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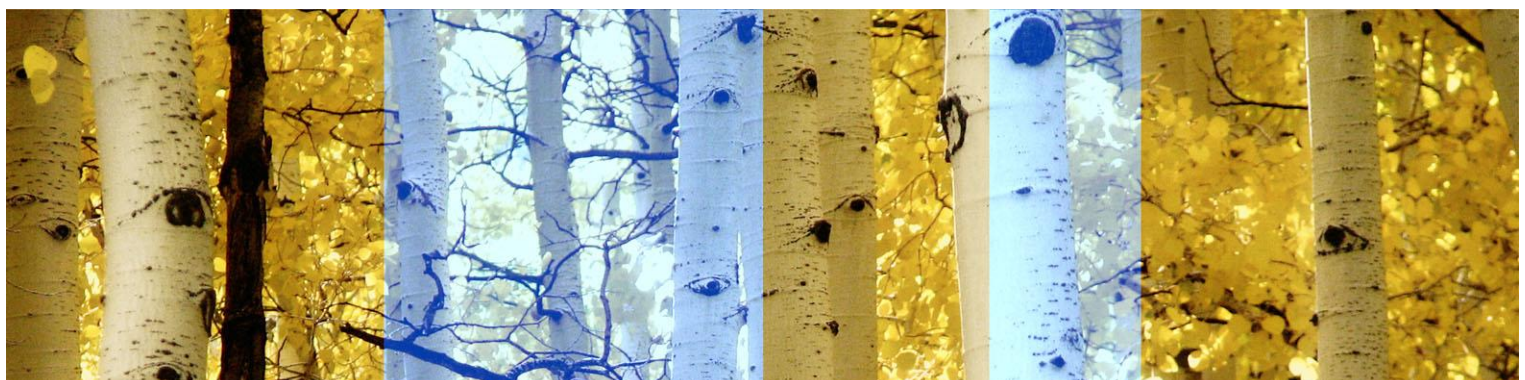
## **Department of Environment, Land, Water and Planning**

### **Independent review of the Leadbeater's possum colony 200 m radius buffer review Impacts on the timber industry**

### **Final Report**

May 2017  
Melbourne

Job No: A17-21286



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May 2017	Final	Final report – changes as requested by DELWP regarding the contribution of each of DELWP and VicForests to the THEZ review report. Changed 'joint report' to 'THEZ review report' throughout References to chapter 3 (VicForests' chapter on costs) changed to chapter 4 to address change noted in email from DELWP May 2017. Note Indufor has not sighted the final THEZ review report.



## **PREFACE**

This report was prepared at the request of the Victorian Department of Environment, Land, Water and Planning (DELWP, the Client) by Indufor Asia-Pacific (Australia) Pty Ltd. The intended user of this report is the Client. No other third party shall have any right to use or rely upon the report for any purpose.

The project involved assessing the implementation of methodologies provided by VicForests and the cost estimates subsequently derived by VicForests, based on the information provided by VicForests and DELWP.

This report may only be used for the purpose for which it was prepared and its use is restricted to consideration of its entire contents. The conclusions presented are subject to the assumptions and limiting conditions noted within.

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Appendix A: Documents reviewed

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Appendix B2: *Road Cost Analyses.* VicForests.

Appendix B3: *Fragmentation flowchart.* VicForests.

## 1. INTRODUCTION AND BACKGROUND

One of the key recommendations of the Leadbeater's Possum Advisory Group<sup>1</sup> (LPAG) was the establishment of 200 metres (m) radius timber harvesting exclusion zones<sup>2</sup> (THEZ) around verified colonies of Leadbeater's Possum.

The LPAG also recommended that the effectiveness of this action in 1) supporting the recovery of the species and 2) providing for a sustainable timber industry, would be assessed after two years of surveying (commencing July 2014) or once 200 new colonies were identified where their buffers impact State forest zoned as General Management Zone (GMZ) or Special Management Zone (SMZ). Both milestones were reached in June 2016.

The requirement for a 200 m radius buffer has been incorporated into the *Planning Standards for timber harvesting operations in Victoria's State forests 2014*<sup>3</sup>, specifically that a Special Protection Zone (SPZ) of 200 m radius must be established, centered on each verified Leadbeater's Possum colony<sup>4</sup>. Timber harvesting operations must be excluded from SPZs<sup>5</sup>; however, there is provision for application to the Minister or delegate for approval to conduct roading activities within an SPZ<sup>6</sup>.

In April 2017, the DELWP completed a report, *A review of the effectiveness and impact of establishing timber harvesting exclusion zones around Leadbeater's Possum colonies* (THEZ review report), which reviewed the effectiveness and impact of establishing THEZ around Leadbeater's Possum colonies. DELWP's Arthur Rylah Institute contributed content on the ecological requirements of the Leadbeater's Possum, and VicForests contributed to the report on financial impacts to VicForests from the timber harvesting exclusion zone.

DELWP engaged Indufor Asia Pacific (Australia) Pty Ltd (Indufor) to undertake an independent review of aspects of chapter 4 of the THEZ review report, specifically in respect to the additional costs to industry directly resulting from the introduction of the LBP buffers, the methodologies used to determine those costs, and VicForests' assessment of alternative options to protect Leadbeater's Possum. Note the impact of the LBP buffers on foregone timber availability was excluded from the Indufor review.

This independent review is intended to inform the broader assessment of the impacts of the buffers on the sustainability of the timber industry.

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<sup>1</sup> *Leadbeater's Possum Recommendations: Report to the Minister for Environment and Climate Change and the Minister for Agriculture and Food Security*. Leadbeater's Possum Advisory Group. 20 January, 2014.

<sup>2</sup> Terminology used by DELWP and VicForests for SPZs around LBP colonies in the THEZ review report *A review of the effectiveness and impact of establishing timber harvesting exclusion zones around Leadbeater's Possum colonies*. Department of Environment, Land, Water and Planning and VicForests. 28 April 2017.

<sup>3</sup> *Planning Standards for timber harvesting operations in Victoria's State forests 2014*. Appendix 5 to the *Management Standards and Procedures for timber harvesting operations in Victoria's State forests 2014*.

<sup>4</sup> *Planning Standards for timber harvesting operations in Victoria's State forests 2014*. Appendix 5 to the *Management Standards and Procedures for timber harvesting operations in Victorian State forests 2014*. Department of Environment and Primary Industries, State Government of Victoria. Table 4, p39.

<sup>5</sup> *Code of Practice for Timber Production, 2014*. Department of Environment and Primary Industries, State Government of Victoria.

<sup>6</sup> *Management Standards and Procedures for timber harvesting operations in Victorian State forests 2014*. Department of Environment and Primary Industries, State Government of Victoria.

## **2. SCOPE OF THIS REVIEW**

The scope of this review considers the methodologies developed by VicForests to determine additional costs expected to be incurred by the timber industry resulting from the introduction of the 200 m radius THEZ, and any other potential alternative management options.

The methodology for calculating revenue foregone from removal of access to forest areas within the LBP THEZs has already been established, and is explicitly excluded from the scope of this review. However, review of the method and assumptions applied by VicForests to identify areas that are no longer commercially viable due to fragmentation and isolation caused by the LBP buffers, is included in the scope.

VicForests' methodologies address the impact of the LBP colonies that have been recorded between 1998 and 29 January 2017 on those coupes listed on the current Timber Release Plan (TRP), dated January 2017. The categories of THEZ are noted in section 4 of the THEZ review report as:

1. Existing records from 1998 to February 2014 ('existing')
2. New 200 records verified between February 2014 – June 2016 ('towards 200')
3. Additional records up to 30 January 2017 ('beyond 200').

VicForests has limited its estimation of additional costs to those incurred directly by VicForests.

The scope of Indufor's review is to:

1. Review the adequacy and implementation of VicForests' methodology;
2. Assess the appropriateness of the data used and the results of the analyses; and
3. Review the assessment of the impacts to the timber industry of the alternative options.



### 3. METHODOLOGY

#### 3.1 Overview

Indufor's review is based on a briefing and subsequent discussions with VicForests about methodologies used and cost estimates generated, and review of supporting documentation provided by VicForests and DELWP. Indufor provided initial comment on the draft methodology used to assess costs, and a draft short report of key findings to DELWP during April and May.

