

# URBAN POST-DISASTER INTERIM HOUSING



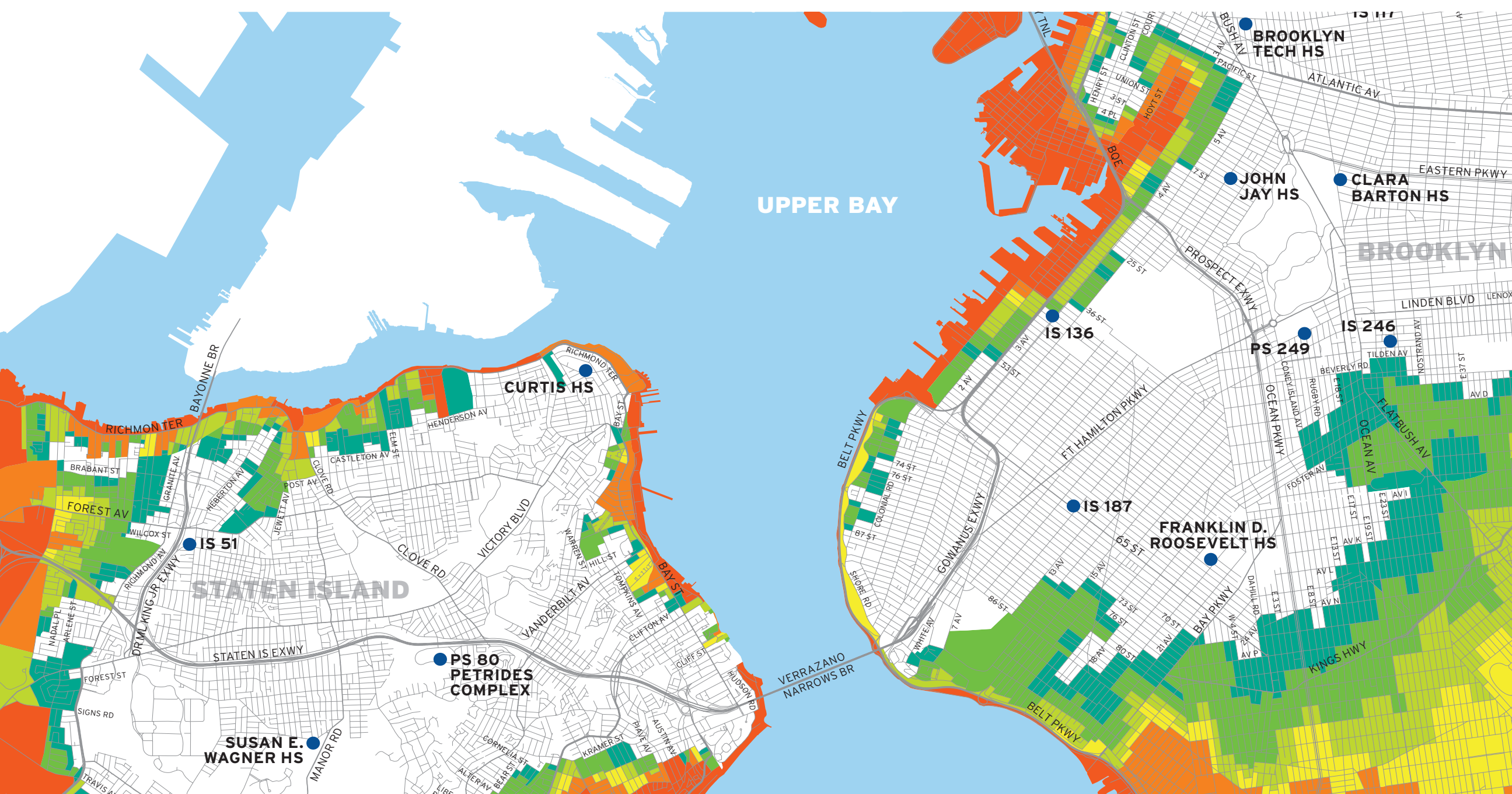
WHAT IS POST-DISASTER INTERIM HOUSING:

Interim housing is a temporary solution that helps heal neighborhoods and keeps people safe and comfortable until their homes are restored.

After a disaster, some people may not be able to return home right away. Because cities have few existing vacancies, the ability to bring in temporary modular housing can provide an option for keeping communities together.

THE NEED FOR AN URBAN MODEL:

Existing post-disaster housing models -such as trailers- do not work in urban conditions. We need housing that will suit urban densities and family types. The Office of Emergency Management (OEM) and the Department of Design and Construction (DDC) are developing a way to bring multi-story, multi-family housing to cities quickly after a disaster. This exhibit shows the development of the country's first urban post-disaster housing prototype.



WHAT IS IT, AND WHY DO WE NEED IT?

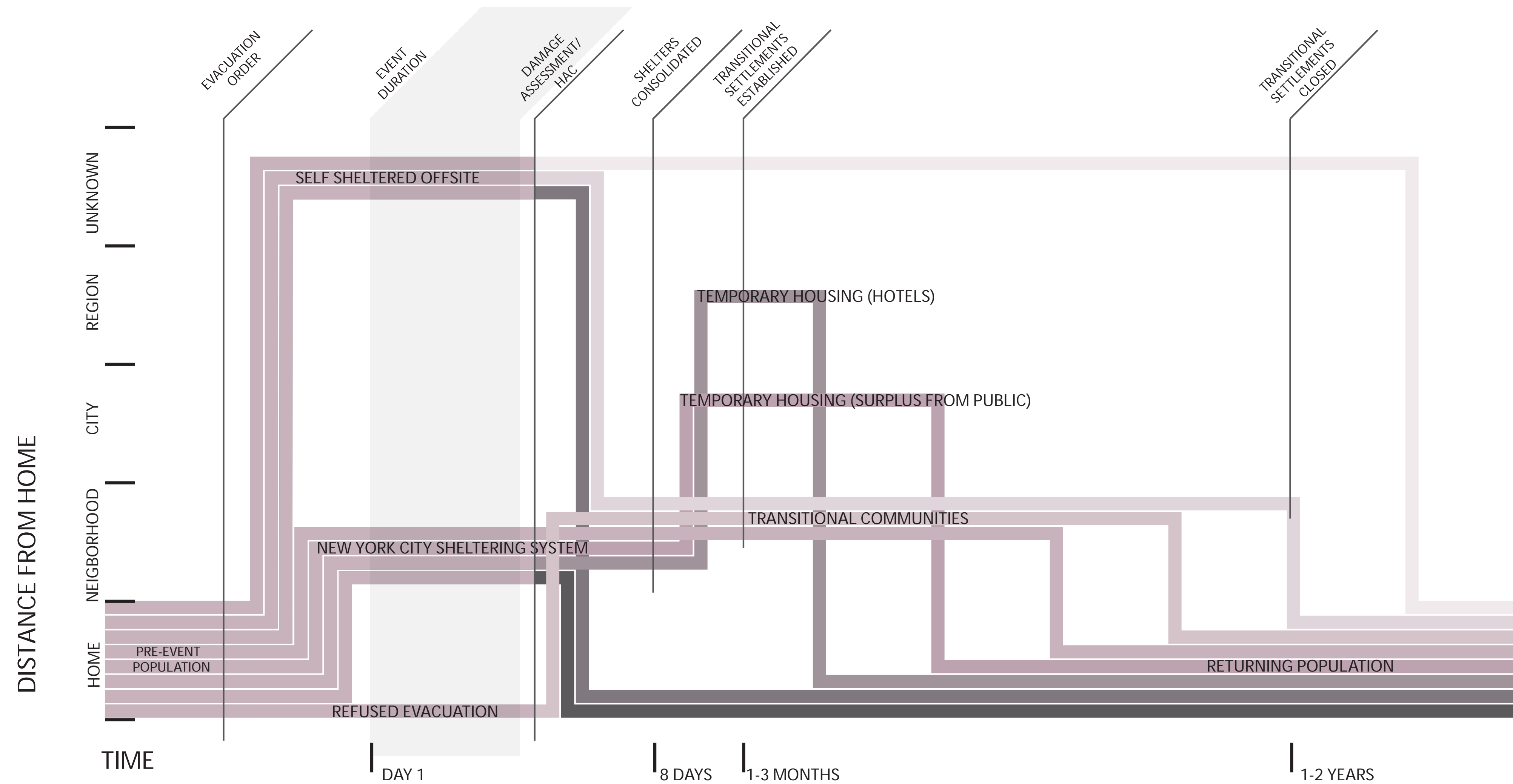
## PROJECT SUMMARY:

- 1 PROTOTYPE
- 3 STORIES
- 3 UNITS
- 15 CITY AGENCIES
- 3 STATE AGENCIES
- 5 FEDERAL AGENCIES
- 21 NON-GOVERNMENTAL AGENCIES

The Urban Post-Disaster Housing Prototype Program is a project of the NYC Office of Emergency Management and the NYC Department of Design and Construction in collaboration with the Federal Emergency Management Agency and the US Army Corps of Engineers New York District.



