Indiana DNR Division of Forestry

Classified Forest & Wildlands

1997 through 2015

Forestry Best Management Practices Monitoring Results

By: Duane A. McCoy and Jennifer Sobecki

1996 through 2015

Classified Forest & Wildlands BMP Report

I. Executive Summary

This report quantifies the application and effectiveness of Forestry Best Management Practices (BMPs) on Classified Forest and Wildlands (CFW) sites, based upon guidelines laid out in the Indiana Forestry BMP Field Guide. This report includes 400 CFW timber harvests monitored between November 1996 and December 2015, ranging in size from 1 to 785 acres.

A figure of 85.17% of the BMPs were applied as directed in the BMP guidelines, and 12.86% had minor departures as defined in the monitoring sheet (Appendix). There have been 288 major departures, which add up to 1.90% of all practices monitored. Of the total 400 sites monitored on CFW sites, 10 practices have scored “Total Negligence” for 0.07%, Figure 1.

Effectiveness rates are used to evaluate the success of the BMPs applied to a site. The CFW effectiveness rate for the 400 sites monitored is 89.59%. Indirect and temporary impacts to water quality were found 3.81% of the time, indirect and prolonged impacts were found 1.35% of the time, direct and temporary impacts occurred 3.14% of the time, and there were 2.10% direct and prolonged impacts to water quality, Figure 2.

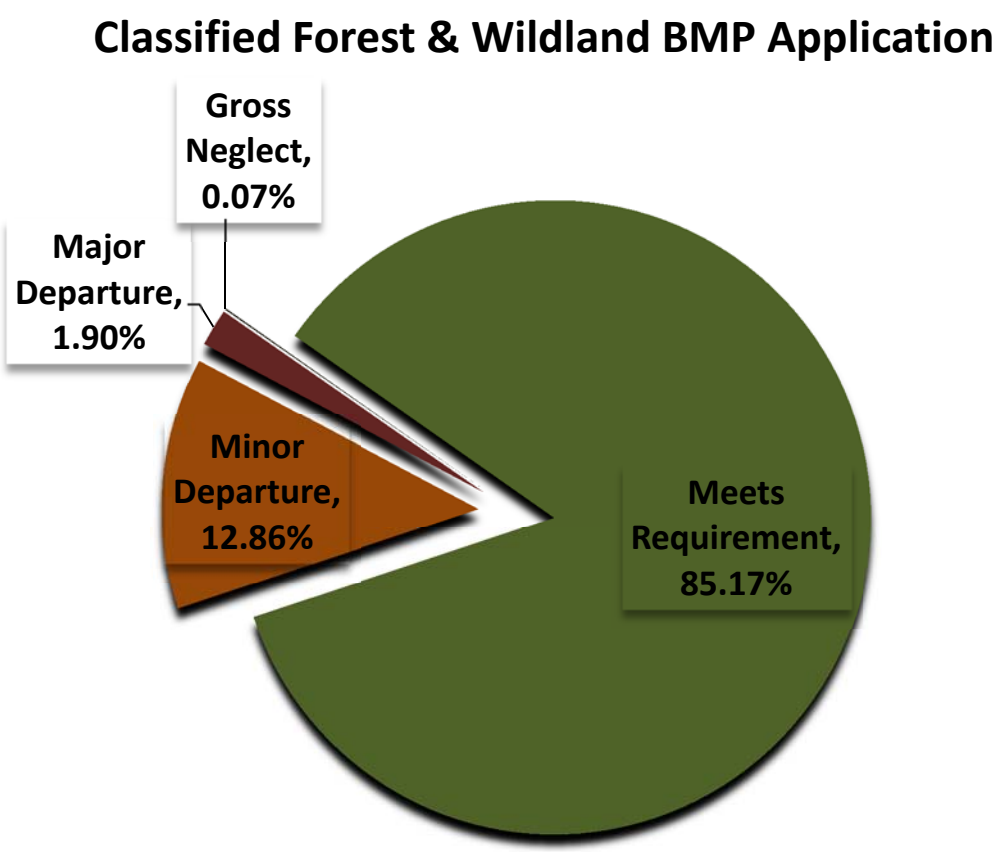

Figure 1: Overall CFW BMP application percentages.

