

An aerial photograph of Tokyo Bay, Japan, with several land parcels highlighted in a vibrant teal color. These parcels are scattered across the bay, some near the coast and others further inland. Overlaid on the image are several concentric, semi-transparent circles that radiate from a point on the right side, likely representing evacuation zones or areas of influence for the infrastructure being discussed. The sky is filled with soft, white clouds, and the water of the bay is a light blue-grey.

RISK TO RESILIENCE

RE-IMAGINING THE PUBLIC REALM AS MULTI- FUNCTIONAL INFRASTRUCTURE FOR
DISASTER EVACUATION IN TOKYO BAY

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ADVISOR: EMILY SCHLICKMAN

GREAT EAST JAPAN EARTHQUAKE

MARCH 11, 2011

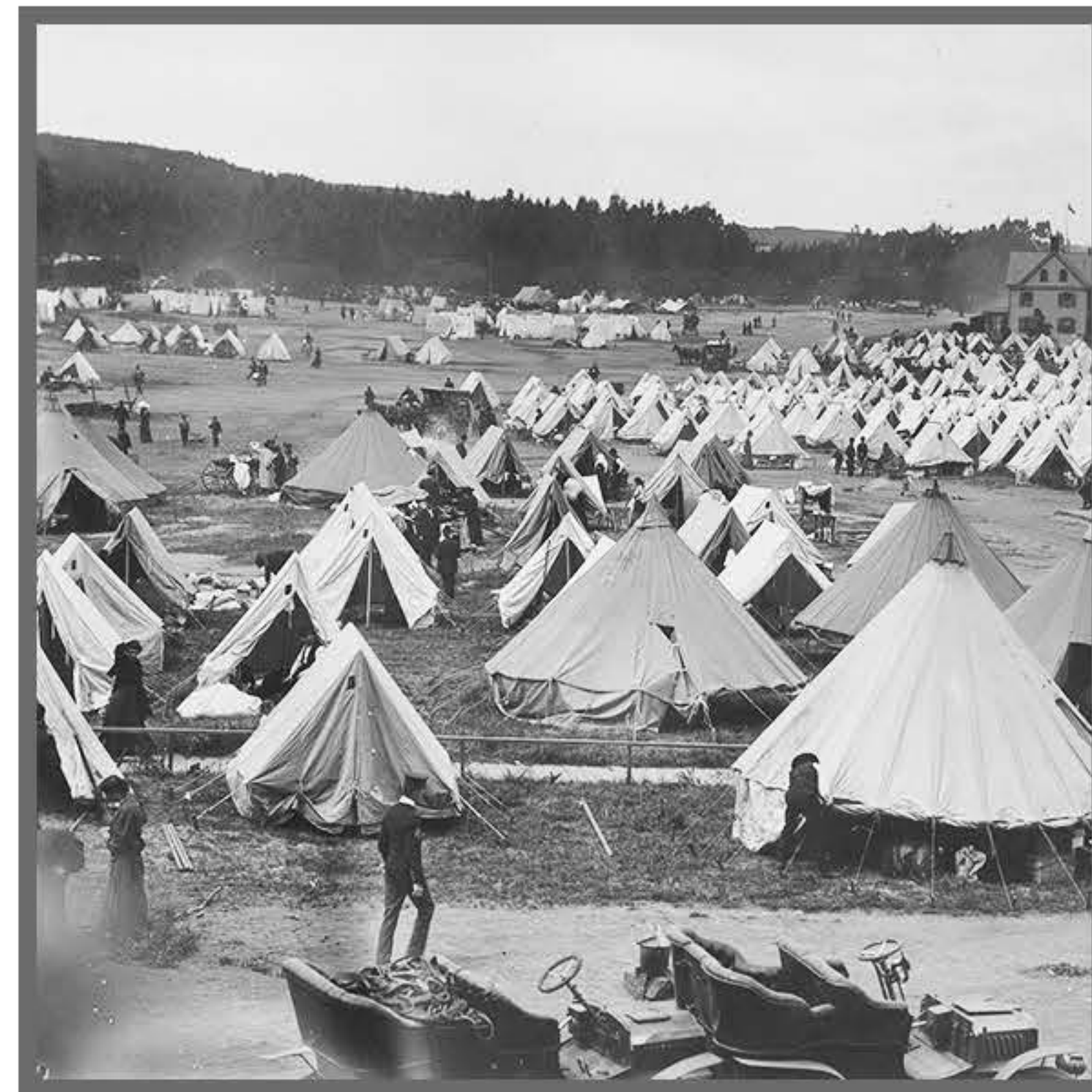
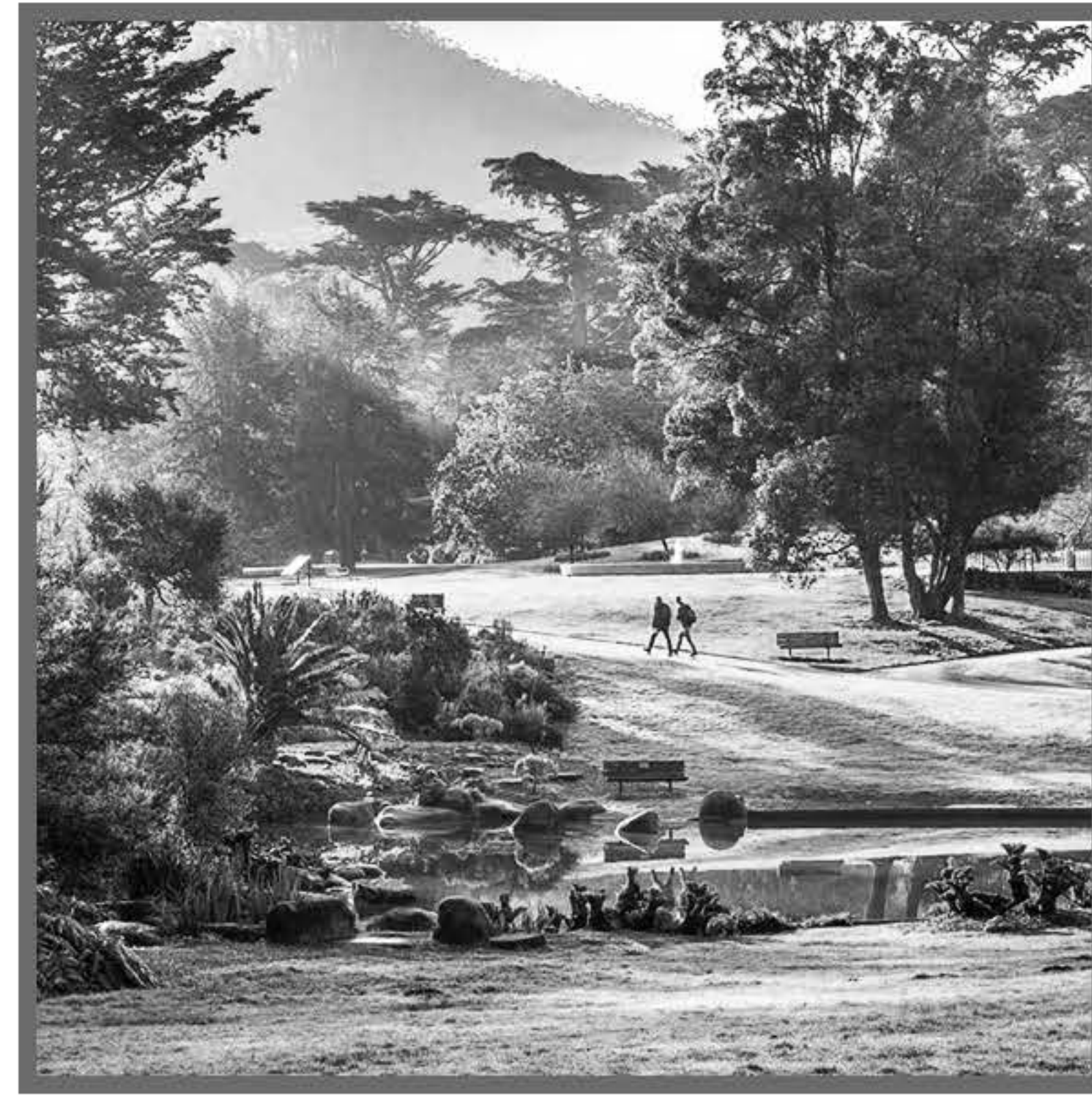


JAPAN WAS ROCKED BY A 9.0-MAGNITUDE EARTHQUAKE THAT CAUSED WIDESPREAD DAMAGE TO THE COUNTRY'S EASTERN COASTAL REGION. THE EARTHQUAKE WAS SO POWERFUL IT MOVED HONSHU, JAPAN'S LARGEST ISLAND, 7.9 FEET EAST AND SHIFTED THE EARTH ON ITS AXIS BY AN ESTIMATED 4 TO 10 INCHES.

