DESIGNING ASSEMBLY MODIFICATIONS TO REDUCE DISEASE TRANSMISSION.

ASFIPP-PPS-018

Prepared By South West Veterinary Services on behalf of
Swine Health Ontario, a committee of the Ontario Pork Industry Council

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INTRODUCTION

The Canadian pork sector is a major economic driver that contributes over 100,000 direct and indirect jobs and generates $24 billion for the Canadian economy[1]. A single case of African Swine Fever (ASF) in Canada would result in Canada ceasing its pork and live hog exports. According to the October 2024 edition of Canadian Pork Marketing Report[2] by Kevin Grier, the Canadian swine industry exports a total of approximately 6.6 million live hogs annually. This number includes 4. 7 million weaners and feeders, 1.5 million market hogs and 340,000 cull sows and boars.

Disease presents enormous risk to the Canadian agricultural economy. Economic impact measures show that a Foot-and-Mouth Disease (FMD) outbreak today would likely cost the industry $38 - $50 billion while a 4-month trade ban alone would cost $2.75 billion to the economy[3]. However, whether reportable or not, all animal disease outbreaks will result in economic effects measured in hundreds of millions of dollars. Many diseases can be transmitted by bodily secretions (manure, urine, saliva) and Porcine Reproductive and Respiratory Syndrome (PRRS) falls into this category. PRRS - a production-limiting pig disease that is common in central and eastern Canada - is calculated to cost almost $200 million annually[3] and is considered the most significant endemic swine disease in Ontario.

Although cull assembly is an essential aspect of the swine industry, it also poses a disease transmission risk back to Canadian farms. The majority of the 340,000 cull animals that leave Canadian farms per year are transported, assembled and reloaded and trucked to slaughter plants in the United States. Cull pigs from most of Eastern Canada are assembled in yards in Ontario, where they are held and sorted before shipping to slaughter. In addition to cull pigs, Ontario currently exports weaner pigs for finishing and finishing pigs for slaughter to the United States, amounting to upwards of 50,000 pigs leaving Ontario each week. Manitoba also has two large assembly sites which operate in a similar function. This cross-border transport increases the risk of disease movement between the two countries and cross contamination of Canadian facilities upon return of trailers following contact with U.S. packers.

In most cases assembly yards are solid floors and straw bedded making sanitation controls challenging. Animals often stay longer than the incubation periods of many diseases and therefore having actively shedding animals on site is a real risk if a disease enters the facility. In addition to the cull sow market Ontario has a robust BBQ pig market and these animals will leave primary assembly points shedding diseases and further contaminate the transport infrastructure.

This project was developed to assess biosecurity risk points at assembly facilities and design an exemplary facility which would put in place strategies to minimize these risks. The biosecurity improvements recommended were targeted to meet these four primary goals:

- to allow delivery of cull animals at the facility in a biosecure fashion to minimize the risk of contaminating the incoming vehicle with a pathogen from the facility
- to contain any pathogens present within the facility
- to minimize the risk of bringing a new pathogen into Canada through cross-border trade with assembly contact and
- to consider modifications which could allow for cleaning and disinfection of an assembly facility.

SITE ASSESSMENTS LESSONS LEARNED

The first phase of this project included site assessments focused on the inbound, internal holding area (campground) and outbound aspects of the major Ontario and Western Canadian cull assembly sites. During this assessment phase, three assembly sites were visited in Ontario and two assembly sites were visited in Manitoba.

Visit reports were prepared following each of the site assessments and the assembly workgroup met to review site reports and consolidate learnings by stage of assembly. The key points considered critical for each stage of assembly are detailed below. The detailed observations from each visit are summarized in Appendix 1.

GENERAL OPERATIONS AND SITE ACCESS

The workgroup noted the importance of maintaining a swine only focus on the site to avoid issues with potential cross-species disease transmission and the added traffic associated with a more diverse business model. It was also emphasized that an assembly only business model, avoiding sale of goods and alternative services significantly reduces unrelated traffic and avoids inadvertent contamination risks to materials such as bedding which might then be used on farm.

Yard design should include designated inbound and outbound traffic flow. Traffic accessing the inbound chutes should utilize a separate driveway from traffic accessing the outbound chutes. Consideration of yard grade, drainage and yard and driveway material to reduce mud and water accumulation is also critical to reduce contaminating vehicles entering the facility and foot traffic contamination associated with exiting the cab of the truck.

Some sites included a trailer scrape out option – this option has pros and cons to consider associated with convenience for drivers balanced with contamination risks with manure and bedding from multiple sources accumulating on site. It was agreed that if included on site, location relative to inbound chutes and design to reduce foot traffic contamination risks when drivers enter the trailer to scrape out are key. Options discussed to reduce these risks included a concrete wall with a drop-off pit to prevent traffic cross-over or a grain elevator design with a grated platform area sitting over a collection pit.

Further recommendations to reduce foot traffic cross-contamination risks include use of electronic paperwork and consideration of the location if a public bathroom is provided for drivers. And finally, low risk activities such as feed delivery should be located on the inbound side of assembly.

INBOUND

The primary goal of enhanced biosecurity measures at assembly is to prevent transfer of disease from the outbound and campground (short-term internal pig spaces) to the inbound area where pig deliveries occur and risk of disease transfer back out to the industry is greatest. Preventing disease transmission requires consideration of the flow of vehicles, people, animals and equipment and the storage of supplies, feed and deadstock. The development of zones and risk reduction strategies within these zones will be critical to achieving advanced biocontainment.

Inbound is a critical control point for assembly sites as this is the point where further contact back to Canadian farms is most likely and so reducing disease transmission risks is paramount. Upon entry into the site, pigs have not intermingled with pigs inside the campground where potential diseases reside; thus maintaining this separation from the interior of the assembly (campground), and in-coming pigs is the goal. If design and delivery protocols are respected, a truck should be able to arrive and depart without "new" contamination. Designated inbound chutes separated from outbound chutes are very important in reducing this risk equation. The chutes should be well spaced to reduce cross-contamination risks and allow for cleaning of one chute while unloading at another. One design option seen during the site assessment was the separation of the receiving area (inbound) in a building connected to the main assembly providing generous spacing of the inbound chutes and greater isolation from the campground.

Inclusion of 2 to 4 inbound chutes based on traffic volume to the site should allow for cleaning and disinfecting between loads and the opportunity to designate chutes based on disease status. The goal would be to have enough capacity to allow for a firehose or high-volume wash and disinfection after each load is delivered to significantly reduce pathogen load remaining on the chutes. This concept is supported by work done previously by Swine Health Ontario (formerly Ontario Swine Health Advisory Board). The study investigated the effectiveness of this approach to reduce disease transmission risks when Porcine Epidemic Diarrhea virus (PEDv) or Porcine Delta Coronavirus (PDCoV) positive pigs were transported in a trailer which was subsequently washed using a high-volume wash followed by disinfection with Synergize® disinfectant. (see Table 1). The study showed reduction of viral load using this rapid cleaning and disinfection methodology.

Delivery by appointment with details on disease status would support designation of chutes, focused on a select list of diseases such as PED and PDCoV, new PRRS breaks and Senecavirus A (SVA). An additional disease category for elevated but undiagnosed mortality could reduce risks associated with an unknown pathogen. In Ontario, disease status notifications could be linked to the Swine Health Area Regional Control program (SHARC). This could be a win/win for the industry, with scheduling and designated chutes reducing risks for producers while allowing producers facing a disease challenge to handle positive flows in a safe and effective manner.

Construction of the inbound area should include a roof extension or overhead protection for chutes and back-end of trailer to assist in keeping this area clean and dry. Construction materials for the chutes and surrounding area should be easy to wash and disinfect with solid or slatted concrete with in-floor heat to facilitate drying. A slatted walkway for drivers from the cab to the back of the trailer would allow washing and disinfection of this area and reduce foot traffic contact with standing water or debris. A trucker platform with stairs to facilitate entry into trailer (under roof cover), with consideration for adding a boot wash at platforms as a final disinfect before entering the trailer would also reduce foot traffic contamination risks.

To facilitate keeping the inbound area clean and dry, consideration of the slope and drainage of the area will be important, with addition of an underground water storage pit with grates an option to manage used wash water.

Developing a protocol to deal with any animals that die in transit and require dead animal removal from trailers is also important. A disinfected chain or cable and winch at each chute may be an option to resolve dead on arrival challenges without contaminating the trailer via entry of assembly staff onto the trailer.

TABLE 1. PED AND PDCOV PCR RESULTS - TRAILERS MOVED KNOWN INFECTED PIGS FOLLOWED BY FIREHOSE WASH AND DISINFECTION WITH SYNERGIZE

PEDV CT VALUES

	PREWASH		CLEAN TRAILER SAMPLES			
Date	#1 PEDV	#2PEDV	#1 PEDV	#2 PEDV	#3 PEDV	#4 PEDV
19-Nov	30.84	27.82	ND	ND	ND	ND
12-Jan	ND	ND	ND	ND	ND	ND
13-Jan	31.54	28.96	ND	ND	ND	ND
15-Jan	27.32	28.92	ND	ND	ND	ND
21-Jan	26.58	27.31	ND	ND	37.37	36.53
29-Jan	31.97	30.09	32.83	ND	ND	ND

PDCoV CT Values

	PREWASH		CLEAN TRAILER SAMPLES			
Date	#1 PDCov	#2PDCoV	#1 PDCoV	#2 PDCoV	#3 PDCoV	# 4PDCoV
19-Nov	33.89	31.42	ND	ND	ND	ND
12-Jan	38.55	37.49	ND	ND	ND	ND
13-Jan	28.96	36.15	ND	ND	ND	ND
15-Jan	28.92	26.96	ND	ND	ND	ND
21-Jan	27.31	29.18	ND	ND	ND	39.36
29-Jan	30.09	31.81	34.00	ND	ND	ND

#1: Nose deck and bottom area; #2: Middle deck near swing gate; #3: Main ramp and back door area; #4: Lower ramp and gate to bottom deck; ND: Not Detected

CAMPGROUND

The campground is the area where pigs will be held until assembled for shipment. They may remain in this area for 1 to 10 days. Because of the mixing of animals, the hold time and the potential connection to the outbound area, the campground should be considered contaminated. As such, separation from the inbound area is the significant biosecurity consideration and many of the other considerations relate to animal welfare and functionality of the space. At all assembly sites assessed, it was deemed important to include a rest pen near the inbound chutes for compromised animals, with consideration

for access for deadstock removal equipment if needed. Similarly, the width and construction of the alleyways throughout the facility should accommodate a skid steer or alternative removal equipment.

Inclusion of slatted areas in the inbound area and the sorting area would facilitate effective cleaning and disinfection. Addition of one-way gates would help to prevent animals returning from the campground to the inbound area to further reduce the risk of contaminating trailers which may return to farm.

Flooring considerations within the campground are a balance between slats which would optimize ease of cleaning and disinfection and solid floors with bedding which can improve animal welfare for compromised animals, providing warmth and comfort. It could be a consideration to ensure hallways and sort area which are higher traffic areas are easily cleaned and disinfected and inclusion of solid heated or bedded floors for sections of the main campground where animals would have a time to rest at assembly.

Staff with campground contact should not enter trailers in either the inbound or outbound areas – no inbound trailers to reduce the risk of contaminating those trailers with diseases endemic to the campground and no outbound trailers to avoid bringing any potential new diseases into the campground. Similarly, drivers from both areas should not enter the campground.

OUTBOUND

The outbound area has the highest amount of contact with trucks returning from the U.S. often returning directly to assembly to pick up the next load. Currently, the disease status of these trucks is highly variable. They may be just scraped and so potentially containing infective materials, or they may be washed and disinfected. The workgroup recommends a requirement for high-volume wash and disinfection of all trailers returning from the U.S. It could also be an option to investigate alternatives such as scrape and bake technology to reduce man hours associated with washing and disinfection.

Deadstock holding and pick-up should be located on the outbound side of the assembly with consideration of traffic flow to minimize cross-contamination from vehicles collecting deadstock for rendering or alternative methods of carcass management.

ASSEMBLY DESIGN RECOMMENDATIONS

This project aims to provide biosecurity recommendations that would, if implemented, improve the Canadian swine industry's level of biosecurity without sacrificing animal welfare or facility functionality. This assembly design from a bird's eye view aims to minimize disease spread potential by separating the higher risk points of contact from those of lower risk (Figure 1). This design provides options to achieve the goal of biocontainment, however, implementation will depend on the conditions of the site and there are certainly many ways to achieve the goal. This facility has been designed to withstand the challenging conditions associated with handling large animals and vehicles, including heavy duty slats and gates. All staff areas and accessory rooms are designed with drains and impermeable flooring to allow easy and effective washing and disinfection.

