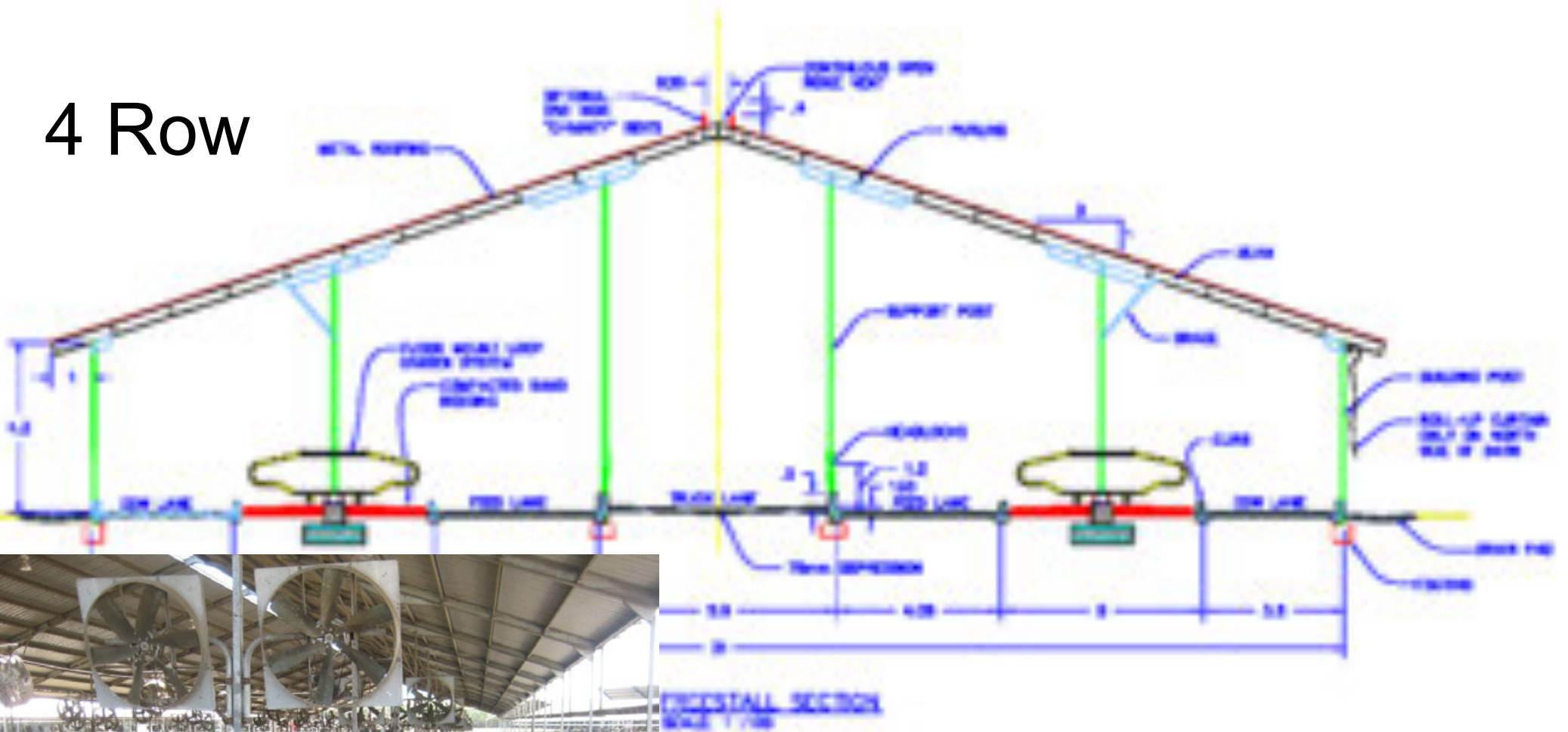


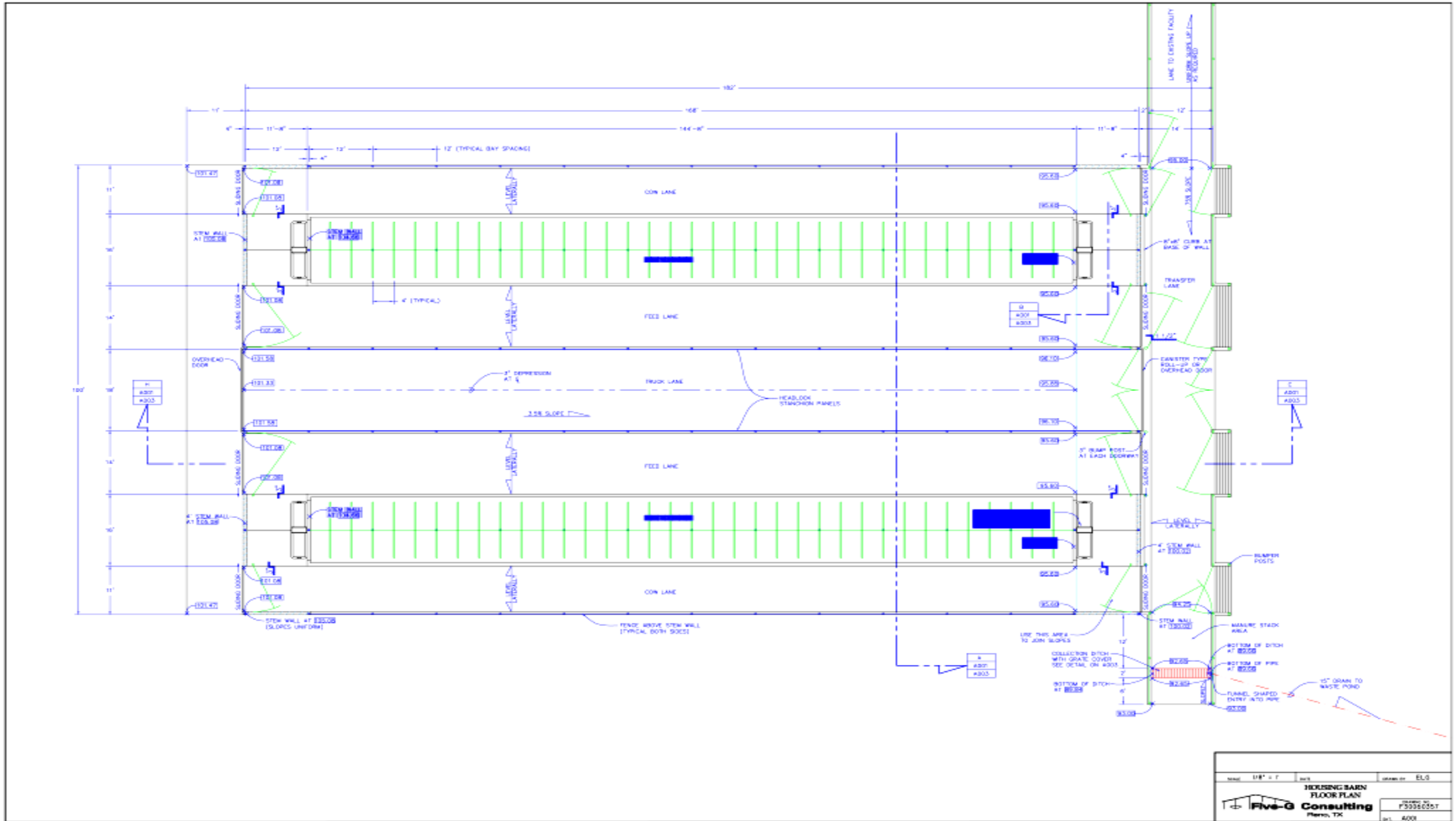
Housing, Ventilation and Cooling

The Best System for You.

4 Row



4 Row Barn

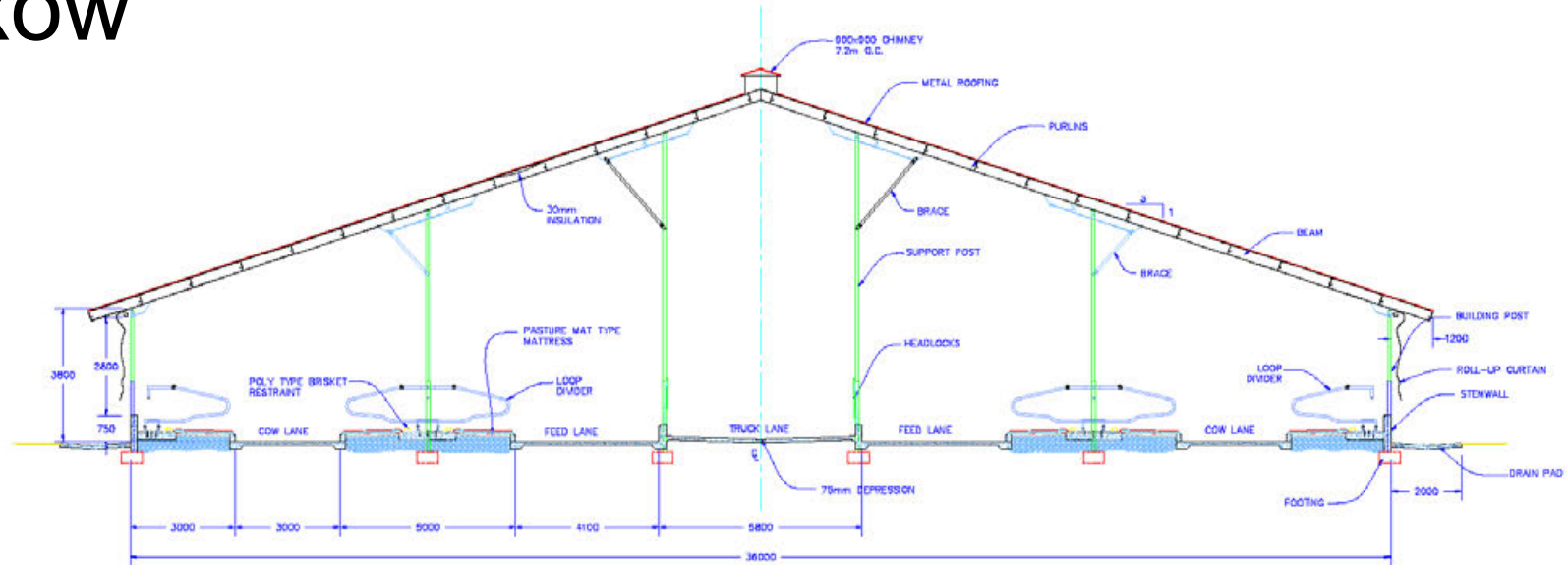


Scale: 1/8" = 1'	Date:	Drawn by: ELG
HOUSING BARN FLOOR PLAN		
Five-G Consulting		
Memph, TN		Project No: F0026557
		Rev: 4/08





6 Row



① TYPICAL HOUSING SECTION
1:75





4 Row

vs.

6 Row

- Lower Density
- Less Sun On Beds
- Lower Cow Stress
- Feed Bunk Space
- Higher Production

- Larger Area
- Higher Cost

- Lower Cost
- Higher Temperature
- Less Freezing
- Less Space

- Heat Stress
- 2/3 Feed Bunk Space

Clean and Comfortable



Clean and Comfortable?

