

**NATURAL RESOURCES CONSERVATION SERVICE
NEVADA CONSERVATION PRACTICE SPECIFICATION**

FOREST TRAILS AND LANDINGS

(Acre)

CODE 655

I. SCOPE

The work shall consist of providing material, labor, and equipment to allow removal of forest products from areas as shown on the conservation plan or forest management plan map.

II. GENERAL

Determine and document the suitability of soils of the treatment area for the intended harvest equipment operations.

For logging (haul) roads refer to Table 1 -Soil Rating Criteria for Potential Erosion Hazard (Road/Trail), Table 4 - Soil Rating Criteria for Road Suitability - Natural Surface, and Table 6 - Soil Rating Criteria for Construction Limitations for Haul Roads and Log Landings.

For log landings refer to Table 5 -Soil Rating Criteria for Log Landing Suitability and Table 6 -Soil Rating Criteria for Construction Limitations for Haul Roads and Log Landings.

For off-road operations refer to Table 2 -Soil Rating Criteria for Potential Erosion Hazard (Off-Road/Off-Trail), Table 3 - Soil Rating Criteria for Soil Rutting Hazard, and Table 7 - Soil Rating Criteria for Harvest Equipment Operability.

III. DESIGN SPECIFICATIONS

Haul Roads

Planners will refer to standards and specifications for ACCESS ROADS (Code 560) for road construction design and construction specifications. Installation of erosion control measures does not preclude the need for storm patrol during severe weather or maintenance of the road and erosion control measures.

Logging roads shall:

- Be located and constructed to take advantage of local topography to avoid excessive cuts, fills, and road grades.
- Be constructed to single lane width with turnouts at appropriate intervals. Roads and turnouts shall be no wider than necessary to safely accommodate logging trucks and equipment.
- Not exceed a grade of 15% except for pitches up to 20% in grade and no more than 500 feet in length.

Water Control Measures

Surface drainage. Drainage is needed along the roadway to remove water before it has a chance to concentrate and cause erosion. Grade active roads to inslope, outslope, a combination, or reshape crown.

Inslope. (Sloping the road surface towards the uphill side of the road). Insloped roads are preferred in areas of unstable fills.

- Water drainage from the road is carried along the inside of the road in a ditch. Plan ditch gradient steep enough (greater than 2%) to prevent sediment deposition but not so steep (less than 4%) as to cause gullyng.
- Install culverts frequently enough to avoid accumulation of water that will cause erosion of ditches. See d. Relief Culverts for installation requirements.
- Clean ditches as needed to maintain capacity. If ditches are to be pulled mark culvert locations to avoid damaging them. Do not undercut side slopes. If pulled material is not suitable for road surfacing, the material should be hauled to a stable area.

NRCS NV, NHCP

March 1997

Outslope (Sloping the surface towards the downhill side of the road) Only use where runoff will flow off the road onto stable surfaces. Outsloping is not advised directly above insloped sections on steeper gradients as it requires large amounts of maintenance during and after heavy storms.

Crowned. (Sloping road surfaces both directions away from the centerline.) These are difficult to maintain and are unsafe if the surface is slippery. Crowned roads require ditch drains and relief culverts.

Rolling dips or drainage dips. These are effective ways of gathering surface water and routing it safely off the road. They are used where no intermittent or permanent stream crosses the road. This dip should not be used on roads that exceed 10% in grade. They are most efficient when designed into the road during planning and construction.

- Shape a road segment from the inside edge to outside to form a cross grade slope 1-3% greater than originally designed.
- Change the original road grade up and downslope to direct water into the dip.
- The base, or total length of the dip may vary from short (65 to 80 feet) to long (80 to 95 feet). This distance where the centerline resumes downhill grade is typically 15 feet. The uphill design grade is typically 50 to 90 feet. Use short-based dips where traffic is infrequent.
- Use a minimum of 2 inches of 1-1/2 minus crushed stone on dips where the centerline grade exceeds 8%.
- Protect the discharge area. Use stone, grass, heavy litter, brush, logs, or anything that will reduce the water velocity. Natural litter may be adequate if the slope of the outlet area is less than 2%.
- Spacing. Estimated spacing between dips can be calculated using the formula:

$$\text{Spacing (ft.)} = (400/\text{slope } \%) + 100$$

Actual spacing will depend on a number of factors, including road grade, type of base material, use, erosion rate or erosion

hazard rating of the soil and frequency of erosion control measures.

