History of the Portsmouth, N.H. Sewerage System

"Bird's Eye View of Portsmouth, Rockingham Co., New Hampshire, 1877," by J. J. Stoner. The city hired a professional engineer in 1877 to help solve its sewage disposal problems, complicated by its low-lying areas and near-surface bedrock.

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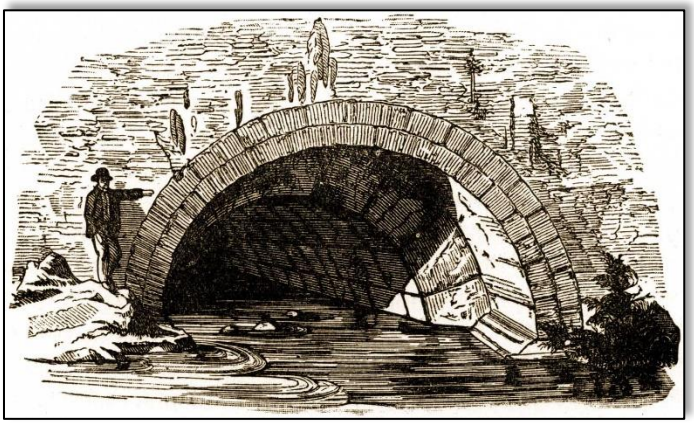
1. INTRODUCTION

Clean drinking water is our greatest need for without it we last about three days before our organs begin shutting down. As human populations cluster and discard their wastes, ready sources of drinking water in streams and ponds become polluted and human survival wanes. It was recognized early on that some water harbored contaminates that could sicken or kill. Water emanating from the ground was found to be clean and settlement clustered around natural springs until humans developed the dug well, perhaps 8,000 BC. Water supply ditches, tunnels and aqueducts, storage cisterns and reservoirs fed by springs and wells followed over the centuries allowing humans to concentrate into large societies in cities.

After a water supply, the next greatest need of a city is a means to remove human excreta and other waste material containing the germs of disease. It was not until the second half of the 19th century however, that the seriousness of this need was explained by science and fully appreciated.

The Greeks recognized that disease was spread by human contact, but in other cases was seemingly spread by "seeds" floating in the air. The Romans postulated that the "seeds" were actually minute creatures that bred in swamps and were released into the air. This *miasma* – Greek for pollution – was known as "bad air" and was attributed to the rotting of organic matter and the cause of the Black Plague, cholera, typhoid, malaria and other diseases.

The Romans built great underground drains to carry rainwater and waste from the city but most cities up to the 19th century were laced with open ditches leading downhill to a stream or river. A law governing London, England's sewers was enacted under the reign of Henry VIII but did little to prevent the construction of separate systems that were interconnected without regard to conflicts of size or grade. By the 18th century London's sewers were an ill-designed maze that perpetually clogged and backed up.



Mouth of the *Cloaca Maxima* or Great Sewer, of Ancient Rome (Marston and Fleming, 1908).

Following the Hamburg, Germany, conflagration of 1842, English engineer William Lindley designed a new sewer system for the city that he placed underground and integrated with other aspects of the reconstruction plan. Hamburg's new system proved so satisfactory that it "awakened public recognition of the need of improvement of such works" and marked the beginning of modern sewerage practice.[1] Lindley went on to design new underground systems for cities across Europe.

On the heels of the innovations at Hamburg came another turning point in urban sanitary thinking. The outbreak of a worldwide cholera pandemic (1846-1860) spread to London in 1848 where it eventually killed over ten thousand. Data collection and experiments by physician John Snow made during the course of the London epidemic proved the disease was spread by contaminated water. In 1855 Parliament passed acts for better sanitation and formed the Metropolitan Board of Works to plan and build a modern sewerage system, a precedent soon followed by other cities.

In America, cholera was killing people by the thousands in the major ports of entry and spread to the interior by way of New Orleans and the Mississippi River killing 4500 in St. Louis in 1849 alone. Another cholera wave killed 3500 in Chicago in 1854. As word spread that contaminated water carried the disease, states began creating boards of health to improve sanitation, Louisiana being the first in 1855 following their cholera outbreak.

The miasma theory had prevailed as the cause of the spread of disease up until the 1850s when John Snow's findings had pointed to a different theory. The work of Louis Pasteur, then Robert Koch and others that followed, identified specific pathogens and firmly established the modern germ theory of disease. The discovery of the typhoid fever bacillus in 1880 by Karl Eberth established the link between sewage disposal and disease-carrying stream pollution and "marked the beginning of a new era in sanitation."[2]

The response to these discoveries was immediate. New Hampshire established a State Board of Health in 1881 with powers to investigate, report and correct issues of sanitation that put its people at risk. In 1886 the Massachusetts Board of Health was given independent powers to supervise and enforce sanitary water supply and sewage disposal practices. The Massachusetts Board founded the Lawrence Experiment Station in 1887, the first laboratory in the world to conduct experiments on drinking water purification and sewage treatment. Its director Hiram F. Mills in conjunction with Massachusetts Institute of Technology scientists established filtration methods and other practices of modern sewer sanitation that were widely adopted and form the foundation of the methods in use today.

The first sewers in America, as elsewhere in the world, were constructed for the purpose of carrying away rainwater and draining low laying swamps and bogs, thought to be the source of the miasma. The term *sewer* is derived from *essevour,* Old French for drain or ditch. The term *drain* was often used interchangeably with *sewer* to describe the typically open drainage ditches that were built in most cities and towns until the latter half of the 19th century. These drains were the natural repository for human and kitchen waste and became a nuisance in hot weather and wherever frequent heavy rains did not keep them flushed out. Cities built on coastal plains or otherwise flat ground with little elevation difference between the streets and the water course into which the sewers drained, suffered from frequent backups and stench.

After it was proven that surface disposal of excrement was polluting water supplies and spreading disease, there was a great movement to design sewers as underground pipes and tunnels using hydraulic engineering principles to insure adequate flushing. In the U.S. the first engineered sewers are considered to be those designed by Julius Adams in 1857 for the City of Brooklyn, N.Y. and Chicago's system designed by E. S. Chesbrough in 1858.

The Brooklyn and Chicago systems and most that followed including those of Providence, R.I. and Boston, Massachusetts, that were noteworthy for introducing important advancements, were "combined systems" based on the European precedents in which rain water and sewerage were carried in the same conduits. An entirely different methodology called the "separate system" was built in 1879 in the city of Memphis, Tennessee, the first of its type in the U.S. It was designed by Col. G. E. Waring, an engineer based in Newport, Rhode Island, to be a closed system of piping completely separate from the storm water drains and equipped with water reservoirs for automatic flushing.

The separate or "Waring system" quickly gained advocates. Keene, New Hampshire, one of the earliest adopters, commissioned Waring to design their system in 1882. The separate system proved troublesome in certain situations and by the early 20th century the combined system had become the accepted standard of practice by the sanitation engineering community.[3]

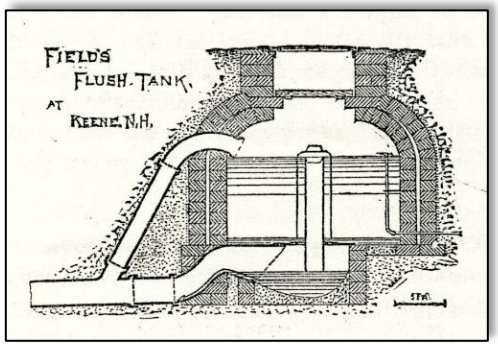
2. NEW HAMPSHIRE SEWERAGE SYSTEMS

The earliest sewers constructed in New Hampshire towns were often the simplest possible drains constructed for the purpose of carrying away rainwater and draining wet areas. The cheapest were unlined open ditches, the next improvement being open channels lined with stone or brick and finally covered channels and buried piping. References to these various types of structures can sometimes be found in town financial reports and engineering reports that refer to "existing conditions." Detailed information regarding the history, design and construction of these early drains and sewers is lacking.

Surface water drainage systems that evolved into sewerage systems, sewage meaning wastewater containing human excrement, rarely met the needs of the growing population. Even the engineered sewer systems of the late 19th and early 20th century were soon undersized as hotels, apartments, and residences were fitted with sinks, water closets and bath tubs fed by a public water system.

New Hampshire's largest cities were motivated to study and upgrade their drainage/sewer systems after contaminated water supplies were implicated in the London cholera outbreak. The first seems to have been the city of Manchester that hired James Slade, a civil engineer from Boston, Massachusetts, to study and report on its system in 1856.[4] In 1868 the Concord City Council approved hiring James A. Weston, a civil engineer from Manchester, New Hampshire to "make a survey of the city and a profile of the streets and various localities requiring drainage, with a view to the establishment and construction of permanent and substantial drains and sewers."[5]

Shortly after Keene, New Hampshire, incorporated as a city in 1874 it hired Civil Engineer Phineas Ball of Worcester, Massachusetts, to study the requirements of "a proper system of sewers."[6] Ball proposed building a combined system but no immediate action was taken. Construction of a "separate system" of sewers designed by George Waring, noted above, began in 1883.



Underground flush tank with freeze-proof double brick walls built in 1883 for Keene's separated "Waring system" of sewers, among the first of the type built in the U.S. (State Board of Health, 1884).

In 1877 the Sanitary Committee of the Board of Aldermen of the City of Portsmouth engaged L. Frederick Rice, a civil engineer from Boston, "to inquire into the best method of improving the sanitary condition of the North and South Ponds…[which] as receptacles of our drainage have become mere cesspools on a large scale."[7]

The era of modern sewerage and sewage disposal in New Hampshire began on August 16, 1881 with the establishment of the State Board of Health (Board).[8] The law specified the Board's duty regarding sanitary matters:

> The board shall take cognizance of the interests of health and life among the people of the state, making sanitary investigations, and advising and assisting local boards of health in conducting special investigations into the cause of epidemics and the sources of mortality; and they shall collect such information in respect to these matters as may be useful to the people of the state, and report the same, through the governor and council, in the same manner as other state officials are now required to do.

Laying Laconia's 15" main outlet pipe discharging into the Winnipesaukee River at Dixon's Point in 1891 (Waring 1892).

