[Design and Layout of Houston OHV Trail]

By US Forest Service Trails Unlimited Enterprise Unit

Trails Unlimited

USDA Forest Service Enterprise

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FIELD TRAIL LAYOUT WORK:

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WES STURDEVANT

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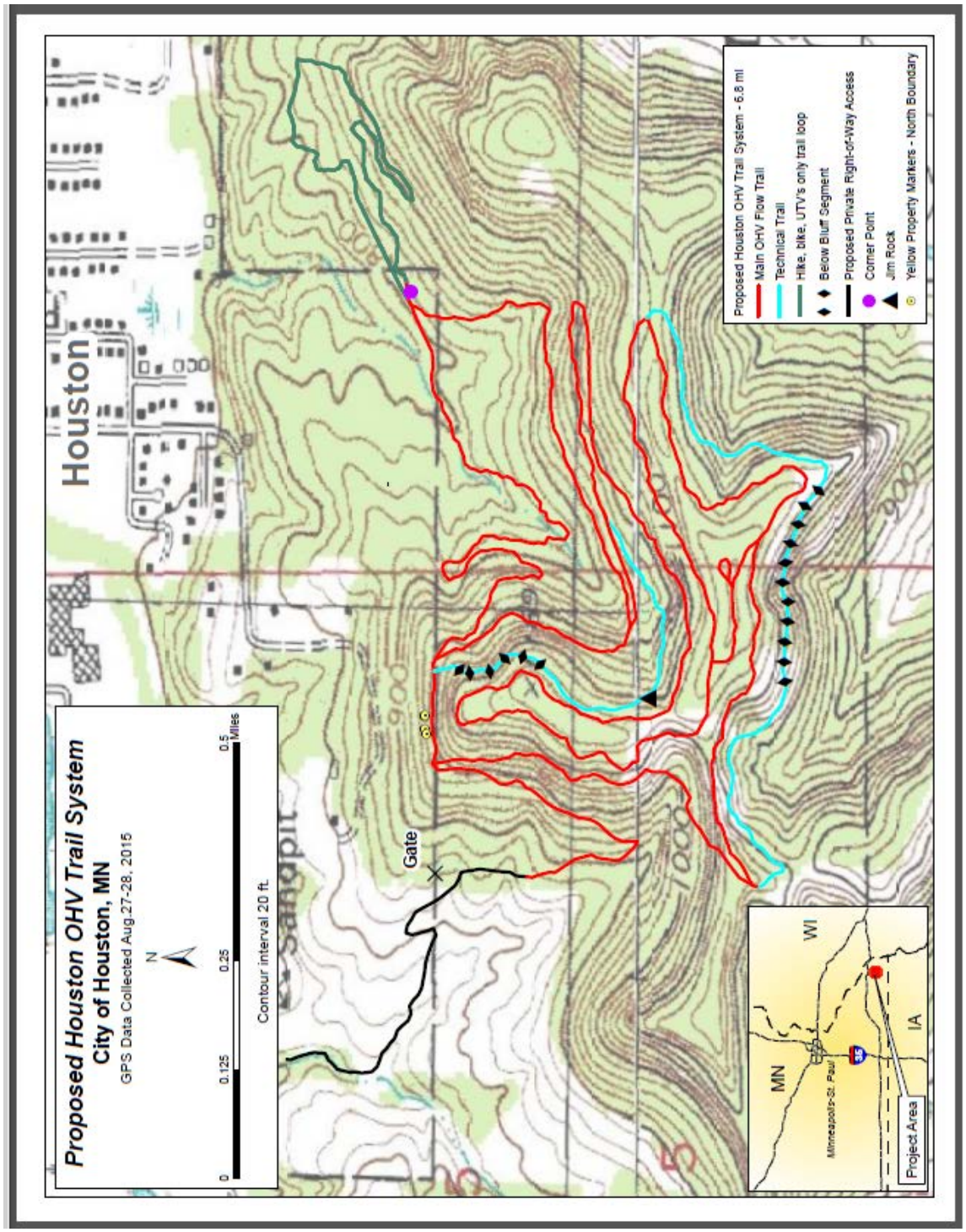
Proposed Flagged Centerline Houston OHV Trail System -- GPS August 27, 2015


Proposed Houston OHV Trail System
City of Houston, MN
GPS Data Collected Aug.27-28, 2015
N
0
0.125
0.25
0.5 Miles
Contour interval 20 ft.
Houston
Sanborn
Gate
Proposed Houston OHV Trail System - 6.8 mi
Main OHV Flow Trail
Technical Trail
Hike, bike, UTV's only trail loop
Below Bluff Segment
Proposed Private Right-of-Way Access
Corner Point
Jim Rock
Yellow Property Markers - North Boundary
WI
MN
IA
Minneapolis-St. Paul
35
Project Area

I. INTRODUCTION

The City of Houston, Minnesota, the Minnesota DNR – State Parks and Trails, and the National Off Highway Vehicle Conservation Council (NOHVCC), partnered together to assign the tasks of the proposed Houston OHV trail system design, ground layout, and construction to the U.S. Forest Service Trails Unlimited Enterprise Team. Under time constraints to get a proposed trail design centerline flagged on the ground before September 2015, the Trails Unlimited team contracted the design and layout to Jerry Barrow, a recently retired USFS Trails Unlimited Civil Engineer. Mr. Barrow has degrees in both Civil Engineering and Forestry, with over 32 years with the Forest Service and 6 years in private practice as a Civil Engineer and Forester and over 30 years in trails.

Over the previous 5 years lands were studied for the proposed OHV trail site just outside the southern boundary of the City of Houston. These were studied by the Minnesota DNR for an OHV trail system development. The final tracts for consideration of the first Phase comprises approximately 205 acres of moderate elevation mountain lands. Several environmental documents, land studies and the letter from the Minnesota DNR Division of Parks and Trails for preliminary review of the potential Houston OHV trail system were provided to Trails Unlimited and Jerry Barrow. These papers also included the GIS analysis for optimal OHV Route on the lands and the noise monitoring and analysis for Houston LAWCON Environmental Assessment. Mr. Barrow thoroughly reviewed the documents and incorporated as practical the observations in his engineered trail design and then to his ground truth, field flagged, trail centerline layout of the proposed design.

In this report are the summary list of considerations and assumptions used to guide the field layout of the designed proposed trail plan, and the recommendations made as a result of the layout experiences and the field conditions encountered during the actual trail centerline flagging.

Attached to the end of the Houston OHV Report is additional information on construction techniques, wet weather management recommendations, and Best Practices and some relevant trail information for future managers of the OHV system. The information comes from the experience derived from assessments on a large Forest Service OHV system in the east.

II. BACKGROUND

As the contracted OHV trail design and layout civil engineer, I arrived on the Houston OHV site August 13, 2015 and spent several hours looking at the northern general property and access locations. The temperatures were in the 90's with 90% humidity and the ground vegetation was extremely thick. This made viewing terrain variations very difficult for trail layout and slowed the field work progress accordingly.

On August 14th I meet with Karen Umphress with NOVACC, Geoffrey Obrien and Alan of the MN 4Wheel Drive Club from the Minneapolis, MN. Area. The group spent the day walking the higher elevation property sections of the 205 acre proposed OHV site. This included several bluff sections, ridge tops, existing woods roads, steep western slopes and potential vista points. The group reviewed, flagged, and obtained GPS points for several assumed property boundary markers in the north and south tract areas before trail layout began. Topics discussed during the field review were soil types and erosion potential, trail grades for sustainability, development of technical trails for challenge OHV users, wildlife concerns, potential noise generated by the OHV trail vehicles as a concern for the Houston citizens living near trails, long term maintenance requirements, and trail management issues.

On August 15 and 16, I transversed all the property terrain from north to south and east to west so as to flag trail control points, mapped potential vista points to include along the trail routes, map and GPS the trail boundary limitations for the proposed trail system, map potential bluff areas to avoid, map figures such as Jim Rock to include near proposed trail routes as interest points, reviewed any concerned watersheds as indicated on my topographic maps and associated drainages for potential trail crossing conflicts, and reviewed the vegetation types. The following is a summary of characteristics I attempted to thoroughly ground truth and incorporate in my planning process before beginning the actual trail centerline flagging process on August 17th with Wes Sturdevant of the U.S. Forest Service Trails Unlimited Enterprise Team:

- Terrain conditions.
- Slope aspects and side slopes along the proposed trail design layout routes.
- Vegetation types – mature forest canopy.
- Soils types in the proposed trail design areas. Sensitive soils.
- Wildlife observations in the hot summer environment and thick vegetation.
- Experience on what to advise and incorporate as the sustainable trail grades for the OHV use on the small proposed project site adjacent to the City of Houston.
- Trail route turns and intersections – how to layout for construction on difficult site.
- OHV noise – be aware of potential noise developed in north slopes facing Houston city neighborhoods.
- Improved access route for future OHV users to get to the proposed trail system.
- Technical trail considerations and the trail routes/features that provide users the option for more difficult and challenging trail segments and incorporate sustainable trail construction techniques.

- Consideration for the recommended appropriate trail building machines to construct the trail systems and protect the integrity of a good design and yet create an interesting trail system.
- Specific tract land areas and proposed trails – their sensitivity to potential trail abuse and over use by the OHV users. What might rogue trail riders do and the environmental repercussions.
- Construction techniques and strategy to develop sustainable trail features:
  Example: 1. Design concrete planks to armor the surface of the rolling dips that are required for water control on steep trail grades greater than 18% to protect from any OHV harsh traffic and failure of the water device mound.
  Example: 2. Construct the OHV trails along the contours of mountain sides in the areas of large mature trees by carefully constructing the trail using very skilled operators on select trail building equipment for tight winding trails and not to overcut the ground for the trail between two large mature adjacent trees. The trail is flagged to spare large mature trees wherever possible.
- Consider concerns of adjacent landowners and the potential volatile situations that could develop for the OHV users.