Water bars. Install water bars on sloping roads, skid trails and landings which do not have permanent and adequate drainage after the conclusion of forest management activities. These help to minimize the volume of water flowing over exposed areas, avoid concentration of water and remove water from disturbed and unstable soil areas.

Spacing. Minimum spacing guidelines are set forth in the Nevada Forest Practice Act (528.0551 1.(d)). The following guidelines should be modified to consider the erosion potential of the soil.

Slope (%)	Spacing (feet)
0-10	100-300
11-25	75-200
26-49	50-150
50+	25-100

Location

- insure that water flowing from the water bar does not flow directly into streams.
- Place above changes in grade.
- Place above the intersection of roads, skid trails, and landings. Position them so that the diverted water will not flow onto parallel roads or skid trails.
- Place at all natural watercourses on skid trails and firebreaks when permanent drainage facilities are not installed.
- Do not place in low areas where water has no place to escape.
- Locate to place the discharge into some form of vegetative cover, duff, slash, rocks, or less erodible material.

Construction. The minimum height and depth may be utilized provided there is sufficient evidence based on the slope, soil material, amount of precipitation, and period of use that the waterbars will be effective in diverting water flow from the road surface.

- a berm will be cut a minimum of 6 inches into a firm surface across the road at a 30 to 45 degree angle downslope.

- The inside berm end will be tied into the inside bank.
- The berm will be a minimum height of 6 inches immediately adjacent to the lower edge of the cut.
- Construct to provide an unobstructed water flow and spread so that erosion is minimized.

Relief Culverts. These are used to divert water collection roadside ditches across the road or to channel water across waterways from uphill drainages. Planners will refer to standards and specifications for STRUCTURE FOR WATER CONTROL (Code 587).

- Install during construction of permanent roads. Open-top culverts may be used on uncrowned, low-cost, low-traffic roads. Open-top culverts require significant amounts of hand labor to maintain.
- Spacing will depend upon on-site investigation based on road grade, soil material, amount of precipitation, etc. Ditch erosion is an indication that culvert spacing is too distant. Suggested spacing:

Slope (%)	Spacing (ft.)
0-5	900
5-12	600
12+	400

- Sizing. Eighteen-inch diameter culverts are generally adequate for properly spaced culverts. Culverts in drainageways shall be sized to accommodate peak flow.
- Install at an approximate 30-degree downslope angle.
- Place a minimum of 12 inches below the final grade. Allow it to slope 5 inches for every 10 feet of length.
- Install ditch plugs to keep water from bypassing culverts.
- Allow outlet to extend beyond fill. Place energy dissipaters at culvert outlets to prevent erosion.
- Where trash may be a problem, install trash racks to prevent culverts from becoming plugged.

NRCS NV, NHCP

March 1997

Water and Sediment Control Basins.

Permanent or temporary measures to trap sediment, control gully erosion, and improve downstream water quality.

Permanent Basins. Design to control runoff from a 10 year, 24 hour frequency storm for the drainage area. Install in accordance with standards and specifications for WATER AND SEDIMENT CONTROL BASIN (Code 638).

Temporary Basins. Used for short-term sediment control and may be constructed from straw bales or other man-made materials.

- Each shall be designed on an individual structure basis.
- Place across drainageways or road ditches and anchor in place.
- Maintain until eroding area is stabilized.

Grade Stabilization Structures. These are designed to prevent the formation of an advance of gullies and control erosion in natural or artificial channels. Install according to standards and specifications for GRADE STABILIZATION STRUCTURE (Code 410).

Diversions. Diversions are channels constructed across the slope with a supporting ridge on the lower side to divert excess water from one area for use or safe disposal in other areas. Planners will refer to standards and specifications for DIVERSION (Code 362).

Stream Crossings

There are 3 methods for crossing natural drainageways; fords, culverts, and bridges. Factors influencing the appropriate crossing include construction and maintenance costs, equipment and supplies available, debris potential, stream size, expected road use and life, foundation conditions, and position of the road relative to the stream.

