

# Design of Robotic Milking Systems in the Southeast US



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*Dairy Design Engineers*

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## Why Consider Robotic Milking Systems?



Existing conventional parlor worn out?



Looking to reduce labor costs and increase efficiencies?



Desire more free time/flexible work hours?



Cow health/data collection

# Interested in a Voluntary Robotic Milking System?



What is your desired  
barn design?



What is your desired  
cow flow design?



What is your desired  
return on investment?



What is your desired barn design?

Natural/tunnel ventilated barns

4 or 6 row freestall barn

Central or perimeter feed drive lane

# Natural vs. Tunnel Ventilated Barns

- Tunnel Barns approx. 40% more expensive
- Naturally ventilated barns do well in Southeast US
- Challenges to ventilating around robotic milking units/operating pits





What is your desired barn design?

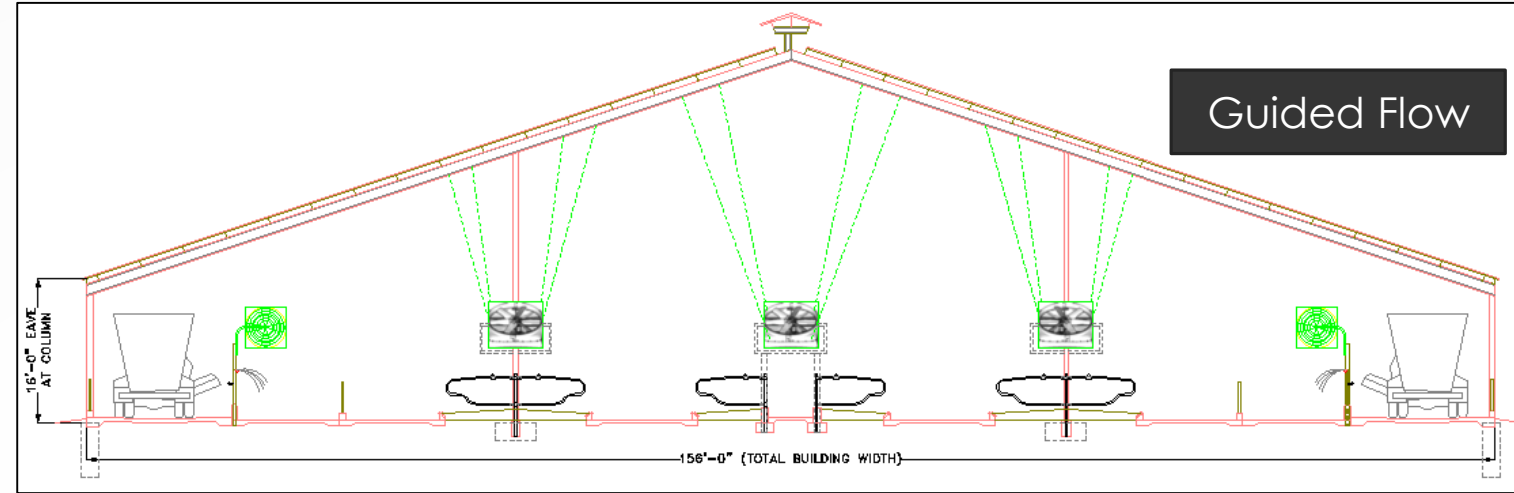
Natural/tunnel ventilated barns

4 or 6 row freestall barn

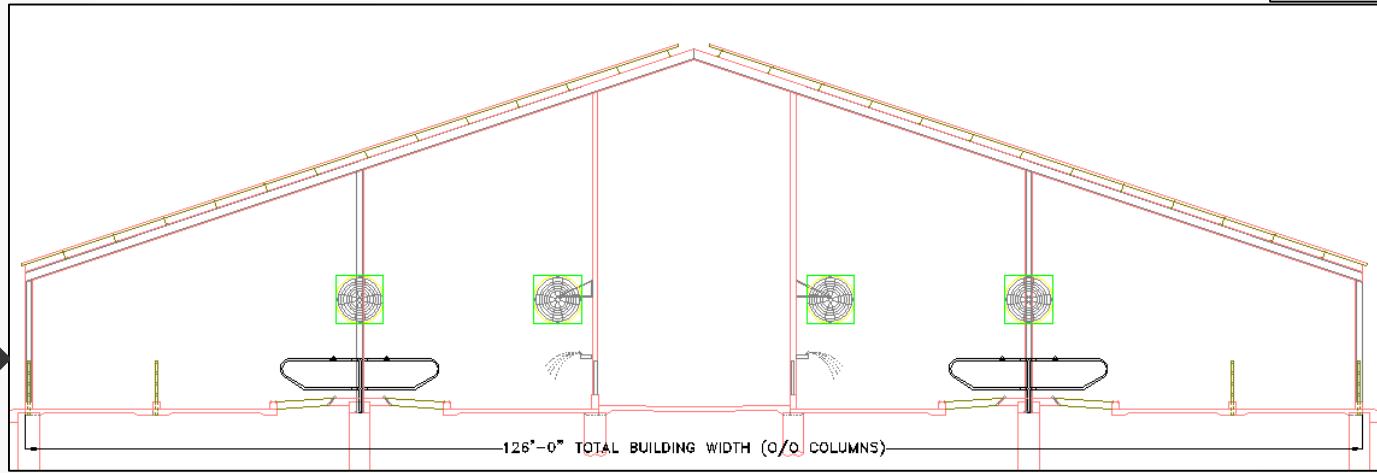
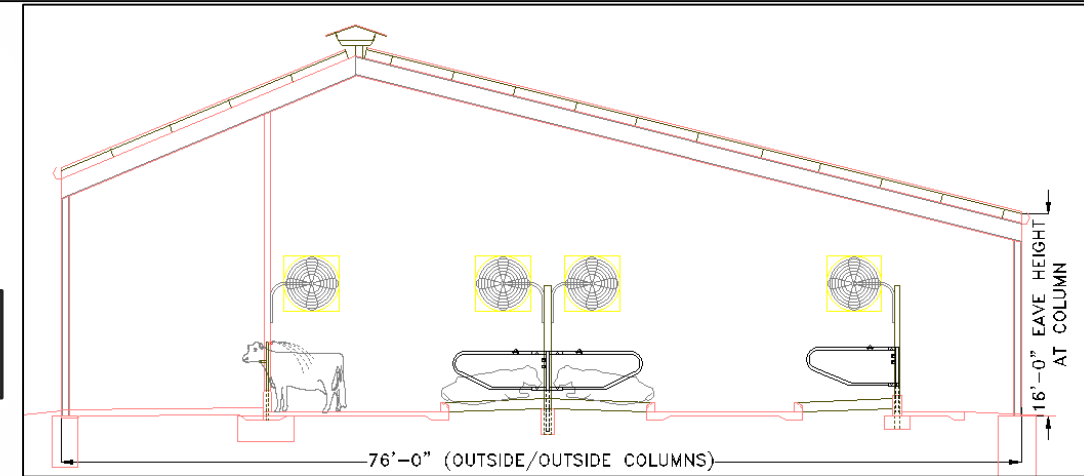
Central or perimeter feed drive lane

# 4 or 6 Row Barn? Feed drive location?

- Cost difference?
- Feed face difference?
- Can affect overall cow flow decision



Hybrid  
Guided Flow

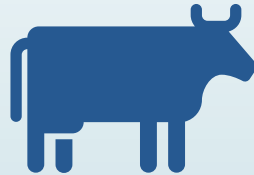


Free Flow

# Interested in a Voluntary Robotic Milking System?



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What is your desired  
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What is your desired  
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What is your desired cow flow design?

