ENVIRONMENTAL MANAGEMENT PLAN

Meat Processing Facility
Livingstone Locality, NT

Prepared for

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Table of Contents

1.0 INTRODUCTION

This Environmental Management Plan has been prepared as part of the environmental assessment of a cattle processing facility proposed to be established by the Australian Agricultural Company Limited on land approximately eight (8) kilometers south of Noonamah adjacent to the Stuart Highway.

The EMP is intended to guide the environmental management at the processing facility and focuses on the key environmental aspects over which the owners will have some control and influence. These environmental aspects are the basis for development of the operational environmental management plan. Refer to Section 3.0

One aspect over which management has no influence is the build up and onset of the annual wet season. This can have significant environmental effects and has to be carefully considered with the proposed development.

Overall, the environmental objectives of the project are to:

- prevent pollution
- minimize any adverse impacts on the environment, both on and off site
- treat the solid by-products (cattle manure & paunch contents) on an environmentally sustainable basis by composting
- safely dispose of wastewater by beneficially irrigating crops & pasture for haymaking operations
- recycling of salt from hide curing processes.

Importantly, the EMP outlines best practicable environmental management options including regular on-site environmental monitoring, and annual review and reporting of environmental performance. This will enable the Department of Natural Resources, Environment, Arts and Sports (the agency whom is responsible for overseeing implementation of this EMP) to ensure that compliance with this EMP is being achieved.

The design of the facility and the proposed operations satisfy three fundamental pollution reduction and environmental management principles, namely:

- minimisation of process water volumes through implementation of State Of The Art processing designs and water use efficiencies

- beneficial utilization of treated water using effective treatment, storage & irrigation

- recycling composted organic matter on an environmentally sustainable basis.

This document should be read in conjunction with the detailed plans and supporting information that accompanies the Public Environmental Review report.

2.0 THE MEAT PROCESSING FACILITY

Following is a brief description of key features of the proposed facility:-

- The intention is to establish a meat processing facility with a capacity to humanely slaughter and process approximately 1000 cattle per day or over 210,000 head per annum
- The intention is that slaughtering capacity will begin at 240 cattle per day and increase in stages to the maximum intended capacity of 1000 head per day using two shifts
- Facilities to include a fully contained lairage area with about 2 days holding capacity, a State Of The Art slaughter floor with boning and slicing areas, chilling and freezing rooms, rendering plant and bio-filter, a bunded manure/paunch content composting area, water treatment ponds, and treated water irrigation system
- Best management practices will be employed to minimize odour generation
- The property has an area of ~ 600 hectares of mainly gently undulating cropping and pasture land with a centrally located wet area draining to the west
- The typical soil type is a relatively deep mottled yellow duplex soil often with a lateritic &/or ironstone layer at about 80 – 100 cm and deep yellow/grey clayey soils lower in the terrain and associated with seasonally waterlogged areas
- Historically land use has focused on intensive rotational cattle grazing during the wetter seasons and then stock removal and growing out improved pastures for haymaking operations later in the dry season
- The majority of arable land across the property has had improved pastures (mainly Humidicola and Jarra grass) established to enhance livestock carrying capacity and fodder and hay production
- Future land use will focus on the beneficial reuse of treated water by irrigating crops such as lucerne and improved pastures with the objective of maximizing the uptake of applied nutrients and optimal hay production
- Composted cattle manure and paunch contents will be reused offsite
- Construction of the water treatment ponds will include 3 x anaerobic ponds, 3 x aerobic ponds and a 2 cell storage dam designed to treat the water from the facility
- Operation of the storage dam, water balance and irrigation system is to be carefully scrutinized to determine the need for additional water by collection and storage of stormwater runoff to ensure sustainability of the irrigation system and the maximization of fodder production
- Water treatment ponds will be carefully monitored to help ensure optimal treatment of the process water being generated
- An environmental monitoring program is to be undertaken including regular monitoring of treatment ponds, groundwater, surface water and the soils of the irrigation area
- An annual Environmental Monitoring Report outlining the overall environmental performance of the facility will be routinely completed

3.0 ENVIRONMENTAL ASPECTS

Key environmental aspects comprise those elements of the processing operation that may have potential effects on the environment, either harmful or positive effects, and over which management has some control and influence.

The identification of these key environmental aspects is important to help prevent pollution and minimize adverse impacts on the local environment. The following aspects are the basis for development of this environmental management plan.

The key environmental aspects are identified as follows:

- Process Water Treatment System
- Cattle Holding Yards
- Composting Area
- Runoff Holding Dam
- Composting Site & Operations
- Treated water Irrigation System
- Irrigation Management
- Sewage Treatment System
- Salt Evaporation System
- Environmental Monitoring Program

Note that in addition to the above listed aspects separate design information and details have been prepared to support the proposal, covering -

- Stormwater Runoff Management
- Soil Erosion & Sediment Control
- Odour Control – Rendering
- Noise, Dust and Light Impacts
- Traffic impacts

4.0 PROCESS WATER TREATMENT SYSTEM

As indicated above the intention is that approximately 1000 head of cattle will be slaughtered and processed daily in the facility. Water usage at the plant has been calculated as a maximum of two (2) kilolitres per head or two (2) megalitres per day with 75 % of this water ie. approximately 1.5 megalitres, presenting to the water treatment system.

The treatment system is to comprise a series of treatment ponds and dams as follows:-.

- 3 x Anaerobic ponds (Total ~15 ML and 14 days retention time)
- 3 x Aerobic serpentine ponds (Total of ~20 ML and 20 days retention time)
- A Treated Water Storage Dam comprising 2 x separated sections with a common dividing earthen wall

It is generally acknowledged that processing water contains a variety of valuable nutrients including nitrogen (N), phosphorus (P) and potassium (K). When sustainably applied to land these nutrients support significant increases in agricultural productivity and the greater yields of fodder harvested from the plant-soil system.

Table 1. Rainfall and Evaporation – Elizabeth Valley, NT

Month	Mean Monthly Rainfall (mm)	Pan Evap. (mm)	Pond Evap.[1] (mm)
Jan	404.0	186	171
Feb	365.3	160	155
Mar	301.6	180	178
Apr	99.8	189	185
May	20.2	211	205
Jun	0.1	204	200
Jul	0.8	211	207
Aug	2.1	223	212
Sep	18.1	231	224
Oct	74.6	248	236
Nov	158.8	222	220
Dec	311.4	205	201
	1677.9	**2470**	**2394**

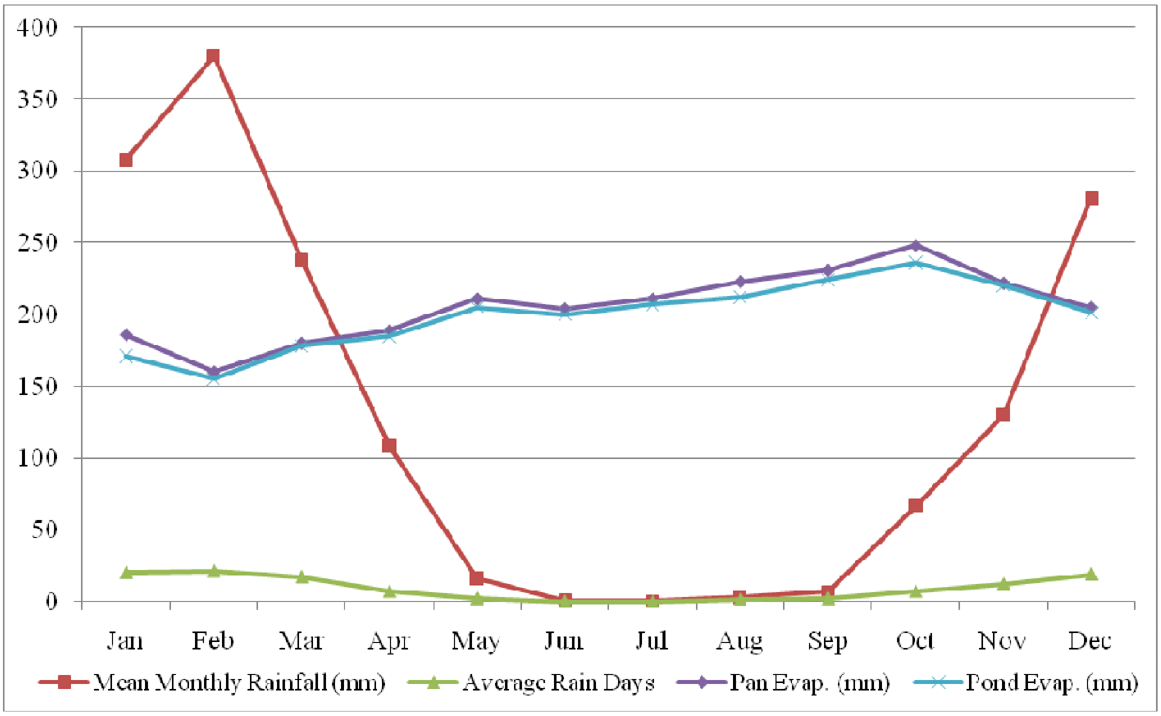
Note 1.

A coefficient is applied to Pan Evaporation allowing for differential evaporation from an open water body which is deeper, cooler and subject to wind action

(Ref. Bureau of Meteorology)

Processing water passes through the series of treatment ponds to the water storage dam and it is from the storage structures that treated water is pumped and beneficially reused by irrigating crops and pasture for haymaking.

Figure 1. Rainfall and Evaporation – Elizabeth Valley, NT



It follows that the sizing of the irrigation area is a key component in achieving environmental sustainability.

The critical design parameter is determined by comparing the area calculated for each parameters' sustainable loading rate as follows:-

- hydraulic loading, or
- treated water constituent/nutrient loading

and then selecting the largest area.

The critical design parameter is that which corresponds to the largest field area requirement.

Details of the treated water volume generated, the water balance, the storage dam and irrigation reuse are outlined in the following sections.