- Stream crossing activities that are in conjunction with a timber harvest plan will meet standards established in the Nevada Forest Practice Act.
- Stream and water crossings shall be designed to accommodate runoff from a 50-year frequency storm.

- Locate crossings at stream reaches showing signs of stability as evidenced by well-vegetated banks, absence of bank cutting, absence of meander, and areas of exposed bedrock.
- Sediment traps or drainage diversions must be placed above water crossings to reduce sediment entering streams and drainageways.
- Watercourses that support fish shall utilize drainage structures that shall allow for the unrestricted passage of fish.
- Temporary water crossing structures shall be removed prior to normal maximum stream flow and upon completion of logging.
- Fish passage will be planned for when selecting location, date of installation, and type of structure or crossing. To allow for fish passage:
 - Provide resting pools just above and below obstacles
 - Keep individual jumps as low as possible as specified for the species and/or as specified by Division of Wildlife personnel.
 - Keep water depth and speed within the fish's ability to swim.
 - Avoid sudden changes in water velocity.
- Installation of circular, arched, or elliptical corrugated metal pipe shall comply with construction specification STRUCTURE FOR WATER CONTROL (Code 587). Wherever possible the center of the fill section shall be filled to an elevation slightly lower than the sides. In case of a plugged culvert or blow out only the culvert and fill area will be removed instead of a portion of the road.

Trails and Landings

No tree shall be felled unless a way exists or can be created to fell and extract it without causing excessive damage to the residual stand.

NRCS NV, NHCP

March 1997

Skid trails shall be oriented as perpendicular to the slope as possible to avoid gullying. Avoid downward converging skid trails on steeper slopes.

Lay out main skid trails prior to cutting as straight as possible.

Fell trees at an angle to main skid trails and roads, forming a herringbone pattern, to minimize turning logs.

Tractors should be turned in openings and backed into the log.

Utilize tractors with winches and cables to draw logs out of residual stand areas to avoid damage.

Disturbed areas such as roads, firebreaks, burned areas, skid trails and landings, should be artificially revegetated unless natural reproduction of native species will be timely and sufficient for protection. Planners will refer to standards and specifications for CRITICAL AREA PLANTING (Code 342).

Erosion Control Measures

Slash as Mulch. Where concentrated flow is unavoidable, use slash to slow water velocity and to divert concentrated flows to duff areas, stumps, stable channels, or flat areas. Lopping and scattering tops and limbs and crushing where possible in skid trails and other disturbed areas will filter sediment from concentrated flows.

Slash material will not be placed in drainageways with perennial water or in watercourses imply to dispose of slash.

Filter windrows. These are barriers constructed of logging slash and cull logs that slow the velocity of surface runoff, acting as a sediment trap or filter to reduce the erosion from newly constructed fill slopes. They are constructed on or immediately below the fillslope. Filter windrows can be constructed simultaneously with road construction from slash from the right-of-way clearing operation.

- Slash to be used shall consist of tops, limbs and brush which does not exceed 6 inches in diameter and 12 feet in length. Stumps and root wads are not included. Logs to be used shall not be less than 9

inches in diameter; however, 12-inch diameter is preferred. Reasonably sound cull logs may be used.

- Logs shall be placed on the fill slope or immediately below the fill slope parallel to the toe for the windrow to catch against. If at all possible, they should be anchored against undisturbed stumps, rocks or trees or as otherwise determined.
- Slash will be placed to form a neat, compact and uniform pile. These piles will be from 6 to 10 feet wide and from 1.5 to no more than 3 feet high.
- They will be placed so they do not interfere with the functioning of drainage structures or block stream channels and other natural drainages.
- It is recommended that once the windrows have filled in and no vegetative cover is present that the filter windrows be seeded. (See standards and specifications for CRITICAL AREA PLANTING (Code 342) and TREE/SHRUB ESTABLISHMENT (Code 612.))

Filter Strips. A filter strip is an area of undisturbed vegetation used to reduce delivery of sediment into waterways, or other sensitive areas. Filter strips shall be in accordance with standards and specifications for FILTER STRIP (Code 393). The minimum width of the filter strips will be calculated using the following formula:

$$\text{Width} = 50 \text{ ft} + ((4) \times (\text{percent slope}))$$

Sediment traps. Place small logs on the contour across the slope and anchor, if needed, to trap sediment and reduce water velocity and to divert concentrated flows to more suitable areas. Periodic maintenance of these sediment traps will be included in operation and maintenance scheduling.

