Indiana DNR Division of Forestry

State Forest Properties

3rd Party Audit

Forestry Best Management Practices Monitoring Results

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3rd Party Audit State Forest BMP Report

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I. Executive Summary

Forestry BMP monitoring, as an internal audit by Division of Forestry personnel of all timber harvests on State Forest Properties began on November 1, 2000. The timber harvests being monitored were sold starting July 1, 1999 when Forestry BMPs were included on the timber sale contract and enforced, even though they had been commonly practiced before that date. The Statewide Forestry BMP program had conducted 4 rounds of monitoring before this time in which state properties had been monitored by monitoring teams that included DoF personnel as well as private and industry people interested in forestry in the state.

It was determined in early 2006 that an external or 3rd Party audit of BMP monitoring be conducted every year in perpetuity to insure the Division of Forestry's internal audits are accurate and true. Ten percent of sites monitored in a year are to be reviewed. Sites monitored in 2005 and 2006 were included in this audit, which took place in July 2007. Three sites monitored in each of the two years were randomly chosen for audit. The comparisons being made throughout this report are for the 6 sites that the external auditing monitored for BMPs, unless otherwise stated.

The overall BMP application rates for the 6 sites monitored by state employees was 91.52% and the overall BMP application rates as determined by the 3rd Party auditors at those same sites was 91.51% (Figure 1a). Of the six sites included in this comparison study the state monitors found there were only minor departures in BMP application 8.48% of the time, or 24 instances (Figure 2a). The 3rd Party auditors found minor departures in application 7.72% of the time, or 20 instances, and only a 0.77% major departure of BMP application, 2 instances (Figure 2b).

The overall BMP effectiveness rates for sites monitored by state employees was 97.16% and the effectiveness scores from the 3rd Party audit was 98.46% (Figure1b). State monitors found 8 departures in effectiveness. Three of the departures (1.06%) were determined to have an indirect and temporary impact, 2 departures (0.71%) had an indirect and prolonged effect (Figure 3a). One (0.35%) direct and temporary impact to soil and water quality was found, while 2 departures (0.71%) were determined by state BMP monitors to have a direct and prolonged impact (Figure 3a). Third party monitors only found four departures in BMP effectiveness; 2 (0.77%) were determined to have an indirect and temporary effect on soil and water resources of the sites and 1(0.38%) had an indirect and prolonged impact and the other (0.38%) had a direct, temporary impact (Figure 3b).

The overall rates of the internal monitoring for forestry BMPs on state forests since 1996 are 88.8% application and 94.8% effectiveness in protecting the soil and water quality of the 161 sites internally monitored (Figures 1a & b). This means that 88.8% of the practices were applied as directed in the BMP guidelines, and another 10.8% were departures that were classified as minor departures as defined in the monitoring sheet (Appendix B). There have only been 26 major departures and they add up to only 0.37% of all practices monitored.

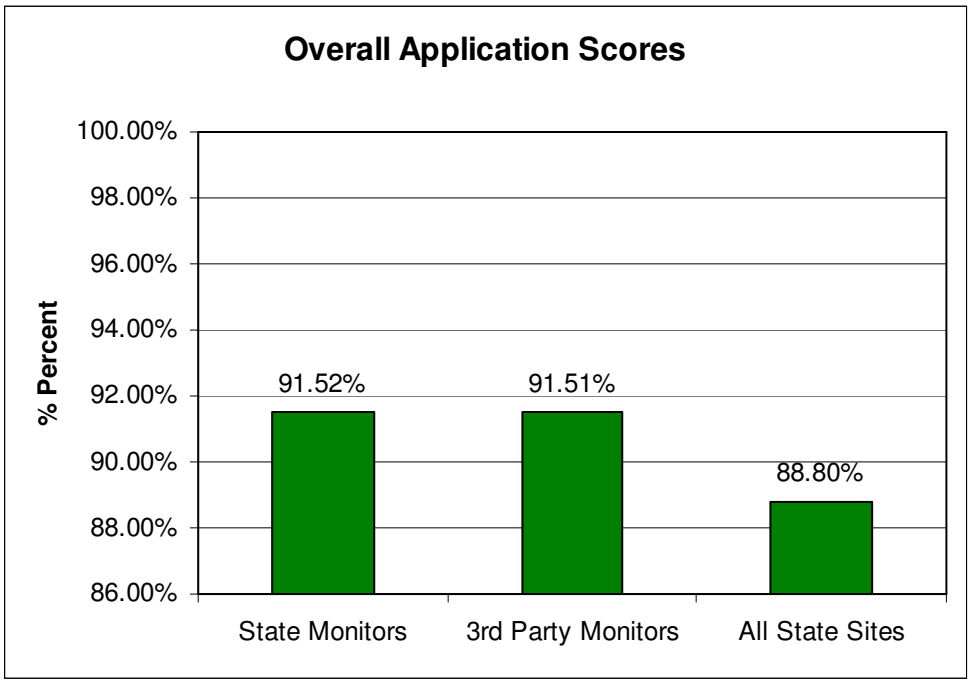

Figure 1a. Overall BMP application scores for the 6 sites monitored by both state and 3rd party groups compared to the overall application score for the 161 state forest harvest sites monitored for BMPs from 1996 to 2006.

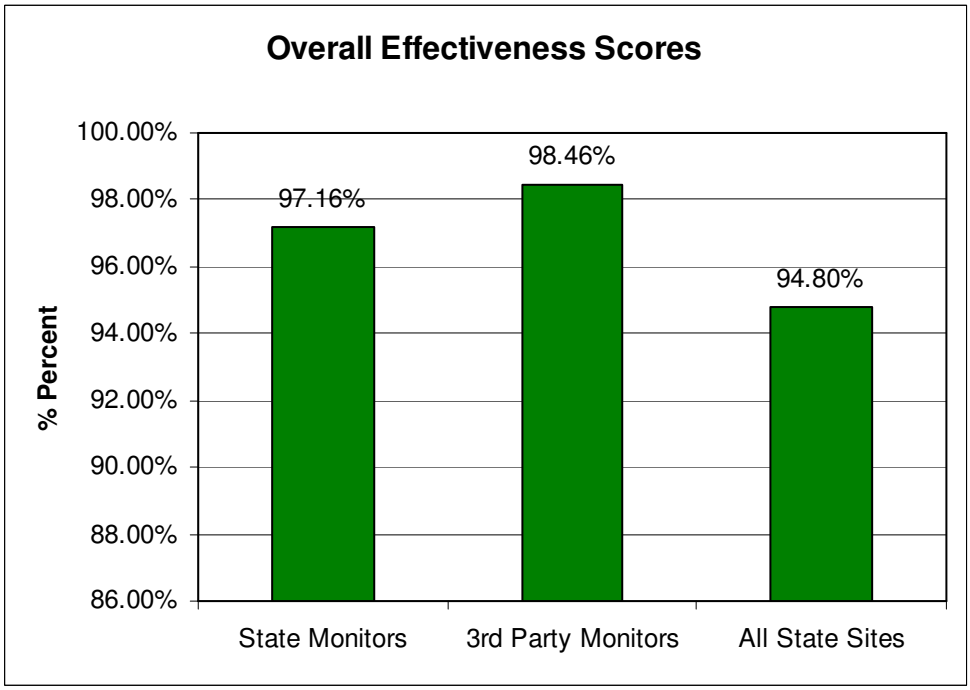

Figure 1b. Overall BMP effectiveness scores for the 6 sites monitored by both state and 3rd party groups compared to the overall effectiveness score for the 161 state forest harvest sites monitored for BMPs from 1996 to 2006.

