Final Report

Hide ID marking system

Cattle hide identification applied on the slaughter floor for use through the supply chain to wet-blue grading

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Prepared by
Management for Technology

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1.0 Executive Summary

Management for Technology has been working in partner with ACC to establish a hide marking system at ACC's Processing Facility that can meet the technical, operational, cost and supply chain constraints of the project.

There are two main benefits for establishing such a system:

- **Cost reduction**: Applying ID's and tracking products is the first step to being able to analyse areas to reduce costs. Recalls can be narrowed down to the individually affected products, reducing the amount of wasted, unaffected product.
- **Wider market share**: Providing hides with ID marks that will survive throughout the manufacturing process assists manufacturers being able to trace the hide back to its country of origin and provide that information for the consumer. Consumers will be more likely to source hides with durable marks already on them (Macchion et. al. 2018).

However, there are four main areas of concern that will need to be investigated before investing in a hide marking system:

1. **Technical** – what type of hide marking system.
2. **Operational** – what type of ID, where should it be placed? How will it be integrated into production?
3. **Cost** – Can the costs be kept below a threshold of $1 per hide processed annually?
4. **Supply Chain** – Can the hide marks withstand the tanning process and be viable throughout a global supply chain?

This feasibility study has been split into four main phases that will investigate these areas:

- **Background Research**: identifying constraints in, and exploring solutions to, the four main areas mentioned above (technical, operational, cost and supply chain).
- **Supplier engagement**: Once a suitable marking system has been chosen, potential suppliers will be engaged to support the next two phases and assess if they will be suitable as product or service providers of the system when it has been integrated into the Processing Facility.
- **Pilot Trial – Phase 1:** Objective of which is to assess the systems technical suitability and the hide ID marks operational suitability.
- **Pilot Trial – Phase 2:** Objective of which is to assess the systems operational suitability and the hide ID marks supply chain suitability.

At time of publishing, the first three stages have been completed, and the fourth stage (Pilot Trial – Phase 2) has started. A custom laser marking system has passed the technical feasibility, being able to mark the outside of hides with ID marks that can still be read after wet-blue tanning. Alfex Laser have been engaged to supply ACC with a custom laser marking system and marking services that have been used to test the technical and operational objectives of the pilot trial. Overall, 73 hides have been marked at the Processing Facility. Of those 73, 17 have been tanned, photographed, and assessed for their mark's readability. Only one of the hides' ID marks was unreadable after wet-blue grading. The remaining 50 hides have been prepared for export, with shipping expected by 2nd week of July. Feedback is expected from China by 2nd week of August.

The project report is expected to be completed by 2nd week of September.

2.0 Introduction

Hides have a large value range caused by many factors. A wet-blue hide processor in a foreign country ideally needs to be able to determine the source of the hide to provide feedback to the slaughter establishment on grades and values. The ability to start value-based payments for livestock to the producer could be realised by linking the wet-blue grade and representative value of the hides to the producer and individual animal NLIS device. Producers with higher quality hides can be financially rewarded, while those with lower value hides are paid according to value.

2.1. Concept or project outline

The concept is to apply a globally unique identification mark to the hide on the slaughter floor to allow identification of the hide through to wet-blue grading. The size and position of the identification needs to be suitable in that it does not lower the grade or the value of the hide. The globally unique identification mark would be human readable and readily identifiable as coming from Australia and the slaughter establishment. The globally unique identification mark would be linked to the establishment, kill date and body number to allow for easy traceback to the source property and the individual animal NLIS device number.

2.2. Project objective

The objective of the project can be defined as:

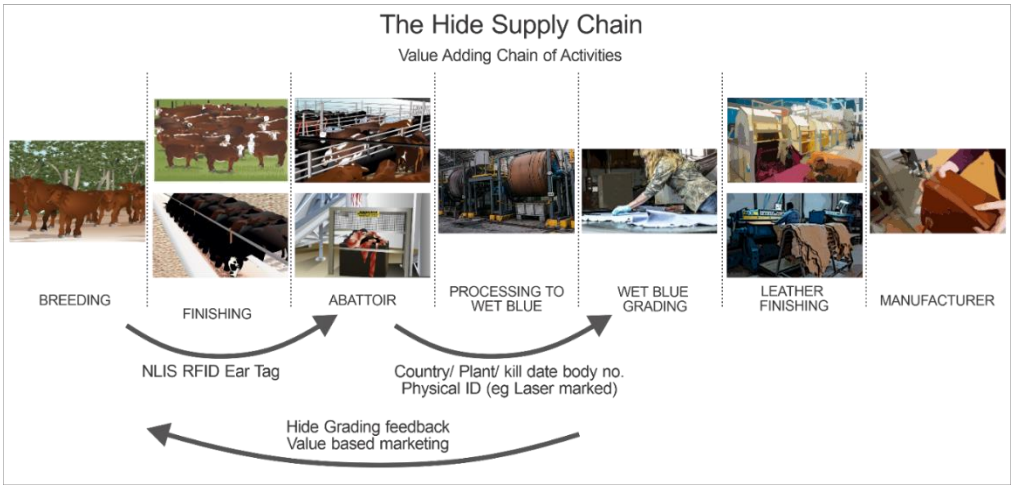
'Determine the cost-benefits and operational constraints in a hide marking system suitable for a foreign country hide processor to report on quality of hides at the time of grading of wet-blue hides. The hallmarks of which would allow the foreign hide processor to identify and pass-on information on both hides with defects and hides of a high grade on a unique ID basis. If hide unique ID system can be demonstrated as cost-effective and commercially practical along the supply chain, the use of a hide ID system can facilitate adoption of value-based marketing with producers.'

At the completion of the 'Preliminary Feasibility Review' a conclusion will be presented defining the likelihood of the hide identification marking solution being commercially possible.

2.3. Project or process relationship to the Supply Chain

The hide identification along the hide supply chain, from slaughter to wet-blue grading, is shown in the diagram below (Figure 1)

Figure 1. Overview of the hide supply chain.



Successfully achieving a commercially viable unique identification linkage that can trace a hide from wet-blue hide grading back to its plant, kill date and body number provide a powerful supply chain tool that will facilitate a model for value-based marketing with producers.

If the unique identification mark can be maintained through to finished leather, the ID mark may provide additional benefits to more sections of the leather supply chain.

2.4. Potential outcomes of a project

The project outcome will either be that:

1. Existing technologies do not overcome the identified constraints indicating that there is no currently available suitable solution, or
2. A specific technology appears suitable to provide a means to track the product forward with a reliable hide ID mark and therefore provide tracing of product from the ID at wet-blue hide grading back to the producer (production lifecycle).

3.0 Project Objectives

The project has been designed into three stages. Stage 1 of the project will deliver a first pass understanding if a commercial laser can mark a hide, whilst on the carcase, that results in both a human (and ideally machine) readable traceability mark with no visible resulting meat impact at the location of the mark.

At the conclusion of Stage 2, the type of laser (power) and its operational setpoints will be established. The optimum size of font (time vs OCR readability) will have been ascertained, and any characters to be excluded for OCR readability will have been determined. A concept design and budget price will be developed to move to Stage 3 and build an on-line solution, which will form part of the next project submission.

The agreed upon objectives by AMPC for each stage were as follows:

Stage 1

1. Evaluate if commercial lasers can etch a marking into a hide whilst still on the beef animal.
2. Evaluate if a commercial laser meeting objective one has any visual impact on the meat underneath the marking point.
3. Garnish other information that would need to be taken into consideration when conceptualising a full-scale installation (for example odours, human eye projection, human safety).