1906

SAN FRANCISCO EARTHQUAKE

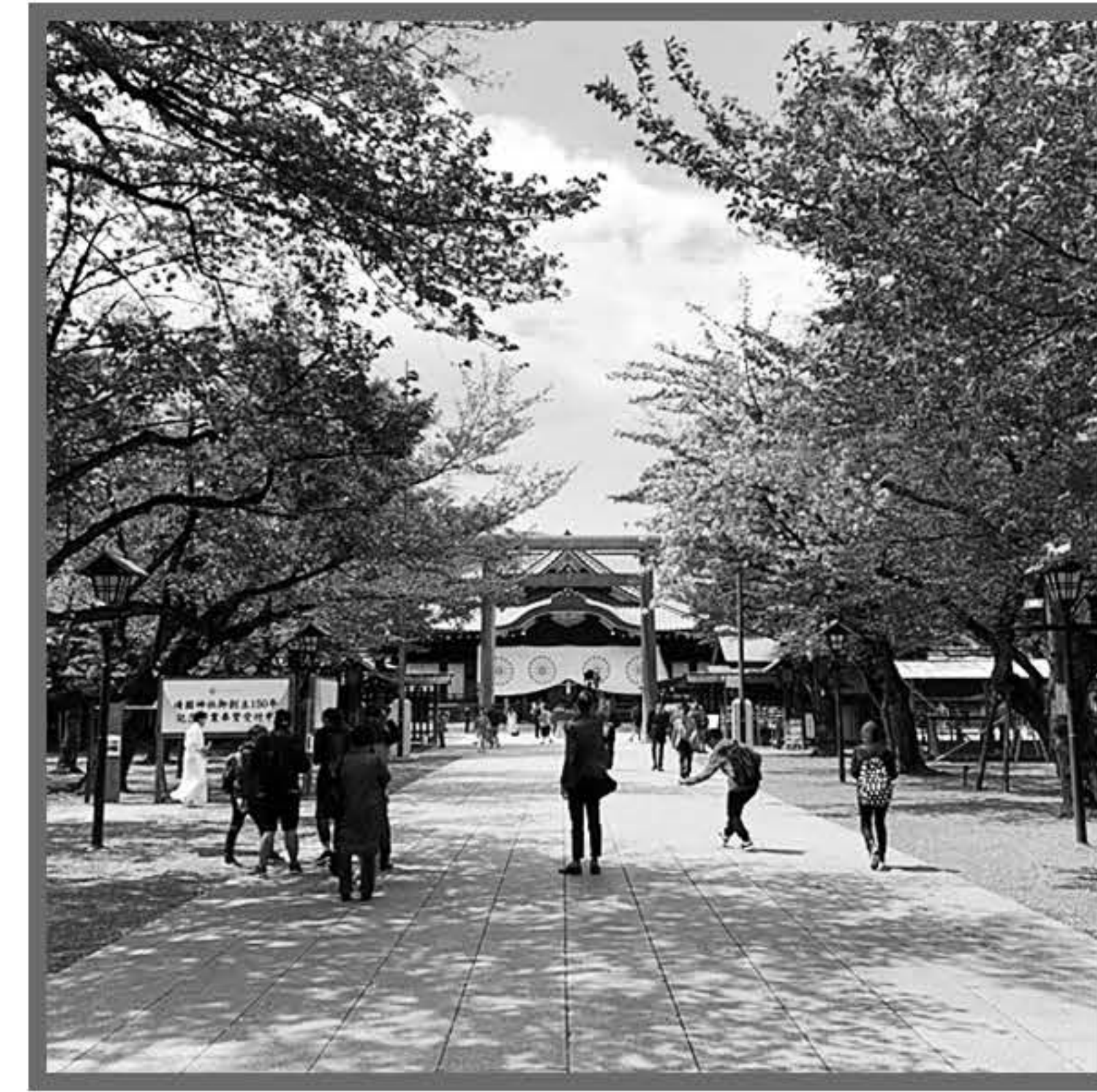
GOLDEN GATE PARK, SF



1923

GREAT KANTO EARTHQUAKE

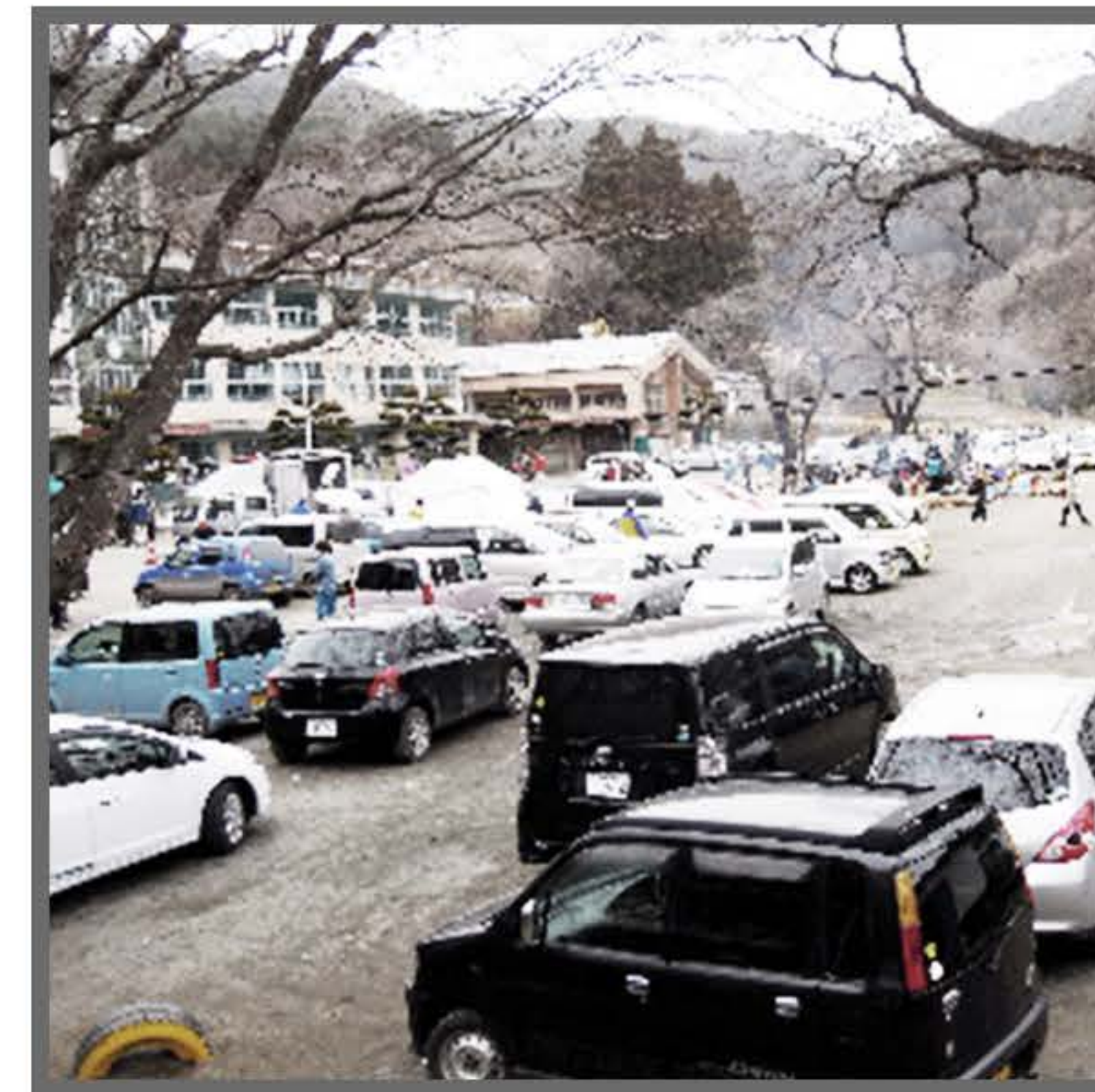
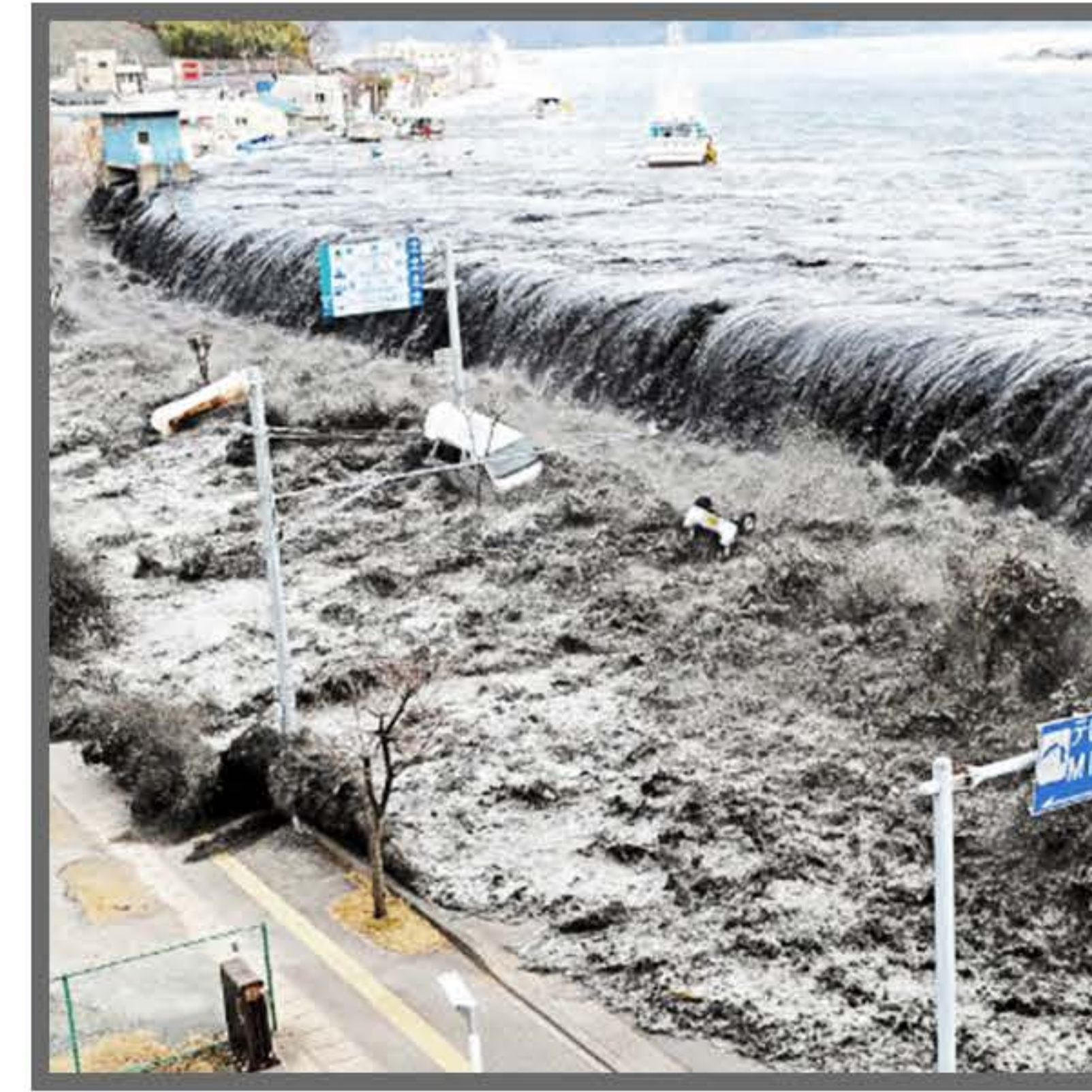
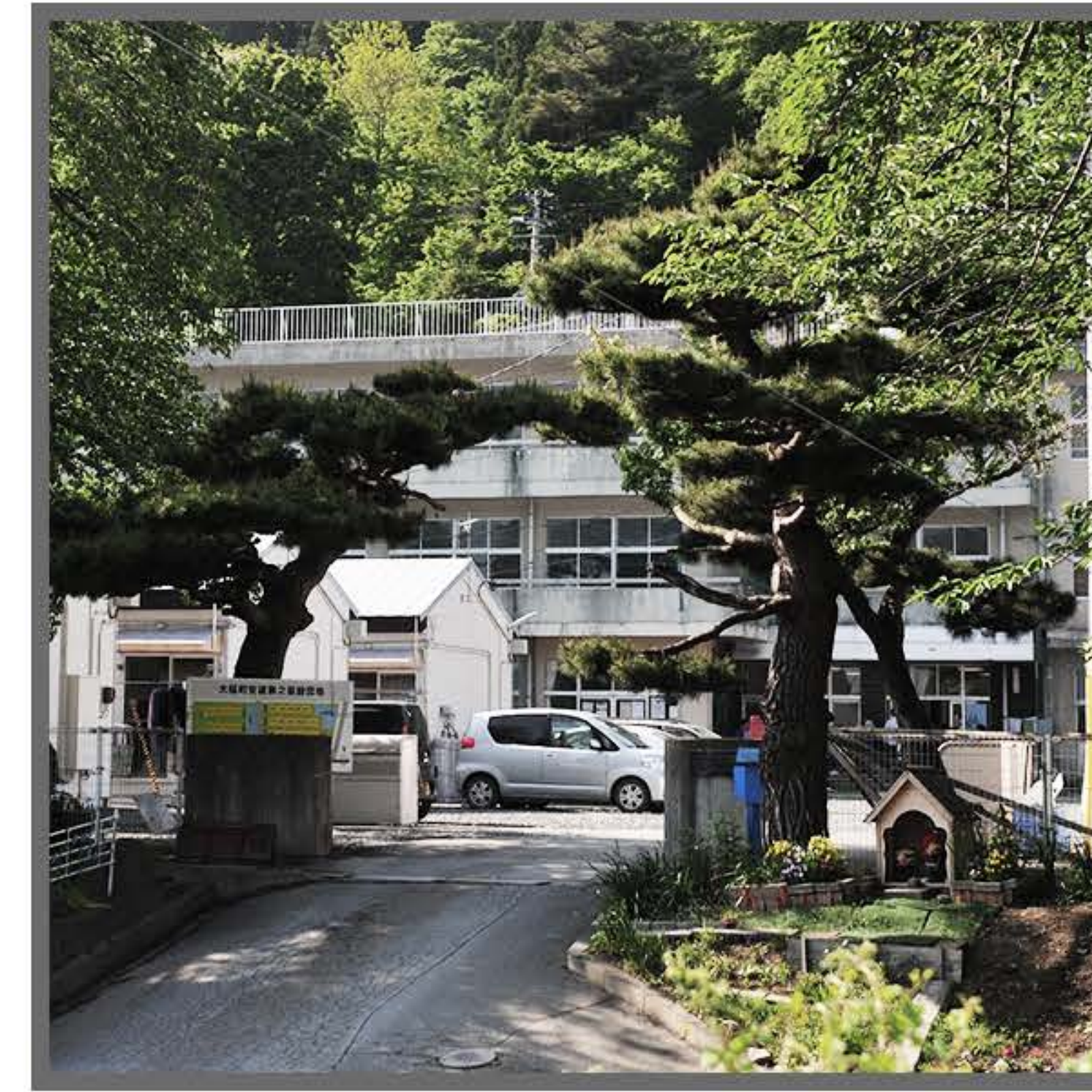
YASUKUNI SHRINE, JAPAN



