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Case Study: Hudson Yards, New York

Manhattan's Last Frontier Becomes a Mini-City



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Marianne Kwok has more than 20 years of professional experience in architectural design for a variety of built commercial, residential, and cultural facilities in North America, Europe, and Asia. Since joining KPF in 1994, she has been the Senior Designer for some of the firm's most high-profile projects, including numerous corporate headquarters, mixed-use commercial developments, and master planning projects. These include Hudson Yards in New York, One Shenzhen Bay in Shenzhen, China, and the headquarters of Clifford Chance, State Street Bank, KPMG and Fitch Ratings in Canary Wharf, London.

Kwok received her Master of Architecture degree from the Harvard University Graduate School of Design and her Bachelor of Architecture degree from Cornell University, where she was the recipient of the Charles Goodwin Sands Memorial Silver Medal.

Hudson Yards is a mixed-use development built over rail yards on the west side of New York's Manhattan Island. As the largest real estate project ever undertaken in the United States, its unprecedented scale and sophistication provide a model for sustainable urban development and architectural interventions, which integrate a new neighborhood into a complicated existing infrastructure and surrounding context.

The Site

Hudson Yards is located between 10th and 12th Avenues, 30th and 33rd Streets. Eleventh Avenue bisects the project and divides it into the Eastern Rail Yards (ERY) and the Western Rail Yards (WRY) sections (see Figure 1). The greater Hudson Yards area expands to the north and northeast, but it is these two blocks over the rail yards that have earned the project the title of "America's Biggest Real Estate Development" (see Figure 2).

Historically, the West Side remained mostly undeveloped through the 19th century. Farmland was interrupted by the opening of the Hudson River Rail Road in 1851 (connecting New York City to points north), securing the area's importance to regional infrastructure connections. Before there was a rail connection west to New Jersey, train ferries would dock on piers built on the Hudson River. The rail lines at Hudson Yards would connect to tracks taking trains up and

down Manhattan. In 1904, the Pennsylvania Railroad began construction on the first tunnel under the Hudson River for passenger trains going to the new Pennsylvania Station, which opened in 1910. At the time, it was a feat of engineering to build a tunnel over tidal silt; the accomplishment was considered to have rivaled the nearby construction of the Brooklyn Bridge.

Freight trains continued to cross the Hudson by ferry, and because of the dangers presented by railroad operations at street level, including many pedestrian accidents, the High Line was built in 1931 so that freight railroad tracks would be above the street. The High Line opened in 1934, but was largely abandoned in the 1950s and officially decommissioned by 1980 due to the popularity and convenience of interstate trucking. The West Side Elevated Highway was built starting in 1929, resulting in a complete safety and maintenance debacle that separated the waterfront from the urban fabric, which was closed within 20 years of its opening in 1951. The area was further separated from the street grid in the 1970s, when the holding yards for the Long Island Rail Road (LIRR) commuter trains were built. The West Side Elevated Highway was dismantled; the High Line was abandoned; and the Henry Hudson Parkway was extended southward at-grade. This is the condition that existed until construction started on Hudson Yards in 2012.



Figure 1. Hudson Yards location plan showing the Eastern Rail Yards and Western Rail Yards.

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Hudson Yards, Related and Oxford Properties are Diamond Sponsors of the conference and will be exhibiting Hudson Yards in the "Americas Room."

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Since the 1980s, the area has been a hotbed for proposed development and design competitions to infill the urban fabric. In 2001, the New York Jets football stadium was proposed for the WRY. The idea gained momentum in 2004 when the Bloomberg administration made the stadium part of the city's bid for the 2012 Olympic Games. A plan to rezone the area was envisioned, which entailed improving the Javits Convention Center to the north, extending the No. 7 subway train from Times Square, creating Hudson Park and Boulevard on top of the subway extension, and developing a large public plaza outside the stadium on decking over the ERY. While New York lost the Olympic bid, the public investment in the area was heightened.

During this time, ERY was rezoned for 557,418 square meters of mixed-use, with a maximum set for residential and a minimum for commercial. This was joined by an 18,581-square-meter cultural facility, and 50% public open space. This facilitated the 2007 competition, with The Related Companies winning the right to develop Hudson Yards (both East and West). After gaining the rights to develop the site, Related rezoned the WRY to approximately 557,418 square meters as well, including a 9,290-square-meter K-8 public school.