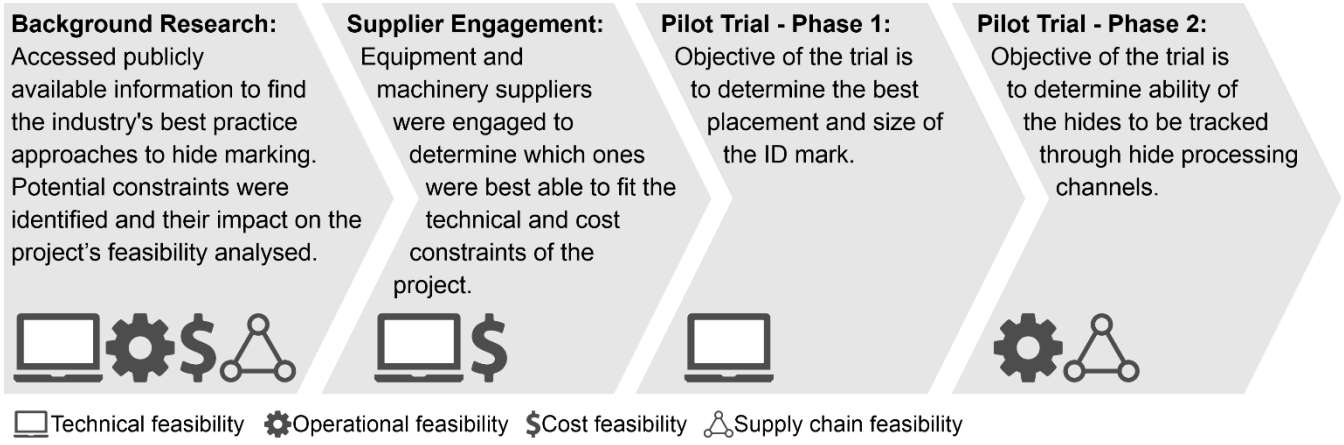
Stage 2

1. Undertake additional hide evaluation work at A1fex (CO21aser provider) along with a Optical Character Recognition (OCR) provider to ascertain optimum font size for speed of mark application and OCR efficacy
2. Purchase a high powered (100 watt) CO21aser from A1fex, that has complete programming capability of power, path etching/scribing mode and flexibility within each pass independent of the previous pass. The system will be installed off-line at AGC.
3. Take samples off-line (can be full hides) and process at varying speeds, passes, depths, pass patterns, power settings. These samples will then be processed through an Australian (or international) tannery. All samples will also be used to evaluate efficacy of OCR solution provider's suggested solution.
4. Project team to evaluate samples at the end of the supply chain (could be international), and on the assumption of a successful outcome, prepare a Stage 3 – technology process integration stage scope and budget.

4.0 Methodology

The feasibility study will go through four major steps across the first two stages, exploring the technical, operational, cost and supply chain constraints that could impact hide ID marking in Stage 1 and testing the technical and operational features of the system against those constraints in Stage 2. See Figure 2 below for an outline showing how each step contributes to these different feasibility themes.

Figure 2 - Methodology steps for the Hide ID feasibility study.



4.1. Background research

There are many constraints that will need to be considered to achieve the application of a globally unique hide identification on the slaughter floor. The challenges that need to be overcome to provide an operational and cost-effective solution may not be overcome.

4.2. Supplier Engagement

Several suppliers that were identified during Background Research were contacted for quotes on hide marking systems. Laser systems were selected based on cost and technical specifications identified from background research, as they were deemed suitable to fit the

4.3. Pilot Trials

A two-phased pilot trial was designed to test the technical, operational and supply chain feasibility of the laser marking systems.

The first phase was to confirm that the laser system could achieve the hide marking requirements on a technical and operational level. Hide ID marks were applied in two sizes to both sides of the hide. Success was measured on the ability of the laser marking system to mark the hides, and that those marks are readable on the wet-blue hides after tanning.

This phase of the pilot trial has been carried out over five marking sessions, marking limited number of hides diverted from the facilities stock that have the appropriate hair length and dirt on them.

The second stage commenced on 24th May 2021. Its objective is to confirm the additional operational and supply chain feasibility concerns, including the rate and capacity of hides that can be marked, and how best to integrate the laser marking system into the production line. Full details of the trials design are covered in Appendix C – Trial Design.

4.3.1 Trial design

Initially, six hides sourced from ACC's processing facility were marked using an Alfex Laser iMeta laser marking and engraving system, supplied by Alfex Laser. The hide ID mark was engraved in two sizes, at the bottom of both the inside and outside of each hide. This was extended to an additional hide marking session. Hide marking sessions and wet-blue grading readability are assessed as separate trials.

Full design details of the trial can be found in Appendix C – Trial Design.

4.4. Project timeframe considerations

There have been intermittent delays in the Trial phases due to a combination of difficulty finding hides with suitable hair length and level of dirt, and a COVID-19 restriction in Queensland that conflicted with a proposed hide marking day. Specifically, series of approximately 10 hides that were to be marked in late-March/early April were delayed due to the restrictions.

As of publishing, Pilot Trial – Phase 1 has been completed, with a larger scale trial (50 hides) aimed at testing the operational capacity of the system was conducted on 24th May 2021.

This group of 50 hides were sent to H.J. Hides & Skins, on 1st June 2021 and prepared for export to China.

Export is expected to occur by 2nd week of July.

Feedback is expected back from China by 2nd week of August.

5.0 Project Outcomes

5.1 Technical feasibility considerations

There are research projects that have been conducted over many years on options for hide identification. These research projects have considered various technologies that provide a range of different levels of identification options. No ideal solution has yet been identified to date.

5.1.1 Previous research projects

The research area of hide traceability has undergone a renewal in interest over the last few years, driven mainly from consumer interest in the origin of product (region or country) meeting standards for animal welfare, environment, and ethical trading initiatives. There are certification programs providing marketing branding to support these various supply chain claims.

Specifically, two studies released in the last two years have identified laser marking technology, amongst others, as a very promising solution to hide mark traceability (Tveit et. al., 2019; CTC, 2020).

5.1.2 Existing commercial technologies

There are existing commercial technologies that provide hide identification, none of which are in wide use in the industry.

The company A+B Hide in Germany have combined micro-RFID chips and laser marking on their hides in a semi-automated production process to identify and track their hides. Details of A+B Hide's process is shown in detail in a later section of this document.

5.1.3 Identified Technologies to be considered.

There are many different possible technologies that need to be considered. This list does not suggest that the technologies can achieve any or all of the above constraints, but only that they are considered.

1. Laser ID marking.
2. Hole punching ID marking.
3. Micro RFID chips inserted into the hide.
4. Dot peening.
5. Magnetic and spectroscopic ID solutions (Magnetic particle or chemical signature tattoos or microdots).
6. Biological ID systems (DNA, trace element/ isotopic).
7. Attached ID systems.