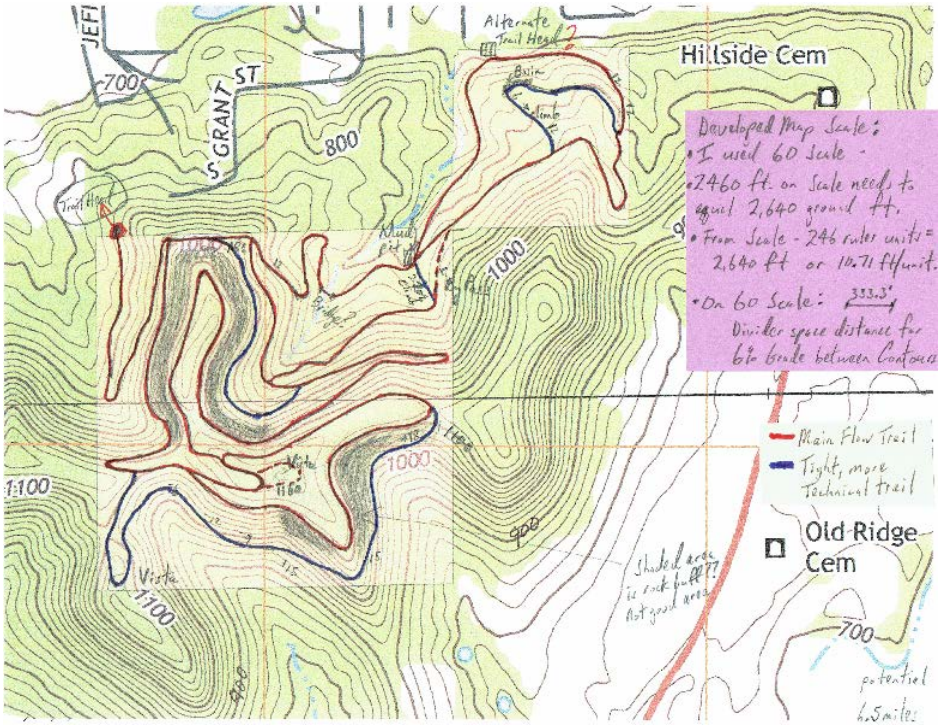
Recreational use on Minnesota State Park land can impact natural resources and it is the intent of the USFS Trails Unlimited Team to recommend and demonstrate how to mitigate these impacts while offering a sustainable recreational experience for the public. It is the intent of Trails Unlimited to help reduce the impacts of Off Highway Vehicles (OHV's) on the proposed Houston OHV Trail System in order to enhance both the ecosystem and recreational experience for the user.

III. FIELD TRAIL LAYOUT, SITE ASSESSMENT AND OBSERVATIONS AND RECOMMENDATIONS

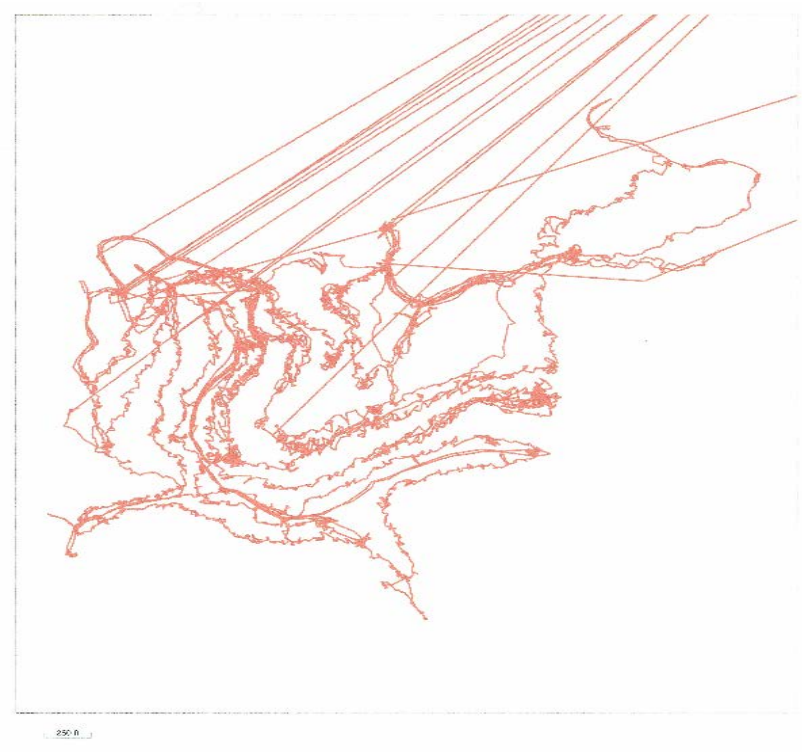
A. PROPOSED HOUSTON OHV TRAIL DESIGN AND LAYOUT BY TRAILS UNLIMITED

As discussed earlier in this paper, the proposed Houston OHV trail design was engineered by calculating grades and layout routes on topographic maps by Jerry Barrow, a former Civil Engineer with USFS Trails Unlimited Team, prior to his arrival to Houston on August 13, 2015. He reviewed, studied, and researched the information in several Houston site specific documents provided by the City of Houston and the Minnesota DNR – Division of Parks and Trails to assist his design decisions. These documents included the GIS Analysis for Optimal OHV Route by Saint Mary's University of Minnesota, the Natural Resources Conservation Service soil types in the project vicinity, the paper of the Minnesota DNR preliminary review of potential Houston Off-Highway Vehicle Trails System, and the Noise Monitoring and Analysis for Houston LAWCON Environmental Assessment.

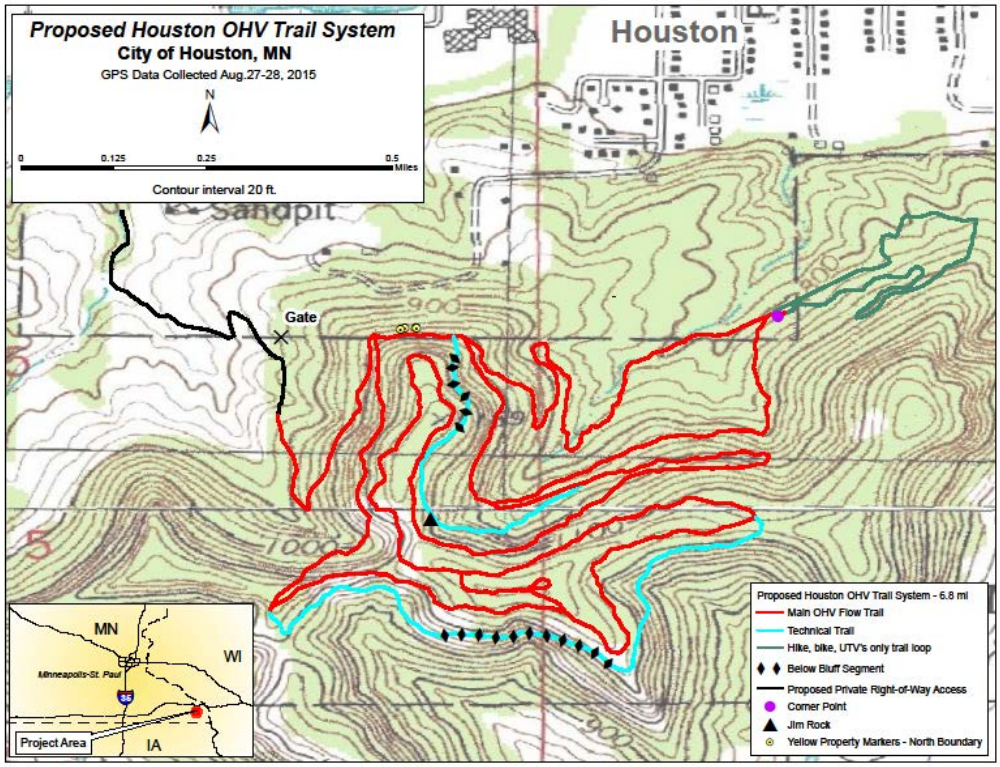
A snap shot below of the preliminary field layout map is shown that guided the two man Trails Unlimited OHV trail layout team on the 205 acre tract. Also shown is the combined GPS routes walked and scouted by Jerry Barrow to establish the final neon pink flagged trail centerline as shown on the third small map. Also, see Sheet 4 of this report for larger proposed flagged trail map view.



View of field map of the proposed trail route designs for Houston OHV System



GPS Scouting routes performed to verify potential OHV trail system and to ground truth area



The completed flagged OHV routes on the estimated 205 acre Houston project site – 6.8 miles, not including the proposed private property access route in black.

As noted during the first five days of field work, humidity was over 90% and temperature was around 93 degrees F. There were several days of light rain that the two person team trail layout crew worked through so as to complete the trail system layout within the 2 week schedule. The vegetation was extremely thick in many areas of the project site. It was much more difficult to view the ground soil surface and topography to make quick trail routing decisions. This increased layout and flagging time operations.

Thick vegetation in August slowed progress and made it more difficult to note the terrain and soils.

The Engineer's (I) trail design objective was to maximize the OHV trail routes on the small 205 acre project site to provide at least 5.5 to 7.5 miles of sustainable OHV trail opportunity that would be interesting to ride, provide opportunities to move slowly to enjoy forest scenery and scenic vistas, and provide options for some challenging technical trail segments, if possible. I scouted the entire property for 2.5 days to mark on my field topographic trail layout plan map the identifiable boundary lines, property corners, exposed rock bluff locations, trail layout control points, accessible scenic vista points, concerned drainage areas, existing trail/old wood roads locations, any obvious changing soil types/conditions for construction considerations, the potential proposed trail routes intersections locations on mountain slopes, and the ridge crossings. The important ground points, for my personal layout use, were GPS and flagged with either orange or neon pink survey flagging that I could see from a distance in the thick vegetation. I could reference and navigate with this location point when I would be performing the trail centerline route location flagging procedure.

The team flagged the proposed trail centerline with bright neon pink survey flagging for a total of 6.8 miles within the property boundaries. The grade objective was to keep trail grades in the 6% to 15% range for the most sustainable conditions, but short distances, less when constructing the trail than 150 ft., often had to be 16% to 20% grades to effectively work the available terrain to connect to control points. These grade deviations might also allow to protect the desirable vegetation, such as large mature trees and their root systems as the trail is constructed to thread tightly between the large trees. This technique could protect soil, save large mature trees from being cut down to retain the woodlands setting, make the trail more technical with the close objects, and therefore keep OHV speeds down.

Yellow steel post boundary line marker along north boundary of private property and City of Houston park property, with Wes Sturdevant of USFS Trails Unlimited.

USFS Trails Unlimited member near point on small ridge of a proposed 3 way trail intersection, just below rock bluff on northwest corner of property and adjacent to private property boundary. Very tight turns will be required to be constructed.