Hudson Yards benefits from US\$4 billion of public investment in the surrounding area. This includes US\$465 million for the Javits Center renovation, US\$265 million for the Moynihan Station renovation, which would add space to the existing Penn Station by taking over part of the adjacent 1912 main US Post Office building, and most significantly, US\$2.4 billion for the No. 7 subway extension.

There are three adjacent parks that will meet the open space at Hudson Yards. The High Line, directly adjacent to the south and west, has received US\$150 million of public and private funding since the project was first conceived in 1999. Hudson River Park, across 12th Avenue to the west, connecting Battery Park City up to the George Washington Bridge, has received US\$440 million of public and private funding, and has seen continued



Figure 2. The skyline of Hudson Yards, New York, from the southwest when both the Eastern and Western Rail Yard halves of the development are complete.

“Hudson Yards is a mixed-use development in every sense. The Eastern Rail Yards is the first to be developed, with two office towers, a retail podium, a mixed-use tower including office, hotel, and residential, and a residential tower attached to an expandable cultural facility called the ‘Culture Shed’.”



Figure 3. Culture Shed, with the public square in the foreground.

development. Hudson Park and Boulevard, created between 10th and 11th avenues and the location of the No. 7 subway station to the north, has been aided by US\$30 million.

Hudson Yards is a mixed-use development in every sense. The ERY is the first to be developed, with two office towers, a retail podium, a mixed-use tower including office, hotel, and residential, and a residential tower attached to an expandable cultural facility called the “Culture Shed” (see Figure 3).

This case study will essentially take a slice or “section” through the project and discuss three scales of habitat – “macro”/city scale, “medium”/neighborhood scale, and “micro”/human scale. Paired with each of these habitats are design elements found at the “macro” or “top” (the towers in the skyline); the

“medium” (lower street and podium levels); and the “micro” or “bottom” (the interstitial space of the platform). Each will be studied for its effect on the city.

“Macro” Scale: Skyline/Habitat

The skyline of New York City is changing dramatically, more than at any other time since the period from 1910–1932, when icons such as the Woolworth Building, the Chrysler Building, and the Empire State Building were constructed. For Hudson Yards, the client wanted a skyline presence, which brings considerable risk for a project of such magnitude. The project’s fortunes could either be blunted or exacerbated by the skyline and image it developed for a new neighborhood on the west side of Manhattan. Most of the



Figure 4. 10 Hudson Yards (right) and 30 Hudson Yards (left).

supertall towers currently being built in New York City are luxury condominiums and marketed to the global financial elite. In contrast, the highest occupiable level of the 387-meter 30 Hudson Yards will be an exterior public observation deck, higher than that of the Empire State Building, and with its own iconic presence.

The two commercial towers, 10 and 30 Hudson Yards (see Figure 4), were always conceived as a pair. Unlike the many pairs of towers on Manhattan’s west side – the towers along Central Park South, Time Warner Center at Columbus Circle, and the original World Trade Center downtown, the two Hudson Yards towers are not equal in height.

The office towers had to meet the requirement of a core-to-wall dimension of 13.7 meters, the most efficient and desirable commercial dimension in the New York market. As the elevator banks drop off approximately every 15 floors, the buildings could either step back or slope to keep the 13.7-meter dimension. The angle offered an approach that could be more dramatic at the top of the tower, as well as a language that was more sculptural and could be used consistently down to the details. Because of the differing heights, 10 Hudson Yards slopes towards the river and 30 Hudson Yards slopes towards the city. This results in a dynamic relationship between the two towers and a changing profile from different vantage points in the city. The retail between the two

“The towers are further refined by notching corners and stepping volumes. This enables the reading of two principal volumes – one clad in taut, structural silicon-glazed glass, facing the interior of the site, and the other with an overlapping story-high ‘shingle’ extended towards the exterior of the site.”

towers is implied to be emanating this energy and is thus symbolic of the activity and the social aspect of the buildings. The highest points of each tower are angled toward each other, with the low point of each tower situated diagonally across from its counterpart. The building maintenance unit (BMU) resides within these diagonals, with folded enclosures and triangular forms on either side hiding the cooling towers. While it is dramatic on the skyline, the form is functional.

The towers are further refined by notching corners and stepping volumes. This enables the reading of two principal volumes – one clad in taut, structural silicon-glazed glass, facing the interior of the site, and the other with an overlapping story-high “shingle” extended towards the exterior of the site. The shingle is angled slightly upwards, reflecting more light than a vertical pane of glass. It gives the wall texture more shadow, and a level of detail at the vertical joint in the overlap, contrasting with the taut façade. The stepping of the massing creates terraces, an amenity for the office tenants, as well as a means to better scale the building to its surroundings. Each of the major tenants has its own exterior space.

