***Section Eight(a)***

**Road Construction**

**and Maintenance**

**2011-2016 NPS Pollution Management Plan**

**Statewide Programs**

**Introduction**

Regulatory oversight exists for road construction in many instances. Road construction projects that affect one acre or larger must receive a National Pollutant Discharge Elimination System (NPDES) permit, which is issued by the Arkansas Department of Environmental Quality (AEDQ). When road construction may affect the quality of a waterbody, 404 and 401 permits from the U.S. Army Corps of Engineers (USACE) and ADEQ may need to be obtained. Finally, pipeline right of ways and drilling pad construction are permitted components of resource extraction permits issued by the Arkansas Oil and Gas Commission. State highway construction projects are regulated under both the National Environmental Protection Act (NEPA) and the NPDES Construction Stormwater Permit program administered by ADEQ. Other examples of road construction, road maintenance, recreational vehicle road and trail use, and heavy equipment use of rural roads have been identified as threats to water quality. Significant types of road construction remain unpermitted, exempted from stormwater protection rules, and a source of nonpoint water quality degradation concern.

The local impact of sediment from timber harvesting and unregulated road construction on water quality can be significant when best management practices (BMPs) are not followed, especially in smaller headwater streams. Gravel, dirt, and other roads are considered to be the major source of erosion from forested lands, contributing up to 90 percent of the total sediment production from forestry operations according to studies (Rothwell, 1983).

These effects are of greatest concern where forestry activity occurs in high-quality watershed areas that provide municipal water supplies or support fisheries. Rural road use by heavy trucks involved in resource extraction, exacts a toll on roadway integrity, resulting in significant potential for erosion and sediment impacts on receiving streams. Roads, constructed and maintained without use of recommended BMPs, especially those with steep gradients, deep cut-and-fill sections, poor drainage, erodible soils, and poorly or improperly constructed road-stream crossings contribute to most of this sediment load, with road-stream crossings being the most direct source of erosion and sediment.

Improperly installed or undersized culverts increase energy in stormwater delivered to receiving streams, resulting in increased headcutting, and streambank destabilization, adding significant sediment loads, especially in flashy upland headwater stream circumstances. While ADEQ’s most current List of Impaired Waterbodies does not indicate any stream segments or waters identified with Road Construction (RC) as the cause, there were several segments listed with siltation/turbidity (SI) as the cause or impairment with the source being unknown (UN).

**Water Quality/Program Goals**

Roads, highways, and bridges are a source of significant contributions of pollutants to our nation’s waters. Contaminants from vehicles and activities associated with road construction and maintenance are washed from roads and roadsides when it rains or snow melts. Road construction and maintenance that are not required to follow or do not adequately follow NPDES permitting requirements may cause a further discharge of pollutants into waterbodies.

Runoff controls are essential to preventing polluted runoff from roads, highways, and bridges from reaching surface waters. For construction and maintenance projects which do not install and adhere to proper BMPs, erosion during and after construction of roads, highways, and bridges can contribute large amounts of sediment and silt to runoff waters. This sediment can deteriorate water quality and lead to fish kills and other ecological problems. Heavy metals, oils, other toxic substances, and debris from construction traffic and spillage can be absorbed by soil at poorly maintained construction sites and carried with runoff water to lakes, rivers and other waterbodies.

Runoff control measures can be installed at the time of road, highway, and bridge construction to reduce runoff pollution both during and after construction. Such measures can effectively limit the entry of pollutants into surface waters and groundwaters and protect their quality, fish habitats, and public health. Pesticides and fertilizers used along roadway rights-of-way and adjoining land can pollute surface waters and groundwater when they filter into the soil or are blown by wind from the area where they are applied.

**Contaminants in Runoff Pollution from Roads, Highways, and Bridges**

**Oils and Grease:** Oil and grease can leak onto road surfaces from car and truck engines, be spilled at fueling stations, or discarded directly onto pavement or into storm sewers instead of being taken to recycling stations.

**Heavy Metals:** Heavy metals come from some “natural” sources such as minerals in rocks, vegetation, sand, and salt. But they also come from car and truck exhaust, worn tires and engine parts, brake linings, weathered paint, and rust. Heavy metals are toxic to aquatic life and can potentially contaminate groundwater.

**Deicing Materials:** Deicing materials can be a major pollutant in both urban and rural areas. Snow runoff containing deicing materials may concentrate in waterbodies and potentially degrade water quality.