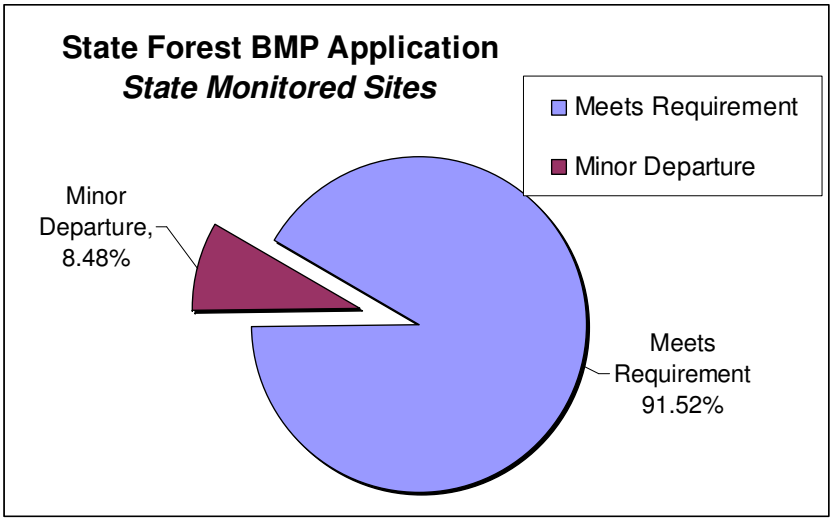

Figure 2a. State Forest BMP application percentages for the 6 sites monitored by state personnel.

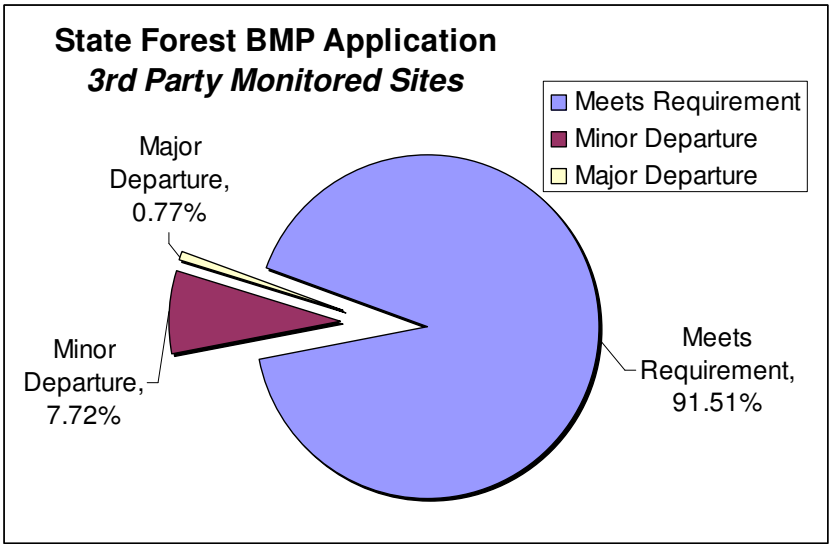

Figure 2b. State forest BMP application percentages for the 6 sites monitored by the 2007 3rd Party Audit Team.

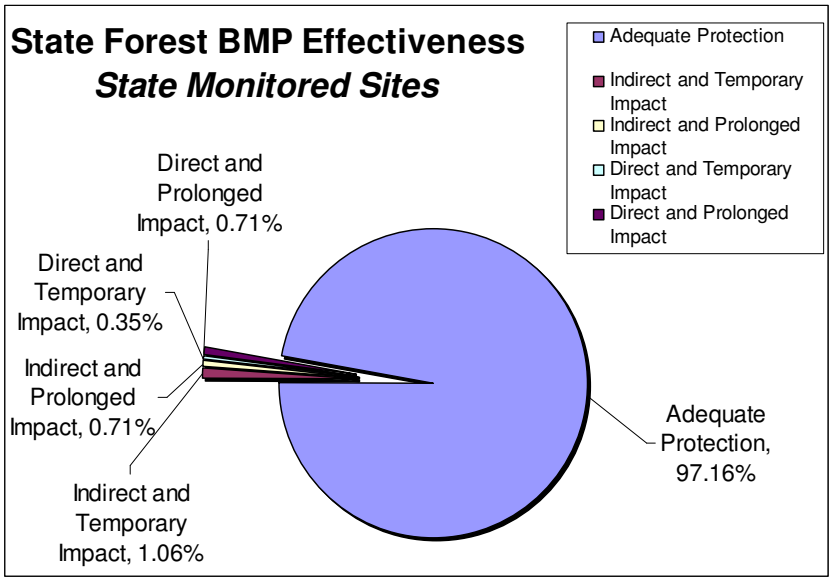

Figure 3a: State Forest BMP effectiveness percentages for the 6 sites monitored by state personnel.

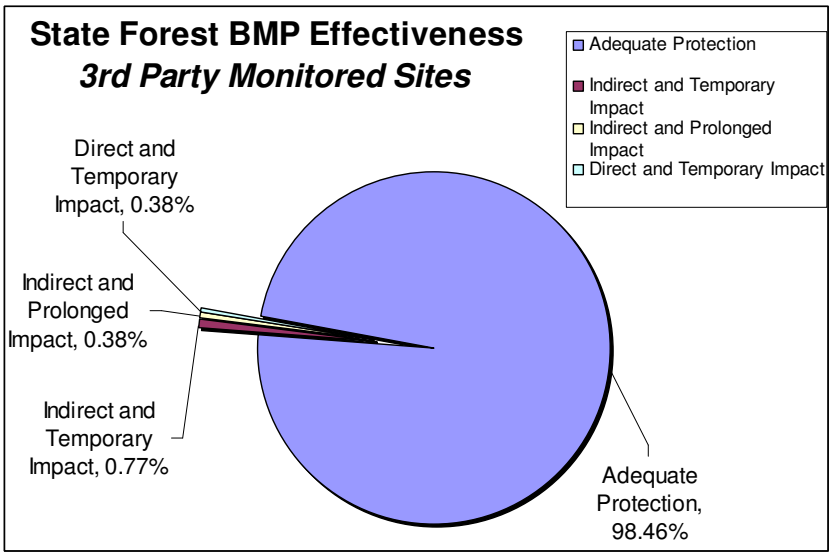

Figure 3b: State forest BMP effectiveness percentages for the 6 sites monitored by the 2007 3rd Party Audit Team.