At the top of 30 Hudson Yards is a dramatically cantilevered observation deck (see Figure 5) seen distinctly from afar. It is an exterior space accessible to the public. From there, one can inhabit the ultimate urban habitat and become a part of the skyline.



Figure 5. 30 Hudson Yards cantilevered observation deck.
© Hudson Yards

“Medium” Scale: Built Form at Grade/ Neighborhood Habitat

Hudson Yards presented an opportunity to connect areas of the city that had previously been separated by inaccessible infrastructure. But first, the designers had to resolve challenges of grade changes, building on a platform, and mediating the considerable density and scale that makes the platform financially viable. Often, transit infrastructure is located at grade or street level. At Hudson Yards, the tracks are at the same level as 12th Avenue, then slope downwards, dipping underground at 10th Avenue as they enter Penn Station two blocks to the east. South of the site, Chelsea is of lower density, with a mixture of townhouses east of 9th Avenue, large industrial buildings closer to the river, and new building construction of increasing height and density. The area to the north of Hudson Yards is zoned to be very dense, with a Floor Area Ratio (FAR) of 25–33. It was thus imperative to connect to the surrounding contexts in order to link together these two neighborhoods to the north and south, and to join the city fabric to the river.

While the height of the Hudson Yards towers is closer in scale to those of Midtown, there are many elements at the base of the buildings that are designed to mediate their scale to the lower surroundings, to activate the surrounding streets, and to provide as much porosity as possible into the landscape plaza and gardens at the center of the site.

The brief for the ERY required 50% of the site to be public open space, realized as a plaza, created west of 10 Hudson Yards, the retail podium and 30 Hudson Yards, with the residential tower and Culture Shed at the southwest corner and the mixed-use building at the northwest (see Figure 6). It is very important that the open space is easily accessible and can be physically and visually connected to the surrounding parks. There are considerable grade changes on the site, with the lowest corner at 30th Street and 11th Avenue, sloping up to 10th Avenue, then sloping again along 10th Avenue to 33rd Street. One level above the tracks, 11th Avenue is actually a bridge, separating the ERY and the WRY.

To the south of the ERY, approximately 9.1 meters above on the north side of 30th Street, is the High Line, the second-most popular tourist destination in New York City, with more than 6 million users annually. The benefits of the High Line being at roughly the same level as the plaza are considerable for public access both to and from Hudson Yards (see Figure 7). At the street level at 10th Avenue and 30th Street is a public plaza, with an entry stair up to the High Line at this corner (see Figure 8). The southern face of the development is inviting to pedestrians at street level. This is supported by the presence of the High Line stairs, a food hall under the High Line at 30th Street, the entry to the Culture Shed under the High Line, and the lobby of the residential tower. With the connection to the



Figure 6. Hudson Yards master plan.



Figure 7. 10 Hudson Yards viewed from the High Line. © Royce Douglas



Figure 8. 10 Hudson Yards viewed from 30th Street.

plaza overhead, it is also very active at the High Line level.

Neighborhood-scale connections

To connect the buildings to the surrounding neighborhood, the design employs a series of moves and gestures by changing both scale and form. For 10 Hudson Yards, the materials are chosen carefully to allow for transparency, so that pedestrians can see into the building and the street is visually activated. Stone surfaces are applied so that there is a solidity and robustness relating to the old warehouse buildings to the south. Metal, perforated and cast with texture and detail, continues the High Line urban pedestrian experience.

Additionally, 10 Hudson Yards is built over the High Line with a row of stone-clad columns enclosing the pathway along the building's south face. The columns support the tower 18.2 meters above, and are deliberately massive and sculptural in character, appropriate to the industrial grain of the High Line. The High Line spur continues through the building, bridging over 10th Avenue at 30th Street.

To incorporate itself into the context at this location, the chamfer at the southeast corner responds to the High Line spur over 10th Avenue. On axis with the north-south portion of the High Line, the large atrium space for the retail tenant, represents an upward visual extension. The scale of the southern lobby is separated from the building to relate to the mass of the Culture Shed and the building steps, mediating between the scale of Chelsea and the much larger scale of Hudson Yards. Stone is used at the base, again with "heroically"-sized columns that match the industrial robustness of the High Line.

