Surface Erosion
## APPENDIX B

### Surface Erosion Assessment

Thompson Creek Watershed Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Distribution</th>
<th>Method</th>
<th>Reference</th>
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<td>A.1</td>
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<td>C.A.</td>
<td>N.A.</td>
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<td>T.C.</td>
<td>C.A.</td>
<td>N.A.</td>
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<td>A.4</td>
<td>T.C.</td>
<td>C.A.</td>
<td>N.A.</td>
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<td>C.A.</td>
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<td>A.6</td>
<td>T.C.</td>
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<td>N.A.</td>
</tr>
</tbody>
</table>

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*Appendix B - March 10, 1997*
THOMPSON CREEK WATERSHED ANALYSIS - SURFACE EROSION MODULE

A level two analysis for soil erosion was conducted in the Thompson Creek WAU, following the procedures outlined in Version 2.1 of the manual.

I) Overview

A) General

The Thompson Creek WAU is located approximately 15 miles northeast of Spokane along the Idaho-Washington border. The basin is broken into six subbasins, four of which drain directly or indirectly (subsurface flow) into Newman Lake (Fig. 1). The southern-most basin, Moab, is the second largest subbasin, but has the lowest drainage density (Tables 1 and 2). Weighted average rainfall for the basin is 571 mm, as calculated by the Department of Natural Resources (DNR), Geographic Information System (GIS).

Table 1  Stream Lengths (Type 1-5) by Subbasin

<table>
<thead>
<tr>
<th>Subbasin Name</th>
<th>Length in Feet</th>
<th>Feet/Square Mile</th>
<th>Mile/Square Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moab</td>
<td>41449.9</td>
<td>4494</td>
<td>1.0</td>
</tr>
<tr>
<td>NW Newman Lk</td>
<td>62907.5</td>
<td>8501</td>
<td>1.6</td>
</tr>
<tr>
<td>Schackle</td>
<td>42594.9</td>
<td>7099</td>
<td>1.3</td>
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<tr>
<td>Shaw</td>
<td>49369.3</td>
<td>9874</td>
<td>1.9</td>
</tr>
<tr>
<td>SW Newman Lk</td>
<td>74218.2</td>
<td>10453</td>
<td>2.0</td>
</tr>
<tr>
<td>Thompson</td>
<td>198209.4</td>
<td>14682</td>
<td>2.8</td>
</tr>
</tbody>
</table>

The WAU has three main land uses: agriculture, silvi-culture, and rural development. One small cattle ranching operation occurs near the mouth of Thompson Creek, and another larger ranch occurs in the southwest portion of the Moab subbasin. Lakeshore and nearshore development into approximately 1/4 acre lots is common along all of the hilly regions around the lake. The flat areas surrounding the lake are all in active agriculture. However, rural and suburban development is occurring in the southern portions of the flats. Throughout the rest of the basin, rural lots of 5 acres and greater are interspersed with commercial forest lands. Hobby farms are common.

Table 2  Subbasin Areas

<table>
<thead>
<tr>
<th>Subbasin Name</th>
<th>Acres</th>
<th>Percent of Basin</th>
<th>Square Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW Newman Lk</td>
<td>4738.2</td>
<td>15.7</td>
<td>7.4</td>
</tr>
<tr>
<td>SW Newman Lk</td>
<td>4522.3</td>
<td>14.9</td>
<td>7.1</td>
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<tr>
<td>Moab</td>
<td>5323.7</td>
<td>17.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Thompson</td>
<td>8655.4</td>
<td>28.6</td>
<td>13.5</td>
</tr>
<tr>
<td>Shaw</td>
<td>3203.4</td>
<td>10.6</td>
<td>5.0</td>
</tr>
<tr>
<td>Schackle</td>
<td>3829.3</td>
<td>12.7</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>30272.3</td>
<td></td>
<td>47.3</td>
</tr>
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</table>
The WAU is dominated by patchwork ownership patterns. The Inland Empire Paper Company (IEP) owns several large parcels on the north and west sides of the WAU (Fig. 2).

Ground-based tractor thinning is the dominant forest harvest type in the WAU. Clearcutting is less common. Heavy thinning and clearing during conversion of forest lands to rural and suburban uses is common around the lake and along county roads.