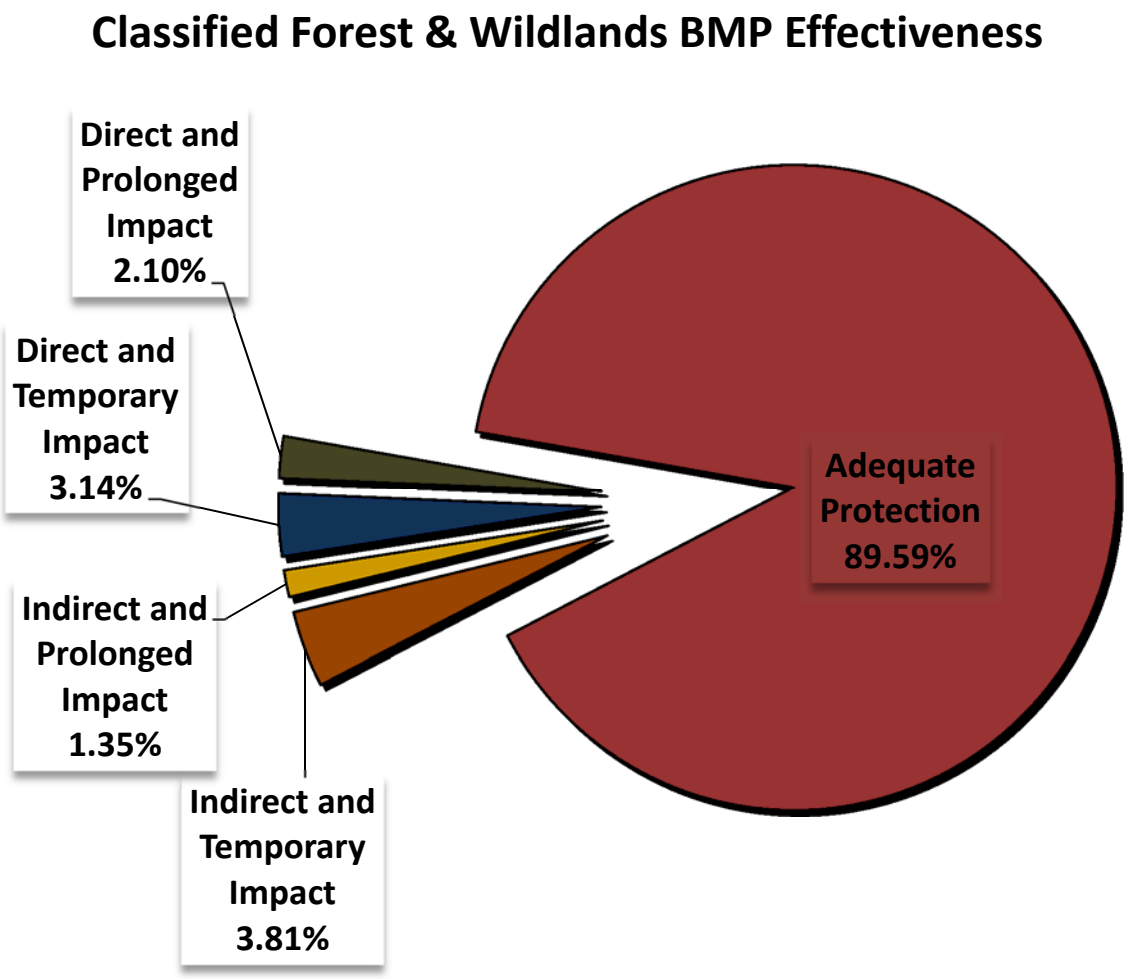

Figure 2: Overall CFW BMP effectiveness percentages.

II. Introduction

Indiana contains 4.9 million acres of forestland that provides many benefits to Indiana's people and wildlife. A total of 87% of the forestland in the state is privately owned. At the end of 2015, the CFW program had 782,667 acres and made up approximately 16% of the total forestland in the state. CFW are generally high-quality woodlands that are important for timber production, wildlife habitat, watershed protection and other non-tangible benefits. Being in the

CFW program profits not only the forest owner, but also other residents. Forests are known to be the best way to reduce nonpoint source pollution (NPS) to waterways; however, when forest soils are exposed, NPS pollution may occur.

BMPs are the foundation for water-quality protection during forestry operations. This report is a summary of the application and effectiveness of BMPs for timber harvests conducted on 400 CFW sites from 1996-2015. In the 1996 and 1997 BMP Monitoring reports, there were more sites that were understood to be CFW sites, but this cannot be confirmed by the records that have survived, so we have included only those sites that were confirmed to be CFW at the time they were harvested and monitored.

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 (Appendix). A total of 58 BMP specifications are evaluated under the five 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 its effectiveness at protecting water quality. Seven general questions are posed on the evaluation. The questions deal with the cause of the noted failures and successes, and record other land uses on the site that could affect water quality.

III. Methods

A. BMP Monitoring Objectives

The objectives of BMP monitoring are: 1) to assess the effectiveness of the BMP guidelines in protecting water and soil quality, 2) to provide information on the extent of BMP implementation, past and current, 3) to identify areas on which

to focus future program training and educational efforts to improve BMP implementation and effectiveness, 4) to identify BMP specifications that may need technical modification, 5) to identify improvements needed in future monitoring efforts and, 6) to maintain Forest Stewardship Council® (FSC)® certification of CFW (FSC-C071226).

