

## **FPRA Soil Conservation Effectiveness Evaluation Program**

### **2004 Soils EE Pilot Data Forms and Procedures – September 9, 2004 (small update Oct. 15)**

Prepared by MoF staff<sup>1</sup> on the Soils Value Team

#### **Introduction:**

This document provides data forms and procedures for completing the 2004 Soil Effectiveness Evaluation (EE) Pilots. Further background and air photo examples are provided in the following Appendices:

- Appendix 1: Introduction and Background
- Appendix 2: Site Selection and Sampling Concepts for Other Soils EE Work
- Appendix 3: Example Air Photo Overview
- Appendix 4: List of Indicators for 2004 Soils EE Pilot
- Appendix 5: Table 4a, Office Summary of Dispersed Disturbance Categories in NAR (includes soil disturbance codes to use in 2004 pilot)

These data forms and procedures are to be used during the Soils EE Pilots scheduled for the summer and fall of 2004.

The objective of the 2004 pilots is to evaluate how effective policy and related practices have been in conserving soil productivity and hydrologic function within cutblocks. Off-site or landscape effects are not the target of this exercise, but any concerns will be noted for future consideration.

Even though EE is not directed towards compliance or enforcement (C&E), incidents of possible or apparent non-compliance that become evident during the EE process will be identified for C&E consideration.

The data forms provide:

- (1) cutblock level soil conservation FRPA effectiveness evaluation questions and indicators, along with tables of criteria information for office and field data collection of each indicator;
- (2) ancillary questions, which are included to evaluate underlying policy assumption, or to highlight areas for follow-up related to possible C&E or off-site issues, information gaps (research), or off-site or landscape issues beyond the scope of this exercise.

---

<sup>1</sup> Compiled by: Mike Curran\*, Chuck Bulmer and Shannon Berch with other contributors including MoF Soil Specialists: Bill Chapman, Paul Courtin, Sandy Currie, Stephane Dube, Graeme Hope, Marty Kranabetter; and Rocky Mountain and Arrow Boundary District staff: Paul Chalifour, John Currie, Calvin Groll, Paul Mika and Kevin Vaters. (\*denotes contact for proposed changes to methods; **contact any of the specialists re -questions**)

**For the 2004 pilot we are focussing on randomly selected cutblocks that were logged without snow or frozen soil in the last two years. These should be further broken down into two categories, based on slope** (greater or less than 30 % using “percent average slope” from the cutblock cruise summary).

**Background data needs and documentation (office):**

Review of existing information for each cutblock is essential to planning and executing the field portion of EE, and also for interpreting the results of field surveys. Establish a file for each cutblock to be sampled, and use the checklist to ensure that copies of the following records, and any other applicable information (e.g. certification audits; Forest Practices Board audits; C&E actions; etc), are placed in the file:

| <b>Office Checklist for Soil Conservation Effectiveness Evaluation</b> | <b>Copy has been placed in the EE file</b> | <b>Reviewed</b> |
|------------------------------------------------------------------------|--------------------------------------------|-----------------|
| 1. Operational plan, including maps                                    |                                            |                 |
| 2. Post harvest or interim inspections (if available)                  |                                            |                 |
| 3. Cutblock cruise summary                                             |                                            |                 |
| 4. Preliminary site plan data collection cards                         |                                            |                 |
| 5. Air photos or satellite images (GIS support needed)                 |                                            |                 |
| 6. Schedule 7 Fire Hazard Assessment                                   |                                            |                 |
| 7. Other item                                                          |                                            |                 |
| 8. Other item                                                          |                                            |                 |

**Review of background information, including maps and air photos:**

Cutblocks selected for EE need recent air photos, which might need to be flown once the randomly selected blocks are screened using the soil EE criteria. Use of recent air-photos, in conjunction with operational plans and maps, is the most effective way to gain overview information needed to carry out the field component of the effectiveness evaluation. An overview of site conditions could also be obtained by other means, including viewing the block from a high vantage point, but this is much less desirable and should be only done if weather prevents obtaining air photos.

For recently harvested blocks, areas of potentially “inordinate soil disturbance”<sup>2</sup> are readily visible on overview or formal air photos, provided they are taken at a suitable scale for the disturbance and soil conditions present. The use of orthophotos, if available, would allow for more accurate estimates of areas and distances. The desire for high quality photos should be balanced against the costs of collecting the required information (to the required precision) by measuring on the ground. Most measures from air photos are based on proportions, so if software

---

<sup>2</sup> Inordinate soil disturbance is defined as: “30 % or higher disturbance on areas larger than 0.2 ha, or smaller areas if there is a high risk to other values”

or dot grids are used to estimate proportions the quality can be lower than if a scale is required for these estimates (which are confirmed in the field anyways).

Based on the air photo review, and other available information, a walk-through survey should be planned, incorporating inspection of areas of potentially inordinate disturbance, access structures, and features of interest, as well as areas that appear to represent average conditions on the block. Transects for quantitative evaluation of soil disturbance, green tree retention, and coarse woody debris are carried out at representative areas during the walkthrough.

From the photo reconnaissance, it is expected that preliminary estimates could be made of

- Area of the block in permanent (unrehabilitated) access
- Area of the block in potentially inordinate soil disturbance, if any
- Area of the block in landslides, if any
- Green tree retention
- Erosion and any drainage alteration that may be visible from the air.

