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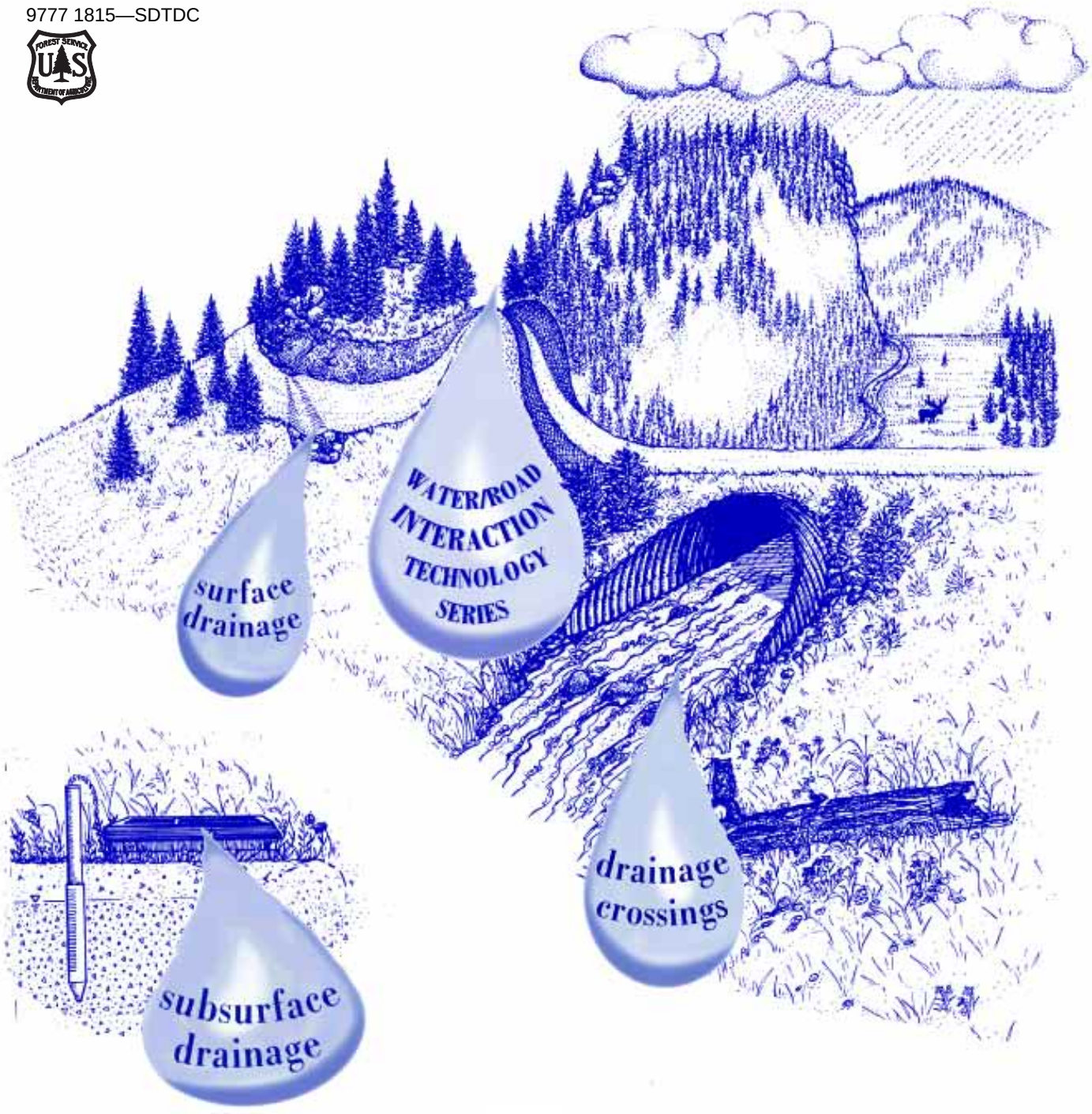

Summary of Historical and Legal Context for Water/ Road Interaction

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SUMMARY OF HISTORICAL AND LEGAL CONTEXT FOR WATER / ROAD INTERACTION

This paper briefly outlines the historical and legal context within which water/road management is practiced for the benefit of the water/road interaction technology series of publications.