2011

GREAT EAST JAPAN EARTHQUAKE

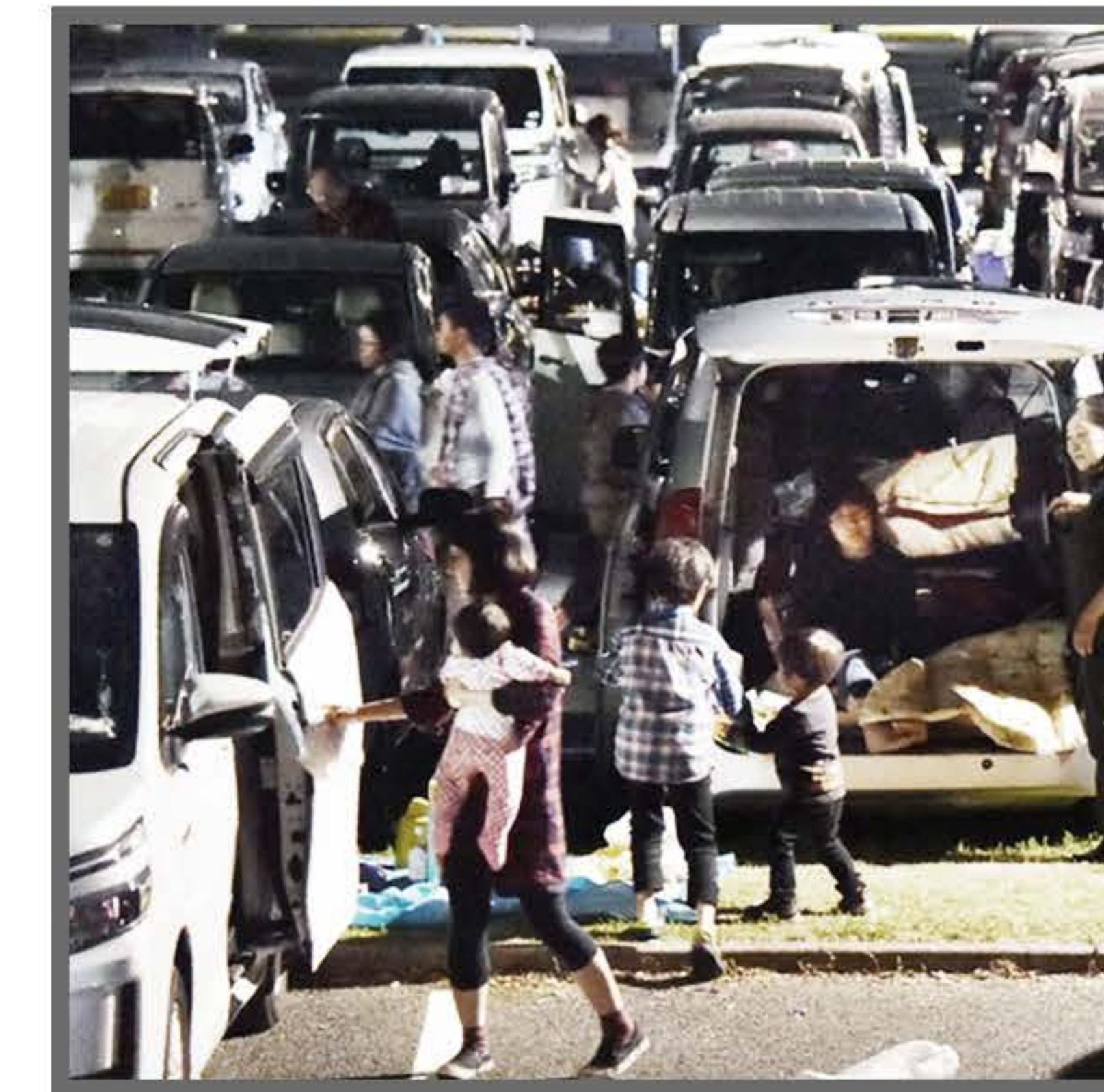
ANDO ELEM SCHOOL, JAPAN



2016

KUMAMOTO EARTHQUAKE

KUMAMOTO CONVENTION, JAPAN



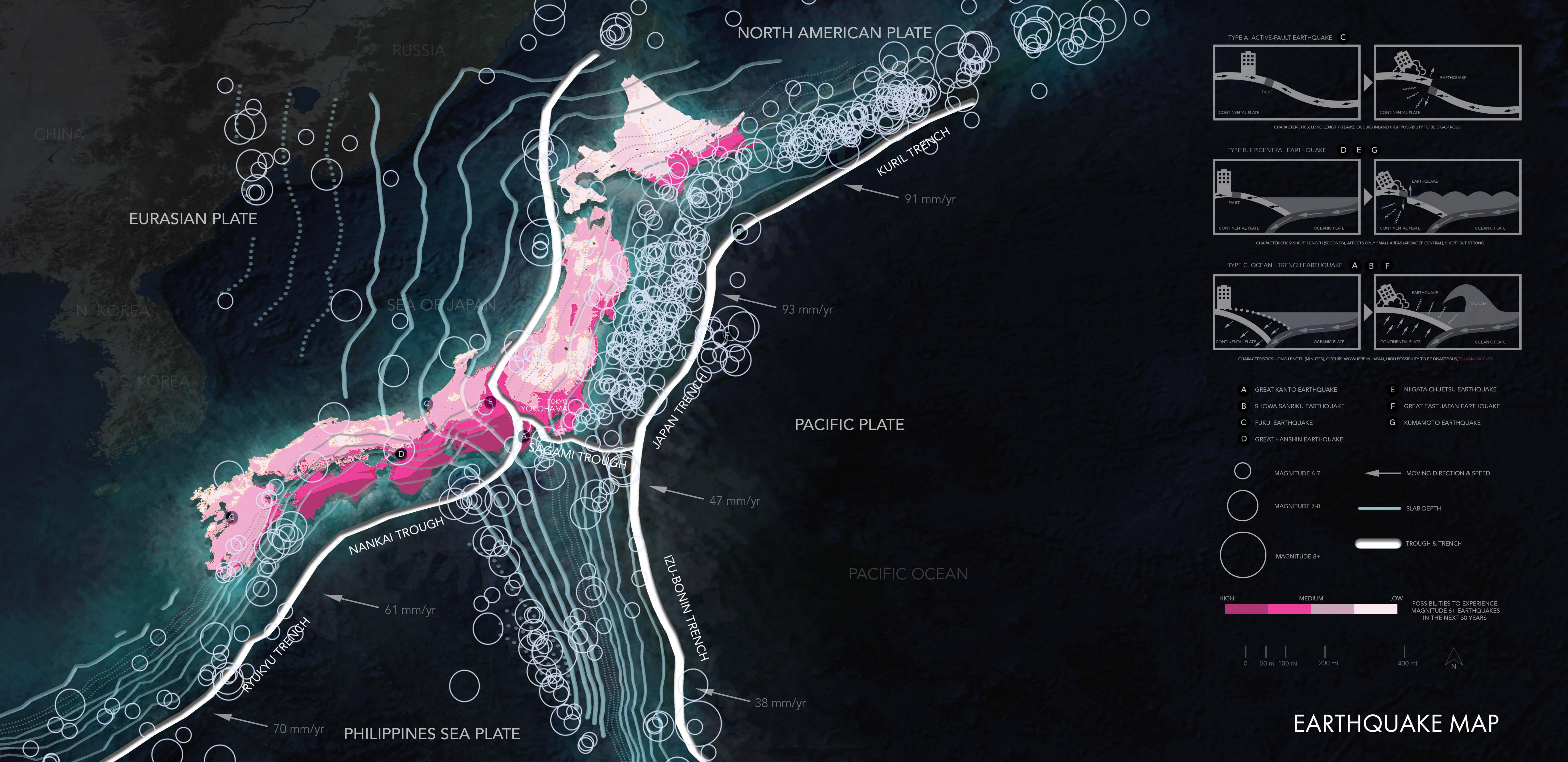
2020

COVID-19

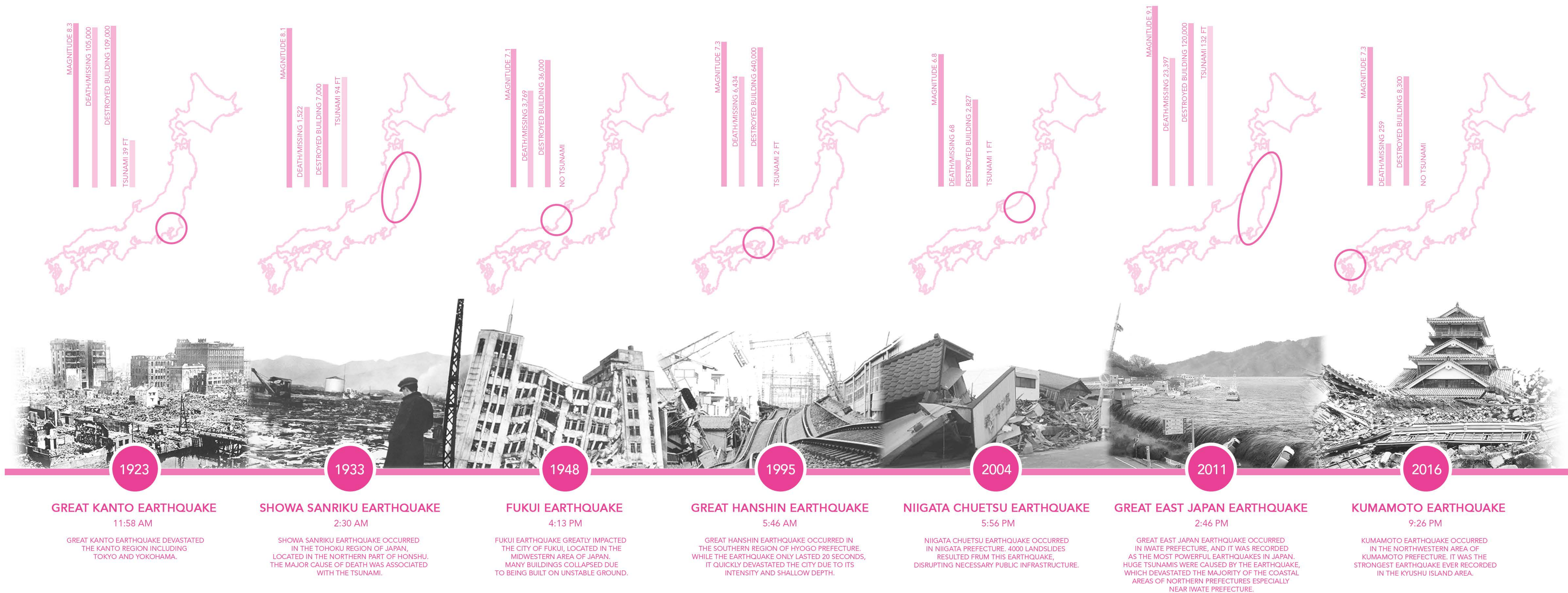
CENTRAL PARK, NY



DURING TIMES OF CRISIS, COMMUNITIES OFTEN LOOK TO THE PUBLIC REALM.



THE COUNTRY OF JAPAN, SITUATED BETWEEN THE PACIFIC PLATE, PHILIPPINES SEA PLATE, NORTH AMERICAN PLATE, AND EURASIAN PLATE, IS UNIQUELY VULNERABLE TO CATASTROPHIC EARTHQUAKES AND TSUNAMIS.

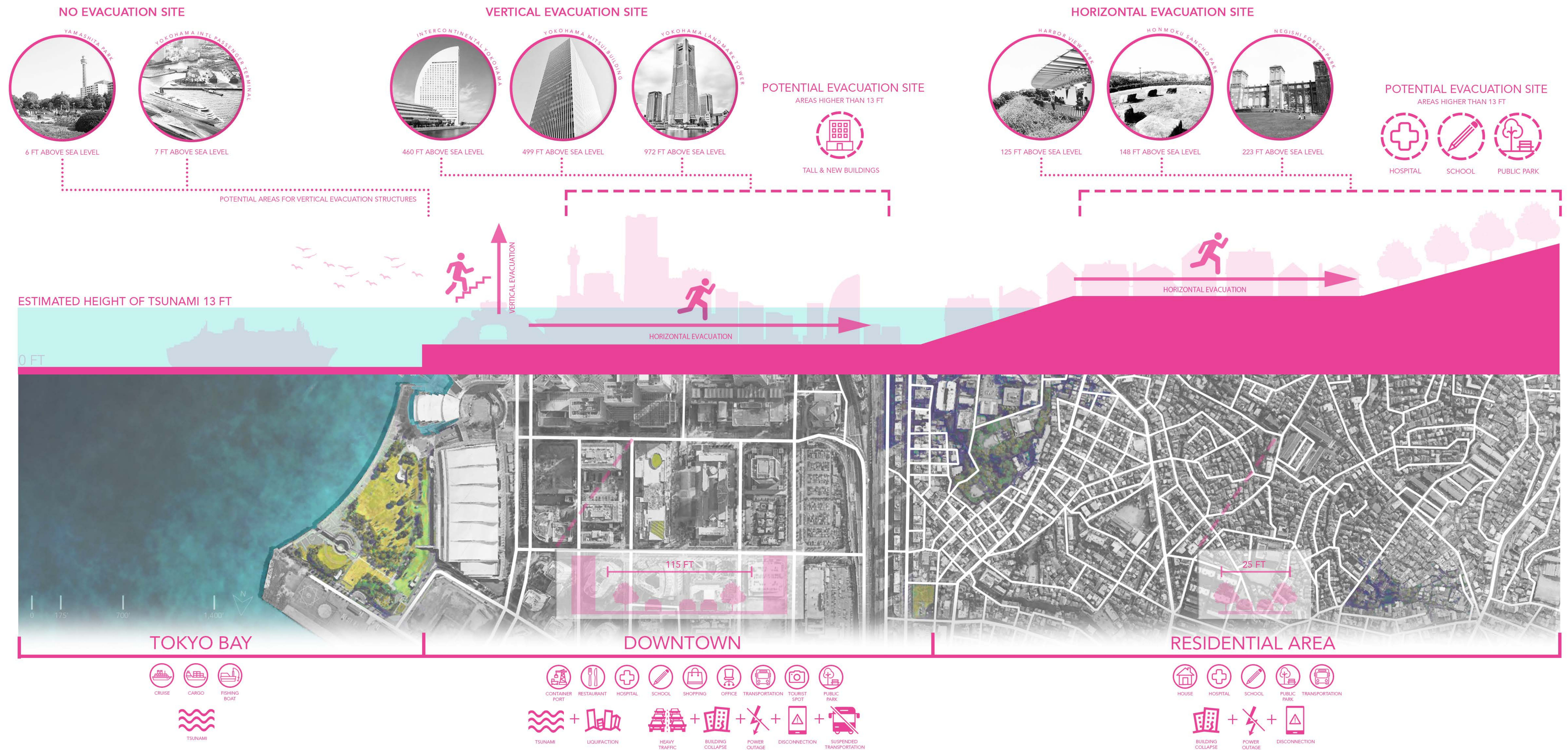


SEISMIC TIMELINE

OVER THE PAST CENTURY, SEVEN SEISMIC EVENTS HAVE CAUSED A SIGNIFICANT LOSS OF LIFE AND PROPERTY ACROSS THE ARCHIPELAGO.



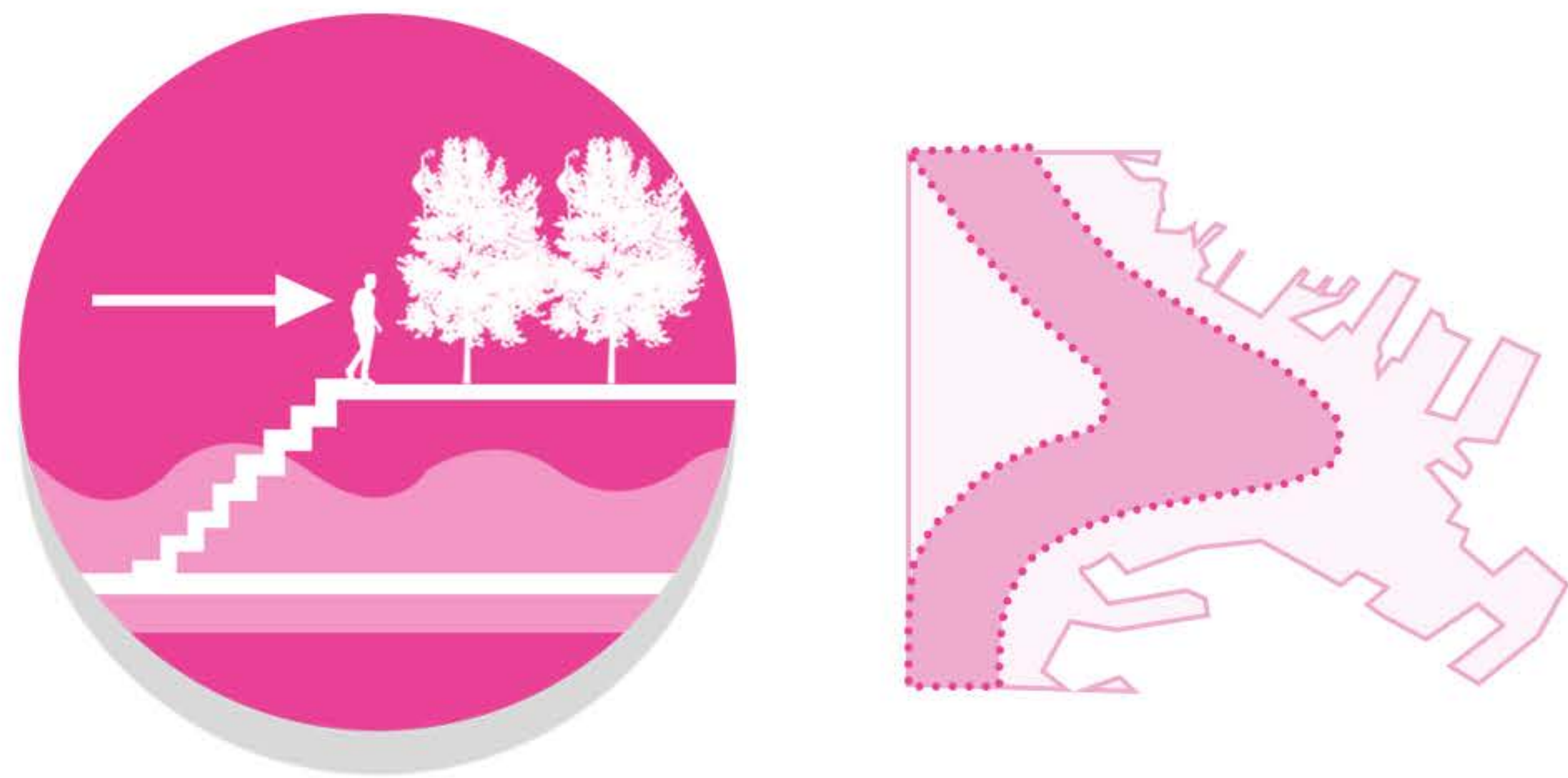
THE CITY OF YOKOHAMA, LOCATED IN THE SOUTHWESTERN AREA OF TOKYO BAY, IS PARTICULARLY VULNERABLE AS IT PARTIALLY SITS WITHIN THE ALLUVIAL LOWLANDS OF THE KANTO PLAIN AND HAS AN ELEVATED RISK OF TSUNAMI INUNDATION.



