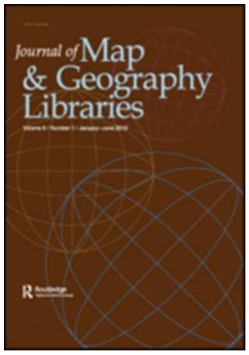


Using old maps and new methods to discover the early chemicals and petroleum industries of Newtown Creek

Journal:	*Journal of Map & Geography Libraries*
Manuscript ID:	WMGL-2012-0024
Manuscript Type:	Original Article
Keywords:	Keyword 1, Keyword 2, Keyword 3, Keyword 4, Keyword 5

Abstract

As sources of information to reveal contemporary environmental issues, historic maps reveal not only specific land uses and construction methods and materials, but also locations of potential sources of pollution. Newtown Creek is a narrow but navigable channel that separates two "outer" boroughs of New York City, Queens to the North and Brooklyn to the South. In the nineteenth and early twentieth centuries, Newtown Creek was one of the country's most productive industrial corridors. This paper concerns the chemicals and oil production history of the Newtown Creek. We examine period maps for the purpose of determining the locations of the area's major producer, and, to some extent, their methods of production. We take particular interest in the geographic and technical relationships between the producers of sulfuric acid and the petroleum refineries.

The significance of Newtown Creek

Newtown Creek is a narrow but navigable channel that separates two "outer" boroughs of New York City, Queens to the North and Brooklyn to the South. The Creek empties into New York's East River, at a point that is roughly one kilometer east of a tall waterside apartment building at East 25th Street and the FDR Drive in Manhattan. The Creek runs for about six kilometers, winding south and east and ending near Metropolitan and Flushing Avenues. The word "creek" implies some discernible flow of water from a source toward the ocean. This is the case at Newtown Creek after a significant rainfall; at other times, Newtown Creek appears to be generally stagnant. (The East River, into which the Newtown Creek flows, is misnamed in a similar way; it is not a river, it is a tidal straight, a river that reverses its direction of flow twice a day.)

In the nineteenth and early twentieth centuries, Newtown Creek was one of the country's most productive industrial corridors. One could view Newtown Creek as the prototype, an early mock-up, of the Houston Ship Canal of today. Maps of Newtown Creek from the 1860s through the 1920s indicate a densely packed collection, along almost the entirety of the Creek's shoreline, of facilities for high-volume production and refining of materials. If one relied only on period maps of Newtown Creek, and a small number of these would be adequate, one could indentify nearly all the important materials and energy-processing industries of this country at the start of its industrial expansion. Examination of a succession of the area's insurance maps would provide a reasonably complete history of the evolution of chemical and fuel technologies in the first 100 or 150 years of the United States.

This paper concerns the chemicals and oil production history of the Newtown Creek. We examine period maps for the purpose of determining the locations of the area's major producer, and, to some extent, their methods of production. We take particular interest in the geographic and technical relationships between the producers of sulfuric acid and the petroleum refineries. Each of these was well-represented at Newtown Creek for the hundred-year period that began about 1860. Our larger goals in this effort include understanding (1) the economic and geographic factors that attracted industries to the location, and (2) the industries' methods and practices of production. The first will of these will provide insight to the role of New York City's economic geography in America's growth as a materials and energy superpower, while the second will help elucidate causes for the Newtown Creek's current condition of extreme environmental distress.

In 2010 the US Environmental Protection Agency added Newtown Creek to the National Priorities List specified by CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), making Newtown Creek a "Superfund site" and initiating the process of discovery and remediation of the site's apparent large-scale and chemically-diverse pollution. The EPA is, at the time of this writing, in its data collection stage, which will be followed by analysis and identification of the chemical substances that appear to have destroyed the environmental health of the waterway and which limit its development and future use. The goal is ambitious: the revitalization of a navigable waterway at the geographic center of New York City.

