# City of Houston Wastewater History

By Susan Smyer
May, 2008

> ***Sewerage and the Sanitary Engineer***.*—Present day conceptions of sanitation are based on the scientific discoveries which have resulted so much in the increased comfort and safety of human life during the past century, in the increase of our material possessions, and the extent of our knowledge. The danger to health in the accumulation of filth, the spreading of disease by various agents, the germ theory of disease, and other important principles of sanitation can be counted among the more recent scientific discoveries and pronouncements. Experience has shown, and continues to show, that the increase of population may be inhibited by accumulations of human waste in populous districts. The removal of these wastes is therefore essential to the existence of our modern cities.*
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> *The greatest need of a modern city is its water supply. Without it city life would be impossible. The next most important need is the removal of waste matters, particularly wastes containing human excreta or the germs of disease. To exist without street lights, pavements, street cars, telephones, and the many other attributes of modern city life might be possible, although uncomfortable. To exist in a large city without either water or sewerage would be impossible.*
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> *Sewerage and Sewage Treatment*
> *by Harold Eaton Babbitt, 1922*

The early history of human waste disposal in Houston was little different than that of the relatively unchanging history of waste disposal since the fall of the Roman Empire. For the most part, private citizens routinely disposed of their personal household waste using various methods, ranging from the merely unpleasant to the unspeakably foul, such as the use of privies, cesspools, chamber pots or waste carelessly deposited into streets, gutters or streams. These methods resulted in differing degrees of sanitary conditions. Methods which might be tolerated in a small or a geographically separated population, will contribute to noxious odors, disease or even widespread epidemics in teeming cities with closely packed inhabitants. Louis Pasteur made the discovery that germs cause diseases in the middle of the nineteenth century. As the quotation above by an assistant professor of municipal and sanitary engineering from the University of Illinois indicated, the principles of sanitation had, at the start of the twentieth century, only recently really been widely disseminated and understood.

"The Telegraph," one of the first newspapers published in Houston, derided the state of affairs in the infant community in 1839.

> *We know not the cause—but early in the Summer the Board of Health, which had been previously created and had effected much good ceased the performance of its duties—the streets have remained unattended to, and consequently horridly filthy—carrion has been suffered to lay unremoved in our vicinity, so near as to impregnated the atmosphere with its putridity—the washings of the kitchens and backyards of the whole city have been permitted to be thrown into the streets and gutters, there to rot and emit a stench disgusting and poisonous in the extreme! No rains have fallen which might have washed the City of the concentrated filth, and we therefore have been under the necessity of living in and breathing an atmosphere which has proved almost as withering as the wind from off the fabled... of the Desert.*

Historic Buffalo Bayou
*Courtesy of Metropolitan Research Center, Houston Public Library*

Several bayous, including Buffalo Bayou, flow through the virtually flat prairie that the rainy, semi-tropical City of Houston is built upon. From the city's founding in 1836, its inhabitants used the bayou waters as a commercial thoroughfare for boat traffic, as a source of drinking water and, simultaneously, as a depository for rain runoff and waste—animal, domestic and commercial. Rapidly flowing streams easily dilute waste as it is carried downstream, but Buffalo Bayou is a slow-moving stream and its unhurried currents hamper such purifying actions. Even if the bayou had run swiftly to "dilute and disperse," the discovery of bacteria and the harm it can cause would have made it imperative to provide some form of treatment system to remove the pollution.

Houston's waste disposal issues and Houston's polluted bayous have from the city's founding days been interwoven stories—cause and effect. One created the other and it would take most of a century to understand the connectedness of the two components and make positive changes.

City of Houston Chief Engineer W. E. White understood the connections and explained it in a talk to the Texas Public Works Association in 1960, "The only purpose of sewage treatment is to protect the streams into which the treated effluent from the treatment plant is permitted to flow." A popular children's pamphlet about wastewater simplifies the concept even more when it states, "Wastewater treatment is the 'last line of defense' against water pollution. Clean water—that's the goal of wastewater treatment! Why are wastewater treatment plants important? They protect public health. They protect water quality. What could be more important?"