B. Monitoring Team Selection

In the monitoring rounds from 1996 to 2004, an assortment of technical backgrounds was the basis for monitoring team selection. Each team was led by a DNR forester to provide technical and logistic support. Team members also included individuals from the forest industry and the environmental community, as well as landowners, planning and development staff, and individuals who work in wildlife biology, hydrology, logging and soil conservation. Team size was four or five individuals. Team members often possessed multiple areas of expertise.

In the 2009-2015 monitoring of CFW sites, the District Forester and one or more of the BMP monitoring staff monitored each site. The landowner or harvesting professional were included if they attended.

C. Site Selection

From 1996 through 2004 monitoring, sites were selected by their geographic position. The 1996 and 1997 rounds were in the Monroe Lake Watershed. The 1999 round was in five randomly selected counties throughout the state (Ohio, Jefferson, Clay, Martin and Steuben). The 2000 round monitored sites in seven of the 13 counties that have watersheds flowing into the Great Lakes (Adams, Allen, Elkhart, LaGrange, LaPorte, Noble, Steuben). One site in 1996, six sites in 1997, and five sites in 1999 were recorded as being CFW. All others were recorded as being in another type of ownership or their ownership type was unknown.

The 2009 round of monitoring focused on CFW. In 2008 there were approximately 374 harvests from the tracts in the CFW program from which the Division of Forestry (DoF) had to monitor at least 10%. From the total 374 sites reported to have been harvested in 2008, the DoF monitored 40 randomly selected sites, 10.69% of the total sites harvested.

For the 2010 round of CFW monitoring, sites reported to be harvested in 2009 were randomly selected. In 2009 there were approximately 366 harvests from the tracts in the CFW program, from which the DoF had to monitor at least 10%. From the total 366 sites harvested in 2009, the DoF monitored 45 for a 12.3% of the total sites harvested.

The 2011 round of CFW monitoring consisted of 60 sites that were randomly selected from the 519 sites that were reported to have harvests in 2010. The 60 sites that were reviewed made up 11.6% of the CFW sites reported to have been harvested in 2010.

The 2012 round of monitoring involved 56 sites randomly chosen from a total of 467 sites that reported a harvest in 2011. A total of 12% of sites reported to have been harvested in 2011 were monitored in the 2012 round of monitoring.

2013 CFW monitoring consisted of 53 sites chosen randomly from 422 sites that reported a harvest in 2012. A total of 12.6% of reported 2012 harvest sites were randomly chosen for monitoring in 2013.

The 2014 monitoring round included 60 sites randomly chosen from 515 sites that reported a harvest in 2013. A total of 11.6% of sites reporting harvests were chosen randomly for the 2014 round of monitoring.

The 2015 round of monitoring included 74 sites that were randomly chosen from 672 sites that reported a harvest in 2014. At total of 11% of sites reporting a harvest were monitored.

