BAKERVIEW ECODAIRY

ABBOTSFORD, BRITISH COLUMBIA

CATEGORY: A. BUILDINGS

Architect: Focus Architecture Corp.

Stantec

Bakerview EcoDairy, Abbotsford, British Columbia

Bakerview EcoDairy is a unique combination of cutting edge engineering and Agricultural Entrepreneurial spirit. It is an operational dairy farm with a few twists.

Architecturally, the buildings were designed to fit into a rural, agricultural setting. Mechanically, the concept of "less is more" was applied to heating and ventilation systems, using many state-of-the-art concepts and systems to simplify the operation of these facilities. Electrically, lighting and power loads were minimized, using leading edge technology to try to match input requirements with the electricity produced by an onsite generator burning "gas" produced by an onsite anaerobic digester fueled by animal waste.

Significant seasonal challenges were anticipated because of the proposed location. This project is located on the Sumas Prairie, between Abbotsford and Huntington, British Columbia, adjacent to Highway 11 and a local industrial and shopping area. Significant prevailing winds are experienced in this area, especially in the winter season. Significant rainfall in the area suggested this would be excellent for rainwater harvesting for other uses.

Preliminary discussions regarding the heating and ventilation systems resulted in a desire to use natural ventilation and hydronic radiant floor throughout the building, if possible. The design of the buildings provided the height necessary to permit stratification/displacement ventilation concepts to be applied.

Presentation Centre – Several area based challenges were identified: A theatre, an enclosed observation room, and a large mezzanine planned for a meeting area connected to the large display/gathering area. Independent modeling of each space and its use/occupancy loading was reviewed.

The high roof line permitted the installation of a large rainwater collection system in a visible above ground system. Rain from the building roof levels is collected into the tank, and then used as a gravity feed for irrigation of local vegetated areas.

The use of radiant floor throughout the building (both levels) was proposed in anticipation of assisting the stratification process necessary to make displacement ventilation function properly. Separate zones were to be provided within each room or area, while the hydronic system heat source consists of two high efficiency, condensing, wall mounted boilers.

A detailed study of the anticipated ventilation load requirements was undertaken. To achieve the comfort and ventilation rates required, it was determined that low level inlets and high level relief openings would be required in each space.

In the theatre room, a louver (with a motorized low leak damper) located at low level on an exterior wall was recommended as this would permit ventilation air to enter the cavity below the seating platform. Bare hydronic fin tube radiation was installed between strategically located baffles in the platform cavity, which provided adequate heat for the ventilation air. This tempered air is released into the occupied space by a series of floor grilles, located in front of the seating. Relief from the theatre space is provided via a "chimney" feature that extends through the mezzanine to the roof.

Some changes to that configuration were required for the concept to function in the observation room. Since the observation room is fully surrounded by other rooms, and is directly adjacent and connected to the

livestock area, "forced" air, ducted from outside, was proposed to be distributed into the space, using similar displacement concepts. However, it was determined later in design, to eliminate the platform and provide bleacher style seating. To adjust for this, the supply grilles were located at low level along the wall behind the bleacher. Heating was revised to an electric coil within the incoming duct. Once again, the "chimney" relief concept was included, to complete the ventilation system.

In the display area on the main floor and the interconnected mezzanine area above, low level louvers (with dampers) were utilized once again. Louvers were located below the windows and a special 'window box' was developed to permit the ventilation air to be released at floor level (cooling) or at window sill level (in heating). Relief is provided at high levels within the space through a vertical 'skylight' as a result of the building design. Consideration was given to provide mechanical operators on some window sections; however, due to the noted wind considerations, it was determined to replace some windows with louvers and motorized low leak dampers to provide better controllability of the ventilation volume. As the mezzanine area was determined to be somewhat protected from the ventilation path of the display area, additional ventilation was provided, via a horizontal "wind tunnel" through the building. Again, louvers with low leak dampers were provided at both ends of the tunnel, to control the air flow. Electric heating elements are also provided at both ends of the tunnel, to provide any heating necessary. Supply grilles in the mezzanine floor, connected to the tunnel, provide ventilation air along the length of the mezzanine, allowing the air to blend with the relief from the display area, exiting the building via the high level relief dampers.

Retail Centre – The building, similar to the Presentation Centre, was examined to determine any area based challenges. Originally both ends of the building included overhead doors that were intended to be part of the summer ventilation. As the functional design evolved, one of the doors was removed and a glass surrounded patio was added.

The use of radiant floor throughout the building was proposed, in anticipation of assisting the stratification process necessary to make displacement ventilation function properly. The hydronic system heat source consists of two high efficiency, condensing, wall mounted boilers.

Next, a detailed study of the anticipated ventilation load requirement was completed. To achieve the comfort and ventilation rates required, it was determined that low level inlets and high level relief openings would be provided. Due to the removal of one overhead door, multiple speed supply fans were provided, adjacent to the removed door, to provide an equivalent level of ventilation.

Louvers (with a motorized low leak damper) located at low level on an exterior wall were indicated adjacent to the remaining overhead door to provide winter ventilation. The "window box" concept is implemented once again, and as noted previously, to provide tempering of the airflow, if required. At the other end, the multi-speed fans operate at low speed, to provide the necessary winter ventilation; bare fin tube radiation is installed in the fan enclosure to provide any necessary tempering of the ventilation air. In shoulder season and during the summer time, it is anticipated that the large overhead door will be open, providing the majority of the required ventilation. To supplement ventilation in the enclosed end of the building, the fans will be increased to high speed. Relief (for both seasons) will be provided by the roof mounted cupolas; each face of each cupola will be provided with a louver and a low leak damper.

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NEW APPLICATION OF EXISTING TECHNIQUES/ ORIGINALITY/ INNOVATION

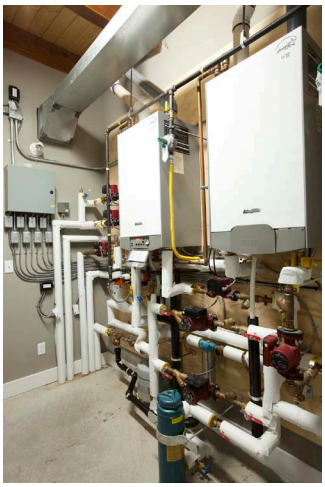
1. Does the entry represent some kind of breakthrough in technology or science?

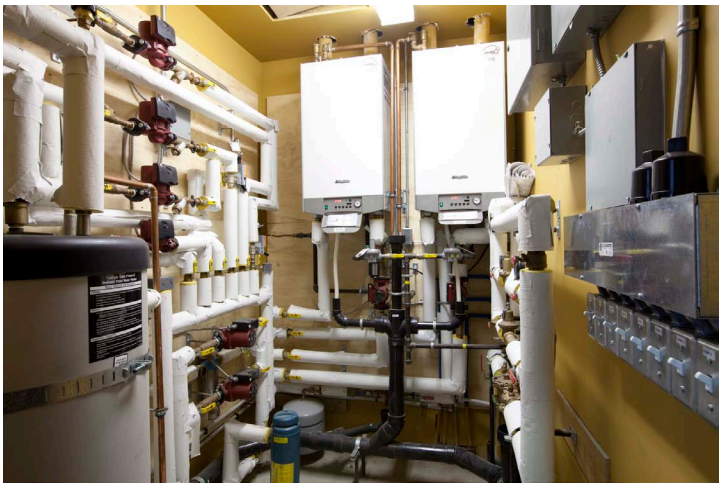
The systems used are existing technology, applied in a different manner, to achieve the client's desires and requirements. Mechanically, the concept of "less is more" was applied to heating and ventilation systems, using many state-of-the-art concepts and systems to simplify the operation of these facilities. Electrically, lighting and power loads were minimized, using leading edge technology to try to match input requirements with the electricity produced by an onsite generator burning "gas" produced by an onsite anaerobic digester fueled by animal waste.

