

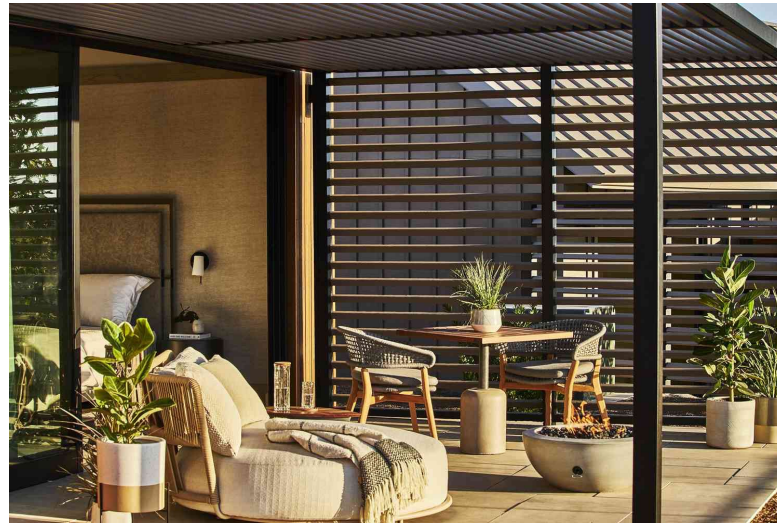
Phytoremediation

A nature-based solution against poor indoor air quality

Wellness Hotels



- Sensei Porcupine Creek
 - Rancho Mirage, California



- Stanly Ranch, Auberge Resorts Collection
 - Napa Valley, California

Guest Expectations



- Cleanliness



- Air Diffusers

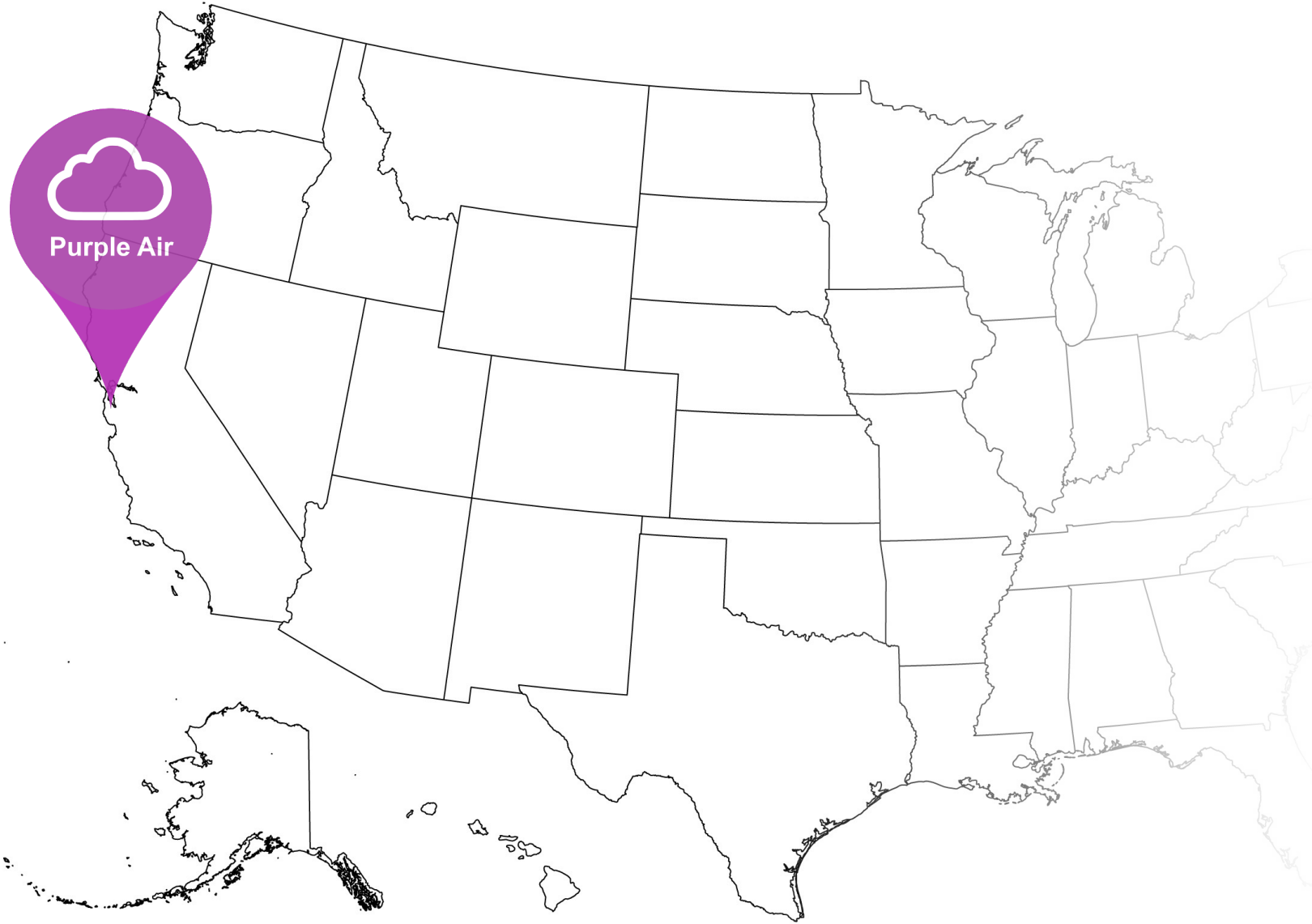


- Air Purifiers

Wildfires

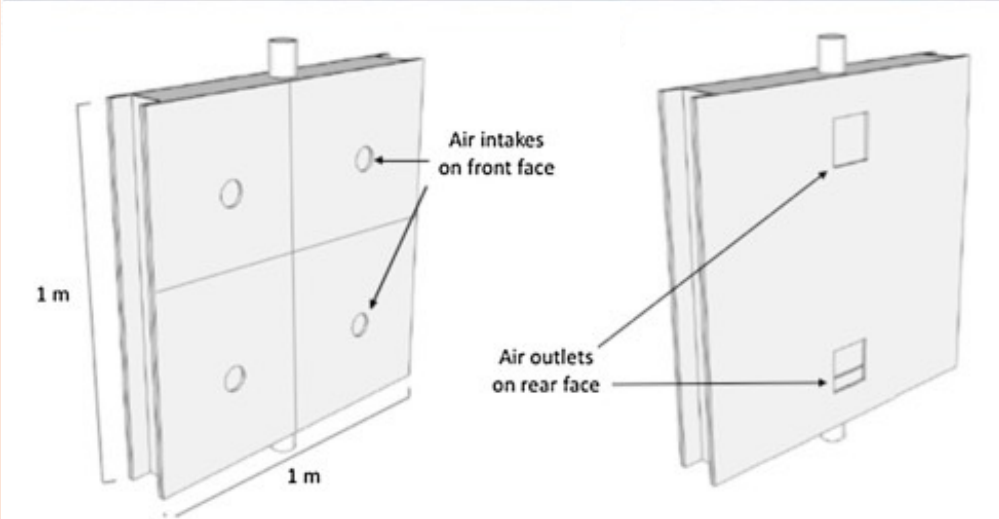
- Increase in wildfires = Increase in smoke
- Increase in smoke = Increase Health Threat
- Relative to us here in the Midwest
- Health threat not much of a concern, at least not yet.





California

- Readily available data
- Health Concern
- Least Air-Conditioned City in the U.S
- Passive Cooling



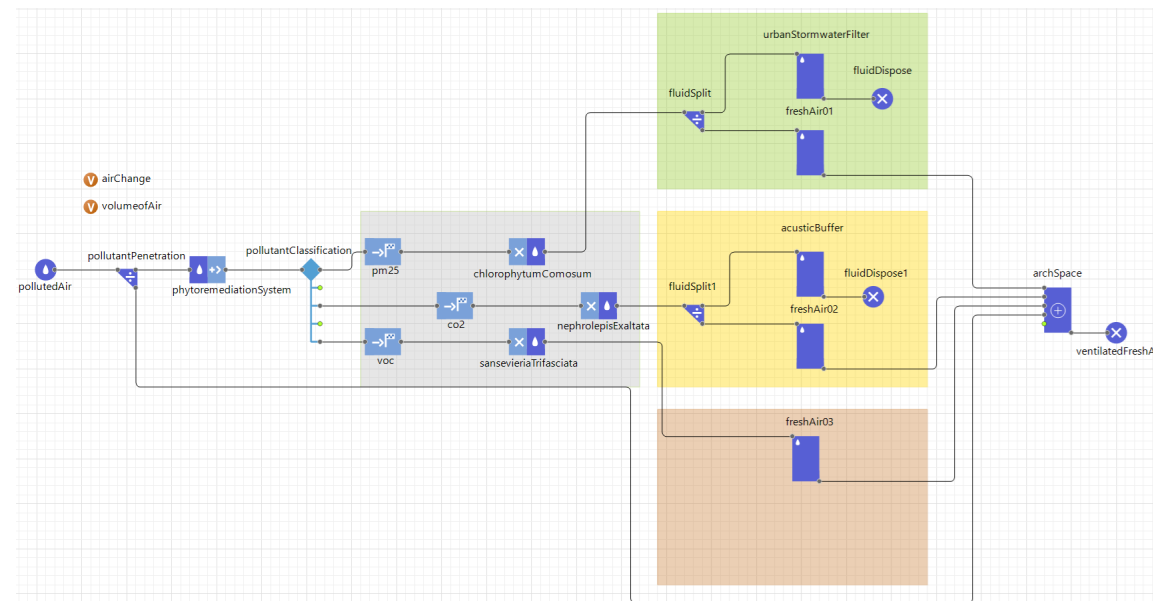
Nature Based Solution

- Air Filtration
- *Chlorophytum comosum*
- *Nephrolepis Exaltata*
- *Sansevieria Trifasciata*