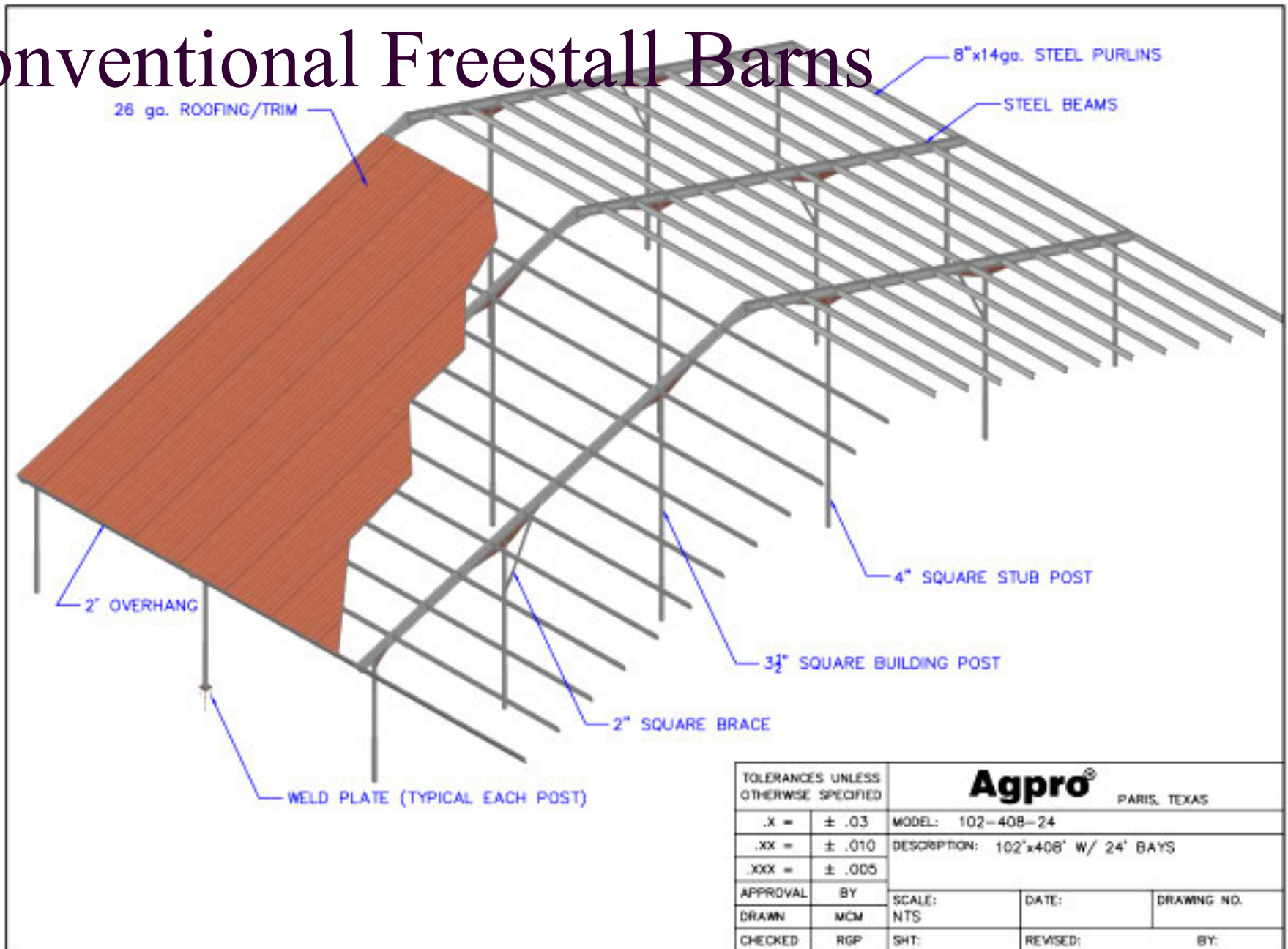


Ventilation and Cooling

- Natural Ventilation
- Modified Natural Vent
- Tunnel Ventilation
- Cross Ventilation
- 8 to 12 rows Cross Vent

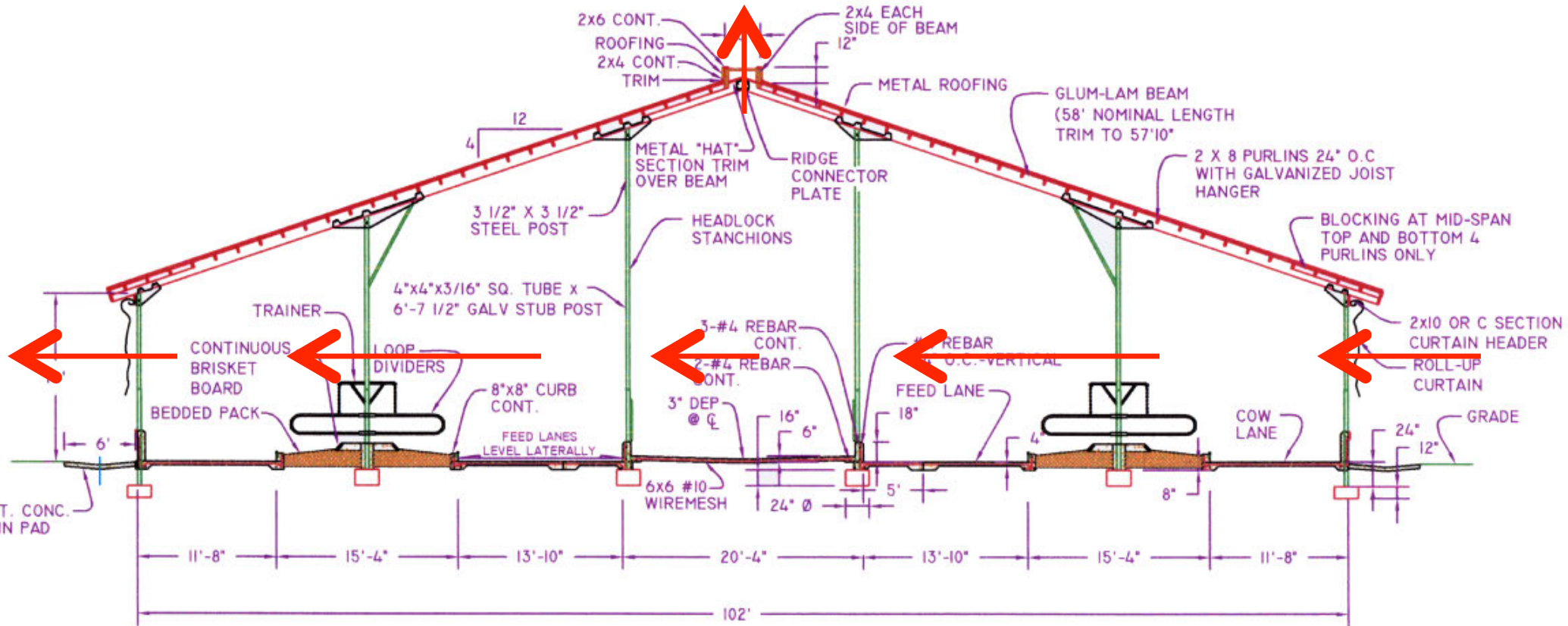


Conventional Freestall Barns



TOLERANCES UNLESS OTHERWISE SPECIFIED		Agpro® PARIS, TEXAS		
.X =	± .03	MODEL:	102-408-24	
.XX =	± .010	DESCRIPTION:	102'x408' W/ 24' BAYS	
.XXX =	± .005			
APPROVAL	BY	SCALE:	DATE:	DRAWING NO.
DRAWN	MCM	NTS		
CHECKED	RGP	SHT:	REVISED:	BY:

Natural Ventilation Concept



TYPICAL 4-ROW FREESTALL SECTION

With proper design and location no operational cost.





65' to 100'
20m to 30m
Between Barns



Typical 4 Row N.V. Barn

Kleinpeter Dairy
Pine Grove, Louisiana

“Clean” Structure

4 in 12 Pitch

Open Ridge

Insulation

High Side
Walls

Supplemental
Fans Due to
Short Term
Heat Issues



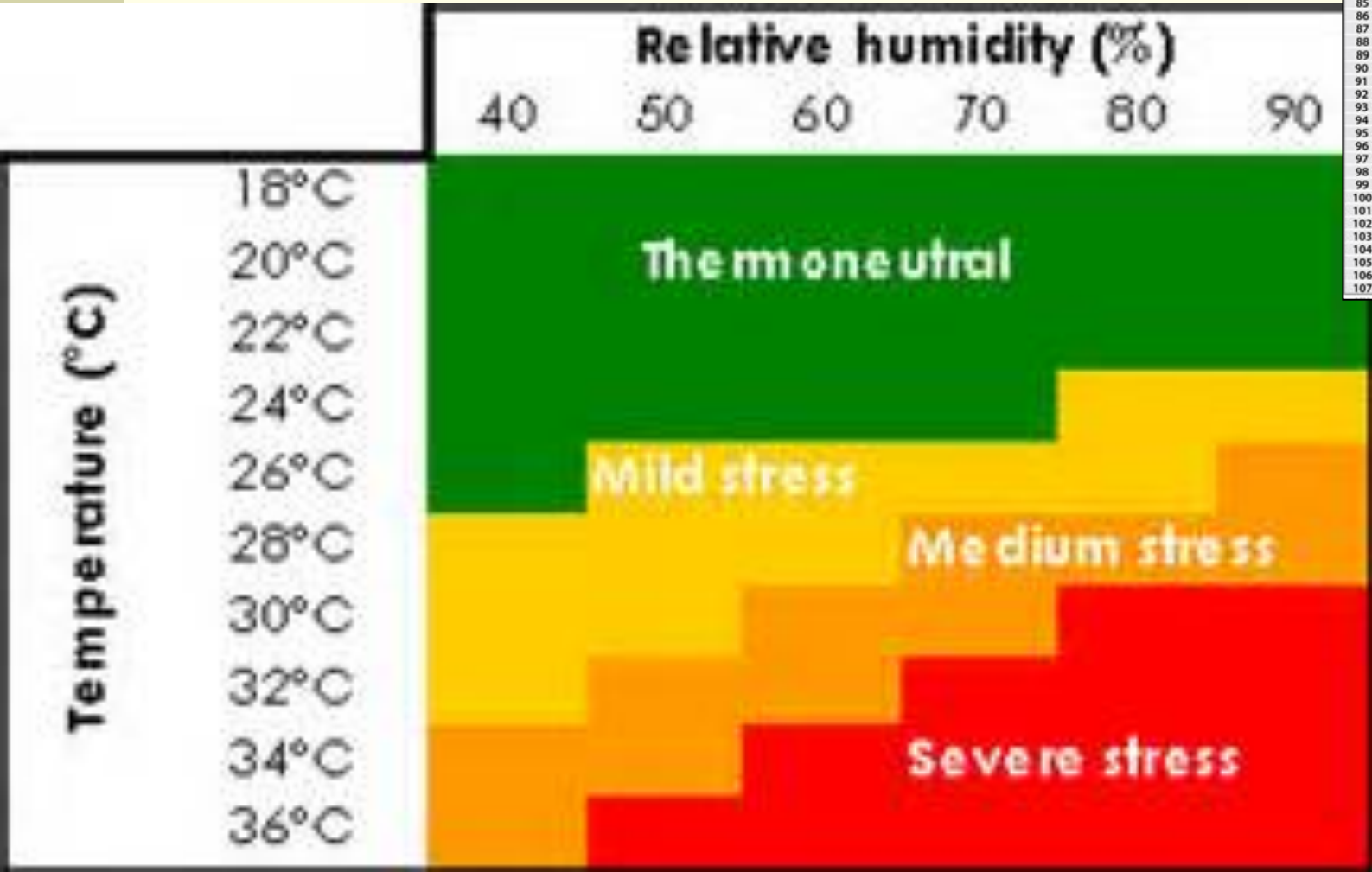
Conventional/ Natural Ventilation

- Lower Installation Cost
- Lower Operation Cost
- Simpler Management
- Better Cooling than Open Systems
- Excellent Air Quality
- Wind Protection in Winter (with Curtains)

- Heat Stress
- Walking Distance
- Area / Footprint
- Freezing
- E-W Orientation

Cow Cooling

Temperature	% Relative Humidity																		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
72	22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	71	71
73	23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72
74	23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73
75	24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74
76	24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75
77	25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
78	25.5	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76
79	26.0	67	68	69	69	70	70	71	71	72	72	73	73	74	74	75	76	76	77
80	26.5	68	69	69	70	70	71	71	72	72	73	73	74	74	75	76	76	77	78
81	27.0	68	69	70	70	71	71	72	72	73	73	74	74	75	76	77	77	78	79
82	28.0	69	69	70	71	71	72	72	73	73	74	74	75	76	77	77	78	79	80
83	28.5	69	70	71	71	72	72	73	73	74	74	75	76	77	78	78	79	80	81
84	29.0	70	70	71	72	72	73	73	74	74	75	76	77	78	78	79	80	81	82
85	29.5	70	71	72	72	73	73	74	74	75	76	77	78	78	79	80	81	81	82
86	30.0	71	71	72	73	73	74	74	75	76	77	78	78	79	80	81	81	82	83
87	30.5	71	72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85
88	31.0	72	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86
89	31.5	72	73	74	75	76	77	77	78	79	80	80	81	82	83	84	85	86	87
90	32.0	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	87	88
91	33.0	73	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
92	33.5	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
93	34.0	74	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
94	34.5	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
96	35.5	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
97	36.0	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
98	36.5	76	77	78	80	80	82	83	83	85	86	87	88	89	90	91	92	93	94
99	37.0	76	78	79	80	81	82	83	84	85	87	88	89	90	91	92	93	94	95
100	38.0	77	78	79	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
101	38.5	77	79	80	81	82	83	84	86	87	88	89	90	92	93	94	95	96	98
102	39.0	78	79	80	82	83	84	85	86	87	88	89	91	92	94	95	96	97	98
103	39.5	78	79	81	82	83	84	86	87	88	89	91	92	93	94	96	97	98	99
104	40.0	79	80	81	83	84	85	86	88	89	90	91	93	94	95	96	98	99	100
105	40.5	80	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101
106	41.0	80	81	82	84	85	87	88	89	90	91	93	94	95	97	98	99	101	102
107	41.5	80	81	83	84	85	87	88	89	91	92	94	95	96	98	99	100	102	103





