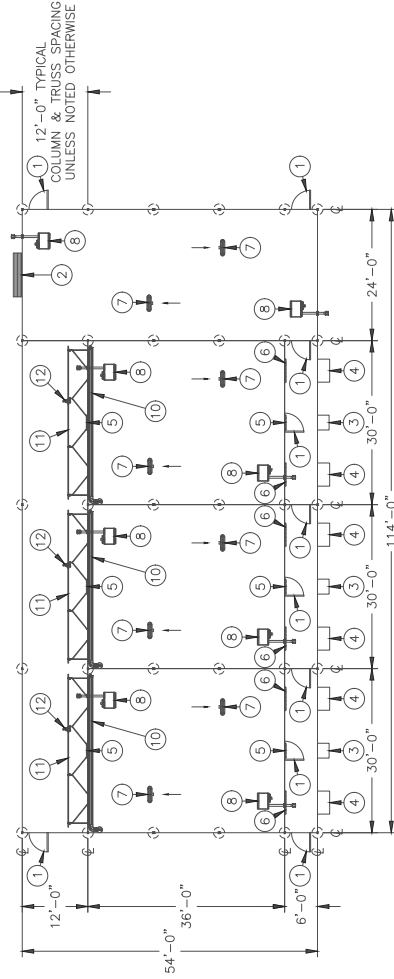


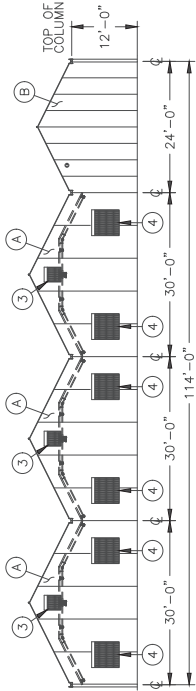
ITEM #	MATERIAL LIST - PART DESCRIPTION	QTY
1	PERSONNEL DOOR	10
2	8'x8' ROLL-UP DOOR	1
3	MAL24G EXHAUST FAN	3
4	MAL42K EXHAUST FAN	6
5	33"x33" SHUTTER	6
6	51"x51" SHUTTER	6
7	HAF20A HORIZONTAL AIR FLOW FAN	8
8	MODINE HD 125SS HEATER	6
9	MODINE HD 75SS HEATER	2
10	4" X 48" KUUL PAD X 27FT	3
11	48" RIGID VENT SYS 1-1/4" DR X 27FT	3
12	WADSWORTH VC2000 3RPM MOTOR	6
13	SLOPE-FLAT-SLOPE SHADE SYSTEM	3

ITEM #	MATERIAL LIST - PART DESCRIPTION	QTY
A	8MM TWIN WALL POLYCARBONATE	---
B	PRO-PANEL CORRUGATED METAL	---
C	INSECT SCREEN	---

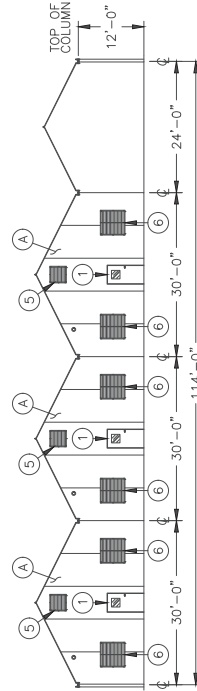
- NOTES:
- CHECK WITH CUSTOMER FOR EXACT LOCATION OF DOORS AND ALL EQUIPMENT.
  - REFER TO ENDWALL FRAMING DRAWINGS FOR ASSEMBLY OF ENDWALLS.
  - IN THE EVENT OF UNINTENDED CONFLICT OF EQUIPMENT PLACEMENT & CODE STRUCTURE, WHEN APPLICABLE, PRIORITY WILL BE GIVEN TO CODE STRUCTURE.
  - DRAWING FOR ESTIMATION PURPOSE ONLY.