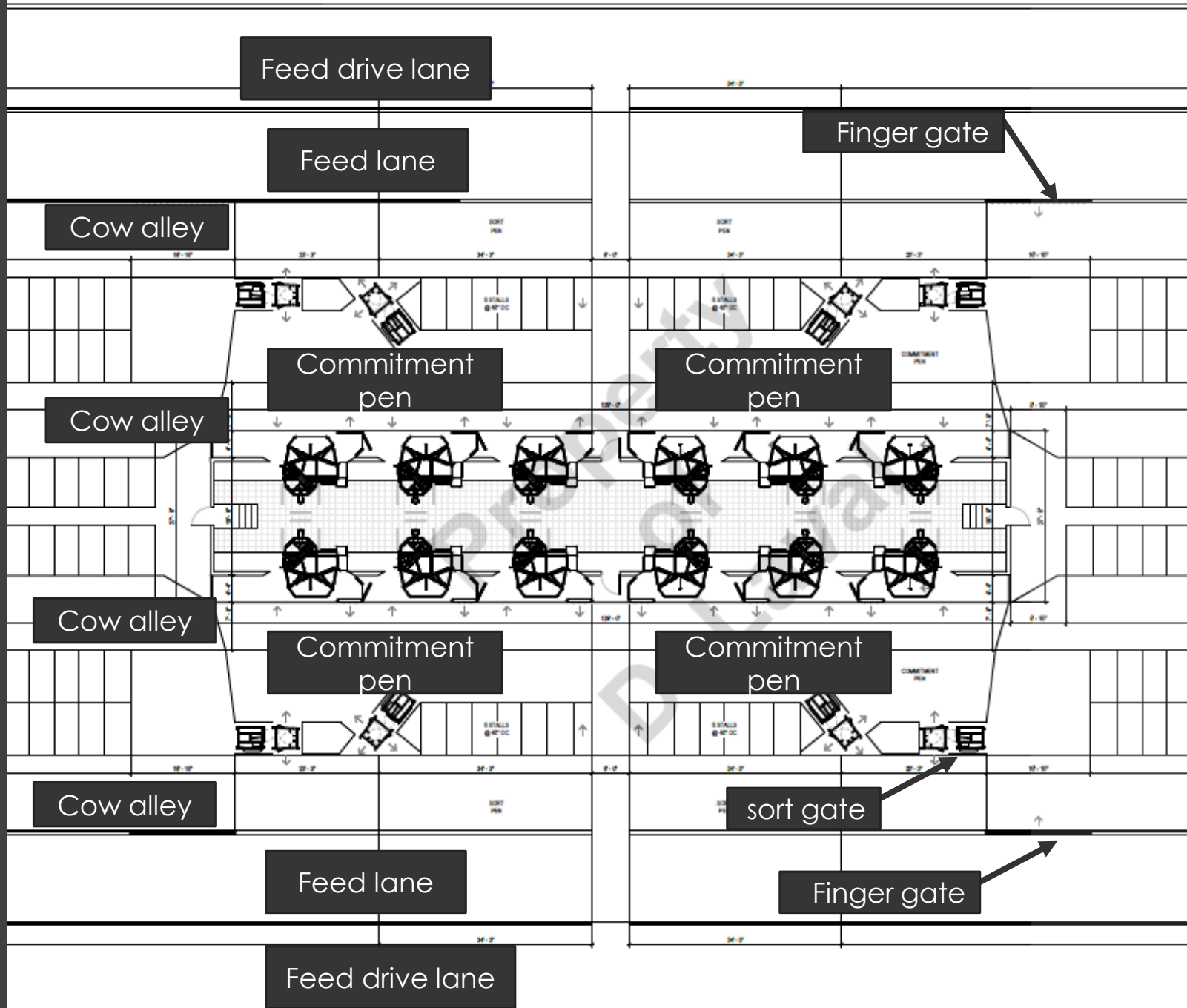
Guided flow

Free flow

Hybrid flow

# Cow Flow Design: Guided Flow

- Higher initial cost
- Lower labor cost
- Lowest refusal rate
- Highest level of management control



# Types of Guided Flow Design



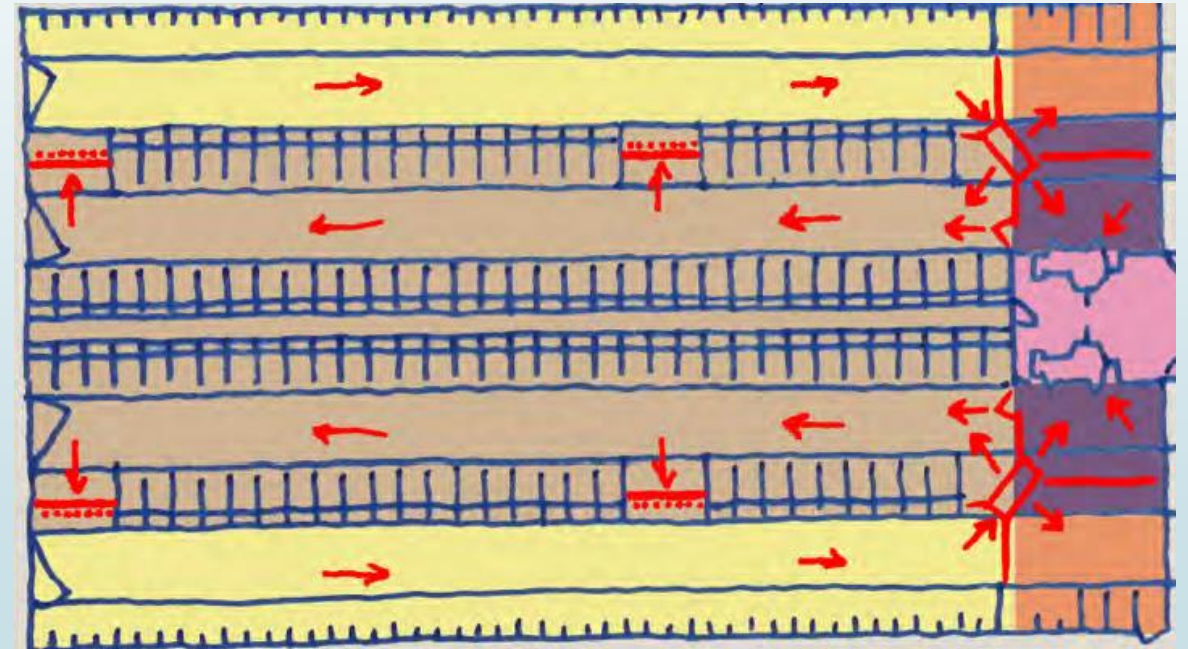
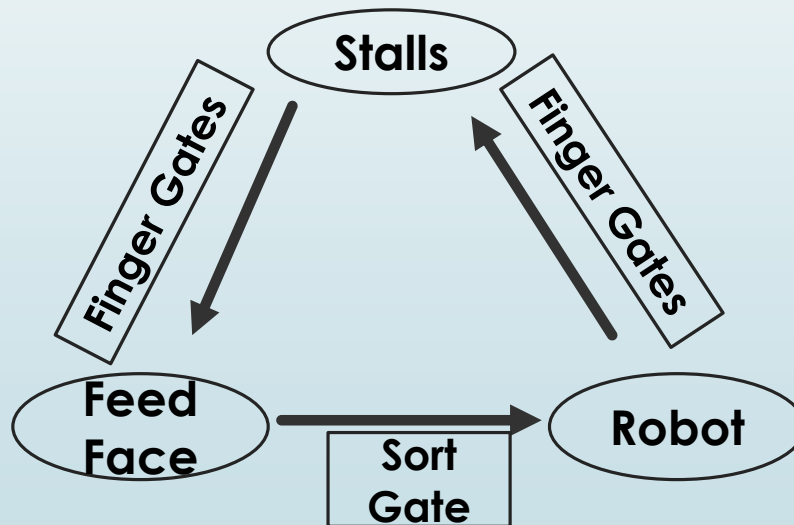
FEED FIRST OPTION