HISTORY AND TRENDS

There has always been a close association between human transportation corridors and naturally occurring bodies of water. Early trails and paths were often beaten alongside rivers, lakes, and streams if for no other reason than the need for humans to be close to water for daily needs. As civilizations migrated throughout the world, explorers used rivers as transportation corridors, and commerce soon followed. New inhabitants to an area tended to settle near lakes, streams, rivers, and oceans. Near the water, terrain tends to be gentler, grades are often less steep, and so it has been desirable and easier to build roads to serve growing populations who live in these areas. Engineering practice regarding roads has traditionally emphasized protecting the road from all manner of deterioration, with regard for the surrounding area being secondary. The engineering and construction of early forest roads also tended to follow this pattern.

The great westward expansion of the nineteenth century in the U.S. was the backdrop for the creation of the federal forest reserves in 1891 and, in 1897, the agency which became the Forest Service. The legislative trail of the period from 1871 to 1897 related to forests included nearly 200 bills, many of which had the objective of protecting the headwaters of navigable rivers, and protecting and assuring adequate water supplies.(1) The concerns of the day were fueled by experiences in forests of the European Alps where erosion, severe flooding, and torrent flows had led to forest protection measures as early as the fourteenth century in Switzerland, and sixteenth century in Austria, France, and Italy.(2) Early guidelines for the U.S. Forest Reserves advised that water flow was to be influenced by slowing snow melt with shading, windbreaks to cut drying action, reduction of erosion, and maintenance of the absorptive qualities of the soil.(3) East of the 100th meridian, the land for many national forests was purchased from private landowners under provisions of the Weeks Law (1911), which had the goal of returning land to the public domain for the purpose of protecting watersheds of navigable streams.(4) In fact, virtually all establishment of national forests until after 1924 had watershed protection as the primary legal underpinning. Although passage of the Clarke-McNary Act in 1924 added the "production of timber" as a purpose for forest land acquisition, forested areas in the United States remained largely inaccessible, and public demand for forest resources (timber, recreation and aesthetic amenities) was low by today's standard. Conflicts among resource uses were not common.

Although federal funding for forest road systems began prior to 1920 for the purpose of the custodial management of national forests, it was not until after World War II, when there was pressure to provide wood products for a rapidly expanding economy, that roads began to be built on these lands at a great rate. Historically, log transport was accomplished by draft animals skidding logs from stump to mill or to streams and rivers for floating or sluicing to mills. From the 1850's to the 1930's, the typical method for transporting logs overland was by railroad with draft animals and steam winches used to skid logs to the rail spur. Technological improvements in motor truck and trailers, well-developed public and private road systems, and the geographical flexibility afforded by trucks to the economics of large-scale timbering operations spelled the end of most logging railroads. Mileage of roads in national forests doubled to 257,000 kilometers (160,000 miles) between 1940 and 1960.(5) The chief of the Forest Service acknowledged at the time that the increased construction of roads and the use of heavy equipment instead of animals for harvest operations would increase soil disturbance and erosion.(5,6) Since then forest road mileage has increased to over 563,000 kilometers (350,000 miles) by 1993, (7) although 59 percent of these roads were maintained "at a level less than adequate for current use" in 1993.

PAST ROAD DESIGN PHILOSOPHY

Often in the past, water has been viewed as a liability that must be managed so that it would not destroy the road. Standards for roads were stated largely in economic terms. Consider, for example, this excerpt from a standard forest engineering text:

"No other single item of road building is as important as drainage. The first requisite of maintaining a good roadbed is to keep the soil just as free of water as possible and preferably to keep it dry. There are two conditions which must be met in order to accomplish the objectives. First, all surface and ground water must be eliminated by an intensive network of culverts, ditches, and water courses, all of which will effectively carry the water away from the roadbed as quickly as possible. Secondly, where it is economically feasible to do so, a roof in the form of a seal coat should be put over the road surface in order to keep the roadbed dry. The more nearly these objectives can be fully accomplished, the more ideal will be the foundation under the road to sustain heavy loads.(8)"

The general view was that if drainage was designed so that the road remained intact, the surrounding area would benefit from reduced sediment deposition and other mass wasting that can be triggered by roads. Furthermore, this line of thought held that the surrounding area would adapt to whatever disturbance was caused by the presence of the road without causing irreversible changes to the physical or biological resource values. Analyses of the water-related effects of roads on the surrounding area were typically done only for the purpose of specifying drainage-related features intended to prevent water from damaging the road. Analyses for assessing potential biophysical effects of specific road designs typically were secondary or not done, nor was the methodology for doing such assessments well developed. While the intent expressed in this example represents good engineering practice with respect to the road, it predates important legislation regarding the protection of surrounding resource values, putting it at odds with current legal requirements for forest roads.

