



Colorado Forestry Best Management Practices

Forest Stewardship Guidelines for Water Quality Protection

2021 Field Monitoring Report
Compiled November 2021

Diana Selby, Manager of Program Delivery



Table of Contents

Executive Summary	1
Acknowledgements.....	1
Introduction.....	2
Monitoring Objectives.....	3
Monitoring Process.....	4
Monitoring Procedure	5
Field Monitoring Results.....	6
Recommendations	11
Summary.....	12
Appendix A	15
2021 Field Monitoring Data and Rating Guide Criteria	
Appendix B.....	20
Site Information and Ranking Criteria Field Form	

COVER: *A forestry operator uses a grapple to create a slash pile on a timber sale in Jackson County. Photo: Carolina Manriquez, CSFS*

BACK COVER: *The Colorado State Forest Service and Bureau of Land Management worked together to reduce wildfire risk and improve forest health, wildlife habitat and public safety on the slopes of Sheep Mountain in Grand County. Photo: Teddy Parker-Renga, CSFS*

Executive Summary

Water is a valuable commodity in Colorado that requires protection from nonpoint source pollution. A primary water quality concern following forest harvesting is sediment movement and delivery to surface water. To proactively protect water quality, Colorado has implemented Best Management Practices (BMPs) for forestry activities. Forestry BMPs are a set of water-quality protection measures and guidelines that provide direction on planning, roads, Streamside Management Zones (SMZs), timber harvesting, pesticides and fertilizers, stream crossings and fire management. Compliance with BMPs in Colorado is voluntary and administered within a non-regulatory framework.

In August 2021, an interdisciplinary team visited five timber harvest and/or fuel treatment sites in the northwestern area of Colorado to assess Colorado forestry BMP application and effectiveness. Sites were selected from a combination of federal, private and state lands. Each site was evaluated on BMP criteria described in the field monitoring rating guide (Appendix A), which includes planning, roads, SMZs, timber harvesting, hazardous substances, stream crossings and fire management.

The 2021 monitoring team found that the general application of BMPs on the five sites reviewed were met 96 percent of the time. Minor departures from the application of BMPs occurred the remaining 4 percent of the time and no major departures or gross neglect were observed. The team found that for the five sites observed, BMPs were effective at limiting water quality concerns by providing adequate or improved resource conditions 97 percent of the time. In the few instances where concerns were observed (3 percent), the effects were minor and temporary. No major and prolonged effects were observed on any of the sites during the 2021 site visits.

Based on its findings during the 2021 assessment, the monitoring team made several recommendations to address specific questions or concerns related to SMZs, road drainage and maintenance, equipment operations and ongoing monitoring.

Acknowledgements

As part of its continuing efforts to develop and provide education on protecting water quality during forestry and silviculture operations, the Colorado State Forest Service (CSFS) organized the 2021 BMP Field Monitoring site visits. The BMP Field Monitoring Program is an ongoing effort that began in 2008 with the initiation of the first audit. In 2011, a follow-up re-audit report was written to document the effectiveness of several BMPs on four of the six original sites. The program is now conducted on a biennial schedule with the last four field monitoring site visits occurring on even years from 2012 through 2018. Due to travel restrictions and safety measures, the BMP Field Monitoring site visits planned for 2020 were delayed until 2021.

The following individuals served on the 2021 field monitoring team:

- Tony Auciello, Jefferson County Open Space
- Lucy Bauer, Colorado State Tree Farm Committee
- Erik Castello, Colorado State Forest Service
- Maddy Castro, U.S. Environmental Protection Agency
- Molly Pitts, Colorado Timber Industry Association
- Chuck Rhoades, U.S. Forest Service, Rocky Mountain Research Station
- Andrea Rogers, U.S. Forest Service
- Diana Selby, Colorado State Forest Service

The CSFS is grateful to these individuals, agencies and organizations for contributing to the 2021 BMP Field Monitoring. In addition, the CSFS values the assistance and cooperation of contractors, landowners and local agency personnel for their participation and support of this effort.

Editing assistance was provided by Dr. Chuck Rhoades, U.S. Forest Service, Rocky Mountain Research Station. Photos for this report were provided by Diana Selby, CSFS. Editing and design assistance was provided by Teddy Parker-Renga, CSFS.

Introduction

The headwaters of all of Colorado's major rivers originate in the state's forested lands, where forests help produce high-quality water. Across the state, at least 80 percent of the population relies on this for its domestic water supply. These waters also provide for irrigation, livestock, recreation and industrial uses and support important fisheries in Colorado, 18 other states and Mexico. It is essential that landowners and managers take the necessary measures to maintain surface water quality.

The U.S. Environmental Protection Agency (EPA) classifies forestry and silviculture activities as potential sources of nonpoint source pollution (NPS) under the Clean Water Act (www.epa.gov/nps). The EPA defines nonpoint source pollution as follows:

“Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.”

Timber is harvested from federal, private and state forested lands in Colorado. Though caution is taken during harvesting operations, standard practices can impact land during logging projects. Excessive sediment entering waterways, usually from roads and/or skid trails, is the most common NPS pollution from forestry and silviculture activities. Typical timber harvesting practices include construction and use of forest roads, skid trails and landings. These activities remove vegetative cover and can result in soil compaction, thus reducing precipitation infiltration rates. If poorly planned, located or constructed, these structures can intercept other surface waters, concentrating surface flow and transporting sediment into receiving waters. These potential sources of pollution are preventable if forestry and timber harvest Best Management Practices (BMPs) are implemented.

Forestry BMPs are a set of water-quality protection measures and guidelines. BMPs provide direction on planning, roads, Streamside Management

Zones (SMZs), timber harvesting, hazardous substances, stream crossings and fire management. Implementation of BMPs can limit the NPS pollution that forestry operations produce. Compliance with forestry BMPs is voluntary in Colorado and is administered within a non-regulatory framework. BMP implementation monitoring serves as an acceptable surrogate for water-quality monitoring, which is a more quantitative, time consuming and expensive approach.

The Colorado Timber Industry Association (CTIA) and the Colorado State Forest Service (CSFS) developed “Colorado Forest Stewardship Guidelines to Protect Water Quality, Best Management Practices (BMPs) for Colorado” in 1998. The CTIA, the CSFS, the Colorado NPS Task Force and the U.S. EPA provided funding for this publication, which is now out of print.

Following the inaugural 2008 BMP field audit, the CSFS received funding from the Colorado Water Quality Control Division of the Colorado Department of Public Health and Environment to update forestry BMPs for Colorado. The resulting booklet, “Forestry Best Management Practices to Protect Water Quality in Colorado 2010,” is available in print at all CSFS locations throughout the state and online at: <http://static.colostate.edu/client-files/csfs/pdfs/ForestryBMP-CO-2010.pdf>.

The Colorado forestry BMP monitoring process is designed to spot check BMP compliance across the state. The *2020 Colorado Forest Action Plan* identifies 24 million acres of forest and woodlands, with roughly 65 percent in federal ownership and 30 percent in private ownership. Colorado's NPS 2012 Management Plan states that “nearly 37 percent of the total surface land and water of the state is federally owned, largely in headwaters areas.”