MILK FIRST OPTION

# Guided Flow - Feed First Option

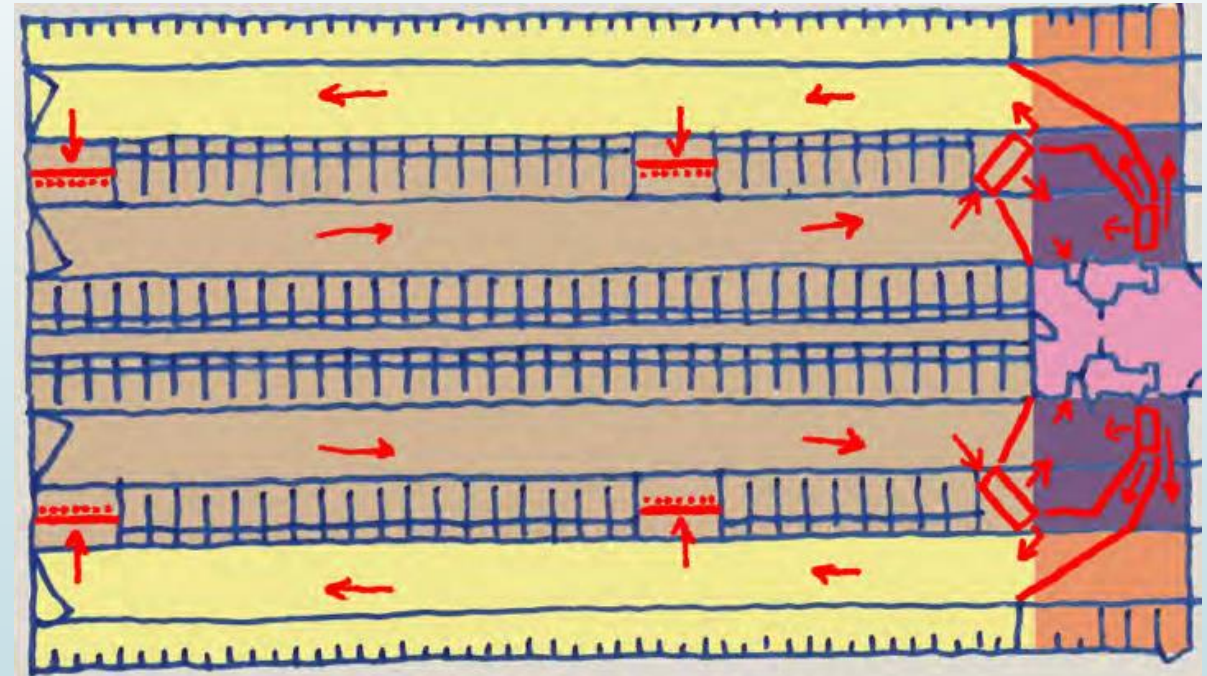
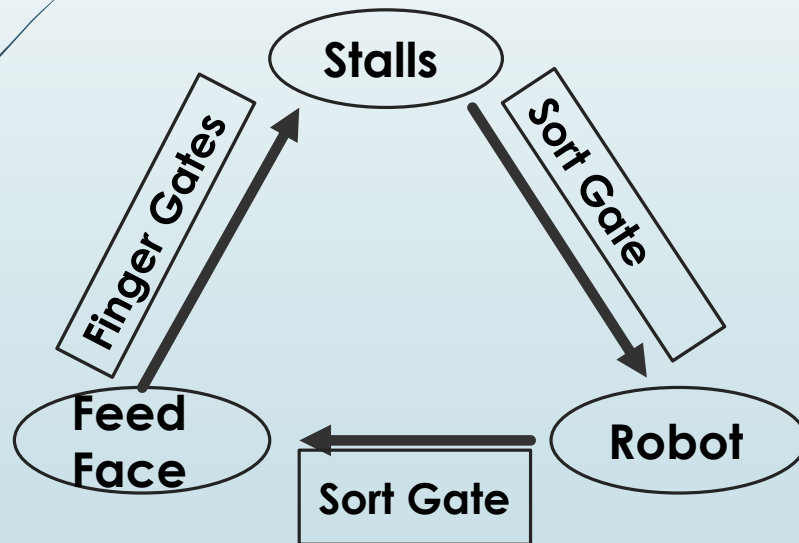
- Approx. 8-12lb/cow/day grain in robot
- Cows access feed face via finger gates
- Cows access robot after entering feed lane



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# Guide Flow - Milk First Option

- Approx. 3-4lb/cow/day grain in robot
- Cows must walk through sort gate to gain access to either robot or feed face



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What is your desired cow flow design?

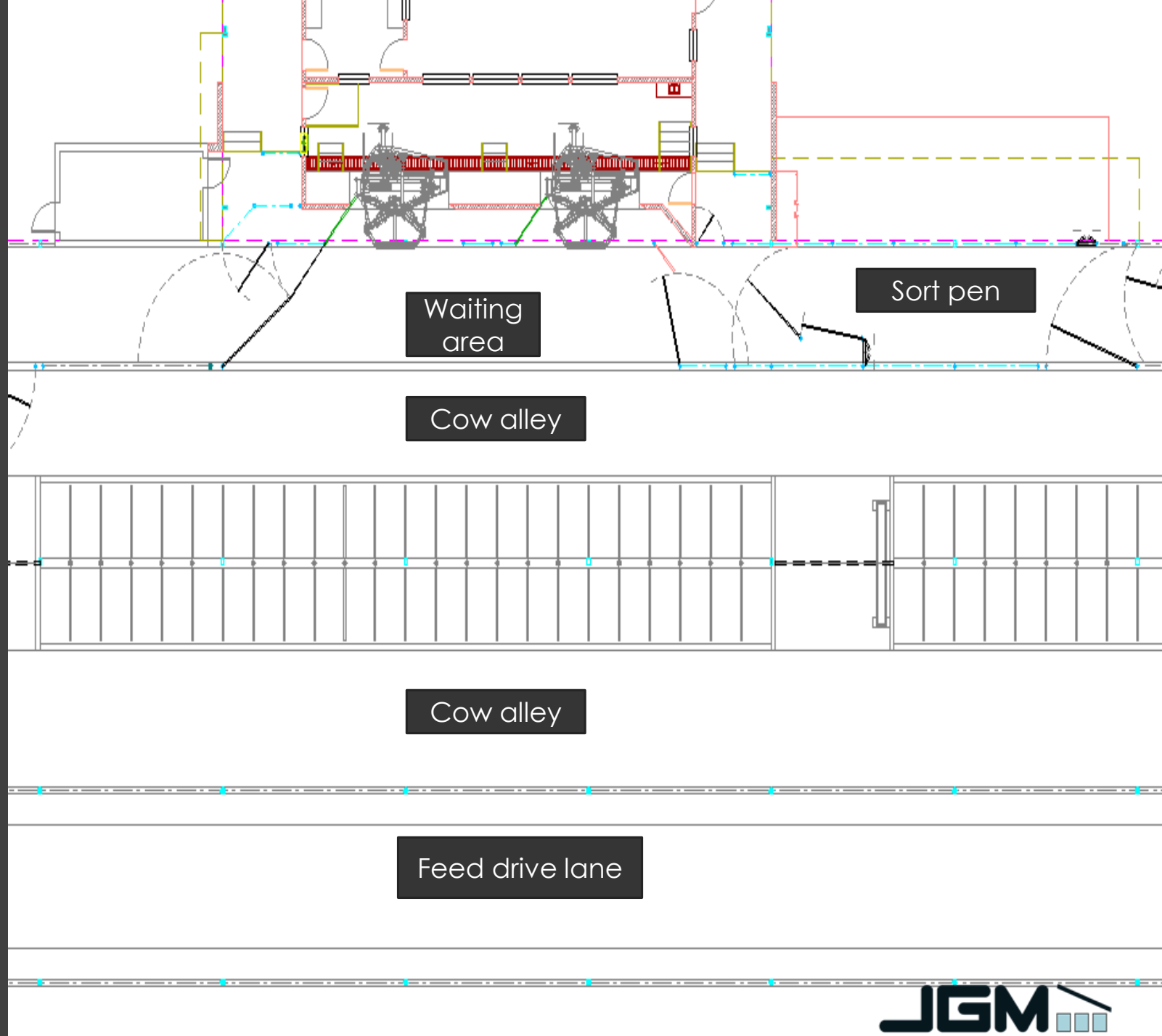
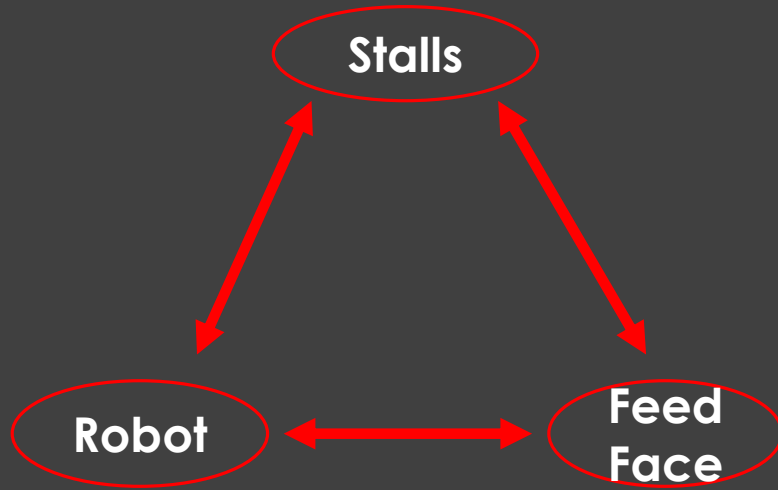
Guided flow

Free flow

Hybrid flow

# Cow Flow Design: Free Flow

- Lowest initial cost
- Highest labor cost
- Highest refusal rate
- Lowest level of management control





What is your desired cow flow design?