ENVIRONMENTAL CONCERNS

Beginning in the 1920's, and continuing to the present, watershed studies have shown that timber harvesting and associated roads in forested areas can have a noticeable impact on both physical and biological aquatic resources.(9,10,11,12,13, 14,15,16). These impacts can be categorized by their effect on water quantity and timing of flows into drainages, and by their effect on the habitat of aquatic and riparian species. In some studies, distinction is made among the effects of road construction, the longer term effects of road operation, and the effects associated with the biomass removal component of timber harvesting operations.(2,17,18,19)

One study showed that if harvesting was done without roads or ground-based machinery, the magnitude of changes in peak flows was insignificant.(20) Other studies show that alteration of streamflow quantity, timing of peak flows, and the degree to which road drainage systems are connected to stream systems may be of concern.(21,22,23,24) Some studies linked management practices and water quality, including sedimentation and chemical pollutants.(25,26,27, 28,29) One current view is that in addition to the localized physical and biological problems that can be caused by forest management practices (including roads), simplification of aquatic habitats by confining channels, encroachment on floodplain areas necessary for aquatic and riparian ecosystem function, and isolation of channels from their natural riparian and upland areas can result. This tends to reduce the diversity of aquatic habitat and can favor abundance of some species over others.(30) Some current authors warn that regardless of technique, degradation of habitat or other unintended consequences will inevitably result from any forest management including roadbuilding if such management is not done from a whole-catchment perspective.(31)

As more intensive management of National Forest System (NFS) lands became common during the late 1940's, and especially as a result of the shift from holding national forests in reserve to using them to meet the demand for wood during and

after World War II, public concern mounted regarding water quantity and pollution, runoff and flood damage in forests, rangelands, and adjacent areas. Although concern for watersheds had been a motivation for the legislation that created and expanded the Forest Service (Organic Administration Act and the Weeks Law), relatively rapid population increases (especially in the western U.S.) combined with changes in public perceptions and values with regard to natural resources led to the further enactment of comprehensive federal legislation with respect to water resources—the Wilderness Act (1964), the Water Resources Planning Act (1965), the Wild and Scenic Rivers Act (1968), the National Environmental Policy Act of 1969, and the Endangered Species Act of 1973. The 1972 amendments to the Federal Water Pollution Control Act, (further amended and reauthorized in 1977 and 1987) are commonly known as the Clean Water Act and provide the basis for most of the legal structure regarding water pollution that exists today.

During this same period other legislation (primarily the Multiple Use-Sustained Yield Act of 1960, the Forest and Rangeland Renewable Resources Planning Act of 1974, and the National Forest Management Act of 1976 (NFMA)) eventually required the Forest Service to formalize its land management processes with integrated, comprehensive plans, to be revised every 10 years. Under these laws, interdisciplinary teams are to prepare plans for each administrative unit of the NFS, considering a range of alternative responses to public issues, management concerns, and resource opportunities. Each alternative is to show the timing and quantity of goods and services produced and an estimate of the physical, biological, economic, and social impacts of carrying out the alternative. Protection and enhancement of water quality, watersheds, riparian, and aquatic resources is identified as an expected output of the planning processes prescribed by these laws.

The determination by the Fish and Wildlife Service that dozens of riparian and aquatic species, including hundreds of fish stocks, were either threatened and endangered or otherwise at risk, and regional assessments and ecosystem analyses (e.g., the FEMAT report, the PACFISH environmental assessment, and the Interior Columbia Basin Ecosystem Management Project) called attention to the need to reevaluate forest management practices. Typically these analyses and recommendations included updated road management guidelines. In other cases, better implementation of guidelines that were already in place was needed. Watershed analyses and hydrologic condition assessments are becoming an important tool for recognizing and prioritizing sites that need restoration or other special attention.