A summary of the relevant meetings and reporting is provided below:

Date	Activity
5 April 2017	Initial briefing to Indufor from VicForests regarding proposed methodology for calculating additional costs
10 April 2017	Provision of short report to DELWP providing Indufor's views of adequacy of proposed methodology
21 April 2017	Indufor meeting with VicForests to receive and discuss estimated additional costs and supporting documentation
27 April 2017	Provision of short report to DELWP providing Indufor's key initial findings of the independent review
1 May 2017	Receipt of report: <i>A review of the effectiveness and impact of establishing timber harvesting exclusion zones around Leadbeater's Possum colonies</i> . Department of Environment, Land, Water and Planning, and VicForests. 28 April 2017

Following Indufor's initial review of VicForests' draft methodologies, VicForests provided its revised methodology titled *Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies – documentation of methodology and metrics*, dated 7 April 2017 (updated 12 April 2017); and provided a supplementary methodology document titled *Road costs analyses*. A list of documents and files reviewed as part of this assessment is provided in Appendix A. A copy of VicForests methodology documents are attached as Appendix B1-B3.

The methodology developed by VicForests was broader in scope than the scope of the independent review. Indufor assessed the relevant sections of VicForests' methodology, cost data and the THEZ review report that were within the scope of the review, as set out in Table 3-1. This results in Indufor reviewing two metrics of the analysis.

The implementation of Indufor's review of each of the two relevant sections of the THEZ review report is described in sections 3.2 and 3.3 of this report. The review of VicForests consideration of cost impacts of alternative options for the protection of Leadbeater's Possum is included in section 4.3.

**Table 3-1: Indufor approach to assessment of metrics reported on by VicForests in Chapter 4 of the THEZ review report**

Ref	Metric	Applicability to Indufor assessment
4.2.2.1	Reduction in forest available – Available and suitable forest within exclusion zones	✗ The metric is outside the scope of this review.
4.2.2.2	Reduction in forest available – Forest types within exclusion zones	✗ The metric is outside the scope of this review.
4.2.2.3	Reduction in forest available – Forest age within timber harvest exclusion zones	✗ The metric is outside the scope of this review.
4.2.2.4	Reduction in forest available – Inaccessible forest fragments	✓ The implementation of the methodology to determine fragmented forest areas is addressed in this report.
4.2.2.5	Reduction in forest available – Inaccessible areas	✗ The implementation of the methodology to determine inaccessible areas is not addressed in this report, as it has not been undertaken by VicForests.
4.2.3	Sales foregone	✗ The metric is outside the scope of this review.
4.2.4	Additional roading costs	✓ The implementation of the methodology and cost estimates are addressed in this report.
4.2.5	Additional management costs	✗ VicForests has not estimated costs associated with delineation of coupe boundaries not in annual harvest plan. Therefore, this metric has not been addressed by this review.

### 3.2 Metric 1 – Additional roading costs

VicForests has presented its discussion of additional roading costs in section 4.2.4 of the THEZ review report.

Indufor reviewed information provided by VicForests and DELWP, comprising two methodology documents<sup>7, 8</sup>, a spreadsheet<sup>9</sup> containing coupe on the current TRP<sup>10</sup> impacted by LBP THEZs and associated additional roading requirements and cost summary, an example map<sup>11</sup> of an aggregation of coupes showing a proposed road realignment around a series of THEZs, and the then Chapter 3 of the THEZ review report<sup>12</sup> (which subsequently became chapter 4 of the final THEZ review report).

<sup>7</sup> *Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies –documentation of methodology and metrics*, dated 7 April 2017 (updated 12 April 2017). File name [methodology to review impacts\\_sustainable timber industry v2\).pdf](#). VicForests document provided by VicForests 12/4/2017.

<sup>8</sup> *Road cost analysis*, file name [Leadbeater Roding analysis\\_20 April 2017\(003\).pdf](#), provided by VicForests 21/4/2017.

<sup>9</sup> Microsoft Excel spreadsheet, file name [Extra Roding costs for Indufor.xlsx](#), provided by VicForests 21/4/2017

<sup>10</sup> VicForests Timber Release Plan (including approved changes) – January 2017. Published by VicForests, January 2017.

<sup>11</sup> Map for Coupe ID: 348-514-0001, file name [road redesign estimate \(003\).pdf](#), provided by VicForests 21/4/2017.

<sup>12</sup> *A review of the effectiveness and impact of establishing timber harvesting exclusion zones around Leadbeater's Possum colonies*. Department of Environment, Land, Water and Planning, and VicForests. 28 April 2017. Chapter 3 updated and provided by DELWP 10 May 2017.

As part of our desktop review, Indufor tested for the presence on the current TRP of all coupes nominated by VicForests as needing additional roading due to the creation of THEZ. Spreadsheet calculations forming the basis of roading cost projections were checked; and the appropriateness of unit roading costs were considered.

Indufor discussed the methodology with VicForests to confirm our understanding of the process used to estimate the total length of additional road and number of stream crossing required and the basis for the unit costs used in the VicForests cost estimate spreadsheet.

Indufor reviewed the example coupe map provided by VicForests showing the estimated location of an additional road needed to access an aggregation of three coupes and considered the location of the existing access road, alternative roading routes and the number of waterway crossings that may be required, based on the map, in comparison with VicForests assessment of that group of coupes.

Indufor's findings are discussed in section 4 of this report.

### **3.3 Metric 2 – Inaccessible forest fragments**

VicForests has presented its discussion of inaccessible forest fragments in section 4.2.2.4 of the THEZ review report.

Indufor examined the methodology used by VicForests to determine GMZ and SMZ areas that can no longer be accessed for harvesting as a result of the implementation of LBP THEZs. This spatial analysis was conducted using ArcGIS 10.5, using a combination of DEWLP and VicForests provided GIS data, publicly available GIS data, and satellite imagery.

VicForests provided one geodatabase file, being 'Indufor\_20170502', which contained the 'Fragments\_LBP\_Indufor' shapefile showing areas no longer able to be harvested as described above. DEWLP provided one geodatabase file, 'FMZ\_100\_and\_SFRIRED\_2007', which contained the shapefiles 'SFRIRED\_2007' and 'FMZ\_100', providing spatial data from the Statewide Forest Resource Inventory (SFRI) program, and Forest Management Zoning (FMZ) respectively.

The analysis involved overlaying the spatial files described above with satellite imagery available within ArcGIS, and road network shapefiles sourced from the Victorian Government website, Spatial Datamart. Indufor visually inspected the boundaries of the LBP fragments to determine their alignment with the available spatial data.

Indufor's findings are discussed in section 4 of this report.

## 4. DISCUSSION OF FINDINGS

### 4.1 Metric 1 - Additional roading costs

#### *Adequacy and implementation of VicForests' methodology*

The methodology used by VicForests to determine additional roading costs is based on its estimation of the additional length of road construction required to access coupes on the current TRP, where the creation of LBP THEZ have precluded access via an existing route. This approach is based on two key assumptions:

1. *No roading through THEZ:* In applying its methodology to estimate additional roading costs, VicForests has assumed that no new road construction or major improvements to existing roads will be approved within any THEZ created to protect a verified LBP colony. This appears to be a reasonable assumption based on our discussions with VicForests and DELWP that no requests to road through LBP THEZs have been approved in recent years. It should be noted however that this assumption is based on current government policy position, and therefore may be subject to change over time. If roading through THEZs to access approved coupes is authorised, the VicForests need for additional roading is likely to be reduced.
2. *Existing road access is located optimally in the landscape:* VicForests has assumed the timber haulage routes currently in place on coupes impacted by THEZs are located in the landscape such that they minimise construction cost (while meeting required regulatory and environmental standards). This assumption appears reasonable for a commercial entity such as VicForests. However, Indufor has not been able to verify this assumption beyond the one example provided, which did appear to support the assumption, with the intended road alignment being located along a ridgeline.

There is a third assumption that has not been explicitly stated in the methodology documents or the THEZ review report. It is not stated that there was no road construction required for any of the 43 coupes prior to imposition of the 200 m buffers. However, VicForests confirmed this verbally and by email with Indufor during the review process.