I designed the average OHV trail grades to be confined in the 6% to 15% range for sustainability. Also, the Natural Resource Conservation Service soil report for the general area and the actual field observed soils supported the evidence of predominate sandy soils and silty clay loams soils throughout much of the OHV project tract. These are weak soils for frequent vehicle traffic. Therefore, the trail grade will control as well as the trail construction techniques. Techniques such as frequent grade reversals (break in grade) and artificial rolling dips where necessary to control water on the trail, to be essential to maximize the wear resistance by OHVs on the trail over extended periods. The elevation of the proposed OHV trail project tract ranges from approximately 685 ft. elevation to 1180 ft. elevation. The average annual rainfall is 30 to 38 inches and the average annual snowfall is 34 inches. These site statistics reflect the degree of efforts that should be incorporated into the engineering aspects of the trail design and construction to provide the water control necessary over such a small proposed OHV land tract area. Wet weather management will be an issue.

600 LF of existing woods road of 26% grade recommended to be used for connecting trail segment for technical trail route. Construct as 7 ft. width and incorporate design of engineered rolling dips, hardened with concrete planks (dog bone reinforcement) and riprap, approximately every 75 ft. to control water run-off and erosion, and the speed of OHVs.

It is recommended as a general guideline on weaker soils the following to harden the trail tread:

- Grades of 12-15% - install a 3-4 inch thick road base layer on the trail section
- Grades of 16-20% - incorporate rock cobles and riprap in the trail tread to decrease rutting and erosion
- Grades of 21-28% - incorporate boulders, rocks, concrete planks along the rolling grade reversals

Sustainability also has an economic component in terms of what the City of Houston can reasonably expect to afford in terms of management, operations and maintenance cost over the long-term. The Houston main concerns and considerations are to maximize trail distance from active stream channels, decrease the average grade of the trail system, armor select segments, and reduce the tread width of the trails, such as 7 ft. width for technical trails and 8 ft. width for main flow trails. These actions will reduce the soil erosion potential and the impacts on the watershed. The reduced width and two-way traffic shall require multiple pull outs, where possible, every 500 ft. or so, to allow two-way traffic to pass.

Experience has shown that it is best to keep average grades below 8% on a preliminary flag line where breaks in grade are not yet identified. Preliminary flag lines expedite the process when it is known that breaks in grade will be installed upon construction. Specific number and size of culverts recommended may be refined at a later date. For the Houston OHV trail system very few, if any, small culverts would be required to move water away from the trails.

I have classified two of the proposed trail route segments flagged as technical trails as shown on the **Proposed Houston OHV Trail System** map, page 4. These flagged trails pass beneath the limestone bluffs on steep side slopes greater than 40%. They may offer the OHV trail users greater challenge to negotiate, at slower speeds, several rock formations in the trail of steep terrain. These

trail segments are going to required much greater skilled equipment operators with the expertise to carefully construct the 7 ft. wide bench cut trail tread adjacent to rock formations along the mountain side contours. Construction cost will be substantially higher due to rock encountered and the terrain steepness. As on all the proposed Houston OHV trail routes, selection of the appropriate construction equipment is important to minimize over-building the trail by moving too much soil. This will help to lessen the soil material and vegetation cover disturbed and therefore decrease overall erosion potentials. These constructed routes will provide options for the skilled OHV users that seek greater driving challenges.

Terrain of proposed technical trail (note rock outcropping near top of ridge) on south quadrate of OHV tract

Layout route below Jim Rock to squeeze between 6 ft. width or climb over low rock boulder

Proposed technical trail segment – below Jim Rock. Note yellow measuring tape set at 6 ft. on ground. OHV machine could climb over low boulder on downhill side of tape if over 6 ft. wide.

The most southern proposed centerline flagged technical trail is located on the south facing slope. This will be the most challenging trail to construct. I attempted to locate this trail segment just below the rock bluffs because I could not set in steeper trail grades on the 70% and greater side slopes. Also, it would be difficult to negotiate the trail route back up the mountainside to tie back into the ridge top loops. The property boundary lines confine the trail to remain at higher elevations in the souther property section.

Construction of the most southern technical trail will be a challenge and yet provide skilled OHV users an option for the challenge they are seeking.

During the field design and layout of the trail system in the thick underbrush and around the rocky bluffs formations, the Trails Unlimited crew avoided disturbing any potential cultural resources discovered and noted any wildlife observed. The layout team understood that timber rattlesnakes are state threatened and protected species. Because of the very thick underbrush and most often one could not even see their boots on the ground, the team wore knee high snake guards. After traversing the property for 13 straight days of August and climbing among the limestone bluffs, no snakes of any kind were encountered. The team saw only two bucks during the work periods.

The proposed trail was laid out above and away from the discovered location of a stacked rock pit that can offer interpretation opportunities along the trail route

The City of Houston and the citizens have concerns with the potential sound of OHV's coming from the proposed OHV trails just south of the city. As the Trails Unlimited team flagged the trail segments on the northern sectors of the tract, adjacent to the city park, it was clear they could hear the sounds from sports players practicing on the high school field in town. The Noise Monitoring and Analysis report for Houston states the MPCA State Noise Standard restrict noise levels to 65/60 dBA (L10/L50) during the daytime and 55/50 dBA during the nighttime. This is a low level and might be difficult for OHV machines to achieve at the City of Houston doorsteps. The State of California currently has a 96 decibel A-scale (dBA) limit for dirt bikes and ATV's. This is enforced by a test procedure approved by the Society of Automotive Engineers (SAE J1287 JUL98). This test is a simple procedure that involves a vibratory tachometer and a sound meter. This is a recommended model to regulate sound because there has been much accomplished with the stakeholders to achieve this successful model. These stakeholders include; Sierra Club, American Motorcyclist Association, and the Blue Ribbon Coalition.

The final observation and a recommendation for the success of the proposed Houston OHV trail system involves the City and OHV groups working very closely and involving the adjacent landowners in some decision making, if that is possible. During the Trails Unlimited team work time on the property, we were threaten by one adjacent landowner in the field. He claimed he owned some of the State property and had disputes about boundary lines. Our belief is he had hiked in or rode an ATV, in the earlier hours or night before, up on the north ridge, above the bluff on the State property, and removed the flagging on approximately 2500 LF of a completed trail segment. The team discovered the removed flagging one morning and notified the Houston Police Chief. These issues will need to be somewhat resolved before construction can begin in the future.

Some material I reviewed as a reference as I prepared my field location plan:

1. Park Guidelines for OHVs, by George E. Fogg, FASLA, NOHVCC
2. ORV Design Guidelines, Oakland County Parks, Rowe Professional Service Co.
3. Designing Sustainable Off-Highway Vehicle Trails, An Alaska Trail Manager's Perspective, by Kevin G. Meyer, US Park Service and the USDA Forest Service Technology and Development Center, Missoula, MT….November 2013, 1123-2804P-MTDC
4. Managing Degraded Off-Highway Vehicle Trails in Wet, Unstable, and Sensitive Environments, USDA Forest Service Missoula Technology and Development Center, publication 2300 Recreation – October 2002 – 0223 – 2821 - MTDC

A *rolling dip* is a manufactured break in grade for water control (Appendix 5 - Diagram A). It offers a more gradual transition than a water bar. A water bar is not designed for traffic use but is used to rehabilitate and to melt away over time. In comparison, a rolling dip is a permanent water control structure designed to function under OHV traffic. In some locations a rolling dip can utilize a sediment basin.

Sediment or catchment basins traps soil eroded from trails so it can be recycled back into the trail (Appendix 5 – Diagram B). Sediment basins also minimize the delivery of sediment to watercourses.

Energy dissipaters slow down the flow of water exiting a catchment basin or rolling dip. Commonly constructed of rock, they are placed on the downhill side of the basin (Appendix 5 - Diagram C).

The method *hay and seed* uses annual rye, or native seed, to establish vegetation in order to reduce the exposure of bare soil. Roots act to hold soil in place. The straw is used as a ground cover to improve germination and protect from impact erosion by rainfall.

Reclaiming soil that has been pushed off the trail, the idea is to keep material on the trail, not to remove it. The excavator is the best tool for this purpose. This material can be stockpiled for future use or for use at other locations along the trail.

Arch culverts offer a natural stream bottom that does not disrupt the natural path of wildlife (Appendix 5 – Diagram D). They allow for twice the volume of water when compared with round culverts and it does not focus water into one location but allows for multiple pathways for water. Armoring or hardening of the inlet and outlet of the arched culvert protects the banks from the flow of water. It also protects the stream banks through rain events and prevents the trail from unraveling into the stream.

Blending of soil types to enhance strength of the soil is recommended. Either off-site soil can be brought in or soil reclaimed from other sections of the trail can be utilized. Differing particle size allows for proper compaction of the soil. When lacking a specific particle size it may optimize soil strength by blending. It is also recommended that rock six inches and larger not be incorporated into the trail tread, when possible, due to the inability for compaction.

There are several factors that have led to the current situation of less than sustainable trails. Like many trails throughout the Forest Service the WPG Trail Complex was not properly planned, designed or constructed for OHV use. In addition the user vehicle type has changed over time and will likely continue to evolve. In the last five years there has been an increase in the use of UTVs. The drainage structures used on the trail can be modified to better accommodate these new vehicles. The majority of the trails require reconstruction due to road maintenance practices that occurred in the past. It is not uncommon to find this situation when road maintenance practices are implemented on trails. Ideally trail maintenance is done by a highly trained individual with appropriate and properly maintained trail equipment well suited to the particular job. Improper trail

maintenance techniques contribute to a non-sustainable trail including: blading 100 percent of the trail, creating large berms, moving material off of the trail, and installation of wing ditches. While these practices may be appropriate for roads they are not appropriate for trails. A road is a structure placed upon the land whereas sustainable trails work with the landscape rather than trying to change it.

Trails Unlimited has a philosophy for trail work.

This can be divided into three distinct ideas. They are: ***Less is More, Dirt Management,*** *and the* ***Progression to a Trail Builder****. Trails Unlimited will be working closely with the District to pass this information on to managers and operators alike.*

Less is More

The SUTTER trail machine has a blade width of 52". Due to the width of the blade and the speed and reactivity of the trail machine, it's sometimes more desirable to take less material per pass with a few more passes. This allows for compaction in small lifts and facilitates dirt management.