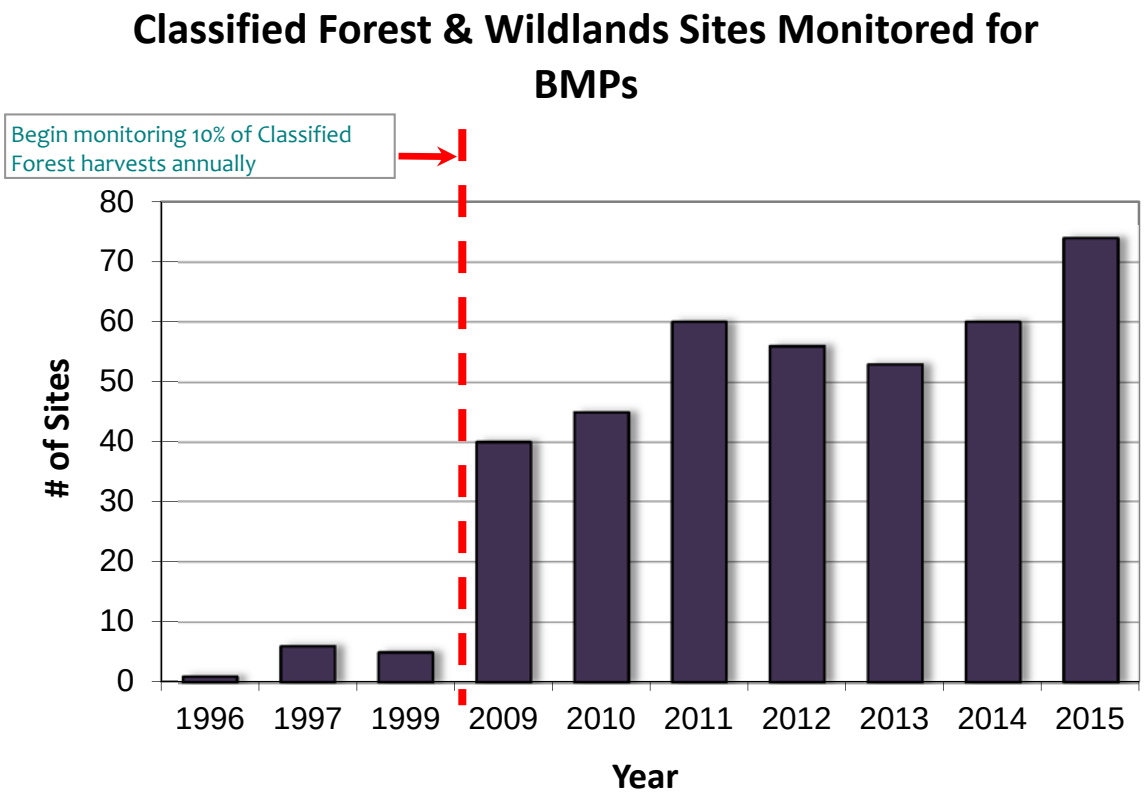

Figure 3: 1 CFW site was monitored in 1996, 6 in 1997, 5 in 1999, 40 in 2009, 45 in 2010, 60 in 2011, 56 in 2012, 53 in 2013, 60 in 2014 and 74 in 2015.

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 preventing pollutants from 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. It is also possible not apply or poorly apply BMPs to a site and have no impact to water quality.

The team meets at the site to conduct the BMP monitoring on a harvest that is completed and closed. The team walks each part of the harvest area and inspects all of the access roads, log landings, skid trails, riparian management zones, and stream crossings as directed in the Indiana BMP Monitoring Protocol. The team also comments on successes and departures from the BMP guidelines.

The monitoring team also inspects adjacent and interior intermittent or larger streams. This time allows each team member to evaluate the BMPs on the site for themselves. Once all members have inspected the harvest area, the team comes together at the vehicle or other gathering place, and they discuss each question on the BMP monitoring form until they reach consensus on the scores that go with each question.

IV. Results

A. Overall application and effectiveness

Of the 400 sites monitored, there was an 85.17% application rate with an 89.59% effectiveness rate. This means the BMPs that were needed were correctly carried out 85.17% of the time and were effective at protecting water quality from NPS 89.59% of the time.

More detailed definitions can be found on the FORESTRY BMP MONITORING WORKSHEET (Appendix).

B. BMP Application & Effectiveness by Section

1. Access roads

Access road BMPs were correctly applied 94.9% of the time. All of the access road BMP specifications employed had a 98.3% effectiveness rate.

Table 1: Application and effectiveness of BMP specification on access roadsAccess Roads	% Application	% Effective
A1. Uses existing routes where appropriate	99.3	100.0
A2. Adequate buffer strip next to watercourses and sensitive areas	93.5	98.8
A3. Avoids unstable gullies, seeps, very poorly drained areas	96.2	98.9
A4. Road grades are within standards	98.9	99.6
A5. Amount of roads minimized	100.0	100.0
A6. Stream crossings minimized	99.6	99.6
A7. Road excavation minimized	99.2	100.0
A8. Excavated and fill materials placed properly	99.6	99.6
A9. Roads constructed to drain well	91.0	96.3
A10. Appropriate road stabilization, drainage and diversions installed	88.3	93.4
A11. Water diversions functioning properly	95.2	96.1
A12. Runoff diverted onto stable forest floor areas	93.2	95.5
A13. Public road drainage system maintained	100.0	99.6
A14. Public road's drainage maintained	99.6	99.6
A15. Traffic barriers installed	70.2	97.7
Overall Access Road	94.9	98.3

The following areas of access-road application need greater attention: A10) appropriate road stabilization, drainage and diversions installed, 88.3% and A15) traffic barriers installed 70.2%. The reason for the low incidence of traffic barriers was that many of these roads are frequently used by the landowner to access other parts of their property or their or others' homes. Even with relatively low application rates in the above areas, the effectiveness rates are still 93.4% or higher. Therefore these departures in application appear to have a minimal impact upon the soil and water resources of these sites.

2. Log Landings

Log-landing BMPs were correctly applied 94.1 % of the time. All log-landing BMP specifications employed were 97.6% effective at protecting the water resources of the site.