# DEVELOPMENT PROCESS



## MILESTONES IN DETAIL:

“What If New York City....” Design Competition

- Gathered best ideas from design teams around the world.

Urban Interim Housing Design Guidelines and Performance Specifications

- Created a way to leverage the capacity of the entire manufactured housing industry.

Urban Interim Neighborhood Design Guidelines

- Developed a playbook for post-disaster site selection with design principles for restoring whole communities.

## HOW DO WE CREATE A LOCAL SOLUTION FOR A NATIONAL PROBLEM?

MILESTONES: “What If New York City....” Design Competition

Urban Interim Housing Design Guidelines and Performance Specifications

Urban Interim Neighborhood Design Guidelines

WHAT'S NEXT: Prototype for Urban Interim Housing

A three-story, multi-family structure will be assembled next to the OEM and be in place for one year

It enables NYC to test construction processes and living conditions of housing under real-world conditions

## RISK SUMMARY:

6	NYC EVAC ZONES
2.99 mil	RESIDENTS IN EVAC ZONES
3.4 mil	HOUSING UNITS IN NYC
1.3 mil	HOUSING UNITS IN EVAC ZONES
605,000	ANTICIPATED MAX SHELTER POPULATION



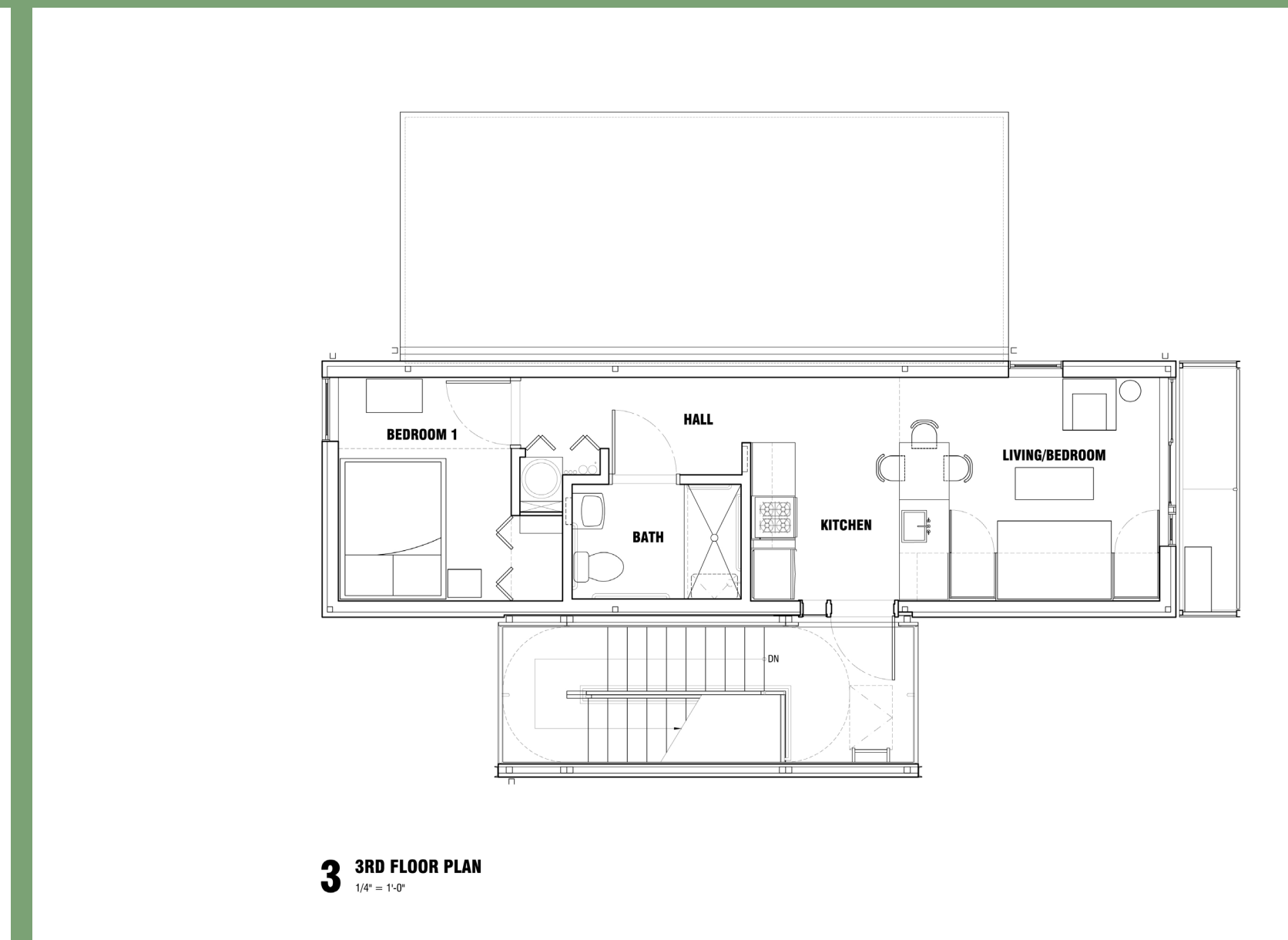
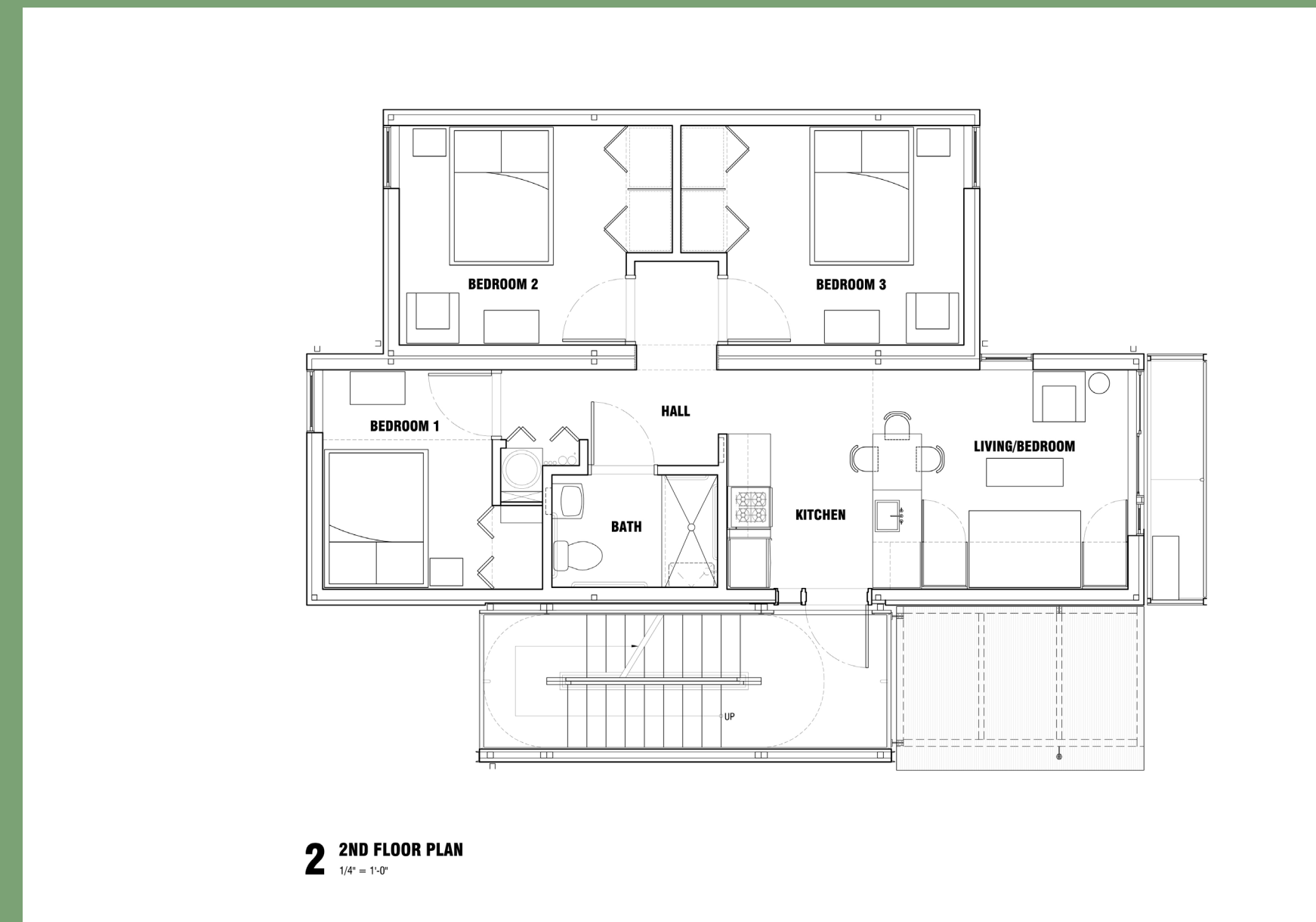
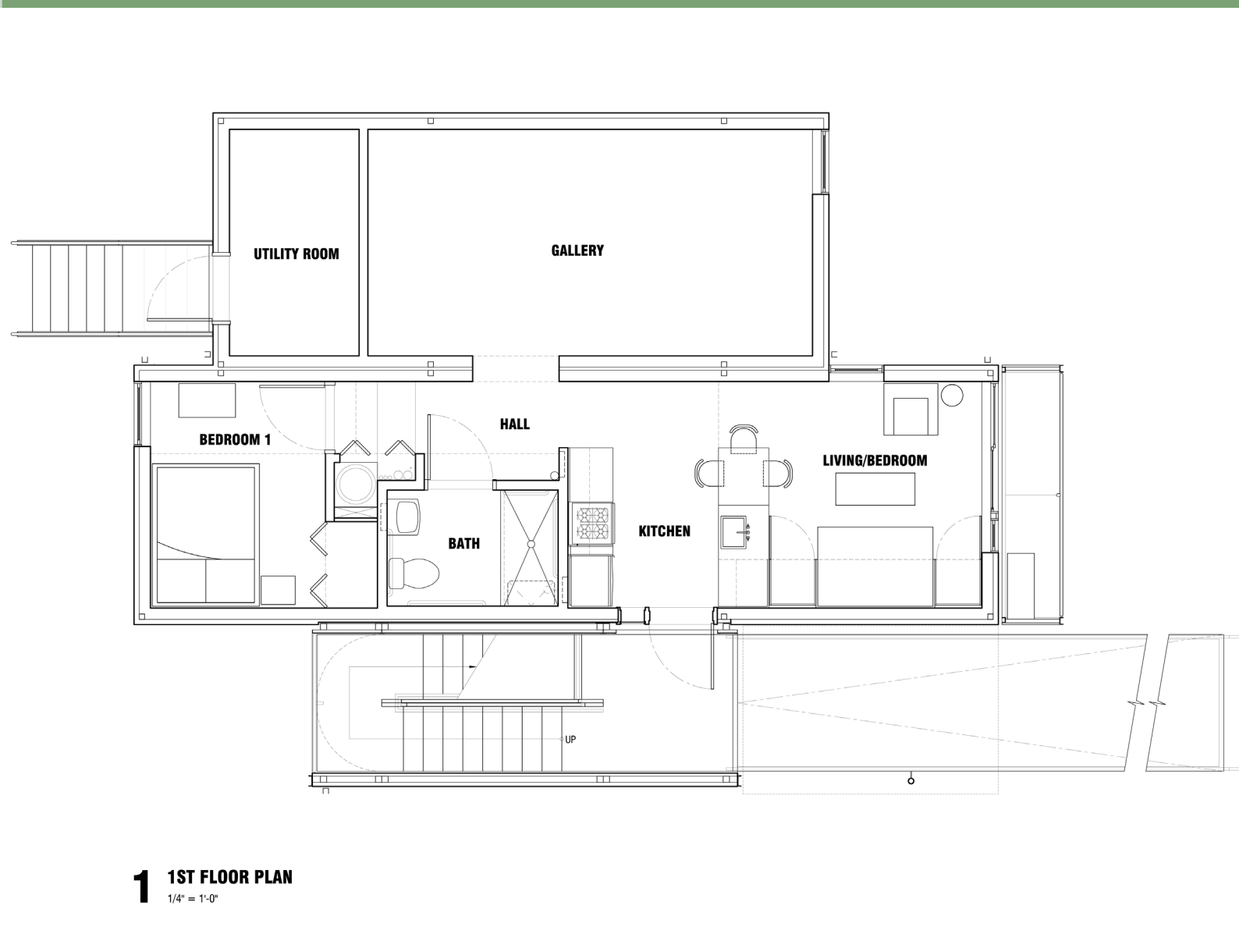
# PROTOTYPE DESIGN