2. Does the entry represent a unique mix of different techniques, materials or equipment?

Architecturally: Recycled and beetle killed timber was used for sustainability purposes.

Mechanically: A combination of natural and displacement ventilation and a detailed control system were implemented, in addition to custom designed heating cabinets.





The high roof line permitted the installation of a large rainwater collection system in a visible above ground system. Rain from the building roof levels is collected into the tank, and then used as a gravity feed for irrigation of local vegetated areas.

The use of radiant floor throughout the building (both levels) was proposed in anticipation of assisting the stratification process necessary to make displacement ventilation function properly. Separate zones were to be provided within each room or area, while the hydronic system heat source consists of two high efficiency, condensing, wall mounted boilers.

In the theatre room, a louver (with a motorized low leak damper) located at low level on an exterior wall was recommended, as this would permit ventilation air to enter the cavity below the seating platform. When required, bare hydronic fin tube radiation was installed between strategically located baffles in the platform cavity provided adequate heat for the ventilation air. This tempered air is released into the occupied space by a series of floor grilles, located in front of the seating. Relief from the theatre space is provided via a "chimney" feature that extends through the mezzanine to the roof.

In the display area on the main floor, and the interconnected mezzanine area above, low level louvers (with dampers) were utilized once again. Louvers were located below the windows and a special 'window box' was developed to permit the ventilation air to be released at floor level (cooling) or at window sill level (in heating). Relief is provided at high levels within the space through a vertical 'skylight' as a result of the building design.

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In shoulder season and during the summer time, it is anticipated that the large overhead door will be open, providing the majority of the required ventilation. To supplement ventilation in the enclosed end of the building of the retail centre, the fans will be increased to high speed. Relief (for both seasons) will be provided by the roof mounted cupolas; each face of each cupola will be provided with a louver and a low leak damper.

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Electrically:

Anaerobic Digester: An anaerobic digester was used to capture "bio-gas" derived from cow manure, then used to drive a 20KW generator to produce electricity. Working with BC Hydro, a bi-directional meter, voltage and frequency synchronization, and anti-islanding protection was installed to allow excess electricity to be provided to the electrical grid.

Induction Lighting: Induction lighting was installed in the barn area. Instead of using electrodes like typical fluorescent lighting, induction lights power the tube using electromagnetic fields generated outside the lamp. Twelve (12) 200W induction lights were used in the barn, the light produced is the equivalent of using twelve 320W metal halide lamps.

3. Does the entry advance the state of the engineer's art and skills?

Yes. The application of these concepts/systems to this project required thinking outside the box and stretching the known concepts to make them apply to the situation at hand, without over-designing or over-complicating the systems.

The expectation conveyed to Stantec's mechanical group was to provide all required systems at a minimum electrical impact and reduced environmental impact. There was no place for large air conveying systems as the goal was to make the mechanical systems almost invisible.

COMPLEXITY

1. Does the entry involve very complex criteria or types of problems?

Significant seasonal challenges were anticipated because of the proposed location. This project is located on the Sumas Prairie, between Abbotsford and Huntington, British Columbia, adjacent to Highway 11 and a local industrial and shopping area. Significant prevailing winds are experienced in this area, especially in the winter season. Significant rainfall in the area suggested this would be excellent for rainwater harvesting for other uses.

Some complexity was encountered; in providing the required ventilation to some building areas, without straying from the desired mandate. Several area based challenges were identified in the Presentation Centre as a theatre, an enclosed observation room, and a large mezzanine planned for a meeting area was connected to the large display/gathering area. Independent modeling of each space and its use/occupancy loading was reviewed.

Architect: Focus Architecture Corp.

The Retail Centre, similar to the Presentation Centre, was examined to determine any area based challenges. Originally both ends of the building included overhead doors that were intended to be part of the summer ventilation. As the functional design evolved, one of the doors was removed and a glass surrounded patio was added.


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To accommodate the complexity of properly adjusting the Control Systems to suit weather conditions; a DDC building automation system is provided. Outdoor air temperature, wind speed and direction, and other weather information is collected by the on-site weather station. The data from the weather station, along with data from the indoor CO_2 sensors, is evaluated to determine which dampers to open (up-wind vs. downwind) and the damper position required to maintain maximum CO_2 levels (winter) and maximum temperature setpoints (summer).

2. Were extraordinary problems of site, location, hazardous conditions present?

Controlling the ventilation system to negate the forces of the prevailing winds, when not required for ventilation, required some additional care and attention.

ENVIRONMENTAL IMPACT

1. Does the entry provide environmental benefits?

Yes. The designed systems use significantly less mechanical equipment than a conventional design; while providing a functional, comfortable building in all seasons. Using induction lighting has resulted in an approximately 40% savings in electricity for the barn lighting, along with extended lamp life.

2. Does it conserve energy and have a low carbon footprint?

Yes. The use of CO_2 sensors within the buildings during the heating season permits reduces the ventilation requirements to match the actual building loading. The use of condensing boilers reduces the volume of gas required to heat the remaining system load. The installation and implementation of the anaerobic digester captures and contains on-site combustible gas, which is used for powering an electric generator, instead of being naturally released into the atmosphere.

3. Does it conserve or improve land, restore or improve air quality, water systems, ecosystems, etc.?

Yes. The installation and implementation of the anaerobic digester captures and contains on-site combustible gas, which is used for powering an electric generator, instead of being naturally released into the atmosphere. Additionally rain water is being captured and used to provide irrigation to vegetated areas.

SOCIAL AND ECONOMIC BENEFITS

1. Does the entry provide any social or economic benefits?

Yes. It is a functional Dairy, a tourist attraction, and a "for profit" retail sales outlet.

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2. Are additional benefits realized as a spin-off?

Yes. The provision of a visual link between the milk people drink and the process to create it is an educational tool being used by the local educational community. Curriculum has been developed to integrate this facility into the educational system.

MEETING AND EXCEEDING OWNER'S/CLIENT'S NEEDS

1. Is it an economical and cost-effective solution?

Yes. A cost-effective solution has been implemented for the Dairy.

2. How did final cost relate to original budget estimate?

The final costs stayed within budget of the original estimate.

3. How closely does the solution meet the overall goals of the owner/client?

The solutions that were implemented as a part of the design met the overall goals of the owner/client. The mandate for this project was to provide a Presentation Centre and a Retail centre that connected seamlessly with a fully functional modern-day dairy farm, while being environmentally responsible. This would provide opportunity for the public to get in touch with this food source, see how it was produced, and, if desired, purchase the products before they left the site.

Mechanically, the concept of "less is more" was to be applied to heating and ventilation systems, using many state-of-the-art concepts and systems to simplify the operation of these facilities. Electrically, lighting and power loads were to be minimized, using leading edge technology to try to match input requirements with the electricity produced by an onsite generator burning "gas" produced by an onsite anaerobic digester fueled by animal waste.

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4. Did the entrant meet the client's schedule?

Yes. The project was completed on time, based on the original schedule that was determined.