Our methods of discovery are largely visual: we analyze digital versions of period maps, mainly political and insurance maps, supplemented by awareness of contemporary chemical practice, to construct an industrial history of the location. We use geospatial referencing methods to specify the locations of particular chemical processes. A further goal of our work to identify the materials balance of this site's large-scale industries, that is, to understand the fates of raw materials that were brought to the site, how starting materials were converted to high-value products or to unwanted by-products.

Literature review

Scholars from many disciplines have described the utility of historic fire insurance maps; environmental scientists, historians (especially architectural historians and preservationists), public health researchers, and economists, as well as geographers all make enhanced contributions to their fields through careful analysis of these historic maps. The usefulness of fire insurance maps to historians has been well documented

by Gilliand and Novak (2006), but scholars in other disciplines can mine their features and compare development across time. Gilliland and Novak (2006) recognize the potential of HGIS (Historical GIS) to both preserve historic maps and to assist analysis of environmental conditions over time and space. As Wrigley (1949) and Moulder (1994) have shown, the accuracy of fire insurance maps as data sources is sometimes questioned, though not exhaustively; perhaps this is because the level of detail about land use data these maps provide is not replicated in any other source. Through the preservation and digitization of collections, archivists and librarians support the role of maps in scholarship, teaching, and professional practice, as Youngblood demonstrates (2006).

Beaton's early study of the origins of the American petroleum industry situate Newtown Creek at the center of this emerging economic activity (1955). As the first to refine coal-oil illuminants and lubricants from crude oil, Dr. Abraham Gesner's kerosene refining facility initiated a market for related chemical industries, and a legacy of localized soil and water contamination began. As North Brooklyn neighborhoods gentrified, even the popular mass media treated the topic of the oil spill with gravitas. Eviatar's lengthy piece in *New York* magazine (2007) introduced to a wide audience the environmental and public health implications of soil and water contamination in Greenpoint, Brooklyn. This article clarified the process of the contamination of soil and water in the area as one which took place over decades and resulted from the convergence of several industries' runoff seeping through sandy soil into groundwater; other popular media sources continually referred to the contamination as an "oil spill," which connotes one catastrophic event. As the EPA moves forward in its testing and

remediation of Newtown Creek and its banks, future researchers will have new data to describe, analyze, and create meaning from.

The diversity of American chemical manufacturing in the nineteenth century

Even a casual reading of a 19th century map of north Brooklyn's waterfront makes evident that the variety of chemicals that were manufactured there or used there in the refining of other materials was great. The chemicals industry at Newtown Creek was as large in scale as it was diverse. Maps made during the second half of the 19th century indicate that a succession of chemical process-driven industries prospered at different times in the Newtown Creek – north Brooklyn area, reflecting the success of the US producers in catching up in sophistication and scale with their European counterparts. In the period between the end of the Civil War and the beginning of the First World War, the US chemicals and petroleum industries grew from adolescence to adulthood. Maps of the area made between 1868 and 1912 provide detail on who was where and when. We mine the maps to construct the area's industrial history.

The region's industrial innovation and commercial prosperity brought huge financial reward and led to the formation of several large business concerns that continue even today to grow and adapt to economic opportunities of this age. In reading these maps, we see that Newtown Creek was an incubator space that nurtured heavy industries in their youth; as "adults," the companies outgrew and moved from the area, leaving a significant legacy of chemicals substances that environmental scientists, working under contract to the EPA, are in process of identifying and documenting.

A number of the important chemical-process-driven industries that thrived at the Newtown Creek had started in Manhattan. The waterfront of north Brooklyn and south

Queens offered access to sea-going vessels and, in particular contrast to Manhattan, large areas adjoining the waterfront for the processing and manufacture of heavy materials. New York's dye wood, sugar, and chemicals industries all had begun in Manhattan during or before the early Federal period but relocated from Manhattan to Brooklyn just in the 1850s. In the years immediately preceding and following the Civil War, energy-related industries, specifically the refining of hydrocarbon fuels, that were without significant roots in Manhattan, were born along Newtown Creek and grew rapidly.