Guided flow

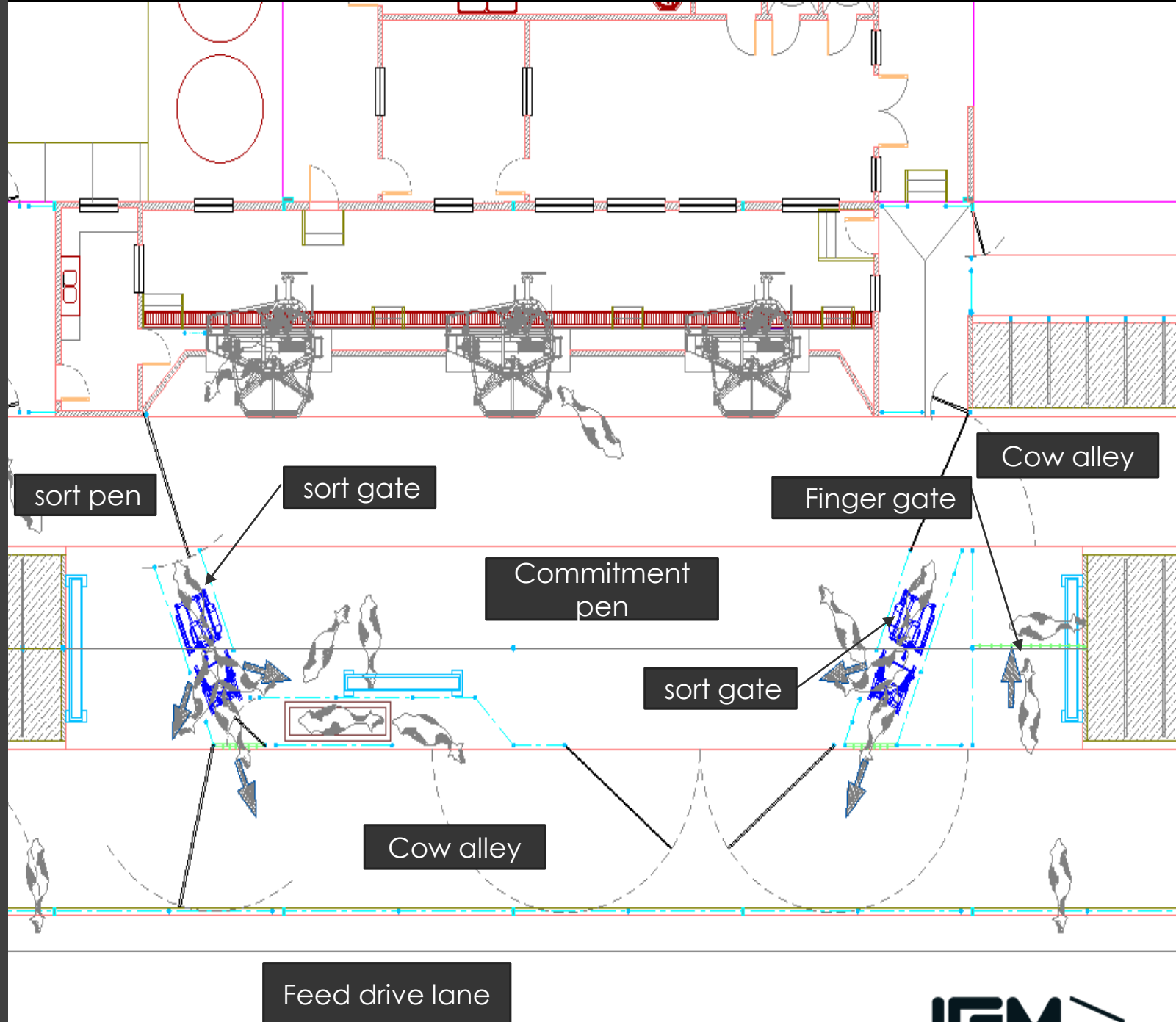
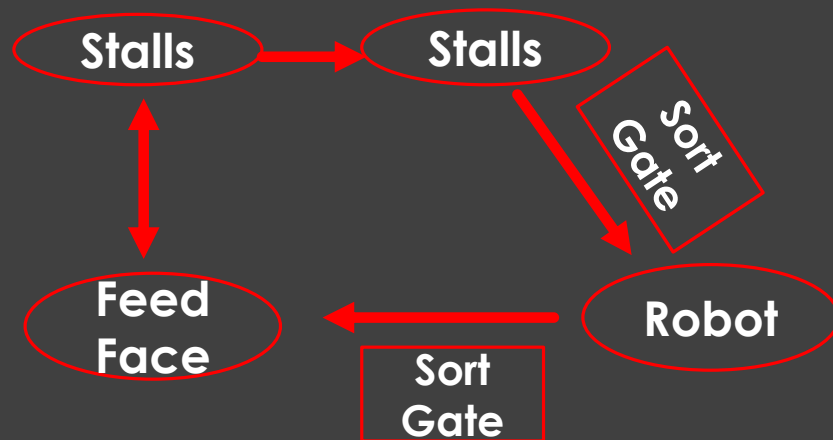
Free flow

Hybrid flow



# Cow Flow Design: Hybrid Flow

- Moderate initial cost
- Moderate labor cost
- Moderate refusal rate
- Moderate level of management control



# Guided vs. Free vs. Hybrid Flow

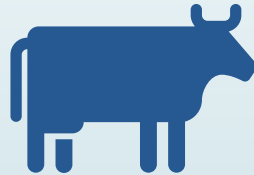
Cow Flow Design	Initial Investment	Labor Costs	Feed Costs	Refusal Rates	Management Control
Guided	Highest	Lowest	Lowest	Lowest	Highest
Hybrid	Middle	Middle	Middle	Middle	Middle
Free	Lowest	Highest	Highest	Highest	Lowest

*Ultimate deciding factor: management philosophy*

# Interested in a Voluntary Robotic Milking System?



What is your desired barn design?



What is your desired cow flow design?



What is your desired return on investment?

What is your desired return on investment?

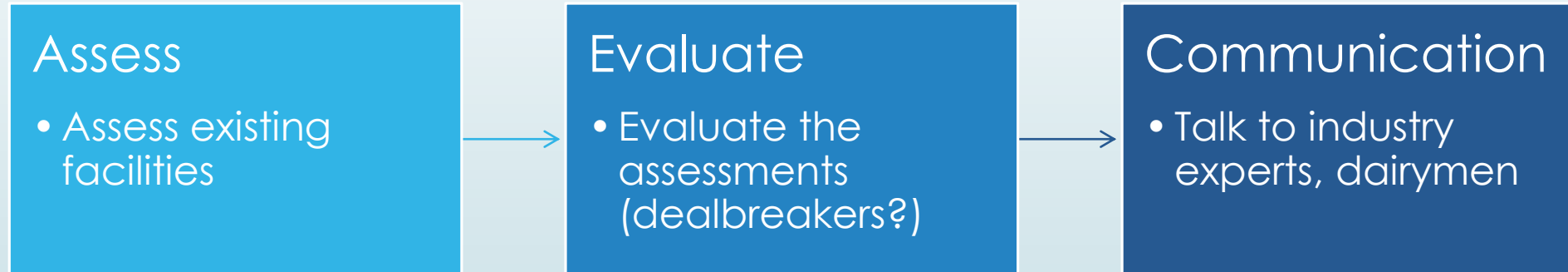


RETROFIT?



NEW BUILD?

# Retrofit vs. New Build



Assess  
existing  
facilities

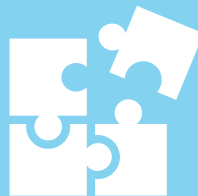
# Retrofit vs. New Build



Cooling/Ventilation design



Freestall barn design



Location for robots/gates etc.