B) Road Conditions

This WAU is heavily roaded. Typically roads are native surfaced, outsloped, and lack proper ditching (Table 3). Roads maintained by Spokane County are an exception. The county gravels or paves most of it's maintained roads in the basin. Appropriate ditches and cross drains are required on all county maintained roads. Some county roads are not maintained and have a designation of 'Summer Use Only'. However, private residences are located off of these roads, so the probability of year-round use is high. IEP water bars it's maintained roads, and when maintained, these waterbars are effective at reducing road erosion. The mainline is graded annually, and on an as-needed basis. Graveling is rare.

<table>
<thead>
<tr>
<th>Subbasin Name</th>
<th>Length in Feet</th>
<th>Foot/Square Mile</th>
<th>Mile/Square Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moab</td>
<td>248698.4</td>
<td>29963.7</td>
<td>5.67</td>
</tr>
<tr>
<td>NW Newman Lk</td>
<td>198076.7</td>
<td>25550.9</td>
<td>4.84</td>
</tr>
<tr>
<td>Schackle</td>
<td>165213.8</td>
<td>27535.6</td>
<td>5.22</td>
</tr>
<tr>
<td>Shaw</td>
<td>206905.4</td>
<td>41381.1</td>
<td>7.84</td>
</tr>
<tr>
<td>SW Newman Lk</td>
<td>204622.0</td>
<td>28820.0</td>
<td>5.46</td>
</tr>
<tr>
<td>Thompson</td>
<td>445721.7</td>
<td>33016.4</td>
<td>6.25</td>
</tr>
</tbody>
</table>

Many of the roads in this basin are owned by small landowners, who have varying degree of ability to properly maintain their roads. Commonly, the roads are only improved when absolutely necessary. Water management on these private road surfaces is largely absent and erosion from these rural roads is commonly high. Many of the private roads that lead to residences are not culverted at the county ditch, so that erosion occurring on the road surface fills county ditches.

The use of dust-oil is prohibited in the Newman Lake watershed by the Newman Lake Association (P. Barto, county engineer, oral commun.), but locally dust-oiling roads for a few hundred feet near construction zones occurs. The graveling of roads is uncommon, with the exception of county maintained roads. At no place was gravel deeper than six inches measured (Map B-5). If the road is an active haul road, a crowned or insloped road is common, but ditches are not.

Water management and diversion regimes are noticeably absent throughout much of the basin. Few forest roads in the WAU meet Forest Practice standards. Water-bars and rolling dips are rare, except on most non-active IEP roads. Water-bars are removed on haul roads, allowing for significant erosion during summer rains. The usefulness of water-bars has been debated, for they tend to be short-lived. High traffic volumes and lack of maintenance easily flatten them because the soil is so sandy. Ditches and culverts are also rare, except on most county roads and most active IEP roads. Streamside roads and multiple stream crossing roads are common. Road
approaches to county roads typically lack appropriate drainage and culverts. Road grading commonly leaves a soil berm on the outer edge of the road, further channeling runoff and transport of sediments down road grades. The use of organic material in road fill was observed at several locations. Lack of water management, inadequate culvert size, and lack of maintenance has caused an artificial lake to form in the SW Newman Lake subbasin above highly valued lakefront property.

Road construction techniques vary from high-tech, well-maintained to 'lay-the-blade-down-and-go'. Because techniques lean toward the latter in this WAU, surface erosion from roads is moderate to extreme. However, road-building techniques and placement are not the only important parameter. Part of the reason this WAU is so heavily roaded with active roads is the patchwork of ownership and the amount of traffic these roads receive. Logging roads are a common recreational destination in this WAU, especially in the Thompson and Shaw subbasins. Recreational motorcycle, ORV, and 4WD traffic occurs from morning until night, seven days a week. In order to control some of the traffic in the Thompson subbasin, IEP’s mainline roads are gated from December 31st to May 31st (Map B-5). Discussion with local citizens suggest that this measure is effective at limiting some ORV and most 4WD traffic. Few other landowners gate off their lands, or limit access to their roads during the winter or early spring, when extreme damage to roads is most likely to occur. Road damage of this sort arises when roads are water-saturated (from snowmelt and/or precipitation), and driven upon. This creates deep ruts in the road tread that act as channels for water, further eroding the road. As a result of these factors, many of the roads in this WAU that are built on slopes steeper than 15 degrees show evidence of rilling and rutting.