The Board was composed of three medical doctors and one civil engineer, plus the Governor and Attorney General. Within three months the Board issued its first informational "Circular," copies of which were sent "to all physicians, and town and city authorities or health boards in the state; also to all the states newspapers and journals."[9] Circular No. 1 was addressed "To Local Boards of Health, Physicians and others, interested in Sanitary Science" and began with an appeal for help with their mission:

> We ask the earnest and hearty cooperation of all who desire to better the sanitary conditions of our state, who would alleviate human suffering and death. Most prominent in our work will be the instruction of people relative to the causes and prevention of disease; to study local conditions affecting health, – soil, water supply, ventilation, drainage, climate, productions, race, population, and social conditions; to obtain correct and reliable vital statistics; to watch the invasion of contagious and infectious diseases, to study the conditions that produce and maintain them, and to devise and recommend methods for their control; to systemize the work throughout the state by cooperation with local boards of health, and all interested in sanitary science.[10]

In their 2nd Annual Report, the Board reprinted an article from *The American Architect and Building News* entitled "The Sewerage of the City of Keene, N.H." by L. M. Muzzey, describing the innovative system built there. In the 3rd Report, "Homestead and Suburban Sewerage" by J. T. Fanning, a civil engineer practicing in Manchester, was reprinted. Fanning gave detailed descriptions and drawings of sanitary systems suitable for dwellings in areas outside of cities not equipped with drains and sewers. These were the first of many technical papers on sewerage practices regularly included in the Reports well into the 20th century. In 1921, for example, a "Special Bulletin" was published and distributed entitled "Sewers, Sewage, Sewerage and Drainage, Information for Town Officials and Others Responsible for the Proper Layout and Construction of Pipe Sewers & Drains; Especially for the Betterment of Villages or Neighborhood Districts."[11]

The creation of the State Board of Health and its dissemination of practical information was likely responsible for much of the adoption of modern sanitary sewer practices across the state. During the 1880s the cities of Laconia, Nashua and Claremont conducted studies of their drainage and sewer needs and constructed systems. In 1891, Laconia constructed a "separate system" of sewers like that of Keene, as described in the Reports. [12]

By the end of the nineteenth century the state's sanitary problems related to sewer disposal had undergone great change. Judge Edward E. Parker, in 1898, described the progress made in Nashua that was applicable to many of the state's cities and towns:

> The various innovations and improvements made in regard to our sanitary condition have been slow but sure and permanent. Years ago, early in the twenties and even up to the fifties, when there were practically no sewers and the people drank from the old fashioned wells, there were, at each autumn time and even throughout the summer abundant cases of typhoid fever, dysentery, and other kindred diseases. On the adoption of the system of sewerage and the supply of pure water the whole trouble pretty much ceased. I remember that one of the older physicians said, that during his early practice, in the autumn months he would have anywhere from twenty to thirty cases of typhoid fever to treat; but that since the city had put in the sewers and given us Pennichuck water he rarely had more than eight or ten. This goes to prove the efficacy of good drains and pure water in eliminating disease. The well water was all right until the increase of people, settling so close together, had polluted the soil, then it became a veritable poison to the system. We have at the present time a very complete sewerage system, the refuse of all sewers being eventually carried away by the Merrimack river.

3. PORTSMOUTH'S SEWERAGE SYSTEM

When the Aldermen hired L. Frederick Rice in 1877 to study Portsmouth's sewerage system, the problem had reached the boiling point. The mess had grown incrementally with the haphazard construction of sewers dumping into the two large tidal ponds on the north and south sides of the city. Blame could be laid in part on the taxpayers who had proven a conservative lot with little appetite for costly public improvements. Five hundred copies of Rice's report were printed and "distributed as called for by citizens." In their introductory comments, the Aldermen braced the taxpayers for the potential cost:

> That this system can be carried out at small expense is not to be thought of; we think it is beyond a question of cost; it has become one of vital importance, a question of health and length of life.

The Aldermen noted that the subject of sewerage in cities was at the forefront of discussion, "particularly so where such primitive means as we find here are used to put out of sight the refuse which needs such serious consideration." They continued:

> "The North and South Ponds, as receptacles of our drainage, become mere cesspools on a large scale, where the heavier matter deposits itself, while the lighter in a series of tides finds its way to the sea. Low water exposes the deposits: a summer's continuous sun with a westerly or southerly breeze wafts the odor of the decaying refuse to our streets and homes, each pond rivaling the other in the quantity and quality of offensiveness. This trouble has been of long standing, but its continuous growth by gradual accumulation and increasing sewerage call our attention to the necessity of active measures for the permanent abatement of the cause of the trouble.
>
> … you should not be disappointed in finding that first-class sanitary conditions are only to be attained by a corresponding expenditure at the outset… [but] if carried out would at once and probably forever wipe away these nuisances and give us in place two sheets of pure water, beautifying forever our surroundings, and causing by their purity and the undulating nature of their borders such probable erection of residences and improvement of grounds that it would be only a question of time when the expense incurred to-day would prove but nominal to the results attained… and with the expenses properly apportioned or distributed by a bonded debt with a sinking fund, the annual draft need be but small while we shall each year reap the whole benefit of our investment, by a purer atmosphere, a beautiful city, a charming, annual visitation from abroad, and general happiness.

Engineer Rice provided further explanation of the problem:

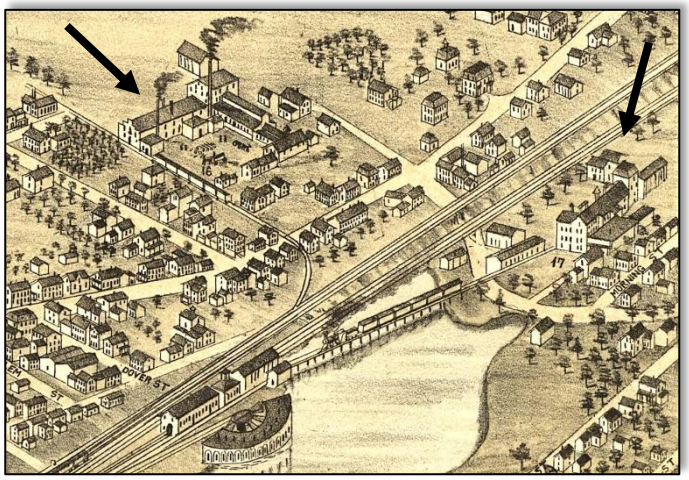
> The most densely populated portion of your city lies between two ponds, which are formed by damming the outlets of two bays emptying in the Piscataqua River, and which, although filled by the incoming tide, are slowly emptied through the sluiceways of their respective mills and the current through them thereby rendered very sluggish. Into these ponds a number of drains – public and private – have for years emptied, and the solid refuse matter brought down by them has gradually accumulated until the depth of water near the outlet of these sewers has been greatly decreased. Into these drains or directly into the ponds, several privies are discharging, altho' in violation of a city ordinance.[13]"

Rice identified several sewers discharging into South Pond, "which for some hundreds of feet are mere open ditches." Numerous private drains and privies overhanging the pond were observed near the outlet of the pond. The sewage floated across the surface of the pond, settling on the bottom as the water was lowered each day by the working of the tide mill at the outlet of the pond. On exposure to air the whole of the pond emitted a crippling stench.

The same conditions existed at North Pond where two large sewers emptied into the upper end of the pond. The so-called Jones' sewer, built by the city in 1868 by Mayor Frank Jones' to serve his

brewery, was a covered stone box culvert roughly 3 feet square that collected the liquid waste from the ale brewing process. It also collected sewage from houses above the brewery along Cabot and Middle streets that ran in an open ditch to the culvert. From the brewery the sewer culvert ran to a point between the Eastern and Concord railroads where it emptied into a "stagnant pool of putrifying matter, perhaps 100 feet in length, choked with old railroad ties and rubbish."[14] The pool then drained into the head of the pond through a culvert under the Concord railroad tracks.

The other large sewer dumping into North Pond was also a covered stone culvert collecting the waste from Eldredge's Brewery along with all the surface drainage from the general area. In addition, several smaller covered sewers were also found terminating along the east side of the Eastern Railroad embankment where another large pool of open sewerage accumulated, eventually draining through culverts under the railroad into the pond.



Bird's Eye View map, 1877 showing Jones Brewery (left arrow) and Eldredge Brewery near the head of North Pond. The brewery sewers were each stone box culverts that also collected effluent from numerous other drains and sewers in their respective areas, all of which was discharged into the pond.

Rice concluded that as long as the ponds were used for mill purposes there would remain insufficient flushing to move the sewage into the river. The only practical solution was to build new sewer trunk lines to the river and connect the line dumping into the ponds to them. Rice provided a detailed plan using "stoneware pipes" of increasing sizes from 6" to 18" to intercept existing drains and culverts and then empty into two new 24" brick sewers leading down to the river. The North Pond system would empty into the river at the Concord and Portsmouth Railroad Wharf [in the vicinity of the State Pier]; the South Pond system would empty at Melcher and Salter's Wharf at the foot of Charles Street [in the vicinity of Sheafe Warehouse in Prescott Park]. Each outlet was to be equipped with an outlet chamber below the low water mark and tide gates to prevent backflow up the sewers during high tide. The hydraulic design of the system was oversized to accommodate the retention of all of the inflow normally anticipated during the high tide cycle and equipped with overflow basins to contain any excess inflow during exceptional rain events.

Rice also proposed that "the filthy pools" be filled in and that the ponds be dredged and the material deposited along the shoreline and covered with clean material to create usable land. Alternatively, he suggested "if the gates at the mill are of sufficient capacity to pass a scow, the mud might be taken out into the swift current of the river and there dumped." [15]

A rough understanding of how the city got in such a mess by 1877 can only be pieced together by the occasional mention of "drains" and "sewers" in the newspapers along with a handful of entries in the Annual Reports of the city pertaining to the relatively few proper sewer lines – meaning covered culverts of some substantial construction built by the city up to that time. It was a subject that was rarely discussed and not in any comprehensive way until the Rice report.

Open ditches and drains to carry rainwater runoff were evidently constructed with public funds along the sides of the roads in the course of street improvements made by the city. These open

drains became to be regarded as "common sewers" and the contents of chamber pots and pail closets were often emptied into them.

In 1845 the Portsmouth Board of Health enacted regulations requiring that waste water from houses must be "conveyed by their owners to the common sewers" and that the "content of privies and vaults shall not be permitted to rise within one foot of the surface of the earth."[16] In most cities, high-use privies such as those serving hotels, boarding houses, schools and in some cases large households that could afford it, were emptied at night by "nightmen" hired to remove the "night soil" which was emptied into carts and hauled out of town to be dumped into fields or into the river. The offensiveness of the work dictated its execution at night, often by ordinance, hence its name. It was reported in the late 1840s that the nightmen of Portsmouth chose to operate during the day and were observed by a visitor to the city who noted that "principle streets were rendered impassable for any man or woman of decency by the constant passage through them of carts loaded with the contents of your privies."[17]

The earliest "common sewers" that could be identified as built by the city ran along Cabot Street, "commencing at the land of James Rundlett, Esq. and following the low land to the North Mill Pond."[18] Other than it was built in 1848, no other details regarding its construction were found. The city's Annual Report for 1848 only notes that $2,140.72 was expended for "Roads Streets, and Common Sewers."

Brief mention of the drain being laid for the new federal Custom House being built in 1875 was made in the newspaper. It was laid down State Street to the river and in later years referred to as a stone box drain. While digging the trench human bones were found buried about four feet deep in the middle of the street with evidence they were originally contained in a coffin.[19]

Few municipal improvements were made during the years of the Civil War but as the toll on soldiers taken by disease and sickness became evident, over 50% of the dead, there were renewed calls for improvement in the city's sanitary conditions. In his address to Portsmouth's citizens in 1865, John H. Bailey made perhaps the first mayoral plea for better sewers:

> I would call to your attention to the importance of constructing durable sewers in the principal streets. We are very deficient in these valuable outlets for the water and filth of the streets. They are required not only as a matter of convenience, but also and especially for the health of the inhabitants of the City. The work can be performed by degrees by using each year, a portion of the appropriation for streets. Vaughan street, during the past winter and spring, must have convinced everyone that it is impractical for the large flow of water in that vicinity to be carried away upon the surface of the ground.[20]

Despite his hopes, no sewer construction of any apparent significance was completed during Bailey's term and it would be his successor, Frank Jones, who would become associated with the first era of municipal sewer construction although not entirely by choice.

Frank Jones was mayor of Portsmouth from 1868 to 1869 and a New Hampshire U.S. Representative from 1875 to 1879. By 1889 he was the state's wealthiest person (McClintock 1889).

Jones was the owner of Frank Jones Brewery, a large concern that along with Eldredge Brewery was responsible for dumping their waste products into the "cesspool," a low area at the head of North pond that was partly impounded by a railroad embankment and failed to adequately flush with the tide to prevent an overreaching stench in the summer months. Neighbors lodged complaints and then a suit, against Jones, the railroad and others, demanding relief.[21]

During his two terms, 1868 and 1869, Jones oversaw city construction of several sewers of stone box construction including along Cass and Islington streets to serve the Brewery, and along Hanover, Brewster, Anthony, Vaughan and Cabot streets. Most importantly, it would seem, in 1869 an ordinance was passed "establishing a general system of sewerage" for the city, requiring "all drains to be constructed under the direction of the street commissioner" and allowing for abutters to connect to the sewers for a fee of 1.5 percent of the tax valuation of their property.[22] The law and the connection fees ultimately proved ineffectual in delivering the needed order and improvement to the sewer system.