5.1.4 Existing research outcomes or commercial known usage of identified technologies.

The table below lists the identified technologies and the current known status of the technologies or solutions for the objective of the concept or project:

Technology	Any known research outcomes or commercial usage	Research reference or commercial providers	Identified limitations	Does the technology appear commercially viable to meet the project requirements?
Laser ID marking	Visually similar to a brand, this method has been used commercially by A+B Hides [1.] and has been shown through research as a viable method by several others, from concept to implementation.	A+B Hides [1.] CTC Groupe [4.] Tveit et. al., 2019 [19.] Thakur et. al., 2020 [20.]	▪ High frequency of defects on hides could disrupt the viability of the process. ▪ Requires a custom-built mark reading station for full automation.	Cost-benefit analysis is required before to understand costs of installation/upgrading systems.
Hole punching ID marking	Technology is commercially available, e.g., Gibson Bass Sampler. Research has found that the method can track the hide through the tanning stage.	Tveit et. al., 2019 [19.] Thakur et. al., 2020 [20.]	▪ Slow to apply mark. ▪ ID mark is large. * ▪ Limited data contained in the mark, requires creating a propriety solution to assign grading data to the mark that has been physically applied.	As of publishing this report, the method is unable to show wet-blue grade through the mark itself, instead needing to link it to a data management system.
Micro RFID chips inserted into the hide	Viability within hide processing has been researched, and it is commercially available.	CTC Groupe [4.] Tveit et. al., 2019 [19.]	Only viable to track up to the tanning process.	Does not meet requirement of being viable up to wet-blue grading
Dot peening	Commercially available solutions are available. However, a study found that hair from the hide blocked the machines' ability to read the code, requiring the area to be shaved beforehand.	Technifor/Gravotech [2.] [3.] Tveit et. al., 2019 [19.] Datamark Systems S.L. (2017) [23.]	▪ Requires are of mark to be shaved beforehand. ▪ Requires investment in developing an automated machine-reading data system to help track the data.	Research study found the mark cannot be properly read after tanning process, despite marketed claims. In addition, cost-benefit analysis regarding the cost of labour of shaving the mark area and in creating the data management system would need to be conducted.
Magnetic and spectroscopic ID solutions	Includes tattooing the hide with phosphorescent dyes. Research found that these dyes do not survive the tanning process.	Tveit et. al., 2019 [19.]	Dissipates during the tanning process due to contact from bleach.	No, does not survive the tanning process.
Biological ID systems	Research demonstrated from Eurofins BLC. A DNA marker is attached to the collagen proteins in the hide and read by a DNA sequencing machine by extracting samples from the hide mark location.	Eurofins BLC [5.] Tveit et. al., 2019 [19.]	▪ Is not human-readable and would limit the ability for customers to verify data. Applying it to your business within a strict timeframe. Currently, details are limited on how to apply this commercially.	Does not meet requirements of being human-readable. Requires equipment that most customers would not have available to verify and use the data. Cost-estimates are also difficult to obtain and therefore difficult to recommend.
Attached ID systems	Commercially available, and widely available. Most methods consist of a plastic tag with a barcode and RFID contained within. It is attached to the hide and is read by antennas or in combination with barcode scanners.	A+B Hides [1.] CTC Groupe [4.] Thakur et. al., 2020 [20.]	• Requires vendors to have a traceability system in place already, such as ear tags. Only viable to track up to the tanning process.	Partially. The method would not be suitable if used as the sole method of tracking. A couple of research projects show that it can be used in tandem with other methods, but it does not survive the tanning process.

* Tveit et. al., 2019 approached the inventors of the Gibson Bass Sampler if they could use it to create a Data Matrix code to reduce the size. A response has not been published, but they could be contacted for clarification.

5.1.5 Commercial usage of Laser Marking at A+B Hides Germany

There is commercial use of laser marking by A+B Hides in Germany.

The mark is a single line that uses the cattle ear tag unique ID, allowing data to be linked to prior information like origin. In their video (A+B Hides, 2018) they demonstrate how this technology enables traceability through their process plants, including after wet-blue grading.

Figure 3 - Screenshots taken from the A+B Hides 'Traceability' video, showing the laser marking system's clamp feature.

Figure 4 - Screenshots taken from the A+B Hides 'Traceability' video, showing a close-up of the clamp feature in opened and closed position.

Figure 5 - Screenshots from the A+B Hides 'Traceability' video, showing the hide ID marks. Image on right shows the same mark applied on the left and right of the hide.

- A+B Hides, (22 August 2018) '6. Traceability' [video], A+B HIDES GmbH & Co. KG, accessed 20 July 2020.

Figure 6 - Screenshot taken from the A+B Hides video 'Traceability' showing the ID mark withstanding the wet-blue processing.

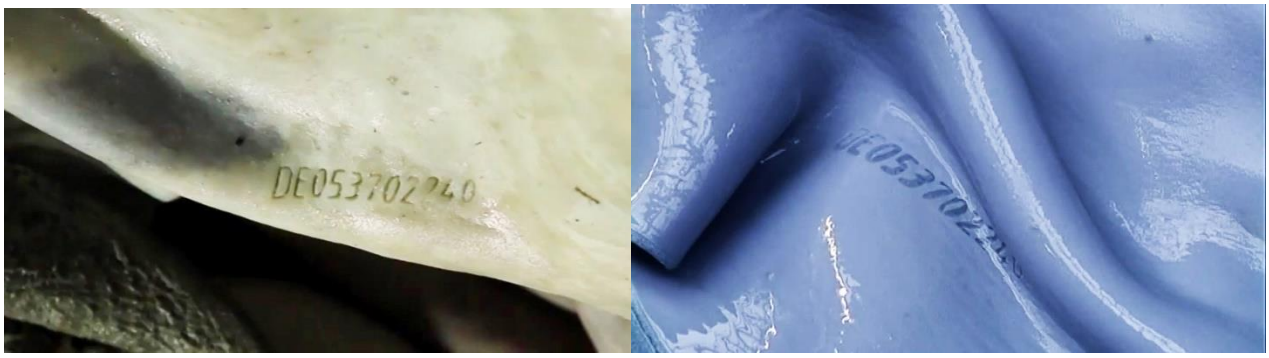


Figure 3, Figure 4, and Figure 5 above shows the process of the hide being clamped on both sides of the marking machine. The mark is applied to the bottom left and right of the hide, on the outside (See Figure 4). This system allows for identifying the hide even after splitting. The mark is also applied effectively enough that it can withstand the wet-blue process, as seen in Figure 6.

- A+B Hides, (22 August 2018) '6. Traceability' [video], A+B HIDES GmbH & Co. KG, accessed 20 July 2020.

5.2 Operational feasibility considerations

There are numerous operational considerations and constraints that need to be identify and addressed for the hide identification to achieve viability.

5.2.1 Background

Currently, hides at the ACC Processing Facility are delivered in bulk to local tanning partners. Once they have arrived, the hides go through the following process:

1. Hides are delivered to tanning warehouse in steel bins.
2. Hides transferred from steel bins into mixers filled with salts and preservatives.
3. Hides are processed in the mixers for 12 hours.
4. Hides are removed from mixers and stored loose on floor to drain liquid for approximately 1-2 weeks.
5. Once dried, the hides are processed individually – each given a grading, then trimmed and weighed.
6. Hides are then folded and packed on to pallets, each pallet being given its own ID.
7. Pallets stored 2 weeks, until they are loaded onto a container and shipped to their buyer in lots of 25 pallets per 20ftr container.

9.0 Appendices

- Appendix A – Hide Processing Sequence Steps
- Appendix B – Tannery Processing Flow Chart
- Appendix C – Trial Design
- Appendix D – Pilot Trial Phase 1: Trial 1 and 2
- Appendix E – Pilot Trial Phase 1: Trial 3 (Hide conditions)
- Appendix F – Pilot Trial Phase 1: Trial 4 (Post wet-blue graded hides)
- Appendix G – Pilot Trial Phase 1: Trial 5

Appendix A – Hide Processing Sequence Steps and Appendix B – Tannery Processing Flow Chart give more general overviews of the entire hide processing and tanning steps. Regardless, this breakdown helps realise the current traceability issues related to the tanning partners production steps.