Timber harvesting takes place on all land ownerships. The number of projects that span multiple ownerships has increased with the use of cooperative agreements and programs such as the Good Neighbor Authority (GNA). The GNA is a national program that allows both the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) to enter into cooperative agreements or contracts with states and Puerto Rico to allow the states to perform watershed restoration and forest management services on National Forest System (NFS) or BLM lands. While past BMP monitoring visits have focused on selecting and reporting results on projects located uniquely on

federal, state and private ownerships, the 2021 BMP monitoring process focused on selecting projects that included each major landowner group in the state: federal, private and state; however, some projects included multiple ownerships.

Using the field monitoring rating guide criteria (Appendix A), each site was evaluated on key components of the timber sale, including planning, roads, SMZs, timber harvesting, hazardous substances, stream crossings and fire management. BMP compliance was evaluated on the basis of two criteria for each practice – application and effectiveness. The application rating indicated the degree of compliance with suggested BMP methodology, and the effectiveness rating established whether the practice, as applied, was sufficient to achieve the intended protection of water resources.

The 2021 Colorado forestry BMP monitoring was the sixth comprehensive BMP monitoring for the state. The monitoring was conducted on five timber harvest sites. The five sites included one private site, two federal sites and two GNA project sites (one that included federal, private and state land, and one that included federal and state land) by a team comprised of professionals in the fields of engineering, forestry, geology, hydrology, weed management and soil science from federal, state and private sectors. Industry and landowners also were represented on the team.

The 2021 BMP field monitoring was partially funded through EPA CWA Section 319 funds via the Nonpoint Source Program of the Colorado Department of Public Health and Environment, Water Quality Control

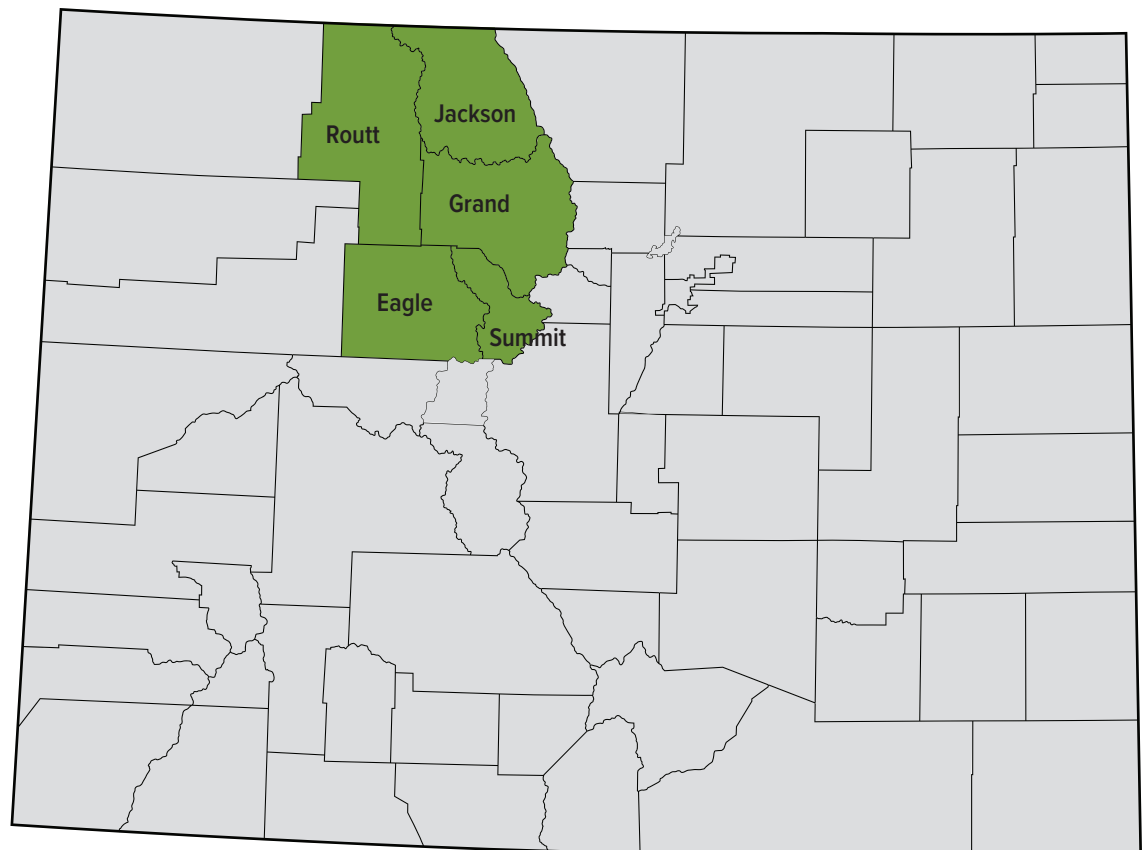


Figure 1. Counties that participated in the 2021 Colorado Forestry BMPs Field Monitoring

Division (WQCD). This report details the findings of the 2021 Colorado forestry BMP monitoring.

Monitoring Objectives

The role of the 2021 monitoring team was to evaluate the voluntary compliance to BMP standards detailed in the 2010 publication “Forestry Best Management Practices to Protect Water Quality in Colorado.” The overall goal was to proactively spot check the implementation of the state forestry BMPs and evaluate the effectiveness of each on selected sites. The CSFS will ultimately use findings to improve education for timber industry professionals and BMP publications.

The 2021 monitoring report objectives include:

1. Monitoring the effects of timber harvesting operations on water quality on selected sites.
2. Monitoring the avoidance and protection of wetland soil and water resources during harvest/treatment and road construction on selected sites.

3. Monitoring road-building effects (temporary/permanent roads/trails) in riparian areas on selected sites.
4. Evaluating the level of fuels treatment/ timber harvest planning and design needed to maintain or improve the hydrographic character of timberlands; protecting soils from erosion and streams from sedimentation during runoff periods on selected sites.
5. Evaluating the protection of SMZs under the BMPs on selected sites.

Monitoring Process

Site Nomination

The CSFS solicited site nominations from the USFS, BLM, CSFS and CTIA. Site nominations were requested for fuel treatments/timber sales on federal, private and state forestlands with the greatest potential to affect water quality. The following baseline criteria were requested for nominations:

1. Sale/treatment has the potential to affect water quality.
2. Minimum of 1,000 board feet/or 1 Mbf (2 cunits or 2 CCF) per acre were harvested/masticated/removed.
3. Sale/treatment was completed within the last two years.
4. Sale/treatment was located in Eagle, Grand, Jackson, Routt or Summit counties.

The minimum requirement of 1 Mbf harvested per acre was used to ensure that sales/treatments with only marginal potential to affect water quality were not selected. In addition, many of the sales/treatments in the state occur in areas where little or no live water or other sensitive hydrologic resources are present. While many BMPs are applicable to such sales/ treatments, the monitoring focused on areas with potential to affect water quality.

The location criteria for the 2021 monitoring consist of counties within two CSFS field office boundaries (Granby and Steamboat Springs). Previous monitoring has been conducted in other areas of the state. The



Figure 2: The sale administrator briefs the monitoring team and answers questions during a site visit. Photo: Diana Selby, CSFS

long-term intent is to cover all forested areas within Colorado that satisfy the first three criteria of site selection on a rotating basis.