Qatar April 2018











More Cooling Than Natural Alone

- Fans



- Soakers



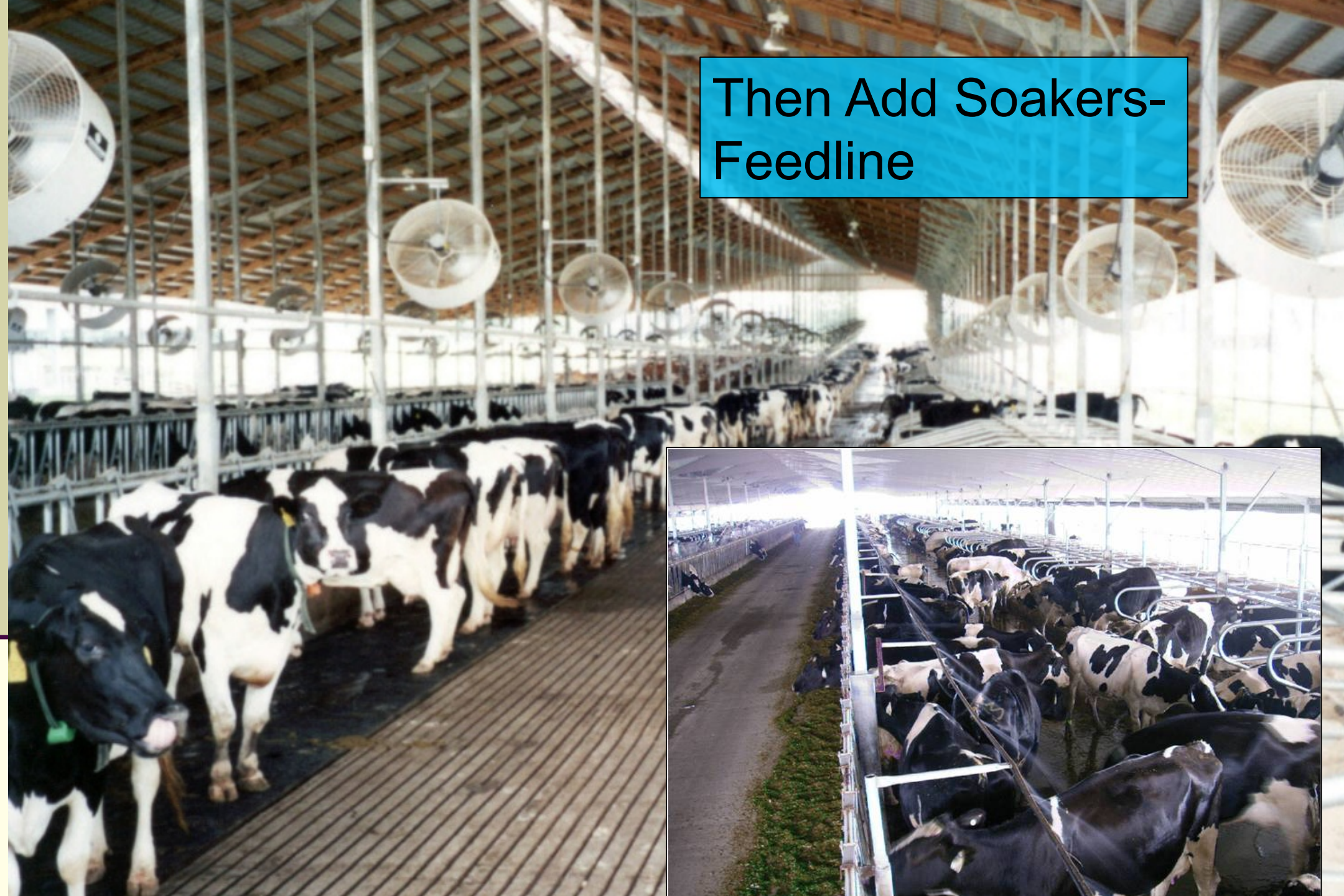






First Add Fans-Feedline

Then Add Soakers-
Feedline





**Feedline Soakers
and Fans**



Then Add More Fans

...More Fans





.....;Add More Fans

...And More Fans



Natural Ventilation Alternatives

Tunnel and Cross Ventilated Freestall Barn Concepts



Ventilation/ Cooling Concepts

■ Air Temperature

- 82 (28c) degrees with evap. Cooling

■ Air Velocity

- One degree cooling for every 1 mph (0.28C / 1 kmph)

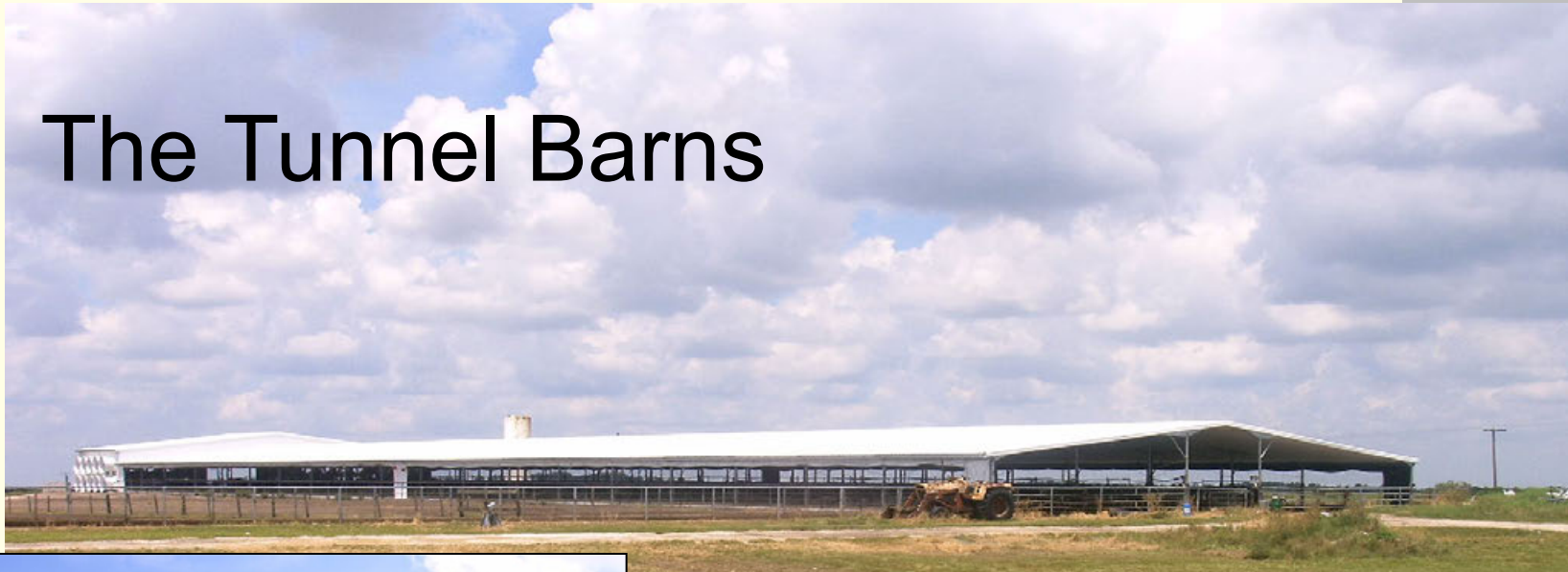
■ Air Quality

- One air change per 30 sec in hot weather
- One air change per 60 sec in cool weather

Forced Ventilation, Tunnel Barn



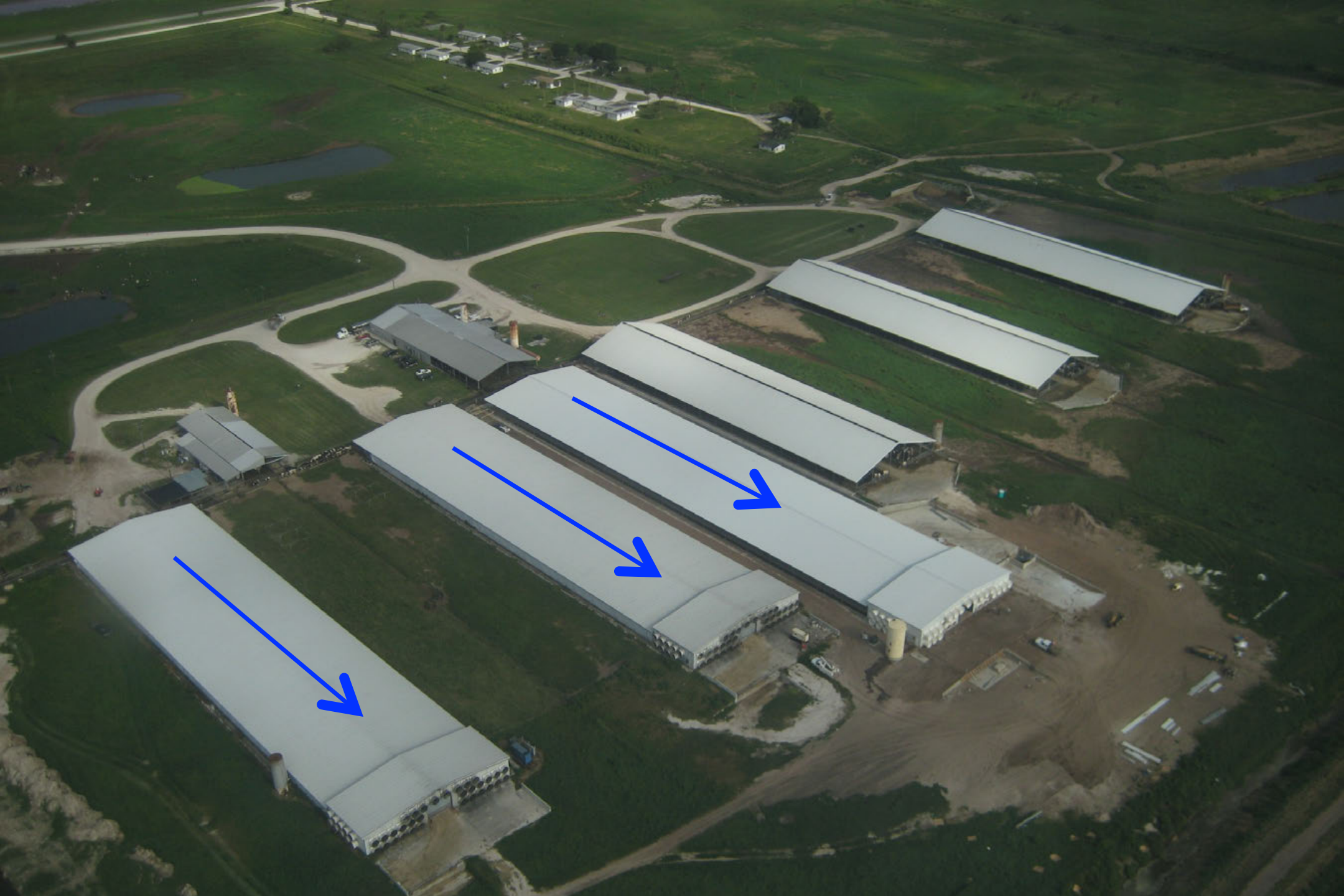
The Tunnel Barns



Mechanically Create High Air Flow

- Large Bank of Fans at One End to Move Air
- Open at Opposite End for Intake
- Looking for **Speeds of 12 mph (19 kmph)**
- Keep Cross Section Small to Limit Area





1600 Cow Dairy, Live Oak, Florida

Typical Southern
U.S. Facility



8 mph (13 kmph) Design
Wind Speed



Close Barn
Spacing





Georgia: Two Tunnel
Barns



Remember Fan Cleaning

McArthur Farms



Built 6 Barns
As Naturally Ventilated



Built 4 Barns As Tunnel





- 10' (3.2m) Eave
- R-19 Insulation (150mm)
- 1.5 in 12 Roof Pitch
- Curtain Sides

Phase I Barns

Keep Area Small
To Increase Speed

Insulated Roof



Misting





53- 52" (1.3m) Fans,
11.5 mph (18.5 kmph)
Speed

McArthur Farms
Okeechobee, FL

Milk 10,000 Cows
on 4 Units



Dairy #1



Dairy #3

2005

What Happened? Tunnel vs. Conventional

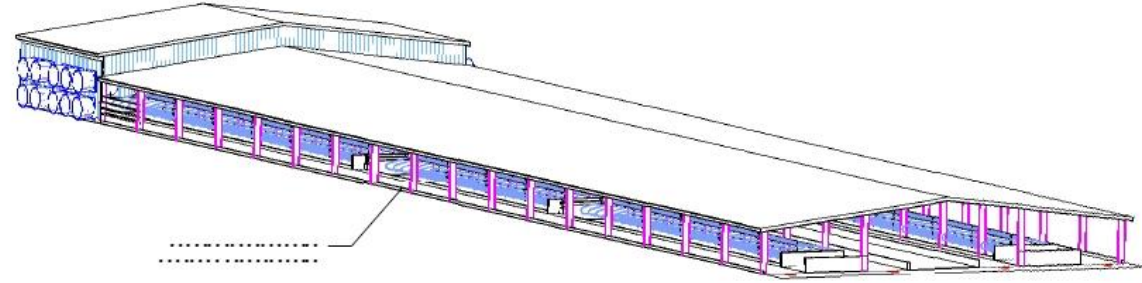
- Insulation alone reduced temp 12 f (5c)
- Dairy results indicate consistent 5% milk increase (4.8 pounds/ 2 kg)
- Reported higher stall usage through out barn
- Noticeable air quality improvement
- Noise not a factor
- Cost increase of 22%