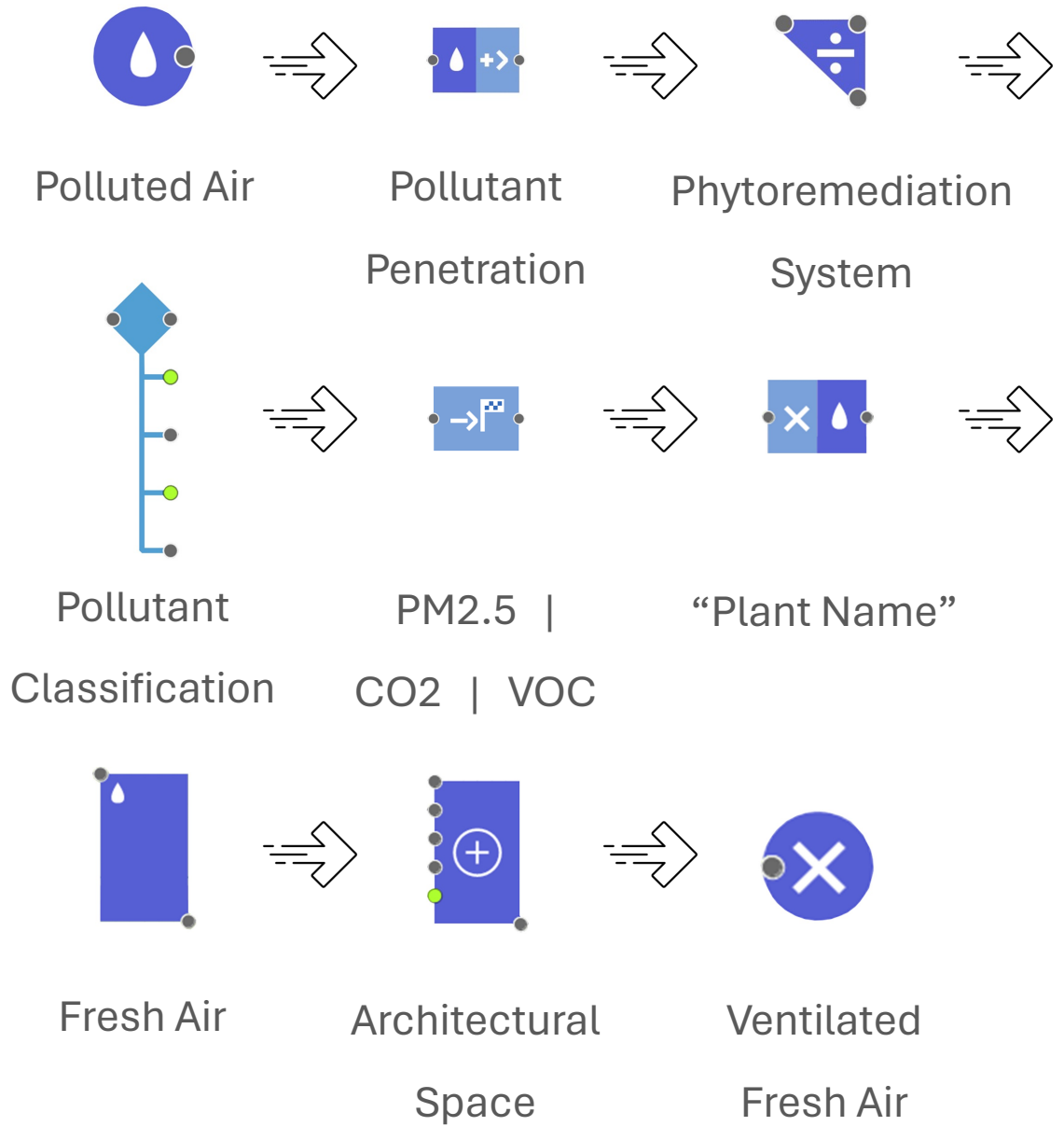


Phytoremediation

- Flow rate
- Bay area data
- Complex Systems and Processes
 - Fluid library
 - Road Traffic Library
 - Material Handling Library
 - Pedestrian Library
 - Process Modeling Library
 - Rail Library



Phytoremediation Process



Holistic Design

- Sustainable Resource
- Benefits and Fit for San Francisco
 - Increasingly popular construction method
- Seismic benefit
 - Lighter material

