ROADSIDE RESIDUAL HANDLING GUIDELINE VERSION 3.0

Prepared by FPInnovations and Forest Tenures Branch

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Document Change Control

Guideline Version	Date of Issue	Brief Description of Change
1.1	June 6, 2016	New guideline prepared by FPInnovations with input from Forestry & Fibre Working Group. Complementary product is the Machine Operator Card.
2.0	July 18, 2016	Minor edits and revisons by Forest Tenures Branch to language for final posting to website
3.0	May 9, 2018	Updated to reflect a comprehensive integrated biomass handling guideline developed by FPInnovations titled "Best Management Practices for Integrated Harvest Operations in British Columbia"

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1. INTRODUCTION

The definition of forest biomass includes logs, branches, bark, needles and cones. Primary harvesters have traditionally harvested logs and not used the biomass if it could not be used to make lumber or chips for pulpmills. The biomass that is not used is commonly referred to as residual fibre. Often this fibre has been left on-site or burned in order to mitigate a fire hazard.

New industries (wood pellets; bioenergy) have emerged that can use residual fibre as a source for their plants. Over the past few years, significant efforts have been made to promote the utilization of residual fibre. The objective has been to ensure a sustainable supply of fibre to these emerging industries. Using the fibre in this manner will also reduce the carbon footprint and emission of carbon dioxide and methane gases associated with the burning to reduce the fire hazard.

Purpose of these Guidelines

The purpose of these operational guidelines are to provide advice on how to handle forestry biomass in the most efficient and cost-effect manner where economics and sufficient demand for secondary fibre allows that some or all of the biomass will be harvested.

This guidebook contains an overview of a new publication completed by FPInnovations titled "Best Management Practices for Integrated Harvest Operations in British Columbia" which describes the most popular and widely used methods for integrated biomass extraction in B.C. and deals largely with providing proper techniques that increase efficiency and save costs for both primary and secondary harvesters.

2. RESIDUE MANAGEMENT AT ROADSIDE

2.1 Planning

Planning is a critical phase in all stages of residue management in order to maximize logistical efficiency and minimize costs and begins prior to layout for initial harvest. Early planning is essential in determining where and how much residue is available, how it will be utilized, and how and where it will be transported.

It is crucial that there is communication between primary harvesters and secondary users to ensure maximum efficiency for both operations. Significant costs can be added to secondary users' operations if residue is piled for burning, or if roads are deactivated before residual extraction can take place. Integrating and stream-lining operations as much as possible should be the goal. If both users can reduce material handling, both will save costs.

2.2 Pile components

The composition of logging residue is highly variable from region to region and even from site to site. Residue composition, quantity, and location on the cutblock depend on stand characteristics, the harvesting prescription, merchantability specifications and the individual machine operators' work habits.

Logging residue can usually be found in one of the following forms:

- Delimbing residues : tops, branches with or without needles, and leaves
- Processing residues: same as delimbing residues, plus long butts and poor quality stems
- Whole trees: non merchantable tree species or sizes; snags; windthrow-, insect-, disease- or fire-killed trees
- In-woods chipping residue (DDC[1]): bark, branches, fines, and pin chips

The greatest proportion by weight of softwood roadside residue is typically from tops, followed by long butts, followed by brush (needles and branches) as a minor component (see Figure 2). In mountain pine beetle killed areas, needles and branches usually fall off during primary logging and very little arrives at roadside. Hardwood residues typically have less tops and more branches than softwood residue.

Figure 2. Typical coniferous residue (unpiled) from a coastal British Columbia skidder operation (tops, long butts, and brush)

[1] Delimber-debarker-chipper

Tops and long butts can generally be used for most secondary uses including hog fuel, chips, pellet stock, and firewood. Branches and needles can usually only be utilized in hog fuel, if at all.

2.3 Current practice

Traditionally, logging residues have been piled into conical piles to facilitate burning (see Figure 3). This piling method slows down recovery operations as the tangled 'beaver dam' piles have to be torn apart in order to comminute or load them. Moreover, conical piling of residues with a bulldozer incorporates more inorganics into the piles, reducing the quality of available residuals.

Figure 3. Logging residuals piled for burning near Campbell River, BC.

2.4 Pile management for residual extraction - parameters

It is very important that processor operators handle residues in a way that will be most accessible for residual harvesting. The easiest and most cost effective way is to simply 'tidy up' tops and long butts as they are created by the processor. Tops should be left perpendicular to road, with enough room for a grinder to operate between the piles and the road (usually a full log length or two to three short log lengths, already created by decking). Residue should not be piled for burning, since this can significantly decrease grinding productivity as time is wasted tearing apart tangled piles. Primary harvesters should also make every effort to avoid driving machines over residue as this makes recovery more difficult and can also lead to increased contamination levels as residues are pushed into the soil.