VicForests' methodology<sup>13</sup> indicates that road costs are based on the accounting of historical road construction costs to derive a unit rate for the differing road classes required to be built. Section 4.2.4.1 of the THEZ review report states that the roading costs have been estimated based on a desktop analysis and professional opinion of experienced staff. Indufor understands that VicForests' intention is that its professional opinion incorporates knowledge of and familiarity with historical road costs for various degrees of complexity, however Indufor has not been provided access to historical cost data against which to verify the nominated unit roading costs. Indufor notes, however that of the 43 coupes nominated by VicForests as having additional roading costs, construction is complete on three roads; and the actual unit costs for those roads are similar to the unit costs used by VicForests in its cost estimates.

VicForests' methodology, as described in its Road costs analyses document, appears to be a reasonable approach in that it has:

- Categorised the 43 coupes requiring additional road construction into three broad groups depending on the extent of road construction required (complete redesign, standard realignment, take off point);
- Allocated a standard unit cost (per km) for each category; and

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<sup>13</sup> Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies –documentation of methodology and metrics, dated 7 April 2017 (updated 12 April 2017)

- Estimated the length of additional road construction required to access each coupe or group of coupes.

VicForests has incorporated consideration of additional waterway crossings in its road cost analysis methodology; however, it is not clear the basis on which it is determined where crossings will be required. Indufor has not been provided access to adequate supporting evidence to verify the number of waterway crossing nominated by VicForests. VicForests' estimates are based on a desktop analysis, and Indufor acknowledges that it is difficult to be definitive about crossing requirements without field inspections of planned road locations.

The road cost analysis provides some cost estimate ranges for waterway crossings; however it does not describe different cost categories. Indufor notes that a standard unit cost appears to have been used for all waterway crossings.

The methodology implemented by VicForests appears to be consistent with the methodology documented in the road cost analyses methodology. VicForests provided a spreadsheet of its estimated length and complexity of road, including the number of waterway crossings required, across the 43 coupes identified as needing 'additional' road construction, and allocated unit costs to each, in accordance with its methodology. All 43 coupes are included in the current TRP, as noted in its methodology.

### ***Appropriateness of VicForests data and results***

Indufor notes that the unit costs are similar to the actual unit costs of three 'additional' roads that have already been constructed to access five coupes on the TRP. Indufor considers that the unit roading costs are relatively high based on our industry experience elsewhere; however unit costs for suboptimal roadline locations, such as these 'additional' roads, are expected to be higher than for roads located optimally in the landscape. Indufor further notes unit roading cost estimates are subject to significant variation, reflective of the variability of terrain and specific environmental requirements of the road construction at each site. Indufor was not able to verify the appropriateness of the unit costs further as Indufor did not have access to VicForests' historical road construction financial data to match with a larger sample of examples of road construction projects of various complexity.

In verifying the total estimated future additional costs of roading, including waterway crossings, it is necessary to multiply the unit roading costs with the length of each complexity level of road estimated by VicForests. VicForests provided one map as an example of the process used to estimate the length of road construction required. On review of this map (see Table 4-1) Indufor found that VicForests had underestimated the required road distance by 500 m in this instance.

**Table 4-1: Review of road length estimates on the example coupe map provided by VicForests**

Coupe map	Road length on map, as estimated by Indufor	Road length in VicForests' spreadsheet*
<b>Coupe ID:348-514-0001</b>	1500 m	1000 m

\* Microsoft Excel spreadsheet, file name Extra Roding costs for Indufor.xlsx, provided by VicForests 21/4/2017

On reviewing the number of waterway crossings required, Indufor found that VicForests' estimates of waterway crossings are fewer than suggested by apparent waterways shown on the coupe map (see Table 4-2). However, without field inspections of the planned road locations it is not possible to determine the significance of the works required to construct each crossing, and whether waterways are in the locations indicated by the maps.

**Table 4-2: Review of waterway crossings estimates on the example coupe map provided by VicForests**

Coupe map	Number of apparent waterways along road alignment, as assessed by Indufor	Number of waterway crossings in VicForests' spreadsheet*
Coupe ID:348-514-0001	3	0

\* Microsoft Excel spreadsheet, file name Extra Roding costs for Indufor.xlsx, provided by VicForests 21/4/2017

On the basis of the limited data available to Indufor it is not possible to provide further informed opinion on the adequacy of the outcomes of VicForests analysis. Due to the level of uncertainty associated with road construction viability and potential variability of unit cost along suboptimal routes, the figures provided by VicForests should be treated as estimates, to be confirmed with actual costs on completion.

## 4.2 Metric 2 – Inaccessible forest fragments

### ***Adequacy and implementation of VicForests' methodology***

VicForests methodology<sup>14</sup> for identifying fragmented areas of forest is considered appropriate in that it reflects an economic viability test that appears to have reasonable basis. The methodology states that it uses spatial analysis to identify forested areas less than 5 ha in size separated by more than 40 m from a suitable neighbouring coupe. It considers costs of road and landing construction (including machinery movements), as well as adjacency rules required to comply with Code<sup>15</sup> coupe aggregation limits. However, VicForests has not provided Indufor with data to support its economic viability test, therefore we are not able to comment further on the adequacy of the methodology.

Based on a review of the available spatial datasets described in section 3.3 of this report, VicForests appears to have implemented its methodology as described in terms of size limits of fragmented forest areas. Due to the data limitations, Indufor is unable to comment on other aspects of the methodology implementation including whether fragments are isolated from other coupes by a minimum of 40 m and the coupe aggregation limit elements of the methodology.

### ***Appropriateness of VicForests data and results***

Indufor's review of the spatial data provided by VicForests and DELWP found that all fragmented forest areas identified by VicForests' analysis were less than 5 ha in size, as intended by the methodology.

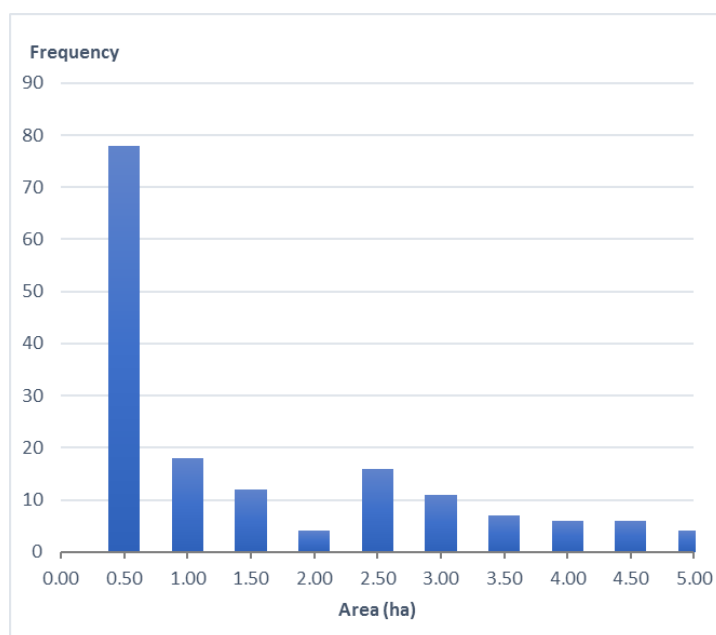
VicForests reported in the THEZ review report (28 April 2017) that 200 ha of forest fragments had been identified. Indufor's review of the spatial data confirmed this figure. However, a revised (10 May 2017) version of Chapter 4 of the final THEZ review report received by Indufor on 10 May reported 203 ha of fragments, 119 ha of which is of the 1930-1939 age class regrowth forest. The data to allow Indufor to verify these figures was not available to Indufor.

Indufor's review of the data identified 162 fragments, and found that the mean fragment size was 1.2 ha, and the median fragment size was 0.6 ha. Figure 4-1 shows the distribution of sizes of fragmented forest areas.

<sup>14</sup> Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies –documentation of methodology and metrics, dated 7 April 2017 (updated 12 April 2017)

<sup>15</sup> Code of Practice for Timber Production, 2014

**Figure 4-1: Distribution of fragment sizes**



Source: VicForests

The data available to Indufor precluded Indufor's confirmation of the isolation of areas identified as fragments by VicForests. Figure 4-2 and Figure 4-3 provide examples of part of the basis for the fragmentations, as well as limitations of the spatial data available to Indufor during our independent review. These figures represent a compilation of spatial data provided by VicForests and DELWP, combined with publicly available datasets of satellite imagery and road network shapfiles (refer to section 3.3 of this report).