Dirt Management

Our philosophy is to move the minimum amount of material, to the right location, in the minimal amount of time. When moving dirt on the trail, it's important to practice dirt management. Sometimes you have to slow down to finish faster. Disturb and move only the amount of material that is needed to accomplish the task at hand.

If you need additional material, the prioritization of places to get it is:

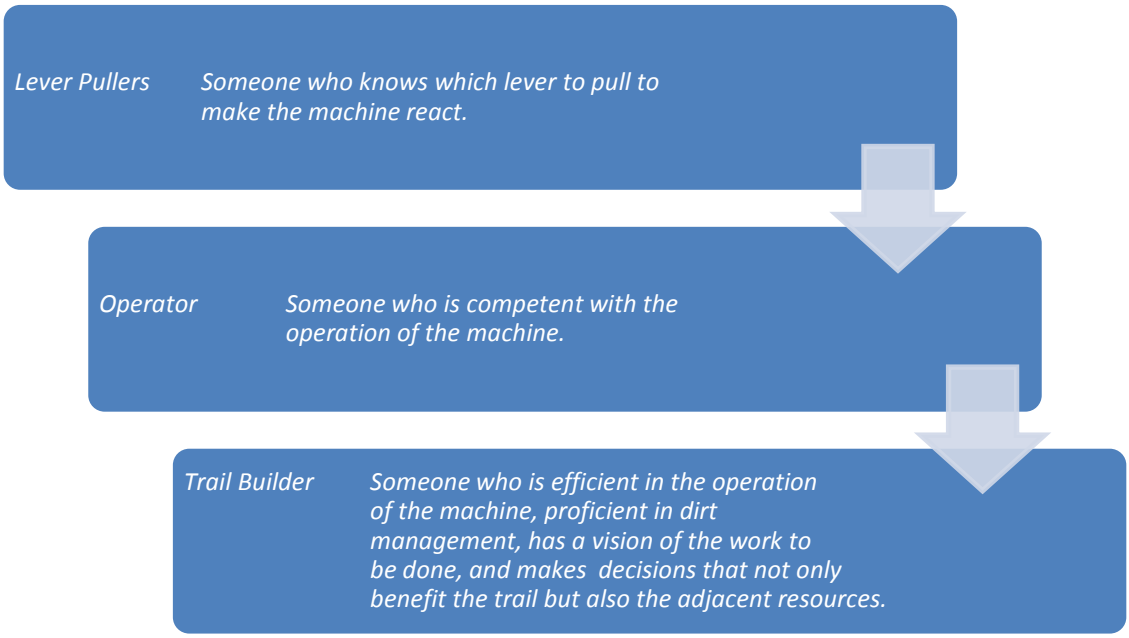
1. Sediment basin

2. from the outside berm.

3. from the trail surface.

4. from the sluff along the cut bank.

Progression to a Trail Builder



An excellent write-up on trail maintenance standards and guidelines and monitoring was completed for Region 5 (File Code 2350-5, Standards and Guidelines for Mechanized OHV Trail Work, November 8, 2002)(Appendix 6). This Letter, and the accompanying document addressing Standards and Guidelines for mechanized equipment developed by Roger Poff, was sent from the Regional Forester to Forest Supervisors within Region 5. The letter also includes a Standard and Guideline Field Checklist. Together these documents clearly and concisely outline actions needed for proper trail maintenance and monitoring. Trails Unlimited recommends these Standards and Guidelines and Field Checklist be adopted for WPG.

B. ADDITIONAL RECOMMENDATIONS

Trails Unlimited would like to make the added recommendations of a sign plan, maintenance plan, implement Tread Lightly!, implement a volunteer program, future developments and possibly sound limits.

SIGN PLAN

A sign plan is an important element of any successful trail system. Signs give direction, orient the user, warn the user of potential hazards, inform the user of difficulty level so they can plan their route, interpret a variety of natural or cultural resources and

communicate Forest Service messages. The sign plan could be as simple as a map with the location of each sign GPS'd and noted by category (warning, reassurance, trailhead marker, kiosks, informational, and interpretive) and the sign wording. All signing should be positive; in other words "keep our trail clean" is better than "don't litter." The Tread Lightly! Website (www.treadlightly.org) has lots of good ideas. The shared (road/trail sections) need warning signs for both trucks and ATVs. Signs stating "ATVs have the right-of-way" remind users of their responsibility. Road signs marking the entrances to OHV areas serve to remind trucks to be on alert. Where trails cross roads, signs stating "ATVs yield to trucks" serves to remind the user to be safe.

Trail identification and trail numbering must be consistent on all maps, brochures and kiosks. It is a good idea to involve the users up front when putting together a logical trail identification strategy. A trails technician, or other Forest Service employee, that has a good rapport with the volunteers and is familiar with the trail system can usually work with the volunteer groups to determine trail names. The name and number format is most appropriate for the WPG Trail Complex. It is likely that users already have names associated with each of the trail. Colors are best to designate difficulty level; green circle = easy, blue square = more difficult, black diamond = most difficult.

MAINTENANCE PLAN

The Trail Maintenance Plan is another critical element of a successful trail system. The maintenance plan outlines maintenance needs, costs and items to be accomplished by volunteers. Ideally no maintenance would occur during the high use period (Memorial Day to Labor Day). The Standards and Guidelines for Mechanized Equipment outlines information needed for the maintenance plan. The maintenance plan will address who will do the work, when the work will be scheduled, why the work is needed, and how, or with what equipment the work will be accomplished. The Maintenance Plan is put together by the trails technician and signed off by the OHV Manager. The trail maintenance cycle will be determined by the individual trail needs and the available budget. If the trail system has a one-year maintenance plan, the entire trail is maintained in a single year. If the trail has a two-year maintenance plan, ½ of the trail is maintained in a year. If the trail has a three-year plan 1/3 of the trail is maintained in a year. Work to be accomplished by volunteers can also be captured in the maintenance plan.

IMPLEMENT TREAD LIGHTLY!

TU recommends implementation of Tread Lightly! program to educate users and others to be responsible outdoor enthusiasts.

Tread Lightly! (www.treadlightly.org) is a non-profit program launched by the Forest Service to provide motorized and non-motorized outdoor ethics, training, and education.

Their training and restoration initiatives are strategically designed to instill an ethic of responsibility in a wide variety of outdoor enthusiasts and the industries that serve them. Their core focus is on people that use or are affected by motorized and mechanized vehicles. Their education materials include: guidebooks, quick-tip brochures, a hunting education curriculum, videos, teaching materials, and materials geared to children. News coverage involving Tread Lightly! reaches 10 million people each year.

IMPLEMENT A VOLUNTEER PROGRAM

Users, Individuals and Agencies Interested in the Trail Complex.

TU recommends the Forest Service facilitate formation of a Trails Coalition. A Trails Coalition is a non-profit, private, group with the mission of providing specific trail opportunities that meet consensus among the various stakeholders. Stakeholders generally include: trail users, adjacent landowners, other adjacent trail providers both public and private, interested individuals, groups, and agencies. Often local Chambers of Commerce and local businesses will elect to be involved in trails coalitions. A Trails Coalition can benefit the Minnesota State Parks by allowing the various groups with an interest in trails to reach consensus, regarding a variety of trail issues, on their own before approaching the DNR with requests for additional, or changes to, trail opportunities. Benefits to the users include: networking, sharing resources, skills, and ideas among a variety of trail.

FUTURE DEVELOPMENT

Recommendations for future trail development were addressed in earlier documents prepared by the Minnesota DNR – State Parks Division. These were not included in this document – for the on the ground phase of the design and layout of the 6.8 miles of OHV trail on the 205 acres tract.

SOUND LIMIT

If there is a concern with sound of OHV's at Wolf Pen Gap (could be applicable to Houston OHV if desired), Trails Unlimited recommends the implementation of sound limit for OHVs. The State of California currently has a 96 decibel A-scale (dBA) limit for dirt bikes and ATV's. This is enforced by a test procedure approved by the Society of Automotive Engineers (SAE J1287 Jul98). This test is simple procedure that involves a vibratory tachometer and sound meter. This is a recommended model to regulate sound because there has been much accomplished with the stakeholders to achieve this successful model. These stakeholders include; Sierra Club, American Motorcyclist Association, and the Blue Ribbon Coalition.

IV. CONCLUSIONS

The general points made on pages 6 and 7 are to be noted here again.

The proposed OHV trail system on the Houston project can be successfully constructed with some specialized engineering considerations in the construction techniques. The trail system shall require diligent maintenance and management in the mountain setting and on the susceptible soils for heavy OHV traffic. Wet weather management will be an important management consideration by the MN State Parks and the City of Houston. As such some wet weather recommendations are attached for information during the project review.

Maintaining the recommended construction techniques and the trail features during the life of the trail system will greatly enhance its enjoyment by the users and gain the support of the community for a sustainable and economically viable OHV trail system.

APPENDIX 1- WET WEATHER MANAGEMENT AND BEST MANAGEMENT PRACTICES

Wet Weather Management

OHV traffic on trails that are too wet can damage trails and increase sedimentation. The goal of wet weather management is to minimize sediment delivery and trail damage, while at the same time maximizing the time trails are open for Off Highway Vehicles (OHV) use. This is accomplished by closing trails when conditions are too wet, but opening them when the risk of damage is low. Although precipitation is often used as a criterion for opening and closing trails, the link between precipitation and actual trail condition is not a direct one, so precipitation alone is not precise enough to meet the management objective.

The wet weather management plan for WPG will use a more precise, "evidence-based," method for determining when to open or close trails. The method will use measurements of soil strength and soil moisture to predict the risk of damage to trails by OHV traffic under wet conditions, and will combine this predicted risk with precipitation to determine when trails should be opened or closed to avoid damage.

There is a concern that wet weather traffic in WPG can increase sediment delivery. Because of this concern, water ponded in trails, and traffic at watercourse crossings, will also play a role in determining suitability for wet weather use until the trail system has been upgraded to a sustainable condition. This may trigger trail closures above and beyond closures based solely on soil strength. As the trail system is upgraded, and Best Management Practices (BMPs) to protect water quality are implemented, criteria for opening and closing trails may become more heavily weighted to the risk of damage to trails and drainage structures.