## FLEXIBLE DESIGN:

The key to supplying great numbers of housing units quickly is to use many manufacturers. To make this possible, NYC created Design Standards and Performance Specifications for Urban Post-Disaster Interim Housing.

Building a prototype according to the specification will show how well the specification suits NYC's needs. The specification will be revised with lessons learned through the prototype so that NYC and any City in the country can obtain post-disaster housing quickly and cost-effectively. The design team focused on creating comfortable, safe housing that can be manufactured in large numbers and that can be configured in many ways. OEM, DDC, and the USACE chose to build this prototype design because of its attention to green design, the ways it meets the needs of many family types, how it suits a wide variety of site types, and how it balances durability and comfort with cost-effectiveness.

The US Army Corps of Engineers serves as the project manager and the prototype is designed and built by American Manufactured Systems and Services (AMSS), working with Garrison Architects, Anastos Engineering Associates and Mark Line Industries of Pennsylvania.



## WHAT KIND OF TEMPORARY HOUSING CAN WORK IN THE CITY?



### DESIGN SUMMARY:

- 3 STORIES
- 6 MODULES
- 1 ONE-BEDROOM
- 1 THREE-BEDROOM
- 1 PUBLIC GALLERY
- 100% UNITS MEETING CRITERIA FOR AMERICANS WITH DISABILITIES ACT
- 1 YEAR OCCUPANCY AND EVALUATION



