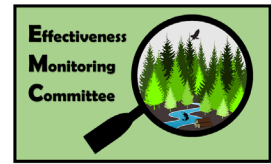


1
2
3

EFFECTIVENESS MONITORING COMMITTEE Strategic Plan



4
5
6
7
8
9
10
11
12

Submitted to the California State Board of Forestry and Fire Protection

Revision: September 23, 2022

**Loretta Moreno, Co-Chair
California Natural Resources Agency**

**Liz Forsburg Pardi, Co-Chair
Member, California State Board of Forestry and Fire Protection**



Revision Date: 09/23/2022

- 13 **Cover photos details and credits (clockwise from the top left):** Measuring algal concentrations with a
14 BentoTorch at a study site in a lower Klamath River tributary for the of Class II riparian prescription
15 effectiveness study (Credit: Jonah Nicholas); Runoff simulation photo for post-fire skid trail Best
16 Management Practices testing (Credit: Drew Coe); Structure for motion photography to characterize
17 surface roughness on post-fire skid trail BMP effectiveness study (Credit: Drew Coe); Conducting a
18 stream survey at a study site in a lower Klamath River tributary for the Class II riparian prescription
19 effectiveness study (Credit: Cedric Pimont).

DRAFT

20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51

TABLE OF CONTENTS

LIST OF ABBREVIATIONS	iii
1.0 EMC BACKGROUND, OPERATIONS, AND REPORTING STRUCTURE	1
2.0 EMC STRATEGIC PLAN ROAD MAP: Bringing science to policymakers	2
2.1 Development of Critical Monitoring Questions	3
2.2 Adaptive Management Framework Guides EMC Funding and Research Review	4
3.0 Guidelines for EMC-Funded Research	6
3.1 Study Design within an Adaptive Management Framework	6
3.2 Additional Study Design Considerations	9
- 3.2.1 Appropriate Scale	9
- 3.2.2 Rare or Large Event Monitoring	10
4.0 EMC PROJECT DEVELOPMENT AND MANAGEMENT	10
4.1 Project Solicitation and Initial Review	10
4.2 Project Ranking and Selection	11
- 4.2.1 Ranking Metrics	12
- 4.2.2 Consideration of Funding Request	14
4.3 Project Management.....	14
- 4.3.1 Proposal Agreement Development and Administration	14
- 4.3.2 Status Reports and Presentations	14
- 4.3.3 Final Reports, Presentations, and Publications	14
4.4 EMC Supported Monitoring Projects	15
5.0 SUMMARY	15
5.0 REFERENCES (pending REVISION updates)	16

LIST OF FIGURES

Figure 1. Example: Structure of relationships among the EMC critical monitoring questions, natural resources of concern, and the California Forest Practice Rules.	4
Figure 2. The Adaptive Management Framework using EMC-funded research to inform Board policy and regulations.	5
Figure 3. EMC Project Solicitation, Submission, Selection, and Funding General Timeline.	11
Figure 4. Ranking of proposed effectiveness monitoring projects.....	13

52

LIST OF ABBREVIATIONS

53	AM	Adaptive Management
54	Board	California State Board of Forestry and Fire Protection
55	CAL FIRE	California Department of Forestry and Fire Protection
56	CCR	California Code of Regulations
57	CRA	Completed Research Assessment
58	CMQ	Critical Monitoring Questions
59	EMC	Effectiveness Monitoring Committee
60	ESA	Endangered Species Act
61	FGC	Fish and Game Code
62	FGCom	Fish and Game Commission
63	FPA	Forest Practice Act
64	FPC	Board Forest Practice Committee
65	FPP	Full Project Proposal
66	FPRs	California Forest Practice Rules
67	ICP	Initial Concept Proposal
68	PI	Principal Investigator
69	TRFR	Timber Regulation and Forest Restoration Program



70 1.0 EMC BACKGROUND, OPERATIONS, AND REPORTING STRUCTURE

71 The California State Board of Forestry and Fire Protection (Board) formed the Effectiveness Monitoring
72 Committee (EMC) in 2014 to develop and implement a monitoring program to provide an active
73 feedback loop to policymakers, managers, agencies, and the public as to the impact and effectiveness of
74 state regulations in California’s timberland ecosystems, including watershed and wildlife concerns.
75 Effectiveness monitoring is necessary to assess whether management practices are achieving the
76 resource goals and objectives set forth in the California Forest Practice Act (FPA) (Z’berg-Nejedly Forest
77 Practice Act of 1973, California Public Resources Code [PRC] § 4511–4630.2 [2021]) and Forest Practice
78 Rules (FPRs) (CALFIRE 2020) and related natural resource protection statutes and laws, codes, and
79 regulations (EMC 2013, MacDonald et al. 1991), including the California Endangered Species Act (ESA),
80 federal ESA, Porter-Cologne Water Quality Act, federal Clean Water Act, and Fish and Game Code (FGC).
81 The EMC collectively refers to these as the **FPRs and associated regulations** and evaluates their
82 effectiveness by utilizing research results stemming from EMC-supported research.

83 Effectiveness monitoring is a key component of Adaptive Management (AM), and is critical in
84 determining compliance with the “ecological performance” reporting requirements outlined in
85 [Assembly Bill \(AB\) 1492](#) (Forest Resource Management 2012). The Timber Regulation and Forest
86 Restoration Fund (TRFR), which funds EMC-supported research projects, is directed by AB 1492 to
87 develop ecological performance measures for state and private forestland management. Findings are
88 presented in a formal AM process to inform the California Board of Forestry and Fire Protection (‘Board’)
89 in future policy development. The AM process provides the basis for decision-making and facilitating
90 adaptation to changing circumstances and unexpected outcomes in dynamic ecosystems.

91 The EMC’s [Strategic Plan](#) was first released in 2018 ([EMC 2018](#)) and documents the AM framework
92 utilized by the EMC and the Board to evaluate the impacts of the FPRs and associated regulations based
93 on the results of EMC-funded scientific research, as well as the process to adapt rules and regulations to
94 new information. The Strategic Plan describes the process for project solicitation, implementation, and
95 evaluation, and is reviewed and updated approximately every three years and presented to the Board
96 for approval. This [2022 Strategic Plan \(EMC 2022a\)](#) has been updated to clarify and simplify language
97 and include newly adopted procedures approved by the Board.

98 Companion documents that should be consulted along with the Strategic Plan include:

- 99 • **EMC Charter:** The [Board-approved Charter](#) (EMC 2013) directs the EMC to implement a
100 collaborative, transparent, and science-based monitoring effort. The Charter communicates the
101 goals and objectives of the EMC; describes the membership and structure of the committee;
102 and details meeting organization, rules of conduct, and how the committee acts and
103 communicates with the Board. [EMC members](#) (EMC 2022b) represent a wide range of natural
104 resource expertise from academia, state and federal agencies, private and state forestland
105 owners, and the public. Expertise includes forest management and ecology, hydrology, geology,
106 aquatic ecology, fisheries, wildlife management, and resource monitoring and sampling.
- 107 • **EMC Research Themes and Critical Monitoring Questions:** First drafted as part of the Strategic
108 Plan in 2018 (EMC 2018) and updated as a stand-alone document in 2022 ([EMC 2022c](#)), the

109 EMC and the Board adopted a suite of Critical Monitoring Questions (CMQs) based on input
110 from a variety of stakeholders and organized them into 11 Research Themes. The goal of the
111 EMC is to develop a process-based understanding of the effectiveness of FPRs and associated
112 regulations in maintaining and enhancing forest ecosystem function, water quality, and aquatic
113 and wildlife habitats. The EMC uses the most recently established **Research Themes and CMQs**
114 **(see EMC 2022c)** as guidance to the EMC itself and prospective grantees to solicit and evaluate
115 prospective effectiveness monitoring projects for funding support.

116 • **EMC Annual Report and Work Plan:** Updated annually, the EMC’s [Annual Report and Work Plan](#)
117 (State of California 2022a) documents EMC accomplishments, changes to EMC membership,
118 project selection processes for the year, and the status of active EMC-supported monitoring
119 projects. The annual allocation from the TRFR fund to the EMC for funding of monitoring
120 research is detailed in the EMC Annual Report and Workplan. Additionally, the EMC receives
121 priorities from Boards, Departments, and Agencies that are incorporated into its annual
122 priorities.