By the end of the 19th century, Newtown Creek was an extremely busy corridor. The foul odors and frequent fires had not escaped the notice of the community that surrounded Newtown Creek (including Greenpoint and Bushwick in Brooklyn and Laurel Hill and Maspeth in Queens), nor had the industrial discharges at Newtown Creek escaped notice of the Department of Health of the city of Brooklyn (until 1898 an independent city). The Department of Health established an office on the Creek and produced a map presumably to assist the department's effort to determine origins of foul odors, but the map also provides further evidence of the breadth of the chemical manufacture, oil works, and other chemical-process-driven activity there. The hand-written text on the map is for the most part legible. On a map made by the Department of Health in 1896, one can read the names of these business concerns located directly on the Creek. These include the US and Canada Degreasing Syndicate, Tuttle Brothers Tannery, Robinson Brothers Kings County Chemical Works, Martin Kalbfleisch Chemical Works, Standard Rope and Twine Company, Wm. Marshall Paper Company, Consolidated Paper Bag Company, (illegible) Whiting Works, (illegible) Gas Works,

(illegible) Starch Works, Acme Fertilizer Company, Champion Fertilizer Company, the "wharf from which fat and bones are shipped," (illegible) dead animal wharf, Atlantic Carbon Works, Night Soil Boat, Lawrence Cordage Works, Peter Cooper Glue Factory, Demuth Glass Works, Kings County Chemical and Oil Works, Nichols Chemical Works, Queens Country Oil Works, Sone and Fleming, Eastern Distilling Company, Greenpoint Chemical Works, and "Manure Barge."

We find detailed information about locations of the working parts of a Havemeyer sugar-refining operation and Devoe Manufacturing Company's oil-refining operations in several maps in an 1868 set of Higginson insurance maps. Figure I shows detail of the mouth (western end) of Newtown Creek. While the north (Queens) side has only lumber yards, the Brooklyn side shows industry: Havemeyer Sugar Refining, Greenpoint Flint Glass, and can manufacturing and "oil packing" facilities of the Devoe Manufacturing Company. At the Havemeyer location, the map provides detail of locations of the plant's retorts, refinery warehouse, syrup storage, and general storage. A companion map in the same volume (plate 73) provides detailed information, including locations of stills, condensers, iron holding tanks, can filling operations, and fire pumps of the Devoe Manufacturing Company's oil refining operations located along the Newtown Creek between Manhattan Avenue and Oakland Street.

FIGURE I. Western end of Newtown Creek to Manhattan Avenue. From Higginson's Insurance Maps of the city of Brooklyn L.I. Surveyed, Drawn & Published by J.H. Higginson. 1868. Volume 4.

A map made 18 years later, Robinson's 1886 map of Greenpoint (Figure II), indicates even greater information concerning the industrial vigor of this area: the "New

York Dye Wood Extract and Chemical Co" along the East River, with "extract works" between Green and Freeman streets and lumber yards along the waterfront, extends onto Newtown Creek, near the juncture of Commercial and Clay streets. East of the northernmost lumber yard are the buildings of "Havemeyer Sugar Refining Co" on the waterfront and 500 feet on Commercial Street. Immediately east of Havemeyer is the "Greenpoint Glass Works." Just east of the Manhattan Avenue bridge (no longer standing) one finds the "Devoe Mfg Company Brooklyn Oil Works." Along roughly three-quarters of a mile of north Brooklyn's waterfront, there were businesses involving extraction of natural dyes from hardwoods, the refining of raw sugar, the manufacture of glass from silica, and the production of lamp oils from petroleum.

The map suggests that land east of Provost Street and beyond Whale Creek was undeveloped, possibly because of its wetness. Approximately ½ mile to the east and south, just beyond the Greenpoint Avenue bridge, between Vail and Wright streets and evidently on more solid ground, one finds the "King's Co Oil Refinery."