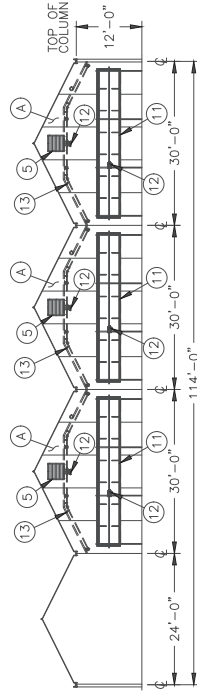
PLAN VIEW



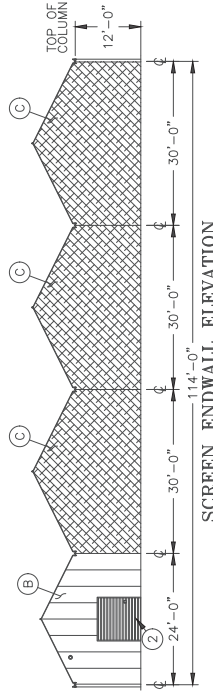
FAN ENDWALL ELEVATION



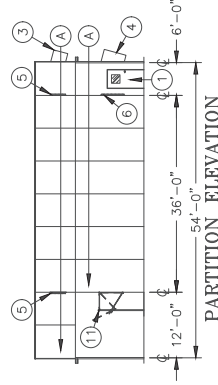
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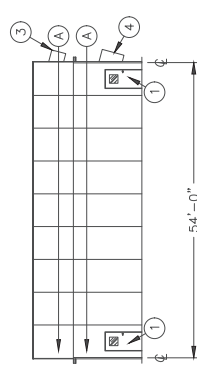
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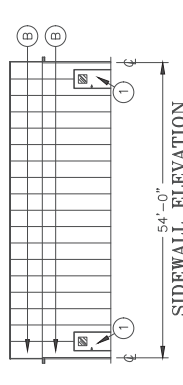
SCREEN ENDWALL ELEVATION



PARTITION ELEVATION



SIDEWALL ELEVATION



SIDEWALL ELEVATION

LINCOLN UNIVERSITY-BUSBY FARM

PROJECT # TBD

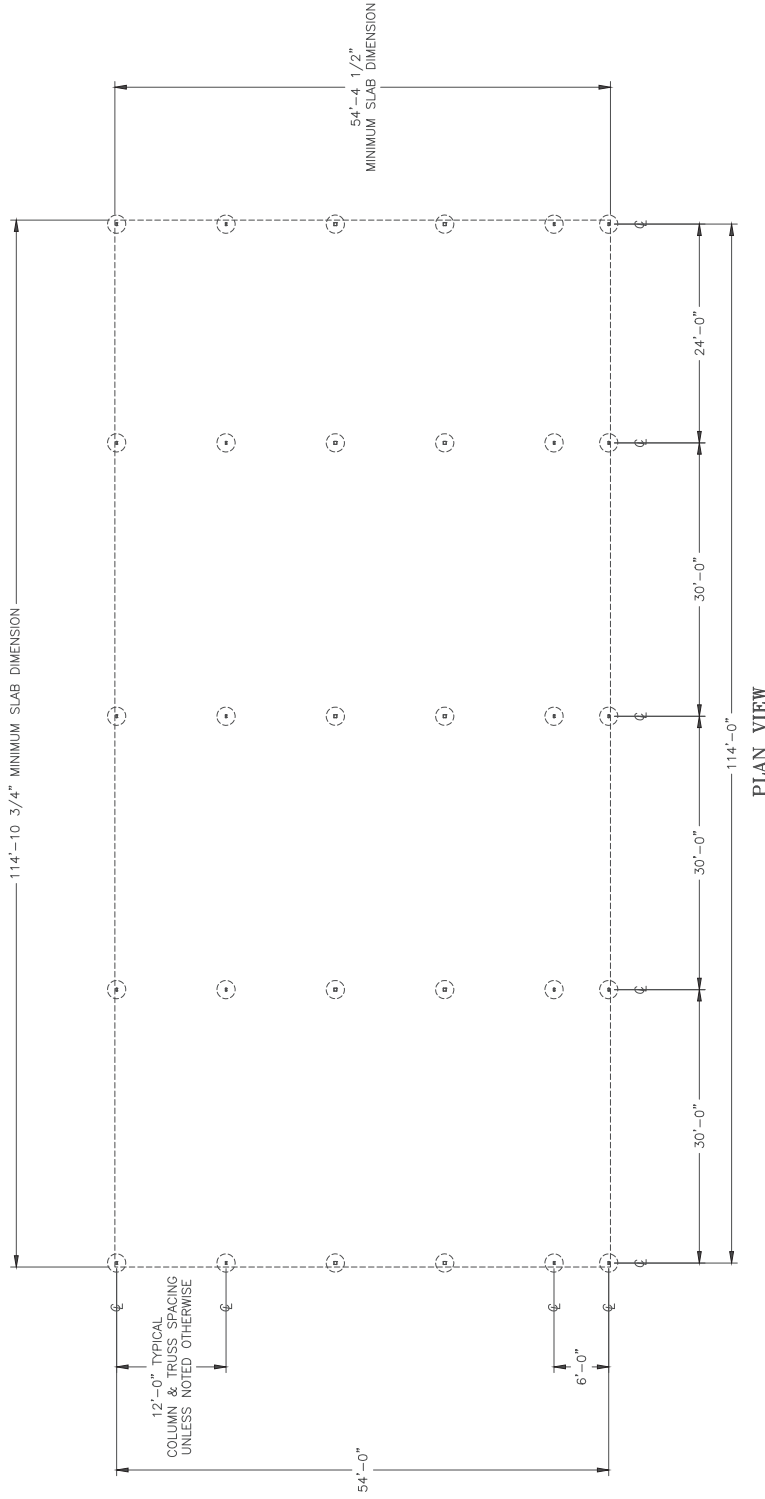
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GS001A  
SLAB LAYOUT



PLAN VIEW

- NOTES:
1. CONCRETE SLAB DIMENSIONS SHOWN ARE OF MINIMUM VALUE.
  2. PIER SIZE TO BE DETERMINED BY CODE ENGINEER.
  3. DRAWING FOR ESTIMATION PURPOSE ONLY.