URBAN SECTION

ELEVATIONALLY THE CITY IS SPLIT INTO TWO ZONES, SEPARATED BY A STEEP BLUFF, A TOPOGRAPHIC CONDITION THAT FURTHER COMPLICATES THE EVACUATION PROCESS.

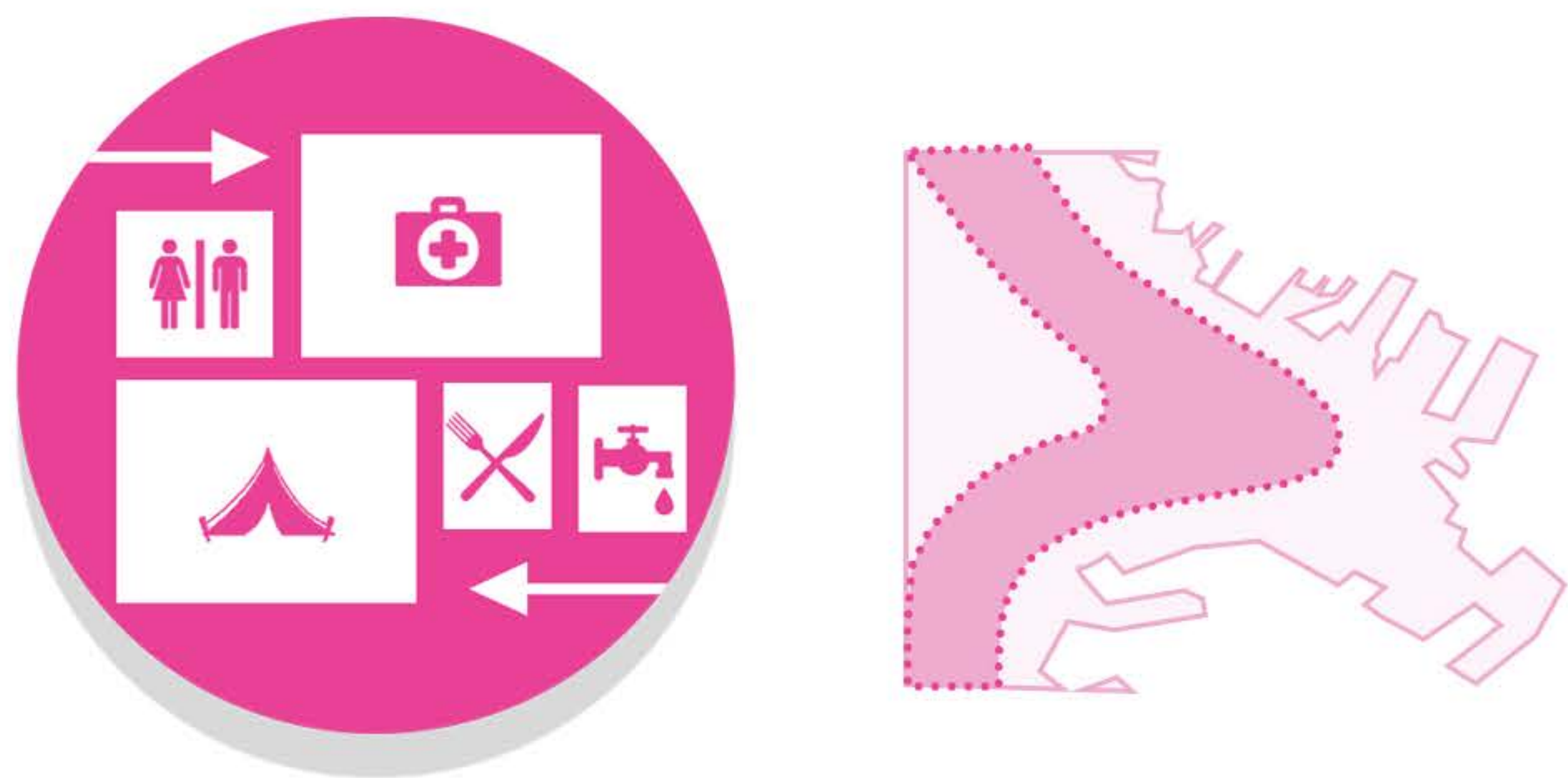
DESTINATION



HORIZONTAL EVACUATION SITE

A HORIZONTAL EVACUATION SITE REQUIRES PEOPLE TO EVACUATE TO HIGHER AREAS THROUGH HORIZONTAL MOVEMENT. THESE SITES ARE GENERALLY LOCATED IN INLAND AREAS WITH HILLY OR MOUNTAINOUS TOPOGRAPHY.

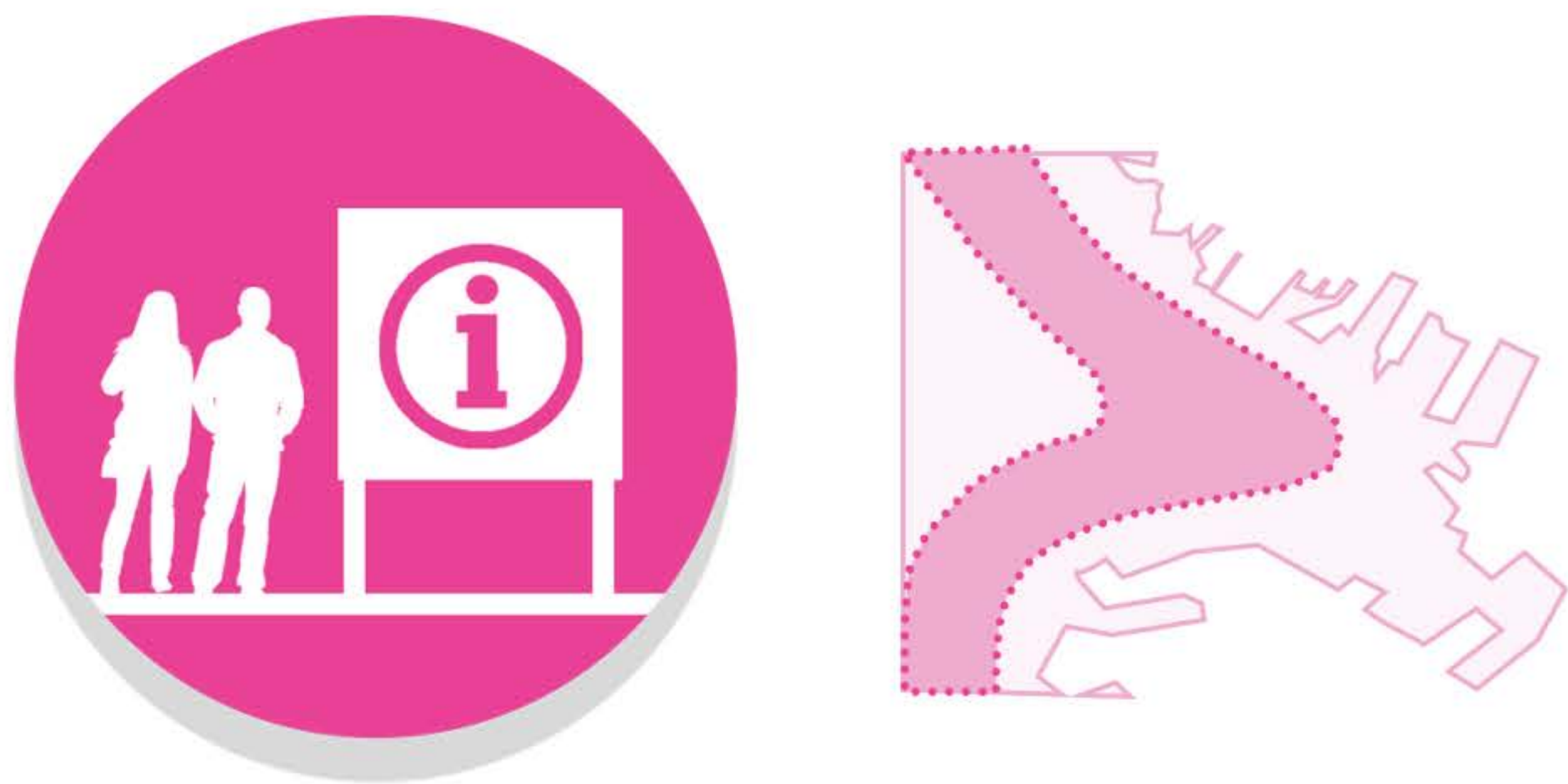
LAYOUT



WELL-DESIGNED EVACUATION SITE

A WELL-DESIGNED EVACUATION SITE IS ORGANIZED, SPACIOUS, AND EMBEDDED WITH MULTI- FUNCTIONAL ELEMENTS TO SUPPORT COMMUNITIES DURING TIMES OF CRISIS.