In 2021, seven unique site nominations were submitted to the CSFS for evaluation from local CSFS, BLM and USFS offices. The CSFS attempted to monitor projects on different landownerships and therefore selected all three CSFS and BLM nominations, which included private and state lands, as well as two USFS nominated sites that were exclusively on federal lands. Two sites located on USFS lands were not selected for monitoring due to distance and time restraints from other nominated sites.

At the time of the monitoring visit, the monitoring team found that one site (Sale #2) did not have the potential to affect water quality and two other sites (Sale #1 and Sale #5) had not yet been completed. The team

determined that additional follow-up with local offices that nominate sites would be beneficial to ensure all desired criteria are met for future monitoring visits.

Overview of Selected Sites

Five fuel treatments/timber sales were selected for monitoring within the geographical boundaries of two CSFS field offices in northwest Colorado (Figure 1) in order to complete the monitoring within one week.

Site nominations were solicited from two USFS supervisor offices, the BLM Forestry Program Lead for Colorado, two CSFS field offices, and the CTIA Executive Committee and local membership list.

In order to maintain confidentiality and privacy, ownership and specific locations of the selected sites are not identified in this report. Only type of land classification is disclosed (i.e., federal, private, state or multiple). Forestry contractor/logging companies were also not identified.

Monitoring Procedure

Field monitoring was conducted over three days, and the monitoring team spent approximately 2-4 hours on each fuel treatment/timber sale. Four of the eight monitoring team members had participated in at

least one other BMP monitoring effort and/or federal BMP consistency review in one or more states over the last few years. This allowed significant cross-training of newer team members and helped improve understanding of rating criteria and applicability of the guide.

Personnel directly associated with each timber sale (either compliance forester or sale administrator) briefed the monitoring team on details of the harvest at each location. Areas of particular importance, such as SMZs, roads and landing areas near the riparian corridor, were identified, as were sale administration details. The monitoring team was given an opportunity to inspect the area.

No effort was made to inspect each acre of the harvested area or each mile of road; rather, the monitoring focused on the critical portions of the timber sale where proper BMP application was most important. The information presented in this report is based on the observational data obtained from each site.

After inspecting these areas, the monitoring team reconvened to evaluate the applicable BMPs for each site through observation and discussion. After reaching consensus on applicability, an on-site team leader recorded the application and effectiveness rating for each of the BMP items. A different member



Figure 3: The monitoring team sits to discuss and fill out a ranking form at a monitoring site. Photo: Diana Selby, Colorado State Forest Service

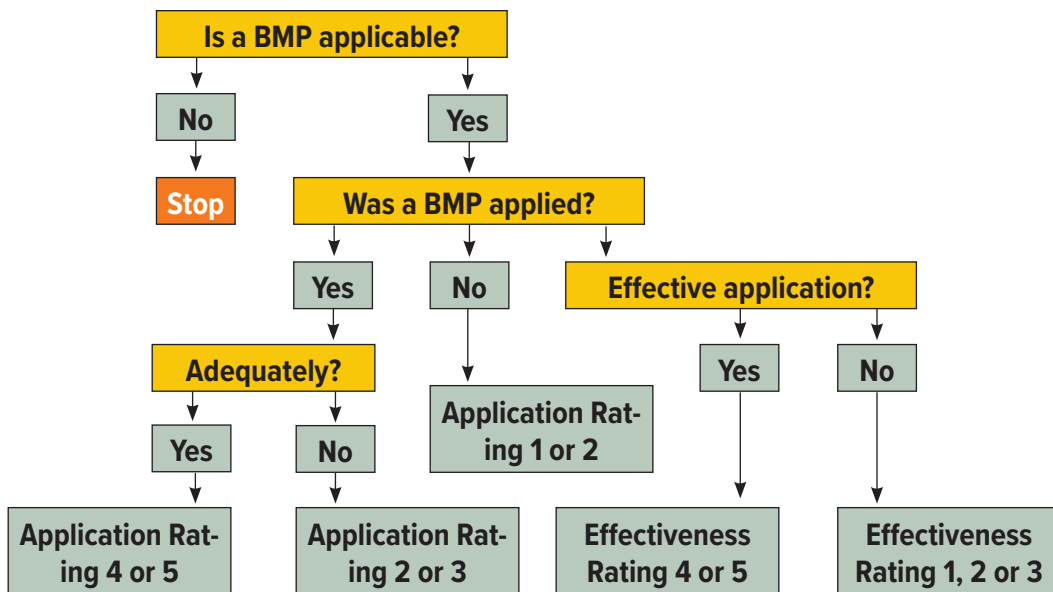


Figure 4: Colorado BMP Monitoring Ranking System

of the monitoring team acted as team leader at each location. The BMP Field Monitoring Data and Rating Guide Criteria are attached (Appendix A).

The rating process conducted for each BMP begins with establishing whether the BMP in question is applicable to the fuels management/harvest activities under consideration (Figure 4). For example, not all fuel treatment/harvest sites require the construction of temporary roads. In these cases, the BMPs that pertain to temporary roads are not applicable. Once the monitoring team establishes that a given BMP is applicable, the application rating for the BMP is determined, based on written criteria (Table 1).

The monitoring team then evaluated the BMP effectiveness, which determined whether the BMP was successful in protecting water quality, again based on written criteria (Table 2).

As monitoring sites were visited, the team kept notes about how the “Forestry Best Management Practices to Protect Water Quality in Colorado 2010” might be improved and how future monitoring processes might be conducted. Those findings are included in the recommendations portion of this report.

Limitations of the Monitoring Process

The extremely low number of sales visited and lack of a representative sample design prevent quantitative interpretation of the monitoring results. However, the visual observations allow general conclusions about

the rate of BMP application and are appropriate for general communication and outreach regarding the BMP process.

Practicality, time and resources prohibit evaluation of each fuels treatment/timber sale for continual compliance with BMPs. Instead, the monitoring process is designed to act as a “spot check,” which is limited to areas of the sale/treatment that have the greatest potential to affect water quality. The timing of the monitoring in the life of

the sale/treatment also is limited, in that monitoring cannot simultaneously examine the pre-sale/treatment, ongoing and post-sale/treatment activities to which BMPs apply. Evaluation of BMPs relating to time was based on implementation to date, where final results were not yet realized. For example, sites where grass seed mixtures have been applied but germination has not yet occurred generally were assumed to germinate successfully.

Field Monitoring Results

In 2021, BMPs were applied overall 96 percent of the time on the five selected sites (264 out of 276 rated items – Table 3). Sale #1 was found to meet BMP standards 100 percent of the time, Sale #2 and Sale #3 met BMP standards 97 percent of the time, Sale #4 met BMP standards 96 percent of the time and Sale #5 met BMP standards 89 percent of the time.

Minor departures occurred 4 percent of the time across the five sites. Minor departures were observed specifically on Sale #2 and Sale #3 (3 percent of the time), Sale #4 (4 percent of the time) and Sale #5 (11 percent of the time). No major departures or gross neglect of any BMP were found on any of the five sites.

BMPs were determined to be effective at providing adequate protection of soil and water resources an average of 96 percent of the time for the monitored sites.



Figure 5: The monitoring team works on reaching consensus on BMP application and effectiveness ratings. Photo: Diana Selby, CSFS

Improved protection of soil and water resource conditions were observed on two sales for an average of 1 percent (Table 4). On Sale #4, the improvement was a result of the decommissioning of an existing road. The improved conditions for Sale #5 were a result of remaining slash levels that improved the soil horizon.

