ANNEXURE 20.0

SOIL MAPS AT AND AROUND “TUBBO” IRRIGATION

ANNEXURE 20.0a

SOILS ASSOCIATION MAP OF THE COLEAMBALLY IRRIGATION AREA

Soil Association Map of Coleambally Irrigation Area (a)

Creation Date: 05/06/2007
File path : T:/Mapping/Four Arrows/tubbo_1_jun_07_A3
Created by : Christelle Borella, GIS Administrator, Booth Associates
Project : Four Arrows Pty Ltd Ethanol Plant &
Intensive Dairy Environmental Assessment

Booth Associates

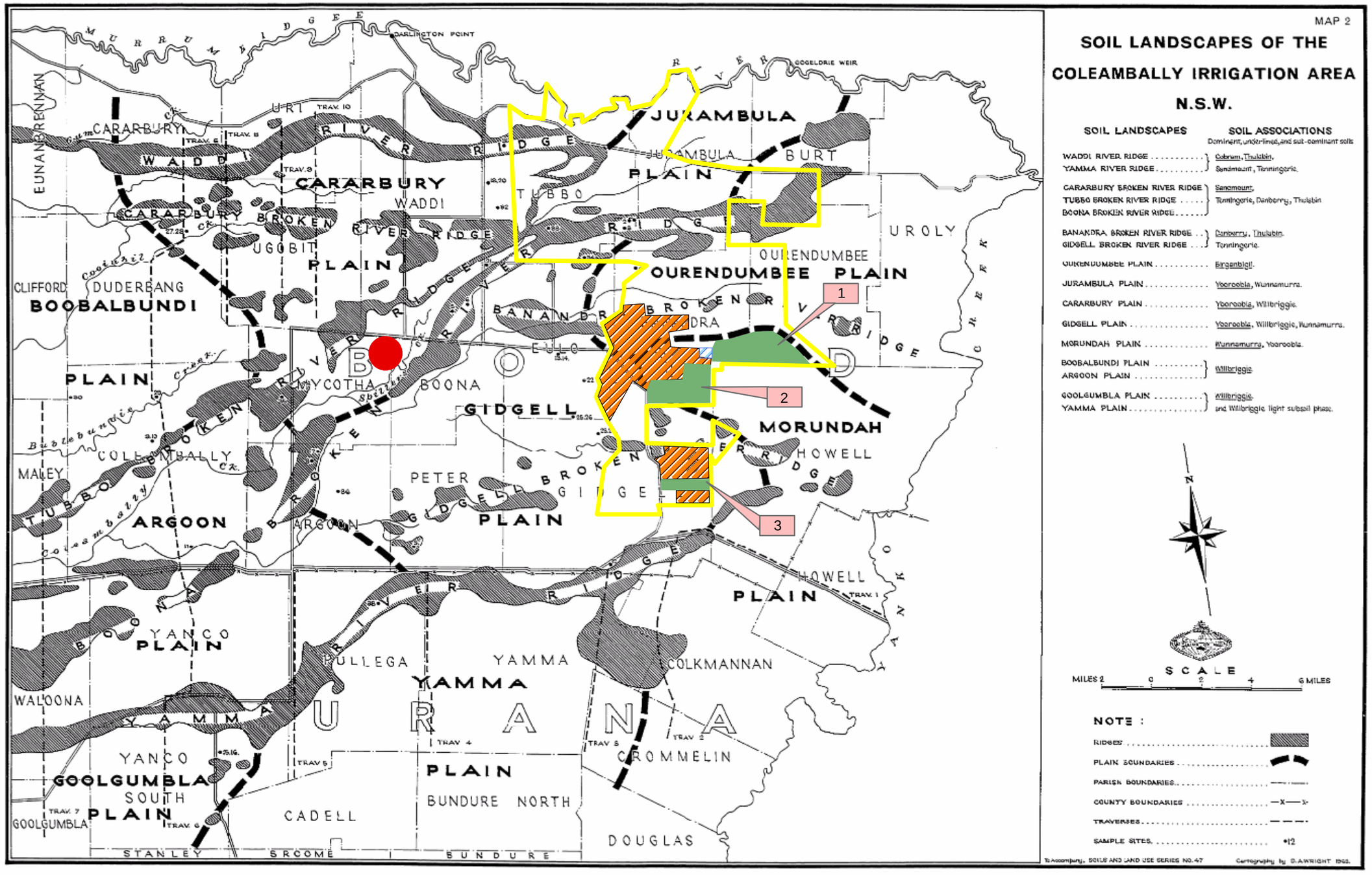
Tubbo boundary

Water storage

Project Site

Mortality areas

Tubbo irrigation



MAP 2

SOIL LANDSCAPES OF THE COLEAMBALLY IRRIGATION AREA N.S.W.

SOIL LANDSCAPES	SOIL ASSOCIATIONS Dominant, subdominant, and sub-dominant soils
WADDI RIVER RIDGE	Cobram, Thulabin,
YAMMA RIVER RIDGE	Sandmount, Tenningerie.
CARARBURY BROKEN RIVER RIDGE	Sandmount,
TUBBO BROKEN RIVER RIDGE	Tenningerie, Danberry, Thulabin
BOONA BROKEN RIVER RIDGE	
BANANDRA BROKEN RIVER RIDGE	Danberry, Thulabin.
GIDGELL BROKEN RIVER RIDGE	Tenningerie.
OURENDUMBEE PLAIN	Birganbigil.
JURAMBULA PLAIN	Yoorcobla, Wunnamurra.
CARARBURY PLAIN	Yoorcobla, Willbriggie.
GIDGELL PLAIN	Yoorcobla, Willbriggie, Wunnamurra.
MORUNDAH PLAIN	Wunnamurra, Yoorcobla.
BOOBALBUNDI PLAIN ARGOON PLAIN	Willbriggie.
GOOLGUMBLA PLAIN YAMMA PLAIN	Willbriggie. and Willbriggie light subsoil phase.

SCALE
MILES 2 0 2 4 6 MILES

NOTE :
RIDGES
PLAIN BOUNDARIES
PARISH BOUNDARIES
COUNTY BOUNDARIES
TRAVERSES
SAMPLE SITES •12

To accompany SOILS AND LAND USE SERIES NO. 47 Cartography by D.A.WRIGHT 1968.

Note : This image was not drawn to scale.

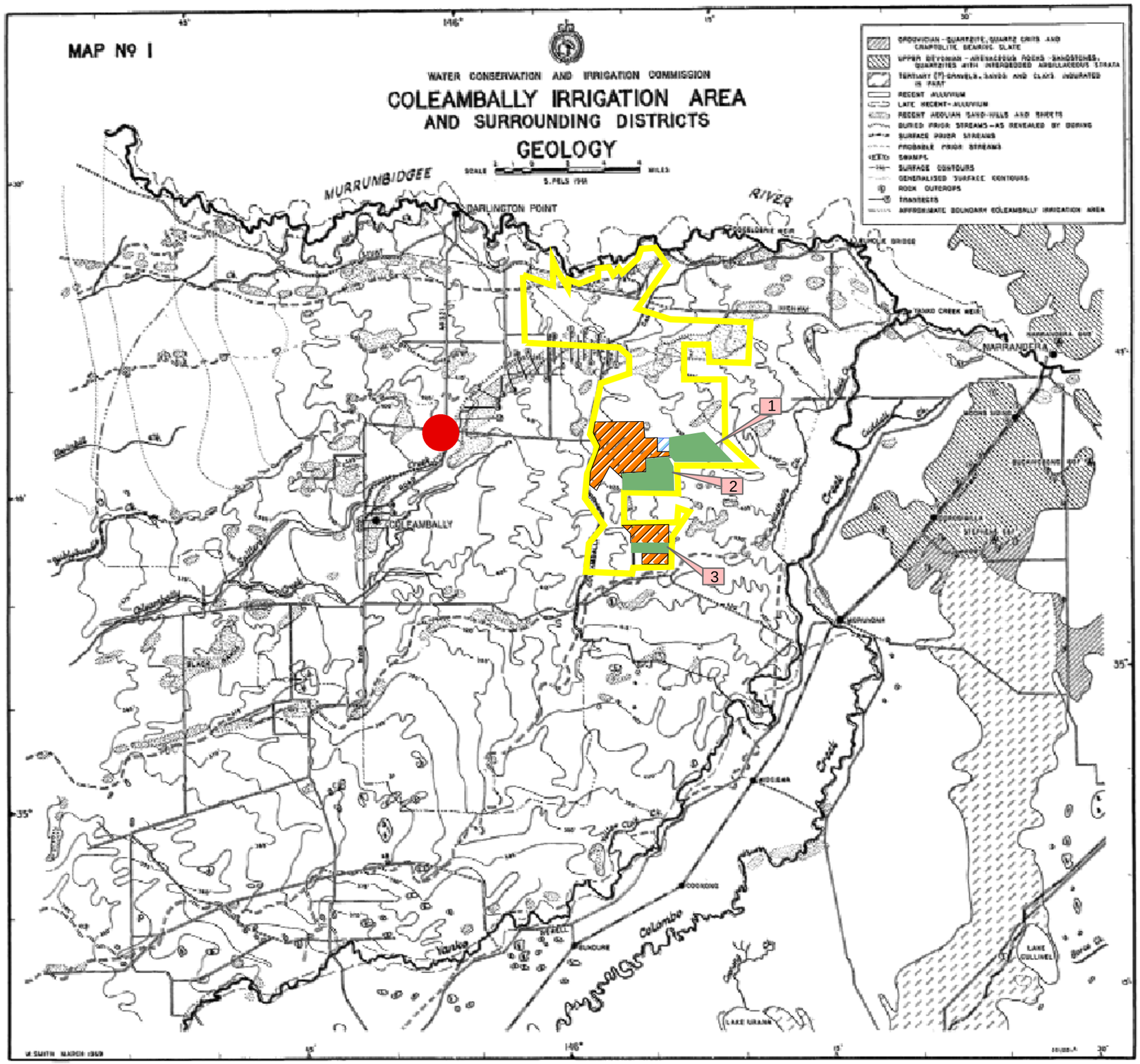
ANNEXURE 20.0b

GEOLOGY MAP OF COLEAMBALLY IRRIGATION AREA AND SURROUNDS

Soil Association Map of Coleambally Irrigation Area (b)

Creation Date: 05/06/2007
File path : T:/Mapping/Four Arrows/tubbo_2_jun_07_A3
Created by : Christelle Borella, GIS Administrator, Booth Associates
Project : Four Arrows Pty Ltd Ethanol Plant &
Intensive Dairy Environmental Assessment

Booth Associates



Project Site

Tubbo boundary

Water storage

Tubbo irrigation

Mortality areas

Note : This image was not drawn to scale.

ANNEXURE 20.0c

SELECTED SOIL PROFILE DESCRIPTORS

Soils in the Coleambally Irrigation Area

Wunnamurra clay

This type which is the grey counterpart of Yooroobla clay occurs manily in association with Coree loam and Coree clay loam as the puff component of Gilgai complexes and may constitute up to ninety percent of the land surface over limited area. In a few isolated locations Riverina clay may be associated with this type in the Gilgai complex. The surface is a grey self-mulching clay, and textures remain heavy in depth.

Typical profile.

0-4 in.	Grey heavy clay, strongly developed fine sub-angular blocky structure of self-mulching character, slight lime in small concretionary form and I the fine earth.
4-24 in.	Grey heavy clay, strongly developed coarse angular blocky structure, slight fine earth and concretionary lime. Structure becomes coarser with depth.
24-36 in.	Grey-brown heavy clay with slight concretionary lime, massive with few permanent cleavage lines.
36-48 in.	Yellowish grey-brown massive medium clay with slight concretionary lime.

Yooroobla clay

This type occurs as the puff component of Gilgai complexes usually associated with Wilbriggie loam or clay loam. The proportion of Yooroobla clay in the complex may be up to eighty percent. This soil is the brown counterpart of the grey Wunnamurra clay, the surface being a brown self-mulching clay, with the texture remaining heavy to depth.

Typical profile.

0-4 in.	Brown heavy clay, strongly developed fine sub-angular blocky structure of self-mulching character, slight lime as fine concretions and in fine earth form.
4-12 in.	Brown heavy clay, strongly developed coarse angular blocky structure, slight fine earth and concretionary lime.
12-24 in.	As above, becoming coarse blocky in structure.
24-36 in.	Weakly mottled, brown and yellow-brown, heavy clay, slight nodular lime, compact with few permanent cleavage lines.
36-48 in.	Mottled, brown and yellow-brown, massive heavy clay.

Wildriggie clay loam and loam

These types are of widespread occurrence as broad plains throughout the district and in many areas occur in a Gilgai complex with varying proportions of puff, the puff component being Yooroobla clay.

The profile possesses two to four inches of surface loam, or clay loam with a heavy clay subsoil remaining of heavy texture to depth.

Typical profile of Wilbriggie clay loam

0-3 in.	Brown clay loam, brittle and compact.
3-18 in.	Dark reddish brown heavy clay of strongly developed medium angular blocky structure.
18-30 in.	Yellowish brown massive medium clay with slight amounts of concretionary lime.
30-42 in.	Mottled, yellow-brown and brown, medium clay, slight concretionary lime and crystalline gypsum throughout.
42-48 in.	Mottled, yellow-brown, brown and grey, medium clay, with slight crystalline gypsum.

In some locations close to sandhill systems the surface horizon is of sandy loam texture, and such soils have been mapped as Wilbriggie sandy loam.

Wilbriggie loam is very similar to Wilbriggie clay loam except the surface horizon is of loam texture 3 to 4 inches in thickness.

ANNEXURE 21.0

EXPRESSION OF INTEREST FOR THE PURCHASE OF WET DISTILLERS GRAIN

The Rice Food Experts

29 May 2007

Mr B Booth
Booth & Associates
PO Box 1458
Griffith NSW 2680

Dear Bill

Further to our conversation regarding the distillers grain by-product from your proposed ethanol plant I wish to advise that SunRice through its stockfeed subsidiary CopRice wishes to express an interest in processing and or procurement of your distillers grain.

CopRice has a pelleting plant at its Leeton facility with an annual capacity of approximately 60,000 tonnes. In consideration of possible volume exceeding this capacity the business would be very likely to invest in upgraded capacity or look to utilise capacity at other plants.

Once your project has reached final approval I would be very pleased to discuss commercial proposals with you.

Yours sincerely

Graham Harvey
General Manager Operations

c Wayne Preston

National Sales and Marketing Office
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www.sunrice.com.au

Ricegrowers Limited
ABN 55 007 481 156
trading as SunRice

Strategic Bovine Services

STRATEGIC BOVINE SERVICES

ABN 94 050 042 754
2 Broughton Street Camden NSW 2570
PO Box 660 Camden NSW 2570
Phone: 02 4655 8532 Int: 61 2 4655 8532
Fax: 02 4655 8501 Int: 61 2 4655 8501
Website: www.dairydocs.com Email: info@dairydocs.com.au

Dear Bill

Re: Assured access to distillers grain

This letter is to confirm our discussion of 4th September in my Camden office where I requested formal affirmation of our right to negotiate a secure supply of distillers grain for our Australian clients and our New Zealand clients and colleagues.

I am fully aware that no formal contract can be entered into until the project is approved and construction is imminent. However, it is our experience with colleagues & clients in the USA, New Zealand and Australia that the once the market sectors have used the product they have a preference for its ongoing use if the supply is reliable and quality assured.

Assuming we are near to signing a contract, we would then settle the supply chain with matching contracts with feed mills for the production of distillers grain based feed pellets. What is not consumed in Australia would then be exported to meet our pre-existing demand shortfalls in our international market.

For the purposes of demand scale our analysis of the market indicates consumption could quickly rise to around the 200,000 to 300,000 tonnes per year level.

Yours Sincerely

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ANNEXURE 22.0

REVISED PROJECT WATER BUDGET

ANNEXURE 22.0a

DECILE 5 (D5) YEAR

FOUR ARROWS ETHANOL PTY LTD : *Consolidated water budget for a decile 5 or median rainfall year*

Category 1 & 2 = good quality water

			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
METEOROLOGICAL															
Rain	CSIRO Griffith	mm/mth	23.0	13.0	20.0	19.0	30.0	29.0	34.0	38.0	32.0	33.0	24.0	20.0	315.0
		effectiveness	80%	80%	80%	85%	85%	90%	90%	90%	90%	90%	85%	80%	
Evapotranspiration	Eto - Griffith CSIRO	mm/mth	282.0	232.0	194.0	115.0	66.0	45.0	50.0	75.0	113.0	178.0	233.0	278.0	1,861.0

Category 1 water

For drinking by cattle, potable other usaes and in ethanol plant

maximum capacity (ML) 150.0 | maximum water depth (m) 4.0 | surface area (ha) 3.75

				JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Open balance				50.0	54.0	63.6	59.5	75.0	107.8	55.2	51.5	47.0	51.7	47.5	52.7	
Add	run-off ex dairy			3.7	2.1	3.2	3.0	4.8	4.6	5.4	6.0	5.1	5.3	3.8	3.2	50.1
	run-off ex ethanol			11.7	7.0	11.0	11.9	20.5	22.8	26.8	29.9	22.9	21.2	14.0	10.3	210.0
	rain			0.9	0.5	0.8	0.7	1.1	1.1	1.3	1.4	1.2	1.2	0.9	0.8	11.8
	transfers	purchase from CICL	input	210.0	200.0	200.0	200.0	200.0	100.0	150.0	150.0	170.0	180.0	200.0	210.0	2,170.0
		Total sources		276.3	263.6	278.5	275.1	301.4	236.3	238.7	238.8	246.2	259.4	266.3	276.9	
Less	evaporation	Kc = 0.95		10.0	8.3	6.9	4.1	2.4	1.6	1.8	2.7	4.0	6.3	8.3	9.9	66.3
	dairy	drinking		40.7	36.8	40.7	32.9	27.6	21.1	21.8	25.5	28.5	35.2	39.4	40.7	
		misting		7.8	7.1	7.8	4.7	-	-	-	-	3.6	6.7	7.6	7.8	
		cow washdown		27.9	25.2	27.9	27.0	27.9	27.0	27.9	27.9	27.0	27.9	27.0	27.9	
		cleaning		1.9	1.7	1.9	1.8	1.9	1.8	1.9	1.9	1.8	1.9	1.8	1.9	
		office+staff+workshop		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	796.1
	ethanol	plant		133.6	120.7	133.6	129.3	133.6	129.3	133.6	133.6	129.3	133.6	129.3	133.6	
		office+staff+workshop		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1,574.8
	transfers	to category 2 storage		-	-	-	-	-	-	-	-	-	-	-	-	
		Total sinks		222.2	199.9	219.1	200.1	193.7	181.1	187.2	191.8	194.5	211.9	213.6	222.1	
		Closing balance		54.0	63.6	59.5	75.0	107.8	55.2	51.5	47.0	51.7	47.5	52.7	54.8	

Note : The maximum capacity for approval purposes is 150 ML. However it is more likely that this storage will be constructed to only 50 ML max capacity under expected delivery agreements with CICL

Category 2 water

Limited contamination - readily made potable if needed

maximum capacity (ML) 300.0 | maximum water depth (m) 2.0 | surface area (ha) 15.0

				JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Open balance				150.0	151.9	134.8	125.5	133.5	149.1	144.2	139.0	128.9	139.6	146.1	149.1	
Add	run-off ex dairy (roof only)			0.5	0.3	0.4	0.4	0.6	0.6	0.7	0.8	0.6	0.7	0.5	0.4	6.3
	run-off ex ethanol			-	-	-	-	-	-	-	-	-	-	-	-	-
	rain			3.5	2.0	3.0	2.9	4.5	4.4	5.1	5.7	4.8	5.0	3.6	3.0	47.3
	transfers	from category 1 storage		-	-	-	-	-	-	-	-	-	-	-	-	
		purchase from CICL	input	60.0	30.0	30.0	30.0	25.0	-	-	-	30.0	40.0	50.0	60.0	355.0
		Total sources		213.9	184.1	168.2	158.7	163.6	154.0	150.0	145.4	164.4	185.2	200.1	212.5	
Less	evaporation	Kc = 0.95		40.2	33.1	27.6	16.4	9.4	6.4	7.1	10.7	16.1	25.4	33.2	39.6	265.2
	dairy	dust control		3.5	2.6	2.4	1.4	0.8	0.5	0.6	0.9	1.4	2.2	2.8	3.5	
		landscape		4.2	3.1	2.9	1.7	1.0	0.7	0.8	1.1	1.6	2.7	3.4	4.2	50.1
	ethanol	dust control		3.5	2.6	2.4	1.4	0.8	0.6	0.6	0.9	1.4	2.2	2.9	3.5	
		landscape		10.6	7.9	7.3	4.3	2.5	1.7	1.9	2.8	4.2	6.7	8.7	10.4	91.9
	transfers	to category 3 storage		-	-	-	-	-	-	-	-	-	-	-	-	
		Total sinks		62.0	49.3	42.7	25.2	14.5	9.9	11.0	16.5	24.8	39.2	51.1	61.2	
		Closing balance		151.9	134.8	125.5	133.5	149.1	144.2	139.0	128.9	139.6	146.1	149.1	151.3	

FOUR ARROWS ETHANOL PTY LTD : ***Consolidated water budget for a decile 5 or median rainfall year***

Category 3 - recycling & evaporation

Category 3 - Recycle ponds

Notes : Pumped post settled water from sedimentation basin/s
Aerated to prevent anaeroboc/anoxic conditions
In two (2) cells of 2 ha each to facilitate maintenance
Operate at around 50% of capacity for storm event management

maximum capacity (ML) 80.0 | maximum water depth (m) 2.00 | surface area (ha) 4.0

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
Open balance		40.0	34.7	33.4	35.3	35.2	35.7	32.0	34.7	37.9	37.7	35.1	22.3	
Add	Cat 3 run-off ex dairy project	222.7	198.6	221.7	214.4	225.1	217.8	226.4	227.8	218.8	226.1	216.1	221.7	2,637.2
	Cat 3 run-off ex ethanol project	-	-	-	-	-	-	-	-	-	-	-	-	-
	rain (assume no cover)	0.9	0.5	0.8	0.8	1.2	1.2	1.4	1.5	1.3	1.3	1.0	0.8	12.6
	transfers from category 2 storage	-	-	-	-	-	-	-	-	-	-	-	-	-
	purchase from CICL input	20.0	20.0	20.0	15.0	5.0	-	5.0	10.0	10.0	10.0	15.0	20.0	150.0
	Total sources	283.6	253.8	275.9	265.6	266.4	254.7	264.8	273.9	268.0	275.1	267.2	264.8	
Less	evaporation Kc = 0.95	10.7	8.8	7.4	4.4	2.5	1.7	1.9	2.9	4.3	6.8	8.9	10.6	70.7
	used to flush freestalls	223.2	201.6	223.2	216.0	223.2	216.0	223.2	223.2	216.0	223.2	216.0	223.2	2,628.0
	transfers to Cat 4 evap ponds input	15.0	10.0	10.0	10.0	5.0	5.0	5.0	10.0	10.0	10.0	20.0	20.0	130.0
	Total sinks	248.9	220.4	240.6	230.4	230.7	222.7	230.1	236.1	230.3	240.0	244.9	253.8	
	Closing balance	34.7	33.4	35.3	35.2	35.7	32.0	34.7	37.9	37.7	35.1	22.3	11.1	