It is unknown if the hides are given any ID when they arrive at the tanning warehouse. They are also never identified individually, just as a pallet. Number of hides per pallet is unknown, instead processed by weight (1100kg/pallet).

All these issues could be fixed if the hides are given individual ID marks that can withstand the tanning process.

5.2.2 Workflow considerations

Workplace considerations include the position of the equipment and the interaction of the equipment with the existing processes and workflows. In the case of hide marking, these considerations or constrains include:

1. Location on the slaughter floor for the marking equipment to be placed. This includes any safety requirements, carcase positioning mechanisms and operator interventions.
2. The available time to apply the marking, which is estimated at 10 to 20 seconds.
3. Interface of the marking equipment to the slaughter floor production system. For example, a trigger from the marking equipment to the Protrace system, so the Protrace system can provide data for the mark, and the response from the marking system to the Protrace system stating that the mark was successfully applied.
4. System for validating that the ID mark was applied.

5.2.3 Production implication considerations

For the purpose of hide identification marking, product implementation considerations relate to the “what to mark?”, “where to mark?” and the size of the mark. These constrains can be defined as:

1. An area or areas of the hide where a mark can be applied and will still be available at the time of wet-blue hide grading?
2. The size of the available area or areas to be marked?
3. The information to be placed on the hide that will provide a simple solution for the foreign country grader to be sure that the hide is from ACC, and to read the unique identification of the hide.
4. Physical size of the characters to suit both the available area and the amount of information to apply? Includes human readable and machine-readable options. If technologies such as inserted micro-RFID chips are used, how would the foreign country grader know to scan for the RFID and where to scan?
5. Whether the hide ID must be visible/ readable at all stages from slaughter through to wet-blue hide grading.

An example of the type of data that is likely to be needed for hide ID coding is defined in the document. This example ID code is made up of:

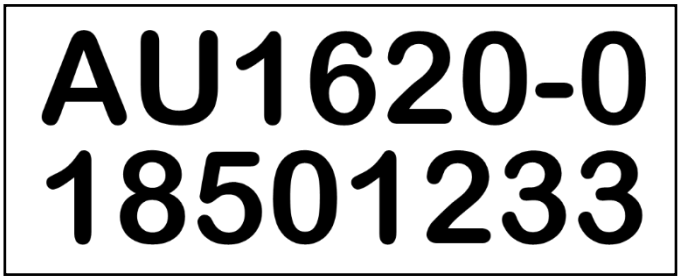
1. AU - indicating the country of source and the country of the slaughter establishment. This AU code allows the foreign country hide processor to know which country database to search.
2. 1620 – the slaughter establishment identifier for the country. Nominated as 4 digits. This may be an issue as there currently is no single standard to identify all slaughter establishment is Australia. The AUS-MEAT establishment register is only AUS-MEAT accredited establishments, not domestic establishments.

3. 0185 or 0-185 – The date encoded as single digit year (e.g., 0 for 2020) and the day of the year (e.g., 185 being Friday the 3rd of July). The date code will repeat every 10 years. The expectation is that the hide in circulation will have been processed and exited the supply chain within 10 years of being slaughtered.
4. 0123 - the body number for the day. This provides a solution that allows for up to 9999 bodies per day per slaughter establishment code.
5. 3 – the calculated check digit for the number string of 162001850123. The check digit is a necessary process for both human readable data recording as well as for Optical Character Recognition data capture. Meat industry manual data error rates have been demonstrated to occur between 1 and 5 percent of manually entered 8 to 10-digit IDs. (The error rate statistics come from monitoring activities related to NVD serial number rates of manual data entry error at slaughter plants and at feedlots).

The example shown below in Figure 7 is 80mm by 28mm. The optimum size has not yet been determined for the available area and location on the hide to apply the ID. The information on the required speed to apply this volume and size of ID by Laser, dot peening or any other technology has not yet been determined. The suitability of the character size in terms of being clearly readable after wet-blue processing also needs to be determined. There will always be a trade-off between the size of the characters and the speed of application, areas of hide taken up with the ID mark and the readability after wet-blue processing.

If this example hide ID code and volume of characters is achievable with existing technologies and can meet the operational and financial constraints, then this code will provide a robust globally unique hide traceability solution capable of linking the hide back through a searchable database to the individual animal and the livestock production supply chain.

Figure 7 - Example ID code, size: 80mm x 28mm.



The hide ID marking possible position or positions need to be determined. The diagram shown in Figure 8 below shows the general hide shape.

The marking trials will test various sizes and location to determine possible optimum size and location to apply the mark.

The options are likely to be:

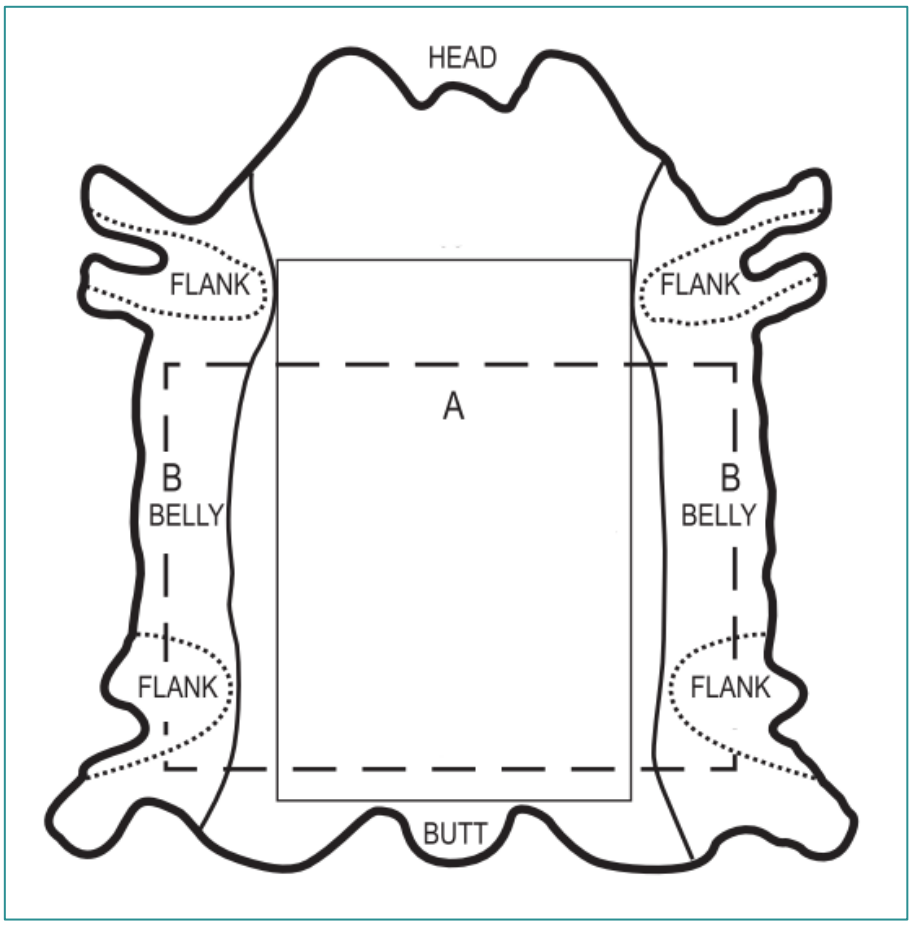
1. Between the fore shoulder and the head.
2. On the fore flank.
3. On the hind flank.
4. Edge of the belly.
5. Between the hind flank and the butt.