Table 2. Water Balance for Irrigation of Treated Water

Month	Mean Monthly Rainfall (mm)	Mean Monthly Evap (mm)	Crop Factor[1]	Evapo-Transpir. (mm)	Potential Water Applied (mm)
Jan	404.0	186	0.4	74	0
Feb	365.3	160	0.4	64	0
Mar	301.6	180	0.4	72	0
Apr	99.8	189	0.9	170	70
May	20.2	211	0.9	190	170
Jun	0.1	204	0.9	184	184
Jul	0.8	211	0.9	190	189
Aug	2.1	223	0.9	201	199
Sep	18.1	231	0.9	208	190
Oct	74.6	248	0.9	223	148
Nov	158.8	222	0.9	200	41
Dec	311.4	205	0.4	82	0
	1677.9	**2470**		**1858**	**1191**

Note 1. Monthly Crop Factor for Lucerne

4.1 Water Balance

In designing a beneficial treated water irrigation system the local water balance needs to be established to determine the maximum volume of treated water which can be sustainably utilised each year, on average, by the intended agronomic system.

The water balance is generally expressed as follows:-

Design Rainfall + Treated Water Applied = Evapo-transpiration

Table 1. outlines information needed to calculate the water balance including average monthly rainfall, and evaporation for the local district. This data set was chosen as it has recorded data since 1986 (Bureau of Meteorology, 2012) and is considered to be more representative than the data set for Darwin which is more subject to maritime influences.

Note that this rainfall data provides an indication of rainfall distribution across the year. It also indicates rainfall in the buildup to the tropical monsoon and during the wet and dry seasons generally.

Evaporation is usually measured in a Standard Evaporation Pan and is expressed as depth of water (mm) per day. Pan evaporation is adjusted for the particular crop being grown by applying a crop factor. For example the evapo-transpiration of lucerne is determined by multiplying the monthly pan evaporation by the monthly crop factor.

There are differences in evaporation between pan evaporation and an exposed water body such as large water storage ponds so a multiplication factor is also applied to determine pond evaporation. Refer to Table 1.

Table 2. indicates the application of rainfall data, evaporation and the crop factor for lucerne in determining the maximum potential water that can be applied monthly to the irrigation area.

Note that the maximum treated water application amount occurs in August and ostensibly nil irrigation can be applied from December – March. (Depending on the actual rain days in the month there may be opportunities to undertake some irrigation during this period).

The annual potential irrigation amount is 1191 millimetres or 11.9 ML/ha.

Table 3. Processing Water

Month	Water Generated [1.] (ML)	Treated Water Available[2.] (mm)
Jan	8	28.3
Feb	8	28.3
Mar	33	116.6
Apr	32	113.1
May	33	116.6
Jun	32	113.1
Jul	33	116.6
Aug	33	116.6
Sep	32	113.1
Oct	33	116.6
Nov	32	113.1
Dec	28	98.9
	337	**1191**

Note -

1. Calculated based on monthly plant operations with shutdown from mid January – mid February & only operating a single shift in the remainder of these two months eg. January has 10 working days @ 1 shift generating 0.75 ML/day = 7.5 say 8.0 ML/month.
2. Treated water available is calculated as follows eg. January : 8000Kl x 0.1 mm/Kl / 28.3 hectares = 28.3 mm where land area required is 36.5 x 923 Kl/day processing water / 1191 mm of potential water applied

4.2 Treated Water Irrigation Area

As indicated earlier, the sizing of the irrigation area is a key component in achieving environmental sustainability of the treated water reuse system.

Table 3. outlines the monthly volume of process water generated from the plant and this data is used in calculating the required irrigation area.

The irrigation area required, based on hydraulic loading using mean monthly rainfall, is calculated as follows:

Area **= C x Q / H**

Where C is a constant (36.5) covering annual time period and to adjust for units in the calculation
Q is kilolitres process water generated per day (337 ML / 365 days)
H is the potential treated water loading per year (1191 mm)

Area **= 36.5 x 923 / 1191**

= 28.3 Ha

4.3 Treated Water Storage Dam

Calculations relating to storage volume requirements are indicated in Table 4. The accumulated storage column comprises the sum of the monthly change in storage.

Calculations indicate that the maximum storage requirement occurs in April and totals 131.1 megalitres. The surface area of the storage dam is nominally 4 hectares where the required design depth is approximately 3.28 metres.

Importantly, approximately 2.2 metres of additional depth in the storage is necessary to comply with requirements eg. capacity for the Q100 storm including the catchment of the anaerobic and aerobic treatment ponds and the drainage area comprising the composting area and cattle holding yards, plus 0.5 metres of freeboard and 0.5 metres of water to be held in the pond late in the irrigation season to help prevent cracking & maintain the integrity of the clay lining.

Thus the storage pond volumetric capacity is ~200 ML.

Table 4. also indicates a shortfall of approximately 40 megalitres of irrigation water late in the irrigation season (September and October).

Naturally, the above calculations are based on the theoretical modelling using mean rainfall. In practice annual seasonal variations occur and each year is different eg. the length of the dry season, the annual build up and the onset of the Wet, as well as the number of rain days and rainfall distribution across each month.

The local daily rainfall and evaporation ie. the water balance, needs to be monitored as well as a soil based measurement and recording system to track soil moisture content. To operate an environmentally sustainable and productive treated water reuse system it is essential that the daily/weekly management of the process water treatment and irrigation system is responsive to these seasonal variations.

Table 4. Treated Water Storage Dam

Month	Water Available (ML)	Mean Rainfall (mm)	Mean Rainfall (ML)	Total Inflow (ML)	Potential Water Applied (mm)	Treated Water Applied (ML)	Pond Evap. (mm)	Pond Evap. (ML)	Total Losses (ML)	Storage (ML)	Accumulative Storage (ML)
Jan	8	404.0	16.2	24.2	0	0	171	6.8	6.8	17.4	67.9
Feb	8	365.3	14.6	22.6	0	0	155	6.2	6.2	16.4	84.3
Mar	33	301.6	12.1	45.1	0	0	178	7.1	7.1	38.0	122.3
Apr	32	99.8	4.0	36.0	70	19.8	185	7.4	27.2	8.8	131.1
May	33	20.2	0.8	33.8	170	48.1	205	8.2	56.3	-22.5	108.6
Jun	32	0.1	0	32.0	184	52.1	200	8.0	60.1	-28.1	80.5
Jul	33	0.8	0	33.0	189	53.5	207	8.3	61.8	-28.8	51.7
Aug	33	2.1	0.1	33.1	199	56.3	212	8.5	64.8	-31.7	20.0
Sep	32	18.1	0.7	32.7	190	53.8	224	9.0	62.8	-30.1	-10.1
Oct	33	74.6	3.0	36.0	148	41.9	236	9.4	51.3	-15.3	-25.4
Nov	32	158.8	6.4	38.4	41	11.6	220	8.8	20.4	18.0	18.0
Dec	28	311.4	12.5	40.5	0	0	201	8.0	8.0	32.5	50.5
	337	**1677.9**			**1191**		**2394**				

Note:- Storage Dam Nominally 200 m x 200 m x 3.28 m
plus 1.2 m (Q100 storm) plus 0.5 m freeboard plus 0.5 to prevent cracking of clay liner

4.4 Land Area Requirement (Based on Nutrient Loadings)

As indicated above the critical design parameter is determined by comparing the area necessary for hydraulic and nutrient loading rate and then selecting the largest area.

The total volume of the nutrient rich water to be generated from processing has been calculated as 337 ML per year.

The nutrients in process water are widely regarded as a valuable resource for the growth of crops and fodder. When properly applied the nutrient rich water will have beneficial effects on soil fertility generally eg. soil organic matter, soil organisms and physical characteristics such as soil structure.

Note that the Environmental Monitoring Program in Section 13. proposes that treated water will be analysed prior to irrigation to enable fine tuning of irrigation practices and the environmental management operations overall.

Table 5. Estimated Mass of Nutrients in Process Water

Water Constituent	Concentration (mg/Litre)	Treated Water Content (Kg/day)	Nutrients Generated (T/annum)
Total Nitrogen	120	110.76	40.4
Total Phosphorus	40	36.9	13.5

Ref: Meat Research Corporation (1995)

Table 5. estimates the mass of the key nutrients in the treated water annually based on typical concentrations of these constituents.

The key nutrient uptake rates for a number of crops are outlined in Table 6. below.

Note that Blue Pea is a perennial tropical legume that responds to dry season irrigation and is considered a suitable companion to a tropical grass such as Rhodes Grass, a highly productive perennial grass. A paddock with Rhodes Grass and Blue Pea as a companion crop is high yielding and a gross user of Nitrogen and Phosphorus.

Lucerne, another perennial fodder crop, can be grown in the NT and with good management will produce an average yield of approximately 12 tonnes/hectare. It will be a useful option in a rotational cropping program but lucerne is not likely to persist as a viable crop longer than about three seasons due to disease problems arising from the extended seasonal hot and humid weather experienced in the tropical north.

There are a number of other irrigated cropping options outlined in Table 6.

Table 6. Nutrient Content of Harvestable Irrigated Crops & Nutrient Uptake

Crop	Estimated Yield (t/ha)	Nitrogen %	Phosphorus %
Forage Sorghum	15	1.8 (270)	0.3 (45)
Forage Oats	5	1.5 (75)	0.3 (15)
Guinea Grass	22	1.25 (275)	0.44 (97)
Rhodes Grass /Blue Pea	15 10	1.6 (240) 3 (300)	0.16 (24) 0.44 (44)
Lucerne	12	3.5 (420)	0.4 (48)

Note 1. Figures in brackets are kg/ha
2. Refer NSW Agriculture, 1997
3. Ref: Meat Research Corporation (1995)

Table 7. indicates the minimum area required for applications of treated water where applied nutrients are in balance with the nutrients taken up by the various crops and including an allowance of 112 kg/hectare for Phosphorus sorption in the clayey subsoils.

Soil storage is an important sink for Phosphorus and it is well known that many light textured soils in Australia "fix" Phosphorus making it largely unavailable for plant growth. The capacity of a soil to absorb P varies widely but the typical soil to be irrigated is expected to have a P sorption capacity of in excess 1200 Kg/hectare.

Table 7. Minimum Area (Ha) Required for Application of N & P in Treated Water

Crop	Nitrogen[1]	Phosphorus	P + Psorp.[2]
Forage Sorghum	112	300	86
Forage Oats	404	900	106
Guinea Grass	110	139	65
Rhodes Grass /Blue Pea	56	199	**75**
Lucerne	72	281	**84**

Note :-
1. A loss of 25 % of applied Nitrogen due to volatilisation is included
2. Includes an allowance of 112 Kg/Ha P sorption in the soil annually – assuming P sorption capacity of 1200 Kg /Ha and a 10 year life of the area for treated water irrigation

Note that a 72 hectare crop of lucerne will take up the mass of nitrogen in treated water from the proposed facility, allowing for a 25 % loss of applied N through volatilisation. An area of 281 hectares is required to utilise the Phosphorus in the treated water. When P sorption of 112 Kg/Ha is added to the equation the area of lucerne required for applied Phosphorus is 84 hectares.