Houston and the surrounding Harris County contained large numbers of cattle, hogs, mules and horses, many of which freely wandered in and out of the streams doing what nature told them to do. One horse deposits approximately twenty pounds of manure each day. Twenty pounds multiplied by dozens of animals a day equals quite a lot of odiferous droppings polluting the walkways and bayous of Houston.

Very early in Houston's history, numerous sawmills were constructed on the banks of Buffalo Bayou to convert the large stands of magnolia and other trees which grew on those waterways into timber for a growing community. Tidying up the mills was apparently easy; the sawdust could quickly and easily be swept out of the buildings into the adjacent streams. Within five years of the city's founding, these actions were recognized as undesirable for the public welfare and unsuccessful attempts were made by civic leaders to prohibit the dumping of sawdust into Buffalo and White Oak Bayous.

For decades, other commercial enterprises were also built along the bayous and the waste from those businesses compounded the contamination of the adjacent streams. The very large F.G. Lock Horse and Mule Market, in business during the 1910's, is one example of such operations. These horses and mules were corralled and not running through the bayous at will, but each animal still contributed twenty pounds of waste a day to the waterways.

By the mid-nineteenth century, American municipalities began to take advantage of the rapid changes and growth in technology and provide water to homes as well as sewage disposal services. The majority of American officials had by then professed responsibility for public sanitation and health—a responsibility that they were loath to relinquish to private franchises. During the decade of the 1880's, numerous cities began constructing water and sanitary systems, but it was not until after World War II that many of the systems were finally complete.

By 1880, water closets were commonly found in American homes. By that date, approximately one fourth of all homes in the United State contained these indoor conveniences. No longer did proud owners of a water closet have to "go out back" on a rainy or chilly night.

City services of all types in Houston were slow in developing. "By 1861 Houston still had only two fire engines, no paid fireman, no paved streets, no covered sewers, no street lighting, and no permanent health board," stated the author of an unpublished manuscript. Houston had a written sewage plan in place in the late 1860's, but implementation lagged behind the concept and a comprehensive underground system was not begun until two decades later—years after the City began piping water to it citizens' homes and businesses.

The sanitary or domestic sewage plan, written in 1866 by civil engineer Colonel William H. Griffin for the city's recently organized Board of Health, described a system which would incorporate three sewer lines. These lines would have enveloped downtown Houston and a southern section of the town and would have emptied into the sluggish Buffalo Bayou. Houston's city council suggested that adjustments broadening the plan needed to be made before they could accept it, but the changes were never made and the plan was never put into effect.

The question of what to do with Houston's waste became particularly acute in the latter decades of the nineteenth century after water began to be piped to households in large quantities from the municipal water works. Water that comes into a building has to leave that same structure in some manner. Without a comprehensive city sewage system, those millions of gallons of water filled up cesspools, privy vaults and flooded yards and ditches. Various citizens built their own private sewage systems to provide relief. In 1874 two Houston drainage ditches were constructed. That same year, the state's first (and only) underground sewage line was run under Caroline Street. Infrastructure had not yet caught up with need.

Over the last two decades of the nineteenth century, many citizens loudly vocalized their disgust with the filthy and unsanitary conditions found in Houston and the heavily polluted Buffalo Bayou. The Bayou was a source of drinking water *and* continued to be the major sewage drainage outlet as well. Understandably, people were greatly concerned when black, tar-like water came out of their taps. Strollers along the Bayou, leisurely escaping Houston's heat and hustle and bustle, recoiled to see human waste floating in the stream. Local doctors treated many cases of diarrhea or "bowel" troubles which were caused by the unhealthy conditions found in Houston.