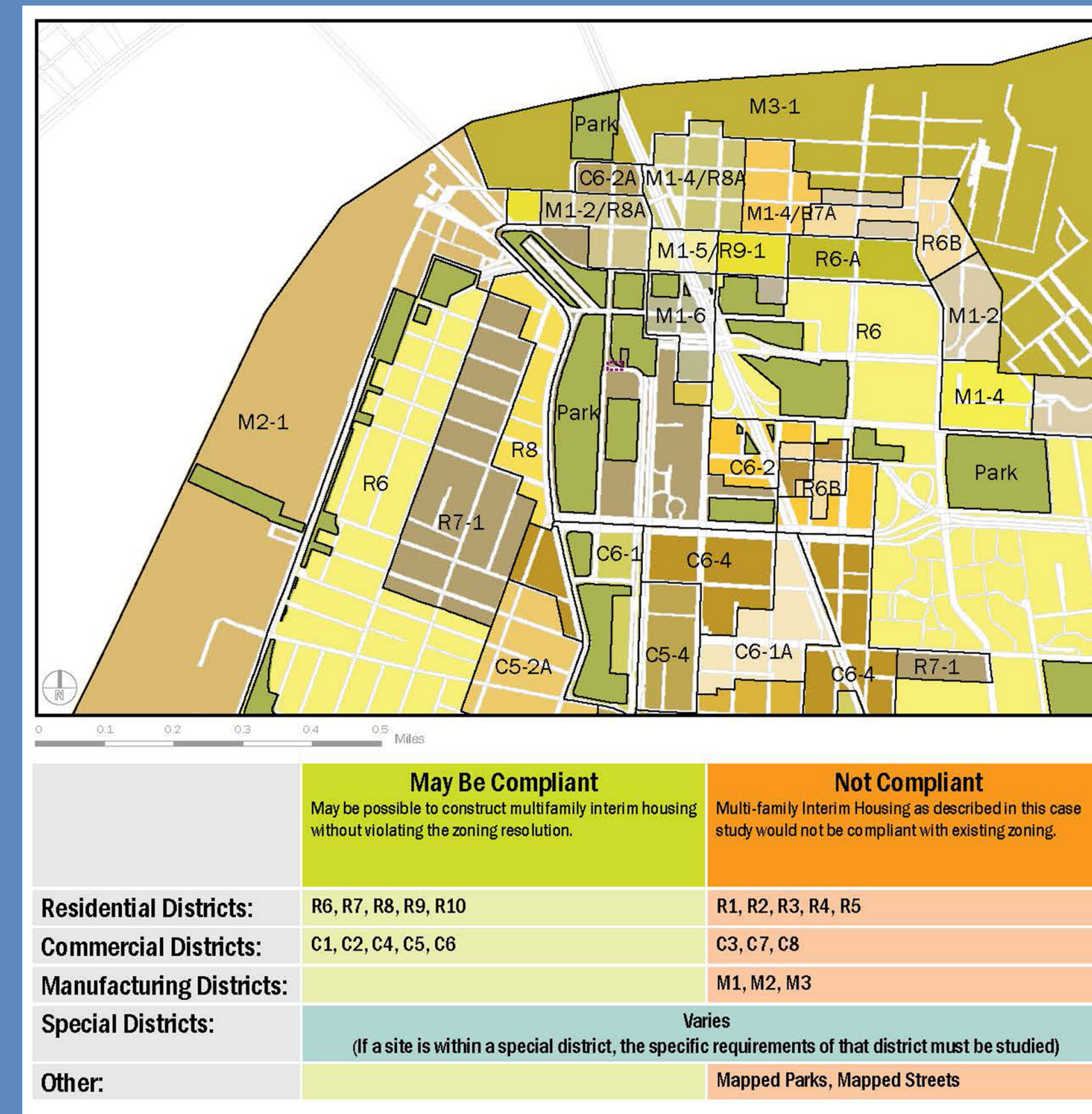
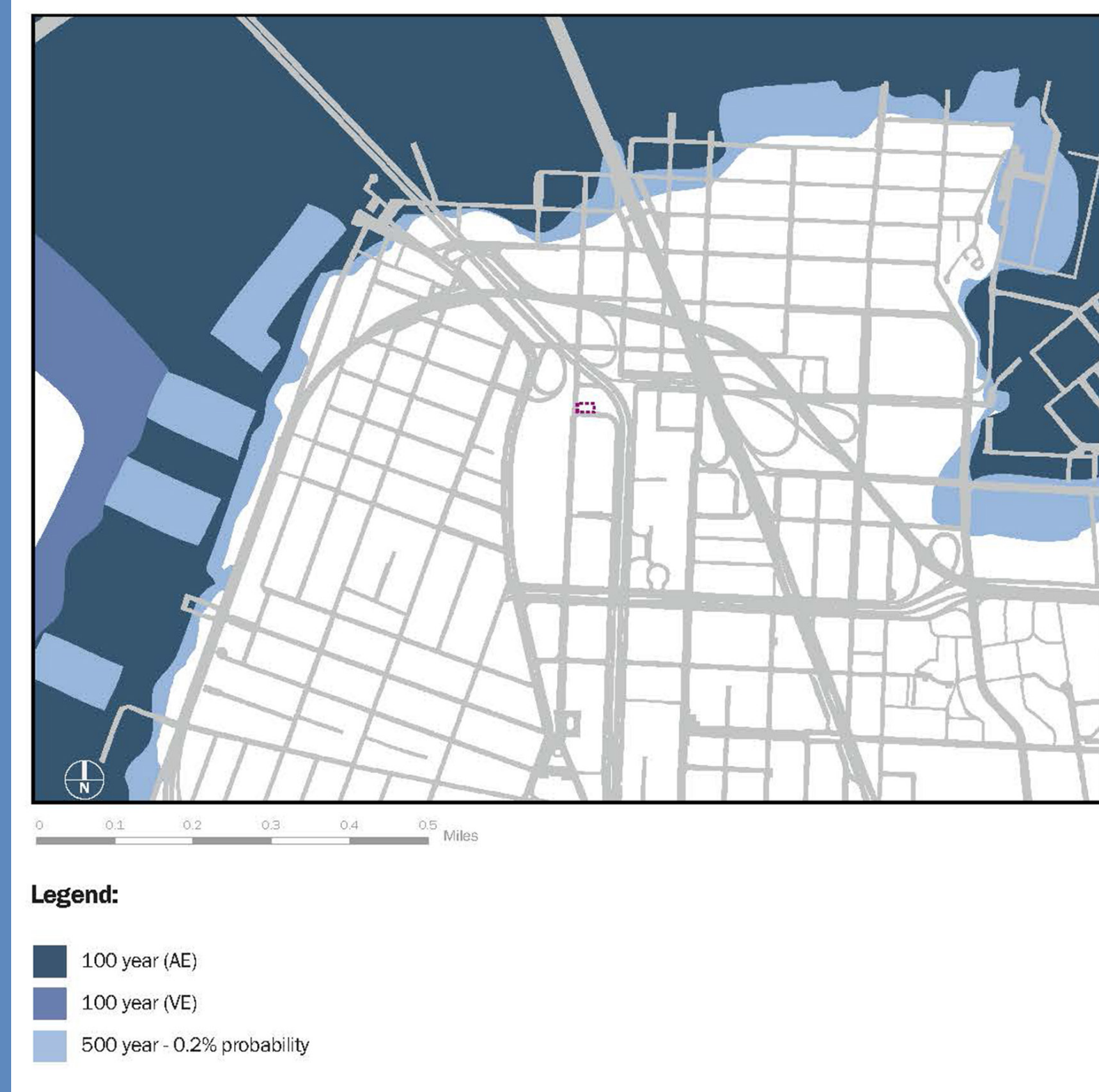
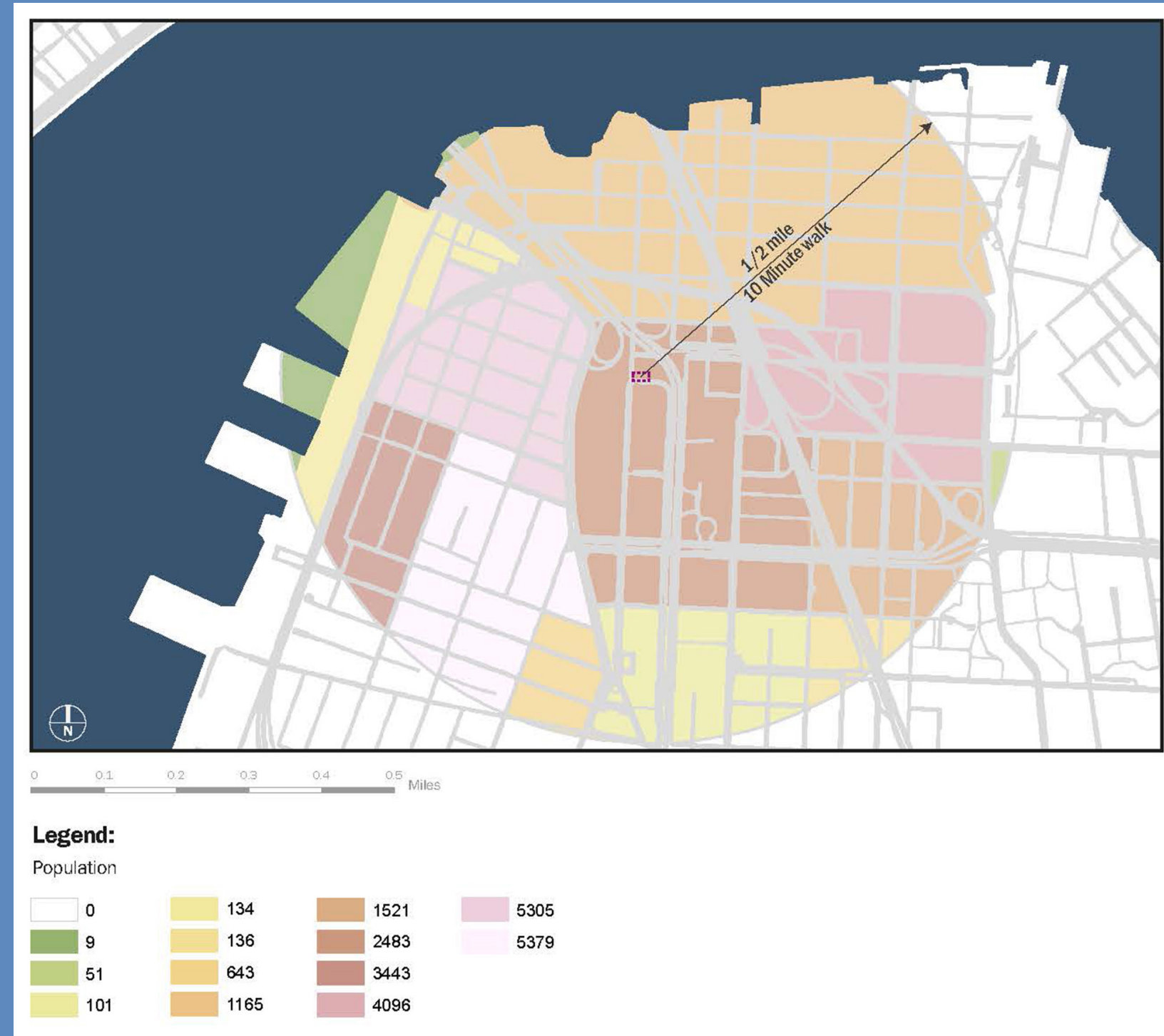
# DESIGN PRINCIPLES