Site



Alcatraz
Island

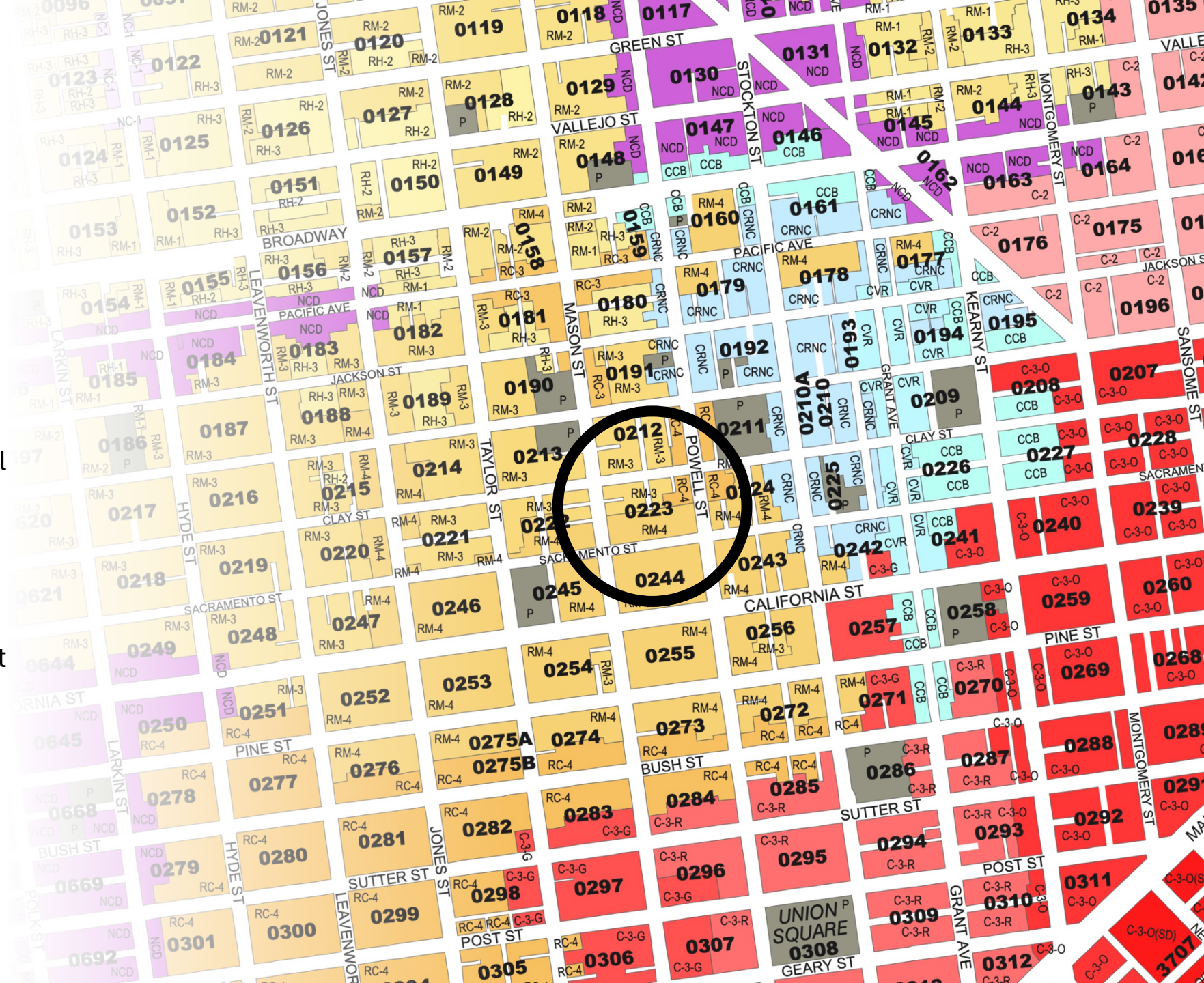


Union
Square

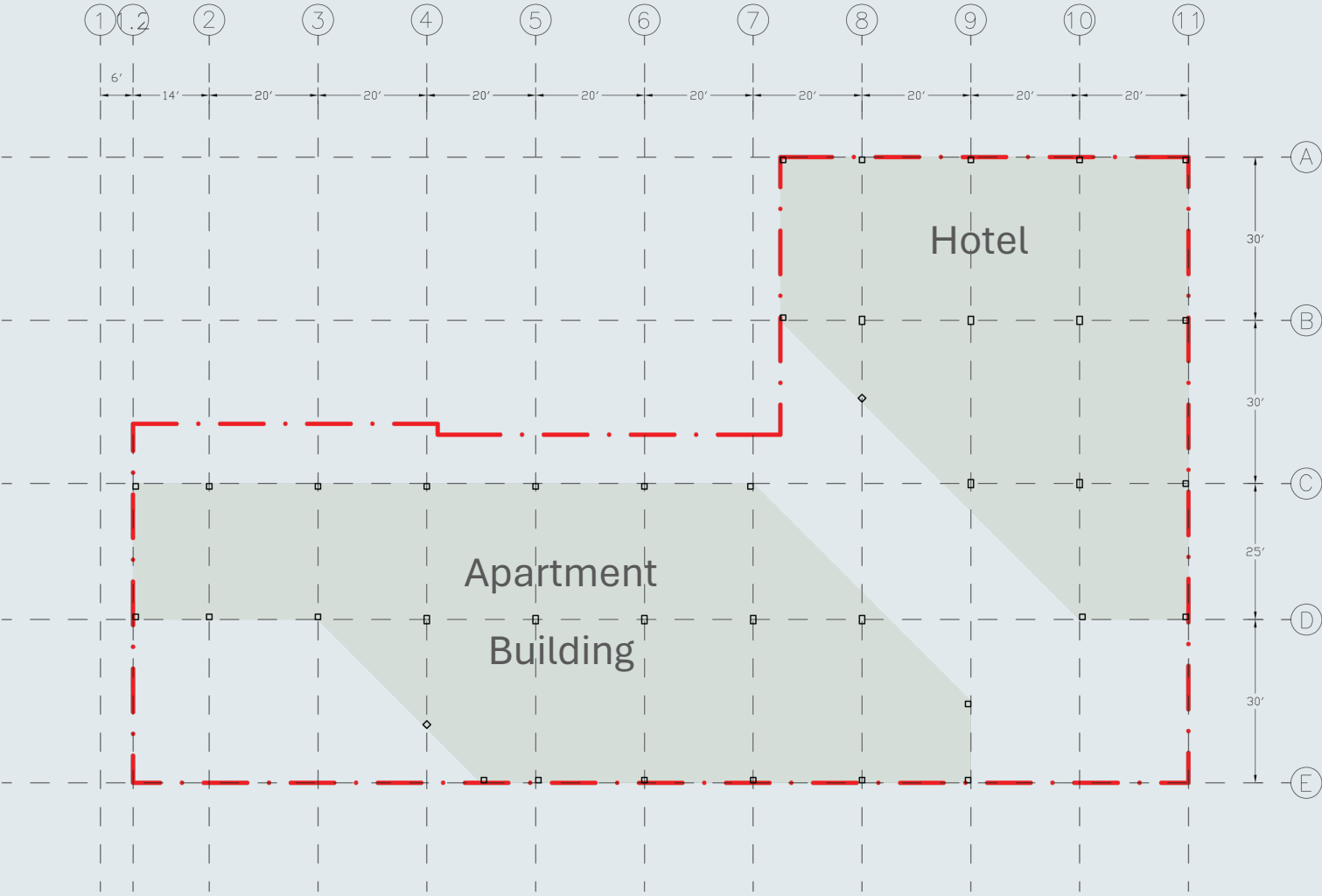
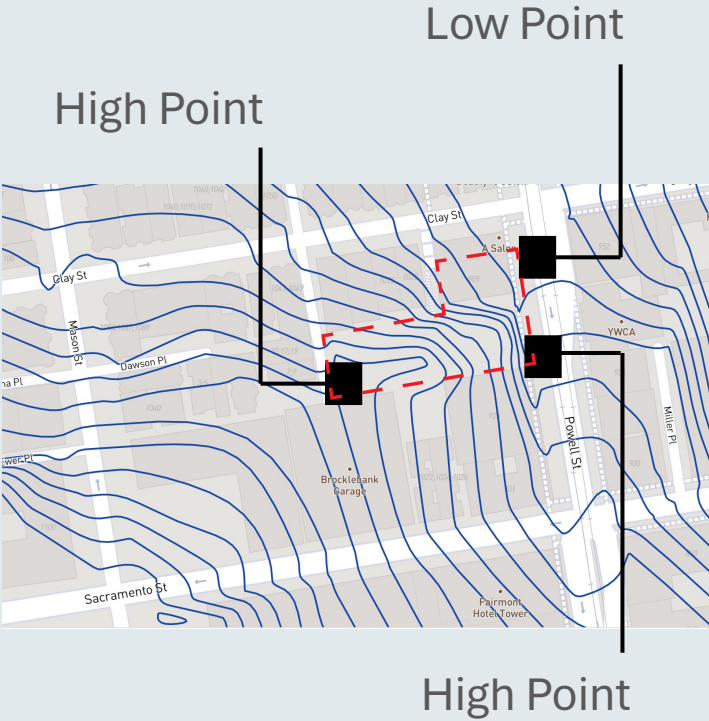