In July 1869 the state legislature passed a law requiring that all buildings used as dwelling-houses within the compact part of any city or town be equipped with suitable privies and vaults and with drains for conveying away the sink water from the premises and into a public sewer whenever one is located within 100 feet of the building.[23] This law along with many others dealing with sewer sanitation, amounted to desperate efforts to control a problem that grew increasingly out of control along with the population explosion of industrialized cities through the late 19th and early 20th century. The lack of political will or civic resources left most sanitary sewer laws unenforced.

Mayor Joseph B. Adams (1870-71) continued much of the sewer construction started under the Jones administration, including completion of the Vaughan Street sewer and reconstruction of portions of the Bridge Street sewer with cement pipe, a relatively new product at the time for sewer lines.

During the remainder of the 1870s sewer construction appears to have continued at a brisk pace based on the large expenditures for cement pipe, labor and other supplies listed under the general heading of "Sewers" in the Annual Reports; unfortunately neither the sewers or streets they were laid in were referred to by name.

In 1875 Mayor Moses H. Goodrich (1874-1875) noted in his address that "the condition of the mill ponds at the north and south ends of the city has become the subject of much public discussion and anxiety; the putrifying waste accumulating there causes great apprehension of the danger to the public health." But he said he was "not prepared to decide what is the best remedy for this great evil" and did nothing, leaving the problem to the next mayor, John H. Broughton (1876-77).

Broughton in his mayoral address also mentioned the condition of the ponds saying that it had become necessary "that something be done speedily to purify those water and prevent the accumulation of filth in them." In September 1877, Broughton appointed a special Sanitary Committee of the Board of Aldermen with authorization to hire a qualified engineer to study the problem. L. Frederick Rice became the first professional engineer to examine the city's sewerage system. Rice, a consulting civil engineer with a practice in Boston, had just designed the sewer system for the city of Lawrence, Mass. He also designed the water systems for several New England cities and served as president of the Boston Society of Civil Engineers in 1887.

Rice was paid $385.75 for his study and plan of action, but little action was taken. Over the next five years, under the Street Commissioners budget, short sections of sewers continued to be extended along streets to allow connections of house drains, which in turn provided the city with a bit of revenue. But many of these new lines fed into existing sewers that emptied into the ponds, or were extended themselves to empty directly into the ponds. The topography, earth conditions and civic thrift of Portsmouth would continue to dictate the growth of the sewer system well into the next century.

Mayor after mayor proclaimed their intention to remedy the problem of the ponds but they balked at the cost. In the 1881 election putting Mayor John S. Treat (1882-1883) into office, the voters

nearly unanimously approved a resolution enjoining the city to abate the nuisance of the mill ponds. Treat responded to the voters that "it is no easy task and requires a great deal of thought and attention… it cannot be done without a large outlay, which at this time will bear heavily on our citizens." In 1882, under Mayor Treat, the city acquired the lease on North Pond from the Eastern Railroad and threw open the tidal gates at the mouth, discontinuing further use of its tidal power. Trout proclaimed "the purity of the water largely increased" and proposed that should a series of traps and filters with a canal extending beyond the Eastern Railroad round house be adopted, we would soon rid ourselves of its disagreeable odors." In other words, simply permanently opening the tide gates did not provide the much hoped-for relief.

Out went Treat and in came Mayor Calvin Page [1884], who gave his view of the problem:

> Ever since the mill ponds commenced to annoy us with their offensive odors, and poison the atmosphere with the foul gases that originate from them, there has been constant agitation in the newspapers, among the people and in the city government in regard to the mode of remedying the evil, until the whole discussion has become as distasteful and disgusting to the citizens as the ponds themselves, and the public has been worn out and tired with the subject. From the best information I can gather, I believe that the south pond, though not free from odor and still capable of being improved, is however, in comparison with the north pond well enough for the present; but the north pond demands our serious, earnest and immediate attention. I am not able at this time to recommend any definite plan to obviate the trouble.

Page failed to advance any solutions in his one term. In 1885, Mayor Marcellus Eldredge (1885-1886) announced the construction of a large brick sewer "from near Creek street along the railroads and through Deer street to the river." The Deer street sewer was a critical part of Rice's plan, proposed fifteen years earlier, that Eldred claimed had proven "a bugbear to each successive City Government." Rice's original intent of the line was to intercept all sewers and drains running into North Pond, but for reasons that remain unclear, that objective would not be fully met.

The Deer Street sewer work was completed in 1886 by contractor R. D. Shanahan who was paid $19,291.95. Additional expenditures on the project brought the total to $37,282.52 which was paid for by selling part of the City Farm for $22,366.00 and by issuing city bonds.

Within a year of completion of the Deer Street sewer, also referred to as the North Pond intercepting sewer, incoming Mayor George E. Hodgdon proclaimed "the offensive odors arising from the pond that threatened widespread epidemic have completely disappeared," recommending that the same remedy for South Pond with the construction of "a large sewer along the north-westerly side of the pond to cut off the sewage and carry it into the deep waters of the river." But again, despite eloquent calls from each successive mayor, nothing was immediately accomplished.

A turning point came with Mayor Charles P. Berry (1893-1894) who upon taking office informed the citizens that fundamental changes in the sewerage system were required:

> It has been the custom in years past to lay sewers promiscuously, wholly disregarding future needs or effort toward a systemized plan. Were the drains of our city uncovered, they would, no doubt, be found running across lots, and forming a most intricate tangle, the unraveling of which would puzzle the shrewdest of engineers. I believe that all lines of sewer should be laid on public property, and that no person should be allowed to construct any sewer without first obtaining a permit…[that is] in compliance with some well-considered plan.

Berry called for an "expert to lay out a general plan of sewerage for the city," and hired civil engineers J. A. Farrington and Leon E. Scruton to survey the system and prepare plans.[24] Upon completion of the overall plan (no copies of the plan are known to exist) the first work was construction of the South Pond intercepting sewer that Berry called "a great trunk line sewer,"

from Miller avenue to Shea's wharf, a length of 4,760 feet of 48" pipe. Placing the outlet at Shea's wharf met with great resistance from property owners along the shore south of the outlet but the line was ultimately completed as designed in the spring of 1896. Due to the low fall of the pipeline, roughly 42", and the need to keep the tide-gate at the outlet closed for 16 hours a day, the sewer was equipped with a 12" flush line fed by South pond to keep it clear of any settled deposits. Another 3000 feet of connecting sewer line was completed in 1896 in conjunction with the South Pond line.

The work of unraveling the intricate tangle of old sewers and rerouting, relaying, and interconnecting them continued over the next decade along with the construction of new lines in streets under development or previously unserved. But no matter how large the scale and speed of the corrective efforts, the city could never seem to keep up with citizen complaints about the sewer problem. Once the overpowering odor coming from the two mill ponds had been mostly eliminated, complaints arose over the stench of Puddle Dock, the small inlet west of Union wharf to which the term cesspool had now been directed, and over the sewer gases emanating from many of the gutter openings (catch basins) that were not equipped with "stench traps."

In 1896, after receiving numerous complaints from abutters of Puddle Dock, one of the first acts of the newly created city Board of Health was to petition the Board of Aldermen to direct city resources to fill in the dock. After the request was approved with some difficulty the Health Board reported, "we succeeded in beginning a slow process of filling at the upper end."[25] Empowered to investigate complaints of unsanitary conditions, the city Board of Health examined the offending catch basins and discovered forty that were not fitted with traps, which were reported to the Aldermen for correction by the superintendent of sewers.

The next big hope for advancement of the city's sewer system came in 1899 with the hiring of Leon S. Scruton as Street Commissioner, under which the sewers were managed. That Scruton had designed the plan of improvements for the sewer system just three years prior made him the most qualified candidate for the job. Scruton was a native of Rochester, N.H. and had obtained his degree in civil engineering from Dartmouth College. Unfortunately Scruton lasted only two years in the job, the reasons for which are unclear; budgetary constraints reflected in the annual expenditures for sewers and streets may have played a role.

During the first two decades of the 20th century small but steady improvements and expansions of the sewer system were made each year within the allotted annual budgets which averaged about $3,500 between 1900 and 1920. In 1905 a long-called for intercepting sewer along the south side of South Pond was built with an additional special appropriation of $3,000. The Board of Health continued to make regular recommendations, reporting now to the City Council, to correct sewer-related health problems; an example from their 1908 report: "One of the best things accomplished, was the extending and repairing of the Thornton Street sewer, whereby the danger of a serious epidemic was averted."[26] The outbreak of 35 cases of diphtheria in school children that year, requiring a 21-day quarantine followed by six or eight weeks of prohibition from school, had prompted quick action by the city even though the source of disease was uncertain.

In closing their 1910 report to the Mayor and Council, the Board of Health made this plea: "We would urge the city to build sewers wherever there are none, to remove all sewage from our mill-ponds, and to extend all constructed sewers to tide-water." From this it seems evident that despite all the work done since 1877, Rice's recommendations to clean out the mill ponds by dredging and to send all of the city's sewage to the river, remained to be fully realized.

Part of the problem was undoubtedly due to the fact that a large amount of the budget was spent repairing the existing system and trouble shooting. In 1916, for example, Mayor Samuel T. Ladd reported:

> We had seventy-three reports of sewer troubles during the year. Sixty-one of these were located in the private drains. Twenty-five catch basins were found clogged, and six sewers stopped with sticks from the basins. Two of the stoppages were caused by poor connections. One sewer was found to be clogged with cheese cloth. The remaining complaints were caused by dirt in the sewers.

Despite the unpredictable needs of the aging system, the city continued to make incremental but important improvements. In 1920 and 1921, for example, 400 feet of new sewer was laid on Aldrich Road, 200 feet on Porter Street, 200 feet on Nobles Island, 270 feet on South Street, 192 feet on Sherburne Avenue and 214 feet on School Street. In addition the outfall on Shea's wharf was "thoroughly repaired and put in first class condition."

Mayor Fernando Hartford (1921-1922; 1928-1932) however, promised more fiscal conservatism of the type that had been the bugbear of Portsmouth's sewer advancement for decades:

> While a great expenditure could be made for a new sidewalk, sewer extension, etc., it is well that we pause, take count of stock, and see just where we are at, with a look into the future, and establish beyond any doubt just what our needs are to be, and just what we can afford to spend.

When the old brick sewer on Miller Avenue proved of insufficient capacity to resist backing up and overflowing during heavy rainfalls, Hartford chose the least costly solution of piping the overflow into South Pond – for the future to deal with. That was evidently fine with the taxpaying voters who put Harford back in office for five terms in a row from 1928 to 1932. In 1929 Hartford reported:

> The sewer system has not improved. In fact, in some places rapid deterioration would indicate the necessity of radical changes and replacements. The usual spring and fall floods were experienced due to the backing up of the tide in the main trunks.