The rail yards' presence at the property line creates a challenge for neighborhood connections along 10th Avenue. Where possible, access to the retail podium involves an ascent of approximately 5.5 meters up to the plaza level and the main level of shopping. Vitrites and large, lighted branding opportunities allow for a retail presence at the street level where it is not possible to have programmed space, due to the location of railroad service buildings. Recalling the industrial history of the site and surrounding area, the retail podium façade (above a

canopy and the double-height entrance), is made of perforated, dimpled, stainless steel panels. The perforations form a subtle pattern that echoes the clouds reflected in the west retail façade facing the plaza.

Welcoming people from points to the east, such as Herald Square, Penn Station, and various subway lines, there will be a significant entry marking the corner into 30 Hudson Yards, shared by the office and retail at the intersection of 10th Avenue and 33rd Street. There is a lower volume with a large canopy, scaled for pedestrians, marking the entry. Because of the slope up 10th Avenue, there is a three-meter vertical separation between this entry and the main plaza level.

To establish more seamless connections between Hudson Park, Hudson Boulevard, the new No. 7 subway station, and the public area west of 30 Hudson Yards, 33rd Street is being regraded. There will be another main entry into the building at that corner, leading up to a raised office lobby. Along the west façade of the retail area is the atrium fronting the plaza. It is composed of horizontal curved glass that angles to reflect the sky. A canopy running

the entire length of the wall, at the same scale as the New York Public Library at Bryant Park, relates to the height of the tree canopy in the plaza and helps to establish a pedestrian-level scale.

The upper lobby of 10 Hudson Yards also faces the open space. It is a glass cable wall, transparent to the activity of the lobby within. This lower volume pulls out from the tower above. The lower massing of the entry at the access point to the High Line and opposite the smaller massing of the Culture Shed forms transitions between the scale of the neighborhood to the south, the open space of the plaza, and the towers above.

"Micro" Scale: Interstitial Space/ Micro Habitat

The opportunity for land creation in many cities and dense urban areas only exists by building over existing transportation infrastructure, such as parking, highways, and railroads. Such areas often consume a great deal of land, resulting in a break within the urban fabric. Devoid of any vitality, they often create discontinuity of streets and neighborhoods, and marginalized edge conditions. By building a platform that would simultaneously allow the transit infrastructure to function and knit together the urban fabric, new neighborhoods can be created and spring to life in urban centers (see Figure 9). Conveniently, mass transit infrastructure typically means good transit access – another attribute of fostering smart growth in these dense areas.

In the case of Hudson Yards, development north of 31st Street is occurring over the holding yard and service buildings for the LIRR at Penn Station, totaling six city blocks. The trains arrive in Manhattan in the morning from Long Island, are serviced and cleaned during the day in the rail yards, and are sent back to Penn Station for the evening journey back to the Long Island suburbs. The yards themselves are built over the Amtrak tunnel for trains traveling to Penn Station under the Hudson River from New Jersey. Additional future underground transport exists in a possible Metropolitan Transit Authority (MTA) subway

line connecting to New Jersey, and further extension of the No. 7 subway line, continuing downtown from Hudson Yards. These rail yards block connection between Chelsea to the south, Hell's Kitchen to the north, and the western edge of Midtown and the Garment District to the east. Penn Station is a 10-minute walk east of Hudson Yards. The tracks and the buildings above require two independent structural systems – an arrangement made possible by the interstitial space created by the trusses of the platform structure. The space of the tracks and its systems resides below the slab at the lower level of the truss. At the upper level of the truss is the slab upon which lies the new *terra firma* (Latin for "solid earth") for the project. In between the two levels reside the "pockets" created for landscape planting and building systems.

The tracks, belonging to the MTA and leased by the LIRR, require a watertight roof, ventilation, exhaust, fire suppression systems, and designated lighting, separate from the buildings above. The only allowable penetrations into the yards are the buildings' structural columns. The buildings themselves require utility services, drainage, and all other infrastructure commonplace under city streets in the 21st century.

Impact on Infrastructure and Resiliency

Creating two connected but independent systems at Hudson Yards allowed the opportunity to improve upon the older infrastructure of New York City on the far West Side (see Figure 10). These improvements, in the interstitial space of the platform, will create much-improved individual experiences or "micro-habitats" for each user, while also allowing for easy access to all of the technology for future upgrades and maintenance.

