



File: 195-30/RWMM
Cliff: 265221

June 17, 2021

BY EMAIL

To: Regional Executive Directors

From: Allan Bennett, Director, Timber Pricing Branch

Re: Amendment No. 4 to the *Provincial Logging Residue and Waste Measurement Procedures Manual – Interior Version*

I hereby approve Amendment No. 4 to the *Provincial Logging Residue and Waste Measurement Procedures Manual – Interior Version*.

The manual can be found here:

[Provincial Logging Residue and Waste Measurement Procedures Manual – Interior Version](#)

The purpose of this amendment is to update the *Provincial Logging and Waste Measurement Procedures Manual – Interior Version* in order to:

- Allow large population sample plans;
- Update the large population sampling design options;
- Clarify the applicability of a post harvest appraisal certification document, and
- Provide clarity throughout.

Amendment No. 4 comes into effect on June 17, 2021.

Allan W. Bennett, RPF
Director
Timber Pricing Branch

Attachment: Highlights for Amendment 4

pc: Jim Schafthuizen, Executive Director, Timber Operations and First Nations Division
Patrick Asante, Manager, Timber Pricing
Carissa Logue, Provincial Waste Specialist
Mary Mitchell, Residue and Log Salvage Policy Forester

Amendment No. 4 – Provincial Logging Residue and Waste Procedures Manual – Interior Version Highlights

Section, Table or Appendix Number	Description
Throughout	Updated the large population sampling design options
4.3	Updated the requirements for submitting a post harvest certification document
5.4.2	Clarified that prediction plots must be completed in the field
5.5	Minor wording changes
6.2.2	Removed the ability to include additional cutblocks less than 2.0 ha into an aggregate sample plan
6.3.3	Clarified the applicability of the example
6.5	Updated table 6-1
6.6	Clarified requirements to submit a rationale
6.7.3	Removed the restriction on large population sampling designs in sample plans
6.7.3.1	Updated the batch selection principles
6.7.3.2	Updated the requirements for the number of blocks in a population
7.1	Linked the areas for the waste survey to the post harvest certification document where applicable
8.4.2 (7)	Minor wording update
9.5.2	Updated wording around reporting trees
Appendix 3	Updated the flowchart

4.2.1.2 Submission Requirements for Waste Assessment Areas Not Requiring Site Treatments or Hazard Abatement

Except as specified in section 4.2.1.1, waste assessment areas must be surveyed and submitted as outlined below.

Single Waste Assessment Area or Small Populations (Aggregate)

Where a waste assessment area within the population has a ready for survey date between:

1. January 1st and July 31st, the waste assessment must be submitted no later than September 15th of the same year, or
2. August 1st and December 31st, the waste assessment must be submitted no later than June 30th of the year following the ready for survey date.

In a small population (aggregate), the waste assessment area with the earliest ready for survey date is used to determine the submission timeframe as stated above.

Large Populations

Large populations must be submitted no later than one year, plus 30 days from the earliest ready for survey date in the population.

4.2.2 Submission of Waste Assessments Not Requiring a Field Survey

Waste assessment areas that will have the waste assessment volumes determined through alternate methods (i.e. cutblocks <2.0 ha in a large population) must be submitted no later than thirty (30) days after:

1. The ready for survey date when District Average rates are used, or
2. The data required for completion and compilation of the sample population to be used to generate the required information is available (i.e. compilation of the sample waste assessment area or population).

4.2.3 Overdue Waste Assessments and Reports

Where the holder of an agreement, other than an agreement entered into with the timber sales manager, does not complete the waste assessment and submit it to the District Manager as required under section 4.2, the District Manager may, in a notice given to the licensees, take actions to complete and submit a waste assessment for a block or blocks. The District Manager may require the holder to pay the costs incurred in carrying out the assessment.

Where the holder of an agreement entered into with the Timber Sales Manager that is required by that agreement to conduct a waste assessment, fails to conduct that waste assessment, the Timber Sales Manager may carry out the assessment, and in a notice given to the holder, may require the holder to pay the costs incurred by the Timber Sales Manager in carrying out the assessment.

4.3 Reporting Requirements

Waste assessments must be surveyed and submitted to the Waste System and include the items outlined below:

1. Licensees must enter and submit the data into the Waste System for a waste assessment area as required in section 4.2.
2. A final survey map for each waste assessment area as required in Table 6-3 and area calculations must be included in the submission.
3. A document describing the post harvest condition of the waste assessment area (where applicable). This document will certify:
 - a. If the post harvest condition of the waste assessment area aligns with the initial appraisal submission, or
 - b. If the post harvest condition of the waste assessment area does not align with the initial appraisal submission, and
 - i. If a changed circumstance reappraisal has, or will be submitted, as per the *Interior Appraisal Manual*, and
 - ii. How leave trees, harvest areas, and reserve areas will be assessed in the waste survey.
4. If used, the following files must be uploaded into the Waste System:
 - a. The final version of the sample plan,
 - b. The Aggregate Sample Plan,
 - c. The EFW file (for aggregate populations only), and
 - d. The HRC file used for compilation.