FIGURE II. From Robinson's atlas of the city of Brooklyn, New York: embracing all territory within its corporate limits; from official records private plans and actual surveys by and under the supervision of E. Robinson and R.H. Pidgeon, civil engineers, published by E. Robinson 82 and 84 Nassau Street, New York, 1886.

A companion map from the same volume (plate 13) shows more small refineries located along the Brooklyn shore of Newtown Creek. These include, reading from north and west to south and east: the Washington Oil Company at Wright Street, Central Refinery at Webster Street, Locust Hill Oil Refining Company above Morse Street, and Greenpoint Oil Refining Company just below Morse Street.

Sulfuric acid and hydrocarbon fuels

Light is an energy by-product of the combustion of hydrocarbon fuels. Light is radiant energy that emanates from high temperature particles produced in many exothermic combustion reactions: energy that had been stored in chemical bonds of the fuel is liberated in the chemical reaction of fuel with oxygen to form carbon dioxide and water. As the 19th century entered its final decades, the refining of hydrocarbon compounds for use as fuels for illumination became Newtown Creek's major industry.

A great number of hydrocarbon compounds can be found in nature. These compounds are formed slowly in the decomposition of the carbohydrate products of photosynthesis. These include coal and petroleum; "coal" and "petroleum" are mixtures of a great number of different substances, including saturated cyclic and acyclic alkanes such as methane, butane, and octane (alkanes contain only carbon-carbon single bonds and no double or triple bonds), alkenes such as ethylene and propylene (alkenes have C-C double bonds), alkynes such as acetylene (alkynes have C-C triple bonds), and aromatics compounds such as benzene and toluene (also called arenes which have cyclic arrangements which are stabilized by the delocalization of bonding electrons). Hydrocarbons contain only the elements hydrogen and carbon; a hydrocarbon compound is "saturated" if the compound has as many hydrogen atoms as the carbon atoms of the compound can accommodate; many of the components of coal and petroleum are unsaturated compounds, with relatively high ratios of carbon to hydrogen.[i]

Some of the early illuminating materials produced at Newtown Creek were not pure hydrocarbons. For example, tallow candles were made from animal fat, which is

most carbon and hydrogen, but which also include some oxygen. Whale oils are similarly mostly carbon and hydrogen, but contain some oxygen.

The balanced chemical reaction for combustion (oxidation) of a saturated 8 carbon hydrocarbon (octane) compound is this: C_8H_{18} + 12 ½ O_2 → 8 CO_2 + 9 H_2O + energy.

Many of the Newtown Creek producers identified themselves as "refiners." The refining of substances that are found in nature as components of complex mixtures became, in the final decades of the 19th century, one of Newtown Creek's areas of industrial expertise. In the second half of the 19th century, Newtown Creek grew as one of the country's most important centers for production of both refined sugar (carbohydrates formed in photosynthesis) and refined petroleum products (hydrocarbons formed slowly in the decay of carbohydrates. We focus on the petroleum production. Beginning in the mid-1850s and continuing until the invention and proliferation of electric lights, Newtown Creek was a center of expertise and efficiency in production "illuminating oils," fuels for kerosene lamps.

Tallow candles were probably the first illumination product made at Newtown Creek. In its earliest industrial years, Newtown Creek was a center for the handling of animal tissues. The Peter Cooper Glue Factory was located along the English Kills at Newtown Creek's eastern end, and at numerous other locations along the creek, insurance maps identify tallow works. Tallow produced in the rendering of animal fat would be used in manufacture of candles and soaps, and as lubricants for metals. A companion map to that shown in Figure II (plate 85) shows Van Iderstine's Tallow Factory and Buchanan's Tallow Factory standing near the Preston's Bone Black

Factory; all three buildings stand near a building labeled “Steer & Bull Pens.” Businesses concerned with packaging or trading of whale oils for lamps may have been located along Whale Creek, a very short but broad branch of the Newtown Creek. Whale Creek is now roughly 150 yards in length, but maps from the mid-19th century show a creek that perhaps 3 times as long; old maps suggest that a network of small creeks emptied into a much longer channel that appears to have been constructed to support commercial use of adjoining (possibly reclaimed) land. Newtown Creek observers are tempted to believe that whale or whale products such as spermaceti and the oil rendered from whale blubber were processed, packaged, or marketed at the location; we have not yet found certain evidence of such activity.