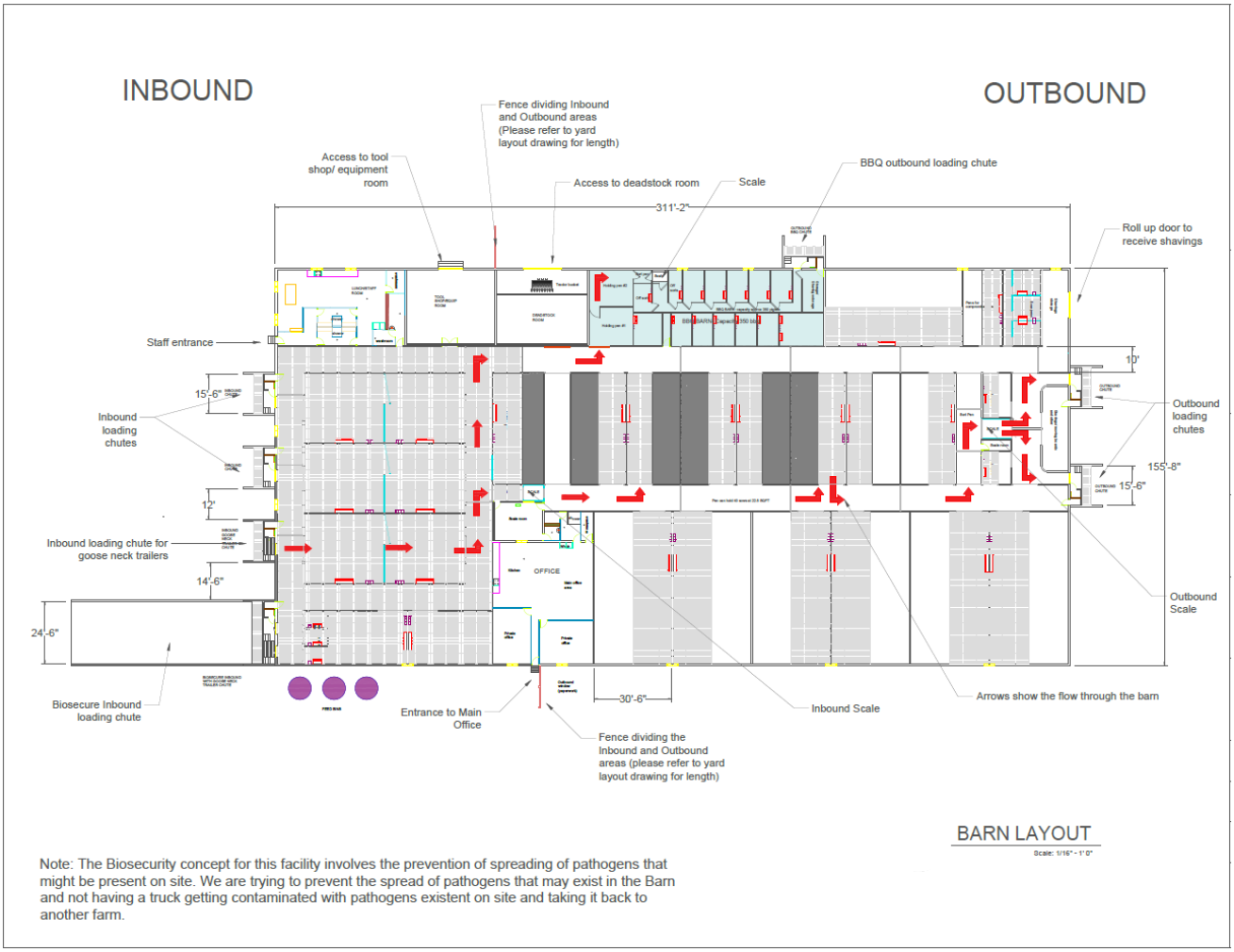
Integral to the purpose of assembly yards, is the need to sort and mix animals. This means that there is little internal biosecurity of merit. The focus then is how to prevent disease from leaving the assembly site through foot traffic from inside the facility onto to the chutes in inbound areas. This is also why it's so important to offer an inbound chute that services only inbound traffic of know health status that meets a certain minimum standard. Unknown disease status and diseased animals should be received in the common chutes.

The focus of the design phase of the project was to maximize containment of any diseases which may infect the assembly site based on information gathered from the site assessments, consultation and biosecurity principles. It is inevitable that an assembly facility, by the very nature of its purpose, will become contaminated with diseases present on the farms who supply the animals to the assembly. Assembly facilities serve an important role in recovering value for small groups of animals who are of diverse size and age. This also means that an assembly inevitably poses a biosecurity risk to every farm in its complex ecosystem of supply farms because the health status of each independent farm will be threatened by the collective disease threat of the assembly facility.

For example, a farm may be experiencing an outbreak of PRRS which is causing significant losses and simultaneously be using the assembly as a market access for cull sows. At the same time, the assembly may be contaminated with PED, another significantly impactful disease. Should biocontainment fail at the assembly site, the farm which is already struggling with PRRS could become infected with PED due to contact with the assembly facility and then experience loss upon loss. To avoid this scenario, every effort needs to be made to achieve biocontainment in assembly facilities, both by facility design and practice.

It becomes obvious in the above example, why biocontainment at assembly is a constant priority in normal daily swine industry activity. What is more, in the event of a new or foreign animal disease introduction into the swine population, biocontainment in swine assembly facilities would be critical to the prevention of rapid spread of the disease throughout the many connected farms.

FIGURE 1. ASSEMBLY LAYOUT



SITE LAYOUT

This site was designed to allow for ease of navigation, separation of risk areas and reduced risk of waste management. The site covers approximately 17 acres and has capacity for approximately 1,200 sows and was design to meet or exceed animal welfare requirements as specified by the Code of Practice for the Care and Handling of Pigs[4].

The facility was designed on a corner lot with access to roadways from two sides. A corner lot allows for driveways for inbound chute traffic separated from outbound chute traffic through inclusion of a minimum of 2 driveways. In this design (Figure 2), three driveways are illustrated, one for the outbound chute traffic, one for “regular” inbound traffic and a third for entrance and exit for the biosecure inbound chute traffic. This separation of traffic flow reduces potential contamination to vehicles that will return to farm.

Mud, standing water and organic matter can be reservoirs of infective agents and contaminate vehicles and foot traffic. A large yard area with gravel to reduce standing water and mud has been included to allow space for trailers of all sizes to negotiate.

Separating the area of the yard designated as inbound with a fence or cement barriers from the area designated for outbound loads further prevents traffic cross-over and reduces risks to vehicles which may return to farms. Although consultative feedback suggested that a scrape out area is an important consideration for many drivers – scrape out areas are a biosecurity risk and drivers using an assembly site scrape out should be informed that they are assuming some risk for contaminating the trailer. In order to reduce the contamination risk, we recommend that:

- the scrape out area should be on a cement pad to improve cleanability
- trucks utilizing the designated biosecure chute should not use an assembly site scrape out
- for others, scrape out for inbound loads will be located on the inbound side of the yard, removed from the biosecure chute and low risk activities such as feed delivery
- The manure and shavings from the inbound scrape out should be regularly transferred over the divider to the outbound yard for collection and removal.

FIGURE 2. YARD LAYOUT

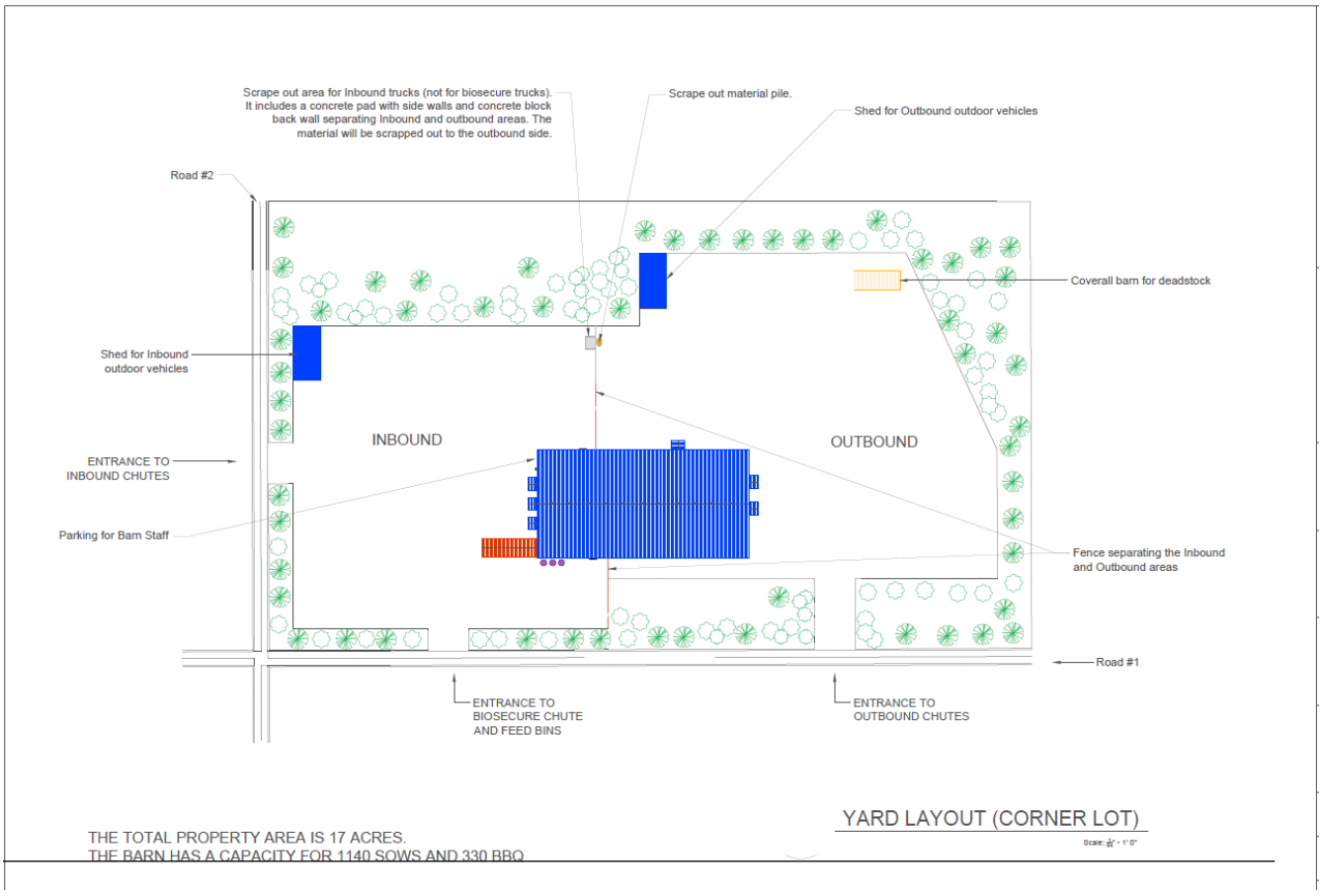
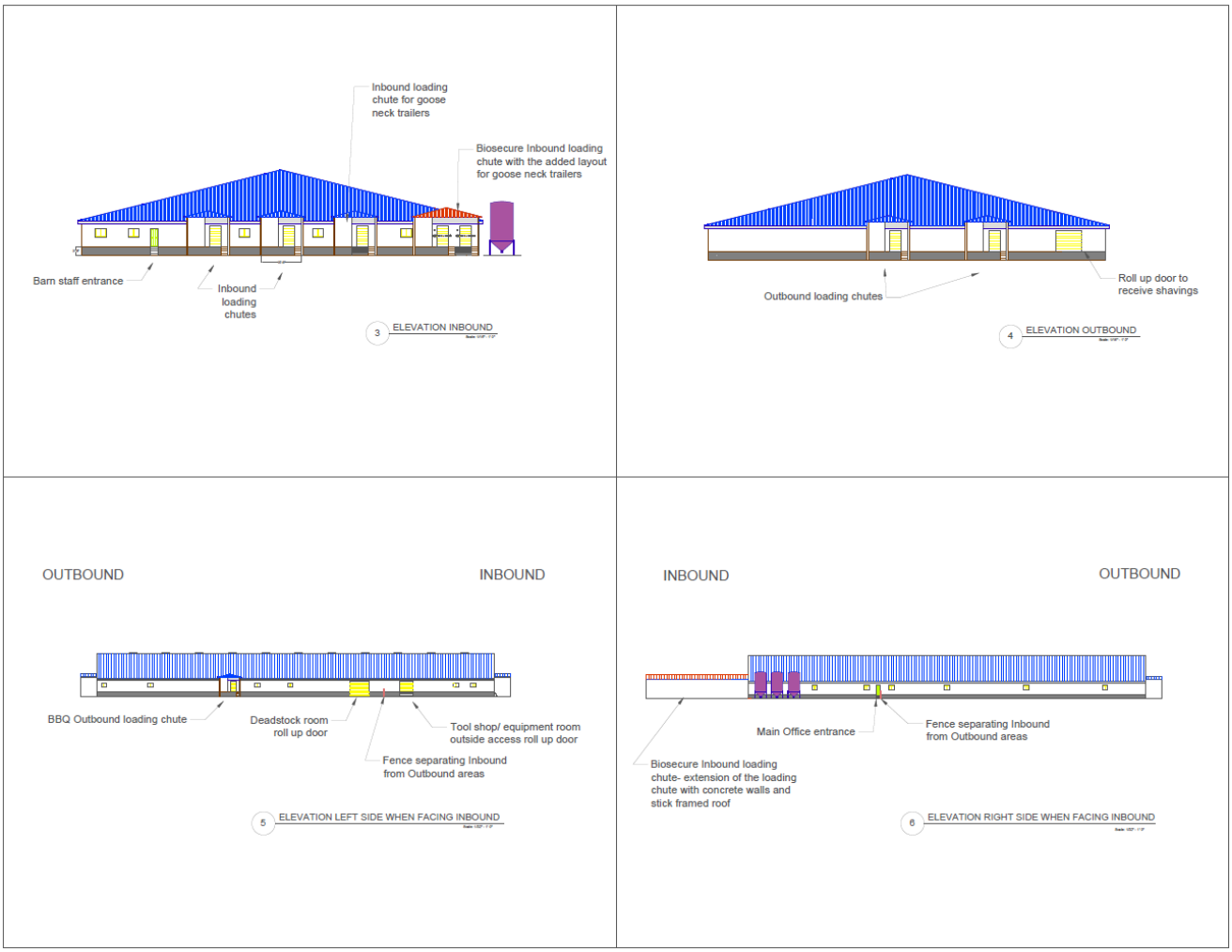