Zoning

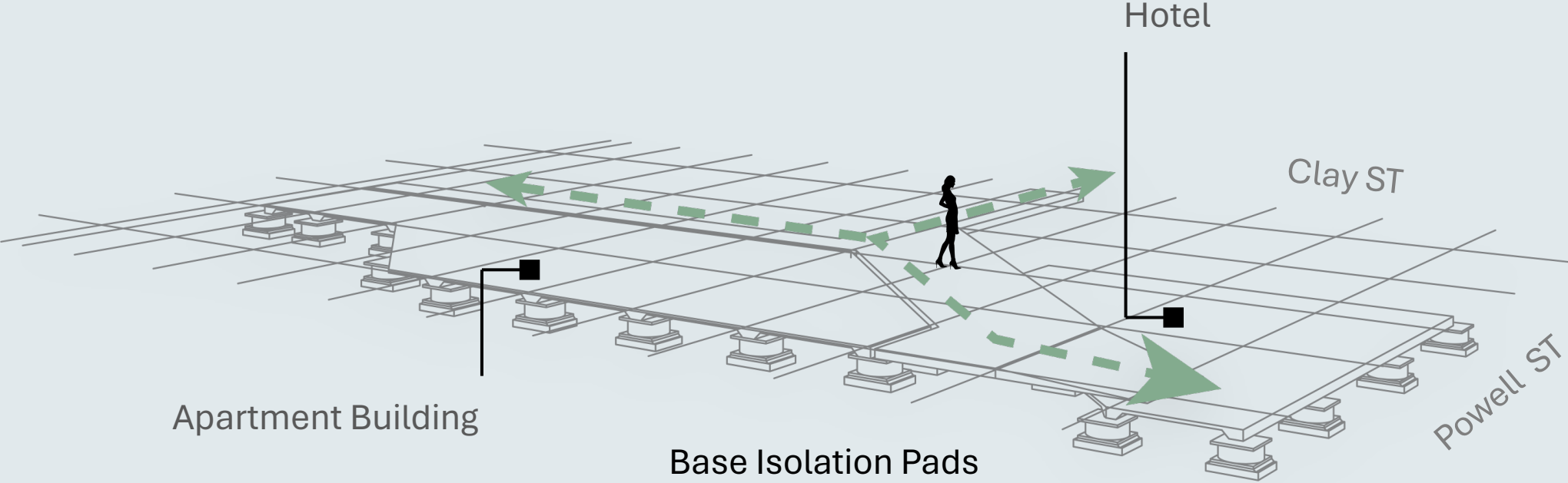
- RC-4
 - Residential - Commercial combined District
- RM-3
 - Residential Mixed District
- Senior Housing