Phase II

Added a Sixth Barn at Each Site in 2008



Tunnel Ventilation



April 09



Oct 2008





Tunnel with Curtains and Mister



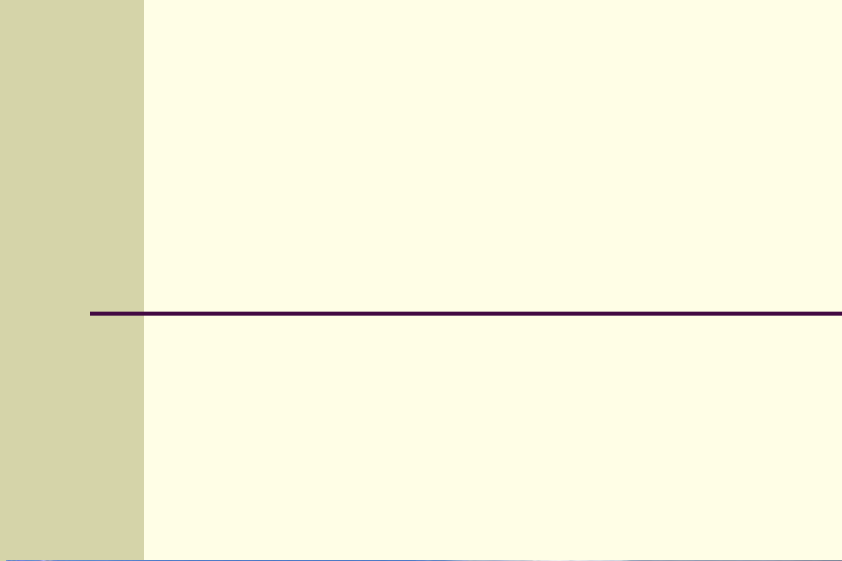
- Fans Work Together to Create Maximum Flow
- Concentrate Electrical Load
- More Efficient Misting Installation
- Allows Barns Closer Together
- Orientation of Barns Less Critical
- Insulation Limits Heat Load Build-up



*Why Tunnel
Ventilate?*

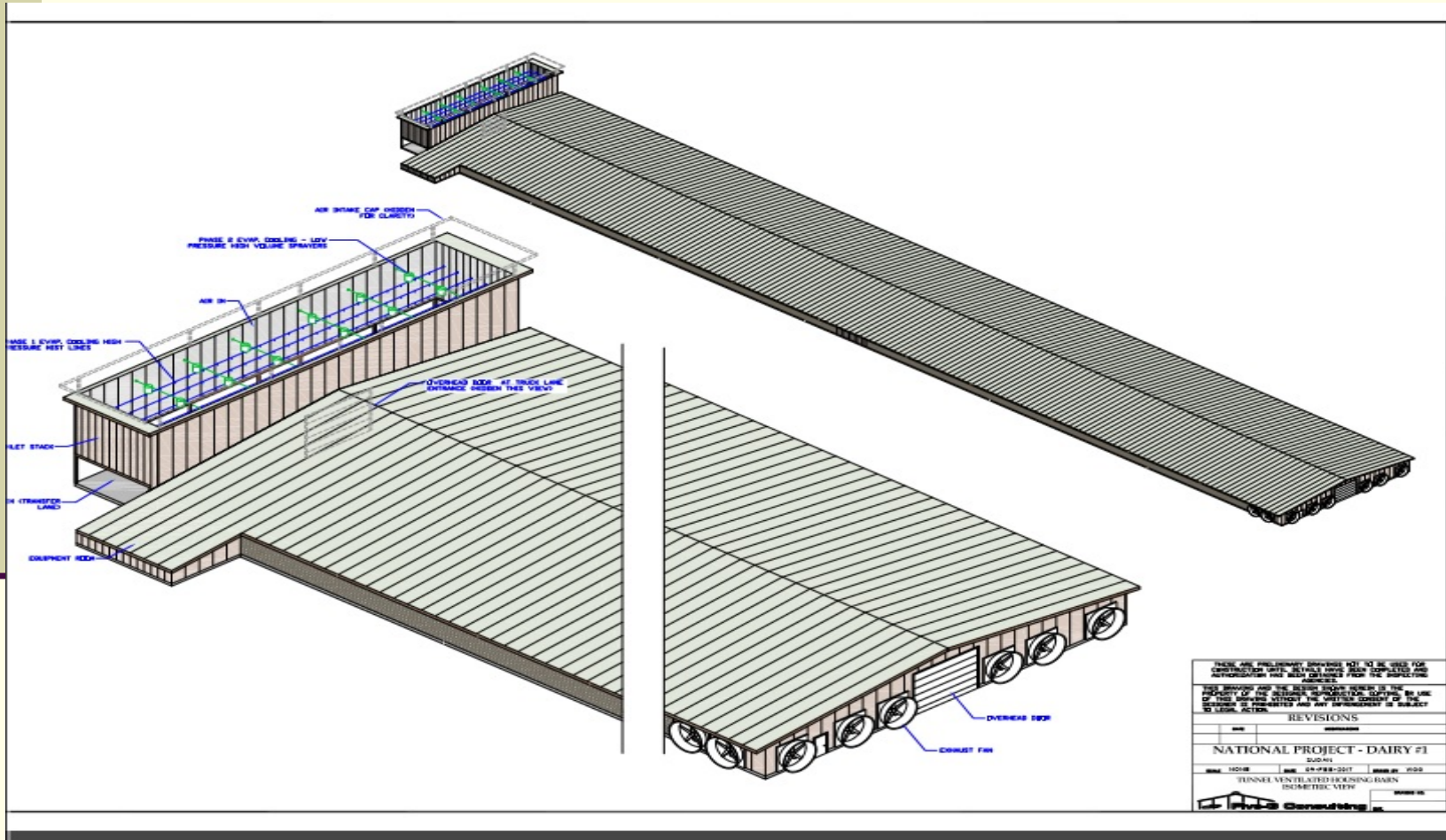
Tunnel Vent Barns

- COOLING!!
 - Excellent Air Quality
 - Less Exposure
 - No Wind Issues
 - Small “Footprint”
 - Less Walking Distance
 - High Production
 - Can Convert to Natural
- Installation Cost
 - Operation Cost
 - Maintenance
 - Design Limitations





Generation 5 ~ Tunnel Ventilation





Qatar April 2018

















Cross Ventilation





Cross Ventilation

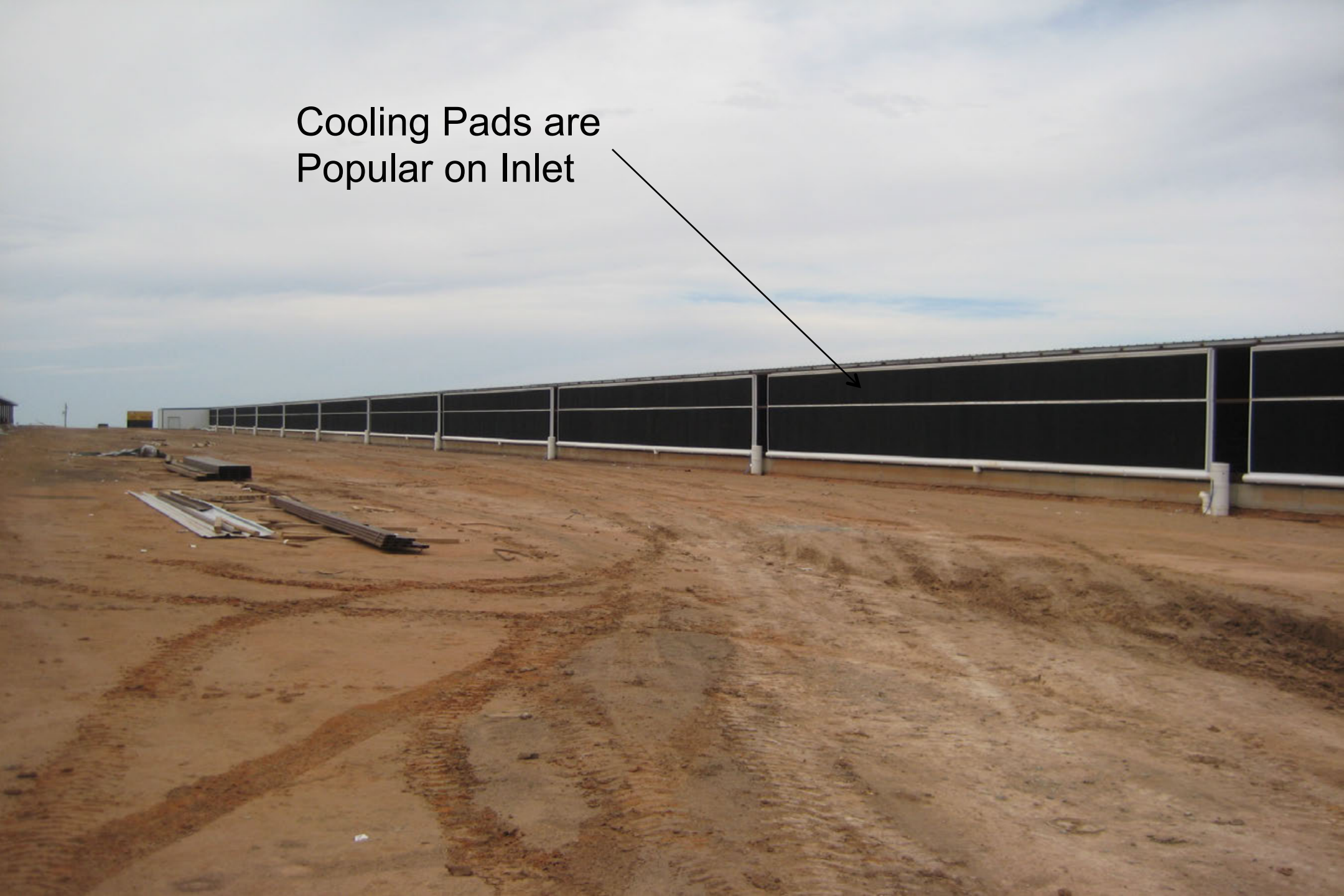


Mechanically Create Consistent Air Flow

- Large Bank of Fans on One Side to Move Air
- Opposite Side for Intake
- Usually Use Cooling Pads
- Looking for **Speeds of 5 to 6 mph (9-10 kmph)**
- Keep Cross Section Small to Limit Area- Usually Baffles



Cooling Pads are
Popular on Inlet







Stand-by Power is Critical!