FIGURE 3. EXTERIOR VIEWS OF THE ASSEMBLY



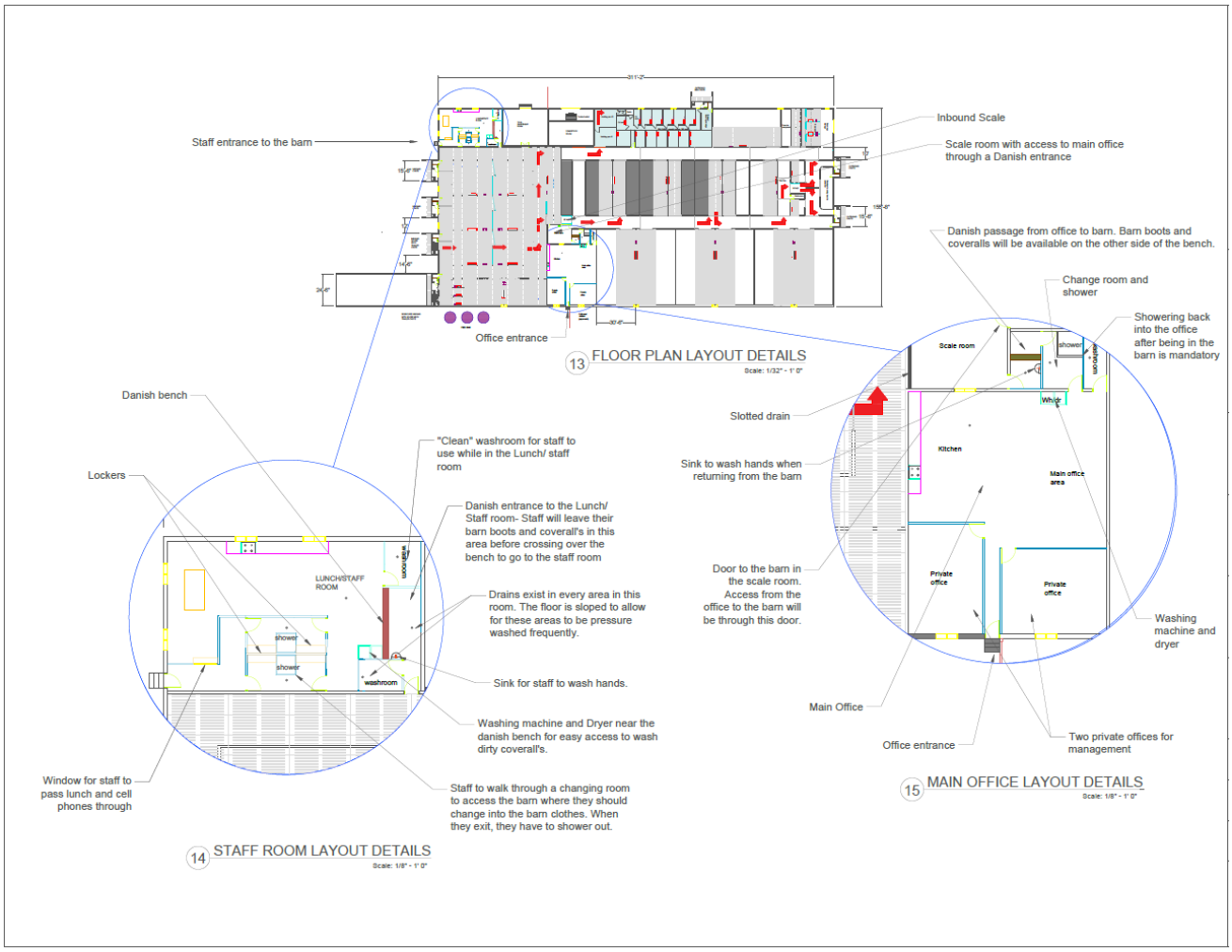
ENTRANCES AND OFFICE AREAS

At first review of the drawings (Figures 4, 5 and 6), the people entrances appear similar to any modern swine facility. However, appearance is where the similarities end. The emphasis on people movement in the assembly facility is biocontainment, or keeping infective agents within the facility, whereas; swine facilities normally focus on exclusion of pathogens. The assembly facility holds animals of all health statuses of the herds that the animals originate from. In addition, transport vehicles utilizing the outbound chutes are of unknown biohazard status, but have been in contact with assemblies and plants in the U.S. Thus, outbound vehicles are at risk of contaminating the assembly site and its inventory. For these reasons, the interior of the assembly is considered to be contaminated with infective agents.

Since fomites such as footwear and clothing can be carriers of diseases, entrances and office areas should be designed to limit disease transmission. The considerations in planning people foot traffic include:

1. Barn staff
2. Office staff
3. Owners and Management
4. Visitors

FIGURE 4. ENTRANCES AND OFFICE AREAS

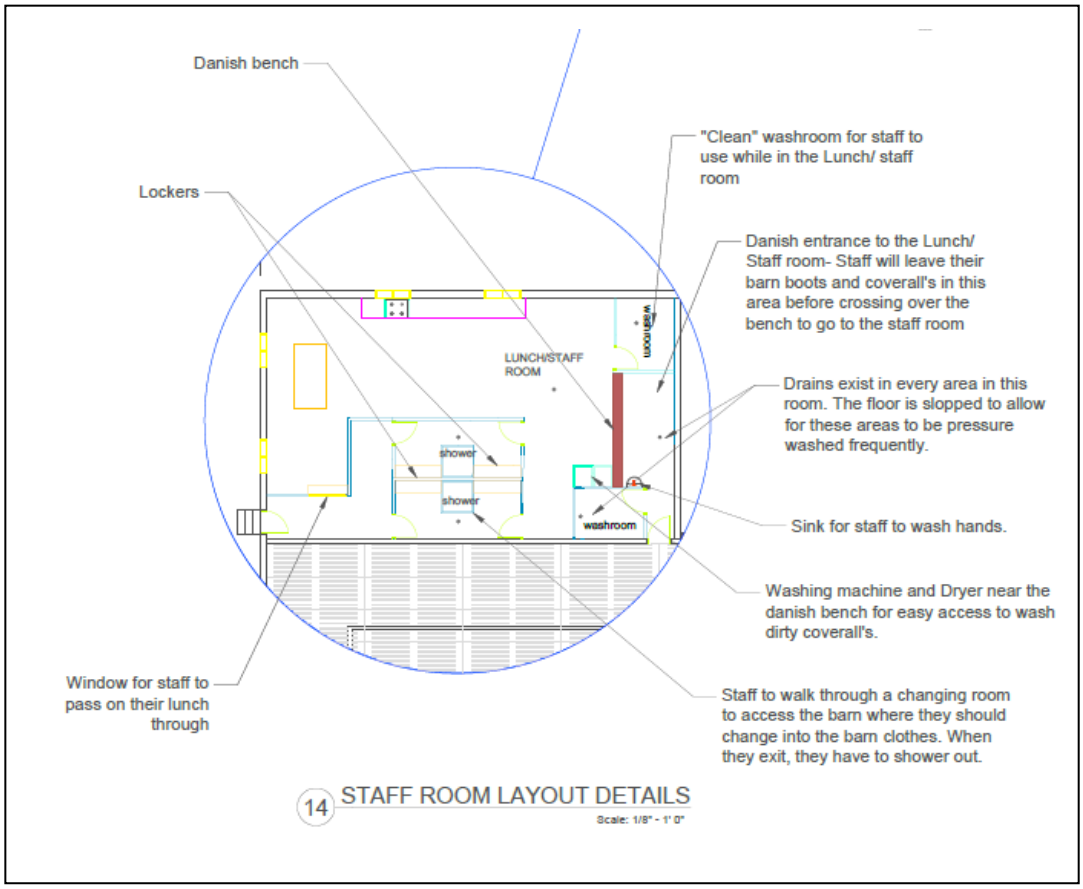


BARN STAFF

The barn staff park their vehicles and enter though a designated door on the inbound side of the site (Figure 3 and 4). Once inside, there is a window, through which staff can place lunches and personal property (phones). They then proceed to the clean washroom and shower area, where they leave their street clothes in a locker, and change to assembly clothing. Showering in is not required to enter the facility as again, the goal is biocontainment, not exclusion. However, showering out is highly recommended and could be deemed mandatory if a disease outbreak required elevated biocontainment actions. Once in the lunchroom area, there are kitchen facilities and a washroom as well as laundry facilities for easy access for washing barn clothing. All areas are finished with impermeable flooring and equipped with drains to allow for easy washing and disinfection.

To enter the assembly campground, there is an area with designated barn boots and clothing (usually coveralls), to be worn within the facility. This area is designed like a Danish entry and when exiting the campground staff will remove and leave their coveralls, change their footwear and wash their hands prior to re-entering the lunch area. There is also access to a washroom that barn staff can use without entering the lunch area.

FIGURE 5. DETAILS OF STAFF ENTRANCE AND LUNCHROOM



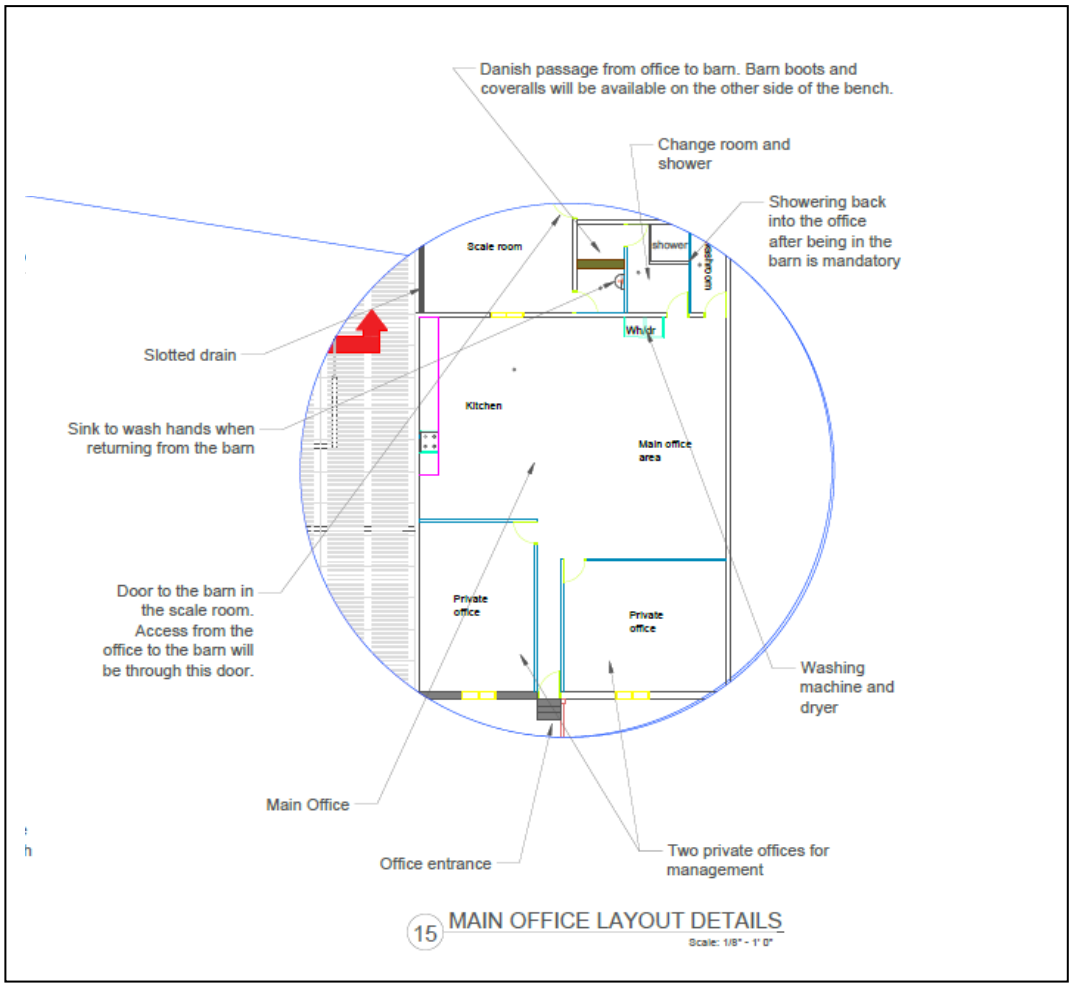
OFFICE STAFF, MANAGEMENT AND VISITORS

The vehicle parking and entrance for the office staff, owners and management, and visitors is in a separate area of the facility on the inbound side (Figure 4). This area is designated as “clean”, in that staff here do not regularly enter the assembly campground. The office area overlooks the scale area of the campground.

It is assumed that from time to time, management, staff or visitors will be required to enter the campground. To minimize this requirement, there is a window to allow communication between barn staff and office staff (Figure 6). Should office staff, management or visitors need to enter the campground, there is a change room with a Danish entry to the barn area, as well as a shower for use on exiting the campground to prevent contamination of the office area.

The facility has private offices in this area to accommodate meetings and business discussions without the need for visitors to enter into the assembly areas of higher disease transmission risks.

FIGURE 6. DETAILS OF THE MAIN OFFICE AND SCALE ROOM



WEIGHING AND SORTING

The scale and sort areas are designed for efficient, safe animal flow, with gating assuring one way flow of animals. Because the sort and weigh area is where value is assigned to the client's animals and incoming weights are used to sort pigs into specific markets, this area becomes the nerve centre of the facility. Designing for efficient proximity to the office from this area drives the office layout in this design (Figure 6). Roller doors and flexible gating in this area will also assist in assuring one-way pig flow as the animals move into the assembly facility.

ACCESSORY ROOMS

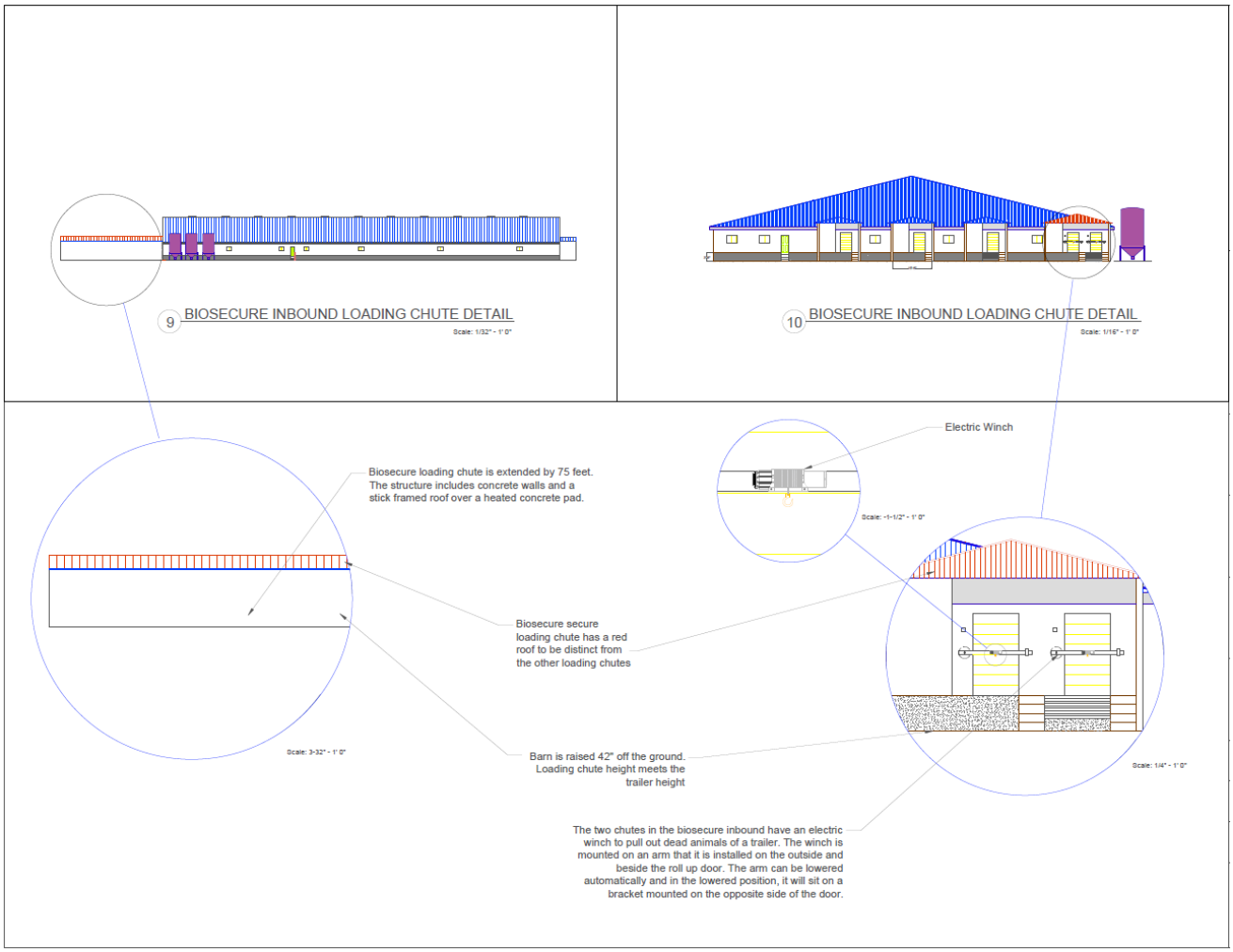
Accessory rooms such as equipment shop, deadstock and shaving storage should be designed to allow easy maneuverability and include drains for ease of washing and disinfecting these areas.