OPERATION AND MAINTENANCE

Watercourses and water quality shall be protected during and after removal and transport of trees. Upon completion of harvest, landings and trails will be left in a stable condition.

NRCS NV, NHCP

March 1997

Periodic inspections of landings and trails will be conducted with necessary repairs applied.

REFERENCES

Natural Resources Conservation Service. 1996. National Forestry Manual, Title 190 - Review Draft. (Washington, DC, US Government Printing Office, December 1996).

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Sierra Nevada Ecosystem Project. Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options (Davis: University of California, Centers for Water and Wildland Resources, 1996).

Smith, D.M., Hawley, R.C. 1962. The Practice of Silviculture. John Wiley & Sons, Inc., New York.

State of Nevada. 1994 Nevada Laws on Forestry and Fire. West Publishing Co.

State of Nevada. 1994. Handbook of Best Management Practices, Appendix H-1, Amended Forest Practice Rules.

Table 1 - Soil Rating Criteria for Potential Erosion Hazard (Road/Trail)

Factor	Slight	Moderate	Severe	Feature	Impact
Slope % Soil Erodibility Factor $K_w < .22$ (uppermost thickest mineral horizon in the upper 6")				Slope; erodibility	Erosion and sedimentation; increased maintenance; land base loss
Rock Fragments <15% rock fragments (weighted average for layers to 12")	<5	5-15	>15		
$\geq 15\%$ rock fragments (weighted average for layers to 12")	<10	10-25	>25		
Soil Erodibility Factor $K_w > .22$ (uppermost thickest mineral horizon in the upper 6")					
Rock Fragments <15% rock fragments (weighted average for layers to 12")	<3	3-8	>8		
$\geq 15\%$ rock fragments (weighted average for layers to 12")	<5	5-15	>15		

Criteria Notes: Certain parent materials (e.g., decomposed granite), high R factors (e.g., >200), snowmelt influences during Spring thaw and other factors may require changes to slope values in the table or adjustment of ratings to one class more limiting.

Description

The hazard or risk of soil loss from unsurfaced roads/trails.

Considerations

Ratings assess:

- The force that natural precipitation events have to dislodge and move soil materials on roads/trails and firebreaks.
- Activities on roads and trails that result in bare ground, compaction, and reshaping of the soil surface.
- Use by trucks, skidders, off-road vehicles and other similar equipment
- The impact on compacted, bare road/trail surface using the representative value for slope gradient of the soil component.

Ratings assume:

- Roads and trails are generally linear, continuous, and narrow ranging up to 25 feet in width.

Ratings do not assess:

- Frozen or snow-covered soil.

Ratings:

Slight - Little or no erosion is likely.

Moderate - Some erosion is likely; occasional maintenance may be needed; simple erosion control measures needed.

Severe - Significant erosion can be expected; roads require frequent maintenance; costly erosion control measures are needed.

NRCS NV, NHCP

March 1997

Table 2 - Soil Rating Criteria for Potential Erosion Hazard (Off-Road/Off-Trail)

Factor	Slight	Moderate	Severe	Very Severe	Feature	Impact
Slope % Soil Erodibility Factor $K_w < .35$ (uppermost thickest mineral horizon in the upper 6")	0-14	15-35	36-50	>50	Slope; erodibility	Erosion and sedimentation; increased maintenance; land base loss
Soil Erodibility Factor $K_w \geq .35$ (uppermost thickest mineral horizon in the upper 6")	0-9	10-25	26-40	>40		

Criteria Notes: Certain parent materials (e.g., decomposed granite), high R factors (e.g., >200), snowmelt influences during Spring thaw and other factors may require changes to slope values in the table or adjustment of ratings to one class more limiting.

Description

Ratings indicate the hazard or risk of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface.

Considerations

Ratings assess:

- Sheet and rill erosion from exposed soil surfaces caused by various silvicultural practices, grazing, mining, fire, firebreaks, etc.
- Activities that disturb the site resulting in 50 to 75 percent bare ground in the affected area.
- The use of any equipment type or size and uncontrolled grazing by livestock.