15,000 Milking

Cross Ventilation Barns

- Small “Footprint”
- No Freezing
- Least Walking Distance
- Effective Cooling
- Consistent Temperature

- Highest Cost
- Waste Handling
- Truck Traffic
- Air Quality
- Lighting
- Power Failure (1.5 Hours till Cows Die)
- High Maintenance

Housing Space Requirements

- Dry Lot/ Corrals
- Open Housing (Saudi)
- 4 Row Natural
- 6 Row Natural
- 4 Row Tunnel
- 4 Row Cross Vent

- 56 sm / Cow
- 37 sm / Cow
- 17 sm / Cow
- 14.5 sm / Cow
- 11 sm / Cow
- 9 sm / Cow

Housing Space Requirements

- Dry Lot/ Corrals
 - Open Housing (Saudi)
 - 4 Row Natural
 - 6 Row Natural
 - 4 Row Tunnel
 - 4 Row Cross Vent
- 610 sf / Cow
 - 400 sf / Cow
 - 185 sf / Cow
 - 155 sf / Cow
 - 120 sf / Cow
 - 98 sf / Cow

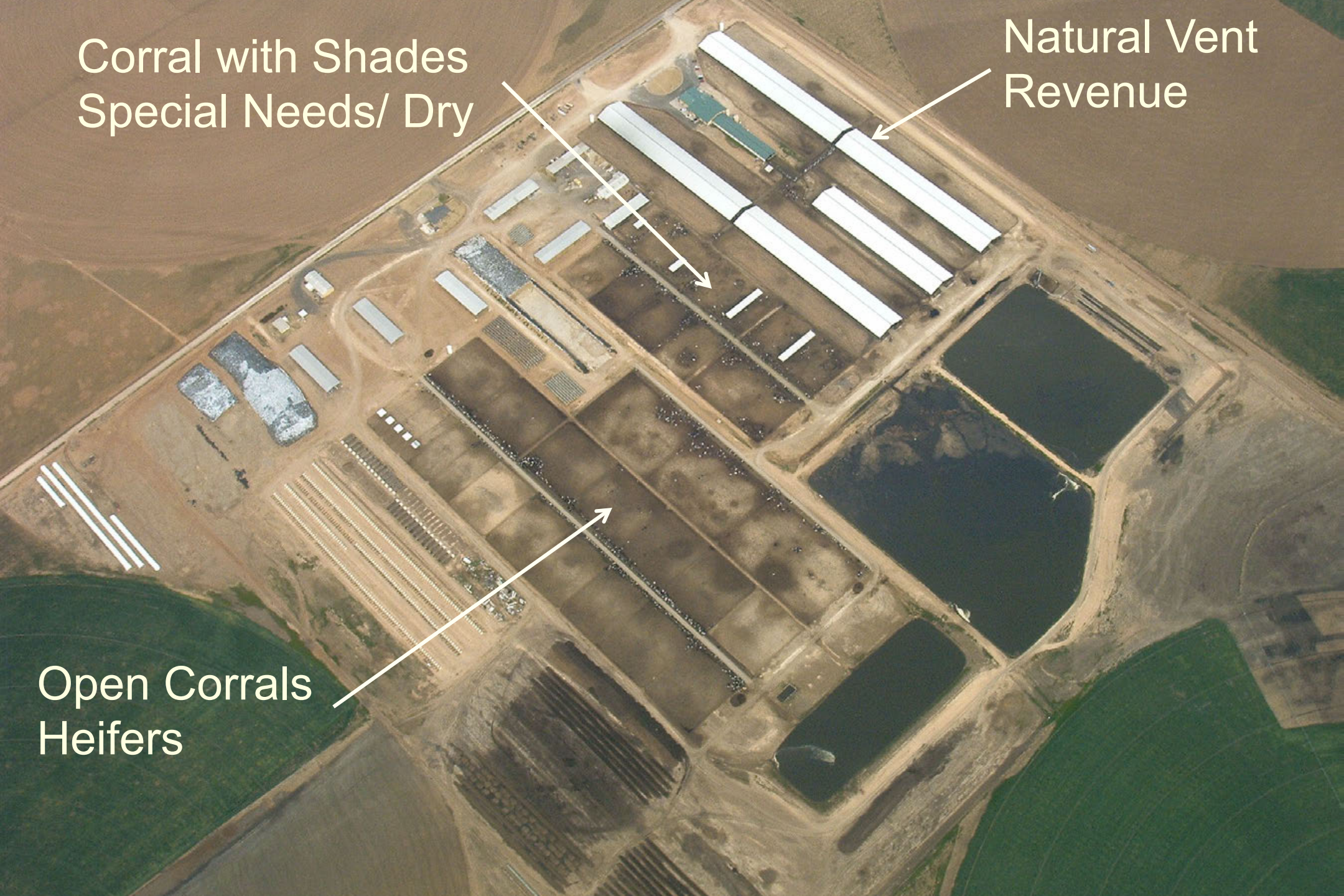
6000 Milking



Corral with Shades
Special Needs/ Dry

Natural Vent
Revenue

Open Corrals
Heifers





Dry

Revenue
Low

Revenue
High

Parlor



Cross Vent
Revenue

Parlor

Natural Vent
Special Needs

Heifers

Dry

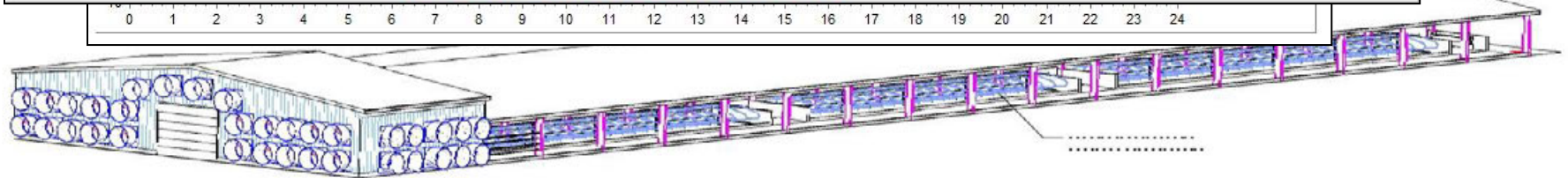
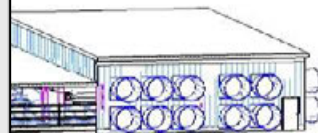
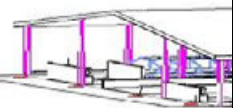
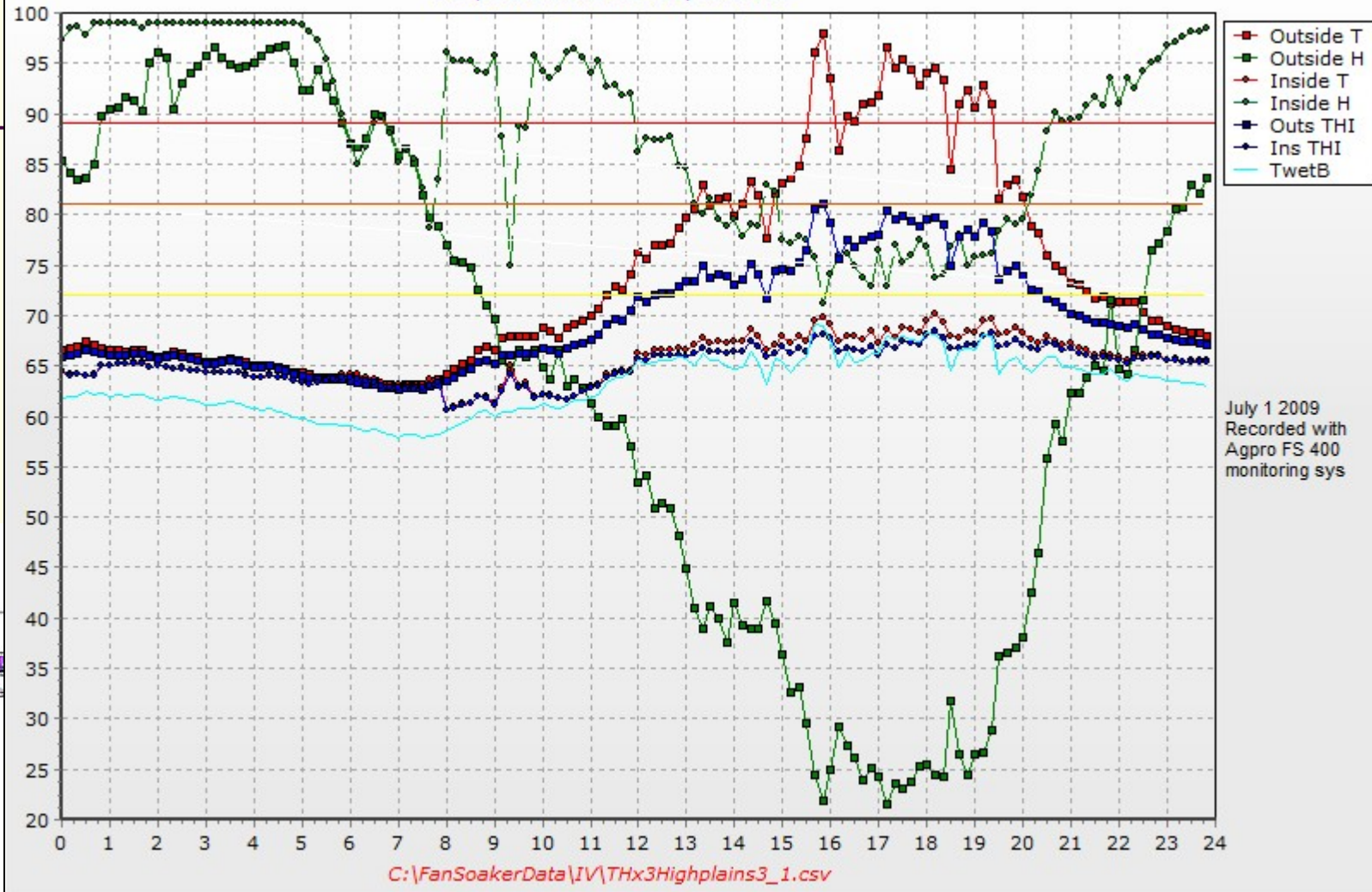


Cross Vent

Natural Vent

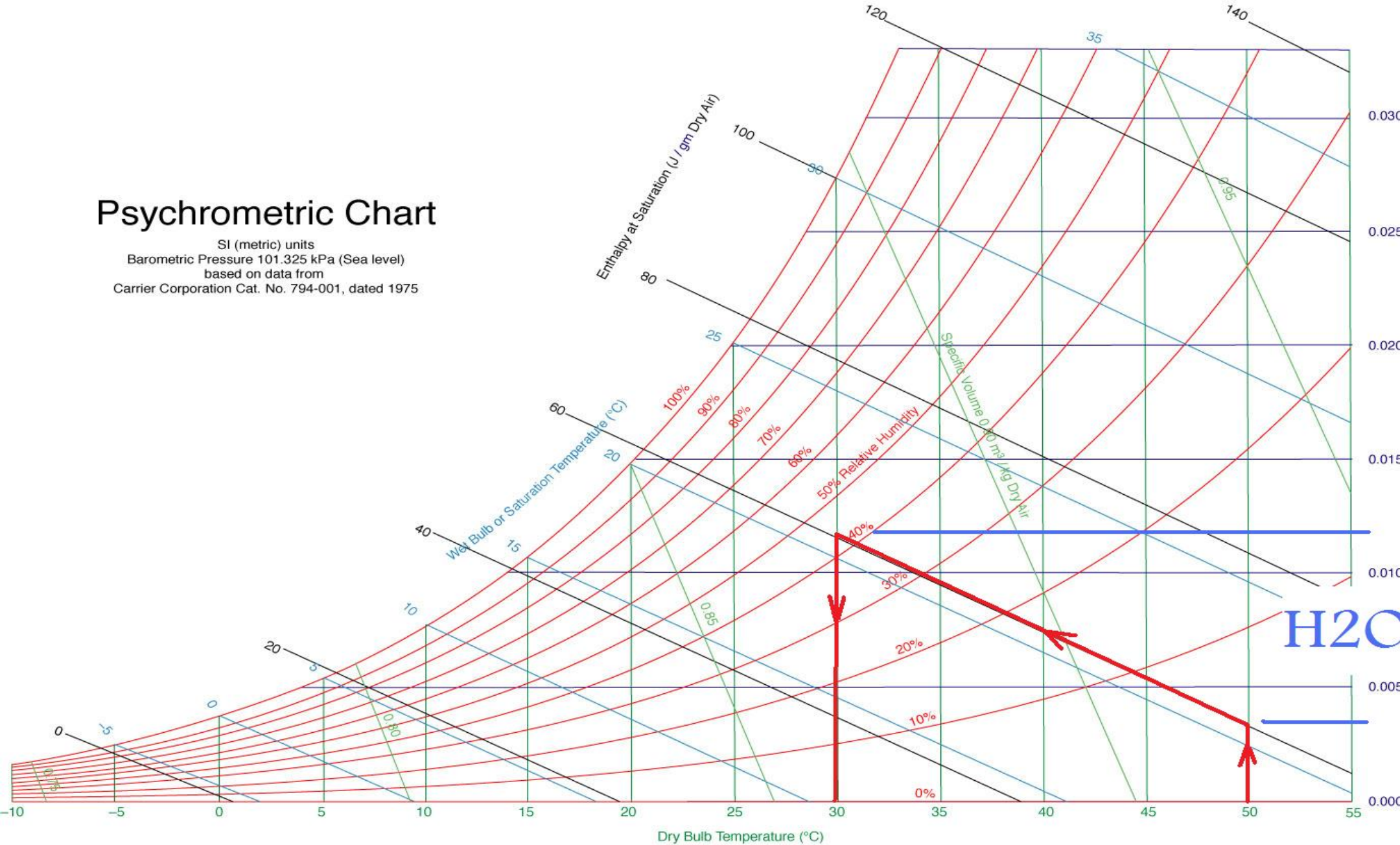
Tunnel Vent

Temperature and Humidity Chart x3



Psychrometric Chart

SI (metric) units
Barometric Pressure 101.325 kPa (Sea level)
based on data from
Carrier Corporation Cat. No. 794-001, dated 1975