123 • The approach described herein is a necessary component of AM. Section 1.0 of the document
124 provides a brief background of the EMC. Section 2.0 describes the Strategic Plan “road map” as
125 described in the Charter, the development of CMQs and associated research themes, and the EMC and
126 the Board’s roles in the AM process. Section 3.0 provides guidelines for development of EMC-supported
127 research, such as considerations of scale in study design, and how project results are utilized in the AM
128 feedback loop to inform policy development. Section 4.0 provides a very brief description of the process
129 utilized by the EMC to solicit, assess, and fund monitoring research projects, and describes expected
130 outcomes of EMC-funded research, including general project deliverables.

131 The EMC achieves its goals as outlined in the Charter (EMC 2017) and Strategic Plan by taking the
132 following actions:

- 133 • Periodically update the EMC Strategic Plan for Board consideration.
- 134 • Prepare an Annual Report and Workplan for Board consideration.
- 135 • Meet in open, webcast public meetings to conduct its business at least four times a year.
- 136 • Annually distribute a [Request for Proposals](#) (RFP) (see EMC 2022e) soliciting project proposals
137 for monitoring research investigating the FPRs and associated regulations. Review and rank
138 project proposals and recommend projects to the Board for funding by December of each year.
139 Funding of projects occurs from an annual allocation of up to \$425,000 each fiscal year from the
140 TRFR Fund.
- 141 • Review membership as needed due to term expirations or resignations. A [Call for Applications](#)
142 (see EMC 2022f), if necessary, is widely distributed to encourage a broad spectrum of applicants
143 that meet membership qualifications.

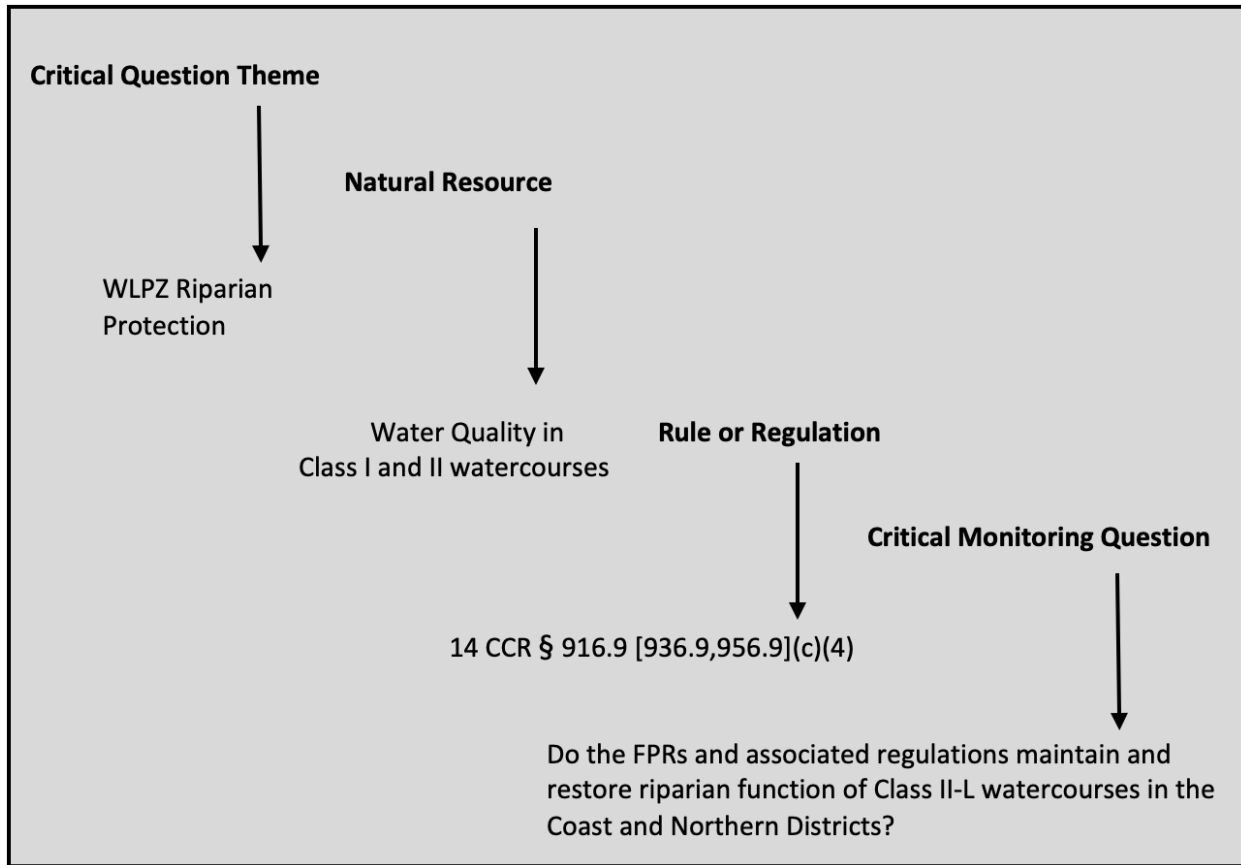
144 **2.0 EMC STRATEGIC PLAN ROAD MAP: BRINGING SCIENCE TO POLICYMAKERS**

145 To facilitate the AM process that informs proposed changes to forestry policy, the EMC supports
146 research that evaluates the FPRs and associated regulations. This section briefly describes the
147 development of critical monitoring questions and related research themes that highlight gaps in

148 knowledge related to the effectiveness of the FPRs and associated regulations; directs readers to the
149 [Research Themes and CMQs \(EMC 2022c\)](#), which also provides context for their relationships to the
150 [policies, goals, and priorities of other Agencies, Departments, and Boards](#) (EMC 2017); and describes the
151 AM Framework, which is a process for utilizing research results to inform changes to the FPRs and
152 associated regulations.

153 **2.1 Development of Critical Monitoring Questions**

154 Critical Monitoring Questions that guide and focus research funding were established initially by the
155 EMC via a public process in which the EMC sought and accepted priorities from a wide variety of
156 stakeholders including agencies, departments, boards, EMC members, and the interested public (see
157 EMC 2017). The EMC transformed the priorities into CMQs following a specific structure which is
158 intended to improve understanding and allow better comparisons between multiple monitoring
159 questions (see example in Figure 1). The Board approved the list of CMQs within the first [Strategic Plan](#)
160 on December 6, 2017 (EMC 2018). The Research Themes and Critical Monitoring Questions were revised
161 by the EMC during open public meetings in 2022, and the EMC **unanimously recommended** to present
162 the revised set of questions to the Board on **DATE** 2022; the Board approved the revised set of questions
163 at a public meeting on **DATE** 2022. Additional information about the process for development of the
164 questions, along with a list of and justification for the updated Research Themes and Critical Monitoring
165 Questions, is available online ([EMC 2022c](#)).



166
 167 **Figure 1.** Example: Structure of relationships among the EMC critical monitoring questions, natural
 168 resources of concern, and the California Forest Practice Rules.

169 **2.2 Adaptive Management Framework Guides EMC Funding and Research Review**

170 Due to relatively small sample sizes and lack of controls for both dependent and independent variables
 171 associated with “specific question” studies, statistically rigorous testing of water quality, aquatic habitat,
 172 and wildlife resource questions is often difficult. The Board recognizes there is scientific uncertainty in
 173 how forested ecosystems function within the framework of managed forestlands, and in how various
 174 ecosystem components and processes interact. However, well-developed resource monitoring
 175 questions can improve scientific monitoring designs to limit spurious results and enhance the range of
 176 inference. Therefore, by formally employing an AM framework, the EMC and Board seek a better
 177 understanding of the effectiveness of FPRs and associated regulations. The EMC focuses on funding
 178 effectiveness monitoring research that feeds an information feedback loop imbedded within the AM
 179 framework to inform Board policy (Figure 2). Specifically, the Board reviews results of EMC-sponsored
 180 scientific studies to evaluate the effectiveness of the FPRs and associated regulations in meeting the
 181 goals of the Board.