There is some evidence that improvements in planning, locating, and constructing roads is reducing negative effects due to transportation systems in forested areas. One study in western Oregon found that constructing roads using full-bench design, hauling excavated road construction material offsite instead of burying it in local fill slopes, and locating roads on ridgetops instead of on middle slopes, reduced the frequency and size of road-related landslides.(32) Another study suggests that the typical progression of road construction from valley-bottom to ridge-top (possibly spanning a decade or more) tends to reduce the number of stream crossings and associated number of opportunities for direct effects of roads on streams, although the integration of road drainage systems with stream networks may remain constant because of the increased tendency for gullying at cross drain outlets on upper slopes.(24) A large amount of work has been done at the Cowetta Hydrologic Laboratory, North Carolina, showing the benefits of vegetative cover on and near roadways, and of traveled way surface shapes that disperse water.(15) Improved road location and advances in timber harvesting technology that have allowed silvicultural operations with reduced road densities have undoubtedly contributed to reduced effects of roads on watersheds, while also tending to confound efforts to determine long-term influences of these activities on aquatic resources in general.(30)

THE LEGAL AND REGULATORY CONTEXT FOR WATER/ROAD INTERACTION

A steady progression of laws, regulations, and judicial interpretations affecting the Forest Service since its inception have reaffirmed the intention of Congress to maintain and "secure favorable conditions of water flow," prevent erosion, and generally promote watershed health (e.g., the Organic Administration Act of 1897, Weeks Act of 1911, McSweeny-McNary Act of 1928, Flood Control Act of 1936, Anderson-Mansfield Reforestation and Revegetation Joint Resolution of 1949, Watershed Protection and Flood Prevention Act of 1954, Multiple-Use Sustained-Yield Act of 1960, Wilderness Act of 1964, Wild and Scenic Rivers Act of 1968, National Environmental Policy Act of 1969, Federal Water Pollution Control Act, and the National Forest Management Act of 1976). In addition, Executive Orders 11988 and 11990 (1977) concerning floodplain management and protection of wetlands include provisions that have a bearing on the planning and construction of forest roads. While most of this legislation does not deal explicitly with water/road interaction, the intent is clearly to mitigate the type of effects that poorly planned, constructed, or maintained roads can have on valued resources. Appendix A summarizes some of these laws and regulations. The Clean Water Act will be described further below. More detailed summaries of law related to the Forest Service and water issues including nonpoint source pollution are provided elsewhere.(6,33,34) Forest Service regional staff, Environmental Protection Agency (EPA) (see appendix B for contact information), U.S. Army Corps of Engineers (COE), and state and local government staff in the area of watershed protection are also good sources of information regarding the legal and regulatory aspects of water and road interaction.

The key legal requirements relating to water and road interaction come from the Clean Water Act and the NFMA. These laws and the regulations derived from them form the basis for standards and guidelines that apply to watershed-related activities on national forests.(35,36) They provide a legal framework from which water and road interactions can be analyzed and managed.

CLEAN WATER ACT

The Federal Water Pollution Control Act, initially enacted in 1948, is now commonly known as the Clean Water Act. The 1948 legislation served to establish goals, recognize the importance of research, provide funding for the construction of waste water treatment and other civil works facilities, and laid the groundwork for resolving interstate pollution disputes. The Clean Water Act legislation enacted in 1972 laid the foundation for watershed and water quality protection that exists today. This law was amended by the Clean Water Act of 1977 and the Water Quality Act of 1987. The simply stated objective of the Clean Water Act is to "restore and maintain the chemical, physical and biological integrity of the nation's waters" (33 USC 1251(a)).

The Clean Water Act makes it unlawful to discharge any pollutant into "waters of the U.S." from a point source without a permit. In accordance with Clean Water Act Section 402, the EPA administers the National Pollutant Discharge Elimination System (NPDES) to regulate the permit process. Forest roads are exempt from being regulated as point sources under the Clean Water Act regulations if certain conditions are met. A few specific road-related activities that sometimes occur on national forests—rock crushing, gravel washing, and log sorting, log storage, and log transfer facilities—are, however, classified as point sources and, therefore, are subject to the permit authority of the EPA on a case-by-case basis. Because forest roads are generally exempted from being treated as point sources under the current law, they are regulated as nonpoint sources, which under Clean Water Act are defined as diffuse sources of pollution not regulated as a point source. Portions of the Clean Water Act which are relevant to water/road interaction are Sections 208, 319, and 404, which relate to requirements for identifying, managing, controlling, or permitting nonpoint source pollution.(36,37,38,39)