## TEMPORARY TO PERMANENT

While interim housing is intended to be in place for only a few years, it often remains for decades. It should provide the same level of comfort, safety and quality as permanent housing. NYC is building a three-story prototype of urban post-disaster housing that will be in place for one year. We are evaluating the design of the units and the way they can be used to restore the City.

## CONTRIBUTES TO NEIGHBORHOOD RECOVERY:

Interim housing units must adapt to different site types. To understand where housing might go in the City, NYC developed a "playbook," for post-disaster site selection and neighborhood design, including codes and zoning issues. The prototype investigates what current codes and permitting processes may need to be investigated following a disaster.



## WHAT IS DIFFERENT ABOUT IT?

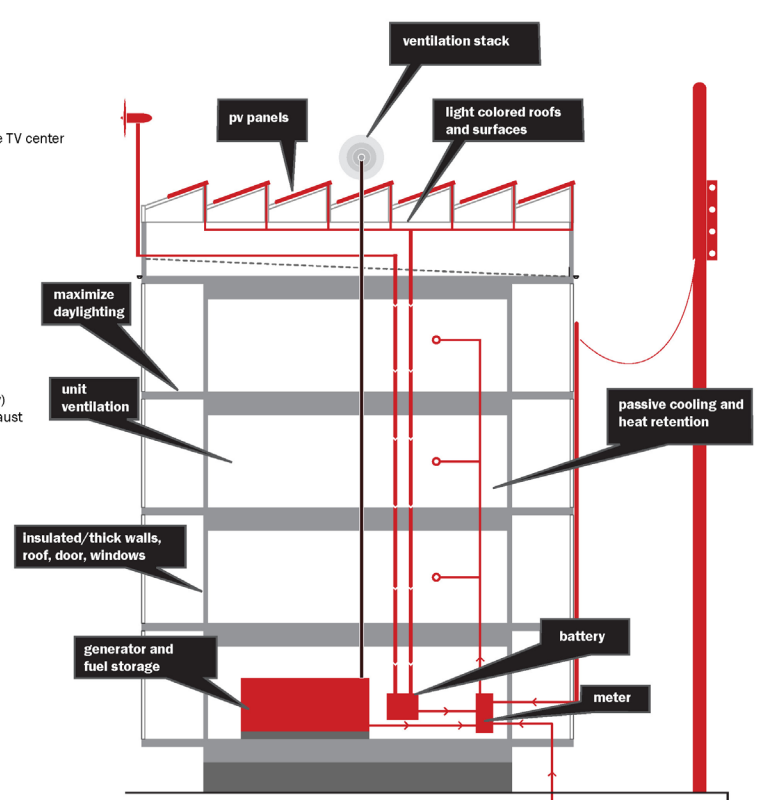
### Systems Guidelines

#### Energy Recommendations

- Connect to grid as soon as possible
- Reduce consumption
  - Cap supply per unit
  - Limit high load appliances
  - Use LED lighting (with per unit)
  - Provide on-site cooling center, laundry service, cable TV center
- Use low demand, energy efficient technologies
  - Lighting (LED, CFL, etc.)
  - Water heating
  - Appliances with energy star rating
  - Shut off air conditioning
  - "How to" decrease daily use
  - Daily bagged renewable energy ready systems
  - Provide generator/fuel tanks as last resort
  - Define maximum electrical demand per unit
- Define maximum fuel demand, storage and delivery protocol (gal/week)
- Consider location on site, structural shelter, and noise/exhaust mitigation
- Install cogeneration capabilities

#### HVAC & Water Heating Guidelines

- Define BTU and hot water demand per site
- Choose appropriate system, modular, centralized



### Systems Guidelines

#### Water Use Recommendations

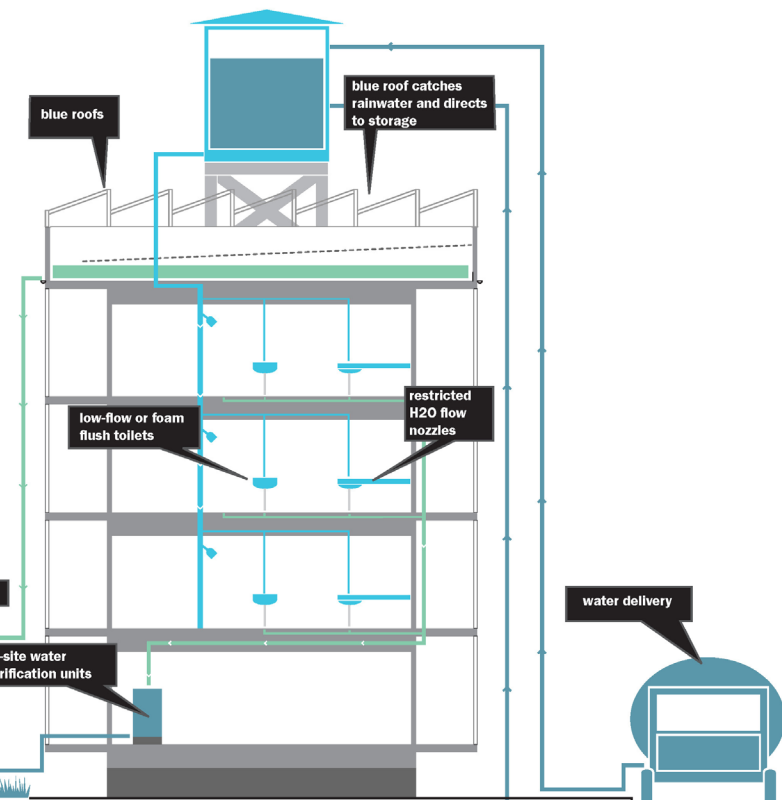
- Connect to grid as soon as possible
- Reduce consumption
  - Cap supply per unit
  - Provide on-site laundry center
  - Regulate water availability
- Design strategies
  - Use low demand water efficient technologies
  - Use flush flush conserving toilets or low flow toilets
  - Restrict flow water fixtures
  - Use appliances with energy star rating
- Implement community education on energy conservation
  - Water conservation
  - Showering
  - Hand washing and hand washing
  - Toilet flushing
  - Appropriate cleaning techniques
- Define maximum demand per unit and site (gal/day)
- Site and install water tanks
- Construct catchment system