Newtown Creek as center for the production of lamp oil was clearly established with construction in 1854 of the New York Kerosene Oil Works at Blissville, on the Queens shore of the creek. Technical expertise at this facility resided in the person of Dr. Abraham Gesner. Gesner had been born and attended school in Nova Scotia, had trained as a physician in London before returning to Nova Scotia to work as a physician. In Nova Scotia he trained himself in geology and, as a geology-hobbyist explored the island collecting samples. He published Remarks on the Geology and Mineralogy of Nova Scotia in 1836. Gesner then became interested in illuminating oils. Believing tar and pitch to be asphalts formed in the drying of petroleum seepage, he experimented with samples of Trinidad pitch, finding that he could extract an oil that burned brightly by heating pitch in a closed retort. Gesner named this coal-derived illuminating oil “kerosene” and moved in 1853 from Halifax to New York, where he worked with

business investors to improve and eventually commercialize his processes for refining "kerosene" from particular kinds of coal.

Gesner was awarded several US patents claiming the composition of kerosene and processes for collecting and refining kerosene from coal and other mineral sources. His refining procedure began with the separation of components by distillation and "subsequent treatment with powerful reagents and redistillation." The treatment describes a method of removing tars in the distillate mixture with sulfuric acid, at 5 to 10 percent the volume of oil being treated. In April 1854 business partners Erastus Smith and Philo Ruggles purchased a seven-acre parcel of land on the east bank of Newtown Creek and deeded the land to the North American Kerosene Gas Light Company, the company that employed Abraham Gesner. Gesner designed the buildings and equipment, purchased reagent chemicals from Martin Kalbfleisch, and purchased cannel coal from New Brunswick. By 1856, the company was in business.

Gesner's process relied on a thorough sulfuric acid wash step, which succeeded in removing impurities that created odor or smoke in the combustion of the lamp oil. The availability of sulfuric acid from Martin Kalbfleisch, whose manufacturing plant adjoined the Newtown Creek at the English Kills, was extremely fortunate or perhaps the key reason for the North American Kerosene Gas Light Company's choice of location.

Martin Kalbfleisch had emigrated to the United States from the Netherlands at age 25, by which time he had already gained experience. He had studied chemistry in his youth, had sailed on an American vessel to Sumatra at age 18, and pursued business ventures in France when he decided to build a life in the United States. Within

a few years of arriving in New York, Kalbfleisch formed a business in dyes; with rather quick success, he relocated from Harlem, first to Bridgeport, Connecticut and then, rather promptly, to Greenpoint, Brooklyn. In Greenpoint (or Bushwick), he organized what would become Martin Kalbfleisch and Sons, producers of sulfuric acid as well as other standard chemicals. The Kalbfleisch works were located at the English Kills, near the eastern end of Newtown Creek.

Martin Kalbfleisch took interest in politics as well as in chemistry and business. He was elected Supervisor of the old town of Bushwick in 1851, served as Alderman of the Eighteenth Ward of Brooklyn in 1855 after Bushwick was consolidated into the city of Brooklyn, was elected Mayor of Brooklyn in 1861, and was elected to represent the Second District in Congress in 1862. With sons in the business, Karlfleisch's chemicals company continued to thrive during Kalbfleisch's public career.