Table 2: Application and effectiveness of BMP specifications on log landings

Log Landings	% Application	% Effective
Y1. Suitable number and size of landings	98.8	100.0
Y2. Landings located outside RMZ	88.6	97.8
Y3. Landings located on stable areas	94.2	97.2
Y4. Excavation of site minimized	97.5	99.7
Y5. Landings avoid concentrating or collecting runoff	86.7	96.3
Y6. Landing's runoff enters stable area	91.3	94.7
Y7. Proper water diversions in working order	92.9	95.0
Y8. Landing smoothed and soil stabilized	92.8	95.9
Y9. Landings free of fuel and lubricant spills and litter	98.8	99.1
Y10. Landing location suitable for equipment fueling and maintenance	99.1	99.7
Overall Log Landings	94.1	97.6

Two log-landing specifications had application issues. A total of 11.4% of sites had landings located within the RMZ, but with other BMP practices to minimize the impacts of this kind of departure, there appears to have been minimal impacts, with an effectiveness of 97.8%. The avoidance of concentrating or collecting runoff and runoff entering a stable area had application scores of 86.7%; however, with other practices such as placing cutoffs into low areas just off the landing to help slow down and filter these concentrated flows, the effectiveness of this specification is 96.3%, showing little impact on the resources of the site.

3. Skid Trails

Skid trail BMPs were correctly applied 80.1% of the time. Skid trail BMP specifications employed were 87.1% effective at protecting the water resources of the sites.

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

Skid Trails	% Application	% Effective
S1. Uses existing routes were appropriate	96.7	98.0
S2. Adequate buffer strip next to water courses and sensitive areas	73.5	89.4
S3. Avoids steep and long straight grades (>20% for >200')	87.7	95.5
S4. Avoids unstable gullies, seeps, poorly drained areas	83.1	91.4
S5. Amount of skid trails minimized	91	95.7
S6. Trail excavation minimized	89.7	92.7
S7. Appropriate drainage and diversions installed	46.7	63.8
S8. Water diversions in working order	74.5	81.5
S9. Runoff diverted onto stable forest floor areas	72	76.9
S10. Streams not used as skid trails (except for crossings)	83.4	83.9
Overall Skid Trail	80.1	87.1

Appropriate drainage and diversions installed (S7) has an application rate of 46.7%, up almost two percentage points better than last year's score of 44.8%. Question S7 has historically been the lowest score in every BMP Monitoring Report. The 2012 Comprehensive BMP Monitoring Report across all ownership types since the beginning of BMP monitoring in Indiana had an application of 40.9%. The 2012 version of the CFW report had 36.1% application rate for S7, and in the first year of the CFW BMP program, 2008, there was a 23.8% application for S7. Although 46.7% leaves room for improvement, it is a sign of steady progress since the beginning of the BMP program in Indiana and for CFW specifically. Application scores showed that RMZs, unstable gullies, and other sensitive areas were adequately buffered or avoided (S2 and S4), 73.5% and 83.1%, respectively. However, both of these specifications had minimal impact on water quality, with 89.4% and 91.4% effectiveness ratings. Water diversions that were in place were found to be fully functioning 74.5% of the time, and had an effectiveness percentage of 81.5%. The purpose of water diversions is to divert overland runoff onto the stable forest floor instead of concentrating flow down trails and access roads, which can cause soil erosion. Runoff was diverted properly 72% of the time, and the effectiveness of these efforts was 76.9%.

4. Stream Crossings

Stream-crossing BMPs were correctly applied 70.8% the time. All stream-crossing BMP specifications employed were 72.4% effective at protecting the water resources of the sites.

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

Stream Crossing	% Application	% Effective
X1. Number of crossings minimized	90.0	90.7
X2. Crossings minimize disturbance to the natural bed and banks	56.7	58.4
X3. Streambank approaches properly designed and stabilized	50.6	53.4
X4. Water runoff diverted from road prior to crossing	47.7	54.1
X5. Crossing as close to 90 degrees as practicable	90.8	93.1
X6. Crossing does not unduly restrict water flow	82.8	83.3
X7. Soil has not been used as fill in the stream (except culverts)	68.8	69.4
X8. Fords constructed of non-erosive materials	73.0	73.0
X9. Fords have stable banks and streambeds	55.9	56.6
X10. Culverts are properly sized and installed	93.3	93.3
X11. Culverts clear of significant flow obstructions	93.1	93.1
X12. Temporary structures properly anchored	85.7	81.0
X13. Temporary structures and resulting obstructions removed	58.3	58.3
Stream Crossing	70.8	72.4

