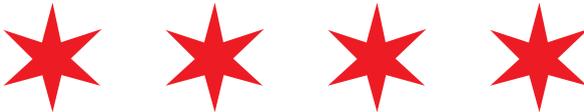


CHICAGO CHAPTER

EWRI

**Illinois Section ASCE  
SELF-GUIDED RIVERWALK TOUR**



The Riverwalk runs along the south side of the Main Branch of the Chicago River from Lake Street to Lake Shore Drive. There are multiple entrances to the Riverwalk from upper level Wacker Drive. There is an ADA ramp at Clark Street. More info at [www.chicagoriverwalk.us](http://www.chicagoriverwalk.us).

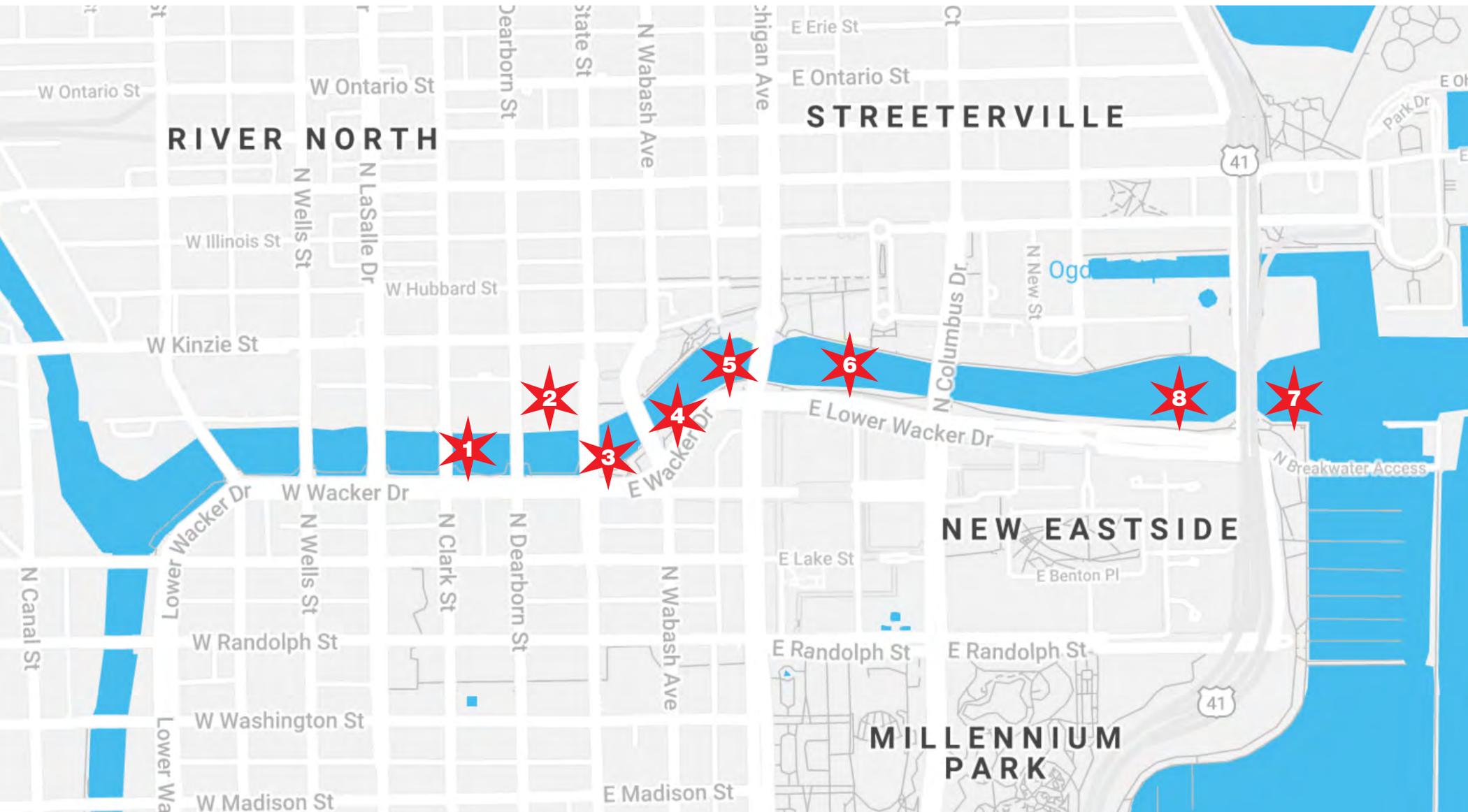
# ★ Overview

1. The Riverwalk
2. Marina City

3. Wacker Drive
4. Chicago-Style Bascule Bridges

5. The Michigan Avenue Bridge
6. Flow Reversal

7. The Chicago River Controlling Works
8. Made Land

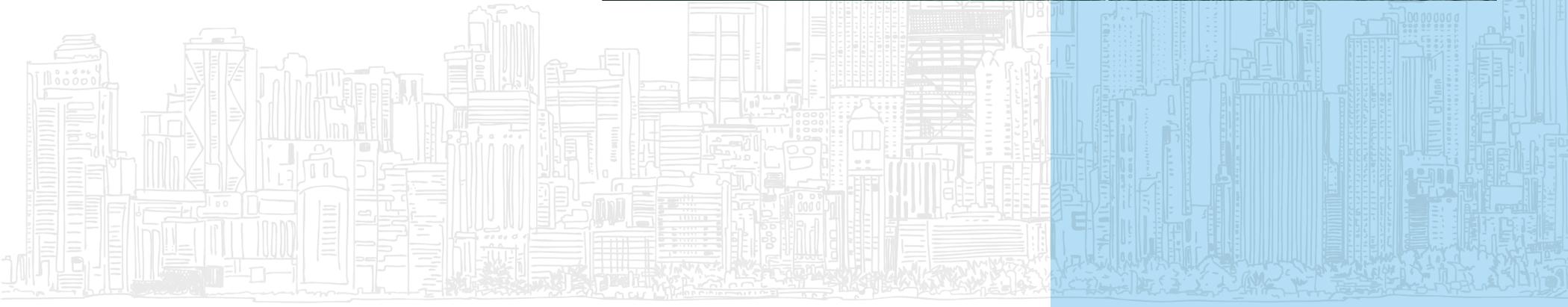


# 1 ★ The Riverwalk

The Chicago River has become cleaner over the last 30 years due to the implementation of the Deep Tunnel system, stricter environmental regulations and the decline of heavy industry along the river.

The City of Chicago is taking advantage of that to make the river a recreational destination. The city has constructed a continuous Riverwalk along the south side of the Chicago River from east of the Lake Shore Drive bridge to Clark Street.

A second phase of the Riverwalk was constructed in 2016 from Clark Street to Lake Street. The Riverwalk provides dining, entertainment and recreational opportunities to residents and visitors.



## 2 Marina City

In the 1950's the City of Chicago began losing population as the construction of the Expressway System began to open what had been rural areas north, west and south of Chicago to new development. Existing suburbs expanded and new suburbs grew rapidly. In response to providing new rental housing to keep Chicago competitive, the idea for a new development that combined apartments in a high rise building, shopping and recreational activities in one location was conceived. The developers retained a young architect named Bertrand Goldberg who designed a revolutionary project, Marina City.



Marina City was revolutionary in its financing, its structural design, its construction and its land use. Marina City is believed to be the first urban high rise complex in the United States and is credited with the beginning of attracting people back to living in and near the downtown area. The idea of a mixed-use development that incorporated residential/office and retail with ample off-street parking is the model for all downtown developments today.

The structural design consisted of twin reinforced concrete circular high rises constructed around a concrete core that would house the elevators and utilities, the standard method of erecting high rises today. The tower foundation consists of three concentric rings of caissons. The caissons vary from 24 inches to 66 inches in diameter and terminate 115 feet below grade. The inner ring of caissons supports the central core and the outer rings support the perimeter columns. It is believed that Marina City is the first local development to utilize a tower crane for its construction. Reinforced concrete beams (16) radiate from the core to support the pie shaped floor slabs, cast with lightweight concrete.

# 2 Marina City

Upon completion of the residential towers in 1964, it was the tallest reinforced concrete structure in the world. The first 19 stories of each tower would be a parking garage providing off-street parking for tenants and visitors. The common lobby area would contain a restaurant, bank and grocery store. Below the grade level, a marina was constructed to moor boats. A bowling alley and movie theater would also be constructed. An office building was constructed immediately north of the residential towers. Marina City was literally a city within a city.