These provide an indication to the basis of the fragmentation, however there is insufficient data available to be definitive regarding the zoning that provides a complete contribution to the fragment boundaries.

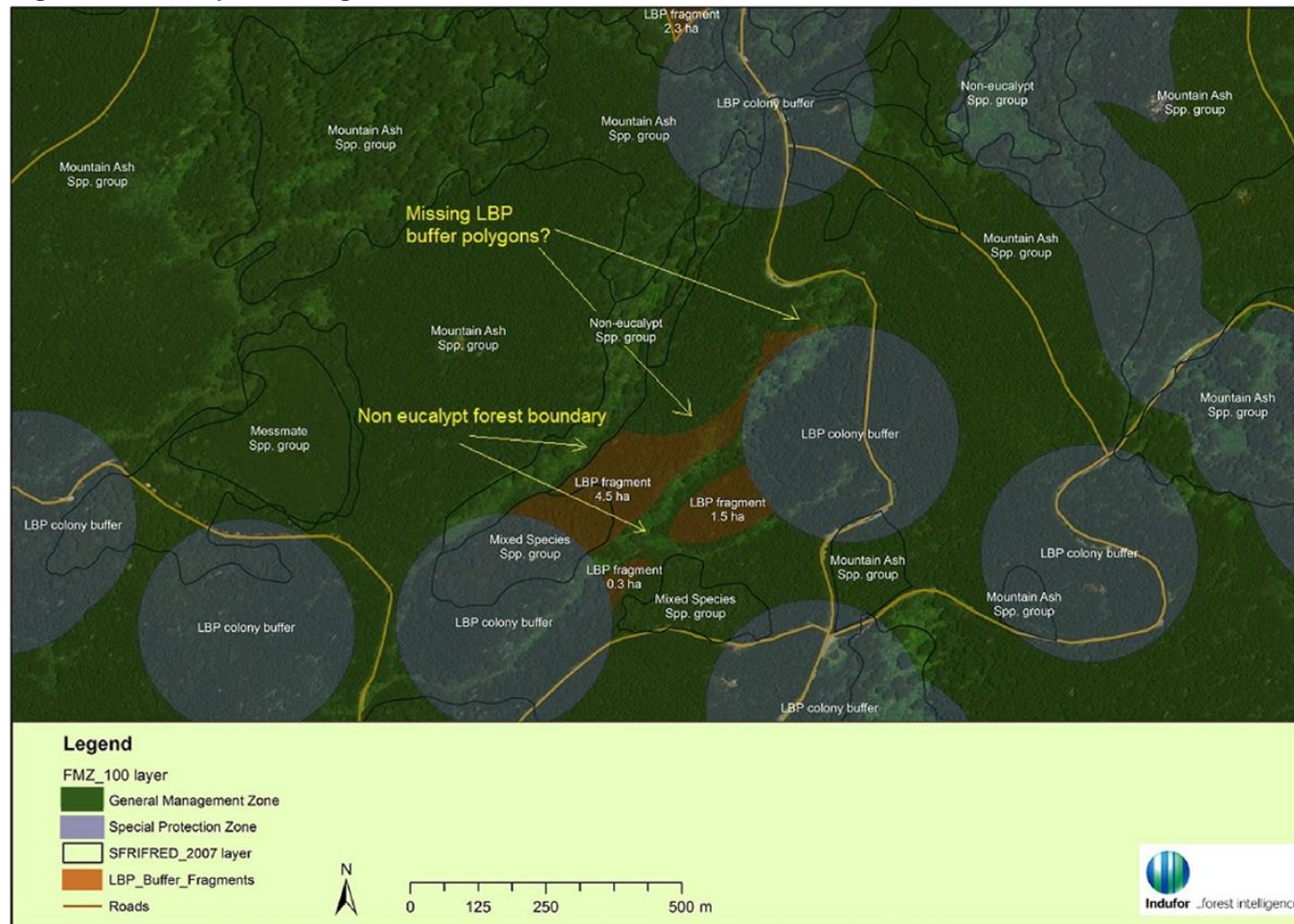
Figure 4-2 displays three fragments. The 1.5 ha fragment is bounded on one side by a LBP THEZ and on all other boundaries by a vegetation change that is possibly a waterway requiring a streamside reserve under Code prescriptions. The 0.3 ha fragment is similarly bounded on two sides, but on the south-east boundary there is nothing evident in the data to indicate inaccessibility and isolation from other productive forest areas. The 4.5 ha fragment is bounded by a THEZ and non-forest boundary, indicative of a waterway. The north-west boundary is shaped such that it suggests it is bounded by two THEZs (i.e. arc shape representative of being a circular shaped zone, however the THEZs are not shown).

Figure 4-3 shows two fragments bounded by THEZ to the west, however data supporting inaccessibility and isolation from other productive forest areas on the other THEZ boundaries has not been provided.

Without access to the full suite of data used in VicForests' modelling, including complete current THEZ and FMZ location data, slope and hydrology data, it is not possible to verify that the fragments identified by VicForests are isolated from other productive forest areas.



**Figure 4-2: Examples of fragmentation basis and data limitations**

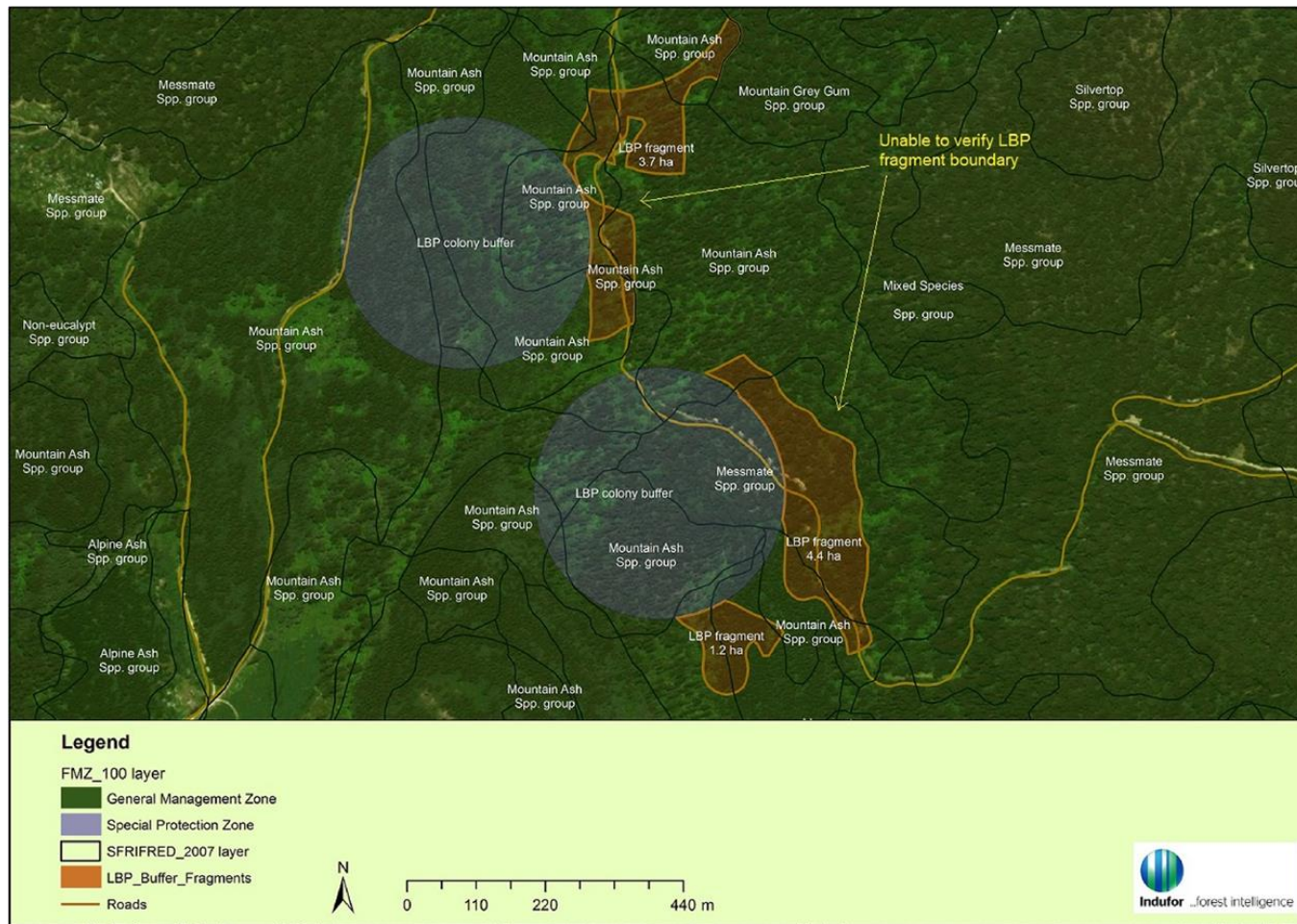


Source: VicForests, DELWP

Note: THEZs are indicated by the circular Special Protection Zone colouring (SPZ) and 'LBP colony buffer' notations.