Wyman P. Boynton fulfilled graduation requirements from the Massachusetts Institute of Technology in 1933 with a thesis entitled "Study of the Public Works Department of the City of Portsmouth, New Hampshire." A portion of his findings on the Sewer Department follows:

> The sewer system of the city is of the combined type and is in very poor condition. In one place, for example, a four foot box sewer empties into a thirty inch pipe. There are also a great number of private sewers about which practically nothing is known. It has apparently grown as required with no thought to the future demand on the system due to the increase of population in the district, and will have to be rebuilt. The condition has been aggravated by the lack of engineers in the office of the Superintendent of the Board of Public Works. There is no complete, accurate map of the system in existence at the present time, and there are but few records of sewer installations on file.
>
> Considerable difficulty was experienced in obtaining any figures on the cost of sewers. On only two short lines of 8" Akron pipe put down in 1924 were the costs available. The only available figures on maintenance were the annual appropriation and the cost of clearing stoppages during two years. The appropriation for maintenance has increased from $3,000 in 1924 to $5,000 in 1931.
>
> As no record is apparently kept of the actual cost of sewer maintenance, it is probable that the appropriation does not reflect the actual amount spent on that item. The sewer revolving fund established in 1923 as a working capital to finance the construction of new lines of sewers and connections which would be repaid by the beneficiaries was entirely extinguished during the years 1927 to 1929. This is due either to failure to make proper benefit assessments or diversion of the funds to other purposes without the necessary provision for replenishment.

> It will be necessary in connection with the rebuilding of the sewer system to eliminate the present outlets at the foot of Dennett Street and the foot of Thornton Street in the North Pond area and the overflow to the South Pond on account of the nuisance created, and the present Newcastle Avenue outlet because of its condition.

Among Boynton's recommendations were that the city should survey the entire sewer system and prepare a comprehensive system plan based on the estimated population of the city in about 1980 and then immediately begin construction of an adequate system as soon as the plans are completed.

No record of the city's response to Boynton's report was found nor was it determined what led to Boynton to choose Portsmouth as the subject of his study. In 1933 however, Civil Engineer John W. Durgin of Portsmouth was hired by Mayor Sylvester F. A. Pickering to prepare a report of recommended improvements to the sewer system with the necessary project plans and cost estimates required for submission to the Public Works Administration for a grant. Durgin's report of September 1933 is presented in full in Appendix A and contains descriptions of the project need and existing components of the sewer system along with the proposed project costs and sketch plans.

The city's proposed improvement project called for construction of 4,687 feet of trunk line sewers, 1,450 feet of lateral sewers and 580 feet of outfall sewers for a total cost of $132,000 based on labor at 50 cents per hour. The plan was approved by the Board of Public Works and an application made to the Federal Emergency Administration of Public Works (PWA) for a grant of 25% of the cost and a loan in the form of a bond issue for the balance. The application was submitted by Mayor Pickering on November 1, 1933.[27]

On January 13, 1934 a loan and grant of $132,000 was awarded to Portsmouth by the PWA for the project.[28] It was not determined when construction began but it was well underway in 1935 when a second application for PWA funds was made in 1935. Mayor Robert Marvin requested $59,177.48 to construct "a trunk line sewer on Maplewood Avenue, in the City of Portsmouth to be connected with the present Deer Street sewer."[29] This line was to consist of 2,318 feet of 24" reinforced concrete pipe and by various connections would divert sewerage flowing into North Pond.

Undated and unidentified photograph showing some section of Portsmouth's sewer system under construction. It likely shows the laying of 24" concrete pipe during the Public Works Administration projects from 1934 to 1937. Courtesy Portsmouth Athenaeum.

By early January 1936 the PWA realized from progress reports that the Maplewood Avenue project was encountering huge cost overruns ranging from 54.8 percent to over 4700 percent on some items in the grant estimate. Laying of the 24" concrete pipe began in early February 1936 on the Deer Street end under the supervision of Civil Engineer Leon Scruton who had been hired by the city to get control of the escalating cost overruns.[30] The February work report showed rock excavation costs running 168% above the estimate and on

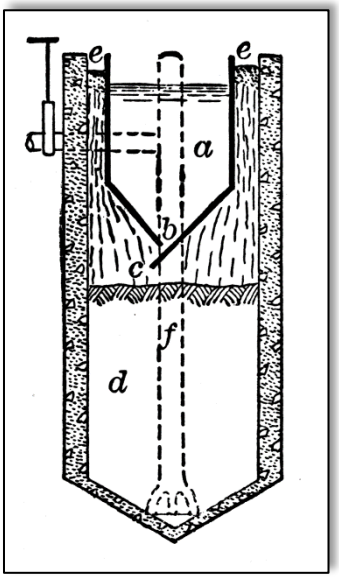
March 10 the PWA shut the job down until a resolution of the federal grant reimbursements could be reached.

With trenches open, the City Council quickly voted to raise the money to resume work and carry the project to completion. Mayor Robert Marvin sent a stern letter to U.S. Representative William N. Rogers (1st District N. H.) who had assisted in acquiring the grant, protesting the city's treatment by the federal government and closing with the following paragraph:

> Please bear in mind that our position is this: that the Federal Government has broken its contract through some ex parte methods of its own and that we are assuming the completion of this project reserving and demanding our right to receive 45% of the amount already expended by us and then closing the matter. I have previously asked Mr. Lockwood, State Director, for forms necessary to be executed in order to receive this sum but to date have not received any. I am enclosing a copy of this letter for Secretary Ickes.[31]

How this situation was ultimately resolved was not determined from the available documents.[32]

During the years of World War II several Defense Housing projects were built in Portsmouth and Kittery, Maine to provide housing for the surge in defense workers at the Portsmouth Naval Shipyard. Pannaway Manor was a grouping of 159 homes built along Sherburne Road in Portsmouth by the Defense Homes Corporation in early 1941. The area lacked the required sewers and considerable debate arose over the cost to the city of building a dedicated sewer plant or building a sewer line to connect to an existing trunk line, and how the taxpayers would recoup the costs in either case. Ultimately the City Council approved construction of a line to tie the development to the Deer Street sewer line.



The Imhoff tank was a so-called two-story tank with an upper sedimentation chamber and a lower sludge-digestion chamber. Sewage entered chamber at *a*; sediment fell through slot at *b;* a trap at *c* prevented gas escaping from lower chamber; *d,* sludge digestion chamber; *e,* scum chamber; *f,* sludge removal pipe. Thousands of Imhoff tanks were installed in early sewerage treatments plants across the US in the 20th century but have been mostly replaced; the number remaining was not determined (Folwell, 1929, p. 318).

Wentworth Acres, later known as Sea Crest Village, then Mariner Village and now Osprey Landing, was an 800 unit government housing project built in north Portsmouth between April 1941 and February 1942. The location prevented connection of the housing complex to any of the city's existing gravity sewer lines. The city conducted studies and hearings regarding the sewerage problem and in October 1941 approved construction of its first sewer treatment plant to serve Wentworth Acres. The federal government contributed $57,000 toward the $150,000 cost of the modern plant that remained in operation until the 1980s. The plant utilized "Imhoff tanks" (the German-designed predecessor of modern sedimentation tanks) and chlorination prior to discharge into the Piscataqua River.

Mayor Mary C. Dondero announced in 1945 that a "survey is underway for an overall sewer project for the city," and in 1946 a payment of $223.70 was made for "Plans for Sewers – Federal Works Agency," but no plans or further information about the survey was located.[33]

On January 1, 1948, after 98 years of Council-Mayor form of government, the Council-Manager form of government was

inaugurated in Portsmouth, giving the City Manager control of all phases of municipal administration. Edward C. Peterson was appointed first City manager and in his first report he reiterated what had been said for well over seven decades – the sewer system remained a nightmare:

> It is also true that our sewer system, which has apparently been put together with neither any thought to engineering design nor to future development, is wholly inadequate. While, for complete satisfactory operation, the sewer system throughout the entire city should be redesigned, the cost of such a project being at this time prohibitive, it has been recommended to the City Council that enough money be borrowed on a bond issue to revamp the sewers in sections of the city which are most seriously affected, namely, Essex Ave., Montieth and Dennett Streets, Boyd Road, Miller Avenue and Sagamore Avenue area. It is sincerely hoped that this work, if the money is forthcoming, will be accomplished during 1951.

The passage of the Federal Water Pollution Control Act in 1948 brought attention to the need to eliminate the discharge of untreated sewerage into rivers and coastal waters. The law authorized the Surgeon General in cooperation with other Federal, state and local entities, to develop programs to reduce the pollution of interstate waters and tributaries and improve the sanitary condition of surface and underground waters for public water supplies, fish and aquatic life, recreational purposes, and agricultural and industrial uses. The Federal Works Administrator was authorized to assist states and municipalities in constructing treatment plants to prevent discharges of inadequately treated sewage and other wastes into interstate waters or tributaries.[34]

The much-needed bond issue for sewers was approved by the City Council in 1951 in the amount of $178,000, and between 1952 and 1958 over 18,000 feet of new sewer lines and drainage extensions were built. The major projects included Dennett Street, Lincoln and Miller Avenues, Fairview Drive, Myrtle Avenue, Elwyn Park, Middle Road, Woodbury and Echo Avenues, and Hillcrest Drive.

In 1960 all of Portsmouth's raw sewage except for the small fraction treated by the Wentworth Acres plant continued to pour into the Piscataqua River from eleven outfalls. The city hired the engineering firm of Metcalf & Eddy of Boston, leaders in the field of sewer treatment facilities design, to study the problem and determine the best location for a treatment plant. The engineers presented their findings to the City Council in June 1961, with an evaluation of three possible sites for the plant and their costs: the south end of Peirce Island, $1,325,287; the tidal land in back of Noble's Island, $1,491,100; and the North Mill Pond area near the Boston and Maine Railroad roundhouse, $1,599,200.[35]

The advantages and disadvantages of each site were considered, such as the locations of pumping stations and force mains and most importantly, where the single large outfall from the plant would dump the treated sewage from the entire city. It was concluded that Peirce Island was the best location from the practical perspectives of engineering and construction, total cost, and outfall location. A bitter two year battle ensued over siting the plant on the historic city-owned island that had been zoned for recreational purposes only.

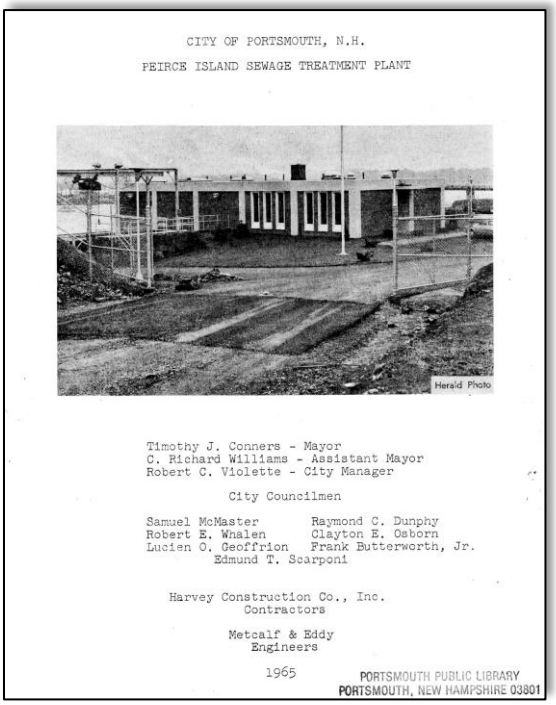
In 1962 the State Water Pollution Commission gave the city two years in which to erect a sewage treatment plant and cease dumping raw sewage into the Piscataqua River. Newly elected city council members tried to pass a motion to study Noble's Island and the former gas-works property at the foot of Marcy Street as alternative locations. Metcalf & Eddy engineer David Duncan told the council that his company would require a new contract to study other locations

and that up to $20,000 in planning costs would "go down the drain" if the Peirce Island site was to be abandoned.[36] The Peirce Island site was finally approved March 29, 1962 in an acrimonious 5-4 vote of the city council.

Rendering of Peirce Island Sewage Treatment Plant that sparked outrage from historic preservationists over its modern design (Portsmouth Annual Report, 1962).