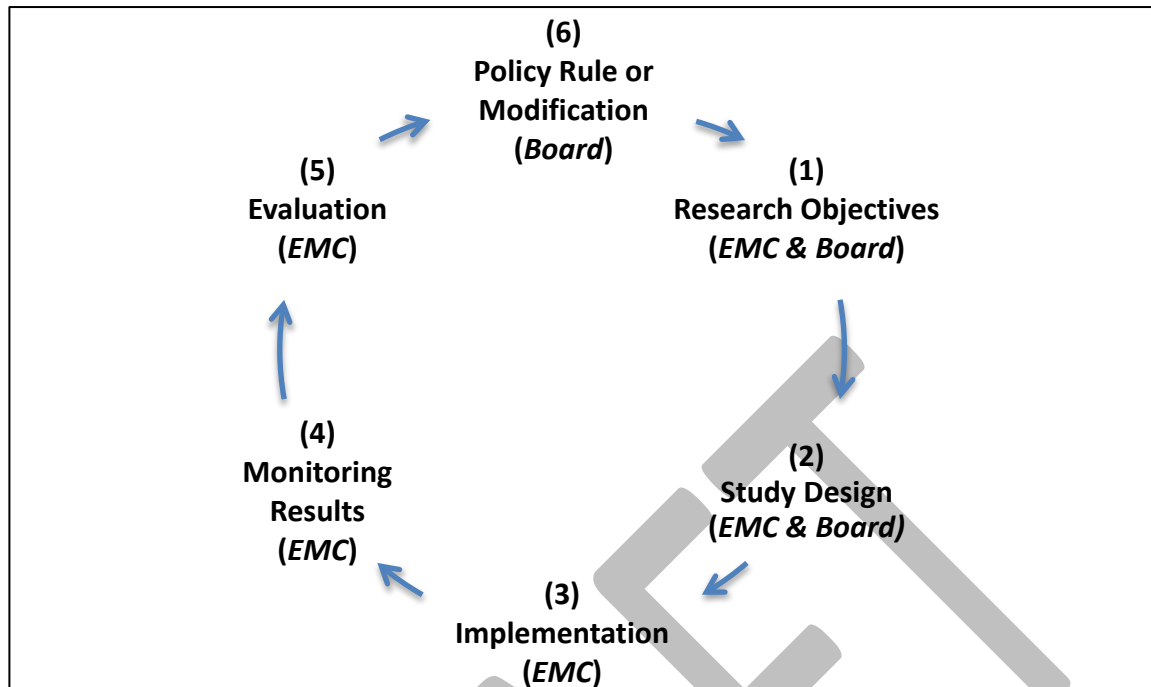


Figure 2. The Adaptive Management Framework using EMC-funded research to inform Board policy and regulations.

182 Additionally, the Board may also consider the following four general goals—in alignment with the
 183 policies, goals, and priorities of other Agencies, Departments, and Boards (EMC 2017) as part of the AM
 184 Framework:

- 185 (1) To provide compliance with the State and federal ESAs for species found on State and
 186 private forestlands.
- 187 (2) To maintain and restore forest-dependent species on State and private forestlands.
- 188 (3) To meet the requirements of the federal Clean Water Act and Porter-Cologne Water
 189 Quality Control Act on State and private forestlands.
- 190 (4) To keep private forestlands economically viable in the State of California, by furthering
 191 regulatory streamlining efforts, while still enhancing California’s timberland habitat.

192 The goal of any effectiveness monitoring study design is to determine if the FPRs and associated
 193 regulations related to natural resources management are maintaining and/or restoring ecological
 194 conditions. The goal of environmental monitoring studies is to detect changes from individual and/or
 195 cumulative effects of activities that are both spatially and temporally distributed across representative
 196 study areas. Results will be used in an AM framework to help the Board determine the appropriateness
 197 of policies and practices, and to revise or craft new management practices, policies, or regulations when
 198 current ones do not meet desired results.

199 When the Board reviews scientific information from EMC-funded studies it is important for Board
200 members to understand the overall context and implications of the research. Therefore, as part of the
201 AM feedback loop, the findings of the EMC-sponsored studies required a means for integrating research
202 results into future forest management plans, either through changed policy, landowner outreach, or a
203 combination of approaches. To address this, the EMC developed a protocol for such an assessment—
204 approved by the BOF in 2021—to further assist in translation of scientific results to the Board, which will
205 aid the Board in adapting policy and regulations to reflect new information gleaned from EMC-funded
206 research. This [Completed Research Assessment](#) (CRA) (EMC 2021) (also referenced as the “Science to
207 Policy Framework”) provides a step-by-step approach to guide EMC and Board members in verifying
208 scientific integrity and validity of the research, and interprets the results of the scientific research as to
209 the implications for management and policy.

210 Two EMC members work with the Principal Investigator(s) of a project to complete the required
211 document, which is then presented to the EMC and amended as necessary prior to presentation to the
212 Board. This process provides an avenue for members to report to the Board with a screening and
213 objective assessment of the scientific results received by the EMC at the conclusion of a given project.
214 Further it can include a high-level assessment of the trade-offs and outcomes of different management
215 practices based on EMC-funded research results, as described in the CRA guidelines (EMC 2021). The
216 role of the EMC is not to determine the “best” course of action for policymakers or managers; rather, it
217 is to provide the Board details as to the strength of the science conducted and an assessment of possible
218 policy implications based on science results. Thereafter, the Board determines whether rule changes
219 and policy changes are merited given that information.

220 **3.0 GUIDELINES FOR EMC-FUNDED RESEARCH**

221 New research proposals are assessed by the EMC for scientific rigor and integrity, and the likelihood and
222 ability of the proposed research in answering the critical monitoring questions. This section describes
223 acceptable study designs and methods that EMC-supported research projects should generally follow,
224 including content on: recommended protocols for field and laboratory methods; selection of
225 appropriate temporal and geographic scale; statistical analysis; reporting guidance and assessment;
226 evaluation and utilization of project results; how the AM framework may be utilized to evaluate the
227 relationships between scientific research results and Board-developed policies; and how policy (i.e., the
228 FPRs and associated regulations) may need to be altered in response to project results.

229 **3.1 Study Design within an Adaptive Management Framework**

230 Adaptive management “provides a framework for making good decisions in the face of critical
231 uncertainties, and a formal process for reducing uncertainties so that management performance can be
232 improved over time” (Williams et al. 2009). The AM process facilitates learning “not by trial and error,
233 but by a structured process,” resulting in reduced uncertainty (Allen and Gunderson 2011). To further
234 account for the complexity and uncertainty surrounding natural resource management, EMC-sponsored
235 study protocols, and EMC and Board responses to results, will be embedded within an adaptive resource
236 management model (Williams et al. 2009), summarized as:

237 (1) Define research objectives and scope of management to be studied

- 238 (2) Develop operational plans to meet the objectives
 239 (3) Implement plans
 240 (4) Collect information about impacts of plans
 241 (5) Evaluate collected information considering stated objectives
 242 (6) Adjusting plans as informed by new information

243 Each of the steps in the AM cycle, and its relevance for the EMC, is elaborated below.

244 ***(1) Define research objectives and scope of management to be studied.***

245 Studies considered by the EMC must be designed to address: (1) existing or proposed forest
 246 management practices; and (2) objectives as defined through legislation (e.g., ESA, FPA), FPRs and
 247 associated regulations, and/or by stakeholders. Studies should state the management objectives being
 248 addressed, and include relevant research questions, which can include ecological, economic, and social
 249 metrics, as appropriate. Objectives should be attainable with the data collection and analysis methods
 250 described. This step in the AM cycle is paralleled by Step 1 (Research Objectives) in the Adaptive
 251 Management Framework (Figure 2).

252 ***(2) Develop operational plans to meet objectives -AND- (3) Implement plans.***

253 The EMC will support evaluation of project impacts from forest management activities implemented by
 254 landowners, managers, and researchers, which may include any activities of interest described in a
 255 management plan (e.g., a Timber Harvesting Plan). Research designs may be observational (e.g., testing
 256 existing management or conditions, or analyzing existing datasets) or experimental. In either case,
 257 anticipated outcomes of forest management and contributions toward achieving defined objectives will
 258 be described based on a thorough literature review outlining existing knowledge and research gaps.

