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Introduction

Over the past few decades, the availability and capability of Off-Highway Vehicles (OHV's) has increased tremendously, as has the intensity of OHV use on National Forest System (NFS) lands. While these vehicles have provided new recreational opportunities and access to many otherwise remote locations. field surveys have shown many OHV activities impact local natural resources. Without careful and wise management of OHV use and travel routes, their misuse can severely impact sensitive resources and water quality.

This increase in OHV use can affect water resources. OHV use near water bodies, particularly at stream crossings, has the potential to cause the following impacts:

- Delivery of sediment and turbid water to streams and water bodies, particularly during storm events
- Vertical and lateral erosion of stream channels at stream crossings
- Destruction or weakening of riparian vegetation, which can compromise stream-bank stability and increase water temperature
- Water pollution by petroleum and chemical products and other organic and inorganic waste, including human pathogens

The purpose of this set of Best Management Practices (BMP's) is to control nonpoint source pollution that may occur because of OHV recreation activities on NFS lands. Activities that indirectly or directly affect OHV and could potentially impact water quality include travel route planning, trail location and design, construction, operations, maintenance, reconstruction, and restoration of OHV-damaged areas. And classification (type) of trail use; i.e. rock crawlers vs ATV or MC.

The term off-highway vehicle (OHV) means any vehicle used for access or recreation on roads, trails and areas other than those built and maintained for highway-licensed vehicles. It can include standard and high-clearance four-wheel drive (4WD) vehicles, off-road motorcycles (MCs), all-terrain vehicles (ATVs), dune buggies, Side-by Sides (Utility Terrain Vehicles - UTV's, Recreational Utility Vehicle - RTV's) and snowmobiles.

OHV routes can also alter natural drainage patterns by intercepting, diverting, blocking, and concentrating surface and subsurface flows. Proper OHV management, route location, design, construction, and maintenance can reduce the impact to natural hydrologic functions and water resources.

Poorly designed and constructed routes are linear features that concentrate runoff. When runoff is concentrated on OHV routes and flows directly to a watercourse or water body, the trail becomes part of the drainage network, and responds accordingly to fluvial processes. Sediment is by far the primary pollutant associated with OHV activity, although human waste, vehicle fluids and petroleum products can also be significant pollutants locally. Discharges of sediment into California's waters that are associated with OHV activity are caused by accelerated soil erosion. OHV traffic accelerates erosion by disturbing and exposing soils.

Comment [DB1]: It is also important to mention: OHV use can also affect water resources through poorly designed trails and rutting of terrain by tire tracks. Trails and ruts not only divert and displace normal hillslope runoff flow paths they can lead to increased erosion and gully formation, often causing greater water quality impact than at low diversion potential stream crossings. Tire tracks and ruts also have the potential to compact soils in meadow environments. Mountain meadows are important temporal aquifers for water storage and biological refugia.

OHV trail stream crossings are important concerns similar in NPS pollution potential as their larger road crossings cousins; However, due to the nature, size and type of trail stream crossing, their potential impacts typically are much less than that of their cousins. I would say all the bullets listed are pollution pathways connected to OHV trail routes and construction design, and not particularly isolated to just stream crossings and other water course crossings.

OHV routes occur on designated FS roads and specific trails. While some roads are typically constructed from deeper sub-soils or regolith, most roads and trails for OHV use typically occur in native soil material that easily erodes.

Roads are also wider, have larger cuts and fill, are more compacted, and generally have gradients that are less steep than OHV trails.

Comment [DB2]: Most current OHV "trails" are FS ML1 and ML2 roads, commonly lacking maintenance, and abandoned "ghost" roads which aren't even acknowledged by the agency. While roads maybe wider, more compacted and have larger cuts and fills they are by no means less impacting to Water Quality. In fact, evidence shows most of these roads have significantly higher sediment yield than smaller 50" wide trails.

The implication that somehow roads by definition are built better should be removed. ALL OHV travel routes, whether on a road or trail, should adhere to the same BMP standards and addressed in the travel management plan.

There are situations where implementation of these BMPs may need to be more rigorous and where additional practices may be needed. Such situations include a water body listed pursuant to Clean Water Act section 303(d) as being impaired by sediment, siltation, or turbidity; and key watersheds in the areas covered by the Northwest Forest Plan and the Sierra Nevada Framework.

Authorities

The Travel Management Rule (36 CFR, Parts 212, 251, and 261) adopted in 2005 provides the framework for managing OHV use on National Forest System lands. It mandates the USFS to designate routes for motor vehicle use by vehicle type, and if applicable by time of year, and to identify the route designations and seasonal restrictions on a motor vehicle use map (MVUM). With some exceptions, it prohibits motor vehicle use that is not in accordance with those designations.

Both the Northwest Forest Plan and the Sierra Nevada Framework incorporate Aquatic Conservation Strategies that encourage identification of key watersheds on national forest lands where protection of aquatic and riparian resources is a priority.

The Off-Highway Motor Vehicle Recreation (OHMVR) Division of the California State Parks has promulgated Soil Conservation Standards and Guidelines for all projects that it conducts and for which it provides funding. The Forest Service receives grant funding from the OHMVR Division for managing and developing OHV use on National Forest System lands. The Soil Conservation Standard specifically requires management of OHV activities to avoid impacts to both on-site and off-site resources, including water quality.

This Water Quality Management Plan (WQMP) provides specific practices to protect and restore water quality while providing opportunities for OHV recreation.

OHV-1 Planning

Reference: FSM 7710, FSH 7709.55 and FSH 7709.59 Chapter 10

Objective: To use the travel management planning processes, including travel analysis, to develop measures to avoid, minimize, and mitigate adverse impacts to water, aquatic, and riparian resources during OHV management activities, and to identify for restoration OHV-damaged areas and routes not designated for use.

Explanation: Determination of the amount, type and location of OHV trails made through various planning processes. OHV trail management planning includes travel analyses as well as trail management at the project level. Planning occurs at scales that can range from Forest-wide assessments and plans, to watershed scale analyses, to project-level trail activities. Effects on water, and on aquatic and riparian resources, are assessed during planning and are balanced with the need to provide OHV recreation opportunities. Protection and mitigation

Comment [DB3]: Determine minimum trail density to meet objectives in the planning process. Project maintenance costs.

measures are considered when adverse impacts to water, aquatic, and riparian resources are anticipated.