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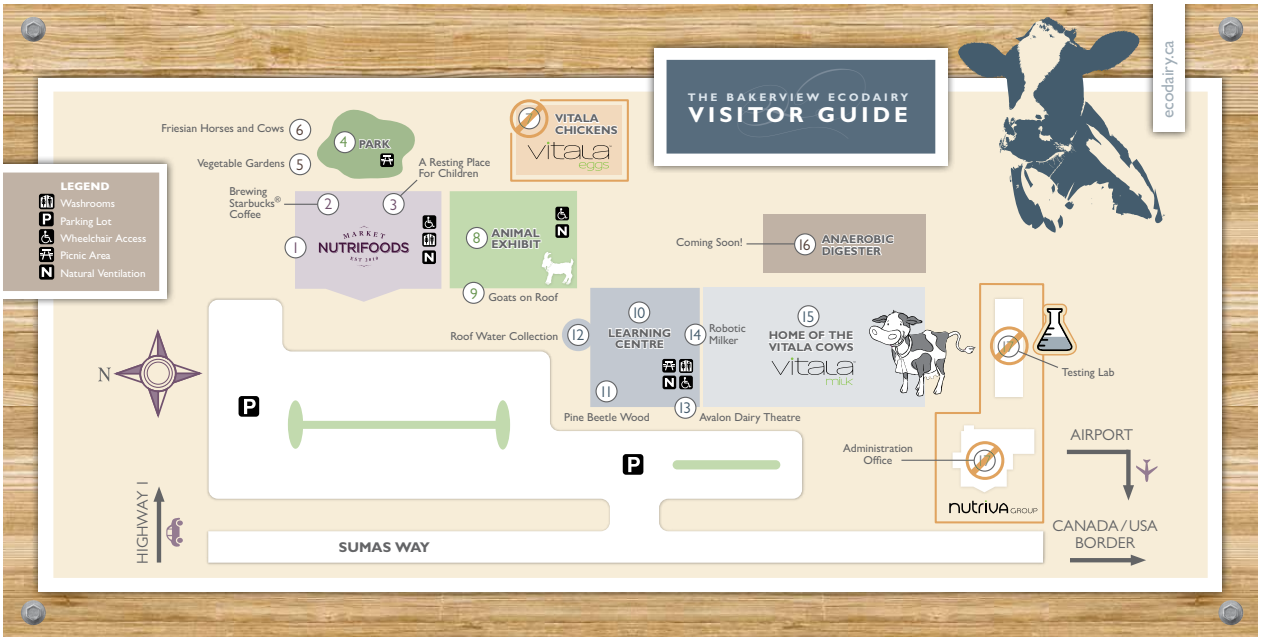


1 NUTRIFOODS MARKET

Natural, healthy and local products including dairy, meat, poultry, fish, produce and grains.

2 BREWING STARBUCKS® COFFEE
3 A RESTING PLACE FOR CHILDREN

4 PARK

Take a stroll. Walk the trails, relax on the benches or enjoy a picnic. The park features:

5 VEGETABLE GARDENS
6 FRIESIAN HORSES AND COWS

7 VITALA CHICKENS

Our Vitala Chickens are not part of the public area.

8 ANIMAL EXHIBIT

Our petting zoo features miniature ponies, sheep, calves, pigs and goats. The Animal Exhibit also features:

9 GOATS ON ROOF

10 LEARNING CENTRE

Enjoy a unique, first hand farm experience. Guided tours showcase the dairy industry and innovative and sustainable farming practices.

11 PINE BEETLE WOOD
12 ROOF WATER COLLECTION
13 AVALON DAIRY THEATRE
14 ROBOTIC MILKER

15 HOME OF THE VITALA COWS

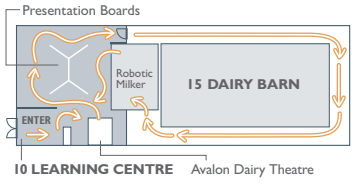
The modern free stall barn is designed to 'Bring the Pasture Inside'.

16 ANAEROBIC DIGESTER

We use manure to create electricity, cow bedding and organic fertilizer.

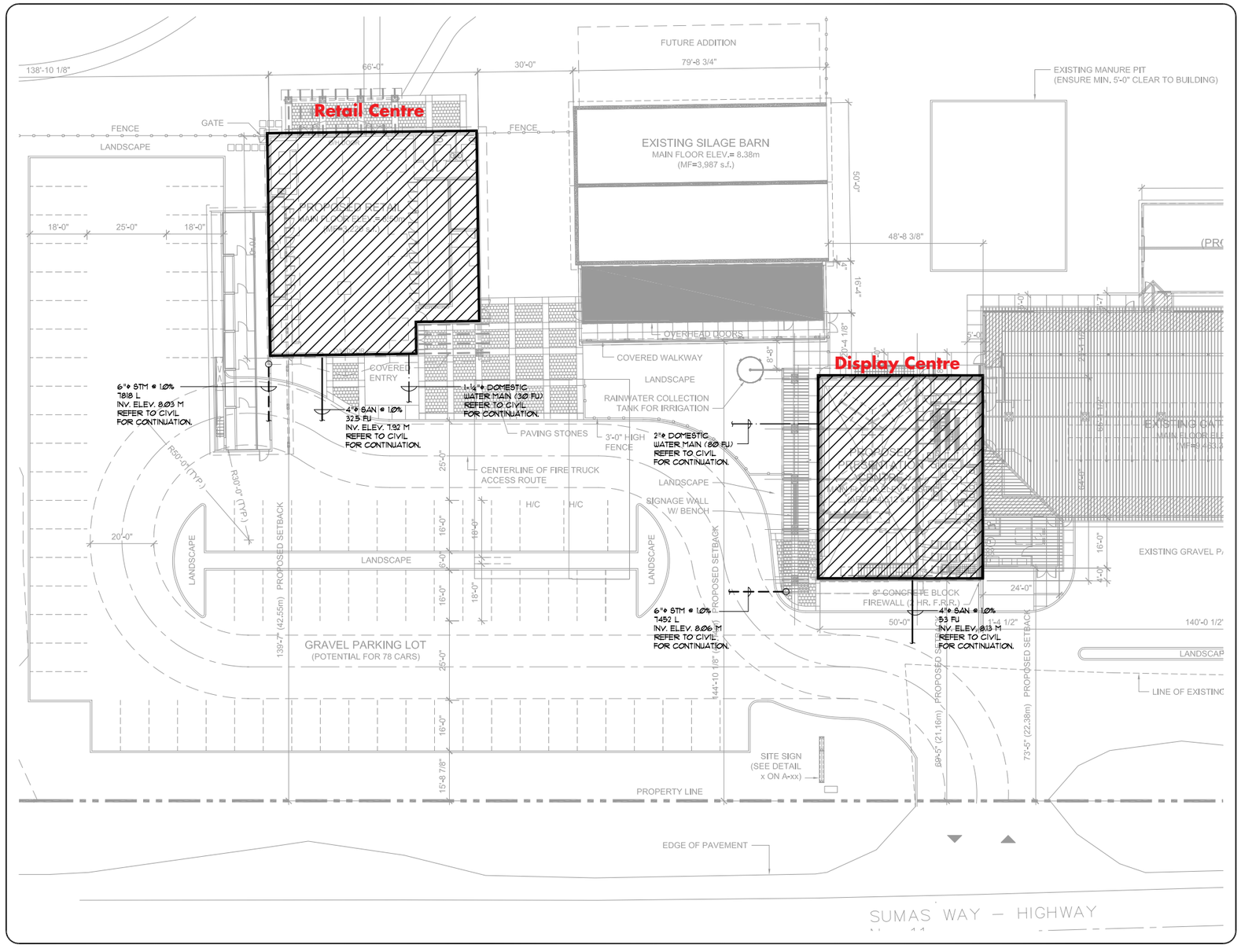
17 TESTING LAB AND NUTRIVA GROUP ADMINISTRATION OFFICE

Our nutritionists make sure the cow's food is of the highest quality. The Testing Lab and the Nutriva Group Administration Office are not part of the public area. Thank you.