**Fertilizers, Pesticides, and Herbicides:** If fertilizers, pesticides/herbicides are applied improperly or in excess they can be carried by rainwaters from green parts of rights-of-way. In rivers, streams, lakes, and other waterbodies, fertilizers contribute to algal blooms and excessive plant growth, and can lead to eutrophication. Pesticides and herbicides can be harmful to human and aquatic life.

**Best Management Practices (BMPs)**

The U.S. Environmental Protection Agency (EPA) has developed a list of general maintenance BMPs. A variety of practices are used at construction sites to control both erosion and polluted runoff. These are identified as Construction Site BMPs. Practices developed as permanent erosion and sediment control devices are both structural and nonstructural. Several of these BMPs are listed below as long-term or Permanent Control BMPs (EPA, 1995).

**Construction Site BMPs**

* Straw bale barriers should be bound, entrenched, and securely anchored to prevent deterioration. A row of straw bales slows runoff flow and creates a pond behind the barrier where sediment can settle out. Straw bale barriers are most effective for filtering low to moderate storm flows, where structural strength is not required.
* Filter fabrics are engineering fabrics designed to retain sediment particles larger than a certain size and allow water to pass through. Filter fabrics can be used in silt fences (see below) or erosion control mats. Erosion control mats protect soil and seed from erosion and can be designed to allow vegetation to grow through the material.
* Silt fences are vertical fences of filter fabric that are stretched across and attached to support poles. The fabric retains sediment on the construction site and allows relatively sediment-free water to pass through. Silt fences are placed to protect streams and surrounding property from sediment-laden runoff.
* Sediment basins are ponds created by excavation or the construction of a dam or barrier. Sediment basins primarily serve to retain or detain runoff to allow excessive sediment to settle out during construction. Sediment basins can be converted into permanent detention ponds or wetlands after construction.
* Stabilized entrances reduce the amount of sediment carried off a construction site by vehicles when pressure-washed on site. These entrances are designed to include stabilized pads of aggregate underlain with a filter fabric. Stabilized construction site entrances should be located at any point in the construction zone where vehicles enter and leave. Wheels and undercarriages of vehicles should be washed before leaving the site.

**Operation and Maintenance**

Inspection and maintenance of erosion and sediment control BMPs both during and after construction has been completed are important to ensure that the BMPs are operating properly and effectively.

* Prepare and adhere to a schedule of regular maintenance for temporary erosion and runoff control BMPs. Two critical maintenance operations that must be performed regularly are cleaning out accumulated sediment and replacing worn-out or deteriorated materials, such as silt fence fabrics, so that the effectiveness of the controls is maintained. Maintenance can include dredging and reshaping sediment basins and revegetating the slopes of grassed swales.
* Remove temporary BMPs from construction areas when they are no longer needed and replace them, where appropriate, with permanent BMPs.
* Schedule and periodically inspect and maintain permanent erosion and runoff controls. This should include a periodic visual inspection of permanent BMPs during runoff conditions to ensure that the controls are operating properly.
* Clean, repair, and replace permanent erosion and runoff control BMPs when necessary.

**General Maintenance BMPs**

* Seeding with grass and fertilizing to promote strong growth provide long-term stabilization of exposed surfaces. Disturbed areas can be seeded and fertilized during construction and after it is completed. Sufficient watering and refertilizing 30 to 40 days after the seeds germinate help establish dense growth.
* Seeding with grass and overlaying with mulch or mats is done to stabilize cleared or freshly seeded areas. Types of mulches include organic materials, straw, wood chips, bark or other wood fibers, or decomposed granite and gravel. Mats are made of natural or synthetic material and are used to temporarily or permanently stabilize soil.
* Wildflower cover has been successfully used by many state and county highway departments to provide attractive vegetation along roadways and erosion control. Careful consideration must be given to visibility, access, soil condition, climate, and maintenance when choosing sites for wildflower cover.
* Sodding with established grass blankets on prepared soil provides a quick vegetative cover to lessen erosion. Proper watering and fertilizing are important to ensure the vitality of newly placed sod.