### **Field data collection:**

The main purpose of the field data collection phase is to:

- confirm estimates of access, soil disturbance, landslides, and green tree retention obtained from the air photo overview,
- visit and evaluate each feature identified from the air photo
- evaluate sites where drainage or erosion may be of concern
- survey each transect planned from the air photo overview to evaluate dispersed and potentially inordinate soil disturbance
- evaluate the effectiveness of rehabilitation treatments,
- confirm the soil disturbance hazard ratings and Standard Unit boundaries, and
- to better evaluate factors which may have affected the results observed.

### **Field method:**

Review the planned transects from the air photo review and make adjustments based on what is visible from the ground. Use the following checklists to ensure that all field gear is available and all relevant aspects of the field survey will be completed. Walk the planned transect through the block, crossing all sensitive areas, SUs, and stop at major features and points of concern. During the walk-through, conduct surveys for dispersed soil disturbance (Table 4a), green tree retention (Table 5a) and woody debris retention (Table 5b). These surveys should be conducted on representative areas within each standards unit. Use an Esalon tape, or equivalent, for the soil disturbance and woody debris surveys.

### **Field markings:**

Flag and label the PoC, the start and end of each transect, and the edges of any roadside work areas.

| <b>Field gear checklist:</b> |                                                                                                                               |                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Item</b>                  | <b>Description</b>                                                                                                            | <b>In field gear?</b> |
| 1                            | 100 m Eslon tape or equivalent                                                                                                |                       |
| 2                            | 2 m tape or equivalent                                                                                                        |                       |
| 3                            | Planting shovel or normal shovel for compaction evaluation and soil pits                                                      |                       |
| 4                            | Auger to check deeper soil layers in hazard rating checks (optional)                                                          |                       |
| 5                            | Clinometer                                                                                                                    |                       |
| 6                            | Compass                                                                                                                       |                       |
| 7                            | Soil disturbance survey Reconnaissance survey field cards (FS 879) <sup>3</sup> or appropriate field paper for transect data; |                       |
| 8                            | Silviculture prescription plot card for checking soil disturbance hazards (FS 39A, both halves) <sup>3</sup>                  |                       |
| 9                            | Soil conservation surveys guidebook <sup>3</sup>                                                                              |                       |
| 10                           | LMH 47 – SP data collection field handbook; <sup>3</sup>                                                                      |                       |
| 11                           | <b>Camera, preferably digital with high resolution</b>                                                                        |                       |
| 12                           | Hip chain for width and length measures (optional)                                                                            |                       |
| 13                           | Personal field gear, food, water, any safety gear needed                                                                      |                       |

| <b>Field data checklist:</b> |                                                             |                          |                           |
|------------------------------|-------------------------------------------------------------|--------------------------|---------------------------|
| <b>Item</b>                  | <b>Description</b>                                          | <b>Survey required ?</b> | <b>Survey completed ?</b> |
| a)                           | length and width estimates for typical roads and landings   |                          |                           |
| b)                           | size, location and rehab status of rehabilitated structures |                          |                           |
| c)                           | structures built through materials unsuitable for rehab     |                          |                           |
| d)                           | landslides (area)                                           |                          |                           |
| e)                           | active erosion                                              |                          |                           |
| f)                           | areas with altered drainage                                 |                          |                           |
| g)                           | areas with inordinate soil disturbance                      |                          |                           |
| h)                           | area and soil disturbance within roadside work areas        |                          |                           |
| i)                           | transects for dispersed soil disturbance                    | All SUs*                 |                           |
| j)                           | transects for green tree retention                          | All SUs                  |                           |
| k)                           | transects for woody debris                                  | All SUs                  |                           |
| l)                           | other areas or features of interest                         |                          |                           |
| m)                           | Check soil disturbance hazards and Standards Units          | All SUs                  |                           |

\*other items require survey when present

<sup>3</sup> Waterproof versions are often available, particularly of the forms. If necessary, these can be downloaded from the following web addresses:

FS 879: <http://www.for.gov.bc.ca/isb/forms/lib/FS879.PDF>

FS 39A: <http://www.for.gov.bc.ca/isb/forms/lib/FS39A.PDF>

LMH 47: <http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh47.htm>

Soil Conservation Surveys Guidebook:

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/SOILSURV/soilconsurv.pdf>

**Field Assessment for Soil Conservation Effectiveness Evaluations**

In these tables, features being measured or surveyed are designated with capital letters, (eg, A,B,C, D, E, and F in the example Figures 1 and 2)