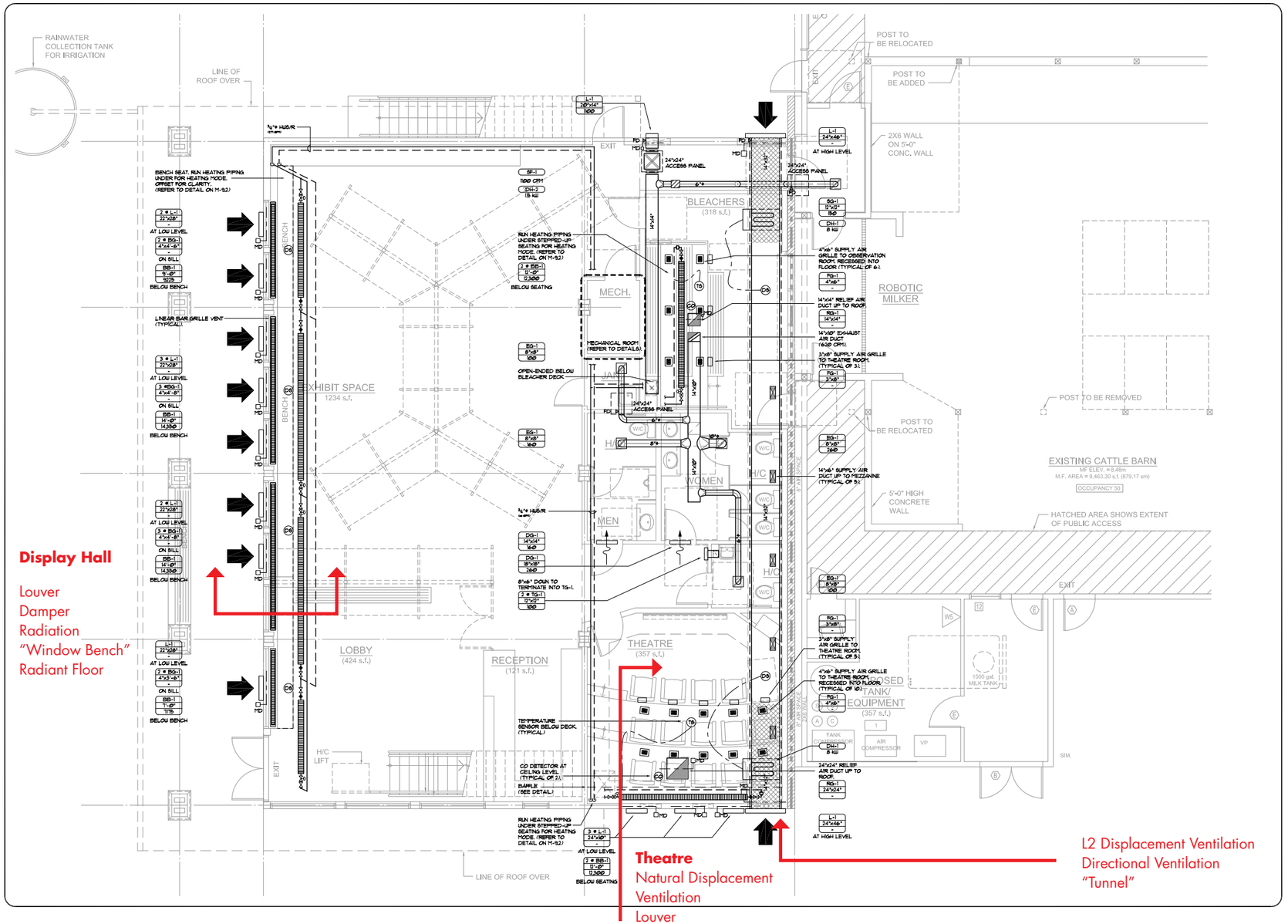


Bakerview EcoDairy

BAKERVIEW EcoDairy ASSOCIATION


Retail Centre
Display Centre
FUTURE ADDITION
79'-8 3/4"
66'-0"
30'-0"
138'-10 1/8"
FENCE
GATE
LANDSCAPE
EXISTING MANURE PIT
(ENSURE MIN. 5'-0" CLEAR TO BUILDING)
EXISTING SILAGE BARN
MAIN FLOOR ELEV.= 8.38m
(MF=3,987 s.f.)
PROPOSED RETAIL
MAIN FLOOR ELEV.= 8.38m
(MF=2,000 s.f.)
18'-0"
25'-0"
18'-0"
50'-0"
48'-8 3/8"
OVERHEAD DOORS
COVERED WALKWAY
LANDSCAPE
COVERED ENTRY
6"ø STM @ 1.0%
7818 L
INV. ELEV. 8.03 M
REFER TO CIVIL
FOR CONTINUATION.
4"ø SAN @ 1.0%
32.5 FU
INV. ELEV. 7.92 M
REFER TO CIVIL
FOR CONTINUATION.
1-1/4"ø DOMESTIC
WATER MAIN (30 FU)
REFER TO CIVIL
FOR CONTINUATION.
RAINWATER COLLECTION
TANK FOR IRRIGATION
PAVING STONES
3'-0" HIGH
FENCE
2"ø DOMESTIC
WATER MAIN (80 FU)
REFER TO CIVIL
FOR CONTINUATION.
CENTERLINE OF FIRE TRUCK
ACCESS ROUTE
LANDSCAPE
SIGNAGE WALL
W/ BENCH
H/C
H/C
R30'-0" (TYP.)
R30'-0" (TYP.)
20'-0"
LANDSCAPE
LANDSCAPE
LANDSCAPE
PROPOSED SETBACK
PROPOSED SETBACK
16'-0"
16'-0"
6'-0"
16'-0"
18'-0"
139'-7" (42.55m)
GRAVEL PARKING LOT
(POTENTIAL FOR 78 CARS)
25'-0"
16'-0"
15'-8 7/8"
144'-10 1/8"
6"ø STM @ 1.0%
7452 L
INV. ELEV. 8.06 M
REFER TO CIVIL
FOR CONTINUATION.
4"ø SAN @ 1.0%
53 FU
INV. ELEV. 8.13 M
REFER TO CIVIL
FOR CONTINUATION.
8" CONCRETE BLOCK
FIREWALL (2 HR. F.R.R.)
24'-0"
50'-0"
16'-0"
4'-0"
EXISTING GRAVEL P
140'-0 1/2"
LANDSCAP
LINE OF EXISTING
69'-5" (21.16m)
73'-5" (22.38m)
SITE SIGN
(SEE DETAIL
x ON A-xx)
PROPERTY LINE
EDGE OF PAVEMENT
SUMAS WAY – HIGHWAY