## **Lincoln University – Busby Farm Greenhouse**

### **Part I – TECHNICAL SPECIFICATIONS**

#### **1.1 Description**

- a. The greenhouse shall be a gable style structure with 12' straight side wall.
- b. The greenhouse shall be furnished and installed according to specifications and drawings.
- c. Greenhouse dimensions are (3) 30'x54' and (1) 24'x54'.
- d. Last 12' of 30' houses to be covered in 8mm Twin wall polycarbonate on roof and sides with bug screening on end wall.
- e. Divider will be located at the first 6' mark of each 30' structure and will be covered in 8mm twin wall polycarbonate.
- f. The University is standardizing its greenhouses and prefers a 10 feet column spacing.
- g. No equipment or materials should be ordered or fabricated prior to approval of shop drawings.

#### **1.2 Plans and Submittals**

- a. Design Criteria
  1. Greenhouse frame shall be designed to meet local building code.
  2. Provide structural prints and calculations sealed by a registered professional engineer in the state of Missouri.
  3. Provide complete shop drawings, including the placement of equipment, covering, and doors.

#### **1.3 Erection of Greenhouse**

- a. A qualified greenhouse specialty greenhouse contractor approved in writing by the manufacturer shall erect the greenhouse.
- b. The greenhouse contractor shall have at least five (5) year's experience in building greenhouses of the type specified.
- c. The General Contractor shall have all site conditions correct and ready prior to greenhouse erection.
- d. No masonry, foundation, or footer installation shall be done prior to approval of greenhouse plans.

### **PART II – MATERIALS AND EQUIPMENT**

#### **2.1 Structure**

- a. The greenhouse column and truss spacing as designated by local code.
- b. Cole County Building Codes
  1. 2015 International Building Code
  2. 2015 International Building Code
  3. 2015 International Plumbing Code
  4. 2015 national Electrical Code
- c. Sidewall height shall be (12) feet.

## 2.2 Components

### a. Primary Structural Steel Members

1. All steel members shall comply with ASTM A500 dimensional tolerances. Steel will meet Lock Joint Tube (LJT) and "Lock-On-Galv ®" specifications for corrosion resistance or equivalent.
2. Columns shall be fabricated from 4 inch by 2 inch steel or 4 inch by 4inch steel with minimum yield strength of 50,000 psi.
3. Columns will be base-plated for attachment to be attached to owner-provided foundation. Anchor bolts for attachment to be included.
4. Truss top cords will be fabricated from 3 inch by 2-inch steel with minimum yield strengths of 50,000 psi.
5. Truss bottom cords will be fabricated from 3 inch by 2-inch steel with minimum yield strengths of 50,000 psi.
6. Id strengths of 50,000 psi.
7. Truss webbing will be fabricated from steel with minimum yield strengths of 50,000 psi. Truss webbing will be attached to top and bottom cords with aluminum connections to enhance corrosion resistance. (Standard is 1.5" square tubing)
8. Roof purlins will be 3 inch by 2-inch steel. Purlins will have a bolted connection to trusses.
9. End walls will be framed with 3 inch by 2-inch rectangular steel tubing with minimum yield strength of 50,000 psi.
10. Gutters are to be extruded aluminum
11. No wood members are required or allowed to complete structure.
12. No rolled form pipe or round columns allowed.

## 2.3 Doors and Door Frames

1. Doors to be 42 inches wide by 84 inches tall steel insulated ADA approved doors. A minimum of two doors to be equipped with both lever lock and panic bar LHL-5. Doors 3100 Series Manufactured by AJ Manufacturing or equivalent. A total of (10) will be supplied.
  - a. Lock sets are to be included in hardware package
  - b. Doors are handicap compliant.
  - c. All doors should be furnished with appropriate framing and hardware.
  - d. Custom cylinder hardware can be provided with construction core. Permanent core and keying by the GC or owner.
    - e. Mortised hardware is not acceptable
2. Doors will be 42" x 84" constructed of aluminum and polycarbonate and will be used to entry the bug screen cages. At total of (2) will be supplied.
  - a. Doors to be furnished with appropriate framing and hardware.
3. (1) 8'x8' Corrugated Metal Roll-up door to be supplied with slide lock in Work House.