**Table 1. Estimating lost soil productivity due to access construction.**

| Variable                                                                                                                                                                                                                                                                                                                |               |              |                       |             | Value                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|-----------------------|-------------|-----------------------------|
| <b>1.1 Percent of the cutblock area in un-rehabilitated roads, landings, and borrow pits</b><br>(determined from aerial photo, vehicle or walk-through traverse - as per the Soil Conservation Surveys Guidebook)                                                                                                       |               |              |                       |             |                             |
| <b>Structure (eg, Landing E)</b>                                                                                                                                                                                                                                                                                        | <b>Length</b> | <b>Width</b> | <b>Area</b>           |             | <b><u>% of Cutblock</u></b> |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 |             | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 |             | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 |             | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 |             | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 |             | _____                       |
| <b>1.2 Percent of the cutblock in rehabilitated access</b>                                                                                                                                                                                                                                                              |               |              |                       |             |                             |
| <b>Structure (eg, Main trail D)</b>                                                                                                                                                                                                                                                                                     | <b>Length</b> | <b>Width</b> | <b>a   b   c = ER</b> | <b>Area</b> | <b><u>% of Cutblock</u></b> |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 | _____       | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 | _____       | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 | _____       | _____                       |
| _____                                                                                                                                                                                                                                                                                                                   | _____         | _____        | _____                 | _____       | _____                       |
| <b>1.3 Effectiveness of rehabilitation treatments on access.</b><br>“ER (effectiveness of rehab) ranges from 0 (unproductive ground) to 1 (fully restored soil conditions), and is determined according to the following method [ <b>partial scores possible for all</b> ], where: <b>ER = a+b+c</b>                    |               |              |                       |             |                             |
| <b>a) Was the rehabilitated area decompacted as necessary?</b> (dig around looking for uncompacted running surface which may appear as a remaining “midroad ridge” along a road or trail)<br>Assign a score from 0 to 0.5 max and make any comments here: _____<br>_____<br>_____                                       |               |              |                       |             |                             |
| <b>b) Was topsoil and/or burnpile debris, and woody debris re-spread with minimal mixing of subsoil ?</b> (dig to determine if it is good rooting medium that is organic rich but free of voids and buried coarse woody debris)<br>Assign a score from 0 to 0.3 max and make any comments here: _____<br>_____<br>_____ |               |              |                       |             |                             |
| <b>c) Has the site been reforested, or is there a reasonable likelihood that natural revegetation and reforestation will occur as a result of natural ingress from the surrounding area?</b><br>Assign a score from 0 to 0.2 max and make any comments here: _____<br>_____<br>_____                                    |               |              |                       |             |                             |

**Questions (please indicate example photos by number or some other tracking method):**

- 1) Does the total amount of permanent access seem appropriate given the site conditions? Provide specifics and rationale.

---

---

---

---

- 2) Indicate on the map and calculate how much of the un-rehabilitated access appears that it would be better considered and treated as Temporary Access (e.g., landing, spur roads in clearcut blocks)?

---

---

---

---

- 3) Do any individual access structures seem larger than necessary? Provide specifics and rationale.

---

---

---

---

- 4) Were pre-existing structures (e.g. old roads and trails) present in the NAR ?? if so, were any not used that appear that they should have been?

---

---

---

---

- 5) Does the rehabilitation incorporate drainage control? If not, do you see any concerns arising?

---

---

---

---

**Table 2: Estimating in-block area affected or potentially affected by landslides, drainage diversion or significant erosion from roads, landings or trails.**

| Variable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |              |             | Value                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|-------------|---------------------------------------------------|
| <b><u>Landslides</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |              |             |                                                   |
| <b>2.1 Delineate and measure cutblock areas in new failures outside the roads, landings or trail prism including dry ravel</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |              |             |                                                   |
| <b>Failure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Length</b> | <b>Width</b> | <b>Area</b> | <b><u>Area affected (m<sup>2</sup>)</u></b>       |
| _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | _____         | _____        | _____       | _____                                             |
| _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | _____         | _____        | _____       | _____                                             |
| <b>2.2 Delineate and measure cutblock areas that could be affected by road, landing or trail construction or maintenance practices, or roadcuts through material and/or slope conditions, known to have stability problems in the local area</b><br>(eg, often includes clay textured materials on wet slope locations)                                                                                                                                                                                                                                                                                                                                                                   |               |              |             |                                                   |
| <b>Failure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Length</b> | <b>Width</b> | <b>Area</b> | <b>Area affected (m<sup>2</sup>)</b>              |
| _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | _____         | _____        | _____       | _____                                             |
| _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | _____         | _____        | _____       | _____                                             |
| <b>Total area affected or potentially affected by landslides</b><br>(sum of above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |              |             |                                                   |
| <b>2.3 Are there areas of water diversion, or potential water diversion, onto slopes, channels or structures that normally would not receive that much water (eg, evidence of overland flow) – estimate area potentially affected .</b><br>If yes, specify potential concerns regarding stability and/or erosion that may be expected to occur. When considering potential concerns, take into account slope steepness/topography involved, other values at risk, etc.<br>Water diversion may not be a concern on flat land:<br><b>Describe potential concern and delineate areas referred to on the map or air photo:</b><br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ |               |              |             | Yes or No<br><br>Estimated size (m <sup>2</sup> ) |

|                                                                                                                                                                           |               |              |             |                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|-------------|------------------------------------|
| <b><u>Erosion*</u></b>                                                                                                                                                    |               |              |             |                                    |
| <b>2.4 Delineate and measure eroded areas, or those at significant risk of erosion, which are typically devoid of vegetation, in the cutblock (Do not count deposits)</b> |               |              |             |                                    |
| <b>Eroded area</b>                                                                                                                                                        | <b>Length</b> | <b>Width</b> | <b>Area</b> | <b><u>Area (m<sup>2</sup>)</u></b> |
| _____                                                                                                                                                                     | _____         | _____        | _____       | _____                              |
| <b>Provides specifics and rationale, referring to map or airphoto</b>                                                                                                     |               |              |             |                                    |
| _____                                                                                                                                                                     |               |              |             |                                    |
| _____                                                                                                                                                                     |               |              |             |                                    |
| _____                                                                                                                                                                     |               |              |             |                                    |
| _____                                                                                                                                                                     |               |              |             |                                    |
| _____                                                                                                                                                                     |               |              |             |                                    |

**Questions(please indicate example photos by number or some other tracking method):**

Are there any potential or existing off-site effects related to mass movement, erosion or sedimentation evident during your field or office review? Provide specifics and rationale, referring to areas delineated on map or airphoto.