Site Plan



Display Hall

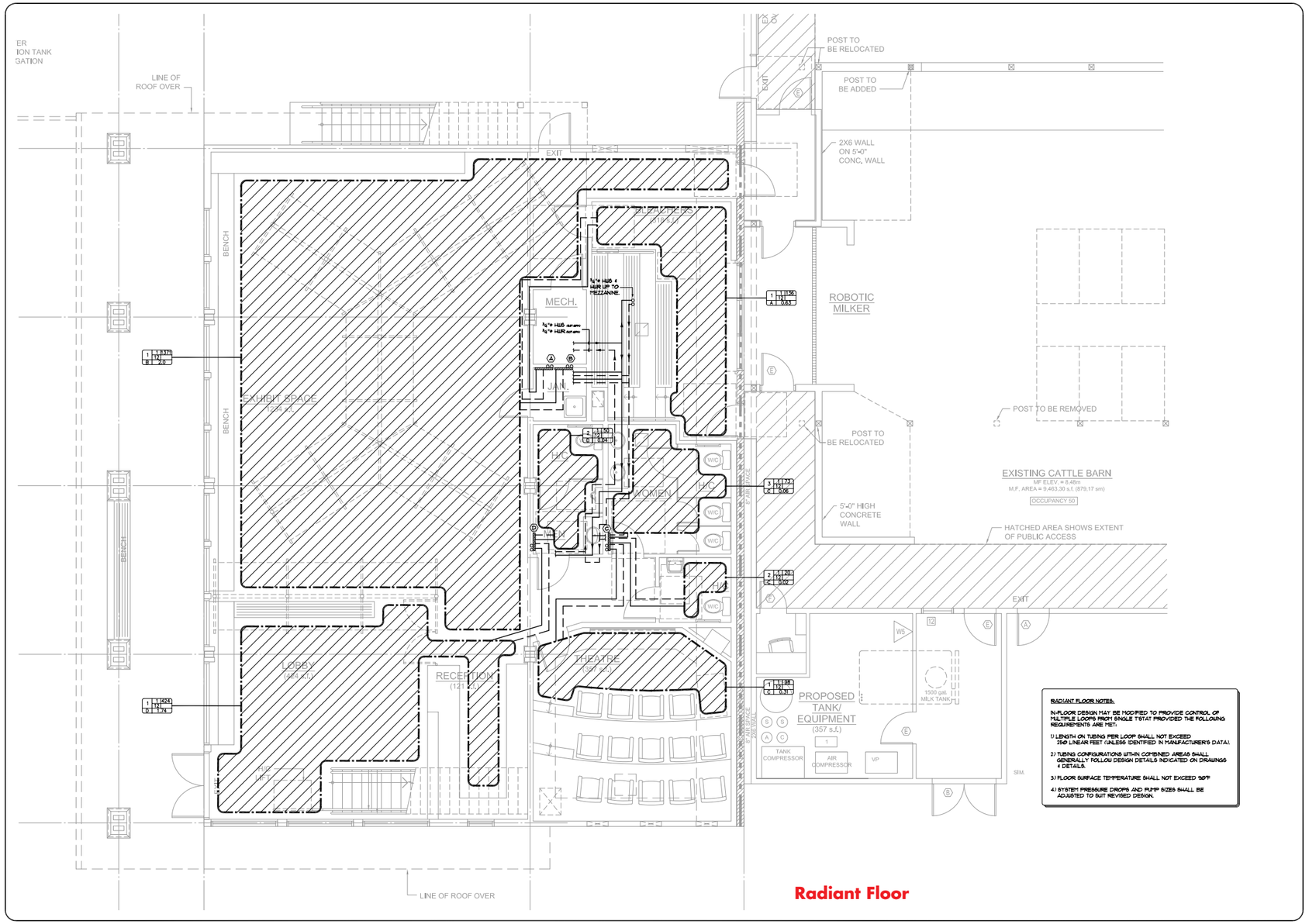
Louver
Damper
Radiation
"Window Bench"
Radiant Floor

Theatre

Natural Displacement Ventilation
Louver
Damper
Radiation
Grilles in Risers
Relief Chimney

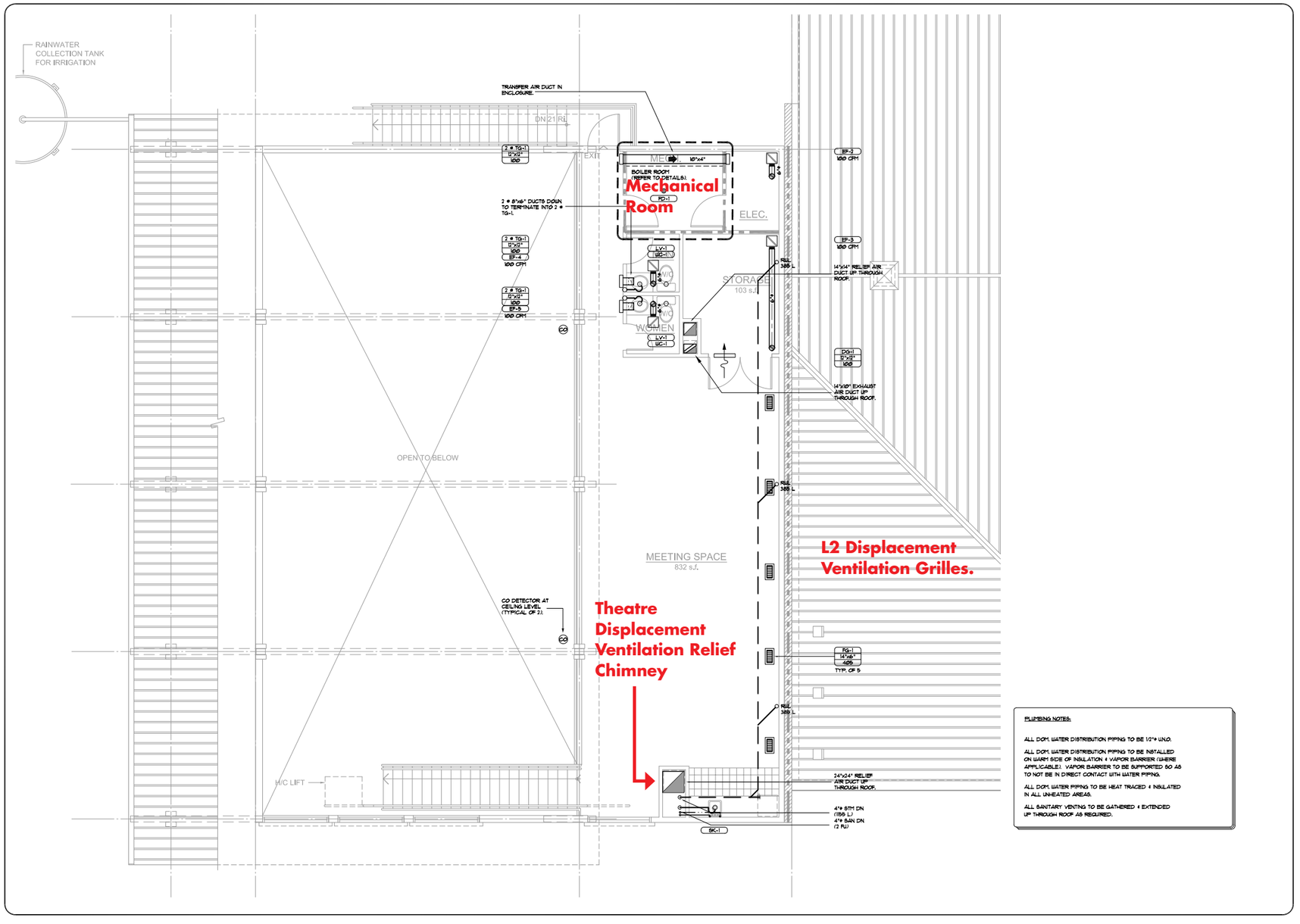
L2 Displacement Ventilation
Directional Ventilation
"Tunnel"