# Retrofit Dealbreakers?

Evaluate  
Assessments  
from Step 1



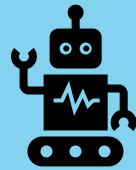
# Retrofit vs. New Build



Other Dairymen



Designers



Manufacturers

Talk To  
Others





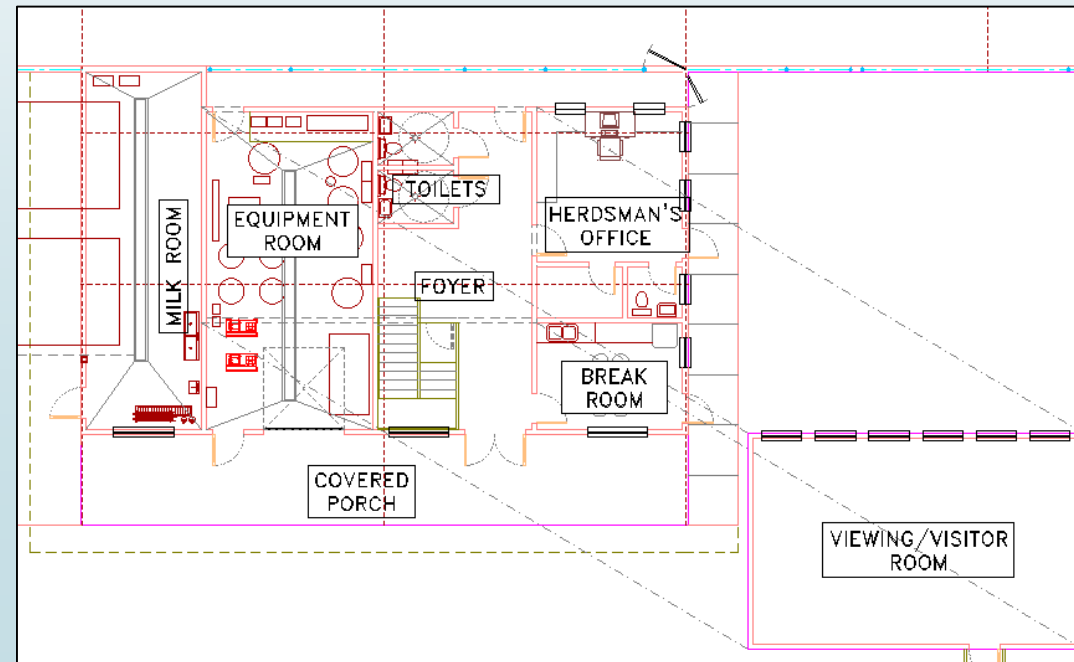
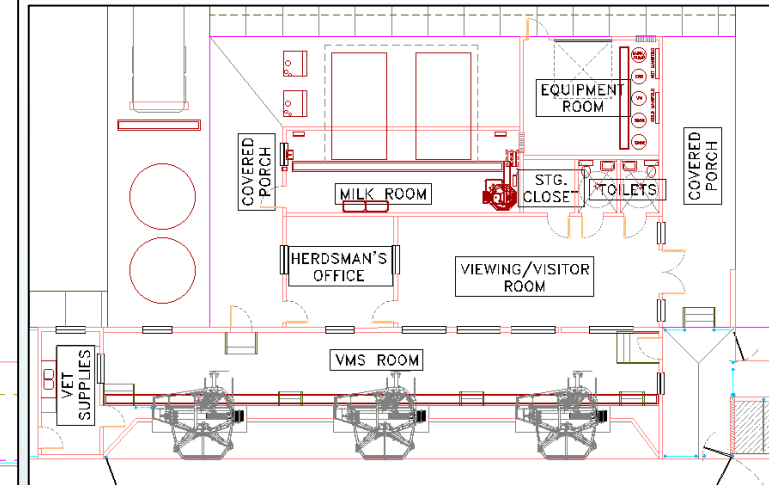
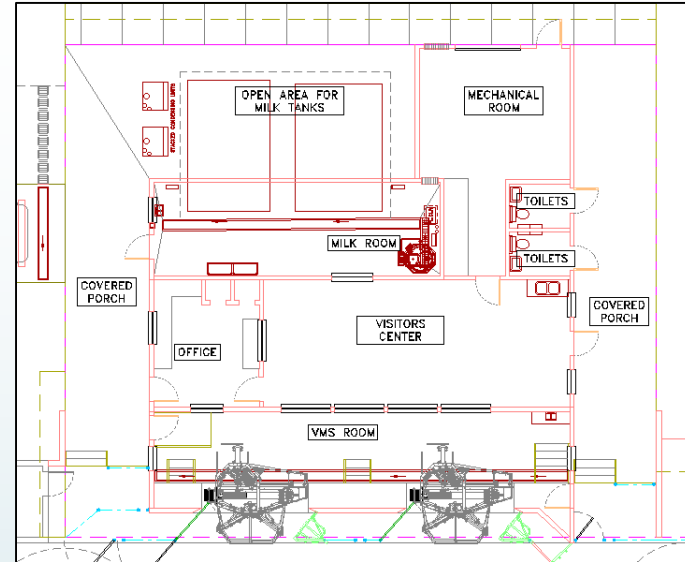
What building components and equipment do these type of barns consist of?

# Design Components for Robotic Milking Barns - Building Components

## ➤ Milk House

### ➤ Common Room Types

- Milk Room
- Equipment Room
- VMS/Robot Room
- Toilets (ADA)
- Herdsman's office
- Viewing room
- Storage closets



# Design Components for Robotic Milking Barns - **Building Components**

## ■ **Milk Room**

- Similar to conventional parlor milk rooms
- Encourage use of at least (2) tanks (backup plan)



# Design Components for Robotic Milking Barns - **Building Components**

## ■ Equipment Room

- Vacuum Pumps
- Water heaters
- Air compressors
- Air tanks
- Water storage tanks
- Electrical panels
- Refrigeration compressors
- Chemicals





# Design Components for Robotic Milking Barns - **Building Components**

## ➤ Robotic milking unit room

- Positive pressure ventilation in VMS rooms
- Size based upon equipment mfg. recommendations for robots
- Operator pit depth
  - Range of 7-28" (depends upon mfg.)



# Design Components for Robotic Milking Barns - **Building Components**

## ➤ Robotic Platform

- **No** steps, ramps ONLY in and out of unit
- Equipotential plane-stray voltage





## Design Components for Robotic Milking Barns – **Building Components**

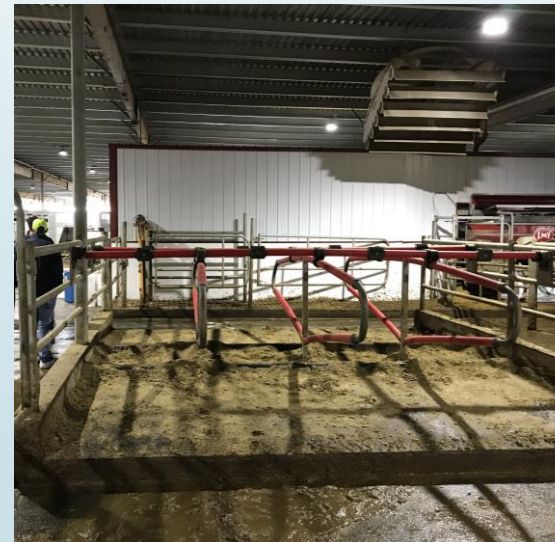
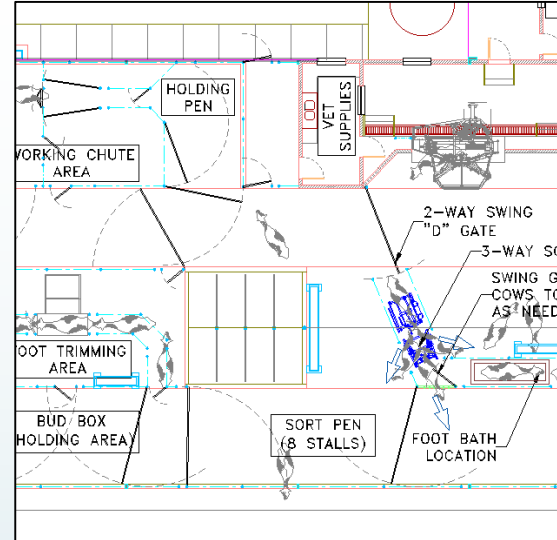
- **Commitment pens** (guided/hybrid flow)
- **Fetch pens** (free flow)



# Design Components for Robotic Milking Barns – **Building Components**

## ➤ Separation Pen/Exception Cow Pen

- Sort pen after robot
- Can be short or long term





# Design Components for Robotic Milking Barns - **Equipment**

## ➤ Voluntary Milking Unit

- Building is designed around chosen manufacturer



## Design Components for Robotic Milking Barns - **Equipment**

- **Finger gates** - guided and hybrid flow designs
- **NOTE:** Prefer placement in middle of crossover-allows cows from both sides access to water trough