In a concise history of Abraham Gesner's key role in developing methods for refining and treating petroleum for lamp oil applications, Kendall Beaton estimates the high profits that the North American Kerosene works is likely to have generated. It appears to have been a highly successful but short-lived company. In 1859 Colonel Edwin Drake, working with the financial backing of investors who that had ample opportunity to be familiar with Gesner's methods of refining rock oil for lamp uses, succeeding in tapping subterranean reserves of petroleum. The days of extracting oil from rock were numbered; Drake's technology enabled the new breed of "oil men" to tap large pools of black gold

At the time Drake struck oil in Titusville, Pennsylvania, Charles Pratt was working in a New York whale oil trading firm. He was 29 and, like many men of that time, he

recognized the opportunity that drilling and refining petroleum offered. In the mid-1860s Pratt began buying crude petroleum and soon organized a business around petroleum refining. As the North American Kerosene Company's business declined, the business of petroleum refiners grew. The Charles Pratt Oil Refining works grew in Queens. Detail of Pratt's Queens facility is indicated in the upper right of Figure III. Pratt's refinery developed procedures for production of a premium product, the high purity Astral Oil (see Figure IV). Pratt founded a new company, the Astral Oil Refinery, in Greenpoint in 1867.

William Nichols arrived at Newtown Creek in 1870. It was not oil that drew him there; what apparently did attract Nichols was the material that was then called "oil of vitriol," sulfuric acid. Nichols had been born in Brooklyn in 1852, studied at Brooklyn Polytechnic but earned a degree in chemistry at New York University. With this degree, Nichols joined the Laurel Hill Chemical Works. Within a year, Nichols had opportunity to become a partner in the company, which then became Walter and Nichols Co. The company acquired more land along the Creek and built a new sulfuric acid production facility and capacity for production of nitric and hydrochloric acids. With investment by Nichols's father, the company was later reorganized as G. H. Nichols and Company, a company focused on production of sulfuric acid. The Nichols company's was located at Laurel Hill, midway along the Newtown Creek, just west of Charles Pratt's Queens location and across the Creek from the many independent oil refining operations. There were, by 1870, approximately 50 petroleum refineries along Newtown Creek.

Within a few years of own joining the company, Nichols hired Francis Herreshoff as chief chemist. Herreshoff had not completed his degree in chemistry at Brown

University, but at the Nichols Chemical Company, he proved himself an extraordinary chemical engineer. He developed and improved methods for preparing concentrated sulfuric acid, which was particularly well suited for removing sulfide impurities from petroleum. Herreshoff also developed electrolytic methods for recovering copper from the waste stream generated by extraction of sulfur (for sulfuric acid) from pyrite ores. Nichols Chemical eventually formed a separate entity, the Nichols Copper Company, which would eventually be sold to Phelps Dodge mining company. The refining of copper, and eventually other metals, from their ores became another refining industry that thrived at Newtown Creek.

At the end of the 19th century, the Nichols Chemical Company could use its strong position in production of high quality sulfuric acid to form the General Chemical Company, an amalgamation of 12 companies and 19 production plants. Among those producers that joined Nichols in forming the General Chemical Company was Martin Kalbfleisch and Sons.

FIGURE III. Atlas of the borough of Queens, city of New York: based upon official plans and maps on file in the various city offices; supplemented by careful field measurements and personal observations / by and under the supervision of Hugo Ullitz. > First and second wards: Long Island City and Newtown. 1903.

The proximities of sulfuric acid producers and petroleum refiners along Newtown Creek in the 1870s are indicated in Figure V.

Figure IV. Cartoon image of various products of Charles Pratt and Company.

FIGURE V. Relative locations of sulfuric acid producers and oil refiners along Newtown Creek.