**Permanent Control BMPs**

* Grassed swales are shallow, channeled grassed depressions through which runoff is conveyed. The grass in swales slows the flow of runoff water, which allows sediment to settle out and water to infiltrate into the soil. Grassed swales can remove small amounts of pollutants such as nutrients and heavy metals. Check dams (see below) can be added to grassed swales to further reduce flow velocity and promote infiltration and pollutant removal.
* Filter strips are wide strips of vegetation located to intercept overland sheet flows of runoff. They can remove organic material, sediment, and heavy metals from runoff. Filter strips can consist of any type of dense vegetation from woods to grass but they cannot effectively treat high-velocity flows. They are therefore best suited to low-density developments.
* Terracing breaks a long slope into many flat surfaces where vegetation can become established. Small furrows are often placed at the edge of each terraced step to prevent runoff from eroding the edge. Terracing reduces runoff velocity and increases infiltration.
* Check dams are small temporary dams made of rock, logs, brush, limbs, or another durable material placed across a swale or drainage ditch. By reducing the velocity of storm flows, sediment in runoff can settle out and erosion in the swale or ditch is reduced.
* Detention ponds or basins temporarily store runoff from a site and release it at a controlled rate to minimize downstream flooding. Pollutant removal effectiveness is quite good for well-designed basins. Effectiveness is greatest for suspended sediments (80 percent or more removal) and related pollutants such as heavy metals.
* Infiltration trenches are shallow, three- to eight-feet deep (.91 to 2.44 m) excavated trenches that are backfilled with stone to create underground reservoirs. Runoff is diverted into the trenches, from which it percolates into the subsoil. Properly designed infiltration trenches effectively remove sediment from runoff and can remove some other runoff pollutants.
* Infiltration basins are relatively large, open depressions produced by either natural site topography or excavation. When runoff enters an infiltration basin, the water percolates through the bottom or the sides and the sediment is trapped in the basin. The soil where an infiltration basin is built must be permeable enough to provide adequate infiltration. Some pollutants other than sediment are also removed in infiltration basins.
* Constructed wetlands are areas inundated by water for a sufficient time to support vegetation adapted for life in saturated soil conditions. Wetlands effectively filter sediment, nutrients, and some heavy metals from runoff waters.

BMP Implementation Surveys conducted by the Arkansas Forestry Commission (AFC) indicate that practitioners should focus more attention on implementing forest road BMPs. Below are several BMPs developed by AFC.

**Road Location/Planning**

Use soil surveys, topographic maps, aerial photographs, or site visits to plan road locations to protect water quality. Design roads to minimize stream crossings. Where stream crossings are required, cross at right angles to the stream, locate roads along the contour or along the crest of long ridges and maintain sufficient distance between the road and the Streamside Management Zones (SMZs) to allow right-of-way maintenance.

**Road Construction**

Use at least the minimum design standard that provides a road sufficient to carry the anticipated traffic load with minimum environmental damage. Remove timber from rights-of-way and deck it outside SMZs. Design roads no wider than necessary. Balance cuts and fills to minimize excess excavated material. Place sidecast or fill material above the ordinary highwater mark of any stream except where necessary to stabilize stream crossings. Plan and conduct work so that water quality is protected during heavy rain. When needed, use seeding and mulching in a timely manner to reduce erosion. Implement appropriate BMPs during road construction.

Out-slope the entire width of the road where road gradient and soil type permit. Use cross drainage on in-sloped or crowned roads to limit travel distance of runoff water. Where roads are in-sloped or crowned and gradients begin to exceed 2 percent for more than 200 feet, broad-based dips or rolling dips should be placed within the first 25 feet of the upgrade.

Road bank cuts normally should not exceed five feet in height, should be sloped, and the soil stabilized to prevent erosion. Cuts may need to be fertilized, limed, seeded, and mulched to establish cover.

**Road Maintenance**

Crown or out-slope the road surface to disperse surface runoff and minimize erosion of the roadbed. Keep wing ditches free of blockages and keep culverts open and clean to allow unrestricted passage of water. Revegetate or stabilize erodible areas where natural vegetation is not sufficient to stabilize the soil. Minimize traffic on roads during wet conditions. Consider using geomat or rock to reduce road damage. Periodically inspect roads to see if BMPs remain effective. Re-establish vegetation as needed. Minimize traffic following maintenance work on sensitive road sections to allow them to stabilize. Keep roads free of obstructions to allow free flow of water from the road to the forest floor. Rework roads if road conditions deteriorate and may harm water quality.

**Road Drainage**

Ensure good road drainage with a combination of properly constructed and spaced wing ditches, broad-based dips, rolling dips, culverts, and bridges. Wing ditches should be constructed so water will be dispersed and not cut channels across the SMZ. At cross drains (culverts or dips), install rip-rap or other devices at outlets to absorb and spread water. Use brush barriers or check dams along road fill areas or other sensitive areas. Install ditches, culverts, cross drains, and wing ditches at low points in the road. Use crowning, ditching, culverts, and/or out-sloping to drain roads naturally. Provide cross drainage on temporary roads. Provide out-fall protection if cross drains, relief culverts, and wing ditches discharge onto erodible soils or over erodible fill slopes. Use diversion or wing ditches wherever possible to carry road drainage water onto the undisturbed forest floor. Use adequate sized culverts to carry the anticipated flow of water.