Trail Management Objectives (TMOs) are developed to document the type of recreational experience each trail will provide, and to provide direction for management of the trail. In addition to considering trail management at the site scale, TMOs also document Forest-wide trail maintenance needs and consider the potential for environmental effects and conflicts with other resources.

The risk from OHV trail management activities can be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

1. Conduct Travel Analysis to determine the appropriate trail system for the recreational objective.
2. Plan routes to:
   - Minimize the number of stream crossings and the hydrologic connectivity[1] of OHV trails and watercourses.
   - Avoid locations through wetlands (e.g., seeps, springs, marshes and wet meadows).
   - Use existing routes instead of new construction where less damage to water quality will result.
   - Designate existing routes where possible. Reconstruction maybe necessary to meet current Road and OHV trail BMP construction and maintenance standards.
   - To the degree feasible, locate new routes on natural benches, flatter slopes, and on stable soils.
3. Avoid locating new routes on
   - Areas prone to mass-wasting;
   - Slopes steeper than 65%;
   - Slopes steeper than 50% where the erosion potential is high or extreme; or
   - Slopes over 50%, which lead without flattening sufficiently to dissipate concentrated runoff and trap sediment before it discharges into a water body.
4. Identify trail segments causing adverse impacts to water resources and prioritize mitigation measures such as:

[1] When trails concentrate runoff that flows directly to a watercourse or water body, they become part of the drainage network and are said to be hydrologically connected. The amount of sediment or turbid water that can be transported to a water body from an OHV route depends on the hydraulic power and capacity of the flow leaving the route. The hydraulic power and capacity of the flow are influenced by the degree to which runoff has been concentrated in the trail.

Comment [DB4]: How are effects measured? Define or cite protocols that demonstrate "balance" at each scale. How is the decision model matrices weighed? How are "adverse impacts" defined? Site-specific or cumulative?

Comment [DB5]: How often are TMOs developed and reviewed? Reviews should be periodically scheduled. TMOs should include annual trail maintenance surveys, needs and costs.

Comment [DB6]: Favor existing routes over new construction when less damage to water quality will result.

Comment [DB7]: Rather arbitrary. Delete bullet. Avoid concentrating trail runoff in the first place.
There are several geologic reasons for "trend and riser" topography as described. One of which is a compound landslide. Any prudent route analysis should sufficiently detail the geomorphology to identify features and avoid reactivating otherwise dormant features.
As well, concentrated runoff often leads to hillslope gully erosion where temporary deposition may occur on shallower slopes only to reemerge down slope in the short term. Common on certain soils and slopes over 50%. In time, discontinuous gullies merge and become continuous.

- To the extent practicable, relocation of existing routes or segments that are in high-risk locations, including the SMZ, riparian areas, and meadows to restore surface and subsurface hydrologic properties.

- Reconstruction to improve, modify, or restore effective drainage.

- Upgrade stream crossings to reduce diversion potential, identify stream type and whether perennial, intermittent or ephemeral, determine if a ford is appropriate or size culvert for minimum 100-year storm event, consider aquatic life passage in design.

5. Develop or update Trail Management Objectives (TMO) for each trail.

- Define the recreation experience and level of difficulty the trail is designed to provide.

- Determine whether existing trail design standards are adequate to support the defined recreational experience, and whether impacts to water, aquatic, and riparian resources are likely to result from not following TMOs.

- Identify current and future needs and uses of each authorized route in the TMO.

- Identify trails that are being managed differently and/or are serving purposes other than those identified in TMOs.

- Operate the trail as intended by TMOs until the TMOs are revised and/or the trail is reconstructed to accommodate different uses.

Comment [DB8]: Define update schedule, how often?

OHV-2 Location and Design

Reference: FSM 7720 and FSH 7709.56

Objective: To prevent or minimize sediment or turbid water originating from designated OHV routes and OHV areas from entering watercourses and water bodies by locating OHV routes to minimize hydrologic connectivity, and by incorporating drainage structures into trail design to effectively disperse concentrated runoff to minimize mass-wasting.

Comment [DB9]: Currently some OHV defined areas occur below the normal high water level in reservoirs, such as at Fordyce reservoir in Tahoe NF. You can't get more hydrologically connected than this. How does this location comply with the standard?

Explanation:

Proper on-site location and design of OHV routes is essential in protecting water quality and sensitive biological resources. Every route built on the landscape can affect natural hillslope processes by rerouting normal runoff and change hillslope mechanics. The effects can include increased gullying and landslides. The degree to which these normal processes are altered by route location and geometry are directly related to increased water quality effects.

When trails concentrate runoff that flows directly to a watercourse or water body, they become part of the drainage network and are said to be hydrologically connected. The amount of sediment or turbid water that can be transported to a water body from an OHV route depends on the hydraulic power and capacity of the flow leaving the route. This is influenced by the degree to which runoff has been concentrated in the trail. Sheet and rill runoff typically cannot penetrate a buffer strip, but concentrated runoff often can.

Comment [DB10]: Turbid water is sediment. Are you trying to distinguish between fine sediment and bulk load?

Comment [DB11]: By definition rills and gullies are formed by concentrated runoff, < 1 sq ft in cross-section; gullies are > 1 sq ft. Both have the ability to deliver sediment to watercourses and in time generally do.