Any files emailed to the District may be accepted at the District's discretion.

5. If the person submitting the survey information into the Waste System is not a Registered Forest Professional, an endorsed cover letter from a Registered Forest Professional accepting responsibility for the submission information must be submitted. This letter must include the Registered Forest Professional's designation and registration number.
6. The agreement between parties when a population contains waste assessment areas from different client codes.

HRC, EFW files, GPS shapefiles, PRP tables, traverse notes, and plot cards will be stored by the Licensee and made available to the Ministry upon request.

5.2 Sample Populations

The sample population is the total net area of all waste assessment areas where estimates of waste and residue volumes are required.

The population is determined by the number of waste assessment areas in the population.

The sample populations are:

1. Single Waste Assessment Area
 - a. The sample population is one waste assessment area.
 - b. In this population, a single waste assessment area is sampled to obtain the waste and residue estimate.
2. Small Population (Aggregate):
 - a. The sample population contains 2 to 19 waste assessment areas.
 - b. Waste assessment areas in a small population are aggregated into one population for sampling and reporting.
 - c. In an aggregate, the results for the population are applied to each waste assessment area within the population, with each waste assessment area receiving the same estimate of volume per hectare by species and grade, except for estimated or 100% measure strata which are reported in the individual waste assessment area(s) they are sampled in.
3. Large Population
 - a. The sample population is 20 or more waste assessment areas.
 - b. In a large population, not all waste assessment areas require sampling. A sample of the waste assessment areas in the population are measured in the field and are used to determine the waste volumes for the waste assessment areas that are not sampled.

5.3 Sampling Designs

The sampling principles used to collect and compile waste information are simple random sampling (SRS) and ratio adjustment (Ratio) sampling. The sampling design names specify which principle is used.

5.3.1 Single Waste Assessment Area or Small Population Sampling Designs

The following designs are used on single waste assessment areas or small populations and employ a single sampling principle to develop the result:

- SRS, or
- Ratio.

5.3.2 Large Population Sampling Designs

In a large population, the sampling design employs two sampling principles to develop the result. The first term defines how the volume is estimated within the plots in sampled waste assessment areas, and the second term defines how the volume is estimated among the waste assessment areas in the population.

This design is referred to as Ratio/Ratio.

5.4 Sampling Designs Within Single Waste Assessment Area and Small Populations

5.4.1 Simple Random Sampling

Simple random sampling uses only measure plots. Within the waste assessment area, a predetermined number of sample plots are established, measured, and averaged to determine an estimate of volume for the population.

5.4.2 Ratio Adjustment Sampling

In ratio adjustment sampling, a predetermined number of prediction plots are established, and a random selection of these plots are measured.

In a prediction plot, the surveyor **must** predict (estimate) the total volume (m³) of merchantable timber within all dispersed or accumulation strata plots **in the field at the plot location**.

In this method:

1. Ratio adjustment sampling is implemented at the plot level,
2. A ratio between the measured plot volumes and predicted plot volumes is developed. This ratio adjustment is applied to the average volume per hectare from all prediction plots in the stratum, and
3. The ratio adjusted volumes per hectare are used to determine an estimated volume for the population, and
4. Other strata volumes are added to derive the total waste assessment area volume.

5.5 Sampling Designs Within Large Populations

Ratio adjustment sampling **is** used at the plot level **and** waste assessment area level. At the plot level, ratio sampling principles are applied the same as in a single waste assessment area or small population.

5.5.1 Ratio Adjustment Sampling

Using ratio adjustment sampling at the waste assessment area level involves:

1. Predicting the total estimated waste volume (m^3/ha of grades 1, 2, and 4) for each waste assessment area in the sample plan prior to sampling,
2. HRC randomly selecting waste assessment areas from the population for sampling,
3. Measuring the selected waste assessment areas using ratio adjustment sampling at the plot level,
4. Developing a ratio between the measured waste assessment areas and the predicted waste assessment area volumes,
5. Applying the ratio to adjust the predicted volume on the non-sample waste assessment areas,
6. The sampled waste assessment areas receiving their specific estimates from the survey, and
7. The non-sampled waste assessment areas receiving unique estimates.

5.5.2 Sampling Design Options

5.5.2.1 Ratio / Ratio

Ratio/Ratio sampling uses:

1. A combination of measured and predicted plots, and
2. A prediction of plot volumes and a prediction of waste assessment area volumes for the population to develop two ratio adjustments.