Cutslope ravelling is a common long-term sediment source. The soils produced from the rock types present in the basin are composed of easily erodible sand-size grains. Cutslopes in this area are typically originally cut at or near vertical, but through the process of erosion, are eroded back to a flatter slope. This long-term ravelling can remove several yards of material per cutslope, much of which gets routed down the road system and exits at stream crossings.

C) Geology and Soil Formation

The parent materials consist of highly weathered metamorphics and granitics, overlain by Pleistocene glacial and glacial flood deposits and more recent volcanic ash (Fig. 4). The metamorphic rocks break down to form pebble and sand-sized detrital grains (grus), and contain abundant micas. Subsoils derived from these metamorphic rocks are sterile and highly erodible. The glacial flood deposits break down to form all grain sizes, depending on whether they were originally sand-rich or cobble-rich. The typical limiting factor in subsoil fertility is the ability to hold water. These parent materials are highly porous and commonly have excessive drainage. Soils that contain significant ash components breakdown to form sand to silt-sized particles. Subsoils derived from ash soils tend to be sterile and highly erodible.

The soil surface layer (humus layer) tends to be thin in the upland areas, but due to the highly weathered nature of the dominant parent material in the basin, rooting tends to be deep.
II) Soil Groupings from the Natural Resource Conservation Survey (NRCS) Data

Seven major soil groups were delineated based on parent material, soil depth, and amount of coarse material (Fig. 5). Overall, the upland areas of the WAU are largely residual and colluvial soils, with the lowlands containing hydric, glacial outwash, and ash derived soils. Varying amounts of volcanic ash is common in all the soil groups. Areas of open water, marshes adjacent to open water, and rock pits were not grouped. The group name, the members of that group, and the percentage of the group occurring within the WAU are listed.

A) Hydric Soils - Cocolalla, Peone, Semiahmoo (5.1% of WAU) - These soils occur in the lowland areas surrounding Newman Lake. They are poorly drained, black to dark grey soils occurring on slopes less than 5 percent. Peat and mottled silty clay loam is common in the subsurface. Rooting rarely goes deeper than a foot. Frequent flooding and standing water yields vegetation indicative of wetlands such as sedges and rushes. Better drained soils of this type can support willows, aspens, alders, cottonwoods, and red cedar. The compaction potential is high. Due to the flatness of the slope, the erosion potential and slope stability hazard are low. The shallow rooting systems of the few trees able to withstand these hydric conditions makes these trees have a high potential for windthrow. These soils are found in wet bottomlands, basins, and drainageways, on landforms that are flat to slightly concave or gently undulating. Soil depths are typically greater than 60 inches, but occasionally as little as 20 inches deep. The most common use for these soils is agriculture.

B) Till Soils - Bernhill, Dearyton (3.0% of WAU) - While the NRCS lists several till soils in the WAU, it is unlikely that these soils are truly till soils. Mistakes of this sort arise from the source of the data (aerial photo interpretation) coupled with limited field verification. Pleistocene continental glaciation did not extend this far south, and the elevation of this area does not permit alpine glaciation. Field evidence suggests that these soils are derived from outwash sands and gravels (see descriptions D and E) and have similar characteristics to these soils.

C) Ash Soils - Hardesty, Narcisse (2.4% of WAU) - While most soils in this area have a component of ash in them, these soils are largely composed of ash. These soils occur on slopes less than five percent, on flat, concave or gently undulating ground. They are moderately well to well drained and have moderate permeability. Soil depths are typically less than 60 inches, but can be as little as 20 inches locally. Compaction is moderate to high, depending on the amount of fines in the parent material. Erosion potential is low due to the low slope. In shallower soils, the windthrow potential is moderate. The most common use on these type soils is agriculture and forestry.

D) Sandy Outwash Soils - Bong & Phoebe. Bonner Varient, Clayton, Marble, Phoebe (5.7% of WAU) - These soils are derived from sandy glacial outwash. Soil depths exceed 60 inches and drainage is well drained to excessively drained. Permeability is moderate to rapid. Rooting depths are 40 to 60 inches. These soils occur on slopes that are flat to rolling. Cutslope, fill and sidecast hazard is slight to moderate. The compaction potential is low to moderate. The erosion potential is moderate to high, due to the low angle of repose of sands. These soils are rarely unstable when disturbed.
E) Gravelly Outwash Soils - Eloika Variant, Garrison, Springdale (5.8% of WAU) - These somewhat excessively drained soils with moderate permeability occur on flat or undulating slopes and steep terrace escarpments. They are formed from glacial outwash and contain up to 60 percent cobbles and pebbles. The soils tend to be deep (greater than 60 inches), but root systems rarely penetrate below the upper two feet. On slopes greater than 20 percent, these soils are unstable when disturbed. Compaction potential is low to medium, the erosion potential is low to medium on slopes less than 30 percent. On slopes greater than 30 percent, the erosion potential is medium to high.