Because of Hurricane Sandy in October 2012 and its consequences to the New York region, the two new systems are more resilient and more sustainable than anything that existed before. The design of the systems, including a flood-proofed platform, responds to the widespread power and water outages that Sandy caused, when water inundated the underground infrastructure of the city. The systems also respond to the anticipated rising sea levels from climate change, and the project's proximity to the Hudson River. The building on *terra firma*, 10 Hudson Yards, has its core and fuel tanks within a "bathtub". If water levels rise, submarine-type doors are closed, keeping the vital systems of the building dry. The

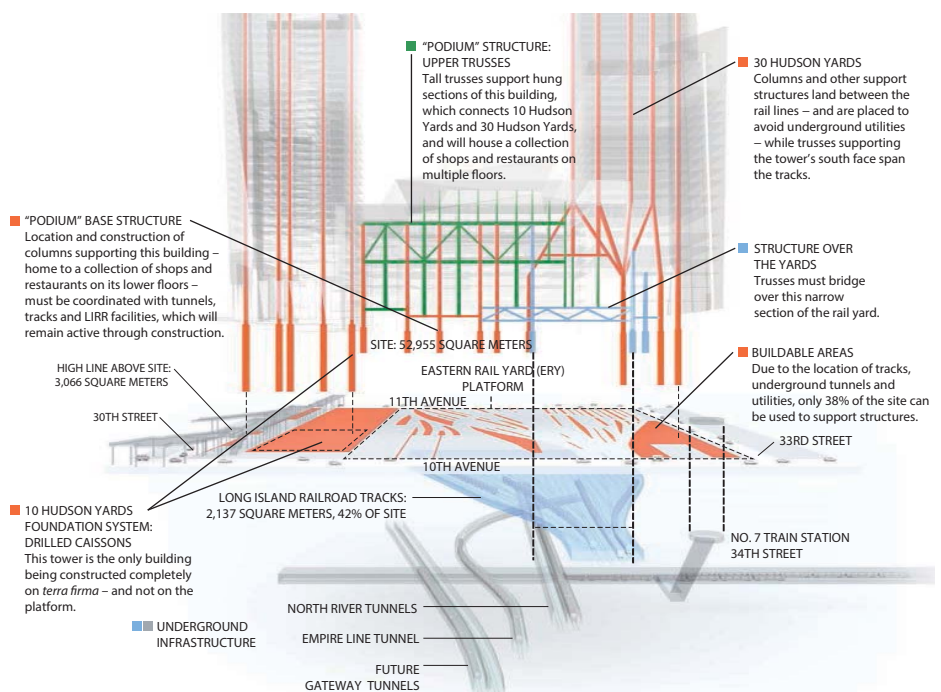


Figure 9. Hudson Yards platform.

buildings on the platform, including elevator pits, are above the flood plain.

There is a substantial 13.2-MW co-generation (co-gen) plant above the retail in the podium shared with 30 Hudson Yards, a smaller co-gen plant at 10 Hudson Yards, and a co-gen loop that provides an alternative source of hot and chilled water to the retail and offices, while acting as the primary source for the residential buildings of the ERY.

Eventually, this loop will extend and tie into the co-gen plant and system of the WRY, thereby ensuring heating and cooling for the Hudson Yards buildings is independent of the city power grid. The larger co-gen plant is fed by ConEd, the local utility provider, from both 33rd Street and 10th Avenue. The co-gen plant in 10 Hudson Yards draws power from 30th Street, thus providing redundancy of power sources to the site. The ERY buildings use a “smart” submetering system that monitors zone and individual appliance usage within buildings and identifies key energy use and waste.

Taking advantage of the interstitial spaces below grade, Hudson Yards will feature a central waste vacuum system provided by the Envac Automated Waste Collection System, pioneered in Sweden and implemented in about 1,000 locations worldwide, including Disney World in Florida and on New York’s Roosevelt Island. Garbage is sorted and sent down subterranean chutes. There are multiple streams for recycling, and all the waste will be collected at a central receiving center located at the WRY site. There, the garbage, already sorted, will be compacted and carted off-site. Additionally, any waste that is not in the Envac system gets collected and centralized in the loading bays to be removed. A novelty in New York, Hudson Yards will not have plastic bags of garbage sitting on the sidewalks.