---



---



---



---



---



---

**Table 3. Estimating percent of the NAR area affected by disturbance to natural drainage patterns as a result of forestry operations**

| Variable                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Value                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| <b>3.1 Delineate and measure cutblock areas experiencing, or at risk of experiencing, altered drainage or standing water as a result of construction of roads, landings, trails, or inordinate soil disturbance</b><br>(e.g. areas with evidence of saturated soils, drowned vegetation or regeneration problems due to raised water table, interception of ephemeral streams or seeps by ditchlines; or areas expected to experience these problems due to evident drainage problems) | <u><b>Area affected (m<sup>2</sup>)</b></u><br><hr/> <hr/> |

**Questions**(please indicate example photos by number or some other tracking method):

Have natural drainage patterns been restored? (eg, waterbarring and cross ditching as appropriate on various structures? Ditch to control water across the back of landings? Etc.)

---



---



---



---



---



---

**Table 4. Description of the soil disturbance hazards\*, and the areas affected by dispersed soil disturbance, potentially inordinate disturbance, and roadside work areas in the NAR.**

**\*Got to the most sensitive areas of the cutblock or SU and check on disturbance hazards following the principles presented in LMH47; as you walk the cutblock or SU, be aware of changes in hazard ratings as you walk-through the cutblock/SU, particularly any changes in compaction hazard, and any time you feel the other hazard might become high (Coast) or very high (Interior).**

| <b>4.1 Determine the soil disturbance hazards for each SU<br/>attach forms FS39A indicating your checking</b> | <b>SU__</b> | <b>SU__</b> | <b>SU__</b> |
|---------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| Compaction                                                                                                    |             |             |             |
| Displacement                                                                                                  |             |             |             |
| Forest floor displacement                                                                                     |             |             |             |
| Erosion                                                                                                       |             |             |             |
| Mass wasting                                                                                                  |             |             |             |

**4.2 Assess area of potential inordinate disturbance. If they appear inordinate, delineate and measure areas of inordinate disturbance greater than 0.2 ha; these should have been designated with capital letters on the airphoto review (eg, A, B, C in Figure 1), if not, assign a new, unique letter to each area. Complete a transect survey to collect 50 or so points to represent the areas.  
(Use and attach FS879 for each transect, following codes from Appendix 5 and circle any points with forest floor displaced)**

Do not include roadside work areas, which are covered below in 4.4.

**Map**

| <b>Code( eg, A)</b> | <b>Length</b> | <b>Width</b> | <b>Transect?</b> | <b>Description (eg, did it end up appearing inordinate?)</b> |
|---------------------|---------------|--------------|------------------|--------------------------------------------------------------|
|                     |               |              | y/n              | #                                                            |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |
|                     |               |              |                  |                                                              |

| <p><b>4.3 Transects for dispersed disturbance in remainder of each SU (Use and attach FS879 for each transect, following codes from Appendix 5 and circle any points with forest floor displaced)</b></p> <hr/> <p>List transect numbers here (eg, T1, T2, T3, ).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|-------|-------------|------------|--------|-------|-------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| <p><b>4.4 Delineate and measure disturbance associated with roadside work areas (these are defined in Soil Conservation Surveys Guidebook as “those areas located adjacent to haul roads and used during roadside harvesting operations for decking, loading, processing and debris disposal”). The edges of these area are typically where the heavy disturbance or woody debris drops off substantially.</b><br/> <b>(Use and attach FS879 for each transect, following codes from Appendix 5 and circle any points with forest floor displaced)</b><br/> <b>Map</b></p> <table border="1"> <thead> <tr> <th>Feature</th> <th>Transect #</th> <th>Length</th> <th>Width</th> <th>Description</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> |            |        |       | Feature     | Transect # | Length | Width | Description |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Feature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Transect # | Length | Width | Description |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <p><b>4.5 Effectiveness of NAR rehabilitation (see Table 1):</b></p> <p><b>Enter this data in Table 1.2 and 1.3</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |        |       |             |            |        |       |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Questions**(please indicate example photos by number or some other tracking method):

1. Do the sensitivity ratings appear to be correct;

---



---



---



---

2. Were the SU's mapped correctly, and have complexes been recognized?

---



---



---



---

3. Were these roadside work areas of an appropriate width for the harvesting system used and was an attempt made to minimize disturbance within the roadside work area? If not, discuss the relative trade-offs between the size and severity of roadside work areas versus if conventional landings were used.

---

---

---

4. Were skid trails and temporary access structures designed/ constructed to minimize the amount of area occupied by these structures while keeping in mind there may be other factors to consider such as safety or efficiency?

---

---

---

5. Were there features smaller than .2 ha, or other areas where soil disturbance was not recognized in the survey, but appeared to be a concern.

---

---

---

6. Are there disturbance types present that should have been rehabilitated but were not? If so, list and describe them, referring to a mapped location (eg, corduroy trails, compacted areas, excavated and bladed trails).

---

---

---

**Table 5a. Describing green tree retention for estimating refugia for mature forest soil organisms**

|                                                                                                                                                                                 | SU _____ | SU _____ | SU _____ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|
| <b>Distance from cutblock to nearest mature forest (km)</b>                                                                                                                     |          |          |          |
| <b>Number of green trees retained on cutblock per ha (all structural classes)</b>                                                                                               |          |          |          |
| <b>Percent of original species retained as mature green trees on cutblock</b> (number of tree species _____ / preharvest number of tree species <sup>1</sup> ) * 100<br>= _____ |          |          |          |
| <b>Structural classes of green trees %</b><br>1. Original dominant or co-dominant trees<br>2. Sub-canopy trees (> 10 m)<br>3. Shrub layer trees (≤ 10 m)                        |          |          |          |

<sup>1</sup> Use the cruise summary to determine preharvest number of species and augment with any other species seen

**Question(please indicate example photos by number or some other tracking method):**

List the species planted.