Remembering that the critical design parameter is determined by selecting the largest area calculated, assuming the nominated rate of P sorption, with a Lucerne crop the critical area is determined by the Phosphorus loading rate.

The area of Rhodes Grass/Blue Pea necessary to take up the phosphorus in the treated water (allowing for 112 Kg/Ha of P sorption) is 75 hectares.

In conclusion :-

- Relatively large cropping areas are required to utilise and balance the nutrients applied in the treated water
- Controlling and managing the nutrients in the treated water is the critical design issue rather than the hydraulic loading
- Additional irrigation water is essential to help maximise the harvestable yield of the crop ie. calculations for hydraulic loading indicate an area of 28.3 hectares is required but to utilise the nutrients in treated water growing lucerne an area of 84 hectares is required (Refer to Section 4.5 and Section 10.3)

As discussed above, the proposed Environmental Monitoring Program, including analysis of the treated water prior to irrigation and soils analysis, will verify the quality of the treated water and help determine the effect of irrigation operations.

Application rates and land and soil management practices can then be subject to fine-tuning and be modified to ensure implementation of a sustainable water reuse system.

Importantly, the processing facility and waste management infrastructure will only take up a minor portion of the proposed area of land AACo are considering for purchase if the project is to proceed.

4.5 Additional Irrigation Water

The basic objective with any irrigation system is to supply sufficient water to meet the needs of the crop and thereby help to maximise plant productivity and overall crop yield. This cannot be achieved if the plant is under water stress.

Earlier discussions indicate that in planning treated water reuse schemes the critical design parameter ie. either hydraulic loading or nutrient loading, is that which corresponds to the largest field area requirement.

The calculations show that the real issue is managing and controlling the nutrients in the treated water because these require the largest area.

Table 7. for example, indicates that 84 hectares of lucerne is needed to balance applied P with that taken up in by the crop or sorbed in the soil profile.

The quoted nutrient use and uptake for lucerne assumes that there is enough water ie. rainfall and irrigation to meet the water needs of the crop. As stated above, Table 4. indicates a shortfall of stored water late in the dry irrigation season and this relates to an area of only 28.3 hectares.

These calculations indicate that there is insufficient treated water to permit maximum crop yield and therefore without additional irrigation water supply crop productivity and nutrient uptake would be significantly reduced.

The local water balance (See Table 2.) indicates that ~11.9 megalitres of water per hectare is required during the irrigation season from April to November in the average rainfall year. Therefore the additional irrigation water required is calculated as follows :-

$$\mathbf{W} = \mathbf{(A - B) \times I \times D}$$
$$= \mathbf{55.7 \times 11.9 \times 0.85}$$
$$= \mathbf{\sim 565\ ML}$$

Where W Irrigation water
A Nutrient application area (84 ha)
B Area for hydraulic loading (28.3 ha)
I Potential irrigation volume (11.9 ML/ha)
D Coefficient allowing for a “deficit irrigation” strategy

Section 10.3 discusses the “deficit irrigation” strategy often employed at meat processing facilities where irrigation water supply is limiting. Essentially it involves irrigating the available water at the crop growth stage when it is of most benefit to help maximise production and thereby the uptake of applied nutrients.

In terms of sourcing this additional water supply, it is proposed to construct up to three (3) stormwater runoff dams, to be sited immediately below each of the three potential irrigation areas, to harvest wet season runoff from within the property. It is proposed that these dams will each have a volumetric capacity of ~200 ML.

Typical design specifications of these stormwater runoff storage dams is outlined as follows :-

Batter grades	-	1V:3H
Crest width	-	4 m
Width	-	120 m
Length	-	280 m
Depth	-	6 m

Bureau of Meteorology records for Elizabeth Valley indicate that there is ~1481 mm of rainfall from December to April in the average rainfall year and ~920 mm of evaporation in this period giving a difference of ~ 561 mm.

Assuming a Coefficient of Runoff of 0.85 then a catchment area of ~107 hectares would yield ~ 600 ML.

Additional water would be conveyed from the holding dam collecting runoff from the cattle holding yards and composting area ie. a combined catchment of ~ 3.6 hectares. This additional water is estimated at ~20 ML ie. average rainfall less evaporation in December to April.

5.0 CATTLE HOLDING YARDS

Cattle will generally be transported to the plant by road trains with a carrying capacity of about 160 head. The cattle holding yards are to have 1.5 days processing capacity plus 0.5 days capacity for load in ie. a total capacity of approximately 2000 head.

The plan is to have 12 cattle yards of 20 m x 40 m and providing ~5 metres^2 per head.

Allowing for access roading above, a cattle laneway and a catch drain below and the unloading pen the overall dimensions of the complex is 280 m x 50 m or 1.4 hectares.

Even though the manure from the cattle holding yards at the proposed facility is to be regularly scraped and cleaned out, the runoff can be heavily contaminated with organic wastes. The regularity of cleaning and manure removal intervals influence sediment accumulation volumes in sedimentation structures.

To help prevent polluted runoff from entering natural waterways a specially designed sedimentation and runoff water holding system is to be constructed.

A fundamental requirement with such a system is that the catchment of the holding yards be the minimum necessary and that the area be fully contained as a "controlled drainage area". Extraneous runon water is to be diverted and safely conveyed away from the cattle complex.

A key component of the system is a sediment removal structure where solids entrained in the runoff are separated from the liquid portion, mainly by settling, prior to the runoff entering the holding dam.

At this site it is intended that there be a common runoff holding dam to retain the runoff from both the cattle holding yards and the proposed composting area (See Section 6.). Temporarily, stored runoff will be safely conveyed to the large water storage holding dam for subsequent disposal by irrigation.

5.1 Sedimentation System

It is proposed that the sedimentation structure comprise a shallow elongated trafficable sedimentation terrace. A trafficable terrace is one that has a concrete entry/exit ramp and compacted gravel bed. The design includes a multi-celled structure to optimise settling of solids and to facilitate removal and clean out.

Cells will be separated by throttle weir structures as will the discharge points to the holding dam. The throttle weir performs as a discharge regulator and helps to reduce flow velocity and thereby promote the settling out of solids/manure.

Note that the important variables in terrace design are the basin volume, bed width and length dimensions, bed slope and discharge regulator flow characteristics. With the intended single vertical slot discharge regulator the most important design parameters are the height and aperture width.

Solids cleaned from the sedimentation system will be incorporated into manure stockpiles and be composted into a stable moist and crumbly dark soil-like product.

The formula for design of sedimentation terraces comprises a calculation of the volume required to achieve significant settling of solids as follows :-

$$\mathbf{V = Qp \times (l/w) \times z / v}$$

where:	V	=	volumetric capacity of sedimentation terrace
	Qp	=	peak inflow rate (m^3/s) ARI 1 –20 Year (Tc is 12 min.)
	l/w	=	length to width ratio (l is length of direction of flow)
	z	=	a scaling factor (1.0 for this site)
	v	=	maximum flow velocity 0.005 m/s.

Therefore

$$\mathbf{V = Qp \times (l/w) \times z / v}$$
$$\mathbf{= 0.7 \times 8 \times 1 / 0.005}$$
$$\mathbf{= 1120\ metres^3}$$

The proposed 2 cell sedimentation terrace has a design capacity of 1120 metres³. It is proposed that the design of the terrace conform with the following specifications:-

Bank height	-	1.0 m (outside bank)
Batter grades	-	1V:2.5H
Crest width	-	1 m
Terrace width	-	12.5 m
Depth of cell	-	0.9 m
Terrace length	-	100 m

Note :- The designs comply with the *National Guidelines for Beef Cattle Feedlots in Aus.* (Standing Comm. Agriculture and Resource Management, 1997). The National Guidelines are developed by the three tiers of government working with the beef industry and animal welfare organisations.

5.2 Runoff Holding Dam

The purpose of the retention or runoff holding dam is to temporarily hold treated runoff for safe conveyance to the large treated water storage dam and thereby prevent its discharge to natural drainage. It is intended as a temporary, short-term holding dam not as an anaerobic treatment pond or evaporation pond.

The approach adopted in designing the holding dam is the major storm design method ie. based on the 1 – 20 year, 24 hr storm event over the area of the yards and composting. Note that in the event of Q100 rainfall event all of the runoff would be conveyed to the treated water storage dam.

As there is to be a common runoff holding dam to retain the runoff from both the cattle holding yards and the proposed composting area the design details are outlined in a subsequent part of this document after consideration of the composting area drainage system. Refer to Section 7.0.

6.0 COMPOSTING AREA

As discussed above it is proposed that ~1000 head of cattle will be processed daily and that about 1000 cattle will be held in the cattle unloading and holding yards when the facility is operating at capacity.

It is therefore estimated that approximately 1000 tonnes of manure will be cleaned from the cattle holding yards per year and this by-product, along with the fibrous paunch content, is to be composted into a stable moist and crumbly dark soil-like product.

The composting area will include numerous active stockpiles to be regularly turned and aerated as well as a minimal amount of stockpiled product that has been through the composting process and is ready for transport, mainly for reuse off site.

Similar to the cattle holding yards composting will be carried out on a fully contained and compacted area that forms part of the “controlled drainage area”.

Extraneous runon water is to be diverted and safely conveyed away and stormwater runoff from the composting area will be directed to the runoff holding dam via a specially designed sedimentation structure.

As per the cattle holding yards, a key component of the controlled drainage system is a sedimentation terrace where solids entrained in the runoff are separated from the liquid portion prior to the runoff entering the holding dam.

The runoff is to be conveyed to the large treated water storage dam where it will ultimately be reused for irrigation of crops grown for haymaking.

The composting facility will be approximately 150 m x 135 m or 2 hectares.

6.1 Sedimentation System

It is proposed that the sedimentation structure comprise a shallow elongated trafficable multi-celled sedimentation terrace.

Cells will be separated by throttle weir structures as will the discharge point to the holding dam.