Where to Add Cooling First?
Holding Pen-Parlor







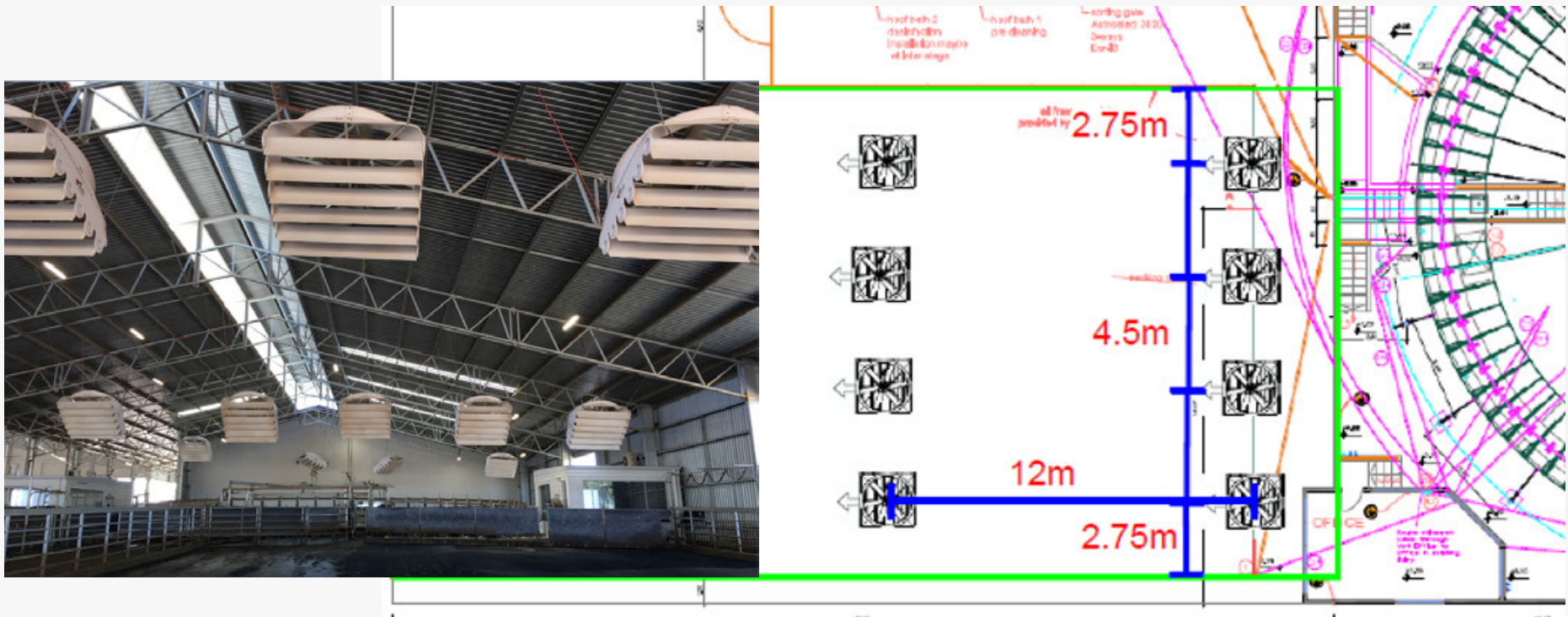


Then Add Misters
or Soakers

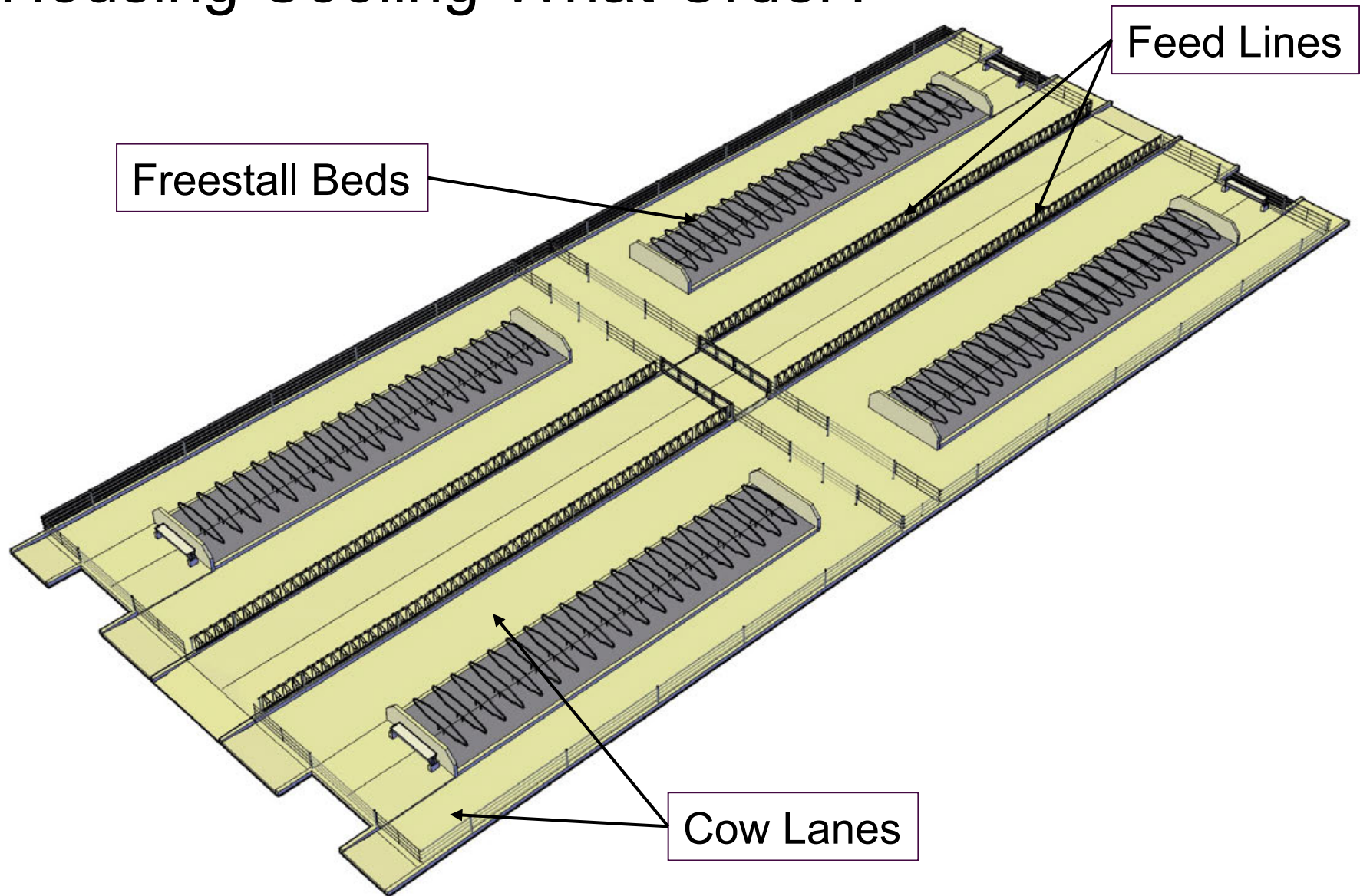


Ventilation and Cooling Solution

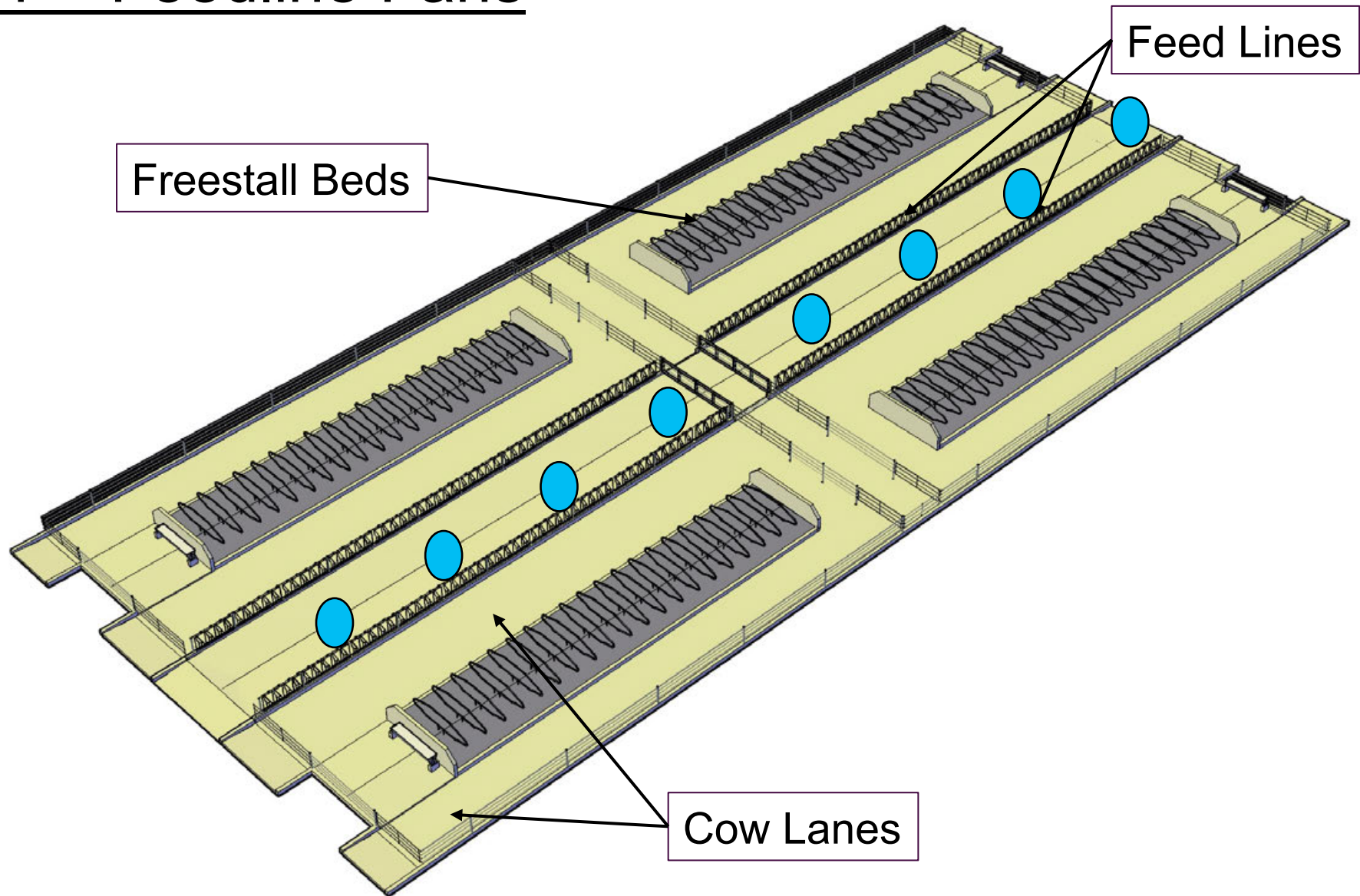
- Target air speed at the cow = +3m/second
- Strategy is different in the holding yard on account of animal density – need to force greater airspeed onto the cows = fans spaced every 12m down the yard and no more than 4.5m on center