INBOUND CHUTES AND DELIVERY CONSIDERATIONS

In this design (Figures 7, 8 and 9), three inbound chutes are designated for regular deliveries including one designed to accommodate a gooseneck trailer. All chutes include a drainage area at the back of the chute where the trailer will unload. This area includes a water holding tank which can be pumped out into the manure pit under the barn. The holding tank is covered with heavy duty cattle slats to allow

water and some organic material to pass through while withstanding wear and tear from trailers. The intention of including a drainage area near the chutes is to eliminate standing water and facilitate washing and disinfection of the chutes.

FIGURE 7. EXTERIOR VIEWS OF THE INBOUND LOADING CHUTES

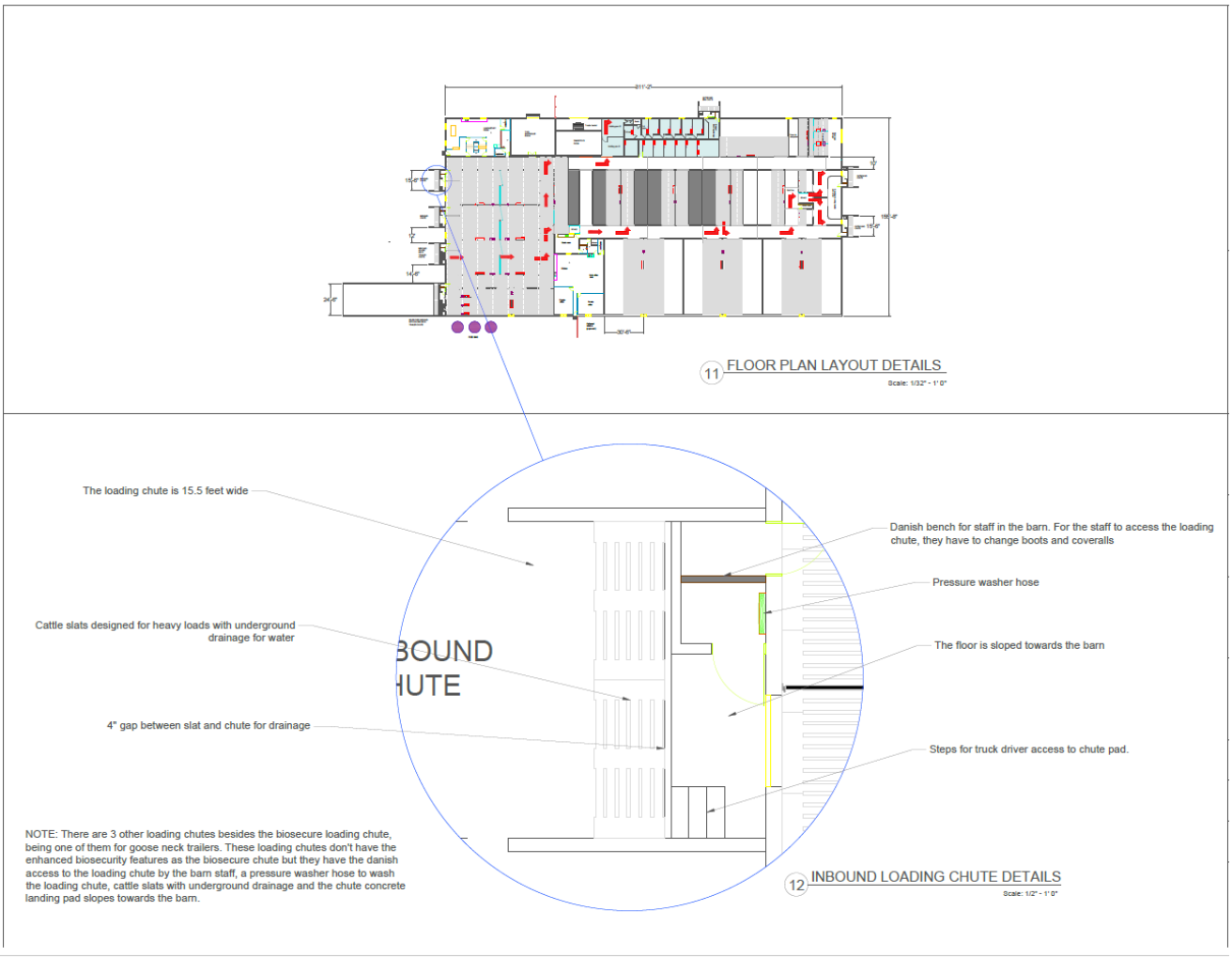


Steps with a Danish entry option for the driver to enter the trailer are included at all chutes for safety, ease of access and biosecurity considerations. To reduce the risk of transferring infective agents from inside the assembly to the inbound chutes area, unloading of the animals is expected to be done by the drivers. Assembly staff have a second Danish entry separating the inside of the assembly from the chutes (Figure 8). The door between the assembly building and the chute is a barrier that staff should not cross when the chute is in use. However, barn staff do have the ability to enter the loading area with a change of boots at the Danish entrance that separates the assembly from the loading chutes. This is primarily intended for them to clean and disinfect the loading area after the transport vehicle is gone.

It will also be important to develop a protocol to deal with any animals that may die in transit, requiring dead animal removal from trailers upon arrival at the assembly site. A disinfected chain or cable and winch at each chute may be an option to resolve this challenge without contaminating the trailer via entry of assembly staff onto the trailer. The use of winches at each chute prevents trailers from

travelling to other areas of the yard that may be infectious and prevents contaminated assembly equipment from entering the trailer. The animal can then be moved from the inbound area to the deadstock room using a skid steer or Hercules unit. If a dead animal must be removed from the trailer in the inbound yard area, the animal will be transferred over the separating fence into the outbound area and placed in the deadstock holding bin.

FIGURE 8. INBOUND CHUTE DETAILS

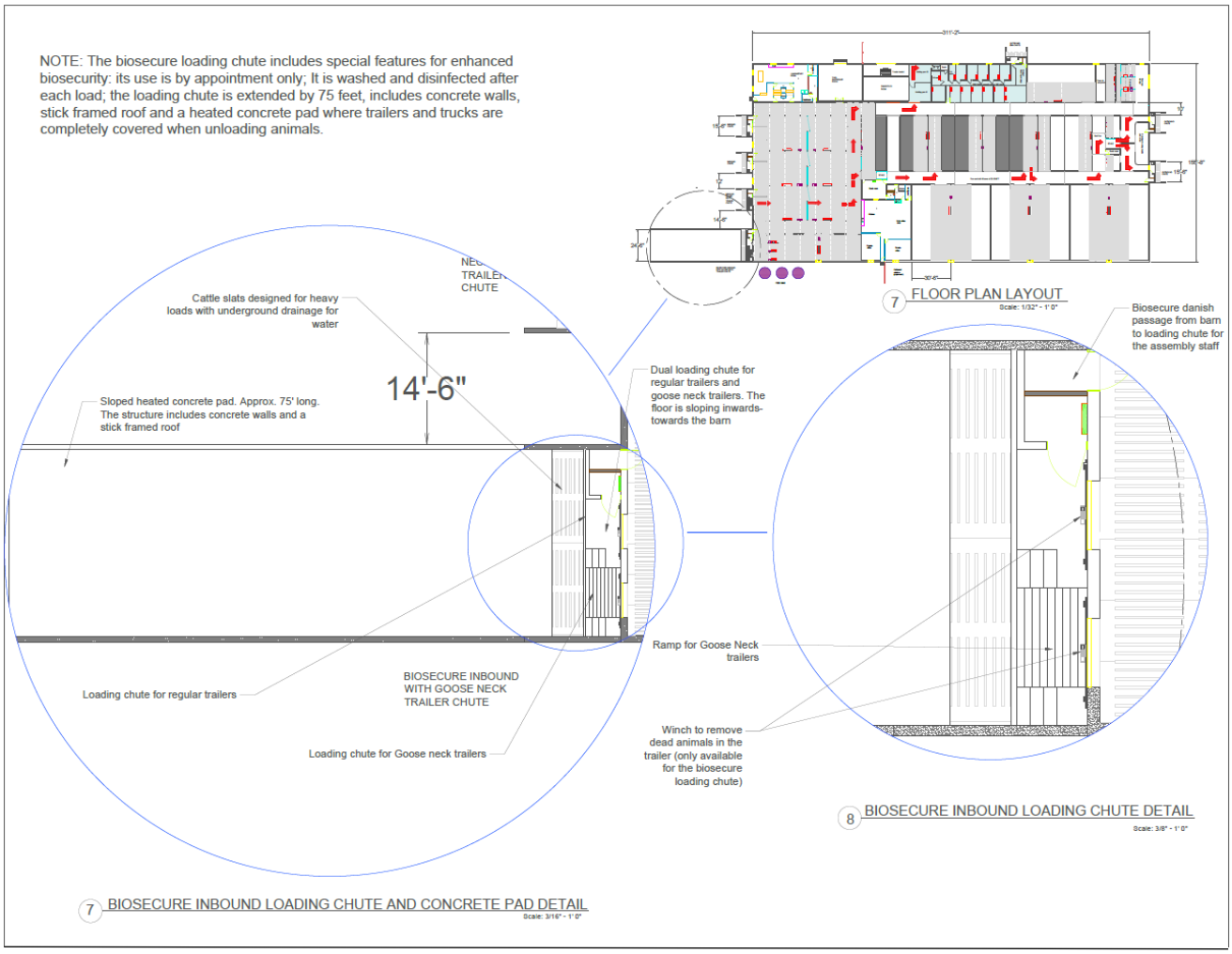


An additional chute is designated for by appointment for biosecure deliveries from farms with known health status (i.e. negative disease status). The goal of this chute is to make every effort to ensure a delivery to the assembly does not result in taking a pathogen back to the farm via the trailer. Disease status notifications could be linked to the Swine Health Area Regional Control program (SHARC) in Ontario.

The biosecure chute is 30 feet wide to allow for access for a regular trailer or a gooseneck trailer (Figure 9). Construction of this inbound area includes a roof extension, hoop cover or other overhead protection for chutes and trailers to assist in keeping this area clean and dry. Construction materials for the chutes and surrounding area should be easy to wash and disinfect with solid or slatted concrete with in-floor

heat to facilitate drying. This chute and covered area would be scraped, washed and disinfected after every load delivered. To facilitate keeping this area clean and dry, consideration of the slope and drainage of the area will be important, with addition of the aforementioned underground water storage tank with grates to manage used wash water.

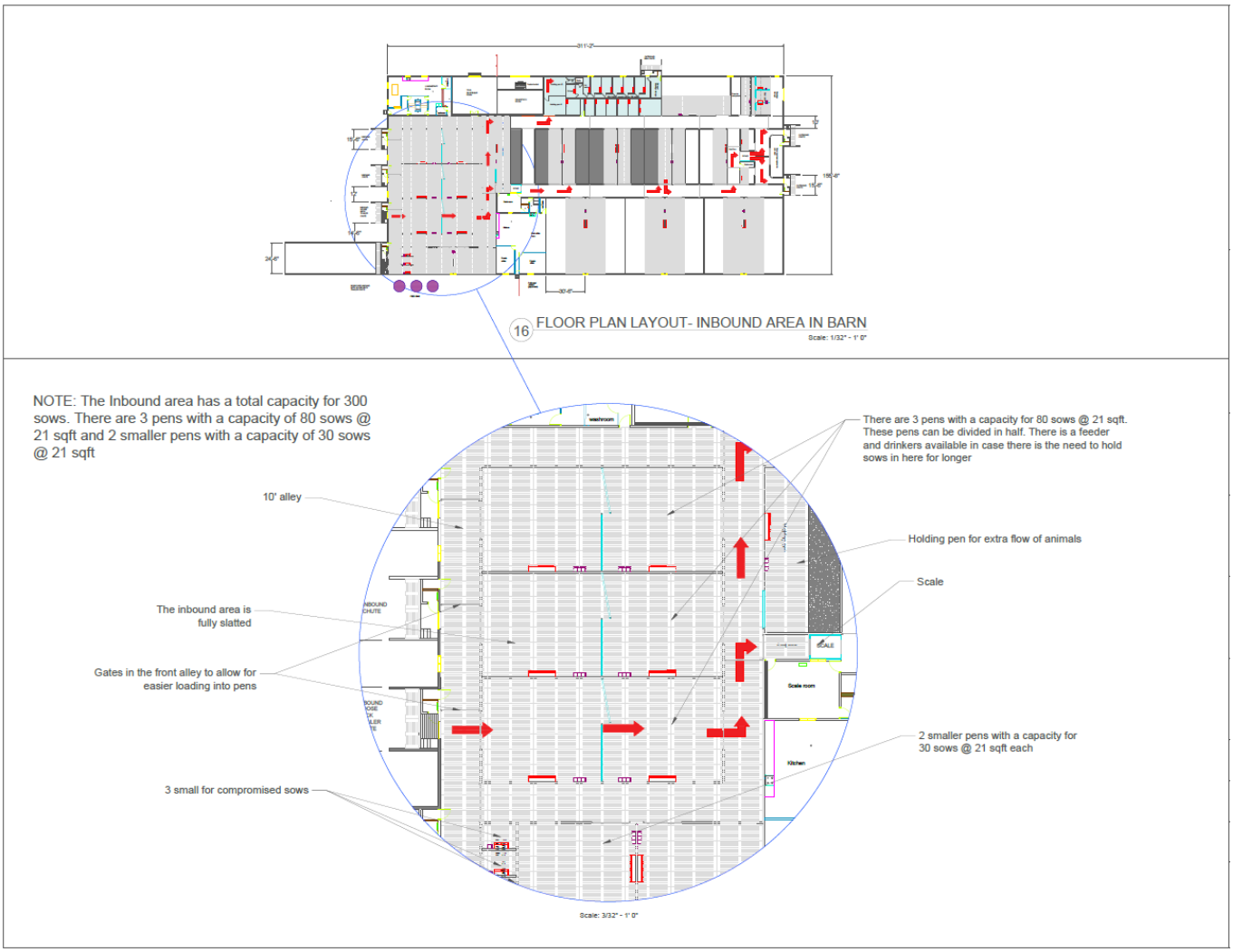
FIGURE 9. DETAILS OF BIOSECURE INBOUND CHUTE



RECEIVING

This receiving area design includes small pens and ample aisle space in the inbound end of the barn to handle animals who need immediate rest following transport (Figure 10). Primary inbound area pens are design to accommodate groups of all sizes depending on lot configuration upon delivery. Gates can be closed to create smaller pens or opened to accommodate whole truckloads in one pen. Lot configuration and flexibility is paramount here because valuation of the animals happens at the sort and scale area. Lot integrity must be maintained until a value can be attributed to the lot and assigned to the client who owns those animals. Roll doors and flexible gates in this area will ensure one-way flow of pigs as they enter the facility.