Rating assume:

- 50 to 75 percent exposed, roughened mineral surface layer.

Ratings do not assess:

- Clean tillage and other similar activities that disturb up to nearly 100% of the area and change the character of the soil
- Histosols.
- Individual precipitation or storm events.
- The impact of gully erosion
- Sediment production/delivery ratio or streambank or streambed erosion for water courses on the site.
- Ground disturbing activities on the amount of surface or subsurface water runoff.

Ratings:

Slight - Erosion is unlikely under ordinary climatic conditions.

Moderate - Some erosion is likely; control measures may be needed.

Severe - Erosion is very likely; control measures for vegetation re-establishment on bare areas and structural measures are advised.

Very Severe - Significant erosion is expected; loss of soil productivity and off-site damages are likely; control measures are costly and generally impractical.

Table 3 - Soil Rating Criteria for Soil Rutting Hazard

FACTOR	SLIGHT	MODERATE	SEVERE	FEATURE	IMPACT
<p>Unified Classification Group Thickest layer with an upper boundary ≤ 4" of the surface</p> <p>Rock Fragments ≥ 3" less than 20% (by vol.)</p> <p>Depth to Wet Layer Within 12" of surface, year round</p> <p>Rock fragments ≥ 3" greater than 20% (by vol.) or 3% surface cover</p> <p>≥ 3" greater than 20% (by vol.) or 10% surface cover</p> <p>Restrictive Layer Depths (upper boundary) to paralithic, lithic, duripan and other similar restrictive layers within 6" of the surface</p>	<p>GW, GP, GM, GW-GM, GC-GM, GW-GC, GP-GM, GP-GC</p> <p>GW, GP, GM, GW-GM, GC-GM, GW-GC, GP-GM, GP-GC, GC, SW, SP, SM, SC, SW-SM, SC, SM, SW, SW-SC, SP-SM, SP-SC, SC-SM</p> <p>All groups</p> <p>GW, GP, GM, GW-GM, GC-GM, GW-GC, GP-GM, GP-GC, GC, SW, SP, SM, SC, SW-SM, SW-SC, SP-SM, SP-SC, SC-SM</p>	<p>GC, SW, SP, SM, SC, SW-SM, SW-SC, SP-SM, SP-SC, SC-SM</p> <p>CL, CH, CL-CH, ML, MH, ML-MH, OL, OH, PT</p> <p>CL, CH, CL-CH, ML, MH, ML-MH, OL, OH, PT</p> <p>CL, CH, CL-CH, ML, MH, ML-MH, OL, OH, PT</p>	<p>CL, CH, CL-CH, ML, MH, ML-MH, OL, OH, PT</p> <p>GC, SW, SP, SM, SC, SW-SM, SW-SC, SP-SM, SP-SC, SC-SM</p>	<p>Low strength</p>	<p>Reduced efficiency, soil damage, equipment damage</p>

Criteria Notes: Steeper slope classes (e.g., $>20\%$) may shift ratings to one class more limiting.

Description

Ratings indicate the hazard or risk of ruts in the uppermost soil surface layers by operation of forest equipment. Soil displacement and puddling (soil deformation and compaction) may occur simultaneously with rutting.

Considerations

Ratings assess:

- The operation of equipment on forest sites (3-10 passes) when the soil moisture is near field capacity.
- The use of standard rubber-tired vehicles (non-flotation tires).
- Year-long water tables ≤ 12 "
- Soil displacement and puddling which may affect aesthetics, groundwater hydrology, and productivity of the site.

Ratings assume:

- Rutting depths usually range from 2 to 24" and depends, in part, on the weight of equipment (including carried or pulled loads) and shape and size of wheels.
- Lack of organic/vegetation surface cover.
- Conditions occur on soil with slopes and other characteristics that allow use of ground-based equipment.

Ratings do not assess:

- Impacts of rutting on sloping sites that may channel surface water and affect hydrology.
- Frozen soil within 24" of the surface.

Ratings

Slight - Little or no rutting.

Moderate - Ruts are likely.

Severe - Ruts readily.

