**DC WATER HEADQUARTERS**

**DESIGN NARRATIVE**

**The new headquarters of DC Water, the sewer and water utility serving the District of Columbia and several suburban jurisdictions, demonstrates that modern civic architecture can be both beautiful and sustainable, yet efficient in every sense.**

The design/build team, consisting of SmithGroup and Skanska, faced a number of unusual challenges in this project:

* The site is a narrow wedge of land in the floodplain of the Anacostia River, partially occupied by an existing pumping station that had to remain operational during construction and beyond.
* A complex web of critical infrastructure beneath the site could not be disturbed.
* The presence of that vital underground infrastructure dictated relatively tight security requirements for the new building.
* The site, which was already occupied by DC Water, lies at the heart of an emerging mixed-use neighborhood, where expectations for design quality are increasingly high.
* The project budget was modest considering the complexities of the site, reflecting DC Water’s goal of having the project pay for itself through savings from the consolidation of multiple facilities.

The team managed to turn each of these challenges into opportunities, producing a distinctive, elegant building that is also a model of sustainable design. **Much of the project’s architectural interest, in fact, derives from the designers’ creative responses to the unique challenges posed by its site, its program, and its unusual urban context**

A STRIKING FORM

**The building’s most distinguishing feature is its sinuous form, which may appear to be a purely sculptural exercise, but actually reflects a pragmatic response to the unique constraints of the site.** The curvilinear plan derived in part from the need to maintain and protect the existing mid-20th-century pumping station along the northern edge of the site. There was not enough space to avoid the existing structure completely, however, so the architects experimented with various layouts until arriving at one that engaged only a portion of the pumping station, while avoiding serious conflicts with the fragile underground infrastructure.

The designers then manipulated the new building’s massing, taking into account environmental considerations such as solar heat gain and potential daylighting of interior spaces, before deciding on the final shape. Beyond its practical benefits, the distinctive form optimizes views from inside the building. It also evokes the fluidity of water, which is ultimately the project’s *raison d’etre.*

Although the two structures partially overlap, the new headquarters had to be structurally isolated from the existing pumping station—both for building code reasons and to facilitate future modifications to the station without affecting the headquarters. To achieve this, the design team introduced a pair of huge trusses, intersecting at a right angle, to carry the weight of the new building over the station. Portions of these trusses are left exposed on the interior, adding sculptural accents to office and support spaces.

SENSITIVE SITE PLANNING

**The new DC Water headquarters is a welcome landmark in a rapidly changing neighborhood that is still in search of a clear identity.** The building is located between the Nationals Park stadium and an ambitious new mixed-use development known as the Yards. It overlooks a riverfront boardwalk that is becoming a popular pedestrian thoroughfare. The site is also adjacent to another noteworthy property owned by DC Water: an early 20th-century pumping station in the Beaux-Arts style, which, though generally in good condition, has long been an overlooked civic asset.

Given the site’s security requirements, the new building could have ended up as a barrier between the Yards and the ballpark area. Instead, it is well integrated into its surroundings, thanks to large-scale design decisions that maximized visual and physical connections wherever possible. For example, the design team reestablished a stretch of Canal Street between the new building and the Beaux-Arts pumping station, thus resurrecting a long-lost portion of the traditional street grid. That street ends with a cantilevered deck over the waterfront landscape, simultaneously creating a promenade and providing a visual link to the existing boardwalk that runs along the river. At the southwestern corner of the building, a secondary entrance is situated so as to serve as the visual terminus of Potomac Avenue. Meanwhile, a planted zone between the building and the river provides a gentle security buffer without interrupting views from and to the boardwalk.

While the DC Water headquarters stands in stark visual contrast to the historic Beaux-Arts building, that aesthetic counterpoint ultimately enhances each. The historic building was exemplary of its era in terms of materials and architectural vocabulary. The same is true for the new building. The presence of the newer structure, which is diagonally offset from its older neighbor, actually gives the historic building greater presence. Taken together, the two buildings testify to the value of well-designed civic architecture—a value that was often neglected in similar projects of the late 20th century.

SUSTAINABILITY AND RESILIENCY

The management of water resources is one of the fundamental issues facing modern societies. As a water and sewer authority, DC Water has a vested interest in environmental stewardship. **The design team for the new headquarters exploited unique opportunities afforded by the site to produce a building that will be one of the most energy-efficient in the Washington area.**

The undulating riverfront façade is sheathed almost entirely in glass, allowing ample daylight to penetrate deep into office spaces. Of course, such an expanse of south-facing glass poses challenges in terms of solar heat gain, which could increase the building’s air-conditioning load on sunny days. To counteract that, the architects carefully modeled the varied solar exposures of all points on the façade, yielding a diagram that they then used to further sculpt the building. As the south façade rises, each successive floor projects slightly over the floor below, creating a series of overhangs that reduce solar gain. The architects also added a second layer of tinted glass panels over portions of the façade that are especially susceptible to heat gain. Further solar control is provided by mechanized roller blinds that are automatically adjusted on a window-by-window basis.