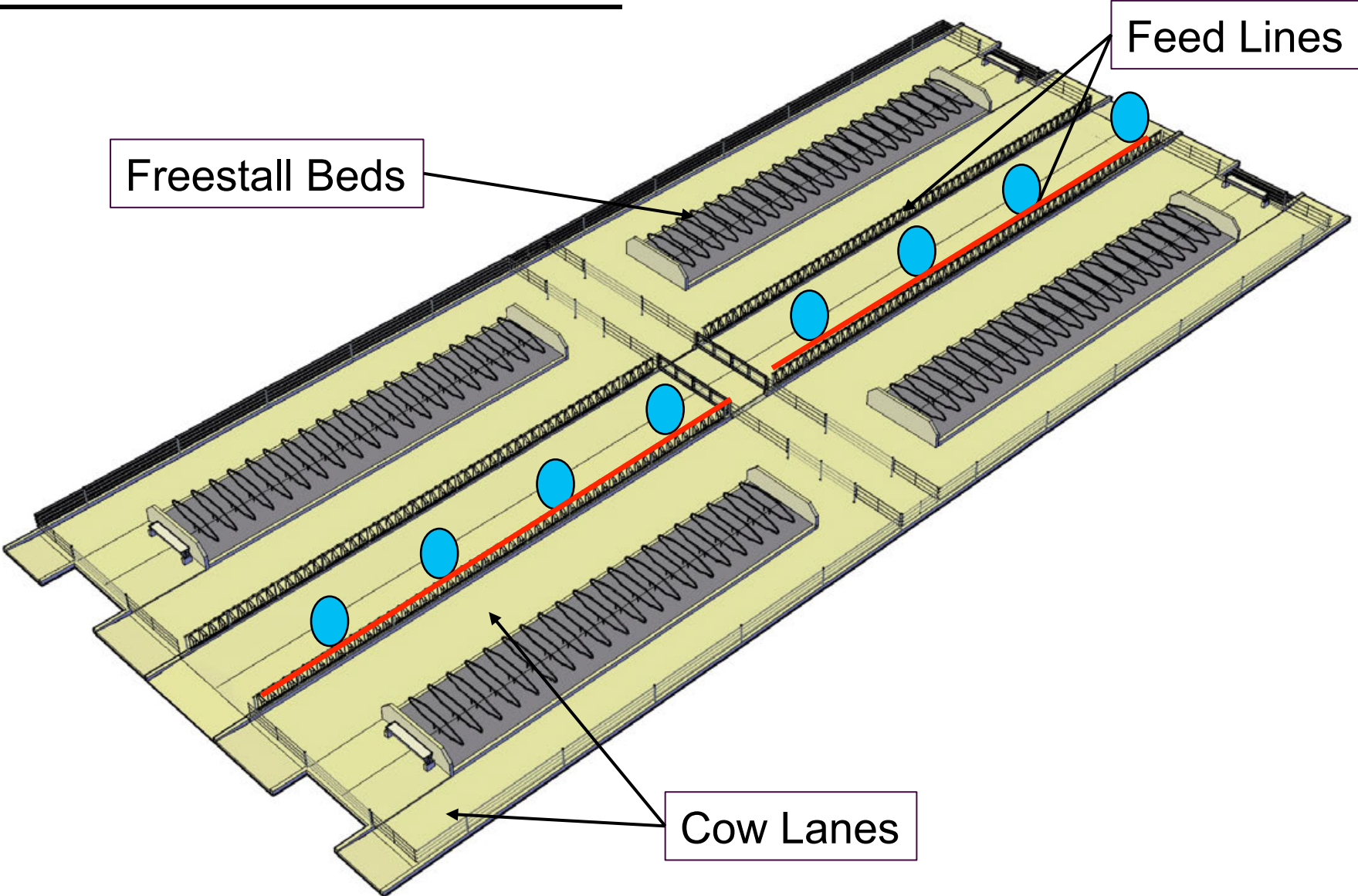
Housing Cooling-What Order?



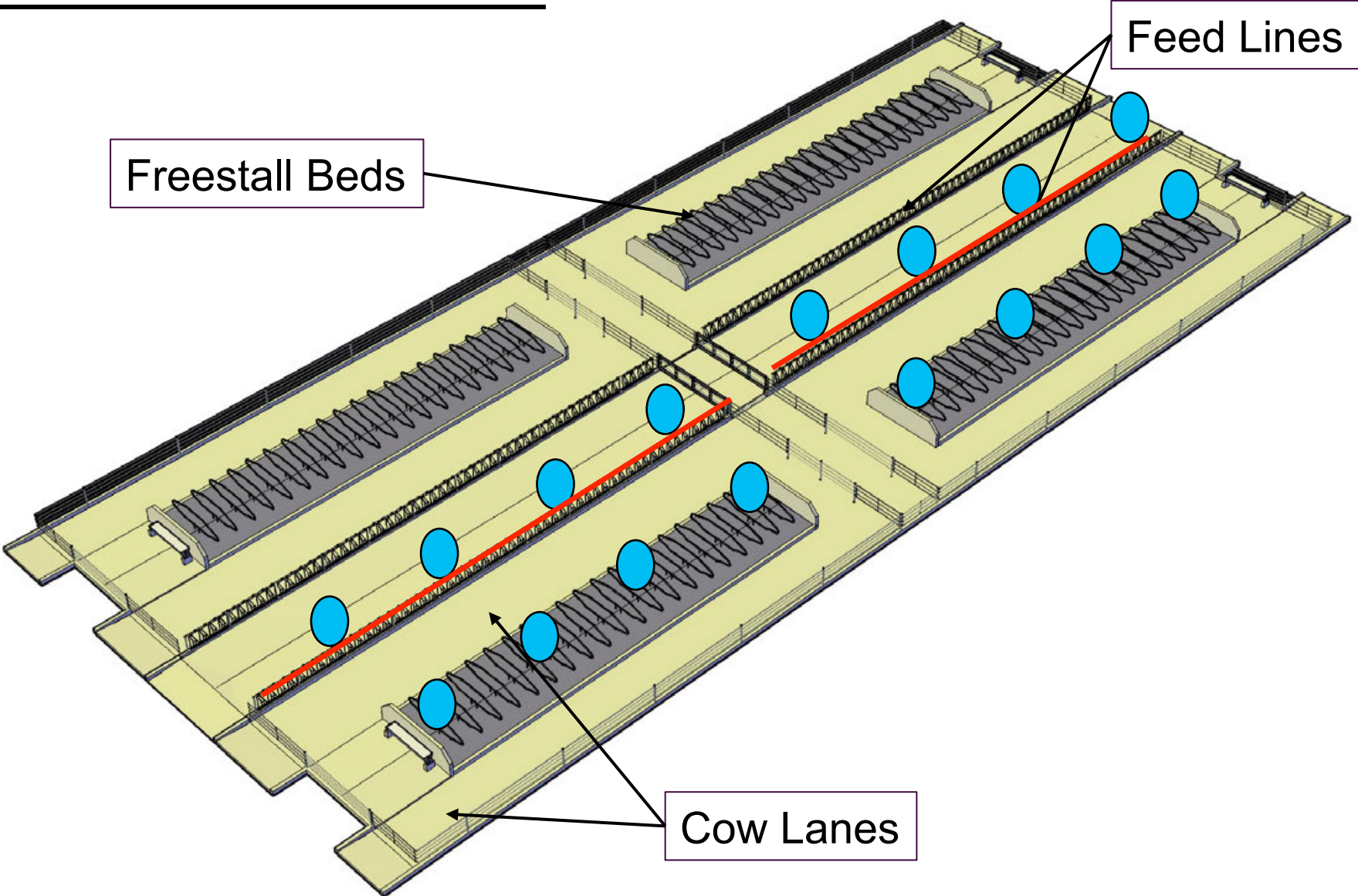
1st- Feedline Fans



2nd- Feedline Soaker



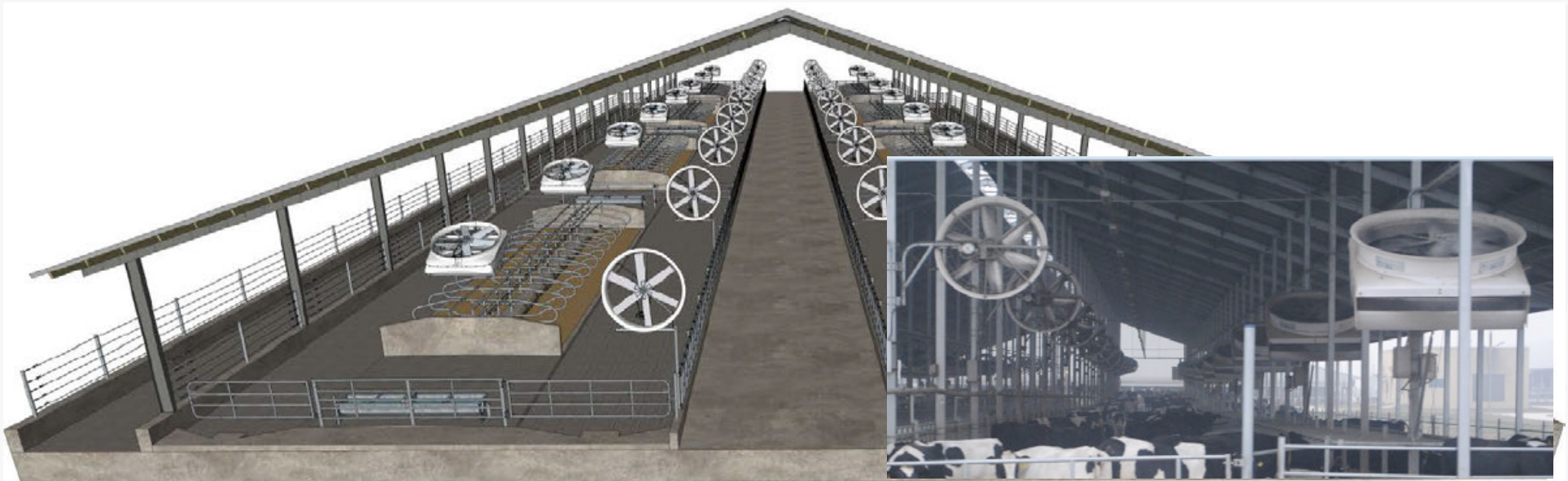
3rd- Freestall Fans



Ventilation and Cooling Solution

4 Row Freestall Barn

- Over the freestalls 72" Fans spaced every 15 to 18m down the barn; 72" Storm Fans preferred as the louvers allow all the air to be directed onto the cows in their beds
- Over the feedlane 50" or 55" Fans spaced every 12m down the barn; 55" HE Breeze Fans preferred as use less electricity greater air velocity
- Add soakers over the feedlane, nozzles have 120 degree spray pattern and spaced every 1.52m to allow soaker overlap



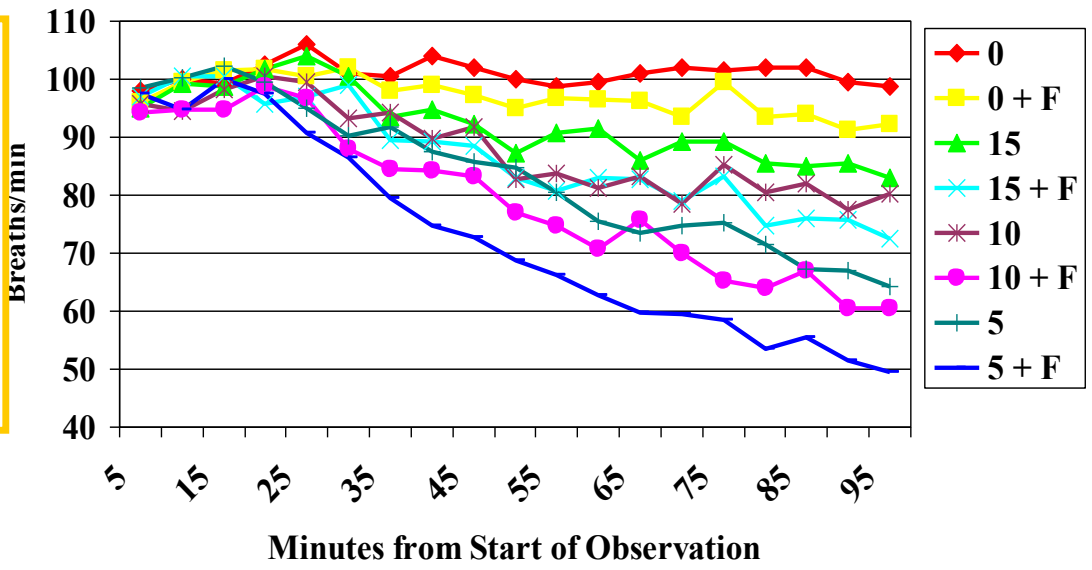
How to Keep Cows Cool

Cooling – Direct Cooling

The Greater the Frequency the Better

Numerous studies have shown that using soaking in combination with supplemental airflow resulted in a rapid change in body temperature and respiration rate

- Body temperature drops the fastest with soaking the cow every 5 minutes in addition to providing supplement airflow
- Just the fan alone did not significantly reduce body temperature.



