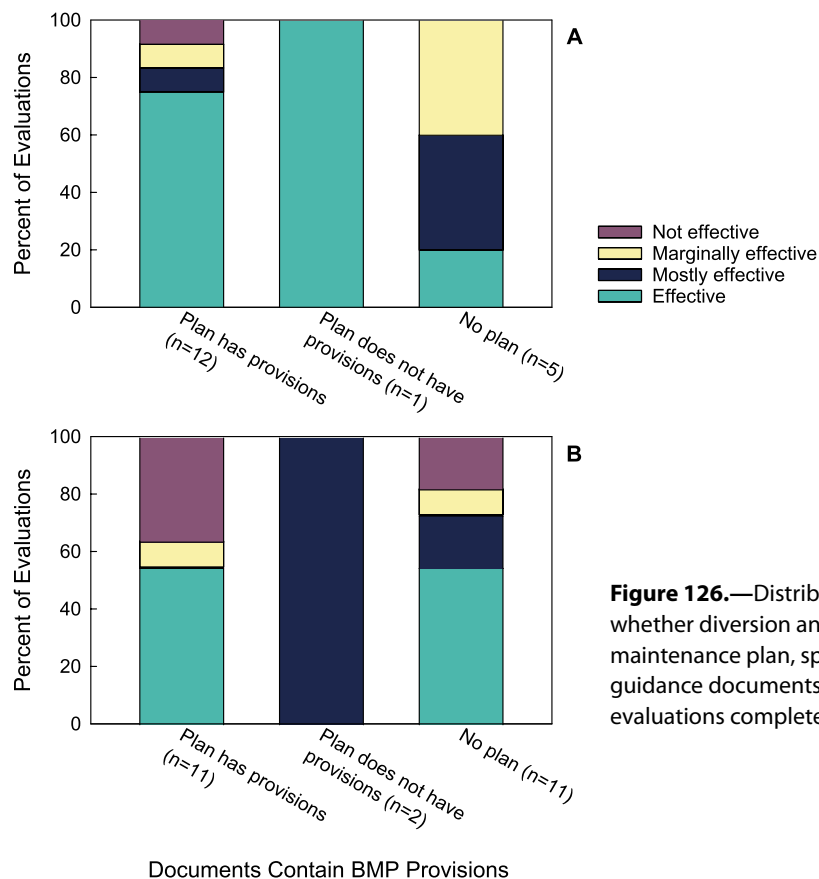
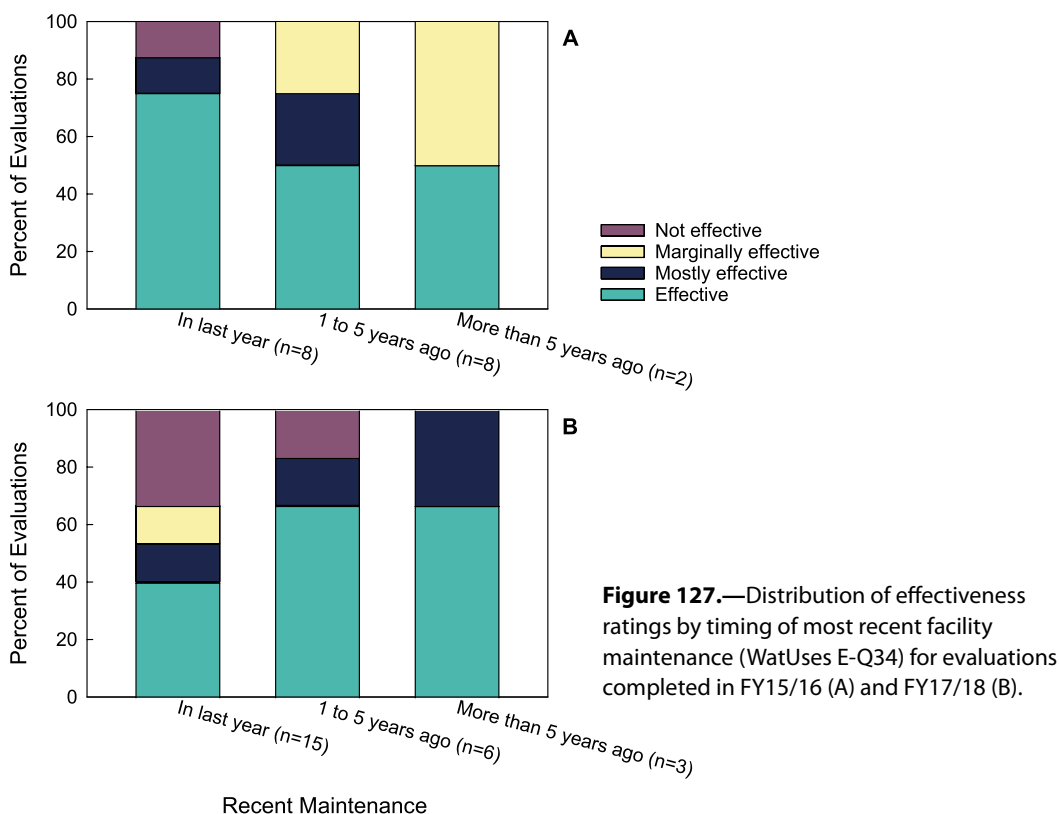


Figure 126.—Distribution of effectiveness ratings by whether diversion and conveyance facility operation and maintenance plan, special use authorization, or other guidance documents contained BMPs (WatUses E-Q32) for evaluations completed in FY15/16 (A) and FY17/18 (B).

monitoring period was due to the one facility rated *marginally effective* that had no BMPs implemented fully, compared to 97 percent for facilities rated *effective* and 68 percent for facilities rated *not effective*.

When effectiveness rating distributions were compared by timing of the most recent facility maintenance, significant associations did not exist in either monitoring period ($p = 0.51$ FY15/16, $p = 0.82$ FY17/18). In FY15/16, ratings were slightly better when maintenance had occurred in the year prior to the evaluation (Fig. 127), but the opposite was true in FY17/18. Effectiveness ratings also were not significantly associated with whether one or more components of the facility (diversion, head gate, or conveyance) was not operating as intended in either period ($p = 0.87$ FY15/16, $p = 0.74$ FY17/18). Comparisons between individual components not operating as intended and ratings also found no significant associations. Effectiveness ratings tended to be better in each monitoring period when water flow in the conveyance had not occurred in the year prior to the evaluation (Fig. 128), although significant associations were not found in either period ($p = 0.40$ FY15/16, $p = 0.72$ FY17/18). This result is not surprising given the expectation that BMP effectiveness would be affected by the presence of flow.

During the implementation portion of the evaluation, review of documents and inquiries with site administrators occur to determine whether corrective actions were taken if problems were observed during the past 5 years (WatUses E-Q43). Such actions



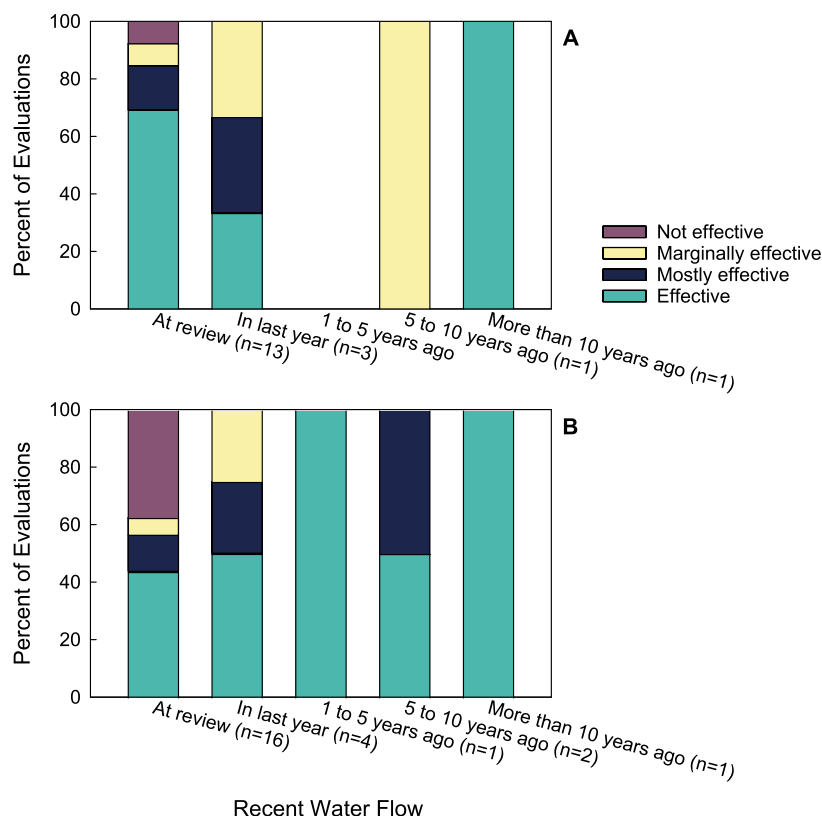


Figure 128.—Distribution of effectiveness ratings by timing of most recent water flow in the conveyance system (WatUses E-Q38) for evaluations completed in FY15/16 (A) and FY17/18 (B).

can protect water quality and be reflected in an improvement in BMP effectiveness. Significant associations were not found between whether corrective actions were taken (if implementation problems occurred) and the effectiveness ratings in either monitoring period ($p = 0.18$ FY15/16, $p = 0.43$ FY17/18); however, effectiveness ratings in each period were poorer when needed corrective actions were not taken (Fig. 129).

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 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 include actions to improve implementation of BMPs applicable to the project or site; corrective actions for effectiveness include actions to improve or better protect water quality or aquatic health.

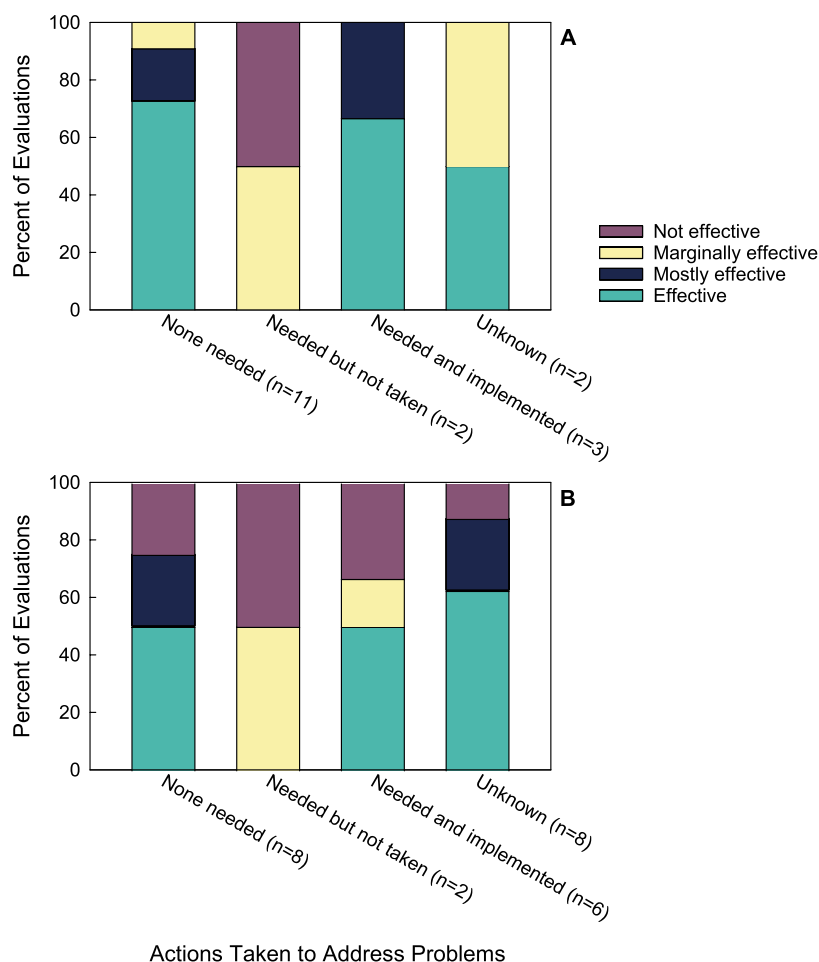


Figure 129.—Distribution of effectiveness ratings by whether corrective actions were taken if problems occurred during the past five years (WatUses E-Q43) for evaluations completed in FY15/16 (A) and FY17/18 (B).