#### If supply falls demand

- Install on-site water purification system (i.e. chlorination)
- Distribute water to units
- Close water delivery

#### If supply cannot reach demand

- Store and catchment for laundry use only
- Proceed to water delivery protocol
- Provide water delivery to site
- Implement tank refill delivery protocol (gal/week)



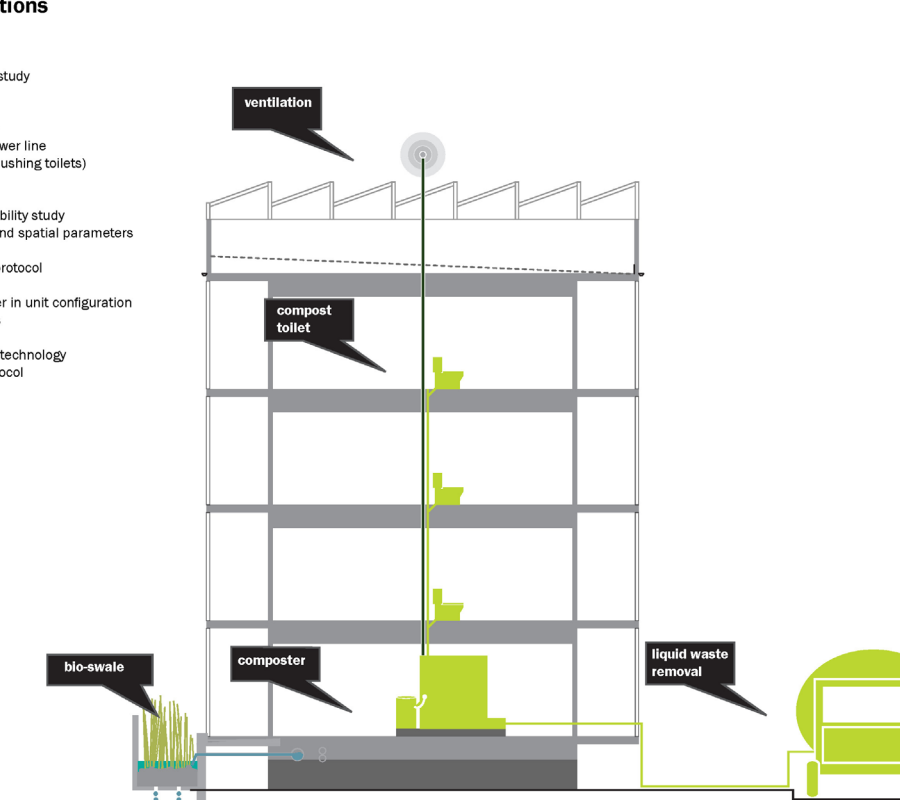
### Systems Guidelines

#### Sewerage Recommendations

- If average connection available
  - Conduct sewer connection feasibility study
  - Install above ground sewer lines
  - Gravity flow
  - Sub pumps/energy necessary
  - Exclude for connection to existing sewer line
  - Water availability (water demand for flushing toilets)

#### If average connection not available:

- Conduct energy retention basin feasibility study
- Above ground basin location and spatial parameters
- Interim pumping energy
- Daily hourly waste extraction protocol
- Conduct complete feasibility study
- Location and spatial parameter in unit configuration
- Minimum tank requirements
- Monthly maintenance
- Community education on new technology
- Biannual liquid extraction protocol