259 Studies will develop sampling designs using peer-reviewed literature or pilot tests to determine
 260 population variability (if applicable) and will include statistical power analyses to determine adequate
 261 sample sizes and ensure that differences, if present, can be detected with the selected experimental and
 262 analytical methods. Scale may play an important role in detecting statistically significant differences and
 263 can strongly impact variability (see Section 3.2.1 for a discussion of appropriate scale). The high natural
 264 variability commonly found in natural systems can make finding appropriate comparative groups
 265 difficult, as the goal is to have these groups as similar to each other as possible to allow for the
 266 detection of differences.

267 Monitoring studies must have valid study designs to ensure proper inference and application of study
 268 results to management. There are a variety of potential approaches to design effectiveness monitoring
 269 studies. For example, populations may be sampled by comparing response variables from one set of
 270 existing management practices with another set (e.g., treatment-control). A second approach is using
 271 experiments where treatments are deliberately prescribed and randomly assigned to experimental
 272 units. The advantage of the experimental approach is that the treatments may be of greater or different
 273 forest management intensities than the current FPRs allow, and the results of an experiment can
 274 provide information that would not be available from a simple observational study. This step in the AM
 275 cycle is paralleled by Steps 2 (Study Design) and 3 (Implementation) in the Adaptive Management
 276 Framework (Figure 2).

Revision Date: 09/23/2022

277 (4) Collect information about impacts of plans.

278 The EMC will rely on information collected through monitoring, which can take multiple forms, including
279 baseline monitoring (measuring current conditions); trend monitoring (measuring attributes over time);
280 effectiveness monitoring (measuring whether objectives of a project have been met); and validation
281 monitoring (testing whether models are accurate).

282 Of note, anadromous fish monitoring warrants additional consideration when developing monitoring
283 methods. Anadromous fish reside most of their adult life in the ocean and return to freshwater to
284 spawn; although, juveniles and adults of some species may hold in freshwater for extended periods
285 while others spend more of time in the ocean. Chinook salmon (*Oncorhynchus tshawytscha*), coho
286 salmon (*Oncorhynchus kisutch*), and steelhead trout (*Oncorhynchus mykiss*) in California have complex
287 life cycles, not only among the different species, but also among the different runs (e.g., winter vs.
288 spring run) of species. This complexity, along with the quality and/or abundance of available data and
289 other confounding factors (e.g., climate change, ocean conditions, predator-prey dynamics, etc.), may
290 cause difficulties in identifying correlations between fisheries populations and timber harvesting
291 practices or restoration projects, particularly at the reach or watershed scale.

292 Determining impacts to fish populations requires intensive, multi-year monitoring, as long-term trends
293 may not be detectable for many years due to high natural variability, as well as the complexity and
294 variation of life histories. Habitat data are relatively easy to collect, less costly, and less intensive than
295 monitoring for populations. It is also relatively easier to document changes—positive or negative—from
296 timber harvesting practices or restoration projects at a reach or watershed scale within a short
297 timeframe. Various types of stream habitat monitoring allow managers to make inferences on potential
298 impacts to fish populations from timber operations. For these reasons, the EMC will focus primarily on
299 stream habitat monitoring and, when available, will use fish population data as a basis to evaluate the
300 effectiveness of specific FPRs and associated regulations. Research results will be collected to answer
301 critical monitoring questions about the impacts of the activities being evaluated. This step in the AM
302 cycle is paralleled by a portion of Step 4 (Monitoring Results) in the Adaptive Management Framework
303 (Figure 2).

304 (5) Evaluate collected information in light of stated objectives.

305 The EMC will evaluate the results for evidence of consistency with the project's identified objectives.
306 Analysis of the data will frequently take the form of statistical analysis, using either frequentist or
307 Bayesian statistical methods. However, data may take multiple forms and they should be analyzed
308 according to the research questions posed. At times, analysis and subsequent inference may need to
309 rely on expert opinion, especially when statistical analysis is inconclusive. This step in the AM cycle is
310 paralleled by a portion of Step 5 (Evaluation) in the Adaptive Management Framework (Figure 2).

311 (6) Adjust plans as informed by new information.

312 Research results can be utilized to determine if changes in the FPRs and associated regulations outside
313 the existing allowed practices might be advisable. Final project reports are presented to the EMC and
314 the Board and refined in an iterative and interactive process at publicly noticed open meetings led by
315 the EMC, followed with review by the Board. If determined to be prudent, proposals for changes to

316 regulations may follow as initiated by the Board and standing committees, and the Forest Practice
317 Committee (FPC) in particular. This step in the AM cycle is paralleled by Step 6 (Policy Rule or
318 Modification) in the Adaptive Management Framework (Figure 2).

319 **3.2 Additional Study Design Considerations**

320 **3.2.1 Appropriate Scale**

321 This section provides guidance for the selection of appropriate spatial and temporal scales when
322 designing a monitoring study. The selection of appropriate scales for a monitoring study requires a
323 review of current knowledge and professional judgment. Selection must correspond to the specific study
324 objectives, which should define the resource of concern (e.g., water quality), the controlling factors
325 affecting the resource, and the geographic scope of those controlling processes (e.g., hillslope, reach, or
326 watershed scale). Using an AM framework, experience and refinements made from initial study phases
327 can be used to adjust temporal and spatial scales so that study objectives are achieved. To address more
328 complex study objectives, a monitoring plan framework of nested and cross-referenced monitoring
329 studies at a range of scales can be applied (MacDonald 2000). Such a framework can be used to identify
330 linkages and increase certainty in cause-and-effect relationships for complex studies, as well as save on
331 costs and resources over time (Cafferata and Reid 2013).

332 ***Spatial or Geographic Scale***

333 Spatial scale defines the geographic area of a study such as a road segment, hillslope, or watershed. It is
334 an objective of the EMC that research should plan to provide maximum insights for broader application
335 in other areas of the state, to the degree feasible. However, monitoring at large spatial or temporal
336 scales increases the number and complexity of controlling processes, and dependent on the questions
337 posed and spatial scale chosen, this has the potential to make it difficult to discern specific linkages
338 between a controlling process and resource of concern. Therefore, spatial scale must be carefully
339 managed in developing monitoring questions and objectives (MacDonald and Coe 2007).

340 ***Temporal Scale***

341 Temporal scale defines the period of interest; in forest practice, this may be as short as one storm event,
342 or could span several decades. Most FPR effectiveness monitoring studies to date are directed at
343 effectiveness over one- to four-year periods (e.g., Brandow and Cafferata 2014). For studies conducted
344 over time with repeated measures, controlling processes should be identified as deterministic or
345 stochastic.

346 Deterministic processes are finite and produce the same result for a given set of input variables,
347 whereas stochastic (i.e., probabilistic) processes are indeterminate: they produce a range of possible
348 outcomes defined by a probability distribution. The temporal scale of a study should be at least as long
349 as the duration of controlling processes relevant to the study objectives, including lag times. Temporal
350 and spatial scales are not effortlessly separated, and knowledge of variability over time and space is
351 necessary.

3.2.2 Rare or Large Event Monitoring

An effectiveness monitoring program that relies on annual measurements may not capture the information necessary to determine the effectiveness of the FPRs relative to large, frequent, or rare events. Kirchner et al. (2001) found that catastrophic erosion events are infrequent and of short duration, but can control long-term sediment yield, although they also noted that management activities may alter the probability or magnitude of catastrophic events. Since these events are rare and can be difficult to capture with infrequent or short-term monitoring, they should be proactively targeted for effectiveness monitoring. Therefore, a different approach to standard monitoring is required to detect and respond to large or rare events immediately following occurrence and thereafter. This type of monitoring will require that a reserve of funds be set aside to respond immediately following the occurrence of such events to determine the effectiveness of the FPRs—an approach sometimes referred to as “post-mortem” monitoring (Stewart et al. 2013).

A critical component of any monitoring or research design is to identify the potential for rare or large events that would trigger the need for “post-event” monitoring and allocate needed resources should such an event occur. Timing can be critical, as much of the forestry monitoring or research evidence can quickly fade away or be lost during restoration activities or other management activities.