The potential to deliver sediment or turbid water originating from OHV routes and OHV areas to watercourses and water bodies following OHV use is a function of

- The number, location, and design geometry of watercourse crossings

The template geometry of route segments between watercourse crossings

- The volume and energy of concentrated flow leaving the area or route
- The buffering capability (ability to absorb or disperse concentrated flow) of the intervening terrain, including slope gradient and surface cover
- The distance between the route and the receiving water body
- The inherent erodability of the disturbed and exposed soil

The first four of these factors determine the hydrologic connectivity between the route and the watercourse or water body. Watercourses are so important in managing the effects of OHV use on water quality that they have a BMP of their own. (OHV-3)

The techniques included in this BMP are intended to improve drainage and reduce or eliminate the hydrologic connectivity of trails and watercourses. The risk from OHV use can be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

Location

1. Locate OHV routes to avoid sensitive areas such as riparian areas, wetlands, meadows, bogs, fens, inner gorges, overly steep slopes, and unstable landforms to the extent practicable.
2. Limit hydrologically connected areas to necessary watercourse and stream crossings.
3. Locate trails to minimize the capture, diversion, and/or concentration of runoff from adjacent slopes.
4. Minimze hydrologically connected trail segments as much as practicable.
5. Locate drainage structures near watercourses to maximize the filter distance between the drainage outlet and the water resource.
6. Locate steep routes only on well-armored locations than can sustain traffic without accelerated erosion.
7. Limit the length of steep stretches to less than 100 feet on highly erodible soils.

Design

1. Design and space rolling dips, critical dips, reverse grades, and over-side drains to remove storm runoff from the trail surface before it concentrates enough to initiate rilling or surface erosion.

Comment [DB12]: five

Comment [DB13]: Interesting. What is overly steep? Does this mean steeper than adjacent slopes?

Comment [DB14]: And in particular, diversion of watercourses and stream crossings from their natural flow path.

Comment [DB15]: Explain? Drainage structures should be located at watercourses and stream crossings. Drainage structures such as at springs and seeps should be located as near as possible to capture surface flow with the drainage outlet aligned to natural watercourse to maximize inherent stability.

Comment [DB16]: Here and in #6, steep is arbitrary and relative. The issue is erodibility of soils.

Comment [DB17]: I would reorder the bullets in order of importance: 8, 9, 7, 2, 6, 1, 3, 4, 5.

#2—Design trail surfaces to dissipate hillslope runoff by curvilinear design, outsloping travelway and rolling of grade. Whoever thinks outsloping OHV trails is non-effective should spend more time in the field.
#1—locate, design and space rolling dips, etc. to mimic natural contour and hillslope swales.
#4, 5—Sediment basins and energy dissipaters are unnecessary in most cases with a properly designed and constructed/reconstructed route. If the dip carries enough flow to scour, then either the dip captures too much surface area or the dip needs to be armored. Relying on maintenance to clean out sediment basins is wishful thinking.

2. Design trail surfaces to dissipate intercepted water by rolling the grade.
3. Where trails cannot be effectively drained by rolling the grade or using reverse grades, provide trail drainage using OHV rolling dips as specified in *Rolling Dips for Drainage of OHV Trails*, USDA-Forest Service, Pacific SW Region, January, 2006.
4. Wherever possible, incorporate sediment basins at the outlet for rolling dip outlets instead of lead off ditches.
5. Install energy dissipaters at rolling dip outlets if sediment basins will not work.
6. Extend drainage outlets beyond the toe of fill or side-cast.
7. Install aggregate, paver blocks, or other surfacing treatment on tread segments that are steep, erosive, or heavily traveled.
8. Design routes to be no wider than necessary to provide the recreation experience for which they designed as identified in the TMO.
9. Incorporate design elements that discourage off-route use (e.g., taking shortcuts, cutting new lines).

OHV-3 Watercourse Crossings

Reference: FSM 7722 and FSH 7709.56b

Objective: To prevent or minimize the discharge of coarse sediment, turbid water and other pollutants into water bodies when locating, designing, constructing, reconstructing, and maintaining watercourse crossings.

Explanation: The importance of watercourse crossings in managing the effects of OHV use on water quality cannot be overemphasized. Of the pollutants generated by OHV use, sediment has by far the greatest volume and the greatest potential for sediment delivery at and near watercourse crossings where the potential for hydrologic connectivity is high. The approaches to watercourse crossings are typically constructed in native soils that can erode and deliver sediment to channels.

Typical OHV watercourse crossings include low water crossings, fords, bridges, arched pipes, culverts, and permeable fills. Crossing materials and construction vary based on the type of trail and kind of use. To minimize impacts to water quality, design crossings to provide for the unimpeded flow of water, bed-load and large woody debris, and aquatic organisms. Watercourse crossings must be constructed with minimal disturbance to the streambed and to surface and shallow groundwater resources.

Fill-slopes and the approaches to watercourse crossings are especially important. All sediment resulting from erosion on these surfaces is delivered directly into the watercourse.

Construction, reconstruction, and maintenance of watercourse crossings often require equipment to be in and near streams, lakes and other aquatic habitats. Such disturbance can increase the potential for accelerated erosion and sedimentation by destabilizing stream-banks or shorelines, removing vegetation and ground cover, and exposing and compacting the soil. Permits may be required for in-stream work associated with stream crossing construction and maintenance projects.

Comment [DB18]: Watercourse crossings are locations where OHV routes cross streams, springs, seeps and wet areas. These locations are where the greatest potential for direct delivery of pollutants to water bodies can occur. Routinely, these are sites where streams and smaller watercourses can divert out of their native channels or wash out crossing fills. They are the primary source for significant erosion with direct sediment delivery.

The primary causes for crossing failure are undersized drainage structure (commonly culverts), grade approach angles and poor construction. When drainage structures are undersized they cannot pass the natural by-products (water and woody debris) causing the structure to plug. Water can then breach the crossing fill either washing out the prism or diverting down the route scouring gullies and causing potential landslides.

Comment [DB19]: Delete. You cannot construct watercourses crossings without directly disturbing the streambed of the right-of-way unless you're installing a bridge.

You could say, watercourse crossing must be constructed as to not impede surface flow or create a diversion potential.

The risk of sediment delivery at watercourse crossings can be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions. Location, construction, and maintenance of watercourse crossings, and assessment of watercourse crossing condition, requires consultation with qualified personnel.

Implementation Techniques:

Crossing Location

1. Locate OHV trails to limit the number of watercourse and surface-water crossings necessary to meet planned activity objectives. (See also OHV-1)
2. Avoid long, steep trail segments on OHV routes that approach crossings.
3. Orient the stream crossing perpendicular to the channel in straight and resilient stream reaches.
4. Disturb as little area as possible when crossing a standing water body.