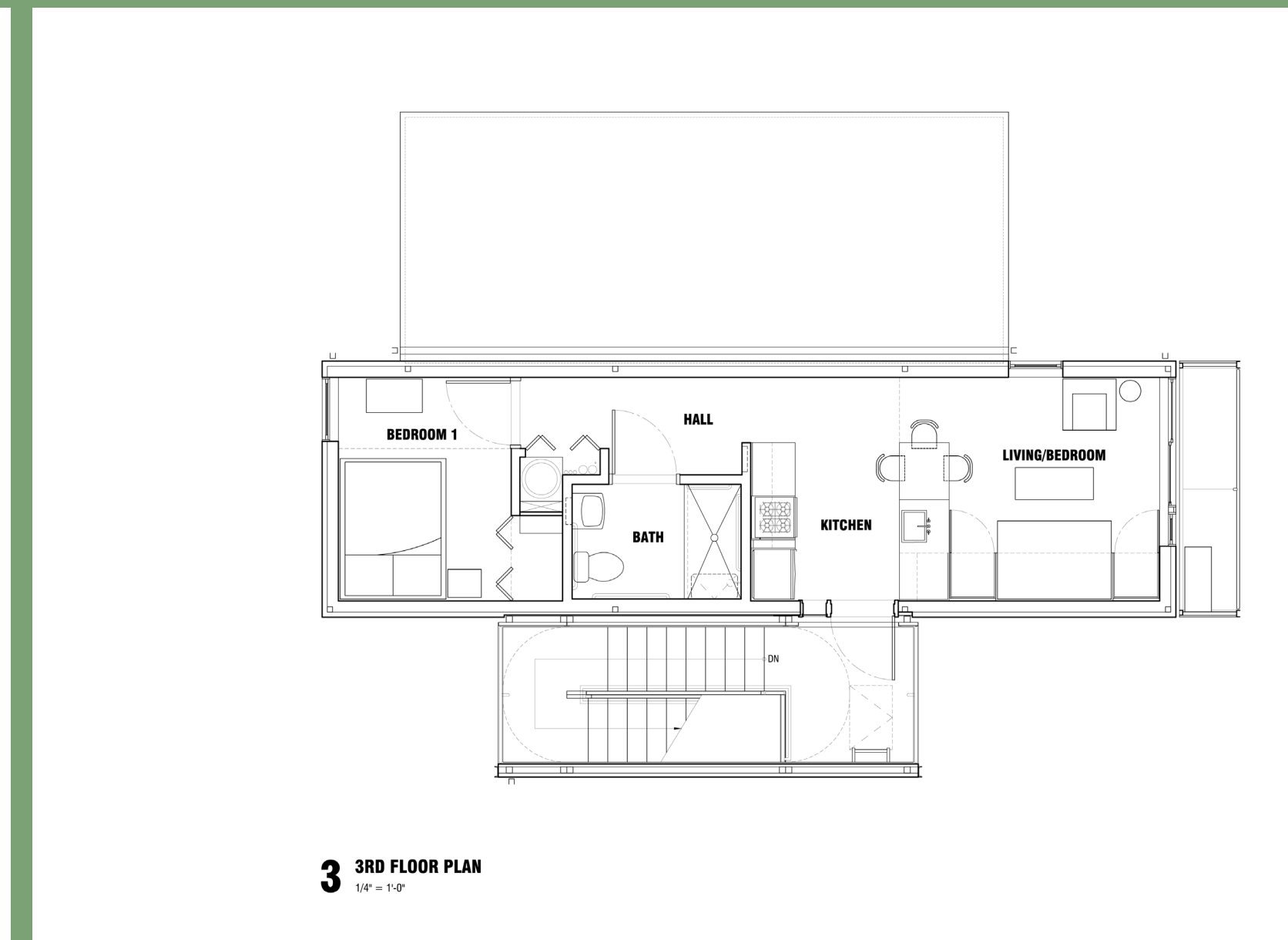
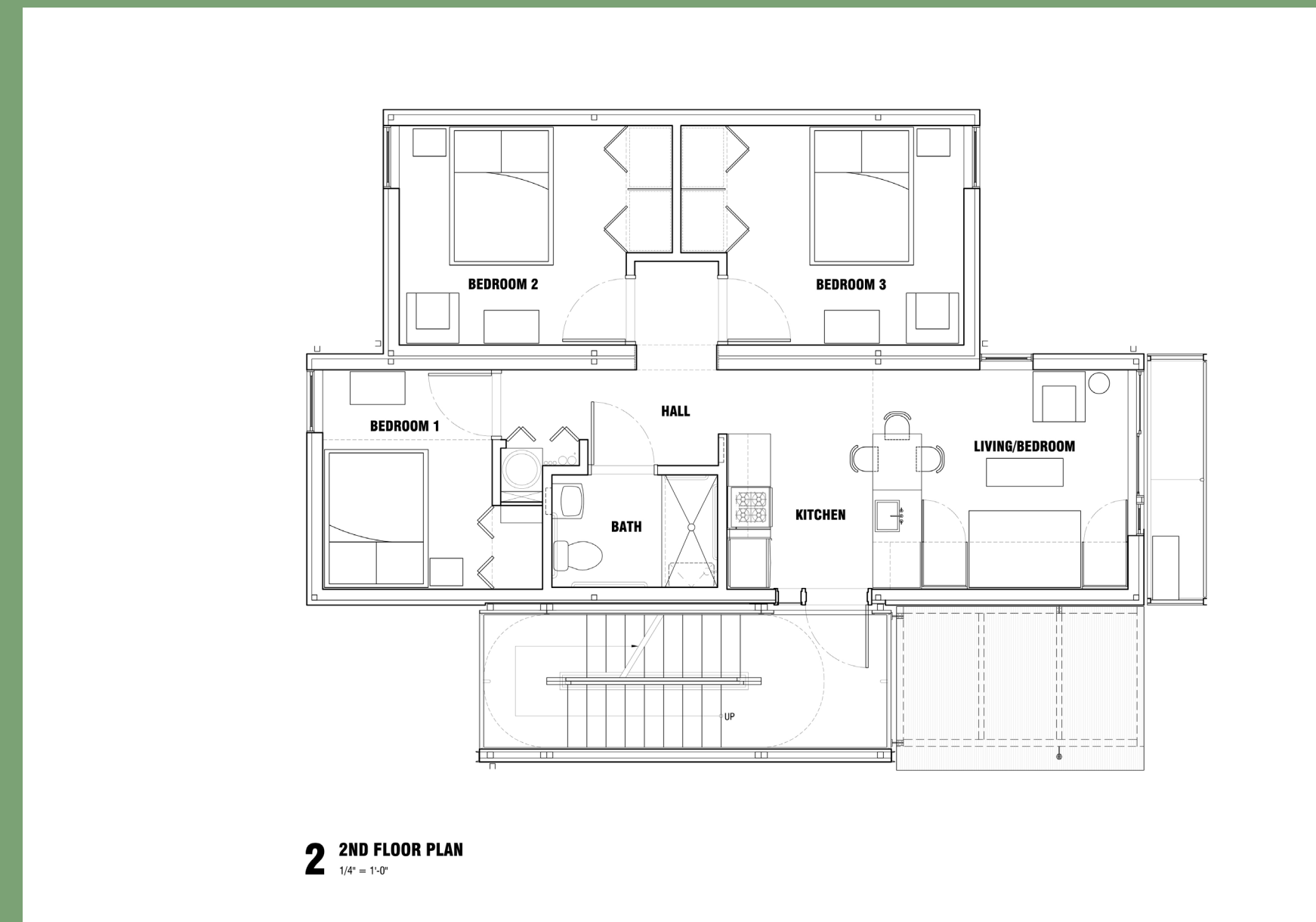
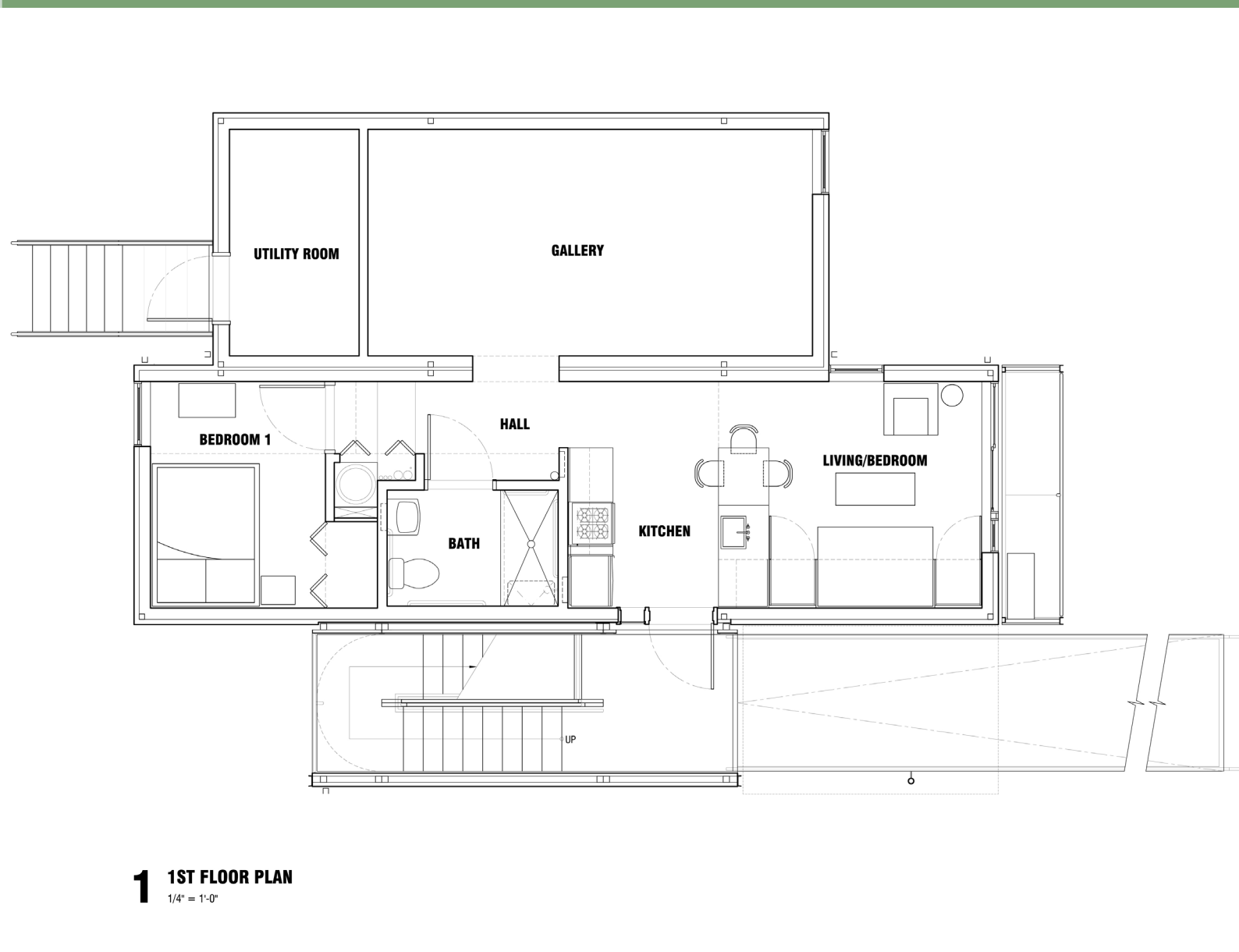