Data on soil strength and soil moisture has already been collected to develop relative risk curves for some WPG soils. Relative risk curves can be used to predict the potential for damage to trails by OHV traffic.

A draft wet weather management plan will be developed by June 30, 2011. This draft plan will present an overall framework and process for determining when to open and close trails. However, one to three years of field testing will be needed to develop a fully functional wet weather management plan. Over time, as the WPG trail system is upgraded, adjustments will be made to maximize OHV use while minimizing sedimentation and trail damage.

BMPs for the Wolf Pen Gap Trail Complex (These could be applicable for Houston OHV)

Trails Unlimited is working with the ID Team, Ouachita National Forest specialists, and Mena Ranger District staff to develop BMPs for the Wolf Pen Gap (WPG) area.

BMPs are usually practices implemented to protect water quality, but are not limited to water quality. BMPs typically provide a purpose or objective, and design specifications that can be used to assure proper implementation.

The purpose of the set of BMPs for WPG is to construct and maintain sustainable OHV trails that have a minimum impact on sediment delivery. Over time, implementation of the OHV trail BMPs for WPG will significantly reduce sediment delivery from the trail system to watercourses.

The BMPs for WPG will include many "state-of-the-art" BMPs, including new combinations of existing BMPs, and new BMPs designed specifically for WPG. After they are installed, the WPG BMPs will be monitored for implementation and effectiveness.

The WPG BMPs will also be used to integrate the trail maintenance and construction practices implemented by Trails Unlimited.

A list of BMPs—by descriptive name only—has been developed for trail maintenance and reconstruction, and for new construction in WPG.

A first draft set of BMPs for the WPG trail system will be available for review by August 15, 2011. The final set of BMPs for WPG should be completed by late fall 2011.

APPENDIX 5 - DIAGRAMS

DIAGRAM A - ROLLING DIP CROSS VIEW

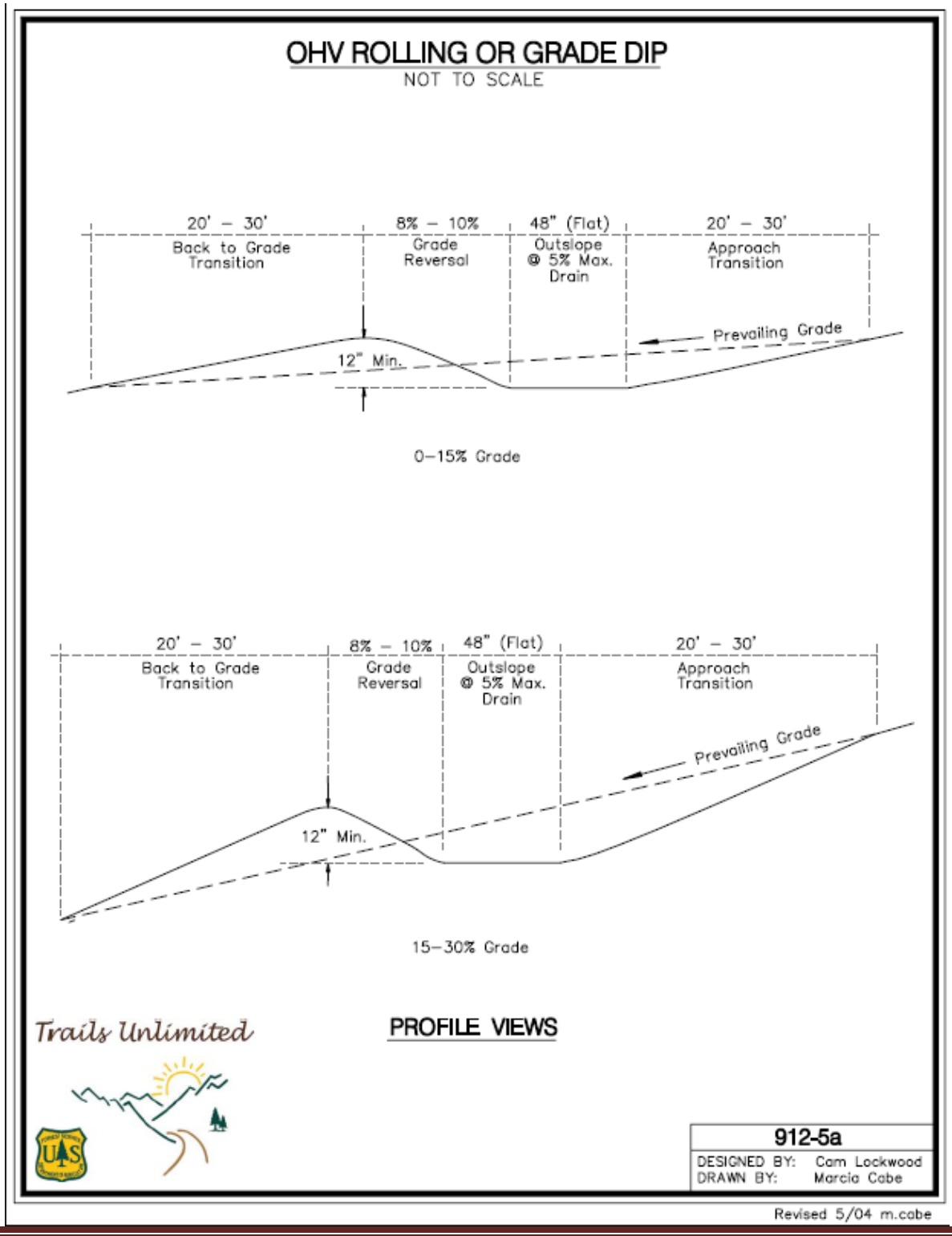
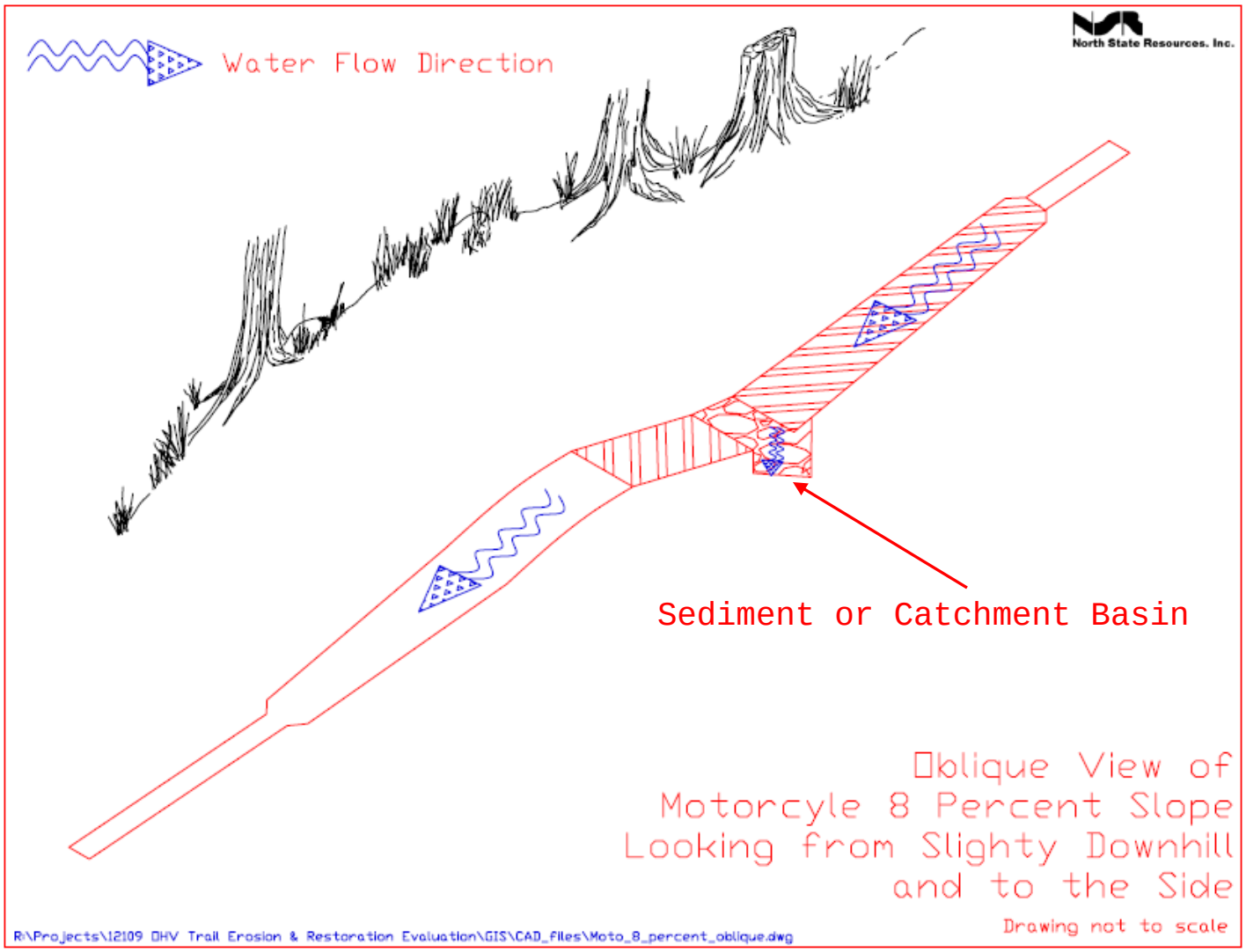