Built by James McHugh Construction Company (the same company that built Water Tower Place, Aqua and Trump Tower) it utilized tower cranes on the east and west residential towers. Work crews were rotated between towers alternating formwork and concrete placements between the towers. It also utilized fiber glass lined forms for the concrete placements to obtain the complex shapes.

Constructed from 1961 to 1967 (the residential towers and office building were completed in 1964, the theatre building in 1967) Marina City was way ahead of the curve. Many integrated developments today that combine residential, work and recreation follow the path set by Marina City.



# 3 Wacker Drive

The 1909 Plan of Chicago proposed many needed modifications to the street network to improve traffic circulation and efficiency even though the primary mode of transportation at that time was a horse drawn wagon. The rise of the automobile was just beginning in 1909 and would expand dramatically in the 1920's. The 1909 Plan called for the construction of the Michigan Avenue Bridge (completed 1920), widening of major streets, a lakefront boulevard (now Lake Shore Drive) and the elimination of the South Water Street Market and its replacement with a double decked roadway along the south bank of the Chicago River's Main Branch.

South Water Street, the first east-west street south of the Chicago River, was the location of produce markets for the growing city and was extremely congested. The Plan called for the construction of a new produce market at S. Racine Avenue and W. 14th Street in order to relocate the existing businesses. Upon its completion, the South Water Street property was condemned and demolished. Construction was begun in 1925 and was completed in 1926.

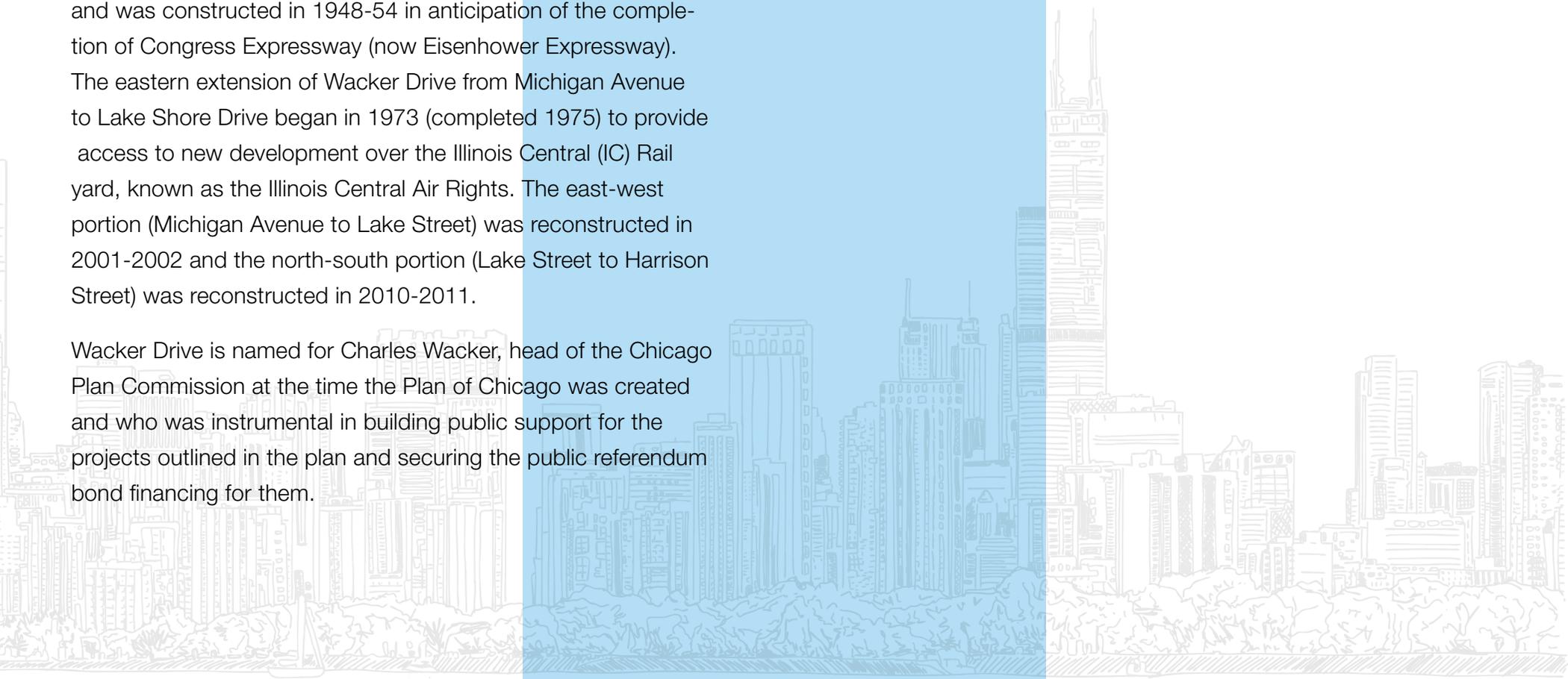
The design of the double decked roadway was unique. The upper level would serve to provide local access for vehicles and pedestrian access. The lower level was intended for the delivery of freight by service vehicles and to provide a continuous roadway with limited access. Initially it was thought that freight would be unloaded from ships docking on the first segment of the river, however, the amount of boat traffic on the river began to decline in the 1910's and by the time Wacker Drive was completed in 1926, traffic was minimal.