Trail Approaches to Watercourse Crossings[2]

1. Install cross drainage (cut-off waterbreaks) at crossings to prevent water and sediment from being channeled directly into watercourses or surface waters.
2. Locate cut-off waterbreaks as close to the crossing as possible without being hydrologically connected.
3. To the extent possible, make crossing approaches short and reverse the grade towards crossing.
4. Armor steep crossing approaches with stable aggregate or trail hardening materials.
5. Where possible, such as at bridges or arch culverts, reverse the grade of the crossing approaches so runoff drains away from the watercourse.

Design of Watercourse Crossings

1. Design crossing approaches and adjacent trail segments to shorten hydrologic connectivity.
2. Instead of pipe culverts, use bridges, bottomless arches or buried pipe-arches for watercourses with identifiable floodplains and elevated trail prisms.
3. Design watercourse crossings to allow for unobstructed flow including bed-load and organic debris, and to provide for passage of desired aquatic and terrestrial organisms. [Add reference to manuals for sizing & AOP]
4. Place stable materials below the outlets of cut-off waterbreaks to dissipate energy.
5. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces.

[2] The watercourse *crossing approach* is the segment of trail from the last point where all runoff is diverted from the trail to the edge of the stream channel. This last drainage structure is referred to as a "cut-off waterbreak."

Comment [DB20]: What is a surface-water crossing? Do you mean stream crossing since OHV-1 is already avoiding wetlands, bogs, fens?

Comment [DB21]: Avoid creating trail grade segments that dip away from watercourse crossings. Create reverse grades when approaching watercourse crossings.

Comment [DB22]: OHV-1 outlines avoiding crossing standing bodies of water. Avoid altering natural movement of water.

Comment [DB23]: A correctly constructed trail segment would already avoid concentrating runoff and the need for any "cut-off waterbreak", which in any other case is named a rolling dip. Stick to the same nomenclature.

Comment [DB24]: Not a bad idea for ford crossings.

Comment [DB25]: **Delete**. There are extremely rare situations where this might be necessary on rivers and those are all on larger ML4 and ML5 class roads, not something that should ever be considered for a "trail" alignment.

Comment [DB26]: What about intermittent or ephemeral streams. This is a case where a ford maybe the best choice that offers the least impact. Elevated trail prisms across floodplains are not a good idea, they are through fills and reroute flood flows and cause scour.

Consider using .... Instead of; and harden trail prism to grade instead of elevating.

Comment [DB27]: Delete

6. Construct watercourse crossings to sustain bankfull dimensions of width, depth and slope, and to maintain streambed and bank resiliency.
7. Harden fords with gravel or cobble of sufficient size and depth to prevent movement during wet weather traffic.
8. Harden crossing approaches as needed to minimize soil displacement by traffic during the rainy season.
9. Use USFS design specifications for bridges [Add reference].
10. Cross meadows or areas which have naturally high water tables with culvert arrays, perched culverts, and/or permeable fills, such as wood chips, to maintain meadow function.

Comment [DB28]: This only works for certain stream types with clearly defined floodplains and minimal active meandering. Otherwise depending on type of crossing structure it will be undersized and fail. "Bankfull dimension" is only 2+ yr storm event, crossing structures should accommodate at least a 100 yr. event.

Construction of Watercourse Crossings

1. Conduct construction operations during the least critical periods for water and aquatic resources (usually during low water conditions and non-spawning/breeding seasons).
2. Minimize excavation of stream banks and riparian areas during construction.
3. Stabilize adjacent areas disturbed during construction.
4. Keep excavated materials out of channels, floodplains, wetlands, and lakes.

OHV-4 Construction, Reconstruction

Reference: FSH 7709.57

Objective: To prevent or minimize the discharge of sediment or turbid water into water bodies during construction and reconstruction of OHV routes and trails.

Explanation: The construction or reconstruction of OHV routes and trails require ground-disturbing activities. These activities remove vegetation, ground cover and involve moving earth materials that may expose bare mineral soils to erosion. The logarithmic relationship applies--The wider the OHV route, greater the ground disturbing activities, higher the risk for erosion to occur. Temporary and long-term erosion control measures are necessary to minimize potential erosion and sediment delivery. The risk from construction and reconstruction activities can be managed by developing and implementing a specific erosion control plan. The erosion control plan details specific measures and implementation techniques that are adapted to local site conditions. These measures and techniques include and are not limited to the following list:

Implementation Techniques:

Comment [DB29]: Reorder bullets, differentiate between measures and techniques: Measures: 6, 7, 8, 9, 10, 5, 2, 3
Techniques: 1, 4

Add to measures: 1'- Cover all disturbed area susceptible to erosion and sediment delivery with two inch layer of mulch prior to increment weather. Wood chips, vegetation mulch or weed-free straw may be used.
Technique: Masticated vegetation and large woody debris developed from within right-of way and/or from adjacent areas is desirable.

1''- install temporary water control measures at watercourse crossings during construction activities. Use local rock to harden inlets and outlets.

1. Windrow slash and organic litter at the base of fill slopes to trap sediment.
2. When constructing trails near Streamside Management Zones (SMZ), do not permit side-casting of soil into the SMZ.
3. Do not operate ground disturbing equipment during wet weather when ground conditions could result in excessive rutting, or runoff that could deliver sediments directly to watercourses or water bodies.

4. Construct OHV-rolling dips[3] when soil moisture is sufficient to allow adequate compaction of OHV rolling dip drainage structures.
5. Close newly constructed trails for one season to allow consolidation of soils in treads and drainage structures so treads and structures can better withstand OHV traffic.
6. Develop and implement an erosion and control sediment plan that describes:
   - Amount of vegetative clearing and amount of soil material to be moved
   - Proposed erosion control measures
   - Proposed sediment control measures to capture mobilized sediment
   - Proposed sequence of implementation for erosion and sediment control treatments
7. Maintain erosion control measures to function effectively throughout the project area during trail construction and reconstruction.
8. Keep erosion control measures sufficiently effective during ground disturbance to allow rapid closure if weather conditions deteriorate.
9. Complete all necessary stabilization measures prior to predicted precipitation that could result in surface runoff.
10. Complete erosion and sediment control treatments before leaving project areas for the winter or rainy season.