Table 4 - Soil Rating Criteria for Road Suitability - Natural Surface

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	FEATURE	IMPACT
Slope %	<6%	6-12%	>12%	Slope	Reduced efficiency; unsafe operation
Rock Fragments On the surface ≥3" ≥10" ≥24"	<15% <3% <0.1%	15-50% 3-15% 0.1-3%	>50% >15% >3%	Stoniness	Obstruction
Plastic Index Greatest value for uppermost thickest mineral horizon in the upper 6"	<30	≥30		Stickiness	Reduced efficiency
Particle Size Separates ≥3" thickness in the upper 6"	≤85% coarser than vfs	≥85% coarser than vfs		Too sandy	Reduced efficiency
Unified Classification Group >3" thickness in the upper 6"		CL, CH, CL-CH, ML, MH, ML-MH	OL, OH, PT	Low strength	Reduced efficiency
Ponding Duration Frequency None, Rare All Durations Occasional Very Brief Brief Long Very Long Frequent Very Brief Brief Long Very Long	 12 mos. 12 mos. 1-6 mos 1-2 mos --- 1 mo. 1 mo. --- ---	 --- --- >6 mos. 3-6 mos. 1-2 mos. 2-3 mos. 2-3 mos. 1 mo. ---	 --- --- >6 mos. >3 mos. >3 mos. >3 mos. >1 mo. >1 mo.	Ponding	Reduced efficiency; unsafe operation
Flooding Duration Frequency None, Rare, Very Rare All Durations Occasional Extremely Brief, Very Brief Brief Long Very Long Frequent, Very Frequent Extremely Brief, Very Brief Brief Long Very Long	 12 mos. 12 mos. 1-6 mos 1-2 mos --- 1 mo. --- --- ---	 --- --- >6 mos. 3-6 mos. 1-2 mos. 2-3 mos. 1 mo. --- ---	 --- --- >6 mos. >3 mos. >3 mos. >3 mos. >1 mo. >1 mo.	Flooding	Reduced efficiency; unsafe operation

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	FEATURE	IMPACT
Landscape Stability Hazard	Slightly unstable to stable	Moderately Unstable	Unstable	Landslides	Landing failures; unsafe operation
Water Table Depth Duration \geq 2 months	>24"	12-24"	<12" depth	Wetness	Reduced efficiency

Criteria Notes: If road suitability is "moderately suited" or "poorly suited," refer to Construction Limitations for Haul Roads and Log Landings interpretation.

(1) Description

Suitability for using the natural surface of the soil component for roads by trucks for the transport of logs and other wood products from the site.

Considerations

Ratings assess:

- The efficient and safe transport of forest products from the site.
- The landscape in its natural setting.
- Frequency and duration of flooding, ponding and depth and duration of water table.
- The use of trucks (1/2 ton to log-transport capability).
- Activities that disturb 100% of the soil surface area with rutting, puddling or displacement up to a depth of 18".

Ratings assume:

- Vegetation and debris is cleared from an area sufficient in width for the road before use begins.
- Using the natural setting of the soil without cut and fill construction.
- Slopes are less than 20% gradient.
- Use occurs during customary periods of such activity for the local area.
- Roads are generally less than 1 mile in length with up to a 20-foot wide running surface.

Ratings do no assess:

- Non-soil obstacles, e.g., slash.
- Frozen or snow-covered soils.

Ratings

Suited - Little or no restrictions to natural road suitability.

Moderately Suited - One or more restrictions reduce site suitability.

Poorly Suited - One or more restrictions generally make the use of the site for a natural road very difficult or unsafe.