## **2.4 Ventilation Equipment**

- a. Horizontal Air Flow Fans – Acme HAF20A fans or equivalent. Quantity of (8) to be installed.
- b. Exhaust Fans – American Cool Air MAL42K or equivalent. Quantity of (6) – (2) per 30' house.
- c. Upper Gable Fan – American Cool Air MAL24G or equivalent. Quantity of (3) – (1) per 30' house.
- d. Divider Wall Shutter – American Cool Air 51x51" i.d. with motor or equivalent. Quantity of (6) - (2) per 30' house.
  1. Fans must include automatic shutters, inlet/outlet guards, slant wall housings and belt tighteners.
  2. Exhaust fans and shutters are by American Cool Air or equivalent.
  3. Horizontal air flow fans are to be manufactured by Acme Engineering, Inc. or equivalent.
  4. Exhaust fans are to have aluminum fan blades.
  5. Steel propeller fans are not acceptable.
- e. Inlet Vents and Vent Operators
  1. A single run of vents shall be made up of a top rail and bottom rail of extruded aluminum and bolted together in accordance with manufacturer instructions. All vents shall have provisions made at the hinge point to prevent creeping of the vents. A total of (3) vents will be provided. Vent size to be 48" tall and 27' long.  
Vent openers to be Wadsworth VC2000 – 3RPM.
  2. Motorized Inlet Gable Shutter  
(6) American Cool Air 33"x33" gable inlet shutters or equivalent are to be provided. Shutter's to be installed in the upper gable of structure end wall and divider wall. Motor and linkage to operate shutters is to be included.

## **2.5 Heating Equipment**

- a. Greenhouse is to be equipped with Modine power vented heaters or equivalent.
- b. Quantity of (6) Modine HD 125SS located (2) per 30' house and (2) Modine HD 75SS located (2) per 24' house to be provided.
- c. Heaters are to have stainless steel burners and exchangers.
- d. Heaters with aluminum heat exchangers are not acceptable.
- e. Single-walled stacking is to be included as well as appropriate heater hangers to mount the heaters.

## **2.6 Cooling Equipment**

- a. Evaporative pad system will consist of pads made of cross-fluted cellulose paper; PVC distribution and return system completely self-contained with pump and sump.
- b. (3) Systems 27'x48"x4" are to be provided.
- c. Distribution and return system to be a covered top, PVC, totally self-contained as manufactured by American Cool Air or equivalent.
- d. Size of system to be determined upon size of greenhouse.
- e. No wood support stringers are allowed.

## **2.7 Environmental Controls**

- a. Wadsworth Step-Up Greenhouse control system with a minimum of two stages of heating, set point, and four stages of cooling. Controller should also control interior shade system and vent motor. Controller to be equipped with temperature and humidity sensor. Controller is to be complete with contractor panel and wiring diagram. A total of (3) systems, (1) for each 30' house will be provided.
- b. Control training by the Manufacturer's representative.
- c. (2) Single-stage thermostats will be provided for (2) heaters in 24' house.

## **2.8 Covering Material**

- a. Roof, sides, and ends of 30' houses to be covered with 8MM double walled polycarbonate.
- b. Polycarbonate panels are to be of virgin resin. Regrind is not acceptable.
- d. Polycarbonate panels must carry a minimum warranty of 15 years against yellowing.
- e. Roof, Sides and Ends of 24' house to be covered in Pro-Panel metal siding or equivalent and with interior panel insulation.

## **2.9 Shade System**

Interior shade/heat retention system with Svensson Tempa 5557 D FB shade material. Shade is automated with (3) Wadsworth VC2000 3RPM motors and controlled by the greenhouse automated control system. (3) Total slope/flat/slope shade systems included.

## **2.91 Benching**

(30) 5'x12' Benches with Dura-Bench tops included. Benches have rolling tops. Bench support to be on 16" centers under tops.

Benches should be of standard height of approximately 30 inches tall.

Benches will need to be able to support seedling trays up to 10-gallon containers.

## **2.92 Irrigation**

(3) Complete irrigation systems for (10) benches each house with fertilizer injector, control, sprinkler heads, pipe, valves and hardware needed for install. Owner to provide backflow preventor and pressure regulator. Final design of irrigation system to be approved by owner prior to installation.

## **PART III – EXECUTION**

### **3.1 Installation**

- a. Installation including construction of (4) houses with attached to owner provided foundation with base plates. **General Contractor will install the base plates on top of piers and then the concrete floor will be poured over the base plates at a depth of approximately 6 inches.** All covering will be installed. All equipment and control will be installed in place. Shade systems will be installed, and benching with irrigation constructed. No gas, water or electrical running of lines or connections will be made. No control wiring running of lines or connections will be made. No concrete flooring installation will be provided. Drop trailer or storage trailer containing greenhouse materials and equipment to be locked and left on site for duration or project.

### **3.2 Warranty**

- a. Greenhouse shall have a warranty period of one year for defects of structural and glazing installation. Equipment in the greenhouse will carry the manufacturer's standard warranty for parts only. Covering's will also carry the manufacturer's standard warranty. Labor is not included.