Stream crossings are always dealing directly with water bodies. Therefore, even if there are no departures of application, there may be some impact to the water quality, and it will almost always be a direct impact. The avoidance of stream crossings by sale administrators and loggers is reflected in the statistic for stream crossings. A total of 59% of sites (236 of 400 sites monitored) had no stream crossings. There were 164 sites (41%) that had at least one stream crossing. There were 69 (42.1% of sites with crossings) sites that had only one crossing, 47 (28.7%) sites with two crossings, 20 (12.2%) sites with three crossings, 13 (7.9%) sites with four crossings, five (3%) sites with five crossings, five (3%) sites with six crossings, one (0.6%) site with seven crossings, one (0.6%) site with nine crossings, two (1.2%) sites with 11 crossings, and one (0.6%) site with 14 crossings. These figures added up to a total of 382 crossings on CFW sites monitored over this 19-year period. A total of 119 of the 382 stream crossings occurred on unmapped

intermittent streams. This means they were classified as intermittent streams on the ground, but the USGS quadrangle maps did not map them as intermittent streams. There were 216 crossings on intermittent streams identified on the USGS maps. There were 47 crossings on perennial streams.

Areas of the stream-crossing category that had the lower application and effectiveness scores in CFW are minimization of disturbance to natural bed and banks (X2), proper design and stabilization of stream bank approaches (X3), diversion of water from road prior to crossing (X4), construction of fords with non-erosive materials (X7, X8), stable banks and streambeds of fords (X9) and removal of temporary structures and resulting obstructions (X13). These questions deal more directly with closing stream crossings at the end of their use, which would give a focus area for training in the future.

5. Riparian Management Zones

Riparian management zone (RMZ) BMPs were correctly applied 76.8% of the time. All of the RMZ BMP specifications employed were 82% effective at protecting the water resources of the sites.

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

Riparian Management Zones	% Application	% Effective
Z2. Perennial & large intermittent streams clear of obstructing debris	59.3	61.6
Z3. Tree tops and cutoffs placed back from water course to prevent movement into streams during floods	89.3	93.9
Z4. RMZ free of excavated material & debris (other than above)	93.9	96.2
Z5. Less than 10% bare mineral soil exposed within RMZ (not including crossings)	96.2	97.1
Z6. Adequate tree stocking in primary RMZ next to perennial streams	97.0	98.0
Z7. RMZ free of roads and landings (except crossing)	59.6	80.1
Z8. Water diverted from roads before entering RMZ	62.3	71.9
Z9. Water diverted onto stable areas of the forest floor	71.2	75.8
Z10. Road and trail surfaces stabilized as needed within RMZ	77.9	81.3
Z11. Ephemeral channels free of excavated material	70.4	70.4
Riparian Management Zones	76.8	82.0

Out of 400 sites, 308 had a water body of some type that had a RMZ. In specification Z2, “streams clear of obstructing debris,” the application rate was 59.3%, and the effectiveness rate was 61.6%. Of the 101 sites that had departures in effectiveness for obstructing debris, nine were indirect and temporary, six were indirect and prolonged, 23 had direct and temporary impacts, and 63 had a direct and prolonged impact to the water quality of the site. The nature of the debris would be prolonged unless it could be removed or mitigated. Mitigation by removing the debris is the standard recommendation. Roads and landings in the RMZ scored lower in application with a 59.6% but had 80.1% effectiveness. A total of 22 of the sites with departures in Z7 had indirect and temporary impact to water quality, two had indirect and prolonged impact, and 32 sites had direct and temporary impacts. Six sites had direct and prolonged impacts due to roads and/or landings in the RMZ. More attention is needed in the diversion of water from roads before entering the RMZ (Z8). This is supported by the 62.3% application rate for this specification, and the effectiveness rate

for Z8 was 71.9%. Road and trail surfaces were stabilized as needed within the RMZ with a 77.9% application rate and an 81.3% effectiveness rate. Keeping soil out of ephemeral channels (Z11) needs more attention with an application rate of 70.4% and effectiveness rate of 70.4%.

C. Yearly Monitoring Trends

Breaking down data by years can be a useful way to interpret them. CFW sites have only been monitored on a consistent basis since 2009; therefore, it is difficult to draw any conclusions about yearly trends. However, continuing to examine the data in this way will be useful for the DoF to determine if any interventions or further education is needed to continue a high level of BMP implementation and success on CFW grounds.