Reconstruction of Newtown Creek's economic history from historic maps

Historic maps capture corporate or industrial progression on a site in ways that narrative histories, written at a point later in time, and contemporary documents such as newspaper articles or gazetteers do not. The value of a series of maps of the same location over time is invaluable in showing relationships between industries as well. Fire insurance maps in particular are relevant and irreplaceable information sources for 21st century environmental quality analysis. Maps of the Newtown Creek area from the 19th century provide detail of the origins of petroleum refining industries that were central to the local and regional economy as well as interdependent chemical production industries. These industries left a toxic legacy, the spread and effect of which historic maps can be used to illustrate, especially when layered with data from the present. The democratization of web-based mapping tools enables wider study of aspects of industrial history that have contributed to environmental contamination and threats to human health. Digitized map and library collections play an increasingly important role in this expanded analysis. Once digitized, historic maps can be georectified and exported as a KLM file for use with a GIS or in accessible mapping tools such as Google Earth. The New York Public Library's digitized map collection and web-based georectifier, Map Warper, serves as a critically important resource for the study of Newtown Creek's nineteenth-century petroleum and related chemical industries. These maps indicate that even before the petroleum age, the area was already becoming a locus for noxious industries: "night-soil" docks, fat-rendering facilities, and dye-wood extraction plants proliferated on both banks of the creek during the early and mid-nineteenth century, along with shipbuilding, rope manufacturing, and sugar refining.

Once the land was used for any contaminating, noxious, flammable, or otherwise hazardous activities, further noxious uses in the area seemed inevitable, as ground, soil and air contamination would render the sites undesirable for residential, retail, office or light manufacturing. The succession of petroleum refining and the gradual consolidation of refining facilities under Pratt & Co. and eventually Standard Oil is also made visible through the study of historic maps. Likewise, discovery of the proximity of sites of chemical manufacturing and petroleum refining activities is greatly enabled by the use of digitized fire insurance maps. Beginning in the middle of the nineteenth century, refining of petroleum and coal required access to chemicals such as sulfuric acid; proximity to their manufacture was critical for success in a competitive market.

Map analysis need not be very sophisticated in order to yield a great deal of information. Simple visual analysis of the digitized fire insurance maps enhances what is known about the petroleum refining process and also establishes relationships between chemical manufacturers and petroleum industries that depended upon an array of chemical agents for the refining process. The detail present in fire insurance maps includes the footprints of refining facilities, including furnaces, distilleries, storage tanks, and other points in the production process. The accuracy of the positioning of these features on the fire insurance maps may be questioned; yet this problem of surveyors' accurate work is somewhat obscured. With a digitized insurance map that is derived from a print map updated and corrected over a period of years, the physical layers created by successive efforts of survyeors are lost and we are sometimes left to speculate how often surveyors actually positioned the footprints of buildings or corrected errors from previous surveys. More sophisticated analysis through use of

georectified maps and historic and contemporary data sets bring past and present together to illustrate potentially hazardous refining or manufacturing activity and contemporary environmental complaints and even vectors of disease.

Discussion: 1). Economic Geography: How interrelated industries choose where to build production plants; 2). Significance of site-specific information about production of chemicals to the Superfund remediation process

In this paper, we have report our use of old maps (in their new digitized and searchable form) to determine the locations of companies and production sites along the Newtown Creek in the in the second half of the 19th century. Beginning about 1850, the location seemed an especially attractive place to receive natural products grown near the equator and refine these raw or semi-raw materials into higher value products. Dye made from Caribbean hardwoods and raw sugar grown and processed in Central America are examples of this. New York companies, starved for space at docks and production space relocated from New York to Brooklyn. Chemical companies apparently were attracted to New York, probably to enable their expansion.

A second goal of this paper is to explore the idea that Newtown Creek's nascent chemicals industry, coupled with some know-how in production of tallow candles and possibly whale oil, made the site attractive to one important producer of kerosene, lamp oil made from coal. As the kerosene business thrived in the late 1850s and 1860s, the site developed greater capacity and expertise in production of sulfuric acid. Those two areas of expertise, sulfuric acid production and "rock-oil" refining appear to have attracted significant talent, in the persons of William Nichols and Charles Pratt. It may prove to be that case that the combination of technical expertise developed in the

Nichols and the Pratt companies would become a strong attraction to John D. Rockefeller and the Standard Oil Company.

It is of course most important that New York has a large deep and protected harbor and that Europe, and particularly England, were great markets for kerosene illuminating oils. The effect is that new technical expertise grew in Newtown Creek, new and very profitable businesses also grew. The industries of the rough and tumble Newtown Creek contributed significantly to New York and Brooklyn's growth in population and prosperity.