FIGURE 10. DETAILS OF THE RECEIVING AREA



PRIMARY HOUSING - THE CAMPGROUND

The campground area needs to provide appropriate housing accommodations for swine of all ages and fitness levels that the assembly will house. The welfare of the stock is a key consideration in the campground, just as it is in every other area of the facility. Here in the campground, we expect the animals to experience “normal” life, similar to their respective home farms. They need to have easy and free access to feed, water, and a comfortable resting area. Minimizing social stress and providing abundant resources to the animals provides the best opportunity for a healthy, well conditioned animal at the time of loading for transport.

The campground penning needs to be constructed using heavy gauge materials and designed as indestructibly as possible. Damaged penning is inefficient to operate and presents an unacceptable hazard to the animals. Assembly campgrounds need to be able to withstand daily sow movement and routine wear from equipment. Concrete and heavy gauge steel are proven material solutions.

The animals should have ad lib access to feed and water. The campground may house the same animals for up to 10 days. Oversized feeders that can store enough feed for many hours at a time provides constant feed access in the campground. This is in keeping with industry standards for raising market hogs. The actual size of the feeders would be dependent on the maximum number of animals

that would be housed in the particular pen. Water access needs to be constant. There are several appropriate ways of achieving continuous water access. There is no need for novelty here, but the option selected to achieve constant water access needs to account for the conditions of an assembly barn that differ from industry standard swine housing conditions. Namely, a traditional water nipple secured to the wall is a poor choice where animals are moved in and out of the pen regularly and social groups are routinely being established in these spaces. Wall mounted water nipples protrude out from the wall and present a potential contusion hazard for sows competing for social hierarchy and who are moving in and out of these pens on a regular basis. Water troughs or concrete housed water bowels with proper drain holes, are proven options. Water bowls need to be designed to easily drain for effective cleaning.

The campground pens need to provide comfortable resting areas for animals in all body conditions fit for transport. Comfort in this case needs to include generous floor space that is clean and dry. It also means providing temperatures within comfortable ranges for various ages and body conditions.

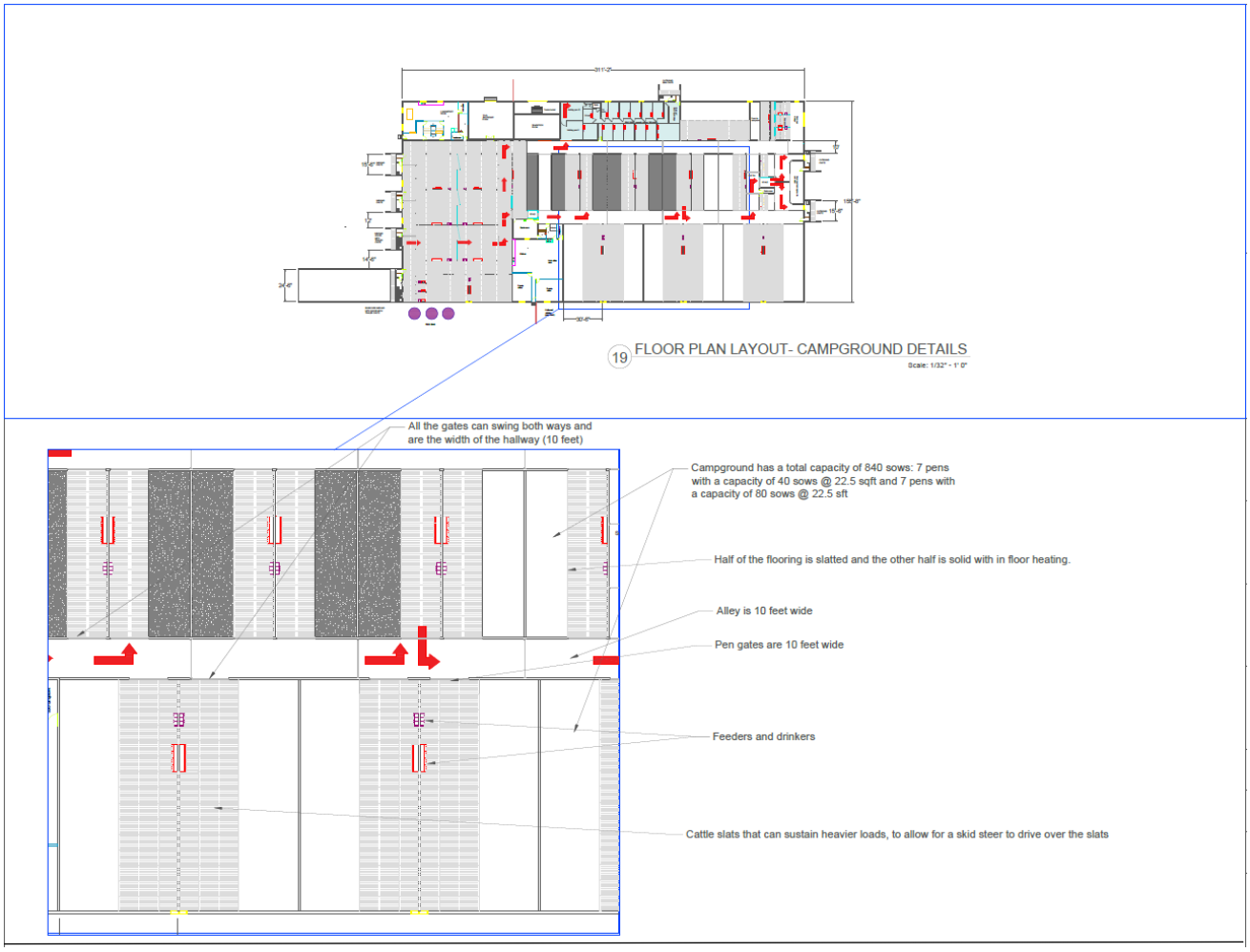
Observations from site visits of currently operational swine assembly barns across Canada illuminated the apparent value of using straw bedding in the campground. Straw is no longer commonly used in most commercial swine farms in Canada but in assembly barns, its use remains prominent. Deep straw bedding provides the distinct advantage of allowing the animal to retain body heat in its “nest” area. This allows for animal comfort at a broader range of ambient temperatures. Straw bedding implies solid flooring which in combination with the bedding, provides good footing and limits the risk of injury during travel throughout the facility.

Straw bedding creates some biosecurity challenges that should not be overlooked despite its benefits. Bedding creates a need for daily manure handling/removal. Containing diseases within the campground through biocontainment efforts becomes more difficult when large quantities of manure need to be removed from the facility. More organic matter generally present in pens results in more effort required prior to washing and disinfection. Rest areas with straw bedding need regular cleaning, if left without fresh bedding, they quickly become sources of ammonia and dirty conditions. The daily demand for cleaning increases the labour required to effectively operate the facility and makes the facility more vulnerable to labor shortage.

We believe a swine assembly facility needs to be designed with efficient cleaning built into the infrastructure. Biocontainment relies heavily on a clean environment to minimize the risk of contamination outside the containment area. In this case the containment area is the assembly facility. A design combining slatted flooring for excellent drainage and a solid floor lying area with in-floor heating would capture animal comfort and the microenvironment benefits of straw without the bio-containment, labor, and air quality issues associated with straw bedded housing designs (Figure 11).

Slatted flooring in every pen would allow the facility to be washed on a rotating schedule by pen as they are emptied or washed out entirely during a complete site empty and clean event. In these cases, dirty wash water is easily contained in the pit below the slatted floor. Water from one pen cannot run into another pen causing an uncomfortable dirty, wet environment for the animals in the adjacent pen.

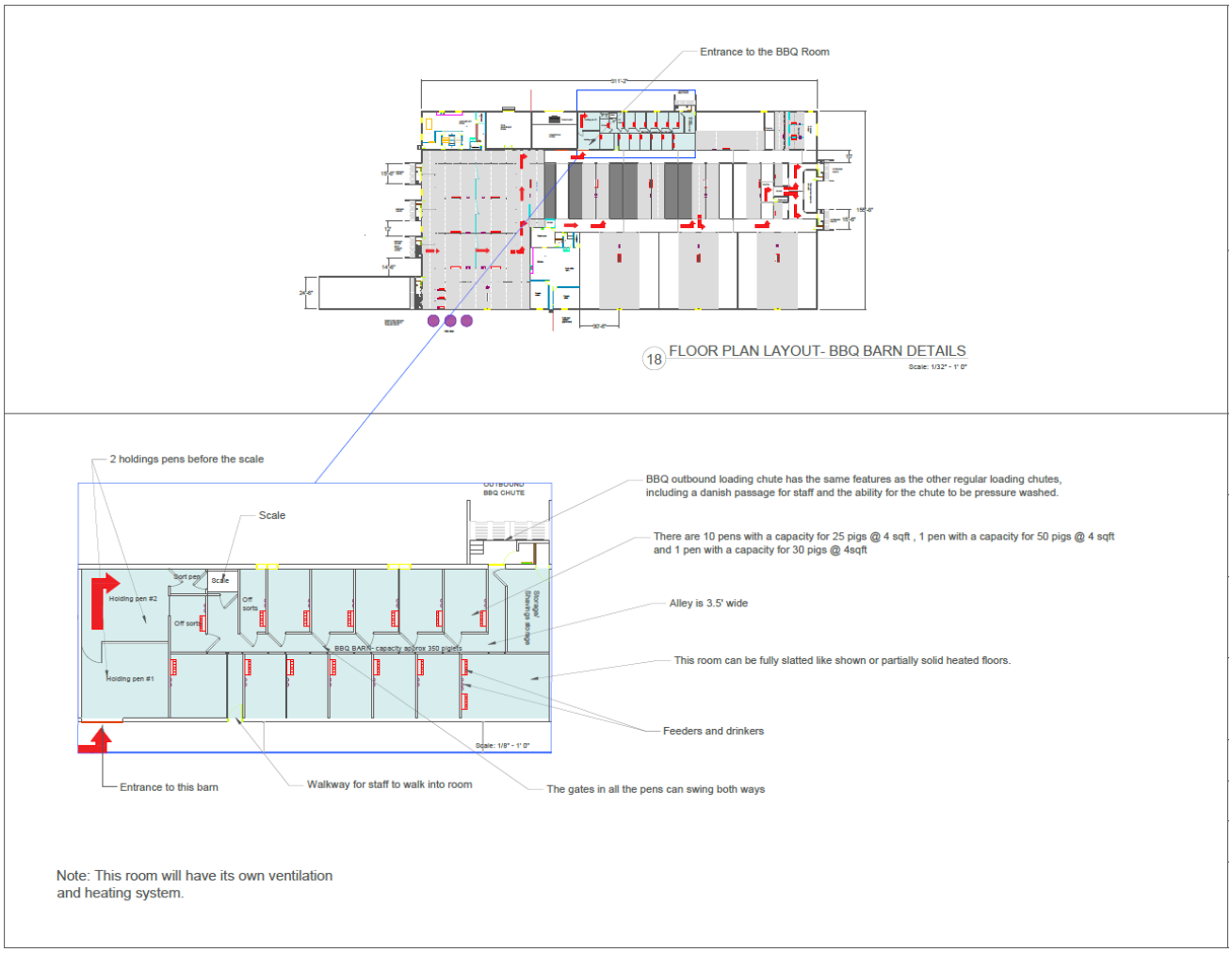
FIGURE 11. CAMPGROUND DETAILS



BBQ PIGS ROOM

Although a BBQ holding room is not found in all assemblies, it is a common feature in Ontario. This room is designed to safely house smaller pigs and allow for further weighing and sorting to meet market needs (Figure 12). Smaller pens and either in-floor or room heating improve animal welfare in this area. Separate ventilation control would allow for further customization of the environmental conditions. A separate outbound chute in this area is essential as these animals will be sorted and shipped to unique markets.