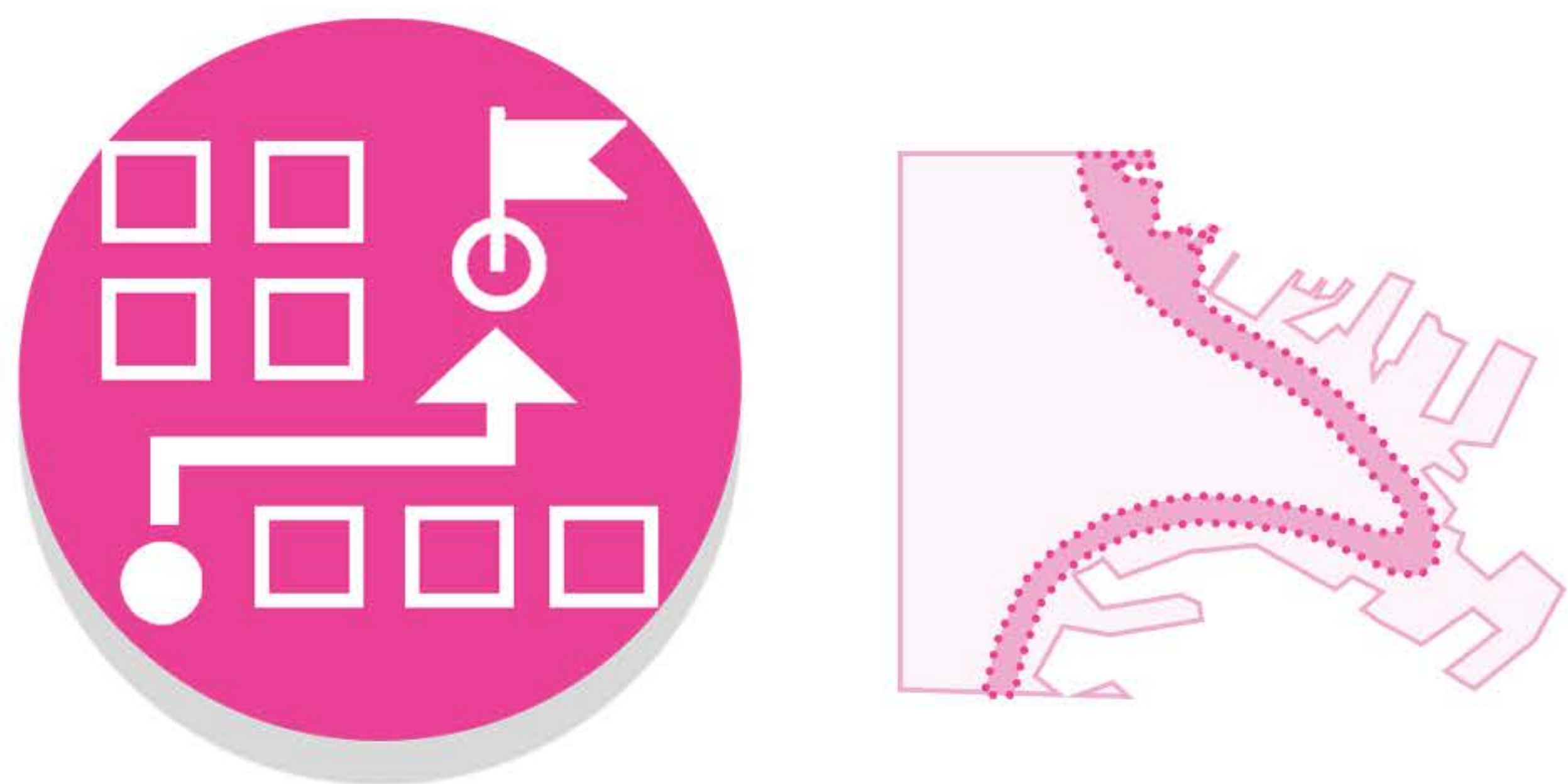
WAYFINDING



INFORMATIONAL

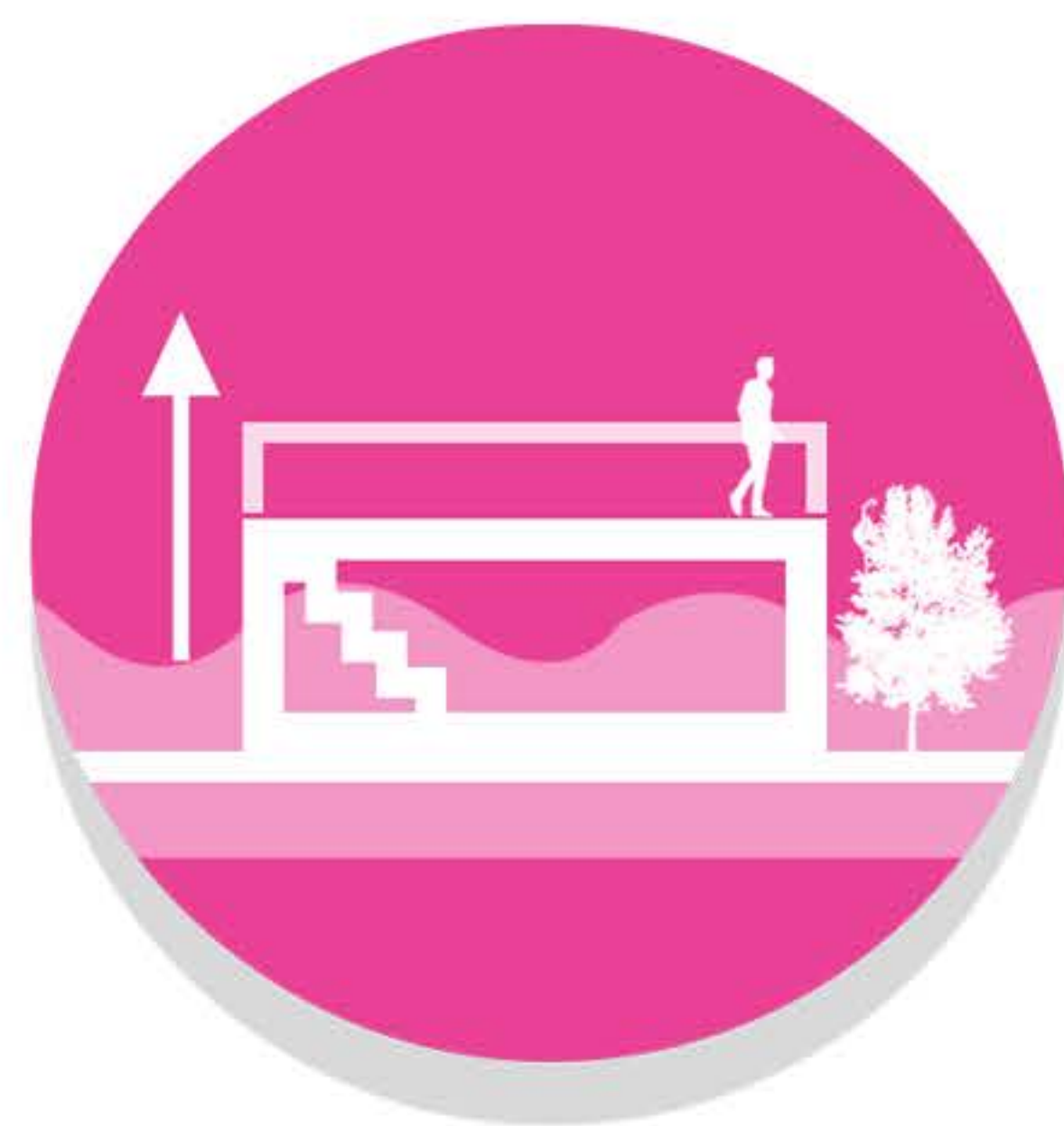
AN INFORMATIONAL SIGN IS A WAYFINDING TACTIC THAT PROVIDES EVACUEES WITH ESSENTIAL INFORMATION DURING A DISASTER.

GUIDANCE



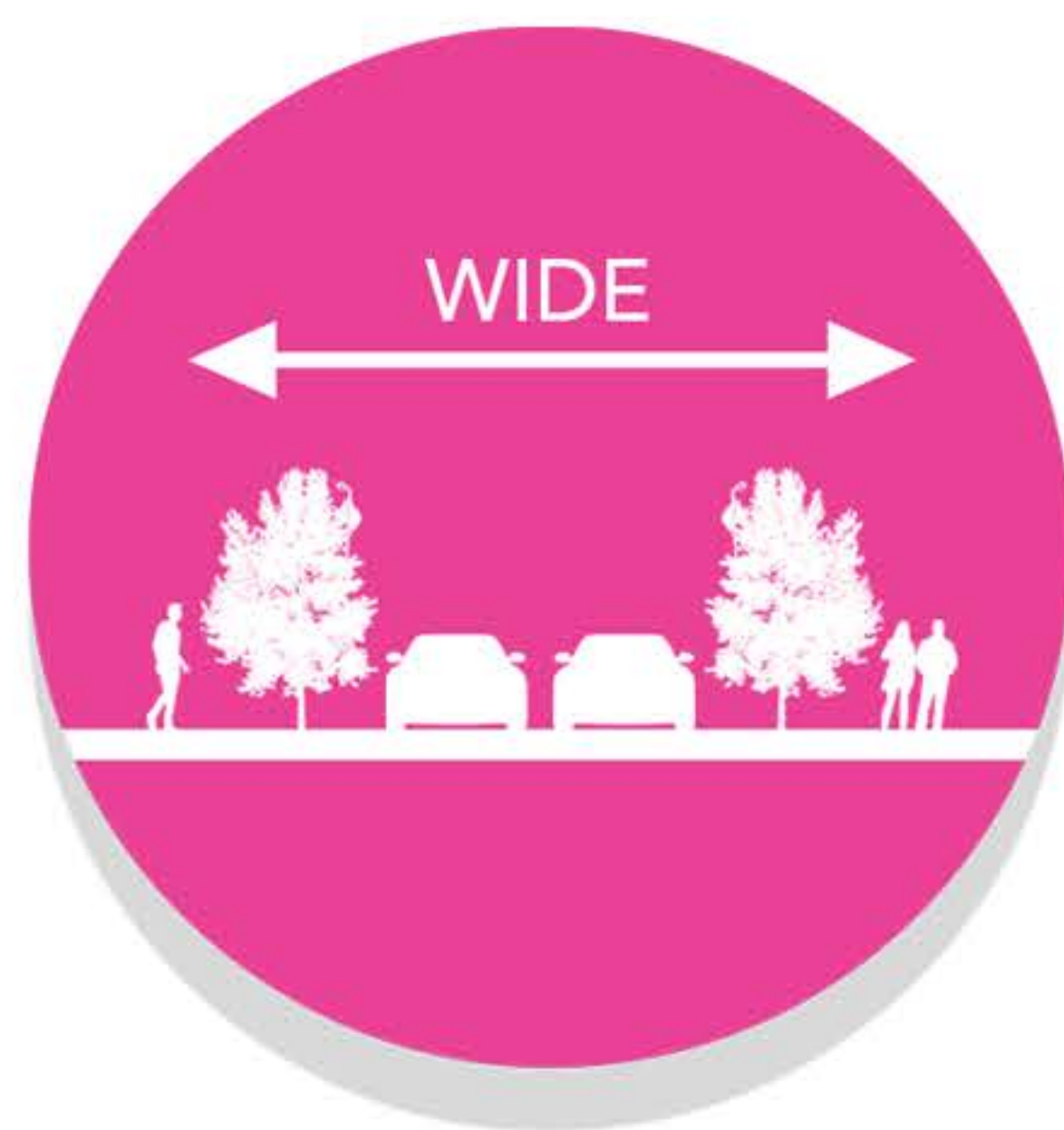
CLEAR EVACUATION ROUTE

A CLEAR EVACUATION ROUTE IS A CRITICAL ELEMENT FOR DISASTER RESILIENCY. THE ROUTE SHOULD BE CHOSEN ACCORDING TO SAFETY AND SPEED.



VERTICAL EVACUATION STRUCTURE

A VERTICAL EVACUATION STRUCTURE IS A STRUCTURE THAT PROVIDES A TEMPORARY REFUGE FOR PEOPLE WHO CANNOT MAKE IT TO A HORIZONTAL EVACUATION SITES. THESE SHOULD BE LOCATED NEAR LOW- LYRING COASTAL AREAS.



APPROPRIATE STREET SPACING

APPROPRIATE STREET SPACING SERVES TO EFFICIENTLY GUIDE EVACUEES TO SAFETY WHILE REDUCING VEHICULAR TRAFFIC DURING AN EVENT.



DIRECTIONAL

A DIRECTIONAL SIGN IS A WAYFINDING TOOL THAT SIMPLY AND CLEARLY GUIDES EVACUEES TOWARDS SAFETY. IT IS TYPICALLY DEPLOYED ALONG KEY EVACUATION ROUTES.



SENSORY STIMULUS DESIGN

SENSORY STIMULUS DESIGN IS A TECHNIQUE THAT USES LIGHT AND SOUND TO GUIDE EVACUEES TOWARDS SAFETY.



VERTICAL EVACUATION BUILDING

A VERTICAL EVACUATION BUILDING IS A TYPE OF BUILDING THAT MEETS SEISMIC RESISTANCE REQUIREMENTS, WHILE ALSO PROVIDING EVACUEES WITH A TEMPORARY REFUGE. THESE BUILDINGS SHOULD BE TALLER THAN PROJECTED TSUNAMI HEIGHTS AND IS OFTEN THE MOST COMMON AND SUITABLE EVACUATION OPTION FOR THOSE IN THE DOWNTOWN COASTAL AREA.



APPROPRIATE BUILDING SPACING

APPROPRIATE BUILDING SPACING ALLOWS FOR SAFE EVACUATION ROUTES AND ALLOWS FOR WATER TO PASS THROUGH NEIGHBORHOODS DURING MOMENTS OF INUNDATION. THIS TACTIC INCREASES POROSITY AND REDUCES LOCALIZED FLOODING.



PREPARATIONAL

A PREPARATIONAL SIGN IS A WAYFINDING DEVICE THAT MENTALLY AND PHYSICALLY PREPARES A COMMUNITY FOR THE POTENTIAL THREAT OF NATURAL DISASTERS. IT MIGHT MARK TSUNAMI AND LIQUEFACTION AREAS.



INTERACTIVE ART PIECE

AN INTERACTIVE ART PIECE CAN BE PROGRAMMED TO GUIDE PEOPLE TOWARDS SAFETY DURING TIMES OF CRISIS.

KIT OF PARTS

IN AN EFFORT TO HELP REDUCE URBAN RISK IN THE FACE OF FUTURE SEISMIC-RELATED EVENTS, THIS PROJECT PROPOSES A DECENTRALIZED, MULTI-SCALAR AND LAYERED APPROACH TO DISASTER RESPONSE BY LEVERAGING THE PUBLIC REALM.