4. One or more cutblock(s), or partial cutblock(s) held by one or more licensees that are all within the same Timber Supply Area where the population does not contain any cutblocks from a Timber Sale Licence, and:
 - a. All licences within the population are held by the same company (client code), or
 - b. A population is comprised of two or more licensees (client codes) and an agreement has been made between the licensees accepting the waste sampling results within the population for each licence. This agreement must be included as an attachment in each waste submission entry in the Waste System. Each licensee will need a separate RU for reporting purposes in the Waste System.
 - c. Examples of populations:
 - i. One or more Forest Licences held by the same licensee containing more than one waste assessment area in the same TSA.
 - ii. One or more Forest Licences held by multiple licensees containing more than one waste assessment area in the same TSA (agreement required).

6.4 Stratification

Stratification can increase the precision of population volume estimates and reduce the amount of sampling required to achieve a desired level of precision. Therefore, it is useful to stratify subpopulations where possible and practical.

In waste assessments, stratification should be limited to significant differences in the relative quantity of waste. Unique strata must be easily and consistently identifiable and must be estimated in the same manner throughout the population. All stratification decisions must occur prior to field sampling and be identified on the waste assessment area survey map.

All strata within a waste assessment area must be reported in the survey submission. The correct and consistent coding of these strata is a key driver in the compilation of the survey information.

Each stratum must be assigned one of the three subpopulation types listed below and requires the minimum number of samples required for that strata type. Each subpopulation must be sampled independently of other subpopulation areas.

Any stratification of waste types must be supported with field notes and a map and must be consistently applied within each waste assessment area of the population.

6.4.1 Subpopulations

Three subpopulations exist: accumulated, dispersed, and standing trees. Each subpopulation may be subdivided into one or more strata.

Subpopulations and strata are and are always sampled independently of each other.

6.4.1.1 Dispersed

Dispersed waste occurs on the areas from which trees or logs have been cut or removed and is scattered throughout the waste assessment area. The majority of area in a waste survey will be in this stratum.

6.4.1.2 Accumulations

Accumulated waste occurs at landings, along roadsides, and at other areas in a waste assessment area where waste material has been piled (accumulated) by a machine. Accumulated strata can include spot accumulations, roadside accumulations from yarding, windrows, and cold decks.

The key identifying feature of accumulated strata is the waste material is gathered onto a small area creating a condensed pile of waste material.

Accumulation strata must not be confused with areas of high waste volume in the dispersed stratum.

6.4.1.3 Standing Trees

Standing trees are trees authorized for harvest under the cutting authority (excepting reserved trees) but at the discretion of the licence holder, are not cut and removed.

Individual standing trees that are found at different locations of the waste assessment area must be stratified, measured, and scaled individually. Standing tree patches must be delineated separately from the dispersed to form their own subpopulation and the volumes determined with methods outlined under section 9.5.2.

6.5 Sample Size and Number of Plots

The sample size (number of sample waste assessment areas or sample plots within a waste assessment area) is based on the sampling system to be used for the population or size of the sample waste assessment area.

The number of sample plots required within each waste assessment area is dependent on the sampling design (single waste assessment area, aggregate or large population plans).

To determine the number of plots within a sample plan:

1. For small population sampling plans, either:
 - a. For single waste assessment area populations, use Appendix 4, or
 - b. For aggregate populations, use the Aggregate Sample Plan to calculate the required number of dispersed, roadside, or spot accumulation plots for the sample population.
 - i. The Aggregate Sample Plan is available through Timber Pricing Branch.
2. For large population sampling plans:
 - a. Use Table 6-1 and Table 6-2 to determine the required number of waste assessment areas to be sampled and the number of plots for all strata.

Table 6-1 Minimum Sampling Requirements for Large Populations

Sampling Design	Minimum Waste Assessment Areas to be Sampled	Minimum Number of Plots per Waste Assessment Area					
		Dispersed		Spot Accumulation		Other Accumulation Strata	
		Predict	Measure	Predict	Measure	Predict	Measure
Ratio/Ratio	20, 25, 30*	18	6	12	4	12	4

* The minimum number of samples are determined using Table 6-2.

Table 6-2 Minimum Sample Waste Assessment Area Requirements for Large Populations

Population Size (Waste Assessment Areas)	Minimum Number of Waste Assessment Areas to be Sampled
20 - 100	20
101 - 150	25
151 +	30

6.6 Amendments

The objective of a sample design is to identify a population to be sampled. Changes to a plan can significantly impact the sample size and the number of plots required. Changes to a small population sample plan or to the waste assessment areas selected to be sampled in a large population sample plan should only be undertaken to affect unforeseen issues that affect good forest management or other operational issues (i.e. a wildfire burns a cutblock).

The submitting forest professional recognizes that changes to a plan, such as the addition or removal of a waste assessment area or a significant change in area will significantly alter the sample plan requirements. The forest professional will assess the impact of the changes against the principles of sampling identified in these standards.

The submitting forest professional will submit a rationale for any changes to a sample plan. This model is consistent with the direction of professional reliance.

For guidance on how to prepare a professional rationale, please refer to the document *Guidance for Professional Quality Rationales and Commitments* published by and available on the Association of BC Forest Professionals website.