FIGURE 12. BBQ PIGS HOLDING ROOM DETAILS



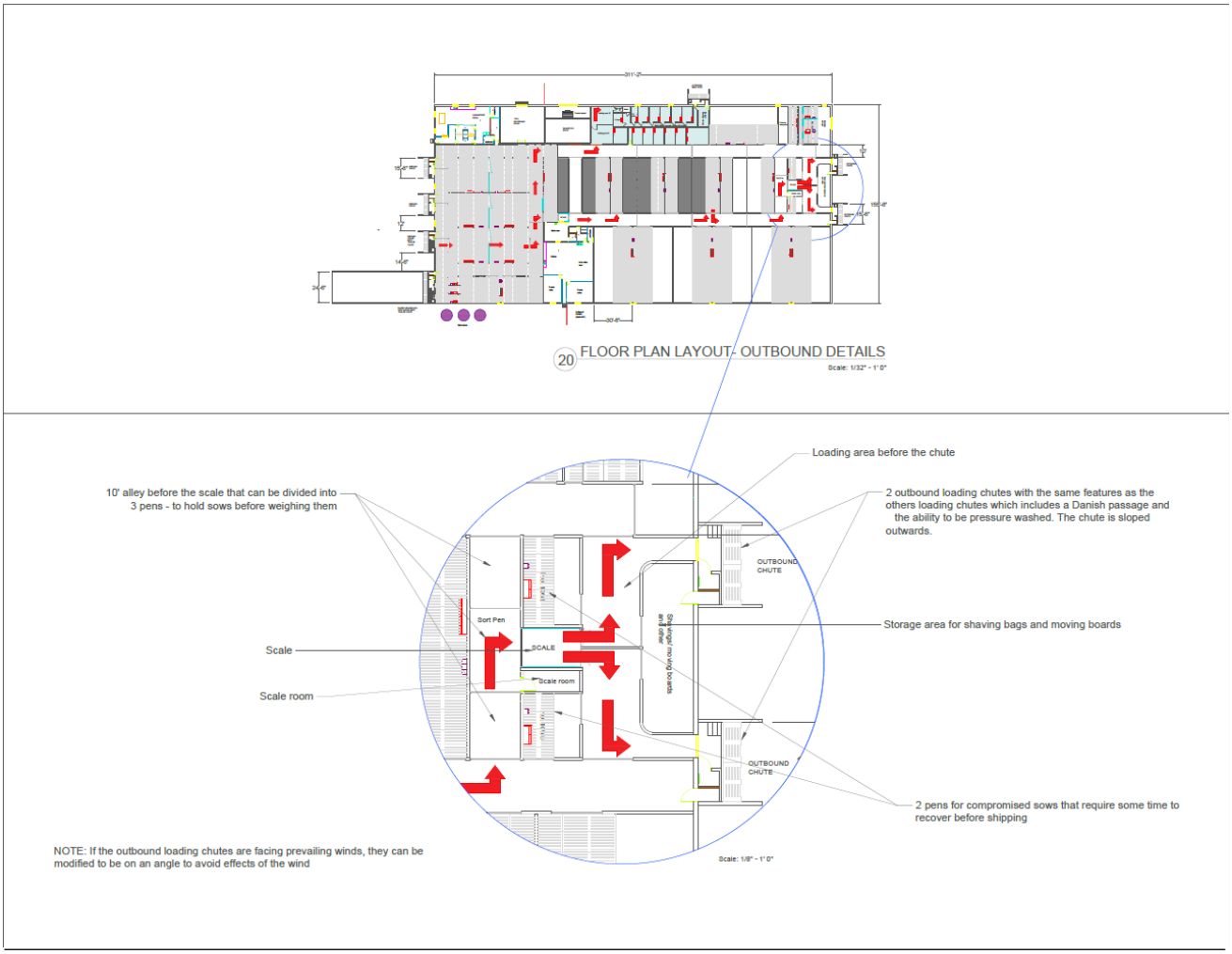
PIG FLOW/OUTBOUND

Outbound is an active area and should be designed to facilitate pig movement with as little stress as possible. Pigs may be weighed and sorted for a final time in this area. Easy transition from the sort pens to the scale and inclusion of gating which can be swung to route animals to the appropriate outbound chute aides in this process. This area also includes pens for compromised animals to be held for recovery before loading should that be required).

There are two outbound chutes included in Figure 13. The outbound area is considered contaminated and only trailers headed to the U.S. with cull sows for slaughter should utilize these chutes. The chutes follow a similar design to the inbound chutes with a Danish entry for drivers and assembly staff and ability to wash and disinfect the area.

This design also includes a storage room for holding shavings for the trailers and moving boards and equipment.

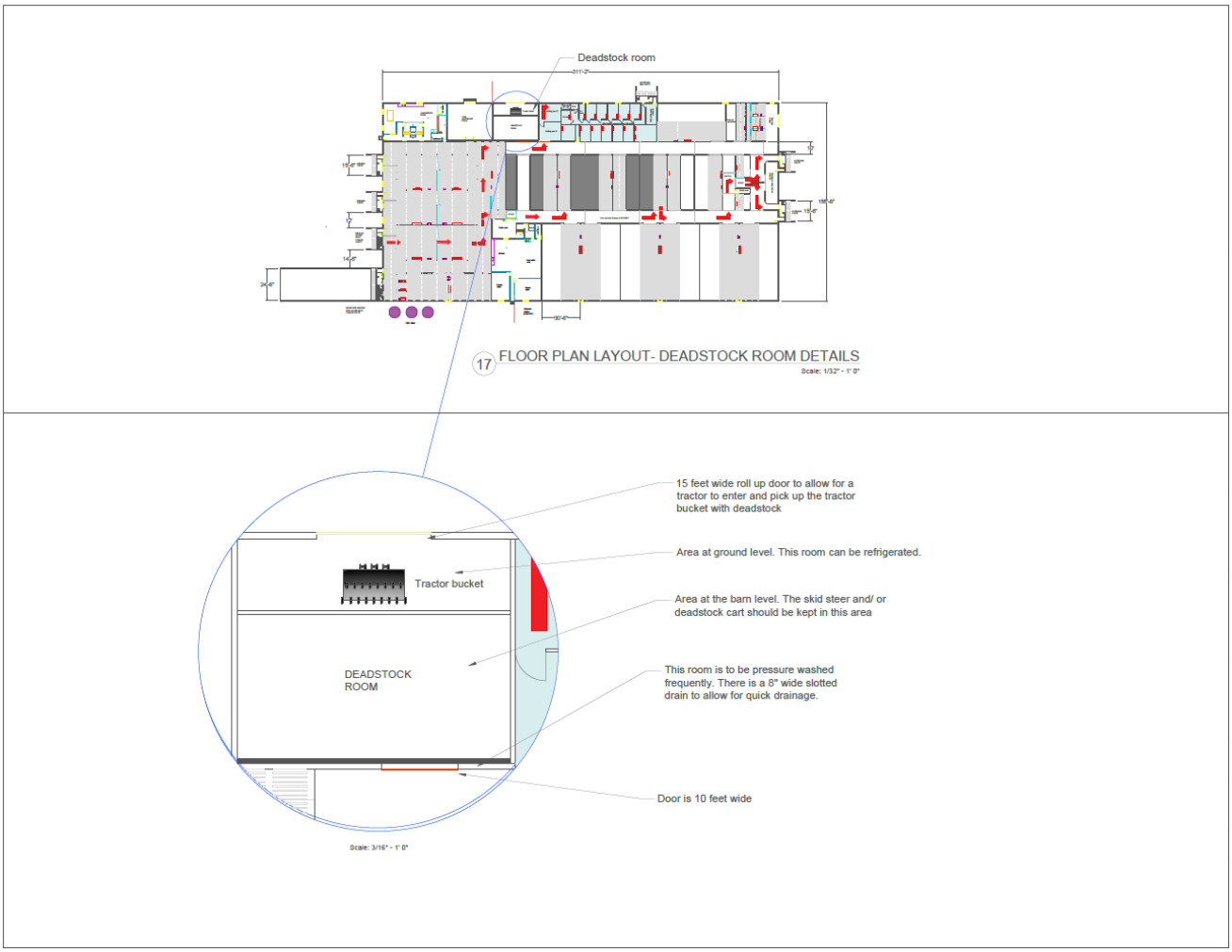
FIGURE 13. OUTBOUND CHUTE DETAILS



DEADSTOCK MANAGEMENT

Deadstock is inevitable and will need to be removed from the facility in a timely manner. Deadstock can be removed from all areas of this facility via a skid steer or Hercules unit. The hallways are all wide enough to accommodate a skid steer limiting the amount of manual effort caused by deadstock and allowing efficient disposal through the designated area. In this design, an internal bucket in a designated deadstock collection room temporarily holds the deadstock and prevents access by scavengers. The collection room may be refrigerated to slow decomposition. As with other accessory rooms, inclusion of a grated drain will allow effective cleaning and disinfection of the deadstock holding room (Figure 14).

FIGURE 14. DEADSTOCK ROOM DETAILS



An external roller bin in a covered, separate building is recommended for pick-up by rendering. Assigned assembly deadstock bins with specific branding is highly recommended to prevent cross-contamination of the regular farm flow of deadstock bins with bins used at assembly – further protecting farms from the pathogens present at assembly. Consideration of traffic flow to avoid cross over with collection vehicles also reduces potential disease transmission.

DEADSTOCK DISPOSAL OPTIONS

The requirements for deadstock management at an assembly yard are similar to those of a large farm. The exception is that the deadstock material produced by assembly is likely to be more heavily contaminated with a wider range of pathogens than would be typical of deadstock derived from a single farm.

The Ontario regulations for deadstock management can be found at the following website https://www.ontario.ca/laws/regulation/090105

There are a number of deadstock disposal management options to consider, listed below in order of preference:

- third party pick up (using designated roller bins)
- incineration
- composting

Table 2 presents the pros and cons of each disposal method and rates the impact on labour and cost using a scale of 1 (minimal) to 4 (maximal).

TABLE 2. COMPARISON OF DEADSTOCK DISPOSAL METHODS

Method	Pros	Cons	Labour	Costs
Third Party pick up with traditional dead stock bin	Easy to manage, minimal storage requirement for deadstock, cost efficient	Trucks for deadstock pick up travel from farm to farm to accumulate their load, accidental discharge from the vehicle at other sites is a biosecurity risk	1+	1+
Third Party Pick up - dedicated bin direct to processing	Minimal storage required for deadstock, minimal chance for cross contamination of other pig sites	Requires dedicated bin with covered storage	1+	1+
Incineration	Excellent containment of infective material	Investment in the incinerator, fuel for the incinerator an ongoing cost, environmental considerations.	1+	4+
Composting - contained	Good containment of infective material, pest management is critical	Investment in composting vessel, ongoing costs in substrate and maintenance.	2+	2+
Composting - open bay	Infective material remains on site, enclosure in a shed and/or a roof and secure gates required	Investment in composting bays, ongoing cost in substrate and maintenance, risk of disease transmission due to pests	3+	3+

Third Party Pick-up

The most common way to manage deadstock in Ontario is via third party pick up. This activity is regulated under the Environmental Protection Act. https://www.ontario.ca/page/deadstock-disposal-options-farm .

There are several companies in Ontario dealing with Deadstock. Two pickup options exist:

- Pick up done based on call in from a small bin. The process is that a truck with a lift on the front, dumps the deadstock into the back of the truck. These trucks travel from site to site and the risk for contamination of other sites is high, by the truck itself or by the dumping process. Additionally, getting timely pick up, especially in times of extreme heat in the summer, can be

challenging. This method is not recommended for assembly deadstock management due to the risks to other sites.

- Pick up of larger amounts from a roll off bin. This method is significantly preferred over the small bin, multi site pick up in that:
    - there is potential for bins dedicated to the assembly with the option of dedicated signage
    - the bin can be stored inside, potentially in a cold room and/or covered building, reducing challenges with scavengers, reducing the frequency of pick ups required, and eliminating the multi-site visit process

Third party pick-up with assembly designated collection bins stored in a covered shed or outbuilding is a simple and reasonable deadstock solution for assemblies.

Incineration

Incineration processing of swine deadstock is not that common in Ontario. There is a significant investment required to setup an incinerator system although the labour requirement is less than with composting. The large size and volume of the deadstock, requires significant amounts of fuel to incinerate. Additionally, there are environmental considerations (carbon emissions) associated with the incineration process. Nevertheless, it is an effective way of dealing with infectious deadstock material and advances in technology make incineration a more feasible option. There are some Canadian made alternatives for incineration which can be seen at:

https://triplegreenproducts.com/agricultural-composting-dehydrating/?gad_source=1&gclid=CjwKCAiAwaG9BhAREiwAdhv6Y2abdaMBHWyVUVRplAFH2jsKvQurBz8obT13o_sxsCz5rUr6PvCKlhoCWFUQAvD_BwE

Composting

Composting for deadstock disposal has seen increased usage in Ontario because of the challenges of getting regular pick up from a third party. Containment and pest management are critical in the implementation of this disposal method. There are two main methods of composting on site.

- **Vessel composting**: To use this method, the deadstock is loaded into a large tube, along with organic substrate (shavings typically). The tube is closed and rotates slowing, to promote decomposition of the deadstock. Additional deadstock can be added, in process. Various sized units can be purchased, the largest of which will decompose about 4400 kg. per week.
  Two companies providing composting vessels can be seen at
    - https://www.nioex.com/biovator#:~:text=3%20ft%20diameter%20x%208,BIOvator
    - https://county-line.ca/product_type/swine/

  Processed material is discharged out the farm end of the tube and is considered non-infective. It can be stored in a pile for future land application. This process requires a tractor and a loader along with a spreader designed for solid manure, and land for application of the processed product.

- **Pile or Bin Composting**: is another option. In this case a series of bins are constructed to hold a mixture of deadstock and carbon-based substrate (shavings, sawdust, silage etc). Concrete based bins, sloped towards the back of the bin are preferred to control runoff. Bins need to be

covered and secured from scavengers, to prevent them from moving infectious material out of the bins. If the bin has a roof and/or is within a building such as a shed (preferred in this case for biocontainment), there will need to be a way to add water (hydrant). The watering system need to be weatherproof so water is available in all seasons. The deadstock is placed on a bed of approximately 30 cm of substrate and then covered with additional substrate. A series of bins is required, as breakdown of deadstock takes place over time. Bins are filled in sequence, and eventually the first filled bin is transferred to the last bin and additional substrate added, until break down of the deadstock is complete.

Breakdown of the deadstock is faster if the size of the deadstock is smaller, so some method to cut up larger carcasses would be advantageous. This would speed up the decomposition process and reduce the bin space required.

This method of handling compost is more labour intensive than vessel composting and requires more substrate. As with vessel composting, it requires a tractor and a loader along with a spreader designed for solid manure, and land for application of the processed product.

The advantage of composting is that the material remains on site and is broken down and rendered non-infective by the process. The disadvantage is that there is a requirement for capital investment and containment of the piles is critical.

Directions on building and sizing of composters are available at a number of sites including:

- http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex6118/$file/440_29-1.pdf?OpenElement
- https://www.ontario.ca/page/farm-bin-composting-deadstock

Other options

There are a number of other options available for dealing with deadstock, including dehydration and anaerobic digestion. Most of these options require a significant up front investment and more material to breakdown to be economically reasonable to operate. There is ongoing research into these other areas of disposal, and they may become more workable in the future.

REFERENCES

1. Enhancing African swine fever prevention and preparedness - Canada.ca
2. Canadian Pork Market Report, Kevin Grier Oct 28, 2024
3. Inventory Assessment and Gap Analysis of Canada's Prevention, Preparedness, Response, and Recovery from an Animal Health Event Report for Animal Health Canada Working Group National Farmed Animal Health And Welfare Council (On Behalf Of The Animal Health Canada Working Group), February 13, 2020
4. Canadian Pork Council & National Farm Animal Council (2014). Code of Practice for the Care and Handling of Pigs.