2.4.1 Gentle terrain

Processor operators are to place tops parallel to each other and perpendicular to the road, similar to decked logs (see Figure 4). Tops decks need only be loosely piled. Trying to pile tops too neatly is expensive for the primary user and is not necessary for secondary users. If the secondary user will be using the residue for chips or pellets, long butts and brush should be placed in separate piles beside decks of tops to avoid incorporating brushy material into the feedstock (see Figures 5, 6 and 7). If the secondary user will be grinding the residue to hog fuel, long butts and brush piles may be mixed but

tops decks should be kept separate to facilitate grinding efficiency. If it is not possible for the processor to neatly pile residues, an excavator or log loader equipped with a power grapple can be used to neatly align residues after logs are loaded out.

Figure 4. Residual tops piled loosely but neatly for secondary harvest.

Figure 5. Residual long butts piled for secondary harvest

Figure 6. Residual brush piled for secondary collection or burning.

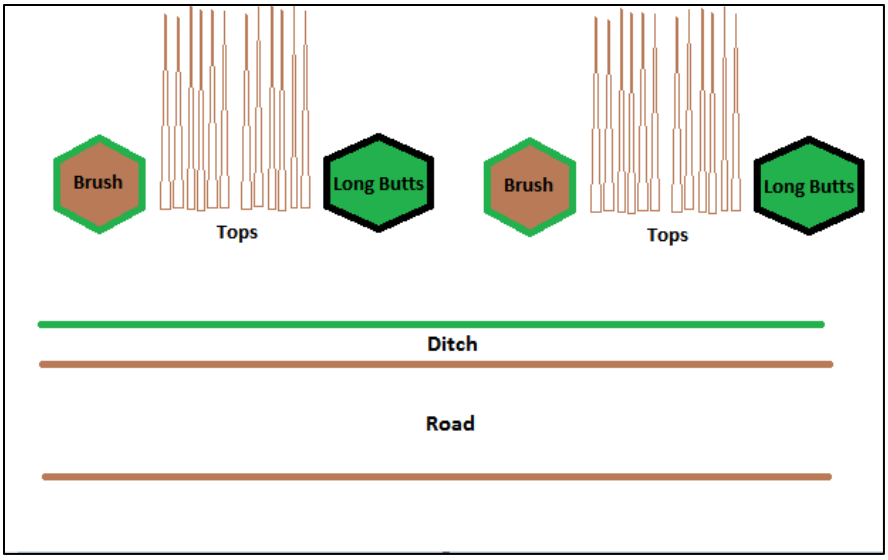

Figure 7. Diagram of ideal separation of residue components for secondary extraction.

It should be noted that if residues are very difficult to access (steep side slopes or road grades, end of spurs), it may be more cost effective to burn the pile, rather than recover it, but this depends on the practices of the secondary user. Again, communication is paramount to optimize use of the resource.

2.4.2 Steep terrain

Grapple yarding and helicopter logging can create unique challenges for handling logging residue. There may be insufficient roadside space to access or handle residue and residues may be in an alignment not easily accessed by secondary harvesting equipment.

Large road cut and fill slopes make field comminution very difficult since equipment may not be able to work safely because of grade, reach distance, or slope stability. Therefore it is at the discretion of the secondary user to decide whether to harvest residue in areas of large cuts and fills. Secondary users gathering residues for off-site processing (pulp mill, pellet plant, etc) generally do not need to situate a machine on top of the road cut to facilitate loading into the side of a truck, and therefore generally have a higher tolerance for road cuts and steep slopes.

Table 1. Summary of residual collection guidance for secondary users based on road cut and fill slope heights.

	Residue collection guideance for secondary user	
Vertical height difference between road and pile base	**Field comminution**	**Unprocessed collection**
< 3m	Yes	Yes
3m to 5m	No	Yes
>5m	No	No

As shown in Table 1, field comminution operators should only harvest residues where the vertical height difference between the road and the pile base is less than three meters (example, Figure 8).

They may harvest residues on slopes higher than three meters but it is not recommended. Secondary operators doing off-site processing can collect residues from areas with fill slopes less than five meters. No operator should harvest residues from areas with cut and fill slopes higher than five meters (see Figure 9), so primary harvesters may pile for burning unless otherwise requested by the secondary user.