DIAGRAM B – SEDIMENT OR CATCHMENT BASIN



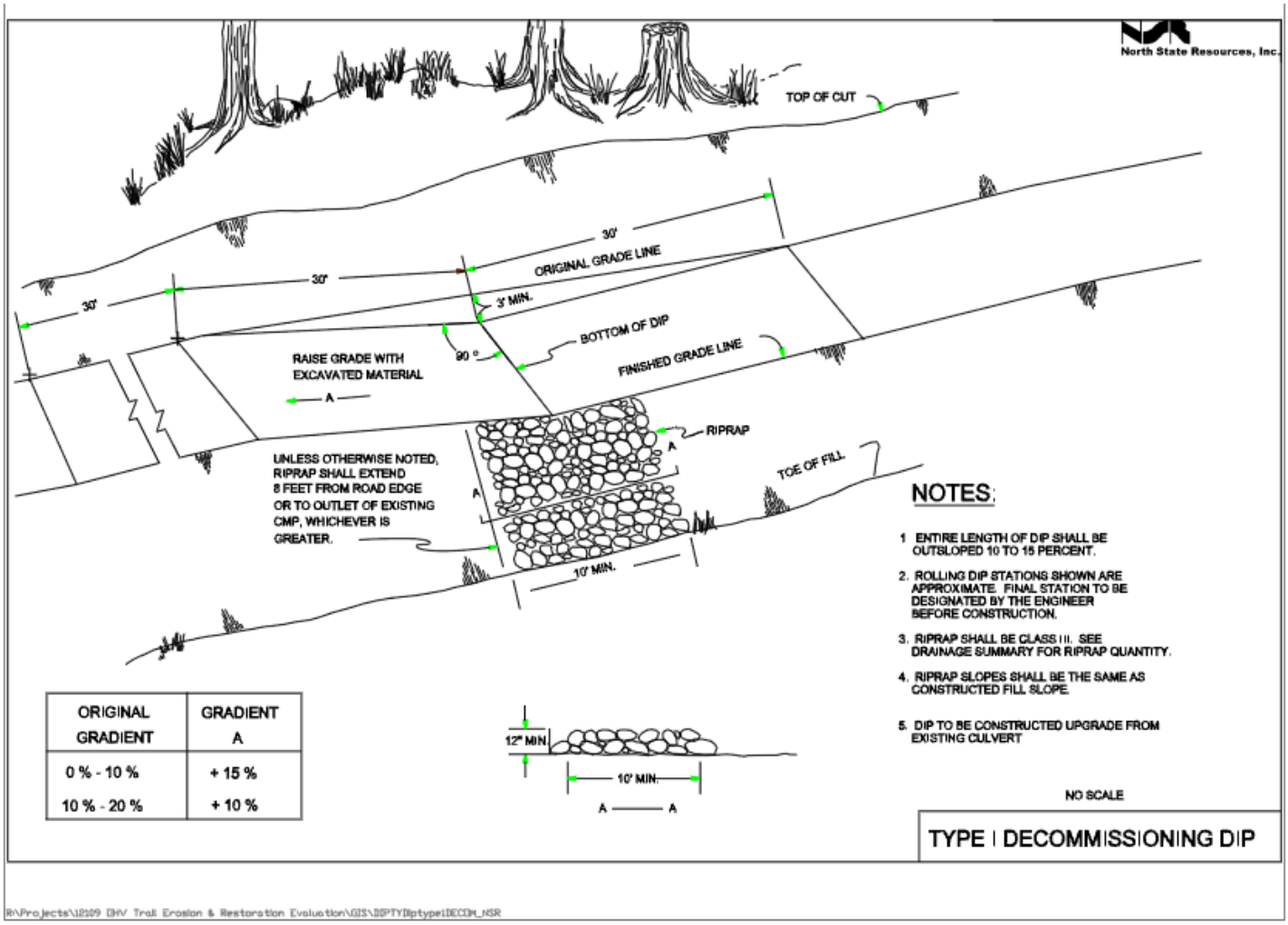
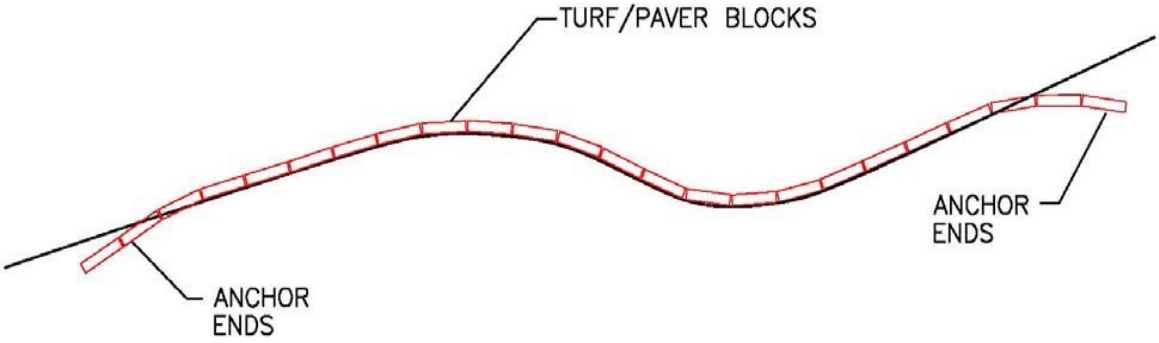

North State Resources, Inc.
TOP OF CUT
30'
30'
30'
ORIGINAL GRADE LINE
3' MIN.
BOTTOM OF DIP
90 °
FINISHED GRADE LINE
RAISE GRADE WITH EXCAVATED MATERIAL
A
RIPRAP
A
A
TOE OF FILL
UNLESS OTHERWISE NOTED, RIPRAP SHALL EXTEND 8 FEET FROM ROAD EDGE OR TO OUTLET OF EXISTING CMP, WHICHEVER IS GREATER.
10' MIN.
NOTES:
1 ENTIRE LENGTH OF DIP SHALL BE OUTSLOPED 10 TO 15 PERCENT.
2. ROLLING DIP STATIONS SHOWN ARE APPROXIMATE. FINAL STATION TO BE DESIGNATED BY THE ENGINEER BEFORE CONSTRUCTION.
3. RIPRAP SHALL BE CLASS III. SEE DRAINAGE SUMMARY FOR RIPRAP QUANTITY.
4. RIPRAP SLOPES SHALL BE THE SAME AS CONSTRUCTED FILL SLOPE.
5. DIP TO BE CONSTRUCTED UPGRADE FROM EXISTING CULVERT
ORIGINAL GRADIENT
GRADIENT A
0 % - 10 %
+ 15 %
10 % - 20 %
+ 10 %
12" MIN.
10' MIN.
A A
NO SCALE
TYPE I DECOMMISSIONING DIP
R:\Projects\12109 OHV Trail Erosion & Restoration Evaluation\GIS\DIPTYP\dptype\DECOM_NSR

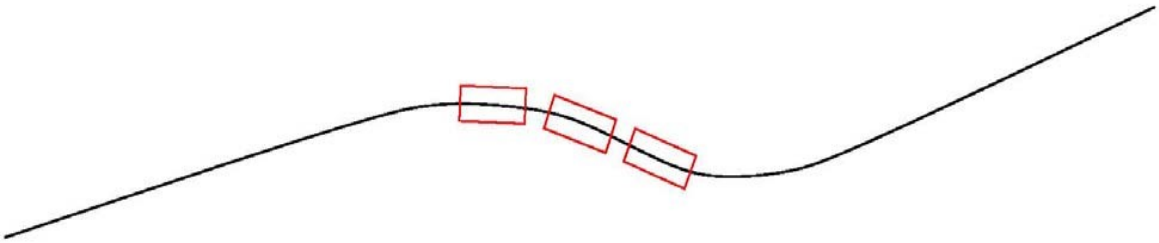
Diagram D – Hardened Dips

Technical Specifications for Erosion and Sediment Control on OHV Trails

HARDENED TRAIL ROLLING DIP



PAVER BLOCK HARDENING
PROFILE VIEW



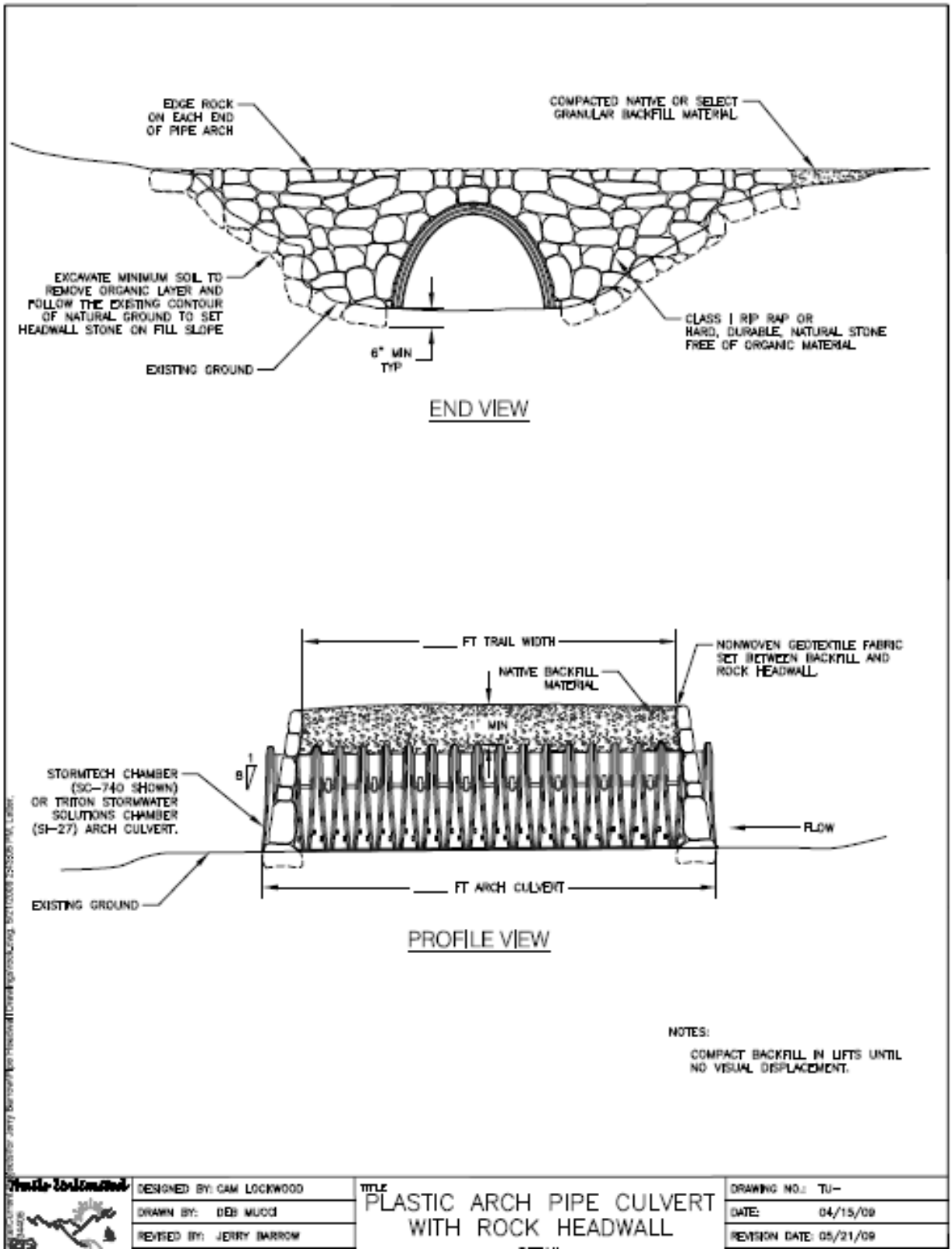
DOG BONE REINFORCEMENT
PROFILE VIEW

Visual examples of the types of hardened rolling dips

Rolling Dip hardened with paver block (after about 18 years of very heavy use)