The formula for design of sedimentation terraces comprises a calculation of the volume required to achieve significant settling of solids as follows :-

$$\mathbf{V = Qp \times (l/w) \times z / v}$$

where:	V	=	volumetric capacity of sedimentation terrace
	Qp	=	peak inflow rate (m^3/s) ARI 1 –20 Year (Tc is 10 min.)
	l/w	=	length to width ratio (l is length of direction of flow)
	z	=	a scaling factor (1.0 for this site)
	v	=	maximum flow velocity 0.005 m/s.

Therefore

$$\mathbf{V = Qp \times (l/w) \times z / v}$$

$$\mathbf{= 0.95 \times 8 \times 1 / 0.005}$$

$$\mathbf{= 1520 \text{ metres}^3}$$

Therefore the 2 cell sedimentation terrace has a design capacity of 1520 metres^3.

It is proposed that the design of the terrace conform with the following specifications:-

Bank height	-	1.0 m (outside bank)
Batter grades	-	1V:2.5H
Crest width	-	1 m
Terrace width	-	14 m
Terrace length	-	110 m
Terrace depth	-	1.0 m

7.0 RUNOFF HOLDING DAM

As stated in Section 5.2 the purpose of the holding dam is to temporarily hold the runoff from both the cattle holding yards and composting area before it is conveyed to the treated water storage dam and subsequently irrigated onto cropping paddocks.

The stated approach in designing the holding dam is the major storm design method ie. based on the 1 – 20 year, 24 hr storm event.

The design volume of holding dams is calculated as follows :-

$$V = C \times (I \times 24) \times A$$

where:	V	=	volumetric capacity
	C	=	Coefficient of Runoff (0.8)
	I	=	Rainfall intensity (mm/hr) of 1 – 20 Yr 24 hour storm (9.37 mm/hour)
	A	=	Area factor inclusive of the sedimentation structures (36.0)

Therefore

$$V = C \times (I \times 24) \times A$$
$$= 0.8 \times 225 \times 36.0$$
$$= 6480 \text{ metres}^3$$

It is proposed that the design of the structure conform with the following specifications including two identical storage cells (~3240 m^3) divided by a common internal wall as follows:-

Batter grades	-	1V:3H
Crest width	-	3 m
Width	-	30 m
Length	-	60 m
Depth	-	4 m
Freeboard	-	0.5 m

The spillway and channel will be designed with the capacity for the Q100 and a Peak Discharge of 1.89 metres^3/second where Tc is 13.3 minutes and Rainfall Intensity is 222 mm/hour.

Note :-

The design of the dam complies with the *National Guidelines for Beef Cattle Feedlots in Aus.* (Standing Comm. Agriculture and Resource Management, 1997).

The *National Guidelines* were developed by the tree tiers of government working with the beef industry and animal welfare organizations.

However, the runoff storage and conveyance system dealing with this “controlled drainage area” of 3.6 hectares is designed with the capacity for the Q100 rainfall event.

Assuming a Coefficient of Runoff of 1.0 ~500 mm (1-100 year, 72 hour rainfall event) off 3.6 hectares will be safely conveyed to the Treated Water Storage Dam.

This volume comprises ~ 18 ML of water.

Similarly, the ~500 mm of rainfall over the localised catchment of the anaerobic and aerobic treatment ponds of ~2 hectares is calculated as a volume of ~10 ML.

The Treated Water Storage Dam has been designed with a volumetric capacity to store all this rainfall from the Q100, 72 hour duration rain event ie. a total of ~28 ML, plus that which falls on the catchment of the storage dam itself.

Thus the Treated Water Storage Dam (4 hectare surface area) has a design capacity of ~ 200 ML including :-

-	treated water depth	=	3.28 m
-	Q100 rain event	=	1.2 m
-	Freeboard	=	0.5 m
-	Water held for lining integrity	=	0.5 m
	Total Depth	**=**	**~5.5 m**

8.0 COMPOSTING SITE AND OPERATIONS

8.1 Composting Site

It is considered important to summarise a few key features of the proposed composting area to help demonstrate that adverse environmental impacts to surface and groundwaters have been minimised as follows :-

- the site has been selected in part because it is above the land that experiences periodic and seasonal inundation by stormwater and is not flood prone
- extraneous runon stormwater has been diverted away and safely conveyed to natural drainage
- the composting area forms a fully contained "controlled drainage area"
- construction will ensure that a properly compacted clayey base with a gravel surface lining be established to ensure all weather access and to minimise the downwards movement of salts
- a specialised sedimentation system has been incorporated into the design ie. a trafficable sedimentation terrace to separate and settle solids entrained in runoff
- runoff is to be directed to a runoff holding dam before it is safely conveyed to the treated water storage dam for subsequent irrigation

Note that great care will be taken to not disturb the manure/surface interface during operations on the composting pad because the compacted organic lining that develops is a relatively impermeable barrier to any downwards movement of leachate and salts.

8.2 The Composting Operation

It is considered relevant that a brief description of the proposed composting operation be outlined.

Essentially, the manure and organic matter collected from various sources associated with the proposed facility including the cattle holding yards and unloading area, solids cleaned from sedimentation structures and the fibrous paunch contents from the so called "green stream" are to be subjected to composting.

Composting involves the microbial conversion of biodegradable organic matter over a minimum of 6 weeks into a relatively stable humus by thermophilic organisms under controlled conditions (Aust. Standard AS 4454-1999).

It is generally conducted under aerobic conditions facilitated by regular turning of material stockpiled in windrows to remove released moisture, remove excess heat, release the carbon dioxide generated by the process and to introduce atmospheric oxygen.

The end product of composting is generally described as having the following characteristics :-

- a stabilised product that can be stored or easily spread on farm land
- little odour nor fly breeding potential
- improved physical properties such as relatively uniform particle size, friable texture, reduced volume and weight and low moisture content (<35 %)
- weed seeds and most pathogens have been sterilised
- the three major plant nutrients Nitrogen, Phosphorus and Potassium are generally retained

8.3 Composting System Management

The objective in managing the overall composting system is to minimise any adverse environmental impacts.

The above discussion indicates that the composting site is to be constructed to operate as a fully contained area in relation to surface and groundwater impacts.

Following is an outline of the operational procedures to be implemented in composting :-

- organic matter from the various sources around the facility will be regularly collected, mixed and formed into windrows of ~2 metres high with a base of ~4-5 metres
- the mix of cattle manure and paunch contents will be managed to achieve the ideal Carbon:Nitrogen range for microorganisms to decompose organic matter of about 1: 20-30
- the initial pH of the mix will be assessed and if it is found to be too acid ie. < pH 6.0, then a buffering agent or lime will be provided to raise it closer to the ideal of pH 6.5 – 7.2
- temperature is the main determinant of the rate of composting so the temperature is to be regularly monitored using a portable electronic thermometer with a long probe to reach the centre of the pile
- the optimum temperature is ~50-60 ^{0}C so regular turning of the windrow will be employed to stimulate or control heat production
- typically the turning frequency will be as follows :-

1st week	3	turnings
2nd week	2	turnings
3rd week	2	turnings
4th week &		
5th week	1	turning
5th & above	0	turning

- the moisture content for aerobic thermophilic composting should be about 40-60 % so this will be regularly monitored and if the composting material is too dry supplemental water will be added

The minimum composting period is 6 weeks and depending on the composting operation windrows would generally go through a further curing period of another 6 weeks or so prior to transport off site.

9.0 TREATED WATER IRRIGATION SYSTEM

As discussed earlier the basic objective with any irrigation system is to supply sufficient water to meet the needs of the crop, prevent water stress and thereby help to maximise plant productivity and overall crop yield.

When operating an environmentally sustainable treated water irrigation system there are other requirements that have to be met (i.e. the system needs to match the nutrients applied with that taken up by the crop or immobilised in the soil).

As is normally the case with a meat processing facility the critical design parameter here is the nutrient load in the treated water which significantly increases the land area required over and above that needed based on the hydraulic loading and the local water balance.

Thus significantly more irrigation water is needed for this larger area (not ~27 but ~84 hectares of lucerne) for the crop to reach its yield potential.

It appears that this water will need to be sourced from stormwater runoff during the wet and be retained in a series of large storage dams until needed during the long dry season.

9.1 System Requirements

In deciding on an appropriate type of irrigation system there are a number of factors that were considered including the local soil characteristics such as infiltration rate, soil depth, the water holding capacity and readily available water and nutrient immobilisation capacity (P sorption).

Agronomic issues included the type of crop and pasture to be grown, its growth pattern and seasonality, type of root system and rooting depth, as well as nutrient requirements have also been considered.

A key feature of an efficient irrigation system is that it has the capacity to deliver the required water uniformly across the irrigated area, can supply the required capacity needed during the peak summer period and at an application rate that is less than the infiltration rate of the soil.

For a large scale operation such as the one proposed this necessarily means a pressurised spray irrigation system, either a large mobile irrigation machine ie. a centre pivot, and/or a travelling gun irrigator, each dedicated to unique irrigation areas.

9.2 Spray Irrigation Systems

Spray irrigation systems are the most flexible and are generally recommended for treated water irrigation for a number of reasons including :-

- they are relatively easy to set up and manage

- they are suitable for the intended types of crops to be grown, the soil types and the topographic features of the land

Another important factor is that spray irrigation systems result in significant loss to the atmosphere of nitrogen from the system in gaseous form as a result of volatilisation. This is estimated at ~25 % at this location. The net effect of these nitrogen losses is the reduction in area of land needed to balance applied nitrogen with that taken up.

<u>Centre Pivot Machines</u>

These large mobile irrigation machines, being self propelled, require less labour than alternative systems. As well, centre pivot machines are particularly useful for the frequent watering needed when water is limiting and, as in this case, where a strategy of “deficit irrigation” is to be employed.

Another obvious advantage with centre pivot machines is that after completing a duty circuit the machine is back at its starting point and in place to begin the next watering.

<u>Travelling Irrigators</u>

Travelling irrigators have a single spray head with a large rain gun and rely on the irrigator head being moved across the field by a winch arrangement driven by a water turbine which obtains its power from the flow of water on its way to the irrigator.

Because they require high water pressure they have high operating and power costs.

A problem can be that the large jet of water can be affected by medium to strong wind leading to uneven watering and the risk of nuisance to neighbours from spray drift. This can be overcome by only watering during calm weather and ensuring adequate buffer distances to property boundaries.