In June 1963, after a rendering of the treatment plant Operation Building (later known as the Sludge Processing Building) was published in the *Portsmouth Herald*, the Directors of Strawbery Banke, Inc. responded with a letter to the City Council, in which they "deplored the building's design and would like to see it revised to be of colonial type architecture…in keeping with its historic site alongside the old breastworks of Fort Washington."[37] With the opening of bids for construction of the plant only weeks away, the Council responded to Strawbery Banke that redesign was "almost an impossibility" and ultimately no changes were made.

Construction of the plant began in August 27, 1963 and the plant was officially opened March 22, 1965 when Mayor Timothy J. Connors threw the main operating switch. A bronze plaque commemorating the project still hangs in the hallway of the Sludge Processing Building.[38] Metcalf & Eddy Engineers produced a short synopsis of the purpose, cost and operation of the plant which is located in the Portsmouth Public Library.


CITY OF PORTSMOUTH, N.H.

PEIRCE ISLAND SEWAGE TREATMENT PLANT

Herald Photo

Timothy J. Conners - Mayor
C. Richard Williams - Assistant Mayor
Robert C. Violette - City Manager

City Councilmen

Samuel McMaster — Raymond C. Dunphy
Robert E. Whalen — Clayton E. Osborn
Lucien O. Geoffrion — Frank Butterworth, Jr.
Edmund T. Scarponi

Harvey Construction Co., Inc.
Contractors

Metcalf & Eddy
Engineers

1965

Cover page of Metcalf & Eddy Engineers project report for the 1964 Peirce Island Sewage Treatment Plant. The report is located in the Portsmouth Public Library.

In 1972 the largely ineffectual Pollution Control Act of 1948 was amended and became known as the Clean Water Act. The amendments specified the means for regulating pollutant discharges into the waters of the United States and gave the Environmental Protection Agency (EPA) the authority to implement pollution control programs. It made it unlawful to discharge pollutants into navigable waters without a permit, but also provided funding for the construction of sewage treatment plants.

Following the Clean Water Act, Portsmouth was ordered by the EPA to separate its sewer and storm water system and begin planning the construction of a larger and more efficient treatment plant on Peirce Island. Planning, approvals, securing grants and other means to finance the improvements stretched into the 1980s. The firm of Whitman & Howard, Inc., of Wellesley, Massachusetts, another leader in the field of sewage treatment facility design, was hired by the City to design the major upgrade of the Peirce Island plant. The firm initially designed a treatment

facility that could meet secondary level treatment. This was later replaced with a design that included primary treatment and primary effluent filtration at the request of the State of New Hampshire. The State of New Hampshire assisted the City with obtaining a 301(h) waiver from secondary treatment. Plans for the new "Wastewater Treatment Facility" (primary treatment and primary effluent filtration) were completed in 1985 but underwent revisions for years until finalized in 1989. Construction of the new plant was completed in 1993. The work required conversion of the Operations Building into the Sludge Processing Building, conversion of the Sedimentation Tanks into Chlorine Contact Tanks and demolition of the Grit Chamber.

Meanwhile, in 1986 the city began construction of the "Sewer Separation Program" ordered by the EPA to eliminate Combined Sewage Overflows (CSOs) where storm water and sewage overflows into water bodies. Old sewer lines were torn up and new plastic sewer lines laid to separately carry rainwater drainage to the river or other water body, and carry sewage to the sewage treatment plant. The hugely expensive work of eliminating CSOs continues today (2019) with all but three of the original fourteen CSOs eliminated. More information of the city's CSO program can be found on the Department of Public Works website under "Wastewater and Sewer."[39]

The Portsmouth Wastewater Facility was upgraded again in 2002. New piping and controls were installed in the basement of the sludge process building. In 2016 the city approved and began construction of the Peirce Island Wastewater Treatment Facility Upgrade Project, a $75 million project to add secondary treatment process equipment to the plant. The work requires modification and partial demolition of the Sludge Processing Building (the original 1965 Operations Building) including removal and reconstruction of the upper level and renovation of the lower level. More information on the Upgrade Project can be found on the Department of Public Works Wastewater and Sewer website, cited above.

4. PROJECT INFORMATION

In 2016, the Sludge Processing Building, the former Operations Building of the Peirce Island Sewage Treatment Plant, was determined to be a contributing property of historical significance within the Portsmouth Downtown Historic District. The building was determined to retain the necessary integrity to convey its association with the development of Portsmouth's primary sewage treatment system following enactment of the Federal Water Pollution Control Act of 1948, as well as the necessary integrity of design to convey the Modern architectural style. The proposed alterations to the building were determined to constitute an adverse effect to a historic property.

This history of Portsmouth's Sewerage System was prepared to satisfy a historic property mitigation requirement contained in the Memorandum of Agreement between the City of Portsmouth, the Environmental Protection Agency and the New Hampshire State Historic Preservation Office, signed 30 September 2016. It was authored by Richard M. Casella, Historic Documentation Company, Inc. Portsmouth, Rhode Island, for the City of Portsmouth, New Hampshire, Department of Public Works.

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[10] Ibid, p. 23.

[11] Robert Fletcher, July 1921.

[12] See James A. Weston, 1868 [Concord]; Young & Gay, Civil Engineers, 1889 [Claremont]; George E. Waring, Jr., 1892 [Keene and Laconia].

[13] Rice 1877, p. 9.

[14] Rice, 1877, p. 16.

[15] Ibid., p. 32
[16] *New Hampshire Gazette*, "Board of Health," May 6, 1845.
[17] See, Ray Brighton, "Disposal of privy contents considered barbaric." *Portsmouth Herald*, September 10, 1989:A4.
[18] *New Hampshire Gazette*, "To Benjamin Watkins…" [Notice of the Selectman], May 23, 1848.
[19] *Portsmouth Journal of Literature and Politics*: "Proposals," December 20, 1856:3; "Custom House," December 12, 1857:2.
[20] Portsmouth Annual Report, 1865, p. 63.
[21] See chapter two, "Beginnings at the Brewery" in Ray Brighton, *Frank Jones, King of the Alemakers*. Portsmouth: Peter E. Randall Publisher, 1976.
[22] Sources for this paragraph include: *Portsmouth Journal of Literature and Politics*: "Proposals for Building a City Sewer," July 18, 1868:3; "Streets and Roads," January 9, 1869:2; "Municipal," May 8, 1869:2.
[23] Laws of New Hampshire, 1869, Chapter 8, Approved July 8, 1869, being a act in addition to Chapter 101 of the General Statutes in Relation to the Removal of Nuisances.
[24] The work of Farrington and Scruton and in some cases detailed descriptions of how the existing sewers were rerouted are given in numerous news articles in the *Portsmouth Herald*. See Oct. 23, 1893; may 19, 1894; 26 May, 1894; July 7, 1894; July 21, 1894; July 28, 1894.
[25] The Annual Report of the [Portsmouth] Board of Health is contained within the Annual Reports of the city.
[26] See report of C. E. Johnson, M.D., Board of Health, pp. 58-59, in 1908 Annual Report.
[27] The grant application and associated documentation is located the Portsmouth Athenaeum, Mayor's Files, Sylvester F. A. Pickering Collection.
[28] "Public Works Adm. Allots Big Sum to Portsmouth." *Portsmouth Herald*, January 15, 1934:1.
[29] The grant application (July 19, 1935) and associated documentation is located the Portsmouth Athenaeum, Mayor's Files, Robert Marvin Collection.
[30] "Begin Pipe Laying on Sewer Job. *Portsmouth Herald*, February 8, 1936.
[31] Ibid.
[32] Further research into the records of Mayor Kennard Goldsmith (1937-1940) who followed Mayor Marvin, held in the Portsmouth Athenaeum collection, might answer how the PWA funding issues were resolved.
[33] Annual Report, 1945, p. 20; 1946, p. 106.
[34] Chapter 758; P.L. 845, June 30, 1948; 62 Stat. 1155).
[35] *Portsmouth Herald*, Jun 17, 1961, p. 10.
[36] *Portsmouth Herald*, March 6, 1962, p. 1
[37] *Portsmouth Herald*, July 8, 1963, p. 1.
[38] The plaque was in place in January 2017 when the Portsmouth Wastewater Treatment Facility Sludge Processing Building was photographically documented prior to alterations. See New Hampshire Historic Property Documentation No. 743, on file at New Hampshire Division of Historical Resources, Concord.
[39] DPW Wastewater and Sewer web page: https://www.cityofportsmouth.com/publicworks/wastewater. CSOs information is located under the Collections tab.

Post Office Address: Box 125

JOHN W. DURGIN

CIVIL ENGINEER

Portsmouth, N. H.,

September 28, 1933.

PROJECT REPORT, PORTSMOUTH, N. H.

To the Honorable Mayor and Council,

Portsmouth, N. H.

Gentlemen:-

The attached drawings show by plan and profile the location and general character of the structures proposed for this project.

The problem of sewage disposal in Portsmouth, N. H. is that of discharging into the Piscataqua River. In the river the volume of rapidly moving tidal water is such that a dilution many times that necessary to prevent nuisance is obtained. This statement applies to the main river, not to its numerous inlets and bays.

Over a period of years the topography of the city and the fact that ledge is usually found near the surface of the ground has led to the construction of a sewer system in which the flow from various natural drainage areas has been carried to several different outfalls. These points of discharge have differed greatly in their character. Outfalls at the main river have been entirely satisfactory. Those on tidal flats have naturally been an offense to eye and sense of smell.

The trunk sewer discharging at the foot of Deer Street and draining an area a mile and one-half in length through the center of the city has always functioned in a very satisfactory manner. It is large enough to carry its load and discharges into deep water without any nuisance. For about two hundred fifty feet it is constructed in the form of a wooden box, 48 inches square, supported on piles under the wharf of the Consolidation Coal Company. It is proposed to replace this section with a sixty inch cast iron pipe as shown on Plan 1604-6.

About forty years ago the south trunk sewer was constructed through the area from Wibird Street to the South Pond and continued to the river at Shea's Wharf. This sewer varied in size up to thirty inches diameter at the river. In 1909 a forty inch to forty-eight inch auxillary sewer was built from Lincoln Avenue through Richards and Parrott Avenues to a point off the latter to relieve the overloaded condition of the older trunk sewer. This construction was not carried through to the river but an overflow was provided into the South Pond so that when the thirty inch line to Shea's Wharf was unable to carry the load the excess would be discharged into the pond. This situation has continued until today and sewage flows into the pond frequently.

Surrounding the pond are the State Armory, Junior High School, Veterans Building, Haven Park, Langdon Park, South Playground, Portsmouth Hospital and many residences. It is to relieve the present unsanitary conditions resulting from sewage discharge into the South Pond that it is proposed to extend the present forty-eight inch sewer along the shore of the pond to Marcy Street and thence continuing with a fifty-four inch sewer through Mechanic Street to an outfall at the river shown on Plans 1604-1 and 1604-2.

To relieve the overloaded conditions at Miller Avenue and Marston Avenue and to serve a section of South Street three comparatively short sections of new sewer are also proposed, see Plans 1604-3, 1604-4 and 1604-5.

A section of the city in the neighborhood of South Street and Newcastle Avenue and including the hospital is served by a sewer known as the "South End Sewer". It discharges on the tidal flats near Newcastle Avenue. It is proposed to abate that nuisance by carrying the flow up Marcy Street and connecting with the proposed new trunk sewer so that the discharge will be in the main river, see Plans 1604-1 and 1604-2.

At the foot of Dennett Street a wooden box carries the discharge from that area out across the flats to the channel. This box is out of repair and much of the sewage is discharged on the flats forming a sludge bed exposed at low tide. The proposed cast iron pipe, see Plan 1604-5, would do away with this condition.

