GREENHOUSE

SPACE DESCRIPTION

The Greenhouse is a large, dedicated open space supporting the Agriculture Open Lab for the instruction of Controlled Environmental Agriculture (CEA) and Horticulture. This space is considered as an "add on" space to the fundamental space of the Agriculture program. Greenhouses are clean spaces for growing, with preparation and planting occurring in adjacent spaces. Depending on the program, students may practice various methods of growing plants in addition to conventional growth in soil. Additional space may be required for alternative growing methods such as hydroponics, aquaponics, and aquaculture.

Greenhouses are most economical and effective when delivered as a prefabricated structure, designed and engineered by a greenhouse manufacturer. The structure and cladding shall be governed by the specific locale and program requirements. Climate control is essential. Automated systems shall be employed to control irrigation, temperature, humidity, ventilation, light and shade. Manually controlled systems require daily adjustment and care, which requires a significant amount of labor.

The layout shown is illustrative of basic concepts and spatial needs and should be adjusted according to each campus' specific requirements. When Precision Agriculture is included in campus programming, additional space and outdoor facilities will be needed (see **Agriculture Lab** and **Diesel / Precision Agriculture Lab**). Greenhouses are most successful when located with other Agriculture facilities at the rear of campus property, outside the common path of travel, and with direct access to growing fields.

Exterior access shall be provided via overhead doors to allow movement of equipment and materials. Some programs may open the Greenhouse for plant sales during various times of the year. Verify specific site requirements with the program.

SUCCESS FACTORS

Exterior Access: Overhead doors are critical for moving equipment and supplies in and out of the Greenhouse.

Automated Systems: For the wellbeing of the live plants and fish that may be housed in the space, it is essential that climate and conditions always remain within acceptable limits. Use of technology and automated systems is key to prevent losses and reduce manhours for the support staff. Automated systems shall be employed for irrigation and misting, grow lights, temperature and humidity. A backup generator shall be installed, and a monitoring system with cameras and alarms shall be employed for after-hours observation and emergency alerts.

GENERAL

Greenhouses may be freestanding or attached to larger Agriculture program space. Any freestanding structure shall be within short walking distance from other academic spaces. Prefabricated structures must comply with all building code and environmental regulations.

ADJACENCIES

In addition to the standard spaces required by the **Agriculture Lab**, the Greenhouse requires separate and/or adjacent space for the following: **Prep/ Grow Room, Material Storage, and Classrooms.** Additional spaces that may be required for the program could include: **Aquaculture and Utility Room.**

ACOUSTICS

Greenhouses are loud spaces due to the utilities and activities in the space. STC-rated walls and Corridor buffer zones shall be used to decrease sound transmission to adjacent classrooms.

Where Greenhouses border acoustically sensitive spaces, exterior walls should have a minimum STC rating of 50.

MECHANICAL

Climate control is of utmost importance in Greenhouses. Proper temperature, ventilation and humidity are required, depending on the plants and fish housed in the space. Verify specific needs with the program. Electrical service and Water shall be provided, with Distilled/ Reverse Osmosis water supplied as needed. Verify specific needs on a project-by-project basis while planning for flexibility in the future.

- Provide independent climate control in select areas.
- Provide Building Automation technology with automated mechanical, lighting and irrigation systems.
- Provide irrigation/ misting system, hose bibs and sinks with adjustable faucets.
- Provide pumps, lines, filters and float systems for Aquaponics and Hydroponics when included in programming.
- Provide floor drains/ trench drains in locations as required for certain equipment.
- Consideration shall be given when selecting equipment such that it is made of materials that are suitable for the environmental operating conditions.

ELECTRICAL & DATA

- Provide flexibility for 120/208V 3-Phase and 240V. High voltage service may be required. Verify required voltages with planned and future equipment.
- A backup generator is required.
- Consider opportunities for alternative energy sources such as wind and solar.
- Use either PVC or Fiberglass raceways and boxes that are suitable for the environmental operating conditions.

Provide power and data at 6’ intervals or in raceways along perimeter walls at locations which may be used for desktop computer workstations and/or lab equipment.