Consideration needs to be given to:

1. The likelihood of trimming removing the ID mark during the primary tanning process.
2. The ID mark lowering the value of the hide because it was placed in a commercially relevant position.

3. The mark was unreadable because it was located in a position that was subject to excessive distortion or damage at hide removal.
4. The mark was unreadable because it was located in a position that was subject to excessive distortion or damage during initial tanning processes.

Figure 8 - Schematic of hide after it has been removed from carcase.



5.2.4 Safety considerations

Any operational systems that exist in the production environment have some level of safe risk. The use of fully or semi-automated machinery have a high safety risk.

Laser technology has additional safety risks that need to be managed.

The vendors of any laser marking equipment for use in human/machine shared production areas will need to conduct the necessary safety assessment and prepare a suitable safety management plan for the safe use of the equipment in the environment.

The safety consideration includes any generated fumes or other non-direct laser related safety risks.

5.2.5 QA considerations

The hide identification marking process would be an important production process where any failures would have a substantial negative impact on the traceability of the hide. Therefore, a QA production start-up and accompanying monitoring programs will need to be developed.

The specific activities required for the hide identification marking QA program would need to be developed in conjunction with the laser marking equipment provider.

5.2.6 Maintenance considerations

The hide identification marking process would be an important production process where any failures would have a substantial negative impact on the traceability of the hide. Therefore, a suitable maintenance program would need to be developed. The nature of the hide ID marking method would require adequate hot spares available on the slaughter floor to ensure the least downtime as practical should there be an equipment failure, variable to the method chosen.

The maintenance program would also need to consider both planned preventive maintenance as well as failure management.

5.3 Supply chain feasibility considerations

Any project that spans the supply chain needs to consider supply chain implications. The concept of hide identification marking spans the supply chain from slaughter through to wet-blue hide grading. This is likely to span country as well as commercial entities.

The information that would need to be contained in the hide identification coding will need to be meaningful along the sections of the supply chain, as they may use the identification marking. If the hide identification marking technology is operational and commercially viable then many companies may potentially implement the technology.

When this happens the need for common universal coding standards become critically important otherwise duplicate hide identification markings may be applied to different hide by different slaughter plants, increasing labour costs and decreasing the value of the hide.

5.4.1 Supply Chain Interoperability considerations

To achieve interoperability along the supply chain, global standards will need to be implemented. These standards may be industry published and only applicable to cattle hide identification. A key element of the interoperability is the need to ensure that no competing standards emerge, resulting in confusion along the supply chain.

Another area of consideration is the need to ensure that each section of the supply chain can readily determine that a hide identification mark has been applied (i.e., is the mark readable?).

5.4.2 Traceability considerations

The key purpose of the hide identification marking is to provide traceability from the wet-blue hide grading to the slaughter plant and back to the property of source and the individual cattle identification (e.g., NLIS record).

Another area of consideration is the need to investigate compatibility with existing standards related to consumer expectations, including animal welfare, environment, and ethical trading initiatives. These requirements can vary in degree of information needed, depending on the region or country traded in.

Examples of these standards are the initiatives of:

- • ‘Leather Working Group’ https://www.leatherworkinggroup.com
- • ‘USHSLA Hide and Skin Traceability Program’ https://ushsla.org/USHSLA-Traceability-Program
- • ‘Institute of Quality Certification for the Leather Sector’ http://www.icec.it/en
- • ‘LEATHER STANDARD by OEKO-TEX’ https://www.oeko-tex.com/en/apply-here/leather-standard-by-oeko-tex .

5.4.3 Commercial data sensitivity considerations

There is some level of commercial sensitivity associated with traceability information. A hide mark acting as an identifier to commercial data at the point of wet-blue grading should have limited access to its related data.

The source country, slaughter plant, kill date and body number is the maximum amount of information that should be provided along the supply chain.

The ability to drill deeper to identify the source property and the individual animal identification should only be available to the slaughter plant.

5.4.4 Acceptability of the technology or solution to the supply chain

Any operational and systematic changes that are visible or impact other sections of the supply chain must be considered in terms of the level of acceptability along the supply chain. The best technology or solution may have negative impacts for other sectors of the supply chain.

A globally unique hide identification solution may potentially have negative impacts on some section of the supply chain. These potential negative impacts include:

1. The proposed hide ID code within this review readily identifies the country and slaughter plant of the hide. Is this acceptable all the way along the hide supply chain?
2. Any hide ID marking solution will make the specific location on the hide where the mark is applied not suitable for commercial use. Will the mark lower the overall hide grade and value?

5.4 Potential suppliers of suitable technology or solutions in the market

Market feasibility considerations are yet to be investigated. These considerations include identifying which commercial providers offer the proposed technologies or solutions in the market. Proprietary technology that is only available from a single vendor is not considered ideal as a monopoly will lead to increasing costs as demand increases.

Additional research is yet to be conducted.

5.5.1 Availability of potential suppliers in market

Currently, Alfex Laser has been the supplier of the laser marking system during the technical feasibility pilot trials.

Additional research on suppliers for a suitable laser marking system that aligns with ACC Processing Facility production is yet to be conducted.

5.5 Pilot trial at ACC processing facility

The first phase of a pilot trial was conducted at ACC. Primary objective of the trial was to find the best placement and size of the hide ID mark using the laser ID marking equipment, while confirming that the laser had sufficient power to mark the hide.

Since its initial conception, the Phase 1 trial was expanded to included marking different areas of the hide, marking hides with different conditions (e.g., long-haired, slick, and dirty), and trying to replicate processing floor conditions by marking a large amount in succession.

Figure 9. Percent of hides that were readable or not.

This analysis is missing context about the hides. Anecdotally, the 2 hides that had the majority of their digits obscured looked to be on hides with curly, long-hair. This could be an issue if the ACC Processing Facility staff also were unable to read IDs from these types of hides. Based on previous trials, it is not expected to impact the readability post-tanning.

5.6.1 Pilot Trial Phase 1 [Trial 1 and 2] - Hide Marking and post wet-blue grade readability.

All five large hide ID marks and four of the five smaller hide ID marks were clearly human readable on the hides outside.

Photographs of the laser marking system, and hides pre- and post-tanning, can be found in Appendix D.

5.6.2 Pilot Trial Phase 1 [Trial 3] – Second round of Hide Marking.

Eight hides of varying condition were laser marked. Three sizes of marks were engraved onto long-haired, slick, dirty cattle hides.

At time of publishing, photos of the hides post-tanning have not been received, and therefore the impact of the hide conditions on their readability, post-tanning.

5.6.3 Pilot Trial Phase 1 [Trial 4] - Assessing readability of wet-blue graded hides.

Six hides had their ID marks assessed for readability after wet-blue grading. Each hide had a total of six ID marks, three different sizes at two locations on the hide. Only a single set of ID marks on one hide was unreadable.

5.6.4 Pilot Trial Phase 1 [Trial 5] – Large Scale hide marking.

Forty-eight hides were marked in succession. Hides were also assessed for readability pre-tanning. Over 60% of hides were readable. Based on previous trials, it is not expected that this will impact the readability of the hides post-tanning. At time of publishing, the hides have been shipped to the tanning partner.