## Design Components for Robotic Milking Barns - **Equipment**

- **Counterbalance gates** – free flow designs
  - Assist with bedding application/cleaning stalls



## Design Components for Robotic Milking Barns - **Equipment**

- **Sort gates/Smart Selection gates**
  - Preselection sort gate





## Design Components for Robotic Milking Barns - **Equipment**

- **Sort gates/Smart Selection gates**
  - Post milking sort gate



# Design Components for Robotic Milking Barns - **Equipment**

## ➤ Exit gates at Robots

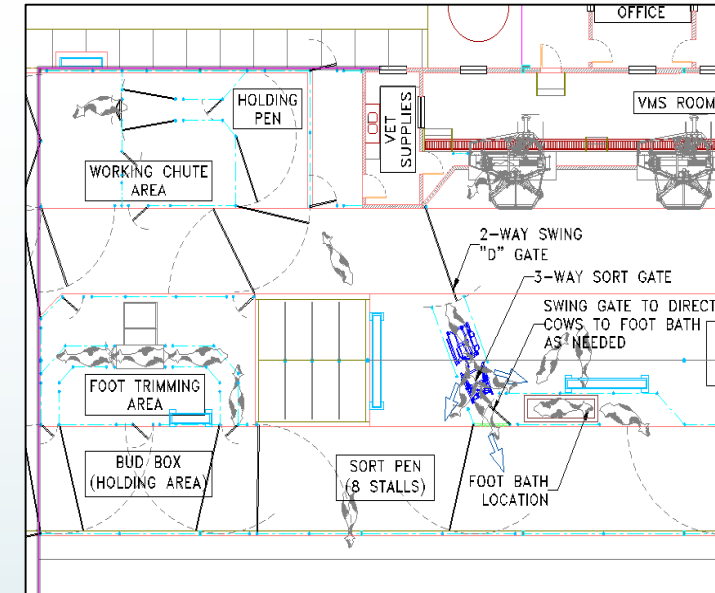
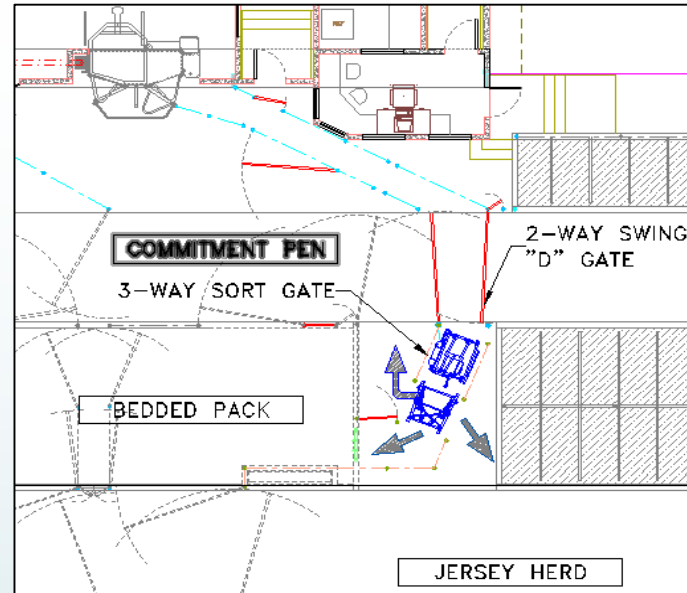
- Prevent cows from entering robot via exit





# Design Components for Robotic Milking Barns - Equipment

- D-swing gates at exit sort gates
  - For dual purpose sort gates





Possible design challenges...



# Challenges to Robotic Milking Barn Designs

## Where to work cattle:

- Existing facilities can be used (existing parlors/working areas)
- New build-place management rails/head catch/foot trimming areas next to sorted pen (post milking sort gate)



# Challenges to Robotic Milking Barn Designs

## Manure Management System:

- When to apply bedding?
- When to clean beds/scrape floors (if applicable)?
- Scrape vs. flush system?





# Challenges to Robotic Milking Barn Designs

## Foot Bath location:

- After the post milking sort gate (guided flow or hybrid free flow only)
- At the last barn cross over (requires more labor)
  - Perfect time to apply bedding to stalls
- Avoid placing in or near the robotic milking unit