LIGHTING

Proper lighting is crucial in Greenhouses with preference to providing options for natural and artificial light. Verify specific needs with the program.

- In high-bay areas, provide LED lighting in warm, soft white color.
- Task lighting is required at individual workstations.
- Grow lights on timers are required in select locations. Provide full spectrum LED grow lights.
- Provide dimmer switches in select locations.

TECHNOLOGY

Verify specific needs on a project-by-project basis while planning for flexibility in the future.

- Provide Wireless capability throughout the Greenhouse and adjacent spaces with Wireless Access device.
- Provide Building Automation technology and security/ alarm systems.
- Provide telephone service.
- Provide high-speed internet throughout, with dedicated data connections for Smart TV and additional equipment as identified by the program. Verify specific requirements.
- PSEP cameras are required throughout the labs and outdoor facilities.
- Provide card reader/ key fob at entry doors and storage rooms.

ACCESSORIES AND EQUIPMENT

Equipment needs should be determined on a project-by-project basis while planning for flexibility in the future. At minimum, equipment shall include:

- Fire extinguishers
- Wall-mounted tack boards and marker boards

FURNITURE

Provide the following standard furnishings for Greenhouses:

- (3) zones of Grow tables and benches on rollers for flexibility and mobility.
- Wall shelving and storage racks on perimeter walls.

FINISHES

Ceilings

Recommended Height: 20’ clear with exposed structure.

Floors

Polished or sealed concrete slab (6” min. thickness) with slip-resistant finish. Floors may be flat or low-sloped toward drains.

DOORS AND WINDOWS

Overhead doors for exterior access. 10’W x 12’H, typical.

Lab interior doors shall be minimum STC 30 with 6” x 30” Window Lite preferred.

Provide interior glazing for visual connection between spaces.

PREP/ GROW ROOM

SPACE DESCRIPTION

The Prep/ Grow Room is directly adjacent and supports the activities in the Greenhouse. In this space, seeds are started, plants are potted and prepared for growing in the Greenhouse. Soil is stored in tubs and used for planting.

Utilities and systems required include Power, Lighting, Water and HVAC. By nature of the messy activities in the space, a hose bib and floor drain are required.

ACCESSORIES AND EQUIPMENT

Provide workbenches on rollers for flexibility and mobility. Wall shelving and storage racks shall be located on perimeter walls.

MATERIAL STORAGE

SPACE DESCRIPTION

Material Storage is a dedicated storage room with independent climate control for the storage of seeds, soils, fertilizers and other sensitive items.

Provide direct access to the Greenhouse and Agriculture Open Lab.

Double doors or an overhead door shall be provided for exterior access and receiving.

ACCESSORIES AND EQUIPMENT

Wall shelving and Lockers.

AQUACULTURE LAB

SPACE DESCRIPTION

The Aquaculture Lab is a dedicated space, adjacent to the Greenhouse, for fish production and aquaponic growing systems. The size of the room and the equipment therein are dependent on the species of fish used in the program. All requirements must be verified with the program before design can progress.

Utilities and systems required include Power, Lighting, Water and HVAC.

- Provide independent climate control.
- Provide Building Automation technology with automated mechanical, lighting and plumbing systems. Provide cameras, sensors and alarms for monitoring the space including water levels and temperature.
- Provide hose bibs and sinks with adjustable faucets.
- Provide rough-ins and valves for water supply to fish tanks. Tanks may be on recirculating or closed system. Provide pumps, lines, filters and float systems.
- Provide floor drains/ trench drains in locations as required for certain equipment.

Natural light encourages algae growth and is not preferred in the Aquaculture Lab. No exterior windows allowed. Provide interior glazing for visual connection between spaces.

Provide direct access to the Greenhouse and other spaces as needed per program requirements.

A dedicated Storage & Utility Room is required for service and pumps adjacent to the Aquaculture Lab. Sump pump and/or floor drain are required. Verify specific requirements with the program.

ACCESSORIES AND EQUIPMENT

Wall shelving and storage racks on perimeter walls.