There were minor, temporary impacts on soil and water resources recorded on three of the sales (Sale #1, Sale #2 and Sale #5) for an average of 3 percent of the time. Minor impacts observed on Sale #1 were due to the steep road grade and lack of a culvert installed on a short stretch of road that was kept as a permanent road but was originally designed and built to be a temporary road. Sale #2 was found to have minor impacts to resources because recommendations to seed and scarify pile burn scars had not occurred at the time of monitoring. The minor impacts to soil and water resources observed on Sale #5 were due to minor soil and road drainage issues due to inadequate erosion control features that were not fully functioning as intended.

Minor/prolonged or major/temporary effects, as well as major/prolonged effects, were not observed on any forestland during this monitoring period.

In general, BMPs were properly applied and effective in most cases in 2021. Table 5 illustrates the 2021 BMP application and effectiveness rating results for all sites, compared to the results of the previous 2008, 2012, 2014, 2016 and 2018 monitoring periods. No major and prolonged effects were observed during any of the monitoring periods to date. The monitoring team will continue to spot check projects on a biennial basis to provide recommendations for improvement.

Based on the 2021 forestry BMP monitoring, the following observations were made. The order of the observations parallels the BMP guidance document.

Planning

Sanitary guidelines for the construction of camps

Camping was not an issue on any of the monitored sites. Sale operators and their employees only stayed on three of the sites. The BMP application standard was met and BMP effectiveness adequately protected on all three sites.

Roads

Road design and location

Existing roads were used on most of the sites wherever possible. Sites with newly constructed or reconstructed roads met BMP requirements. All new and reconstructed roads adequately protected soil and water resources except one new section of road, which rated as having minor and temporary impacts on soil and water resources on Sale #1. The road originally was planned as a temporary road and met BMP requirements for temporary roads; however, the landowner later decided to keep the road permanently. If a permanent road had been planned from the start of the project, the design of the road would have been held to a higher standard for anticipated use and would have likely included installation of a culvert.

Road construction/reconstruction

Where road construction/reconstruction occurred, proper techniques were used to construct only to the extent necessary to provide for adequate drainage and safety. In general, earth-moving activities were

Table 1: BMP Application Ratings and Criteria

Rating	Criteria
5	Operation exceeds requirements of BMP.
4	Operation meets the standard requirement of BMP.
3	Minor departure from BMP.
2	Major departure from BMP.
1	Gross neglect of BMP.

Table 2: BMP Effectiveness Ratings and Criteria

Rating	Criteria
5	Improves protection of soil and water resources over pre-project conditions.
4	Adequate protection of soil and water resources.
3	Minor and temporary impact to soil and water resources.
2	Major and temporary or minor and prolonged impacts to soil and water resources.
1	Major and prolonged impacts to soil and water resources.

Definition of Effectiveness Terms

Adequate: Small amount of material eroded, but does not reach draws, channels or floodplain

Minor: Some material erodes and is delivered to stream or annual floodplain

Major: Material erodes and is delivered to stream or annual floodplain

Temporary: Impacts last less than one season

Prolonged: Impacts last more than one year

Table 3: Colorado Forestry BMP 2021 Field Monitoring Application Results, by Sale

Project	Exceeded BMP	Met BMP Standard	Minor Departure	Major Departure	Gross Neglect	Total
Sale 1	0	62	0	0	0	62
	0%	100%	0%	0%	0%	100%
Sale 2	0	38	1	0	0	39
	0%	97%	3%	0%	0%	100%
Sale 3	0	60	2	0	0	62
	0%	97%	3%	0%	0%	100%
Sale 4	0	48	2	0	0	50
	0%	96%	4%	0%	0%	100%
Sale 5	0	56	7	0	0	63
	0%	89%	11%	0%	0%	100%
Total	0	264	12	0	0	276
	0%	96%	4%	0%	0%	100%

Table 4: Colorado Forestry BMP 2021 Field Monitoring Effectiveness Results, by Sale

Project	Improved Conditions	Adequate Protection	Minor and Temporary	Minor/Prolonged or Major/Temporary	Major and Prolonged	Total
Sale 1	0	60	2	0	0	62
	0%	97%	3%	0%	0%	100%
Sale 2	0	38	1	0	0	39
	0%	97%	3%	0%	0%	100%
Sale 3	0	62	0	0	0	62
	0%	100%	0%	0%	0%	100%
Sale 4	1	49	0	0	0	50
	2%	98%	0%	0%	0%	100%
Sale 5	2	57	4	0	0	63
	3%	91%	6%	0%	0%	100%
Total	3	266	7	0	0	276
	1%	96%	3%	0%	0%	100%

Table 5: Comparison of BMP Application and Effectiveness Results, by Year Monitored (2008-2021)

Application	Exceeded BMP	Met BMP Standard	Minor Departure	Major Departure	Gross Neglect
2008	3%	84%	11%	3%	0%
2012	2%	84%	10%	4%	0%
2014	2%	80%	13%	3%	3%
2016	5%	79%	10%	6%	0%
2018	4%	91%	5%	0%	0%
2021	0%	96%	4%	0%	0%

Effectiveness	Improved Conditions	Adequate Protection	Minor and Temporary	Minor/Prolonged or Major/Temporary	Major and Prolonged
2008	1%	81%	15%	3%	0%
2012	2%	86%	12%	0%	0%
2014	1%	83%	16%	0%	0%
2016	2%	88%	4%	6%	0%
2018	3%	97%	0%	0%	0%
2021	1%	96%	3%	0%	0%



Figure 6: Team members observe inadequate drainage at a stream crossing. Photo: Diana Selby, CSFS

minimized during wet periods; slope stabilization, erosion and sediment control work was kept as current as possible; erodible soils were stabilized; and excavation into ground water was avoided. One sale improved protection of soil and water resources by decommissioning an existing legacy road.

Road drainage

Road drainage met BMP requirements on two of the sales visited and included some minor departures from BMPs for three sites.

In one instance (Sale #1), BMPs were adequate; however, the road grade and drainage were rated as having minor and temporary impacts on soil and water resources. The section of road was built with temporary specifications that met BMPs for temporary roads; however, after construction, the landowner chose to maintain it as a permanent road.

Sale #4 had a minor departure from recommended BMPs related to the lack of rolling dips, water bars, ditches or outlets in case of a rain event. At the time of the site visit, no impacts were observed in the sale's site despite this departure from BMPs.

The most minor departures of BMPs occurred on Sale #5 in providing adequate road surface drainage, spacing road drainage outlets so that runoff did not

exceed capacity of drainage outlets, and constructing drain dips deep enough to the sub grade so that traffic did not obliterate them. In this situation, drain dips were installed on a newly constructed road; however, the dips were reduced/removed during hauling operations for log trucks. At the time of the site inspection, no functional dips were observed on the road and surface drainage was occurring on the road.

Road maintenance

All of the sites evaluated in 2021 met the requirements of the maintenance BMPs and provided for adequate protection of soil and water resources. This included avoiding the use of roads during wet periods and leaving any abandoned roads in sufficient condition to provide adequate drainage.