DEPLOYMENT SCENARIO A



DEPLOYMENT SCENARIO B

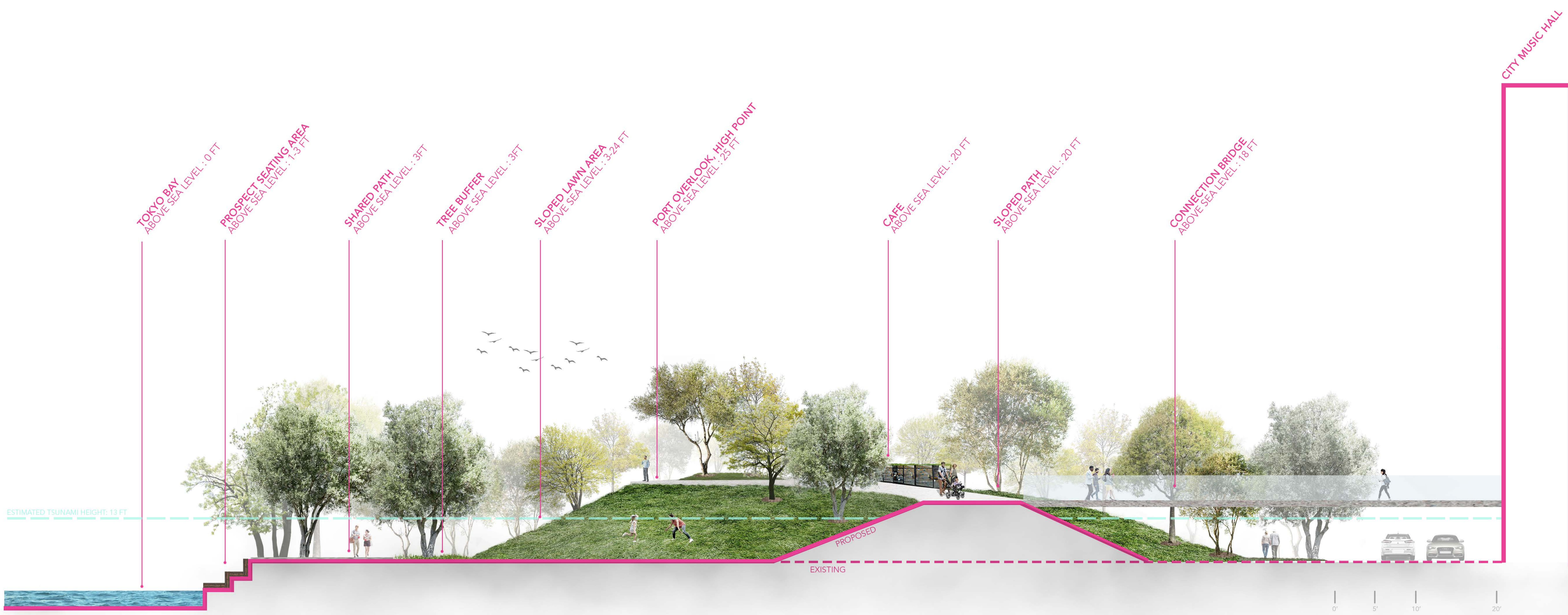


DEPLOYMENT SCENARIO C



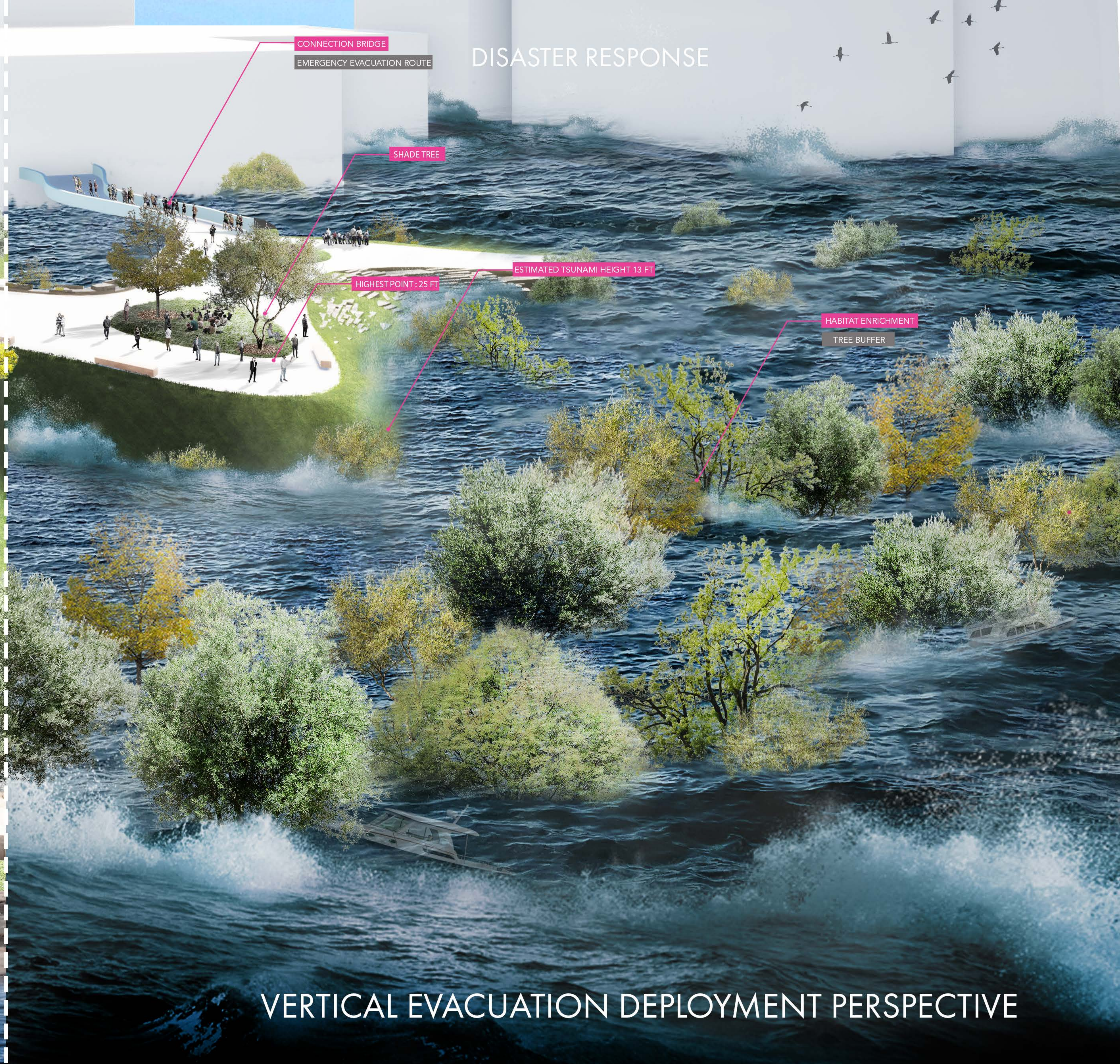
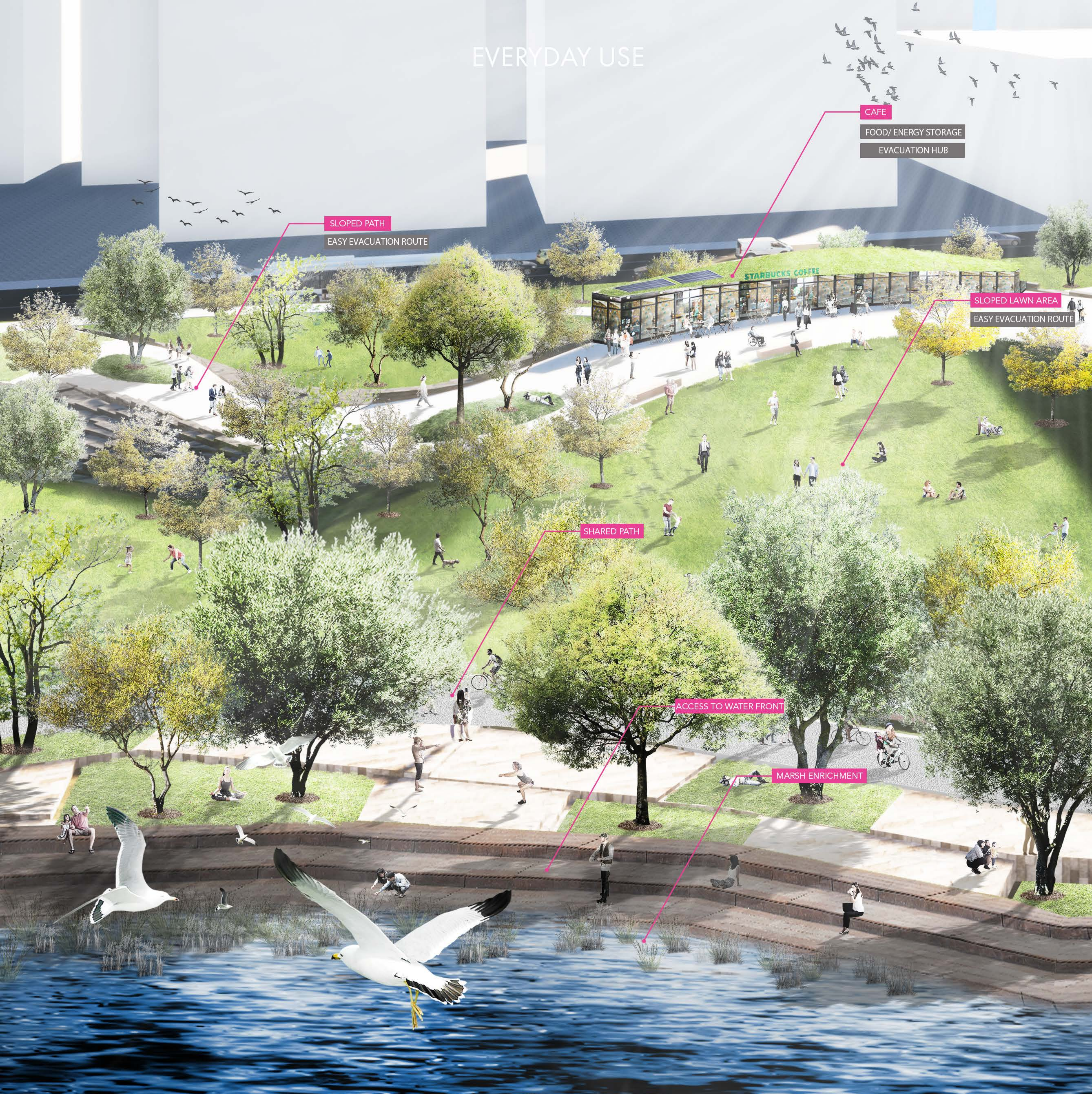
DEPLOYMENT SCENARIOS

THE PROJECT USES THE CITY OF YOKOHAMA AS A TESTING GROUND FOR THESE IDEAS AND EXPLORES A RANGE OF DEPLOYMENT SCENARIOS ACROSS THE URBAN LANDSCAPE, FROM THE WATER'S EDGE TO HILLY AREAS FURTHER INLAND.



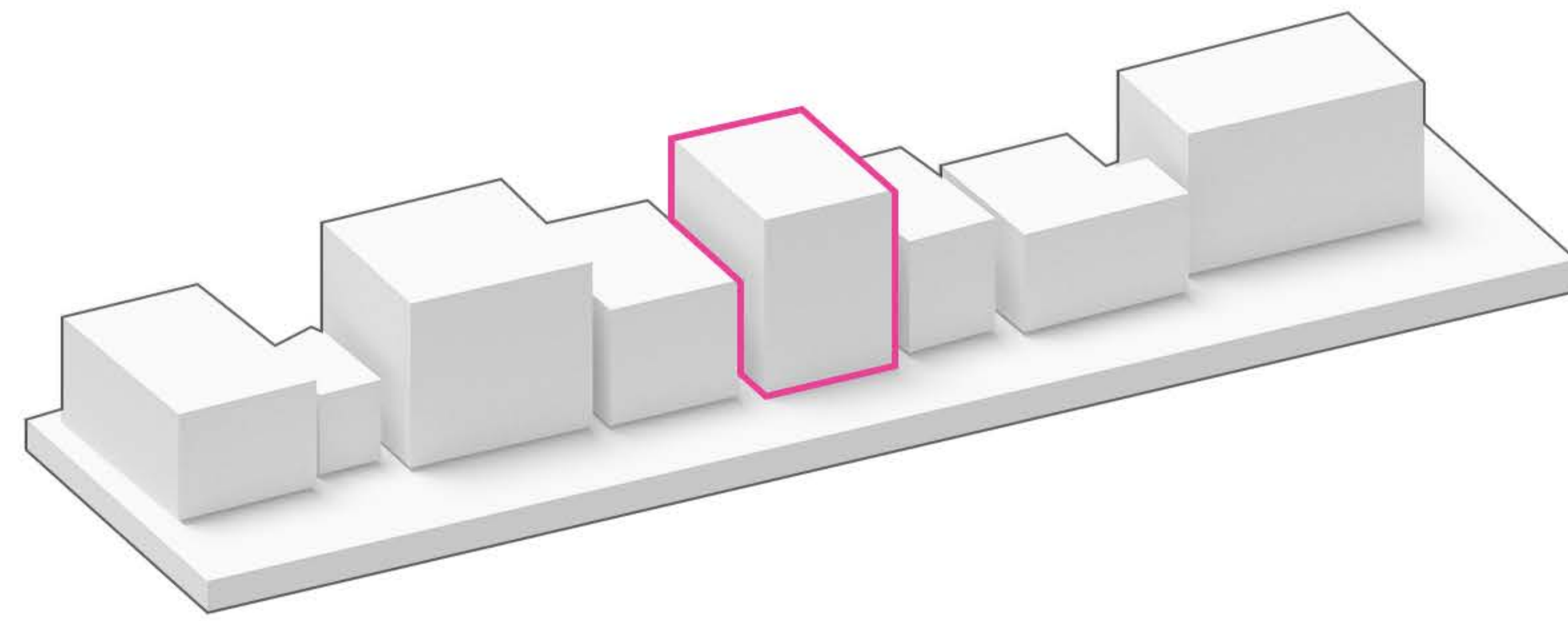
VERTICAL EVACUATION DEPLOYMENT SECTION

THE FIRST TACTIC RE-IMAGINES THE CITY'S RELATIONSHIP WITH TOKYO BAY BY DEPLOYING A SERIES OF VEGETATED BERMS AND RIBBONS OF TREES ALONG THE WATER'S EDGE.



DURING A TYPICAL DAY, THIS NEW LANDSCAPE ENRICHES THE COMMUNITY'S EXPERIENCE WITH THE BAY THROUGH INCREASED ACCESS TO THE WATERFRONT, AUGMENTED HABITAT, POP-UP SHOPS, AND FLEXIBLE OUTDOOR ROOMS. DURING DISASTERS, IT DISSIPATES WAVE ENERGY WHILE SERVING AS A VERTICAL REFUGE.

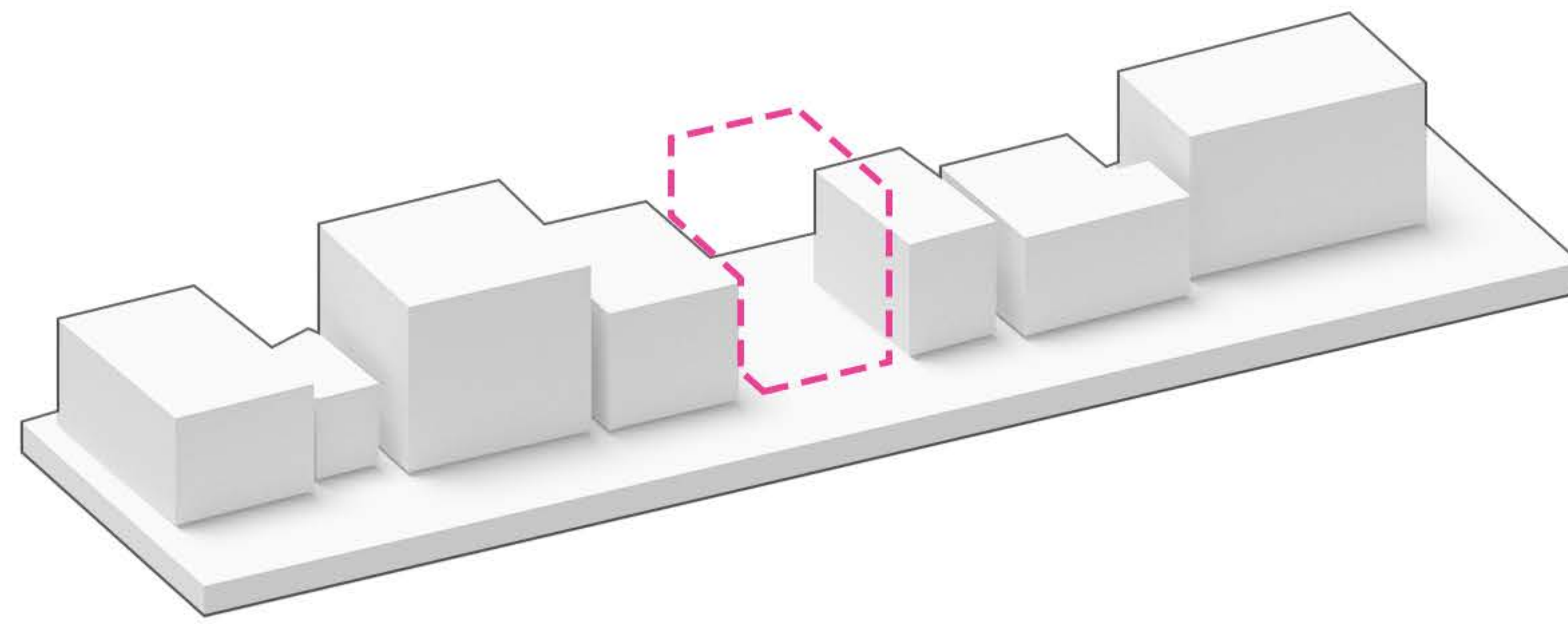
1



IDENTIFY

LOW-LYING NEIGHBORHOODS CAN WORK TOGETHER AS A COMMUNITY TO IDENTIFY A SERIES OF VACANT OR DILAPIDATED BUILDINGS.