Figure 8. Residue located in gentle terrain (< 3 metre height difference between the road and the pile base)

Figure 9. Residue located in difficult terrain (> 5 metre height difference between the road and the pile base).

Road grades can also limit areas accessible to the secondary user. As shown in Table 2, secondary users should only collect residues from roads with road grades of less than 10%. Secondary users may use their discretion on whether to harvest residue on roads with grades between 10% and 15%. Secondary users should not harvest residues from access roads with grades more than 15% (see Figure 10).

Table 2. Summary of residual collection requirements based on road grades.

Road Grade	Collection required for secondary user
<10%	Yes
10-15%	secondary user discretion
>15%	No

In situations where the secondary user wishes to harvest residues outside of the situations outlined in Tables 1 and 2, it is necessary for the secondary user to inform the primary user that they wish to do so before the primary harvest begins. If the secondary user has not contacted the primary user about collecting residues outside of these situations, the primary user may assume the residue is not desirable and pile it for burning.

Figure 10. Steep road grade near Nanaimo, BC.

2.4.3 In-woods chipping at roadside (Full tree harvesting/chipping)

In-woods chipping operations usually chip full trees that have been brought to roadside. Residues from these operations are usually composed of branches, bark, small chips and discarded stems (see Figure

11). Contamination levels (inorganics) are usually high in delimber-debarker residue as it is usually scraped away by a skidder or bulldozer to clear space beside the chipper. As there is little use for these delimber-debarker residues aside from hog fuel, conical piles are usually adequate for the secondary user, since the material is already partially comminuted. If possible, place residues beside the road to allow for easy loading into trucks or grinders.

Figure 11. Delimber-debarker chipper residue.

2.4.4 Winter pile management

If the residues are to be harvested in the winter and the area is known for heavy snow, the primary harvester should attempt to pile the residue higher to provide visibility of the piles in deep snow. Failure to do this can result in the piles being missed during a winter biomass harvest. In the case of long butt piles, this may not be possible if there are not many long butts. Tops can usually be piled higher by decreasing the width of the decks.

Figure 12. Residue piles drifted in by snow.

2.5 Contaminants

Contaminants are easily introduced into residues in the pile preparation and secondary harvesting phases, although with proper care these contaminants can be reduced or avoided.

2.5.1 Inorganics

Inorganics are usually the most common contaminant in logging residues. These include clay, silt, sand, pebbles, cobbles and metal. Large rocks and pieces of metal can cause damage to comminution machinery, including grinders, chippers and stationary hoggers at mills. At processing facilities, excessive soil, sand, and gravel accelerate wear and can damage the conveying equipment, cause lagging and fouling in the boiler, or wear pellet dies too quickly, resulting in expensive maintenance and repair costs (see Figure 13).

Figure 13. Pile contaminated with sand.

Care should be taken in both the primary and secondary phase of residue extraction to minimize the incorporation of inorganics to the residues. Stumps, dirt clods and old cables should be moved away from residue piles (see Figure 14). Old cables or other large pieces of metal should be flagged with ribbon or paint if possible. Primary harvesters should take care not to include plastics into residues destined for secondary collection as they may cause problems in chip pulping. Even if residues are destined for hogging, plastics can blow from hog piles into chip piles at mill sites.

Figure 14. Cables mixed into residue pile.

2.5.2 Moisture

The inclusion of snow can decrease the volume of residual material transported in each load and can lead to the truck reaching its weight threshold before it reaches its volume threshold (see Figure 15). Moisture from snow creates a problem for the user of residual material in that energy is spent driving the moisture from the feedstock. In the case of pellet manufacture, the feedstock must be dried to approximately 10% before it can be utilized. In co-generation, less net energy is gained from wet hog fuels and if the hog is wet enough, there is even a chance of extinguishing the boiler. Primary harvesters should attempt to minimize the incorporation of snow into residue piles at the time of harvest.

Figure 15 . Snow mixed with hog fuel

3. ADDITIONAL REFERENCES

- **Forest Tenures Branch website.** Information on programs and initiatives that can improve the use of waste timber (residual fibre) from primary harvesting left on road sides and landings within cut blocks which would otherwise be burned.

- **Fibre Recovery Process**. The Fibre Recovery Process focuses on encouraging business-to-business relationships to improve the use of lower-quality timber in areas of the province where there is a demand for the residual fibre from secondary users (pulp mills, pellet plants, bioenergy facilities, and other users of low quality logs). Where business to business cannot be established, there are additional legislative tools available for the District Manager (secondary recovery tenures, do not destroy orders, etc.).