Travelling irrigators are popular because of the relative simplicity of their mode of operation.

10.0 IRRIGATION MANAGEMENT

This section outlines a number of key operational requirements for managing the treated water irrigation system.

10.1 Nutrient Management

The management of the nutrients in the treated water is the main issue for sustainable irrigation.

Earlier sections of the report have discussed the fact that processing water contains high levels of both nitrogen and phosphorus. The treatment ponds do not remove significant quantities of nitrogen or phosphorus but mainly act in reducing the BOD (reflective of organic matter) in process water and convert organic nitrogen (proteins) into ammonium.

Nitrogen goes through a number of transformations i.e. proteins are mineralised to form ammonia and ammonia is transformed by nitrification into nitrates. It is this nitrate form of nitrogen that is the plant available form i.e. it is in solution where it can be taken up via plant roots.

Thus nitrate nitrogen can also become a pollutant because it is readily transported by runoff to natural watercourses or through drainage from soils to groundwater. This is why it is important to carefully balance the nitrogen applied in the process water with that quantity taken up and removed from the soil/plant system in haymaking operations.

With regard to the other major nutrient in treated water ie. phosphorus, the main way that phosphorus becomes a pollutant is when soil particles are transported off site by soil erosion.

Because phosphorus compounds in solution are readily sorbed to clay particles they can become fixed or immobilised within the soil profile.

Note that laboratory test results confirm these soils have a good P sorption capacity.

Preventing soil erosion eg. by using land according to its capability, minimising soil disturbance and being mindful of the need to retain a protective surface cover, is important in operating an environmentally sustainable irrigation system.

To determine the key constituents in treated water and to facilitate proper irrigation management practices it is intended that the treated water be regularly analysed. Refer to Table 8. which lists the wastewater analysis parameters.

Decisions on the area over which irrigation will be undertaken ie. allowing for sustainable nutrient application rates, as well as consideration of the water volumes available will determine the need for special irrigation practices such as “deficit irrigation”. Refer to Section 10.3.

Table 8. Treated Water Analysis Parameters

Test Parameter	Comment
Total Nitrogen	Measures nitrogen for calculating N balance ie. that applied & removed in hay
Ammonium-N	Measures nitrogen available or potentially lost through volatilisation
Nitrate-N	That nitrogen in solution & readily available to plants
Total Phosphorus	Measures phosphorus for calculating P balance ie. that applied & removed in hay
Electrical Conductivity & Chloride	Treated water salinity
Sodium Absorption Ratio	Treated water sodicity

10.2 Irrigation Scheduling

The key to irrigation cropping is in scheduling the application of water so that the crop always has sufficient water for growth ie. normally water lost by evapo-transpiration is replaced when the soil moisture holding capacity is depleted by about 50 %.

As discussed, irrigating with treated water is different to this scenario because it is dictated by nutrient application rates and the limits to water supply will mean operation of a deficit irrigation regime.

Practical operation of the irrigation system requires knowledge of the soil type and profile depth, rooting depth of the crop or pasture and the available water capacity of the soil ie. mm water/metre depth of soil.

NABL plans to establish a soil based measurement and recording system to track soil moisture and help make decisions on when and how much irrigation water to apply.

Naturally, within the design and limits of the irrigation system, the operation will endeavour to avoid under watering and thus retarding crop growth, as well as over watering, causing surface ponding, runoff and/or deep drainage of applied water from the soil profile.

10.3 Deficit Irrigation

It is planned that the irrigation system will operate under a deficit irrigation regime.

An irrigation system employing a deficit irrigation strategy generally has the following characteristics :-

- water is applied more frequently than normal (every 2-3 days) and in smaller quantities
- the top 30 cm of soil is maintained at >50 % of the moisture storage capacity for the first 2-3 weeks after planting a crop
- in dry weather, frequent irrigations are carried out aiming to maintain the moisture content of the top 30 cm of soil above 30 % of capacity
- irrigation only ever supplies up to 85 % of the soil moisture storage capacity
- the limited water is applied at the crop growth stage when it is of most benefit eg. the sensitive stage for lucerne and perennial pastures is just after hay is made and with cereal crops it is generally at flowering and seed formation
- almost full crop production can be achieved with a 15-30 % saving on the normal irrigation requirement (MRC, 1995)

Calculations in Section 4. indicate that to achieve a nutrient balance using treated water the land area required is approximately three (3) times the area needed to balance the hydraulic loading ie. ~84 hectares versus ~27 hectares.

The monthly water balance (Table 2.) indicates that ~11.9 megalitres of irrigation water per hectare is required during the dry cropping season.

Even adopting a deficit irrigation strategy it is apparent that additional irrigation water in the order of ~ 500-600 megalitres is required.

To address this situation it is intended that <u>a series of up to three (3) ~200 ML storage dams will be designed and constructed</u>. These dams are to be sited downgradient of each of the irrigation areas to harvest wet season stormwater runoff.

10.4 Irrigation Management Plan

AACo intends that a site specific Irrigation Management Plan will be developed detailing the necessary procedures to maintain optimal performance of the irrigation system and ensure that any adverse environmental impacts are minimised.

Best management practices will be employed to ensure that the system is environmentally sustainable including nutrient management, irrigation scheduling and deficit irrigation strategies and the all important monitoring program (Refer to Section 14.) to demonstrate the environmental performance of the system.

In addition to, and to compliment the targeted monitoring of the soils, groundwater and surface waters detailed in Section 14. a documented operational, management and control system will be developed including details on the following :-

- the process water treatment system performance
- irrigation operations including the water balance & irrigation scheduling
- quantification of nutrients generated & nutrient balancing

- crops/pasture yields (harvested as hay or forage)
- the salt balance and leaching
- crop/pasture management including a 3-5 year rotational plan
- soil erosion control
- buffer zones & vegetative screens
- composted solids
- reporting on scheme performance

In discussing the sustainability of the irrigation system it is noted that grazing of cattle is not a viable nutrient removal practice because over 90 % of the nutrient in feed is returned to the land in manure.

11.0 SEWAGE TREATMENT SYSTEM

Similar to other cattle processing facilities around the country the sewage treatment system will comprise concrete sealed primary septic tanks where the outflow will be piped direct to the treatment ponds for further treatment.

As per information outlined in Section 4. the system allows for in excess of 30 days of process water treatment, useful for pathogen control. Importantly, the irrigation system is not to be used for food production but will be used on crops grown for haymaking for cattle feed.

Safeguards and public health controls will include :-

- Irrigation areas will be left for a minimum withholding period of 4 hours or until the area has dried out before they are accessed
- Treated water application controls will help prevent spray drift
- Vegetated buffer zones will be established between irrigation areas, the property boundary and public areas
- Irrigation areas will be fenced with signage to restricting public access

12.0 SALT EVAPORATION SYSTEM

As in other similar facilities salting of hides is to be carried out in a separate fully contained and bunded hide shed located adjacent to the rendering plant.

This area would occasionally undergo a washdown process where the salty wastewater would be collected and transported in a sealed tank to the salt evaporation structure.

The salt evaporation pans will comprise a concrete lined and fully covered two (2) celled structure where evaporation and filling takes place periodically in the alternative sections. The properly sealed concrete evaporation structure is to have double ended trafficable entry/exit ramps to facilitate recovery of the dried salt.

Dried salt will be transported off site for either recycling or go to an approved waste disposal facility.

13.0 COMMUNITY HEALTH AND AMENITY

The proposed operations have the potential to impact upon the external environment, and consequently community health and amenity. Broadly, potential impacts may include:

- Odour sources impacting on sensitive receivers in the locality
- Noise impacting upon sensitive receivers in the area
- Dust creating health issues for personnel and sensitive receivers in the immediate vicinity of the operation
- Light spill affecting neighbouring properties
- Increases in local road and rail traffic including heavy vehicles posing a safety risk to other road users, and
- Facilitation of breeding areas for mosquitoes and the attraction of pest species such as vermin.

All of the above issues, including potential impacts and associated mitigation measures are detailed in other sections of the PER Report, specifically: Section 5.3.3.1 (odour); Section 5.3.3.2 (noise); Section5.3.3.4 (dust); chapter 5.3.3.3 (light); chapter 5.3.3.6 (traffic); and chapter 5.3.3.5 (pest species).

Additionally, although most unlikely, the potential for mass mortality has been identified by the proponent as an issue that may potentially impact upon community health and amenity. As such, a contingency plan will be in place to ensure that carcasses will be properly disposed of. In these circumstances, pending the cause and nature of the event, the rendering plant would be utilised to process the dead animals.

The management of mosquito breeding areas is detailed in Section 13.1 below.

13.1 Mosquito Management Plan

A number of measures have been proposed in accordance with NT Department of Health guidelines (1998; 2005; 2006; 2009) to ensure that the operations do not pose a public health risks from the facilitation or creation of mosquito breeding areas:

1. Cattle holding yards are fully contained with all runoff directed to the holding dam via the sedimentation structure and in earthen trapezoidal shaped channels with 0.5% slope gradient - preventing surface ponding and mosquito breeding sites
2. Anaerobic and aerobic water treatment ponds will likely be lined with an impermeable flexible membrane which will extend up near the top of the embankment well above full supply levels - helping to prevent vegetation growth and the likelihood of mosquito breeding
3. Treated water storage dams will naturally have a sloping floor (~0.5% slope gradient) to facilitate drainage and cleaning in the future
4. See Point 2. - Embankments on treated water storage dam are likely to be lined with an impermeable flexible membrane to well above full supply level –additionally an ongoing weed control program will routinely be undertaken
5. Irrigation operations will be undertaken based on the local water balance, irrigation

scheduling and allowing for the infiltration and percolation capacity of the soil to prevent saturation of the soil profile, surface ponding and treated water runoff
6. A system of "interception" banks and channels will safely convey storm runoff to storage dams with sloping floors (~0.5% gradient)
7. Two options are proposed for consideration by the Department of Health :

   - proposed solids treatment on impermeable & compacted clay base, in a fully contained area with runoff directed to holding dam for conveyance to treated water storage dam via sedimentation structures; or
   - Collect and transport solids eg. collected manure, paunch content & solids cleaned from ponds and sedimentation structures, periodically off site to an approved waste disposal facility or to an agricultural area for treatment or spreading on farm land.