II. Acknowledgements

The Division of Forestry would like to thank all of those individuals and organizations that took part in this BMP monitoring audit. Thanks to Richard Langdon for taking time from his small business; to Barbara Wilhoit for the time and effort, and Foley Hardwoods for allowing her to participate; and to Barry Wilson and The Nature Conservancy for their involvement. The time and understanding that went into getting this project "off the ground" was immense, not to mention the effort in carrying this monitoring forward through 4 days in the heat and humidity of this summer. Thank you all.

III. Introduction

Indiana contains 4.5 million acres of forestland that provides many benefits to all of Indiana's people and wildlife. The State Forest system owns only 3.3% or 149,553 acres of Indiana's forestland. However, this land is important to many Hoosiers who frequently use state forest properties for various forms of recreation including; hiking, biking, hunting, fishing and wildlife watching. Since state forest lands are important to the public, it is imperative that harvesting carried out on the state forests is done in a way that reduces environmental impacts as much as possible. Although forests are known to be the best way to reduce nonpoint source pollution (NPS) to waterways, they can also be a source of pollutants. When forest soils are bared there is opportunity for NPS pollution to occur. Forestry Best Management Practices (BMPs) are the practices that are employed to reduce and or eliminate any impacts that harvesting can have upon forest soils and water quality.

Forestry BMPs are a foundation for water quality protection and are guidelines for protecting water quality during forest operations. The purpose of BMPs is to minimize the impact of forest activities that may affect soil and water quality. This report is a comparison of BMP monitoring results from Division of Forestry employees and a 3rd party monitoring group at the same 6 sites. The intent of this effort is to determine if there is consistency between the internal and external monitors in order to ensure the public that the state forest lands are being adequately managed to reduce soil and water impacts during and following timber harvests.

From July 1999 to winter 2003, BMP monitoring on state forests was conducted with the Watershed Conservation (WC) Forester and/or the License Timber Buyer (LTB) Forester from the Special Programs Section of the Division of Forestry, the Administering Forester of the timber harvest being monitored, an Administering Forester from another property, and the Property Specialist that administered the timber harvest program. The Property Specialist stopped coordinating the monitoring as well as participating in the monitoring of sites late in 2003. In October 2004, the Division of Forestry started to change the monitoring system to a sampling method, but was transitioning the system when a change in leadership halted the monitoring until new leadership was put in place, at which time we moved back to 100% monitoring. At the present time, we are monitoring 100% of the timber harvests after they are completed, but the monitoring team consists of the LTB, and the Administering Forester of the timber harvest being monitored.

The 3rd party audit needed to cover at least 10% of the sites that were monitored through our regular process in the years 2005 and 2006, which was determined to be 3 sites from each year. The site selection process is described in Site Selection. The basic data on the front page of the monitoring sheet such as the location and time of the harvest, minus data that could bias the monitoring of the group such as the logger and forester, was given to the monitoring team and they monitored the sites with the method described in the Monitoring Process. The Division's LTB Forester coordinated the efforts of the 3rd Party Auditing Team and the Division's Property personnel were not informed of the sites or locations where the monitoring was to be held.

BMP Monitoring is a site evaluation based on the Indiana Logging and Forestry Best Management Practices: BMP Field Guide (BMP Field Guide) and Indiana's Forestry BMP Monitoring Worksheet. 58 BMP specifications are evaluated under the 5 forestry operation categories: 1) Forest access roads, 2) Log landings, 3) Skid trails, 4) Stream crossings, and 5) Riparian management zones. Each BMP specification is rated for application of the BMP and the effectiveness in protecting the water quality. Seven general questions are posed on the evaluation dealing with the root of the noted failures and successes, and records other land uses on the site that could affect water quality.

IV. Methods

A. 3rd Party BMP Monitoring Objectives

The objectives of BMP monitoring are: 1) to assess the effectiveness of the BMP guidelines in minimizing soil erosion and stream sedimentation, 2) provide information on the extent of BMP implementation, past and current, 3) identify areas to focus future program training and educational efforts to improve BMP implementation and effectiveness, 4) identify BMP specifications which may need technical modification, 5) identify improvements needed in future monitoring efforts, and 6) determine if internal monitoring is being implemented and reported in a consistent, truthful, and environmentally significant way.

B. Monitoring Team Selection

For State Forest Properties, we first try to have the WC and LTB foresters come to every BMP monitoring, however there have been many sites in which one or the other was absent for either personal or professional reasons, but the monitoring continued, which kept a good balance for consistency in the monitoring and results without the monitoring falling behind.

The other participants would be the Administering Forester and an Administering Forester from another property, which balanced the team for input in the site evaluation of monitoring process and provide good training and discussion.

From July 1999 until 2003, the coordination of monitoring dates and people was carried out by the Property Specialist who would also attend the monitoring of every timber

harvest, but this practice discontinued when administrative duties increased for that position and the coordination of the monitoring was passed to the WC forester.

The 3rd party needed to have at least 3 people that could take the time to visit the six sites together. The team represented an array of interested parties from outside state government. Richard Langdon, a private landowner, has participated in the BMP monitoring program since its inception in 1997. Barry Wilson is a forester from The Nature Conservancy, with no past BMP monitoring experience. Barbara Wilhoit is a forester for Foley Hardwoods who has participated in BMP monitoring in past rounds.

C. Site Selection

It was determined that 10% of sites monitored in 2005 and 2006 would be remonitored for quality control purposes. Sites were given numbers then numbers were chosen randomly. Three sites originally monitored in 2005 were chosen for the audit to fulfill the 10% audit requirement. Three more sites were chosen from the sites originally monitored in 2006. All 6 sites were monitored over a 2 week period.

The 3 sites randomly chosen for this audit from those monitored internally in 2005 were Clark State Forest Compartment 18 Tracts 2 and 6 (C18T2+6); Yellowwood State Forest C14T6; and Owen State Forest C9T1.

The 3 sites chosen for this audit from those monitored internally in 2006 were Clark State Forest C5T7; Jackson-Washington State Forest C1T2; and Morgan-Monroe State Forest C18T7.

D. Monitoring Process

BMP monitoring is based on the evaluation of each specific practice for application and effectiveness. Application is the installation of a practice and the condition of the practice at the time of monitoring. Effectiveness is the level of success a practice has in the prevention of pollutants entering a water body or the level of impact the pollutant is having on the water body at the time of monitoring. It is possible to apply all of the BMPs properly and get a good score in application, but still have soil entering a stream, which would call for a lower score in effectiveness, and the opposite may be possible as well.

The monitoring on state forest properties follows the same format as all other forestry BMP monitoring in Indiana except that the team of monitors is made up of people from similar backgrounds. On any monitoring day, the team meets at the forest office and then goes to the field to conduct the BMP monitoring on a harvest that is already completed and closed. The team will walk each part of the harvest area covering all of the access roads, inspecting the log landings, skid trails, riparian management zones, and stream crossings as suggested in the Indiana BMP Monitoring Protocol, and comment on successes and departures from the BMP guidelines. Also, the WC or the LTB forester will walk all of the intermittent or larger streams in or adjacent to the timber harvest area.