Category 4 - Evaporation basin

Notes : To evaporate excess water & accumulate salts & nutrients
In four (4) cells to spread risk and facilitate storage management

Notes : Aerated to prevent anaeroboc/anoxic conditions
Consider salt tolerant macrophytes

maximum capacity (ML) 275.0 | maximum water depth (m) 2.75 | surface area (ha) 10.0

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
Open balance		100.0	91.9	82.3	76.9	78.4	80.5	84.3	88.2	95.3	98.3	95.6	97.0	
Add	rain	2.3	1.3	2.0	1.9	3.0	2.9	3.4	3.8	3.2	3.3	2.4	2.0	31.5
	transfers from Cat 3	15.0	10.0	10.0	10.0	5.0	5.0	5.0	10.0	10.0	10.0	20.0	20.0	130.0
	purchase from CICL input	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total sources	117.3	103.2	94.3	88.8	86.4	88.4	92.7	102.0	108.5	111.6	118.0	119.0	
Less	evaporation Kc = 0.90	25.4	20.9	17.5	10.4	5.9	4.1	4.5	6.8	10.2	16.0	21.0	25.0	167.5
	transfers input	-	-	-	-	-	-	-	-	-	-	-	-	
	Total sinks	25.4	20.9	17.5	10.4	5.9	4.1	4.5	6.8	10.2	16.0	21.0	25.0	
	Closing balance	91.9	82.3	76.9	78.4	80.5	84.3	88.2	95.3	98.3	95.6	97.0	94.0	

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Storm buffer capacity in Cat 3 ponds (ML)	228.4	239.3	242.8	241.4	238.8	238.7	232.1	221.8	219.0	224.3	235.6	249.9
Required storm to fill airspace (mm ex 90ha)	253.7	265.8	269.8	268.2	265.3	265.2	257.9	246.5	243.3	249.2	261.8	277.7

FOUR ARROWS ETHANOL PTY LTD : *Total water demands in a decile 5 or median rainfall yea*

						JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
METEOROLOGICAL																		
Rain			CSIRO Griffith		mm/mth	23.0	13.0	20.0	19.0	30.0	29.0	34.0	38.0	32.0	33.0	24.0	20.0	315.0
Evapotranspiration			Eto - Griffith CSIRO		mm/mth	282.0	232.0	194.0	115.0	66.0	45.0	50.0	75.0	113.0	178.0	233.0	278.0	1,861.0
WATER DEMAND - DAIRY ENTERPRISE																		
Cattle	milkers		6,000	hd using	L/day	140	140	140	120	100	80	80	90	100	120	140	140	
	dries & 1st heifers		1,975			80	80	80	65	50	40	40	50	60	70	80	80	
	heifers	calves	1,599			10	10	10	8	5	3	3	5	7	9	10	10	
		weaners	2,942			20	20	20	15	11	8	8	10	14	18	20	20	
		yearlings	2,842			40	40	40	32	27	20	20	25	30	35	40	40	
		joined	1,666			75	75	75	60	45	35	35	45	55	65	75	75	
	bulls	calves	178			10	10	10	8	5	3	3	5	7	9	10	10	
					ML/d	1.31	1.31	1.31	1.10	0.89	0.70	0.70	0.82	0.95	1.13	1.31	1.31	
					ML/mth	40.71	36.77	40.71	32.93	27.64	21.09	21.79	25.52	28.47	35.18	39.40	40.71	390.9
Free	flushing		7,200	hd using	L/day	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	
stalls	misting		7,200			10	10	10	5						5	10	10	
					ML/d	7.27	7.27	7.27	7.24	7.20	7.20	7.20	7.20	7.20	7.24	7.27	7.27	
					ML/mth	225.43	203.62	225.43	217.08	223.20	216.00	223.20	223.20	216.00	224.32	218.16	225.43	2,641.1
Dry lots	misting		12,000	hd using	L/day	15	15	15	10					10	15	15	15	
	other/dust control		12,000															
					ML/d	0.18	0.18	0.18	0.12	0.00	0.00	0.00	0.00	0.12	0.18	0.18	0.18	
					ML/mth	5.58	5.04	5.58	3.60	0.00	0.00	0.00	0.00	3.60	5.58	5.40	5.58	40.0
Dairy	cow wash down		6,000	hd using	L/day	100	100	100	100	100	100	100	100	100	100	100	100	
	yard wash down		6,000			50	50	50	50	50	50	50	50	50	50	50	50	
	cleaning		6,000			10	10	10	10	10	10	10	10	10	10	10	10	
					ML/d	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
					ML/mth	29.76	26.88	29.76	28.80	29.76	28.80	29.76	29.76	28.80	29.76	28.80	29.76	350.4
Other	office	10	people using	20	L/day	200	200	200	200	200	200	200	200	200	200	200	200	
	staff	60	people using	25	L/day	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	
	workshop	1	facility using	3,000	L/day	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
	landscape inner	2	ha with Kc =	0.75	L/day	136,452	112,258	93,871	55,645	31,935	21,774	24,194	36,290	54,677	86,129	112,742	134,516	
	outer	5	ha with Kc =	0.25	L/day	113,710	93,548	78,226	46,371	26,613	18,145	20,161	30,242	45,565	71,774	93,952	112,097	
					ML/d	0.25	0.21	0.18	0.11	0.06	0.04	0.05	0.07	0.10	0.16	0.21	0.25	
					ML/mth	7.90	6.53	5.48	3.31	1.96	1.38	1.52	2.21	3.25	5.04	6.55	7.79	52.9
	Total water demand by dairy enterprise				**ML/mth**	**309.38**	**278.83**	**306.96**	**285.72**	**282.56**	**267.27**	**276.27**	**280.68**	**280.12**	**299.88**	**298.31**	**309.27**	**3,475.3**
WATER DEMAND - ETHANOL PLANT																		
Ethanol production	grain usage		725,000	tonnes/yr	t/mth	61,575	55,616	61,575	59,589	61,575	59,589	61,575	61,575	59,589	61,575	59,589	61,575	
	water usage		2170	./t grain @ 12%	ML/mth	133.62	120.69	133.62	129.31	133.62	129.31	133.62	133.62	129.31	133.62	129.31	133.62	1,573.3
Other	office	10	people using	20	L/day	200	200	200	200	200	200	200	200	200	200	200	200	
	staff	45	people using	25	L/day	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	
	workshop	1	facility using	3,000	L/day	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
	landscape inner	5	ha with Kc =	0.75	L/day	341,129	280,645	234,677	143,750	79,839	56,250	60,484	90,726	141,250	215,323	291,250	336,290	
	outer	5	ha with Kc =	0.25	L/day	113,710	93,548	78,226	47,917	26,613	18,750	20,161	30,242	47,083	71,774	97,083	112,097	
					ML/d	0.46	0.38	0.32	0.20	0.11	0.08	0.08	0.13	0.19	0.29	0.39	0.45	
					ML/mth	14.23	10.60	9.83	5.88	3.43	2.38	2.63	3.88	5.78	9.03	11.78	14.03	93.5
	Total water demand by ethanol plant				**ML/mth**	**147.85**	**131.29**	**143.45**	**135.19**	**137.05**	**131.69**	**136.25**	**137.50**	**135.09**	**142.65**	**141.09**	**147.65**	
TOTAL WATER DEMAND	Dairy enterprise				ML/mth	309.38	278.83	306.96	285.72	282.56	267.27	276.27	280.68	280.12	299.88	298.31	309.27	
	Ethanol plant				ML/mth	147.85	131.29	143.45	135.19	137.05	131.69	136.25	137.50	135.09	142.65	141.09	147.65	
	Total				**ML/mth**	**457.24**	**410.12**	**450.42**	**420.90**	**419.62**	**398.96**	**412.53**	**418.19**	**415.21**	**442.53**	**439.40**	**456.93**	**5,142.0**

FOUR ARROWS ETHANOL PTY LTD : *Water run-off from dairy enterprise in a decile 5 or median rainfall year*

							JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS	Category
METEOROLOGICAL																				
Rain			CSIRO Griffith			mm/mth	23.0	13.0	20.0	19.0	30.0	29.0	34.0	38.0	32.0	33.0	24.0	20.0	315.0	
Evapotranspiration			Eto - Griffith CSIRO			mm/mth	282.0	232.0	194.0	115.0	66.0	45.0	50.0	75.0	113.0	178.0	233.0	278.0	1,861.0	
WATER RUN-OFF GENERATED : DAIRY ENTERPRISE																				
Cow sheds	roof area	4.5	sheds			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		35	m wide	600	m long	ML/mth	2.17	1.23	1.89	1.80	2.84	2.74	3.21	3.59	3.02	3.12	2.27	1.89	29.8	1
	open pens	9	pens			R_o =	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80		
		30	m wide	600	m long	ML/mth	2.98	1.68	2.59	2.46	3.89	3.76	4.41	4.92	4.15	4.28	3.11	2.59	40.8	3
	flushing	7,200	head	1,000	L/hd/day	R_o =	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85		
						ML/mth	189.72	171.36	189.72	183.60	189.72	183.60	189.72	189.72	183.60	189.72	183.60	189.72	2233.8	3
Dry lots	roof area	60	pens			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		10	m wide	70	m long	ML/mth	0.97	0.55	0.84	0.80	1.26	1.22	1.43	1.60	1.34	1.39	1.01	0.84	13.2	1
	open pens	60	pens			R_o =	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80		
		52	m wide	70	m long	ML/mth	4.02	2.27	3.49	3.32	5.24	5.07	5.94	6.64	5.59	5.77	4.19	3.49	55.0	3
	paved area	60	pens			R_o =	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80		
		7.5	m wide	70	m long	ML/mth	0.58	0.33	0.50	0.48	0.76	0.73	0.86	0.96	0.81	0.83	0.60	0.50	7.9	3
Dairy	roof area	2	sheds			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		20	m wide	250	m long	ML/mth	0.23	0.13	0.20	0.19	0.30	0.29	0.34	0.38	0.32	0.33	0.24	0.20	3.2	1
	milk store	1	sheds			R_o =	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		
		20	m wide	250	m long	ML/mth	0.11	0.06	0.10	0.09	0.14	0.14	0.16	0.18	0.15	0.16	0.11	0.10	1.5	1
	cow wash	6,000	head	100	L/hd/day	R_o = 0.85	15.81	14.28	15.81	15.30	15.81	15.30	15.81	15.81	15.30	15.81	15.30	15.81	186.2	3
	yard wash	6,000		50		R_o = 0.85	7.91	7.14	7.91	7.65	7.91	7.65	7.91	7.91	7.65	7.91	7.65	7.91	93.1	3
	cleaning	6,000		10		R_o = 0.85	1.58	1.43	1.58	1.53	1.58	1.53	1.58	1.58	1.53	1.58	1.53	1.58	18.6	3
Other buildings	office	20	m wide	25	m long	R_o = 0.8	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.1	1
	staff	20	m wide	20	m long	R_o = 0.8	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.1	1
	feed mill	20	m wide	50	m long	R_o = 0.8	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.3	1
	commodity	50	m wide	100	m long	R_o = 0.8	0.09	0.05	0.08	0.08	0.12	0.12	0.14	0.15	0.13	0.13	0.10	0.08	1.3	1
	workshop	30	m wide	50	m long	R_o = 0.8	0.03	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.04	0.03	0.02	0.4	1
	equipment	30	m wide	50	m long	R_o = 0.8	0.03	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.04	0.03	0.02	0.4	1
Paved areas	roads	9	m wide	2,000	m long	R_o = 0.8	0.33	0.19	0.29	0.27	0.43	0.42	0.49	0.55	0.46	0.48	0.35	0.29	4.5	2
	cemented		say	3,000	sq m	R_o = 0.8	0.06	0.03	0.05	0.05	0.07	0.07	0.08	0.09	0.08	0.08	0.06	0.05	0.8	2
	carparks			4,000	sq m	R_o = 0.8	0.07	0.04	0.06	0.06	0.10	0.09	0.11	0.12	0.10	0.11	0.08	0.06	1.0	2
	truck wash			4,000	sq m	R_o = 0.8	0.07	0.04	0.06	0.06	0.10	0.09	0.11	0.12	0.10	0.11	0.08	0.06	1.0	3
Other	landscape		say	150	ha	R_o =	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2	0.1	0.1		
						ML/mth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2
	cattle yards		say	3,000	sq m	R_o = 0.8	0.06	0.03	0.05	0.05	0.07	0.07	0.08	0.09	0.08	0.08	0.06	0.05	0.8	3
Total project area	230.0		**RUN-OFF -** total volume generated				226.84	200.89	225.30	217.85	230.44	222.99	232.50	234.56	224.54	231.99	220.42	225.30	2693.6	
Total above areas	60.7																			
Remainder landscape	169.3		1	best quality water			3.66	2.07	3.18	3.02	4.78	4.62	5.41	6.05	5.09	5.25	3.82	3.18	56.4	1
Say	150.0		2	some contamination			0.46	0.26	0.40	0.38	0.60	0.58	0.68	0.76	0.64	0.66	0.48	0.40	103.8	2
			3	heavily contaminated			222.72	198.56	221.72	214.45	225.07	217.80	226.41	227.75	218.80	226.07	216.12	221.72	2533.4	3
						Total	226.8	200.9	225.3	217.9	230.4	223.0	232.5	234.6	224.5	232.0	220.4	225.3	2693.6	

Table Key

ha = hectares; m^3 = cubic metres; hd = head; ML = Megalitres; kp = Pan Coefficient; mm = millimetres; L = Litres; mth = month; m = metres; R_o = Run-off Factor; m^2 = square metres; sq = square

FOUR ARROWS ETHANOL PTY LTD : *Water run-off from ethanol plant in a decile 5 or median rainfall year*

								JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS	Category
METEOROLOGICAL																					
Rain			CSIRO Griffith				mm/mth	23.0	13.0	20.0	19.0	30.0	29.0	34.0	38.0	32.0	33.0	24.0	20.0	315.0	
Evapotranspiration			Eto - Griffith CSIRO				mm/mth	282.0	232.0	194.0	115.0	66.0	45.0	50.0	75.0	113.0	178.0	233.0	278.0	1,861.0	
WATER RUN-OFF GENERATED : ETHANOL PLANT																					
Ethanol plant	roof area	25	units				R_o =	0.7	0.7	0.7	0.8	0.9	1.0	1.0	1.0	0.9	0.8	0.7	0.7		
		25	m wide	25	m long		ML/mth	0.25	0.14	0.22	0.24	0.42	0.45	0.53	0.59	0.45	0.41	0.26	0.22	4.2	1
	service access	25	units				R_o =	0.7	0.7	0.7	0.8	0.9	1.0	1.0	1.0	0.9	0.8	0.7	0.7		
		5	m wide	3,000	m long		ML/mth	6.04	3.41	5.25	5.70	10.13	10.88	12.75	14.25	10.80	9.90	6.30	5.25	100.7	1
	wash down	375,000	m^2	0.05	L/day/m^2	guesstimated		0.58	0.53	0.58	0.56	0.58	0.56	0.58	0.58	0.56	0.58	0.56	0.58	6.8	1
	chemical shed	20	m wide	25	m long			0.36	0.32	0.31	0.35	0.47	0.30	0.53	0.59	0.44	0.51	0.57	0.31	5.0	
							Total ML/mth	7.23	4.40	6.36	6.85	11.59	12.19	14.39	16.01	12.25	11.41	7.70	6.36	116.7	
Grain storage	Bunkers	150,000	tonnes capacity																		
		30	m wide	1.0	m rise in	2.2	repose														
				1.0	m retaining side wall																
				7.8	m high																
				147.3	m^3 per linear meter																
				0.72	tonnes/m^3 bulk density																
				106.0	tonnes per linear metre																
				1,415	linear "m" of grain bunkers																
			say	1,600	linear "m" of grain bunkers																
	Bunkers	8	units				R_o =	0.5	0.5	0.6	0.7	0.8	1.0	1.0	1.0	0.9	0.8	0.7	0.5		
		30	m wide	200	m long		ML/mth	0.55	0.31	0.58	0.64	1.15	1.39	1.63	1.82	1.38	1.27	0.81	0.48	12.0	1
	Service access	8	units				R_o =	0.5	0.5	0.6	0.7	0.8	1.0	1.0	1.0	0.9	0.8	0.7	0.5		
		9	m wide	3,968	m long		ML/mth	3.29	1.86	3.43	3.80	6.86	8.29	9.71	10.86	8.23	7.54	4.80	2.86	71.5	1
	Roads	9	m wide	500	m long		R_o =	0.5	0.5	0.6	0.7	0.8	1.0	1.0	1.0	0.9	0.8	0.7	0.5		
							ML/mth	0.05	0.03	0.05	0.06	0.11	0.13	0.15	0.17	0.13	0.12	0.08	0.05	1.1	1
							Total ML/mth	3.89	2.20	4.06	4.50	8.12	9.81	11.50	12.85	9.74	8.93	5.68	3.38	84.7	
Other buildings	office	20	m wide	25	m long	R_o =	0.8	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.1	1
	staff	20	m wide	20	m long	R_o =	0.8	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.1	1
	workshop	30	m wide	50	m long	R_o =	0.8	0.03	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.04	0.03	0.02	0.4	1
	equipment	30	m wide	50	m long	R_o =	0.8	0.03	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.04	0.03	0.02	0.4	1
	other	30	m wide	50	m long	R_o =	0.8	0.03	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.04	0.03	0.02	0.4	1
							Total ML/mth	0.10	0.06	0.09	0.08	0.13	0.13	0.15	0.16	0.14	0.14	0.10	0.09	1.4	
Service areas	roads	9	m wide	2,000	m long	R_o =	0.8	0.33	0.19	0.29	0.27	0.43	0.42	0.49	0.55	0.46	0.48	0.35	0.29	4.5	1
	cemented		say	3,000	sq m	R_o =	0.8	0.06	0.03	0.05	0.05	0.07	0.07	0.08	0.09	0.08	0.08	0.06	0.05	0.8	1
	carparks			4,000	sq m	R_o =	0.8	0.07	0.04	0.06	0.06	0.10	0.09	0.11	0.12	0.10	0.11	0.08	0.06	1.0	1
	truck wash			4,000	sq m	R_o =	0.8	0.07	0.04	0.06	0.06	0.10	0.09	0.11	0.12	0.10	0.11	0.08	0.06	1.0	1
							Total ML/mth	0.53	0.30	0.46	0.44	0.70	0.67	0.79	0.88	0.74	0.77	0.56	0.46	7.3	
Other	landscape		say	25	ha		R_o =	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2	0.1	0.1		
							ML/mth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2
	other		say	0	sq m	R_o =	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3
							Total ML/mth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	
Total project area		100.0	**RUN-OFF -** total volume generated					11.75	6.96	10.97	11.87	20.54	22.80	26.82	29.91	22.87	21.24	14.04	10.29	210.0	
Total above areas		76.4																			
Remainder landscape		23.6	1	best quality water				11.75	6.96	10.97	11.87	20.54	22.80	26.82	29.91	22.87	21.24	14.04	10.29	210.0	1
Say		25.0	2	some contamination				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2
			3	heavily contaminated				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3
							Total	11.75	6.96	10.97	11.87	20.54	22.80	26.82	29.91	22.87	21.24	14.04	10.29	210.0	

Table Key

ha = hectares; m^3 = cubic metres; hd = head; ML = Megalitres; kp = Pan Coefficient; mm = millimetres; L = Litres; mth = month; m = metres; R_o = Run-off Factor; m^2 = square metres; sq = square

Rainfall (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Decile 1 (1:10 dry)	16.4	16.7	17.4	17.3	21.7	21.9	18.5	19.6	19.1	21.6	14.8	15.6	220.6
Decile 5 (average)	27.3	27.8	38.9	28.7	36.1	36.5	30.8	32.6	31.8	35.9	24.6	26.0	377.0
Decile 9 (1:10 wet)	38.3	39.0	40.6	40.3	50.7	51.2	43.2	45.8	44.6	50.4	34.5	36.5	515.1
Decile 9 (monthly)	80.0	75.0	60.0	70.0	85.0	80.0	75.0	70.0	60.0	80.0	75.0	80.0	890.0
Decile 10 (monthly)	220.0	160.0	190.0	150.0	140.0	150.0	85.0	90.0	100.0	150.0	125.0	150.0	1,710.0

Assume The ratio of D10 & D9 monthly data is a fair representation of the ratios for the D10 & D9 annual data
That is, inflate the D9 annual data by 1710 divided by 890 = 1.92

Decile 10 (extreme wet)	73.6	74.9	78.0	77.4	97.4	98.4	83.0	88.0	85.7	96.8	66.3	70.1	989.7
	73.6	74.9	78.0	77.4	97.4	98.4	83.0	88.0	85.7	96.8	66.3	70.1	989.6

Comments on rainfall data

A decile 9 year provides the best data for accumlative impacts of a very wet year but does not reflect significant rain events
The decile 10 data is the largest rainfalls recorded in any single month and will be from one or more significant rainfall events
For modelling a major rainfall event the following parameters are adopted
the pens are wet from recent succession of wet days
the run-off factor shall increase to say 0.95 from the standard of 0.80
the assumed rain event shall be 150mm over 24 hrs

Evaporation (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Decile 1 (1:10 dry)	300.0	260.0	220.0	110.0	75.0	50.0	55.0	80.0	120.0	185.0	250.0	300.0	2,005.0
	0.55	0.55	0.60	0.70	0.80	0.90	0.90	0.90	0.80	0.70	0.60	0.60	
	165.0	143.0	132.0	77.0	60.0	45.0	49.5	72.0	96.0	129.5	150.0	180.0	1,299.0
Decile 5 (average)	274.0	237.0	192.0	111.0	62.0	39.0	45.0	65.0	99.0	158.0	218.0	272.0	1,772.0
	0.60	0.60	0.60	0.65	0.80	0.90	0.90	0.90	0.80	0.70	0.60	0.60	
	164.4	142.2	115.2	72.2	49.6	35.1	40.5	58.5	79.2	110.6	130.8	163.2	1,161.5
Decile 9 (1:10 wet)	220.0	190.0	150.0	90.0	50.0	30.0	35.0	50.0	80.0	125.0	175.0	215.0	1,410.0
	0.70	0.70	0.70	0.75	0.80	0.90	0.90	0.90	0.80	0.80	0.70	0.70	
	154.0	133.0	105.0	67.5	40.0	27.0	31.5	45.0	64.0	100.0	122.5	150.5	1,040.0
Decile 10 (extreme wet)	200.0	180.0	140.0	80.0	45.0	25.0	30.0	45.0	75.0	115.0	165.0	200.0	1,300.0
	0.75	0.70	0.75	0.80	0.90	0.95	0.95	0.95	0.85	0.85	0.75	0.70	
	150.0	126.0	105.0	64.0	40.5	23.8	28.5	42.8	63.8	97.8	123.8	140.0	1,005.8

ANNEXURE 22.0b

DECILE 9.5 (D9.5)