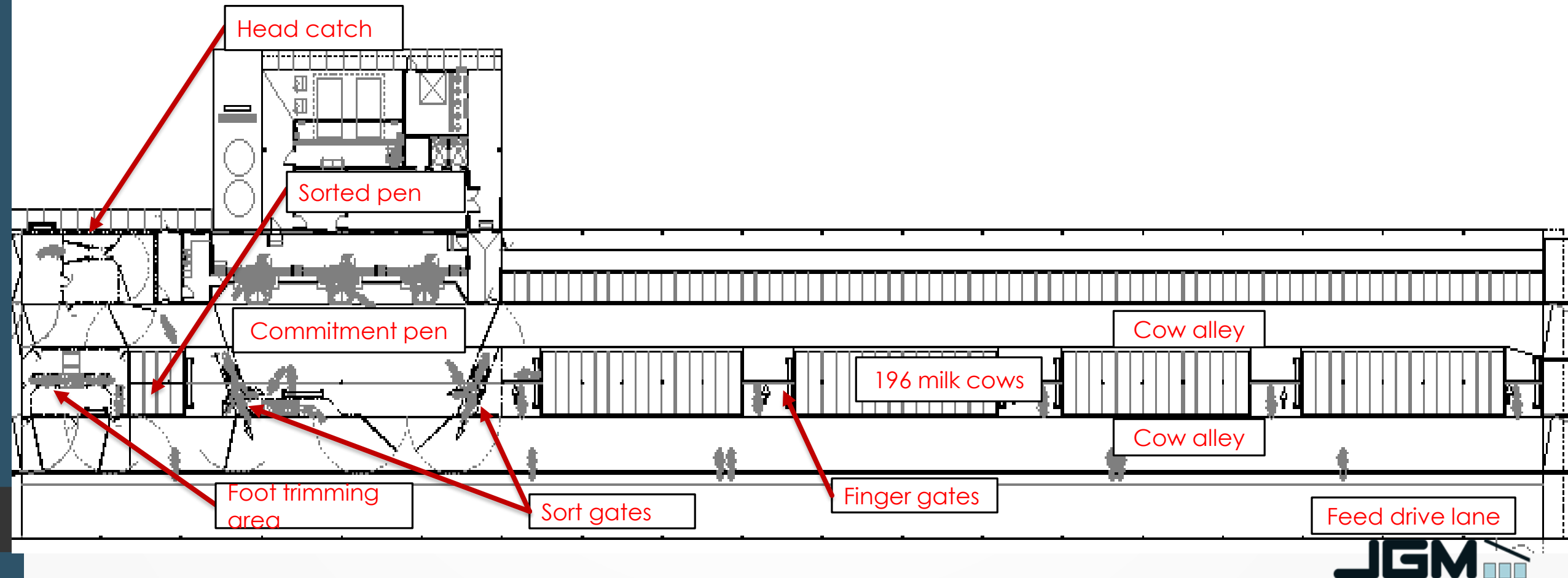




# Design examples

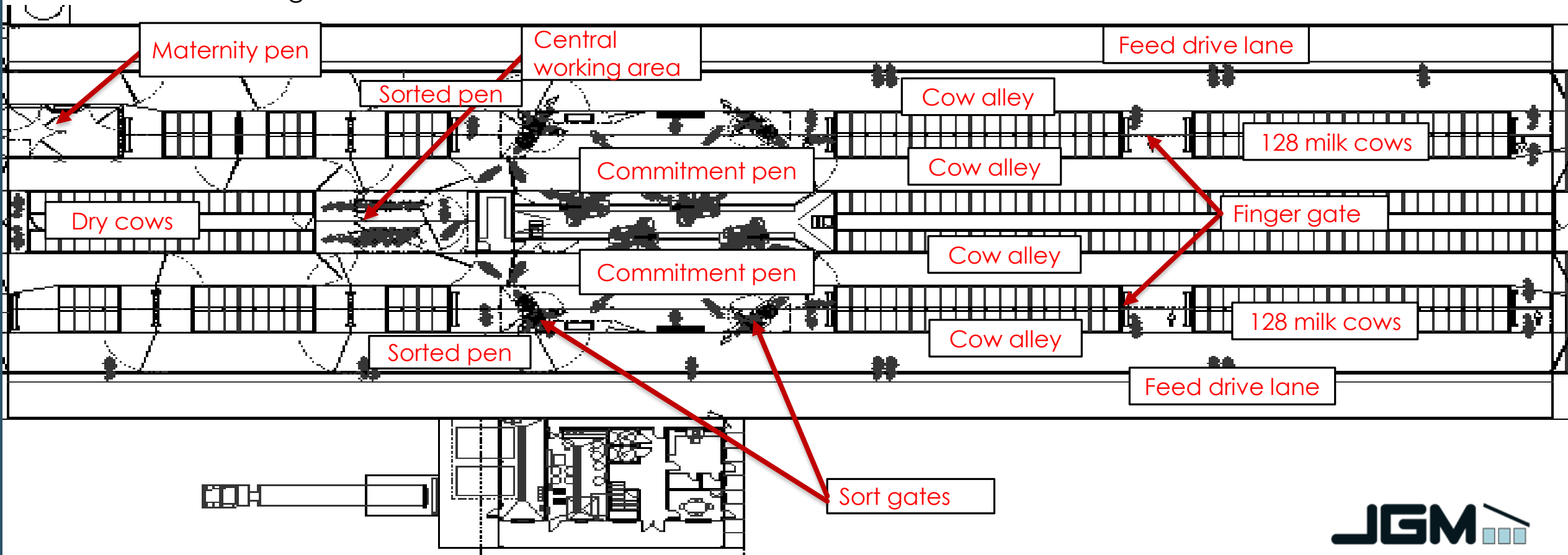
## New Build - **Hybrid Flow:** Hickory Hill Milk, Edgefield, SC

- 3 robots for 196 milking cows
- 2-way pre-selection sort gate
- 3-way dual purpose pre/post selection sort gate
- Commitment pen/finger gates



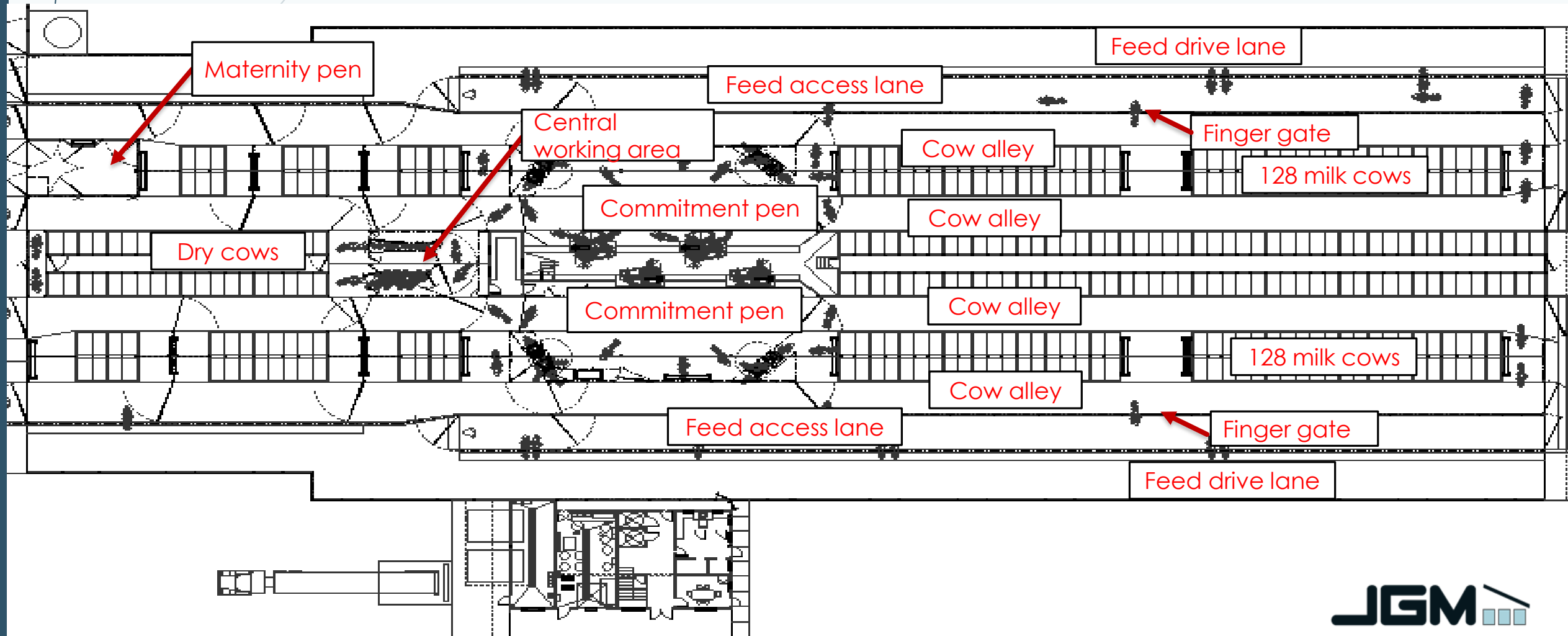
# New Build- Hybrid Flow: Martin Dairy, Bowersville, GA

- 4 robots for 256 milking cows
- (2) outer feed lanes
- Centralized VMS room
- (2) pre-selection gates and (2) dual purpose pre/post selection sort gates
- Far-off and Close-Up dry cow stalls/maternity bedded pack
- Working area with head catch
- (2) 8 stall exception cow pens
- (2) commitment pens



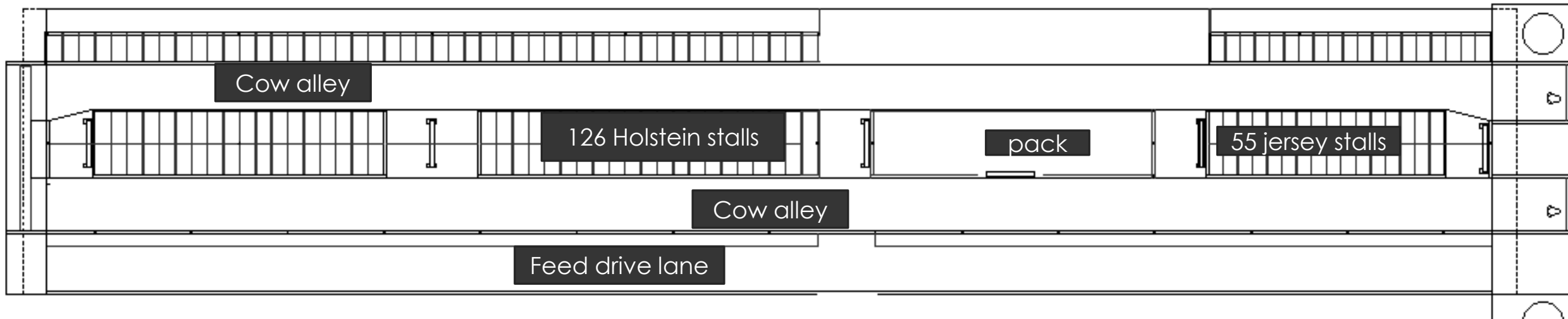
## New Build- Milk First Guided Flow Option: Martin Dairy, Bowersville, GA

- Same as hybrid with addition of (2) outer feed lanes
- Finger gates relocated to feed lane, out of cross overs