Once on the site the state forest monitoring team will walk the area and its adjacent and interior intermittent or larger streams carrying maps of the site, the BMP monitoring form and the BMP Field Guide. This time allows each team member to evaluate the BMPs on the site for themselves. Once they have walked most of the area, the team will come together at the vehicle or other gathering place and discuss each question on the BMP monitoring form until they reach consensus. This process was also followed by the 3rd party audit team.

On state forest properties, the definition of intermittent streams is focused on streams that are 4 feet in width at the bed of the stream or marked as mapped intermittent streams on USGS quadrangle maps. This is done to more easily determine what streams would need to be monitored for stream crossings and what streams needed to have large woody debris, caused by the harvest, removed. A better history and definition for streams that qualified as 4 feet is in Appendix A of this report.

V. Results

A. Overall application and effectiveness

State monitors and 3rd party auditors were in accord on the overall application of forestry BMPs with rates of 91.52% and 91.51% respectively (Figure 1a). State BMP monitors found 24 (8.48%) minor departures in BMP application (Figure 2a). Third party monitors found 20 (7.72%) minor departures and 2 (0.77%) major departures in application (Figure 2b). The 2 major departures were for lack of traffic barriers on an access road and excavated material in an ephemeral channel.

BMP effectiveness between the two groups was not as close as application but still had minimal deviation. State employees scored the BMPs as having a 97.16% overall effectiveness and the 3rd party group scored overall effectiveness as 98.46% (Figure 1b). The state monitors scored the effectiveness of the BMPs audited 1.3% lower than did the 3rd party auditors.

B. BMPs by Category

1. Access roads

Access roads were considered to be implemented correctly 93.3% of the time by the state monitors while the 3rd Party Auditors determined they were applied correctly 96.5% of the time. State monitors determined that the BMPs in place were 97.8% effective in protecting the soil and water resources of the site. Third Party auditors rated the access road BMPs as 98.8% effective.

Table 1: Application and effectiveness of BMP specifications for access roads.

Access Roads	% Application State Monitored	% Application 3rd Party Monitored	% Effective State Monitored	% Effective 3rd Party Monitored
A1. Uses existing routes where appropriate	100	100	100	100
A2. Adequate buffer strip next to watercourses and sensitive areas	83.3	100	100	100
A3. Avoids unstable gullies, seeps, very poorly drained areas	100	100	100	100
A4. Road grades are within standards	100	100	100	100
A5. Amount of roads minimized	100	100	100	100
A6. Stream crossings minimized	100	100	100	100
A7. Road excavation minimized	100	100	100	100
A8. Excavated and fill materials placed properly	100	100	100	100
A9. Roads constructed to drain well	66.7	83.3	100	100
A10. Appropriate road stabilization, drainage and diversions installed	100	100	100	100
A11. Water diversions functioning properly	83.3	100	83.3	100
A12. Runoff diverted onto stable forest floor areas	83.3	80	83.3	100
A13. Public road drainage system maintained	100	100	100	83.3
A14. Public road's drainage maintained	100	100	100	100
A15. Traffic barriers installed	83.3	83.3	100	100
Overall Access Road	**93.3**	**96.5**	**97.8**	**98.8**

Both parties were in agreement that the access roads could have been constructed to drain better, state monitors giving a 66.7% application rate in this area and 3rd Party monitors scoring 83.3%. However, both parties felt that this departure in application had no negative effect on soil and water quality. The 3rd Party group gave a major application departure to one site for the lack of a traffic barrier. No negative effects to the soil and water resources of the site were detected due to this departure. Access roads are often permanent fire trails or other road that are used and maintained to varying degrees, thus some are more structurally stable while others have had the diversions worn down by use over long periods.

2. Log Landings

State monitors found the overall Log Landing BMP application to be 91.7% and 3rd Party monitors scored this category 93.3% application rate. Both parties determined that all BMPs were 100% effective in protecting soil and water resources of the sites.

Table 2: Application and effectiveness of the BMP specifications for log landings.

Log Landings	% Application State Monitored	% Application 3rd Party Monitored	% Effective State Monitored	% Effective 3rd Party Monitored
Y1. Suitable number and size of landings	100	100	100	100
Y2. Landings located outside RMZ	100	100	100	100
Y3. Landings located on stable areas	83.3	100	100	100
Y4. Excavation of site minimized	100	100	100	100
Y5. Landings avoid concentrating or collecting runoff	66.7	100	100	100
Y6. Landing's runoff enters stable area	83.3	66.7	100	100
Y7. Proper water diversions in working order	100	83.3	100	100
Y8. Landing smoothed and soil stabilized	100	83.3	100	100
Y9. Landings free of fuel and lubricant spills and litter	83.3	100	100	100
Y10. Landing location suitable for equipment fueling and maintenance	100	100	100	100
Overall Log Landings	**91.7**	**93.3**	**100**	**100**

The state monitors saw problems in two sites with landings collecting runoff. The 3rd Party monitors did not see this problem and gave a 100% rating to this specification. The explanation for this is probably due to the very dry conditions in 2007, thus little to no standing water was seen in the landing areas. Landing runoff entering stable areas had a deviation between monitoring groups on application score; state only recorded 1 of these sites having problems while the 3rd party group recorded 2 sites having this issue. All application departures showed no impact on the water resources of the sites as there was 100% compliance with BMP effectiveness specifications.

3. Skid Trails

State monitors found skid trail BMP effectiveness to be 84.8% while 3rd party monitors found it to be 82.8%. The state monitors recorded 93.2% effectiveness of BMPs in this category and the 3rd party group determined skid trail BMPs to be 100% effective in maintaining soil and water integrity.

Table 3: Application and effectiveness of BMP specifications for skid trails.

Skid Trails	% Application State Monitored	% Application 3rd Party Monitored	% Effective State Monitored	% Effective 3rd Party Monitored
S1. Uses existing routes were appropriate	100	100	100	100
S2. Adequate buffer strip next to water courses and sensitive areas	100	66.7	100	100
S3. Avoids steep and long straight grades (>20% for >200')	80	100	100	100
S4. Avoids unstable gullies, seeps, poorly drained areas	83.3	83.3	100	100
S5. Amount of skid trails minimized	83.3	66.7	100	100
S6. Trail excavation minimized	100	100	100	100
S7. Appropriate drainage and diversions installed	83.3	66.7	83.3	100
S8. Water diversions in working order	83.3	50	83.3	100
S9. Runoff diverted onto stable forest floor areas	66.7	100	83.3	100
S10. Streams not used as skid trails (except for crossings)	66.7	100	83.3	100
Overall Skid Trail	**84.8**	**82.8**	**93.2**	**100**

Third party monitors determined that 2 sites didn't have adequate buffers next to streams and other sensitive areas. State monitors, however, scored 100% application compliance in this area. Other specifications were comparably scored except for the last 2 where the state monitors determined that two sites were deficient in BMP application. These same site's BMPs were given a 100% application rate by the 3rd party monitors.