In contrast to corrective actions, the need for adaptive management actions often results from recurring deficiencies or problems and typically applies more broadly than to 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 to ensure that standards are met or initiating soil amendments or treatments when ground cover is below standard requirements.

The number of evaluations in which implementation or effectiveness corrective actions or adaptive management actions were needed was about one-third less than the number for which no actions were needed (Figs. 130 and 131). No significant associations existed in either monitoring period among implementation ratings and corrective action needs ($p = 0.17$ FY15/16, $p = 0.51$ FY17/18) or among implementation ratings and adaptive

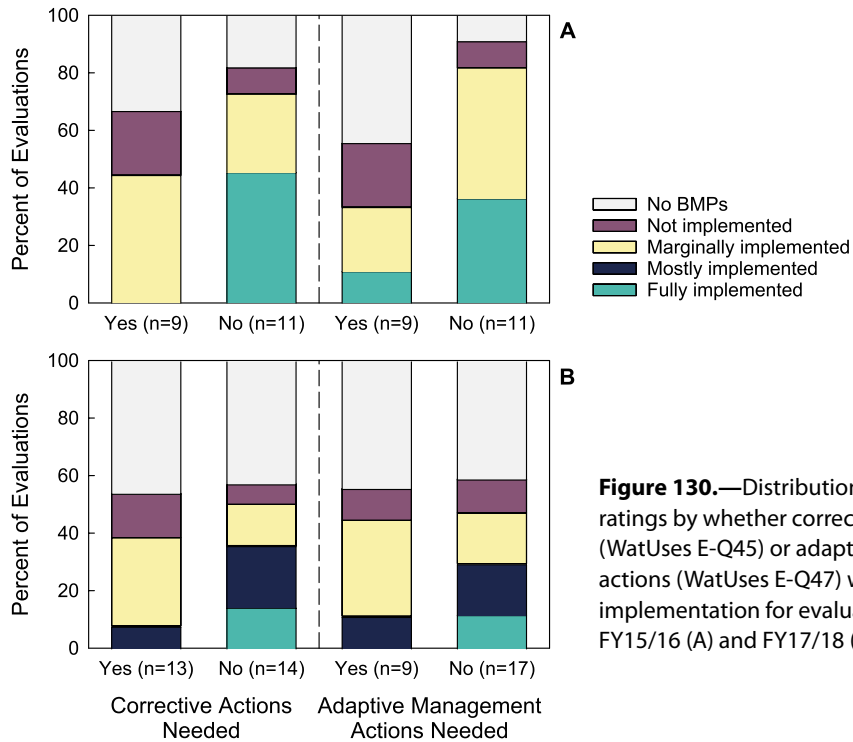


Figure 130.—Distribution of implementation ratings by whether corrective actions (WatUses E-Q45) or adaptive management actions (WatUses E-Q47) were needed to improve implementation for evaluations completed in FY15/16 (A) and FY17/18 (B).

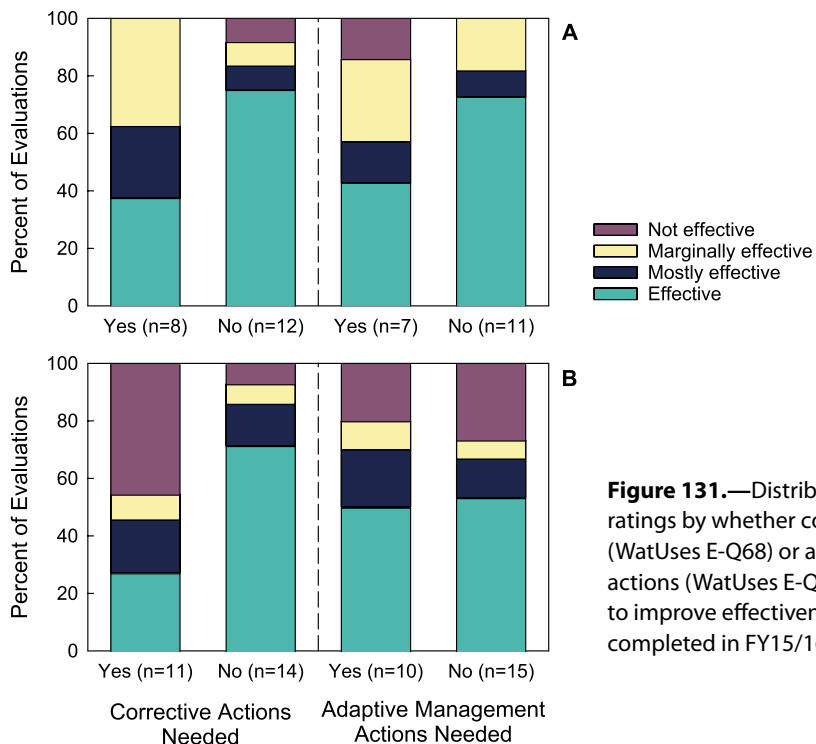


Figure 131.—Distribution of effectiveness ratings by whether corrective actions (WatUses E-Q68) or adaptive management actions (WatUses E-Q70) were needed to improve effectiveness for evaluations completed in FY15/16 (A) and FY17/18 (B).

management action needs ($p = 0.20$ FY15/16, $p = 0.88$ FY17/18). These results are not surprising given the poorer implementation ratings in both periods (Fig. 130). In comparison, there was no significant association among effectiveness ratings and whether corrective actions were needed in FY15/16 ($p = 0.18$), but there was in FY17/18 ($p = 0.07$). Significant associations also were not found among effectiveness ratings and whether adaptive management actions were needed in either period ($p = 0.59$ FY15/16, $p = 1.00$ FY17/18). Effectiveness ratings were better for a higher percentage of facilities that needed no corrective or adaptive management actions for three of the four comparisons (Fig. 131).

Some evaluations were rated as *not implemented* or *no BMPs* and *not effective* when no corrective actions or adaptive management actions were identified as being needed. This combination of results may seem counterintuitive. The 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 this 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 WatUses E-Q45, WatUses E-Q47, WatUses E-Q68, and WatUses E-Q70.

Composite Ratings

Composite rating results for WatUses E diversion and conveyance facilities that were evaluated for both implementation and effectiveness and had complete data are given in Table 241. Seventeen percent of facilities had a composite rating of *excellent*, 24 percent were rated as *good*, 17 percent were rated as *poor*, and 38 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, significant associations were not found in either monitoring period ($p = 0.12$ FY15/16, $p = 0.25$ FY17/18). In both periods, better effectiveness occurred across all levels of implementation, including when facilities had implementation ratings of *no BMPs* due to O&M documents not including BMPs to protect water, aquatic, and riparian resources.

Water Uses E: Examination of Component and Subcomponent Scores

The overall implementation ratings for WatUses E were determined from the component scores described in Table 220. WatUses E effectiveness rating components and scores are similar to those for WatUses A and WatUses C (Table 192), but WatUses E has three erosion and sedimentation components and a trash and waste component (Table 242). When a facility had neither aquatic organism passage nor flow requirements and no AOI in the source waterbody, the waterbody protection component was scored as *not applicable* (Table 242). When a facility has not had sediment removed during maintenance activities, the erosion and sedimentation-maintenance component score was *not applicable*. *Not applicable* scores for either component do not influence the final effectiveness rating.

Table 241.—Composite rating matrix for WatUses E facilities evaluated for both implementation and effectiveness in FY15/16 (n=18 evaluations) and FY17/18 (n=24 evaluations). Numbers in cells indicate the number of evaluations 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	4		5	1	1
	Mostly effective	1				2
	Marginally effective			1		2
	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	1	3		6
	Mostly effective				2	2
	Marginally effective				1	1
	Not effective		2	2		2

■	Excellent
■	Good
■	Fair
■	Poor
■	No plan

Table 243 shows the distribution of scores across the three implementation components. Seven facilities had *all* scores for all three implementation components, which resulted in implementation ratings of *fully implemented* (Table 244). Lack of O&M guidance documents containing BMPs resulted in a *no O&M* planning component score for 17 facilities and ratings of *no BMPs*. 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 220). This results from a “no” answer for at least one provision in Table 228 and a “yes” response for at least one other provision. The on-the-ground execution component also considers whether all parts of the facility are operating correctly. Of the 13 facilities in FY15/16 and 14 facilities in FY17/18 with a *some* score for the on-the-ground execution component (Table 243), 3 facilities in each period had that score because at least one BMP provision was not implemented fully. Four facilities in FY15/16 and five in FY17/18 had a *some* score for the on-the-ground execution component because one or more parts of the facility (diversion, head gate, or conveyance) were not operating as intended (WatUses E-Q36). Four other facilities (one in FY15/16 and three in FY17/18) had a *some* score because adequate freeboard had not been maintained (WatUses E-Q40) or evidence of seepage or leakage was observed below the conveyance (WatUses E-Q41). The remaining five facilities in FY15/16 and three in FY17/18 had deficiencies in two or all three of the metrics. The project oversight

Table 242.—Effectiveness components, scores, and interpretation of each score used for determining overall effectiveness ratings for the WatUses E protocol

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
	Not applicable	No aquatic passage or flow requirements or aquatic organisms of interest; does not affect the effectiveness rating
Erosion and sedimentation-conveyance failures	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-ditch, source waterbody, and receiving waterbody (DSR)	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
Erosion and sedimentation-maintenance	Effective	No adverse effect
	Mostly effective	Minor adverse effect
	Marginally effective	Minor adverse effect but potentially could be major
	Not effective	Major adverse effect
	Not applicable	No sediment removal during maintenance; does not affect the effectiveness rating
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

component is determined from two metrics: inspections (WatUses E-Q42) and whether corrective actions were taken if needed (WatUses E-Q43). Forty percent of facilities had a *some* score for the project oversight component (Table 243) because facilities were not inspected or inspections were not at critical times, and 12 percent had a score of *none* because needed corrective actions were not taken.