The phrase “waters of the U.S.” defines the geographical extent of the applicability of the laws and regulations. Its meaning has been established by judicial precedence and encompasses virtually all bodies of water, perennial and intermittent streams, mudflats, sandflats, sloughs, prairie potholes, wet meadows, and wetlands. Wetlands are defined as “those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soils.”(40) Navigable waters, aquatic environments, and aquatic ecosystems that serve as habitat for interrelated and interacting communities of plants and animals are all “waters of the U.S.”(40 CFR 230.3).

Section 208 specifically identified silvicultural and livestock grazing practices as potential sources of nonpoint pollution and required states to prepare area-wide water quality management plans. The cumulative effects of silviculturally related nonpoint source pollution are also to be considered. By this law, state plans set forth procedures and methods (including land use requirements) to control, “to the extent feasible,” such sources (33 USC 1288 (b)(2)(F)). Typically state forest practices codes and regulations have been written in part to satisfy these requirements.

Section 319 concerns state nonpoint source management programs and requires that nonpoint pollution sources be related to specific navigable waters, that specific nonpoint sources or categories of sources for these navigable waters be identified, and requires that a management program for “controlling pollution added from nonpoint sources to the navigable waters within the state and improving the quality of such waters.” Best management practices (BMPs) are to be identified to reduce pollution from each identified source, “taking into account the impact of the practice on ground water quality.”(33 USC 1329)

The Clean Water Act regulations require that state plans include an antidegradation policy, which means that uses that were actually attained in the water body on or after November 28, 1975 shall be maintained and fully protected.(36) States may designate Outstanding Natural Resource waters (e.g., parks, wildlife refuges, locations of exceptional ecological significance) in which case lowering of water quality is prohibited (40 CFR 131.12). The goal is to ensure that water- related values do not worsen.

The EPA is charged with approving and overseeing the state plans. States have the authority under the Clean Water Act to regulate nonpoint pollution on public lands, including those managed by the Forest Service. In practice, this has usually resulted in the state delegating authority to the agency via memoranda of understanding that places responsibility for regulating nonpoint pollution with the Forest Service. This means that the Forest Service must apply BMPs to at least meet each state’s nonpoint pollution program, considering local environmental and management factors, to meet water quality standards and protect watershed and stream health. Summaries of state-by-state programs are published elsewhere.(37)

Section 404 (33 USC Sec. 1344) of the Clean Water Act was added by the 1972 legislation and amended in 1977 and 1987. It established the regulatory program that makes it unlawful to discharge dredge or fill material into “waters of the U.S.” without first receiving a permit from the U.S. Army COE. The EPA again provides oversight. Fill material means soil, sand, gravel, dredged material, or other material—certainly the type of material that is used during forest road construction and maintenance.

There are three ways to meet the requirements of Section 404: 1) apply for and obtain a permit for the discharge of fill material, 2) meet the criteria for a general permit, or 3) meet the criteria for exemption from permit requirements stated in the laws and regulations. The third method predominates for the case of Forest Service roads. The exemption is *“for the purpose of construction or maintenance of farm roads or forest roads, or temporary roads for moving mining equipment,*

where such roads are constructed and maintained, in accordance with best management practices, to assure that flow and circulation patterns and chemical and biological characteristics of navigable waters are not impaired, that the reach of the navigable waters is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized;" (33 USC 1344 (f)(1)(E), codified in 33 CFR 323.4 (a)(6)). The regulations promulgated from Section 404 go on to specify the "baseline provisions" that must be applied (figure 1), including the specification of those detailed BMPs described in the state's approved Section 208 and 319 nonpoint program.

General nationwide permits (NWPs) are another method to satisfy the Section 404 requirements. The COE is authorized to issue these, and in fact there are some 40 of these that are intended to regulate with a minimum of effort certain categories of activities that are thought to cause only "minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effect on the environment" (33 USC 1344 (e)(1)). NWP 14 is for "road crossings" (33 CFR 330, appendix A). There are specific notification requirements on NWPs, states can modify the conditions under which they apply, and they must be renewed periodically.