Display Centre

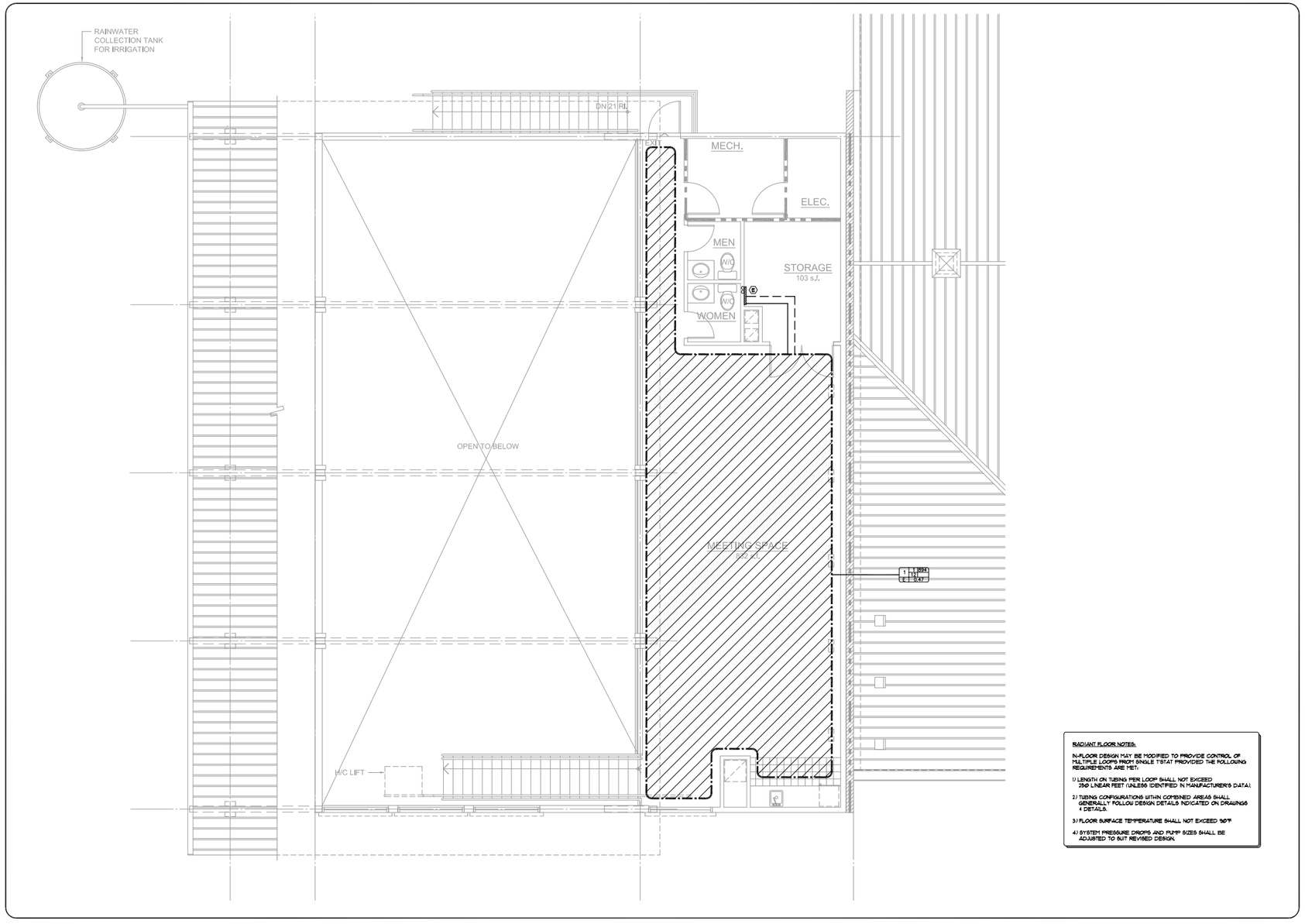


Radiant Floor

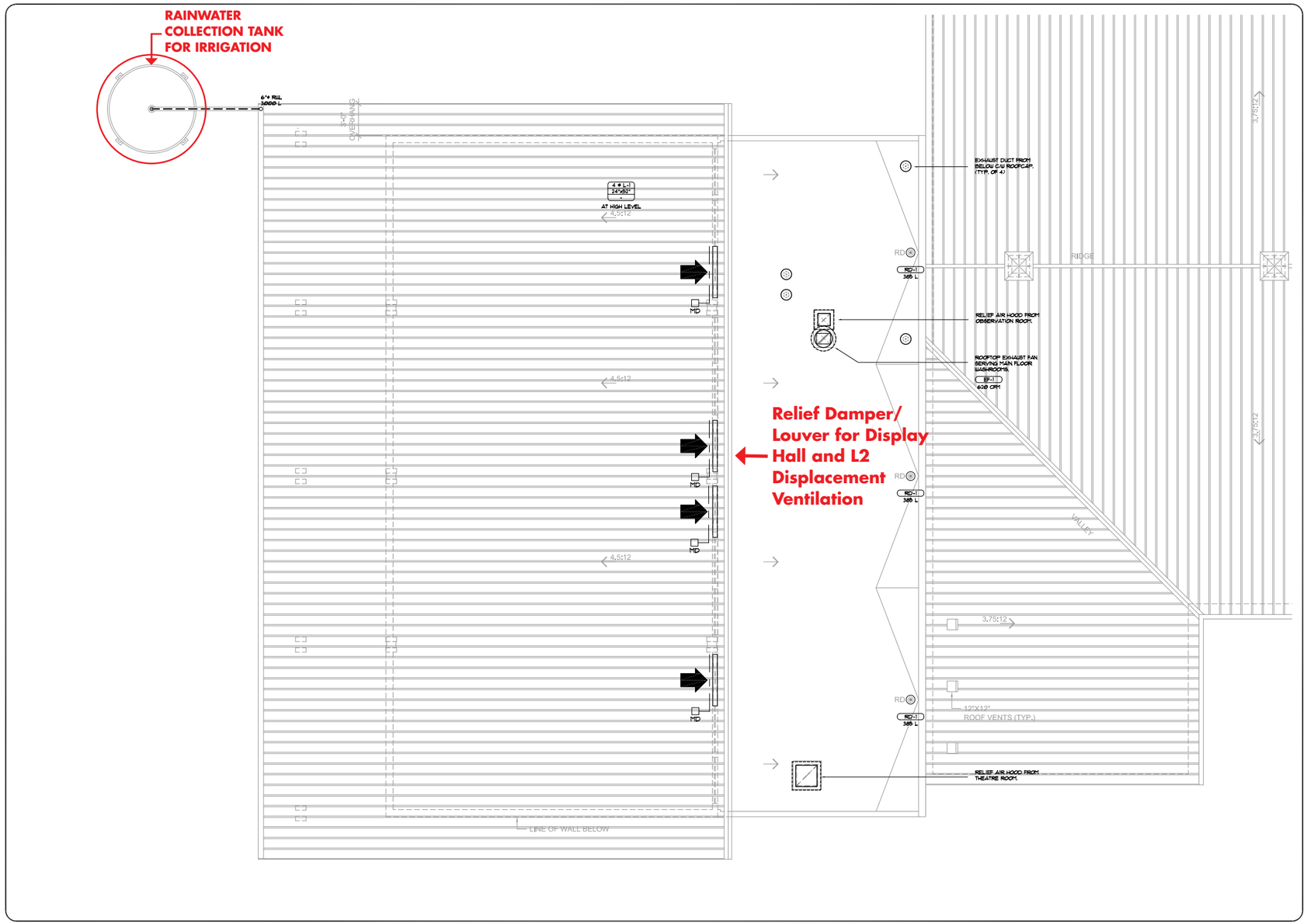
Display Centre



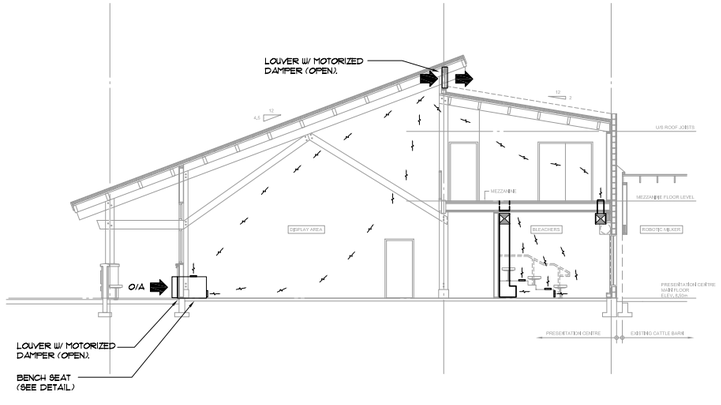
Mezzanine - Display Centre



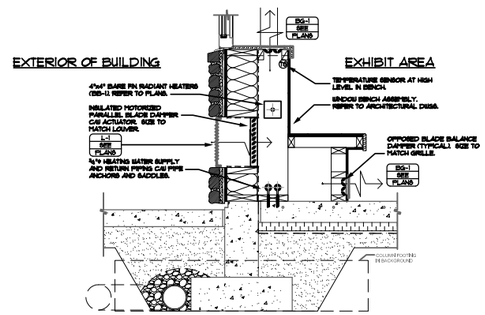
Mezzanine –
Display Centre



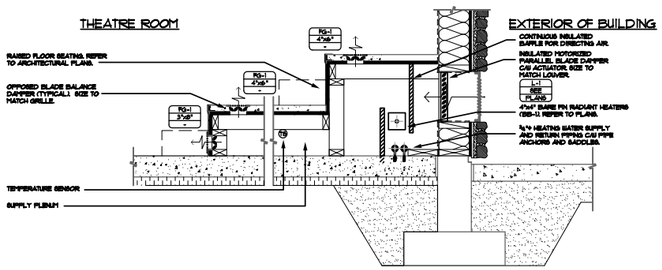
Roof / Attic –
Display Centre



VENTILATION DIAGRAM
N.T.S.