The distribution of scores across the six effectiveness components is summarized in Tables 245 and 246. At least 65 percent of scores for each component were *effective*, and every chemical pollutants component score was *effective* (Table 245). Twenty-five of the facilities in both monitoring periods combined had scores of *effective* (or *not applicable* for the erosion and sedimentation-maintenance component) for all six components and an effectiveness rating of *effective* (Table 246). Six facilities had a *not effective* score

Table 243.—Distribution of implementation component scores by component for WatUses E 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=20)							
	All	14	70	7	35	12	60
	Some ^a			13	65	5	25
	None ^a					3	15
	No BMPs prescribed ^b	1	5				
	No O&M ^{b,c}	5	25				
FY17/18 (n=28)							
	All	14	50	13	46	11	39
	Some			14	50	14	50
	None					3	11
	No BMPs prescribed	2	7				
	No O&M	12	43				
	Incomplete data ^d			1	4		

^a Score applies only to on-the-ground execution and project oversight components (see Table 220).

^b Score applies only to planning component (see Table 220).

^c Operation and maintenance.

^d Some of the questions needed to determine a component score were not answered.

for one component, and one facility had *not effective* scores for two components. *Not effective* scores for the waterbody protection component contributed to an effectiveness rating of *not effective* for four of the seven facilities with that rating (Table 246). Seven facilities could not be scored for one or more effectiveness components and thus could not be rated.

Effectiveness component scores were analyzed to determine whether associations existed between the component scores and the implementation ratings (Fig. 132). Significant associations were found for the three components in FY15/16 that could be tested: waterbody protection ($p = 0.04$); erosion and sedimentation-conveyance failures ($p = 0.08$); and erosion and sedimentation-ditch, source waterbody, and receiving waterbody (DSR) ($p = 0.02$). In all cases, the component scores tended to be better when the implementation ratings were better (Fig. 132). The erosion and sedimentation-conveyance failures component scores were associated with the implementation ratings in FY17/18 ($p = 0.06$); all other association test results were not significant (waterbody protection: $p = 0.76$, erosion and sedimentation-DSR: $p = 1.00$, erosion and sedimentation-maintenance: $p = 0.45$, trash and waste: $p = 0.32$). The larger number of evaluations with implementation ratings of *no BMPs* compared to the other ratings (Fig. 122) limits the usefulness of the FY17/18 comparisons.

Table 244.—Implementation component scores corresponding to the overall implementation ratings for WatUses E evaluations with complete data in FY15/16 and FY17/18. See Table 220 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	5
	Mostly implemented				0
	Marginally implemented	All	Some	All	5
		All	Some	Some	2
	Not implemented	All	Some	None	2
		No Rx ^a	Some	Some	1
	No BMPs	No O&M ^b	All	All	2
		No O&M	Some	Some	2
		No O&M	Some	None	1
FY17/18 (n=27)					
	Fully implemented	All	All	All	2
	Mostly implemented	All	All	Some	4
	Marginally implemented	All	Some	All	4
		All	Some	Some	2
	Not implemented	All	Some	None	1
		No Rx	All	Some	1
		No Rx	Some	All	1
	No BMPs	No O&M	All	All	3
		No O&M	All	Some	3
		No O&M	Some	All	1
		No O&M	Some	Some	3
No O&M		Some	None	2	

^a No BMPs prescribed.

^b Operation and maintenance.

The relationships between the BMP implementation component scores and the overall effectiveness ratings are shown in Figure 133. No significant associations existed in either monitoring period for any component except the planning component in FY17/18 (planning: $p = 0.20$ FY15/16, $p = 0.09$ FY17/18; on-the-ground execution: $p = 0.87$ FY15/16, $p = 0.64$ FY17/18; project oversight: $p = 0.15$ FY15/16, $p = 0.31$ FY17/18). However, the association between the planning component scores and effectiveness ratings in FY17/18 was the opposite of what might be expected, with better ratings for facilities without O&M documents containing BMPs. In most other cases, effectiveness ratings tended to be better when component scores were better (Fig. 133).

Table 245.—Distribution of effectiveness component scores by component for WatUses E evaluations completed in FY15/16 and FY17/18

Monitoring period	Effectiveness component score	Waterbody protection component (number)	Waterbody protection component (percent)	Erosion and sedimentation-conveyance failures component (number)	Erosion and sedimentation-conveyance failures component (percent)	Erosion and sedimentation-ditch, source waterbody, and receiving waterbody component (number)	Erosion and sedimentation-ditch, source waterbody, and receiving waterbody component (percent)
FY15/16 (n=23)							
	Effective	16	70	15	65	16	70
	Mostly effective ^a	2	9	2	9	4	17
	Moderately effective ^b						
	Marginally effective ^a	1	4	4	17	1	4
	Not effective	3	13	2	9		
	Not applicable ^c						
	Incomplete data ^d	1	4			2	9
FY17/18 (n=29)							
	Effective	20	69	24	83	25	86
	Mostly effective	4	14			1	3
	Moderately effective						
	Marginally effective	2	7			1	3
	Not effective	3	10	5	17		
	Not applicable						
	Incomplete data					2	7

(continued)

Table 245.—(continued)

Monitoring period	Effectiveness component score	Erosion and sedimentation-maintenance component (number)	Erosion and sedimentation-maintenance component (percent)	Trash and waste component (number)	Trash and waste component (percent)	Chemical pollutants component (number)	Chemical pollutants component (percent)
FY15/16 (n=23)							
	Effective	11	85	22	96	23	100
	Mostly effective ^a						
	Moderately effective ^b						
	Marginally effective ^a						
	Not effective			1	4		
	Not applicable ^c	10	-- ^c				
	Incomplete data ^d	2	15				
FY17/18 (n=29)							
	Effective	13	76	23	79	29	100
	Mostly effective	1	6				
	Moderately effective			5	17		
	Marginally effective	1	6				
	Not effective	1	6				
	Not applicable	12	--				
	Incomplete data	1	6	1	3		

^a Score applies only to waterbody protection and all erosion and sedimentation components (see Table 242).

^b Score applies only to trash and waste and chemical pollutants components (see Table 242).

^c Not included in calculation of percentages.

^d Some of the questions needed to determine a component score were not answered.

Table 246.—Effectiveness component scores corresponding to the overall effectiveness ratings for WatUses E evaluations completed in FY15/16 and FY17/18. See Table 242 for meaning of effectiveness component scores.

Monitoring period	Effectiveness rating	Waterbody protection component	Erosion and sedimentation-conveyance failures component	Erosion and sedimentation-ditch, source waterbody, and receiving waterbody component	Erosion and sedimentation-maintenance component	Trash and waste component	Chemical pollutants component	Number of evaluations
FY15/16 (n=20)								
	Effective	Effective	Effective	Effective	Effective or not applicable	Effective	Effective	12
	Mostly effective	Effective	Effective	Mostly effective	Not applicable	Effective	Effective	1
		Effective	Mostly effective	Effective	Not applicable	Effective	Effective	1
		Mostly effective	Effective	Effective	Effective	Effective	Effective	1
	Marginally effective	Effective	Effective	Marginally effective	Not applicable	Effective	Effective	1
		Effective	Marginally effective	Effective	Not applicable	Effective	Effective	1
		Mostly effective	Marginally effective	Effective	Not applicable	Effective	Effective	1
		Marginally effective	Mostly effective	Mostly effective	Effective	Effective	Effective	1
	Not effective	Not effective	Marginally effective	Mostly effective	Effective	Effective	Effective	1
FY17/18 (n=25)								
	Effective	Effective	Effective	Effective	Effective or not applicable	Effective	Effective	13
	Mostly effective	Effective	Effective	Effective	Not applicable	Moderately effective	Effective	1
		Effective	Effective	Effective	Mostly effective	Effective	Effective	1
		Mostly effective	Effective	Effective	Effective or not applicable	Effective	Effective	2
	Marginally effective	Marginally effective	Effective	Effective	Effective	Effective	Effective	1
		Marginally effective	Effective	Effective	Effective	Moderately effective	Effective	1
	Not effective	Effective	Not effective	Effective	Marginally effective	Effective	Effective	1
		Effective	Not effective	Effective	Not effective	Effective	Effective	1
		Mostly effective	Not effective	Effective	Not applicable	Effective	Effective	1
		Not effective	Effective	Effective	Not applicable	Effective	Effective	1
		Not effective	Effective	Effective	Not applicable	Moderately effective	Effective	1
		Not effective	Effective	Mostly effective	Effective	Moderately effective	Effective	1
		Not effective	Effective	Mostly effective	Effective	Moderately effective	Effective	1

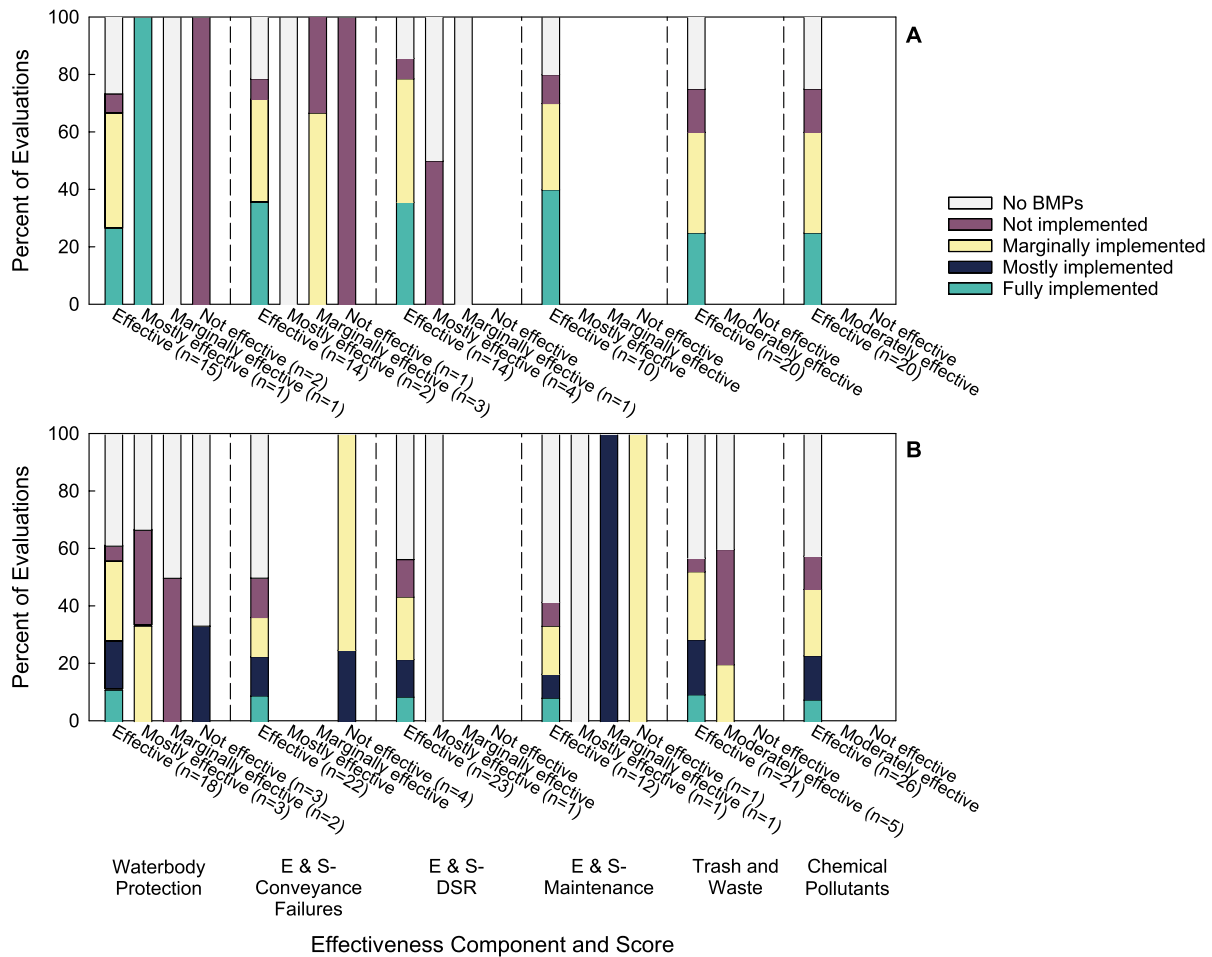


Figure 132.—Distribution of implementation ratings across effectiveness component scores for WatUses E evaluations completed in FY15/16 (A) and FY17/18 (B). E & S = erosion and sedimentation. DSR = ditch, source waterbody, and receiving waterbody.