FOUR ARROWS ETHANOL PTY LTD : *Consolidated water budget for a decile 9.5 year*

Category 1 & 2 = good quality water

			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
METEOROLOGICAL															
Rain	Griffith CSIRO	mm/mth	104.0	93.0	72.0	97.0	88.0	72.0	82.0	62.0	95.0	112.0	66.0	72.0	1,015.0
		effectiveness	90%	90%	90%	95%	95%	95%	95%	95%	95%	95%	90%	90%	
Evapotranspiration	Griffith CSIRO - Eto	mm/mth	229.0	199.0	155.0	85.0	50.0	29.0	37.0	55.0	88.0	118.0	186.0	219.0	1,450.0

Category 1 water

For drinking by cattle, potable other uses and in ethanol plant

maximum capacity (ML) 150 | maximum water depth (m) 4.0 | surface area (ha) 3.75

				JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Open balance				50.0	65.8	72.6	44.9	40.5	33.6	44.3	38.8	33.4	32.0	48.2	43.4	
Add	run-off ex dairy			16.6	14.8	11.5	15.5	14.0	11.5	13.1	9.9	15.1	17.9	10.5	11.5	161.8
	run-off ex ethanol			65.7	62.2	50.9	75.5	68.8	57.1	65.1	48.4	73.5	78.9	44.2	45.7	735.9
	rain			3.9	3.5	2.7	3.6	3.3	2.7	3.1	2.3	3.6	4.2	2.5	2.7	38.1
	transfers	purchase from CICL	input	150.0	125.0	125.0	100.0	100.0	120.0	100.0	125.0	100.0	125.0	150.0	160.0	1,480.0
		Total sources		286.2	271.3	262.6	239.5	226.7	224.8	225.6	224.5	225.6	257.9	255.3	263.2	
Less	evaporation	Kc = 0.95		8.2	7.1	5.5	3.0	1.8	1.0	1.3	2.0	3.1	4.2	6.6	7.8	51.7
	dairy	drinking		40.7	36.8	40.7	32.9	27.6	21.1	21.8	25.5	28.5	35.2	39.4	40.7	
		misting		7.8	7.1	7.8	4.7	-	-	-	-	3.6	6.7	7.6	7.8	
		cow washdown		27.9	25.2	27.9	27.0	27.9	27.0	27.9	27.9	27.0	27.9	27.0	27.9	
		cleaning		1.9	1.7	1.9	1.8	1.9	1.8	1.9	1.9	1.8	1.9	1.8	1.9	
		office+staff+workshop		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	796.1
	ethanol	plant		133.6	120.7	133.6	129.3	133.6	129.3	133.6	133.6	129.3	133.6	129.3	133.6	
		office+staff+workshop		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1,574.8
	transfers	to Cat 2		-	-	-	-	-	-	-	-	-	-	-	-	
		Total sinks		220.3	198.7	217.7	199.0	193.1	180.5	186.8	191.1	193.6	209.7	212.0	220.0	
		Closing balance		65.8	72.6	44.9	40.5	33.6	44.3	38.8	33.4	32.0	48.2	43.4	43.2	

Note : The maximum capacity for approval purposes is 150 ML. However it is more likely that this storage will be constructed to only 50 ML max capacity under expected delivery agreements with CICL

Category 2 water

Limited contamination - readily made potable if needed

maximum capacity (ML) 300 | maximum water depth (m) 2.0 | surface area (ha) 15.00

				JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Open balance				150.0	227.9	259.8	245.2	247.0	255.4	269.9	286.4	287.4	288.4	286.9	266.1	
Add	run-off ex dairy			2.1	1.9	1.4	1.9	3.9	8.6	10.6	1.2	1.9	2.2	1.3	1.4	38.7
	run-off ex ethanol			-	-	-	-	-	-	-	-	-	-	-	-	-
	rain			15.6	14.0	10.8	14.6	13.2	10.8	12.3	9.3	14.3	16.8	9.9	10.8	152.3
	transfers	from category 1 storage		-	-	-	-	-	-	-	-	-	-	-	-	
		purchase from CICL	input	100.0	50.0	-	-	-	-	-	-	-	-	-	-	150.0
		Total sources		267.7	293.8	272.1	261.7	264.1	274.9	292.8	296.9	303.6	307.4	298.2	278.3	
Less	evaporation	Kc = 0.95		32.6	28.4	22.1	12.1	7.1	4.1	5.3	7.8	12.5	16.8	26.5	31.2	206.6
	dairy	dust control		-	-	-	-	-	-	-	-	-	-	-	-	
		landscape		1.4	1.1	0.9	0.5	0.3	0.2	0.2	0.3	0.5	0.7	1.1	1.3	8.5
	ethanol	dust control		-	-	-	-	-	-	-	-	-	-	-	-	
		landscape		5.7	4.5	3.9	2.1	1.3	0.7	0.9	1.4	2.1	3.0	4.5	5.5	35.5
	transfers	to Cat 3 evaporation		-	-	-	-	-	-	-	-	-	-	-	-	
		CICL drain (after Cat 2 full)		-	-	-	-	-	-	-	-	-	-	-	-	0.0
		Total sinks		39.7	33.9	26.9	14.7	8.7	5.0	6.4	9.5	15.2	20.5	32.1	38.0	
		Closing balance		227.9	259.8	245.2	247.0	255.4	269.9	286.4	287.4	288.4	286.9	266.1	240.3	

FOUR ARROWS ETHANOL PTY LTD : ***Consolidated water budget for a decile 9.5 year***

Category 3 - recycling & evaporation

Category 3 - Recycle pond for dairy

Notes : Pumped settled water from sedimentation basin/s
Aerated to prevent anaerobic/anoxic conditions
In two (2) cells of 2 ha each to facilitate maintenance
Operate at around 50% of capacity for storm event management

			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
maximum capacity (ML)			80.0					maximum water depth (m)		2.00		surface area (ha)		4.0	
Open balance			40.0	52.1	60.1	60.3	58.7	59.5	59.8	58.6	58.6	56.1	59.1	56.0	
Add	Cat 3 run-off ex dairy		249.9	228.4	241.5	243.7	247.4	234.5	245.2	237.8	243.0	256.2	232.3	241.5	2,901.3
	Cat 3 run-off ex ethanol		-	-	-	-	-	-	-	-	-	-	-	-	-
	rain	(Assume no cover)	4.2	3.7	2.9	3.9	3.5	2.9	3.3	2.5	3.8	4.5	2.6	2.9	40.6
	transfers from category 2 storage		-	-	-	-	-	-	-	-	-	-	-	-	-
	purchase from CICL	input	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total sources		294.0	284.2	304.4	307.9	309.6	296.9	308.2	298.9	305.4	316.7	294.0	300.3	
Less	evaporation	Kc = 0.95	8.7	7.6	5.9	3.2	1.9	1.1	1.4	2.1	3.3	4.5	7.1	8.3	55.1
	used to flush freestalls		223.2	201.6	223.2	216.0	223.2	216.0	223.2	223.2	216.0	223.2	216.0	223.2	2,628.0
	transfers to Cat 4 evap ponds	input	10.0	15.0	15.0	30.0	25.0	20.0	25.0	15.0	30.0	30.0	15.0	10.0	240.0
	Total sinks		241.9	224.2	244.1	249.2	250.1	237.1	249.6	240.3	249.3	257.7	238.1	241.5	
	Closing balance		52.1	60.1	60.3	58.7	59.5	59.8	58.6	58.6	56.1	59.1	56.0	58.8	

Category 4 - Evaporation basin

Notes : To evaporate excess water & accumulate salts & nutrients
In four (4) cells to spread risk and facilitate storage management

Notes : Aerated to prevent anaerobic/anoxic conditions
Consider salt tolerant macrophytes

			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
maximum capacity (ML)			275.0					maximum water depth (m)		2.75		surface area (ha)		10.0	
Open balance			100.0	99.8	106.2	114.4	146.5	175.8	200.4	230.2	246.5	278.1	308.7	313.5	
Add	rain		10.4	9.3	7.2	9.7	8.8	7.2	8.2	6.2	9.5	11.2	6.6	7.2	101.5
	transfers from Cat 3		10.0	15.0	15.0	30.0	25.0	20.0	25.0	15.0	30.0	30.0	15.0	10.0	240.0
	purchase from CICL	input	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total sources		120.4	124.1	128.4	154.1	180.3	203.0	233.6	251.4	286.0	319.3	330.3	330.7	
Less	evaporation	Kc = 0.9	20.6	17.9	14.0	7.7	4.5	2.6	3.3	5.0	7.9	10.6	16.7	19.7	130.5
	transfers	input	-	-	-	-	-	-	-	-	-	-	-	-	
	Total sinks		20.6	17.9	14.0	7.7	4.5	2.6	3.3	5.0	7.9	10.6	16.7	19.7	
	Closing balance		99.8	106.2	114.4	146.5	175.8	200.4	230.2	246.5	278.1	308.7	313.5	311.0	

Storm buffer capacity in Cat 3 ponds (ML)	203.1	188.7	180.2	149.8	119.7	94.8	66.1	49.9	20.8	-12.7	-14.5	-14.8	
Required storm to fill airspace (mm ex 90ha)	225.6	209.7	200.3	166.4	133.0	105.3	73.5	55.4	23.2	-14.1	-16.1	-16.4	
										freeboard intrusion			

FOUR ARROWS ETHANOL PTY LTD : *Overall water demands in a decile 9.5 year*

						JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
METEOROLOGICAL																		
Rain		Griffith CSIRO			mm/mth	104.0	93.0	72.0	97.0	88.0	72.0	82.0	62.0	95.0	112.0	66.0	72.0	1,015.0
Evapotranspiration		Griffith CSIRO - Eto			mm/mth	229.0	199.0	155.0	85.0	50.0	29.0	37.0	55.0	88.0	118.0	186.0	219.0	1,450.0
WATER DEMAND - DAIRY ENTERPRISE																		
Cattle	milkers		6,000	hd using	L/day	140	140	140	120	100	80	80	90	100	120	140	140	
	dries & 1st heifers		1,975			80	80	80	65	50	40	40	50	60	70	80	80	
	heifers	calves	1,599			10	10	10	8	5	3	3	5	7	9	10	10	
		weaners	2,942			20	20	20	15	11	8	8	10	14	18	20	20	
		yearlings	2,842			40	40	40	32	27	20	20	25	30	35	40	40	
		joined	1,666			75	75	75	60	45	35	35	45	55	65	75	75	
	bulls	calves	178			10	10	10	8	5	3	3	5	7	9	10	10	
					ML/d	1.31	1.31	1.31	1.10	0.89	0.70	0.70	0.82	0.95	1.13	1.31	1.31	
					ML/mth	40.71	36.77	40.71	32.93	27.64	21.09	21.79	25.52	28.47	35.18	39.40	40.71	390.9
Free stalls	flushing		7,200	hd using	L/day	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	
	misting		7,200			10	10	10	5						5	10	10	
					ML/d	7.27	7.27	7.27	7.24	7.20	7.20	7.20	7.20	7.20	7.24	7.27	7.27	
					ML/mth	225.43	203.62	225.43	217.08	223.20	216.00	223.20	223.20	216.00	224.32	218.16	225.43	2,641.1
Dry lots	misting		12,000	hd using	L/day	15	15	15	10					10	15	15	15	
	other/dust control		12,000															
					ML/d	0.18	0.18	0.18	0.12	0.00	0.00	0.00	0.00	0.12	0.18	0.18	0.18	
					ML/mth	5.58	5.04	5.58	3.60	0.00	0.00	0.00	0.00	3.60	5.58	5.40	5.58	40.0
Dairy	cow wash down		6,000	hd using	L/day	100	100	100	100	100	100	100	100	100	100	100	100	
	yard wash down		6,000			50	50	50	50	50	50	50	50	50	50	50	50	
	cleaning		6,000			10	10	10	10	10	10	10	10	10	10	10	10	
					ML/d	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
					ML/mth	29.76	26.88	29.76	28.80	29.76	28.80	29.76	29.76	28.80	29.76	28.80	29.76	350.4
Other	office	10	people using	20	L/day	200	200	200	200	200	200	200	200	200	200	200	200	
	staff	60	people using	25	L/day	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	
	workshop	1	facility using	3,000	L/day	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
	landscape inner	2	ha with Kc =	0.30	L/day	44,323	38,516	30,000	16,452	9,677	5,613	7,161	10,645	17,032	22,839	36,000	42,387	
	outer	5	ha with Kc =	0.00	L/day	0	0	0	0	0	0	0	0	0	0	0	0	
					ML/d	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	
					ML/mth	1.52	1.34	1.08	0.66	0.45	0.32	0.37	0.48	0.67	0.85	1.26	1.46	10.4
	Total water demand by dairy enterprise				**ML/mth**	**303.00**	**273.65**	**302.56**	**283.06**	**281.05**	**266.21**	**275.12**	**278.95**	**277.54**	**295.69**	**293.02**	**302.94**	**3,432.8**
WATER DEMAND - ETHANOL PLANT																		
Ethanol production	grain usage		725,000	tonnes/yr	t/mth	61,575	55,616	61,575	59,589	61,575	59,589	61,575	61,575	59,589	61,575	59,589	61,575	
	water usage		2170	L/t grain 12%	ML/mth	133.62	120.69	133.62	129.31	133.62	129.31	133.62	133.62	129.31	133.62	129.31	133.62	1,573.3
Other	office	10	people using	20	L/day	200	200	200	200	200	200	200	200	200	200	200	200	
	staff	45	people using	25	L/day	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	1,125	
	workshop	1	facility using	3,000	L/day	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
	landscape inner	5	ha with Kc =	0.50	L/day	184,677	160,484	125,000	68,548	40,323	23,387	29,839	44,355	70,968	95,161	150,000	176,613	
	outer	5	ha with Kc =	0.00	L/day	0	0	0	0	0	0	0	0	0	0	0	0	
					ML/d	0.19	0.16	0.13	0.07	0.04	0.03	0.03	0.05	0.08	0.10	0.15	0.18	
					ML/mth	5.86	5.11	4.01	2.26	1.38	0.86	1.06	1.51	2.33	3.08	4.78	5.61	37.9
	Total water demand by ethanol plant				**ML/mth**	**139.48**	**125.80**	**137.63**	**131.57**	**135.00**	**130.17**	**134.68**	**135.13**	**131.64**	**136.70**	**134.09**	**139.23**	**1,611.1**
TOTAL WATER DEMAND	Dairy enterprise				ML/mth	303.00	273.65	302.56	283.06	281.05	266.21	275.12	278.95	277.54	295.69	293.02	302.94	
	Ethanol plant				ML/mth	139.48	125.80	137.63	131.57	135.00	130.17	134.68	135.13	131.64	136.70	134.09	139.23	
				Total	**ML/mth**	**442.48**	**399.44**	**440.19**	**414.63**	**416.05**	**396.38**	**409.80**	**414.08**	**409.19**	**432.40**	**427.11**	**442.17**	**5,043.9**

FOUR ARROWS ETHANOL PTY LTD : *Water run-off ex dairy enterprise in a decile 9.5 year*

							JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS	Category
METEOROLOGICAL																				
Rain			Griffith CSIRO			mm/mth	104.0	93.0	72.0	97.0	88.0	72.0	82.0	62.0	95.0	112.0	66.0	72.0	1,015.0	
Evapotranspiration			Griffith CSIRO - Eto			mm/mth	229.0	199.0	155.0	85.0	50.0	29.0	37.0	55.0	88.0	118.0	186.0	219.0	1,450.0	
WATER RUN-OFF GENERATED : DAIRY ENTERPRISE																				
Cow sheds	roof area	4.5	sheds			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		35	m wide	600	m long	ML/mth	9.83	8.79	6.80	9.17	8.32	6.80	7.75	5.86	8.98	10.58	6.24	6.80	95.9	1
	open pens	9	pens			R_o =	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		30	m wide	600	m long	ML/mth	13.48	15.07	11.66	15.71	14.26	11.66	13.28	10.04	15.39	18.14	10.69	11.66	161.1	3
	flushing	7,200	head	1,000	L/hd/day	R_o =	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85		
						ML/mth	189.72	171.36	189.72	183.60	189.72	183.60	189.72	189.72	183.60	189.72	183.60	189.72	2,233.8	3
Dry lots	roof area	60	pens			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		10	m wide	70	m long	ML/mth	4.37	3.91	3.02	4.07	3.70	3.02	3.44	2.60	3.99	4.70	2.77	3.02	42.6	1
	open pens	60	pens			R_o =	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80		
		52	m wide	70	m long	ML/mth	18.17	16.25	12.58	16.95	15.38	12.58	14.33	10.83	16.60	19.57	11.53	12.58	177.3	3
	paved area	60	pens			R_o =	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80		
		7.5	m wide	70	m long	ML/mth	2.62	2.34	1.81	2.44	2.22	1.81	2.07	1.56	2.39	2.82	1.66	1.81	25.6	3
Dairy	roof area	2	sheds			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		20	m wide	250	m long	ML/mth	1.04	0.93	0.72	0.97	0.88	0.72	0.82	0.62	0.95	1.12	0.66	0.72	10.2	1
	milk store	1	sheds			R_o =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
		20	m wide	250	m long	ML/mth	0.52	0.47	0.36	0.49	0.44	0.36	0.41	0.31	0.48	0.56	0.33	0.36	5.1	1
	cow wash	6,000	head	100	L/hd/day	R_o = 0.85	15.81	14.28	15.81	15.30	15.81	15.30	15.81	15.81	15.30	15.81	15.30	15.81	186.2	3
	yard wash	6,000		50		R_o = 0.85	7.91	7.14	7.91	7.65	7.91	7.65	7.91	7.91	7.65	7.91	7.65	7.91	93.1	3
	cleaning	6,000		10		R_o = 0.85	1.58	1.43	1.58	1.53	1.58	1.53	1.58	1.58	1.53	1.58	1.53	1.58	18.6	3
Other buildings	office	20	m wide	25	m long	R_o = 0.8	0.04	0.04	0.03	0.04	0.04	0.03	0.03	0.02	0.04	0.04	0.03	0.03	0.4	1
	staff	20	m wide	20	m long	R_o = 0.8	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.04	0.02	0.02	0.3	1
	feed mill	20	m wide	50	m long	R_o = 0.8	0.08	0.07	0.06	0.08	0.07	0.06	0.07	0.05	0.08	0.09	0.05	0.06	0.8	1
	commodity	50	m wide	100	m long	R_o = 0.8	0.42	0.37	0.29	0.39	0.35	0.29	0.33	0.25	0.38	0.45	0.26	0.29	4.1	1
	workshop	30	m wide	50	m long	R_o = 0.8	0.12	0.11	0.09	0.12	0.11	0.09	0.10	0.07	0.11	0.13	0.08	0.09	1.2	1
	equipment	30	m wide	50	m long	R_o = 0.8	0.12	0.11	0.09	0.12	0.11	0.09	0.10	0.07	0.11	0.13	0.08	0.09	1.2	1
Paved areas	roads	9	m wide	2,000	m long	R_o = 0.8	1.50	1.34	1.04	1.40	1.27	1.04	1.18	0.89	1.37	1.61	0.95	1.04	14.6	2
	cemented		say	3,000	sq m	R_o = 0.8	0.25	0.22	0.17	0.23	0.21	0.17	0.20	0.15	0.23	0.27	0.16	0.17	2.4	2
	carparks			4,000	sq m	R_o = 0.8	0.33	0.30	0.23	0.31	0.28	0.23	0.26	0.20	0.30	0.36	0.21	0.23	3.2	2
	truck wash			4,000	sq m	R_o = 0.8	0.33	0.30	0.23	0.31	0.28	0.23	0.26	0.20	0.30	0.36	0.21	0.23	3.2	3
Other	landscape		say	180	ha	R_o =	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.4	0.3	0.3	0.2		
						ML/mth	0.00	0.00	0.00	0.00	2.16	7.20	9.00	0.00	0.00	0.00	0.00	0.00	18.4	2
	cattle yards		say	3,000	sq m	R_o = 0.8	0.25	0.22	0.17	0.23	0.21	0.17	0.20	0.15	0.23	0.27	0.16	0.17	2.4	3
Total project area	230.0		**RUN-OFF** - total generated				268.53	245.07	254.40	261.13	265.31	254.66	268.87	248.93	260.04	276.27	244.18	254.40	3,101.8	
Total above areas	60.7																			
Remainder landscape	169.3		1	best quality water			16.58	14.83	11.48	15.46	14.03	11.48	13.07	9.88	15.14	17.86	10.52	11.48	182.1	1
Say	180.0		2	some contamination			2.08	1.86	1.44	1.94	3.92	8.64	10.64	1.24	1.90	2.24	1.32	1.44	382.3	2
			3	heavily contaminated			249.87	228.39	241.48	243.73	247.36	234.54	245.15	237.80	242.99	256.18	232.34	241.48	2,537.3	3
						Total	268.53	245.07	254.40	261.13	265.31	254.66	268.87	248.93	260.04	276.27	244.18	254.40	3,101.8	

Table Key

ha = hectares; hd = head; kp = Pan Coefficient; L = Litres; m = metres; m^2 = square metres
m^3 = cubic metres; ML = Megalitres; mm = millimetres; mth = month; R_o = Run-off Factor; sq = square

FOUR ARROWS ETHANOL PTY LTD : *Water run-off from ethanol plant in a decile 9.5 year*

								JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS	Category
METEOROLOGICAL																					
Rain			Griffith CSIRO				mm/mth	104.0	93.0	72.0	97.0	88.0	72.0	82.0	62.0	95.0	112.0	66.0	72.0	1,015.0	
Evapotranspiration			Griffith CSIRO - Eto				mm/mth	229.0	199.0	155.0	85.0	50.0	29.0	37.0	55.0	88.0	118.0	186.0	219.0	1,450.00	
WATER RUN-OFF GENERATED : ETHANOL PLANT																					
Ethanol plant	roof area	25	units				R_o =	0.80	0.85	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.85	0.80		
		25	m wide	25	m long		ML/mth	1.30	1.24	1.01	1.52	1.38	1.13	1.28	0.97	1.48	1.58	0.88	0.90	14.65	1
	service access	25	units				R_o =	0.80	0.85	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.85	0.80		
		5	m wide	3,000	m long		ML/mth	31.20	29.64	24.30	36.38	33.00	27.00	30.75	23.25	35.63	37.80	21.04	21.60	351.58	1
	wash down	375,000	m^2	0.05	L/day/m^2	guesstimated		0.58	0.53	0.58	0.56	0.58	0.56	0.58	0.58	0.56	0.58	0.56	0.58	6.84	1
	chemical shed	20	m wide	25	m long			1.61	1.46	1.12	1.56	1.36	1.08	1.27	0.96	1.08	1.74	0.93	1.12	15.28	
						Total ML/mth		34.69	32.86	27.01	40.01	36.32	29.77	33.88	25.76	38.75	41.69	23.41	24.20	388.36	
Grain storage	Bunkers	150,000	tonnes capacity																		
		30	m wide	1.0	m rise in	2.2	repose														
				1.0	m retaining side wall																
				7.8	m high																
				147.3	m^3 per linear meter																
				0.72	tonnes/m^3 bulk density																
				106.0	tonnes per linear metre																
				1,415	linear "m" of grain bunkers																
			say	1,600	linear "m" of grain bunkers																
	Bunkers	8	units				R_o =	0.80	0.85	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.85	0.80		
		30	m wide	200	m long		ML/mth	3.99	3.79	3.11	4.66	4.22	3.46	3.94	2.98	4.56	4.84	2.69	2.76	45.00	1
	Service access	8	units				R_o =	0.80	0.85	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.85	0.80		
		9	m wide	3,968	m long		ML/mth	23.77	22.58	18.51	27.71	25.14	20.57	23.43	17.71	27.14	28.80	16.03	16.46	267.85	1
	Roads	9	m wide	500	m long		R_o =	0.80	0.85	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.85	0.80		
							ML/mth	0.37	0.36	0.29	0.44	0.40	0.32	0.37	0.28	0.43	0.45	0.25	0.26	4.22	1
						Total ML/mth		28.14	26.73	21.92	32.81	29.76	24.35	27.73	20.97	32.13	34.09	18.97	19.48	317.08	
Other buildings	office	20	m wide	25	m long	R_o =	0.8	0.04	0.04	0.03	0.04	0.04	0.03	0.03	0.02	0.04	0.04	0.03	0.03	0.41	1
	staff	20	m wide	20	m long	R_o =	0.8	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.04	0.02	0.02	0.32	1
	workshop	30	m wide	50	m long	R_o =	0.8	0.12	0.11	0.09	0.12	0.11	0.09	0.10	0.07	0.11	0.13	0.08	0.09	1.22	1
	equipment	30	m wide	50	m long	R_o =	0.8	0.12	0.11	0.09	0.12	0.11	0.09	0.10	0.07	0.11	0.13	0.08	0.09	1.22	1
	other	30	m wide	50	m long	R_o =	0.8	0.12	0.11	0.09	0.12	0.11	0.09	0.10	0.07	0.11	0.13	0.08	0.09	1.22	1
						Total ML/mth		0.45	0.40	0.31	0.42	0.38	0.31	0.35	0.27	0.41	0.48	0.29	0.31	4.38	
Service areas	roads	9	m wide	2,000	m long	R_o =	0.8	1.50	1.34	1.04	1.40	1.27	1.04	1.18	0.89	1.37	1.61	0.95	1.04	14.62	1
	cemented		say	3,000	sq m	R_o =	0.8	0.25	0.22	0.17	0.23	0.21	0.17	0.20	0.15	0.23	0.27	0.16	0.17	2.44	1
	carparks			4,000	sq m	R_o =	0.8	0.33	0.30	0.23	0.31	0.28	0.23	0.26	0.20	0.30	0.36	0.21	0.23	3.25	1
	truck wash			4,000	sq m	R_o =	0.8	0.33	0.30	0.23	0.31	0.28	0.23	0.26	0.20	0.30	0.36	0.21	0.23	3.25	1
						Total ML/mth		2.41	2.16	1.67	2.25	2.04	1.67	1.90	1.44	2.20	2.60	1.53	1.67	23.55	
Other	landscape		say	25	ha		R_o =	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.4	0.3	0.3	0.2		
							ML/mth	0.00	0.00	0.00	0.00	0.30	1.00	1.25	0.00	0.00	0.00	0.00	0.00	2.55	2
	other		say	0	sq m	R_o =	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
						Total ML/mth		0.00	0.00	0.00	0.00	0.30	1.00	1.25	0.00	0.00	0.00	0.00	0.00	2.55	
Total project area		100.0	**RUN-OFF -** total volume generated					65.69	62.15	50.91	75.49	68.80	57.10	65.12	48.44	73.49	78.86	44.20	45.66	735.91	
Total above areas		76.4																			
Remainder landscape		23.6	1	best quality water				65.69	62.15	50.91	75.49	68.80	57.10	65.12	48.44	73.49	78.86	44.20	45.66	735.91	1
Say		25.0	2	some contamination				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
			3	heavily contaminated				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
							Total	65.69	62.15	50.91	75.49	68.80	57.10	65.12	48.44	73.49	78.86	44.20	45.66	735.91	

Table Key

ha = hectares; m^3 = cubic metres; hd = head; ML = Megalitres; kp = Pan Coefficient; mm = millimetres; L = Litres; mth = month; m = metres; R_o = Run-off Factor; m^2 = square metres; sq = square

Rainfall (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Decile 1 (1:10 dry)	16.4	16.7	17.4	17.3	21.7	21.9	18.5	19.6	19.1	21.6	14.8	15.6	220.6
Decile 5 (average)	27.3	27.8	38.9	28.7	36.1	36.5	30.8	32.6	31.8	35.9	24.6	26.0	377.0
Decile 9 (1:10 wet)	38.3	39.0	40.6	40.3	50.7	51.2	43.2	45.8	44.6	50.4	34.5	36.5	515.1
Decile 9 (monthly)	80.0	75.0	60.0	70.0	85.0	80.0	75.0	70.0	60.0	80.0	75.0	80.0	890.0
Decile 10 (monthly)	220.0	160.0	190.0	150.0	140.0	150.0	85.0	90.0	100.0	150.0	125.0	150.0	1,710.0

Assume The ratio of D10 & D9 monthly data is a fair representation of the ratios for the D10 & D9 annual data
That is, inflate the D9 annual data by 1710 divided by 890 = 1.92

Decile 10 (extreme wet)	73.6	74.9	78.0	77.4	97.4	98.4	83.0	88.0	85.7	96.8	66.3	70.1	989.7
say	73.7	75.0	78.2	78.0	100.0	100.3	87.0	88.0	86.0	97.0	66.6	70.2	1,000.0

Comments on rainfall data

A decile 9 year provides the best data for accumlative impacts of a very wet year but does not reflect significant rain events
The decile 10 data is the largest rainfalls recorded in any single month and will be from one or more significant rainfall events
For modelling a major rainfall event the following parameters are adopted
the pens are wet from recent succession of wet days
the run-off factor shall increase to say 0.95 from the standard of 0.80
the assumed rain event shall be 150mm over 24 hrs

Evaporation (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Decile 1 (1:10 dry)	300.0	260.0	220.0	110.0	75.0	50.0	55.0	80.0	120.0	185.0	250.0	300.0	2,005.0
	0.55	0.55	0.60	0.70	0.80	0.90	0.90	0.90	0.80	0.70	0.60	0.60	
	165.0	143.0	132.0	77.0	60.0	45.0	49.5	72.0	96.0	129.5	150.0	180.0	1,299.0
Decile 5 (average)	274.0	237.0	192.0	111.0	62.0	39.0	45.0	65.0	99.0	158.0	218.0	272.0	1,772.0
	0.60	0.60	0.60	0.65	0.80	0.90	0.90	0.90	0.80	0.70	0.60	0.60	
	164.4	142.2	115.2	72.2	49.6	35.1	40.5	58.5	79.2	110.6	130.8	163.2	1,161.5
Decile 9 (1:10 wet)	220.0	190.0	150.0	90.0	50.0	30.0	35.0	50.0	80.0	125.0	175.0	215.0	1,410.0
	0.70	0.70	0.70	0.75	0.80	0.90	0.90	0.90	0.80	0.80	0.70	0.70	
	154.0	133.0	105.0	67.5	40.0	27.0	31.5	45.0	64.0	100.0	122.5	150.5	1,040.0
Decile 10 (extreme wet)	200.0	180.0	140.0	80.0	45.0	25.0	30.0	45.0	75.0	115.0	165.0	200.0	1,300.0
	0.75	0.70	0.75	0.80	0.90	0.95	0.95	0.95	0.85	0.85	0.75	0.70	
	150.0	126.0	105.0	64.0	40.5	23.8	28.5	42.8	63.8	97.8	123.8	140.0	1,005.8

ANNEXURE 22.0c

GRIFFITH CSIRO CLIMATIC DATA

Griffith Historical Data - ETo - Average monthly and various percentiles

mm/month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
						Averaged monthly Eto							
Av.	282	231	192	115	67	44	50	77	115	174	228	275	1849
						Eto Percentiles							
5 %	229	199	155	85	50	29	37	55	88	118	186	219	1450
10%	242	202	163	99	56	32	38	60	91	129	192	230	1533
50%	282	232	194	115	66	45	50	75	113	178	233	278	1861
90%	322	264	222	136	79	57	64	93	142	210	261	313	2162
95%	327	267	225	143	82	59	69	103	145	223	264	320	2226

Source : CSIRO griffith, 8th August 2007 by email

Griffith Historical Data - Rain - Average monthly and various percentiles

mm/month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
						Averaged monthly rainfalls							
Av.	33	28	33	31	38	35	34	37	37	42	29	29	406
						Rainfall Percentiles							
5 %	2	0	0	2	2	8	4	3	8	4	1	1	34
10%	5	1	1	4	7	13	6	9	10	8	5	1	69
50%	23	13	20	19	30	29	34	38	32	33	24	20	314
90%	65	65	64	76	86	69	70	62	86	93	54	65	853
95%	104	93	72	97	88	72	82	62	95	112	66	72	1014

Source : CSIRO Griffith, 8th August 2007 by email

ANNEXURE 23.0

SALT AND NUTRIENT MASS BALANCES

NITROGEN LOAD - PROPOSED TOTAL PROJECT

Imports	Dairy cattle	all rations (incl DDG)	193.01	t/day DM			3.06%	nitrogen	2155.73	t/yr	Dr Ian Lean - direct from project ration computer model
		less N in DDG re-cycled on site							-1309.69	t/yr	Not an import - came with grain - see exports DDG below
	CICL supply	Cat 1 - ethanol	2100.00	ML/yr			0.44	mg/L	0.92	t/yr	} G Shulze (DNR Deni)
		Cat 2 - aesthetic	50.00	ML/yr			0.44	mg/L	0.02	t/yr	} Gogeldrie weir (Stn 410080)
		Cat 3 - recycle pond/s	150.00	ML/yr			0.44	mg/L	0.07	t/yr	} only one (1) reading avaiable
		Irrigation- cell 1	0.00	ML/yr			0.44	mg/L	-	t/yr	} for total N
		Irrigation - cell 2	0.00	ML/yr			0.44	mg/L	-	t/yr	}
		Irrigation - cell 3	0.00	ML/yr			0.44	mg/L	-	t/yr	} Water volumes as per
		Irrigation - cell 4	0.00	ML/yr			0.44	mg/L	-	t/yr	} EA water budgets
		Cat 4 - evaporation	0.00	ML/yr			0.44	mg/L	-	t/yr	}
	Grain	purchases	725,000	t/yr			1.77%	nitrogen	12,832.5	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
								Total nitrogen imports	13,679.6	t/yr	
Exports	Milk	carted to factory	76.00	ML/yr			5.57	gm/L	423.32	t/yr	Dr Ian Lean - direct from project ration computer model
	Cattle sales	culls/dry	1584	hd/yr	700	kg LW	1.50	gm/kg LW	1.66	t/yr	}
		calves heifer	320		100		1.50	gm/kg LW	0.05	t/yr	} Dr Ian Lean
		bull	664		100		1.50	gm/kg LW	0.10	t/yr	}
		heifers 3-9 mth	177		300		1.50	gm/kg LW	0.08	t/yr	} data direct from project ration model
		9-15 mth	2259		400		1.50	gm/kg LW	1.36	t/yr	}
		15-20 mth	200		500		1.50	gm/kg LW	0.15	t/yr	}
		1st calf	1085		600		1.50	gm/kg LW	0.98	t/yr	}
											}
	Cattle deaths	culls/dry	288	hd/yr	700	kg LW	1.50	gm/kg LW	0.30	t/yr	}
		calves heifer	192		100		1.50	gm/kg LW	0.03	t/yr	}
		bull	21		100		1.50	gm/kg LW	0.00	t/yr	}
		heifers 3-9 mth	59		300		1.50	gm/kg LW	0.03	t/yr	}
		9-15 mth	56		400		1.50	gm/kg LW	0.03	t/yr	}
		15-20 mth	33		500		1.50	gm/kg LW	0.02	t/yr	}
		1st calf	155		600		1.50	gm/kg LW	0.14	t/yr	}
	Silage ex Cat 3 irrigation (substituted purchases)			say	0%	of external sourced rations			-	t/yr	estimate by BA
	Distillers grain	to dairy cows	21,124	t/yr	6.20%	N =	1,309.69	t not exported - ratio	-	t/yr	} Dr I Lean & calculation of quantum of concentration
		for sale off site	186,226	t/yr			6.20%	nitrogen	11,546.0	t/yr	} during ethanol manufacture (grain % * 3.5)
		in water in WDG							0.92	t/yr	direct transfer from water used in ethanol plant
	Manure production..		25,019	t/yr DM @	6.40%	nitrogen	1,601.2	t/yr N			Dr Ian Lean
				Volatilised from pens, basins & ponds				90.0%	1,441.09		MLA project FLOT.328 (still in print - agreed quotable)
				Captured in manure & carted to Tubbo				7.0%	112.09		MLA project FLOT.328 (still in print - agreed quotable)
				In water & applied to irrigation cells				3.0%	48.04		BA estimate as a default
								Total nitrogen exports	13,576.4	t/yr	
								Net nitrogen accumulation	**103.15**	**t/yr**	0.8%

NITROGEN LOAD - CURRENT PRACTICES

Assume	4 year crop/pasture rotation												
	Farm aggregation		359	ha									
	Base water entitlement		4.0	ML/benefitted ha		1436	ML @ 100% when assuming an averaged entitlement for non rice approved areas						
	Annual averaged allocation		75%	Water Sharing Plan		1077	ML available on average						
	rice	after long fallow	42.0	ha	13.75	ML/ha	577.5	ML total producing	10.00	t/ha grain	420.0	t/yr grain	
	wheat	into rice stubble	42.0		3.00		126.0		4.00		168.0		
	canola	after short fallow	42.0		4.60		193.2		2.50		105.0		
	wheat	after short fallow	42.0		4.20		176.4		5.00		210.0		
	total		168.0	47%	Total water needs		1073.1	ML needed			903.0	t/yr grain	
Imports	In water for irrigation		1073.10	ML/yr			0.44	mg/L	0.47	t/yr	G Shulze (DNR Deni) - Gogeldrie weir (Stn 410080)		
	Other - fertilisers		150.0	kg/ha/yr averaged			168.0	ha	25.20		BA estimates		
								Total nitrogen imports	25.67	t/yr			
Exports	In grain being produced		903.0	t/yr grain			1.77%	nitrogen	15.98	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst		
	other products								0.00	t/yr			
								Total nitrogen exports	15.98	t/yr			
								Net nitrogen accumulation	**9.7**	**t/yr or**	**57.7**	**kg/ha/yr**	

INCREMENTAL CHANGES IN NITROGEN LOADINGS

Net project loading	103.15	t/yr
Net current loading	9.69	
Incremental change	**93.46**	**t/yr**

NITROGEN LOAD - DAIRY COMPONENT OF PROPOSED PROJECT

Imports

Dairy cattle	all rations (inc DDG)	193.01	t/day DM	3.06%	nitorgen	2155.73	t/yr	Dr Ian Lean - direct from project ration computer model
CICL - Cat 1	drinking water	390.90	ML/yr	0.44	mg/L	0.17	t/yr	} G Shulze (DNR Deni)
	misting	40.00	ML/yr	0.44	mg/L	0.02	t/yr	} Gogeldrie weir (Stn 410082)
	cow wash-down	219.00	ML/yr	0.44	mg/L	0.10	t/yr	}
	dairy cleaning	109.50	ML/yr	0.44	mg/L	0.05	t/yr	}
	sundry	21.90	ML/yr	0.44	mg/L	0.01	t/yr	} only one (1) reading avaiable
								} for total N
CICL - augmentation	Cat 3 - recycle pond/s	150.00	ML/yr	0.44	mg/L	0.07	t/yr	}
	Irrigation- cell 1	0.00	ML/yr	0.44	mg/L	-	t/yr	}
	Irrigation - cell 2	0.00	ML/yr	0.44	mg/L	-	t/yr	}
	Irrigation - cell 3	0.00	ML/yr	0.44	mg/L	-	t/yr	} Water volumes as per
	Irrigation - cell 4	0.00	ML/yr	0.44	mg/L	-	t/yr	} EA water budgets
	Cat 4 - evaporation	0.00	ML/yr	0.44	mg/L	-	t/yr	}
					Total nitrogen imports	2,156.14	t/yr	

Exports

Milk	carted to factory		76.00	ML/yr			5.57	gm/L	423.32	t/yr	Dr Ian Lean - direct from project ration computer model
Cattle sales	culls/dry		1584	hd/yr	700	kg LW	1.50	gm/kg LW	1.66	t/yr	}
	calves	heifer	320		100		1.50	gm/kg LW	0.05	t/yr	} Dr Ian Lean
		bull	664		100		1.50	gm/kg LW	0.10	t/yr	}
	heifers	3-9 mth	177		300		1.50	gm/kg LW	0.08	t/yr	}
		9-15 mth	2259		400		1.50	gm/kg LW	1.36	t/yr	}
		15-20 mth	200		500		1.50	gm/kg LW	0.15	t/yr	}
		1st calf	1085		600		1.50	gm/kg LW	0.98	t/yr	}
											} data direct from project ration model
Cattle deaths	culls/dry		288	hd/yr	700	kg LW	1.50	gm/kg LW	0.30	t/yr	}
	calves	heifer	192		100		1.50	gm/kg LW	0.03	t/yr	}
		bull	21		100		1.50	gm/kg LW	0.00	t/yr	}
	heifers	3-9 mth	59		300		1.50	gm/kg LW	0.03	t/yr	}
		9-15 mth	56		400		1.50	gm/kg LW	0.03	t/yr	}
		15-20 mth	33		500		1.50	gm/kg LW	0.02	t/yr	}
		1st calf	155		600		1.50	gm/kg LW	0.14	t/yr	}
Silage ex Cat 3 irrigation (substituted purchases)				say	0%	of external sourced rations			-	t/yr	estimate by BA
Manure production..			25,019	t/yr DM @	6.40%	nitrogen	1,601.21	t/yr			Dr Ian Lean
				Volatilised from pens, basins & ponds				90.0%	1,441.09		MLA project FLOT.328 (still in print - agreed quotable)
				Captured in manure & carted to Tubbo				7.0%	112.09		MLA project FLOT.328 (still in print - agreed quotable)
				In water to holdong ponds				3.0%	48.04		BA estimate as a default
								Total nitrogen exports	2,029.47	t/yr	

Net nitrogen accumulation 126.67 t/yr

Manure production & distribution

Freestall	7,200	cows producing		18,780	t/yr faeces as DM	(EA annexure ……)			Sediment		Scrapings				
		distributed	90%	in flushing lanes	16,902	t/yr DM	15%	captured in flushing	2,535			} of the	30,757	t/yr	
							85%	scraped with bobcat			14,367	} generate	4,171	t/yr	
			10%	in loafing yards	1,878	t/yr DM	60%	scraped off yards			1,127	} remains in pens or is lost as			
							10%	captured rain run-off	188			} dust, degradation, etc			
Dry lot	10,870	heifers producing		11,957	t/yr faeces as DM	(EA annexure ……)						}			
							60%	scraped off yards			7,174	}			
							10%	captured rain run-off	1,196			}			
									3,919	13%	22,668				

Sedimentation basin/s

Solids	receive into basins	13%	for settling	3,919	t/yr DM	Nitrogen (total)	volatilises	pens/shed	90.0%	1,441.1	t/yr
	retain in basins	60%	to remove	2,351	to Tubbo			basins	7.0%	112.1	
	passes to Cat 3 holding pond			1,568			passes to Cat 3 holding p		3.0%	48.0	t/yr

Irrigation applications

Tubbo manure	scrapings	22,668	t/yr of manure			Project manure	receive into Cat 3 pond/s			1,568	t/yr manure
	basins	2,351									
		25,019					settles	60%		941	t/yr removal to Tubbo
	or	10.01	t/ha/year				recycled	20%		314	
	over	2,500	ha				evap'n ponds	20%		314	
										1,568	
									or	0.0	t/ha/year
									over	0	ha
Tubbo nitrogen	scrapings	112.1				Project nitrogen	settles	1%	in manure	0.5	t/yr removal to Tubbo
	basins	0.0					volatilises	80%		38.4	
		112.1	t/yr of nitrogen				evap'n ponds	19%		9.1	
	or	44.8	kg/ha/year							48.0	t/yr of nitrogen
	over	2,500	ha						or	0.0	t/ha/year
									over	0	ha

PHOSPHORUS LOAD - PROPOSED TOTAL PROJECT

Imports	Dairy cattle	all rations (incl DDG)	193.01	t/day DM			0.41%	phosphorus	288.84	t/yr	Dr Ian Lean - direct from project ration computer model
		less P in DDG re-cycled on site							-177.44	t/yr	Not an import - came with grain - see exports DDG below
	CICL supply	Cat 1 - ethanol	2100.00	ML/yr			0.0464	mg/L	0.10	t/yr	} G Shulze (DNR Deni)
		Cat 2 - aesthetic	50.00	ML/yr			0.0464	mg/L	0.00	t/yr	} Gogeldrie weir (Stn 410082)
		Cat 3 - recycle pond/s	150.00	ML/yr			0.0464	mg/L	0.01	t/yr	} average of all available readings
		Irrigation- cell 1	0.00	ML/yr			0.0464	mg/L	-	t/yr	} since Jan 1997
		Irrigation - cell 2	0.00	ML/yr			0.0464	mg/L	-	t/yr	}
		Irrigation - cell 3	0.00	ML/yr			0.0464	mg/L	-	t/yr	} Water volumes as per
		Irrigation - cell 4	0.00	ML/yr			0.0464	mg/L	-	t/yr	} EA water budgets
		Cat 4 - evaporation	0.00	ML/yr			0.0464	mg/L	-	t/yr	}
	Grain	purchases	725,000	t/yr			0.241%	phosphorus	1,747.25	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
							Total	phosphorus imports	1,858.75	t/yr	
Exports	Milk	carted to factory	76.00	ML/yr			1.00	gm/L	76.00	t/yr	Dr Ian Lean - direct from project ration computer model
	Cattle sales	culls/dry	1584	hd/yr	700	kg LW	0.40	gm/kg LW	0.44	t/yr	}
		calves heifer	320		100		0.40	gm/kg LW	0.01	t/yr	} Dr Ian Lean
		bull	664		100		0.40	gm/kg LW	0.03	t/yr	}
		heifers 3-9 mth	177		300		0.40	gm/kg LW	0.02	t/yr	}
		9-15 mth	2259		400		0.40	gm/kg LW	0.36	t/yr	}
		15-20 mth	200		500		0.40	gm/kg LW	0.04	t/yr	}
		1st calf	1085		600		0.40	gm/kg LW	0.26	t/yr	}
											}
	Cattle deaths	culls/dry	288	hd/yr	700	kg LW	0.40	gm/kg LW	0.08	t/yr	} data direct from project ration model
		calves heifer	192		100		0.40	gm/kg LW	0.01	t/yr	}
		bull	21		100		0.40	gm/kg LW	0.00	t/yr	}
		heifers 3-9 mth	59		300		0.40	gm/kg LW	0.01	t/yr	}
		9-15 mth	56		400		0.40	gm/kg LW	0.01	t/yr	}
		15-20 mth	33		500		0.40	gm/kg LW	0.01	t/yr	}
		1st calf	155		600		0.40	gm/kg LW	0.04	t/yr	}
	Silage ex Cat 3 irrigation (substituted purchases)				say	0%	of external sourced rations		-	t/yr	estimate by BA
	Distillers grain	to dairy cows	21,124	t/yr	0.84%	P =	177.44	t not exported - ratior	-	t/yr	} Dr I Lean & calculation of quantum of concentration
		for sale off site	186,226	t/yr			0.84%	phosphorus	1,564.30	t/yr	} during ethanol manufacture (grain % * 3.5)
		in water in WDG							0.10	t/yr	direct transfer from water used in ethanol plant
	Manure carted to Tubbo, etc..		25,019	t/yr DM			0.80%	phosphorus	200.15	t/yr	Dr Ian Lean
							Total	phosphorus exports	1,841.86	t/yr	
							Net phosphorus accumulation		**16.89**	**t/yr**	**0.9%**