Streamside Management Zone (SMZ) delineation

The applications in streamside management zones met requirements in all cases where they were



Figure 7: Materials fill in existing culverts on Sale #5. Photo: Diana Selby, CSFS

applicable except for one site (Sale #3). Sale #3 had a minor departure of BMPs where a tank trap was located above an ephemeral stream and therefore not functioning properly. Despite this departure, the monitoring team found that there was adequate protection of soil and water resources at the time the site was evaluated.

In addition, another candidate site (Sale #2) was not evaluated since it had no surface water or streamside management zone.

Stream crossings and stream bank protection

Two of the sales evaluated in 2021 did not have any applicable BMP requirements related to stream crossings and stream bank protection. Another two of the sites met requirements of BMPs and had adequate protection of soil and water resources.

The fifth site, Sale #5, was found to have minor departures from BMPs including proper sizing for stream crossing structures and directing road drainage

away from a stream crossing site. In this instance, the monitoring team found that the two existing culverts that were installed for the crossing were inadequate and had begun to fill with soil. Additionally, drainage away from the stream crossing was not occurring. Even with these departures from application of BMPs, the team found that the soil and water resources were still adequately protected during the time of the evaluation. The team recommended that a larger and/or longer culvert would have been more appropriate for the site.

Installation of stream crossings

Three of the monitoring sites did not contain applicable BMPs for installation of stream crossings. One site, Sale #3, was rated as meeting BMP requirements and providing adequate protection of soil and water resources.

Sale #5 was found to have a minor departure in preventing erosion of the stream crossing culvert and the effectiveness was found to have minor and temporary impacts to the soil and water resources. Again, this rating was given because materials had begun to fill in the existing culverts.

Timber Harvesting, Thinning, Slash Treatment and Revegetation

Harvest design

All harvest sites used suitable location, size and number of landings and skid trails to minimize disturbance in addition to including suitable logging systems for the topography, soil type and season of operation.

Other harvesting activities

All harvest sites met BMP requirements and provided adequate resource protection for skidding operations. The sites all included adequate drainage for landings and skid trails.

Slash treatment and site preparation

Scarification was used only on one of the sites (Sale #4) and met BMP requirements. All sites left adequate slash material to slow runoff, return soil nutrients and provide shade for seedlings. In addition, all sites limited activities to frozen or dry conditions to minimize soil compaction and displacement. Four of the five sites monitored treated their slash so as to preserve the surface soil horizon. The fifth site, Sale #5, was deemed to have improved the surface soil horizon



Figure 8: Team members view slash treatment that improved moisture and soil horizon on Sale #5. Photo: Diana Selby, CSFS

on a portion of the site where a higher level of slash remained across the unit after treatment.

Re-vegetation of disturbed areas

Several of the sites evaluated in 2021 were determined to have minor departures from BMPs because seeding wasn't done (Sale #3 and Sale #4) or seeding was recommended but not completed by the landowner at the time of evaluation (Sale #2). Two sites (Sale #1 and Sale #5) still had active operations on some portions of the project area and, therefore, revegetation was not applicable at the time of monitoring. All sites where this BMP was applicable, except for Sale #2, met BMP application and effectiveness requirements. The Sale #2 site was deemed to have minor impacts on soil resources in pile burn areas where seeding had not yet occurred and noxious weeds were becoming established; however, water resources were not impacted.

Hazardous Substances Including Pesticides, Fertilizers and Chemicals

Pesticides and fertilizers were not used on any of the sites that were visited. All sites had proper designated areas selected for servicing and refueling to prevent contamination of waters from accidental spills.

Fire Management

Protection of soil and water from the effects of prescribed burning

Three of the sites (Sale #1, Sale #4 and Sale #5) had not completed pile burns at the time of the monitoring trip and, therefore, evaluation of protection of soil and water from effects of prescribed burning was not applicable at that point in time. The other two sites (Sale #2 and Sale #3) met BMP requirements and sufficiently protected soil and water resources.

Stabilization of fire suppression-related work damage

This BMP was only applicable on Sale #1 when a nearby wildfire prompted the creation of a safety zone to stage equipment. The area was restored appropriately and therefore met BMP requirements and provided adequate protection of resources. This BMP was not applicable on any of the other sites because no suppression-related activities occurred.

Emergency rehabilitation of watersheds impacted by wildfires

This BMP was not applicable on any of the sites because no emergency rehabilitation of watershed activities occurred.

Recommendations

During the monitoring, several BMPs required clarification or expansion. The following recommendations were made for future BMP guide documents and monitoring:

- As recommended in the past, it appears that additional, continued, focused outreach and training in this subject matter area is required for forestry and logging operators, landowners and managers.
- With an increase in GNA projects that include multiple ownership types (federal, private and state), the BMP field handbook should be evaluated for alignment with national BMPs where appropriate.
- Additional guidance should be developed for temporal constraints when sites are being selected and evaluated. The monitoring team struggled to stay consistent in reviewing and rating sites that were at different stages of completion (e.g., where pile burns hadn't occurred yet or roads had not been closed at the time of inspection).
- Guidance that is more specific is needed for forestry and logging operators, landowners and managers on stream types (i.e., perennial, intermittent and ephemeral), in addition to determining when operations might affect water resources, and operational guidance should be provided to address acceptable activities within the SMZ.
- A separate "Fire Management" category should be added to the BMP field handbook when it is updated. These changes will better facilitate handbook use during the monitoring and allow for easier general reference.

- Supplemental guidance should be provided for SMZ width, especially with regards to slope in subsequent BMP versions. Other states have more specific guidance for width, depending on side-slope gradient.
- The monitoring team needs guidance on spatial limits of BMPs to be inspected within a given site on the inspection form. Some confusion has occurred over the years regarding whether the team needed to be concerned with areas outside of site boundaries (e.g., between site boundary and county road).
- Language can be added regarding use of existing landing and skid trail areas to minimize soil disturbance within an updated BMP field handbook.
- The BMP field handbook and BMP inspection forms should be evaluated and updated for overall clarity as well as current forestry operation trends, such as the use of virtual project and SMZ boundaries.
- Forestry BMPs should continue to be available to various users through online resources and meetings.

Summary

The 2021 monitoring team found that application of BMPs in forestry and logging operations in Colorado occurred at a rate of 96 percent, with an effectiveness rate of 97 percent across the five sites that were observed. The monitoring team is generally pleased with the ratings during the 2021 visit. The monitoring team has made several recommendations and believes that the application and effectiveness rates can be maintained or improved with updated guidance and continued education and outreach.

A variety of factors, including statewide insect and disease issues, an increase in the incidence of destructive and relatively high-intensity wildfires, an improving forest products industry infrastructure, and increased funding opportunities to support forest restoration and wildfire mitigation, will lead to an increase in the number of acres being harvested and/or treated. It is essential to continually evaluate and adjust BMPs as new issues and information are presented. The BMP monitoring will serve as the information source for updating state BMPs.