The District Manager will make a determination on each change on a case by case basis and decide if the change meets the intent of the sampling principles within this manual.

6.7 Implementation

6.7.1 Single Waste Assessment Area Sample Plans

1. Identify the sample population,
2. Select a sampling design,
3. Determine the sample size, including:
 - a. The number of plots in dispersed strata
 - b. The number of accumulation samples,
4. Prepare the waste assessment area survey map,
5. The waste assessment area survey map is signed by a Forest Professional, and
6. Submit the waste assessment area survey map.

6.7.2 Aggregate Sample Plans

1. Identify the sample population,
2. Select a sampling design,
3. Using the Aggregate Sample Plan, determine the sample size:
 - a. Number of plots in dispersed strata
 - b. Number of other samples as required
 - c. The plots are located within the waste assessment areas proportional to their weighted size within the population and are allocated using a random starting point
 - d. The assigned plot numbers on the Aggregate Sample Plan in each waste assessment area must be used to label the plots on the survey map and to record the plots in EForwasteBC exactly,
4. The sample plan is signed by a Forest Professional,
5. Prepare waste assessment area survey maps,
6. Submit the sample plan and waste assessment area survey maps, and
7. Once the Aggregate Sample Plan is submitted, no variation is allowed.

6.7.3 Large Population Sample Plans

Sample plans for large populations must be developed using the HRC system.

To create a large population sample plan:

1. Identify the population to be sampled. The population is comprised of waste assessment areas that are expected to be harvested and sampled within the applicable sampling year (as per section 6.3.2).
 - a. The sample plan can contain waste assessment areas where the harvest status is:
 - i. **Complete:** primary harvesting operations are completed and ready for survey status has been achieved,
 - ii. **Active:** harvesting operations have commenced, and the waste assessment area has not achieved ready for survey status, or
 - iii. **Not started:** cutblocks that are planned for harvest completion within the sampling year; however, harvesting operations have not started.
2. In HRC, create a sample plan and enter the sample population attributes.
3. Update the sample plan as per section 6.7.3.2.
4. Use HRC to determine the sample waste assessment areas from the population by creating a batch.
5. Confirm or update the sample size (the number of waste assessment areas in the population to be sampled). HRC will default to the minimum sample size. Users can increase it if desired.
6. The sample plan is signed by a Forest Professional in HRC.
7. Users can view the sample plan or create the sample plan report. On the sample plan report, adjust the number of plots in the strata if required.
8. Update the sample plan as needed.
9. Create subsequent batches until all waste assessment areas within the sample plan have been included in a batch.

6.7.3.1 Batch Selection Principles

A sample of waste assessment areas are selected from the population for measurement when a batch is created.

Sample batches are created from the waste assessment areas where harvesting is complete and ready for survey status has been reached. A sample batch can be created when there are enough waste assessment areas to result in a minimum sample size of five.

The remaining (active or not complete) waste assessment areas are retained in the system for subsequent batches.

The sample plan contains set fields that are used for sorting. Specific (user selected) criteria that directly correlate to the levels of waste within the waste assessment areas in the population must be added. Sorting the waste assessment areas in the population by common criteria prior to selecting samples helps to ensure that the sample represents the population.

Within each batch, a random start point is used to determine the waste assessment areas to be sampled. This may lead to an additional waste assessment area being selected to be sampled within each batch. Creating large batches reduces the likelihood of additional waste assessment areas being selected to be sampled and improves the distribution of samples throughout the population.

Once the first batch has been created, HRC will display the minimum batch size required for subsequent batches to result in a sample size of five. If the minimum sample size is not achieved, and there are enough waste assessment areas in the population to meet the minimum batch size requirement, a batch will not be created until there are enough waste assessment areas in completed status.

Once the number of completed waste assessment areas in a batch cannot meet the minimum batch size requirement, HRC will randomly select waste assessment areas using the Bernoulli selection process.

Example:

A sample plan contains 204 waste assessment areas and a minimum of 30 will be sampled.

The sampling frequency is calculated by dividing the total number of waste assessment areas in the population by the minimum number of samples.

$$\text{Sampling frequency} = 204 / 30 = 6.8$$

The minimum batch size required to result in 5 waste assessment areas to sample in subsequent batches is calculated using the sampling frequency (6.8) * minimum sample size (5) = 34

Therefore, a batch cannot be created until a minimum of 34 waste assessment areas are in a status of complete.

Batch 1 is created with 160 waste assessment areas in completed status.

The minimum number of waste assessment areas to be sampled in batch 1 will equal $160 / 6.8 = 23.5$ (rounds to 24 samples).

Batch 2 is created with 34 waste assessment areas. A minimum of five waste assessment areas are selected to be sampled.

Batch 3 is created with 10 waste assessment areas and uses the Bernoulli selection process to select the sample waste assessment area(s).

6.7.3.2 Sample Plan Updates and Amendments

Throughout the sampling year, cutblock scheduling and harvest completion will change. Sample plans must be updated throughout the sampling year to record changes within the population and enable batch creation.