PHOSPHORUS LOAD - CURRENT PRACTICES

Assume	4 year crop/pasture rotation										
	Farm aggregation		359	ha							
	Base water entitlement		4.0	ML/benefitted ha		1436	ML @ 100% when assuming an averaged entitlement for non rice approved areas				
	Annual averaged allocation		75%	Water Sharing Plai		1077	ML available on average				
	rice	after long fallow	42.0	ha	13.75	ML/ha	577.5	ML total producing	10.00	t/ha grain	420.0 t/yr grain
	wheat	into rice stubble	42.0		3.00		126.0		4.00		168.0
	canola	after short fallow	42.0		4.60		193.2		2.50		105.0
	wheat	after short fallow	42.0		4.20		176.4		5.00		210.0
					Total water needs		1073.1	ML needed			903.0 t/yr grain
Imports	In water for irrigation		1073.10	ML/yr			0.0464	mg/L	0.05	t/yr	G Shulze (DNR Deni) - Gogeldrie weir (Stn 410082)
	Other - fertiliser		15.0	kg/ha/year averaged			168.0		2.52		BA estimates
							Total	phosphorus imports	2.57	t/yr	
Exports	In grain being produced		903.0	t/yr grain			0.241%	phosphorus	2.18	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
	other products								0.00	t/yr	
							Total	phosphorus exports	2.18	t/yr	
							Net phosphorus accumulation		**0.39**	**t/yr or**	**2.3 kg/ha/yr**

INCREMENTAL CHANGES IN PHOSPHORUS LOADINGS

Net project loading	16.89	t/yr
Net current loading	0.39	
Incremental change	**16.50**	**t/yr**

PHOSPHORUS LOAD - DAIRY COMPONENT OF PROPOSED PROJECT

Imports

Dairy cattle	all rations (inc DDG)	193.01	t/day DM	0.41%	phosphorus	288.84	t/yr	Dr Ian Lean - direct from project ration computer model	
CICL - Cat 1	drinking water	390.90	ML/yr	0.0464	mg/L	0.02	t/yr	}	G Shulze (DNR Deni)
	misting	40.00	ML/yr	0.0464	mg/L	0.00	t/yr	}	Gogeldrie weir (Stn 410082)
	cow wash-down	219.00	ML/yr	0.0464	mg/L	0.01	t/yr	}	
	dairy cleaning	109.50	ML/yr	0.0464	mg/L	0.01	t/yr	}	
	sundry	21.90	ML/yr	0.0464	mg/L	0.00	t/yr	}	average of all available readings
								}	since Jan 1997
CICL - augmentation	Cat 3 - recycle pond/s	150.00	ML/yr	0.0464	mg/L	0.01	t/yr	}	
	Irrigation- cell 1	0.00	ML/yr	0.0464	mg/L	-	t/yr	}	
	Irrigation - cell 2	0.00	ML/yr	0.0464	mg/L	-	t/yr	}	
	Irrigation - cell 3	0.00	ML/yr	0.0464	mg/L	-	t/yr	}	Water volumes as per
	Irrigation - cell 4	0.00	ML/yr	0.0464	mg/L	-	t/yr	}	EA water budgets
	Cat 4 - evaporation	0.00	ML/yr	0.0464	mg/L	-	t/yr	}	
				Total	phosphorus imports	288.88	t/yr		

Exports

Milk	carted to factory		76.00	ML/yr			1.00	gm/L	76.00	t/yr	Dr Ian Lean - direct from project ration computer model
Cattle sales	culls/dry		1584	hd/yr	700	kg LW	0.40	gm/kg LW	0.44	t/yr	}
	calves	heifer	320		100		0.40	gm/kg LW	0.01	t/yr	} Dr Ian Lean
		bull	664		100		0.40	gm/kg LW	0.03	t/yr	}
	heifers	3-9 mth	177		300		0.40	gm/kg LW	0.02	t/yr	}
		9-15 mth	2259		400		0.40	gm/kg LW	0.36	t/yr	}
		15-20 mth	200		500		0.40	gm/kg LW	0.04	t/yr	}
		1st calf	1085		600		0.40	gm/kg LW	0.26	t/yr	}
											}
Cattle deaths	culls/dry		288	hd/yr	700	kg LW	0.40	gm/kg LW	0.08	t/yr	} data direct from project ration model
	calves	heifer	192		100		0.40	gm/kg LW	0.01	t/yr	}
		bull	21		100		0.40	gm/kg LW	0.00	t/yr	}
	heifers	3-9 mth	59		300		0.40	gm/kg LW	0.01	t/yr	}
		9-15 mth	56		400		0.40	gm/kg LW	0.01	t/yr	}
		15-20 mth	33		500		0.40	gm/kg LW	0.01	t/yr	}
		1st calf	155		600		0.40	gm/kg LW	0.04	t/yr	}
Silage ex Cat 3 irrigation (substituted purchases)			say	0%	of external sourced	rations			-	t/yr	estimate by BA
Manure carted to Tubbo, etc..			25,019	t/yr DM			0.80%	phosphorus	200.15	t/yr	Dr Ian Lean
						Total	phosphorus exports		277.47	t/yr	

Net phosphorus accumulation 11.42 t/yr

Manure production & distribution

Freestall	7,200	cows producing		18,780	t/yr faeces as DM	(EA annexure ……)			Sediment		Scrapings				
		distributed	90%	in flushing lanes	16,902	t/yr DM	15%	captured in flushing	2,535			} of the	30,757	t/yr	
							85%	scraped with bobcat			14,367	} generate	4,171	t/yr	
			10%	in loafing yards	1,878	t/yr DM	60%	scraped off yards			1,127	} remains in pens or is lost as			
							10%	captured rain run-off	188			} dust, degradation, etc			
Dry lot	10,870	heifers producing		11,957	t/yr faeces as DM	(EA annexure ……)						}			
							60%	scraped off yards			7,174	}			
							10%	captured rain run-off	1,196			}			
									3,919	13%	22,668				

Sedimentation basin/s

Solids	receive into basins	13%	for settling	3,919	t/yr DM	Phosphorus	receive into basins	13%	for settling	25.5	t/yr
	retain in basins	60%	to remove	2,351			retain in basins	60%	to remove	15.3	to Tubbo
	passes to Cat 3 holding pond			1,568			passes to Cat 3 holding pond			10.2	

Irrigation applications

Tubbo manure	scrapings	22,668	t/yr of manure			Project manure	receive into Cat 3 pond/s			1,568	t/yr manure
	basins	2,351									
		25,019					settles	60%		941	t/yr removal to Tubbo
	or	10.01	t/ha/year				recycled	20%		314	
	over	2,500	ha				evap'n ponds	20%		314	
										1,568	
									or	0.0	t/ha/year
									over	0	ha
Tubbo phosphorus	scrapings	181.3				Project phosphorus	settles	60%	in manure	6.1	t/yr removal to Tubbo
	basins	15.3					recycled	20%		2.0	
		196.6	t/yr of phosphorus				evap'n ponds	20%		2.0	
	or	78.7	kg/ha/year							10.2	t/yr of phosphorus
	over	2,500	ha						or	0.0	kg/ha/year
									over	0	ha

POTASSIUM LOAD - PROPOSED TOTAL PROJECT

Imports	Dairy cattle	all rations (incl DDG)	193.01	t/day DM		0.27%	potassium	190.21	t/yr	Dr Ian Lean - direct from project ration computer model
		less K in DDG re-cycled on site						-251.38	t/yr	Not an import - came with grain - see exports DDG below
	CICL supply	Cat 1 - ethanol	2100.00	ML/yr		1.60	mg/L	3.36	t/yr	} G Shulze (DNR Deni)
		Cat 2 - aesthetic	50.00	ML/yr		1.60	mg/L	0.08	t/yr	} Gogeldrie weir (Stn 410082)
		Cat 3 - recycle pond/s	150.00	ML/yr		1.60	mg/L	0.24	t/yr	} av of 1.53 & 1.57 mg/L only
		Irrigation- cell 1	0.00	ML/yr		1.60	mg/L	-	t/yr	} rounded up to 1.60 mg/L
		Irrigation - cell 2	0.00	ML/yr		1.60	mg/L	-	t/yr	}
		Irrigation - cell 3	0.00	ML/yr		1.60	mg/L	-	t/yr	} Water volumes as per
		Irrigation - cell 4	0.00	ML/yr		1.60	mg/L	-	t/yr	} EA water budgets
		Cat 4 - evaporation	0.00	ML/yr		1.60	mg/L	-	t/yr	}
	Grain	purchases	725,000	t/yr		0.34%	potassium	2,465.00	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
							Total potassium imports	2,407.52	t/yr	
Exports	Milk	carted to factory	76.00	ML/yr		1.30	gm/L	98.80	t/yr	Dr Ian Lean - direct from project ration computer model
	Cattle sales	culls/dry	1584	hd/yr	700 kg LW	1.70	gm/kg LW	1.88	t/yr	}
		calves heifer	320		100	1.70	gm/kg LW	0.05	t/yr	} Dr Ian Lean
		bull	664		100	1.70	gm/kg LW	0.11	t/yr	} data direct from project ration model
		heifers 3-9 mth	177		300	1.70	gm/kg LW	0.09	t/yr	}
		9-15 mth	2259		400	1.70	gm/kg LW	1.54	t/yr	} affirmed Dr Stuart Barber
		15-20 mth	200		500	1.70	gm/kg LW	0.17	t/yr	} Melb Uni Vet school
		1st calf	1085		600	1.70	gm/kg LW	1.11	t/yr	} telecon & email 15 Dec 06
										}
	Cattle deaths	culls/dry	288	hd/yr	700 kg LW	1.70	gm/kg LW	0.34	t/yr	}
		calves heifer	192		100	1.70	gm/kg LW	0.03	t/yr	}
		bull	21		100	1.70	gm/kg LW	0.00	t/yr	}
		heifers 3-9 mth	59		300	1.70	gm/kg LW	0.03	t/yr	}
		9-15 mth	56		400	1.70	gm/kg LW	0.04	t/yr	}
		15-20 mth	33		500	1.70	gm/kg LW	0.03	t/yr	}
		1st calf	155		600	1.70	gm/kg LW	0.16	t/yr	}
	Silage ex Cat 3 irrigation (substituted purchases)			say	0%	of external sourced rations		-	t/yr	estimate by BA
	Distillers grain	to dairy cows	21,124	t/yr	1.19% K = 251.38	t not exported - ratio		-	t/yr	} Dr I Lean & calculation of quantum of concentration
		for sale off site	186,226	t/yr		1.19%	potassium	2,216.09	t/yr	} during ethanol manufacture (grain % * 3.5)
		in water in WDG						3.36	t/yr	direct transfer from water used in ethanol plant
	Manure carted to Tubbo, etc..		25,019	t/yr DM		0.30%	potassium	75.06	t/yr	Dr Ian Lean
							Total potassium exports	2,398.89	t/yr	
							Net potassium accumulation	**8.62**	**t/yr**	

POTASSIUM LOAD - CURRENT PRACTICES

Assume	4 year crop/pasture rotation										
	Farm aggregation		359	ha							
	Base water entitlement		4.0	ML/benefitted ha	1436	ML @ 100% when assuming an averaged entitlement for non rice approved areas					
	Annual averaged allocation		75%	Water Sharing Plan	1077	ML available on average					
	rice	after long fallow	42.0	ha	13.75 ML/ha	577.5	ML total producing	10.00	t/ha grain	420.0	t/yr grain
	wheat	into rice stubble	42.0		3.00	126.0		4.00		168.0	
	canola	after short fallow	42.0		4.60	193.2		2.50		105.0	
	wheat	after short fallow	42.0		4.20	176.4		5.00		210.0	
					Total water needs	1073.1	ML needed			903.0	t/yr grain
Imports	In water for irrigation		1073.10	ML/yr		1.60	mg/L	1.72	t/yr	G Shulze (DNR Deni) - Gogeldrie weir (Stn 410082)	
	Other - fertiliser		0.0	kg/ha/year averaged		168.0		0.00		BA estimates	
							Total potassium imports	1.72	t/yr		
Exports	In grain being produced		903.0	t/yr grain		0.34%	potassium	3.07	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst	
	other products							0.00	t/yr		
							Total potassium exports	3.07	t/yr		
							Net potassium accumulation	**-1.4**	**t/yr or**	**-8.1**	**kg/ha/yr**

INCREMENTAL CHANGES IN POTASSIUM LOADINGS

Net project loading		8.62	t/yr
Net current loading	-	1.35	
Incremental change		**9.97**	**t/yr**

POTASSIUM LOAD - DAIRY COMPONENT OF PROPOSED PROJECT

Imports

Dairy cattle	all rations (inc DDG)	193.01	t/day DM		0.27%	potassium	190.21	t/yr	Dr Ian Lean - direct from project ration computer model
CICL - Cat 1	drinking water	390.90	ML/yr		1.60	mg/L	0.63	t/yr	} G Shulze (DNR Deni)
	misting	40.00	ML/yr		1.60	mg/L	0.06	t/yr	} Gogeldrie weir (Stn 410082)
	cow wash-down	219.00	ML/yr		1.60	mg/L	0.35	t/yr	}
	dairy cleaning	109.50	ML/yr		1.60	mg/L	0.18	t/yr	}
	sundry	21.90	ML/yr		1.60	mg/L	0.04	t/yr	} av of 1.53 & 1.57 mg/L only
									} rounded up to 1.60 mg/L
CICL - augmentation	Cat 3 - recycle pond/s	150.00	ML/yr		1.60	mg/L	0.24	t/yr	}
	Irrigation- cell 1	0.00	ML/yr		1.60	mg/L	-	t/yr	}
	Irrigation - cell 2	0.00	ML/yr		1.60	mg/L	-	t/yr	}
	Irrigation - cell 3	0.00	ML/yr		1.60	mg/L	-	t/yr	} Water volumes as per
	Irrigation - cell 4	0.00	ML/yr		1.60	mg/L	-	t/yr	} EA water budgets
	Cat 4 - evaporation	0.00	ML/yr		1.60	mg/L	-	t/yr	}
						Total potassium imports	191.70	t/yr	

Exports

Milk	carted to factory		76.00	ML/yr			1.30	gm/L	98.80	t/yr	Dr Ian Lean - direct from project ration computer model
Cattle sales	culls/dry		1584	hd/yr	700	kg LW	1.70	gm/kg LW	1.88	t/yr	}
	calves	heifer	320		100		1.70	gm/kg LW	0.05	t/yr	} Dr Ian Lean
		bull	664		100		1.70	gm/kg LW	0.11	t/yr	} data direct from project ration model
	heifers	3-9 mth	177		300		1.70	gm/kg LW	0.09	t/yr	}
		9-15 mth	2259		400		1.70	gm/kg LW	1.54	t/yr	} affirmed Dr Stuart Barber
		15-20 mth	200		500		1.70	gm/kg LW	0.17	t/yr	} Melb Uni Vet school
		1st calf	1085		600		1.70	gm/kg LW	1.11	t/yr	} telecon & email 15 Dec 06
											}
Cattle deaths	culls/dry		288	hd/yr	700	kg LW	1.70	gm/kg LW	0.34	t/yr	}
	calves	heifer	192		100		1.70	gm/kg LW	0.03	t/yr	}
		bull	21		100		1.70	gm/kg LW	0.00	t/yr	}
	heifers	3-9 mth	59		300		1.70	gm/kg LW	0.03	t/yr	}
		9-15 mth	56		400		1.70	gm/kg LW	0.04	t/yr	}
		15-20 mth	33		500		1.70	gm/kg LW	0.03	t/yr	}
		1st calf	155		600		1.70	gm/kg LW	0.16	t/yr	}
Silage ex Cat 3 irrigation (substituted purchases)			say		0%	of external sourced rations			-	t/yr	estimate by BA
Manure carted to Tubbo, etc..			25,019	t/yr DM			0.30%	potassium	75.06	t/yr	Dr Ian Lean - most of excreted K in soluble forms
								Total potassium exports	179.45	t/yr	

Net potassium accumulation 12.26 t/yr

Manure production & distribution

										Sediment		Scrapings		
Freestall	7,200	cows producing		18,780	t/yr faeces as DM	(EA annexure ……)							} of the 30,757 t/yr
		distributed	90%	in flushing lanes	16,902	t/yr DM	15%	captured in flushing		2,535			
							85%	scraped with bobcat				14,367	} generate 4,171 t/yr
			10%	in loafing yards	1,878	t/yr DM	60%	scraped off yards				1,127	} remains in pens or is lost as
							10%	captured rain run-off		188			} dust, degradation, etc
Dry lot	10,870	heifers producing		11,957	t/yr faeces as DM	(EA annexure ……)							}
							60%	scraped off yards				7,174	}
							10%	captured rain run-off		1,196			}
										3,919	13%	22,668	

Sedimentation basin/s

Solids	receive into basins	13%	for settling	3,919	t/yr DM	Potassium	receive into basins	13%	for settling	9.6	t/yr
	retain in basins	60%	to remove	2,351			retain in basins	20%	to remove	1.9	to Tubbo
	passes to Cat 3 holding pond			1,568			passes to Cat 3 holding pond			7.7	

Irrigation applications

Tubbo manure	scrapings	22,668	t/yr of manure		Project manure	receive into Cat 3 pond/s			1,568	t/yr manure
	basins	2,351								
		25,019				settles	60%		941	t/yr removal to Tubbo
	or	10.01	t/ha/year			recycled	20%		314	
	over	2,500	ha			evap'n ponds	20%		314	
									1,568	
								or	0.0	t/ha/year
								over	0	ha
Tubbo potassium	scrapings	68.0			Project potassium	settles	10%		0.8	t/yr removal to Tubbo
	basins	1.9				recycled	10%		0.8	
		69.9	t/yr of potassium			evap'n ponds	80%		6.1	
	or	28.0	kg/ha/year						7.7	t/yr of potassium
	over	2,500	ha					or	0.0	kg/ha/year
								over	0	ha

CALCIUM LOAD - PROPOSED TOTAL PROJECT

Imports	Dairy cattle	all rations (incl DDG)	193.01	t/day DM			0.50%	calcium	352.24	t/yr	Dr Ian Lean - direct from project ration computer model
		less Ca in DDG re-cycled on site							-23.24	t/yr	Not an import - came with grain - see exports DDG below
	CICL supply	Cat 1 - ethanol	2100.00	ML/yr			10.84	mg/L	22.76	t/yr	} G Shulze (DNR Deni)
		Cat 2 - aesthetic	50.00	ML/yr			10.84	mg/L	0.54	t/yr	} Gogeldrie weir (Stn 410082)
		Cat 3 - recycle pond/s	150.00	ML/yr			10.84	mg/L	1.63	t/yr	} average of total Ca levels
		Irrigation- cell 1	0.00	ML/yr			10.84	mg/L	-	t/yr	} data only available for Jan 97 to Oct 99
		Irrigation - cell 2	0.00	ML/yr			10.84	mg/L	-	t/yr	}
		Irrigation - cell 3	0.00	ML/yr			10.84	mg/L	-	t/yr	} Water volumes as per
		Irrigation - cell 4	0.00	ML/yr			10.84	mg/L	-	t/yr	} EA water budgets
		Cat 4 - evaporation	0.00	ML/yr			10.84	mg/L	-	t/yr	}
	Grain	purchases	725,000	t/yr			0.031%	calcium	224.75	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
								Total calcium imports	578.69	t/yr	

Exports	Milk	carted to factory	76.00	ML/yr			1.06	gm/L	80.56	t/yr	Dr Ian Lean - direct from project ration computer model
	Cattle sales	culls/dry	1584	hd/yr	700	kg LW	0.50	gm/kg LW	0.55	t/yr	}
		calves heifer	320		100		0.50	gm/kg LW	0.02	t/yr	} Dr Ian Lean
		bull	664		100		0.50	gm/kg LW	0.03	t/yr	}
		heifers 3-9 mth	177		300		0.50	gm/kg LW	0.03	t/yr	}
		9-15 mth	2259		400		0.50	gm/kg LW	0.45	t/yr	}
		15-20 mth	200		500		0.50	gm/kg LW	0.05	t/yr	}
		1st calf	1085		600		0.50	gm/kg LW	0.33	t/yr	}
											}
	Cattle deaths	culls/dry	288	hd/yr	700	kg LW	0.50	gm/kg LW	0.10	t/yr	}
		calves heifer	192		100		0.50	gm/kg LW	0.01	t/yr	}
		bull	21		100		0.50	gm/kg LW	0.00	t/yr	} data direct from project ration model
		heifers 3-9 mth	59		300		0.50	gm/kg LW	0.01	t/yr	}
		9-15 mth	56		400		0.50	gm/kg LW	0.01	t/yr	}
		15-20 mth	33		500		0.50	gm/kg LW	0.01	t/yr	}
		1st calf	155		600		0.50	gm/kg LW	0.05	t/yr	}
	Silage ex Cat 3 irrigation (substituted purchases)			say	0%	of external sourced rations			-	t/yr	estimate by BA
	Distillers grain	to dairy cows	21,124	t/yr	0.11%	Ca =	23.24	t not exported - ratio	-	t/yr	} Dr I Lean & calculation of quantum of concentration
		for sale off site	186,226	t/yr			0.11%	calcium	204.85	t/yr	} during ethanol manufacture (grain % * 3.5)
		in water in WDG							22.76	t/yr	direct transfer from water used in ethanol plant
	Manure carted to Tubbo, etc..		25,019	t/yr DM			0.86%	calcium	215.16	t/yr	Dr Ian Lean - most excreted in soluble forms
								Total calcium exports	524.98	t/yr	

Net calcium accumulation 53.71 t/yr

CALCIUM LOAD - CURRENT PRACTICES

Assume	4 year crop/pasture rotation										
	Farm aggregation		359	ha							
	Base water entitlement		4.0	ML/benefitted ha		1436	ML @ 100% when assuming an averaged entitlement for non rice approved areas				
	Annual averaged allocation		75%	Water Sharing Plan		1077	ML available on average				
	rice	after long fallow	42.0	ha	13.75	ML/ha	577.5	ML total producing	10.00	t/ha grain	420.0 t/yr grain
	wheat	into rice stubble	42.0		3.00		126.0		4.00		168.0
	canola	after short fallow	42.0		4.60		193.2		2.50		105.0
	wheat	after short fallow	42.0		4.20		176.4		5.00		210.0
					Total water needs		1073.1	ML needed			903.0 t/yr grain

Imports	In water for irrigation		1073.10	ML/yr			10.84	mg/L	11.63	t/yr	G Shulze (DNR Deni) - Gogeldrie weir (Stn 410082)
	Other - fertiliser		0.0	kg/ha/year averaged			168.0		0.00		BA estimates
								Total calcium imports	11.63	t/yr	
Exports	In grain being produced		903.0	t/yr grain			0.031%	calcium	0.28	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
	other products								0.00	t/yr	
								Total calcium exports	0.28	t/yr	