Floor Plan Grid

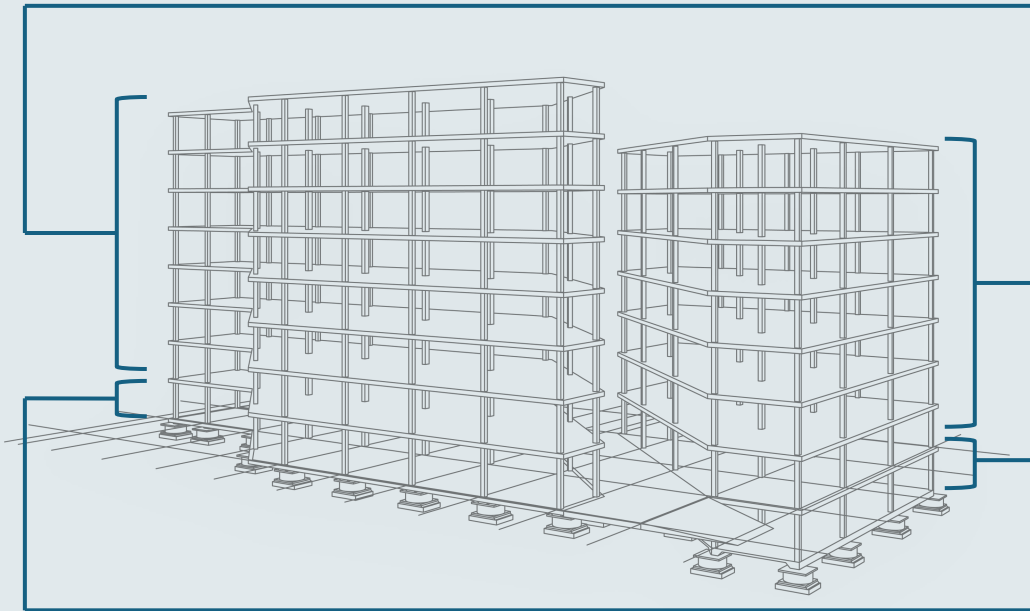


Pedestrian Circulation & Foundation



Structure and Fin Design

Cross laminated timber (CLT)



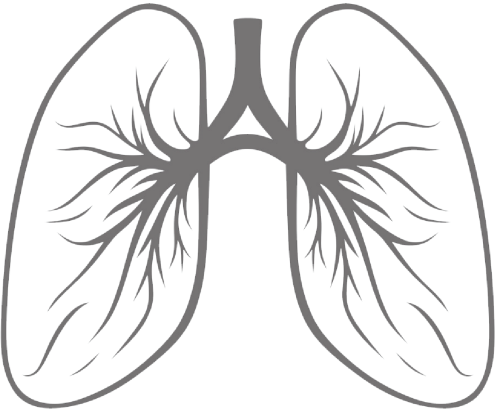
Concrete Podium

Prefinished CLT Fins

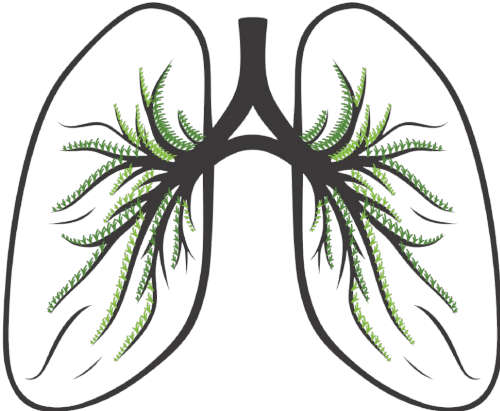
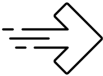


Base Isolation Pads

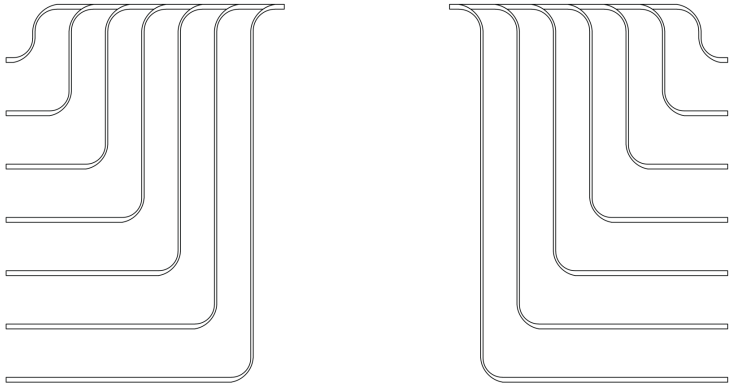
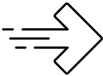
Building Lungs