Rolling Dips reinforced with “dog bones”

DIAGRAM E - ARCH CULVERT



United States Department of Agriculture | Forest Service | Pacific Southwest Region

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Date: November 8, 2002

Subject: Standards and Guidelines for Mechanized OHV Trail Work

To: Forest Supervisors

I am writing to provide direction for the use of mechanized equipment for the maintenance and construction of OHV trails in Region 5. A Regional activity assessment was conducted in accordance with FSM 2355.04c on the maintenance and construction of OHV trails using mechanized equipment. Soil conservation protection practices were evaluated. The results of the review are documented in the report "*A Field Evaluation of the Use of Small Trail Tractors to Maintain and Construct OHV Trails on National Forests in California,*" August 22, 2001, by Roger Poff. This report contains recommended "Standards and Guidelines" to conserve soil and prevent erosion. The recommendations are based on successful practices and techniques used by trail experts. Good equipment operators and contractors should have no problem meeting these standards. In addition to the standards and guidelines, the report contains monitoring guidelines and checklists to assist field personnel in evaluating OHV trail maintenance and construction.

In compliance with FSM 2355.04c(4), Forests are to implement 1) *"Standards and Guidelines"* on page 9 in the above report, 2) *"Standard and Guideline Field Checklist Form,"* in Appendix 6, 3) *"Compliance Monitoring"* found in Appendix 5, and 4) *"Field Moisture Determination,"* Appendix 8. The required and recommended sections are enclosed. The complete report can be viewed at http://fsweb.r5.fs.fed.us/ftp/pub/open/ohv/.

In addition, I recommend that you implement "*Implementation and Effectiveness Monitoring"* that is found in Appendices 5 and 7. Please contact Rich Farrington at (707) 562-8849 or Kathy Mick at (707) 562-8859, if you have any questions.

/s/ Kent P. Connaughton (for)
JACK A. BLACKWELL
Regional Forester

Enclosure

cc: Rich Farrington, Kathy Mick, Gary Schmitt, pdl r5 rec officers, OHV Managers, Zone Soil Scientists, Charles R Mitchell

Caring for the Land and Serving People

STANDARDS AND GUIDELINES

(PG.9, R. POFF, AUG.22, 2001)

The following Standards and Guidelines were developed after observing the practices and techniques used by equipment operators, experienced as well as less experienced. They are not all inclusive, but they do address the issues raised by those critical of the use of mechanized equipment. Good operators should have no problem meeting these standards; they are already meeting most, if not all of them.

1. Use certified operators, or persons under their direct supervision, to operate trail tractors and mini excavators.
2. Construct new trails using R-5 design standards.
3. Close newly constructed trails to all use for one season.
4. Construct OHV rolling dips using design standards (standards to be developed; see Finding 7 and Recommendation 3).
5. Before moving equipment in, examine trails to determine the need for maintenance with mechanized equipment.
6. Lift the blade and walk equipment across sections of trail that need no maintenance.
7. Examine drainage structures, and the tread between them, for evidence of tread loss before starting maintenance.
8. At failed drainage structures, determine the cause of failure before starting repairs.
9. Recycle soil collected in rolling dip outlets into rolling dip structures or back into the trail tread.
10. Do not blade outside berms off the trail as sidecast; work berms back into the trail tread.
11. Repair rills and gullies in treads with soil reclaimed from rolling dip outlets or from outside berms, not with soil bladed from the trail tread.
12. 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.
13. Repair “sutterbumps” by ripping, blading, and compacting the trail tread when soil is moist (except for non-cohesive soils).
14. Move the smallest amount of soil necessary to meet the maintenance objective.

Defer maintenance on drainage structures or do hand maintenance where soil is to dry or to wet for compaction (consult the enclose soil moisture chart for guidance, Appendix 8, Table 1, enclosed and on page 33, R.Poff, 8/22/01)

Monitoring

(pg. 9-11, R.Poff, Aug.22, 2001)

The Standards and Guidelines should be monitored to assure they are being implemented and that they are effective in maintaining trail tread and minimizing off-site effects on water quality. The monitoring discussed here and in Appendixes 5, 6, and 7 deals only with the issues raised concerning the use of mechanized equipment in trail maintenance and construction. In future years, this monitoring may be incorporated into a comprehensive, Region wide trail monitoring program.

Operator Self-Evaluation

Monitoring occurs at many levels. One of the most important functions of monitoring is to provide feedback to equipment operators on how well they are meeting standards. For this reason, the Standards and Guidelines have been put into the form of a checklist (Appendix 6) that equipment operators are to fill out before and after trail maintenance and construction. The checklist serves two purposes. First, it gives the operators a quick review of the Standards and Guidelines before starting a new job; and second, it gives them an opportunity for self-evaluation after completing a job. We suggest the checklist be completed for all trails maintained or constructed with mechanical equipment.

Compliance Monitoring

Compliance monitoring is simply checking to see that a field checklist was filled out on all trails maintained or constructed with mechanical equipment. During the first year, this monitoring should be done on each district that has maintained or constructed trails with mechanical equipment.

COMPLIANCE MONITORING

COMPLIANCE MONITORING SHOULD BE COMPLETED ANNUALLY ON EACH DISTRICT THAT HAS DONE MAINTENANCE OR CONSTRUCTION WITH MECHANIZED EQUIPMENT. THIS MONITORING COULD BE CONDUCTED BY STAFF AT THE SUPERVISOR'S OFFICE OR AT THE DISTRICT.

1. OBTAIN A MAP THAT SHOWS TRAILS MAINTAINED OR CONSTRUCTED WITH MECHANIZED EQUIPMENT.
2. COMPARE EACH COMPLETED STANDARD AND GUIDELINE (S&G) CHECKLIST FORM (APPENDIX 6) WITH THE MAP TO VERIFY THAT A FORM WAS COMPLETED ON ALL TRAILS MAINTAINED OR CONSTRUCTED WITH MECHANIZED EQUIPMENT.
3. CHECK EACH FORM TO VERIFY THAT IT WAS PROPERLY COMPLETED.
4. PREPARE A BRIEF SUMMARY OF THE RESULTS OF THIS MONITORING.
5. SHARE THE RESULTS OF THE MONITORING WITH THE EQUIPMENT OPERATORS AND DISCUSS THE NEED FOR IMPROVEMENTS IN THE FORMS OR HOW THEY ARE BEING USED.
6. FORWARD THE MONITORING SUMMARY TO THE REGIONAL OHV COORDINATOR.

IMPLEMENTATION AND EFFECTIVENESS MONITORING

THIS MONITORING SHOULD BE CONDUCTED ANNUALLY ON ALL TRAILS THAT HAVE BEEN MAINTAINED OR CONSTRUCTED USING MECHANIZED EQUIPMENT. THE SAMPLING PROTOCOL DESCRIBED BELOW IS DESIGNED TO EVALUATE THE S&G AS THEY ARE APPLIED TO EACH DISTRICT. THE SAMPLE POOL IN THIS CASE IS ALL QUALIFYING TRAILS ON THE DISTRICT. SEE THE DISCUSSION BELOW FOR OTHER ALTERNATIVES TO DEFINING SAMPLE POOLS.

SAMPLING PROCEDURE

THE SAMPLE UNIT TO BE MONITORED IS A WATER BREAK PLUS THE TRAIL SEGMENT UPSLOPE TO THE NEXT WATER BREAK. ONE IMPLEMENTATION AND EFFECTIVENESS FORM (APPENDIX 7) IS TO BE COMPLETED ON EACH SAMPLE UNIT SELECTED.

1. OBTAIN A MAP SHOWING ALL TRAILS MAINTAINED OR CONSTRUCTED WITH MECHANIZED EQUIPMENT.
2. DIVIDE THE TOTAL LENGTH OF QUALIFYING TRAILS INTO APPROXIMATELY 500 FOOT SEGMENTS AND NUMBER EACH CONSECUTIVELY. THE 500 FOOT SEGMENTS NEED NOT BE MEASURED PRECISELY. TO PUT THIS IN PERSPECTIVE, FOR 18 MILES OF TRAIL THIS PROCESS WOULD IDENTIFY APPROXIMATELY 190 500 FOOT SEGMENTS.
3. NOTE THE TOTAL NUMBER OF SEGMENTS NUMBERED, AND RANDOMLY SELECT FOUR FOR SAMPLING, USING A RANDOM NUMBER TABLE OR THE RANDOM NUMBER FUNCTION ON A SCIENTIFIC CALCULATOR.
4. IN THE FIELD, RIDE OR WALK UNTIL YOU ARE WITHIN ONE OF THE RANDOMLY SELECTED 500 FOOT TRAIL SEGMENTS, AND FLIP A COIN TO DETERMINE THE DIRECTION OF TRAVEL TO THE FIRST SAMPLE UNIT (HEADS FORWARD, TAILS BACK). THIS WILL ALSO BE THE DIRECTION OF TRAVEL FOR SAMPLING SUBSEQUENT SAMPLE UNITS.
5. WALK IN THIS DIRECTION TO THE FIRST WATER BREAK. THIS COULD BE A REVERSE GRADE ROLLING DIP, AN OHV ROLLING DIP, OR A NATURAL LOW POINT IN THE TRAIL; WHEREVER WATER WAS INTENTIONALLY DRAINED OFF THE TRAIL. THIS WATER BREAK, AND THE SEGMENT OF TRAIL IT DRAINS, IS THE FIRST SAMPLE UNIT TO MONITOR.
6. FLAG THE WATER BREAK AND NOTE IT'S LOCATION ON A MAP OR OBTAIN A UTM LOCATION USING A G.P.S.
7. WALK THE TRAIL UPSLOPE TO THE NEXT WATER BREAK, OBSERVING WHETHER THE S&G WERE IMPLEMENTED AND HOW EFFECTIVE THEY WERE IN MAINTAINING TRAIL TREAD AND MINIMIZING SEDIMENTATION. RETURN TO THE WATER BREAK AND EVALUATE IT ALSO. NOTE THESE OBSERVATIONS ON THE MONITORING FORM SHOWN IN APPENDIX 7. TAKE PHOTOS OF THE TRAIL SEGMENT AND WATER BREAK.
8. FLIP A COIN TO DETERMINE THE NEXT WATER BREAK/TRAIL SEGMENT TO SAMPLE (HEADS 2ND AND TAILS 3RD) WATER BREAK ALONG THE TRAIL IN THE DIRECTION DETERMINED UNDER NUMBER 4.
9. CONTINUE SAMPLING UNTIL THREE WATER BREAK/TRAIL SEGMENT SAMPLE UNITS HAVE BEEN OBSERVED. THIS

COMPLETES THE SAMPLING AT THE FIRST OF THE FOUR RANDOMLY SELECTED 500 FOOT TRAIL SEGMENTS.