Net calcium accumulation 11.4 t/yr or 67.6 kg/ha/yr

INCREMENTAL CHANGES IN CALCIUM LOADINGS

Net project loading	53.71	t/yr
Net current loading	11.35	
Incremental change	**42.36**	**t/yr**

CALCIUM LOAD - DAIRY COMPONENT OF PROPOSED PROJECT

Imports

Dairy cattle	all rations (inc DDG)	193.01	t/day DM	0.50%	calcium	352.24	t/yr	Dr Ian Lean - direct from project ration computer model	
CICL - Cat 1	drinking water	390.90	ML/yr	10.84	mg/L	4.24	t/yr	}	G Shulze (DNR Deni)
	misting	40.00	ML/yr	10.84	mg/L	0.43	t/yr	}	Gogeldrie weir (Stn 410082)
	cow wash-down	219.00	ML/yr	10.84	mg/L	2.37	t/yr	}	
	dairy cleaning	109.50	ML/yr	10.84	mg/L	1.19	t/yr	}	
	sundry	21.90	ML/yr	10.84	mg/L	0.24	t/yr	}	average of total Ca levels
								}	data only available for Jan 97 to Oct 99
CICL - augmentation	Cat 3 - recycle pond/s	150.00	ML/yr	10.84	mg/L	1.63	t/yr	}	
	Irrigation- cell 1	0.00	ML/yr	10.84	mg/L	-	t/yr	}	
	Irrigation - cell 2	0.00	ML/yr	10.84	mg/L	-	t/yr	}	
	Irrigation - cell 3	0.00	ML/yr	10.84	mg/L	-	t/yr	}	Water volumes as per
	Irrigation - cell 4	0.00	ML/yr	10.84	mg/L	-	t/yr	}	EA water budgets
	Cat 4 - evaporation	0.00	ML/yr	10.84	mg/L	-	t/yr	}	
					Total calcium imports	362.34	t/yr		

Exports

Milk	carted to factory		76.00	ML/yr		1.06	gm/L	80.56	t/yr	Dr Ian Lean - direct from project ration computer model	
Cattle sales	culls/dry		1584	hd/yr	700 kg LW	0.50	gm/kg LW	0.55	t/yr	}	
	calves	heifer	320		100	0.50	gm/kg LW	0.02	t/yr	}	Dr Ian Lean
		bull	664		100	0.50	gm/kg LW	0.03	t/yr	}	
	heifers	3-9 mth	177		300	0.50	gm/kg LW	0.03	t/yr	}	
		9-15 mth	2259		400	0.50	gm/kg LW	0.45	t/yr	}	
		15-20 mth	200		500	0.50	gm/kg LW	0.05	t/yr	}	
		1st calf	1085		600	0.50	gm/kg LW	0.33	t/yr	}	
										}	
Cattle deaths	culls/dry		288	hd/yr	700 kg LW	0.50	gm/kg LW	0.10	t/yr	}	
	calves	heifer	192		100	0.50	gm/kg LW	0.01	t/yr	}	
		bull	21		100	0.50	gm/kg LW	0.00	t/yr	}	
	heifers	3-9 mth	59		300	0.50	gm/kg LW	0.01	t/yr	}	data direct from project ration model
		9-15 mth	56		400	0.50	gm/kg LW	0.01	t/yr	}	
		15-20 mth	33		500	0.50	gm/kg LW	0.01	t/yr	}	
		1st calf	155		600	0.50	gm/kg LW	0.05	t/yr	}	
Silage ex Cat 3 irrigation (substituted purchases)				say	0% of external sourced rations			-	t/yr	estimate by BA	
Manure carted to Tubbo, etc..			25,019	t/yr DM		0.86%	calcium	215.16	t/yr	Dr Ian Lean - most excreted in soluble forms	
							Total calcium exports	297.37	t/yr		

Net calcium accumulation 64.97 t/yr

Manure production & distribution

												Sediment		Scrapings	
Freestall	7,200	cows producing		18,780	t/yr faeces as DM	(EA annexure ……)									
		distributed	90%	in flushing lanes		16,902	t/yr DM	15%	captured in flushing			2,535			} of the 30,757 t/yr
								85%	scraped with bobcat					14,367	} generate 4,171 t/yr
			10%	in loafing yards		1,878	t/yr DM	60%	scraped off yards					1,127	} remains in pens or is lost as
								10%	captured rain run-off			188			} dust, degradation, etc
Dry lot	10,870	heifers producing		11,957	t/yr faeces as DM	(EA annexure ……)									}
								60%	scraped off yards					7,174	}
								10%	captured rain run-off			1,196			}
												3,919	13%	22,668	

Sedimentation basin/s

Solids	receive into basins	13%	for settling	3,919	t/yr DM		Calcium	receive into basins	13%	for settling	27.4	t/yr
	retain in basins	60%	to remove	2,351				retain in basins	20%	to remove	5.5	to Tubbo
	passes to Cat 3 holding pond			1,568				passes to Cat 3 holding pond			21.9	

Irrigation applications

Tubbo manure	scrapings	22,668	t/yr of manure		Project manure	receive into Cat 3 pond/s		1,568	t/yr manure	
	basins	2,351								
		25,019				settles	60%	941	t/yr removal to Tubbo	
	or	10.01	t/ha/year			recycled	20%	314		
	over	2,500	ha			evap'n ponds	20%	314		
								1,568		
							or	0.0	t/ha/year	
							over	0	ha	
Tubbo calcium	scrapings	194.9			Project calcium	settles	10%	2.2	t/yr removal to Tubbo	
	basins	5.5				recycled	10%	2.2		
		200.4	t/yr of calcium			evap'n ponds	80%	17.5		
	or	80.2	kg/ha/year					21.9	t/yr of calcium	
	over	2,500	ha				or	0.0	kg/ha/year	
							over	0	ha	

MAGNESIUM LOAD - PROPOSED TOTAL PROJECT

Imports	Dairy cattle	all rations (incl DDG)	193.01	t/day DM			0.28%	magnesium	197.26	t/yr	Dr Ian Lean - direct from project ration computer model
		less Mg in DDG re-cycled on site							-76.05	t/yr	Not an import - came with grain - see exports DDG below
	CICL supply	Cat 1 - ethanol	2100.00	ML/yr			7.29	mg/L	15.31	t/yr	} G Shulze (DNR Deni)
		Cat 2 - aesthetic	50.00	ML/yr			7.29	mg/L	0.36	t/yr	} Gogeldrie weir (Stn 410082)
		Cat 3 - recycle pond/s	150.00	ML/yr			7.29	mg/L	1.09	t/yr	} Average of data Jan 97 to Oct 99
		Irrigation- cell 1	0.00	ML/yr			7.29	mg/L	-	t/yr	} only data available
		Irrigation - cell 2	0.00	ML/yr			7.29	mg/L	-	t/yr	}
		Irrigation - cell 3	0.00	ML/yr			7.29	mg/L	-	t/yr	} Water volumes as per
		Irrigation - cell 4	0.00	ML/yr			7.29	mg/L	-	t/yr	} EA water budgets
		Cat 4 - evaporation	0.00	ML/yr			7.29	mg/L	-	t/yr	}
	Grain	purchases	725,000	t/yr			0.102%	magnesium	739.50	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst
							Total	magnesium imports	877.48	t/yr	
Exports	Milk	carted to factory	76.00	ML/yr			0.11	gm/L	8.36	t/yr	Dr Ian Lean - direct from project ration computer model
	Cattle sales	culls/dry		1584	hd/yr	700	kg LW	240	mg/kg LW	0.27	t/yr }
		calves	heifer	320		100		240	mg/kg LW	0.01	t/yr } Dr Ian Lean
			bull	664		100		240	mg/kg LW	0.02	t/yr }
		heifers	3-9 mth	177		300		240	mg/kg LW	0.01	t/yr }
			9-15 mth	2259		400		240	mg/kg LW	0.22	t/yr }
			15-20 mth	200		500		240	mg/kg LW	0.02	t/yr }
			1st calf	1085		600		240	mg/kg LW	0.16	t/yr }
											}
	Cattle deaths	culls/dry		288	hd/yr	700	kg LW	240	mg/kg LW	0.05	t/yr }
		calves	heifer	192		100		240	mg/kg LW	0.00	t/yr }
			bull	21		100		240	mg/kg LW	0.00	t/yr } data direct from project ration model
		heifers	3-9 mth	59		300		240	mg/kg LW	0.00	t/yr }
			9-15 mth	56		400		240	mg/kg LW	0.01	t/yr }
			15-20 mth	33		500		240	mg/kg LW	0.00	t/yr }
			1st calf	155		600		240	mg/kg LW	0.02	t/yr }
	Silage ex Cat 3 irrigation (substituted purchases)				say	0%	of external sourced rations			-	t/yr estimate by BA
	Distillers grain	to dairy cows		21,124	t/yr	0.36%	MG =	76.05	t not exported - ratio	-	t/yr } Dr I Lean & calculation of quantum of concentration
		for sale off site		186,226	t/yr			0.36%	magnesium	670.41	t/yr } during ethanol manufacture (grain % * 3.5)
		in water in WDG								15.31	t/yr direct transfer from water used in ethanol plant
	Manure carted to Tubbo, etc..			25,019	t/yr DM			0.70%	magnesium	175.13	t/yr Dr Ian Lean - mostly soluble forms (90%)
								Total	magnesium exports	870.00	t/yr
								Net magnesium accumulation		**7.47**	**t/yr**

MAGNESIUM LOAD - CURRENT PRACTICES

Assume	4 year crop/pasture rotation											
	Farm aggregation		359	ha								
	Base water entitlement		4.0	ML/benefitted ha		1436	ML @ 100% when assuming an averaged entitlement for non rice approved areas					
	Annual averaged allocation		75%	Water Sharing Plan		1077	ML available on average					
	rice	after long fallow	42.0	ha	13.75	ML/ha	577.5	ML total producing	10.00	t/ha grain	420.0	t/yr grain
	wheat	into rice stubble	42.0		3.00		126.0		4.00		168.0	
	canola	after short fallow	42.0		4.60		193.2		2.50		105.0	
	wheat	after short fallow	42.0		4.20		176.4		5.00		210.0	
					Total water needs		1073.1	ML needed			903.0	t/yr grain
Imports	In water for irrigation		1073.10	ML/yr			7.29	mg/L	7.82	t/yr	G Shulze (DNR Deni) - Gogeldrie weir (Stn 410082)	
	Other - fertiliser		0.0	kg/ha/year averaged			168.0		0.00		BA estimates	
							Total	magnesium imports	7.82	t/yr		
Exports	In grain being produced		903.0	t/yr grain			0.102%	magnesium	0.92	t/yr	Dr Lean, Aust Soil Fertility Manual & Bread Res Inst	
	other products								0.00	t/yr		
							Total	magnesium exports	0.92	t/yr		
							Net magnesium accumulation		**6.9**	**t/yr or**	**41.1**	**kg/ha/yr**

INCREMENTAL CHANGES IN MAGNESIUM LOADINGS

Net project loading	7.47	t/yr
Net current loading	6.90	
Incremental change	**0.57**	**t/yr**

MAGNESIUM LOAD - DAIRY COMPONENT OF PROPOSED PROJECT

Imports

Dairy cattle	all rations (inc DDG)	193.01	t/day DM	0.28%	magnesium	197.26	t/yr	Dr Ian Lean - direct from project ration computer model	
CICL - Cat 1	drinking water	390.90	ML/yr	7.29	mg/L	2.85	t/yr	}	G Shulze (DNR Deni)
	misting	40.00	ML/yr	7.29	mg/L	0.29	t/yr	}	Gogeldrie weir (Stn 410082)
	cow wash-down	219.00	ML/yr	7.29	mg/L	1.60	t/yr	}	
	dairy cleaning	109.50	ML/yr	7.29	mg/L	0.80	t/yr	}	
	sundry	21.90	ML/yr	7.29	mg/L	0.16	t/yr	}	Average of data Jan 97 to Oct 99
								}	only data available
CICL - augmentation	Cat 3 - recycle pond/s	150.00	ML/yr	7.29	mg/L	1.09	t/yr	}	
	Irrigation- cell 1	0.00	ML/yr	7.29	mg/L	-	t/yr	}	
	Irrigation - cell 2	0.00	ML/yr	7.29	mg/L	-	t/yr	}	
	Irrigation - cell 3	0.00	ML/yr	7.29	mg/L	-	t/yr	}	Water volumes as per
	Irrigation - cell 4	0.00	ML/yr	7.29	mg/L	-	t/yr	}	EA water budgets
	Cat 4 - evaporation	0.00	ML/yr	7.29	mg/L	-	t/yr	}	
				Total	magnesium imports	204.05	t/yr		

Exports

Milk	carted to factory		76.00	ML/yr			0.11	gm/L	8.36	t/yr	Dr Ian Lean - direct from project ration computer model
Cattle sales	culls/dry		1584	hd/yr	700	kg LW	240	mg/kg LW	0.27	t/yr	}
	calves	heifer	320		100		240	mg/kg LW	0.01	t/yr	} Dr Ian Lean
		bull	664		100		240	mg/kg LW	0.02	t/yr	}
	heifers	3-9 mth	177		300		240	mg/kg LW	0.01	t/yr	}
		9-15 mth	2259		400		240	mg/kg LW	0.22	t/yr	}
		15-20 mth	200		500		240	mg/kg LW	0.02	t/yr	}
		1st calf	1085		600		240	mg/kg LW	0.16	t/yr	}
											}
Cattle deaths	culls/dry		288	hd/yr	700	kg LW	240	mg/kg LW	0.05	t/yr	} data direct from project ration model
	calves	heifer	192		100		240	mg/kg LW	0.00	t/yr	}
		bull	21		100		240	mg/kg LW	0.00	t/yr	}
	heifers	3-9 mth	59		300		240	mg/kg LW	0.00	t/yr	}
		9-15 mth	56		400		240	mg/kg LW	0.01	t/yr	}
		15-20 mth	33		500		240	mg/kg LW	0.00	t/yr	}
		1st calf	155		600		240	mg/kg LW	0.02	t/yr	}
Silage ex Cat 3 irrigation (substituted purchases)				say	0%	of external sourced rations			-	t/yr	estimate by BA
Manure carted to Tubbo, etc..			25,019	t/yr DM			0.70%	magnesium	175.13	t/yr	Dr Ian Lean - mostly soluble forms (90%)
							Total	magnesium exports	184.28	t/yr	

Net magnesium accumulation 19.76 t/yr

Manure production & distribution

Freestall	7,200	cows producing		18,780	t/yr faeces as DM	(EA annexure ……)			Sediment		Scrapings				
		distributed	90%	in flushing lanes	16,902	t/yr DM	15%	captured in flushing	2,535			} of the	30,757	t/yr	
							85%	scraped with bobcat			14,367	} generate	4,171	t/yr	
			10%	in loafing yards	1,878	t/yr DM	60%	scraped off yards			1,127	} remains in pens or is lost as			
							10%	captured rain run-off	188			} dust, degradation, etc			
Dry lot	10,870	heifers producing		11,957	t/yr faeces as DM	(EA annexure ……)						}			
							60%	scraped off yards			7,174	}			
							10%	captured rain run-off	1,196			}			
									3,919	13%	22,668				

Sedimentation basin/s

Solids	receive into basins	13%	for settling	3,919	t/yr DM	Magnesium	receive into basins	13%	for settling	22.3	t/yr
	retain in basins	60%	to remove	2,351			retain in basins	20%	to remove	4.5	to Tubbo
	passes to Cat 3 holding pond			1,568			passes to Cat 3 holding pond			17.9	

Irrigation applications

Tubbo manure	scrapings	22,668	t/yr of manure		Project manure	receive into Cat 3 pond/s		1,568	t/yr manure	
	basins	2,351								
		25,019				settles	60%	941	t/yr removal to Tubbo	
	or	10.01	t/ha/year			recycled	20%	314		
	over	2,500	ha			evap'n ponds	20%	314		
								1,568		
							or	0.0	t/ha/year	
							over	0	ha	
Tubbo magnesium	scrapings	158.7			Project magnesium	settles	10%	1.8	t/yr removal to Tubbo	
	basins	4.5				recycled	10%	1.8		
		163.1	t/yr of magnesium			evap'n ponds	80%	14.3		
	or	65.3	kg/ha/year					17.9	t/yr of magnesium	
	over	2,500	ha				or	0.0	kg/ha/year	
							over	0	ha	

FOUR ARROWS ETHANOL PTY LTD : *Sodium mass balances*

SODIUM LOAD - PROPOSED TOTAL PROJECT

Imports	Dairy cattle	all rations (inc DDG)	193.01	t/day DM		0.19%	sodium	133.85	t/yr	Dr Ian Lean - from project ration computer model - range 0.109% to 0.28% with 0.19% Av
		less Na in DDG re-cycled on site						-21.12	t/yr	Not an import - came with grain - see exports DDG below
	CICL supply	Cat 1 - ethanol	2100.00	ML/yr		17.20	mg/L	36.12	t/yr	} G Shulze (DNR Deni)
		Cat 2 - aesthetic	50.00	ML/yr		17.20	mg/L	0.86	t/yr	} Gogeldrie weir (Stn 410082)
		Cat 3 - recycle pond/s	150.00	ML/yr		17.20	mg/L	2.58	t/yr	} Average of data Jan 97 to Oct 99
		Irrigation- cell 1	0.00	ML/yr		17.20	mg/L	-	t/yr	} only data available
		Irrigation - cell 2	0.00	ML/yr		17.20	mg/L	-	t/yr	}
		Irrigation - cell 3	0.00	ML/yr		17.20	mg/L	-	t/yr	} Water volumes as per
		Irrigation - cell 4	0.00	ML/yr		17.20	mg/L	-	t/yr	} EA water budgets
		Cat 4 - evaporation	0.00	ML/yr		17.20	mg/L	-	t/yr	}
	Grain	purchases	725,000	t/yr		0.03%	sodium	217.50	t/yr	No data available - BA best estimate
							Total imports of sodium	369.79	t/yr	
Exports	Milk	carted to factory	76.00	ML/yr		0.40	gm/L	30.40	t/yr	Dr Ian Lean - direct from project ration computer model
	Cattle sales	culls/dry	1584	hd/yr	700 kg LW	1.40	gm/kg LW	1.55	t/yr	Dr Ian Lean
		calves heifer	320		100	1.40	gm/kg LW	0.04	t/yr	Dr Ian Lean
		bull	664		100	1.40	gm/kg LW	0.09	t/yr	Dr Ian Lean
		heifers 3-9 mth	177		300	1.40	gm/kg LW	0.07	t/yr	Dr Ian Lean
		9-15 mth	2259		400	1.40	gm/kg LW	1.27	t/yr	Dr Ian Lean
		15-20 mth	200		500	1.40	gm/kg LW	0.14	t/yr	Dr Ian Lean
		1st calf	1085		600	1.40	gm/kg LW	0.91	t/yr	Dr Ian Lean
	Cattle deaths	culls/dry	288	hd/yr	700 kg LW	1.40	gm/kg LW	0.28	t/yr	Dr Ian Lean
		calves heifer	192		100	1.40	gm/kg LW	0.03	t/yr	Dr Ian Lean
		bull	21		100	1.40	gm/kg LW	0.00	t/yr	Dr Ian Lean
		heifers 3-9 mth	59		300	1.40	gm/kg LW	0.02	t/yr	Dr Ian Lean
		9-15 mth	56		400	1.40	gm/kg LW	0.03	t/yr	Dr Ian Lean
		15-20 mth	33		500	1.40	gm/kg LW	0.02	t/yr	Dr Ian Lean
		1st calf	155		600	1.40	gm/kg LW	0.13	t/yr	Dr Ian Lean
	Silage ex Cat 3 irrigation (substituted purchases)				say 0% of external sourced rations			0.00	t/yr	estimate by BA
	Distillers grain	to dairy cows	21,124	t/yr	0.10% Na =	21.12	t not exported - ratio	-	t/yr	} Dr I Lean & calculation of concentration plus water
		for sale off site	186,226	t/yr		0.10%	sodium	186.23	t/yr	} during ethanol manufacture (grain % * 3.5)
		in water in WDG						36.12	t/yr	direct transfer from water used in ethanol plant
	Manure	carted to Tubbo, etc..	25,019	t/yr DM		0.40%	sodium	100.08	t/yr	Dr Ian Lean - nearly all in solids
							Total exports of sodium	357.42	t/yr	
							Net sodium accumulation	**12.36**	**t/yr**	

SODIUM LOAD - CURRENT PRACTICES

Assume

4 year crop/pasture rotation

Farm aggregation		359	ha								
Base water entitlement		4.0	ML/benefitted ha		1436	ML @ 100% when assuming an averaged entitlement for non rice approved areas					
Annual averaged allocation		75%	Water Sharing Plan		1077	ML available on average					
rice	after long fallow	42.0	ha	13.75	ML/ha	577.5	ML total producing	10.00	t/ha grain	420.0	t/yr grain
wheat	into rice stubble	42.0		3.00		126.0		4.00		168.0	
canola	after short fallow	42.0		4.60		193.2		2.50		105.0	
wheat	after short fallow	42.0		4.20		176.4		5.00		210.0	
				Total water needs		1073.1	ML needed			903.0	t/yr grain

Imports	In water for irrigation	1073.10	ML/yr		17.20	mg/L	18.46	t/yr	G Shulze (DNR Deni) - Gogeldrie weir (Stn 410082)
	other						0.00		BA estimates
						Total imports of sodium	18.46	t/yr	
Exports	In grain being produced	903.0	t/yr grain		0.03%	sodium	0.27	t/yr	Dr Ian Lean (verbally affirmed by Bread Res Institute)
	other products						0.00	t/yr	
						Total exports of sodium	0.27	t/yr	
						Net sodium accumulation	**18.19**	**t/yr or**	**108.3 kg/ha/yr**

INCREMENTAL CHANGES IN SODIUM SALT LOADINGS

Net project loading	12.36	t/yr
Net current loading	18.19	
Incremental change	**-5.82**	**t/yr**

SODIUM LOAD - DAIRY COMPONENT OF PROPOSED PROJECT

Imports

Cattle rations	all rations (inc DDG)	193.01	t/day DM	0.19%	sodium	133.85	t/yr	Dr Ian Lean	- from project ration computer model - range 0.109% to 0.28%
CICL - Cat 1	drinking water	390.90	ML/yr	17.20	mg/L	6.72	t/yr	}	G Shulze (DNR Deni)
	misting	40.00	ML/yr	17.20	mg/L	0.69	t/yr	}	Gogeldrie weir (Stn 410082)
	cow wash-down	219.00	ML/yr	17.20	mg/L	3.77	t/yr	}	Average of data Jan 97 to Oct 99
	dairy cleaning	109.50	ML/yr	17.20	mg/L	1.88	t/yr	}	only data available
	sundry	21.90	ML/yr	17.20	mg/L	0.38	t/yr	}	
CICL - augmentation	Cat 3 - recycle pond/s	150.00	ML/yr	17.20	mg/L	2.58	t/yr	}	
	Irrigation- cell 1	0.00	ML/yr	17.20	mg/L	-	t/yr	}	
	Irrigation - cell 2	0.00	ML/yr	17.20	mg/L	-	t/yr	}	Water volumes as per
	Irrigation - cell 3	0.00	ML/yr	17.20	mg/L	-	t/yr	}	EA water budgets
	Irrigation - cell 4	0.00	ML/yr	17.20	mg/L	-	t/yr	}	
	Cat 4 - evaporation	0.00	ML/yr	17.20	mg/L	-	t/yr	}	
					Total imports of sodium	149.87	t/yr		