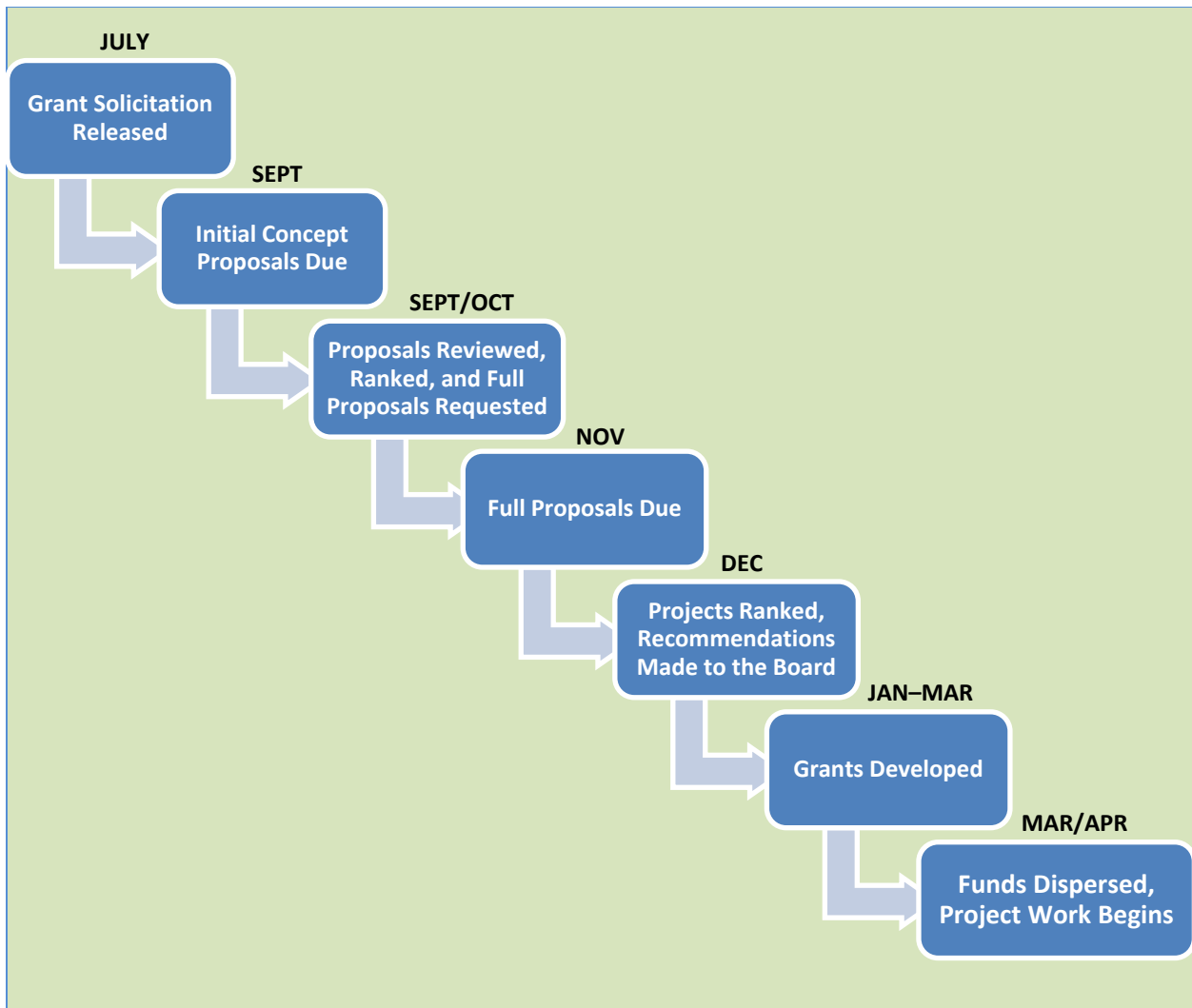
Once a rare or large event has occurred, the following procedure should be implemented:

- (1) The project proponent will notify the EMC as soon as possible regarding the event; the EMC will work with the project proponent to review the event and determine if the event qualifies as a rare or large event, as identified in the study plan.
- (2) The pre-approved study plan will be reviewed and modified to best match the conditions that resulted from the rare or large event. Minor adjustments to the monitoring or research plan should be made and then executed without delay.

4.0 EMC PROJECT DEVELOPMENT AND MANAGEMENT

4.1 Project Solicitation and Initial Review

The EMC generally awards effectiveness monitoring research projects on an annual basis. In fiscal year (FY) 2021/2022 and prior, projects were awarded as contracts. Beginning in 2022/23 FY, projects are solicited through a once-a-year Grant Solicitation. The solicitation for project proposal is usually released at the start of the FY in July (also see Figure 3 for general timeline), although the solicitation may be released sooner in future years. Prospective projects must be proposed to the EMC using the Initial Concept Proposal (ICP), which is a form that must be submitted electronically by a specified date and time (typically September). All ICPs that are not submitted by the specified deadline in the solicitation, are not complete, or are outside the scope of the EMC will be rejected. All ICPs that are not submitted by the specified deadline in the RFP, are not complete, or are outside the scope of the EMC will be rejected.



387
388 **Figure 3.** EMC Project Solicitation, Submission, Selection, and Funding General Timeline.

389 The EMC conducts a preliminary technical review at a publicly noticed open meeting, considering the
390 completeness of the proposals and whether they are within the scope of the Research Themes and
391 CMQs (EMC 2022c), which are available on the [EMC website](#) (State of California 2022b). At this meeting,
392 which typically occurs in the late summer or fall, the EMC sends an email invitation the Principal
393 Investigator (PI) for any ICPs on which it would like to see a Full Project Proposal (FPP). Detailed
394 instructions for completing and submitting the ICP are given in the grant guidelines, which can be found
395 on the EMC website under the section titled “Project Applicants,” along with other related documents
396 (i.e., the ICP and FPP).

397 **4.2 Project Ranking and Selection**

398 Applicants may reference the CRA (EMC 2021), which provides additional information on how projects
399 will be evaluated once complete, which provides further guidance as to the expectations of EMC-funded

400 research. The EMC will conduct a thorough technical review of all FPPs that are received by the
401 indicated due date. When a FPP is deemed complete and ready for ranking, EMC members will
402 individually rank each project and the average ranking score will be calculated for each project. No
403 specific minimum average ranking score is required for support; rather, individual project scores will be
404 considered relative to other project scores.

405 Once all FPPs have been ranked, the EMC members discuss the projects in detail, and vote whether to
406 allocate available EMC funds to the project proposed, taking into consideration the project ranking
407 score, likelihood of effectively testing the effectiveness of the FPRs, and the requested budget. Ranking,
408 discussion, and voting takes place during regular, publicly noticed meetings of the EMC. The EMC may
409 decide to recommend funding a proposal in full, in part, or not at all. The Board will make the final
410 funding decision. Subsequent to ranking actions, both written notes of the meeting and ranking results
411 are published on the EMC's website. Principal Investigators will be notified of their project ranking, and
412 any comments regarding their project referred to them from the Committee.

413 **4.2.1 Ranking Metrics**

414 The metrics used for ranking proposed EMC projects were modeled on the Cooperative, Monitoring,
415 Evaluation and Research Committee (CEMR) (established by the State of Washington Forest Practices
416 Board) general method for ranking projects. This was deemed prudent during the initial formation of the
417 EMC, as CEMR is roughly similar in scope and mission as the EMC and is a well-respected governmental
418 advisory committee (Forest Practices Board 2022). Proposals will be evaluated based on the guidelines
419 described in Section 3.0, and ranked in five categories (see Figure 4).