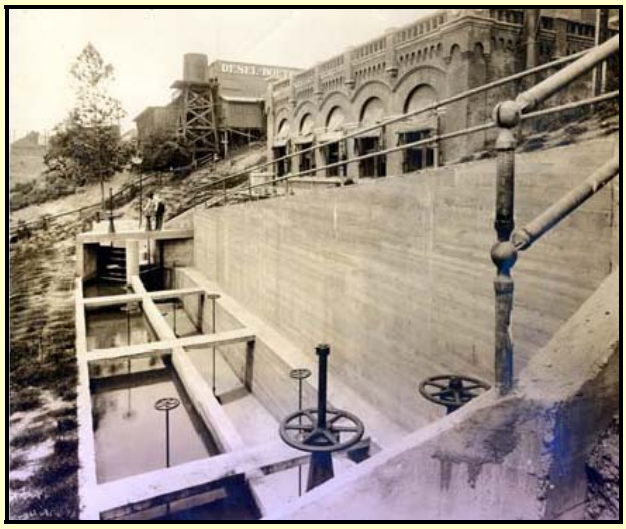
An 1893 "Houston Daily Post" article noted that the Houston Cotton Exchange had requested that the city council stop the pollution. Their request referred to the Buffalo Bayou, perpetually active with commercial boat traffic, as "an immense cesspool, reeking with filth and emitting a stench of vilest character." In a further article later that month, a "Houston Daily Post" writer exposed the fact that 40,000 gallons of sewage from the Houston and Texas Central Railroad shops gushed daily into Buffalo Bayou *above* the Water Works dam, thus contaminating the bayou and Houston's drinking water as well.

Two years later conditions had not improved and Buffalo Bayou, a sparkling creek 60 years before, was "covered with a light scummy substance" from which "an almost unbearable stench" arose. A medical group investigative team found pollution in the stream caused by privies, a dead cow, an oil mill and a cattle yard. It took the United States Government, using a large carrot *and* a large stick, to convince community officials that changes must be made or commercial interests would suffer.

Wishing to by-pass Galveston and become a port city itself, the City of Houston needed federal aid to construct a deepwater ship channel incorporating Buffalo Bayou as a key section of the channel. In 1895, Major A. M. Miller of the U.S. Army Corps of Engineers was sent to inspect the proposed channel and his report was unflattering and blunt. Buffalo Bayou must be cleaned up or there would be no federal dollars for the project. Greatly distressed, Houston city council reacted to the report. The council's May 15, 1899 minutes state,

*We have studied closely the results of the Engineer's examination of the existing condition of the Bayou and they amply emphasize our own ideas and those of most of the citizens that the condition of the Bayou is deplorable, and should be speedily corrected. We further believe, that until the sewage is taken out of the bayou, action of the Federal Government on the deep water project will not be taken.*

The threat of lost funding convinced the Houston Business League to support the city council in their efforts to accept consulting engineer Alexander Potter's plans for a $250,000 Houston lift station sewer system. Mayor Samuel Brashear and the city council then approved a $300,000 bond issue to finance the innovative system which would be completed in 1902. It would not be too soon. By 1900, the municipality of Houston had grown to cover nine square miles, boasted a population of nearly 45,000 and was using twenty miles of separate sanitary sewers which discharged directly into Buffalo Bayou with no prior treatment.



Willow Street Pumping Station
*Courtesy of City of Houston, E. B. Cape Center*

David G. McComb described the completed Willow Street Pumping Station and sewage system in his book, *Houston a History* in the following statement:

*The sewer system, utilizing advanced concepts then applied only in a few other places in the world, consisted of a series of pipes, varying eighteen to forty-two inches in diameter, which led to a central pumping station in the Fifth Ward. Where necessary, the sewage crossed the bayous through siphons. Centrifugal pumps at the station forced the sewage through a twenty-four-inch iron pipe to filter beds, four and one-half miles away. Heavy matter stayed on the surface of the beds where it dried. Workmen removed this with rakes, but the rest of the sewage filtered through various layers of broken stone, gravel, coke, and sand. The final effluent flowed into a long canal leading to Buffalo Bayou. At the opening inspections of the system, which finally cost $280,000, Potter bragged about the purity of the effluent. George L. Porter, one the visitors, jokingly suggested that it should be bottled, but Potter and his assistant demonstrated their conviction by dramatically drinking some of the treated water. Though they declared it quite palatable, no one else could be induced to taste it.*

(Willow Street is now named San Jacinto Street and is located near the confluence of Buffalo and White Oak Bayous. The building as been adapted and now functions as a University of Houston, Downtown facility.)