Exports

Milk	carted to factory		76.00	ML/yr			0.40	gm/L	30.40	t/yr	Dr Ian Lean - direct from project ration computer model
Cattle sales	culls/dry		1584	hd/yr	700	kg LW	1.40	gm/kg LW	1.55	t/yr	Dr Ian Lean
	calves	heifer	320		100		1.40	gm/kg LW	0.04	t/yr	Dr Ian Lean
		bull	664		100		1.40	gm/kg LW	0.09	t/yr	Dr Ian Lean
	heifers	3-9 mth	177		300		1.40	gm/kg LW	0.07	t/yr	Dr Ian Lean
		9-15 mth	2259		400		1.40	gm/kg LW	1.27	t/yr	Dr Ian Lean
		15-20 mth	200		500		1.40	gm/kg LW	0.14	t/yr	Dr Ian Lean
		1st calf	1085		600		1.40	gm/kg LW	0.91	t/yr	Dr Ian Lean
Cattle deaths	culls/dry		288	hd/yr	700	kg LW	1.40	gm/kg LW	0.28	t/yr	Dr Ian Lean
	calves	heifer	192		100		1.40	gm/kg LW	0.03	t/yr	Dr Ian Lean
		bull	21		100		1.40	gm/kg LW	0.00	t/yr	Dr Ian Lean
	heifers	3-9 mth	59		300		1.40	gm/kg LW	0.02	t/yr	Dr Ian Lean
		9-15 mth	56		400		1.40	gm/kg LW	0.03	t/yr	Dr Ian Lean
		15-20 mth	33		500		1.40	gm/kg LW	0.02	t/yr	Dr Ian Lean
		1st calf	155		600		1.40	gm/kg LW	0.13	t/yr	Dr Ian Lean
Silage ex Cat 3 irrigation (substituted purchases)				say	0%	of external sourced rations			0.00	t/yr	estimate by BA
Manure	carted to Tubbo, etc..		25,019	t/yr DM			0.40%	sodium	100.08	t/yr	Dr Ian Lean - nearly all in solids
								Total exports of sodium	135.08	t/yr	
								Net sodium accumulation	**14.79**	**t/yr**	

Manure production & distribution

									Sediment		Scrapings	
Freestall	7,200	cows producing	18,780	t/yr faeces as DM	(EA annexure ……)							
		distributed	90%	in flushing lanes	16,902	t/yr DM	15%	captured in flushing	2,535		} of the	30,757 t/yr
							85%	scraped with bobcat			14,367	} generate 4,171 t/yr
			10%	in loafing yards	1,878	t/yr DM	60%	scraped off yards			1,127	} remains in pens or is lost as
							10%	captured rain run-off	188			} dust, degradation, etc
Dry lot	10,870	heifers producing	11,957	t/yr faeces as DM	(EA annexure ……)							}
							60%	scraped off yards			7,174	}
							10%	captured rain run-off	1,196			}
									3,919	13%	22,668	

Sedimentation basin/s

Solids	receive into basins	13%	for settling	3,919	t/yr DM		Sodium	receive into basins	13%	for settling	12.8	t/yr
	retain in basins	60%	to remove	2,351	to Tubbo			retain in basins	20%	to remove	2.6	to Tubbo
	passes to Cat 3 holding pond			1,568				passes to Cat 3 holding pond			10.2	

Irrigation applications

Tubbo manure	scrapings	22,668	t/yr of manure		Project manure	receive into Cat 3 pond/s		1,568	t/yr manure
	basins	2,351							
		25,019				settles	60%	941	t/yr removal to Tubbo
	or	10.01	t/ha/year			recycled	20%	314	
	over	2,500	ha			evap'n ponds	20%	314	
								1,568	
							or	0.0	t/ha/year
							over	0	ha
Tubbo sodium	scrapings	90.7			Project sodium	settles	10%	1.0	t/yr removal to Tubbo
	basins	2.6				recycled	10%	1.0	
		93.2	t/yr of sodium			evap'n ponds	80%	8.2	
	or	37.3	kg/ha/year					10.2	t/yr of sodium
	over	2,500	ha				or	0.0	kg/ha/year
							over	0	ha

ANNEXURE 24.0

CSIRO GHG ABATEMENT CALCULATOR MODELS

Greenhouse Abatement Calculator

Data Summary

Units for Greenhouse Results kilotonnes

Details of your fuel project

Q1 How much biofuel will be produced? 300.00 Megalitres

Q2 What type of biofuel is it? Ethanol as E10 (10% ethanol with 90% premium unleaded petrol)

Biofuel	300.00	Megalitres	Ethanol
Blended fuel upstream	2,700.00	Megalitres	PULP
Total fuel volume	3,000.00	Megalitres	

	Fuel Type	Amount	Unit
Amount fuel is being replaced/ offset	Premium unleaded petrol	2,909.46	Megalitres

Details of Biofuel Production

Q3 Select biofuel production method? Ethanol - from sweet sorghum

Customise your Production Process

Ethanol based biofuels - Click on feedstock: Wheat | Molasses | Sorghum | Lignocellulose

Biodiesel based biofuels - Click on feedstock: Canola | Tallow | Waste vegetable oil

	Total CO2eq	CO2	CH4	N20	Other
	kt CO2eq	kt CO2	kt CH4	kt N20	kt CO2eq
Biofuel					
Upstream Bio-fuel	316.23	262.59	0.483	0.1403	0.00
Upstream Blend fuel	1202.40	1050.58	7.117	0.0077	
Tailpipe combined blend	6136.42	5435.15	1.904	2.1332	
Biofuel FFC emissions	7655.06	**6748.32**	**9.504**	**2.2811**	**0.00**
Displaced Fuel					
Upstream	1295.68	1132.08	7.669	0.0082	0.00
Tailpipe	6559.86	5856.80	1.909	2.1386	0.00
Total Displaced	**7855.54**	**6988.88**	**9.578**	**2.1469**	**0.00**
	kt CO2eq	kt CO2	kt CH4	kt N20	
Nett Savings (-impacts)	**200.49**	**240.56**	**0.074**	**-0.1343**	**0.00**

CO2 equivalence values used — Return to Defaults

	CO2	CH4	N20
GWP =	1.00	21.00	310.00

Details of Sweet Sorghum Feedstock

Back to main sheet

				Impact for your feedstock g CO2eq	g CO2	g CH4	g N20	g Other
	Sorghum Growing - Input per ha of sorghum			142600.0			460.0000	
s1	Yield of dry matter (tonnes)	12						
s2	Phosphate Fertilizer (kg)	40		13697.1	13280.0	18.64	0.0828	
s3	Fertiliser Urea (kg)	200		711966.4	113142.9	954.29	1867.0438	
s4	Lime (kg)	0		0.0	0.0	0.00	0.0000	
s5	Active pesticide (kg)	2		22346.2	21500.0	39.20	0.0743	
s6	Tractor fuel (diesel litres)	27.0		98584.0	95945.1	100.47	1.7062	
s7	Other			0.0				
		Distance km	Transport method					
s8	Transport of feedstock to ethanol	150	Articulated Truck	17.3	16.8	0.02	0.0002	
				g CO2eq	g CO2	g CH4	g N20	
	Impacts per kg of Feedstock			82.4	20.3	0.09	0.1941	

Details of Fermentation and Distillation

				Upstream impacts per litre ethanol				
s9	How much feedstock in required per litre of ethanol produced	2.37	kg	195.4	48.2	0.22	0.4600	
s10	Process heat/steam used in fermentation and distillation per litre of ethanol produced	9	MJ	804.2	774.0	1.3	0.0	
s11	Electricity used in fermentation and distillation per litre of ethanol produced	0.1	kWh	28.0	26.4	0.1	0.0	
s12	Transport of fuel to market	600	Articulated Truck	54.6	53.1	0.06	0.0005	
s13	Other Environmental impact/benefits.			0.0				

Back to main sheet

		g CO2eq	g CO2	g CH4	g N20	
	Total Upstream Impacts per litre for ethanol	**1054.1**	**875.3**	**1.61**	**0.4677**	**0.00**

Specify your steam and electricity fuel mix here | Customise energy source

s14				0.0	0.0	0	0.0000	
s15	Percentage of energy in cogeneration being exported		30%	**Fuel Mix Contributions**				
	Heat- Steam	%	Cogen	g CO2eq	g CO2	g CH4	g N20	g Other
	Black coal NSW	80	No	77.52	74.53	0.1312	0.0007728	0
	Natural Gas NSW & ACT	20	No	11.83	11.48	0.01636	0.0000344	0
	Not Used	0	No	0.00	0.00	0	0	0
	Not Used	0	No	0.00	0.00	0	0	0
	Profile per MJ fuel consumed	**100%**		**89.35**	**86.01**	**0.14756**	**0.0008072**	**0**

Heat- Steam	%	Cogen	g CO2eq	g CO2	g CH4	g N20	g Other
Electricity - NSW HV 2003	80	No	224.16	211.20	0.5904	0.001808	0
Not Used	20	No	56.04	52.80	0.1476	0.000452	0
Not Used	0	No	0.00	0.00	0	0	0
Not Used	0	No	0.00	0.00	0	0	0
Profile per MJ fuel consumed	**100%**		**280.20**	**264.00**	**0.738**	**0.00226**	**0**

Greenhouse Abatement Calculator

Data Summary

Units for Greenhouse Results kilotonnes

Details of your fuel project

Q1 How much biofuel will be produced? 300.00 Megalitres

Q2 What type of biofuel is it? Ethanol as E10 (10% ethanol with 90% premium unleaded petrol)

Biofuel	300.00	Megalitres	Ethanol
Blended fuel upstream	2,700.00	Megalitres	PULP
Total fuel volume	3,000.00	Megalitres	

	Fuel Type	Amount	Unit
Amount fuel is being replaced/ offset	Premium unleaded petrol	2,909.46	Megalitres

Details of Biofuel Production

Q3 Select biofuel production method? Ethanol - from wheat products

Customise your Production Process

Ethanol based biofuels - Click on feedstock: Wheat | Molasses | Sorghum | Lignocellulose

Biodiesel based biofuels - Click on feedstock: Canola | Tallow | Waste vegetable oil

	Total CO2eq	CO2	CH4	N20	Other
	kt CO2eq	kt CO2	kt CH4	kt N20	kt CO2eq
Biofuel					
Upstream Bio-fuel	441.87	359.84	0.663	0.2197	0.00
Upstream Blend fuel	1202.40	1050.58	7.117	0.0077	
Tailpipe combined blend	6136.42	5435.15	1.904	2.1332	
Biofuel FFC emissions	7780.69	**6845.57**	**9.684**	**2.3605**	**0.00**
Displaced Fuel					
Upstream	1295.68	1132.08	7.669	0.0082	0.00
Tailpipe	6559.86	5856.80	1.909	2.1386	0.00
Total Displaced	**7855.54**	**6988.88**	**9.578**	**2.1469**	**0.00**
	kt CO2eq	kt CO2	kt CH4	kt N20	
Nett Savings (-impacts)	**74.85**	**143.31**	**-0.106**	**-0.2136**	**0.00**

CO2 equivalence values used — Return to Defaults

	CO2	CH4	N20
GWP =	1.00	21.00	310.00

Details of Wheat Feedstock

Back to main sheet

			Impact for your feedstock g CO2eq	g CO2	g CH4	g N20	g Other
w1	Primary wheat product in feedstock	90%	240.2	139.5	0.33	0.3024	0.00
w2	Off grade wheat product or starch waste	10%					
	About this waste/byproduct						
w3	Is the feedstock referred to in w2 above a true waste *(ie currently sent to landfill, sewer, discharge, land disposal)*, or a byproduct *(currently provided for use in an industrial or agricultural application)*, or a bit of both.	Waste / Byproduct / part waste-part byproduct					
		Waste 0% / Byproduct 10%					
w4	If part of your feedstock is a byproduct, what is it currently used for.	Animal feed - Field peas/lupins used to fill shortage.	user specified replacement				
w5	Replacement ratio -How many kilograms of the replacement are need per kg of wheat/starch waste diverted	1	1.7	0.8	-0.0	0.0	
		Distance km / Transport method					
w6	Transport of feedstock to ethanol	150 Articulated Truck	17.3	16.8	0.0	0.0002	
			g CO2eq	g CO2	g CH4	g N20	
	Impacts per kg of Feedstock		259.1	157.1	0.35	0.3057	

Details of Fermentation and Distillation

				Upstream impacts per litre ethanol			
w7	How much feedstock is required per litre of ethanol produced	2.37	kg	614.2	372.3	0.82	0.7246
w8	Process heat/steam used in fermentation and distillation per litre of ethanol produced	9	MJ	804.2	774.0	1.3	0.0
w9	Electricity used in fermentation and distillation per litre of ethanol produced	0.1	kWh	28.0	26.4	0.1	0.0
		Distance km	Transport method				
w10	Transport of fuel to market	600	Articulated Truck	54.6	53.1	0.06	0.0005
w11	Other Environmental impact/benefits.			0.0			
				g CO2eq	g CO2	g CH4	g N20
	Total Upstream Impacts per litre for ethanol			**1472.9**	**1199.5**	**2.21**	**0.7323**

Back to main sheet

w12 Specify your steam and electricity fuel mix here / Customise energy source

w13 Percentage of energy in cogeneration being exported 30%

Fuel Mix Contributions

Heat- Steam	%	Cogen	g CO2eq	g CO2	g CH4	g N20	g Other
Black coal NSW	80	No	77.52	74.53	0.1312	0.0007728	0
Natural Gas NSW & ACT	20	No	11.83	11.48	0.01636	0.0000344	0
Not Used	0	No	0.00	0.00	0	0	0
Not Used	0	No	0.00	0.00	0	0	0
Profile per MJ fuel consumed	**100%**		**89.35**	**86.01**	**0.14756**	**0.0008072**	**0**

Heat- Steam	%	Cogen	g CO2eq	g CO2	g CH4	g N20	g Other
Electricity - NSW HV 2003	80	No	224.16	211.20	0.5904	0.001808	0
Not Used	20	No	56.04	52.80	0.1476	0.000452	0
Not Used	0	No	0.00	0.00	0	0	0
Not Used	0	No	0.00	0.00	0	0	0
Profile per MJ fuel consumed	**100%**		**280.20**	**264.00**	**0.738**	**0.00226**	**0**

ANNEXURE 25.0

RECALCULATED CO_2 EQUIVALENT EMISSIONS

FOUR ARROWS ETHANOL PTY LTD : *Amended Herd Methane Calculations*

Notes : The research detail and data accuracy is simply not available to provide reliable and highly defendable outcomes
: Notwithstanding, the following spreadsheet provides a sound measure of the broad quantum of greenhouse gas emissions

Ethanol plant

			Credits		Debits	
GHG balance from CSIRO model utilising wheat feedstock	(assuming 100% feedstock)	74.85 kt				
GHG balance from CSIRO model utilising sorghum feedstock	(assuming 100% feedstock)	200.49 kt				
	realistically → 70% wheat / 30% Sorghum		112.54	kt		

Dairy cattle

Methane - digestive emissions

multiplier 21 CO_2 equivalents
emission rate 8 Kg CH_4 per dse/year (good nutrition)
factor for project 1

cows		7,200	hd @	18.0	dse/hd	21.77
calves		4,563		2.7		2.07
heifers	3 to 9 mths	1,889		5.0		1.59
	9 to 15 mths	1,813		9.0		2.74
	15 to 20 mths	1,070		13.0		2.34
	first calf	1,990		15.0		5.01
		18,525	hd			35.52 kt

Debits: 35.52 kt

Methane - manure emissions

multiplier 21 CO_2 equivalents
emission rate 65 Kg CH_4 per dse/year (feedlot basis)
factor for project 0.25 manure carted off site and spread asap
minimal mass under anaerobic conditions

cows		7,200	hd @	18.0	dse/hd	44.23
calves		4,563		2.7		4.20
heifers	3 to 9 mths	1,889		5.0		3.22
	9 to 15 mths	1,813		9.0		5.57
	15 to 20 mths	1,070		13.0		4.75
	first calf	1,990		15.0		10.19
		18,525	hd			72.15 kt

Debits: 72.15 kt

Feed supply to cattle

Irrigation - fixing

maize silage	1,500	ha	40.0	t/ha/yr CO_2 fixed	5%	Seq'd =	3.00	kt
maize grain	1,000		40.0		5%		2.00	
winter cereals	1,000		18.0		5%		0.90	

Total sequestrated 5.90 kt — Credits: 5.90 kt

Irrigation - emissions

maize silage	1,500	ha	300	kg N	0.5%	N_2O emitted	2.25	kt N_2O
maize grain	1,000		300		0.5%		1.50	
winter cereals	1,000		80		0.5%		0.40	

Total N2O emitted 4.15

N_2O multiplier to CO_2 equivalents 310

Total emissions 1,286.50 kt CO_2 equiv

Proportion not already being generated by current crops 5%

Net increase in emissions 64.33 kt CO_2 equiv — Debits: 64.33 kt

	Credits	Debits
Totals	118.44	172.00
Net increase in emissions	53.56	$ktCO_2e$

ANNEXURE 26.0

AMENDED TRAFFIC MOVEMENTS PLUS ORIGINAL SPREADSHEET

FOUR ARROWS ETHANOL PTY LTD : Vehicle movements generated by development

VEHICLES TRANSPORTING RESOURCES AND STAFF ONTO SITE PER YEAR

Ethanol Inputs/ year

Product	Tonnes/year		Vehicle type	Tonnes/load		Numbers
Wheat	326,250	t	heavy	38	t	8,586
Barley	253,750	t	heavy	38	t	6,678
Corn	145,000	t	heavy	38	t	3,816
Citrus pulp	0	t	heavy	38	t	0
Winegrape marc	0	t	heavy	38	t	0
Rice hulls	0	t	heavy	38	t	0
Sugar beet	0	t	heavy	38	t	0
Additives	1,973	t	heavy	38	t	52
Total	726,973				Total	19,131

Dairy Inputs/ year

Product	Tonnes/year		Vehicle type	Tonnes/load		Numbers
Grain	16,759	t	heavy	38	t	441
Silage	89,956	t	heavy	38	t	2367
Cotton seed	6,841	t	heavy	38	t	180
Molasses	1,747	t	heavy	38	t	46
Sundries	2,263	t	heavy	38	t	60
					Total	3,094

Others

Product	Tonnes/year		Vehicle type	Tonnes/load		Numbers
Replacement stock	0	heifers	heavy	90	head	0
					Totals	0

Ethanol and Dairy Staff

							Numbers
100	staff	@	1.0	person/ light vehicle	365	days	36,500
						Total	36,500

VEHICLES TRANSPORTING PRODUCT, WASTE & STAFF OFFSITE PER YEAR

Ethanol outputs/ year

Product	Measurement		Vehicle type	Measurement		Numbers
Wet distillers grain	931,130	t	heavy	40	t	23,278
Ethanol production	305	ML	heavy	30,000	litres	10,167
CO2 production	240,697	t	heavy	39	t	6,252
					Total	39,697

Dairy outputs/ year

Product	Measurement		Vehicle type	Measurement		Numbers
Manure	29,952	t	heavy	40	t	749
Culled cattle	3,009	head	heavy	90	head	33
Milk	76,650,000	litres	heavy	30,000	litres	2,555
					Total	3,337

D	Trucks required to pick-up product & waste	43,034
E	Less 50% backloads	11,112
F	Total	31,922

Ethanol and Dairy Staff

							Numbers
100	staff	@	1.0	people / light vehicle	365	days	36,500
						Total	36,500

SPREADSHEET RESULTS (worst case scenario)

		60% vehicles north per/day	40% vehicles south per/day
Total vehicle movement per year	203,517		
Total heavy vehicle movement per yea	130,517		
Total light vehicle movement per year	73,000		
Average annual daily heavy vehicle movement	358	215	143
Average annual daily light vehicle movement	200	120	80
Total daily vehicle movements	558	335	223
Average heavy vehicle movements per hour over 15 hour perio	24	14	10

SPREADSHEET ASSUMPTIONS

Heavy vehicle movements will be over a fifteen (15) hour period between 7am and 10pm
6000 milkers will be in production 365 days of the year producing 35 litres/day/cow
Only a percentage of trucks will be back-loading output from the site
The largest capacity trucks possible will be utilised for all transporting
100 people will be employed 365 days of the year in both ethanol production and dairy enterprise
There is no public transport option available to the site
50% of trucks that deliver grain and resources can be back-loaded with wet brewers grain etc
60% of all vehicles will be to and from a northerly direction whilst 40% of vehicles will be to and from a southerly directio

SCENARIO AT 50% BACKLOAD WITH CARPOOLING (improved vehicle efficiency)

Heavy vehicles moving onsite loaded with resources	22,225	A
Heavy vehicles moving offsite empty after unloading i.e. 50% will remain for backload	11,112	B
Total	33,337	(A+B)=C
Heavy vehicles required to move onsite to pickup product & waste	43,034	D
Heavy vehicles remaining onsite from resource delivery back-loaded with product	11,112	(A-B)=E
Total	31,922	(D-E)=F
Heavy vehicles moving onto site empty to pick-up product & waste	31,922	F
Heavy vehicles moving offsite loaded with product and waste	43,034	D
Total	74,956	(F+D)=G

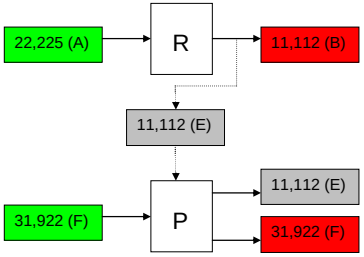
			60% vehicles north per/day	40% vehicles south per/day
Total heavy vehicle movements per yea	108,293	(G+C)=H		
Average annual daily heavy vehicle movement	297	(H/365 days)=I	178	119
Average annual staff vehicle movements i.e.. carpooling 2 passengers/vehicl	100	J	60	40
Total daily vehicle movements	397	I+J	238	159

If the heavy vehicle movements are conducted over the 15 hour period between 7am and 10pm which allows the maximum daily noise goal being 55dBA

			60% vehicles north per/hour	40% vehicles south per/hour
Truck movements per hou	20	I/15	12	8

GRAPHICAL REPRESENTATION OF TRUCK MOVEMENTS (50% BACKLOAD)

= Trucks On Site
= Trucks Off Site
= Trucks Backloaded
R = Resource Delivery Onsite
P = Product/Waste Offsite
= Summary



Total In = 54,147 | Total Out = 54,147

Total In + Total Out = 108,293
Thus : 108,293/365 = 297
Thus : 360/15 = 20 truck movements/hour

FOUR ARROWS ETHANOL PTY LTD : Vehicle movements generated by development adopting Flagnagan figures contained in "public display responses"