### **3.2 Instruction**

- a. Approved representative of the greenhouse manufacturer to visit the job site a minimum of one time during construction to meet with building erectors and once after construction to meet with the owner.





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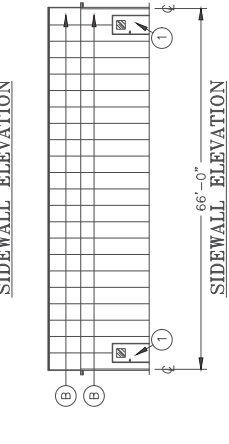
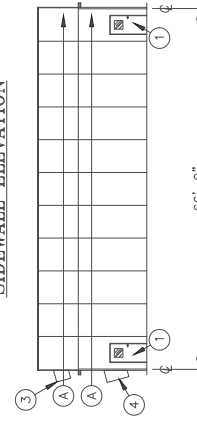
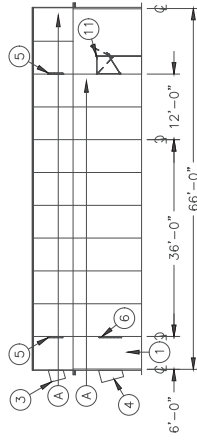
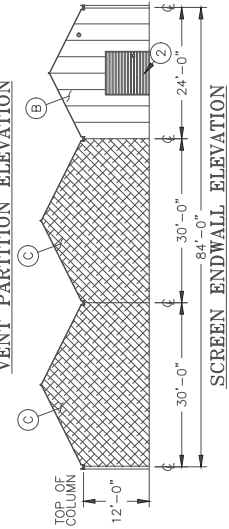
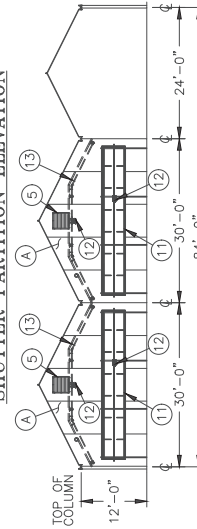
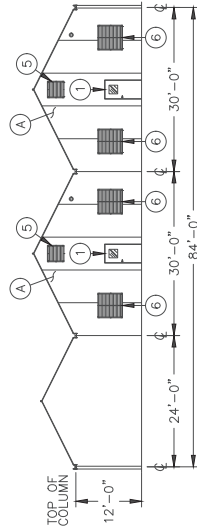
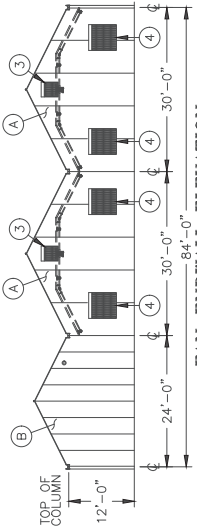
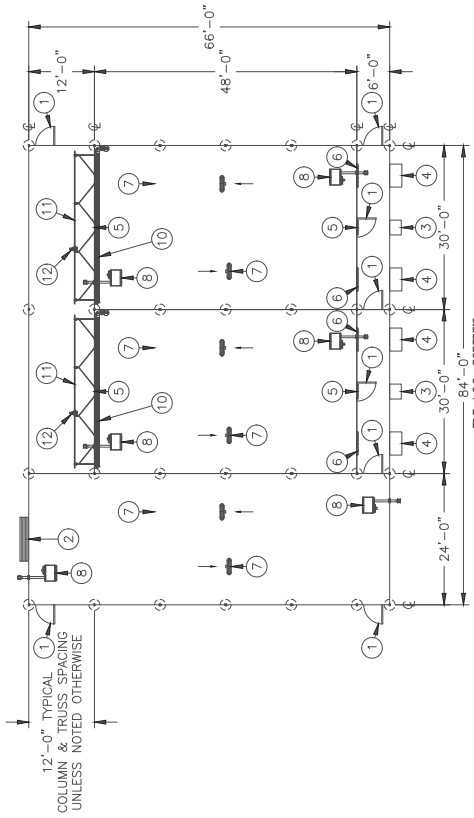
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GS002  
EQUIPMENT LAYOUT

#	ITEM #	MATERIAL LIST - PART DESCRIPTION	QTY
1	----	PERSONNEL DOOR	8
2	----	8'x8' ROLL-UP DOOR	1
3	----	MAL24G EXHAUST FAN	2
4	----	MAL42K EXHAUST FAN	4
5	----	33"x33" SHUTTER	4
6	----	51"x51" SHUTTER	4
7	----	HAF20A HORIZONTAL AIR FLOW FAN	6
8	----	MODINE HD 125SS HEATER	4
9	----	MODINE HD 75SS HEATER	2
10	----	4" X 48" KIJUL PAD X 27FT	2
11	----	48" RIGID VENT SYS 1-1/4" DR X 27FT	2
12	----	WADSWORTH VCG2000 3RPM MOTOR	4
13	----	SLOPE-FLAT-SLOPE SHADE SYSTEM	2