- ensure that all areas around the plant, as well as that associated with meatworks infrastructure, are well drained to eliminate shallow standing water and the potential for mosquito breeding
- regularly mow or slash grassed or vegetated areas around the plant and infrastructure, and control any vegetation that establishes at treatment or storage ponds
- routinely carry out inspections and monitor key areas with the potential for mosquito breeding
- implement control operations including routine spraying of insecticides as warranted
- record the findings of the on-going regular inspection program and any preventative or control operations (eg. spraying) undertaken

14.0 ENVIRONMENTAL MONITORING PROGRAM

14.1 Targeted Environmental Monitoring

The fully integrated environmental "system" at the site including :-

the terrain - soils - crops - scheduled irrigation & monitoring program

comprises a ***dynamic bio-physical system*** which will be operated and managed daily in a responsive fashion allowing for variable seasonal rainfall conditions, temperatures, evaporation rates, fodder cropping, harvesting of nutrients, soil erosion control, etc

The overall methodology is that indicators of environmental sustainability have been identified, based on the best current knowledge and available information, that are judged to provide the best practical and objective measures of sustainability.

The key environmental monitoring targets are :-

- <u>Soils</u> of the treated water irrigation area

The risk assessment, based on data (including soils laboratory testing results) collected as part of the site and soils investigation, found that with good soils and irrigation management, the beneficial reuse of treated water will be environmentally sustainable in the long term

- Groundwater – down gradient of critical potential sources of leachate

  Measures to prevent groundwater pollution include :-

  - sealing of critical infrastructure eg. treatment ponds, composting area, cattle yards
  - crop selection/rotations/establishment using conservation farming methods
  - soil fertility management ie. chemical & physical
  - understanding the local water balance - irrigation scheduling - deficit irrigation
  - nutrient balancing - where applied N & P will balance with that harvested
  - salt balance - application of a leaching fraction (or wet season leaching)
  - targeted monitoring program

- Surface water at the discharge point from the site (western boundary)

  Any treated water that leaves the site boundary will be of much lower strength than when it exits the treatment ponds e.g. only in a rainfall event that exceeds the Q100 event, and also it will be subject to significant dilution by water runoff from heavy or prolonged rainfall events.

Refer to Tables 9, 10 & 11. below.

Note that the targeted Environmental Monitoring Program was developed to provide a tool for Northern Australian Beef Limited to demonstrate the sustainability of the proposed treated water reuse/irrigation system.

One key reference is as follows :-

Eugene McGahan and Robyn Tucker (Principal Authors) "*Resource Manual of Development of Indicators of Sustainability for Effluent Reuse in the Intensive Livestock Industries*: Piggeries and Cattle Feedlots.

Project No. 1816, Australian Pork Limited, Canberra, Australia, May 2003.

Table 9. Soil Analysis Parameters

Test Parameter	Depth	Frequency	Desirable Limits	Comment
pH	S & P	Annually	5.5- 8.0	A large influence on nutrient availability
ECe	S & P	"	< 4 dS/m	Indicates soil salinity
Effective Cation Exch. Capacity	S & P	"	> 6 me/100 gm	Indication of overall soil fertility
Exch. Ca	S & P	"	65-80 %	% of Eff. CEC
Exch. Mg	S & P	"	10-15 %	"
Exch. K	S & P	"	1-5 %	"
Exch. Na	S & P	"	< 5 %	"
Total Nitrogen(N)	S & P	"	> 0.15 %	A measure of soil fertility
Nitrate – N	S P	"	>30 mg/kg <10 mg/kg (base of root zone)	Measures nitrogen available for plant uptake
Bray Phosphorus (P)	S & P	"	10 – 25 mg/kg	Measures P available for plant uptake
P sorption capacity	P	Initial test then 3 years	> 125 mg/kg	Ability of clayey soils to immobilise P
Organic Carbon	S	"	> 1%	Influences soil stability

S – Surface 0.0 – 0.1 metres
P – Profile @ Base of Root Zone (~0.8-1.0 metres)

Table 10. Groundwater Monitoring

Test Parameter	Unit of Measure	Frequency [1]	Desirable Limits	Comment
pH	no units	Annually	6 – 8	A measure of acidity or alkalinity
Total Phosphorus	mg/L	Quarterly	<1	Measures phosphorus available for plant uptake
Electrical Conductivity	dS/m	"	<2300	Indicates salinity
Nitrate-Nitrogen	mg/L	"	<10	Nitrate-N is readily transported in water
Standing Water Level	metres	"	~	Seasonal fluctuation

1. Piezometers should be installed asap initially to establish baseline data

Table 11. Surface Water Monitoring

Test Parameter	Unit of Measure	Frequency [1]	Quality
pH	no units	Medium – High Flow	6 – 7.5
Total Phosphorus	mg/L	“	<10
Electrical Conductivity	dS/m	“	<0.2
Total Nitrogen	mg/L	“	<10
NO_x -N	mg/L	“	<10
Total Susp. Solids	mg/L	“	<5
BOD	mg/L	“	<20
Dissolved O_2	mg/L	“	>4
Total coliforms	cfu/100 mL	“	<1000
Enterococci bacteria	org/100 mL	“	<500

Note:

- that the monitoring indicated in Table 11. is judged as covering the important parameters to verify that the rainfall runoff discharging from the site is significantly diluted and not representative of the treated water from the meat processing plant, which actually undergoes tertiary treatment by beneficial reuse onto irrigated cropping paddocks
- Surface waters are to be sampled & analysed several times before reuse commences, during medium - high flows & following rainfall, to help establish baseline data

14.2 Operational Monitoring

As well as the targeted monitoring outlined above i.e. to determine the environmental sustainability of the treated water reuse/irrigation system, the proponent will also undertake operational monitoring including :-

- outlet of the proposed type-approved package sewage treatment system (to be designed based on the number of employees on-site)
- inlet from plant to anaerobic treatment pond
- inlet to treated water storage dam
- irrigation water in treated water storage dam.

Refer to Tables 12, 13, 14 & 15.

Table 12. Outlet of Sewage Treatment Plant[1]

Parameter	Units	Frequency	Limits
BOD	mg/L	Quarterly	20 – 50
E. coli	cfu/100 mL	"	10^4
Susp. Solids	mg/L	"	<30 – 50
Total N	mg/L	"	20 – 50
Total P	mg/L	"	10 – 15
Dissolved O_2	mg/L	"	>2

1. Typical of Aerated Wastewater Treatment Systems

Table 13. Inlet to Anaerobic Pond from Plant

Parameter	Units	Frequency	Limits
BOD	mg/L	Monthly	1500 - 2000
E.coli	Orgs/100 mL	"	1000
Total N	mg/L	"	200
TKN	mg/l	"	100 – 200
NH_3 - N	mg/L	"	<30
Total P	mg/L	"	50
EC	dS/m	"	2300
pH	pH units	"	6 – 9

Table 14. Treated Water into Wet Weather Storage Dam

Parameter	Units	Frequency	Limits
BOD	mg/L	Monthly	100
E.coli	org./100 mL	"	1000
Total N	mg/L	"	120
TKN	mg/l	"	100 – 120
NOx	mg/L	"	<20
Total P	mg/L	"	<50
EC	dS/m	"	<2300
pH	pH units	"	6 – 9

14.3 Project Environmental Management Structure

In addition to the groundwater, surface water and soil monitoring outlined above, a holistic project environmental management structure has been developed by VDM EcOz, contained in Appendix A of this document.

Table 15. Irrigation Water in Wet Weather Storage Dam

Parameter	Units	Frequency	Limits
BOD	mg/L	Pre irrigation	100
E.coli	org./100 mL	"	1000
Algae	-	"	Not visible
Total N	mg/L	"	120
Total P	mg/L	"	50
EC	uS/cm	"	2300
pH	pH units	"	6 – 9
Chloride	mg/L	"	300 - 700
SAR	-	"	8

14.4 Annual Reporting

It is proposed that the results from the monitoring program will be presented in an Annual Environmental Monitoring and Management Report.

It would include an interpretation of the data collected, indicate the effectiveness of the reuse system and outline a Plan of Management for the ensuing year, allowing continual review of the program and adaptive management measures where required.

15.0 PROJECT ROLES AND RESPONSIBILITIES

AAco is responsible for implementation of, and compliance with, this EMP. NABL may engage construction contractors to carry out activities such as construction, transportation etc. NABL will be responsible for ensuring that contractors comply with this EMP and for regularly monitoring the performance of the contractors. NABL will also be responsible for approval of quality management procedures and systems prepared in association with the contractors and in accordance with this EMP.

Amongst other obligations, the contractors shall be responsible for:

- Development of Systems, Procedures and Reporting mechanisms which will ensure and demonstrate in a tangible way, compliance with the EMP;
- Development and implementation of appropriate training to all staff and contractors on the requirements of this EMP. This shall range from detailed training for supervisors, through to inclusion of environmental matters in project induction for other workers; and
- Participating in audits and reviews and undertaking corrective actions and system improvements when audit and review results deem necessary.
- All personnel are responsible for the environmental performance of their activities and for complying with the laws of the Northern Territory (NT). Specific environmental roles and responsibilities are detailed in the following sections.
- Board Environmental and Occupational Health, Safety (EOHS) Committee

The committee reviews and reports to the Board on the management of the company's occupational health, safety and environmental responsibilities. The role includes monitoring the company's compliance with all State and Territory legislation in respect of Occupational Health and Safety (OH&S) and environmental matters.

Chief Executive Officer

- Establishes the environmental goals and sets key performance indicators to measure progress towards achieving those goals;
- Ensures the allocation of adequate resources to natural resource management;
- Reviews recommendations of the Natural Resource Management Advisory Committee; and
- Ensures an annual review is conducted into the effectiveness of the Natural Resource Management Policy in meeting the company's quality goals.

Rangeland Co-ordinators

- Creates the company Environment Business Plan annually;
- Advises on policy and planning issues in relation to environment and natural resource management issues;
- Advises and assists station managers on natural resource management issues;
- Assists the company to undertake research into natural resource management issues to provide opportunities for improved national resource management practices throughout the company; and
- Ensures the company plays a pro-active role in natural resource management issues on a community level.

Natural Resource Management Advisory Committee

Consists of the Committee Chair, currently the Group Manager Southern, Rangeland Manager and Rangeland Officer, the Quality Systems Coordinator and feedlot and station representatives.