Notes

[illegible]

Notes

[illegible]

Appendix A

2021 Forestry BMP Field Monitoring Data and Rating Guide Criteria

TIMBER SALE IDENTIFICATION		Sale #1		Sale #2		Sale #3		Sale #4		Sale #5	
		Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
PLANNING											
Sanitary Guidelines for the Construction of Camps											
Adequate sewer and soil waste considerations on site to protect water quality if camps are present.	4		4	NA	NA	4	4	4	4	NA	NA
ROADS											
Road Design and Location											
Design roads to minimum standard necessary to accommodate anticipated use and equipment.	4		3	4	4	4	4	4	4	4	4
Minimize number of roads necessary.	4		4	4	4	4	4	4	4	4	4
Use existing roads unless aggravated erosion will be likely.	4		4	4	4	4	4	4	4	4	4
Avoid long, sustained, steep road grades.	4		4	4	4	4	4	4	4	4	4
Locations avoid high-hazard sites (i.e., wet areas and unstable slopes).	4		4	NA	NA	4	4	4	4	4	4
Minimize number of stream crossings.	4		4	NA	NA	4	4	NA	NA	4	4
Choose stable stream crossing sites.	4		4	NA	NA	4	4	NA	NA	4	4
Locate roads to provide access to suitable log landing areas.	4		4	4	4	4	4	4	4	4	4
Locate roads a safe distance from streams when they are parallel.	4		4	NA	NA	4	4	4	4	4	4
Keep roads outside of Stream Management Zones.	4		4	NA	NA	4	4	4	4	4	4
Road Construction/Reconstruction											
Construct/reconstruct only to the extent necessary to provide adequate drainage and safety.	4		4	4	4	4	4	4	5	4	4
Minimize earth moving activities when soils appear excessively wet.	4		4	4	4	4	4	4	4	4	4
Keep slope stabilization, erosion, sediment control work as current as possible, including "slash filter windrows".	4		4	4	4	4	4	4	4	4	4
Cut and fill slopes at stable angles.	4		4	4	4	4	4	NA	NA	4	4
Stabilize erodible soils (i.e., seeding, benching, mulching).	4		4	4	4	4	4	4	4	NA	NA
Avoid incorporating woody material in road fill.	4		4	4	4	4	4	4	4	4	4

TIMBER SALE IDENTIFICATION	Sale #1		Sale #2		Sale #3		Sale #4		Sale #5	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Leave existing rooted trees and shrubs at the toe of fill slope.	4	4	4	4	4	4	NA	NA	4	4
Balance cuts and fills or use full bench construction.	4	4	4	4	4	4	NA	NA	4	4
Sediment from borrow pits and gravel pits minimized.	4	4	4	4	4	4	4	4	4	4
Excess materials placed in locations that avoid entering stream.	4	4	NA	NA	4	4	4	4	4	4
Avoid excavation into ground water.	4	4	4	4	4	4	4	4	4	4
Exclusion of side-casting of road material into a stream, lake, wetland or other body of water.	4	4	NA	NA	4	4	4	4	4	4
Road Drainage										
Vary road grade to reduce concentrated drainage.	4	3	4	4	4	4	4	4	4	4
Provide adequate road surface drainage for all roads.	4	4	4	4	4	4	4	4	3	3
Space road drainage outlets so peak runoff will not exceed capacity of drainage outlets.	4	4	4	4	4	4	3	4	3	3
For in-sloped roads, plan ditch gradients of generally greater than 2%, but no more than 8%.	4	4	4	4	NA	NA	NA	NA	4	4
Construct drain dips deep enough into the sub grade so that traffic will not obliterate them.	4	4	4	4	4	4	4	4	3	4
Install culverts at original gradient, otherwise rock armor or anchor downspouts.	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. Catch basins where appropriate.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Provide energy dissipaters at drainage structure outlets where needed.	4	4	4	4	4	4	NA	NA	NA	NA
Route road drainage through adequate filtration zones before entering a stream.	4	4	NA	NA	4	4	4	4	4	4
Road Maintenance										
Maintain erosion control features (dips, ditches and culverts functional).	4	4	4	4	4	4	4	4	3	3
Avoid use of roads during wet periods.	4	4	4	4	4	4	4	4	4	4
Grade roads only as necessary to maintain drainage.	4	4	4	4	4	4	4	4	4	4

TIMBER SALE IDENTIFICATION	Sale #1		Sale #2		Sale #3		Sale #4		Sale #5	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Avoid cutting the toe of cut slopes.	4	4	4	4	4	4	NA	NA	4	4
Exclusion of side-casting of road material into a stream.	4	4	NA	NA	4	4	4	4	4	4
Abandoned roads in condition to provide adequate drainage without further maintenance.	4	4	NA	NA	4	4	4	4	NA	NA
Streamside Management Zone Designation										
Adequate SMZ width identified.	4	4	NA	NA	4	4	4	4	4	4
SMZ properly marked.	4	4	NA	NA	4	4	4	4	4	4
Maintain or provide sufficient ground cover.	4	4	NA	NA	4	4	4	4	4	4
Equipment operation in SMZ allowed only per approved practices.	4	4	NA	NA	4	4	4	4	4	4
Exclusion of burning in SMZ.	4	4	NA	NA	4	4	4	4	4	4
SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody material.)	4	4	NA	NA	NA	NA	4	4	4	4
Exclusion of side-cast material into a stream, lake, wetland or other body of water during harvest/operation.	4	4	NA	NA	3	4	4	4	4	4
Exclusion of slash in streams, lakes or other bodies of water.	4	4	NA	NA	4	4	4	4	4	4
SMZ protected during site preparation activities.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stream Crossings and Stream Bank Protection										
Proper permits for stream crossings obtained.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cross streams at right angles, if practical.	4	4	NA	NA	4	4	NA	NA	4	4
Proper sizing for stream crossing structures.	NA	NA	NA	NA	4	4	NA	NA	3	4
Direct road drainage away from stream crossing site.	4	4	NA	NA	4	4	NA	NA	3	4
Avoid unimproved stream crossings. Use temporary log stream crossings if necessary.	4	4	NA	NA	4	4	NA	NA	4	4
Installation of Stream Crossings										
Minimize stream channel disturbance.	4	4	NA	NA	4	4	NA	NA	4	4
Erodible material not placed in stream channels.	4	4	NA	NA	4	4	NA	NA	4	4
Stream crossing culverts conform to natural streambed and slope.	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Culverts placed slightly below stream grade.	NA	NA	NA	NA	NA	NA	NA	NA	4	4

TIMBER SALE IDENTIFICATION		Sale #1		Sale #2		Sale #3		Sale #4		Sale #5	
		Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet).		NA	NA	NA	NA	NA	NA	NA	NA	3	3
Minimum cover for stream crossing culverts provided.		NA	NA	NA	NA	NA	NA	NA	NA	4	4
Stream diversions are carefully planned to minimize downstream sedimentation.		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TIMBER HARVESTING, THINNING, SLASH TREATMENT AND REVEGETATION											
Harvest Design											
Suitable logging system for topography, soil type and season of operation.		4	4	4	4	4	4	4	4	4	4
Design and locate skid trails to minimize soil disturbance. Use existing areas wherever possible.		4	4	4	4	4	4	4	4	4	4
Suitable location, size and number of landings. Use existing areas wherever possible.		4	4	4	4	4	4	4	4	4	4
Other Harvesting Activities											
Equipment/skidding operation minimizes soil compaction and displacement.		4	4	4	4	4	4	4	4	4	4
Avoid equipment/skidding operation on unstable, wet or easily compacted soils and on slopes that exceed 40% unless not causing excessive erosion.		4	4	4	4	4	4	4	4	4	4
Appropriate drainage control for landing.		4	4	4	4	4	4	4	4	4	4
Appropriate drainage control for skid trails.		4	4	4	4	4	4	4	4	4	4
Slash Treatment and Site Preparation											
Scarify only to the extent necessary to meet resource management objective.		NA	NA	NA	NA	4	4	NA	NA	NA	NA
Treat slash so as to preserve the surface soil horizon.		4	4	4	4	4	4	4	4	4	5
Adequate material left to slow runoff, return soil nutrients and provide shade for seedlings.		4	4	4	4	4	4	4	4	4	5