Table 7. Number of CFW sites monitored by year and the application and effectiveness rates broken down by year

# of Sites	Year	Application %	Effectiveness%
n=1	1996	97.96%	97.78%
n=6	1997	80%	75.56%
n=5	1999	95.42%	97.71%
n=40	2009	82.52%	91.70%
n=45	2010	85.32%	91.71%
n=60	2011	87.86%	92.85%
n=56	2012	81.68%	86.73%
n=53	2013	85.80%	88.44%
n=60	2014	88.31%	92.65%
n=74	2015	84.63%	85.38%

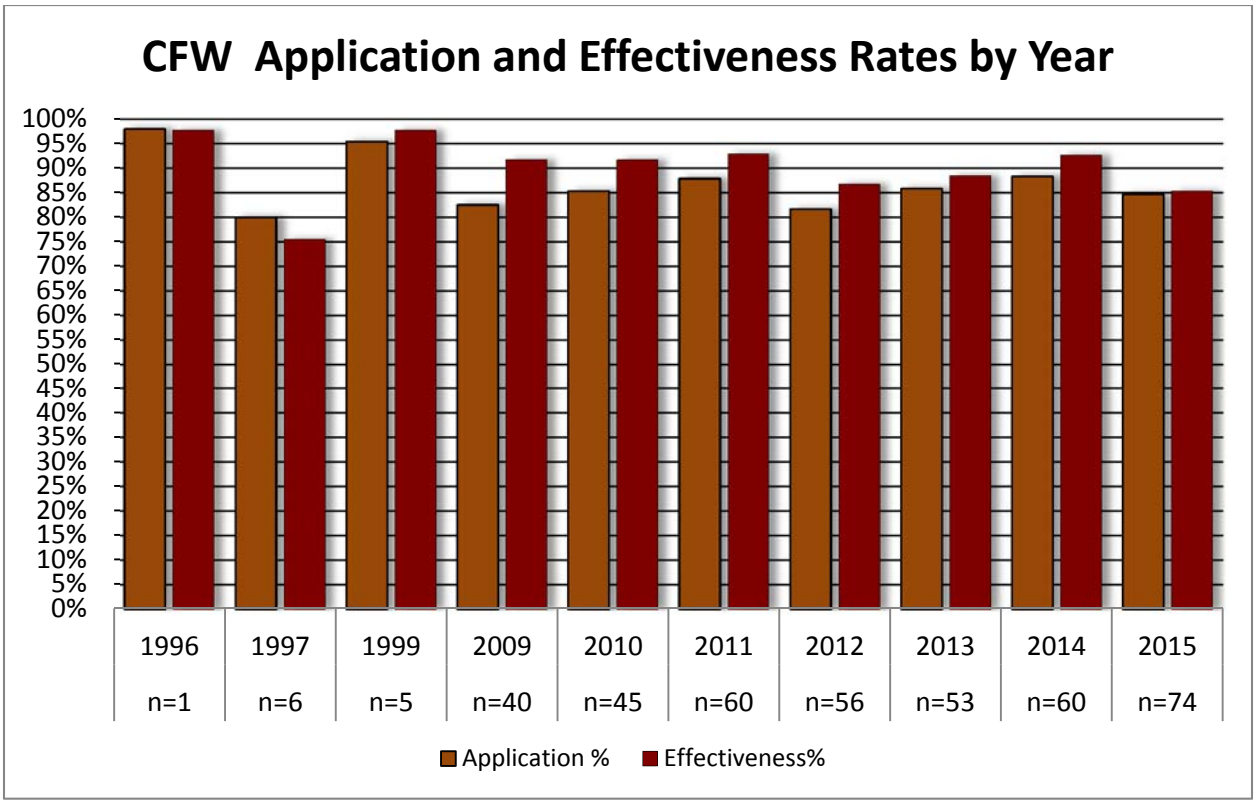

Figure 4. Application and effectiveness scores by year of all CFW sites

D. Overall Site Ratings

On the final page of the monitoring form there is an opportunity for each monitor to rank his or her overall subjective impression of the site's BMP application & effectiveness (Appendix). Sites can be rated from 1 to 4 or any number in between. The ratings are decided by the following scale for application: 1=above average, 2=average, 3=poor, 4=total negligence. The rating scale for effectiveness is as follows: 1= no visible impact, 2=slight, 3=moderate, 4=severe. Table 6 shows the average ratings for all the sites monitored on the CFW. The overall site rating is an average of the application and effectiveness ratings for all sites.

Table 6. The average site ratings for application, effectiveness and the overall site rating.

Overall Application	Overall Effectiveness	Overall Site Rating
1.57	1.59	1.59

Monitors found overall application to be between above-average and average. They found overall effectiveness to be between no visible impact and slight impact.

V. Discussion

The BMP application rate on CFW sites monitored was 85.17%. Minor departures in application accounted for 12.86%. Major departures accounted for 1.90%. Seven practices were considered “total negligence” for 0.07%. Forestry BMPs on CFW sites were 89.59% effective at protecting water quality; 3.81% of practices had indirect and temporary impacts; 1.35% had indirect and prolonged impacts; 3.14% had direct and temporary impacts, and 2.10% had direct and prolonged impacts to water quality. The application and effectiveness scores show that there are many sound practices taking place on CFW timberharvest sites. This effort results in few negative impacts to the soil and water resources. When there are problems in either application or effectiveness, they are minor and short term.