- Endorses the company Environment Business Plan annually;
- Reviews progress against the plan quarterly;
- Recommends priorities for funding for Natural Resource Management budget;
- Reviews and supports proposals from Rangeland Manager; and
- Collate information from community groups representing Natural Resource Management issues.

General Managers and Group Managers

Promote and monitor NRM issues throughout their regions/areas of operations, and provide the necessary support to enable Managers to implement appropriate natural resource management practices at each site.

Feedlot/Station Managers

- Implementation of natural resource management and environmental practices in accordance with agreed principles; and
- Identification of areas for improvement and working with the Rangeland officers to establish improvement programs.

Employees and Contractors

- Undertake environmental and natural management work as directed; and
- Conduct all station duties with a care for the environment and report any environment hazards to management.

15.1 Commitments

Table 16. Project Commitments

Aspect	Commitments	Timing
Design Features	Installation of a Biofilter	2012
	Use of an approved wastewater treatment system	2012
	Development and approval of an Irrigation Management Plan	2012
	Siting of the plant to reduce environmental impacts	2012
	Fencing of riparian areas to promote regeneration	2013
	Build sotrmwater runoff dams	2012
	Installation of anaerobic and aerobic ponds	2012
	Containment and rotational ability of salt evaporation ponds	2012
	Installation of sedimentation cells	2012
	installation of a Render Plant	2012
Legislation	Comply with all relevant legislation, guidelines, codes of practice and best practice, specifically: AQIS, Department of Health, Commonwealth Government legislation and other relevant NT legislation	Ongoing
Management Practices	Comply with the Environmental Management Plan	Ongoing
	Provision for review of the Environmental Management Plan	2013 and ongoing
	Establishment of an Environmental Management Committee with both plant and community personnel	2013
	Management structure	2012
	Disciplined cleaning practices	2012
	Re-use and recycle water where practicable	2012
	Diversion of stormwater runoff from cattle yards and compost	2012
	Reporting and monitoring commitments	Ongoing
	Complaint register	2012
	Irrigation Management Plan	2012
	Operational Management Plan	2012

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APPENDIX A

PROJECT ENVIRONMENTAL MANAGEMENT STRUCTURE

PROJECT ENVIRONMENTAL MANAGEMENT STRUCTURE

1.1 Water

Objectives	Develop proven efficient water management systems to reduce potential impacts on Darwin's potable water supply. Demonstration that stormwater and effluent treatment systems are adequate, climate appropriate and will have minimal if any impacts on surface and ground water quality and downstream environments.
Targets	Incorporate into the facility design measures to improve water efficiency; Reuse of treated effluent (e.g. dust suppression, use of treated effluent for washdown, etc); Understand the facility water balance and identify where losses or deficits may occur. Appropriate management of irrigation during periods of prolonged low rainfall, such that there is no requirement for additional take from Darwin's Water Supply. No detectable impact to surface water or groundwater, attributable to the Meat Processing Facility. Development of a water quality monitoring plan that includes characterisation of the physical and chemical contaminants present in stored waters (effluent and stormwater), including monitoring sites and parameters (nutrients, pathogens, algae) to inform reporting obligations in the event of overflows. Management of irrigation such that nutrients remain within acceptable parameters and achieve land management objectives
Actions	Management of irrigation Stormwater capture dams Installation of water saving initiatives such as: - Dedicated Standard & Temperature Flow Lines - Overhead mist sprays for cattle washing - Sensor flow controls - Reduced hose nozzle sizing - Efficient process design & Introduction of process efficient techniques - Disciplined cleaning practises & management - Efficient cleaning system - Reviewing options for 3rd Part Contract Laundry service - Storage & re-use of Storm water – Fire Hydrant Supply - Re-use of Treated waste water – Nutrients for Land Maintain a freeboard of 0.5m on ponds and remove excess from site prior to known/predicted extreme weather events. Ponds to be designed, constructed and operated to best practice guidelines developed by Australian EPA's and authorities including Food Science Australia and CSIRO Ensure use of waste minimisation methods including capture in three ponds for use as irrigation of pasture paddocks Management of both diverted and undiverted stormwater as per the Erosion and Sediment Control Plan (ESCP) Ponds to be designed, constructed and operated and checked against best practice guidelines developed by Australian EPA's and authorities including Food Science Australia and CSIRO

1.1 Water

Monitoring	Surface water, Groundwater and soils monitoring as specified in the Environmental Management Plan.
Reporting	Annual reporting including monitoring.
Corrective Actions	Incident Response and Sampling procedures as outlined in the Water Quality Management Plan.
Relevant legislation, Standards and Plans	**Legislation** *Water Act* (NT) *Waste Management and Pollution Control Act* (NT) **Code of Practice** Septic treatment plant in accordance with the Department of Health's Code of Practice for Small On-site Sewage and Sullage Treatment systems and the Disposal or Re-Use of Sewage Wastewater **Standards** Controls regulated under Australian Quarantine Services (AQIS) **Guidelines** NRETAS *Erosion and Sediment Control Plan Content*

1.2 Land Management

Objectives	Land management and irrigation practices shall not adversely impact or degrade soils or groundwater resources. Weeds will be controlled to prevent spread to the surrounding areas.
Targets	Manage crops such that they are viable even in times of prolonged low rainfall Achievement of land management objectives through the identification of responsive actions to negative impact Selection of appropriate fodder crops that enable achievement of land management objectives Through irrigation maintain or improve the capacity of the land to grow plants with no measurable deterioration of land quality through soil structure degradation, salinisation, water logging, chemical contamination or soil erosion Ongoing safe disposal and storage of pesticides such that there are no spills to the environment or impacts to the health and safety of employees Management of weeds such that no new species of weed are introduced to site, and no weeds currently found the property are permitted to spread to waterways and surrounding properties, attributable to NABL Implementation of a Weed Management Plan aimed at the control of weed species present on site and those which may be introduced Development of a comprehensive Erosion and Sediment Control Plan (ESCP) that includes detailed control measures for construction and operational phases

1.2 Land Management

Actions	Develop a site specific ESCP and ensure that all contractors and employees are aware of it and ensure all contruction works comply with design specifications made in the ESCP Develop a site specific Irrigation Management Plan and ensure compliance with all recommendations Ensure compliance with all monitoring recommendations as per this EMP. Weed Management will include the following commitments: - Reduce the size of current weed infestations - Develop networks with appropriate groups and organizations weed control/management - Prevent weed seed spread to clean locations; and - Encourage sub-catchment approach to weed control/management - To manage pest populations to minimise localised damage to the environment and protect against greater threats from the spread of exotic disease or noxious weeds. - Development of a Weed Management Plan - Management of composting material to minimise weed seed spread Protect ecosystems along the watercourses within NABL property boundaries through tactical riparian zone management including fencing of these areas Practical operation of the irrigation system through establishment of a water balance and Irrigation Management Plan. Employ and comply with best management practices to ensure that the system is environmentally sustainable including nutrient management, irrigation scheduling and deficit irrigation strategies as well as a comprehensive monitoring program to demonstrate the environmental performance of the system.
Monitoring	Monitor wastewater on a weekly basis to determine levels of: - Total Nitrogen - Ammonium-N - Nitrate-N - Total Phosphorus - Electrical Conductivity & Chloride - Sodium Absorption Ratio All results are to be recorded as per AQIS Guidelines for Electronic Records and an annual summary of all results should be made available in the Facility Management Plan.
Reporting	Annual reporting of land management commitments including all monitoring results to be included in the Operational Management Plan
Corrective Actions	Revise/review commitments and the Irrigation Management Plan as necessary to ensure they remain effective and applicable

1.2 Land Management

Relevant legislation, Standards and Plans	**Legislation** *Environmental Protection Biodiversity Conservation Act* (Cth) *Weed Management Act* (NT) *Territory Parks and Wildlife Conservation Act* (NT) *Planning Act* (NT) **Guidelines** NRETAS *Land Clearing Guidelines 2010* NT Planning Scheme

1.3 Community Health and Amenity - Odour

Objectives	Operation of the facility will not unduly impact community amenity or cause detrimental effects to the health of residents or the environment
Targets	Control of point of source odour such that minimal complaints are received from nearby residents
Actions	Foul air from point sources will be collected near roof level of the building and ducted to a Biofilter (efficiency of 95 – 98%) manage manure stockpiles and effluent to ensure there are no offensive odours design the complex to meet the recommended separation distances from houses of 500 m from the meat processing plant and 1,000 m from the rendering plant installation of state-of-the-art purpose-designed machinery and equipment Enclosing the Render Plant Ensure that all material sent to the rendering plant is fresh Operate wastewater ponds to best practice guidelines developed by Australian EPAs and industry authorities (including Food Science Australia/CSIRO). Ensure that aerated ponds are located away from plant boundaries regular cleaning out of animal waste from yards and pens Installation of a tree break around the populated boundaries of the site
Monitoring	maintaining adequate reduction-oxidation potential in the aerobic system, and desludging periodically Regular maintenance of the Biofilter Monitor Biofilter during periods of environmental extremes to ensure that there are no incidents or occurrences of odour
Reporting	Maintain a Complaints Register and address any issues through the Environmental Management Committee.
Corrective Actions	Review management and maintenance of the Biofilter Review wastewater pond management

1.3 Community Health and Amenity - Odour

Relevant legislation, Standards and Plans	**Legislation** *Waste Management and Pollution Control Act* (NT) Waste Management and Pollution Control (Administration) Regulations (NT) *Workplace Health and Safety Act* (NT) Work Health (Occupational Health and Safety) Regulations (NT) *Public Health Act* and Regulations (NT)

1.4 Community Health and Amenity - Noise

Objectives	Operation of the facility will not unduly impact community amenity or cause detrimental effects to the health of residents or the environment
Targets	Ensure that noise from the site, or cumulative noise from the surrounding area, does not cause nuisance or environmental health issues
Actions	Construct the walls of the meat processing plant with insulated panels to assist in noise reduction Locate animal holding pens as far from existing houses as practical Ensure that heavy vehicles arriving at the site when ambient noise levels are highest, i.e. in daylight hours Develop a Noise Management Plan Installation of a tree break around the populated boundaries of the site
Monitoring	Monitor noise through complaints received and review noise reduction strategies as appropriate
Reporting	Maintain a Complaints Register and address any issues through the Environmental Management Committee.
Corrective Actions	Review management and monitoring commitments and update the Noise Management Plan as required