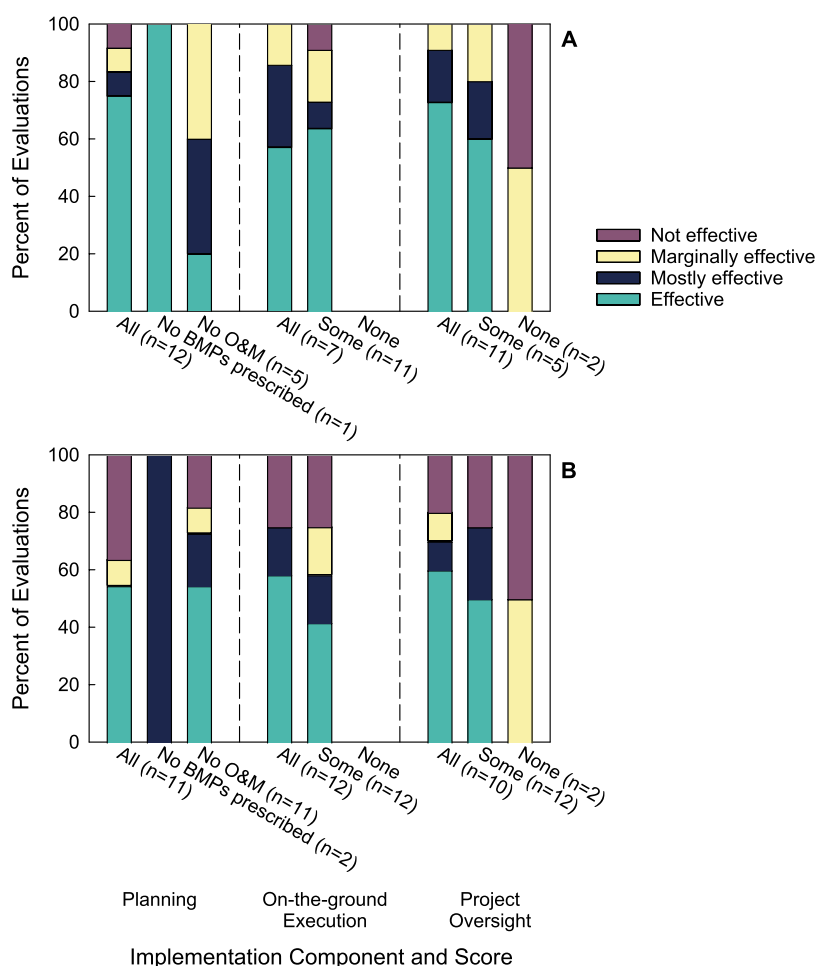


Figure 133.—Distribution of effectiveness ratings across implementation component scores for WatUses E evaluations completed in FY15/16 (A) and FY17/18 (B). O&M = operation and maintenance.

Water Uses E: Management Implications for Forest Service Resource Managers

Twenty-four percent of the diversion and conveyance facilities evaluated for operation and maintenance rated either *fully implemented* or *mostly implemented* for BMP implementation, and 49 percent rated *not implemented* or *no BMPs*. Project planning was a deficiency for 42 percent of the facilities. Planning deficiencies were predominantly a lack of operation and maintenance documents; 85 percent of facilities were not scored *all*. Deficiencies in on-the-ground execution occurred for more than half of the facilities, and 30 percent of those sites had deficiencies in two or three metrics: BMPs not implemented fully, structures not operating as intended, lack of adequate freeboard, or evidence of seepage present. Project oversight was better than on-the-ground execution; 48 percent of the facilities scored *all* for this component. Deficiencies in project oversight included a lack in inspections and corrective actions not implemented when the need was identified.

For BMP effectiveness, 71 percent of the facilities rated *effective* or *mostly effective*, indicating that either no impacts to water quality were observed or observed impacts were minor and temporary. Of the six effectiveness components, the occurrence of *effective* scores was lowest for the waterbody protection and erosion and sedimentation-conveyance failures components, at 71 and 75 percent of evaluations, respectively. Four of the seven facilities rated *not effective* were due to a *not effective* score for the waterbody protection component, and three facilities were rated *not effective* due to erosion and sedimentation-conveyance failures or erosion and sedimentation-DSR components. A *not effective* score for the waterbody protection component results when two of the following three metrics are not met: aquatic organism passage requirements, AOI non-entrainment, or flow requirements. When erosion and sedimentation were observed due to conveyance failures, 69 percent of those evaluations found evidence within 10 feet of or in the waterbody. Types of evidence reported most frequently were traceable evidence to the waterbody and vegetation damage or bare ground. Headcutting and slumping/slips were observed in two evaluations each. Mass wasting was reported in one evaluation. Trash and waste was a deficiency for three facilities. All of the facilities scored *effective* for the chemical pollutants component.

No significant association was found between BMP implementation and BMP effectiveness at the rating levels due to high numbers of facilities rated *effective* across all implementation ratings and high numbers of *no BMPs* implementation ratings. However, significant associations were found at the component levels. In FY15/16, significant associations were found between the implementation ratings and the waterbody protection, erosion and sedimentation-conveyance failures, and erosion and sedimentation-DSR component scores. The effectiveness component score was better when the implementation rating was better. A visual inspection of the relationships between implementation components and effectiveness ratings (Fig. 133) suggests that better effectiveness is associated with better implementation scores for all implementation components except the planning component in FY17/18, although none of these associations were statistically significant.

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

- Developing a written operation and maintenance (O&M) plan for the diversion and conveyance facility. Thirty-five percent of the facilities evaluated lacked an O&M plan, resulting in a *no BMPs* rating. Facilities authorized prior to 1980 were less likely to have an O&M plan.
- Checking that BMPs in the O&M plan are implemented. When a BMP provision was included in the O&M plan, it was implemented fully in 81 percent of those evaluations on average. BMP provisions “streamflow/volume control requirements,” “aquatic/riparian invasive species control,” and “trash management” were implemented fully at less than 76 percent of the facilities that included them in the O&M plan.
- Performing periodic inspections of diversion and conveyance systems, particularly during critical times. Forty percent of the facilities evaluated were not inspected or not inspected at critical times. More than half of the facilities had

an on-the-ground execution component score of *some*, often due to the facility not operating as intended or a lack of adequate freeboard or evidence of seepage. Site inspections could discover problems such as these and provide opportunities for correction.

- Taking corrective actions when problems that may affect water quality are discovered. Of the 18 facilities that had problems, needed corrective actions were not taken at 6 facilities. The effectiveness rating for those 6 evaluations was *marginally effective* or *not effective*.
- Ensuring that diversion and conveyance facilities are maintained regularly. About half of the facilities evaluated had received maintenance in the year prior to the evaluation, and about 10 percent had not been maintained in the 5 years prior to the evaluation. A significant association was found in FY17/18 between when the most recent maintenance occurred and facility structures operating as intended. Seventy percent of the facilities operating as intended had been maintained in the year prior to the evaluation, but 43 percent of facilities with a problem had been last maintained more than 5 years prior to the evaluation.
- Disposing of sediment removed during facility maintenance at a sufficient distance from the waterbody and implementing erosion control measures to reduce the potential for the sediment to reach a waterbody. Three evaluations reported evidence of erosion or sedimentation of sediment removed during maintenance, and all three reported that the evidence was within 10 feet of a waterbody or in a waterbody.
- Establishing a means of determining whether requirements for aquatic organism passage, AOI non-entrainment, or flow requirements are being met. Ten percent of the facilities lacked means to determine aquatic organism passage requirements, 23 percent lacked means to determine AOI non-entrainment requirements, and 25 percent lacked means to determine water flow requirements.

Water Uses E: Best Management Practices Monitoring Form

Best Management Practices Evaluation WatUses E. Operation and Maintenance of Diversions and Conveyances (Reference BMPs WatUses-1, WatUses-4, Range-3, AqEco-2, and AqEco-4) v3.0 February 2016	
Header	
WatUses E-Q1	Type of review being performed. Select one: Implementation Effectiveness Both Implementation and Effectiveness Follow-up Implementation Follow-up Effectiveness Follow-up Implementation and Effectiveness
WatUses E-Q2	If current review is for an initial evaluation of effectiveness only, what was the date of the implementation review for this site?
WatUses E-Q3	If current review is a follow-up evaluation, what was the date of the most recent evaluation?
WatUses E-Q4	Date of current field evaluation:
WatUses E-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:
WatUses E-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:
WatUses E-Q7	Reviewers and titles:
WatUses E-Q8a	Region number:
WatUses E-Q8b	State:
WatUses E-Q9a	Proclaimed Forest or Grassland number and name:
WatUses E-Q9b	Administrative Forest or Grassland number and name:
WatUses E-Q10	District number and name:
WatUses E-Q11a	Reason for monitoring. Select all that apply: National BMP Targets Land Management Plan Monitoring Project Review Quality Assurance Other (specify):
WatUses E-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: a. Yes b. No If No, describe the procedures used to select the project/site:

continued on next page

Header (continued)	
WatUses E-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: a. Yes b. No 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:
WatUses E-Q12	6 th level HUC number and name of the subwatershed at the point of diversion:
WatUses E-Q13	Are the diversion and conveyance located within a municipal supply watershed? Select one: a. Yes b. No
WatUses E-Q14a	Location. UTM Zone: UTM Datum:
WatUses E-Q14b	Location. Easting:
WatUses E-Q14c	Location. Northing:
WatUses E-Q15a	Location. Latitude:
WatUses E-Q15b	Location. Longitude:
WatUses E-Q15c	Location. Lat/Long Datum:
WatUses E-Q16	Wet weather conditions during the field evaluation and the 24 hours before the evaluation. Select all that apply: Rain Snow Snowpack on the ground Melting snow Hail/sleet Freezing rain/freezing fog Other (specify): Unknown
WatUses E-Q17	Is there a valid water right for this diversion? Select one: a. Yes (go to question 18) b. No (go to question 21)
WatUses E-Q18	State water right number for this diversion and conveyance system:
WatUses E-Q19	Permitted periods of water use and amounts for each period (cfs, acre-ft, gal/min; specify unit):
WatUses E-Q20	Owner of the water right:

continued on next page

Header (continued)	
WatUses E-Q21	Forest Service name or identifier for this diversion and conveyance system:
WatUses E-Q22	Use served by this water facility. Select all that apply: a. Forest Service administrative use b. Public or private use
WatUses E-Q23	What is the authorization for the water facility? Select one: a. Permit (go to question 24) b. Easement (go to question 24) c. Assertion (go to question 24) d. Lease (go to question 24) e. No current authorization (go to question 27)
WatUses E-Q24	Year the water facility was authorized:
WatUses E-Q25	Is the authorization renewable? Select one: a. Yes b. No
WatUses E-Q26	What year does the current authorization expire?
WatUses E-Q27	Infrastructure present. Select all that apply: - Diversion - Head gate - Earthen ditch - Concrete ditch - Pipeline - Flume - Water level gauge - Staff gauge - Tunnel - Drop structure - Fish screen - Other (specify):
WatUses E-Q28	Are there aquatic organisms of interest in the diversion-source waterbody? Select one: a. Yes (go to question 29) b. No (go to question 30)
WatUses E-Q29	Provide the names of the aquatic organisms of interest:
WatUses E-Q30	Intended uses of the diverted water. Select all that apply: - Hydropower - Wildlife - Stock pond/watering - Municipal/domestic water supply - Fire suppression water source - Irrigation - Other (specify):
WatUses E-Q31	Beneficial uses of the diversion-source water. Select all that apply: - Fishery - Other aquatic organisms - Municipal/domestic water supply - Recreation - Wildlife - Industrial - Other (specify):

continued on next page

Implementation	
WatUses E-Q32	Does the operation and maintenance plan, special use permit (SUP), or other operation and maintenance guidance documents for this diversion and conveyance facility contain provisions for protecting water, aquatic, and riparian resources? Select one: a. Yes, the plan, SUP, or other O&M guidance documents contain provisions for water/aquatic/riparian protection (go to question 33) 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 34) c. No operation and maintenance plan, SUP, or other O&M guidance documents exist for this facility (go to question 34)
WatUses E-Q33	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 12 months. 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, select Not applicable. a. Erosion control (vegetation, structures, etc.) Yes/No/Not applicable b. Locations for disposal of materials, including sediment, vegetation, and debris Yes/No/Not applicable c. Streamflow/volume control requirements Yes/No/Not applicable d. Aquatic passage requirements Yes/No/Not applicable e. Prevent/minimize loss or entrainment of target organisms Yes/No/Not applicable f. Aquatic/riparian invasive species control Yes/No/Not applicable g. Trash management Yes/No/Not applicable h. Human sanitary waste management Yes/No/Not applicable i. Domestic animal waste management Yes/No/Not applicable j. Maintenance of facilities (frequency, types of actions, etc.) Yes/No/Not applicable k. Other (specify): Yes/No/Not applicable For any provisions you answered No, briefly explain how implementation is deficient:
WatUses E-Q34	When did the most recent maintenance of the facility occur? Select one: a. Observable evidence or records indicate maintenance has occurred within the past year b. Observable evidence or records indicate that maintenance occurred 1–5 years ago c. Observable evidence or records indicate no maintenance has occurred within the past 5 years
WatUses E-Q35	Are any of the materials from which the diversion is constructed potentially toxic to aquatic organisms? Select one: a. Yes b. No c. Unknown If Yes, identify the toxic materials:

continued on next page

Implementation *(continued)*

WatUses E-Q36	Which structures are not operating as intended? Select all that apply: a. Not applicable, all are operating as intended (go to question 38) b. Diversion (go to question 37) c. Head gate (go to question 37) d. Conveyance (go to question 37)
WatUses E-Q37	For the structures that are not operating as intended, what are the causes? Select all that apply: a. Clogged by vegetation b. Clogged by sediment or bedload c. Physical failure of facilities d. Mechanical failure e. Other (specify):
WatUses E-Q38	When was the most recent occurrence of water flow in the conveyance system? Select one: a. System is conveying water at the time of review (go to question 40) b. Evidence indicates that it conveyed water within the past year (go to question 39) c. Evidence indicates that it conveyed water 1–5 years ago (go to question 39) d. Evidence indicates that it conveyed water 5–10 years ago (go to question 39) e. Evidence indicates that water has not been conveyed during the past 10 years (go to question 39)
WatUses E-Q39	What evidence was used to determine recency of water conveyance? Select one: a. Field observations b. Inspection reports c. Both field observations and inspection reports
WatUses E-Q40	Is adequate freeboard maintained to reduce the potential for ditch failure and resource damage? Select one: a. Not applicable, conveyance is not by ditch b. Yes c. No
WatUses E-Q41	Is there evidence of seepage or leakage below the conveyance system that may contribute to failure or resource damage? Select one: a. Yes b. No
WatUses E-Q42	Were inspections during the past 5 years performed at critical times for addressing water quality issues? Select one: a. No inspections were performed b. Yes c. No
WatUses E-Q43	If problems occurred 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: a. No problems occurred so no corrective actions were needed b. Corrective actions were needed but not taken c. Corrective actions were needed and implemented d. Unknown, insufficient documentation and information exists to make the decision

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Implementation (continued)	
WatUses E-Q44	Were chemical or fuel spills or leaks that occurred at this facility during the past 5 years handled/treated according to the contingency and emergency response plan? Select one: a. The Forest or Grassland has no contingency and emergency response plan b. Not applicable, no spills or leaks occurred during the past 5 years c. Yes, spills or leaks were handled/treated according to the contingency and emergency response plan d. No, spills or leaks were not handled/treated according to the contingency and emergency response plan
WatUses E-Q45	Are any corrective actions needed to improve implementation? Select one: a. Yes (go to question 46) b. No (go to question 47)
WatUses E-Q46	Provide information about corrective actions needed to improve implementation, and reference the question number to which each correction applies.
WatUses E-Q47	Are any adaptive management actions needed to improve implementation? Select one: a. Yes (go to question 48) b. No (go to question 49 if effectiveness is to be evaluated at this time; otherwise go to General Comments)
WatUses E-Q48	Provide information about adaptive management actions needed to improve implementation, and reference the question number to which each action applies. Go to question 49 if effectiveness is to be evaluated at this time; otherwise go to General Comments after answering this question.
Effectiveness	
WatUses E-Q49	Have aquatic passage requirements been met? Select all that apply: a. Not applicable, no aquatic passage requirements b. No means to make the determination c. Measurement or monitoring indicate that aquatic passage requirements have been met d. Measurement or monitoring indicate that aquatic passage requirements have not been met e. Periodic inspections indicate that aquatic passage requirements have been met f. Periodic inspections indicate that aquatic passage requirements have not been met g. Other means indicate that aquatic passage requirements have been met (specify the means used for this answer): h. Other means indicate that aquatic passage requirements have not been met (specify the means used for this answer):
WatUses E-Q50	Have any aquatic organisms of interest been entrained in the conveyance system? Select all that apply: a. Not applicable, no aquatic organisms of interest identified for this facility b. No means to make the determination c. Current review indicates that aquatic organisms of interest are not entrained d. Current review indicates that aquatic organisms of interest are entrained e. Measurement or monitoring indicate that non-entrainment requirements have been met for aquatic organisms of interest f. Measurement or monitoring indicate that non-entrainment requirements have not been met for aquatic organisms of interest g. Periodic inspections indicate that non-entrainment requirements have been met for aquatic organisms of interest (continued)

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Effectiveness (continued)	
(WatUses E-Q50 continued)	h. Periodic inspections indicate that non-entrainment requirements have not been met for aquatic organisms of interest i. Other means indicate that non-entrainment requirements have been met for aquatic organisms of interest (specify the means used for this answer): j. Other means indicate that non-entrainment requirements have not been met for aquatic organisms of interest (specify the means used for this answer):
WatUses E-Q51	Have flow requirements been met for the source water? Select all that apply: a. Not applicable, no flow requirements (go to question 53) b. No means to make the determination (go to question 52) c. Measurements or monitoring indicate that flow requirements have been met (go to question 52) d. Measurements or monitoring indicate that flow requirements have not been met (go to question 52) e. Periodic inspections indicate that flow requirements have been met (go to question 52) f. Periodic inspections indicate that flow requirements have not been met (go to question 52) g. Other means indicate that flow requirements have been met (specify the means used for this answer; go to question 52 after answering): h. Other means indicate that flow requirements have not been met (specify the means used for this answer; go to question 52 after answering):
WatUses E-Q52	Have flow requirements been effective for meeting beneficial uses? Select one: a. No means to determine if flow requirements have been effective for meeting beneficial uses b. Monitoring plan is in place, but unable to determine effectiveness at this time c. Yes d. No
WatUses E-Q53	Is there evidence of erosion or sedimentation from conveyance failures? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from b to d. a. No evidence of conveyance failures (go to question 57) b. Evidence of erosion or sedimentation outside an AMZ (go to question 55) c. Evidence of erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 55) d. Evidence of sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 54)
WatUses E-Q54	How many total places do you observe erosion or sedimentation delivered to/ present in the waterbody and changes to waterbody morphology? Select one; after answering go to question 56: a. 1 or 2 b. 3 or 4 c. 5 or more
WatUses E-Q55	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet

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Effectiveness (continued)

WatUses E-Q56	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 53, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):
WatUses E-Q57	Is there evidence of active ditch bank erosion that is not associated with failures reported in question 53? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from d to g. a. Not applicable, the conveyance is not a ditch b. Not applicable, the conveyance is a hardened ditch c. No evidence of active ditch bank erosion d. Evidence of active ditch bank erosion that does not exceed amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents e. Evidence of active ditch bank erosion, but there is no description of the amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents f. Evidence of active ditch bank erosion that exceeds amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents, but ditch stability is not currently threatened g. Evidence of active ditch bank erosion that threatens ditch stability or has resulted in ditch instability
WatUses E-Q58	Is there evidence of erosion or sedimentation or morphology changes in the source waterbody downstream of the diversion that is attributable to the diversion? Select one: a. No evidence of erosion, sedimentation, or morphology changes b. Evidence of erosion, sedimentation, or morphology changes that does not exceed amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents c. Evidence of erosion, sedimentation, or morphology changes, but there is no description of the amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents d. Evidence of erosion, sedimentation, or morphology changes that exceeds amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents

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Effectiveness *(continued)*

WatUses E-Q59	Is there evidence of erosion or sedimentation or morphology changes in the receiving waterbody downstream of the conveyance return? Select one: a. No evidence of erosion, sedimentation, or morphology changes b. Evidence of erosion, sedimentation, or morphology changes that does not exceed amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents c. Evidence of erosion, sedimentation, or morphology changes, but there is no description of the amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents d. Evidence of erosion, sedimentation, or morphology changes that exceeds amounts allowed in the operation and maintenance plan, SUP, or other O&M guidance documents
WatUses E-Q60	Is there evidence of uncontrolled erosion from sediment removed during maintenance of the diversion or conveyance system? Select one; when multiple occurrences would yield different answers, select the most severe occurrence, with severity increasing from c to e: a. Not applicable, no sediment removed from either location (go to question 64) b. No evidence of uncontrolled erosion (go to question 64) c. Evidence of uncontrolled erosion or sedimentation outside an AMZ (go to question 62) d. Evidence of uncontrolled erosion or sedimentation within an AMZ, but not reaching a waterbody (go to question 62) e. Evidence of uncontrolled sediment transport to or deposition in a waterbody, or evidence of changes to waterbody morphology (go to question 61)
WatUses E-Q61	How many total places do you observe erosion or sedimentation delivered to/present in the waterbody and changes to waterbody morphology? Select one; after answering go to question 63: a. 1 or 2 b. 3 or 4 c. 5 or more
WatUses E-Q62	What is the shortest distance between the evidence and the waterbody? Select one: a. ≤10 feet b. >10 to 50 feet c. >50 to 100 feet d. >100 feet
WatUses E-Q63	For all of the occurrences of erosion and sedimentation observed in the area you identified in question 60, what is the evidence? Select all that apply: a. Traceable evidence to the waterbody, but not currently visible in the waterbody b. Turbidity present c. Evidence of localized sediment deposition in the waterbody d. Changes to substrate composition e. Changes to waterbody geometry (e.g., width, depth, meander patterns, bank or bed slope, etc.) f. Bank instability g. Bank trampling or compaction h. Vegetation damage or bare ground i. Sheet erosion j. Rill erosion k. Gully erosion l. Headcutting m. Slumping/slips n. Mass wasting o. Sediment plumes or accumulations p. Rutting q. Water quality monitoring results r. Other (specify):