APPENDIX 1 – SITE REPORTS

SITE 1

Inbound:

- This site does not attempt to control foot traffic, clothing or fomites. This includes all the truck drivers coming to unload or pickup, access into the barn is not controlled and drivers commonly enter the facility.
- The yard grade is an issue, with grading toward the base of the chutes – proper grading and drainage could improve capacity to keep this area clean and reduce contamination risks for incoming trucks.
- Receiving has a chute and pen area that could be designated as a specific disease risk receiving chute, there is an advantage to having designated chutes for risk and potentially a separate chute for clean, low risk deliveries.
- A larger receiving area would improve flexibility and speed and opportunities for biocontainment.
- The scale is slightly rectangular and the entrance is one end of the rectangle, kitty corner to the scale gate latch is an angled corner in the sort pen that facilitates sort by eliminating a dead corner. The animals exit the scale on the side of the rectangle, kitty corner to the entrance gate latch. This scale layout appears to be highly effective.
- It would be important to develop a plan to manage compromised animals in receiving (the ones that can't travel through the scale and survive the barn but might make it with extra accommodations).
- These animals may be euthanized, and skid steer loader is their only acceptable option for deadstock handling.
- BBQ pigs lighter than the light sow cut off bypass the main receiving scale and are sorted halfway down the barn in a separate little pig barn which is heated and fan ventilated space but still fully skid steer accessible

Campground:

- Some pens that hold a truck load of sows is a benefit to reduce mixing, but smaller pens near the sort chute are necessary because depending on markets and volumes flexibility to prioritize certain loads is needed.
- It is highly debatable whether the ideal campground is slatted or bedded. Bedding results in a considerable amount of time to cleanout manure and re-bed and this format makes a full clean-out with disinfection very challenging. When considering animal welfare, it ensures sow comfort at a wide temp range and provides good footing. Unknows whether livability of the environment would be harmed by full slat environment. As well, skid steer access is essential.
- The walls are built extremely heavy, for example, where 2 gates latch on either side like a precast finisher are approximately 10" thick solid concrete, heavily re-enforced with rebar and steel channel guarding the corners.
- Water areas need to be re-enforced by heavily build protective posts or curbs.
- Natural ventilation is sufficient in this facility.
- Alley ways are very wide to allow skid steer access and this is also a benefit to moving large groups of sows.
- Shrink is a concern to this industry so there is lots of intrinsic motivation for adlib feed and water and a very peaceful stay during the 1-7days the sow spends at the campground.

Sows on Straw in Campground

Outbound:

- There are 3 categories of live outbound inventory, sows of all sizes, BBQ, and then the recovered compromised sows.
- Recovered compromised sows are loaded out of the inbound from time to time due to travel distance to outbound chute, this poses a disease transmission risk as time spent in the facility increases the risk of infection with resident diseases. A design consideration for placement of these animals should be considered.
- Ease of loading is critical and should be considered in facility design including the design of the outbound chutes with minimal rise to truck, no sharp turns or width changes - loading may favour chute designs where the chute is a consistent width the whole way to the truck door.
- Current BBQ outbound is beside and behind inbound chutes, consideration of this placement re disease transmission risks.
- Small pens close to the load out for special needs sows is essential for welfare reasons and to reduce disease transmission risks associated with using inbound chutes to load out these animals.
- All sows are weighed out on exit.

Marginal stock and deadstock:

- The volume of deadstock seems best handled by rendering and is equivalent to 1 or 2 trailer loads per week. Rendering company leaves a trailer there all the time and they load it with a zoom boom loader.
- There's a designated euthanasia room – consideration of any biosecurity re placement and deadstock removal.

SITE 2

Background:

The yard has clear signage and a concrete barrier separating the inbound traffic from the outbound. The animals are on full hopper feed, underground waterlines to insulated water bowls, solid floors with straw bedding, and natural ventilation.

Inbound:

- There is one inbound receiving area consisting of a low chute for goose neck trailers and a high chute for transport trucks.
- This area is not easily cleaned due to wood construction of the floor of the chute ramps and poor drainage.
- The receiving pen extends into the alleyway so as constructed, there is ill-defined separation between the holding area and the receiving area.

Campground:

- The penning is concrete stub walls with wooden penning above and wooden gates. There are 3 rows of pens in the main housing area adjacent to the receiving. The middle bank of pens are long narrow pens with a gate on either end. The perimeter pens have their long axis parallel to the exterior walls.
- The outbound and secondary campground area are not connected to the receiving area under the same roof. There is approximately 20ft of space between the 2 buildings which means regardless of the weather, animals are going outside to get to the loading area.
- The secondary campground barn is the building closest to the road and also contains the office space and main entrance. The penning in this barn was purpose build for housing sows and is constructed of wide concrete walls and metal gates.
- All areas of the campground are bedded with straw and accessible to clean out with a skid steer.

Sows in Campground

Outbound:

- The outbound consists of a loading chute alley way with a 90 degree turn perpendicular to the side of the building. The loading chute inclines from ground level to highway tractor trailer livestock trailer height. The loading alley and chute are under a lean-to roof off the side of the main building which contains the office and secondary campground pens.

SITE 3

Inbound:

- The site has a large yard, allowing for routing of vehicles.
- There is a concrete pad in front of the loading chutes that slopes away from the barn with the exception of the area immediately outside the chute designed to wash between each load. This chute has approximately an area from the barn out 10 feet that drains into a street style steel grate drain.
- This barn has an office in the middle of the long side of the barn. The office space is generously proportioned with an original design allowing a sectioned off, “clean” side entrance for producers. Functionally, the barn is entered via a side door between the primary office vestibule and the main barn area.
- This entrance utility area is roughly 20 feet X15 feet with a full width Danish entry bench. This site has a boot change and supplies the barn boots. Common practise is that the inbound trucker comes in main barn entrance, uses the Danish entry to put on supplied barn boots and then goes into their truck to unload.
- On the barn side of the bench is an adjacent utility room that holds the pressure washer, disinfectant injection system, water softener/amendment equipment, work bench and tools, etc.
- Inbound has a fire hose, pressure-washer hose reel and a disinfectant hose reel all conveniently located on the wall of the inbound pen area with on-demand pressure.
- The main barn is a simple rectangle. On the same side as the office, toward the yard, are 6 loading chutes. 4 inbound, 2 outbound. Inbound are a Berdex, regular width, trailer height chute, cleaned and disinfected between uses. A “dirty” goose-neck trailer chute does not get cleaned between each load.
- The “clean” goose-neck chute has its own door off the side of the chute and the producers that use this chute would enter their trailers through the chute side door. This facility allows these producers to scrape their trailers out on the concrete pad area at this chute.

Campground:

- Chute side of the barn has approximately 10 feet wide walkway to allow for animal and vehicle movement, the back walkway adjacent to the long wall of the back of the barn is approximately 6 feet wide. The walkways and inbound landing area are solid slats, the rest of the barn is a typical concrete slat you might see in a loose housing dry sow barn. Slatting does facilitate cleaning and disinfecting the facility but may impact animal welfare.
- The majority of the barn is long narrow pens, approximately 14’ wide by 40’ long with a crystal springs feeder and sow size wall mount water bowl in the style typical of finishing barns. These

pens have a 12’ gate in the front of the pen and the back of the pen. Pens are loaded from the front and shipped out the back. There is a continuous walkway looping around the entire bank of main large pens. At the inbound end of the barn there are 4 extra pens about 10’ x 15’ perpendicular to the other pens, the long axis of these pens is parallel to the length of the barn with only access via front gate and they butt up against the end wall of the barn. The outbound end of the barn has a separate room housing about 5 pens roughly 12’ square in the same layout as the inbound extra pens. This room is used for over-weekend BBQ’s in cold weather. The small pens are plastic gates and pen dividers. The main big pens are poured-in-place concrete walls about 4” thick with painted steel diamond bar gates.

- One main big pen has a platform scale in it so they can weigh loads that go direct to slaughter.

Marginal stock and deadstock:

- Large deadstock is towed out of the barn with an ATV with a winch. These dead sows get dragged within feet of main barn entrance – consideration regarding management of deadstock such as removal from the back side of the barn away from the chutes and entrance could reduce disease transmission risks.

Comments:

- This assembly is the first call holding area in the case of slaughterhouse breakdown when plant barns can’t take the pigs in transit.
- Overall, pass through pen layout, wide walkways, pen sizes of 30-50 sows, extra small pens, and a heated area for small pigs seems to be a functional collection of attributes.
- The office, entrance and utility room space and layout would allow for excellent biosecurity.
- Deadstock removal should be addressed.

SITE 4

Background:

- This site is a commercial pig and cattle assembly.
- Over decades, more buildings have been added to accommodate for greater capacity needs.
- All infrastructure is very capital efficient. They believe in a “simple is best” approach from equipment to procedure.
- The workflow is remarkably similar to other assemblies we have toured and the general, layout and design follows in step. They have defined inbound, sorting, campground, and outbound areas and all are solid floor, straw bedded, skid steer cleaned. The campground is an arrangement of metal Quonset shelters connected via outdoor alleyways.
- There are 2 driveways coming in off the road but no defined inbound and outbound traffic.
- Layout is complicated by the cattle assembly and straw business running of the same site.

Inbound:

- The inbound chutes are 2 equivalent semi truck height, concrete, full trailer width, steeply sloped, floor heated chutes, located inside the barn, 3-4’ back from a large overhead door. Each chute has its own overhead door and the space from the door to the chute would allow the truck

driver to be under roof to enter and exit the trailer. The floor heating is incorporated into the chute to allow cold weather washing and disinfecting.

- Inbound is a high ceiling, typical stick frame building. This building only houses inbound animals until they can be sorted and run across the scale. It is set up in a circle with pens along each side wall with single side access and then a bank of pens in the middle of the barn spanning from one side of the circle to the other with gates on either end of the long narrow pens. There is no feed or water in the receiving barn.
- The scale and scale office are on the opposite end of the barn from the 2 inbound semi truck chutes. There is also a gooseneck trailer inbound chute down the side of the barn toward the scale.
- Customers leave with a cheque in hand. Presumably this is only for customers that have dropped their own stock off which may apply more often to the gooseneck deliveries. The inbound barn office has a window set up as a drive through window to allow the cheque to be handed to the farmer without having him get back out of his truck or enter the office.
- Inbound is very well lit. They believe the excellent LED lighting is well worthwhile to eliminate shadows to facilitate easy pig movement.

Inbound Pens

Campground:

- The Quonset buildings that make up the campground are split into pens that hold a truckload of sows. Here the sows are fed and watered, water is through underground lines to cattle water bowls, feed is provided via internal feed manufacturing by a PTO drive mix-mill.
- When the sows leave the scale, they go outside into the alley system connecting the Quonset buildings, they do not stay in the inbound barn for any longer than is required to sort and weigh.

Quonset building holding sows

Outbound:

- The newest outbound infrastructure is a loading chute off the alley system and off the back side of one of the Quonset shelters. The loading chute is a unique long, side by side, twin ramp structure, made of wood. One ramp reaches the top deck of their custom-built sow trailers. This chute system is not used very often because they have not come up with a good way of inspecting snouts for vesicular lesions with this set up.
- The active (old) outbound chute and adjoining area includes a few pens parallel to a narrow sort chute system very similar to what is used in sheep ranching. Basically, the chute is made of gates parallel to a pen wall, where the gates are low enough to work through the top of the chute which makes it ideal for seeing the snout of every animal as it walks by. If there is a suspect lesion, the sow is sorted out into one of the near-by pens, the rest get loaded straight onto the truck. The loading chute in this area is a simple concrete ramp with wood sides. This is an old, open air, wood frame structure with poor drainage.

Deadstock:

- There is a small building with a refrigeration system to store dead animals in. This building is a recent addition to the site. They have cattle and pigs on this site so they need to keep the deadstock sorted according to species. Consequently, the fridge building has two overhead doors, each leading to a short wall trench silo, one for pigs and one for cattle.
- Their arrangement with the deadstock company is that whenever they are in the area and have room to add a few animals to their load they drop in. Deadstock is handled via skid steer in the barns and loaded with a loader tractor or zoom boom type loader into the deadstock truck.

Comments:

- There is a drive-through window at the main office for the outbound trucks to collect their paperwork. Adjacent to each side of the drive-thru lane is a disinfectant dispensing nozzle to spray disinfectant on the wheels of the truck and trailer.
- Stock turnover in their yard is several days but varies a fair amount. This seems to be the case everywhere. “Sows are here for as little time as possible, average 2-4 days, except when they’re not.”
- The general cleanability of the site is poor.

SITE 5

Background:

- The site has well defined inbound and outbound traffic control with a barrier wall splitting the inbound yard from the outbound.
- The overall footprint of the barn is that of an “L” and the property is a corner property of a sideroad and a county road. The short part of the “L” is parallel to the county road and is the receiving section of the barn. The long side of the “L” is parallel to the side road. All chutes come off the long part of the “L” opening toward the side road. The property is accessed off the side road.

Inbound:

- There are at least 3 inbound chutes, 2 semi truck height chutes and 1 gooseneck trailer height chute.
- The inbound trucks have an inbound only, designated scrape out pad with a bootie disposal bin adjacent to it, positioned in such a way that they could dispose used boots from the truck cab, so no contaminated booties need to leave with the truck.
- The barn staff have their own entrance to the campground side of the inbound barn area. Included is a kitchen/lunchroom/ locker space and a washer and dryer. Employees use clothing designated to the assembly facility for work.
- There is one staff member who gets designated for the day to receiving, thought being, this person doesn’t drag contamination from the campground to the receiving chute line – effective

only if protocols are followed. There is no designated footwear to the receiving side of the facility.

- The inbound chute flows directly into a long pen roughly 12ft wide by approximately 50ft long allowing room for a full truck load of animals. This allows an after hours drop off to be done entirely without setting foot inside the assembly facility. The driver would back up to the chute, pull up the overhead door of the chute, chase off his load, close the chute gate that protects the overhead door, drop the overhead door, and exit the side of his trailer again.
- They use as little bedding as possible in the receiving pens so there's less need utilize a skid steer in this area.
- Parallel to and inline with the above receiving pens are another bank of pens with feed and water. This allows for holding capacity in receiving until the sort and weigh can take place.

Inbound Chutes and Pens

Sort and weigh:

- The receiving barn feeds through the sort and weigh area. The main office juts out into the barn in line with the scale so this makes for very efficient workflow between the scale, sort, load organization, and sales activities.
- This also means the barn is conveniently narrow or bottle necked through the scale area.
- There are many small pens on the receiving side of the scale to facilitate reassortment of animals ahead of running them across the scale. There are several rows of these pens and they're roughly an average capacity of 10 sows.