10. REPEAT STEPS 4 THROUGH 9 UNTIL MONITORING HAS BEEN COMPLETED ON ALL FOUR RANDOMLY SELECTED TRAIL SEGMENTS.

WHEN MONITORING EACH SAMPLE SET, IF A TRAIL JUNCTION IS REACHED BEFORE THE REQUIRED THREE SAMPLES HAVE BEEN LOCATED AND OBSERVED, FOLLOW THE TRAIL THAT HAS BEEN MAINTAINED WITH MECHANICAL EQUIPMENT. IF BOTH QUALIFY FOR SAMPLING, FLIP A COIN TO DETERMINE WHICH TRAIL FORK TO TAKE (HEADS RIGHT, TAILS LEFT). IF THE END OF THE QUALIFYING TRAIL IS REACHED BEFORE THREE SAMPLES HAVE BEEN OBSERVED, RETURN TO THE FIRST WATER BREAK SAMPLED AND CONTINUE IN THE OPPOSITE DIRECTION.

THIS PROCEDURE WILL YIELD 12 RANDOMLY SAMPLED WATER BREAKS ON EACH DISTRICT. OUR PAST EXPERIENCE WITH THIS TYPE OF MONITORING SUGGESTS THIS IS THE MINIMUM LEVEL OF SAMPLING NEEDED TO GET MEANINGFUL RESULTS. IN ANY CASE, THE PROCESS SHOULD BE FIELD TESTED BEFORE FULL SCALE IMPLEMENTATION.

DATA COLLECTION

THE FIELD FORM SHOWN IN APPENDIX 7 IS SETUP TO EVALUATE S&G. THE IMPLEMENTATION PART (LIST OF THE S&G) CAN BE MODIFIED AS NEEDED, BY ADDING OR DELETING S&G, WITHOUT AFFECTING THE EFFECTIVENESS PART. IN THE EFFECTIVENESS PART, THE TEN BASIC OBSERVATIONS ASSESS EROSION AND SEDIMENTATION ON TRAILS AS THEY RELATE TO THE BASIC CONCERNS RAISED ABOUT THE USE OF MECHANICAL EQUIPMENT TO MAINTAIN AND CONSTRUCT OHV TRAILS, TRAIL WIDENING, TREAD LOSS, AND SEDIMENT DELIVERY.

GENERAL DISCUSSION

ONCE FAMILIAR WITH THE PROCESS, AN EXPERIENCED PROFESSIONAL SHOULD REQUIRE NO MORE THAN 10 TO 15 MINUTES IN THE FIELD TO FILL OUT A FIELD DATA SHEET AND TAKE A PHOTO ON EACH SAMPLING UNIT. THE LARGEST TIME COMPONENT IN THIS TYPE OF MONITORING IS PHYSICALLY GETTING TO THE SAMPLE SITE.

ALTHOUGH THE SAMPLING IS RANDOM AND THE DATA COLLECTED CAN BE QUANTIFIED, THE BASIC FIELD OBSERVATIONS ARE QUALITATIVE AND DO REQUIRE PROFESSIONAL JUDGMENT. MONITORS SHOULD BE FAMILIAR WITH HOW OHVS AFFECT TREAD WEAR AND HOW TRAIL TRACTORS ARE USED TO MAINTAIN TRAILS. WE RECOMMEND THE MONITORING BE DONE BY PROFESSIONALS IN EROSION AND SEDIMENT CONTROL OR BY RESOURCE TECHNICIANS TRAINED BY THEM.

IF THE MONITORING IS DONE BY AN INDIVIDUAL, OR BY A VERY SMALL GROUP OF TRAINED PROFESSIONALS, THE DATA SET WILL BE REPEATABLE AND CONSISTENT. IN THIS CASE, A RELATIVELY SMALL DATA SET WOULD BE SUFFICIENT TO DRAW VALID CONCLUSIONS. IF THE MONITORING IS DONE BY A LARGER GROUP OF RESOURCE TECHNICIANS, EVEN IF TRAINED BY PROFESSIONALS, FIELD OBSERVATIONS WILL BE MORE VARIABLE AND A MUCH LARGER DATA SET WILL BE NEEDED TO DRAW CONCLUSIONS. THIS APPROACH WOULD ALSO REQUIRE SOME QUALITY CONTROL. IN THE END, THE COST OF THESE TWO APPROACHES MAY NOT DIFFER SIGNIFICANTLY. THE SECOND APPROACH HAS THE ADVANTAGE OF GETTING MORE PEOPLE INVOLVED IN THE PROCESS, WHICH MAY HELP MEET OTHER OHV MANAGEMENT OBJECTIVES.

IN THE SAMPLING PROTOCOL DESCRIBED ABOVE, EACH DISTRICT IS AN INDIVIDUAL SAMPLE POOL. WHILE THIS WOULD PROVIDE GOOD INFORMATION ON INDIVIDUAL DISTRICTS (AND OPERATORS), IT WOULD NOT NECESSARILY REPRESENT HOW WELL THE S&G ARE BEING IMPLEMENTED ON A REGIONAL BASIS. IF THIS REGIONAL VIEW IS OF GREATER INTEREST, THE SAMPLE POOL FROM WHICH SAMPLE UNITS ARE DRAWN SHOULD BE ALL TRAILS IN THE REGION THAT QUALIFY.

THE IMPORTANT POINT IS THIS: THE QUESTIONS THE MONITORING WILL BE EXPECTED TO ANSWER SHOULD BE CAREFULLY FORMULATED BEFORE THE SAMPLE POOL IS DEFINED.

APPENDIX 6 – STANDARD & GUIDELINE FIELD CHECKLIST (PG.26, R.POFF, AUG.22, 2001)

Forest_____District_____Trail Segment_____

Operator_____Assistant(s)_____Date_____

Activity: /__/ Maintenance /__/ Reconstruction /__/New Construction

Equipment: /__/ SWECO 450/480 /__/ Mini Excavator (size____) /__/ Other

Drainage: /__/ Outslope /__/ OHV Rolling Dip /__/ Rev Grade RD /__/ Other

Last Maintenance (month/year)_____ Maintenance Objective _____

Standard & Guideline	Yes	No	N/A
1. This standard and guideline checklist was reviewed before starting maintenance or construction on this trail.			
2. Equipment was operated by certified operators, or under their direct supervision.			
3. If new, this trail was constructed to R-5 design standards.			
4. If new, this trail has been closed to all use for one season.			
5. OHV rolling dips were constructed/maintained by compacting moist soil in small lifts.			
6. Before equipment was moved in, this trail was examined to determine the need for maintenance with mechanical equipment.			
7. The blade was lifted and the equipment walked across sections of trail that needed no maintenance.			
8. Drainage structures and the tread between them were examined for evidence of tread loss before starting maintenance.			
9. At failed drainage structures the cause of failure was determined before starting repairs.			
10.Soil collected in rolling dip outlets was recycled into rolling dip structures or placed back onto the trail tread.			
11.Outside berms were worked back into the trail tread, not bladed off the trail as side cast.			
12.Rills and gullies in treads were repaired with soil reclaimed from rolling dip outlets or from outside berms, not by blading the trail tread.			
13.Soil sloughed from cutbanks or sideslopes above the trail was bladed only as needed to maintain a safe trail; cutbanks were not bladed into or undercut.			
14."Sutterbumps" were repaired by ripping, blading, and compacting trail treads when soil was moist (except for non cohesive soils).			
15.The amount of soil moved was the smallest amount needed to meet the maintenance objective.			
16.Where soil was to dry for compaction, maintenance on drainage structures was deferred or done by hand.			

Comments:

INSTRUCTIONS

REVIEW THIS FORM FOR EACH OHV TRAIL CONSTRUCTED OR MAINTAINED WITH MECHANICAL EQUIPMENT. COMPLETE ONE FORM FOR EACH DAY EQUIPMENT IS OPERATED, OR FOR A TRAIL LOOP OR OTHER TRAIL SEGMENT IF A VARIETY OF TRAIL TYPES ARE DONE IN THE SAME DAY.

FILL IN FOREST, DISTRICT, NAME OF OPERATOR AND ASSISTANTS, AND DATE. NOTE THE STARTING AND END POINT OF TRAIL SECTION THE FORM COVERS. CHECK THE ACTIVITY TYPE AND EQUIPMENT TYPE. NOTE SIZE OF BUCKET ON THE MINI-EXCAVATOR IF USED. CHECK ALL DRAINAGE TYPES THAT APPLY. IF KNOWN, ENTER MONTH/YEAR OF LAST MAINTENANCE BY MECHANICAL EQUIPMENT, OR IF NOT KNOWN, ESTIMATE YEARS SINCE LAST MAINTENANCE AND NOT "EST.". WRITE OUT THE MAINTENANCE OBJECTIVE FOR THE TRAIL SECTION, INCLUDING ANY SPECIAL NEEDS OR CONCERNS RELATED TO DRAINAGE, SEDIMENTATION, OR TREAD WEAR.

FOR EACH S&G ENTER A CHECKMARK IN THE YES, NO, OR N/A (DOES NOT APPLY) COLUMNS. IF "NO" IS CHECKED, ENTER A FOOTNOTE NUMBER AND WRITE A BRIEF EXPLANATION UNDER COMMENTS.