Human Lung & Bronchial Tree

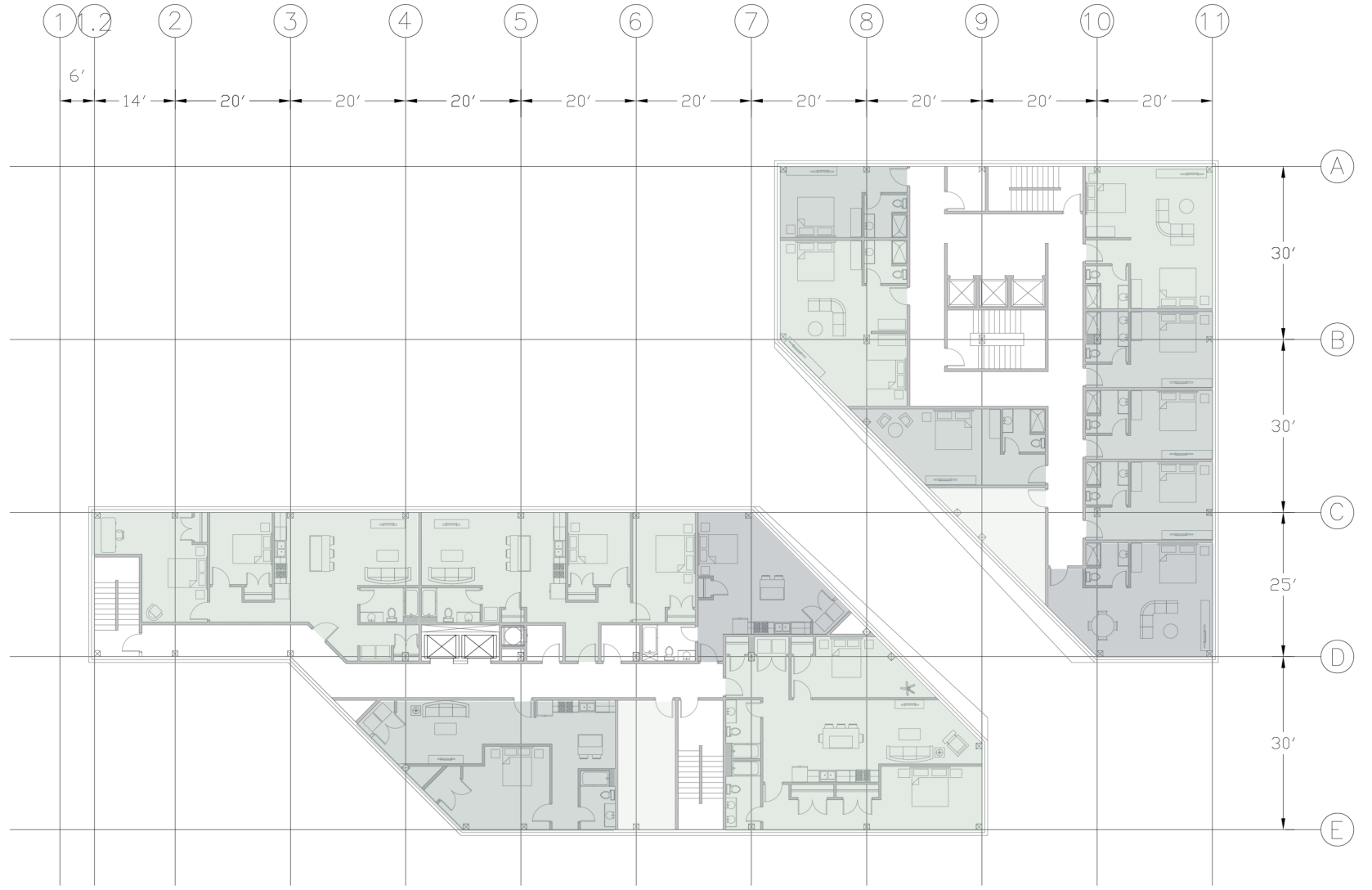


Phytoremediation



Prefinished CLT Fins

Floor Plan



Hotel:

Standard Room with one bed

Standard Room with two beds

Deluxe Room with one bed

Apartments:

Studio

1 bedroom

2 bedroom

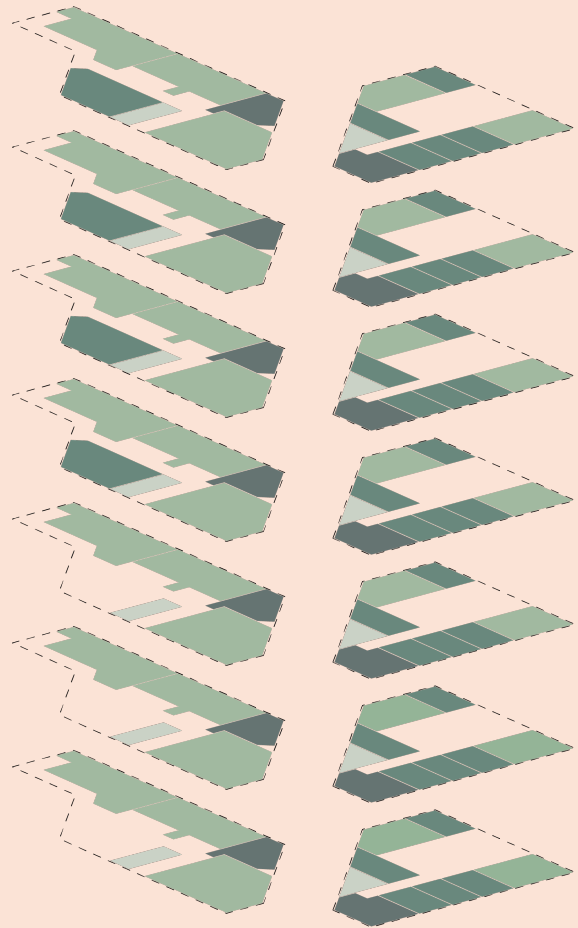
Primary Winds



Biofilter Locations

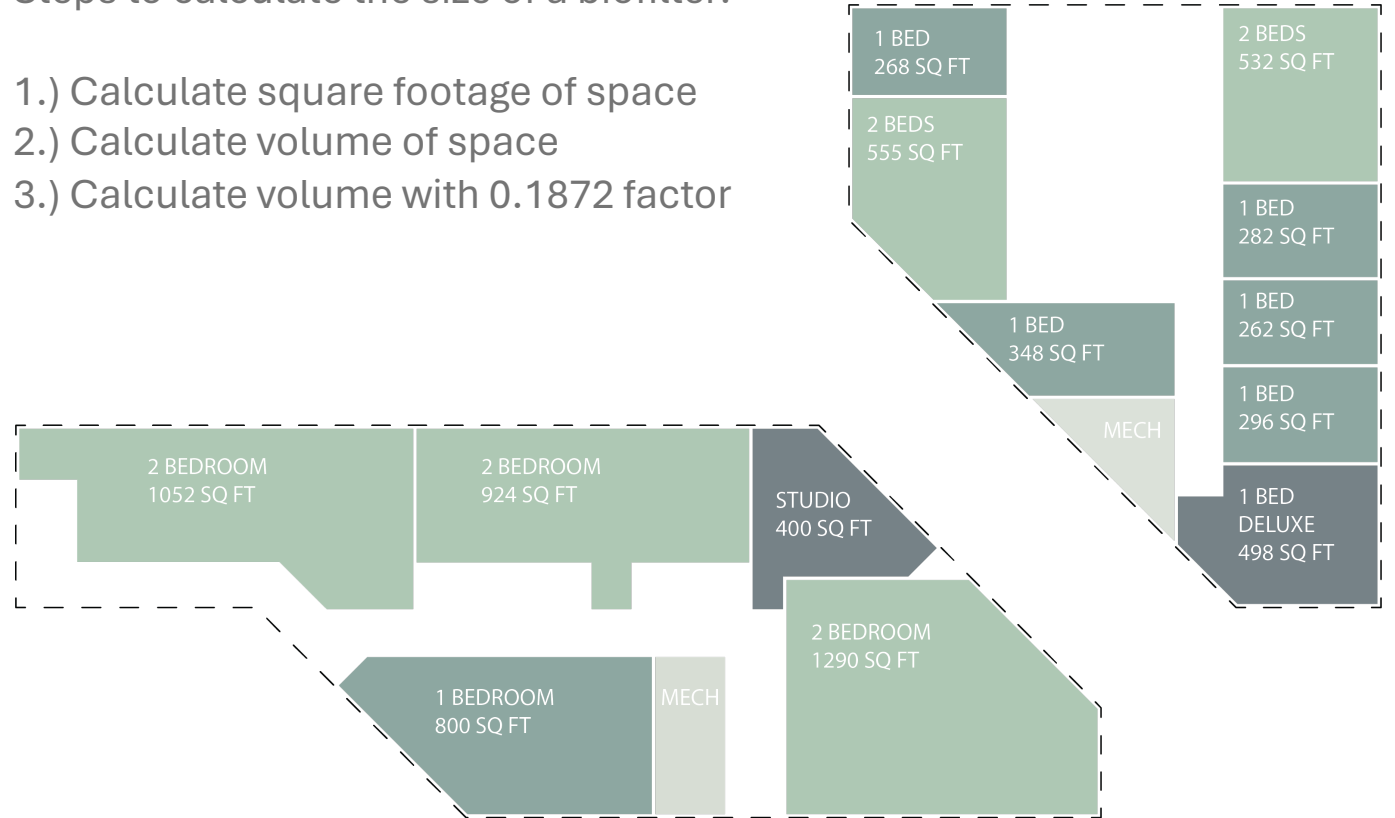


Biofilter Sizing



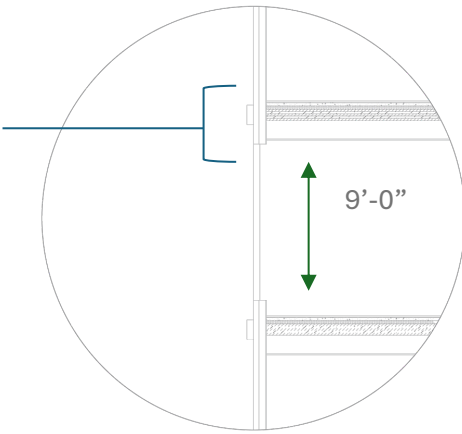
Steps to calculate the size of a biofilter:

- 1.) Calculate square footage of space
- 2.) Calculate volume of space
- 3.) Calculate volume with 0.1872 factor

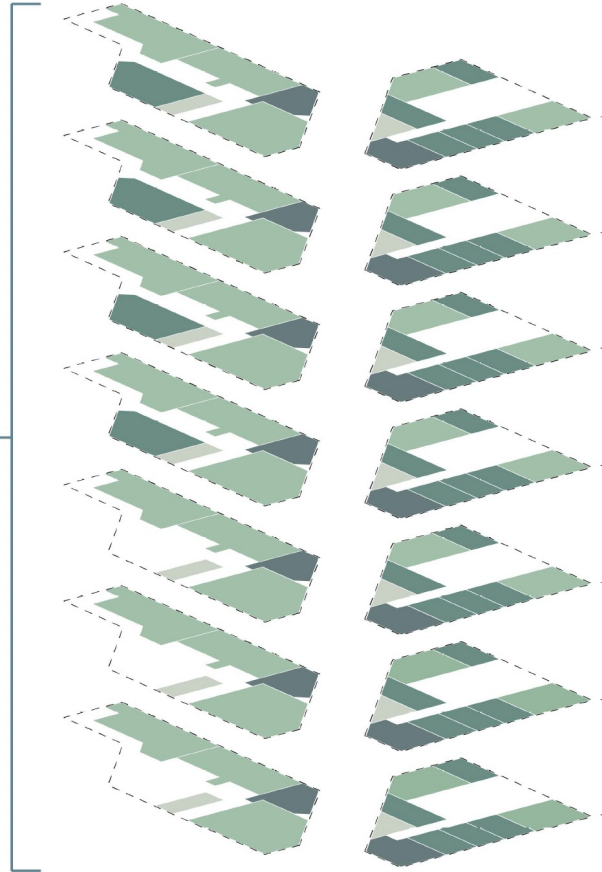


Calculations

- 15/16" Finish Flooring
- 1/16" Rubber Layer
- 2" Concrete Screed
- 2" Acoustic Insulation
- 7" 5-layer CLT
- 11-3/8" Plenum Space
- 5/8" Gypsum