Willow Street Pumping Station
Currently Adapted for Use as a University of Houston, Downtown Facility
April 25, 2008
*Photo by Susan Smyer*

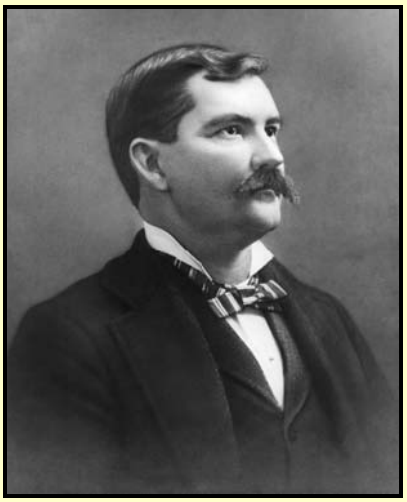
The U. S. Government was pacified by the forward thinking technology of the new filter bed type sewage treatment system and federal aid was forth coming to build the deep water port and the Houston Ship Channel. Unfortunately, the new system did not solve all of Houston's sanitary problems. Animals continued to freely roam in and out of the bayous depositing fecal matter. The sewage system was not kept in good repair (its maintenance was woefully neglected) and the system had no storm water component. Many people would not be hooked up to a sanitary sewage system for years and continued using alternate disposal methods.

Regarding the new filter beds, Houston City Engineer F. L. Dormant complained in his 1902 annual report.

> *The majority of pipes both in coke beds and sand beds will have to be relaid account of bad workmanship during construction. Hundreds of holes have appeared in the sand beds indicating sand is being washed away into the pipes. The brick dwelling house (for plant caretaker) has never been finished, the roof leaks badly and the chimney was omitted entirely. When the coke bed nearest the house is used the sludge leaks into the house thru the walls…Anyone visiting the plant can judge for himself that the effluent as finally discharged is not what it should be.*

A year later, the bacteria level of Buffalo Bayou was found to be at 161,606 bacteria per cubic centimeters which is well above the then considered safe level of 500 per cubic centimeters. Contamination of the city's waterways continued unchecked.

Mayor H. Baldwin Rice discovered for himself during a 1905 tour of the Willow Street facility that there had been no exaggeration in Engineer Dormant's report three years previously and no improvements during the lapsed time either. Coke beds were clogged and there was standing water (four to five feet deep) in some of them. The coke bed that Engineer Dormant had previously reported leaking into the caretaker's house had never been repaired and was now completely non-functioning. In one section of the plant, Mayor Rice found a newly formed lake inhabited by water birds, snakes and alligators—a state of affairs which is not recommended for an efficient sewage treatment system. The operations were unhealthy and offensive to the eyes and to the nose.



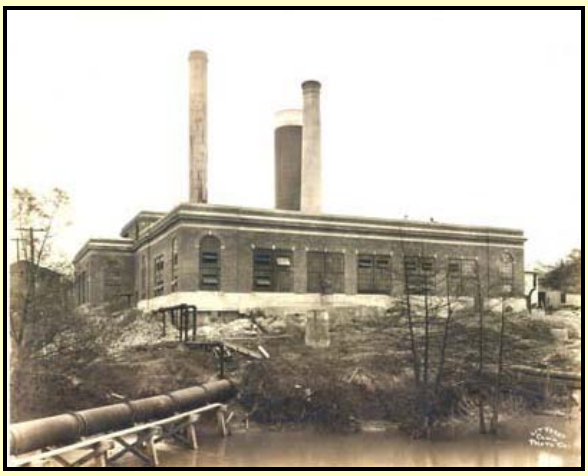
Mayor H. B. Rice
*Courtesy of Metropolitan Research Center*
*Houston Public Library*

In a delayed response to Mr. Potter's boastful toast at the plant's opening, Mayor Rice wryly remarked, "Well, I do not know how the water looked when Mr. Potter drank it, but I readily relinquish any claim that I may have on any portion of it to Mr. Potter or anyone else who desires to quaff from it."