---



---



---



---

**Table 5b. Describing wood debris for estimating amount and diversity of habitat for dead wood-occupying soil biota**

|                                                         | SU _____                                                                       | SU _____ | RW _____ |
|---------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|
| <b>Amount of woody debris</b>                           |                                                                                |          |          |
| <b>Schedule 7 Fire Hazard Assessment from Licensee:</b> |                                                                                |          |          |
| 2) Fuel size (% of all fuels that are < 7.1 cm)         |                                                                                |          |          |
| 3) Horizontal fuel arrangement (% of area)              |                                                                                |          |          |
| <b>Number of snags or stubs in NAR, per ha</b>          |                                                                                |          |          |
| <b>Percent of original species retained as CWD</b>      | number of tree species as CWD _____ / preharvest number of living tree species |          |          |

Were the branch and fine slash materials left in the cutblock or did they end up primarily in the debris pile?.

---

---

---

---

---

[illegible]

## **Appendix 1: Introduction and Background**

The soil conservation provisions in FPC and FRPA recognize that it may take 20 years or more to understand soil disturbance effects on forest productivity. The FRPA policies and the EE process consider soil disturbance observable on the ground at the time of completing operations as a proxy for longer-term effects. The FRPA policy framework for soil disturbance (hazard ratings, disturbance types, cumulative limits) is also being tested through validation (research), and is revised from time to time as new knowledge arises. Therefore, part of EE is to identify needs for validation (research), in addition to information gaps related to policy implementation.

### **Approach and Methodology for Pilot Project**

The method and indicators presented here are suitable for use for one to two years after harvesting operations are completed. Other indicators, including direct measures of forest productivity such as site index, have not been included in this document because they are more useful after longer time periods. Research efforts (validation monitoring) are underway to evaluate the linkage between soil disturbance at the time of operations and long term forest productivity.

Successful interpretation of the results from the EE relies on obtaining consistent field measurements. Training will take place to ensure field crews are familiar with the methods. Ideally, field data collection at every site will be carried out by the same crew, with additional expertise being drawn in as required.

## **Appendix 2: Site Selection and Sampling Concepts for Other Soils EE Work**

### **Site selection and sampling concepts:**

In general, sample blocks are randomly selected from a list of all the blocks harvested during the two year period prior to field data collection. To address issues of local or regional concern, the site selection process can be broadened to include risk based (weighted) sampling, or stratification may also be involved in site selection. A “risk-based” approach would see additional sample blocks selected from high-risk sites. One could also consider an “extent”-based approach, where additional sites are selected based on how much area is affected by various practices. For a particular Forest District, the final sampling design will likely reflect a balance of the benefits of each approach.

Where risk-based sampling is used, it should consider the following factors for site selection:

- sites with high or very high hazard for soil degradation
- sites with summer skidding
- sites that were salvage harvested
- sites with partial cutting
- sites with ridged or hummocky terrain or catenas with mixes of distinctly different soil types.
- small cutblocks
- steep slopes
- “sensitive soils”

- drier or wetter ecosystems
- specific prescribed practices meeting higher disturbance guidelines (eg, stump removal or other aggressive site preparation is prevalent in the area)
- roadside work areas where these are considered to represent a large proportion of cutblocks

### Appendix 3: Example Air Photo Overview

Figures 1 and 2 illustrate the process of air photo review for an effectiveness evaluation. In this example, the 10.8 ha block consists of a single standards unit, and is entered by a single road. Three wildlife tree patches occupy a total of 0.8 ha (est'd). The NAR area indicated on the SP was 9.8 ha. Soil compaction and displacement hazards were indicated as high, and the surface erosion hazard moderate. No slope stability indicators were noted in the SP, sandy soil materials were identified as an unfavourable subsoil material occurring at 24-55 cm depth. A root removal treatment was planned, so the limit for soil disturbance in the NAR was set at 20%.

In Figure 1, three areas of potential inordinate soil disturbance (A,B,C) were identified, and rough estimates of their areal extent were made (est'd total of .37 ha – including one large area (C) of converging trails occupying an estimated 0.25 ha). A possibly rehabilitated area was apparent (D), and a landing (E) was shown on the operational plan map, but was not readily identified from the photo. It may have been rehabilitated, so size and status will be determined in the field. Road area (F) was estimated at 0.38 ha using a computer drawing program after scaling the image to the map obtained from the operational plan (e.g., a block width or road length clearly comparable to the paper plan). Roadside work areas were not visible on the photo, possibly because of only moderate resolution, so their presence and extent will be evaluated in the field survey.

The planned walkthrough is shown in white and red on Figure 2, starting at the Point-of-Commencement (PoC) indicated. The objective is to visit all features of interest as well as areas representing typical conditions on the block. Features that were not apparent on the air photo can be identified with a unique letter, and information on their extent and characteristics would be included in the field tally sheets. In the example, disturbance associated with the road, and the possible existence of a roadside work area can initially be observed on the drive into the block.