## Retrofit - Hybrid Flow: Clemson University-Lamaster Dairy, Clemson, SC

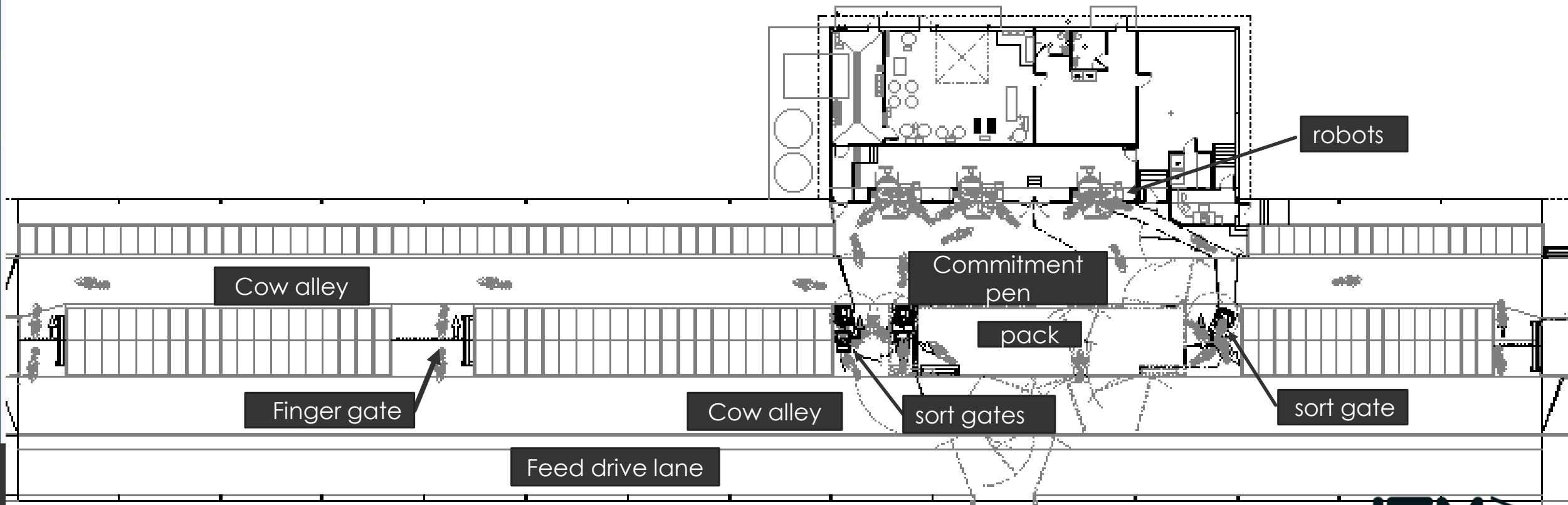
- Existing Facility
  - Bedded pack
  - 126 Holstein cow freestalls
  - 55 Jersey cow freestalls





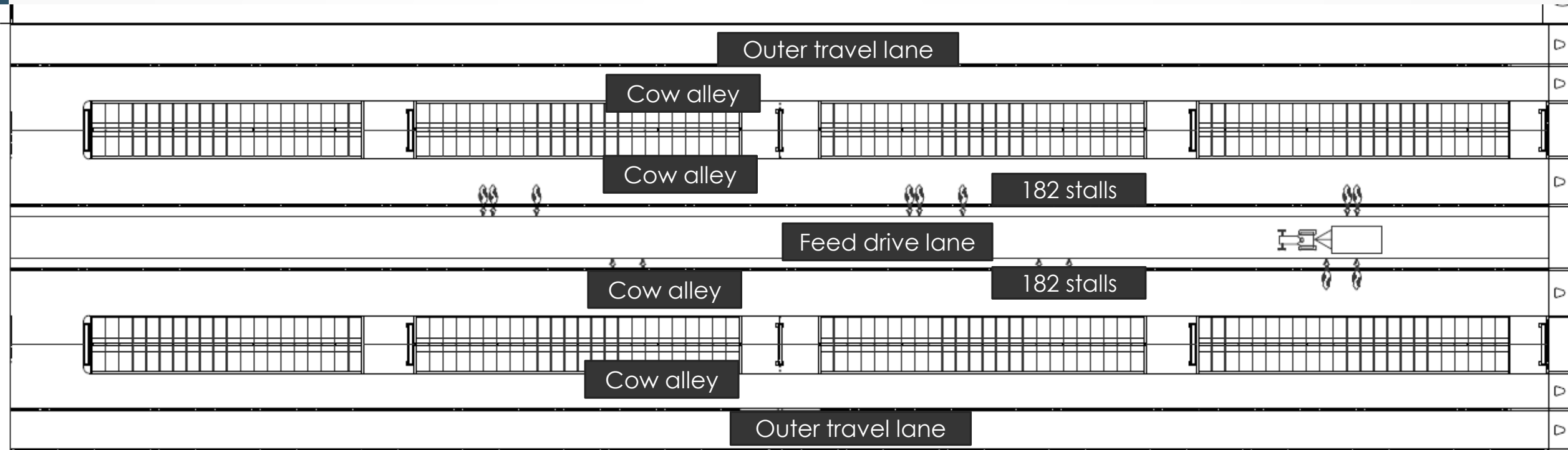
# Retrofit - Hybrid Flow: Clemson University-Lamaster Dairy, Clemson, SC

- Retrofit Portion
  - (2) VMS units for Holsteins
  - (1) VMS unit for Jersey cows
  - Pre and post-selection sort gates for Holsteins
  - (1) dual purpose pre/post selection sort gate for Jerseys



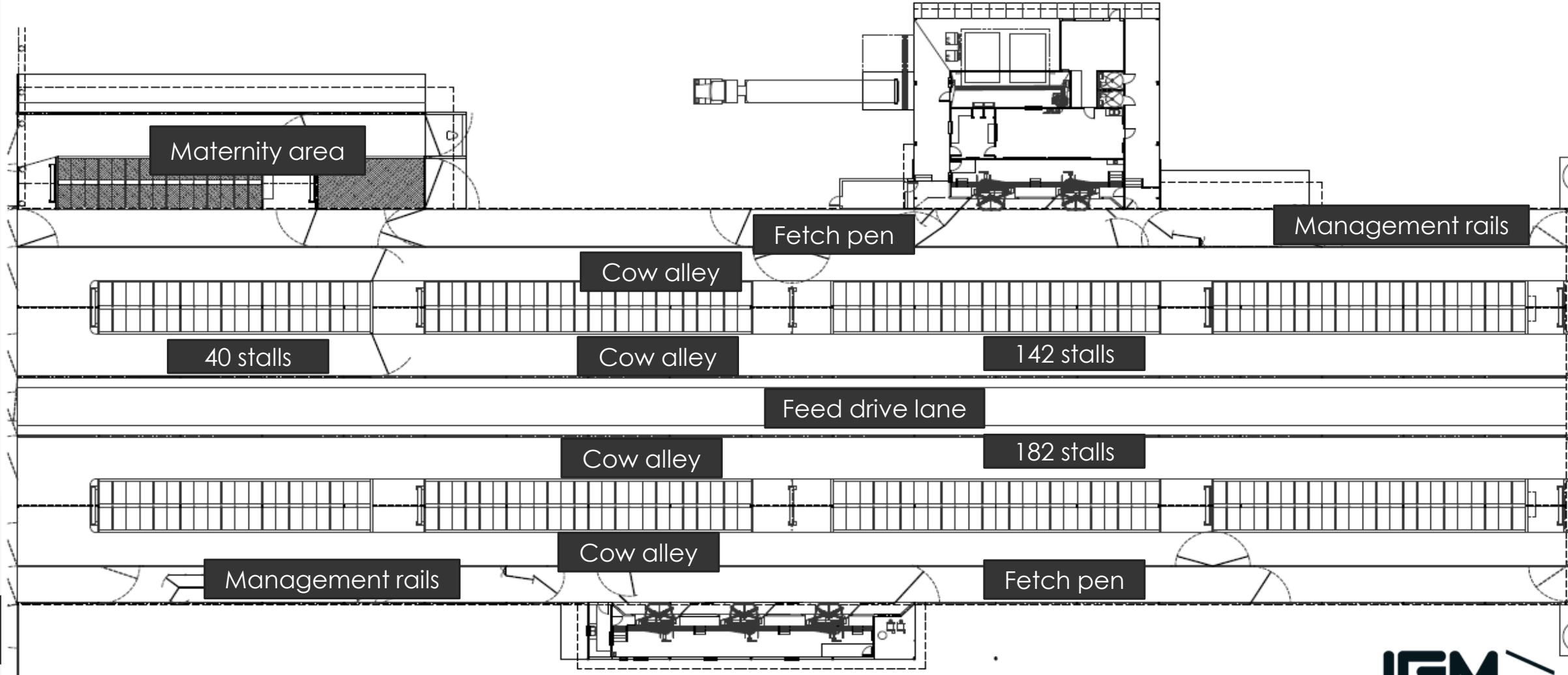
## Retrofit – Free Flow: Hillcrest Farms-Dearing, GA

- Existing Facility
  - 4-row freestall barn with central feed drive
  - 182 stalls/side of barn
  - Outer travel lanes both sides of barn



# Retrofit – Free Flow: Hillcrest Farms-Dearing, GA

- Retrofit Portion-total milk herd of 325
  - (2) VMS units on north side for 142 stalls
  - (3) VMS units on south side for 182 stalls
  - Maternity building with 30 c/u stalls & bedded pack for 5 maternity cows
  - 40 existing stalls for dry cows





# Is Robotic Milking Suitable for you?

- What is your preferred barn design/cow flow design?
- How do you want to manage your herd and people?
- What is your desired return on investment?

# Questions/Comments?