VEHICLES TRANSPORTING RESOURCES& STAFF&VISITORS ONTO SITE PER YEAR

Ethanol Inputs/ year

Product	Tonnes/year		Vehicle type	Tonnes/load		Numbers
Wheat	326,250	t	heavy	38	t	8,586
Barley	253,750	t	heavy	38	t	8,082
Corn	145,000	t	heavy	38	t	4,088
Citrus pulp	0	t	heavy	38	t	0
Winegrape marc	0	t	heavy	38	t	0
Rice hulls	0	t	heavy	38	t	0
Sugar beet	0	t	heavy	38	t	0
Additives	1,973	t	heavy	38	t	52
Denaturing petroleum	15	ML	heavy	30,000	litres	508
					Total	21,316

Ammended figures adjusted to included BD values

Dairy Inputs/ year

Product	Tonnes/year		Vehicle type	Tonnes/load		Numbers
Grain	16,759	t	heavy	38	t	441
Silage	89,956	t	heavy	20	t	4498
Cotton seed	6,841	t	heavy	38	t	180
Molasses	1,747	t	heavy	38	t	46
Sundries	2,263	t	heavy	38	t	60
					Total	5,224

Others

Product	Tonnes/year		Vehicle type	Tonnes/load		Numbers
Replacement stock	0	heifers	heavy	90	head	0
					Totals	0

Staff and Visitors

						Numbers
100	staff @	1.0	person/ light vehicle	360	days	36,000
2	visitors @	1.0	person/ light vehicle	360	days	720
					Total	36,720

VEHICLES TRANSPORTING PRODUCT, WASTE & STAFF OFFSITE PER YEAR

Ethanol outputs/ year

Product	Measurement		Vehicle type	Measurement		Numbers
Wet distillers grain	931,130	t	heavy	40	t	23,278
Ethanol production	305	ML	heavy	30,000	litres	10,167
CO2 production	240,697	t	heavy	39	t	6,252
					Total	39,697

Cattle deaths 609 head/year removed every second day @360 days operation — Total 180

Dairy outputs/ year

Product	Measurement		Vehicle type	Measurement		Numbers
Manure	29,952	t	heavy	25	t	1,198
Culled cattle	3,009	head	heavy	90	head	33
Milk	76,650,000	litres	heavy	30,000	litres	2,555
					Total	3,787

D	Trucks required to pick-up product & waste		43,663
E	Less 50% remaining onsite for backloads		13,016
F		Total	30,647

Staff and Visitors

						Numbers
100	staff @	1.0	person/ light vehicle	360	days	36,000
2	visitors @	1.0	person/light vehicle	360	days	720
					Total	36,720

SPREADSHEET RESULTS (worst case scenario)

		60% vehicles north per/day	40% vehicles south per/day
Total yearly vehicle movements	213,847		
Total yearly heavy vehicle movements	140,407		
Total yearly light vehicle movements	73,440		
Daily heavy vehicle movements	390	234	156
Daily light vehicle movements	204	122	82
Total daily vehicle movements	594	356	238
Average heavy vehicle movements per hour over 15 hour period	26	16	10

SPREADSHEET ASSUMPTIONS

- Heavy vehicle movements will be over a fifteen (15) hour period between 7am and 10pm
- 6000 milkers will be in production 365 days of the year producing 35 litres/day/cow
- Only a percentage of trucks will be back-loading output from the site
- The largest capacity trucks possible will be utilised for all transporting
- 100 people will be employed 360 days of the year in both ethanol production and dairy enterprise(for the sake of Flanagan response, refer intro)
- There is no public transport option available to the site
- 50% of trucks that deliver grain and resources can be back-loaded with wet brewers grain etc
- 60% of all vehicles will be to and from a northerly direction whilst 40% of vehicles will be to and from a southerly direction

SCENARIO AT 50% BACKLOAD WITH CARPOOLING (improved vehicle efficiency

Total heavy vehicle movement on and off site for the delivery of resources per year

Total heavy vehicles moving onsite loaded with resources	26,540	A
Heavy vehicles moving offsite empty after unloading (not remaining for backload)	13,016	B
Denaturing transport moving offsite empty as not suitable vehicles for backloading	508	B1
Total	40,064	(A+B+B1)=C

Total heavy vehicle required to move onsite for the tansportation of product per yea

Heavy vehicles required to move total product & waste offsite	43,663	D
Less heavy vehicles remaining onsite to be backloaded	13,016	(A-B-B1)=E
Total	30,647	(D-E)=F

Total vehicle movements for the transportation of productper year

Heavy vehicles moving onto site empty to pick-up product & waste	30,647	F
Heavy vehicles moving offsite loaded with product and waste	43,663	D
Total	74,311	(F+D)=G

Total heavy vehicle movements delivering resources and transporting product per year

Total	114,375	(C+G)=H

Total staff vehicle movements per year/2 taking into account carpooling

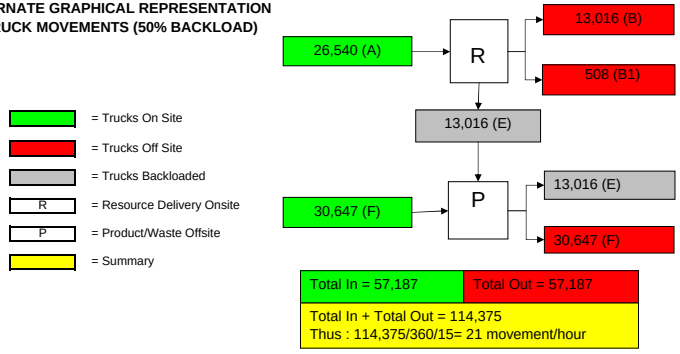
Total	36,000	H1

				60% vehicles north approach & exit	40% vehicles south approach & exit
Total visitor vehicle per ymovements per year	Total	1,440	H2		
Total vehicle movements per year	Total	151,815	(H+H1+H2)=I	91,089	60,726
Total vehicle movements per day	Total	422	I/360	253	169

If the heavy vehicle movements are conducted over the 15 hour period between 7am and 10pm which allows the maximum daily noise goal being 55dBA

21	H/360/15	13	8

ALTERNATE GRAPHICAL REPRESENTATION OF TRUCK MOVEMENTS (50% BACKLOAD)



ANNEXURE 27.0

HOLMES AIR SCIENCES' EMISSION ASSESSMENT REPORT

FACSIMILE

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To:	Chris Neilson	From:	Kerry Holmes
Company:	Booth & Associates	Pages:	2
Fax:		Date:	10 July 2007
Phone:		CC:	
Subject:	*Coleambally – ICM data set*		

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Dear Chris

We have reviewed the information you provided on the ICM data set for the 416 ML ethanol plant and have compared these to the emission rates that were used in the Environmental Assessment for the 300 ML plant at Coleambally. We noted that the emission rates proved were in tons per annum where one US ton is equivalent to 0.907 metric tonnes.

The following table summarises the emission rates from the various sources at the ICM plant expressed as tonnes per year (t/y) and then converted to grams per second as used by the model (g/s). We have scaled the emissions to a 300 ML plant and compared these with the emissions assumed in the EA.

Emission sources for 416 ML plant	**PM (t/y)**	**PM_{10} (t/y)**	**SO_2 (t/y)**	**NO_X (t/y)**	**CO (t/y)**	**VOC (t/y)**
Unload Baghouses (2 each)	12.9	12.9				
Grain Handling Fugitives	3.3	1.5				
2 Boilers (120MMbtuh each)	7.25	7.25	0.57	85.8	80.1	5.2
1 RTO (process vents)	0.73	0.73	0.018	3.2	6.4	4.9
Fermentation (CO_2) Scrubber	0.53	0.53				44.9
Purge Scrubber	0.09	0.09				13.5
Emission sources scaled to 300 ML	**PM (g/s)**	**PM_{10} (g/s)**	**SO_2 (g/s)**	**NO_X (g/s)**	**CO (g/s)**	**VOC (g/s)**
Unload Baghouses (2 each)	0.29	0.29				
Grain Handling Fugitives	0.07	0.03				
Total fugitives	**0.36**	**0.32**				
2 Boilers (120MMbtuh each)	0.165	0..165	0.013	1.96	1.83	0.12
1 RTO (process vents)	0.017	0.017	0.004	0.072	0.145	0.113
Fermentation (CO_2) Scrubber	0.012	0.012	-	-	-	1.03

Purge Scrubber	0.002	0.002	-	-		0.308
TOTAL POINT SOURCES	**0.196**	**0.196**	**0.017**	**2.032**	**1.975**	**1.571**
Emission sources assumed for EA	**PM (g/s)**	**PM_{10} (g/s)**	**SO_2 (g/s)**	**NO_X (g/s)**	**CO (g/s)**	**VOC (g/s)**
Grain hammer milling	0.2	0.2	-	-	-	-
Grain Handling Fugitives	0.28	0.10	-	-	-	-
Total fugitives	**0.48**	**0.3**				
Boiler	0.6	0.6		8.4	6.7	
Emergency generation	0.067	0.067	0.092	2.2	0.13	
Fermentation (CO_2) scrubber						4.66
TOTAL POINT SOURCES	**0.667**	**0.667**	**0.092**	**10.6**	**6.83**	**4.66**

As can be sees from this table, the emission rates from the 416ML plant scaled down to 300 ML are lower than those assumed for the 300 ML plant in the EA which were scaled up from a 60 ML plant.

The issue of scaling was one of the uncertainties in the emission estimates however emission rates from a 60 ML and 416 ML plant show reasonable correspondence when emissions are scaled to a 300 ML plant, with the scaling up process appearing more conservative. Therefore it appears that this aspect of the emission estimates is reasonably robust.

The other significant issue was the type of feedstock and whether the use of grain at Coleambally would give equivalent emissions to the use of corn as nominated in the ICM data.

Firstly the boiler emissions will not be dependent on the type of feedstock for the ethanol process.

Secondly the emissions used in the EA were actually based on grain feedstock. Therefore the emission assumptions are likely to be reasonable.

The fermentation scrubber is the most significant source of VOCs from the ethanol plant. We did not assume any emissions from the thermal oxidiser in the EA, however emissions are only about 10% of the fermentation scrubber. In practice the main source of odour impact will be from the dairy.

If we assume that VOCs as a surrogate for odour then the total odour emission from the ICM data are lower than those assumed in the EA. On this basis there is no necessity to remodel the odour emissions.

The final issue is whether the in-stack concentrations meet the POEO (Clean Air) Regulation 2002 limits.

The following table summarises the estimated in-stack concentrations for NO_x, PM and SO2 compared to Schedule 4: Standards of concentration for scheduled premises: general activities and plant

The boiler is the most significant source of NO_x and PM. In-stack concentrations for the boilers were calculated from an assumed volumetric flow rate of 22 Nm^3/s per stack as assumed in the EIS

In-stack concentrations for the RTO were taken from stack testing documentation in the ICM report. (Section 7)

These values are all well below the POEO limits.

Pollutant	NO_X	SO_2	PM
Limit	350 mg/m^3 (For boilers)	1000 mg/m^3 (for sulfuric acid plant)	50 mg/m^3
Boiler	44	0.3	3.7
RTO stack	60 (29.2 ppm)	-	5.4 (0.0024 gr/dscf)

With regards
Kerry Holmes

ANNEXURE 28.0

COPY OF THE EXECUTIVE SUMMARY AND CONCLUSION FROM THE MLA FLOT.328 REPORT

finalreport

FEEDLOTS

Project code:	**FLOT.328**
Prepared by:	**RW Tucker, RJ Davis, K Klepper, PJ Watts and EJ McGahan** **FSA Consulting**
Date published:	**April 2006**
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Environmental Sustainability Assessment of the Australian Feedlot Industry

Part C Report: Nutrient Cycling at Australian Feedlots

Executive Summary

The Australian red meat industry, as with most primary industries, is coming under increasing pressure from both the community and government to document and justify its impacts on the environment. Currently, a lack of credible supply chain data prevents the industry from being able to respond in a meaningful manner.

Meat and Livestock Australia (MLA) is undertaking a project (COMP.094) that will address these issues and provide credible data on the industry's environmental impacts and sustainability for use by industry, including its interactions with government, community groups and the media. This project will utilise the standardised tool, Life Cycle Analysis (LCA), to quantify natural resource consumption and environmental interventions to water, soil and air.

LCA is a form of cradle-to-grave system analysis developed for use in manufacturing and processing industries to assess the environmental impacts of products, processes and activities by quantifying their environmental effects throughout the entire life cycle. An LCA is essentially a quantitative study. Sometimes environmental impacts cannot be quantified due to a lack of data or inadequate impact assessment models. Quantitative analysis requires standardised databases of main processes (e.g. energy, transport) and software for managing the study's complexity.

As part of the overall industry project, the beef cattle lotfeeding sector is undertaking a related project (FLOT.328) that will contribute to the whole of industry dataset, but more importantly addresses the public misconceptions of the environmental sustainability of the feedlot industry. It will identify and quantify the environmental costs associated with the production of one kilogram of grained beef to enable comparison with its domestic competing products (grass fed beef, lamb, pig and poultry meats).

Extensive research has been undertaken in the areas of animal growth and composition and the factors that influence feed intake and digestibility, feed composition and waste management. There is a wide variation in reported values for feedlot cattle nutrient excretion. Over the past ten years, there has been a significant development of the feedlot industry in terms of feeding for specific markets and in manure management. However, research into nitrogen losses through volatilisation of ammonia (NH_3) from feedlots systems has not kept pace with these changes.

This report covers the issue of the usage of one resource by feedlots – nutrients. It aims to provide factual information on the quantity of the major nutrients supplied to the feedlot and the fate and quantities of nutrients leaving the feedlot.

Factual site-specific information on cattle numbers, diet ingredients, market type, days on feed, quantity of manure produced and effluent concentrations was collected where possible from nine feedlots. The life cycle inventory for nitrogen (N), phosphorus (P) and potassium (K) within the feedlot sub-system was determined.

N enters the feedlot in incoming cattle (0.05-0.12 kg/kg HSCW gain) and feed (0.15-0.33 kg/kg HSCW gain). In this context, HSCW gain is the difference between total dressed carcass weight of cattle leaving the feedlot less the estimated total dressed carcass weight of cattle entering the

feedlot. The contribution of N from diet ingredients was found to range from 60-87% of the total N input. The level of N contained in individual diets varies between feedlots and within feedlots.

N is removed from the system in outgoing cattle (0.08-0.13 kg/kg HSCW gain) and manure (0.13-0.3 kg/kg HSCW gain). Hence, most N exits the feedlot in manure (50–80 %). Approximately 80% of the manure N is lost to the atmosphere from volatilisation, with the remainder exported in effluent and scraped manure.

The total P input level is around one-fifth of the total N input. It enters the system in incoming cattle (0.012-0.029 kg/kg HSCW gain) and feed (0.028-0.054 kg/kg HSCW gain). The contribution of P from feed is 47-80% of the total P input. P exits the system in outgoing cattle (0.023-0.038 kg/kg HSCW gain) and in manure (0.017-0.039 kg/kg HSCW gain). Variations in diet composition influence the level of P in manure, with cattle having higher P concentration in their diet correspondingly having a higher P concentration in their manure. P is present in scraped manure at 94-99% of the total P excreted in manure. The balance is contained in the effluent.

The total K into the system was 0.05-0.13 kg/kg HSCW gain. This is similar to the P inputs and around one-fifth of the total N inputs. Over 90% of the K into the system comes from feed. K out of the system is partitioned between outgoing cattle (0.01 kg/kg HSCW gain) and manure (0.06-0.09 kg/kg HSCW gain). The K output rates vary significantly between feedlots. This is mainly due to dietary variation, with cattle offered diets that have a high molasses content correspondingly having a high K content. The percentage of K retained in scraped manure ranges from 65-99%. The balance is exported in effluent.

The outcomes of this study will allow the feedlot industry to develop a better understanding of the relativity and pathways for nutrient cycling and provide factual information on the life cycle inventory for major nutrients.

A knowledge of the total nutrient input and output levels will allow the industry to benchmark itself against other intensive or extensive livestock industries and or industrial processes. More research into NH_3 losses from Australian feedlot pads, manure stockpiles and compost heaps, holding ponds, manure spreading and effluent irrigation is warranted. Further research into methods for minimising NH_3 losses from feedlot systems is also recommended.

7 Conclusions and Recommendations

7.1 Conclusions

Nutrient pathways into and out of feedlots are complex and diverse. Nutrients enter the feedlot in cattle, feed and water and leave the feedlot in cattle, scraped manure, effluent, atmospheric losses and water flows. Inputs and feedlot management govern the concentration of N, P and K contained in each of these outputs. For example, the weight of cattle on exit, the timeframe over which they are fed, the diet they consume and the manure and effluent treatment system all have an influence.

Extensive research has been undertaken in the areas of animal nutrition, growth and composition. Over the past decade, there has been a significant development of the feedlot industry in terms of feeding for specific market and manure management.

The literature contains a wide range of reported rates of nutrient excretion by feedlot cattle. However, information on N losses through NH_3 volatilisation is patchy.

Research involving nine Australian feedlots showed that total N input ranges from 0.24-0.38 kg/kg HSCW gain. The contribution of N from diet ingredients was found to range from 60-87% of the total N input. Some 50–80 % of the incoming N ends up in the manure. Over 90 % of the manure N is lost to the atmosphere from volatilisation, with the balance exported in runoff and scraped manure.

Total P input level was found to be around one fifth of the total N input. The contribution of P from feed ranges from 47-80% of the total P input. Total P output ranges from 0.051-0.063 kg/kg HSCW gain with 0.017-0.039 kg/kg HSCW gain of this in the manure. Variations in diet composition are the most likely reason of the level of P in manure, with the feedlots with long-fed cattle producing manure with a higher P level in manure. Of the P deposited to manure, some 94-99% remains in the manure on the pad with the balance exported to the effluent ponds in rainfall runoff.

Total K input is 0.05-0.13 kg/kg HSCW gain, which is similar to the P input level. Over 90% of the K is from feed. K output is partitioned between outgoing cattle (0.01 kg/kg HSCW gain) and manure (0.06-0.09 kg/kg HSCW gain). The percentage of K retained in scraped manure ranges from 65% to 99%. The remaining K is exported during runoff into the holding pond.

The outcomes of this study will allow the feedlot industry to develop a better understanding of the relativity and pathways for nutrient cycling and provide factual information on the life cycle inventory for major nutrients. Knowledge of the total nutrient input and output levels will allow the industry to benchmark itself against other intensive or extensive livestock industries and or industrial processes.

ANNEXURE 29.0

SOIL PROFILE LOGS BELOW PROPOSED EVAPORATION BASINS AND RECYCLE PONDS

Lloyd Angove Soil Surveying & Drilling Pty Ltd
ACN 088 289 221

GRID DRILL REPORT

DATE: 05/07/06 **LRN: 25, 26 & 108** **LANDHOLDER: FOUR ARROWS**

Drilled, soil textured & logged by: Lloyd Angove **Drilling method:** AUGER

Test bore No:	1		
Depth (cm)	Colour	Texture	Other
0-50	RB	CL	
50-100	RB	MC	
100-200	GB	MC	
200-350	YG	MC	
350-450	G	MC	/c CC
450-700	G	MC	
700-750	Y	S	
750-850	G	SC	
850-1000	G	S	

Test bore No:	2		
Depth (cm)	Colour	Texture	Other
0-50	RB	MC	
50-150	G	SC	
150-350	Y	S	
350-450	YG	SC	
450-700	Y	S	
700-1000	YG	S	WET

Test bore No:	3		
Depth (cm)	Colour	Texture	Other
0-50	RB	CL	
50-150	B	MC	
150-550	G	MC	
550-800	YB	S	
800-1000	G	SiS & Gvl	WET

Test bore No:	4		
Depth (cm)	Colour	Texture	Other
0-50	RB	CL	
50-100	RB	MC	
100-400	G	MC	
400-700	Y	S	
700-1000	YG	Gvl	MOIST

Test bore No:	5		
Depth (cm)	Colour	Texture	Other
0-50	RB	CL	
50-350	G	MC	
350-450	G	SC	
450-650	G	S	
650-10000	YG	SiS	

Test bore No:	6		
Depth (cm)	Colour	Texture	Other
0-50	RB	SL	
50-100	RB	MC	
100-400	G	MC	
400-550	G	S	
550-800	Y	S & Gvl	
800-1000	G	SiS & Gvl	

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Lloyd Angove Soil Surveying & Drilling Pty Ltd
ACN 088 289 221

DATE: 24/08/2007 **LRN:** **LANDHOLDER:** Bill Booth

Drilled, soil textured & logged by: Lloyd Angove **Drilling method:** AUGER

Test bore No:	8			Test bore No	9		
Depth (cm)	Colour	Texture	Other	Depth (cm)	Colour	Texture	Other
0-50	**GB**	**MC**		0-50	**RB**	**MC**	
50-100	**YB**	**MC**		50-100	**RB**	**MC**	
100-150	**TG**	**MCcFS**		100-150	**B**	**MCTFS**	
150-200	**G**	**MCcFS**		150-200	**GB**	**MCcFS**	
200-250	**G**	**MCcFS**		200-250	**GB**	**MCcFS**	
250-300	**G**	**MCcFS**		250-300	**GB**	**MCcFS**	
300-350	**YB**	**FS**		300-350	**GB**	**MCcFS**	
350-400	**YB**	**FS**	**Damp**	350-400	**YB**	**FS**	**Damp**
400-450	**YB**	**FS**	**Damp**	400-450	**YB**	**FS**	**Damp**
450-500	**YB**	**FS**	**Damp**	450-500	**YB**	**FS**	**Damp**
500-550	**YB**	**FS**	**Damp**	500-550	**YB**	**FS**	**Damp**
550-600	**YB**	**FS**	**Damp**	550-600	**YB**	**FS**	**Damp**
600-650	**YB**	**FS**	**Damp**	600-650	**YB**	**FS**	**Damp**
650-700	**YB**	**FS**	**Damp**	650-700	**YG**	**CS**	**Damp**
700-750	**YB**	**FS**	**Damp**	700-750	**YG**	**CS**	**Water Level**
750-800	**YG**	**FSC**	**Damp**	750-800			
800-850	**G**	**FSC**	**Water Level**	800-850			
850-900				850-900			
900-950				900-950			
950-1000				950-1000			
100-1050				100-1050			
1050-1100				1050-1100			
1100-1150				1100-1150			
1150-1200				1150-1200			

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DATE: 24/08/2007 **LRN:** **LANDHOLDER:** Bill Booth

Drilled, soil textured & logged by: Lloyd Angove **Drilling method:** AUGER

Test bore No:	**10**						
Depth (cm)	Colour	Texture	Other				
0-50	**GB**	**MC**					
50-100	**GB**	**MC**					
100-150	**GB**	**MC**					
150-200	**GB**	**MCcFS**					
200-250	**YB**	**MCcFS**					
250-300	**YB**	**MCcFS**					
300-350	**GB**	**MCcFS**					
350-400	**GB**	**FSC**					
400-450	**YB**	**FSC**	**Damp**				
450-500	**YB**	**FSC**	**Damp**				
500-550	**YB**	**FSC**	**Damp**				
550-600	**YB**	**FSC**	**Damp**				
600-650	**YB**	**FSC**	**Damp**				
650-700	**YB**	**FSC**	**Damp**				
700-750	**YB**	**FSC**	**Damp**				
750-800	**YB**	**FSC**	**Damp**				
800-850	**YG**	**CLYSILT**	**Water Level**				
850-900							
900-950							
950-1000							
100-1050							
1050-1100							
1100-1150							
1150-1200							

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