Table 5 - Soil Rating Criteria for Log Landing suitability

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	FEATURE	IMPACT
Slope %	<6%	6-12%	>12%	Slope	Reduced efficiency; unsafe operation
Rock Fragments On the surface ≥3" ≥10" ≥24"	<15% <3% <0.1%	15-50% 3-15% 0.1-3%	>50% >15% >3%	Stoniness	Obstruction
Plasticity Index Greatest value for uppermost thickest mineral horizon in the upper 6"	<30	≥30		Stickiness	Reduced efficiency
Particle Size Separates ≥3" thickness in the upper 6"	<85% coarser than vfs	≥85% coarser than vfs		Too sandy	Reduced efficiency
Unified Classification Group >3" thickness in the upper 6"		CL, CH, CL-CH, ML, MH, ML-MH	OL, OH, PT	Low strength	Reduced efficiency
Ponding Duration Frequency None, Rare All Durations Occasional Very Brief Brief Long Very Long Frequent Very Brief Brief Long Very Long	 12 mos. 12 mos. 1-6 mos 1-2 mos --- 1 mo. --- --- ---	 --- --- >6 mos. 3-6 mos. 1-2 mos. 2-3 mos. 1 mo. --- ---	 --- --- >6 mos. >3 mos. >3 mos. >1mo. >1 mo. 1 mo.	Ponding	Reduced efficiency; unsafe operation
Flooding Duration Frequency None, Rare, Very Rare All Durations Occasional Extremely Brief, Very Brief Brief Long Very Long Frequent, Very Frequent Extremely Brief, Very Brief Brief Long Very Long	 12 mos. 12 mos. 1-6 mos 1-2 mos --- 1 mo. --- --- ---	 --- --- >6 mos. 3-6 mos. 1-2 mos. 2-3 mos. 1 mo. --- ---	 --- --- >6 mos. >3 mos. >3 mos. >1mo. >1 mo. 1 mo.	Flooding	Reduced efficiency; unsafe operation

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	FEATURE	IMPACT
Landscape Stability Hazard	Slightly unstable to stable	Moderately Unstable	Unstable	Landslides	Landing failures; unsafe operation
Water Table Depth Duration \geq 2 months	>24"	12-24"	<12" depth	Wetness	Reduced efficiency

Criteria Notes: If log landing suitability is considered "moderately suited" or "poorly suited," refer to the Construction Limitations for Haul Roads and Log Landing interpretation.

Description

The suitability of the soil at the forest site to serve as a log landing.

Considerations

Ratings assess:

- Efficient and effective use of equipment for temporary storage and handling of logs.
- The use of grapple hooks, skidders, trucks, loaders, cable yarders and other similar equipment
- Activities that disturb 100% of the soil surface area with rutting, puddling or displacement up to a depth of 18".
- The landscape in its natural setting.
- Frequency and duration of flooding, ponding and depth and duration of water table.

Ratings assume:

- Vegetation and debris is cleared from an area sufficient in size for the road or landing before use begins.
- One-half acre or less in size.

Ratings do not assess:

- Non-soil obstacles, e.g., slash.
- Frozen or snow-covered soil.

Ratings

Suited - Little or no restrictions to road or log landing suitability.

Moderately Suited - One or more restrictions reduce site suitability.

Poorly Suited - One or more restrictions generally make the use of the site for a landing very difficult or unsafe.

Table 6 - Soil Rating Criteria for Construction Limitations for Haul Roads and Log Landings.

FACTOR	SLIGHT	MODERATE	SEVERE	FEATURE	IMPACT
Slope %	<15%	15-30%	>30%	Slope	Reduced efficiency
Landscape Stability Hazard	Slightly unstable to stable	Moderately unstable	Unstable	Landslides	Road or landing failure; increased costs
Flooding Duration				Flooding	Road damage; increased costs
Frequency None, Rare, Very Rare					
All Durations	12 mos.	---	---		
Occasional					
Extremely Brief, Very Brief	12 mos.	---	---		
Brief	1-6 mos.	>6 mos.	---		
Long	1-2 mos.	3-6 mos.	>6 mos.		
Very Long	---	1-2 mos.	>3 mos.		
Frequent, Very Frequent					
Extremely Brief, Very Brief	1 mo.	2-3 mos.	>3 mos.		
Brief	---	1 mo.	>1mo.		
Long	---	---	>1 mo.		
Very Long	---	---	1 mo.		
USDA Texture	---	---	Ice	Perma-frost	Increased costs
Plasticity Index Greatest value for any layer thicker than 6" within 12" on <15% slopes, within 36" on 15-30% slopes, or within 60" on >30% slopes	<30	≥30	---	Stickiness	Reduced efficiency, increased construction costs
Rock Fragments				Stoniness	Reduced efficiency; equipment damage; increased costs
Depth to Layer Texture modifier very stony, extremely stony					
Slope %					
<15%	>20"	≤20"	---		
15-30%	>30"	≤30"	---		
>30%	>40"	≤40"	---		
Depth to Layer Texture modifier very bouldery or extremely bouldery					
Slope %					
<15%	>40"	20-40"	<20"		
15-30%	>60"	30-60"	<30"		
>30%	>80"	40-80"	<40"	Stoniness	
On the surface	<3%	3-15%	>15%		Obstruction
≥10"					