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Effectiveness (continued)	
WatUses E-Q64	What evidence of trash or domestic animal or human sanitary waste exists in the diversion-source water or conveyance water? Select all that apply: a. No evidence of trash or domestic animal or human sanitary waste b. Evidence of trash in the source waterbody c. Evidence of trash in the conveyance d. Evidence of domestic animal or human sanitary waste in the source waterbody e. Evidence of domestic animal or human sanitary waste in the conveyance
WatUses E-Q65	What evidence of chemical or fuel spills or leaks or associated waste containers exists in the areas evaluated for this diversion and conveyance system? Select all that apply: a. No evidence of chemical or fuel spills, leaks, or waste containers b. Evidence of chemical or fuel spills or leaks outside an AMZ c. Evidence of chemical or fuel spills or leaks within an AMZ d. Evidence of chemical or fuel spills or leaks in a waterbody, conveyance, or water storage structure e. Evidence of chemical or fuel waste containers outside an AMZ f. Evidence of chemical or fuel waste containers within an AMZ g. Evidence of chemical or fuel waste containers in a waterbody, conveyance, or water storage structure
WatUses E-Q66	Is there evidence that the water facility introduced or increased the presence of aquatic invasive species in or along the waterbody? Select one: a. Yes b. No If Yes, list the invasive species observed:
WatUses E-Q67	If inspections were not conducted at critical times during the past 5 years, did the lack of administration contribute to observed problems? Select one: a. Not applicable, inspections were conducted at critical times b. Yes c. No
WatUses E-Q68	Are any corrective actions needed to improve effectiveness? Select one: a. Yes (go to question 69) b. No (go to question 70)
WatUses E-Q69	Provide information about corrective actions needed to improve effectiveness, and reference the question number to which each correction applies.
WatUses E-Q70	Are any adaptive management actions needed to improve effectiveness? Select one: a. Yes (go to question 71) b. No (go to General Comments)
WatUses E-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	

Water Uses Management Summary

With a total of 162 evaluations completed, water uses management protocols were among the least frequently used National BMP monitoring protocols in the FY15/16 and FY17/18 monitoring periods (6 percent of all evaluations) (Table 178). Each region completed at least three evaluations using a water uses protocol; Region 6 (45 evaluations) and Region 5 (32 evaluations) completed the most. Region 9 (3 evaluations) and Region 8 (4 evaluations) completed the fewest. The water uses protocols used most frequently were WatUses E to evaluate operation and maintenance of diversions and conveyances (53 evaluations) and WatUses B to evaluate operation and maintenance of spring-source facilities (47 evaluations). Seventy percent of the water uses evaluations were at randomly selected sites (Table 178).

Overall, about 41 percent of the water uses evaluations rated *fully implemented* or *mostly implemented* for BMP implementation. The percentage of *fully implemented* or *mostly implemented* ratings ranged from about 26 percent (WatUses E) to 50 percent (WatUses A [O&M]). WatUses E had nearly 50 percent of sites rated *not implemented* or *no BMPs*. Planning was a deficiency for about two-thirds of the WatUses A and WatUses B sites and 42 percent of the WatUses E sites; the primary planning deficiency was lack of BMPs in O&M plans. On-the-ground execution was a deficiency in 58 and 57 percent of the WatUses B and WatUses E sites, respectively. On-the-ground execution deficiencies included not all prescribed BMPs being implemented fully, not meeting requirements for water flow, aquatic passage or other metric related to operation of a water use facility, and a lack of means to determine whether those requirements had been met. Project oversight was generally better than the other implementation components; however, 40 percent of WatUses B sites and 53 percent WatUses E sites had project oversight deficiencies due to lack of inspections at critical times or lack of corrective actions being taken when identified.

BMP effectiveness ranged from 38 percent of the WatUses D projects rated *effective* or *mostly effective* to 95 percent of the WatUses A projects with those ratings. *Effective* and *mostly effective* ratings indicate that either no impacts to water quality were observed or observed impacts were minor and temporary. Of the effectiveness rating components, the waterbody protection components generally had poorer scores than the erosion and sedimentation or other pollutant components.

For projects in which both the implementation and effectiveness evaluations were completed, the better effectiveness ratings across all implementation ratings made finding significant associations between implementation ratings and effectiveness ratings difficult. However, there were some indications that better implementation ratings or component scores generally were associated with better effectiveness ratings or component scores. In addition, the review teams appear to be recognizing implementation and effectiveness issues while they conduct the monitoring evaluations. Some significant associations existed between the implementation and effectiveness ratings and the need for corrective actions or adaptive management actions in some water uses protocols. Evaluations of projects or sites 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 into BMP implementation and effectiveness, the data are assessed to identify issues with application of the BMP monitoring program. Examination of the data for water uses protocols indicates 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 their effectiveness, with implementation evaluated first, even if both are evaluated on the same day. Two WatUses A, two WatUses B, two WatUses D, and six WatUses E evaluations included 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 have occurred 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.
- Two WatUses A, two WatUses B, one WatUses C, and seven WatUses E evaluations were incomplete in the database. Evaluations with incomplete data in the database cannot be rated. An additional WatUses C evaluation did not indicate whether reconstruction or repair or operation and maintenance was evaluated and had no responses in the database for the implementation portion of the review, even though “both implementation and effectiveness” was selected as the type of evaluation. Data from that evaluation are excluded from the WatUses C analyses.
- Header questions (11a, 11b, and 11c) in all protocols were not answered correctly according to the instructions in a number of water uses evaluations. These questions are designed to capture information about the reasons for monitoring, whether the projects or sites were selected randomly according to the protocol instructions, and whether the protocol instructions for completing the evaluations were followed. The most common mistake was misunderstanding the intended meaning of quality assurance monitoring.
- Incompatible answers to related questions may adversely affect the overall implementation or effectiveness rating:

Several WatUses E evaluations had incompatible answer choices selected for questions on whether aquatic organism passage requirements (WatUses E-Q49) or flow requirements (WatUses E-Q51) were met. Those questions are used in the waterbody protection effectiveness component score. For example, selecting “no means to make the determination” and one or more answer choices indicating a determination was made creates an incompatible pair. A “no means” selection does not affect the component score, but one or more of the answer choices indicating that a determination was made do affect the score.

Incompatible answers to related questions on location of observed erosion and sedimentation evidence and the erosion and sediment features observed were also found in WatUses E evaluations (WatUses E-Q53, WatUses E-Q56, and Table 235). For example, observed evidence of erosion and sedimentation “within an AMZ” coupled with an observed erosion and sediment feature of “evidence of localized sediment deposition in the waterbody” are incompatible. If localized sediment deposition in a waterbody is observed, the location of the evidence question would be answered “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.

- Inconsistent answers to related questions in the implementation section and effectiveness section of the protocol make it difficult to interpret the relationship between BMP implementation and BMP effectiveness.

In most protocols, a pair of questions (e.g., WatUses A-Q34 and WatUses A-Q55; WatUses B-Q40 and WatUses B-Q59; WatUses C-Q30 and WatUses C-Q47; WatUses D-32 and WatUses D-Q50; WatUses E-Q42 and WatUses E-Q67) 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, the answer to the effectiveness question in some evaluations conflicted with the answer given for the implementation question.

In WatUses A, a pair of questions ask about well water withdrawal limits or groundwater level requirements (implementation WatUses A-Q32) and whether those limits or requirements were met (effectiveness WatUses A-Q49). The answers to these two questions in 23 percent of the evaluations conflicted, limiting the usefulness of this paired comparison.

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 the same issues recurring in the future.

METRIC EQUIVALENTS

When you know	Multiply by	To convert to
acres	0.4047	hectares
feet	0.305	meters
miles	1.609	kilometers
cubic feet/second (cfs)	28.317	liters/second (lps)
acre-feet	1233.48	cubic meters
gallons	3.785	liters

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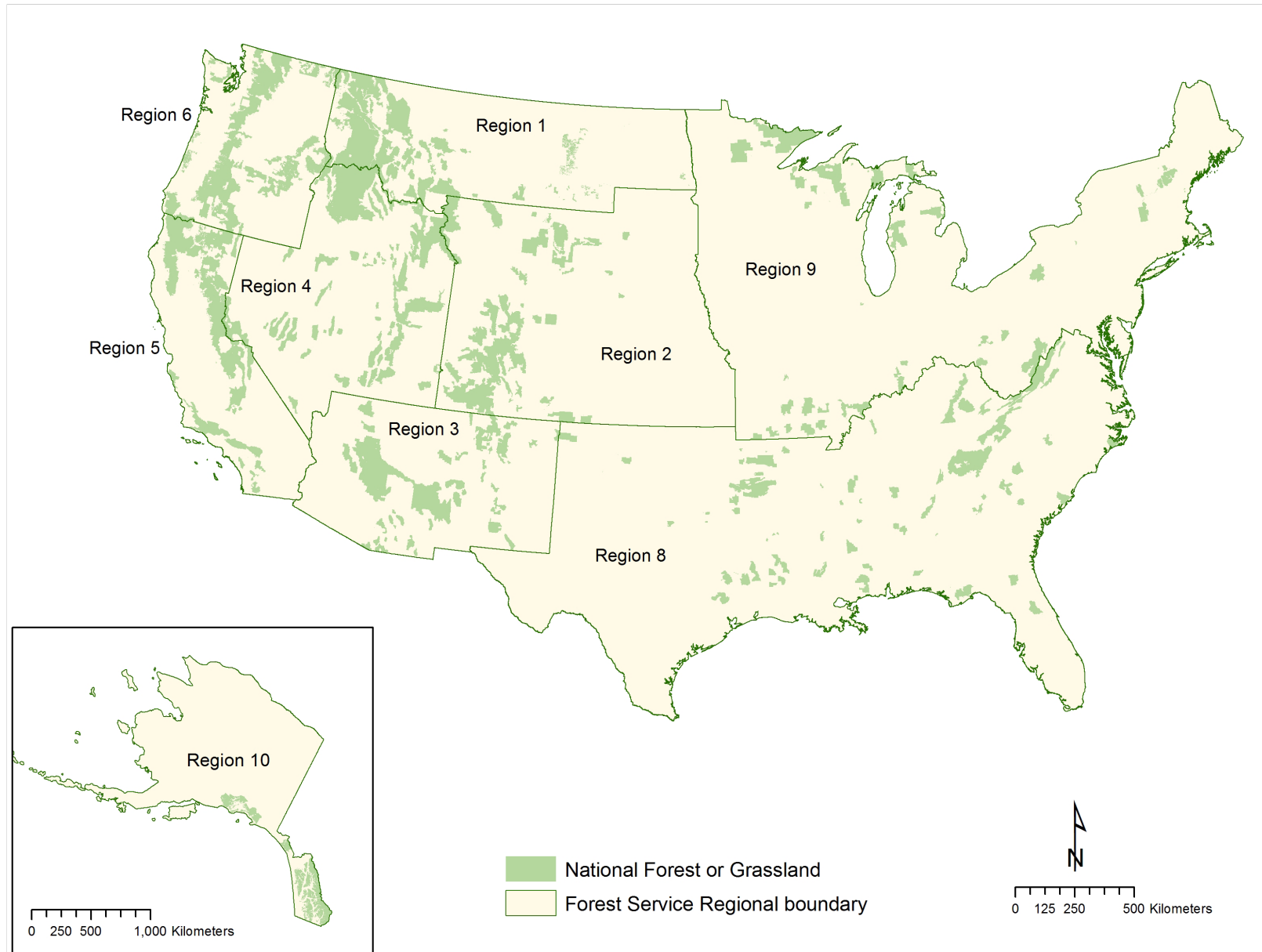
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APPENDIX 1: Map of USDA Forest Service Regions