1.4 Community Health and Amenity - Noise	
Relevant legislation, Standards and Plans	**Legislation** *Waste Management and Pollution Control Act* (NT) Waste Management and Pollution Control (Administration) Regulations (NT) *Workplace Health and Safety Act* (NT) Work Health (Occupational Health and Safety) Regulations (NT) *Public Health Act* and Regulations (NT) **Standards** AS 1055 Description and measurement of environmental noise AS 2012 Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors AS 2221 Methods for measurement of airborne sound emitted by compressor units including prime movers and by pneumatic tools and machines AS 2436 Guide to noise control on construction, maintenance and demolition sites AS 2659 Guide to the use of sound-measuring equipment

1.5 Community Health and Amenity - Dust	
Objectives	Operation of the facility will not unduly impact community amenity or cause detrimental effects to the health of residents or the environment
Targets	Control of point of source dust emissions such that minimal complaints are received from nearby residents and dust does not cause nuisance or environmental health issues
Actions	Maintain vegetative cover over the site where practicable Establish a tree break around the populated boundaries of the site. Seal access roads, vehicle maneuvering surfaces, lairage pens and car parks Dust suppression trucks to be used on unsealed surfaces as required, particularly on windy days Limit cattle movement in high wind conditions Use of water trucks during construction stage
Monitoring	Monitor dust through complaints received and review dust reduction strategies as appropriate
Reporting	Maintain a Complaints Register and address any issues through the Environmental Management Committee.
Corrective Actions	Review management of dust, increase dust suppression activities and review control of dust from cattle holding yards. Avoid cattle movement at times of high wind

1.5 Community Health and Amenity - Dust

Relevant legislation, Standards and Plans	**Legislation** *Waste Management and Pollution Control Act* (NT) Waste Management and Pollution Control (Administration) Regulations (NT) *Workplace Health and Safety Act* (NT) Work Health (Occupational Health and Safety) Regulations (NT) *Public Health Act* and Regulations (NT) **Standards** AS 2724.3 Ambient air Particulate matter – Determination of total suspended particulates (TSP) – High volume sampler gravimetric method *AS 3580 Methods of sampling and analysis of ambient air*

1.6 Community Health and Amenity - Light

Objectives	Operation of the facility will not unduly impact community amenity or cause detrimental effects to the health of residents or the environment
Targets	Control of point of source light emissions such that minimal complaints are received from nearby residents and light does not cause nuisance or environmental health issues
Actions	Selection of external lighting and positioning to be downward and inward facing towards the meat processing facility. Lighting spectrum selected to minimise the attraction of flying insects, as a food safety issue. Establish a tree break around the populated boundaries of the site.
Monitoring	Monitor light through complaints received and review light reduction strategies as appropriate
Reporting	Maintain a Complaints Register and address any issues through the Environmental Management Committee.
Corrective Actions	Review positioning of light sources as required Increase tree break as required to help reduce light spill to nearby properties and roads
Relevant legislation, Standards and Plans	**Legislation** *Waste Management and Pollution Control Act* (NT) Waste Management and Pollution Control (Administration) Regulations (NT) *Workplace Health and Safety Act* (NT) Work Health (Occupational Health and Safety) Regulations (NT) *Public Health Act* and Regulations (NT)

1.7 Community Health and Amenity – Biting Insects and Vermin

Objectives	Operation of the facility will not unduly impact community amenity or cause detrimental effects to the health of residents or the environment
Targets	Comply with all relevant legislation and Australian Standards – AQIS and Department of Health

1.7 Community Health and Amenity – Biting Insects and Vermin

Actions	ensure that all areas around the plant, as well as that associated with meat processing infrastructure, are well drained to eliminate shallow standing water and the potential for mosquito breeding regularly mow or slash grassed or vegetated areas around the plant and infrastructure, and control any vegetation that establishes at treatment or storage ponds implement control operations including routine spraying of insecticides as warranted As per AQIS requirements set and maintain vermin baits around the meat processing facility
Monitoring	routinely carry out inspections and monitor key areas with the potential for mosquito breeding
Reporting	record the findings of the on-going regular inspection program and any preventative or control operations (eg. spraying) undertaken Any reporting as required by AQIS and the Department of Health Maintain a Complaints Register and address any issues through the Environmental Management Committee
Corrective Actions	Review monitoring and management as required
Relevant legislation, Standards and Plans	**Legislation** *Public Health Act* and Regulations (NT) *Workplace Health and Safety Act* (NT) **Guidelines** Department of Health and Families *Guidelines for preventing mosquito breeding associated with construction practice near tidal areas in the NT* 2005 Medical Entomology Guidelines: Mosquito breeding and sewage pond treatment in the Northern Territory Constructed wetlands in the Northern Territory – Guidelines to prevent mosquito breeding

1.8 Community Health and Amenity – Traffic

Objectives	Operation of the facility will not unduly impact community amenity or cause detrimental effects to the health of residents or the environment
Targets	There are no issues regarding safety of road and intersections raised as a result of the new meat processing facility
Actions	The railway crossing will be relocated to the north so that it intersects the railway at a safer right angle. Flashing light and audible train warning signals will be installed. Traffic Impact Study Provide overhead lighting to the Stuart Highway intersection
Monitoring	
Reporting	Maintain a Complaints Register and address any issues through the Environmental Management Committee

1.8 Community Health and Amenity – Traffic

Corrective Actions	Review monitoring and management as required and in consulation with the NT Transport Group Department of Lands and Planning.
Relevant legislation, Standards and Plans	**Legislation** *Traffic Act 2012* and associated regulations

1.9 Solid Waste

Objectives	Sustainable management of solid wastes such as hide curing, salt evaporation, composting and treatment pond sludge in such a way as to ensure no adverse impacts on the environment
Targets	Establish treatment methods for the composting area that minimise susceptibility to climatic conditions No excessive nutrients are discharged to the environment No impacts on visual amenity of the areas surrounding the site To ensure that odour does not impact on nearby residents Salt is managed in such a way that there is no downstream impacts attributable to the meat processing facility
Actions	Design of the processing waste system to include several stages and separation of flows to improve organic nutrient removal of the system, and decrease irrigation dilution requirements Comply with all relevant AQIS regulations and guides Packaging waste such as cartons and plastic materials to be baled for removal to the municipal recycling depot Other trash to be collected in receptacles and removed by licensed contractors for disposal at approved sites Remove all manure stockpiles and wastewater from stock holding yards/pens regularly (at least weekly) and as required Salt laden hide conditioning wash down water to be collected and transported to covered evaporation pans as required dried salt to be removed from site by an authorised contractor and trucked off site Permanent and temporary storage facilities for any fuels or chemicals to be designed as per Australian Standards or relevant guidelines. Undertake induction and training of construction workforce to ensure awareness of waste management responsibilities. All products and wastes stored on site must be kept in accordance with Australian Standards (and MSDS, where appropriate) and in a clean and tidy condition. Consideration should be given of principles to avoid, reduce, reuse and recycle where possible. During construction provide putrescible waste bins for storage of domestic wastes (e.g., food, paper, and wrappers) prior to removal from site. Putrescible waste bins are to be covered at all times Develop a contingency plan for a mass mortality event including provisions for mass carcass disposal In accordance with Australian Code of Practice for the Welfare of Cattle in Beef Feedlots (1996) and the appropriate provisions of the Australian Model Code of Practice for the Welfare of Animals – Cattle (1992)

1.9 Solid Waste

Monitoring	Monitoring of temperature and moisture will be undertaken to optimise the rate of composting. Monitor composting material regularly to identify if it becomes too dry, should this occur supplemental water will be added If results from the monitoring program identify any issues that cannot be resolved within the current composting system, NABL will consider the option of covering the compositing site. It is not expected however that this will be necessary
Reporting	Reporting of incidents as per the *Waste Management and Pollution Control Act*
Corrective Actions	Review composting management, increase or decrease watering and turning of the windrow Cover the composting site should this be deemed necessary
Relevant legislation, Standards and Plans	**Legislation** *Public Health Act* (NT) *Waste Management and Pollution Control Act* (NT) *Water Act* (NT)

1.10 Heritage and Wetlands

Objectives	Protected from disturbance nearby historical sites and riparian areas
Targets	To ensure that there are no detrimental environmental impacts on the riparian and wetland areas within the site boundaries To ensure that there are no detrimental impacts on the nearby WWII Livingstone Airfield, Camp and Anti-Aircraft Gun sites
Actions	Install a buffer fence around the delineated riparian zone to prevent cattle egress Carry out weed management as per the Weed Management Plan to control weeds within the riparian and wetland zones
Monitoring	Monitoring of weeds as per the Weed Management Plan
Reporting	Reporting of any weed infestations, weed control undertaken and control methods used should be included within the annually updated Operational Management Plan
Corrective Actions	Increase weed management if necessary Commence photo monitoring if concerns are raised about degradation of the riparian and wetland areas
Legislation	**Legislation** *Aboriginal Land Rights (Northern Territory) Act 1976* *Native Title Act 1993* *Pastoral Land Act 1992* *Northern Territory Aboriginal Sacred Sites Act 1989* *Environmental Offences and Penalties Act.* *Heritage Conservation Act.* *Miscellaneous Acts Amendment (Aboriginal Community Living Areas) Act.* *Planning Act.*

1.11 Greenhouse Gas Emissions

Objectives	To minimise emissions to a level that is as low as practicable
Targets	Improve herd efficiency such that meat is produced with a reduced level of enteric emissions Improved pasture through the use of legume-based pasture, pasture mapping technologies and prevention of energy stress by altering herding techniques and introducing new supplement products integration of meat processing and rendering operations to improve resource recovery and waste minimisation so that material that would otherwise be waste is given a commercial value and treated as a co-product rather than waste
Actions	Recover nutrients in processing water and applied to pastures recover heat from the rendering plant and re-use to produce hot water for other processing activities Implement an ongoing program to monitor levels of emissions Periodically investigate the opportunity to further reduce emissions Identify and consider national and state eligible offset schemes for residual emissions
Monitoring	Monitor emissions in accordance with government requirements
Reporting	Report emissions in accordance with government requirements
Corrective Actions	Review and amend monitoring and actions as necessary
Legislation	**Guidelines** Northern Territory Strategy for Greenhouse Action National Greenhouse and Energy Reporting Act 2007 (C'Wealth)