OHV-5 Monitoring

Reference:

Objective: To minimize sediment delivery to water, aquatic, and riparian resources by identifying OHV routes and trail segments in need of maintenance, by setting priorities for maintenance, and by identifying OHV areas and routes in need of restoration.

Explanation: The Forest Service monitors OHV activities and effects to detect existing and probable impacts to water quality, aquatic and riparian resources. The Forest Service regularly inspects OHV routes and areas. If adverse water quality effects are occurring or there is a potential to occur, the Forest Service will take immediate corrective action. Corrective actions may include, but are not limited to

- Permanent or temporary erosion and sediment control treatments
- Barriers and signing to redistribute use
- Reduction in the amount or type of OHV use
- Partial or total closure of routes or areas

Implementation Techniques:

Comment [DB30]: To identify OHV areas, routes and trails that impact water quality, wetlands, aquatic and riparian resources and implement corrective actions and treatment measures to meet or exceed TMO objectives.

Comment [DB31]: Where is "regular" inspections detailed? Cite where monitoring plans and protocols are listed. Monitoring Plan should detail: frequency of inspections, date of inspections, data collection scheme, type of problem, observations, analysis, recommended actions, priority for corrective measures, date of resolve, date of follow up inspection, and were the corrective measures a success.

Monitoring Plans and inspection/inventory data should be posted on-line and open to the public with the ability for the public to add specific comments. Excellent Monitoring Plans are adaptive. They document areas of strength and success, and identify areas of weakness and need of improvement. They are interactive and transparent where the public can be involve and supportive of TMO.

[3] *Rolling Dips for Drainage of OHV Trails*, USDA-Forest Service, Pacific SW Region, January 2006.

1. Conduct G-Y-R Trail Condition Monitoring as described in *Revised OHV Trail Monitoring Form (GYR Form) and Training Guide*, USDA-Forest Service, Pacific SW Region, July 30, 2004, to identify routes in need of maintenance and to prioritize maintenance activities.
2. Schedule GYR Trail Condition Monitoring so high-risk and high-maintenance routes are monitored annually; schedule the monitoring of stable routes less frequently, but not less than every three years.
3. Conduct periodic inspections of OHV routes use to identify and assess newly created unauthorized OHV use, and schedule restoration treatments.
4. Close routes that pose immediate significant threats to water quality. As a minimum, install temporary erosion and sediment controls prior to the winter season.
5. Close, and if possible, relocate routes that cannot sustain OHV use without causing adverse effects to the beneficial uses of water. Restore permanently closed routes or portions of routes.

OHV-6 Maintenance and Operations

Reference: FSM 7732, FSH 7709.58 and FSH 7709.59 Chapter 60

Objective: To prevent or minimize discharges of sediment or turbid water into watercourses and water bodies by maintaining OHV routes and associated drainage structures and by regulating OHV use.

Explanation: OHV trails are linear features constructed in native soil that have a potential to concentrate runoff. Except for occasional hardened segments, trails are not typically surfaced with aggregate. In addition, normal OHV traffic tends to create an outside berm along the tread. Drainage and erosion control facilities cease to function if they are worn down by continued traffic. These factors make periodic maintenance critically important in minimizing the impacts of OHV use on water quality.

Trail drainage systems may further increase hydrologic connectivity if they deteriorate because of use, weather, or inadequate maintenance. Trail drainage facilities may become inadequate after wildfires or extreme precipitation events due to increased surface runoff, loss of vegetative cover, and stream bulking. New groundwater springs and seeps saturate trails occasionally after the occurrence of a wildfire or following unusually wet periods. Timely maintenance can correct these conditions. Properly designed, constructed and maintained road/trail minimizes potential wildfire and extreme precipitation adverse effects.

Trail maintenance with mechanized equipment such as SWECO-type trail tractors and mini-excavators can disturb soil, making it susceptible to erosion. Less aggressive maintenance is often necessary to minimize disturbance of stable sites.

The construction of OHV rolling dips is from native soil material. For these structures to hold up under traffic they need to be well compacted. This requires moist soils and the scheduling of maintenance task to exploit the narrow window of time when soil moisture is optimal for compaction.

Obstructions to traffic such as fallen logs and potholes can lead to trail braiding, puddles and off-trail traffic. Prior to opening trails for use, or periodically for trails open year-round, clearing trails of obstructions can reduce the need for repair and restoration.

Comment [DB32]: Where is this?

Comment [DB33]: To maintain OHV routes in a manner which emphases water quality protection by preventing erosion of road and trail right-of-way surfaces, preventing watercourse diversions, maintaining associated drainage structures and by regulating OHV use.

Comment [DB34]: What about the road routes? Water quality impacts from unmaintained roads, designated as OHV routes, are much higher than for a trail.

Proper maintenance is the most important factor after construction to minimize road/trail deterioration and potential water quality impacts.

The rate of deterioration varies greatly, depending on numerous factors: volume and type of vehicle traffic, amount, type and duration of precipitation, soil characteristics, road/trail grade, number and type of drainage features, topography, adjacent vegetation, and frequency of maintenance operations.

Comment [DB35]: Delete. OHV routes are not foot paths and unfortunately by the time maintenance is required mechanized equipment is the most effective long term solution. As with any water quality protection measure, timely preventative action is the best response. Often prompt minor corrective actions can be accomplished with hand tools, such as: clearing drainage structure blockages and removing/breaching berms. Otherwise mechanized equipment will be required.

Avoid or minimize disturbing stable sites, concentrate maintenance activities on site-specific problems.

Comment [DB36]: There is confusion about what a rolling dip is. A rolling dip is just that a dip in the travelway. It is NOT a rolling hump. Avoid installing humps (i.e., waterbars and barrier berms). They consistently fail and only provide "ramps" for jumping.

Rolling dips are cut into bare mineral soils. Preferably spoils are disp ... [1]

Comment [DB37]: Nice thought. It would be nice if this actually happened.