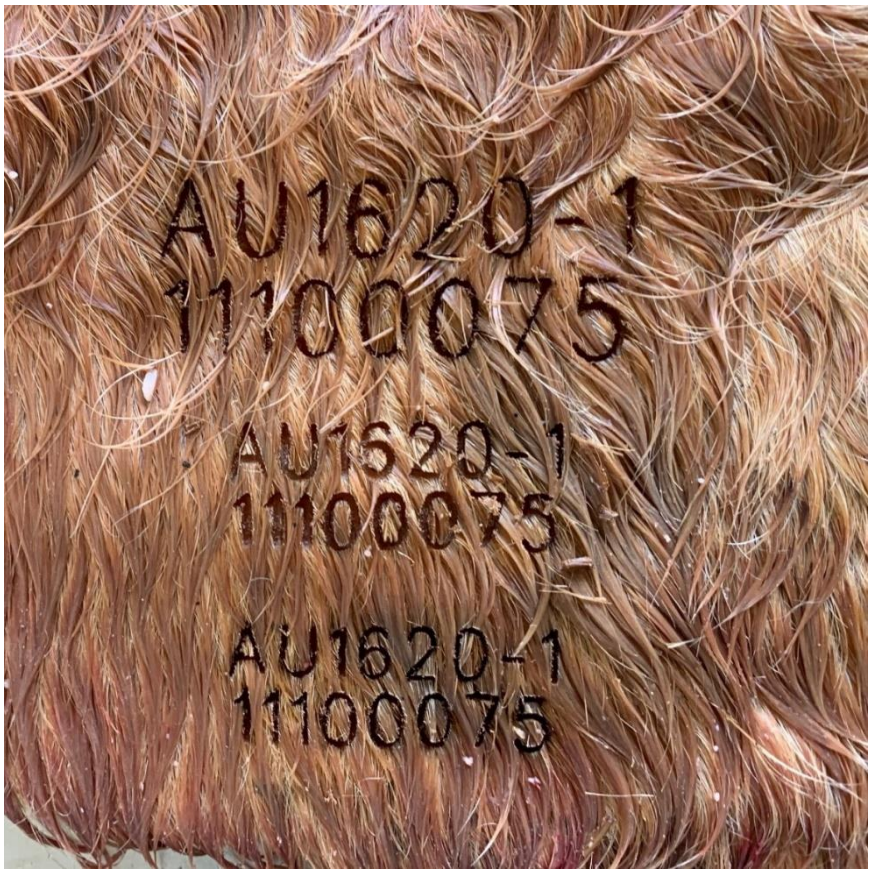
5.6.5 Examples from trials.

Examples from trails are shown below.

Laser mark over brand and the resulting tanned hide

This result shows that even damage hide surfaces can be successfully marked.

Trial phase 1 [Trial 4] examples marks for both raw and tanned.



6.0 Discussion

At time of publishing, the first three stages have been completed, and the fourth stage (Pilot Trial – Phase 2) has started. A custom laser marking system has passed the technical feasibility, being able to mark the outside of hides with ID marks that can still be read after wet-blue tanning. Alfex Laser have been engaged to supply ACC with a custom laser marking system and marking services that have been used to test the technical and operational objectives of the pilot trial.

Overall, 73 hides have been marked at the Processing Facility. Of those 73, 17 have been tanned, photographed, and assessed for their mark's readability. Only one of the hides' ID marks was unreadable after wet-blue grading. The remaining 50 hides have been prepared for export, with shipping expected by 2nd week of July. Feedback is expected from China by 2nd week of August.

7.0 Conclusions / Recommendations

The commercial operation of laser marking hides on the slaughter floor at a suitable point where the carcase has been opened and a flap of the hide is accessible to apply a laser mark appear achievable. The time taken to laser mark the hide with the nominated coding and the applicable size is less than 10 seconds. This 10 second window is compatible with the operational speed of the chain and work stations activities where the hide laser marking would be applied. The nominated position of the laser mark appears to be compatible with the commercial tanning operations and will not be trimmed through the tanning process.

The overall cost per carcase based on capital, operational and maintenance of a laser marking system for hide is yet to be fully demonstrated.

Based on the operational trials to date the laser marking appears to be readable on more than 95% of tanned hides. Issues such as mud and other obstructions on the surface of the hide will block the laser marking the hide surface. Operational processes to mage surface contaminate on the area to be marked will need to be managed on the slaughter floor during the marking process.

The suitability of laser marking in a commercial context needs to be determined by the commercial tanning companies in terms of using the laser mark to report on quality issues back to the processing plants. Feedback on the 50 hides sent to China will be receive once they have been processed.

8.0 Bibliography

The references below are the result of various web searches used for the preparation of this report.

1. A+B Hides (2018) *Traceability* [*PowerPoint presentation*]. Available at: https://www.aplusb-hides.de/wp-content/uploads/2018/05/AB-Hides-Laser-Rückverfolgung.pdf (Accessed: 29 July 2020).
2. Technifor (n.d.), *Dot peen and scribe marking machines*, Available at: https://www.technifor.com.au/products/dotpeen-scribing (Accessed: 29 July 2020).
3. Gravotech (n.d.), *Dot peen marking,* Available at: https://www.gravotech.com/products-and-services/engraving-equipment-and-accessories/dot-peen-marking (Accessed: 29 July 2020).
4. CTC Groupe (2020), *Leather traceability: CTC's unique design for a solution*, Available at: https://www.ctcgroupe.com/en/blog/81/2020-03-25/leather-traceability-ctcs-unique-design-for-a-solution.html (Accessed: 29 July 2020).
5. Eurofins | BLC (2017), *DNA traceability*, Available at: https://www.blcleathertech.com/trending/dna-traceability (Accessed: 29 July 2020).
6. OEKO-TEX (n.d.), *Certification according to leather standard by OEKO-TEX*, Available at: https://www.oeko-tex.com/en/apply-here/leather-standard-by-oeko-tex (Accessed: 29 July 2020).
7. United States Hide, Skin, and Leather Association (n.d.), *Glossary of terms*, Available at: https://www.ushsla.org/content/glossary-terms (Accessed: 29 July 2020).
8. Southern Hide Exports (n.d.) *Australian Cattle*, Available at: https://www.southernhide.com.au/Cattle_Skins.html (Accessed: 29 July 2020).
9. JBS (n.d.), *Dinmore hide plant,* Available at: http://jbssa.com.au/OurFacilities/HideProcessing/default.aspx (Accessed: 29 July 2020).
10. Cuthbertson Brothers Hides & Skins (n.d.), *Tasmanian cattle hides*, Available at: https://cuthbertsonbros.com.au/cattle-hides/ (Accessed: 29 July 2020).
11. Condon, J (2018) *What's behind depressed cattle hide values?*, Beef Central, Available at: https://www.beefcentral.com/processing/whats-behind-depressed-cattle-hide-values/ (Accessed: 29 July 2020).
12. Meat and Livestock Australia (n.d.) *Branding*, Available at: https://www.mla.com.au/research-and-development/animal-health-welfare-and-biosecurity/husbandry/branding/ (Accessed: 29 July 2020).
13. Gregory, GM (1996) *Permanent cattle identification*, North Carolina Cooperative Extension Service, Available at: https://projects.ncsu.edu/cals/an_sci/extension/animal/news/sept96/sept96-2.html (Accessed: 29 July 2020)
14. Burridge, GF (2001) *Hide identification system*, WO2003038132A1. (Accessed: 29 July 2020, retrieved from Google Patents).
15. QC Supply Staff (2018) *Methods for marking livestock*, QC Supply, Available at: https://www.qcsupply.com/blog/product-tips-and-how-tos/methods-for-marking-livestock.html (Accessed: 29 July 2020).

About leather processing.