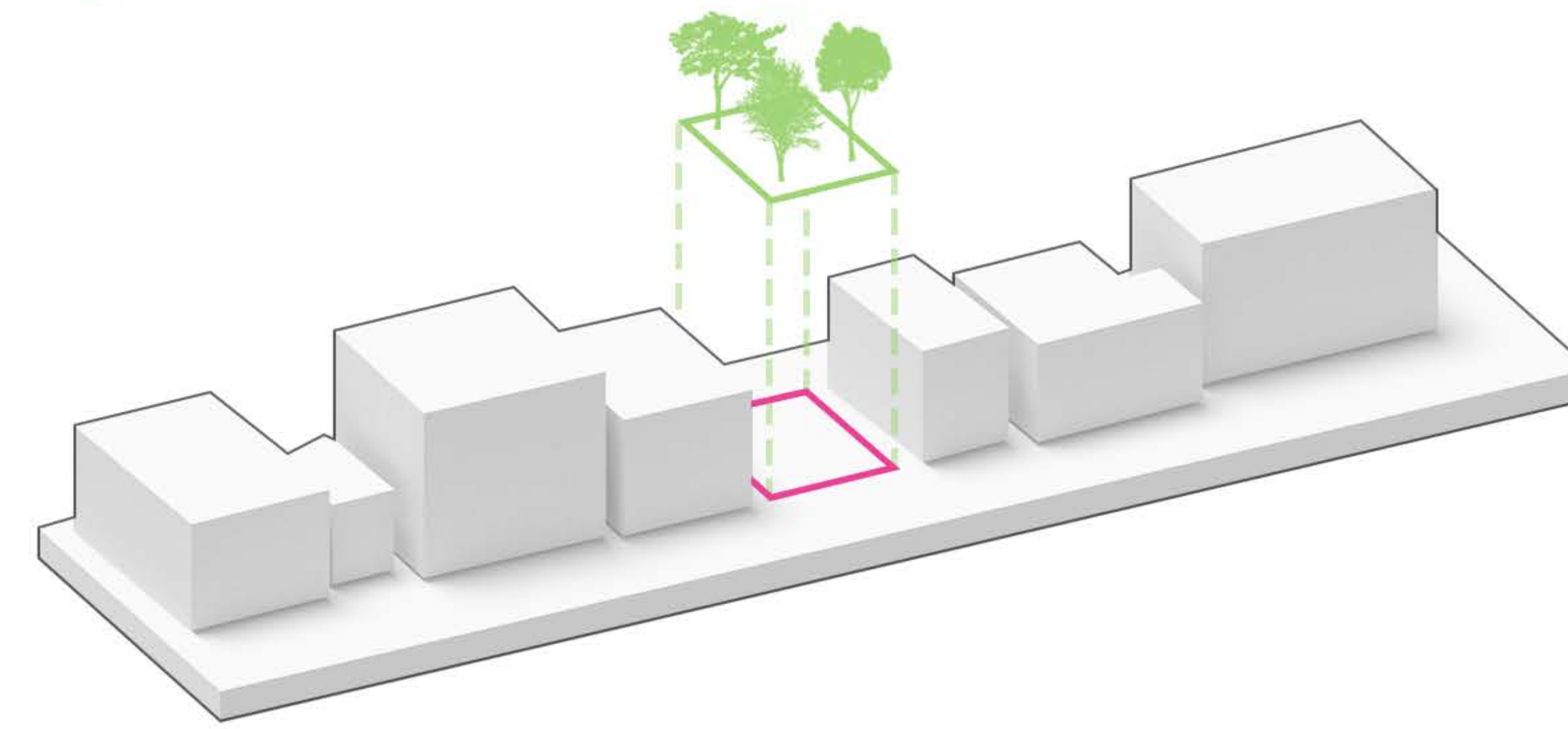
2



REMOVE

AFTER BEING IDENTIFIED, THE COMMUNITY CAN REMOVE THESE VACANT OR DILAPIDATED STRUCTURES TO CREATE EASEMENTS IN THEIR NEIGHBORHOODS. THESE EASEMENTS BREAK UP THE STREETWALL BY INCREASING POROSITY.

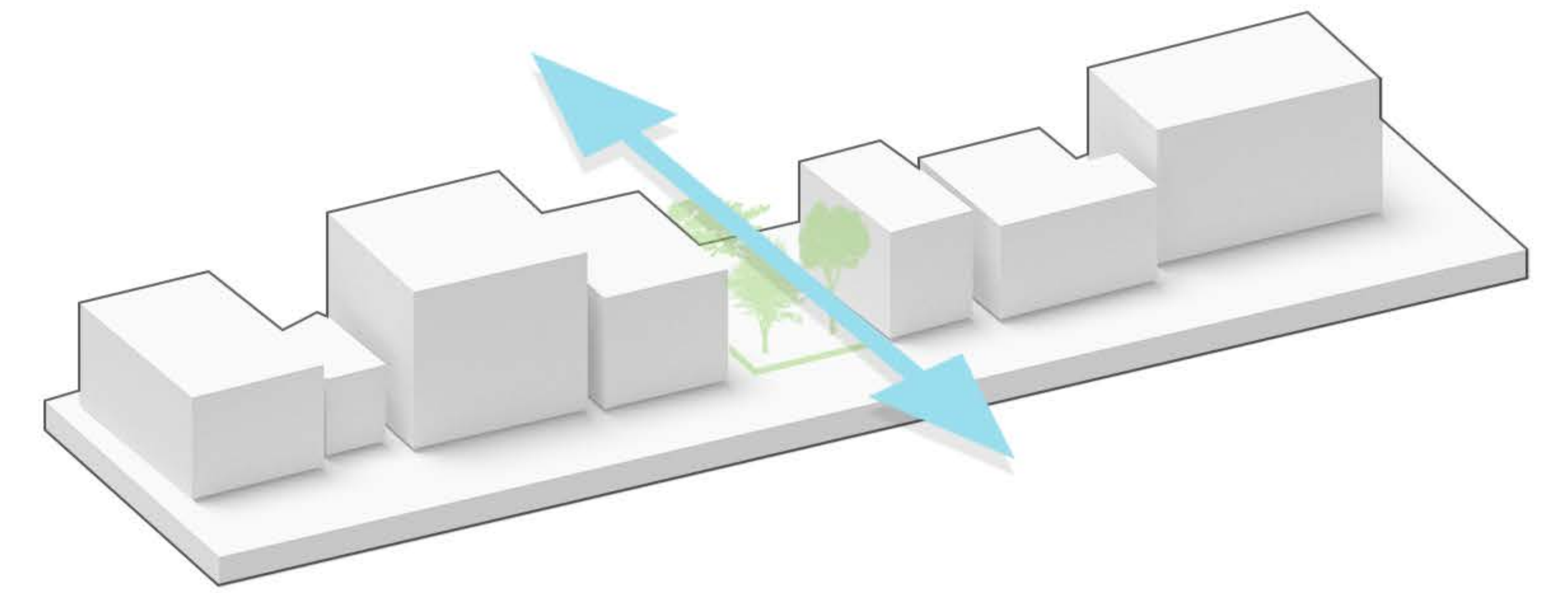
3



CONVERT

THESE OPENINGS IN THE STREETWALLS CAN THEN BE CONVERTED INTO SHARED PUBLIC SPACES FOR THE COMMUNITY BASED ON NEIGHBORHOOD NEEDS AND DESIRES.

4



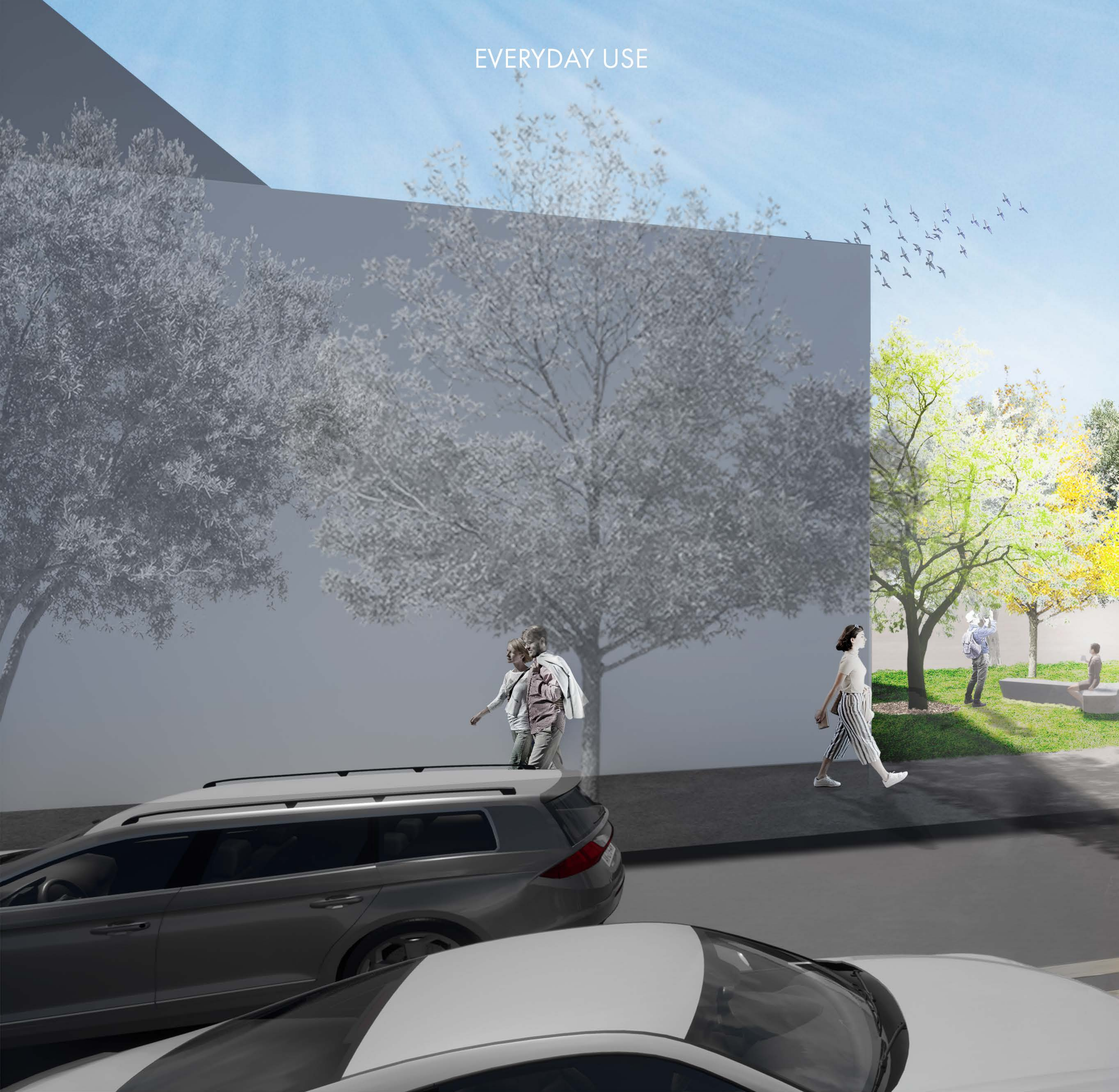
FUNCTION

DAY-TO-DAY, THESE EASEMENTS FUNCTION AS NEIGHBORHOOD POCKET PARKS AND SOCIAL GATHERING SPACES. DURING SEISMIC EVENTS, THEY CAN ALLOW FOR FLOODWATER TO PASS THROUGH, REDUCING LOCALIZED FLOODING.

POROUS EASEMENT DEPLOYMENT PROCESS

THE SECOND TACTIC, LOCATED IN LOWER-LYING RESIDENTIAL AREAS ADJACENT TO THE WATERFRONT DISTRICT, INVOLVES A COMMUNITY-LED EASEMENT EFFORT TO REPLACE VACANT AND DILAPIDATED STRUCTURES IN THE NEIGHBORHOOD WITH POCKET PARKS.

EVERYDAY USE



DISASTER RESPONSE



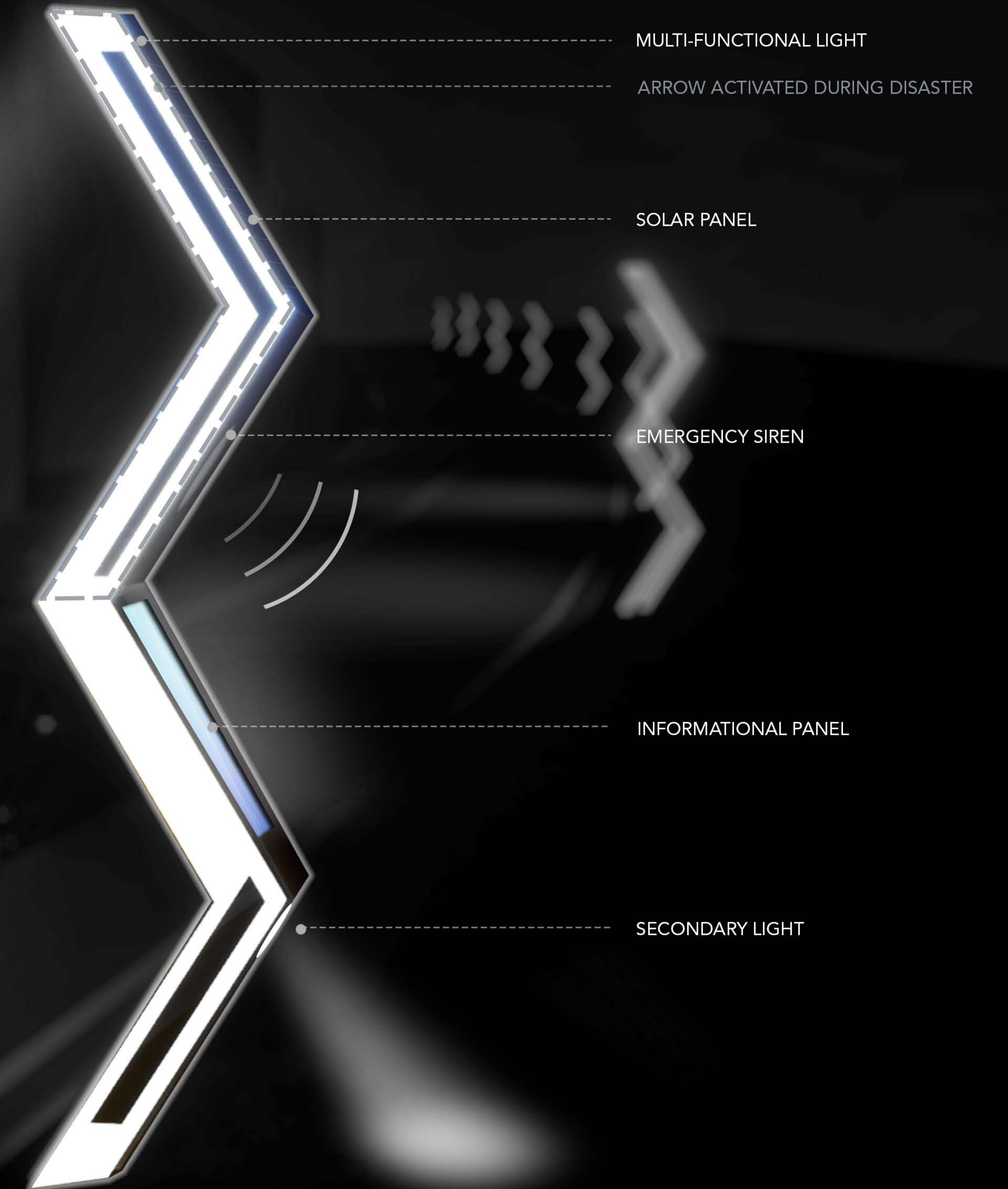
POROUS EASEMENT DEPLOYMENT PERSPECTIVE

DURING A TYPICAL DAY, THESE POCKET PARKS FUNCTION AS LOCAL NEIGHBORHOOD HUBS, AND ARE DESIGNED TO RESPOND TO THE DAILY NEEDS OF RESIDENTS. DURING DISASTERS, THE POCKET PARKS ALLOW FOR WATER TO PASS THROUGH THE NEIGHBORHOOD, REDUCING LOCALIZED FLOOD RISK.