4. Stream Crossings

State monitors found 100% Stream crossing BMP application for the 3 sites with a crossing. Third party monitors gave a 96.4% BMP application rate to the 3 sites. Both groups determined that there was no negative effect upon the soil and water resources of the sites and thus gave a 100% BMP effectiveness rate.

Table 4: Application and effectiveness of BMP specifications for stream crossings.

Stream Crossing	% Application State Monitored	% Application 3rd Party Monitored	% Effective State Monitored	% Effective 3rd Party Monitored
X1. Number of crossings minimized	100	100	100	100
X2. Crossings minimize disturbance to the natural bed and banks	100	66.7	100	100
X3. Streambank approaches properly designed and stabilized	100	100	100	100
X4. Water runoff diverted from road prior to crossing	100	100	100	100
X5. Crossing as close to 90 degrees as practicable	100	100	100	100
X6. Crossing does not unduly restrict water flow	100	100	100	100
X7. Soil has not been used as fill in the stream (except culverts)	100	100	100	100
X8. Ford constructed of non erosive materials	100	100	100	100
X9. Fords have stable banks and streambeds	100	100	100	100
X10. Culverts are properly sized and installed	100	100	100	100
X11. Culverts clear of significant flow obstructions	100	100	100	100
X12. Temporary structures properly anchored	100	100	100	100
X13. Temporary structures and resulting obstructions removed	100	100	100	100
Stream Crossing	**100**	**96.4**	**100**	**100**

There was only one departure in application and effectiveness for all the specifications in this category. This was a minor departure of the crossing minimizing disturbance to the natural bed and banks as determined by the 3rd party group. They determined that this departure had no negative effect upon the soil and water resources of the site.

Since stream crossings deal directly with intermittent streams, that is defined on state properties as 4' or wider streams, often state properties have stream crossings where many other property ownership types in the past would have been classified as ephemeral crossings.

5. Riparian Management Zones

State monitors gave RMZ BMP application a rating of 91.3, while the 3rd Party monitors gave a rating of 85.7%. RMZ effectiveness was given a 95.7% by state monitors and an 89.3% from 3rd party auditors. This is the only category where the 3rd party group gave a somewhat lower overall score in application and effectiveness than the state group.

Table 5: Application and effectiveness of BMP specifications for Riparian Management Zones.

Riparian Management Zones	% Application State Monitored	% Application 3rd Party Monitored	% Effective State Monitored	% Effective 3rd Party Monitored
Z2. Perennial & large intermittent streams clear of obstructing debris	60	75	60	75
Z3. Tree tops and cutoffs placed back from water course to prevent movement into streams during floods	100	100	100	100
Z4. RMZ free of excavated material & debris (other than above)	100	100	100	100
Z5. Less than 10% bare mineral soil exposed within RMZ (not including crossings)	100	100	100	100
Z6. Adequate tree stocking in primary RMZ next to perennial streams	N/A	N/A	N/A	N/A
Z7. RMZ free of roads and landings (except crossing)	60	75	100	100
Z8. Water diverted from roads before entering RMZ	100	100	100	100
Z9. Water diverted onto stable areas of the forest floor	100	100	100	100
Z10. Road and trail surfaces stabilized as needed within RMZ	100	100	100	100
Z11. Ephemeral channels free of excavated material	100	60	100	60
Riparian Management Zones	**91.3**	**85.7**	**95.7**	**89.3**

Interestingly, there was a discrepancy between groups as to the existence of a RMZ on one site. The 3rd party showed no RMZ on one site where the state group determined there was one present. Obstructing debris in perennial and large intermittent streams was considered a problem at one site by both groups. State monitors gave a 60% in application and effectiveness for this specification while the 3rd party monitors scored it at 75% for application and effectiveness. Both groups determined that there were landings and roads that were in the RMZ, but also showed no detrimental effects to the soil and water quality of the sites affected. There was divergence between the two groups on excavated material in the ephemeral channels. The 3rd party auditors scored the application and effectiveness in this area as 60% while the state monitors gave application and effectiveness a rating of 100%. This was due to a salvage harvest that happened on the same site between the State's internal monitoring (December 6, 2006) and the 3rd party audit (July 10, 2007). This is also the site that was given the major departure for excavated material in the ephemeral channel by the 3rd Party monitors. The State's internal audit of the salvage harvest will occur in 2007.

6. Overall Site Ratings

At the conclusion of each site evaluation monitors are asked to give a rating of the application and effectiveness of BMPs at the site. Ratings for application and effectiveness can range from 1 to 4. Monitors are welcome to use integers or nonintegers. Ratings for application of BMPs are as follows; 1= above average, 2= average, 3= poor, 4= total negligence. Ratings for effectiveness or overall impact to water quality are as follows; 1= no visible impact, 2= slight impact, 3= moderate impact, 4= severe impact. The ratings given by each monitor are then averaged to give an overall application and

effectiveness rating for each site. The overall ratings for application and effectiveness are then summed and divided by two to determine the overall site rating (Table 6). It is important to note that these numbers do not necessarily directly reflect the worksheet ratings for application and effectiveness. This rating is a general impression of each monitor of the overall BMP application and effectiveness of the site.

Table 6: Average ratings given to 6 sites audited by state and 3rd party monitors.

	Ave. Application Rating	Ave. Effectiveness Rating	Ave. Overall Site Rating
State Monitored Sites	1.43	1.57	1.5
3rd Party Monitored Sites	1.36	1.14	1.25

VI. Discussion

Overall BMP ratings for the 6 randomly selected sites were mostly congruent between the state and 3rd party monitors. State monitors determined that application rates to be 91.52% and 3rd party monitors scored BMP application at 91.51%, a difference of only 0.01%. The gap between the two groups on effectiveness scores was a bit larger at 1.3%, with the 3rd party group giving the BMPs a better rating than did the state monitors with ratings of 98.46% and 97.16% respectively. The lower application rating for each monitoring group corresponds to higher effectiveness rates, showing that usually where there are departures in application there is little negative effect to the soil and water resources of the site.

Access roads application and effectiveness scores are high between both groups. The 3rd party group scored these this category higher than did the state group. State employees score application and effectiveness for access roads at 93.3% and 97.8% respectively. The auditing group scored these at 96.5% and 98.8%.

Log landings also had a high application and effectiveness rate. State monitors gave this category a 91.7% and the 3rd party monitors gave it a 93.3%. Both monitoring groups determined that log landing BMP for the 6 sites were 100% effective at protecting the soil and water resources of the site.