**Figure 4-3: Examples of fragmentation basis and data limitations**



Source: VicForests, DELWP

Note: THEZs are indicated by the circular Special Protection Zone colouring (SPZ) and 'LBP colony buffer' notations.

#### **4.3 VicForests' assessment of impacts to the industry of alternative options**

In addition to 200 m THEZs, the LPAG also identified a large number of potential alternative actions to support the recovery of LBP, including various radius buffers and variable shaped buffers tailored to each colony site.

VicForests has not provided analysis or commentary of any alternative options in the THEZ review report in relation to ameliorating additional roading costs.

## **5. CONCLUSIONS**

On the basis of our independent review, Indufor considers that the methodology developed and implemented by VicForests appears reasonable. However due to the insufficient breadth and volume of evidentiary data available to Indufor, we are unable to comment further on the validity of VicForests' predicted road construction costs, including waterway crossings.

VicForests' methodology for determining fragmented forest areas is based on an economic viability test that appears to have a reasonable basis. However due to the limited evidentiary data available to Indufor, and limitations in the spatial data provided, Indufor was unable to verify that the methodology had been fully implemented as described.

It is important to note, due to the uncertainty around unit costs for road construction across a variable landscape, in combination with the limited data available during this review, that VicForests' predicted costs should be treated as estimates, to be confirmed against actuals.

## APPENDIX A – Documents reviewed

*A review of the effectiveness and impact of establishing timber harvesting exclusion zones around Leadbeater's Possum colonies.* Department of Environment, Land, Water and Planning and VicForests. 28 April 2017.

Chapter 3 of *A review of the effectiveness and impact of establishing timber harvesting exclusion zones around Leadbeater's Possum colonies.* VicForests, 10 May 2017. Provided by DELWP 10 May 2017.

Flow chart “*Fragmentation*”, showing a summary of work process to determine fragmented forest areas using GIS analysis. VicForests document provided by VicForests 5 April 2017.

FMZ\_100\_and\_SFRIRED\_2007’ geodatabase, comprising two spatial layers – ‘FMZ 100’ and ‘SFRIRED\_2007’, provided by DELWP 4 May 2017.

‘Indufor\_20170502’ file, containing the ‘Fragments\_LBP\_Indufor’ shapefile, provided by VicForests, 2 May 2017

Map for Coupe ID: 348-514-0001, file name road redesign estimate (003).pdf, provided by VicForests 21/4/2017

Microsoft Excel spreadsheet, file name Extra Roding costs for Indufor.xlsx, provided by VicForests 21/4/2017

Microsoft Excel spreadsheet, updated to exclude out of scope elements, file name Extra Roding costs for Indufor.xlsx, provided by VicForests 24/4/2017

*Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies –documentation of methodology and metrics*, dated 7 April 2017. File name methodology to review impacts sustainable timber industry.pdf. VicForests document provided by VicForests 7/4/2017.

*Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies –documentation of methodology and metrics*, updated version, dated 7 April 2017. File name methodology to review impacts sustainable timber industry.pdf. VicForests document provided by VicForests 7/4/2017.

*Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies –documentation of methodology and metrics*, dated 7 April 2017 (updated 12 April 2017). File name methodology to review impacts sustainable timber industry v2.pdf. VicForests document provided by VicForests 12/4/2017.

*Road cost analysis*, file name Leadbeater Roding analysis 20 April 2017(003).pdf, provided by VicForests 21/4/2017.

*VicForests Timber Release Plan* (including approved changes) – January 2017. Published by VicForests, January 2017.

**APPENDIX B1 – Review of the Leadbeater's Possum Advisory Group action: Establishing 200 m timber harvesting exclusion zones around existing and new colonies – documentation of methodology and metrics. VicForests (dated 7 April 2017 (Updated 12 April 2017))**

**Background**

The Leadbeater's Possum Advisory Group (LPAG) recommended the establishment of a 200m timber harvesting exclusion zone around Leadbeater's Possum colonies recorded since 1998, and all new verified colonies reported since February 2014. LPAG recommended that a review be undertaken on the effectiveness of this action in supporting the recovery of Leadbeater's Possum, while maintaining a sustainable timber industry. This review was scheduled to commence after the completion of two years of surveying, or once 200 new colonies were located where the timber harvesting exclusion zone impacted General Management Zone (GMZ) or Special Management Zone (SMZ). In June 2016, both of these milestones were met. Since then, the number of records of the possum reported to DELWP has continued to increase. To more fully assess the impact of this action on supporting the recovery of Leadbeater's Possum, all records reported to DELWP up til 29 January 2017 will be included in this review.

The objectives of this review are to:

1. document the extent of improved protection for Leadbeater's Possum colonies based on this action, and assess the effectiveness of this additional protection in supporting the recovery of Leadbeater's Possum;
2. document the impact on the timber industry of these additional timber harvesting exclusion zones; and
3. explore possible alternative options for protecting Leadbeater's Possum colonies and habitat, and compare their potential effectiveness for the possum's recovery and impact on the timber industry.

ARI is responsible for assessing the effectiveness of the action for Leadbeater's Possum recovery, and VicForests is responsible for assessing the impact on the timber industry, supported by Forest Policy and Planning and the Biodiversity Division (DELWP). All groups are working together to ensure consistency in the underlying data used to assess the benefits of the additional timber harvesting exclusion zones (THEZ) to the possum and the impact on industry.

Presented here is the methodology used to assess objective 2.

**Approach**

Data on the impacts will be assessed on the basis of all Leadbeater's possum records for the time period of 1998 to 29 January, 2017. These observation records are generally categorised into three groups:

1. the existing records from 1998 to February 2014 (existing)
2. the new 200 records (February 2014 – June 2016 (towards 200))
3. additional records up to 29 January 2017 (beyond 200)

Code of Forest Practices rules are obligated for all records. This means records as part of #1 in the above list have established timber harvest exclusion zones and therefore impact the maintenance of a sustainable timber industry.

The performance indicators outlined in the Leadbeater's Possum Implementation Program Evaluation Plan v2.7 (December 2014) provides a range of metrics for assessing benefits of this action, compared to if the action had not been implemented. Some performance indicators suggested in the Evaluation Plan have not been included in the review as there were too many assumptions that could not be validated. Additionally, some metrics were not considered or developed during the initial review and have been included here to further portray the impacts of the current conservation prescription on maintaining a sustainable timber industry. The performance measures from the Evaluation Plan have been rearranged for this review around metrics that document the extent of impact to maintaining a sustainable timber industry. An

overview of the metrics to be used in documenting the extent of additional protection, evaluating its effectiveness, and potential alternatives is outlined below. A more detailed rationale, assumptions and methodology for each of the metrics for documenting and evaluating the effectiveness are outlined in Table 1.