F) Thin Residual Soils - Brickel, Moscow, Spokane (70.5% of WAU) - These soils are created from residuum and colluvium from granites and metamorphics. These soils range from 14 to 30 inches deep and are well drained, and moderately permeable. Weathered or fractured granitic bedrock lies directly below the soil horizon. These soils occur on the uplands, mountainsides and ridgecrests, on irregular to convex slopes. These soils are naturally stable but become variably unstable when disturbed on slopes that are above about 30 percent. Similarly, the sidecast, cut, and fill hazard is moderate, but becomes variably severe when slopes are over 30 percent. The compaction potential is medium to high. The erosion potential is medium except on slopes greater than 30 percent, then the potential is high.

G) Deep Residual Soils - Schumacher, Vassar (3.3% of WAU) - These soils are derived from residuum and colluvium derived from granites, gneisses, schists, or metasediments. These soils tend to be thick (greater than 60 inches), well drained, and have a moderate permeability. They form on mountainsides and foothills. These soils are naturally stable, but are unstable when disturbed on slopes greater than 30 percent. Similarly, erosion potential and cut, slope, fill, and sidecast hazard are high on slopes greater than 30 percent, but below that angle they are moderate. Compaction potential is high.

III) Methodology/Database Design

The summarized data for forms B-2 and B-4 are found in the appendix.

A) Hillslopes

A preliminary soil erosion potential map was created on the DNR GIS, using data from the NRCS. Sites of recent forest practice activity (Map B-3) were visited in the field and their location plotted either with a Global Positioning Satellite (GPS) receiver or on USGS 7.5' quadrangles. An estimate of soil erosion severity was made based on visual indicators of rutting and rilling, and sediment traveling downslope. Hillslope sediment run-out lengths were measured with a tape. The data from these sites is located in forms B-1. Additionally, the background sedimentation rate was calculated for each of the subbasins using the standard analysis methodology (Table 4).
Table 4  Erosion Volumes

<table>
<thead>
<tr>
<th>Sub.</th>
<th>Strm. Length</th>
<th>Soil Depth (in)</th>
<th>Soil Creep (in)</th>
<th>Erosion Vol. (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moab</td>
<td>41449.9</td>
<td>51.0</td>
<td>0.0454</td>
<td>37.8</td>
</tr>
<tr>
<td>NW New. Lk</td>
<td>62907.5</td>
<td>21.1</td>
<td>0.0413</td>
<td>21.5</td>
</tr>
<tr>
<td>Schackle</td>
<td>42594.9</td>
<td>17.0</td>
<td>0.0318</td>
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<tr>
<td>Shaw</td>
<td>49369.3</td>
<td>6.4</td>
<td>0.0134</td>
<td>1.7</td>
</tr>
<tr>
<td>SW New. Lk</td>
<td>73418.2</td>
<td>35.6</td>
<td>0.0556</td>
<td>57.8</td>
</tr>
<tr>
<td>Thompson</td>
<td>198209.4</td>
<td>53.7</td>
<td>0.0891</td>
<td>372.7</td>
</tr>
</tbody>
</table>

The furthest distance soil was measured moving outside of the stream-road network was 150'. Therefore, I buffered all Type 1-5 streams 150' and overlaid this buffer with the preliminary soil erosion potential map. All original soil erosion designations (as defined by the NRCS) falling within this buffer were kept. I then buffered all streams an additional 50' and overlaid this buffer with the preliminary soil erosion potential map. All original calls from the NRCS falling within this second buffer were downgraded one level (Thus, a high erosion potential call falling inside the 150' buffer was kept at high, a similar call in the 150-200' buffer was downgraded to moderate). This extra buffer was added to account for the possible storage of sediment on the hillslope before colonization by vegetation between periods of high precipitation and runoff. Areas outside of these buffers presumably do not deliver sediment to the stream network without mitigating factors (i.e. roads). Streams of unknown type (type 9 on the DNR GIS) were added because of the sensitivity of the soils in these draws to create channels when skidded in.