UP	ITEM #	MATERIAL LIST - PANEL DESCRIPTION	QTY
A	----	8MM TWIN WALL POLYCARBONATE	----
B	----	PRO-PANEL CORRUGATED METAL	----
C	----	INSECT SCREEN	----

- NOTES:
- CHECK WITH CUSTOMER FOR EXACT LOCATION OF DOORS AND ALL EQUIPMENT.
  - REFER TO ENDWALL FRAMING DRAWINGS FOR ASSEMBLY OF ENDWALLS.
  - EVEN IF THERE IS NO UNATTENDED CONFLICT OF EQUIPMENT PLACEMENT, THE CODE STRUCTURE WHEN APPLICABLE, PRIORITY WILL BE GIVEN TO CODE STRUCTURE.
  - DRAWING FOR ESTIMATION PURPOSE ONLY.



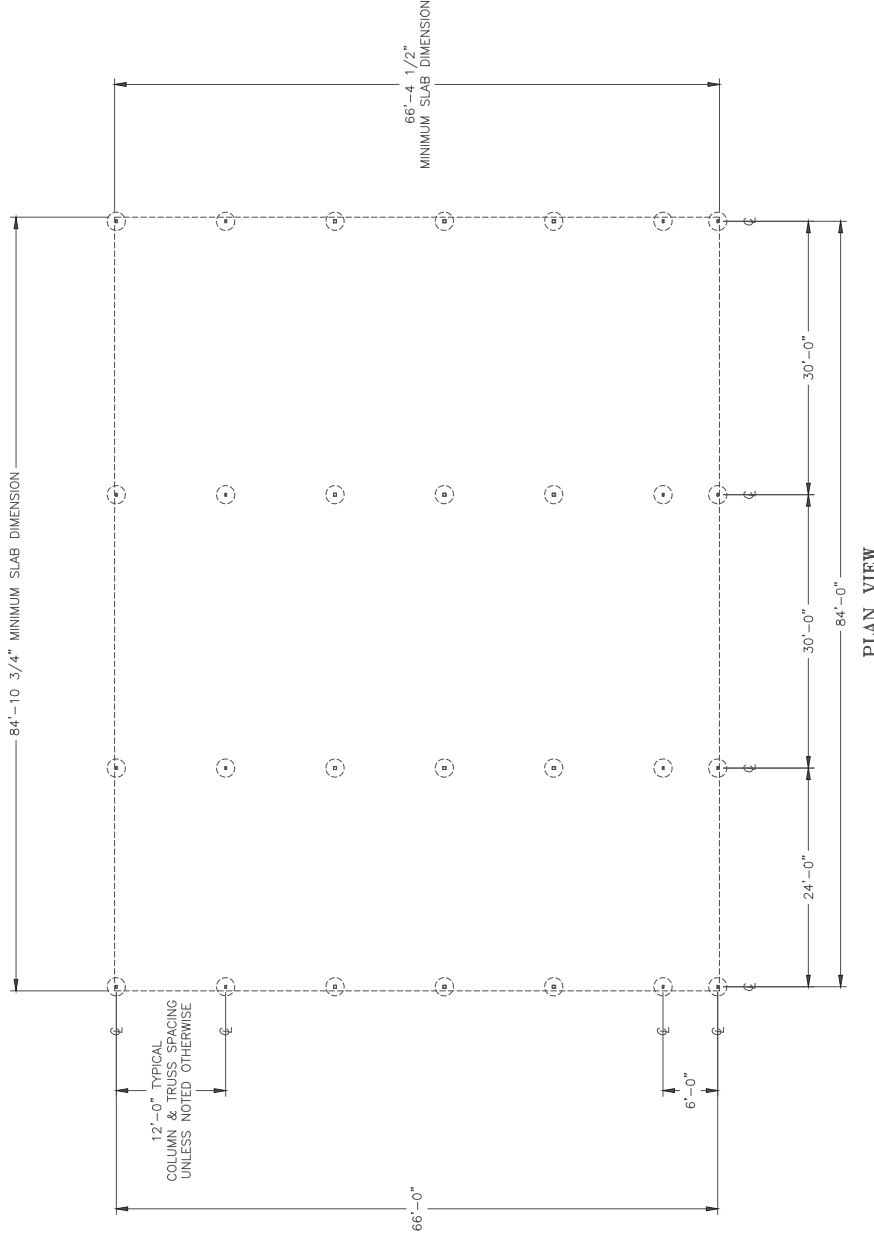
LINCOLN UNIVERSITY-CARVER FARM

PROJECT # TBD

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CG PQN  
SHEET

GS002A  
SLAB LAYOUT



- NOTES:
1. CONCRETE SLAB DIMENSIONS SHOWN ARE OF MINIMUM VALUE.
  2. PIER SIZE TO BE DETERMINED BY CODE ENGINEER.
  3. DRAWING FOR ESTIMATION PURPOSE ONLY.