Skid trails have a somewhat lower application score that the other categories. State monitors determined that skid trail BMPs were correctly applied 84.8% of the time. Third party monitors determined the application rate to be 82.8%. Skid trails can have a spectrum of disturbance levels depending on the amount of times the equipment drives over a particular point on the ground. For instance, the main trail just off the landing would have a higher disturbance level because all of the harvested logs have to be moved to the landing, where an area that is traveled over only twice, once to get to access logs and the other pulling the logs out, has a much lower level of disturbance. Also, skid trails go to areas that other equipment cannot access, so it may cross drainages, travel down or across hill slopes, or go into areas that are wet most of the time, therefore, most of the application and effectiveness issues of a site are from skid trails. Also, most of the closeout practices are put in place with limited space as landforms and adjacent vegetation will often limit the equipment's ability to place structures where they would be most effective, which causes

minor departures with little to no effect on water quality. The good news is that even with the relatively low applications scores on skid trials that the effectiveness remained high. At these 6 sites the departures in application had little negative effect upon the resources of the site. State monitors gave the skid trail BMPs a 93.2% effectiveness rate and the 3rd party monitors gave a 100%.

Stream crossings are the BMP category that must be handled with much care as any departures in this area could lead to pollution being directly deposited into a water body. Of the six sites chosen for this comparison study, only three had stream crossings. The stream crossings at all of these sites there was only one departure in application and effectiveness. The 3rd party group determined that there was a minor departure in the crossing minimizing the disturbance to the natural bed and stream banks. All other BMPs were determined to be applied correctly and performing as expected.

Riparian Management Zone BMP departures can also have a direct negative impact upon the water bodies of a site. There seemed to be less consistency between the two groups on this category. The 3rd party group scored application and effectiveness of RMZ BMPs lower than did the state with an 85.7% application and 89.3% effectiveness rating. The state monitors scored RMZ application at 91.3% while the effectiveness rate was 95.7%. Part of this discrepancy between groups could be explained by a misunderstanding of the definition of what a riparian management zone is. The state group determined that one site had a RMZ while the 3rd party group did not recognize this area as having a RMZ. More of this divergence could also be explained by the salvage harvest activity that occurred on one site between the state and 3rd party monitoring.

VII. Recommendations

- Concentrate on areas where problems are more common, such as skid trails, RMZs, and stream crossings.
- Continue to emphasize importance of diverting water before it concentrates on roads, landings, skid trails and enters streams and RMZs.
- Continue providing BMP educational information and programs for loggers and resource professionals that work on state properties. If there is an area of concern on state properties, focus training on that area.

VIII. Conclusions

The Indiana Forestry BMP Guidelines are scrutinized and enforced on state forest properties more than any other general landowner category in the state of Indiana. When the internal inspections began, the application scores actually dropped due to the standards on the state forest properties being raised by things like the 4' rule. However, effectiveness in protecting water quality, which is the main goal of Indiana's Forestry BMPs, has always been high and continues at the time of this report. The consistency between the state and 3rd party monitors confirms that the division is both implementing and monitoring State Forest BMPs in an acceptable and reliable manner.

Our state forest system has a diverse usage. It is the responsibility of the Division of Forestry to ensure that all of the forest users have a minimal impact upon the other resources of the forests. Forestry BMPs are the means by which soil erosion from harvesting areas is minimized. Minimal soil erosion allows for quick recovery of the site because the topsoil is still in place to allow for natural succession to take place. Limited sedimentation to the water resources of the forest protects or restores water quality.

Appendix A

BMP Definition Clarification – Four Foot Rule

Background

The BMP Field Guide states "Remove felled tops and logging debris from the channels of perennial and large intermittent streams." On the BMP Monitor Sheet (expanded) the definition of the streams was further defined as "…wider than 6'…" The purpose of this was to identify a specified width **for monitoring purposes**, rather than leaving a vague descriptive term (e.g. large intermittent). It should be realized that BMPs are guidelines and in some instances even a 6 foot width may not be "large" and other situations where more narrow streams may be large from a hydrological standpoint. Foresters therefore are expected to interpret the local hydrology and make on-site determinations when applying BMPs. This is clearly true for this BMP standard.

At the start of BMP monitoring on State Forests it was decided to try to adhere to a tighter standard for streams on State Forests- hence the 4 foot standard for large intermittent streams. This would serve both as a demonstration of commitment to water quality, and as a demonstration and test of a tighter standard.

Variable stream width cropped up as a problem early in this process, requiring clarification of stream width. Streams would widen out over four feet then narrow back up to less than four feet. This created a burden of trying to find the last point upstream that a stream was four feet wide. To solve this, it was decided that to meet the four-foot rule, a stream had to be consistently four wide or wider. This solved some of the concerns, but there are still concerns such as what debris needs to be removed and where is a stream consistently four wide or wider.

Below is the latest attempt to clarify the four-foot rule. This covers both the definition of the stream and what debris is to be removed.

Removing Logging Debris from Streams – Four Foot Rule

To meet the BMP Field Guide guidelines for riparian zones that states "Remove felled tops and logging debris from the channels of perennial and large intermittent streams", the BMP Monitor Sheet has Item Z2 "Perennial & large intermittent streams clear of obstructing debris." On state forests, all streams that are to meet this standard will have a clearly defined bed with a width that equals or exceeds four feet.

The bed is that portion of the stream that is the lowest level where water commonly flows at typical (not storm) levels. This will generally be at the base of the banks and will usually consist of aggregate or exposed alluvium. The bed will generally be free of any significant vegetation because of the regular scouring and water flows. An area with a strong, well-rooted vegetative component with a relatively stable soil surface will not be considered streambed. In streams where the channel is strewn with large rocks, the bed will be the area of smaller gravel at the base of the large rocks.

The stream will be considered four feet or wider until the bed, moving upstream, reaches the first point where the stream bed width drops below four feet for a lineal distance of 10 feet or more. Any portion of the drainage system up stream of this point will not be subject to the debris removal guidelines for large intermittent streams, and debris left in these portions of the drainage will not be considered a departure during monitoring.

Downstream of the identified four foot wide point all logging debris, except as noted below, that will come in contact with the water when the stream is "bank full", and impede or divert stream flow, must be removed from the stream channel. Unattached, individual pieces of debris, less than two inches in diameter or less than four feet in length will not ordinarily impede flow and do not need to be removed. Debris that bridges the stream channel from top of bank to top of bank, does not impede flow, and is unlikely to fall into the stream channel within one year is not required to be removed. Debris less than 2 inches in diameter obstructing less than 20% of the stream channel does not need to be removed.

Debris removal is to be accomplished in a manner that will minimize disturbance to the stream banks. The recommended method of removal is to pull the material free of the channel using a cable skidder or other equipment which is kept back from the stream edges. Another option is cut debris into smaller pieces that can be removed from the channel or that would no longer impede flow. Equipment should not be used in the stream channel to push the material out of the channel. Careful marking of the trees to be harvested, use of directional felling, and clearly explaining the BMP requirements during the pre-harvest conference will minimize the amount of debris that must be removed from stream channels.

The point where the stream channel reaches the four-foot width threshold should be clearly delineated in harvest areas. While upstream of this point will not be considered subject to debris removal from streams, care should be taken to avoid excessive, intentional deposition of debris in all naturally occurring drainage features regardless of size. Excessive piling (beyond felling) of debris in any drainage that severely impedes flow may be considered a departure.