# 3 Wacker Drive

The construction of Wacker Drive used staged construction and the enclosure and heating of segments during the winter to allow concrete placements to continue in cold weather. This led to the rapid completion of the roadway. The first segment, the east-west portion of Wacker Drive from Michigan Avenue to Lake Street was completed in 1926. The east-west portion called for an architectural treatment similar to the Boulevards of Paris, hence the ornate lighting and balustrades. The north-south portion followed the alignment of what was originally known as Market Street from Lake Street to Harrison Street and was constructed in 1948-54 in anticipation of the completion of Congress Expressway (now Eisenhower Expressway). The eastern extension of Wacker Drive from Michigan Avenue to Lake Shore Drive began in 1973 (completed 1975) to provide access to new development over the Illinois Central (IC) Rail yard, known as the Illinois Central Air Rights. The east-west portion (Michigan Avenue to Lake Street) was reconstructed in 2001-2002 and the north-south portion (Lake Street to Harrison Street) was reconstructed in 2010-2011.

Wacker Drive is named for Charles Wacker, head of the Chicago Plan Commission at the time the Plan of Chicago was created and who was instrumental in building public support for the projects outlined in the plan and securing the public referendum bond financing for them.



# 4★ The Chicago-Style Bascule Bridge

As Chicago grew rapidly from 1880 to 1900 (its population more than tripled from 503,000 to 1,698,000) it found itself in a dilemma. The Chicago River was an economic engine for the city. Ships from Michigan and Wisconsin brought lumber, grain and other raw materials into the city through the river. Yet the river divided the developing city, snarling traffic and the movement of pedestrians and goods from the south side of the river to the north side. In order to provide access across the river and maintain navigation, center pier swing bridges were erected in the river. The swing bridges were constructed on a pier or turntable that occupied the center of the river. In its closed position, traffic and pedestrians could cross from one side of the river to the other. For a boat to pass through, the bridge swung open parallel to the river, allowing boats to pass to the right of the bridge. The swing bridges were not a good solution. They were slow and cumbersome to open and close. They were an obstruction to river traffic and were frequently hit by ships. They were also primarily constructed of wood and were subject to rotting out. In the 1890's the city's Department of Public Works experimented with different types of moveable bridges to determine a model for all future moveable bridges in Chicago.



A vertical lift bridge was constructed for South Halsted Street over the South Branch in 1894. The entire leaf was lifted straight up between two towers, similar to the existing Pennsylvania (Amtrak) RR Bridge. This vertical lift bridge was eventually replaced with a bascule bridge in 1934.



# 4★ The Chicago-Style Bascule Bridge



The Scherzer rolling lift bridge which moved backwards on a track as the leaf moved from the horizontal to the vertical position required massive foundations that narrowed the river channel. The Scherzer was also a patented design owned by the Scherzer Rolling Lift Bridge Company. Several such bridges were constructed. Cermak Road over the South Branch is the last remaining Scherzer Bridge owned by the City of Chicago.

The trunnion bascule bridge proved to be the answer city bridge engineers were searching for. The bridge leaf is balanced on a trunnion or shaft with a counterweight at the rear to balance the weight of the leaf. The counterweight can be above grade or below grade. A small electric motor drives a pinion gear on the trunnion and the leaf lifts into the air as the counterweight descends.