## **Lincoln University – Carver Farm Greenhouse**

### **Part I – TECHNICAL SPECIFICATIONS**

#### **1.1 Description**

- a. The greenhouse shall be a gable style structure with 12' straight side wall.
- b. The greenhouse shall be furnished and installed according to specifications and drawings.
- c. Greenhouse dimensions are (2) 30'x66' and (1) 24'x 66'.
- d. Last 12' of 30' houses to be covered in 8mm Twin wall polycarbonate on roof and sides with bug screening on end wall.
- e. Divider wall to be located at the 6' mark in each 30' house and covered with 8mm twin wall polycarbonate.
- f. The University is standardizing its greenhouses and prefers a 10 feet column spacing.
- g. No equipment or materials should be ordered or fabricated prior to approval of shop drawings.

#### **1.2 Plans and Submittals**

- a. Design Criteria
  1. Greenhouse frame shall be designed to meet local building code.
  2. Provide structural prints and calculations sealed by a registered professional engineer in the state of Missouri.
  3. Provide complete shop drawings, including the placement of equipment, covering, and doors.

#### **1.3 Erection of Greenhouse**

- a. A qualified greenhouse specialty greenhouse contractor approved in writing by the manufacturer shall erect the greenhouse.
- b. The greenhouse contractor shall have at least five (5) year's experience in building greenhouses of the type specified.
- c. The General Contractor shall have all site conditions correct and ready prior to greenhouse erection.
- d. No masonry, foundation, or footer installation shall be done prior to approval of greenhouse plans.

### **PART II – MATERIALS AND EQUIPMENT**

#### **2.1 Structure**

- a. The greenhouse column and truss spacing as designated by local code.
- b. Cole County Building Codes
  1. 2015 International Building Code
  2. 2015 International Residential Code
  3. 2015 International Plumbing Code
  4. 2015 National Electrical Code
- c. Sidewall height shall be (12) feet.

## **2.2 Components**

### **a. Primary Structural Steel Members**

1. All steel members shall comply with ASTM A500 dimensional tolerances. Steel will meet Lock Joint Tube (LJT) and "Lock-On-Galv ®" specifications for corrosion resistance or equivalent.
2. Columns shall be fabricated from 4 inch by 2 inch steel or 4 inch by 4inch steel with minimum yield strength of 50,000 psi.
3. Columns will be base plated for attachment to owner provided foundation. Anchor bolts for attachment to be included.
4. Truss top cords will be fabricated from 3 inch by 2-inch steel with minimum yield strengths of 50,000 psi.
5. Truss bottom cords will be fabricated from 3 inch by 2-inch steel with minimum yield strengths of 50,000 psi.
6. Id strengths of 50,000 psi.
7. Truss webbing will be fabricated from steel with minimum yield strengths of 50,000 psi. Truss webbing will be attached to top and bottom cords with aluminum connections to enhance corrosion resistance. (Standard is 1.5" square tubing)
8. Roof purlins will be 3 inch by 2-inch steel. Purlins will have a bolted connection to trusses.
9. End walls will be framed with 3 inch by 2-inch rectangular steel tubing with minimum yield strength of 50,000 psi.
10. Gutters are to be extruded aluminum
11. No wood members are required or allowed to complete structure.
12. No rolled form pipe or round columns allowed.

## **2.3 Doors and Door Frames**

1. Doors to be 42 inches wide by 84 inches tall steel insulated ADA approved doors. A minimum of two doors to be equipped with both lever lock and panic bar LHL-5. Doors 3100 Series Manufactured by AJ Manufacturing or equivalent. A total of (8) will be supplied.
  - a. Lock sets are to be included in hardware package
  - b. Doors are handicap compliant.
  - c. All doors should be furnished with appropriate framing and hardware.
  - d. Custom cylinder hardware can be provided with construction core. Permanent core and keying by the GC or owner.
  - e. Mortised hardware is not acceptable
2. Doors will be 42" x 84" constructed of aluminum and polycarbonate and will be used to entry the bug screen cages. At total of (1) will be supplied.
  - a. Doors to be furnished with appropriate framing and hardware.
3. (1) 8'x8' Corrugated Metal roll-up door to be supplied with slide lock.