Trail management objectives (TMO) define the designed use, type of recreation experience, and the level of difficulty that a trail is designed to provide. A specific maintenance plan is developed based on designed use, level of difficulty and road/trail erosion hazard analysis. The number of challenging terrain features, many of which have been created by vehicle wear and erosion processes, often define the level of road/trail difficulty. Design and maintenance plans detail specific erosion and sediment control measures. The deterioration of roads/trails to a more challenging difficulty level due to a lack of maintenance can affect water resources. More challenging trails often produce more sediment.

The effects of trail maintenance activities on water quality is managed by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

Maintenance Planning

1. Develop and implement annual maintenance plans that are based on the results of trail condition surveys (USFS - TRACS) and monitoring (G-Y-R) and periodic inspections. (See OHV-5)
2. Schedule maintenance to maximize the time-period when soils are at optimal moisture levels for soil compaction or prior to seasonal closure.

Inspection

1. Periodically inspect, monitor and assess trail condition to assist in setting maintenance priorities and schedules. (See OHV-5)
2. Identify the need for additional drainage structures, spot rocking, or trail hardening to protect and maintain water, aquatic, and riparian resources.
3. After major storm events, inspect potential problem trails, drainage structures and runoff patterns and, as needed
   - Clean out, repair or reconstruct drainage structures that are not functioning
   - Clear the tread of obstructions to traffic that could lead to trail braiding or off-site impacts

Maintenance Activities

Comment [DB38]: Excellent

1. As per Regional Forester's direction dated 11-8-2002, follow the maintenance standards and guidelines in *A Field Evaluation of the Use of Small Trail Tractors to Maintain and Construct OHV Trails on National Forests in California*, USDA-Forest Service Pacific SW Region, August 22, 2001. These standards and guidelines include the following:
   - Lift the blade and walk equipment across sections of trail that do not need maintenance.
   - Recycle soil collected in rolling dip outlets into rolling dip structures or back into the trail tread.
   - Do not blade the outside berm off the trail as side-cast; work the berm back into the trail tread.
   - Blade soil sloughed from cut-banks, or from side-slopes above trails, only as needed to maintain a safe trail; do not undercut or blade into cut-banks.

- Move the smallest amount of soil necessary to meet the maintenance objective.
- Where soil is too dry or too wet for compaction, defer maintenance on drainage structures, or carry out maintenance by hand.

2. Maintain trail surfaces to dissipate intercepted water in a uniform manner along the trail by the use of OHV rolling dips. (See OHV-2 for design specifications)
3. Groom trails as needed with a rock rake to keep drainage outlets open.

Operations

Comment [DB39]: Excellent

1. Restrict OHV travel to designated routes or designated motor vehicle use areas rather than allowing cross-country travel.
2. Prior to opening routes for use, clear obstructions to traffic to avoid braiding.
3. Close routes or restrict OHV use when the potential for sediment delivery is high or during periods when such use would likely damage the tread or drainage features. (Also see OHV-7)

   Identify and document unauthorized routes. Block unauthorized OHV routes with large woody debris and native materials. Obliterate unauthorized routes to discourage reuse and prevent further erosion potential.

OHV-7 Wet Weather Management

Reference:

Objective: To prevent or minimize sediment washing into water bodies by closing OHV routes to traffic when roads/trails surfaces and drainage structures are susceptible to wet weather damage.

Explanation: Useage of OHV routes during wet weather conditions often result in rutting and churning of surfaces damaging road/trail surfaces. and increases the risk of sediment delivery to watercourses and water bodies. Runoff from such disturbed road/trail surfaces can carry a high sediment load. The damage and maintenance cycle for road/trails that are frequently used during wet periods can create a disturbed surface that is a continuing sediment source

The susceptibility of OHV routes to damage during wet weather conditions varies with soil type, amount of traffic, and type of vehicle. Each OHV area has a unique combination of soil types and precipitation patterns that determine the appropriate implementation techniques to minimize impacts to water resources during wet weather.

Implementation Techniques: To manage potential sediment wash from OHV use during wet weather, the Forest Service will use its authority under 36 CFR Section 261 to close designated OHV routes and areas to vehicular travel. This may be done seasonally by a given date, or be based on local conditions such as precipitation or measurements of soil erosion hazard. Use the following techniques, as appropriate, using local conditions for wet weather management of OHV route systems:

1. Develop a wet-weather management plan.

Comment [DB40]: Define elements in plan, such as seasonal closure dates, wet weather use signage, use during storm events outside of seasonal closure periods.

2. Close routes seasonally for the months when soil moisture is typically high.
3. Close routes for a core period when soil moisture is expected to be high, and extend the closure period as needed, based precipitation or soil trafficability.
4. Determine the levels of soil strength and moisture at which OHV trail damage begins to occur for typical traffic, and close routes when measurements of soil strength indicate there is a high risk of damage to drainage structures and trail treads.
5. Identify benchmark locations where measurements of precipitation or soil trafficability will be taken to determine when trails will be closed.
6. Identify routes, or loops of routes, with similar conditions that can be selectively closed.
7. Identify and reroute or reconstruct trail segments which cause entire routes or trail systems to be closed because they retain moisture longer than is typical for the route.

   This is fine but who monitors and how frequent?

Comment [DB41]: Define.

OHV-8 Restoration of OHV-Damaged Areas

Reference: FSM 7734

Objective: To prevent or minimize sediment wash into watercourses and water bodies by permanently restoring natural hillslope function in OHV-damaged areas, watercourse crossings, and OHV routes no longer designated for use.

Explanation: OHV traffic can damage natural, biological, aquatic resources and affect water quality. OHV traffic can compact soils and lead to Loss of ground cover and vegetation leaving soils exposed and easily erode. Ruts and tracks created by OHV traffic are unnatural channels that can concentrate surface runoff and increase its erosive power and sediment wash.

OHV traffic in wet meadows and marshes damages the root network that stabilizes sensitive soils. This can cause stream incision, which lowers the water table and results in a loss of meadow and riparian vegetation.

Areas of OHV damage require restoration to restore proper ecological function.

OHV-damaged areas, and OHV routes no longer available for use, are identified during the route designation process at the Forest and watershed level and during trail condition surveys and monitoring (see OHV-5). Identify additional trail segments for restoration when rerouting trails.