B) Roads Erosion

Most of the roads in the WAU were driven to determine surfacing, construction type, vegetative cover, traffic, and maintenance level (see Fig. 2 & Map B-5). Many roads are not currently receiving log truck traffic, but were coded as having light traffic due to the abundance of recreational traffic. Sample sites were logged either with a GPS receiver or on USGS 7.5' quadrangles. At these sites, visual estimates of road erosion were measured. The data for these sites is found on form B-1. The estimates of erosion were based on procedures outlined in the manual. Visual erosion measurements included estimations of volumes missing from ruts and volumes of sediment fans found in or directly off roadways, investigations of mitigating factors, and travel distances of sediment.

The calculations for the roads erosion was done on the DNR GIS. This is different in that usually roads are grouped into similar categories, and estimates of construction type, vegetative cover and other factors are given for the entire group. The transportation data on the GIS allows for each individual road to be coded. This allows for more tailored estimates of road erosion for each road segment. The design of the database is available on request. Delivery segments were determined by creating 100' and 200' buffers, then intersecting the roads with these buffers. If the road was known to be water-barred, the delivery rate was halved. The first 100' was given 100% delivery, and the second 100' had 20% delivery. The second rate is higher than the delivery rate specified in the manual. This rate was based on field estimations of road runoff (Map B-6). An extra category was added in the surfacing to indicate subsoil exposure. In some areas traffic has exposed the highly erodible subsoil. This subsoil has few clayey particles to give it cohesion, so the erosion from these exposures is extreme. Subsoils tread surface was given a factor of 1.1, 0.1.
over the factor for native surface roads. A multiplier to account for IEP road closures was added to those segments. It should be noted that while the methodology just outlined is very similar to the methodology suggested in the Manual, due to poor construction techniques, poor (or lack of) maintenance, and high recreational traffic volumes, sediment runout lengths often far exceeded the 100 and 200 foot buffers. These buffers were created for discussion purposes only, and for comparison with the background sediment rate. More reasonable buffers would be much larger in the upland areas and much smaller in the lowlands, due to the lower slope, smaller volume of recreational traffic, and lower road density. The standard methodology was preferred, both because of time constraints and because the volumes of sediment delivered from roads is an estimate, based on several assumptions. While different buffers might be more realistic, the volumes of sediment derived from delivery segments on the roads would not be more real. Monitoring of erosion conditions and volumes would validate erosion and delivery assumptions.

Discussion

Overall, the preliminary soil erosion potential map was accurate at determining soil erosion from forest practices (for exception, see Section 2, part b). The preliminary soil erosion potential map (Map B-2) shows that most of the upland areas have moderate to high erosion potentials, and the flat-lying areas either having low erosion potential or no data. Compaction of the soil profile is also common (Fig. 6).

Although soil erosion potential is high, erosion from hillslopes is a minor contributor of sediment to public resources. The low stream density, shallowness of slopes, and long periodicity of high precipitation events keeps most exposed soil on the hillslope out of the stream systems and on the hillslopes. Commonly, soil is dislodged, moved a small distance during a high precipitation event, deposited on the hillslope, and then reworked in later events, or colonized by vegetation, so that the hillslopes are storing sediment. The prevalence of ground-based (tractor) machinery on moderate to steep slopes exposes abundant mineral soils for detachment and transport.

Soil productivity is diminished when ground-based equipment is allowed to skid up (and down) stream channels. This type of activity compacts the soil, causing water that would have originally filtered into the soil to be forced to the surface, creating new stream channels. Furthermore, the decrease in channel roughness due to compaction leads to increased water velocities, increased erosion potential and possible increased incision of the channel once the water has entered a channel that has not been skidded in.