16. Love your Leather by Trillium TLC (n.d.) *How leather is made in 23 steps*, Available at: https://www.loveyourleather.ca/leather-blog/how-leather-is-made-in-23-steps/ (Accessed: 29 July 2020).
17. Spinneybeck (n.d.) *Architectural products*, Available at: https://www.spinneybeck.com/index.php?/architectural-products/ (Accessed: 29 July 2020).
18. Realgrade Leather (n.d.) *Ethical and sustainable leather from New Zealand*, Available at: https://realgradeleather.org (Accessed: 29 July 2020).

Reports

19. Tveit GM, Thakur M, Vevle G, Mehta S, Standal IB, Greiff K, Indergård E, and Yurt T (2019) 'Traceability of hides through the supply chain', *SINTEF Ocean AS*, accessed on 8th July 2020.
20. Thakur M, Tveit GM, Vevle G and Yurt T (2020) 'A framework for traceability of hides for improved supply chain coordination', *Computers and Electronics in Agriculture*, article no: 105478, accessed on 8th July 2020, doi:10.1016/j.compag.2020.105478

21. Macchion L, Furlan A and Vinelli A (2018) 'The Implementation of Traceability in Fashion Networks' *18th working conference on virtual enterprises*, article no: hal-01674902:86-96, doi:10.1007/978-3-319-65151-4_8

Videos

22. Logical Media Consultants (2015) *How leather is made*. Available at: https://youtu.be/-BB0lA2VSJ0 (Accessed: 29 July 2020).
23. Datamark Systems S.L. (2017) *NEW DATAMARK MP MOBILE PORTABLE DOT PEEN MARKER*. Available at: https://youtu.be/_F9-aU7g8Hs (Accessed: 29 July 2020).
24. A+B Hides (2018) *A+B Hides – Image Film (English)*. Available at: https://www.aplusb-hides.de/en/image-movie/ (Accessed: 29 July 2020).
25. A+B Hides (2018) *6. Traceability*. Available at: https://youtu.be/RsdvXu-Sf44 (Accessed: 29 July 2020)

10.0 Appendices

- Appendix A – Hide Processing Sequence Steps
- Appendix B – Tannery Processing Flow Chart
- Appendix C – Trial Design
- Appendix D – Pilot Trial Phase 1: Trial 1 and 2
- Appendix E – Pilot Trial Phase 1: Trial 3 (Hide conditions)
- Appendix F – Pilot Trial Phase 1: Trial 4 (Post wet-blue graded hides)
- Appendix G – Pilot Trial Phase 1: Trial 5

Appendix A – Hide Processing Sequence Steps

The term hide applies to animal skins used in leather production.

1. Slaughter and hide removal.

During the slaughter process the hide is removed and either directly placed in transport bins for offsite curing or cured on site. Ideally a globally unique hide identification is applied on the slaughter floor that links to the farm and the producer of origin.

2. Curing.

Hides must be preserved to prevent deterioration. This preservation process must be applied ideally as soon as possible after slaughter. These preservation methods often involve salting, freezing, chilling, or the use of chemicals. Often the hide is than packed and stored ready for transport to a tanner for processing.

3. Transporting to a tannery.

Transportation to a tannery. This often will be via a shipping container to another country for tanning. At the receiving tannery, the cured hides may be stored until required for processing.

4. Soaking and shaking.

At the commencement of processing the cured hide is left to soak in water for several hours – sometimes even days. The objective in this step is to rehydrate the hide, as well as to remove any excess salt or dirt. For instance, unwanted deposits of dirt may have occurred during transportation.

5. Painting.

When describing how leather is made, painting refers to removing wool from sheepskins using sulphides.

6. Liming.

The liming steps' primary function is to remove any unwanted hair from the hide through the introduction of alkali. Once the hair has been removed, the result is the raw animal skin. This is more commonly referred to as a pelt.

7. Fleshing.

Fleshing is the process of passing the pelt through a machine that removes any tissue from the flesh side. In some instances, a pelt will also be split into layers at this stage.

8. Optional Splitting prior to Tanning.

Splitting involves separating the hide into a "top-grade" and a "split".

9. De-Liming.

This step involves the graduate neutralization of alkali in the pelt. It is important that this is done gradually, as a rapid change in acidity could result in tissue distortion.

10. Bating.

Enzymes are applied to the pelt, causing it to flatten and relax.

11. Pickling.

Tanning requires pelts to be mildly acidic; therefore, pickling involves the application of weak acids or salt solutions. If a pelt is not to be tanned for several months, a strong solution may be applied to act as a preservative.

12. De-Greasing.

Just prior to tanning, a pelt must have any excess grease removed with water or a mild solvent.

13. Tanning.

Tanning chemically alters the collagen structure of a pelt, such that it is protected against chemicals, moisture, and microorganisms. The objective of this step is the converting of the proteins found in a pelt into a stable material. It is generally done by using:

- Minerals: A mineral, such as salts of chromium, is the most common leather tanning material.
- Oils: When a pelt is tanned with oil, the result is a much softer leather for more fashionable products.
- Vegetables: Plant extracts may be used to produce thick, firm, and brown leather, ideal for belts, shoes, bags, and cases.
- Once a pelt has been tanned, it is now considered leather – but there are still several steps to go before it is ready for sale to a manufacturer.

14. Wet-blue grading.

At this point the hide is referred to as ‘Wet-blue’ as that is the common colour because of the chromium salt tanning. The hide is wet-blue graded where a grade is assigned based of a grading standard.

15. Splitting.

In this step, a machine is used to slice leather into two layers. One of the resulting layers will be without a grain surface. This piece can be used to produce suede or have an artificial grain surface applied to it.

16. Shaving.

With the piece that has a grain surface, another machine is used to shave the non-grain side. This is how leather is made to a desired level of thickness.

17. Neutralization.

This step is done to remove residuals from any of the previous chemical applications. Additional tanning materials may also be applied to create a particular style or texture in the finished product.

18. Dyeing.

Depending upon the intended use for the finished leather, any number of colours may be applied at this stage.

19. Fatliquoring.

This process involves lubricating the leather with oil to ensure it is both flexible and soft. This is especially important when producing leather for fashion, as the absence of oil will cause the leather to become hard as it dries out.

20. Sammying.

Moisture must be taken out of the leather before it will be ready for production. Almost half of the water is removed through multiple machines.

21. Setting Out.

The leather is now stretched, and the grain surface is smoothed out. In so doing, the moisture remaining in the leather is further reduced.

22. Final Drying.

Leather is generally dried until less than 20% water content remains. Several methods can be used, including Vacuum Drying, Toggle rack drying or “toggling”, or Suspension drying.

23. Staking & Dry Drumming.

To ensure that the leather is soft and flexible, it is further massaged in a staking machine. This process separates the fibres. Once complete, the leather is placed inside a rotating drum for extensive tumbling.

24. Buffing & Brushing.

The flesh surface of the leather is now totally removed through buffing to produce a softer feel, or simply to reduce the overall thickness. A thorough brushing happens thereafter to remove any dust accumulated during buffing.

25. Finishing.

Finishing occurs in leather production to ensure even colour, remove any defects on the grain surface, correct the level of gloss, and to add a protective and water-resistant surface. This step can include methods such as rotary spray, embossing, dry milling, and bicast. The hide can also be measured at this step in some processors.