A true copy, Attest:-
Earl D. Smart
City Clerk

File No. 1604 SEWAGE DISPOSAL

SUMMARY OF ESTIMATE

PORTSMOUTH, N. H. SEWERAGE PROJECT

Based on requirements of the National Industrial Recovery Act, labor at 50 cents per hour.

TRUNK SEWERS

Section	Length	Description	Material	Labor
1	1,420 feet	54" Concrete	$ 7,125	$ 40,825
2	1,730 "	48" "	5,850	25,945
3	730 "	18" Tile		
	100 "	20" Cast Iron	1,575	6,290
4	707 "	30" Concrete	1,400	5,900
Totals	4,687 "		$ 15,950	$ 78,960
				15,950
		Grand Total		$ 94,910

LATERAL SEWERS

Section	Length	Description	Material	Labor
1	270 feet	10" Tile		
	430 "	12" "	$ 350	$ 1,120
2	300 "	8" "	750	2,250
	450 "	10" "		
Totals	1,450 "		$ 1,110	$ 3,370
				1,100
		Grand Total		$ 4,470

OUTFALL SEWERS

Section	Length	Description	Material	Labor
1	330 feet	16" Cast Iron	$ 1,250	$ 1,250
2	250 "	60" " "	7,500	7,500
Totals	580 "		$ 8,750	$ 8,750
				8,750
		Grand Total		$17,500

RECAPITULATION

	Material	Labor
Trunk Sewers	$ 15,950	$ 78,960
Lateral Sewers	1,100	3,370
Outfall Sewers	8,750	8,750
Totals:	$ 25,800	$ 91,080
		25,800
Grand Total		$116,880

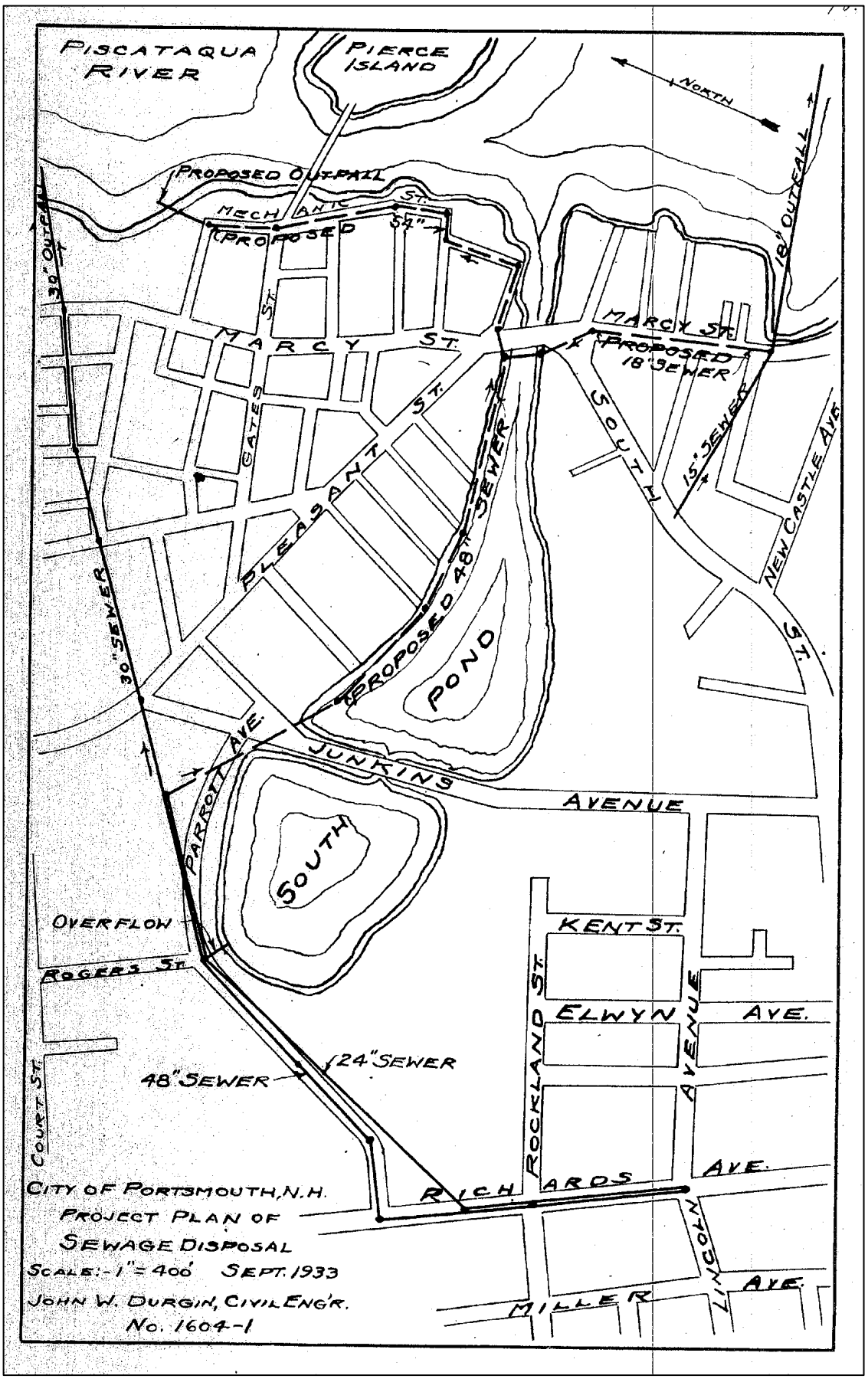
Taken at	$ 117,000
Rights of way	1,600
Engineering and overhead	11,700
Interest during construction	1,700
	$ 132,000

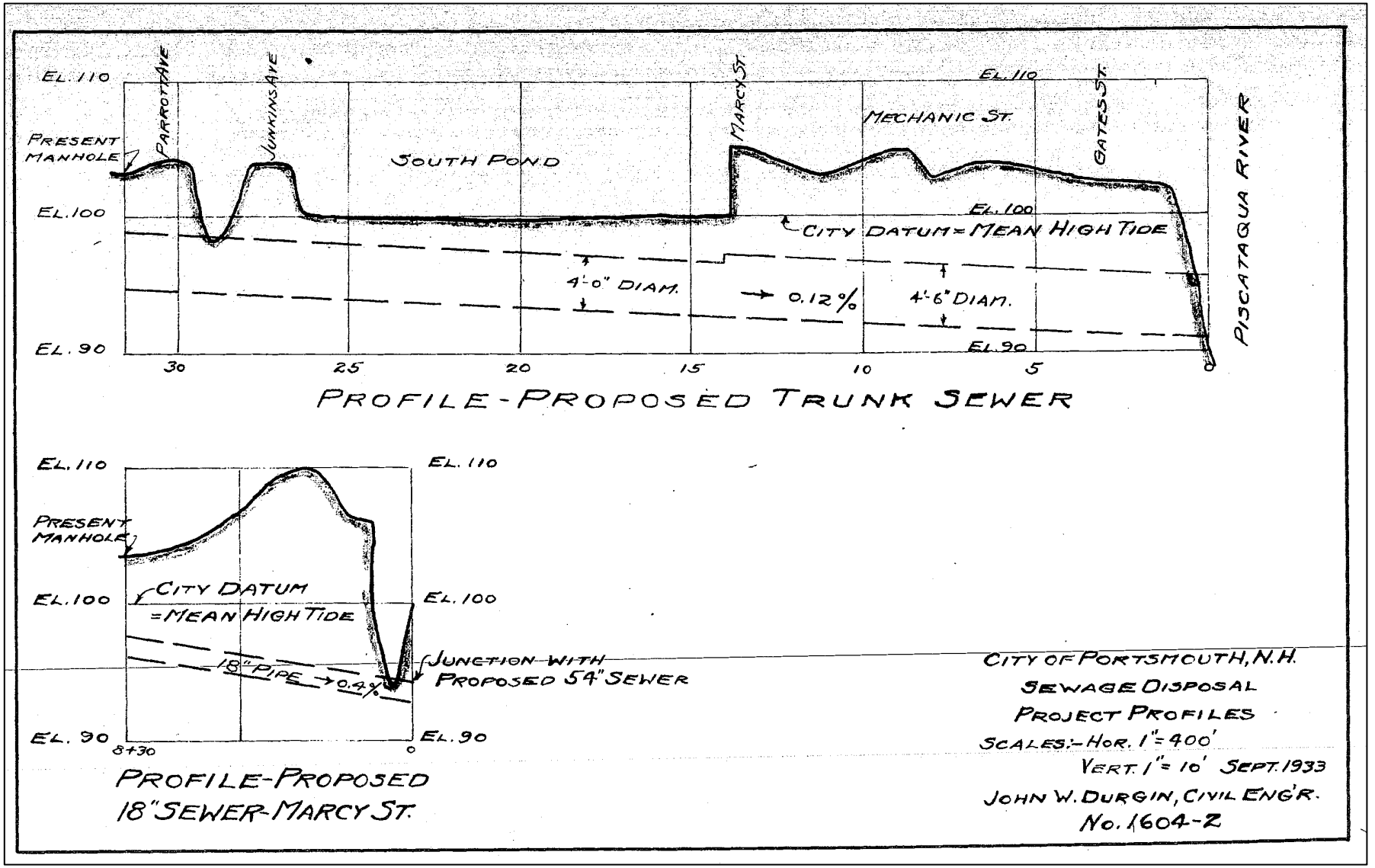
Drawings and specifications can be completed and construction begun within thirty days of the final acceptance of this project. Total construction time is estimated at ten months employing an average of one hundred twenty-five men.