TIMBER SALE IDENTIFICATION		Sale #1		Sale #2		Sale #3		Sale #4		Sale #5	
		Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Activities limited to frozen or dry conditions to minimize soil compaction and displacement.		4	4	4	4	4	4	4	4	4	4
Scarification on steep slopes in a manner that minimizes erosion.		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revegetation of Disturbed Areas											
Practices have been completed to ensure adequate revegetation in disturbed areas.		NA	NA	3	3	3	4	3	4	NA	NA
PESTICIDES, FERTILIZERS AND CHEMICALS											
Know and comply with regulations governing the storage, handling, etc. of hazardous substances.		4	4	4	4	4	4	4	4	4	4
Proper sites were selected for servicing and refueling to prevent contamination of waters from accidental spills.		4	4	4	4	4	4	4	4	4	4
Pesticide materials have been properly applied and effects monitored.		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fertilizers have been properly handled and applied so as to reduce possible adverse effects on water quality.		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FIRE MANAGEMENT											
Protection of Soil and Water from Prescribed Burning Effects											
Soil productivity is maintained; erosion is minimized. Ash, sediment, nutrients and debris are prevented from entering surface water. SMZ is maintained with no piling and/or burning permitted within SMZ.		NA	NA	4	4	NA	NA	4	4	NA	NA
Stabilization of Fire Suppression Related Work Damage											
Areas impacted by fire suppression activities have been stabilized.		4	4	NA	NA	NA	NA	NA	NA	NA	NA
Emergency Rehabilitation of Watersheds Impacted by Wildfires											
Corrective measures have been applied to minimize the loss of soil productivity, deterioration of water quality and threats to life and property, both on-site and off-site.		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMMENTS:											
Sale #1: This is a multiple agency project (GNA – state, fed, private) implemented under 1 contractor and 1 administrator. Can BMPs be adaptable to GNA process?				Sale #4: Road improvements were made possible through the timber sale activities and therefore the sale is providing additional public benefit.							

Appendix B

Site Information and Ranking Criteria Field Form

CO - BMP1

Year: _____

BMP FIELD MONITORING SITE INFORMATION and RANKING CRITERIA

Site Number: _____

Meets Selection Criteria: ☐ Yes ☐ No

Site Name: _____

Owner(s): _____

Legal Description: RNG. _____ TWP. _____ SEC. _____ County: _____

Primary Drainage: _____ Month/Year Harvested: _____

Stream Within 200 Ft.? ☐ Y ☐ N Name: _____ Bankfull Width: _____

Unit Size (Ac): _____ Volume Removed (MBF): _____

Road Construction: YES ☐ (If yes, when) _____ NO ☐ Length: _____

Road Reconstruction: YES ☐ (If yes, when) _____ NO ☐ Length: _____

Slash Disposal Complete: YES ☐ NO ☐ Method: _____

Logging Method: _____

Slope: 0-5% ☐; 5-20% ☐; 20-40% ☐; 40%+ ☐

Rating Guide

Harvest in SMZ: YES ☐ NO ☐

Comments: _____

APPLICATION

- 5—Operation Exceeds Requirements Of Bmp
- 4—Operation Meets Requirements Of Bmp
- 3—Minor Departure From Bmp
- 2—Major Departure From Bmp
- 1—Gross Neglect Of Bmp

EFFECTIVENESS

- 5—Improved Protection Of Soil And Water Resources Over Pre-Project Condition
- 4—Adequate Protection Of Soil And Water Resources
- 3—Minor And Temporary Impacts On Soil & Water Resources
- 2—Major And Temporary Or Minor And Prolonged Impacts On Soil And Water Resources.
- 1—Major And Prolonged Impacts On Soil And Water Resources.

DEFINITIONS (BY EXAMPLE)

- Adequate—Small amount of material eroded; Material does not reach draws, channels, or floodplain.
- Minor—Erosion and delivery of material to draws but not stream.
- Major—Erosion and subsequent delivery of sediment to stream or annual floodplain.
- Temporary—Impacts lasting one year or less; no more than one runoff season.
- Prolonged—Impacts lasting more than one year.

NR – Not Reviewed NA – Not Applicable

FIELD MONITORING

Date: _____

Team Leader/Recorder: _____

Team Members Present:

☐
☐
☐
☐
☐

☐
☐
☐
☐
☐

Other Observers Present: _____

COLORADO FOREST PRACTICES REVIEW WORKSHEET

RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICABLE TO SITE (Y/N)			COMMENTS
	APPLICATION	EFFECTIVENESS		
TIMBER SALE PLANNING (Guidelines page reference*)				
<u>SANITARY GUIDELINES FOR THE CONSTRUCTION OF CAMPS</u> 1. Adequate sewer and soil waste considerations on site to protect water quality if camps are present. (*page 20)	☐			
ROADS BMPs Applicable to:				
+ New Road Construction	# Existing Roads		➤ Reconstruction	
<u>ROAD DESIGN AND LOCATION</u>				
➤+ 1. Design roads to minimum standard necessary to accommodate anticipated use and equipment. (*page 5)	☐			
➤+ 2. Minimize number & length of roads necessary. (*page 4)	☐			
# 3. Use existing roads unless aggravated erosion will be likely. (*page 4)	☐			
+ 4. Avoid long and/or steep road grades. (*page 7)	☐			
+ 5. Locations avoid high-hazard sites (i.e., wet areas and unstable slopes). (*page 5)	☐			
+ 6. Minimize number of stream crossings. (*page 6)	☐			
+ 7. Stable stream crossing sites. (*page 5)	☐			
+ 8. Locate roads to provide access to suitable log landing areas. (*page 5)	☐			
+ 9. Locate roads a safe distance from streams. (*page 5)	☐			
+ 10. Keep roads outside of Stream Management Zones. (*page 5)	☐			
<u>ROAD CONSTRUCTION / RECONSTRUCTION</u>				
➤ # 1. Construct/reconstruct only to the extent necessary to provide adequate drainage and safety. (*page 6)	☐			
+➤#2. Minimize earth moving activities when soils appear excessively wet. (*page 6)	☐			