Erosion from roads is high. This is due to the combined effects of deep erodible soils, native surfaced roads, and abundant traffic. Delivery rates are affected by the high road density and associated high number of road/stream intersections, streamside roads, and minimal maintenance of roads. Other contributing factors are slope and precipitation. An increase in either of these factors increases the likelihood of erosion. A comparison of the Background Sedimentation Rate and the calculated delivery rate suggests that in all the subbasins, the hazard from soil erosion from roads is high (Table 5).
Table 5. Comparison of Sediment Yield and Road Delivery

<table>
<thead>
<tr>
<th>Subbasin</th>
<th>Sed. Yield (Tonnes/Yr)</th>
<th>Road Delivery (Tonnes/Yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moab</td>
<td>57</td>
<td>412</td>
</tr>
<tr>
<td>NW Newman</td>
<td>32</td>
<td>401</td>
</tr>
<tr>
<td>Schackle</td>
<td>14</td>
<td>742</td>
</tr>
<tr>
<td>Shaw(*)</td>
<td>3</td>
<td>668</td>
</tr>
<tr>
<td>SW Newman</td>
<td>87</td>
<td>1213</td>
</tr>
<tr>
<td>Thompson</td>
<td>559</td>
<td>2687</td>
</tr>
</tbody>
</table>

*The data from Shaw Creek subbasin cannot be reasonably compared to the road delivery data, because portions of the Shaw basin are in Idaho. For areas in Idaho, the DNR GIS does not have soil or stream data determined.

Due to the homogeneity of the upland soils, Road Erosion Hazard Units (REHUs) were defined on the basis of drainages that delivered to a vulnerable resource. Drainages were defined on topographic breaks, and units can be identified on Map B-6. Roads that are on a shallow slope (less than 5%), away from waters (200' or more) are excluded from REHUs. Ridgetop roads are also excluded.

IV) Effect on Public Resources

In this basin, there are three main effects of soil erosion on public resources: 1) the addition of sediment to streams, with the effect of decreasing fish habitat by the filling of pools and the addition of fines to spawning gravels, and increasing turbidity (see Water Quality and Channels Modules for further discussion), 2) the addition of sediment to county roads and county maintained ditches, with the effect of increased maintenance (i.e. increased cost to taxpayers), and 3) the addition of phosphorous from road-pulverized sediment, with the effect of increasing the likelihood of algal blooms (see discussion in Fish Module for details). The metamorphic parent materials in the WAU have a naturally high phosphorous level, but the ability of organics to bind with inorganic phosphorous is currently unknown.

V) Confidence

A total of three and a half weeks of field work were completed in May and June of 1995. During this period, rain occurred for a week. This allowed for verification of delivery and transport distances. Confidence in road delivery segments is high to moderate. Measured sediment runout lengths exceeded those suggested in the Manual. An attempt at quantifying runout lengths was stymied due to the inability to separate the effects of the various factors (e.g. slope, traffic level, maintenance level). Certainly the sediment on the roads within the 100 and 200 foot buffers is delivering, but these buffers are illustrative only. Most certainly, some sediment on roads outside the 200 foot buffer is also delivering. Confidence in hillslope delivery areas is moderate. Mitigating factors include: 1) There was little landowner participation in the start-up phase
(creation of Map B-5) that may have led to some sites of recent activity being missed, 2) a long 
(7-9 year) drought period directly preceding this years very wet period, that may be leading to 
increased storage on hillslopes, during this wetter period, more soil may be mobilized than 
predicted. The confidence in the background sediment rate is high for all subbasins other than 
Shaw, which has a moderate confidence rating. The weighted soil depth for the Shaw subbasin is 
too shallow, due to the lack of soil data for the portion of the basin that is located in Idaho. The 
acquisition of soil data for the Idaho portion would provide greater confidence. A methodology 
for accessing landowner activities (DNR MAPS?) would provide greater confidence in the 
creation of Map B-5.

The use of a GPS unit for locating sites accurately and quickly greatly speeded the collection of 
locational data. Further, this GPS data can be fed almost directly into the DNR GIS, for rapid 
overlay with other GIS layers (i.e. soil erosion, geology, etc.).

VI) Suggestions for Improving the Conditions of Roads - 

1. Heavily used haul roads should be surfaced with either gravel or pavement.

2. To route water and sediment off roads and onto the forest floor, control water collection and 
runoff on the roadway by one or more of the following:
   a. Construct rolling dips (rolling dips are the preferred method of runoff control).
   b. Crown or outslope the road, and use ditching and relief culverts.
   c. Armor ditches to prevent excessive erosion.
   d. Remove berms developed on the outside shoulders of the road by grading or plowing.
   e. Provide many routing mechanisms onto the forest floor before road-stream intersections.

3. Roads should be built with cutslopes between 1.5:1 and 2.0:1. Top soil should be draped over 
the cut surface, and cutslopes should be seeded.