The project takes advantage of what would normally be considered a great drawback of the site—the presence of tunnels carrying vast volumes of sewage—and turns it into an environmental asset. An innovative wastewater thermal recovery system made by SHARC Energy Systems—never before used in a U.S. office building—captures heat from the flowing wastewater in the winter, while using it as a heat sink in summer. The device transfers heat between the wastewater piping and a separate clean-water loop that runs to a heat-recovery chiller in the building. The system provides both cold and hot water to a series of fan-powered terminal units in the ceiling that provide space heating or cooling as appropriate. Small, low-speed fans requiring very little energy circulate the conditioned air as needed.

The façade design and overall form of the building help to enhance employee comfort and interior environmental quality. The glassy riverfront façade admits daylight deep into the office spaces, while the overhanging floors, double-layered curtain wall, and automated shades minimize glare. The building’s plan provides varied, open views from the interior to the riverfront boardwalk, the river itself, and the opposite bank, offering opportunities for frequent visual relief to desk workers and connects them to the utility’s mission.

The building design also reflects thoughtful consideration of resiliency—the ability of a building or community to recover quickly from natural or other disasters. The new building is designed so that the ground floor is one foot above the projected 500-year floodplain. The vegetation in the strip between the building and the waterline helps to filter rainwater while adding protection in the event of high river levels. An auto court to the east of the building features “runnels”—shallow channels in the paving that express the collection of rainwater on the site and lead the collected water to the rain gardens. Two giant 20,000-gallon cisterns capture the rainwater, which is used for 100% of toilet flushing and for irrigation of the site.

A green roof—nestled between terraces with spectacular views—further reduces storm water runoff. The green roof is mounded, allowing for deeper soil to support lush native plantings. The plants filter and absorb rainwater while also helping to buffer the terraces from the wind.

AN INNOVATIVE DESIGN PROCESS

**In designing the DC Water headquarters, SmithGroup used a variety of digital tools, allowing the firm to explore an unusually wide range of design options.** The process involved upwards of 20 different pieces of software, including familiar architectural programs such as Revit and Rhino, as well as state-of-the-art parametric workflows that facilitated precise geometrical manipulation and data-sharing across applications in real time. This heavy reliance on digital media afforded the designers a high degree of creative flexibility without compromising constructability.

The development of the building’s complex perimeter is a case in point. Although it appears curvilinear—especially from afar—the continuous façade is actually composed of four-foot-wide, planar modules, each containing either a pane of glass or a metal panel. By using digital splines, the computer equivalent of the flexible curves used in drafting and construction for millennia, the design team was able to explore literally thousands of permutations of this faceted form, all of which retained the readily buildable and cost-effective chain of four-foot modules. This technique allowed the architects to test and perfect every nuance of the perimeter’s shape, thus maximizing views and optimizing solar orientation while maintaining a rational structural grid and meeting square footage targets for each floor. In order to achieve this, the team ultimately wrote more than 40 versions of a script in Grasshopper, a visual programming component within the Rhino computer-aided design software.

A key benefit of this state-of-the-art, digitally-focused design process was fluidity of work flow. At each stage, the architectural team could easily make changes—whether based on new design parameters or requests from the client—and those changes would be reflected across all platforms. The system combined the benefits of modular construction with the freedom of parametric design.

SmithGroup took advantage of other cutting-edge technologies in the DC Water project. These included 3-D prototyping of certain light fixture housings, which could be printed in the firm’s offices or off site. In addition, the design team used virtual reality in the initial stages of the project in order to help the client visualize the interior and exterior of the building. The firm is now using augmented reality in the construction administration phase of the project—team members on site will use goggles to compare the actual structure with a digital model to ensure that everything was completed according to plan.

LEGIBLE ARCHITECTURE

**One of the most remarkable aspects of the DC Water headquarters is the extent to which the design process underlying the building is expressed in its finished form.** The rationales behind the sinuous massing, overhanging upper floors, and layered glass façade are sometimes astonishingly evident—on a sunny day, the patterns of light and shadow slowly moving across the building help to tell the story of its genesis. While a layperson might not fully understand the environmental implications of these design moves, the result is a visually dynamic building of unusual depth and liveliness.

Other aspects of the architecture reinforce that experience. The west, north, and south façades, which offer fewer potential views than the river-facing south façade, are more opaque. As the curtain wall continues around the sides of the building, glass gradually gives way to painted aluminum panels, finished in a narrow spectrum of green colors intended to suggest patinated copper. The apparently random variations in the specific shades of those panels are also meaningful, however: they express the varied solar loads on those sections of the façade, with lighter-colored panels on areas subject to higher heat loads.

The lobby of the headquarters is planned to include an exhibition about the project, including the sustainable-design features of the building and site. Visitors will be able to peer through large windows looking into the existing mid-20th-century pumping station. There they will see not only some of the venerable pumping machinery, but also the state-of-the-art SHARC heat recovery system, allowing them to learn about cutting-edge energy-saving technologies.

The result of all of these design solutions is a uniquely *legible* building—one that expresses not only its purpose, but also why it looks the way it does. It is a remarkably engaging work of architecture that brings a bit of excitement—and perhaps even glamour—to the seemingly mundane workings of the city’s infrastructure.