BMPs in access roads and log landings had little to no effect on water quality. Roads and landings are established with the knowledge that these are areas where the concentration and amount of repeated traffic will be highest. During site planning and layout, managers will put roads and landings on the most stable areas outside RMZs (93.5% (A2) and 88.6% (Y2) application, respectively). Sometimes site landform and characteristics force the roads to cross streams or be in an RMZ or force landings to be within a RMZ, in which case managers are more thoughtful and careful about

how the harvest and closeout are carried out (98.8% and 97.8% effectiveness, respectively). The results of the monitoring show the above inferences to be true by having all of effectiveness scores in both categories above 97%.

Skid trail overall application rate was 80.1%, and the effectiveness score is 87.1%, showing difficulty in carrying out some practices within the guidelines, but still protecting water quality. 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. The main trail just off the landing would have a higher disturbance level because all harvested logs have to be moved to the landing. 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. They 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 within limited space—landforms and adjacent vegetation will often limit the equipment's ability to place structures where they would be most effective. This causes minor departures in application (17.7% of skid trail application scores are minor departures) with little to no effect on water quality. However, the 46.7% application rate on "Appropriate drainage and diversions installed" is concerning and is constantly addressed in trainings with landowners and loggers and through publications. This particular BMP did improve by over 10% in the last three years, indicating steady improvement in drainage and diversion installation on Classified Forest & Wildlands.

Stream crossings are difficult to make or use without affecting water quality. Any impact is either direct and temporary or direct and prolonged. Because of this fact, the BMP guidelines emphasize the avoidance of stream crossings if possible. Out of 400 sites, only 41% (164 sites) had stream crossings. Of those 164 sites with crossings, there were a total of 382 crossings: 216 on mapped intermittent streams, 119 on unmapped intermittent streams, 47 on perennial streams. In the application of stream crossings, 70.8% of the practices were carried out within the guidelines, and 72.4% of the time had a no impact to water quality. As earlier mentioned, if there is an impact from stream crossings,

they can have a direct effect according to the definitions in the effectiveness scoring—10.3% of the effectiveness scores had a 4 (direct and temporary impacts) and 7.5% had a score of 5 (direct and prolonged impacts).

RMZs, like stream crossings, are close to water bodies. Problems often lead to direct impacts to water quality. Problems can be averted by avoidance, not placing high-impact infrastructure like access roads or landings in RMZs (Z7). RMZ BMP Z7 application was 59.6% and RMZ BMP effectiveness was 80.1%. There were 308 sites with at least one RMZ and 126 of those sites had roads or landings in them. Out of the 126 with roads or landings in the RMZ, 64 had no impact upon water quality. A total of 22 with roads and-or landings in the RMZ had an indirect and temporary impact, two sites had an indirect and prolonged impact, 32 sites had a direct and temporary impact, and six sites had direct and prolonged impacts to water quality. The increase in the number of sites that had obstructing debris (Z2) indicates that more tops are being left in the streams.

VI. Recommendations

- Focus on areas where problems are more common, such as skid trails, RMZs and stream crossings.
- Training for landowners and loggers needs to emphasize the use of water diversions.
- 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 who work on private properties.
- Training for landowners, foresters and loggers needs to focus on keeping tops and other debris out of the perennial and large intermittent streams, or removing them if they fall into those waterways.

VII. Conclusions

CFWs are privately owned and have diverse usage. Private lands provide a service to the citizens of this state by producing clean water and air, and increasing biodiversity. Forestry BMPs are the means by which soil erosion from harvesting areas is minimized, and soil and water quality are maintained. Minimal soil erosion allows for quick recovery of the site because the topsoil is still in place to allow for natural succession. Limited sedimentation to the water resources of the forest protects water quality. BMPs allow the forest to remain a “working” timberland while still providing the environmental benefits that the state needs.

While there are BMP applications that need improvement, the negative environmental impact is short term for most sites. By allowing these forests to provide an income for the landowner through timber management, there is an incentive for the landowner to keep that land in forest rather than converting it to grazing, row cropping, or development, all of which are uses that have a larger and more sustained impact on the environment. BMPs are in place to minimize sedimentation due to forest harvest in the waters of Indiana.

Appendix **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.
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.**

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

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.
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 BMP's and still have adequate protection.**

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

0--The Practice Not Needed or Applied on Site
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.
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.**

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

0--The Practice Not Needed or Applied on Site
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.
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.**

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

0--The Practice Not Needed or Applied on Site
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.
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.**

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**