<ul style="list-style-type: none"> Critical Question(s) 	<p>Proposed monitoring project addresses one or more EMC critical monitoring questions with appropriate study design and experimental methods. Projects addressing multiple themes and critical monitoring questions will be ranked higher. Approximate time frame required for results that may be used by the Board in an evidence-based approach in rule revision(s) will also be considered.</p>
<ul style="list-style-type: none"> Scientific Uncertainty 	<p>Projects will be ranked higher when the current scientific understanding of effectiveness in the FPRs and associated regulations is incomplete or not validated. This ranking is weighed twice (2 times) the weight of other rankings.</p>
<ul style="list-style-type: none"> Geographic Application 	<p>Proposed project has broad geographic application to California forestlands—both public and private—will be ranked higher than those with limited geographic applicability. Projects need not be physically located in California to produce findings that apply to multiple areas in the State but should be located in areas that are applicable to systems or areas within California.</p>
<ul style="list-style-type: none"> Collaboration & Feasibility 	<p>Projects with relatively more actively contributing collaborators with substantive expertise and multi-disciplinary approaches will rank higher. Feasibility of monitoring project to meet stated goals and objectives within expected budget and timelines needed by the EMC, Board, or stakeholders.</p>

On a categorical scale of 1 to 5, reviewers should refer to the following guidance when reviewing and ranking a proposal:

- 1 = Does not meet any portion of the Ranking
- 2 = Does not meet key portions of the Ranking
- 3 = May meet some portions of the Ranking, either key or ancillary
- 4 = Meets key portions of the Ranking and does not address ancillary portions
- 5 = Meets all portions of the Ranking

Figure 4. Ranking of proposed effectiveness monitoring projects.

421 Projects will receive higher ranking when they have a broad array of collaborative partners involved with
 422 substantive expertise in the proposed study. This is to encourage multidisciplinary approaches in the
 423 proposals. Project proponents are encouraged to collaborate with state and federal agencies,
 424 universities, private industry, non-governmental organizations (NGOs), watershed groups, and
 425 others. Past performance in delivering timely, acceptable monitoring reports within available
 426 budgets will be considered.

427 **4.2.2 Consideration of Funding Request**

428 The EMC reports the amount of funding requested, but it is not a ranking criterion. The proposed
429 monitoring projects need to describe existing collaboration and funding sufficient to ensure achieving
430 the stated goals and objectives of monitoring. Proposals must clearly state the amount of funding
431 requested from the EMC. Project proponents shall provide the information on the requested funding in
432 proportion to the total project budget, and any sources, types, and amounts of matching funding or
433 other resources. Projects requesting more than the amount available may not be funded, or partial
434 funding may be recommended by the EMC.

435 **4.3 Project Management**

436 The following describes the process of contract development, implementation, periodic management
437 and assessment, and final reporting.

438 **4.3.1 Proposal Agreement Development and Administration**

439 Project agreements will be developed by Board staff under guidance of the Department of Forestry &
440 Fire Protection ('CAL FIRE') contracting or grants staff. It is critical that project selection is completed as
441 early as possible in the fiscal year to ensure that deadlines related to developing the project agreements
442 can be met, and funds are encumbered in the appropriate fiscal year. Beginning in 2022/23 FY, the EMC
443 solicited projects through a once-a-year Grant Solicitation.

444 **4.3.2 Status Reports and Presentations**

445 EMC members and staff, as well as Board and agency staff as needed, will work closely with Principal
446 Investigators to manage the current and ongoing project workload. The EMC implemented a new
447 communication system in 2020 in which individual committee members are assigned as Project Liaisons,
448 and regularly check-in with PIs to ensure project progress and deliverables are on track for EMC and
449 Board review. Project Liaisons or PIs are also asked to provide project updates at regularly scheduled
450 EMC meetings., approximately four times per year. Principal Investigators will provide at least bi-annual
451 updates on project status and progress by no later than June 30th and December 31st of each year.
452 Presentations are requested by the EMC when key results have been collected, or events have occurred
453 that impact the project, and PIs may also initiate project presentations at committee meetings.

454 **4.3.3 Final Reports, Presentations, and Publications**

455 Final deliverables will vary depending on the project proposal and agreed-upon deliverables. Any project
456 presentations are given during open, publicly noticed meetings of the EMC. In general, a final project
457 report and a live presentation shall be provided by the PI to the EMC. Reports shall include descriptions
458 of purpose and need, scientific methods, technical and/or statistical analysis, results, evaluation of
459 implications for resources and forest management operations, and scientific uncertainties or possible
460 limitations of results. Any publications, presentations, or other forms of project reporting given to other
461 organizations, or published papers or reports, should also be shared with the EMC within 12 months of
462 official publication date, and these will be posted to the EMC website.

463 As discussed in Section 2.2, two members of the EMC work with the PI to synthesize project results into
464 the CRA for translation of scientific results to the EMC, and these members will present the results of

Revision Date: 09/23/2022

465 the CRA to the EMC at an open, publicly noticed meeting. Thereafter, the final CRA shall be submitted to
466 the appropriate Board committee. Reports and presentations in any form shall not provide policy or
467 regulatory recommendations, though considerations can be discussed. Further, the EMC shall suggest
468 relevant needs for potential further refinement of study methods to address any significant limitations
469 and remaining scientific uncertainty. All final reports will be made available to the public on the EMC
470 webpage. Development of possible rule language changes based on results and findings of EMC reports,
471 if necessary, shall be initiated by the relevant Board committee for review and comment prior to
472 submittal to the full Board.

473 **4.4 EMC Supported Monitoring Projects**

474 Details on past and current EMC supported projects are available on the EMC Website (State of
475 California 2022) and include project proposals along with all other deliverables related to the project,
476 including presentations, videos, technical reports, or other products. The EMC Annual Report and
477 Workplan (EMC 2022d) and archived versions from past years, available on the EMC website (State of
478 California 2022) also provide detailed status updates on active or recently completed EMC-funded
479 projects.

480 **5.0 SUMMARY**

481 In conclusion, the EMC supports and funds effectiveness monitoring research that seeks to answer or
482 further clarify information about critical monitoring questions related to the impacts of the FPRs and
483 related regulations. Based on resultant scientific reports, presentations, publications, and a final
484 assessment (i.e., CRA), the EMC translates the results of research to the Board, which utilizes an iterative
485 Adaptive Management Framework to further refine forestry-related rules and regulations based on
486 evidence-based effectiveness monitoring.

5.0 REFERENCES (PENDING REVISION UPDATES)

- 487
488 Allen, C.R., and L.H. Gunderson. 2011. Pathology and failure in the design and implementation of
489 adaptive management. *Journal of Environmental Management* 92: 1379–1384. [https://usgs-cru-](https://usgs-cru-individual-data.s3.amazonaws.com/allencr/intellcont/Allen%20and%20Gunderson%202011-1.pdf)
490 [individual-data.s3.amazonaws.com/allencr/intellcont/Allen%20and%20Gunderson%202011-](https://usgs-cru-individual-data.s3.amazonaws.com/allencr/intellcont/Allen%20and%20Gunderson%202011-1.pdf)
491 [1.pdf](https://usgs-cru-individual-data.s3.amazonaws.com/allencr/intellcont/Allen%20and%20Gunderson%202011-1.pdf)
- 492 Benda, L., D. Miller, K. Andras, P. Bigelow, G. Reeves, and D. Michael. 2007. NetMap: A new tool in
493 support of watershed science and resource management. *Forest Science* 53(2):206–218.
- 494 Board. 2009. Monitoring study group meeting minutes from July 22, 2009. Redding, CA. 6 p.
495 [http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/meeting_minutes/2009](http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/meeting_minutes/2009_meeting_minutes/msg_meeting_minutes_07-22-09_1.pdf)
496 [_meeting_minutes/msg_meeting_minutes_07-22-09_1 .pdf](http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/meeting_minutes/2009_meeting_minutes/msg_meeting_minutes_07-22-09_1.pdf)
- 497 Board. 2014. Cumulative effects assessment: Scope of review. Sacramento, CA. 14 p.
- 498 Brandow, C.A., and P.H. Cafferata. 2014. Forest practice rules implementation and effectiveness
499 monitoring (FORPRIEM) program: Monitoring results from 2008 through 2013. Monitoring Study
500 Group Report prepared for the California State Board of Forestry and Fire Protection.
501 Sacramento, CA. 121 p. plus Appendix.
502 [http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_monitoring_report](http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_monitoring_report_s/forpriem_report_final_022715.pdf)
503 [s/forpriem_report_final_022715.pdf](http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_monitoring_report_s/forpriem_report_final_022715.pdf)
- 504 Brown, E.G., Jr. 2018. Executive Order B-52-18, 3 C.F.R. 4 (2018). State of California: Office of the
505 Governor. May 10, 2018. [https://www.gov.ca.gov/wp-content/uploads/2018/05/5.10.18-](https://www.gov.ca.gov/wp-content/uploads/2018/05/5.10.18-Forest-EO.pdf)
506 [Forest-EO.pdf](https://www.gov.ca.gov/wp-content/uploads/2018/05/5.10.18-Forest-EO.pdf)
- 507 Bunte, K., and L.H. MacDonald. 1999. Scale considerations and the detectability of sedimentary
508 cumulative watershed effects. Technical Bulletin no. 776, National Council for Air and Stream
509 Improvement (NCASI), New York, NY. 326 p.
- 510 California Department of Forestry and Fire Protection (CAL FIRE). 2020. California Forest Practice Rules
511 2020. Title 14, California Code of Regulations Chapters 4, 4.5, and 10. Prepared for California
512 Licensed Timber Operators and California Registered Professional Foresters. Compiled by The
513 California Department of Forestry and Fire Protection Resource Management, Forest Practice
514 Program, Sacramento, CA. [https://bof.fire.ca.gov/media/9478/2020-forest-practice-rules-and-](https://bof.fire.ca.gov/media/9478/2020-forest-practice-rules-and-act_final_ada.pdf)
515 [act_final_ada.pdf](https://bof.fire.ca.gov/media/9478/2020-forest-practice-rules-and-act_final_ada.pdf)
- 516 Cafferata, P.H., and L.M. Reid. 2013. Applications of long-term watershed research to forest
517 management in California: 50 years of learning from the Caspar Creek experimental watersheds.
518 California Forestry Report No. 5. California Department of Forestry and Fire Protection.
519 Sacramento, CA. 110 p.
520 [http://calfire.ca.gov/resource_mgt/downloads/reports/California Forestry Report 5.pdf](http://calfire.ca.gov/resource_mgt/downloads/reports/California_Forestry_Report_5.pdf)
- 521 Central Coast Regional Water Quality Control Board. 2011. Water Quality Control Plan (Basin Plan). State
522 of California, San Luis Obispo, CA.
523 http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/