The pollution prevention or reduction controls and procedures are BMPs. BMPs are schedules of activities, construction techniques, maintenance procedures, prohibitions of practices, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include structural devices or nonstructural practices that are designed to prevent pollutants from entering water or to direct the flow of water. They can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. The law states that economic, institutional, and technical factors shall be considered in developing BMPs. Although state codes and guidelines are often identified as applicable BMPs, virtually any practice directed toward the goals of the Clean Water Act can be considered as such. This could range, for example, from overall watershed planning to the selection and application of road surface material.

The importance of BMPs required for exemption from Section 404 permit is underscored by the fact that if these BMPs (see figure 1) and the requirements of the applicable state plan are not met, then the project must be permitted either with a general NWP or specifically permitted. In practice, if the conditions for exemption under Section 404 are not met, then it is unlikely that the conditions for a general NWP will be met. The result is that the activity or project will be subject to Section 208 and 319 controls and conditions.

NATIONAL FOREST MANAGEMENT ACT

While not as specific with regard to water/road interaction as the Clean Water Act, the NFMA strongly reinforces the intent and purposes of the Clean Water Act, and where the Forest Service responsibilities under the Clean Water Act are indirectly assigned through other agencies, the NFMA assigns responsibility directly to the Forest Service.

NFMA provisions that are important when considering water/road interaction are those concerning where and how timber harvesting is to be done (16 USC 1604(g)(3)), planning for fish and wildlife resources (36 CFR 219.19), planning for water and soil resources (36 CFR 219.23), and the management of riparian and soil and water resources (36 CFR 219.27(e) and (f)). The specifics include:

1. ensure that soil, slope, or other watershed conditions will not be irreversibly damaged;

2. ensure that protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat;

Provisions for exemption from permit requirement under Clean Water Act for forest roads

(i) Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the United States shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;

(ii) All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads that must cross water bodies) to minimize discharges of dredged or fill material into waters of the United States;

(iii) The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(iv) The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

(v) Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

(vi) In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the United States shall be kept to a minimum;

(vii) The design, construction, and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

(viii) Borrow material shall be taken from upland sources whenever feasible;

(ix) The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

(x) Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

(xi) The discharge shall not be located in the proximity of a public water supply intake;

(xii) The discharge shall not occur in areas of concentrated shellfish production;

(xiii) The discharge shall not occur in a component of the National Wild and Scenic River System;

(xiv) The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and

(xv) All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Figure 1—Baseline provisions that must be applied (in addition to detailed state nonpoint program BMPs) for permit exemption under Clean Water Act Section 404 regulation. (33 CFR 323.4 (a)(6)

3. ensure that fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired nonnative vertebrate species;

4. evaluate existing or potential watershed conditions that will influence soil productivity, water yield, water pollution, or hazardous events;

5. give special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water.

Also "conservation of soil and water resources involves the analysis, protection, enhancement, treatment, and evaluation of soil and water resources and their responses under management and shall be guided by instructions in official technical handbooks. These handbooks must show specific ways to avoid or mitigate damage, and maintain or enhance productivity on specific sites."

Over the years since the Clean Water Act and NFMA legislation have been in effect, Forest Service field offices, other federal and state agencies, and others, have published guidelines, handbooks, and manuals delineating BMPs for protecting water quality. Research and development have been carried out to identify road-related practices and treatments that will help meet the challenge of the Clean Water Act. One publication in particular, the Water Resources Evaluation Non-point Silvicultural Sources (WRENSS) (41), has been elevated to the status of a national handbook.(42) This technical handbook was developed by the Forest Service under an agreement with the EPA and provides methods for analyzing changes to water and soil resources resulting from silvicultural activities. Part of this publication contains a descriptive catalog of BMPs that are termed "control opportunity descriptions." They are representative of the type of mitigation and design practice that may be further explored in the current water/road interaction series.

DISCUSSION

The evolution of road design and management with respect to the flow and effects of water has been motivated by our perception that ecosystems are more complex and less easily understood than was previously thought, just as it has for other areas of forest and rangeland management. In lieu of falling victim to the "law of unintended consequences," society has demanded that larger areas of our natural environment be preserved for their diversity as a hedge against inadvertently causing unintended and unhealthy changes. At the same time, we have the continued desire to use and cultivate our natural resources. Whether new developments or changes in the technical aspects of road location, design, or management will make forest roads any more acceptable to society is questionable. Some people in our society see naturally occurring features as desirable, or as in the case of natural disasters such as the eruption of Mt. St. Helens, at least forgivable, but tend to regard human works as having "the potential—if not the probability—to be ugly or wrong."(43) For these people, forest roads will, at their best, probably always be considered a marginally tolerable convenience, necessary in very few places, and only for gaining access. Others disagree, and hence forest roads have become highly controversial.