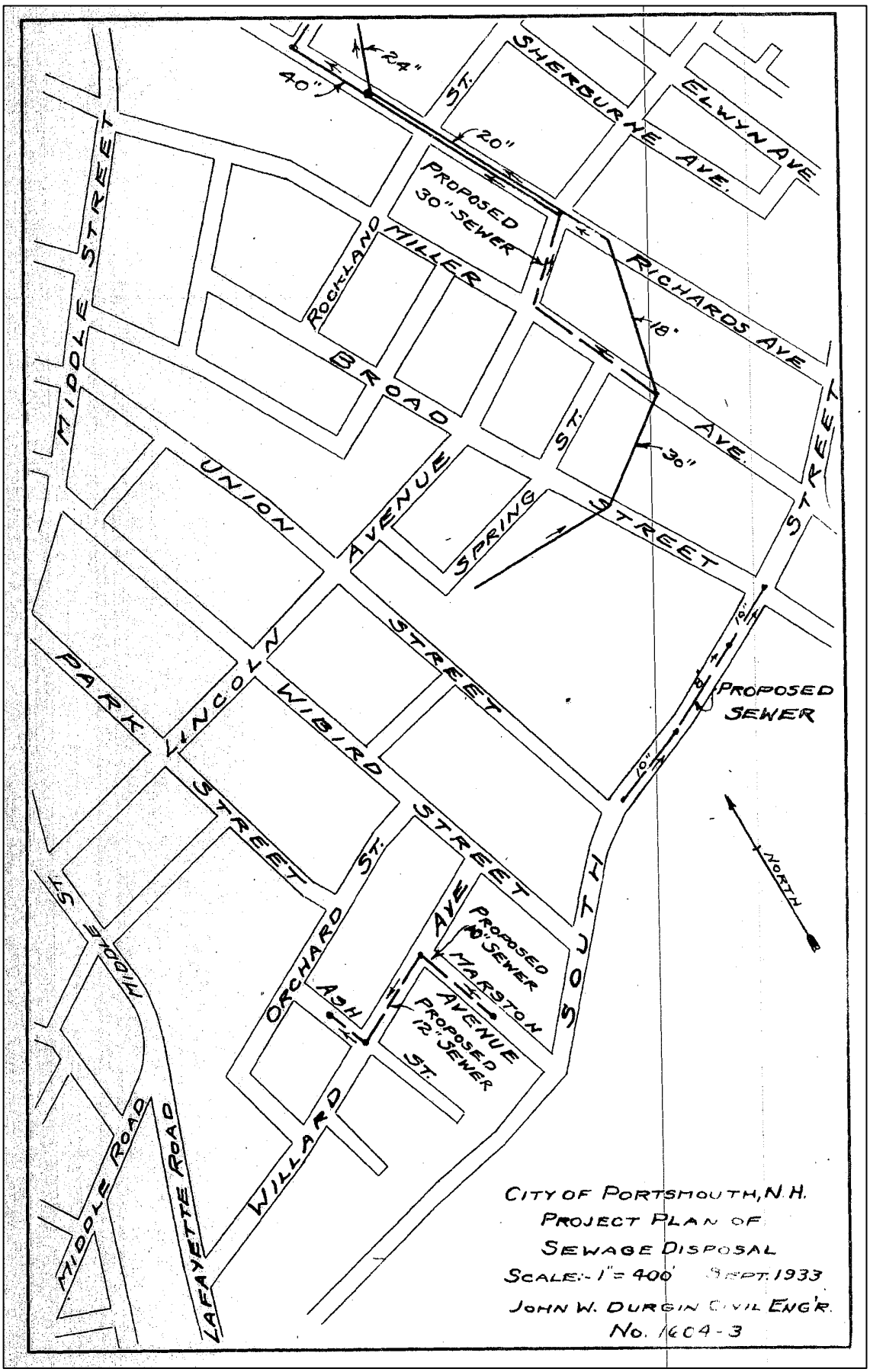
Respectfully submitted,

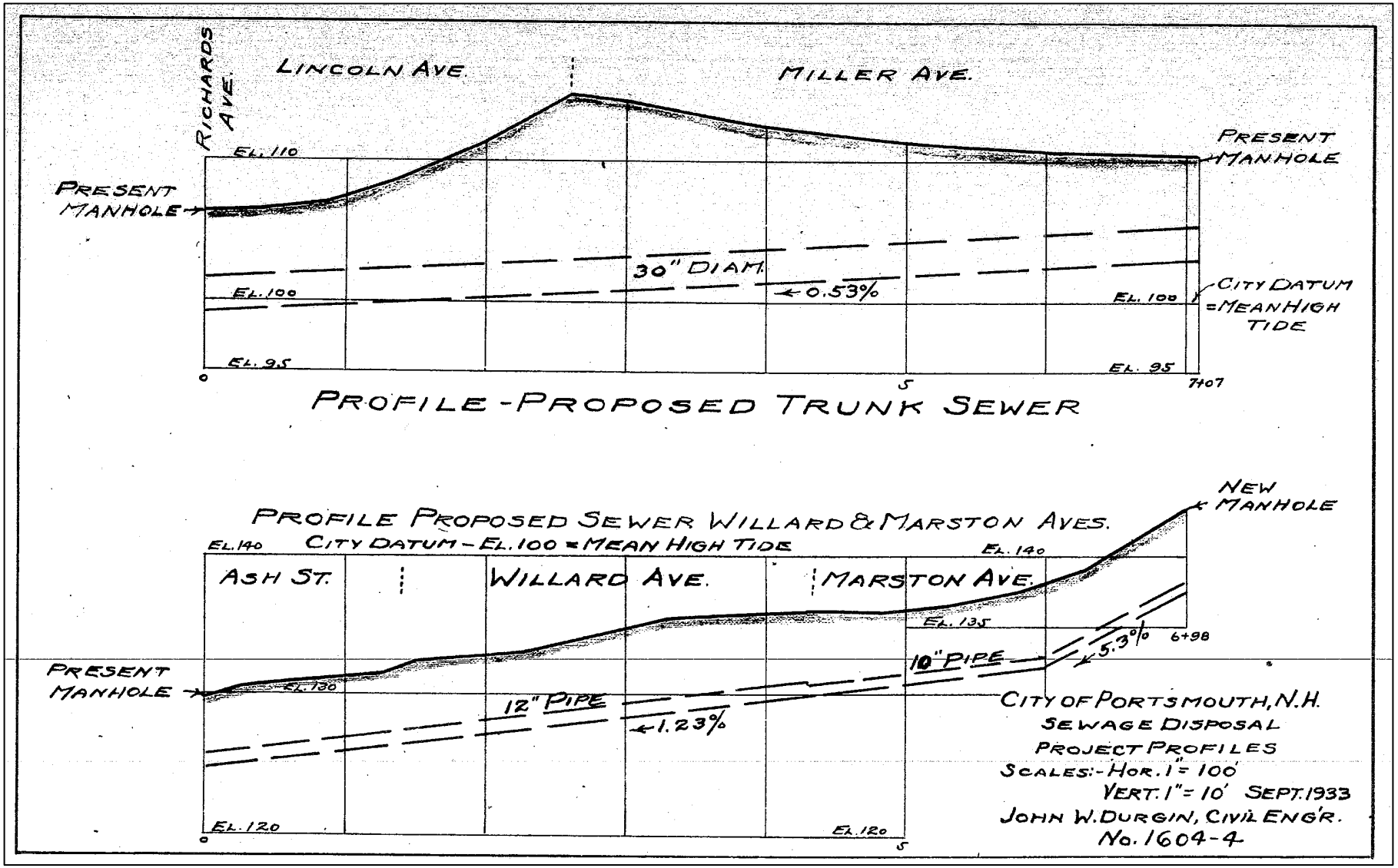
John W. Durgin.

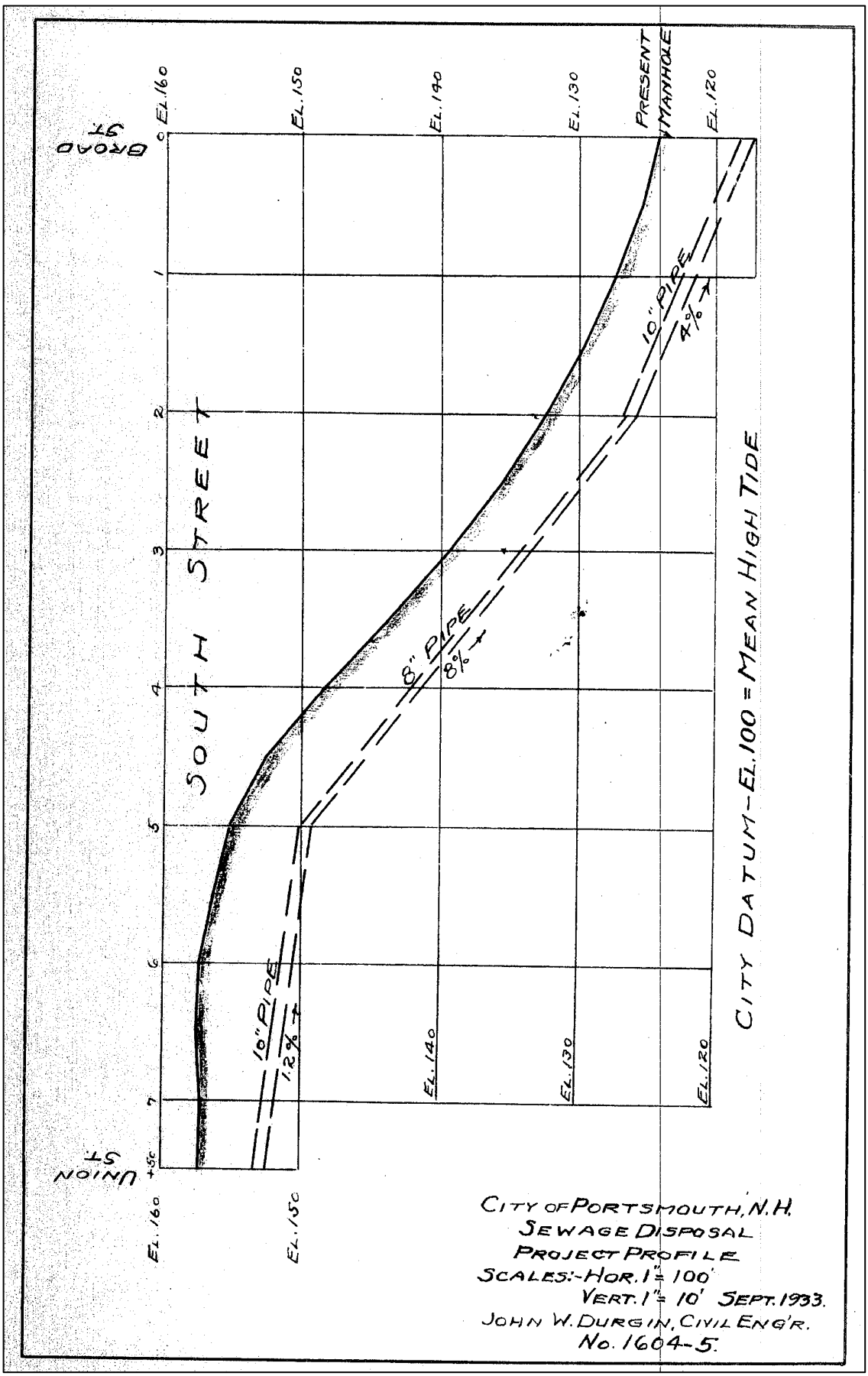
A true copy. Attest
Earl P. Smart
City Clerk.