CONVENTIONAL



PROPOSED

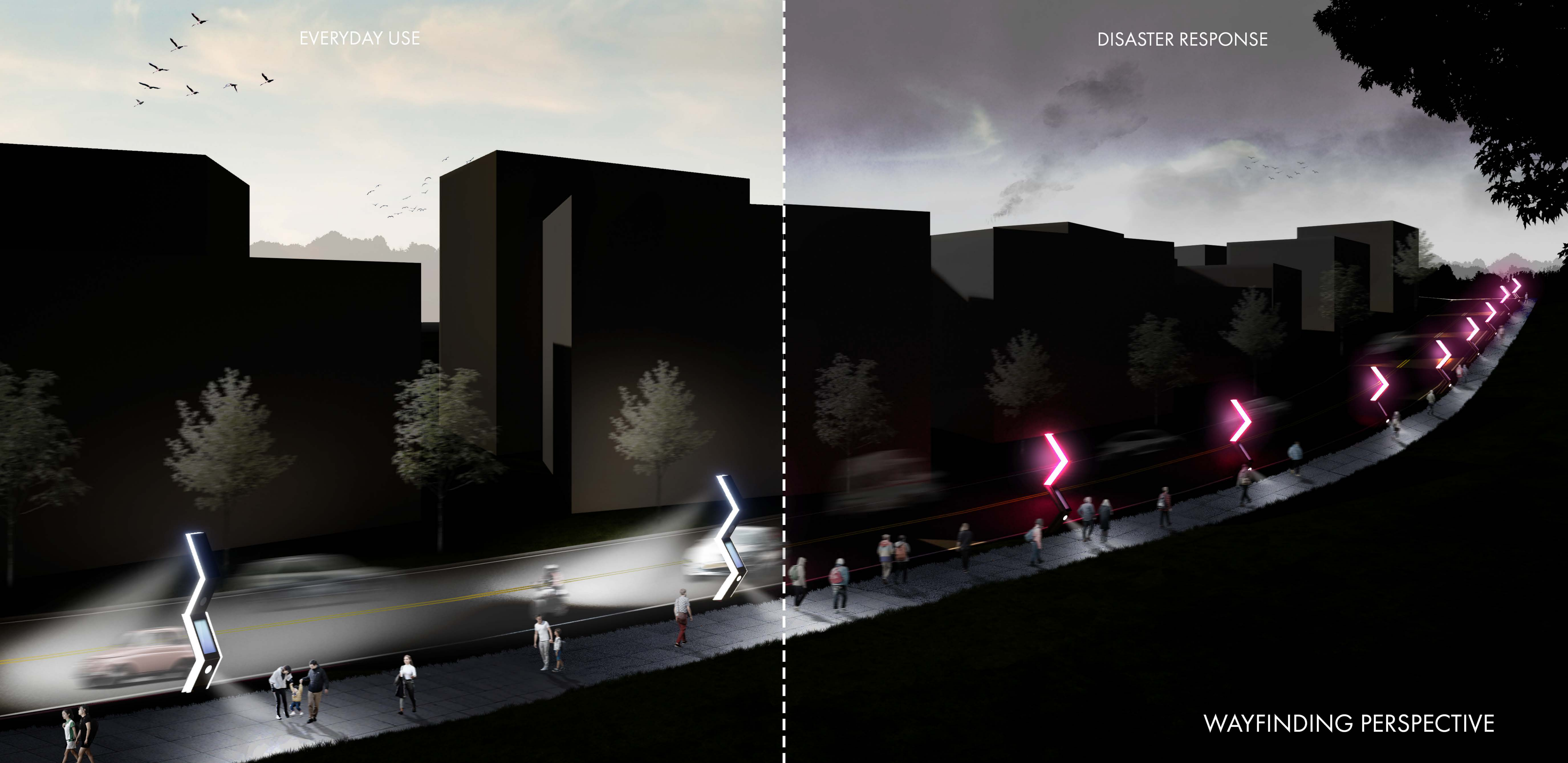


WAYFINDING COMPARISON

THE THIRD TACTIC, SITUATED ALONG ROADS BETWEEN THE LOWER-LYING AND HILLY AREAS, RETHINKS THE MARKING OF TSUNAMI EVACUATION ROUTES WITH SMALL SIGNS. IT INSTEAD PROPOSES A MULT-FUNCTIONAL DEVICE THAT INCORPORATES STREET LIGHTING, SIREN, EMERGENCY LIGHTING, AND EMERGENCY INFORMATIONAL PANEL.

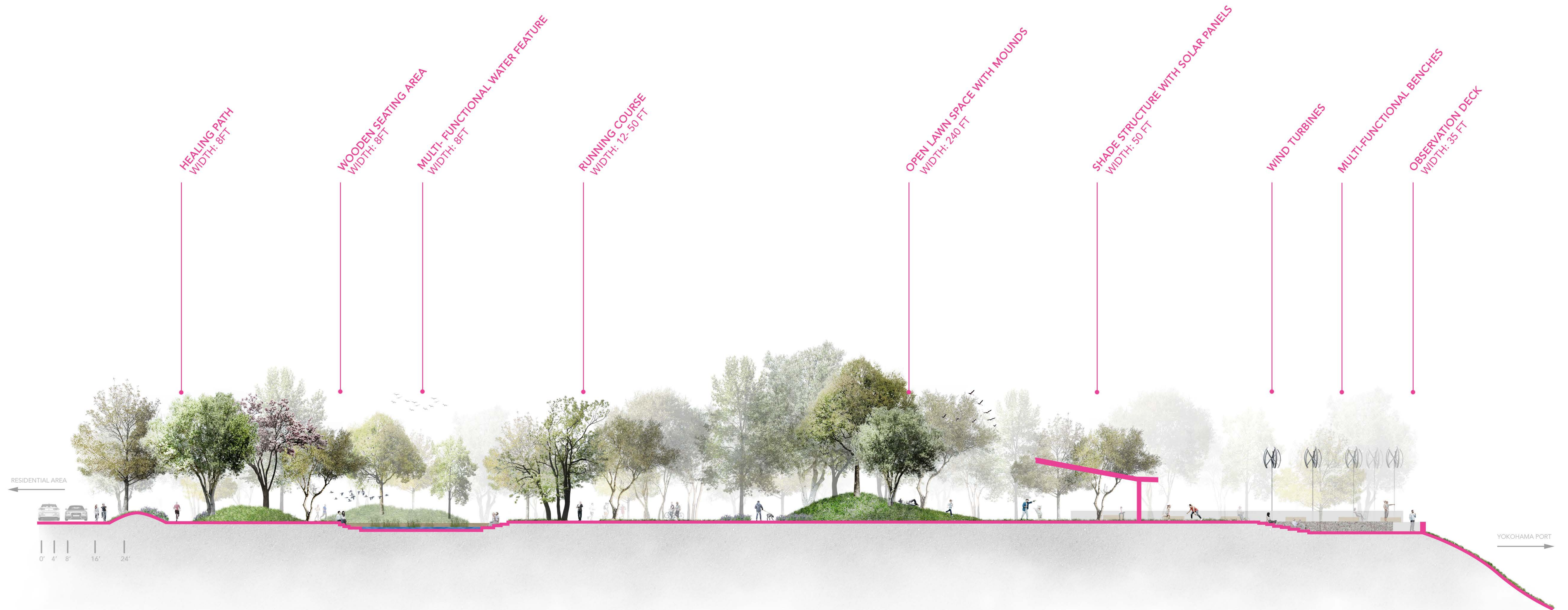
EVERYDAY USE

DISASTER RESPONSE



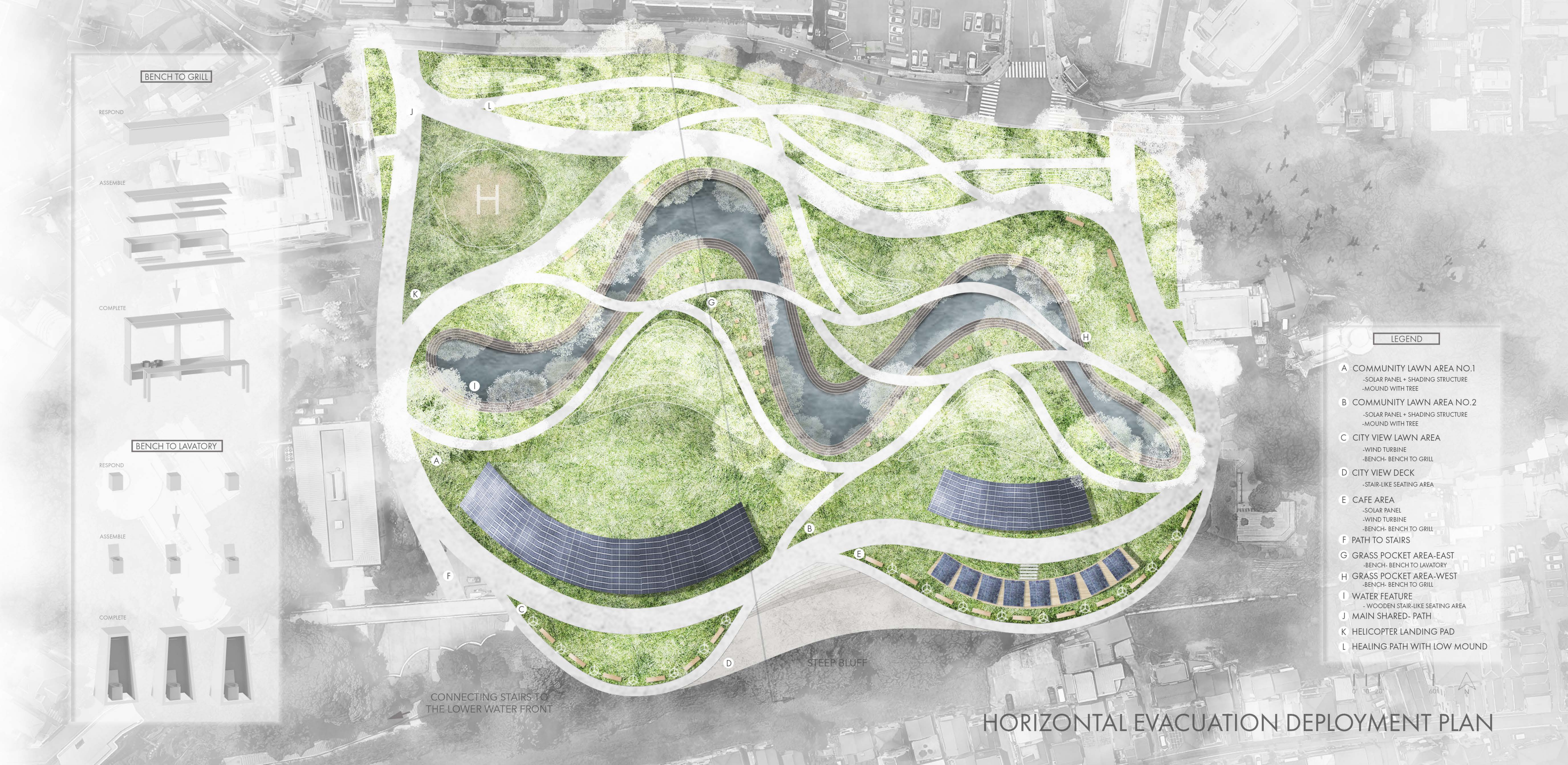
WAYFINDING PERSPECTIVE

DURING A TYPICAL DAY, THIS WAYFINDING INFRASTRUCTURE FUNCTIONS PRIMARILY AS LIGHTING FOR CARS AND PEDESTRIANS. DURING TSUNAMIS, THIS NETWORK OF DEVICES GUIDES PEOPLE TO SAFETY WITH DIRECTIONAL LIGHTING, AUGMENTS THE MUNICIPAL SIREN SYSTEM, AND PROVIDES ESSENTIAL EMERGENCY INFORMATION FOR EVACUEES.



HORIZONTAL EVACUATION DEPLOYMENT SECTION

THE FORTH TACTIC, LOCATED WITHIN THE HILLY NEIGHBORHOODS ABOVE TOKYO BAY, RETHINKS COMMUNITY PARKS AS LONGER-TERM REFUGE ZONES FOR THOSE AFFECTED BY DISASTERS. EACH DESIGN ELEMENT OF THESE PUBLIC REALM SPACES ARE EMBEDDED WITH MULTIPLE FUNCTIONS.



ON THE SURFACE, THESE SPACES MAY APPEAR TO BE FAIRLY TRADITIONAL PARKS, WITH WINDING PATHWAYS, WATER FEATURES, SHADE STRUCTURES, AND BENCHES.



DURING A TYPICAL DAY, THE PARK IS USED FOR RUNNING, PICNICKING, AND WATCHING LOCAL WILDLIFE. DURING DISASTERS, SHADE STRUCTURES OFFER PROTECTION FOR CAMPERS, BENCHES MORPH INTO GRILLS, CAFES BECOME FOOD AND ENERGY HUBS, AND WATER FEATURES ARE FILTERED FOR DRINKING.



A (MORE) RESILIENT TOKYO BAY

BY EMBEDDING RESILIENCE INTO THE PUBLIC REALM AT MULTIPLE ELEVATIONS AND SCALES, THIS DECENTRALIZED AND LAYERED APPROACH AIMS TO HELP REDUCE SEISMIC- RELATED RISK ACROSS THE LARGER TOKYO BAY REGION.