Also within the interstitial space is an IT loop with multiple and redundant access points. It is both wired and wireless, with broadband, satellite, Distributed Antennae System (DAS) and Wi-Fi capabilities. In a joint initiative with New York University’s Center for Urban Science and Progress (NYU-CUSP) and SAP (a tenant of 10 Hudson Yards), the project will contain a

wide range of real-time data collection, driving analysis, and optimum efficiencies. Residents will be able to control smart thermostats, heating, air-conditioning, and lighting from smart phones, monitor energy use, and to choose from a range of providers for personal IT. The retail will have audio-visual (A/V) capabilities throughout. Shoppers in the retail mall podium will be able to access Wi-Fi and Bluetooth building directories on smartphones, and device-charging stations will be available. Office tenants will have a choice of multiple IT providers and platforms. Office workers will benefit from building security access on personal phones as well as Wi-Fi, allowing for maximum flexibility of their work environments.

Conclusion

The Hudson Yards project is often described in superlatives, but it is the management of so many levels of scale that make the project truly remarkable. Much more than a group of tall buildings, this is a once-in-a-lifetime project that challenged even the most skilled design and development team. It is a chance to stitch together a scar in the Manhattan grid that will make for a truly transformative new neighborhood and a sense of continuity that the West side has never had before. It does so by connecting and contributing to the three critical layers of Manhattan’s urban topography: – the subterranean, the street, and the skyline – earning the project a global reputation. ■

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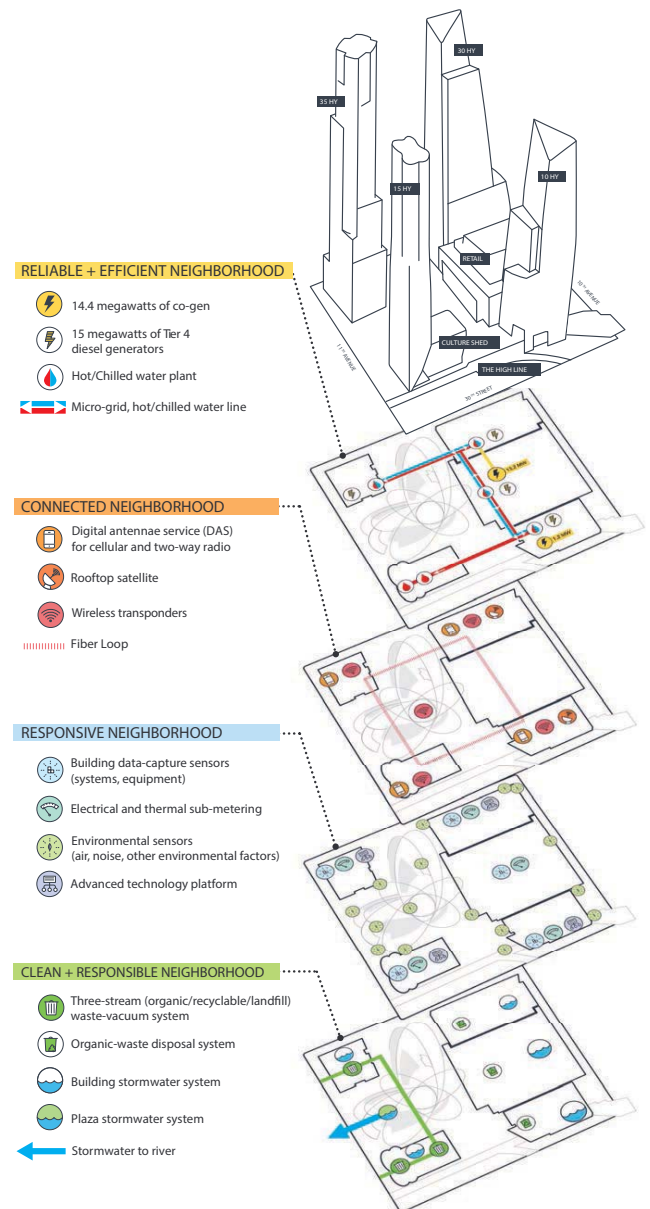


Figure 10. Hudson Yards upgraded infrastructure concept.

Project Data

Tallest Building in Complex: 30 Hudson Yards

Completion Date: 2019

Height: 387 meters

Stories: 73

Total Area: 232,342 square meters

Use: Office

Owners: Oxford Properties Group Inc.; Related Companies

Developer: Related Companies

Architect: Kohn Pedersen Fox Associates

Structural Engineer: Thornton Tomasetti

MEP Engineer: Jaros, Baum & Bolles

Main Contractor: Tishman Construction

Other Consultants: Heintges & Associates

(façade); Langan (environmental, geotechnical);

RWDI (wind); Schlaich Bergermann und Partner

(façade)