Soil disturbance transects are pre-located using the photo and **each transect will be surveyed in the field using a separate soil disturbance data card (listed in field gear checklist)**. These are shown in red on Figure 2. The cutblock disturbance transects are labelled with “T1, T2, T3”, etc. and are designed similarly to meet the following criteria:

1. go at right angles to the major disturbance
2. be representative of the entire area being surveyed, including block edges

The target is 100 points. Achieve this by determining approximate total length of transects from photo and divide by 100 to get sample point spacing to nearest metre. Actual number of points may be more or less, but simply complete the survey to the block edge.

Areas of potential inordinate soil disturbance are delineated on the photo (A, B, and C in the example here) and also checked for during the walkthrough. Upon initial overview, a decision is

made as to whether the disturbance appears inordinate, and if so, a series of parallel transects are surveyed, with these transects labelled with “Ta, Tb, Tc, etc” to designate the feature being surveyed. These are parallel transects with closer sample point spacing, using the same criteria (above) for cutblock disturbance transects. The target is 50 points for all potentially inordinate (concentrated) disturbance from the same stratum. Areas with similar disturbance characteristics can be grouped into one stratum. In the example Figure 2, although we did not find inordinate disturbance on this cutblock, we are showing area C as having warranted a survey, designated as Transect “Tc”..

Roadside work areas are surveyed with transects using the same procedure as inordinate soil disturbance.

In the example in Figure 2, the walkthrough begins at the (PoC), and proceeds along the edge of the wildlife tree patch to transect (T1), which is established in the southeast portion of the block to evaluate soil disturbance, green tree retention, and coarse woody debris. A second transect (T2) is established through the middle of the block to evaluate dispersed soil disturbance, with an initial evaluation of the potentially inordinate disturbance (area C) made at the one end that is crossed. A third transect (T3) is established in the northwest portion after looking at any area of potentially inordinate disturbance (area A). Returning, the extent of potentially inordinate disturbance at area B is evaluated, along with possibly rehabilitated area below the landing (D), and further transects are put in area C (Tc). Then, the state of disturbance and rehabilitation of the landing itself is evaluated (E). Finally, estimates of road length and width are evaluated by walking down the road (F) back to the start point (PoC). If it became apparent there was disturbance associated with a roadside work area, an additional transect would be established there (ie, label the new feature a unique letter, like G in this example, and the Transect would then be Tg).

Throughout the entire exercise, evaluations are made of the soil disturbance hazard ratings for the Standards Units (cutblock), and the appropriateness of the Standard Unit boundaries (or lack thereof). Texture (compaction hazard) should be checked regularly based on local experience with soil variation.

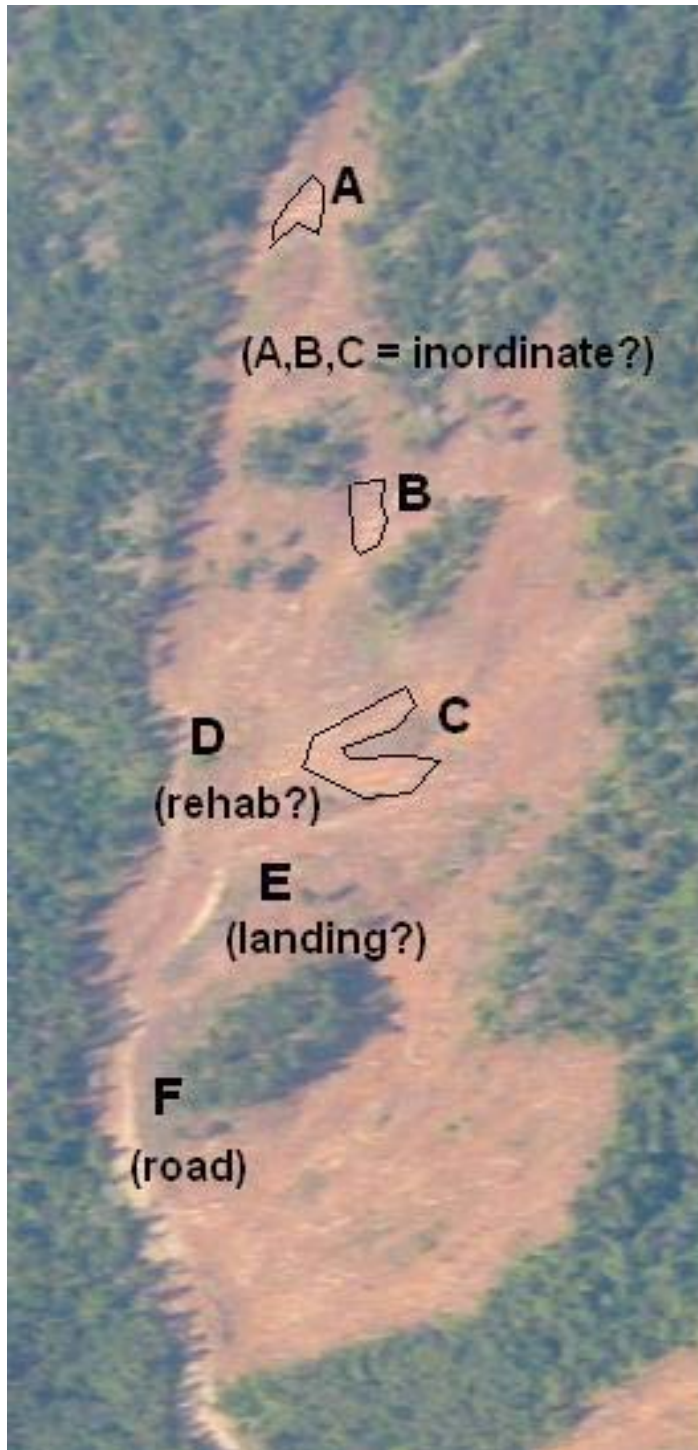


Figure 1. Digital image of CP364-3, on TFL 43, showing features of interest for soil conservation effectiveness evaluation.