- 524 Central Valley Regional Water Quality Control Board (CVRWQCB). 2011. Water Quality Control Plan
525 (Basin Plan). State of California, Rancho Cordova, CA.
526 http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/
- 527 Forest Practices Board. 2022. "Cooperative Monitoring, Evaluation, and Research Committee."
528 Washington State Department of Natural Resources, [dnr.wa.gov/about/boards-and-](http://dnr.wa.gov/about/boards-and-councils/forest-practices-board/cooperative-monitoring-evaluation-and-research)
529 [councils/forest-practices-board/cooperative-monitoring-evaluation-and-research](http://dnr.wa.gov/about/boards-and-councils/forest-practices-board/cooperative-monitoring-evaluation-and-research). Accessed 21
530 September 2022.
- 531 CVRWQCB. 2014. Central Valley Water Board timber harvest waiver for activities on federal and non-
532 federal lands. Order No. R5-2014-0144, Conditional Waiver of Waste Discharge Requirements
533 for Discharges Related to Timber Harvesting Activities, adopted 4 December 2014, includes
534 Attachment A (Categorical Waiver), Attachment B (Monitoring and Reporting Conditions) and
535 Attachment C (Monitoring and Reporting Program).
536 https://www.waterboards.ca.gov/centralvalley/water_issues/forest_activities/
- 537 Effectiveness Monitoring Committee (EMC). 2013. Charter of the effectiveness monitoring committee.
538 California Board of Forestry and Fire Protection. August 12, 2013. 11 p.
539 [https://bof.fire.ca.gov/media/10115/effectiveness-monitoring-committee-charter-](https://bof.fire.ca.gov/media/10115/effectiveness-monitoring-committee-charter-7120_ada.pdf)
540 [7120_ada.pdf](https://bof.fire.ca.gov/media/10115/effectiveness-monitoring-committee-charter-7120_ada.pdf)
- 541 EMC. 2017. Table C1 - Priorities received from Boards, Departments and Agencies. California Board of
542 Forestry and Fire Protection. [https://bof.fire.ca.gov/media/dqxggvid/priorities-received-from-](https://bof.fire.ca.gov/media/dqxggvid/priorities-received-from-boards-departments-and-agencies.pdf)
543 [boards-departments-and-agencies.pdf](https://bof.fire.ca.gov/media/dqxggvid/priorities-received-from-boards-departments-and-agencies.pdf)
- 544 EMC. 2018. Effectiveness Monitoring Committee (EMC) Strategic Plan. Revised November 6, 2018.
545 <https://bof.fire.ca.gov/media/9122/2018-emc-strategic-plan-ada.pdf>
- 546 EMC. 2021. Completed Research Assessment. California Board of Forestry and Fire Protection.
547 https://bof.fire.ca.gov/media/lufd3n5t/emc-completed-research-assessment_final_ada.pdf
- 548 EMC. 2022a. 2022 Effectiveness Monitoring Committee Strategic Plan. California Board of Forestry and
549 Fire Protection. MONTH XX, XXXX. XX pp. LINK.
- 550 EMC. 2022b. EMC Members and Term Expirations. California Board of Forestry and Fire Protection.
551 Updated August 19, 2022. [https://bof.fire.ca.gov/media/vl2mg1kv/members-and-term-](https://bof.fire.ca.gov/media/vl2mg1kv/members-and-term-exp_webpage.pdf)
552 [exp_webpage.pdf](https://bof.fire.ca.gov/media/vl2mg1kv/members-and-term-exp_webpage.pdf)
- 553 EMC. 2022c. Research Themes and Critical Monitoring Questions. California Board of Forestry and Fire
554 Protection. Revised MONTH XX, XXXX. XX pp. LINK.
- 555 EMC. 2022d. 2021 Effectiveness Monitoring Committee Annual Report and Workplan. California Board
556 of Forestry and Fire Protection. January 28, 2022. 22 p.
557 https://bof.fire.ca.gov/media/0yipqkwn/emc-annual-report-and-workplan-2022_final_ada.pdf
- 558 EMC. 2022e. Request for Proposals. California Board of Forestry and Fire Protection.
559 https://bof.fire.ca.gov/media/yuopheif/emc-grant-guidelines-2022-23-final_ada.pdf

- 560 EMC. 2022f. Request for Applicants. California Board of Forestry and Fire Protection.
561 https://bof.fire.ca.gov/media/0cen1wmz/request-for-emc-applicants-2022_ada.pdf
- 562 Fish and Game Commission (FGCom). 1973. Endangered and threatened species policy. Fish and Game
563 Code. December 31, 2014:598. <http://www.fgc.ca.gov/policy/p4misc.aspx#ENDANGERED>
- 564 FGCom. 1993. Raptor policy. Fish and Game Code. December 31, 2014:596.
565 <http://www.fgc.ca.gov/policy/p3wild.aspx#RAPTORS>
- 566 FGCom. 1994. Water policy. Fish and Game Code. December 31, 2014:618.
567 <http://www.fgc.ca.gov/policy/p4misc.aspx#WATER>
- 568 FGCom. 2008. Salmon policy. Fish and Game Code. December 31, 2014:588.
569 <http://www.fgc.ca.gov/policy/p2fish.aspx#SALMON>
- 570 FGCom and Board of Forestry and Fire Protection (Board). 1994a. Interim joint policy on pre, during, and
571 post fire activities and wildlife habitat. Fish and Game Code. December 31, 2014: 633–637.
572 <http://www.fgc.ca.gov/policy/p5joint.aspx#INTERIM>
- 573 FGCom and Board. 1994b. Policy on hardwoods. Fish and Game Code. December 31, 2014:637–639.
574 <http://www.fgc.ca.gov/policy/p5joint.aspx#POLICY>
- 575 FGCom and Board. 2009. Joint policy statement on pacific salmon and anadromous trout. Fish and Game
576 Code. December 31, 2014:625–633. <http://www.fgc.ca.gov/policy/p5joint.aspx#saltrout>
- 577 Forest Resource Management. Assembly Bill (AB) 1492. Chapter 289. Committee on Budget. 2012.
578 https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201120120AB1492
- 579 Kirchner, J.W., R.C. Finkel, C.S. Riebe, D.E. Granger, J.L. Clayton, J.G. King, and W.F. Megahan. 2001.
580 Mountain erosion over 10 yr, 10 k.y., and 10 m.y. time scales. *Geology* 29(7):591–594.
- 581 Lahontan Regional Water Quality Control Board. 2014. Water quality control plan (Basin Plan). State of
582 California, South Lake Tahoe, CA. X p.
583 http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/index.shtml#plan
584 [n](http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/index.shtml#plan)
- 585 MacDonald, L.H., A. Smart, and R.C. Wissmar. 1991. Monitoring guidelines to evaluate the effects of
586 forestry activities on streams in the Pacific Northwest and Alaska. EPA/910/9-91-001, U.S.
587 Environmental Protection Agency Region 10. Seattle, WA. 166 p.
588 [http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/MonitoringGuidelinestoEvaluateEffectsofForestryActivitiesonStreams.pdf)
589 [lab/pubs/MonitoringGuidelinestoEvaluateEffectsofForestryActivitiesonStreams.pdf](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/MonitoringGuidelinestoEvaluateEffectsofForestryActivitiesonStreams.pdf)
- 590 MacDonald, L.H. 2000. Evaluating and managing cumulative effects: Process and constraints.
591 *Environmental Management* 26(3):299–315.
592 [http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/EvaluatingandManagingCumulativeEffectsProcessandConstraints.pdf)
593 [lab/pubs/EvaluatingandManagingCumulativeEffectsProcessandConstraints.pdf](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/EvaluatingandManagingCumulativeEffectsProcessandConstraints.pdf)
- 594 MacDonald, L.H., and D. Coe. 2007. Influence of headwater streams on downstream reaches in forested
595 areas. *Forest Science* 53(2):148–168.