## **2.4 Ventilation Equipment**

- a. Horizontal Air Flow Fans – Acme HAF20A fans or equivalent. Quantity of (6) to be installed.
- b. Exhaust Fans – American Cool Air MAL42K or equivalent. Quantity of (4) – (2) per 30' house.
- c. Upper Gable Fan – American Cool Air MAL24G or equivalent. Quantity of (2) – (1) per 30' house.
- d. Divider Wall Shutter – American Cool Air 51x51" i.d. with motor or equivalent. Quantity of (4) - (2) per 30' house.
  1. Fans must include automatic shutters, inlet/outlet guards, slant wall housings and belt tighteners.
  2. Exhaust fans and shutters are by American Cool Air or equivalent.
  3. Horizontal air flow fans are to be manufactured by Acme Engineering, Inc. or equivalent.
  4. Exhaust fans are to have aluminum fan blades.
  5. Steel propeller fans are not acceptable.
- e. Inlet Vents and Vent Operators
  1. A single run of vents shall be made up of a top rail and bottom rail of extruded aluminum and bolted together in accordance with manufacturer instructions. All vents shall have provisions made at the hinge point to prevent creeping of the vents. A total of (2) vents will be provided. Vent size to be 48" tall and 27' long.  
Vent opener to be Wadsworth VC2000 – 3RPM.
  2. Motorized Inlet Gable Shutter  
(4) American Cool Air 33"x33" gable inlet shutters or equivalent are to be provided. Shutter's to be installed in the upper gable of end wall and divider wall. Motor and linkage to operate shutters is to be included.

## **2.5 Heating Equipment**

- a. Greenhouse is to be equipped with Modine power vented heaters or equivalent.
- b. Quantity of (4) Modine HD 125SS located (2) per 30' house and (2) Modine HD 75SS located (2) per 24' house to be provided.
- c. Heaters are to have stainless steel burners and exchangers.
- d. Heaters with aluminum heat exchangers are not acceptable.
- e. Single-walled stacking is to be included as well as appropriate heater hangers to mount the heaters.

## **2.6 Cooling Equipment**

- a. Evaporative pad system will consist of pads made of cross-fluted cellulose paper; PVC distribution and return system completely self-contained with pump and sump.
- b. (2) Systems 27'x48"x4" are to be provided.

- c. Distribution and return system to be a covered top, PVC, totally self-contained as manufactured by American Cool Air or equivalent.
- d. Size of system to be determined upon size of greenhouse.
- e. No wood support stringers are allowed.

## **2.7 Environmental Controls**

- a. Wadsworth Step-Up Greenhouse control system with a minimum of two stages of heating, set point, and four stages of cooling. Controller should also control interior shade system and vent motor. Controller to be equipped with temperature and humidity sensor. Controller is to be complete with contractor panel and wiring diagram. A total of (2) systems, (1) for each 30' house will be provided.
- b. Control training by the Manufacturer's representative.
- c. (2) Single-stage thermostats will be provided for (2) heaters in 24' house.

## **2.8 Covering Material**

- a. Roof, sides, divider wall, and ends of 30' houses to be covered with 8MM double walled polycarbonate.
- b. Polycarbonate panels are to be of virgin resin. Re grind is not acceptable.
- d. Polycarbonate panels must carry a minimum warranty of 15 years against yellowing.
- e. Roof, Sides and Ends of 24' house to be covered in Pro-Panel or equivalent metal siding and with interior panel insulation.

## **2.9 Shade System**

Interior shade/heat retention system with Svensson Tempa 5557 D FB shade material. Shade is automated with (2) Wadsworth VC2000 3RPM motors and controlled by the greenhouse control system. (2) Total slope/flat/slope shade systems included.

## **2.91 Benching**

(24) 5'x12' Benches with Dura-Bench tops included. Benches have rolling tops or equal. Bench support to be on 16" centers under bench top.

Benches should be of standard height of approximately 30 inches tall

Benches will need to be able to support seedling trays up to 10-gallon containers

## **2.92 Irrigation**

(2) Complete irrigation systems for (12) benches each with fertilizer injector, control, sprinkler heads, pipe, valves and hardware needed for install. Owner to provide backflow preventor and pressure regulator. Final design of irrigation system to be approved by owner prior to installation.

## PART III – EXECUTION

### 3.1 Installation

- a. Installation including construction of (3) houses with columns attached to owner provided foundation with base plates. **General Contractor will install the base plates will set on top of piers and then the concrete floor will be poured over the base plates at a depth of approximately 6 inches.** All covering will be installed. All equipment and control will be installed in place. Shade systems will be installed, and benching with irrigation constructed. No gas, water or electrical running of lines or connections will be made. No control wiring running of lines or connections will be made. No concrete flooring installation will be provided. Drop trailer or storage trailer containing greenhouse materials and equipment to be locked and left on site for duration or project.

### 3.2 Warranty

- a. Greenhouse shall have a warranty period of one year for defects of structural and glazing installation. Equipment in the greenhouse will carry the manufacturer's standard warranty for parts only. Covering's will also carry the manufacturer's standard warranty. Labor is not included.

### 3.2 Instruction

- a. Approved representative of the greenhouse manufacturer to visit the job site a minimum of one time during construction to meet with building erectors and once after construction to meet with the owner.