A road grade of less than 10 percent is preferred. Changing grade frequently, with rolling or broad-based dips, protects water quality better than by using long, straight, continuous grades. On highly erodible soils, grades should not exceed 8 percent. Grades exceeding 8 percent for 150 feet may be acceptable as long as appropriate BMPs are implemented. Graveling the road surface can help maintain stability. Install water turnouts, broad-based dips, or rolling dips before a stream crossing to direct road runoff water into undisturbed areas of the SMZ. With the exception of stream crossings, roads should be located outside the SMZ.

**Broad-Based Dips**

Broad-based dips are recommended for roads with less than 10 percent grade. Installation should take place after basic clearing and grading for roadbed construction. An energy absorber such as rip-rap and, in some cases, a level area where the water may spread, can be installed at the out-fall of the dip to reduce water velocity. On some soils the dip and reverse grade section may require bedding with crushed stone to avoid rutting the road surface. Broad-based dips should be placed cross the road in the direction of water flow. Broad-based dips are not recommended for constantly flowing water.

**Rolling Dips**

Rolling dips are a cross between water bars and broad-based dips. Like broad-based dips, they have a reverse grade (except it is shorter) and they tip water off the road. Like water bars, they may also rely on a mound of soil at the downhill side. Rolling dips can be used on haul roads having a slope of 10 percent and greater.

Rolling dips can be used after basic clearing and grading for roadbed construction after logging is completed. A 10- to 15-foot long, 3 to 8 percent reverse grade is constructed into the roadbed by cutting from upgrade to the dip location and then using cut material to build the mound for the reverse grade. In hills, locate rolling dips to fit the terrain as much as possible. They should be spaced according to the slope of the planned roadbed. Rolling dips are not suitable for constantly flowing water.

**Wing Ditches**

Wing ditches collect and direct road surface runoff from one or both sides of the road away from the roadway and into undisturbed areas. Wing ditches move water from roadside ditches and disperse it onto undisturbed areas adjacent to the road.

**Pipe Culverts**

Road and stream crossing culverts collect and transmit water safely from side ditches, seeps, natural drains, or streams under haul roads and skid trails without eroding the drainage system or road surface.

The pipe should be long enough so both ends extend at least one foot beyond the side slope of fill material. Culverts should be designed to carry the anticipated flow. The culvert should be placed with a 1 to 2 percent downgrade to prevent clogging. Lay the bottom of the culvert as close as possible to the natural grade of the ground or drain. Provide erosion protection for culverts. Lay aggregate or other suitable material on approaches to fords, bridges, and culvert crossings if needed to ensure a stable roadbed approach and reduce sediment in the stream. Fill for temporary culverts can be washed rock. Washed rock may remain in the channel when the culvert is removed. Remove culverts, bridges, and fill material other than washed rock from temporary stream crossings upon completion of operations and return the crossing as close as possible to its original condition. Install erosion protection measures at the culvert outlet as needed to minimize downstream erosion.

**Objectives and Milestones**

8(a).1. Reduce the impact that development and construction has on the state’s waterbodies.

**Timeline for Milestones:** October 2011 – September 2016

8(a).2. Continue to collaborate with the Arkansas State Highway and Transportation Department’s (AHTD) Environmental Division to ensure compliance with environmental laws, regulations, and policies.

**Timeline for Milestones:** October 2011 – September 2016

8(a).3. Continue to collaborate with AHTD, which maintains a manual of BMPs for construction stormwater management and provides training to its contractors and staff on BMPs.

**Timeline for Milestones:** October 2011 – September 2016

8(a).4. Continue to ensure the most current List of Impaired Waterbodies does not indicate any stream segments or waters identified with Road Construction (RC) as the cause.

**Timeline for Milestones:** October 2011 – September 2016

**Cooperating Entities**

Cooperating entities are listed and described in the cooperating entities section of the 2011-2016 NPS Pollution Management Plan.

**Federal Consistency**

Federal consistency is not anticipated to be an issue with this statewide program. If there are federal consistency issues, the Arkansas Department of Health and/or ADEQ will work with the relevant federal agency to achieve consistency.

**References Cited**

Controlling Nonpoint Source Runoff Pollution from Roads, Highways and Bridges EPA, Office of Water, August 1995 (EPA-841-F-95-008a) <http://www.epa.gov/owow/NPS/roads.html>.

Erosion, Sediment and Runoff Control for Roads and Highways, EPA http://water.epa.gov/polwaste/nps/runoff.cfm.