- 596 [http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/MacDonald_Coe_Forest_Science.pdf)
597 [lab/pubs/MacDonald_Coe_Forest_Science.pdf](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/MacDonald_Coe_Forest_Science.pdf)
- 598 Martinson, E.J., and P.N. Omi. 2003. Performance of fuel treatments subjected to wildfires. pp. 7–13 in:
599 Omi, P.N., and L.A. Joyce, eds. Fire, fuel treatments, and ecological restoration: Conference
600 proceedings, April 16-18, 2002. RMRS-P-29. U.S. Department of Agriculture, Forest Service,
601 Rocky Mountain Research Station. Fort Collins, CO.
602 https://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_007_014.pdf
- 603 National Marine Fisheries Service (NMFS). 2012. Recovery plan for the evolutionary significant unit of
604 central California coast coho salmon. Volumes I–III. National Marine Fisheries Service,
605 Southwest Region. Santa Rosa, CA.
606 [https://www.fisheries.noaa.gov/resource/document/recovery-plan-evolutionarily-significant-](https://www.fisheries.noaa.gov/resource/document/recovery-plan-evolutionarily-significant-unit-central-california-coast-coho)
607 [unit-central-california-coast-coho](https://www.fisheries.noaa.gov/resource/document/recovery-plan-evolutionarily-significant-unit-central-california-coast-coho)
- 608 NMFS. 2014. Final recovery plan for the Southern Oregon/Northern California Coast evolutionarily
609 significant unit of Coho Salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service.
610 Arcata, CA. [https://www.fisheries.noaa.gov/west-coast/endangered-species-](https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/southern-oregon-northern-california-coast-coho-salmon)
611 [conservation/southern-oregon-northern-california-coast-coho-salmon](https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/southern-oregon-northern-california-coast-coho-salmon)
- 612 North, M., P. Stine, K. O’Hara, W. Zielinski, and S. Stephens. 2009. An ecosystem management strategy
613 for Sierran mixed-conifer forests. Gen. Tech. Rep. PSW-GTR-220. U.S. Department of Agriculture,
614 Forest Service, Pacific Southwest Research Station. Albany, CA. 49 p.
615 https://www.fs.fed.us/psw/publications/documents/psw_gtr220/psw_gtr220.pdf
- 616 North Coast Regional Water Quality Control Board (NCRWQCB). 2015. Water quality control plan (basin
617 plan). State of California, Santa Rosa, CA.
618 http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/
- 619 North Coast Regional Water Quality Control Board (NCRWQCB). 2015. amendment to the water quality
620 control plan for the north coast region to establish a policy for the implementation of
621 temperature objectives and establish implementation plans for the Eel, Mattole, and Navarro
622 TMDLs. State of California, Santa Rosa, CA.
623 http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/temperature
624 [amendment.shtml](http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/temperature)
- 625 Omi, P.N., and E.J. Martinson. 2004. Effectiveness of thinning and prescribed fire in reducing wildfire
626 severity. Pages 87-92 in: Murphy, D.D., and P.A. Stine, eds. Proceedings of the Sierra Nevada
627 science symposium: science for management and conservation. Gen. Tech. Rep. PSW-193. U.S.
628 Department of Agriculture, Forest Service, Pacific Southwest Research Station. Albany, CA.
629 [http://www.fs.fed.us/psw/publications/documents/psw_gtr193/psw_gtr193_2a_04_Omi_Marti-](http://www.fs.fed.us/psw/publications/documents/psw_gtr193/psw_gtr193_2a_04_Omi_Martinson.pdf)
630 [nson.pdf](http://www.fs.fed.us/psw/publications/documents/psw_gtr193/psw_gtr193_2a_04_Omi_Martinson.pdf)
- 631 Resolution 68-16, the "Statement of Policy with Respect to Maintaining High Quality of Waters in
632 California". see:
633 https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016
634 [.pdf](https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016) and https://www.waterboards.ca.gov/plans_policies/antidegradation.html

- 635 Safford, H.D., J.T. Stevens, K. Merriam, M.D. Meyer, and A.M. Latimer. 2012. Fuel treatment
636 effectiveness in California yellow pine and mixed conifer forests. *Forest Ecology and*
637 *Management* 274:17–28. http://www.fs.fed.us/rm/pubs/rmrs_gtr292/2012_safford.pdf
- 638 San Francisco Bay Regional Water Quality Control Board. 2015. Water quality control plan (basin plan).
639 State of California, Oakland, CA.
640 http://www.waterboards.ca.gov/sanfranciscobay/basin_planning.shtml
- 641 State of California. 2022a. Effectiveness Monitoring Committee Archives. Board of Forestry & Fire
642 Protection, [https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-](https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/effectiveness-monitoring-committee-archives/)
643 [committee/effectiveness-monitoring-committee-archives/](https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee-archives/). Accessed 21 September 2022.
- 644 State of California. 2022b. Effectiveness Monitoring Committee. Board of Forestry & Fire Protection,
645 <https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/>. Accessed 21
646 September 2022.
- 647 State Water Resources Control Board. 2015. Regional board water quality control plans (basin plans).
648 Plans and Policies webpage. State of California, Sacramento, CA.
649 http://www.waterboards.ca.gov/plans_policies/
- 650 Stewart, G., J. Dieu, J. Phillips, M. O’Connor, and C. Veldhuisen. 2013. The mass wasting effectiveness
651 monitoring project: An examination of the landslide response to the December 2007 storm in
652 Southwestern Washington. CMER Publication 08-802. Olympia, WA.
653 https://www.dnr.wa.gov/publications/fp_cmer_08_802.pdf
- 654 Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2009. Adaptive management: The U.S. Department of
655 Interior Technical Guide. Adaptive Management Working Group, U.S. Department of Interior,
656 Washington D.C. <https://www.doi.gov/sites/doi.gov/files/migrated/ppa/upload/TechGuide.pdf>
- 657 Z’berg-Nejedly Forest Practice Act of 1973. 2021. California Public Resources Code 4511–4630.2, Division
658 4 - Forests, Forestry and Range and Forage Lands, Part 2 - Protection of Forest, Range, and
659 Forage Lands, Chapter 8 - Z’berg-Nejedly Forest Practice Act of 1973.
660 [https://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=PRC&div](https://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=PRC&division=4.&title=&part=2.&chapter=8.&article=)
661 [ision=4.&title=&part=2.&chapter=8.&article=](https://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=PRC&division=4.&title=&part=2.&chapter=8.&article=)