New waste assessment areas may be added to the sample population by adding them to the sample plan as they become available. The number of blocks added cannot increase or decrease the population so that the required number of waste assessment areas to be sampled cannot be achieved.

Cutblocks that will not be harvested or do not achieve ready for survey status during the current sampling year can be deleted from the sample population at any time; however, the number of waste assessment areas to be sampled must still be achieved.

Deleting waste assessment areas selected for sampling, or the submission and compilation of sample plans that do not meet the minimum sample size requirements may only be done in circumstances beyond the control of the licensee (i.e. wildfire, landslide, etc.). In these cases, a rationale prepared by a forest professional must be submitted to the Natural Resource District as per section 6.6. Approval by the District Manager is required prior to removal of a sample waste assessment area.

6.8 Waste Assessment Area Survey Map

Once an initial sample plan is complete, a waste assessment area survey map must be created.

The initial waste assessment area survey map is not required to be approved by the District Manager.

6.8.1 Waste Assessment Area Survey Map Requirements

The maps used in a waste survey must accurately reflect the post-harvest condition of a cutblock including the location and shape of areas of unharvested standing timber, and reserved timber, whether grouped or dispersed.

A waste assessment area survey plan map must show the cutblock boundaries, roads, the point of commencement, strip and plot locations, stratum types and locations, and any other areas that are excluded from waste estimations.

The waste assessment area survey plan map is required as part of a complete waste submission. The cartographic standards used by the Ministry of Forests, Lands and Natural Resource Operations are mandatory. Maps drawn digitally must be produced using geographic information system (GIS) software (i.e. ArcGIS).

The waste assessment area survey plan map must:

1. Be legible and of good quality 1:5,000 scale,
 - a. Note: a 1:10:000 scale map may be accepted at the discretion of the District; however, it will be rejected if the required items cannot be mapped legibly due to the scale,
2. Provide neat and clean lines, lettering and numbers,
3. Reflect the post-harvest conditions of the cutblock, and
4. Include the items indicated in Table 6-3.

Only one waste assessment area survey map may be submitted for each waste assessment area and it must align with the submitted sample plan.

After the field survey is completed, the final waste assessment area survey plan map must be submitted with the waste submission.

Accumulations, standing trees not harvested, and areas subject to 100 percent measurement or estimation must be clearly indicated on the final waste assessment area maps. In situations where there are a significant number of piles and they cannot be mapped neatly, individual pile locations do not need to be shown; however, the pile plot locations must be identified on the final map.

7. Waste Area Determination

7.1 Principles

The determination of the area to be surveyed is an important component in obtaining the correct waste volume per hectare, the waste assessment area volume, and waste billing.

The waste survey planner must develop waste assessment area survey maps and conduct area calculations to determine accurate areas for waste reporting.

A cutblock can contain areas of reserved timber, non-productive areas (roads), merchantable timber areas (standing timber), and areas outside of the appraised cutblock boundaries (i.e. external landings) that contain waste from the waste assessment area to be sampled.

The area used to calculate waste volumes is the total area of a waste assessment area that was authorized to remove timber and/or will contain waste material from the waste assessment area.

When any changes to harvest or reserve areas have occurred:

1. The correct areas must be used in the sample plan. **These areas must align with the areas stated in the post harvest certification document where applicable,**
2. Prior to completing any field work, updated maps must be given to the waste surveyor, and
3. The correct areas must be documented and uploaded into the Waste System by a forest professional.

7.1.1 Net Waste Area Calculation

1. The net waste area is calculated as follows:
 - a. Determine the gross harvested area
 - b. Subtract any mapped retention from the waste assessment area's gross area
 - c. Add the sum of the area associated with external roads and/or any external landings to the figure determined in step ii
 - d. Subtract the area of all non-productive areas (i.e. built road surface) from the figure determined in step iii.
2. The net waste area reported into the Waste System does not need to and usually will not reconcile with the cutblock net area in other reporting systems i.e. RESULTS, FTA etc.
3. Waste assessment area net areas are increased by adding external areas containing waste volumes attributable to the cutblock (i.e. external landings or road permit areas outside of the cutblock).

8.4 Dispersed Strata Plot Layout

8.4.1 Plot Spacing (Grid Size)

Once the number of plots within each waste assessment area or population (aggregate or large populations) has been determined, the inter-plot spacing (grid spacing) must be determined. The grid spacing is calculated by taking the square root of $(10\,000 * \text{area (ha)} / \# \text{ of plots})$.

The grid spacing calculation will generate a result to within one metre or less. This value should be used if the survey plan is generated using GIS software. If the survey plan will be produced by hand, the calculated grid spacing value must be rounded to the nearest 5 metre value (the smallest measurable measurement at 1: 5,000 scale).

If necessary when drawing the waste survey plan, after the grid spacing value is calculated, the grid spacing can be reduced or increased to generate the required number of plots within the waste assessment area.