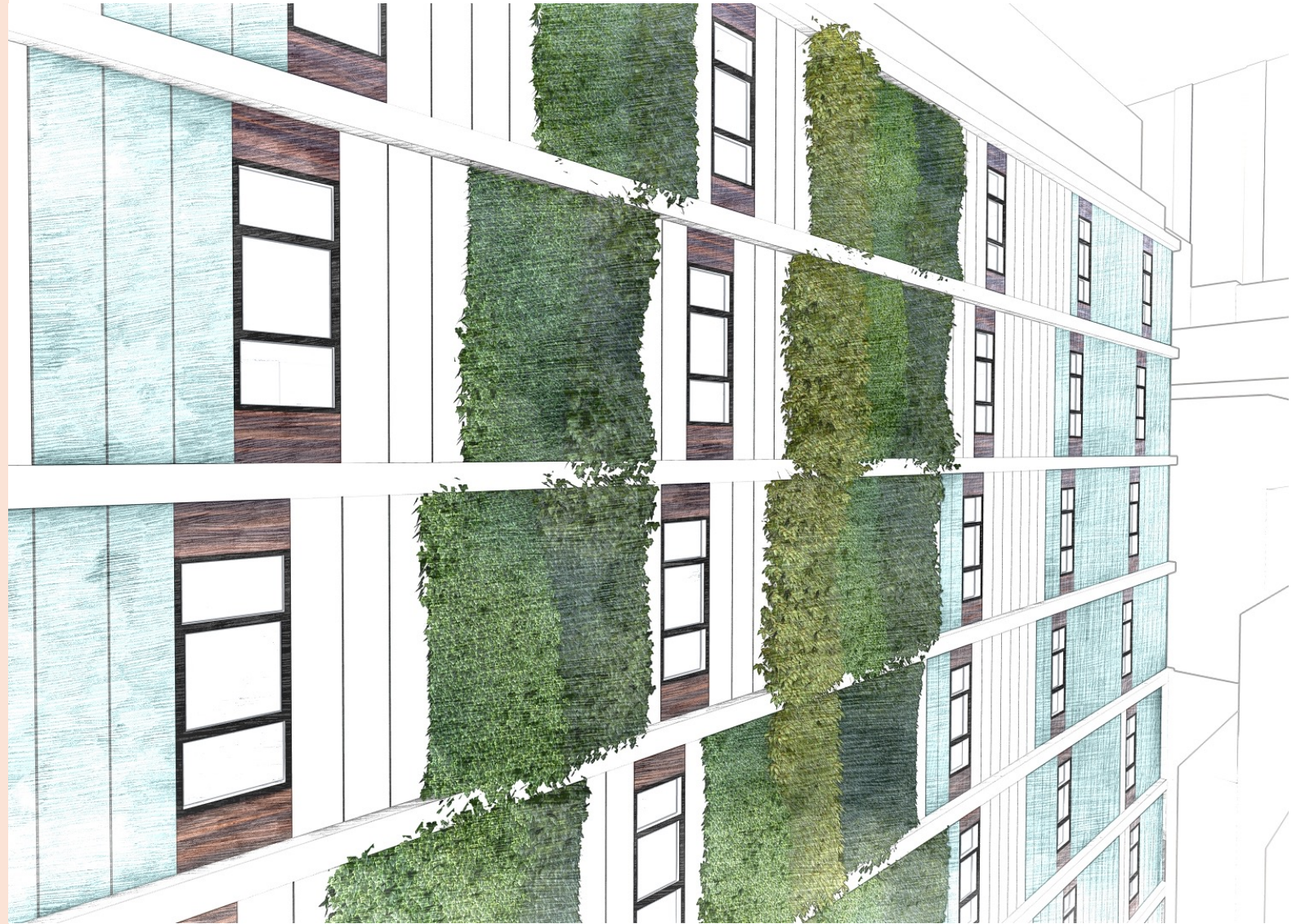
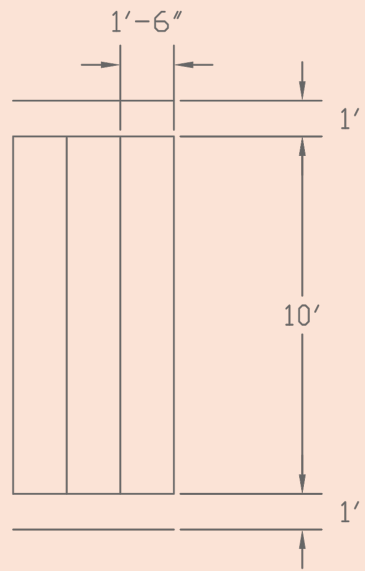
TOTAL CUBIC FEET : 259,758 CUBIC FEET = 7355.5 CUBIC METERS
 (7355.5 CUBIC METERS)(0.1872) = 1376.95 / 4 = 344.24 SQ METERS
 344.24 SQ METERS = 3,705.34 SQ FEET OF BIOFILTER



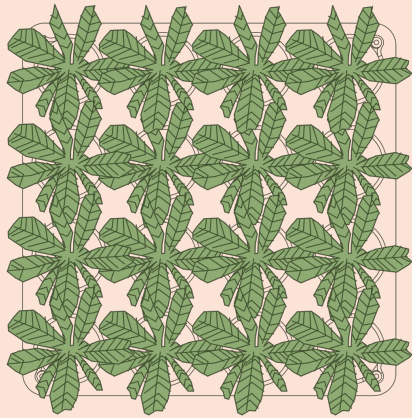
- FLOOR 8**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1
- FLOOR 7**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1
- FLOOR 6**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1
- FLOOR 5**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1
- FLOOR 4**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1
- FLOOR 3**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1
- FLOOR 2**
NUMBER OF ROOMS:
2 BEDS: 2 1 BED: 5
1 BED DELUXE: 1

(3041 SQ FT)(7 FLOORS) = 21,287 SQ FT
 (21287 SQ FT)(9'-0" CEILING HEIGHT) = 191,583 CUBIC FEET
 TOTAL CUBIC FEET : 191,583 CUBIC FEET = 5425.03 CUBIC METERS
 (5425.03 CUBIC METERS)(0.1872) = 1015.956 / 4 = 253.89 SQ METERS
 253.89 SQ METERS = 2,732.86 SQ FEET OF BIOFILTER

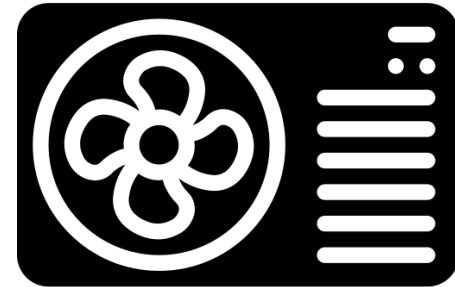
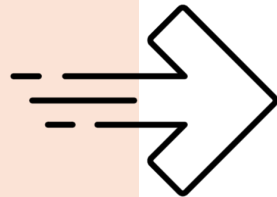
Façade Grid



Results



Green Wall / Biofilter



Conventional HVAC System

Thank You