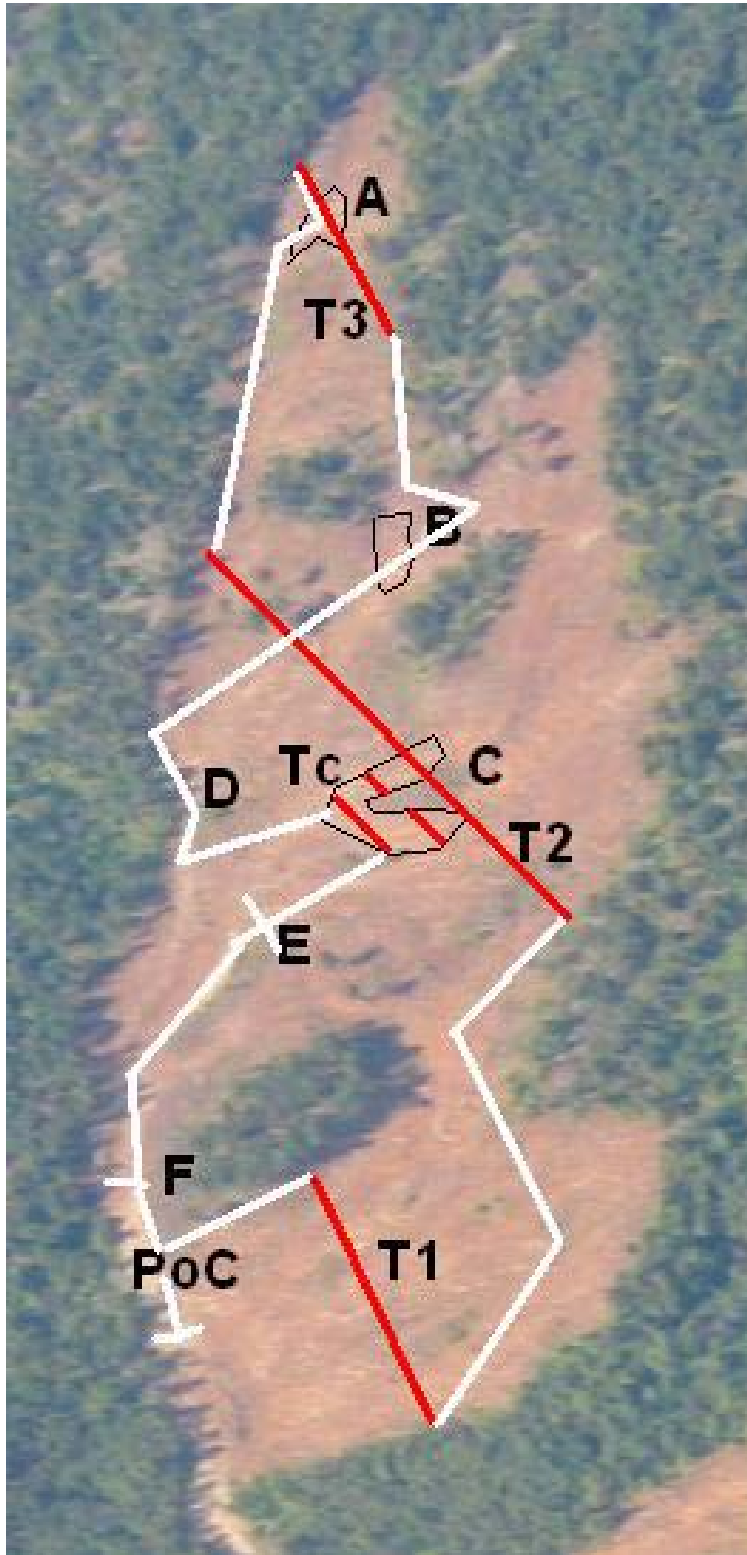


Figure 2. Digital image of CP364-3, on TFL 43. The white lines show the planned walkthrough. Red lines indicate expected locations of soil disturbance and coarse woody debris transects

The example describes an area harvested by clearcutting. Air photos are considered essential for reviewing partially cut areas because forest cover obscures overview assessments of site disturbance from vantage points on the ground.

#### Appendix 4: List of Indicators for 2004 Soils EE Pilot

**Note:** The following indicators are considered essential for evaluating soil disturbance on all harvested areas in BC. They should be evaluated on all sites, using the methods provided, to ensure that information from the entire 2004 pilot is complete and represents a range of areas that can then be compared. It is possible that for various reasons, or and in special situations, there may be a need to evaluate additional indicators during the field survey. Efforts to collect additional information can be included as part of field surveys, and appropriate methods developed and provided to field crews in those areas. However, please ensure that the methods shown here are followed and this core data is complete.

Following is a list of the indicators and the key questions that will be evaluated in the 2004 pilot (the actual methods and data collection start in Table 1).