Controversy has also been fueled, however, by roads that have been the source of damage to surrounding resource values. Although past road design philosophy sometimes has resulted in roads that remain intact, contributing only small amounts of sediment to surrounding areas, often it has resulted in concentrated and channeled water flows that have caused long-lasting detrimental effects on the biological and physical processes over large adjacent areas. Some of these failures have been caused by a lack of understanding of the processes involved (resulting in designs that fail to account for these processes); some were caused by failure to adequately monitor construction practices; and some caused by inadequate or poor road maintenance practices.

The best approach in the midst of this controversy is to ensure that forest and rangeland roads meet standards set by law, regulation, and policy. For situations where water and roads interact, the legal framework provides plenty of guidance for how to approach the subject. For example, when planning road projects, the legal requirements will be determined by whether or not the project adjoins "waters of the U.S." as defined for the Clean Water Act. This will determine the legal structure under which the project will be regulated. Watershed staff and other expertise can help to make these determinations.

Those responsible for road design, construction, operation, and maintenance in forest and rangeland areas must realize that water plays an integral part in the processes that shape these areas. Flows that are concentrated are generally best dispersed to their natural flow paths, and designers need to account for the possibility of drainage system failure occurring during periods of high rainfall and runoff.

SUMMARY

Roads are unique in forest and rangeland areas. Their intended purpose is to afford human access, but they also have the potential to affect these areas in ways that are not intended. As populations have grown and the national forests have come under more pressure to be the source for a wider variety of values, roads have often become a focal point for controversy. Some of the issues surrounding roads in forested areas are those of the interactions between roads and water. These issues range from site-specific subjects such as culvert crossings, surface material erosion, and drainage ditches to larger scale and longer term subjects planning strategies such as locating roads to minimize landslides, and methods for assessing road-related risk to resource values. Several laws and regulations under which the Forest Service and other natural resource agencies work have come about in part because of issues such as these. Engineers, planners, and the other professionals who have responsibility for managing public lands need to be aware of the legal and regulatory environment related to water and roads. In fact, some of this background information is quite specific as to how to approach particular problems.

Iterative, interdisciplinary planning processes and comprehensive protocols are key to ensuring that we make progress toward meeting the goals of the Clean Water Act, NFMA, and the regulatory framework regarding water quality, watershed, and aquatic ecosystem function. The intention of the water/road interaction project is to identify information and methods on the hydrologic aspects of developing, operating, and managing forest transportation systems; help communicate state-of-the-art water/road interaction information effectively among field personnel; identify gaps in the knowledge base; and provide a framework for addressing future research, development, and technology needs on this subject. Field personnel will benefit from the latest information available on the interaction between water and roads with respect to forest and aquatic resources. The agency will be closer to satisfying the need for transportation access, while restoring and maintaining legally mandated water quality and aquatic ecosystem function.

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APPENDICES

APPENDIX A—SOME LAWS AFFECTING WATER/ROAD INTERACTION

Except for a few specific instances, the law does not deal with water/road interaction explicitly, but many laws have implications that affect water/road interaction issues. These include:

- **Organic Administration Act**. (June 4, 1897; 16 USC 473-475, 477-482, 551). This law defines the original purposes of the national forests: to improve and protect the forest within the boundaries, to secure favorable conditions of water flows, and to furnish a continuous supply of timber. At the time of the passage of this law, watersheds were recognized as systems that synthesize inputs of water and energy with geology, soils, landform, and vegetation to produce a range of land and water forms and physical and biotic processes. Implied in the movement that created the National Forest System was the notion that forests (including roads) and water should be managed so that the objectives of this law could be met.