The bridge leaf can be raised to almost a vertical position to allow an unobstructed waterway for the ship to pass through. After the ship passes through, the operation is reversed and the bridge leaf descends. The bridge can consist of a single leaf over a narrow waterway or a double leaf bridge over a wider waterway. With the exception of West 18th Street over the South Branch, all the Chicago bascule bridges are double leaf. To keep the individual leaves acting as one unit they are locked together with an electrically operated sliding bar when the bridge is in the down position.

The trunnion bascule could be opened and closed quickly (as long as the bridge was in balance), and required a less massive foundation. The Chicago bascule design had the counterweight concealed in a pit beneath the trunnion which resulted in a more aesthetic design.

Cortland Street (1800 North over the North Branch of the Chicago River) is the first such bridge constructed by the City of Chicago in 1902. It became the model for all the subsequent bascule type bridges subsequently built by Chicago. The Cortland Street Bridge is a National Civil Engineering Historic Landmark, designated in 1982 by ASCE.



# 5★ The Michigan Avenue Bridge

Proposed by the Plan of Chicago in 1909 a new bridge would be constructed over the river east of the bottleneck of the Rush Street swing bridge. The bridge would have two levels with the lower level to connect to the proposed lower level of Wacker Drive. The bridge would feature ornate plazas and bridge towers in the City Beautiful fashion. Michigan Avenue south of the river would be widened and north of the river, the existing Pine Street would be widened and renamed Michigan Avenue.

The bridge opened in 1920 and was paid for by a public referendum bond issue. Until the Lake Shore Drive Bridge opened in 1937 it was the easternmost crossing over the Chicago River.

The bridge changed the social order of Chicago by opening the near north side to the convenience of automobile traffic and soon the city's wealthy and elite migrated from the south side neighborhoods of Prairie Avenue, Oakwood and Kenwood to north of the river creating what has become known as the Gold Coast.



# 6 Reversal of the flow in Chicago River and South Branch



Ellis Chesbrough had come to Chicago to improve its sewer system, which he did by raising the grade of streets to allow sufficient pitch to drain the combined sewer system into the Chicago River. Chesbrough had concerns about the continued pollution of Lake Michigan by the City of Chicago as the city continued to grow rapidly after the Civil War. In 1885 a summer rainstorm caused a surge of sewage from the river further into the lake than had been previously observed. Mayor Carter H. Harrison established the Drainage and Water Supply Commission to study the situation and make recommendations. Rudolph Hering from the Philadelphia Water Department was hired to lead an engineering study. In January 1887, the Commission recommended construction of a drainage canal from Damen Avenue on the South Branch to the Des Plaines River at Lockport through

the drainage divide that separated the Mississippi River and Lake Michigan water sheds. In 1889, the State Legislature authorized the creation of the Sanitary District of Chicago to construct a drainage canal. The Sanitary District would be an independent unit of government with its own trustees, now called commissioners and the ability to levy property taxes. This body is known today as the Metropolitan Water Reclamation District of Greater Chicago and covers essentially 95% of Cook County.

Construction of the drainage canal, known as the Sanitary and Ship Canal, began in 1892 and was completed in 1900. It connects the South Branch of the Chicago River at Damen Avenue with the Des Plaines River at Lockport in Will County. The canal was designed to allow 10,000 cfs (6,460 MGD) of water flow through it from Lake Michigan (one cfs equal 0.646 mgd). It was thought that this amount of water would provide sufficient dilution to the sewage generated by the City of Chicago for an ultimate population of 2,500,000. In 1907, the Sanitary District extended the canal and constructed a powerhouse two miles south of the City of Lockport, Illinois.

# 6 Reversal of the flow in Chicago River and South Branch

It did not take long for the lawsuits to begin. The right of the Sanitary District to exist, acquire property, and to levy a property tax was challenged. The Sanitary District was successful in asserting its legal powers in the State of Illinois. At the Federal level, however, it was a different matter. The State of Wisconsin sued the State of Illinois and the Sanitary District in 1922 on behalf of shipping interests. The concern was that such a large diversion of water from Lake Michigan into the Sanitary and Ship Canal could lower the water level of the lake, reducing the load-carrying capacity of iron ore boats and freighters.