Campground:

- The campground is simply a high ceiling, naturally ventilated cattle barn style of barn with an offset from center, walkway separating 2 rows of large, bedded pens, largest pens to the opposite side that chutes are on.
- The pens have a gate to divide them in half if needed and can hold a semi trailer load of sows. They use the majority of the campground to hold sows penned according to sort/grade. They will also pre-assemble loads, especially for the Sunday shipment. They ship several loads for the Monday kill so working ahead to assemble these loads make loading on the weekend more efficient.
- The cleaning is done by skid steer, as such the hallways are wide enough to allow easy skid steer access.

Campground hallways and penning

Outbound:

- The outbound chutes are simple concrete ramps to semi truck height that come off the walkway, there is not much of a loading pen, (wide hallway) it's designed to have loading flow from a campground pen down the hall, do a 90 degree turn and go up the chute and onto the truck.

Deadstock:

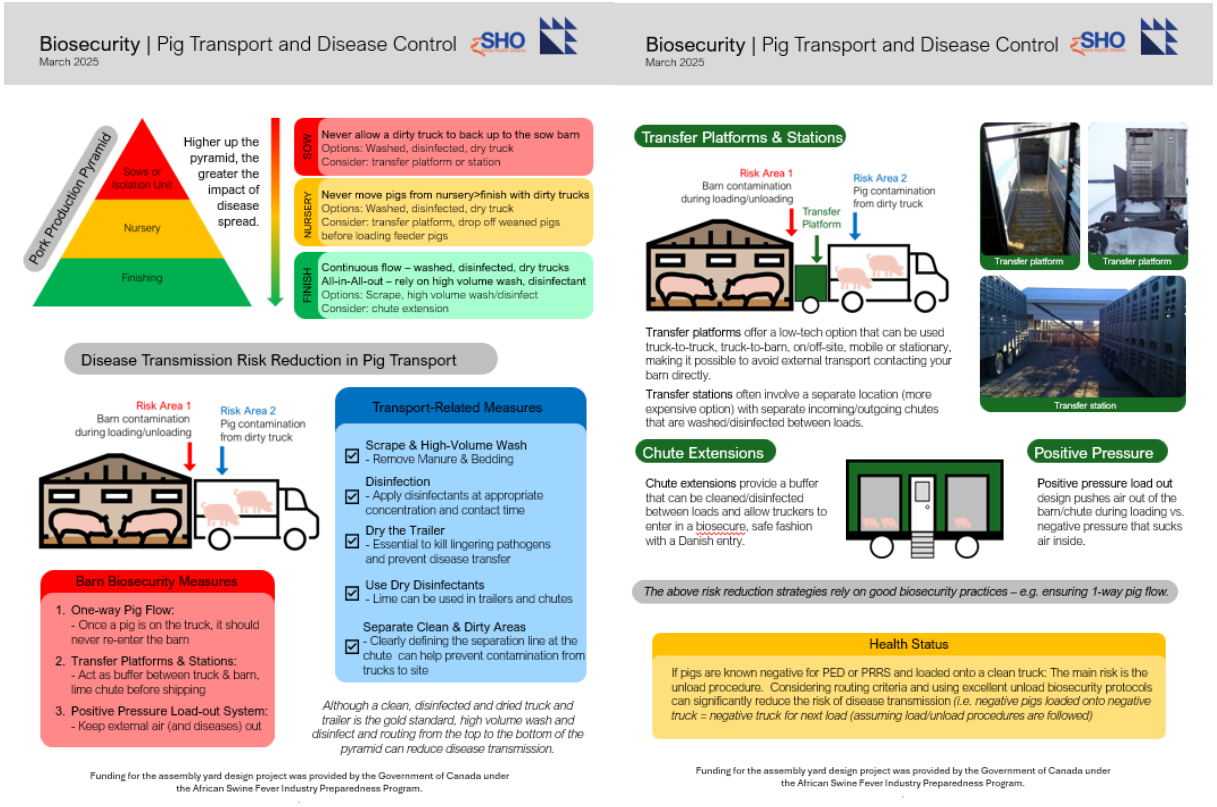
- Deadstock is removed from the assembly with the skid steer through one of a couple overhead doors on the back side of the barn, opposite the loading chutes of out bound and scale.
- Straw storage, shavings and deadstock is all out back of the main assembly.

Comments:

- This facility uses bedding that has undergone a vacuuming process to remove the dust from the fibres of the shavings or straw. It is very effective at improving the working environment.
- They try to keep boot traffic out of the office by changing footwear and stepping across a doorway. They also require visitors to disinfect their shoes before leaving the office.
- They have Lysol spray at their door, and a disinfectant sponge mat at their office entrance.
- They do not have any ideal locations for small BBQ piglets.
- They have been washing and disinfecting their whole barn approximately every 6 months. This is done by walking a gap in animal inventory through their whole barn, starting in the receiving pens, and then following the normal pig flow throughout. They will receive new pigs again in the receiving area before the campground is done. Seneca Virus A motivated this practice.
- Penning is all concrete and metal construction, purpose build for the rigors of assembly life.
- The ventilation is all natural via chimneys and curtain sides.

APPENDIX 2. PRODUCER COMMUNICATION

500 copies were sent to producers through South West Vets distribution and 1,000 copies were prepared for producer and transporter communications through Swine Health Ontario.



APPENDIX 3. PRESENTATION GIVEN AT SWINE HEALTH ONTARIO BIG BUG DAY 2024

Designing Assembly Modifications to Reduce Disease Transmission

Dr. Clint Lichty, South West Vets

A Swine Health Ontario Project

Funding for this project has been provided by the Government of Canada under the African Swine Fever Industry Preparedness Program

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

Canada

Canadian Stats

The Canadian pork sector is a major economic driver that generates $24 billion annually for the Canadian economy. A single case of ASF in Canada would result in Canada ceasing its pork and live hog exports.

According to the October 2024 edition of Canadian Pork Marketing Report by Kevin Grier, the Canadian swine industry exports a total of approximately 6.6 million live hogs annually.

This number includes

- 4. 7 million weaners and feeders,
- 1.5 million market hogs
- 340,000 cull sows and boars

Setting the Stage

- The majority of the 340,000 cull animals that leave Canadian farms annually are transported, assembled and reloaded and trucked to slaughter plants in the U.S. 4,250 truck loads annually
- Cull pigs from most of Eastern Canada are assembled in Ontario, where they are held and sorted before shipping to slaughter.
- In addition to cull pigs, Ontario currently exports weaner pigs for finishing and finishing pigs for slaughter in the United States, amounting to upwards of 50,000 pigs leaving Ontario each week.
- Manitoba also has two large assembly sites which operate in a similar function.
- This cross-border transport increases the risk of disease movement between the two countries and cross contamination of Canadian facilities upon return of trailers following contact with U.S. packers.

Project Focus

- Assess assembly biosecurity risk points and develop solutions including drawings to minimize these risks is the goal of this project.
- The first phase of this project included site assessments focused on the inbound, internal (campground) and outbound aspects of the major Ontario and Western Canadian cull assembly.
- Three assembly sites were visited in Ontario and two assembly sites were visited in Manitoba.

Assembly Assessment Key Points

General Operations and Site Access

- Single species focus and avoid alternative services
- Designated inbound and outbound traffic flow with a solid divider between flows
- Yard grade, drainage and driveway material to reduce mud and water accumulation
- Consideration of waste/manure management
- Reduce foot traffic cross-contamination risks through use of electronic paperwork and consideration of the location if a public bathroom is provided for drivers.
- Low risk activities such as feed delivery located on the inbound side of assembly, high risk activities such as deadstock located on the outbound side of assembly.

Assembly Assessment Key Points

Inbound

- Inbound is a critical control point for assembly as this is the point where further contact back to Canadian farms is most likely.
  - Designated inbound chutes, physically separated from outbound
  - Multiple chutes depending on inbound volume to allow for C/D between loads**
  - Delivery by appointment with details on disease status
  - Roof extension
  - Slated walkways and back of truck area, attention to grade
  - Protocol to remove deadstock from trailers

Assembly Assessment Key Points

Campground

- Consider contaminated, clear separation from inbound.
- One-way gates between inbound and campground.
- Inclusion of slatted areas to the inbound area and the sorting area would facilitate effective cleaning and disinfection and construction must accommodate a skid steer or alternative.
- Staff with campground contact should not enter trailers (inbound or outbound) – no inbound trailers to reduce the risk of contaminating those trailers with diseases endemic to the campground and no outbound trailers to avoid bringing any potential new diseases into the campground.
- Drivers from both areas should not enter the campground.
- Rest pen for compromised animals.
- Alleyways should accommodate a slid steer.

Assembly Assessment Key Points

Outbound

- Area with the highest amount of contact with trucks returning from the U.S.
- Deadstock holding and pick-up should be located on the outbound side of the assembly with consideration of traffic flow to minimize cross-contamination from vehicles collecting deadstock.
- The workgroup recommends a requirement for high-volume wash and disinfection** (or alternate technology to C/D) of trailers returning from the U.S.

**PED and PDCoV PCR Results - Trailers Moved Known Infected Pigs Followed by Firehose Wash and Disinfection with Synergize

LEGEND
- 1 Race deck and picture area
- 2 Medic pen/ morning gate
- 3 Main ramp and back door area
- 4 Lower ramp and gate at bottom deck
- ND = Not Detected

PEDV CT Values

	PREWASH	CLEAN TRAILER SAMPLES				
Date	#1 PEDV	#2 PEDV	#1 PEDV	#2 PEDV	#3 PEDV	#4 PEDV
19-Nov	30.84	27.82	ND	ND	ND	ND
12-Jan	ND	ND	ND	ND	ND	ND
13-Jan	31.56	28.96	ND	ND	ND	ND
15-Jan	27.92	26.92	ND	ND	ND	ND
21-Jan	26.58	27.31	ND	ND	37.37	36.53
29-Jan	31.87	30.06	32.83	ND	ND	ND

PDCoV CT Values

	PREWASH	CLEAN TRAILER SAMPLES				
Date	#1 PDCoV	#2 PDCoV	#1 PDCoV	#2 PDCoV	#3 PDCoV	#4 PDCoV
19-Nov	33.89	31.42	ND	ND	ND	ND
12-Jan	38.55	37.49	ND	ND	ND	ND
13-Jan	38.96	36.15	ND	ND	ND	ND
15-Jan	38.52	36.96	ND	ND	ND	ND
21-Jan	37.31	29.18	ND	ND	ND	39.36
29-Jan	30.09	31.81	34.00	ND	ND	ND

Next Steps

- Engineered drawings highlighting key points
- Application to on farm biosecurity
- Further industry consultation
- Communications - Better Pork article
- Final report

[head] **Study Recommends Assembly Yard Design Changes to Boost Biosecurity in Ontario's Hog Industry**

By Jeanine Moyer

Assembly yards serve an integral role in the movement of Ontario hogs, but they are also a melting pot for diseases.

That's why Swine Health Ontario (SHO) recently conducted an in-depth study to establish assembly yard design recommendations to reduce the risk of disease transmission and ultimately contain diseases that are already circulating within assembly facilities.

"Hog assembly yards are designed for holding livestock for a short period of time before they are organized for transportation, but animals often stay longer than the incubation periods of many diseases and can begin actively shedding diseases to other animals," explains Dr. Cathy Templeton, a swine veterinarian with South West Vets and research consultant on the project. "While the hogs leaving the facilities are destined for slaughter, the animals leaving these primary assembly points pose a serious risk for the contamination of trucks and their destination facilities."

Currently, the majority of the more than 300,000 cull sows in Canada pass through assembly yards for sorting before crossing the boarder for slaughter in the U.S. every year. This requires roughly 4,250 truck loads. Most of the eastern Canadian cull sows are assembled here in Ontario before heading south, along with nearly 50,000 weaner pigs that are exported to the U.S. each week.

Dr. Templeton says that while the commingling of the hogs is a biosecurity concern, the other issue is the trucks returning from the U.S. that increases the risk of disease movement between the two countries. This potential for cross contamination of Canadian facilities upon the return of trailers following contact with U.S. packers is a weak link in biosecurity measures to prevent the introduction of foreign animal diseases like African swine fever.

[subhead] **Assembly yard assessments**

The assembly design project team was made up of three veterinarians from South West Vets, Drs Templeton, Clint Lichty and Marty Misener, along with an engineer Dora Martinho. Project support was provided by SHO, and together, the group conducted a review of six assembly yards across Manitoba, Ontario and Quebec to assess what works well and identify areas for improvement. The 18-month project resulted in a report and drawings for a hypothetical assembly yard that would provide the highest biosecurity protocols possible for such a facility.

"The purpose of the project was to develop assembly design recommendations for a biocontainment facility," says Dr. Lichty, explaining that by evaluating biosecurity risk points at existing assembly yards, the team was able to design a new proposed facility that includes strategic recommendations to minimize risk and improve biosecurity. "We understand that infrastructure changes slowly, so while we designed an ideal facility, anyone in the hog industry who is building or renovating can include recommended design components into their own plans."

Dr. Lichty notes that some components of the project recommendations are specific to assembly yards, especially those that are designed to contain pathogens already present within a facility, but the project outcomes also include biosecurity recommendations that can apply to any hog facility, including hog barns and slaughter plants.

[subhead] **Industry-wide recommendations**

"Many of the principles are applicable to any type of hog facility – from considerations for yard grade and drainage to loading chutes and animal flow through design – the project results can be implemented anywhere to enhance the biosecurity of the specific facility and across the industry," says Dr. Lichty.

Taking the veterinary team recommendations, an engineer created the ideal structure design for a hog assembly yard that would allow for the delivery of animals while containing existing pathogens. The proposed facility would also minimize the risk of contaminating incoming vehicles and the risk of introducing new diseases into Canada from cross-border transportation. Recommendations were also made for cleaning and disinfecting the assembly facility, along with deadstock management.

Dr. Misener explains that "known disease risks in Ontario hogs come from the commingling of animals from multiple sites and provinces in assembly yards, and they come from touchpoints with vehicles that transport to the U.S. that may have unknown or questionable sanitation prior to returning to the assembly for more pick ups." These 'weak links' make it more important than ever to enhance biosecurity protocols and facility designs to protect against known swine diseases here in Ontario and the introduction of foreign animal diseases.

A full report, along with engineered drawings are available at www.swinehealthontario.ca

"Everyone shares the responsibility of managing the risk of disease. Whether we build the ideal assembly yard, or we each level up our own facilities, every step counts towards keeping our provincial and national hog herd healthy," says Dr. Misener.

Funding for the assembly yard design project was provided by the Government of Canada under the African Swine Fever Industry Preparedness Program.

APPENDIX 4 – ASSEMBLY DRAWINGS