Comment [DB42]: Rephrase.

Restoration of OHV-damaged areas and closed trails includes activities that stabilize and restore the landscape to a more natural state. Treatments can range from simply scattering slash or raking in duff and litter, to watercourse or meadow restoration, to using heavy equipment to break up compaction, fill in incised trails, reshape the area to its natural contour, and install drainage structures. Planting native vegetation helps stabilize slopes, intercepts, and defuses rainfall. Effective closure from OHV traffic is essential to allow restored sites to recover.

Accomplish restoration of OHV-damaged landscapes by using the appropriate techniques from the following list, as applicable and adapt as needed to local site conditions.

Implementation Techniques:

Comment [DB43]: Adequate. Oten I've seen "restoration" by abandonment or only by berm or barrier installation. No active restoration as described here. Third party monitoring should be required to ensure BMP compliance.

Restoration of Routes and OHV-damaged Areas

When planning the restoration of OHV-damaged routes and areas consider the following steps taken from *Restoration of OHV-damaged Areas – A Ten-Step Checklist*, USDA-Forest Service, Pacific SW Region, May 31, 2006:

1. Identify the source of the problem
2. Effectively close the area to OHV traffic
3. Reshape the land surface to its original contour
4. Disperse concentrated runoff
5. Prepare the seedbed
6. Planting or seeding
7. Stabilize the surface
8. Signing
9. Enforcement and monitoring
10. Remove signs and barriers

More information on each step is included in the report. Additional information on restoring OHV-damaged areas can be found in *Restoration of Off-Highway Degraded Landscapes* (in press) USDA-Forest Service, San Dimas Technology and Development Center, 2010.

Restoration of Watercourse Crossings

With the possible exception of ephemeral watercourses (those that lack a well-defined, channel bottoms), restoration of watercourse crossings should be done under the direction of—or after consulting—a qualified watershed specialist. A permit may be required if in-channel work is necessary.

When restoring OHV watercourse crossings, follow these guidelines:

1. Remove all crossing fill and drainage structure and restore the channel bottom to its natural gradient and width.
2. Consider adding large woody debris or native substrate to stabilize channel bottom on gradients greater than 4 percent. It is only necessary to add channel substrate (boulders, cobble, gravel) if excavated channel length exceeds bankfull width by a factor of 8.
3. To the extent possible, reshape the stream-banks to their former natural contour.
4. Retard banks back to native ground, contour and blend into adjacent hillslope treatments. Stabilize banks with woody debris or other weed-free mulch on slopes exceeding 20 feet in length.

OHV-9 Concentrated Use Area Management

Reference: FSM 2160 and FSH 7109.19 Chapter 40

Objective: To prevent or minimize the discharge into water bodies—or contamination of groundwater by infiltration through soils—of turbid water, sediment, petroleum and chemical products or human waste by planning, constructing, installing and maintaining drainage and

Comment [DB44]: Excellent-- often topographic swales, springs and seeps are over looked in road/trail restoration requirements. However, these features are extremely important for slope stability and re-establishment of native surface and near-surface water flowpaths.

Comment [DB45]: unnecessary in most situations when land surface is recontoured. There is usually ample native seed from adjacent areas, avoid introducing non-native materials. If seeding is “required”, harvest local mulch with native seed bank and spread on bare areas such as in meadows. In conifer areas, when winter comes wind scatters needles and leaves fall self mulching bare areas.

Comment [DB46]: If the old route is still enticing some OHV users will “reopen” the route. Maintain barriers, or scatter LWD near entrance to discourage use until such time as area is fully restored and old route is invisible to users.

Comment [DB47]: While ephemeral watercourses lack signs of surface flow they do carry near-surface flow and require special attention as stream headwater areas. They are generally sites of high debris slide/torrent potential depending on slope, fill volume and water content. For management purposes, they should be included in “restoration of watercourse crossings” and a qualified watershed specialist should be consulted.

Comment [DB48]: Awkward wording. Revise.

To prevent or minimize the discharge of pollutants into watercourses, water bodies or into groundwater resources at concentrated OHV Use areas by planning, constructing installing and maintaining drainage and runoff measures.

runoff treatments at OHV staging areas, and by managing the risk of pollution at high-use and high-risk OHV areas.

Explanation: Petroleum products and chemicals from spills during refueling, leaking, damaged or overturned vehicles and from improper disposal, practices can be a source of water contamination. Small amounts can be absorbed by the soil and broken down, but the risk of water contamination is often high in concentrated use areas located near watercourses and water bodies.

Comment [DB49]: good

Where sanitation facilities are not available or are inadequate, fecal matter and pathogens can enter water bodies. The risk of contamination from fecal matter and pathogens is highest in areas near water bodies with concentrated use. OHV staging areas sometimes constitute large areas with little or no infiltration capacity. Runoff from these areas is high and can transport sediment, nutrients and other pollutants to any nearby watercourses or surface waters.

OHV staging areas are sometimes used for winter recreation. Snow removal from these facilities may adversely affect water, aquatic, and riparian resources. Plowing can physically displace native or engineered surfaces, damage drainage structures, or alter drainage patterns. Snow plowing may also remove protective soil cover such as vegetation and mulch. These changes can result in concentrated flow, increased erosion, and a risk of sediment delivery.

The risk of delivering sediment, petroleum and chemical products, and human pathogens to water bodies at concentrated use areas can be reduced by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

Staging Areas

1. To the extent possible, locate staging areas away from water bodies and watercourses to reduce the potential for hydrologic connectivity. Good
2. Design OHV staging areas to accommodate the amount of use expected. Good
3. To determine necessary drainage, calculate the expected runoff using the appropriate design storm. Be sure to include total watershed catchment area in calculation.
4. Armor high-use areas with protective materials appropriate for the site.
5. Except where the risk of groundwater contamination is high, armor with permeable pavements and/or integrate vegetative islands to trap and filter runoff. Design and implement infiltration galleries, sediment traps and treatment wetlands in managed stormwater drainage networks.
6. Infiltrate as much of the runoff as possible in areas where the risk of groundwater contamination is low.
7. Where staging areas are located near watercourses or water bodies, and the potential for hydrologic connectivity is high, install a contour berm and trenches around the perimeter to contain sediment and potential spills. Route stormwater to #5.
8. Provide permanent or temporary sanitation facilities as appropriate for the level of recreation use expected.
9. Adopt and implement a Spill Prevention, Containment, and Counter Measures plan.