+➤ 3.	Keep slope stabilization, erosion, sediment control work as current as possible, including "slash filter windrows". (*page 6)	☐			
+➤ 4.	Cut and fill slopes at stable angles. Slope ratio: . (*page 7)	☐			
+➤ 5.	Stabilize exposed soils (i.e., seeding, benching, mulching). (*page 7)	☐			
+➤ 6.	Avoid incorporating woody material in road fill. (*page 7)	☐			
+➤ 7.	Leave existing rooted trees and shrubs at the toe of fill slope. (*page 7)	☐			
+➤ 8.	Balance cuts and fills or use full bench construction. (*page 8)	☐			
+➤ 9.	Road base or other material from borrow pits & gravel pits minimized. (*page 8)	☐			
+➤ 10.	Excess materials placed in location that avoid entering stream. (*page 8)	☐			
+➤ 11.	Avoid excavation into groundwater. (*page 8)	☐			
+➤ 12.	Exclusion of side-casting of road material into a stream, lake, wetland or other body of water. (*page 8)	☐			
ROAD DRAINAGE					
+ 1.	Vary road grade to reduce concentrated drainage. (*page 8)	☐			
+➤# 2.	Provide adequate road surface drainage for all roads. (*page 8)	☐			
+➤ 3.	Space road drainage outlets so runoff will not exceed capacity of drainage outlets. (*page 5, 10)	☐			
+➤ 4.	For in-sloped roads, plan ditch gradients of generally greater than 2%, but no more than 8%.(*page 9)	☐			
+➤ 5.	Construct drain dips deep enough into the sub grade so that traffic will not obliterate them. (*page 9)	☐			
+➤ 6.	Install culverts at original gradient, otherwise rock armor or anchor downspouts. (*page 10)	☐			
+➤# 7.	Design all <u>relief</u> culverts with adequate length and appropriate skew. Protect inflow end from erosion. (*page 4, 10)	☐			
+➤# 8.	Provide energy dissipators at drainage structure outlets where needed. (*page 10)	☐			
+➤# 9.	Route road drainage through adequate filtration zones before entering a stream. (*page 10)	☐			

<u>ROAD MAINTENANCE</u>				
+➤# 1.	Maintain erosion control features if present. (dips, ditches and culverts functional). (*page 11)	☐		
+➤# 2.	Avoid use of roads during wet periods. (*page 11)	☐		
+➤# 3.	Grade roads only as necessary to maintain drainage. (*page 11)	☐		
# 4.	Avoid cutting the toe of cut slopes if present. (*page 11)	☐		
+➤ 5.	Exclusion of side-casting of road material into a stream. (*page 8)	☐		
+➤# 6.	Abandoned roads in condition to provide adequate drainage without further maintenance. (*page 11)	☐		
<u>STREAMSIDE MANAGEMENT ZONE DESIGNATION</u>				
1.	Adequate SMZ width identified, avg. width . (*page 12)	☐		
2.	SMZ properly marked. (*page 13)	☐		
3.	Maintain or provide sufficient ground cover. (*page 14)	☐		
4.	Equipment operation in SMZ allowed only per approved practices. (*page 14)	☐		
5.	Exclusion of pile burning in SMZ (*page 15)	☐		
6.	SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody debris). (*page 15)	☐		
7.	Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance. (*page 8)	☐		
8.	Exclusion of slash in streams, lakes or other bodies of water. (*page 15)	☐		
9.	SMZ protected during site preparation activities. (*page 14)	☐		
<u>STREAM CROSSINGS AND STREAM BANK PROTECTION</u>				
➤+ 1.	Proper permits (i.e. 404) for stream crossings obtained (if needed). (*page 25)	☐		
➤+ 2.	Cross streams at right angles, when practical. (*page 25)	☐		
➤+ 3.	Proper sizing for stream crossing structures. (*page 25)	☐		
➤+ 4.	Direct road drainage away from stream crossing site. (*page 25)	☐		
➤+ 5.	Avoid unimproved stream crossings. (*page 26)	☐		
<u>INSTALLATION OF STREAM CROSSINGS</u>				
➤+ 1.	Minimize stream channel disturbance. (*page 26)	☐		
➤+ 2.	No material placed in stream channels. (*page 26)	☐		

➤+	3.	Stream crossing culverts conform to natural streambed and slope. (*page 26)	☐			
➤+	4	Culverts placed slightly below stream grade. (*page 26)	☐			
➤+	5.	Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet). (*page 26)	☐			
➤+	6.	Minimum cover for stream crossing culverts provided. (*page 11)	☐			
+➤	7.	Stream diversions are carefully planned to minimize downstream sedimentation. (*page 2, 10, 26)	☐			
TIMBER HARVESTING, THINNING, SLASH TREATMENT AND REVEGETATION						
<u>HARVEST DESIGN</u>						
1.		Suitable logging system for topography, soil type and season of operation. (*page 16)	☐			
2.		Design and locate skid trails/primary transport network to minimize soil disturbance (*page 19)	☐			
3.		Suitable location, size, and number of Landings. (*page 19)	☐			
<u>OTHER HARVESTING ACTIVITIES</u>						
1.		Skidding operations minimize soil compaction and displacement. (*page 19)	☐			
2.		Avoid tractor skidding on unstable, wet or easily compacted soils and on slopes that exceed 40% unless not causing excessive erosion. (*page 19)	☐			
3.		Adequate drainage for landing. (*page 20)	☐			
4.		Adequate drainage for skid trails. (*page 20)	☐			
<u>SLASH TREATMENT AND SITE PREPARATION</u>						
1.		Scarify only to the extent necessary to meet resource management objective. (*page 21)	☐			
2.		Treat slash so as to preserve the surface soil horizon. (*page 21)	☐			
3.		Adequate material left to slow runoff, return soil nutrients and provide shade for seedlings. (*page 21)	☐			
4.		Activities limited to frozen or dry conditions to minimize soil compaction and displacement. (*page 21)	☐			
5.		Scarification on steep slopes in a manner that minimizes erosion. (*page 21)	☐			
<u>REFORESTATION/REVEGETATION OF DISTURBED AREAS</u>						
1.		Practices have been completed to ensure adequate revegetation in disturbed areas, if required. (*page 18,19, 21, 22)	☐			

HAZARDOUS SUBSTANCES (including CHEMICALS, FERTILIZERS, FUELS, & PESTICIDES)				
1. Know and comply with regulations governing the storage, handling, etc. of hazardous substances. (*page 23)	☐			
2. Proper sites were selected for servicing and refueling to prevent contamination of waters from accidental spills. (*page 24)	☐			
3. Pesticide materials have been properly applied and effects monitored. (*page 24)	☐			
4. Fertilizers have been properly handled and applied so as to reduce possible adverse effects on water quality. (*page 24)	☐			
FIRE MANAGEMENT				
<u>PROTECTION OF SOIL AND WATER FROM PRESCRIBED BURNING EFFECTS</u>				
1. Soil erosion is minimized. Ash, sediment, nutrients and debris are prevented from entering surface water, and SMZ is maintained. (*page 27)	☐			
<u>STABILIZATION OF FIRE SUPPRESSION RELATED WORK DAMAGE</u>				
1. Areas disturbed by fire suppression activities have been restored. (*page 27)	☐			
<u>EMERGENCY REHABILITATION OF WATERSHEDS IMPACTED BY WILDFIRES</u>				
1. Corrective measures have been applied to minimize soil loss, deterioration of water quality, and threats to life and property, both on-site and off-site. (*page 27)	☐			

ADDITIONAL COMMENTS: (include significant weather events since the harvest if known)

HEALTHY FORESTS START HERE



OUR MISSION

To achieve stewardship of Colorado's diverse forest environments
for the benefit of present and future generations



.....
Colorado State University
5060 Campus Delivery
Fort Collins, CO 80523-5060
(970) 491-6303
csfs.colostate.edu



WARNER COLLEGE
OF NATURAL RESOURCES
COLORADO STATE UNIVERSITY

.....
Colorado State University
1401 Campus Delivery
Fort Collins, CO 80523-1401
(970) 491-6675
warnercnr.colostate.edu

In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age or disability. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.
04202250