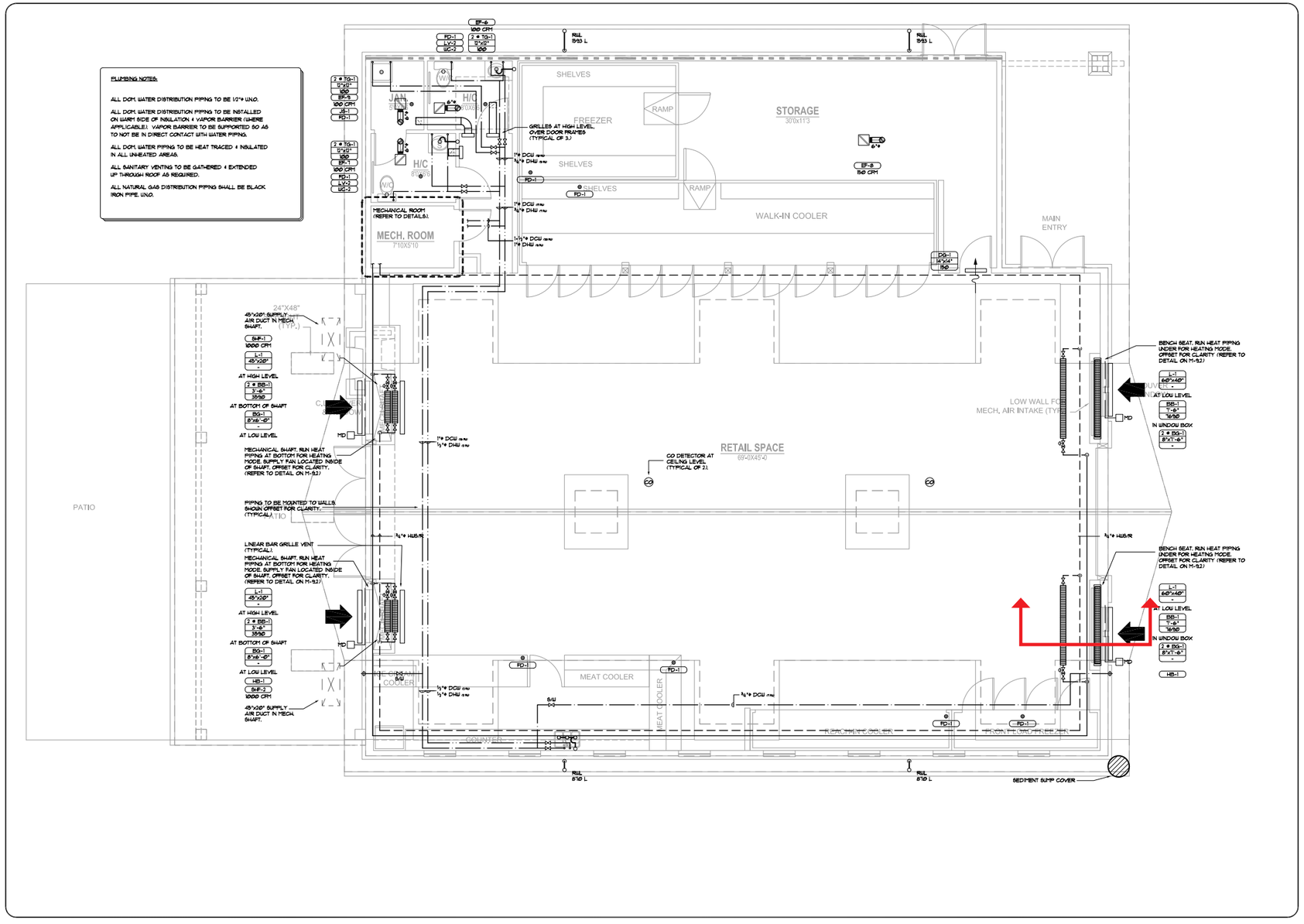


WINDOW BENCH VENTILATION DETAIL
N.T.S.



THEATRE ROOM SEATING VENTILATION DETAIL
N.T.S.

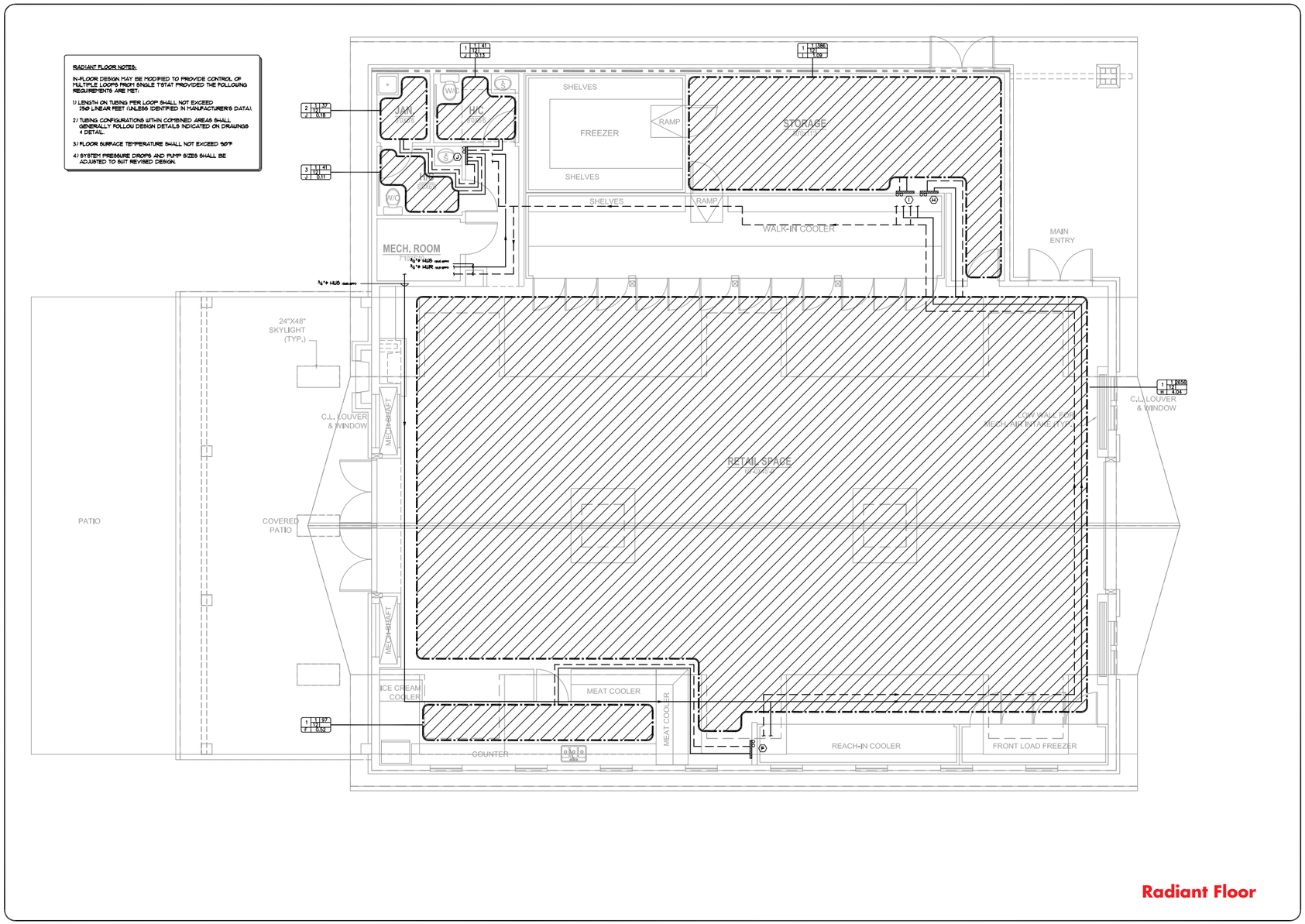
Concept Details – Display Centre



"Window Bench"