Appendix B

FORESTRY BMP MONITORING WORKSHEET

(2000)

DATE INSPECTED:_____TEAM:_____
OWNER:_____ PHONE:_____.
_____
_____

COUNTY:_____Site #:_____ ACRES HARVESTED:_____
CIVIL TWP:_____ USGS QUAD:_____
SEC:_____TWP:_____ RANGE:_____
MAJOR WATERSHED:_____
DATE OF ACTIVITY:_____
HARVEST EQUIPMENT USED: Dozer:__ Skidder:__ Horses:__ Other:__
TYPE OF HARVEST: Diameter limit:__ Single Tree:__ Group Selection:__ Clear Cut:__ Other:__

SITE CONDITIONS

TERRAIN: BOTTOMLAND_____% RIDGES_____% SIDE SLOPES_____%
SLOPE STEEPNESS: (2-6%)_____ (6-12%)_____ (12-20%)_____ (20+%)_____
LAKES PRESENT: name:_____shore length:_____
PERENNIAL STREAMS PRESENT: name:_____width:_____length:_____
SINKHOLES PRESENT: Yes_____ No_____ FLOWING SPRINGS PRESENT: Yes_____ No_____
OPEN WATER WETLANDS PRESENT: Yes_____ No_____ .

FOR OFFICE USE – DO NOT COMPLETE

OPERATOR/FORESTER: (leave blank)_____

TYPE OF OWNERSHIP: nipf:__ clf:__ industry:__ state:__ fed:__ county:__ other:__

APPLICATION	EFFECTIVENESS
0--The Practice Not Needed or Applied on Site	**1--Adequate Protection of Water Resources.**
1--Operation Meets Requirement of Bmp	**2--Indirect and Temporary Impacts on Water Resources.**
2--Minor Departure from Bmp	**3--Indirect and Prolonged Impacts on Water Resources.**
3--Major Departure from Bmp	**4--Direct and Temporary Impacts on Water Resources.**
4--Gross Neglect of Bmp	**5--Direct and Prolonged Impacts on Water Resources.**

APPLICATION DEFINITIONS (BY EXAMPLE)

MINOR DEPARTURE: Practice not clearly needed; attempted practice but poorly applied; small potential for soil to reach streams.
MAJOR DEPARTURE: Practice clearly needed; common departures from practice; large potential for soil to reach streams.
GROSS NEGLECT: No attempt at application; total disregard for water quality; large and direct impacts.

EFFECTIVENESS DEFINITIONS (BY EXAMPLE)

ADEQUATE: Small amount of material eroded; material does not reach drainages, streams, lakes or sinkhole openings.
INDIRECT IMPACT: Erosion and delivery of material to drainages (including ephemerals) but not to intermittent or perennial streams, lakes or sinkhole openings.
DIRECT IMPACT: Erosion and subsequent delivery of sediment to intermittent or perennial streams, lakes or sinkhole openings.
TEMPORARY IMPACT: Impacts lasting one year or less; no more than one runoff season; small amount of material involved.
PROLONGED IMPACT: Impacts lasting more than one year; large amount of material involved.

***It is possible to have a departure from BMPs and still have adequate protection.**

ACCESS ROADS							APPLICATION (0-4)		
								EFFECTIVENESS (1-5)	
								COMMENTS	
There is no access road present _____ (If true, do not answer questions below)									
A1. Uses existing routes where appropriate									
A2. Adequate buffer strip next to watercourses and sensitive areas									
A3. Avoids unstable gullies, seeps, very poorly drained areas									
A4. Road grades are within standards									
A5. Amount of roads minimized									
A6. Stream crossings minimized									
A7. Road excavation minimized									
A8. Excavated and fill materials placed appropriately									
A9. Roads constructed to drain well									
A10. Appropriate road stabilization, drainage & diversions installed									
X=applied	water bars_____ dips/rolls_____ outslopes_____ berms cut_____ culverts____ geotextile____ rock____ seed____ mulch_____								
A11. Water diversions are in working order (_____% working) Failure due to: installation, damage, location, timing, weather, other									
A12. Runoff diverted onto stable forest floor areas									
A13. Mud kept off public roadways									
A14. Public road drainage system maintained									
A15. Appropriate traffic barriers installed									

APPLICATION

0--The Practice Not Applicable
1--Operation Meets Requirement of Bmp
2--Minor Departure from Bmp
3--Major Departure from Bmp
4--Gross Neglect of Bmp

EFFECTIVENESS

1--Adequate Protection of Water Resources.
2--Indirect and Temporary Impacts on Water Resources
3--Indirect and Prolonged Impacts on Water Resources.
4--Direct and Temporary Impacts on Water Resources.
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LOG LANDINGS									
							APPLICATION (0-4)		
								EFFECTIVENESS (1-5)	
									COMMENTS
Y1. Suitable number and size of landings									
Y2. Landings located outside RMZ									
Y3. Landings located on stable areas									
Y4. Excavation of site minimized									
Y5. Landings avoid concentrating or collecting runoff									
Y6. Landing's runoff enters stable area									
Y7. Proper water diversions in working order									
Y8. Landing smoothed and soil stabilized									
Y9. Landings free of fuel and lubricant spills and litter									
Y10. Landing location suitable for equipment fueling and maintenance									
Number of log landings _____ Size: (acres) _____.									

APPLICATION

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EFFECTIVENESS

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SKID TRAILS										
								APPLICATION (0-4)		
									EFFECTIVENESS (1-5)	
										COMMENTS
S1. Uses existing routes where appropriate										
S2. Adequate buffer strip next to watercourses & sensitive areas										
S3. Avoids steep and long straight grades (>20% for >200')										
S4. Avoids unstable gullies, seeps, poorly drained areas										
S5. Amount of skid trails minimized										
S6. Trail excavation minimized										
S7. Appropriate drainage and diversions installed										
X= applied	water bars____ outslopes____ dips/rolls____ berms cut____ culverts____ seed____ mulch____ rock____ other____									
S8. Water diversions in working order (_____% working) Failure due to:installation, damage, location, timing, weather, other										
S9. Runoff diverted onto stable forest floor areas										
S10. Streams not used as skid trails (except crossings)										
Types of streams involved and length of disturbance: perennial_____ , mapped intermittent_____. Unmapped intermittent_____ , ephemeral_____.										

APPLICATION

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EFFECTIVENESS

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STREAM CROSSINGS			
	APPLICATION (0-4)		
		EFFECTIVENESS (1-5)	
			COMMENTS
X1. Number of crossings minimized			
X2. Crossings minimize disturbance to the natural bed & banks			
X3. Streambank approaches properly designed and stabilized			
X4. Water runoff diverted from road prior to crossing			
X5. Crossing as close to 90 degree angle as practicable			
X6. Crossing does not unduly restrict water flow			
X7. Soil has not been used as fill in the stream (except culverts)			
X8. Ford constructed of non erosive materials that will not degrade water quality			
X9. Fords have stable banks and streambed			
X10. Culverts are properly sized and installed			
X11. Culverts clear of significant flow obstructions			
X12. Temporary structures properly anchored			
X13. Temporary structures and resulting obstructions removed			

Number of perennial crossings_____ widths_____.