##### 1. Unrehabilitated access structures:

**Objective:** Permanent access minimized based on-site conditions

**Effectiveness questions:** Does unrehabilitated access cover the least reasonable area of productive soils?

**Indicator:** Percent of the cutblock area occupied by unproductive soil as a result of access construction

**Value:** Percent

**Method:** Table 1. Estimating lost soil productivity due to access construction.

##### 2. Erosion and landslides in-block

**Objectives:** To minimize landslides and erosion to reduce the effects of these events on soil productivity

**Effectiveness questions:**

- Have slope failures or the risk of slope failures been increased?
- Has erosion or the risk of erosion been increased?

**Indicators:**

- Areas with reduced productivity due to slope failure
- Areas outside of the road prism with increased risk of slope failure
- Rills or gullies initiated from structures

**Value:** Area Affected (m<sup>2</sup>)

**Method:** Table 2. Estimating in-block area affected or potentially affected by landslides, drainage diversion or significant erosion from roads, landings or trails.

##### 3. Natural Drainage Patterns

**Objectives:** Protection of natural surface drainage patterns

**Effectiveness questions:** Have forestry operations in the NAR been accomplished with minimum disturbance to surface drainage?

**Indicator:** Percent of the cutblock area that suffers, or is at risk of suffering, reduced productivity or disrupted ecosystem function as a result of disrupted natural drainage in the NAR

**Values:** area affected

**Method:** Table 3. Estimating percent of the NAR area affected by disturbance to natural drainage patterns as a result of forestry operations.

#### 4. Soil Disturbance in the NAR

**Objective:** Limiting cumulative effects of soil disturbance in the net area to be reforested (NAR)

**Effectiveness question:** Does detrimental soil disturbance cover the least reasonable area of productive soils in the NAR?

**Indicators:**

- Proportion of the NAR affected by concentrated and dispersed soil disturbance in the NAR
- Amount of machine traffic on sensitive soils

**Value:** Percent of each standards unit

**Methods:**

Table 4. Description of the soil disturbance hazards\*, and the areas affected by dispersed soil disturbance, potentially inordinate disturbance, and roadside work areas in the NAR.

- .
- Table 4a. Office Summary of dispersed disturbance categories in the NAR.

#### 5. Soil Biology

**Objectives:** Maintain elements of mature forest soil biological properties

**Effectiveness questions:**

- Have refugia for mature forest soil organisms and processes are retained?
- Has habitat been retained and recruited for dead wood- occupying soil organisms?
- Has forest floor been retained?

**Indicators:**

- Availability of inoculum for soil roganisms
- Extent to which mature green trees have been retained
- The amount and diversity of woody debris
- The extent to which forest floor is retained

**Value**

- Distance to nearest mature forest
- Number and Characteristics of green trees retained
- Characteristics of woody debris
- Forest floor displacement

**Methods:**

- Table 5a. **Describing green tree retention for estimating refugia for mature forest soil organisms**
- Table 5b. **Describing wood debris for estimating amount and diversity of habitat for dead wood-occupying soil biota**

**Appendix 5: Table 4a, Office Summary of Dispersed Disturbance Categories in NAR**  
**(includes the soil disturbance codes to use in 2004 pilot)**

Using soil disturbance field cards, carry out a soil disturbance transect (100 points) across representative areas of each standards unit and roadside work area. Do not double count areas of inordinate disturbance recorded in line 4.1 of Table 4. Summarize the percentage of each category below.

| <b>Disturbance type</b><br>Record the percentage of dispersed disturbance over the entire standards unit. Description and hierarchy for assignment of the disturbance type classes are provided in the soil conservation guidebook. | <b>SU</b><br>— | <b>SU</b><br>— | <b>SU</b><br>— | <b>RWA</b><br>— | <b>Inord</b><br>— |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|-----------------|-------------------|
| <b>Ts - Wheel or track ruts 5-15cm deep</b>                                                                                                                                                                                         |                |                |                |                 |                   |
| <b>Td - Wheel or track ruts &gt; 15 cm deep</b>                                                                                                                                                                                     |                |                |                |                 |                   |
| <b>E – Repeated Machine Traffic</b>                                                                                                                                                                                                 |                |                |                |                 |                   |
| <b>G - Deep gouges</b>                                                                                                                                                                                                              |                |                |                |                 |                   |
| <b>L - Long gouges</b>                                                                                                                                                                                                              |                |                |                |                 |                   |
| <b>W - Wide gouges</b>                                                                                                                                                                                                              |                |                |                |                 |                   |
| <b>V – Very Wide scalps</b>                                                                                                                                                                                                         |                |                |                |                 |                   |
| <b>S - Wide scalps</b>                                                                                                                                                                                                              |                |                |                |                 |                   |
| <b>R – Unrehabilitated excavated and bladed trail</b>                                                                                                                                                                               |                |                |                |                 |                   |
| <b>Y – Unrehabilitated corduroy trail</b>                                                                                                                                                                                           |                |                |                |                 |                   |
| <b>A - Unrehabilitated compacted area</b>                                                                                                                                                                                           |                |                |                |                 |                   |
| <b>4a.1 Total “counted” disturbance in the NAR / RWA</b><br>Sum of areas of all disturbances above.                                                                                                                                 |                |                |                |                 |                   |
|                                                                                                                                                                                                                                     |                |                |                |                 |                   |
| <b>O - Other scalps and gouges not meeting above types</b>                                                                                                                                                                          |                |                |                |                 |                   |
| <b>r - Rehabilitated TAS and compacted areas</b>                                                                                                                                                                                    |                |                |                |                 |                   |
| <b>M – other machine traffic not meeting above types</b>                                                                                                                                                                            |                |                |                |                 |                   |