Example: 30 plots required in a 122.0 ha waste assessment area will generate a GSD of 201.7m (202m)

- For survey plans drawn using GIS, use a 202m GSD
- For survey plans drawn by hand, use a 200m GSD
 - If the 200m GSD generates less than 29 plots, reduce the GSD to 190m
 - If the 200m GSD generates more than 31 plots, increase the GSD to 210m

Appendix 5 contains an example of a Grid Spacing Worksheet.

8.4.2 Plot Location

The steps required to locate dispersed plots on the waste assessment area survey map are as follows:

1. Compute the grid spacing distance (GSD) using the grid spacing worksheet or the procedure described in section 8.4.1.
2. Establish a local grid on the waste assessment area using the following procedure:
 - a. Project a line due south from the most western point of the net merchantable area, and
 - b. Project a second line due west from the most southern point of the net merchantable area for the cutblock. This line is the baseline.
3. Obtain the Starting Point Interval Factor (SPIF) from the Timber Pricing Branch website for the ready for survey month. The SPIF multiplied by the GSD will determine the horizontal distance from the point of intersection of the local grid to the initial strip (IS) location.

4. Starting at the point of intersection of the local grid, locate the IS at the SPIF distance. The IS must be oriented North/South.
5. Locate all remaining strips at the full GSD along the baseline from the IS and orient them North/South.
6. Number the strips:
 - a. Sequentially from West to East.
 - b. All strips that fall within the harvested area must be numbered.
7. Locating the plots:
 - a. All plot locations that fall within the harvested area must be mapped.
 - b. On odd numbered strips, locate the first two plots at one half the GSD along the strip from the baseline. Locate the remaining plots at full GSD along the strip.
 - c. On even numbered strips, locate one plot at the intersection of the strip and the baseline, and all remaining plots at full GSD along the strip.

Occasionally the number of located plots on the map will not match the intended number of plots. This can be caused by two situations:

- i. The sample grid was not completed correctly (incorrect GSD, missed plot location, etc.), or
 - ii. The configuration of the cutblock results in a reduced or increased number of sample points.
8. Adjust the GSD when:
 - a. In a single waste assessment area or large population sample cutblock, the number of plots is greater than plus or minus 1 plot from the intended number, or
 - b. In aggregate populations, the located number of plots does not match the intended number from the sample plan.

For survey plans drawn by hand, the grid is reduced or increased in 10 metre increments.

For survey plans drawn using GIS, use the first grid spacing that will result in the required number of plots.

9. Number the plots. Each plot in the dispersed stratum must have a unique number identified on the survey plan map.
 - a. Starting from strip 1, number the plots sequentially from north to south along each strip.

The numbering and selection of roadside sample piles utilizes the right-hand rule and must be completed using the one-sided method:

1. Starting at the POC (where the road enters the waste assessment area), number piles sequentially on the right-hand side of all roads.
2. Always stay to the right-hand side of the road in the direction of travel when numbering the piles. When coming to a branch or spur, go up the spur on the right-hand side. At the end of the spur, turn around and come down on the right-hand side.

For piles that are stratified out under section 8.5.2(2) within the dispersed stratum, all piles must be identified and numbered sequentially throughout the waste assessment area.

In aggregate populations:

1. Pile numbering must restart at one (1) in each waste assessment area in the population, and
2. The pile plot numbers assigned must be established within the corresponding cutblocks exactly as they appear on the Aggregate Sample Plan.

8.5.4 Sampling Method and Procedures

For waste assessment areas that use simple random sampling (single waste assessment area SRS, **or** aggregate SRS sampling designs):

1. Count all piles and label them using the procedure outlined above,
2. Determine the number of samples required,
3. Identify the sample piles to be measured, and
4. Measure the required pile attributes for the selected samples.

For waste assessment areas that use ratio adjustment sampling (single waste assessment area ratio, aggregate ratio, **or** Ratio/Ratio sampling designs):

1. Count all piles and label them using the procedure outlined above,
2. Determine the number of prediction and measure samples required,
 - a. Identify the sample piles to be predicted and measured
3. Complete predictions, and
4. Measure the required pile attributes for the randomly selected samples.

In large populations, the procedures listed above only apply to the waste assessment areas that are selected to be sampled.

For aggregate populations, **the number of** piles may be estimated or counted when completing the sample plan for the population. To estimate the number of piles, the Aggregate Sample Plan will multiply the waste assessment area's net area by a factor of 1 pile per 0.9 hectare to obtain the estimate.

8.5.4.1 Sample Selection Process

To select the piles to be sampled:

1. Calculate the sample pile interval. To do this:
 - a. Divide the number of piles by the planned number of samples.
 - b. Round the result to the nearest whole number.

Note: This will occasionally result in more samples than intended.