- Timber resource (area/volume) excluded from harvesting and the % reduction this represents, and additional impacts
- Estimated impact on available volume - % reduction in foregone ash sawlog (as per audit calculations for 2014-15 and 2015-16 – note this will only cover the first two years and presumably also the impact of protection of existing records post 1998, but does not cover the third category of records post the 200 up to 29 Jan 2017)
  - As outlined in the RSM Bird Cameron audit report to the LBPIC
  - For value lost post fiscal year end 2016 – VicForests will follow procedures as audited for previous reporting
  - Note that this process as outlined by RSM Bird Cameron only considers the volume and value of sawlog foregone due to the direct impact of the conservation buffers, i.e. contained within the 200m radius of the detection site.
- Evaluate additional road construction costs encumbered by delineation of 200 m buffer around LBP observation location (roads built that were not planned to access timber stands)
  - New road construction costs
  - Reconstruction costs
    - These costs will be a direct assessment of road construction invoices from projects implemented as a result of delineation of 200 m buffers
- Evaluate additional haulage distance and costs based on current and predicted rates
- Evaluate additional stream crossing structures
  - These costs will be a direct assessment of road construction invoices from projects implemented as a result of delineation of 200 m buffers
- Describe compounding road lengths over existing road lengths not able to be used
- Describe # of hectares of manageable forest stands lost (removed from active management) over time.
  - What proportion of lost area is in planned coupes vs. unplanned coupes
  - Describe amount of area lost in GMZ, coupe boundary and inaccessible due to 200 m buffer
  - Describe area of forest planned (all GMZ is planned) and lost to conservation of LBP
    - These are areas now termed 'fragments'. VF has developed a routine to identify them. Values will be assessed based on audit procedures.
- Describe additional costs required to delineate coupes for harvest that were not in the annual plan due to lost coupes from delineation of 200 m buffer
  - A routine to determine management fees on a per hectare basis
- Describe lost future timber stands due to lost regenerating opportunities within 200 m buffer (this is a qualitative assessment)
- The loss of young regenerating forest ie post 1970's is enormous
- Overall summary of impact in timber industry
- Key knowledge gaps

Table 1. Methodology to assess impacts of 200 m buffer delineation for LBP observations on native forest management.

<b>Metric</b>	<b>Rationale</b>	<b>Assumptions</b>	<b>Source of Data</b>	<b>Methodology</b>
Resource Foregone Direct impact sawlog sales foregone	Quantify volume and value lost of resource due to delineation of conservation buffer (timber harvest exclusion zone THEZ).	Identified timber was modelled as merchantable and allocated to meet customer purchase orders and was available at time of buffer delineation.	VicForests data layers: Available Resource Layer, TRP, valuation tables	Calculate quality and volume from inventory and multiply by log sales value (as per methods outlined in past audit reports).
Unexpected road construction costs	<p>Conservation buffer prohibits new road construction and existing road reconstruction. Timber harvest exclusion buffers prohibit access to timber stands therefore, additional roads need to be built to access unoccupied timber stands. 3rd party survey efforts as completed by public individuals are not planned and extremely disruptive to professionally planned forest management activities. 3rd party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. This consequence has impact on previously planned road location and construction plans. Roads flagged in the bush; Determine size of trees in road right-of-way;</p> <p>If trees are greater than 150 mm check if planned road is on TRP, if trees are less than 150 mm develop road works plan;</p> <p>Road works on TRP develop coupe plan, if road works are not on TRP do not proceed;</p> <p>If road works on TRP but impacted by LBP Timber harvest exclusion zone (THEZ) do not proceed to coupe plan;</p> <p>If road works impacted by LBP THEZ, redesign road works plan so that road construction does not encroach on LBP THEZ, treat as completely new road and seek construction bids as per Road Works Instruction VicForests document v 3.0. VicForests harvest and haul contracts includes the construction of temporary roads within the harvest area used to link the permanent road network and the landing where trucks are loaded. Where additional roads are required to be constructed to access the coupe due to the placement of Leadbeater's habitat protection zones, the cost</p>	As developed in the LPAG list of recommendations for the recovery of the possum, all 200 m buffers are considered timber harvest exclusion zones (THEZ). These conservation areas prohibit new road construction even if planned on TRP. New roads and old roads that may need reconstruction, cannot go through conservation buffers, existing old road cannot be upgraded for access. Planning for new road location is conducted on a site-by-site basis. Sites do not have similar site characteristics and thus will need to be evaluated individually. Any assumption regarding future colony detections is outside the scope of this review. Therefore so is projection of future road construction areas.	VicForests data layers: Available Resource Layer, LBP observation location records, TRP, VicForests has sourced direct costs associated with identified roading projected from VicForests financial management system (TechnologyOne). As all costs are actuals, no other data sources were required. The values within this system are audited as a component of our annual financial accounting audits.	Costs are based on direct accounting of road construction costs where roads have been built around conservation buffers. Costs can be reported on a per unit basis (i.e. per volume or per ha).

	<p>of constructing these additional costs are borne by VicForests. Therefore within our analysis the actual cost of additional roads does not consider the cost which would have been incurred for standard road construction as this cost would be incorporated in the contract and not borne by VicForests. The Timber Release Plan includes the location of proposed harvesting operations and roads to be constructed that would access these coupes. Roding within the harvesting area constructed by the contractor in the course of the operations are not mapped. As described above these are not considered within this analysis as they are an existing cost. Only additional roding undertaken by VicForests is considered, in these instances the roding is located on the Timber Release Plan layer.</p>			
Unexpected stream crossing structures	<p>Newly constructed roads may have additional stream crossing structures. Conservation buffer prohibits new road construction and existing road reconstruction. Timber harvest exclusion buffers prohibit access to timber stands therefore, additional roads need to be built to access unoccupied timber stands. 3rd party survey efforts as completed by public individuals are not planned and extremely disruptive to professionally planned forest management activities. 3rd party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. This consequence has impact on previously planned road location and construction plans. Roads flagged in the bush; Determine size of trees in road right-of-way; If trees are greater than 150 mm check if planned road is on TRP, if trees are less than 150 mm develop road works plan; Road works on TRP develop coupe plan, if road works are not on TRP do not proceed; If road works on TRP but impacted by LBP Timber harvest exclusion zone (THEZ) do not proceed to coupe plan; If road works impacted by LBP THEZ, redesign road works plan so that road construction does not encroach on LBP THEZ treat as completely new road and seek construction bids as per Road Works Instruction VicForests document v 3.0 VicForests harvest and haul contracts includes the construction of temporary roads within the harvest</p>	<p>As developed in the LPAG list of recommendations for the recovery of the possum, all 200 m buffers are considered timber harvest exclusion zones (THEZ). These conservation areas prohibit new road construction even if planned on TRP. New roads and old roads that may need reconstruction, cannot go through conservation buffers, existing old road cannot be upgraded for access. New, relocated roads may cross streams. These stream crossings were unexpected as the original road plan did not cross streams. Planning for new road location is conducted on a site-by-site basis. Sites do not have similar site characteristics and thus will need to be evaluated individually. Any assumption regarding future colony detections is outside the scope of this review. Therefore so is projection of future road construction areas.</p>	<p>VicForests data layers: Available Resource Layer, LBP observation location records, TRP, VicForests has sourced direct costs associated with identified roding projected from VicForests financial management system (TechnologyOne). As all costs are actuals, no other data sources were required. The values within this system are audited as a component of our annual financial accounting audits.</p>	<p>Costs are based on direct accounting of stream crossing structure install and associated road construction costs where roads have been built around conservation buffers. Costs can be reported on a per unit basis (i.e. per volume or per ha).</p>