FACTOR	SLIGHT	MODERATE	SEVERE	FEATURE	IMPACT
Particle Size Separates Layers ≥ 6 " thick within 12" on <15% slopes, within 36" on 15-30% slopes, or within 60" on >30% slopes	<85% coarser than vfs	$\geq 85\%$ coarser than vfs	---	Too sandy	Increased construction costs
Unified Classification Group Layers ≥ 6 " thick within 12" on <15% slopes, within 36" on 15-30% slopes, or within 60" on >30% slopes	---	CL, CH, CL-CH, ML, MH, ML-MH	OL, OH, PT	Low strength	Increased construction costs
Depth to Indurated Layer Slope% <15% 15-30% >30%	 >40" >60" >80"	 20-40" 30-60" 40-80"	 <20" <30" <40"	Restrictive layer	Reduced efficiency; increased construction costs
Water Table Depth Year round	>24"	12-24"	<12"	Wetness	Reduced efficiency
Ponding	---	---	Year Round		

Description

Ratings reflect limitations for constructing haul roads and log landings.

Considerations

Ratings assess:

- Earth moving activities to meet standards and specifications for haul roads and log landings.
- Excavating, removal and shaping of native soil materials to develop haul roads and log landings for forest harvesting and other management activities.
- Cuts and fills less than 10 feet in depth.
- The use of bladed crawler tractors, excavators, graders and other primary construction equipment.
- Year-round water tables, year-round ponding and permafrost.
- Frequency and duration of flooding.

Rating assume:

- Construction activities occur during customary periods of such work for the local area.
- Roads are up to one mile in length with up to a 20-foot running surface.

Ratings do not assess:

- Snow-covered soils.

Ratings

Slight - Little or no limitations to construction activities.

Moderate - One or more limitations that cause some difficulty.

Severe - One or more limitations that make road or log landing construction very difficult or more costly.

Table 7 - Soil Rating Criteria for Harvest Equipment Operability.

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	FEATURE	IMPACT
Slope %	<20%	20-35%	>35%	Slope	Reduced efficiency; unsafe operation
Rock Fragments One the surface ≥3: ≥10" ≥24"	<15% <3% <0.1%	15-50% 3-15% 0.1-3%	>50% >15% >3%	Stoniness	Obstruction
Plasticity Index Highest value for uppermost thickest mineral horizon in the upper 6"	<30	>30	---	Stickiness	Reduced efficiency
Particle Size Separates ≥3" thickness in the upper 6"	<85% coarser than vfs	≥85% coarser than vfs	---	Too Sandy	Reduced efficiency
Unified Classified Group ≥3" thickness in the upper 6"	---	CL, CH, CL-CH, ML, MH, ML-MN	OL, OH, PT	Low strength	Reduced efficiency
Water Table Depth Year-round	>24"	12-14"	<12"	Wetness	Reduced efficiency
Ponding			Year round		

Description

The suitability for operating harvesting equipment.

Considerations

Ratings assess:

- The off-road transport or harvest of logs and/or wood products by ground-based wheeled or tracked equipment.
- The use of standard rubber-tire skidders and bulldozers used for ground-based harvesting and transport.
- Activities that disturb from 35 to 75 percent of the surface area with rutting, puddling, or displacement up to a depth of 18".
- Year-round water tables and year-round ponding.

Ratings assume:

- Activities occur during customary periods of such work for the local area.

Ratings do not assess:

- Non-soil obstacles, e.g., slash.
- Frozen or snow covered soils.

NRCS NV, NHCP

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Ratings

Well Suited - Little or no restrictions to equipment operability.

Moderately Suited - One or more restrictions reduce the effective and safe use of equipment.

Poorly Suited - One or more restrictions make the use of equipment impractical or unsafe.