- i. In a single waste assessment area or large population, establish the extra plot.
 - ii. In an aggregate, only establish the required number of plots as specified on the Aggregate Sample Plan.
2. Use the date of the month when the surveyor first arrives on site to do the survey to select the first pile to be sampled. Where the date is greater than the number of piles, use the last digit of the date. If the last digit of the date is zero, use the first number of the date.

Example 1:

- 36 piles requiring 15 samples, surveyed on the 23rd of the month
- $36 \text{ piles} / 15 \text{ samples} = 2.40$; survey every 2nd pile
- Select the following piles: 23, 25, 27, 29, 31, 33, 35, 1, 3, 5, 7, 9, 11, 13, 15

Example 2:

- 25 piles requiring 13 samples, surveyed on the 30th
- $25 \text{ piles} / 13 \text{ samples} = 1.92$; survey every 2nd pile
- Select the following piles: 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 2

8.5.4.2 Plot Location Procedure

In spot accumulation strata, the plot is placed on the front for even numbered piles, and on the back for odd. If it is not safe to work around the correct plot location, establish the plot on the side of the pile closest to the POC for odd numbered plots and farthest away from the POC for even numbered plots.

The plot size and shape to be used for pile plots is 50 m². When a rectangular (or other shape as necessitated by the shape of the pile) is used, the plot edges must be painted and clearly marked in the field using stakes or ribbon.

9.5.2 Trees

Trees left standing after timber harvesting that are not reserved for silviculture, biodiversity or a forest management reason are measured in a waste assessment and classified as avoidable or, less commonly, as unavoidable waste.

The surveyor must reference appropriate documents such as the cutting authority, the appraisal, and maps as submitted into ECAS to determine the conifer and/or deciduous leave trees identified by species to be retained as reserved timber for the area being waste assessed.

When a waste assessment area contains standing timber, the post harvest standing tree specifications must be documented by a forest professional **in an assurance statement**, and **confirm**:

1. If standing timber is not to be tallied **as waste**, or
2. If standing timber is to be tallied as waste, the updated documents (maps, etc.) must be provided to the waste surveyor.

In all cases, a document detailing the post harvest standing tree specifications and the updated maps must be submitted into the Waste System.

A tree must contain a log meeting the minimum timber merchantability length (3.0m) from high side of the stump to the utilization top diameter.

9.5.2.1 Recording Trees

For standing trees, record as "T" under "Kind of Material" and classify the trees as avoidable. For downed trees, record "D" and classify the trees as either avoidable or unavoidable. Enter the dimensions for length, top and butt diameters, end codes, and assign a log grade.

9.5.2.2 Individual Tree Measurements

Individual standing tree volumes that are measured must be stratified out and kept separate from the plot waste volumes. Trees that were left scattered sparingly throughout the cutblock are measured and graded individually.

Tree length is determined using a tape/chain and a clinometer or an electronic measuring device such as a laser instrument. The waste surveyor estimates the location of the timber merchantability specification top diameter, and then measures the length from this point down to the timber merchantability stump height. To record as a piece, the tree must contain a 3 m log that meets the timber merchantability specifications.

Record the timber merchantability specification top diameter in rads as the top diameter. If the top is broken, estimate the diameter in rads at the break.

The butt diameter is the tree diameter at the timber merchantability specification stump height, accounting for flare (see *Scaling Manual* section 6.2.2).

Trees are measured, recorded, and graded as a single piece, they are never pencil bucked into multiple pieces.

9.5.2.3 Trees in Patches

For trees that were left in a patch where individual tree measurement is impractical, the waste surveyor will measure the precise area represented by the tree patch (i.e. perform a closed traverse or traverse using GPS). A patch is defined to be a grouping of trees occupying an area of equal to or greater than 0.1 hectare.

The volume may be determined by:

1. Using the cruise compilation information from the appraisal, or
2. Completing a cruise of the timber. The cruise must be completed to the standards contained within the *Cruising Manual*.

Use the procedures in 9.5.2.4 to determine the volume, species, and grade allocations for the waste submission.