	area used to link the permanent road network and the landing where trucks are loaded. Where additional roads are required to be constructed to access the coupe due to the placement of Leadbeater's habitat protection zones, the cost of constructing these additional costs are borne by VicForests. Therefore within our analysis the actual cost of additional roads does not consider the cost which would have been incurred for standard road construction as this cost would be incorporated in the contract and not borne by VicForests.			
Describe compounding road lengths over existing road footprints	Conservation buffers prohibit road reconstruction.	New roads cannot go through conservation buffers, existing old road cannot be upgraded for access.	VicForests data layers: Available Resource layer, road works plans, LBP observation records, LBP THEZ layer	Compare newly constructed road segment lengths to existing road segment lengths where conservation buffers have been delineated.
Area of fragmented forest not viable to access for timber harvest	Fragmented forest areas are not viable to access due to interplay of THEZ and other existing Code of Forest Practice rules. Conservation buffer prohibits new road construction and existing road reconstruction. Timber harvest exclusion buffers prohibit access to timber stands. Isolation, small size, physical topography issues lead to areas of forest not viable to access for harvest, areas. 3rd party survey efforts as completed by public individuals are not planned and extremely disruptive to professionally planned forest management activities. 3rd party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. VicForests recognises that there may be a range of factors the determine the viability of fragments. However, given the range of factors which may be considered and the varying influence of these factors a more detailed viability model does not necessarily provide a more accurate reflection of real world viability. (Additional rationale): VicForests also utilises fragmentation assumptions within its wood supply modelling processes. The fragmentation assumptions utilised within the LBP modelling reflects those utilised within our wood supply modelling systems. The	Isolation, small size, physical topography issues lead to areas of forest not viable to access for harvest, areas identified as less than 5 ha, and not less than 40 m from viable, accessible timber stands. Industry standards identify that costs (engineering, roading, harvesting, administration etc.) associated with harvesting stands smaller than 5 ha are higher than values of average timber prices. VicForests has therefore utilised a standard assumption of 5 ha separated by 40 meters of roading as a general indicator of viability which from our operational experience is indicative of areas that are not viable to be accessed.  40 meters has been used because VicForests operational experience has identified that extending snig tracks or roads to a greater distance than 40 meters through unharvested forest is operationally problematic and generally unviable. This is due to the capacity to construct and maintain long snig tracks and the costs of additional snig distances. These are assumptions based on operational experience and are not	VicForests data layers: Available Resource layer; TRP; LBP observation locations, LBP observation location THEZ layer	GIS database exercise intersecting data layers to determine fragmented areas. Areas isolated by THEZ, and other code of forest practice set asides identify isolated areas. Areas are then evaluated on size (4.99 ha or smaller) and not less than 40 m from other accessible timber stands (40 m is the smallest

	<p>Strategic Wood supply Model (SWSM) utilises the spatial optimisation tool Stanley to couple up the non-spatial harvest schedule determined in a Woodstock optimisation.</p> <p>Stanley considers spatial constraints such as minimum and maximum coupe size, polygons adjacencies, harvest coupes proximity and green up delay. Stanley is an add on to Woodstock that incorporates spatial constraints to determine the proportion of the Woodstock output that is practically achievable to harvest.</p>	<p>supported by detailed financial modelling. Any assumption regarding future colony detections is outside the scope of this review. Therefore so is projection of future fragmented areas.(Additional assumptions): Stanley Coupe design Rules - Long Term SWSM (100 year)</p> <ul style="list-style-type: none"> <li>• Minimum coupe Area 5 ha</li> <li>• Based upon operational experience and based on economic drivers related to coupe set up costs (landing and road construction) and the cost of float shifts</li> <li>• The adjacency rules implemented within Stanley are drawn from the code of forest practices and assume a double streamside reserve (40m).</li> <li>• Any polygon of forest that is not within 40m of a suitable neighbouring harvesting candidate (ash or mxs clearfell) and is less than 5 ha is considered a fragment by Stanley.</li> <li>• These are "islands" or "fragments" of resource that are isolated from a neighbouring harvesting candidate in the modelling time horizon.</li> <li>• In the strategic modelling sense they are excluded by the Stanley optimisation.</li> <li>• Maximum opening size 120 ha over 5 years, with a minimum of 20 m separation between openings</li> </ul>		<p>size of a stream with two sided buffer as defined in Code of Forest Practices that is a modelled exclusion zone which prohibits harvesting).</p>
Additional management costs to delineate coupe boundaries not in annual harvest plan	<p>Conservation buffers eliminate harvest from complete or partial planned coupe boundaries. New timber volume needs to be identified and made available for replacement in order to meet sales obligations. Replacement areas are not fully engineered coupes as 3<sup>rd</sup> party survey efforts as completed by public individuals are not planned and extremely disruptive to professionally planned forest management activities. 3<sup>rd</sup> party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. This consequence has impact on previously</p>	<p>Timber volume allocated to meet individual customer purchase orders need to be replaced. Additional replacement coupes are not fully designed and flagged in the bush. Additional unplanned time and effort to flag coupe harvest boundaries will occur. Allocated volume lost is replaced on a 1:1 ratio. Any assumption regarding future colony detections is outside the scope of this review.</p>	<p>VicForests data layers: Available Resource layer; TRP; LBP observation locations, LBP observation location THEZ layer, financial data to be derived from operations staff time (and per hour cost to</p>	<p>Calculate management costs on a per hectare or volume basis. Costs include: tactical and operational planning for additional coupe boundaries,</p>

	planned road location and construction plans, coupe harvest plans and all forest management activities.		be derived from staff salary) spent designing coupe boundaries.	biodiversity values surveys, road works planning, contract and administration arrangements.
Volume and value of young timber lost to conservation buffers	Conservation buffers eliminate harvest from complete or partial planned coupe boundaries. 3rd party survey efforts as completed by public individuals are not planned and extremely disruptive to professionally planned forest management activities. 3rd party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. This consequence has impact on previously planned road location and construction plans, coupe harvest plans and all forest management activities. Young timber stands previously thought to be unsuitable to LBP ecology is now incorporated into the conservation areas. These stands cannot be accessed for forest management activities thus are lost to future planning efforts and are inaccessible. Young timber stand value can be determined based on log sales values projected into the future.	Growth rates and value can be projected on timber stands now to predict volume and value at future time of harvest.	VicForests data layers: Available Resource layer; TRP; LBP observation locations, LBP observation location THEZ layer, log values tables	Use known growth rates and estimated costs to value young timber.
Area of forest inaccessible	Forest areas are inaccessible due to the concentration of conservation buffers. 3 <sup>rd</sup> party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. This consequence has impact on previously planned road location and construction plans, coupe harvest plans and all forest management activities. These areas differ from lost 'fragmented areas' due to size. VicForests recognises that the code allows for approval of roading through SPZ in certain circumstances. This however cannot be assumed to be granted upon application, and VicForests has not received such an approval for a Leadbeater's Protection Zone ever. Furthermore, VicForests has received only 1 approval for roading through any SPZ in the past two years.	As developed in the LPAG list of recommendations for the recovery of the possum, all 200 m buffers are considered timber harvest exclusion zones (THEZ). These conservation areas prohibit new road construction even if planned on TRP. New roads and old roads that may need reconstruction, cannot go through conservation buffers, existing old road cannot be upgraded for access. New, relocated roads may cross streams. These stream crossings were unexpected as the original road plan did not cross streams. Securing approval to road through SPZ (if required to access timber) will be granted. Additionally, the value of timber to access may be lower than the costs associated with gaining access. These situations will be assessed on a site-by-site basis. These areas are greater than 5 ha in size. Any request for approval sought	VicForests data layers: Available Resource layer; TRP; LBP observation locations, LBP observation location THEZ layer	GIS database exercise intersecting data layers to determine fragmented areas. Areas isolated by THEZ, and other code of forest practice set asides identify isolated areas. These areas are larger than 5 ha.

		is highly unlikely to be approved and therefore capacity to access inaccessible forest is not available under the current regulatory framework.		
Additional Haulage costs incurred due to additional road lengths built to access timber stands	Conservation buffer prohibits new road construction and existing road reconstruction. Timber harvest exclusion buffers prohibit access to timber stands therefore, additional roads need to be built to access unoccupied timber stands. 3rd party survey efforts as completed by public individuals are not planned and extremely disruptive to professionally planned forest management activities. 3rd party general public surveys occur at random times with no collaborative logistical planning. LBP 200 m buffers are delineated around verified observation locations in the midst of forest management activities. This consequence has impact on previously planned road location and construction plans. These new roads create additional haul distances not foreseen in original harvesting plans.	As developed in the LPAG list of recommendations for the recovery of the possum, all 200 m buffers are considered timber harvest exclusion zones (THEZ). These conservation areas prohibit new road construction even if planned on TRP. New roads and old roads that may need reconstruction, cannot go through conservation buffers, existing old road cannot be upgraded for access. New road construction creates longer haulage distances than planned in original harvest plans. Longer distances mean longer haulage costs to operators. Any assumption regarding future colony detections is outside the scope of this review.	VicForests data layers: Available Resource Layer, LBP observation location records, TRP, additional road lengths travelled is based on additional new road construction required to access timber stands.	Haulage costs will be summed over new road construction to access planned or replacement timber stands.

## **APPENDIX B2 – Road Cost Analyses. VicForests (undated, provided to Indufor by VicForests 21 April 2017)**

### **Rationale**

The loss of road access to resource due to Leadbeater's Colony Protection zones blocking viable roadline alignments is the most significant impact to resources access of the current Leadbeater's Possum colony protection measures.