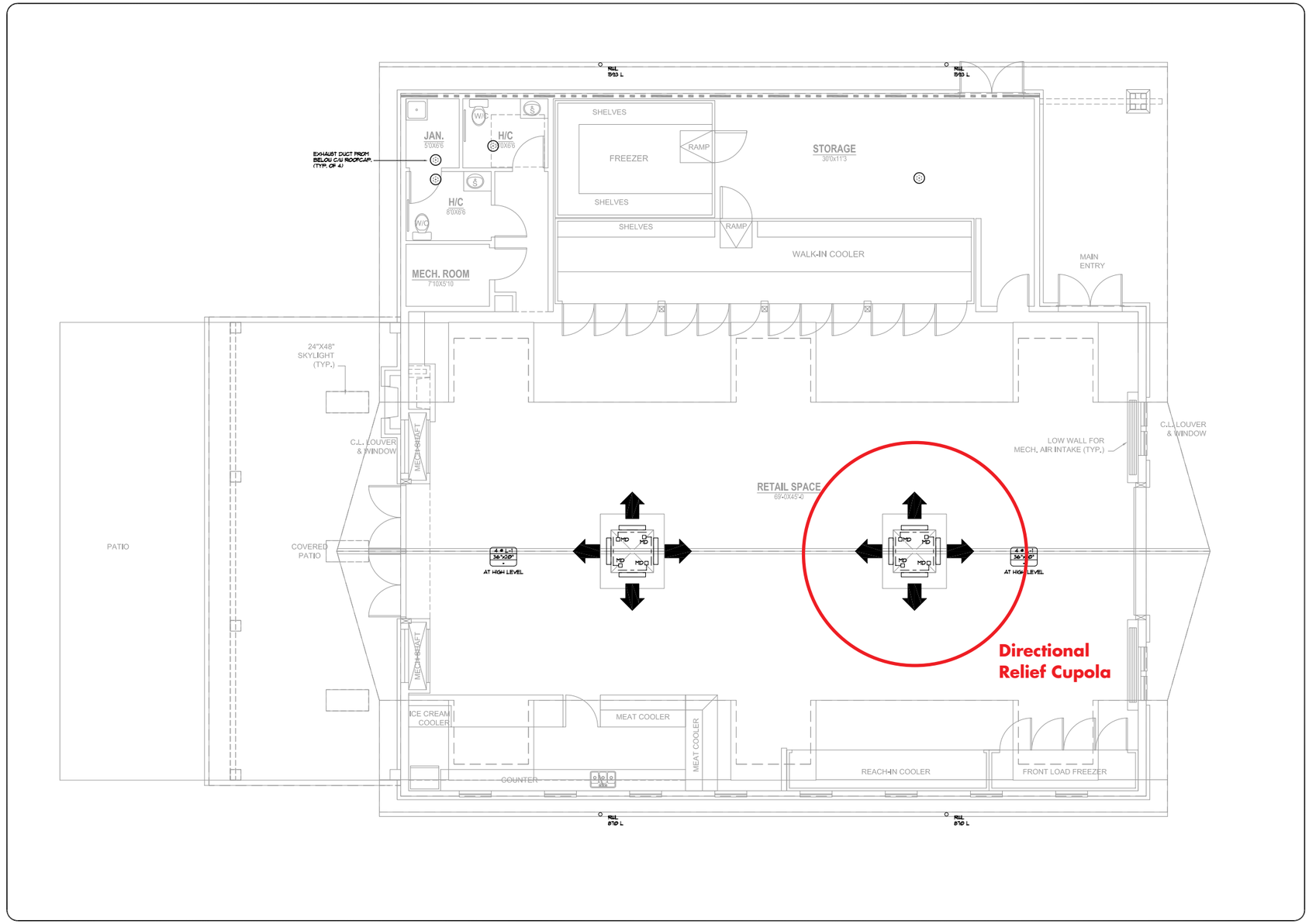
Displacement Ventilation
Louver
Damper
Radiation
Radiant Floor

Retail Centre

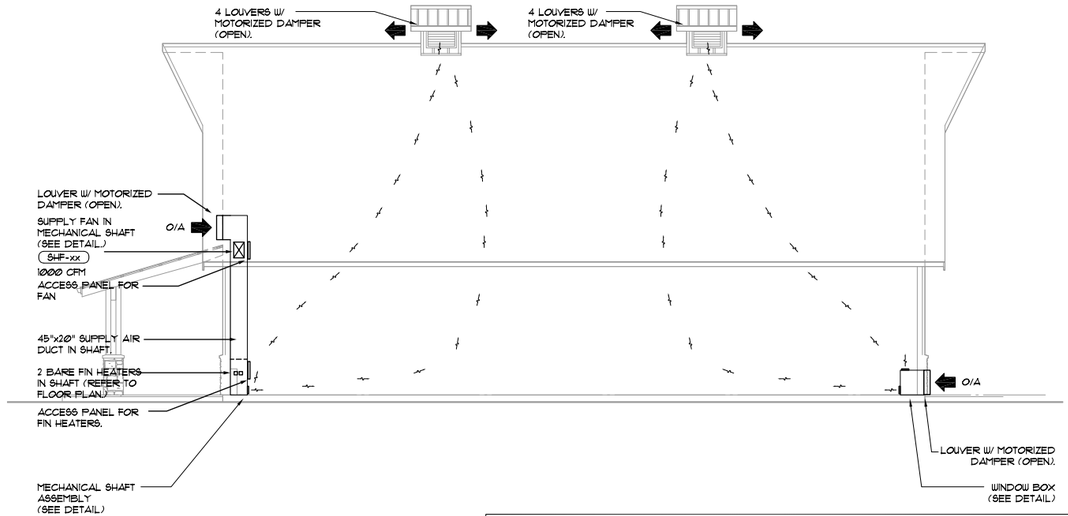


Radiant Floor

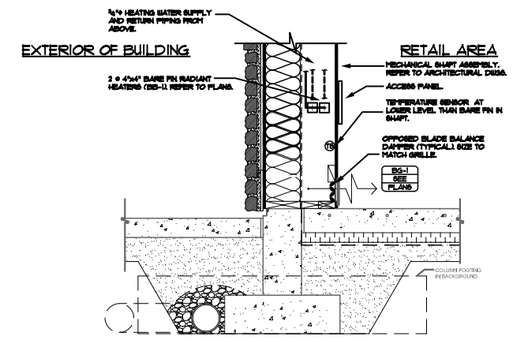
Retail Centre



Roof –
Retail Centre



VENTILATION DIAGRAM
N.T.S.



LOWER MECHANICAL SHAFT VENTILATION DETAIL
N.T.S.

Concept Details –
Retail Centre