Soaking 1 minute every 5 minutes with fans has the biggest cooling impact

How to Keep Cows Cool

Which Fans – 72” Storm

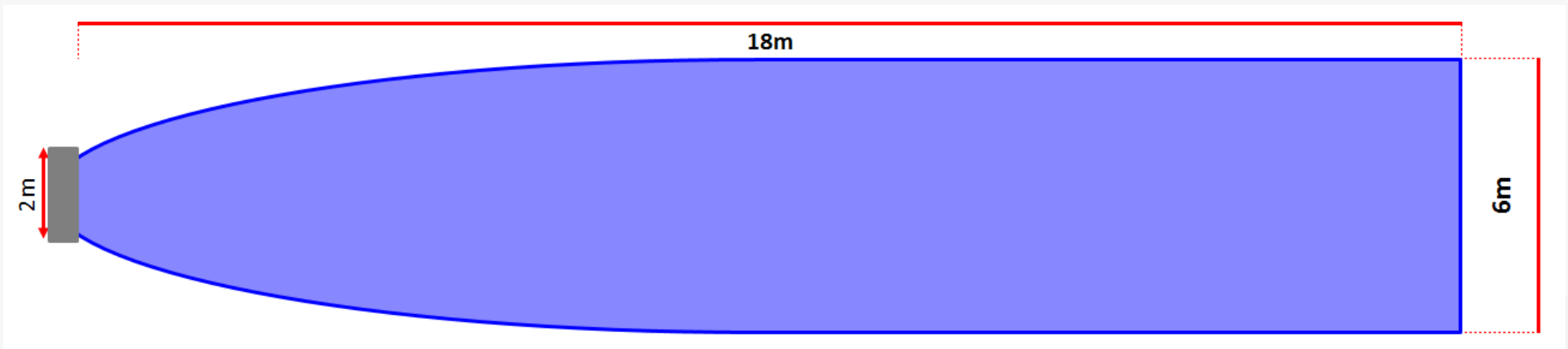
- Creates extreme air velocity for cooling cows, insect control drying bedding and employee comfort
- When spaced correctly the Storm Fan can create airspeeds exceeding 2.5m/second
- The unique airfoil deflectors direct the air over the cows better
- One 72” Storm fan can replace up to 4 large single speed panel (or box) fans
- Typically placed over freestalls, open packs and milking parlours
- Variable Frequency Drive can be added increasing energy savings by controlling motor speed based on temperature thresholds



How to Keep Cows Cool

Which Fans – 72” Storm

- Creates an area of 6m wide by 18m long with a minimum airflow of 2.5 m/second

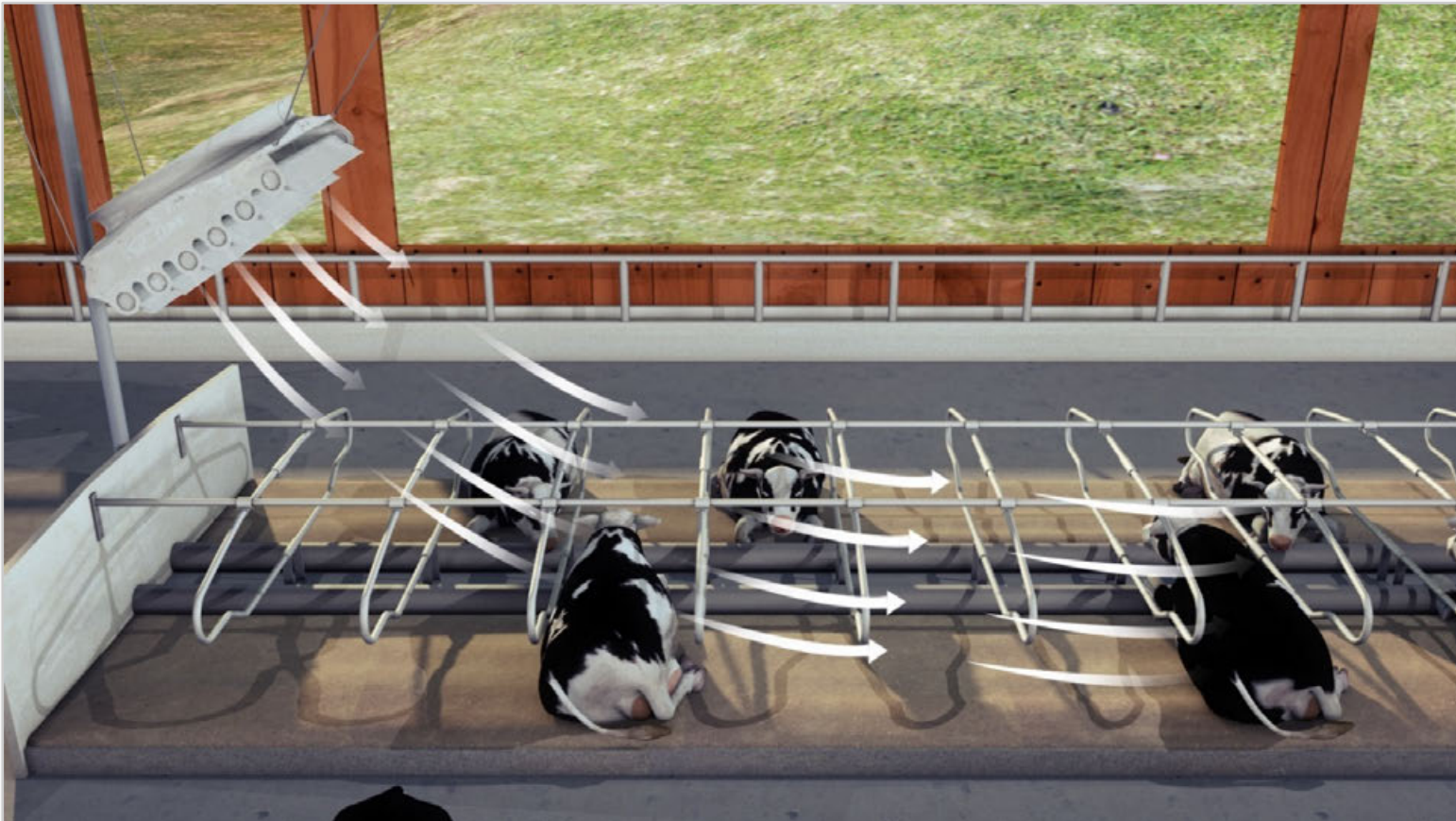


- Corrosion resistant fiberglass housing
- 6 balanced heavy duty paddle aluminum blades
- 3HP Motor
- Optional and recommended Variable Frequency Drive (VFD)

How to Keep Cows Cool

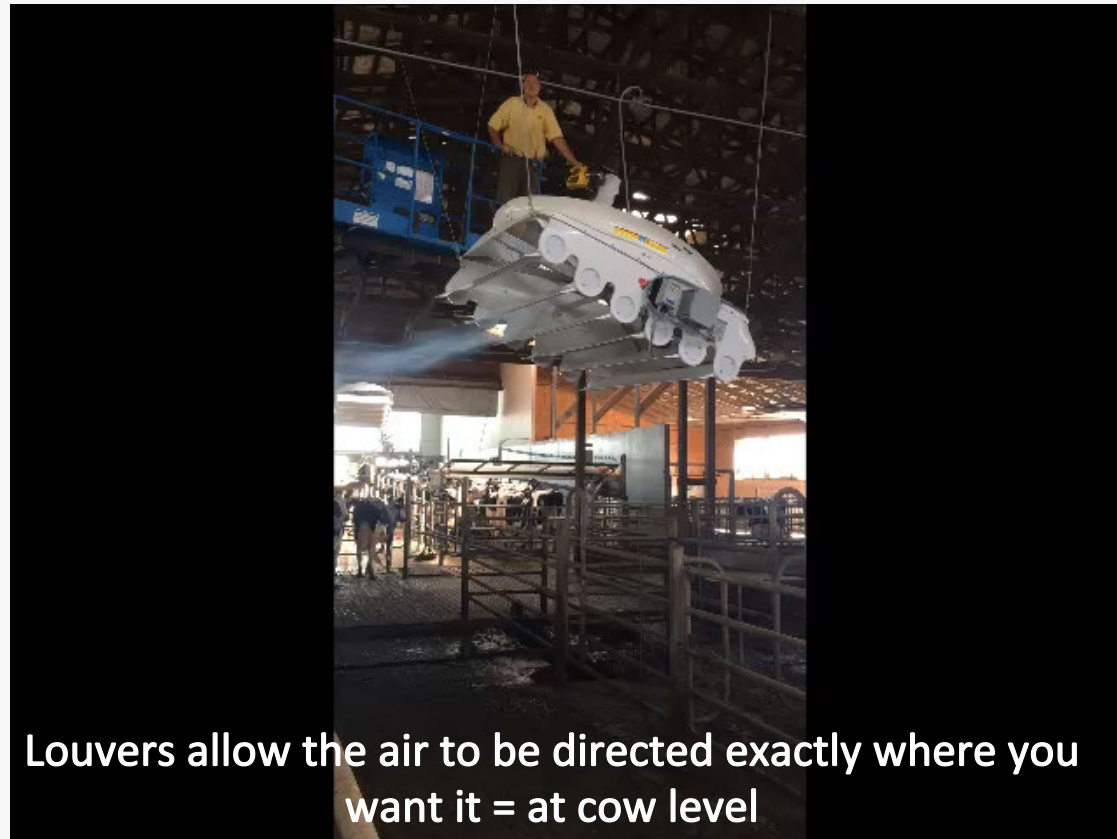
Which Fans – 72” Storm

Adjustable louvers allow full control of air throw distance and direction



How to Keep Cows Cool

Which Fans – 72” Storm



How to Keep Cows Cool

Which Fans – 50” and 55” Breeze

- No height restrictions under the roof
- Creates high air velocity for cooling cows, insect control and employee comfort
- When spaced correctly the Breeze Fan can create airspeeds exceeding 2.5m/second
- Typically placed over feedlane



How to Keep Cows Cool

Which Fans – Storm or Breeze

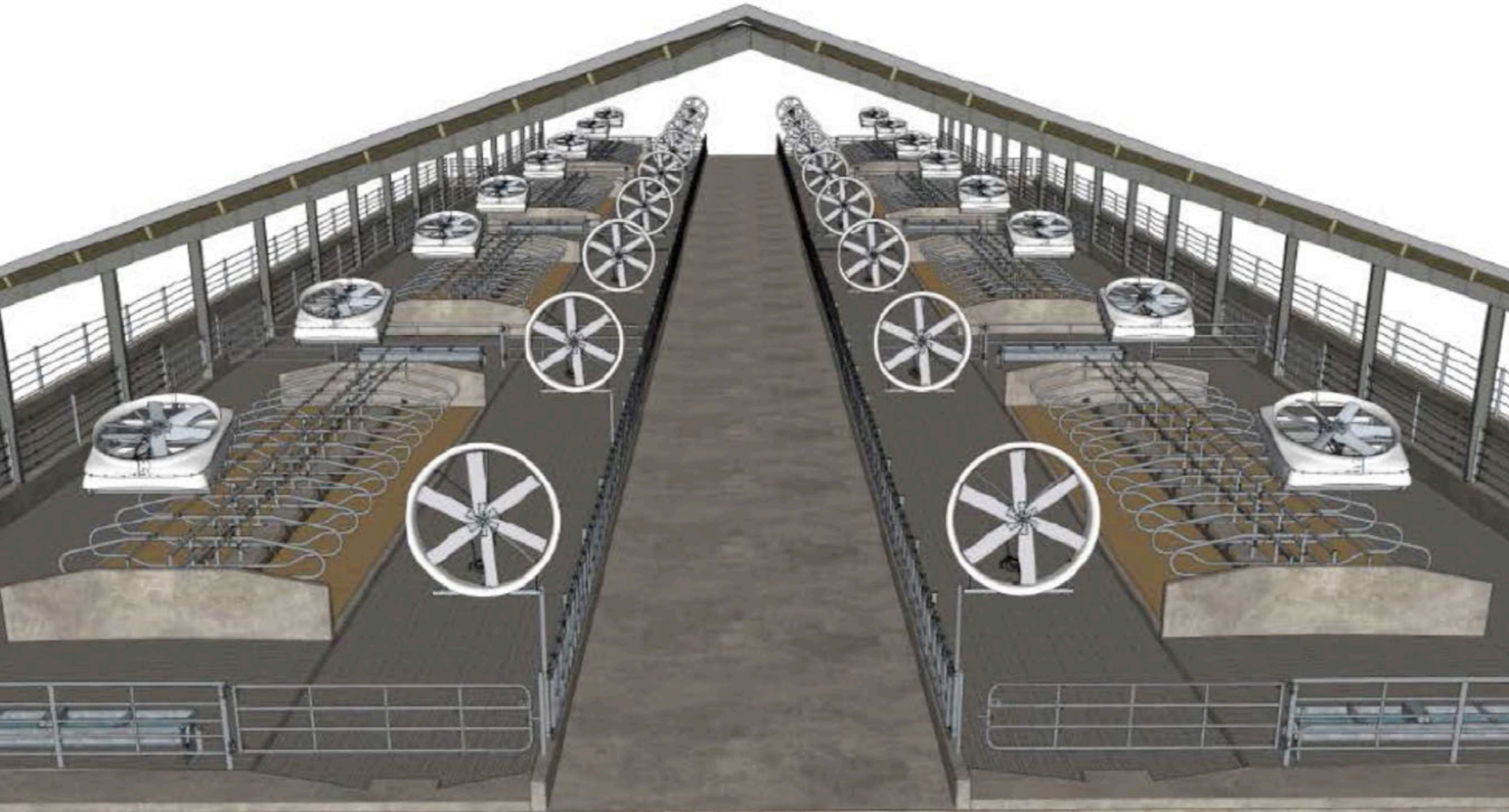
- Storm Fan = adjustable louvers allow air flow to be directed down on to the cows
- Breeze Fan = deep venturi shaped housing allows less air pattern variation
- Spaced correctly airflow achieved = minimum of 2.5m/second

Breeze Fan

Storm Fan

Fan Position and Location

Distance between fans is based on climate – fan capacity (velocity map)







2400 Cow Dairy in Washington, USA

Question and Answer Time



Fire Away