The physical capacity to construct roads and the associated costs are impacted heavily by the slope of the terrain, quantity of rock and extent of stream crossings.

Slope is significant as the gradient which can be traversed safely by a timber haulage truck is relatively flat therefore to create such road in steep terrain requires considerable earth works (sidecuts). If rock is encountered earth works will include the need for blasting which is expensive, time consuming and dangerous. Where large side cuts are being employed rock is more likely as the road is deeper in the soil profile.

Stream crossings are also the most environmentally sensitive and practically difficult pieces of road to construct due to the challenge of managing sediment during construction and road use. The capability to undertake this effectively is highly influenced by the gradient of the approach to the crossing and the size of the stream being crossed. Wet forest vegetation at the crossing point also increases this challenge.

Roadlines are therefore carefully planned to minimise steep slope and significant stream crossings.

### **Assumptions**

Planned road line is the optimum location. Movement of the road will lead to sub optimum location which will create additional costs due to larger side cuts, steeper grades, potential need for switchbacks, and additional road armouring (gravel). Steeper road leading to greater earthworks. Greater side cut and switches. This would be case by case but at a minimum would add \$10,000 – \$50,000 per coupe access. This is primarily at the point of take off from the existing road network.

The diversion would need to create a greater distance road. \$100,000 per km (for standard realignment). Additional costs for blasting: \$10,000 – \$30,000 could be endless.

\$15,000 - \$50,000 per crossing. Likely on the higher end. Could be \$30,000 if need additional graveling due to the passage through deep wet gully. Realigning roads – the use of switchbacks – large earthworks \$15,000 – \$20,000 per switchback.

Roading through reserves potentially have limited impact on the possum colony due to the fact that significant habitat structures can be maintained. This is particularly the case if road works maintain a level of canopy connectivity with the mid and upper canopy.

### **Road costs per km**

Complete redesign – \$300,000

Additional earthworks – \$250,000

Blasting and drilling - \$30,000

Switchbacks - \$20,000

Standard realignment - \$150,000

Additional earthworks – \$100,000

Blasting and drilling - \$30,000

Switchbacks - \$20,000

Access with different take-off - \$50,000

## **Methodology**

Review all coupes impacted by 200 m buffers. Filter those coupes that do not have a developed road plan from total list. Categorise subset of coupes into the following categories based on road plan design:

### Viable Alternative

The proposed roadline has an alternative route which is of similar length and complexity to the alignment which is impacted by the Leadbeater's Possum Colony Reserve. In these instances, would create limited additional costs.

### Access with different take off

The length of road is not increased however movement to a less suitable take-off leads to increased costs. This will generally lead to greater earth works.

The movement of take-off points may in many instances required specialist roading contractors in addition to the harvesting contractor due to the complexity and lead times required. This will lead to additional increased costs.

### Roadline realignment

Realignment of roadline required in the middle of a proposed access road. In these instances, the realignment is possible however it would lead to steeper gradients which require greater earth works and more armouring. Road alignments are often heavily influenced by suitable stream crossing points, therefore forced realignment will often lead to the need for sub-optimal crossing points

which can lead to significant costs.

### Major Roadline Replanning

The impact of the LBP reserves has created an obstacle that cannot be traversed through. The LBP reserves create the need to reassess the broader roading plan. Therefore, to road into these areas is a significant redesign of the roadline to determine if it is feasible.

This will generally be caused by colonies covering the only suitable take off point from an existing road and other options outside the colony reserve being unsuitable (generally due to slope).

Redesigned roading plans may involve contemplation of utilising areas which are steeper, contain rock or have multiple difficult crossings.

Significant realignments appear to be possible and feasible at significant additional costs.

### Inaccessible Resource

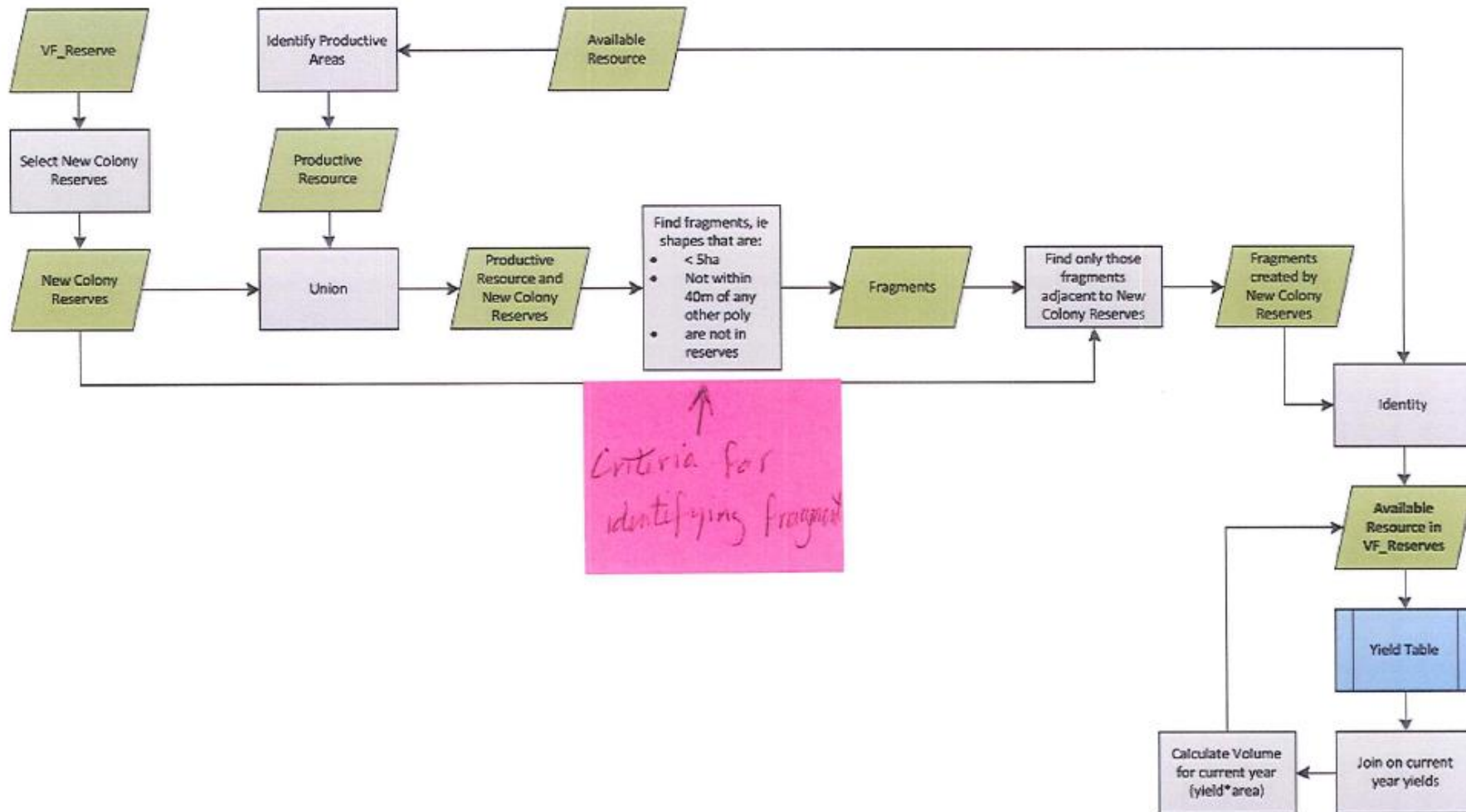
In some instances, the possible road alignments are very limited and therefore placement of reserves across the possible alignment creates areas of forest which is inaccessible under the current Leadbeater's Colony Protection prescriptions.

## **Results**

69 coupes were found to be impacted by LBP 200 m buffers and did not have developed road plans. Of these, 43 coupes had viable options for road plan redesign. 14 coupes did not have access impacted by the LBP buffers. The remaining 12 coupes did not have viable alternative road plans and were categorized as inaccessible resource.

In addition to these coupes, actual costs for several coupes were summed to provide additional detail to the impacts of LBP buffers to road plans.

APPENDIX B3 – Fragmentation flowchart. VicForests (undated, provided to Indufor by VicForests 5 April 2017)







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