4. The stabilization of existing cutslopes could be encouraged by laying any existing topsoil back, 
cutting the cutslope between 1.5:1 and 2.0:1, then redistributing the topsoil onto the cut surface, 
and seeding.

5. New roads should not be built within 200 feet of streams, or in areas where runoff waters 
cannot be drained.

6. New road construction should be limited as much as possible.
7. Traffic should be limited, and ORV traffic in or near streams should be avoided.

8. Encourage cooperative road use and maintenance to decrease active road density and increase maintenance levels.

VII) Forms

Because of the large volume of field forms for surface erosion, they were not included in this document. The forms are available upon request from the Department of Natural Resources.
Thompson Creek
Spokane County, WA
Polygons Labeled with Subbasin Name, Acres and Percent of the Total WAU

THOMPSON
8655.423
0.29

SHAW
3203.356
0.11

NW NEWMAN LK
4738.177
0.16

SCHACKLE
3829.318
0.13

SW NEWMAN LK
4522.342
0.15

MOAB
5323.691
0.18
Thompson Creek
Spokane County, WA

Road Surfacing

- Native
- Subsurface
- Gravel 2 - 6 inches
- Paved
Thompson Creek
Geology and Basic Erosion Rates

Qa - Alluvium
Qp - Peat
Open Water
Ql - Loess
Qfg - Flood Gravels
Qgl - Glaciolacustrine Sands
Eiat - Mt. Rathdrum Granite
TKiaa - Alaskite
Kiat - Mt. Spokane Granite
Kog - Lake Newman Gneiss
Kog - Lake Newman Orthogneiss
Kog - Metagranite with micas
pCam - Amphibolite
pCbg - Hauser Lk. Gneiss

Polygons labeled with the erosion rate for new roads and old roads.
Data used by permission of the USGS. Not for publication.
Thompson Creek
Soil Groups
From the SCS

- Originally mapped as till soils. Limited field inspection suggests that these are Sandy Outwash Soils. No glacial ice has ever reached this basin.

- Sandy Outwash Soils from Lake Missoula flooding.

- Thin Residual Soils forming on very old granitics and gneisses.

- Hydric Soils occur largely around the lake perimeter. Prior to slough construction, most of these areas were under water.

- Gravelly Outwash Soils bar deposits from the Lake Missoula flooding.

- Ash Soils from Mt. Mazama or other Cascade(?!) eruptions.

- Deep Residual Soils forming on very old granitics and gneisses.

Detailed soil descriptions are found in the text.

- Lakes
- Marshes
Figure 6

Compaction Potential

No Data or Not Applicable

Low
Medium
High
Variable

Data from the DNRFIS

Note that most of the areas in active forestry have high compaction potential.
Thompson Creek
Figure 7

GPS Sites

Resource Assessed (points acquired with a GPS unit)

Positional

Hillslope

Road

Hillslope and Road

All of the Above
Thompson Creek
Figure 8

Traffic Patterns

Rare Use
Light Use
Moderate Use
Heavy Use
Thompson Creek
Past 5 Years Activities - 1995
Map B - 3

Percent of Area Harvested (+/- 10%)

☐ 30
☐ 40
☐ 50
☐ 60
☐ 70
☐ 80
☒ Clearcut

Note: most units were harvested using ground-based tractor thinning methods. Rare use of high head cables occurs on the very steep slopes, intermixed with tractor logging.

Inland Empire Paper
Past Activities

☐ Clearcut
☐ Shelterwood Cut
☐ Overstory Cut

Inland Empire Paper
Future Activities

☐ Proposed Harvest

Resource Assessed (points acquired with a GPS unit)

Positional
☒ Hillslope
☒ Road
☒ Hillslope and Road
☒ All of the Above

Hydrology

☒ Type 1
☒ Type 2
☒ Type 3
☒ Type 4

WASHINGTON STATE DEPARTMENT OF Natural Resources
Thompson Creek
Map B - 5
Road Traffic
and Surfacing - 1995

Road Surfacing

- Native
- Subsurface
- Gravel 2 - 6 inches
- Paved

* The use of dust-oil is prohibited in the Thompson Creek WAU for water quality reasons.

Traffic Patterns

- Rare Use
- Light Use
- Moderate Use
- Heavy Use

* Very few roads have officially been abandoned. Most roads receive at least light recreational traffic.

Hydrology

- Type 1
- Type 2
- Type 3
- Type 4