10. Report hazardous spills and initiate appropriate clean-up action in accordance with applicable state and federal laws, rules and regulations.

High Risk Areas and Events

1. Develop and implement a fuel and chemical management plan (e.g. SPCC, spill response plan, emergency response plan) for special events and at locations where the risk of overturned vehicles is high. For example, extreme (highly technical) 4x4 trails and rock crawling areas.
2. Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.
3. Report hazardous spills and initiate appropriate clean-up action in accordance with applicable state and federal laws, rules and regulations.
4. Provide temporary or permanent sanitation facilities as appropriate for the use level.

Comment [TU50]: Nice, but many areas are remote in the backcountry and lack normal access and mobile phone coverage. Unless these are organized events, I'm suspicious that the independent user will notify authorities of fuel or other chemical spills. How would theis plan be implemented and by whom? Would there be caches of clean-up materials on site at each high risk area?

Camping Areas

1. Provide permanent or temporary sanitation facilities at high use areas, especially at campsites and day-use areas near water bodies, watercourses, and riparian areas and meadows.
2. As necessary and feasible, provide sanitation facilities at commonly used camping and resting sites and at other areas of concentrated use.
3. Provide education and training on the principles of backcountry sanitation, pack-it-in and pack-it-out. And for, hazardous spill protocol and emergency response cache locations. And, stay on trail trend lightly philosophy.

Snow Removal

1. Develop a snow removal plan for OHV staging areas plowed for winter recreation.
2. Move snow in a manner that will prevent disturbance of road surfaces and drainage/pollution control structures while protecting adjacent water, aquatic, and riparian resources.
3. Store snow in pre-approved areas where snowmelt will not cause erosion or deposit snow, road de-icers, or traction-enhancing materials directly into surface waters.

Additional Comments—

- Travel Management Plans and Objectives—these plans prefer utilizing existing roads and abandoned logging skid trails. Yet most of these routes were originally designed for other access purposes, primarily logging, and are poorly maintained if at all. Many of these roads go through checker board private in-holdings or the road is County, such as in Tahoe NF. What agency will be responsible for OHV BMP monitoring and compliance in these cases? Are there road/trail management agreements?

- Through out these BMPs the routes are often referred to as "trails" when in fact they are primarily roads and rarely are trails at all. The term "trail", for most people, envisions a foot path, not a 16 foot wide road. If they were only 50" wide trails we wouldn't have nearly so many water quality effects. A distinction should be made. There is a big difference in environmental effects between damage made from rock crawlers on "4x4 trails" and ATVs on 50" wide trails. We have tried to apply these standards to the wider context of routes. However, the difficulty here is will these standards be applied to all OHV routes whether the route follows a FS road or off-road trail? Will water quality protection measures for FS road segments fall under Road BMPs or OHV BMPs?

- Where can the following documents be obtained:

    - *Revised OHV Trail Monitoring Form (GYR Form) and Training Guide*, USDA-Forest Service, Pacific SW Region, July 30, 2004.
    - USFS – TRACS.
    - *A Field Evaluation of the Use of Small Trail Tractors to Maintain and Construct OHV Trails on National Forests in California*, USDA-Forest Service Pacific SW Region, August 22, 2001.
    - *Restoration of OHV-damaged Areas – A Ten-Step Checklist*, USDA-Forest Service, Pacific SW Region, May 31, 2006

- Consistently throughout the author uses "discharge of sediment or turbid water". Turbid water is sediment. How about just calling it sediment wash.

References[4]

Antos-Ketcham, Peter S. and Richard Andrews, Ed. *Backcountry Sanitation Manual* Green Mountain Club/Appalachian Trail Conference, 220 p.

Birkby, Robert C. *Lightly on the Land: The SCA Trail-Building and Maintenance Manual*, 268 p.

Crimmons, Tom M. 2006. *Management Guidelines for Off-Highway Vehicle Recreation*, NOHVCC, 51 p.

[4] These references include information on OHV management, including trail location, design, construction, and maintenance, all of which affect OHV trail drainage, and therefore ultimately sediment delivery and potential impacts on water quality.

Demrow, Carl & David Salisbury *The Complete Guide to Trail Building and Maintenance, 3rd Edition,* 256 p.

International Mountain Bicycling Association *Trail Solutions: IMBA's Guide to Building Sweet Singletrack,* 272 p.

Parker, Troy Scott *Natural Surface Trails by Design: Physical and Human Design Essentials of Sustainable, Enjoyable Trails,* 80 p.

Parker, Troy Scott *Trails Design and Management Handbook*, 230 p.

Steinholtz, Robert and Brian Vachowski, 2001. *Wetland Trail Design and Construction*. USDA Forest Service

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USDA Forest Service — Engineering Staff, 1996 *Standard Specifications for Construction and Maintenance of Trails*, EM-7720-103 and EM-7720-104, September, 1996.

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USDA-Forest Service, Pacific SW Region, 2006. *Rolling Dips for Drainage of OHV Trails*, January, 2006

USDA-Forest Service, Pacific SW Region, 2006. *Restoration of OHV-damaged Areas – A Ten-Step Checklist*, May 31, 2006

Wernex, Joe, *Off-Highway Motorcycle & ATV Trails: Guidelines for Design, Construction, Maintenance and User Satisfaction, Second Edition*, 56 p.

Page 10: [1] Comment [DB36] **David Burns** **9/29/2010 12:34:00 PM**

There is confusion about what a rolling dip is. A rolling dip is just that a dip in the travelway. It is NOT a rolling hump. Avoid installing humps (i.e., waterbars and barrier berms). They consistently fail and only provide “ramps” for jumping.

Rolling dips are cut into bare mineral soils. Preferably spoils are disposed along the dip slope cutbank.