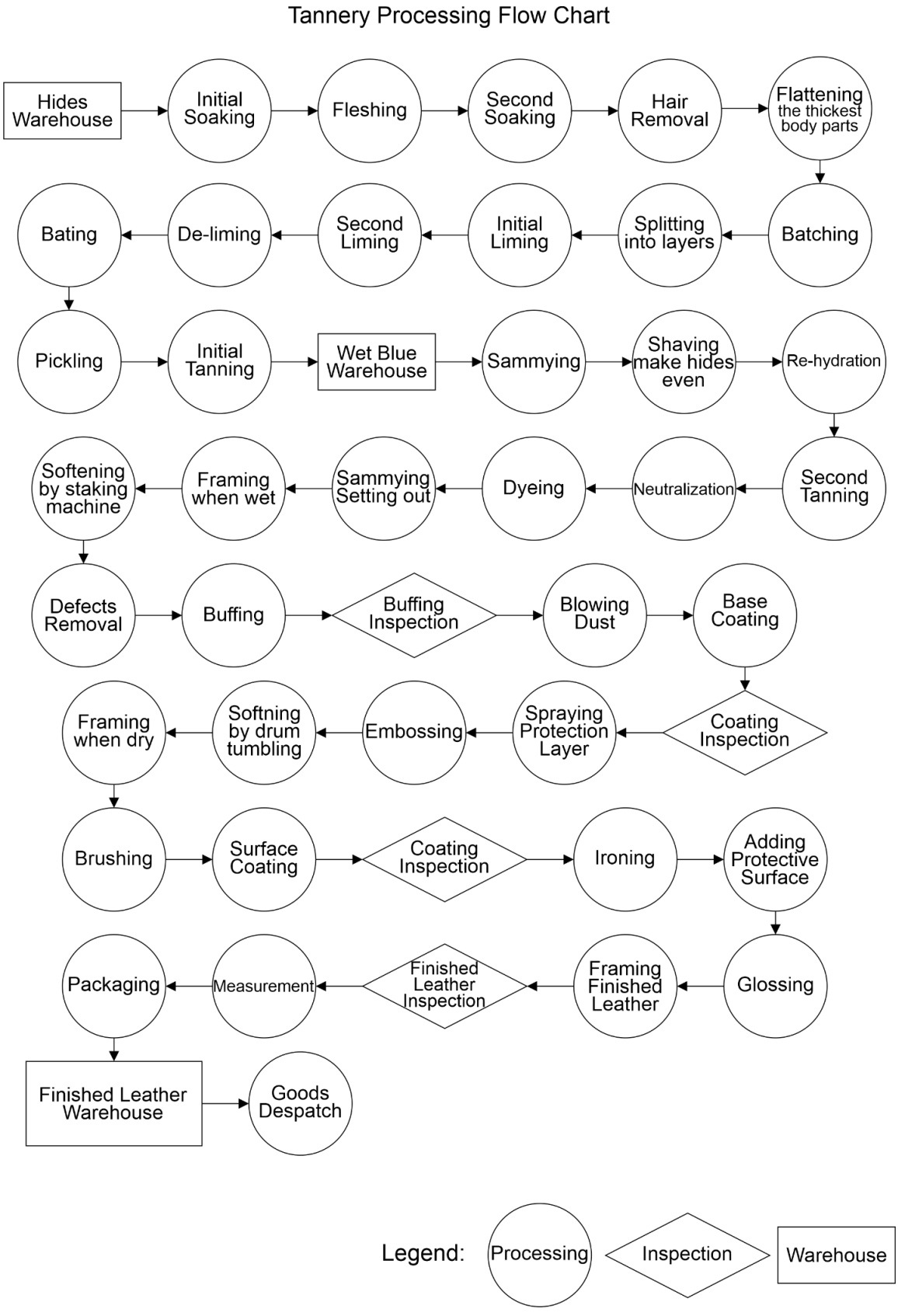
26. Final Grading.

Prior to sale to a manufacturer, the tanner must grade the colour intensity and uniformity of the leather, as well as its feel, softness, thickness, and texture. Any naturally occurring defects, such as scratches, must also be noted during the final grading.

27. Measurement.

The final step is to measure the area of each individual piece, as leather is sold by area. To ensure complete accuracy, measurements are done by machine.

Appendix B – Tannery Processing Flow Chart



Appendix C – Trial Design

Trial objective:

There are two proposed trials:

1. Conduct a very limited trial to test the size and position of the ID mark on both the skin side and flesh side of the hide. This is expected to be limited to less than 5 hides. The hides would have multiple marks of different sizes applied and then tanned locally. The purpose is to evaluate the optimal size, position and skin side or flesh side for the mark to be applied.

Using the feedback from Trial 1 above,

2. Conduct a limited trial applying real marks to a pallet of hides (40 hides – 1 pallet) in a controlled, non-production speed, environment and send the hides through the normal channel as a whole chain trial. The processing channel would be informed of the trial and information requested from them as to the viability of the marks through their respective processes.

Trial 1 design details:

Trial 1 is intended to determine the optimum marking requirements by testing many options on a few hides. The trial design will need to meet the following requirements:

1. The marking trial will take place on a single day in the training room at ACC.
2. The laser marking equipment will be provided and set up by Alfex Laser for that nominated date in the training room at ACC.
3. Up to 5 hides will be collected on the nominated date and brought to the training room for marking. These hides will be hot from the slaughter floor to best represent the physical conditions of the hide during normal processing conditions at ACC.
4. ACC will provide a unit of labour for the day to collect the hides to bring to the training room, conduct any trimming, handling, or storage of the hides.
5. Alfex Laser will provide an operator for the day to setup and use the laser to apply the ID mark.
6. ACC will provide an external consultant for the day to provide instruction on the size, location, and data for the markings to be applied. It is expected that each hide will be marked many times (different sizes and locations) on both the skin side and flesh side.
7. ACC will arrange for the marked hides to be tanned and returned to ACC for inspection and review.
8. The process of marking will be recorded by still photography as well as by video. This activity will be arranged by the ACC provided external consultant.

Points to be determined for trial 1:

- Nominated date for the trial – expect to be completed before the end of August 2020.
- Alfex Laser nominated personnel to attend the day.
- Approval from ACC for the hides to be used.

- Unit of labour from ACC for the physical management of the hides.

When the tanned hides are returned to ACC the hides will be examined in detail to determine as proposed optimal size, location, and side for marking for the trial 2. The examined and consideration will be conducted by ACC nominated personnel, this may include providing photo evidence to the overseas hide processor for feedback on suitability of proposed size, location, and side for marking.

Equipment:

- Alfex Laser iMeta laser marking and engraving system.

Specifications:

- **Type**: CO2.
- **Power**: 90 watts.
- **Connection**: IP67.

Pilot Trial Phase 2 design details:

Trial 2 is intended to determine if the ID mark can survive intact and being readable at the required processing points along the supply chain. The points defining the trial design:

1. The marking trial will take place on a single day in the hide area at ACC. This is likely to require some work areas/ tables being configured for the trail.
2. The laser marking equipment will be provided and set up by Alfex Laser for that nominated date in the hide area at ACC.
3. Up to 40 hides will be collected on the nominated date and presented for marking. These hides will be hot from the slaughter floor to represent what how the hide would appear on the slaughter floor.
4. ACC will provide one to two units of labour for the day to collect the hides to place on the work bench, conduct any trimming, handling, or preparing the marked hides for shipment.
5. Alfex Laser will provide an operator for the day to setup and use the laser to apply the marking.
6. ACC will provide an external consultant for the day to provide instruction on the size, location, and data for the markings to be applied. There is expected to be one mark per hide of the agreed nominated size and position.
7. ACC will arrange for the marked hides to be shipped following the current work practice.
8. The process of marking will be recorded by still photography as well as by video. This activity will be arranged by the ACC provided external consultant.