As some cities developed processes to dispose of their waste, they experimented with methods that combined both sanitary and storm systems. In 1900, Houston's sewage infrastructure consisted of 20 miles of separate sanitary sewage lines as well as 6 ½ miles of combined sewer lines. By early in the 20th century, it was widely accepted in the disposal profession that such a combination was not desirable. The City Engineer affirmed in 1909, "The practice in the past has been to carry off storm water wherever it collects by whatever sewer was near it, with a result that our sanitary sewers are very much over-taxed with storm water. This evil is very rapidly being corrected."

So as City leaders and engineers continued to wrangle with the construction of a citywide sanitary sewage system, they also had to address the persistent problems of storm drainage for the flat and flood-prone region and build another system for storm drainage completely separate from the sanitary one.

Houston officials struggled to resolve the waste disposal requirements of its mushrooming population during the early years of the twentieth century. The sheer number of inhabitants severely strained the limited disposal capacities. Over the next decade, the City of Houston effectively repaired the Willow Street plant and constructed a number of new ones. These labors were only partially successful in treating all of the waste the city produced. Mayor Ben Campbell estimated in 1916, 70 to 80 percent of the city's sewage remained untreated and continued to pollute the waterways. In that same year, a "Houston Post" newspaper article referred to thirty-five private sewers draining directly into Buffalo Bayou.



South Side Disposal Plant
c.1930
*Courtesy of City of Houston, E. B. Cape Center*

Waterways pollution was not a localized issue. The Texas state legislature in 1915 acknowledged their concerns by passing a mandate designed to rectify the appalling statewide contamination. After January 1917, it would no long be lawful to dump untreated sewage into the rivers, streams and bayous that ran throughout the state.

Local officials attempted to comply with the new law by using new technology in the construction of two of the first activated sludge treatment facilities in the United States. One of the operations (the North Side Disposal Plant) was also probably the largest in the country. Houston was lauded in text books of that time as a "pioneer" in wastewater treatment methods for replacing the now old style filter beds with modern activated sludge systems. The North Side Plant treated 5.5 MGD (million gallons per day) and the other new plant (the South Side Plant which was completed in 1918) treated 5.0 MGD. The North Side Plant was built in 1917 and enlarged four times in 1928, 1937, 1950 and 1960. The South Side Plant was enlarged in 1937 and abandoned in 1948. Its site is now part of the University of Houston campus. Until the 1940's, these two major wastewater treatment plants both used an open lagooning method of activated sludge treatment. The lagoon covered ten acres at one plant and 15 acres at the other.

In his 1922 textbook, *Sewerage and Sewage Treatment,* Harold E. Babbitt explained the activated sludge process in the following paragraph:

> *In the treatment of sewage by the activated sludge process the sewage enters an aeration tank after it has been screened and grit has been removed. As it enters the aeration tank it is mixed with about 30 percent of its volume of activated sludge. The sewage passes through the aeration tank in about two to four hours during which time air is blown through it in finely divided bubbles. The effluent from the aeration tank passes to a sedimentation tank where it remains for one-half an hour to an hour to allow the sedimentation of the activated sludge. The supernatant liquid from the sedimentation tank is passed to the point of final disposal. A portion of the sludge removed from the tank is returned to the influent of the aeration tank. The remainder may be sent to any or all of the following: The sludge drying process, the reaeration tanks, or to some point for final disposal.*

Although much had been done by 1920 to provide an effective, citywide sanitary sewage system of two treatment plants, 180 miles of sanitary sewer and five lift stations, there was much yet to be accomplished. Well into the century, there were still sections of the city such as Freeman's Town near downtown Houston that were not connected to the city's sanitary sewage system. A 1929 poll uncovered the fact that less than twenty percent of the Fourth Ward had indoor toilets.

Houston Public Works employees expanded their system by the construction of $403,000 worth of new lines and equipment in 1934, but the sewage pouring into the bayous continued to be a serious issue. The two city treatment facilities removed solids and organic matter from some of the area's wastewater, but did not add chlorine to kill bacteria. There was also no quality control or testing of the effluent as it left the treatment plants and entered the nearby streams.

During the 1930's and 40's, public attention was understandably concentrated on other concerns, such as the Great Depression and World War II, than on its contaminated streams. But occasionally stories circulated which drew attention back to the pollution in the bayous such as the suspicions in the thirties (which surfaced again and again) that the polio epidemic of that decade was caused by the toxic waste in the bayous.