- **Clean Water Act**. (Federal Water Pollution Control Act, June 30, 1948, substantially rewritten in 1972, amended - 1977, 1987; 33 USC 1251, 1254, 1323-1324, 1329, 1342, 1344). The objective of these laws is to "restore and maintain the chemical, physical, and biological integrity of the waters of the United States." Regulatory authority under this law is delegated primarily to the states and the Environmental Protection Agency (EPA). Sections 208 and 319 specify requirements for controlling nonpoint source pollution. Section 404 greatly expanded the federal regulation of dredge and fill activities, which is under the authority of U.S. Army Corps of Engineers (COE). Section 407 streamlined the permitting process for log transfer facilities. Provisions of this law are key to the legal context of water/road interaction for the Forest Service.

- **National Forest Management Act of 1976**. (October 22, 1976; numerous Sections in 16 USC between 472 and 594, and between 1600 and 1614). This law amended several previous laws including the Organic Act of 1897, the Weeks Law of 1911, and the Forest and Rangeland Renewable Resources Planning Act of 1974 with the clear charge to the Forest Service "to be a leader in assuring that the Nation maintains a natural resource conservation posture that will meet the requirements of our people in perpetuity." This was further delineated to include "protection . . . for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment. . ."

- **Endangered Species Act of 1973**. (December 28, 1973; 16 USC 1531-1536, 1538-1540) This law was written in part to declare that "Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." Furthermore, "Each Federal agency shall . . . insure that any [agency action] is not likely to jeopardize the continued existence of any endangered species or result in the destruction or adverse modification of habitat of such species . . ."

- **Fish and Wildlife Act of 1956.** (August 8, 1956; 16 USC 742) This law declares that "the fish and wildlife resources of the Nation make a material contribution to our national economy and food supply, as well as a material contribution to the health, recreation, and well-being of our citizens; that such resources are a living renewable form of national wealth that is capable of being maintained and greatly increased with proper management, but equally capable of destruction if neglected or unwisely exploited; . . ."

- **National Environmental Policy Act of 1969**. (January 1, 1970; 42 USC 4321, 4331-4335, 4341-4347). The stated purpose of this law is "to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; ... " Some of the effects of this legislation were to create the Council on Environmental Quality and the Environmental Protection Agency, and require the preparation of environmental impact statements and environmental assessments for all federal projects. One of the key

concepts embodied in this law is that actions at one point in time and space may affect environmental conditions important to human welfare at another time or place. Cumulative effects of roads and other management activity in watersheds are examples of this concept. Another key concept in this law is the use of "a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment; ... " The Forest Service has many people who are experts in the application of this law.

- **Executive Order 11988** (May 24, 1977), Flood Plain Management. This law requires each federal agency to take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Agencies are to evaluate the potential effect of any actions taken in a floodplain, and to ensure consideration of flood hazards and floodplain management.

- **Executive Order 11990** (May 24, 1977), Protection of Wetlands. This law requires each federal agency to take action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values to wetlands; to avoid undertaking new construction in wetlands unless all practicable measures are taken to minimize harm which may be caused; and to consider factors relevant to effects on the survival and quality of wetlands. This order applies to all federal projects and specifically mentions swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds.

Note: See Forest Service Manual 2527.03 regarding Executive Orders 11988 and 11990.

APPENDIX B—U.S. ENVIRONMENTAL PROTECTION AGENCY REGIONAL OFFICES

EPA Region	States	Nonnpoint Source Contact	NPDES Contact
1	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	(617) 565-3513	(617) 565-3580
2	New Jersey, New York, Puerto Rico, Virgin Islands	(212) 637-3701	(212) 637-3724
3	Delaware, Maryland, Pennsylvania, Virginia, West Virginia	(215) 597-3429	(215) 597-0547
4	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee	(404) 346-2126	(404) 347-3012
5	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	(312) 886-0209	(312) 886-6100
6	Arkansas, Louisiana, New Mexico, Oklahoma, Texas	(214) 665-7140	(214) 665-7175
7	Iowa, Kansas, Missouri, Nebraska	(913) 551-7475	(913) 551-7418
8	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming	(303) 293-173	(303) 293-1630
9	Arizona, California, Hawaii, Nevada	(415) 744-2011	(415) 744-1906
10	Alaska, Idaho, Oregon, Washington	(206) 553-4181	(206) 553-8399
—	National Headquarters	(202) 260-7100	(202) 260-9541
—	Chesapeake Bay Program	(800) 968-7229	
—	Gulf of Mexico Program	(601) 688-7940	