Number of intermittent crossings_____ widths_____ Number of unmapped intermittents widths_____.

APPLICATION

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EFFECTIVENESS

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RIPARIAN MANAGEMENT ZONES			
	APPLICATION (0-4)		
		EFFECTIVENESS (1-5)	
			COMMENTS
Z1. RMZ present on this site include: _____ lakes, _____ rivers, _____ perennial streams, _____ intermittent streams, _____ sinkhole openings (specify), _____ open water wetlands, _____ unmapped intermittent streams			
Z2. Perennial & large intermittent streams clear of obstructing logging debris			
Z3. Logging debris placed back from watercourse to prevent movement into streams during floods			
Z4. RMZ free of piled slash, debris and fill			
Z5. Less than 10% bare mineral soil scattered within RMZ - not including crossing			
Z6. Adequate tree stocking in primary RMZ next to perennial streams			
Z7. RMZ free of roads and landings (except crossings) Were roads pre-existing? _____			
Z8. Water diverted from roads before entering RMZ			
Z9. Water diverted onto stable areas of the forest floor			
Z10. Road and trail surfaces stabilized as needed within RMZ			
Z11. Ephemeral channels free of excavated material			

APPLICATION

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EFFECTIVENESS

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SUPPLEMENTAL QUESTIONS AND SUMMARY

1) WHAT WENT RIGHT ON THIS SITE? (SUMMARIZE HIGHLIGHTS)

2) WHAT WENT WRONG ON THIS SITE? (SUMMARIZE PROBLEMS)

3) HAVE OTHER ACTIVITIES OCCURRED ON THIS SITE THAT POTENTIALLY IMPACT WATER QUALITY? (E.G. ATV use, vehicle traffic, grazing, etc.)
If so, please explain.

4) WERE TRAFFIC BARRIERS IN PLACE TO PREVENT TRESPASS DAMAGE? _____.
WHAT KIND OF TRESPASS DAMAGE WAS OBSERVED?

5) ARE THERE MITIGATING ACTIVITIES THAT SHOULD TAKE PLACE ON THIS SITE OR IS CORRECTIVE ACTION ALREADY BEING TAKEN.

6) -HAS THE SALE ADMINISTRATOR RECEIVED BMP TRAINING? Yes_____ No_____Unknown_____.
- HAS THE OPERATOR (LOGGER) RECEIVED ANY BMP TRAINING? Yes_____ No_____Unknown_____.
- WAS THE SALE ADMINISTERED BY A FORESTER? Yes_____ No_____Unknown_____.
- IS THE LANDOWNER AWARE OF BMPs? Yes_____ No_____Unknown_____.

7) GIVE THIS SITE AN OVERALL RATING OF 1-8 COMBINING APPLICATION OF BMPs WITH IMPACT TO WATER QUALITY.

RATE THIS SITE FROM 1-4 FOR THE OVERALL APPLICATION OF BMPs _____
1=above average 2=average 3=poor 4=total negligence

RATE THIS SITE FROM 1-4 FOR ITS OVERALL IMPACT TO WATER QUALITY _____
1= no visible impact 2=slight 3=moderate 4=severe

SITE RATING _____/2=_____

Note: These numbers do no necessarily need to directly reflect the worksheet ratings for application or effectiveness

Field Guide Cross Reference

On this page is each question in the monitoring sheet and the corresponding pages on the subject in the BMP Field Guide.

ACCESS Roads == Section II, pages 8-16

- **A1 == pages 4, 8, 10**
- **A2 == pages 8, 9, 12, Section V page 32, 33, Table 4 page 34, 35**
- **A3 == page 8**
- **A4 == page 8**
- **A5 == page 10**
- **A6 == page 8 and Section IV page 24 – 30**
- **A7 == pages 8, 10**
- **A8 == pages 10, 12, 24, 29**
- **A9 == pages 8, 10, Table 1 page 11, 12**
- **A10 = pages 8, 10 Table 1 page 11, 12, 14, 15, Table 2 page 21, 22**
- **X=Applied == (waterbars, pages 21-22), (dips/rolls, pages 21-22), (outslopes, Glossary), (berms cut, Glossary), (culverts, pages 27-28), (geotextile, Glossary), (rock, page 10), (seed, Appendix A), (mulch, Appendix A).**
- **A11 = pages 14, 15, Table 1 page 11, 18, Table 2 page 21**
- **A12 = page 10**
- **A13 = pages 13, 14**
- **A14 = page 14**

LOG LANDINGS == Section IV, pages 36-40

- **Y1 == pages 36, 39**
- **Y2 == Table 4 page 34, 36**
- **Y3 == page 36**
- **Y4 == page 38**
- **Y5 == pages 36, 38-40**
- **Y6 == pages 38-40**
- **Y7 == pages 38-40**
- **Y8 == pages 38-40**
- **Y9 == pages 39, 40**
- **Y10 = page 39**

SKID TRAILS == Section III, pages 18-22

- **S1 == pages 4, 18**
- **S2 == pages 18, 20, Section V pages 32-35**
- **S3 == page 18**
- **S4 == page 18**
- **S5 == page 18**
- **S6 == page 18**
- **S7 == Table 1 page 11, pages 18-20, Table 2 page 21, 22, 27, 28**
- **X=Applied == (waterbars, pages 21-22), (dips/rolls, pages 21-22), (outslopes, Glossary), (berms cut, Glossary), (culverts, pages 27-28), (geotextile, Glossary), (rock, page 10), (seed, Appendix A), (mulch, Appendix A).**
- **S8 == Table 1 page 11, pages 14, 15, 20 Table 2 page 21**
- **S9 == page 20**
- **S10 = pages 18-20, Section IV pages 24-30**
- **Types of Streams == page 24, Glossary, and Section V pages 32-35**

STREAM CROSSINGS == Section IV, pages 24-30

- **X1 == page 24**
- **X2 == page 24**
- **X3 == pages 24, 25**
- **X4 == pages 24, 25**
- **X5 == page 24**
- **X6 == pages 24-26, 28**
- **X7 == pages 24, 29**
- **X8 == pages 24, 29**
- **X9 == pages 24, 25, 29**
- **X10 = pages 25, 27, Table 3 page 28**
- **X11 = pages 24, 27, 28**
- **X12 = pages 25, 26**
- **X13 = pages 25-29**

RIPARIAN MANAGEMENT ZONES == Section V, pages 32-35

- **Z1 == pages 32, 34, Glossary**
- **Z2 == page 33**
- **Z3 == pages 32-34**
- **Z4 == pages 32-34**
- **Z5 == pages 32-34**
- **Z6 == pages 32-34**
- **Z7 == pages 32, 34**
- **Z8 == pages 33, 34**
- **Z9 == pages 32-34**
- **Z10 = pages 33, 34**
- **Z11 = page 35**