Over the next few years six other states adjacent to the Great Lakes joined the lawsuit. The issue was referred by the United States Supreme Court to an appointed Special Master to study the issue. In 1930 the Special Master recommended and the United States Supreme Court issued a decree that limited the diversion of water to 1,500 cfs by January 1, 1939 giving the Sanitary District a time frame in which it would comply. The Sanitary District constructed the original controlling works consisting of breakwaters and the navigation lock at the mouth of the Chicago Harbor in 1937 and 1938. This controlled the flow of water between the Chicago River and Lake Michigan to prevent polluted river water during storm events from flowing into the lake. The controlling works are now operated by the US Army Corps of Engineers and were rehabilitated in 2011 and 2012.

Subsequently, there were further legal actions on Lake Diversion; and, in 1967, the amount of diversion was increased to the current 3,200 cfs. This limits the amount of water that may be withdrawn from the lake for flow in the Sanitary and Ship Canal and for potable water for the City of Chicago and other municipal water supply system. The reversal of the Chicago River is a National Civil Engineering Historic Landmark, designated in 1977 by ASCE. The entire sewage disposal system of intercepting sewers, treatment plants and waterways built by the Water Reclamation District was designated by ASCE as one of the seven wonders of modern American engineering. The plaque can be found at 100 East Erie Street, which is the main office of the Metropolitan Water Reclamation District of Greater Chicago.



# 7 ★ The Chicago River Controlling Works and Lake Diversion

From the opening of the Sanitary and Ship Canal on January 17, 1900 through 1938 there was no structure controlling the flow between Lake Michigan and the Chicago River. State Law allowed the Sanitary District of Chicago (now the MWRD) to divert as much as 10,000 cubic feet per second (cfs) of water from Lake Michigan to dilute sewage as it flowed southwesterly to the Des Plaines and Illinois Rivers through the Sanitary and Ship Canal. With this quantity of diversion, there was little chance that the river would flow back into the lake even in times of large storms.

After years of contention between the U. S. Army Corps of Engineers (Corps) and the Sanitary District of Chicago over the diversion of water from the lake, the U. S. Supreme Court found in January 1925 that the Corps had the authority to regulate the flow of water from the lake and the Sanitary District must abide by whatever the Corps permitted. The Sanitary District made application to the Corps for a permit that included a program of intercepting sewer and treatment plant construction to reduce the pollutant loading on the Des Plaines River. Also included was a Chicago River control structure to prevent the discharge of contaminated river water to the lake during periods of stormwater runoff when the quantity of diversion was reduced.

The Sanitary District was on solid ground in proposing this program. Since 1909, the Sanitary District had been experimenting with various technologies to treat sewage. Their first small treatment plant was built in 1914. The first plant using the activated sludge process went into service in 1922. An engineering board of review, consisting of experts in the fields of sewage treatment, stormwater management and Great Lakes water level control made recommendations to the Sanitary District in 1924. The Corps issued a permit to the Sanitary District in March 1924 that included the proposed program and a schedule of construction.

Meanwhile, other states around the Great Lakes, led by Wisconsin, displeased with federal action involving diversion of water from Lake Michigan by the Sanitary District, filed suit against Illinois and the Sanitary District in 1922 to enjoin Illinois and the Sanitary District from diverting water from the lake. This litigation resulted in the 1930 U. S. Supreme Court decree. The decree included the schedule of construction and a schedule of reductions in lake diversion over a period of years to 1,500 cfs by January 1, 1939.

# 7 ★ The Chicago River Controlling Works and Lake Diversion



The Chicago River Controlling Works was built in 1937 and 1938 and placed in service on January 1, 1939. The project included a navigation lock, walls separating the river and lake, reinforcement of the aging federal breakwaters and sluice gates to control the flow of water between the lake and river. Although modifications have been made over the years, the lock, walls and sluice gates are basically the same as built nearly 80 years ago. In 1984 ownership and operation of the lock was turned over to the Corps. In 2000, the State replaced the south harbor wall and sluice gates, thus allowing for the creation of Du Sable Harbor by the Chicago Park District.

The 1930 Decree has also been modified over the years. The 1967 Decree combined the 1,500 cfs of direct diversion with 1,700 cfs of domestic water consumption into a total diversion of 3,200 cfs to be allocated by the State of Illinois to any legal

entity requesting diversion. Domestic consumption has a priority over other uses. The 1,500 cfs of diversion prior to 1967 was divided into direct diversion of 900 cfs from the lake used by the Sanitary District for water quality maintenance in the canal system and 600 cfs of stormwater runoff from the 673 square mile diverted watershed formerly discharging to Lake Michigan. The 1980 Decree changed the method of accounting for diversion under the supervision of the Corps and placed the 3,200 cfs diversion on a 40-year moving average with annual average restrictions. This allowed for long-term financing of municipal water systems. Through hydrological studies, the Corps has determined that 800 cfs is more representative of the stormwater runoff from the diverted watershed.