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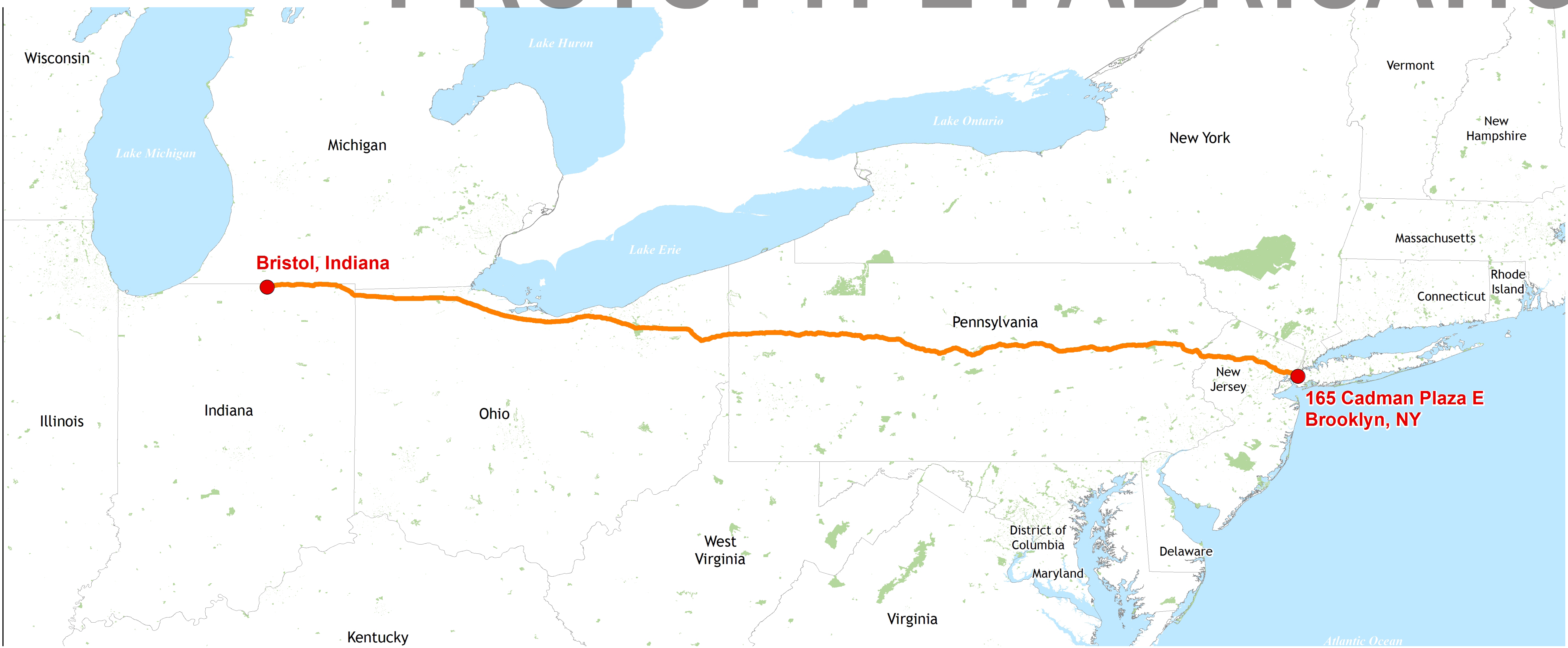
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# PROTOTYPE FABRICATION



## SPEED AND RESUABILITY:

Modular construction is faster than traditional construction methods. After a disaster, distant factories are likely to be up and running regardless of local conditions. Site-work, utility connections and foundations can happen as the units are being manufactured. The units can also be disassembled re-used in different locations.

## TESTING ALL NYC CONDITIONS:

Designing, Building, Transporting, Installing and Removing the Prototype will reveal best practices for managing all the logistical and administrative challenges for a rapid deployment of manufactured housing. Addressing these challenges now allows the process to be smoother after a disaster.

**INFORMATION CONCERNING OVERSIZED/OVERWEIGHT VEHICLES**

Maximum Dimensions of Vehicles and Combinations in New York City

Width: 96 inches (for school buses and fire vehicles, 98 inches, buses having a carrying capacity of more than seven passengers shall not exceed 102 inches). [34 RCNY §4-15(b)(1)]

Height: 13 1/2 feet. [34 RCNY §4-15(b)(2)]

Length: Articulated buses - 65 feet. [34 RCNY §4-15(b)(3)]  
Semi-trailer - 55 feet. [34 RCNY §4-15(b)(4)]  
Single vehicles (except articulated buses and semi-trailers) - 35 feet. [34 RCNY §4-15(b)(3)]

The New York City interstate routes approved for 53 foot trailers are: I-95 between the Bronx-Westchester County line and I-295, and I-295 to I-495 via the Throgs Neck Bridge and I-495 between I-295 and the Queens-Nassau County line.

On I-95 between I-287 and I-295, on I-295 between I-295 and I-495, and on I-495 between I-95 and the Nassau-Queens county line, a semi-trailer over 48 feet (but not over 53 feet) may be operated if the distance between the kingpin of the semi-trailer and the centerline of the rear axle or rear axle group does not exceed 43 feet, and if the semi-trailer is equipped with a rear-end protective device of substantial construction consisting of a continuous lateral beam extending to within 4 inches of the lateral extremities of the semi-trailer and located not more than 22 inches from the surface as measured with the vehicle empty and on a level surface. [NY Vehicle and Traffic Law §385(3)(e)]

In double bottom operation, a semi-trailer or trailer may not exceed 28 1/2 feet. [NY Vehicle and Traffic Law §385(3)(b)]

Combination of Vehicles - 55 feet except that on qualifying highways and access highways there is no limit on length. [34 RCNY §4-15(b)(4), NY Vehicle and Traffic Law §385(4)(b)(1)]

NOTE: The provisions of Section 4-15 shall not apply to any vehicle authorized by the Federal Surface Transportation Assistance Act of 1982, as amended, when such vehicle is operating pursuant to the provisions of such Act.

Permissible Gross Weight of Vehicles And Combinations With Pneumatic Tires

Weight per inch width of tire on one wheel - 800 pounds. [34 RCNY §4-15(b)(6)]

Weight on any one wheel - 11,200 pounds. [34 RCNY §4-15(b)(7)]

Weight on any one axle - 22,400 pounds. [34 RCNY §4-15(b)(8)]

Weight on any two consecutive axles less than 10 feet apart - 36,000 pounds. [34 RCNY §4-15(b)(9)]

Weight on any three axles (34,000 lb. Plus 1,000 lb. Per foot and major fraction of a foot between first and last axles, center to center). However, total weight should not exceed 80,000 lb. [34 RCNY §4-15(b)(10)]

Weight And Height Restrictions On Bridges, Viaducts And Other Structures

No vehicle or combination of vehicles may be operated over, on or through any bridge, viaduct or other structures on any highway if the weight of such vehicle or combination of vehicles and load is greater than the posted capacity of the structure or exceeds the height of the posted clearance as shown by an official sign or other marking or device. [34 RCNY §4-15(b)(13)]



## HOW WILL IT GET TO THE CITY?

### CONSTRUCTION SUMMARY:

20	DAYS FOR SITE WORK
40	DAYS TO MANUFACTURE
677	MILES TO SITE
6	TRUCKS TO CONVEY
1,000	MILES TO NYC
12'x40'	DIMENSION OF THE LARGEST MODULE
28,000	POUNDS PER MODULE
3	DAYS TO SET IN PLACE
28	DAYS FOR FINAL INSPECTIONS

The prototype is being manufactured in Bristol, Indiana by Mark Line Industries. It will be trucked almost 700 miles to the site and set in place by crane. After one year it will be removed and relocated by AMSS and possibly sold. The next destination and owner are to be determined.



# PLANNING TO REBUILD



## URBAN POST-DISASTER NEIGHBORHOOD DESIGN:

Temporary Housing often becomes permanent housing, so all post-disaster deployment of interim housing needs to be planned as neighborhoods.

## DESIGN VERSATILITY:

Post-disaster housing units should be designed to support recovery for many different types of neighborhoods. The prototype design proposal included a variety of options (shown at left), but we needed to know more about post-disaster urban planning.

## HOW CAN THE PROTOTYPE HELP REBUILD NEIGHBORHOODS?



A. TYPICAL 200' \* 600' BLOCK  
44 Apartments  
176 3BR Units  
Occupancy: 1058 people

B. MEWS  
42 Apartments  
168 3BR Units  
Occupancy: 1008 people

A. HYBRID  
40 Apartments  
160 3BR Units  
Occupancy: 960 people

## LARGE-SCALE DEVELOPMENT: CASE STUDIES

To understand how the prototype could be used for large-scale urban restoration, OEM has partnered with the Pratt School of Architecture's Recovery, Adaptation, Mitigation and Planning (RAMP) program.

The projects in this exhibit use the prototype's architectural plans and apply them to different conditions in a real world site. The studies propose ways quickly built modular construction could be aggregated to restore neighborhoods, and how the units function at different scales and in different site configurations. They provide key information about how the prototype can suit and support population densities, infrastructures and public spaces.