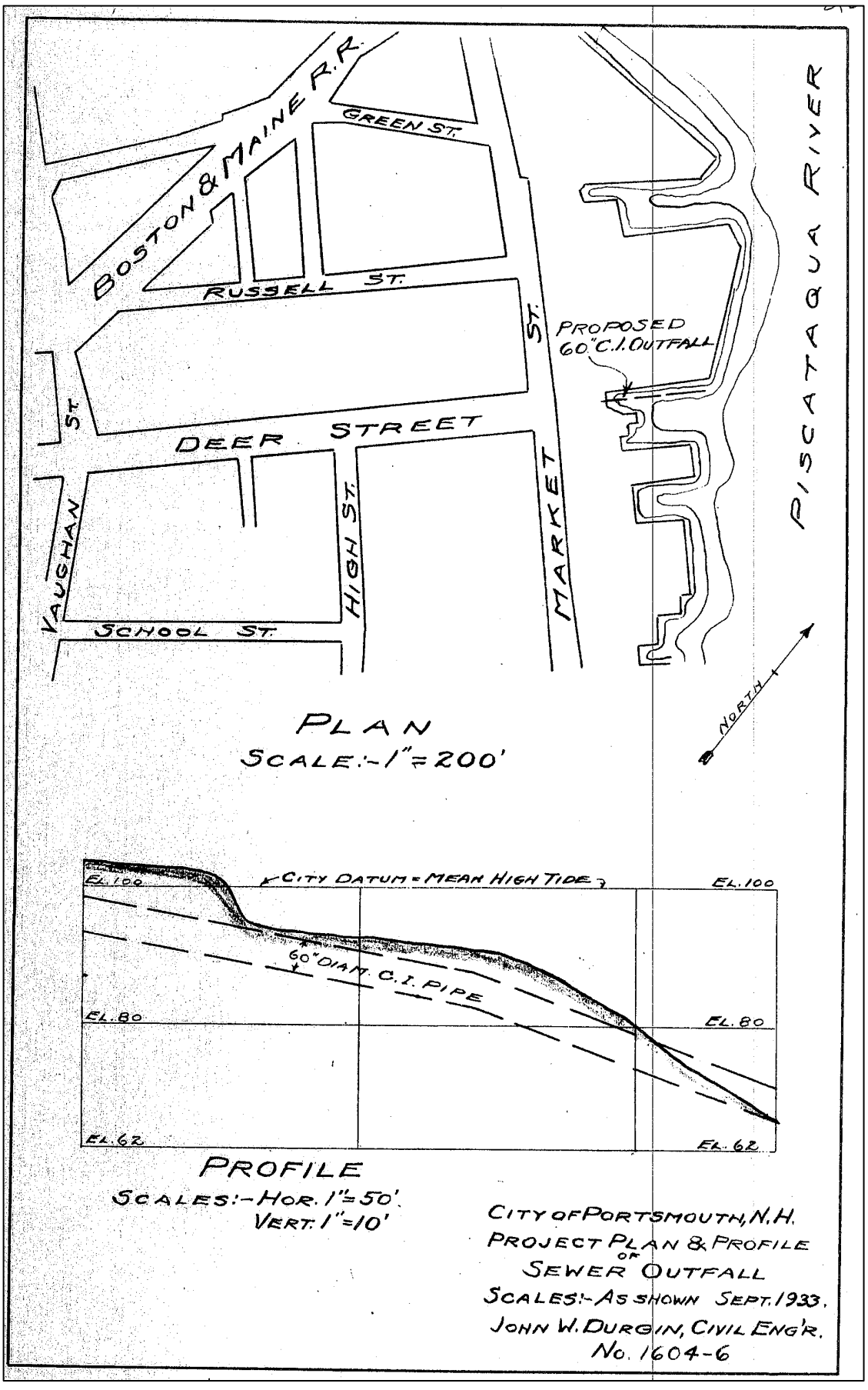

PISCATAQUA RIVER
PIERCE ISLAND
NORTH
PROPOSED OUTFALL
MECHANIC ST.
PROPOSED 54"
30" OUTFALL
18" OUTFALL
MARCY ST.
PROPOSED 18" SEWER
GATES ST.
PLEASANT ST.
SOUTH ST.
15" SEWER
NEW CASTLE AVE
30" SEWER
PROPOSED 48" SEWER
POND
PARROTT AVE.
JUNKINS AVENUE
SOUTH
OVERFLOW
ROGERS ST.
KENT ST.
ROCKLAND ST.
ELWYN AVE.
AVENUE
24" SEWER
48" SEWER
COURT ST.
RICHARDS AVE.
LINCOLN AVE.
MILLER
CITY OF PORTSMOUTH, N.H.
PROJECT PLAN OF
SEWAGE DISPOSAL
SCALE:- 1" = 400' SEPT. 1933
JOHN W. DURGIN, CIVIL ENG'R.
No. 1604-1

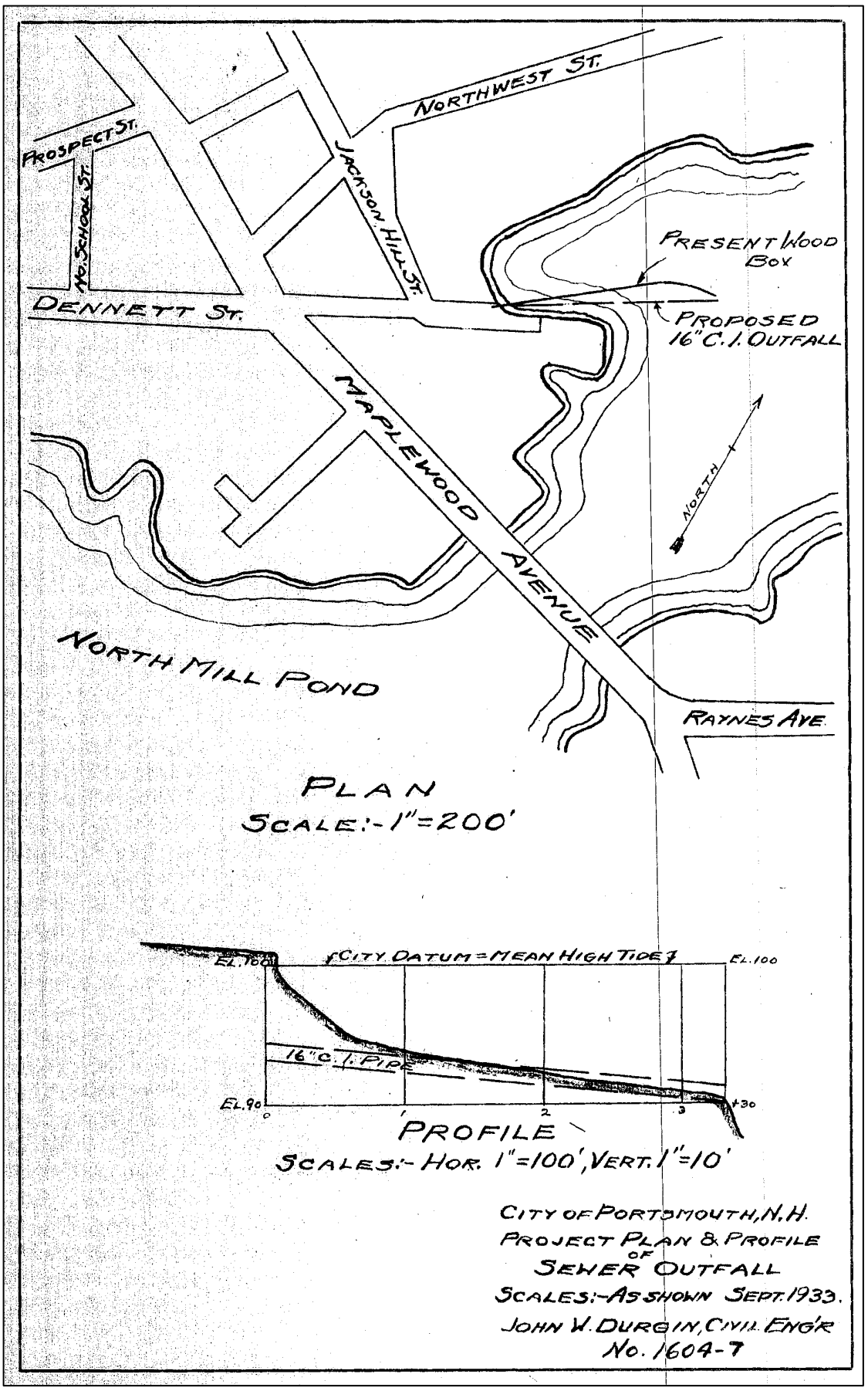

EL. 110
PRESENT MANHOLE
PARROTT AVE
JUNKINS AVE
SOUTH POND
MARCY ST
EL. 110
MECHANIC ST.
GATES ST.
PISCATAQUA RIVER
EL. 100
EL. 100
CITY DATUM = MEAN HIGH TIDE
4'-0" DIAM.
0.12%
4'-6" DIAM.
EL. 90
EL. 90
30
25
20
15
10
5
0
PROFILE - PROPOSED TRUNK SEWER
EL. 110
EL. 110
PRESENT MANHOLE
CITY DATUM
= MEAN HIGH TIDE
EL. 100
EL. 100
18" PIPE
0.4%
JUNCTION WITH PROPOSED 54" SEWER
EL. 90
EL. 90
8+30
0
PROFILE-PROPOSED
18" SEWER-MARCY ST.
CITY OF PORTSMOUTH, N.H.
SEWAGE DISPOSAL
PROJECT PROFILES
SCALES:- HOR. 1" = 400'
VERT. 1" = 10' SEPT. 1933
JOHN W. DURGIN, CIVIL ENG'R.
No. 1604-Z


24"
40"
20"
SHERBURNE AVE.
ELWYN AVE
PROPOSED 30" SEWER
ROCKLAND
MILLER
RICHARDS AVE
18"
MIDDLE STREET
BROAD
ST.
AVE.
30"
STREET
UNION
AVENUE
SPRING
STREET
PARK
LINCOLN
WIBIRD
STREET
PROPOSED SEWER
SOUTH
STREET
ORCHARD ST.
AVE
PROPOSED 10" SEWER
MARSTON
AVENUE
PROPOSED 12" SEWER
ASH
ST.
MIDDLE ST
MIDDLE ROAD
LAFAYETTE ROAD
WILLARD
NORTH
CITY OF PORTSMOUTH, N.H.
PROJECT PLAN OF
SEWAGE DISPOSAL
SCALE:- 1" = 400'
SEPT. 1933
JOHN W. DURGIN CIVIL ENG'R.
No. 1604-3


RICHARDS AVE.
LINCOLN AVE.
MILLER AVE.
EL. 110
PRESENT MANHOLE
PRESENT MANHOLE
30" DIAM.
0.53%
EL. 100
EL. 100
CITY DATUM = MEAN HIGH TIDE
EL. 95
EL. 95
0
5
7+07
PROFILE - PROPOSED TRUNK SEWER
PROFILE PROPOSED SEWER WILLARD & MARSTON AVES.
CITY DATUM - EL. 100 = MEAN HIGH TIDE
EL. 140
EL. 140
NEW MANHOLE
ASH ST.
WILLARD AVE.
MARSTON AVE.
EL. 135
5.3%
6+98
10" PIPE
PRESENT MANHOLE
EL. 130
12" PIPE
1.23%
EL. 120
EL. 120
0
5
CITY OF PORTSMOUTH, N.H.
SEWAGE DISPOSAL
PROJECT PROFILES
SCALES:- HOR. 1" = 100'
VERT. 1" = 10' SEPT. 1933
JOHN W. DURGIN, CIVIL ENG'R.
No. 1604-4


CROAD ST
EL. 160
EL. 150
EL. 140
EL. 130
PRESENT MANHOLE
EL. 120
SOUTH STREET
10" PIPE
4% +
8" PIPE
8% +
10" PIPE
12% +
EL. 140
EL. 130
EL. 120
CITY DATUM - EL. 100 = MEAN HIGH TIDE
UNION ST
+5.0
EL. 160
EL. 150
CITY OF PORTSMOUTH, N.H.
SEWAGE DISPOSAL
PROJECT PROFILE
SCALES:- HOR. 1" = 100'
VERT. 1" = 10' SEPT. 1933.
JOHN W. DURGIN, CIVIL ENG'R.
No. 1604-5.


BOSTON & MAINE R.R.
GREEN ST.
RUSSELL ST.
DEER STREET
VAUGHAN ST.
HIGH ST.
MARKET ST.
SCHOOL ST.
PROPOSED 60" C.I. OUTFALL
PISCATAQUA RIVER
NORTH
PLAN
SCALE:- 1" = 200'
CITY DATUM = MEAN HIGH TIDE
EL. 100
EL. 100
60" DIAM. C.I. PIPE
EL. 80
EL. 80
EL. 62
EL. 62
PROFILE
SCALES:- HOR. 1" = 50'
VERT. 1" = 10'
CITY OF PORTSMOUTH, N.H.
PROJECT PLAN & PROFILE
OF
SEWER OUTFALL
SCALES:- AS SHOWN SEPT. 1933.
JOHN W. DURGIN, CIVIL ENG'R.
NO. 1604-6


NORTHWEST ST.
PROSPECT ST.
No. SCHOOL ST.
JACKSON HILL ST.
DENNETT ST.
PRESENT WOOD BOX
PROPOSED 16" C.I. OUTFALL
MAPLEWOOD AVENUE
NORTH
NORTH MILL POND
RAYNES AVE.
PLAN
SCALE:- 1"=200'
(CITY DATUM = MEAN HIGH TIDE)
EL. 100
16" C.I. PIPE
EL. 90
0
1
2
3
+30
PROFILE
SCALES:- HOR. 1"=100', VERT. 1"=10'
CITY OF PORTSMOUTH, N.H.
PROJECT PLAN & PROFILE
OF
SEWER OUTFALL
SCALES:- AS SHOWN SEPT. 1933.
JOHN W. DURGIN, CIVIL ENG'R
No. 1604-T