9.5.2.4 Volume, Species, and Grade Allocations for Standing Timber

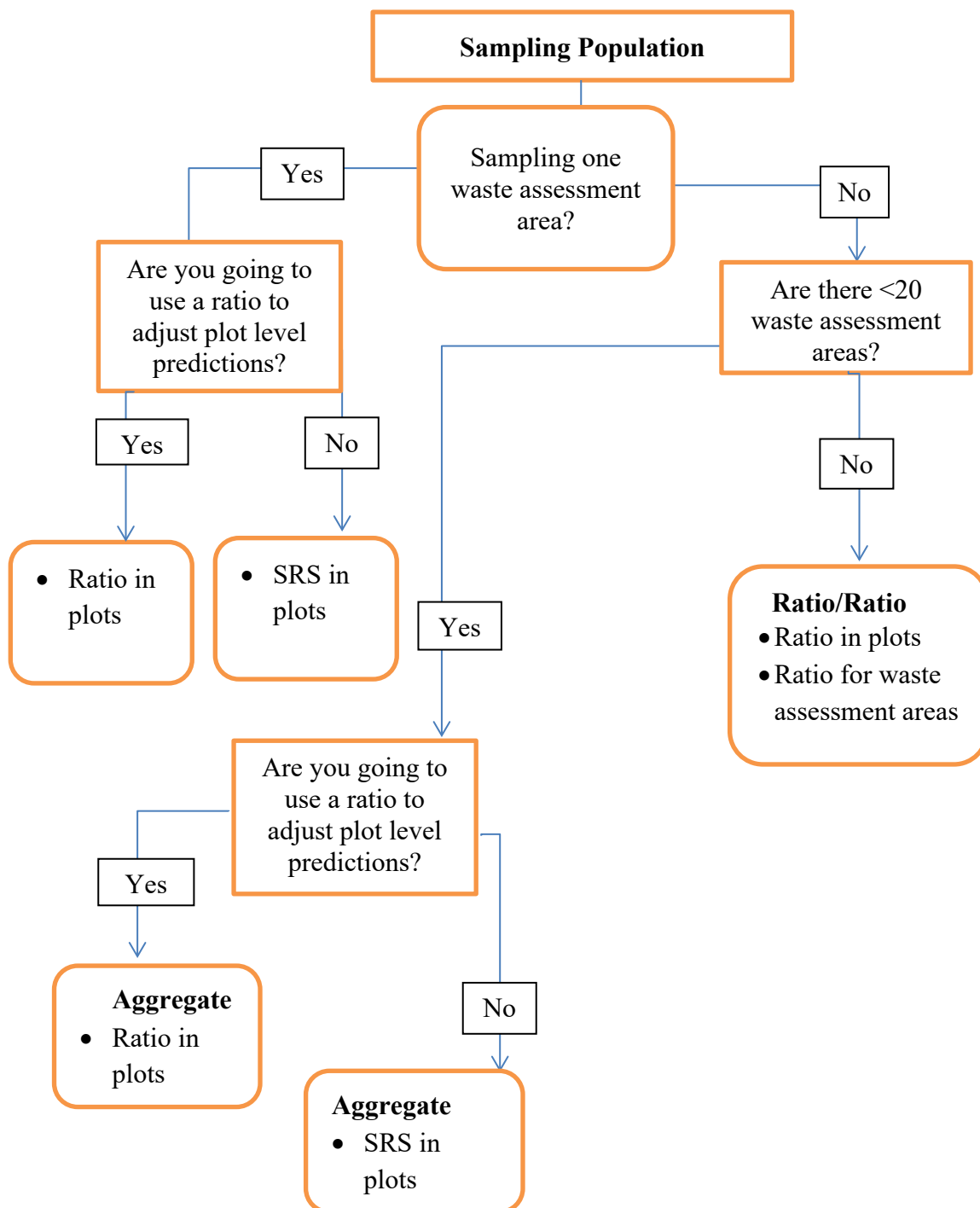
The cruise net volume per hectare (for the applicable timber type(s)) will be used to determine the volume of timber in unharvested tree patches or waste assessment areas.

To obtain the volumes, use the timber type summary report from the net cruise compilation report for the timber type corresponding to each of the patch location(s) or the block summary report when a patch covers multiple timber types.

The grade allocations for tree patches, are based on the historic billing grade profile of the timber mark for the cutting authority from the Harvest Billing System (HBS). The grade profile can be obtained in HBS by running the mark monthly billing history selection report (billing history) for a twelve-month period ending one month after the month primary logging was completed for the waste assessment area.

Only in the absence of the billing history records, the net cruise volume and species for the waste assessment area being surveyed are used. The grades default to sawlog except for dead potential volumes which are recorded as grade 4.

Appendix 3 Sampling Population Flowchart



Appendix 4 Plot Table Charts for Single Waste Assessment Area Populations

Spot Accumulation (Pile) Strata - Minimum # of Plots			
Total Number of Piles (greater than or equal to)	# of Measure Plots for SRS	# of Prediction Plots for Ratio	# of Measure Plots for Ratio
1*	10	12	4
13	11	12	4
15	11	13	4
18	12	13	4
20	12	14	5
23	13	14	5
25	13	15	5
28	14	15	5
30	14	16	5
33	15	16	5
35	15	17	6
38	16	17	6
40	16	18	6
43	17	18	6
45	17	19	6
48	18	19	6
50	18	20	7
53	19	20	7
55	19	21	7
58	20	21	7
60	20	22	7
63	21	22	7
65	21	23	8
68	22	23	8
70	22	24	8
75	23	25	8
78	24	25	8
80	24	26	9
83	25	26	9
85	25	27	9
88	26	27	9
90	26	28	9
93	27	28	9
95	27	29	10
98	28	29	10
100	28	30	10
103	29	30	10
108	30	30	10

* If there are more plots required than spot accumulations, evenly disperse all plots on the spot accumulation(s) in the waste assessment area.