Harris County investigator Frank J. Metyko discovered in 1947 that Buffalo Bayou was

80% polluted from the industry along the streams and from over-loaded and under-maintained treatment plants. A “Houston Post” newspaper article (written a few months after the investigation) described the findings for its readers and graphically painted a picture of the bayou running red from creekside slaughter house refuse.

An article in “American City” magazine, also written in 1947, raised a familiar cry about the dual plight of pollution in the bayous and the lack of an effective waste disposal system in Houston. It stated, “In few cities is complete sewage treatment more seriously needed. Houston ultimately empties its treated sewage into its vitally important commercial link to the rest of the world, the Houston Ship Channel.”

By this time, World War II had ended and Houston’s municipal leaders could now focus on an urgently needed overhaul of the sewage system’s infrastructure to provide for the city’s booming post-war population of 300,000. The Houston Sanitary Sewer System still used the activated sludge process (with open lagoons) without primary sedimentation that they had used for decades.

500 tons of Hou-Actinite waiting to be shipped
*Courtesy of City of Houston*
*E. B. Cape Center*

In 1946, the City of Houston chose to adopt a consulting engineering company’s study which recommended transforming the existing sludge disposal system to a more modern process which would use heat to dry the sludge and produce a marketable fertilizer (eventually named Hou-Actinite). Production at the new sludge disposal plant (located at the site of the North Side Treatment Plant) began in 1949 with an output of 60 tons of fertilizer each day. Ten years later, the plant was enlarged and was able to generate up to 90 tons of Hou-Actinite on a daily basis.

Gradually the old plants were converted to use the newer activated sludge process and nine other activated sludge plants were constructed in the 1950’s and 1960’s. These two decades launched the current modern period of vigorous growth and modernization in Houston’s wastewater history. A 1960 report to the Texas Public Works Association by W. E. White (Chief Engineer Sewer Division) entitled “City of Houston Experience in the Sale & Disposal of Sewage Sludge,” chronicled the changes to the dry system of sludge disposal as well as the growth and expansion of the City’s sewage treatment system. He noted in his account in that year, the Sewer Division operated 68 sewage treatment plants—two large ones and 64 with under one MGD capacity. During the decade of the 1960’s, the city closed forty treatment plants that did not meet its standards, but also continued to enlarge its system. By 1968 either due to construction or annexation, the city was operating 3,085 miles of sanitary sewers, 65 treatment plants and 168 lift pump stations for a population (which had doubled since 1950) of 1,160,000.

Despite the substantial amount of growth and modernization which the City of Houston's Sewer Division had experienced in the post war era, contamination of the area waterways remained a grave problem. Harris County pollution control officer, Dr. Walter A. Quebedeaux noted in 1964 that Houston's "sewage-treatment plants worked poorly, twenty-two operated at near capacity or beyond, and twenty-one emitted noxious odors." The bayous were considered so polluted that in 1966 the Ship Channel actually caught fire killing a shipyard worker. A Baylor Medical School professor boldly pronounced Buffalo Bayou a health menace. "It's just plain sewer water," he asserted. "You shouldn't bathe in this water. You shouldn't even get it on your skin. You shouldn't have anything to do with it. It should be put in a closed pipe and carried out to sea."

Houston's bayous were not the only polluted waterways in the United States; countless creeks and rivers were a national disgrace. In order to finally rectify the problem, the Federal Government approved the Clean Water Act in the 1972. Since that date, the City of Houston has invested more than three billion dollars to ensure that the wastewater from two million homes and industry and which flows through over 6,300 miles of sewage lines, 420 lift stations and 40 treatment plants is clean and sanitary as it enters the bayous. At the heart of the system is the city's showcase complex, the multi-million dollar 69th Street Wastewater Treatment Plant. It can treat over 200 million gallons per day. At the time of its construction, it was the largest single project ever built by the city's Public Works and Engineering Department.

69th Street Wastewater Plant
May 21, 2008
*Photo by Susan Smyer*

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