APPENDIX 2: Summaries of Nonrandomly Selected Sites or Projects

INTRODUCTION

The National BMP monitoring program has a requirement that at least half of the evaluated sites or projects on each administrative unit are selected randomly because results from random samples can be assumed to be representative of other similar sites or projects on that unit. Nationally, random samples should provide unbiased information about the status and trends of BMP implementation and effectiveness. Nonrandom sampling is permitted to allow units to evaluate sites and projects to address local monitoring needs or to meet National BMP targets when the site or project pool is too small for random sampling for a specific monitoring protocol.

Even with the stipulation that at least half of the evaluation sites or projects be selected randomly, the number of random samples available from the first monitoring periods within many of the protocols was limited (because there are 42 total protocols). Consequently, to increase the sample sizes for all protocols, random and nonrandom samples from each monitoring period were combined if statistical associations between the implementation and effectiveness ratings and the sample selection method were not found. When a significant association was found (Fisher's exact test, $\alpha = 0.01$), a determination was made to either combine the random and nonrandom data or include only the random samples in the in-depth analyses. The reasoning behind each determination is given in the introduction for each resource area. Details about the ratings and statistical methods are discussed in the methods section in the introduction to this report.

In this report, protocols Rec D and WatUses B had at least one significant association between ratings and selection method, so only randomly selected samples were included in the full analyses. Results for the nonrandomly selected samples are described briefly in this appendix for readers interested in how the two data sets differ by selection method.

RECREATION MANAGEMENT

Recreation D—Motorized or Nonmotorized Trail Operation and Maintenance

Recreation D: Descriptive Statistics

Sixteen nonrandomly selected Rec D evaluations were completed in FY15/16 and 21 in FY17/18. At least one trail was evaluated in each region except in Region 4, which did not complete any nonrandomly selected evaluations (see App. 1 for region delineations). Thirty-six trails were evaluated for both implementation and effectiveness. One trail was evaluated for implementation only in FY17/18. All evaluations selected National BMP targets as a reason for monitoring. Approximately 0.5 mile of trail was evaluated on average in each monitoring period (Rec D-Q18). The longest trail lengths evaluated were 4 miles and 5 miles in FY15/16 and FY17/18, respectively. Mean dominant grade of the trail segment (Rec D-Q24) was 9.8 percent (standard error [se] = 1.9 percent) in FY15/16 and ranged from 1 to 30 percent. In FY17/18, the mean dominant grade was 6.9 percent (se = 2.5 percent) and ranged from 0.02 to 50 percent. Steepest trail grades (Rec D-Q25) averaged 18.3 percent (se = 3.5 percent) and 14.7 percent (se = 3.6 percent) in FY15/16 and FY17/18, respectively; maximum steep grades were 60 and 65 percent. Thirty-four evaluated trail segments included waterbody crossings (Rec D-Q19), and the number of crossings ranged from one to eight. Twenty trails allowed only nonmotorized uses (Rec D-Q23), eight allowed only motorized uses (Rec D-Q22), and eight allowed both. One evaluation in FY17/18 did not answer the questions about type of allowed use. Predominant motorized uses were by dirt bikes or motorcycles and off-highway vehicles (OHV). Hiking was the allowed nonmotorized use reported most frequently. Three trails in FY15/16 and two in FY17/18 had been used for a special event in the past 12 months (Rec D-Q21), and three of the five events were on motorized trails.

Twenty evaluated trails (8 in FY15/16 and 12 in FY17/18) had no unresolved maintenance needs that had been identified prior to the evaluation (Rec D-Q26). Operation and maintenance (O&M) plans or other O&M guidance documents (Rec D-Q27) existed for 14 trails in FY15/16 and 12 trails in FY17/18, and all contained BMP provisions for protecting water, aquatic, and riparian resources. The remaining trails had no O&M plans or documents. On average, prescribed BMP provisions were implemented fully (Rec D-Q28) for 71 and 82 percent of evaluations in FY15/16 and FY17/18, respectively. The mean number of provisions with prescribed BMPs per evaluation was five in FY15/16 and six in FY17/18, and the mean percentages of provisions implemented fully per evaluation were 78 and 87 percent in FY15/16 and FY17/18, respectively. Nine trails in FY15/16 and eight trails in FY17/18 had all BMPs in all applicable provisions implemented fully.

Four trails in FY15/16 and 11 in FY17/18 either had no inspections or had inspections not during critical times (Rec D-Q29). Corrective actions were not needed to address problems in the 12 months prior to the evaluation (Rec D-Q30) for six trails in FY15/16 and three in FY17/18. Eight evaluations in FY15/16 and 12 in FY17/18 indicated that corrective actions were needed; these actions were not taken for four of those evaluations

in each monitoring period. It was unknown whether corrective actions were needed or taken for the remaining evaluations. Trail closure or use restrictions were needed to protect water resources during the 5 years prior to the evaluation (Rec D-Q31) for four trails in FY15/16 and six in FY17/18; those needs were addressed for all but one trail in FY17/18. Treatments were needed to reduce impacts to water resources in the 5 years prior to the evaluation (Rec D-Q33) for 11 trails in FY15/16 and 17 in FY17/18; treatments were not applied to 4 trails in each monitoring period. One evaluation in each monitoring period indicated that the administrative unit did not have a contingency and emergency response plan (CERP) for handling and cleanup of chemical spills (Rec D-Q36). The remaining evaluations reported that no chemical or fuel spills or leaks had occurred on the trail during the past 5 years.

Thirty-six trails were evaluated for effectiveness. Five trails in FY15/16 and six in FY17/18 had no evidence of erosion or sedimentation on or originating from the evaluated trail segment (Rec D-Q41). Five trails in FY15/16 and 10 in FY17/18 had observed evidence in a waterbody. For both monitoring periods combined, five trails had observed evidence outside an aquatic management zone (AMZ), and five trails had evidence within an AMZ. The most common types of evidence observed (Rec D-Q46) were sheet erosion in FY15/16 and rill erosion in FY17/18. Perennial streams or rivers were the waterbody type most often affected (Rec D-Q44). Lack of or too few water control features was a reported cause of the erosion or sedimentation for 60 percent of evaluations (Rec D-Q47). When waterbody crossings and approaches were part of the evaluated trail segment, no evidence of erosion, sedimentation, or morphological changes (Rec D-Q48) was observed for four evaluations in each monitoring period. Evidence was observed in a waterbody at a crossing for 7 evaluations in FY15/16 and 13 in FY17/18 (59 percent of all evaluations). The remaining evaluations observed evidence in the area of the crossing (not in a waterbody). The types of evidence reported most frequently (Rec D-Q51) were sediment deposition in a waterbody, damage to waterbody banks, and vegetation damage or bare ground. Two-thirds of the waterbodies affected (Rec D-Q49) were perennial streams or rivers. The most common type of crossing structure (Rec D-Q50) was an unhardened ford. The causes of the observed erosion and sedimentation (Rec D-Q52) reported most commonly were unhardened crossing approaches (46 percent of evaluations) and lack of a crossing structure (35 percent of evaluations). Diversion potential existed for at least one evaluated waterbody crossing on three trails (Rec D-Q53). Four evaluations in FY15/16 and 14 evaluations in FY17/18 reported evidence of trash or waste on or along the trail (Rec D-Q54). One evaluation in each period reported trash evidence in a waterbody. No chemical or fuel spills or leaks were reported in either monitoring period (Rec D-Q55).

About 75 percent of all trails with unresolved maintenance needs (five evaluations in FY15/16 and eight in FY17/18) indicated that those needs contributed to problems observed (Rec D-Q56) during the effectiveness evaluation. One evaluation (of three) in FY15/16 and four evaluations (of 10) in FY17/18 reported that a lack of inspections or inspections not at critical times contributed to observed problems (Rec D-Q57). For trails that had treatments applied, two evaluations indicated that desired results were fully achieved (Rec D-Q58), and six evaluations indicated results were partially achieved; however, seven evaluations did not follow the protocol instructions and provided incompatible answer choices for Rec D-Q33 and Rec D-Q58.

Recreation D: Ratings and Component Scores

Six trails in FY15/16 were rated *fully implemented*, three were rated *mostly implemented*, and two were rated *marginally implemented*. Five trails had a rating of *not implemented* or *no BMPs*. Two trails in FY17/18 were rated *fully implemented*, six were rated *mostly implemented*, four were rated *marginally implemented*, and nine were rated *no BMPs*. Nine trails in FY15/16 had effectiveness ratings of *not effective*, four were rated *effective*, and two were rated *marginally effective*. In FY17/18, two trails were rated *effective* and four were rated *marginally effective*. Thirteen trails were rated *not effective*. For the 16 trails in FY15/16 and the 20 trails in FY17/18 that had both implementation and effectiveness evaluations, composite ratings were most frequently *poor* in each monitoring period (56 percent in FY15/16 and 35 percent in FY17/18) (Table A2-1). In FY15/16, two trails had an *excellent* composite rating, one trail had a *good* rating, and two trails had a *fair* rating. In FY17/18, one trail had an *excellent* rating, one had a *good* rating, and three trails had a *fair* rating. Two trails in FY15/16 and eight in FY17/18 had a *no plan* composite rating due to a *no BMPs* implementation rating.

Implementation component scores (Table 64) were best for the planning component in FY15/16, with 88 percent of trails having an *all* score; 69 and 63 percent of trails had *all* scores for the on-the-ground execution and project oversight components, respectively.