Currently the MWRD has an allocation of 270 cfs for water quality maintenance in its system of canals. The reduction from prior higher amounts recognizes the improvements made in sewage treatment and control of combined sewer overflows that are now captured by the Deep Tunnel system. Allocations of lake diversion by the Illinois Department of Natural Resources, Office of Water Resources, observe the principle of conservation and the intent of the U. S. Supreme Court Decrees to reduce the use of lake diversion. In recent years, the accounting of lake diversion supervised and approved by the Corps showed a total diversion of approximately 2,800 cfs, below the 3,200 cfs limit. Much of this saving has come through water conservation initiatives of industry and municipalities.

# 8 ★ Made Land



What do Lake Shore Drive, Navy Pier, Soldier Field and the Adler Planetarium have in common? They are all constructed on “made land”, land that is reclaimed by filling in an area along the existing shoreline creating a new land mass above the existing water surface. Chicago’s beautiful shoreline of 27 miles of parks, beaches, harbors and cultural institutions is constructed on made land. The use of the new land for recreational purposes, free and open to the public, was laid out in Daniel Burnham’s Plan of Chicago published in 1909.

The shoreline of Chicago in 1830 was closer to Michigan Avenue. The first significant made land was created by the Illinois Central Railroad which constructed a timber trestle in Lake Michigan east of Michigan Avenue from 12th Street (now Roosevelt Road) to the Chicago River. The area north of Randolph Street was filled in by the railroad to create a storage yard for railroad cars and service shops.

As with any landfill, a bulkhead was constructed in the water to provide a retaining wall for the fill material deposited. The original bulkheads were timber piles driven into the clay to form a wooden crib and backfilled with stone. The construction of shoreline revetments also utilized wooden piles and tie bars to form the bulkhead for fill material. The bulkhead was then capped with large limestone blocks to form what appeared to be a staircase along the lakeshore.

Over time engineers would find this type of design was a mistake. The elevation of Lake Michigan fluctuates five feet over an approximate cycle of 50 years. When the lake level was at a low elevation, the tops of the wooden piles were exposed and dry rot commenced in the piles, eventually collapsing the revetments; leading to shoreline erosion of the fill material. Beginning in the 1930’s, steel sheet piles and concrete caps were utilized to form the bulkheads for new landfill. These bulkheads have proven to be more long lasting than the ones created with wooden piles. Today the Army Corp of Engineers is replacing failing segments of the original limestone and timber pile revetments with steel sheet pile and concrete shoreline protection.

# 8 ★ Made Land

After the Chicago Fire of 1871, rubble from the fire and soil material excavated for the construction of new buildings was dumped into the strip of water between Michigan Avenue and the ICRR trestle until the area was filled in and became known as Lakefront Park (now Grant Park). Beginning in the 1890s and continuing through the 1940's areas along the lakefront were filled in to create Grant Park, Streeterville, Northerly Island, Lincoln Park and Montrose Harbor. The source of fill material was primarily sand that was dredged from shallow areas of Lake Michigan, transported by barge to the landfill site and deposited.

A primary source was the Indiana Shoals immediately north of East Chicago, Indiana where the water is only 30 feet deep. Secondary sources were excavated spoil from tunnels (water and sewer) and building foundations demolition debris and cinders from spent coal used for heating. The last major landfill was in 1959 to create the area for the Jardine Central Water Filtration Plant immediately north of Navy Pier. It should be noted that these operations occurred before the requirement of environmental impact statements. Minor landfill area have been completed since. In 2016 the area east of Lake Shore Drive and Fullerton Avenue was being filled in to create 3 acres of new land. Since 1850, there have been 5.5 square miles or 3500 acres of land created along Chicago's lakeshore.



## About the Author

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Mr. McGovern retired as a Principal Civil Engineer from the Metropolitan Water Reclamation district of Greater Chicago in 2014 where he worked in the Local Sewer Systems permit group and in the Construction Division. He lives in Chicago with his wife Rachel.



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*Designed by Benjamin Schutte*

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