Table A2-1.—Composite rating matrix for nonrandomly selected Rec D trails evaluated for both implementation and effectiveness in FY15/16 (n=16 evaluations) and FY17/18 (n=20 evaluations). Numbers in the cells indicate the number of evaluations 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			2
	Mostly effective	1				
	Marginally effective	2				
	Not effective	2	2	2	3	
FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective		1			1
	Mostly effective		1			
	Marginally effective	1	2	1		
	Not effective	1	2	3		7

Excellent
Good
Fair
Poor
No plan

In FY17/18, the on-the-ground execution component had the highest percentage of *all* scores: 81 percent compared to 57 percent for the planning component and 24 percent for the project oversight component. Three trails in FY15/16 scored as *none* for the on-the-ground execution component, and two and four trails in FY15/16 and FY17/18, respectively, scored as *some*, indicating that either none of the prescribed BMPs or some of the prescribed BMPs were implemented fully. Deficiencies in inspections, needed corrective actions, and trail closures or trail treatments resulted in project oversight component scores of *some* for 6 and 16 trails in FY15/16 and FY17/18, respectively. Seventeen trails in both periods combined were deficient for one metric, three trails were deficient for two metrics, and one trail had deficiencies for three metrics. Deficiencies were most often related to lack of inspections.

Effectiveness component scores (Table 142) were better for the erosion and sedimentation-trails component than for the erosion and sedimentation-waterbody crossings component in each monitoring period. Fifty-six and 40 percent of the erosion and sedimentation-trails component scores were *effective* in FY15/16 and FY17/18, respectively, compared to 31 and 17 percent of evaluations having that score for the erosion and sedimentation-waterbody crossings component. Forty-four percent of evaluations in FY15/16 and 50 percent in FY17/18 had a score of *not effective* for the erosion and sedimentation-waterbody crossings component. Eighty-eight and 70 percent of evaluations in FY15/16 and FY17/18, respectively, scored as *effective* for the trash and waste component; only two evaluations in FY17/18 had a *not effective* score for the trash and waste component due to trash or waste or both observed in multiple locations. No chemical or fuel spills were observed during any evaluation, so all scores for the chemical pollutants component were *effective*.

WATER USES MANAGEMENT

Water Uses B – Operation and Maintenance of Spring-Source Facilities

Water Uses B: Descriptive Statistics

Nine and five nonrandomly selected spring-source facilities were evaluated in FY15/16 and FY17/18, respectively. Every western region except Region 10 completed at least two nonrandomly selected evaluations (see App. 1 for region delineations). All but one evaluation in FY15/16 included implementation and effectiveness monitoring completed on the same day; the other evaluation included effectiveness only. All evaluations selected National BMP targets as a reason for monitoring; six evaluations also indicated project review as a reason. Thirteen of the 14 springs were perennial (WatUses B-Q18), and the most common types of infrastructure present were pipes, spring boxes, and spring boxes with diversion (WatUses B-Q19). Four of the 10 spring-source facilities with a valid water right were owned by the Forest Service (WatUses B-Q20 and WatUses B-Q23). Four facilities served Forest Service natural resource uses, six served public or private uses, and three served both (WatUses B-Q25). Seven facilities provided wildlife and stock water uses, four facilities provided water for human consumption, and two provided only stock water (WatUses B-Q26). Seven facilities were authorized by permit and two by an easement (WatUses B-Q27). Two facilities had no current authorization, and two were Forest Service developments. The oldest spring evaluated was developed in 1879 (WatUses B-Q31). Five spring developments ranged from approximately 80 to 140 years old, and three springs were less than 10 years old.

Thirteen spring-source facilities were evaluated for implementation. Seven facilities had no collection system design criteria (WatUses B-Q32), four facilities met the design criteria, and information could not be found for two facilities. The collection system for one facility was not functional (WatUses B-Q33). Similarly, six facilities had no design criteria for the distribution system, four facilities met the design criteria, one facility did not meet the criteria, and information could not be found for two facilities (WatUses B-Q34). The distribution system was not functional at one facility (not the facility with the non-functioning collection system). Seven facilities had an operation and maintenance (O&M) plan or documents that included BMPs to protect water, aquatic, and riparian resources (WatUses B-Q36). One facility had an O&M plan that did not include BMPs, and five facilities had no O&M documents. On average, applicable BMPs were included in four provisions per facility (WatUses B-Q37) when O&M documents contained BMPs. Five of seven evaluations indicated that 100 percent of BMPs were implemented fully, one had 75 percent implemented fully, and one indicated that none of the applicable BMPs were implemented fully.

The most recent maintenance had occurred within the year prior to the evaluation at eight spring-source facilities, 1 to 5 years prior for four facilities, and more than 5 years prior for one facility (WatUses B-Q38). Water use, capture, and release requirements were unknown for five facilities and did not exist for three facilities (WatUses B-Q39). Four

evaluations indicated that requirements were being met based on records or observations, and one evaluation indicated that requirements were not being met. Inspections occurred during critical times in the current operating season at six facilities, maintenance work avoided critical times at two facilities, and no inspections occurred at five facilities (WatUses B-Q40). Seven facilities had no problems during the operating season that required corrective actions (WatUses B-Q41). Four facilities had problems; the needed corrective actions were taken at one of those facilities. One evaluation indicated that the administrative unit did not have a contingency and emergency response plan (CERP) for chemical spills. The remaining evaluations reported that no chemical or fuel spills or leaks had occurred at the facility in the previous 5 years (WatUses B-Q42).

Fourteen spring-source facilities were evaluated for effectiveness. Decreasing groundwater levels (WatUses B-Q47), decreasing extent of groundwater-dependent vegetation (WatUses B-Q48), and decreasing numbers of groundwater-dependent vegetation species (WatUses B-Q49) were reported for one facility. Another facility had a decreasing vegetation extent and an increasing number of species with the changes related to a wildfire 2 years before the evaluation. Change could not be determined for one or more of the three groundwater-related metrics at five facilities.

Evidence of physical disturbance to the spring, source area, distribution facilities, or receiving waterbody (WatUses B-Q50) due to livestock was reported for six facilities. Three facilities had no evidence of disturbance, and three facilities reported disturbances due to humans and wildlife. Two spring-source facilities had no pollutants or potential pollutants at any of the reviewed areas of the facilities (WatUses B-Q51, WatUses B-Q52, WatUses B-Q53, and WatUses B-Q54). Five facilities reported no evidence of pollutants or potential pollutants for the spring (WatUses B-Q51), three reported no pollutants for the spring source area (WatUses B-Q52), and five reported no pollutants for the distribution facilities (WatUses B-Q53). Six facilities did not have a receiving waterbody (WatUses B-Q54). One of the eight facilities with a receiving waterbody reported no pollutants. When pollutants or potential pollutants were observed, the types reported most frequently were the same for each of the four areas reviewed: sediment or animal waste (40 percent of facilities), followed by unstable banks.

For the eight spring-source facilities with a receiving waterbody, the review team determined that the condition of the waterbody met desired conditions (WatUses B-Q55) for five facilities, although only one determination was based on established conditions or standards. At the remaining facilities, desired conditions were not met based on professional expectations. When conditions were met, the trend in the receiving waterbody condition (WatUses B-Q56) was unchanged or unknown for four waterbodies and declining for one waterbody. Waterbody condition also was declining for two receiving waterbodies that had not met desired conditions. Overall, 10 of 14 spring-source facilities were meeting desired conditions for the spring (WatUses B-Q57). One evaluation reported that conditions for the spring were improving (WatUses B-Q58). Trends in condition were unchanged or unknown for the other nine facilities. Four springs were not meeting desired conditions; of these, two evaluations indicated that condition trends were declining, and two indicated that trends were unknown. Thirteen facilities were evaluated for both implementation and effectiveness. For the five facilities that had no inspections

(WatUses B-Q40), one evaluation reported that the lack of administration contributed to problems observed during the effectiveness review (WatUses B-Q59). Three other evaluations selected an incompatible answer choice based on the protocol instructions for WatUses B-Q59.

Water Uses B: Ratings and Component Scores

In FY15/16, one spring-source facility had an implementation rating of *fully implemented*, two were rated *mostly implemented*, one had a rating of *marginally implemented*, two were rated *not implemented*, and two were rated *no BMPs* (Table A2-2). Every facility in FY17/18 was rated *mostly implemented*. The effectiveness ratings were *not effective* for five facilities in FY15/16 and two in FY17/18. One facility in FY15/16 was rated *effective*, three facilities in FY15/16 and one in FY17/18 were rated as *mostly effective*, and two facilities in FY17/18 were rated as *marginally effective*. For the eight facilities in FY15/16 and the five facilities in FY17/18 that had both implementation and effectiveness evaluations, the composite ratings were *poor* for three facilities in FY15/16 and two in FY17/18 (Table A2-2). One facility had an *excellent* composite rating, two facilities had a *good* rating, and three facilities had a *fair* rating in both monitoring periods combined. Two additional facilities in FY15/16 had a *no plan* composite rating due to a *no BMPs* implementation rating.

Table A2-2.—Composite rating matrix for nonrandomly selected WatUses B spring-source facilities evaluated for both implementation and effectiveness in FY15/16 (n=8 evaluations) and FY17/18 (n=5 evaluations). Numbers in the cells indicate the number of evaluations 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	1		1		
	Marginally effective					
	Not effective		1		2	2
FY17/18 Composite rating (number of evaluations)		Implementation rating				
		Fully implemented	Mostly implemented	Marginally implemented	Not implemented	No BMPs
Effectiveness rating	Effective					
	Mostly effective		1			
	Marginally effective		2			
	Not effective		2			

Excellent
Good
Fair
Poor
No plan

Implementation component scores (Table 194) were best for the on-the-ground execution component; nine facilities had an *all* score. Three and seven facilities had *all* scores for the planning and project oversight components, respectively. Eight facilities had a *some* score for the planning component; three facilities did not have O&M documents with BMPs, and the others either did not have design criteria for the collection or distribution systems or had design criteria that were not met (WatUses B-Q32 and WatUses B-Q34), or the spring had no water use, capture, and release requirements (WatUses B-Q39). Two facilities that had no O&M documents, no design criteria, and no water use requirements had a planning component score of *no BMPs*. Four facilities scored as *some* for the on-the-ground execution component, indicating one or more deficiencies in four metrics: whether the collection and distribution systems met design criteria, whether the systems were functional (WatUses B-Q33 and WatUses B-Q35), whether BMPs in the O&M documents were implemented fully (WatUses B-Q37), and whether water use requirements were met (WatUses B-Q39). Deficiencies in inspections resulted in project oversight component scores of *some* for three facilities, and corrective actions not being taken when needed resulted in *none* scores for three other facilities.

WatUses B has three effectiveness components: waterbody protection, pollutants, and waterbody condition (Table 211). Five facilities had waterbody protection component scores of *effective*, indicating that changes had not occurred to groundwater-dependent vegetation (WatUses B-Q48 and WatUses B-Q49) and that physical disturbance (WatUses B-Q50) had not occurred or was minor. Three facilities scored as *mostly effective*, four as *marginally effective*, and two as *not effective* for the waterbody protection component. The pollutants component scores are determined by the types of pollutants observed at all areas of the spring facility (WatUses B-Q51, WatUses B-Q52, WatUses B-Q53, and WatUses B-Q54). The pollutants component scores were *effective* or *not effective* for five spring-source facilities each, and the remaining facilities had *mostly effective* scores. Waterbody condition component scores were *effective* for four facilities and *mostly effective* for five facilities. Those facilities had desired conditions for the spring and receiving waterbody—if one existed—that were being met (WatUses B-Q57 and WatUses B-Q55), and condition trends that were not declining (WatUses B-Q58 and WatUses B-Q56). One facility scored as *marginally effective* for the waterbody condition component; four scored as *not effective*, indicating that desired conditions were not being met and that condition trends were not improving.

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