The story is not entirely good news. The petroleum and metal refining industries that grew in size, technical capability, and wealth at Newtown Creek created very large waste stream, that appear to have been deposited in place and which are likely to contain hazardous materials. It appears to be the case that growth and prosperity of the technologically-sophisticated refineries came at enormous environmental cost. The industries outgrew Newtown Creek and left the place a wasteland.

The Superfund process underway now will produce specific information on the chemical identities of materials in the sludge that lay at the floor of the Newtown Creek. Whether this site can be remediated and revitalized is not yet determined.

Endnotes

[i] A concise description of hydrocarbon chemistry and processing of petroleum can be found in Chapters 1 and 2 of George A. Olah and Árpád Molnár, Hydrocarbon Chemistry, New York, John Wiley & Sons, 1995.

References

Aftalion, Fred. 1991. *A History of the International Chemical Industry*. Philadelphia: University of Pennsylvania Press.

Beaton, Kendall. 1955. "Dr. Gesner's Kerosene: The Start of American Oil Refining." *The Business History Review* 29 (1) (March 1): 28–53. Doi:10.2307/3111597.

Cravens, Curtis, Tina Chiu, Katherine Gray, Paul Boyle Parkhill, and Place in History (Organization). 2000. *Copper on the Creek: Reclaiming an Industrial History*. [New York, N.Y.]: Place in History.

Eviatar, Daphne. 2007. "The Ooze." *New York*, June 11.

Gesner, Abraham. 1836. *Remarks on the Geology and Mineralogy of Nova Scotia*. Printed by Gossip and Coade.

Gesner, Abraham. 1861. *A Practical Treatise on Coal, Petroleum, and Other Distilled Oils*. Baillière Brothers.

Hayek, M.Novak. 2010. "Mapping Industrial Legacies: Building a Comprehensive Brownfield Database in Geographic Information Systems." *Planning Practice & Research* 25 (4): 461–475. doi:10.1080/02697459.2010.511018.

Haynes, Williams. 1983. *American Chemical Industry*. New York: Garland.

Higginson, J. H. 2011. "Brooklyn, Vol. 4, Double Page Plate No. 69; [Map Bounded by Bell St., Pink St., Blue St., Bay St., Maspeth Ave., East Williamsburgh, Newtown Creek, Franklyn St., Kent St.; Including East River Dupont St., Eagle St., Freeman St., West

St., Green St., Huron St., India St., Java St.].” http://catalog.nypl.org/record=b10013848. http://digitalgallery.nypl.org/nypldigital/dgkeysearchdetail.cfm?imageID=1695436.

Hurley, Andrew. 1994. “Creating Ecological Wastelands.” *Journal of Urban History* 20 (3) (May 1): 340 –364. doi:10.1177/009614429402000303.

Jason A. Gilliland, and Mathew Novak. 2006. “Jason A. Gilliland and Mathew Novak on Positioning the Past with the Present: The Use of Fire Insurance Plans and GIS for Urban Environmental History.” *Environmental History* 11 (1) (January 1): 136–139.

Lafreniere, Donald, and Douglas Rivet. 2010. “Rescaling the Past through Mosaic Historical Cartography.” *Journal of Maps*: 417–422. doi:10.4113/jom.2010.1120.

Libraries, Pratt Institute. 2009. *[Charles Pratt, the Founder of Pratt Institute]*. http://www.flickr.com/photos/34900073@N07/3460551357/.

Litt, Jill, and Thomas Burke. 2002. “Uncovering the Historic Environmental Hazards of Urban Brownfields.” *Journal of Urban Health* 79 (4): 464–481. doi:10.1093/jurban/79.4.464.

Moulder, Cathy. 1994. “Fire Insurance Plans as a Data Source in Urban Research:” *Art Reference Services Quarterly* 1 (3) (January 12): 49–62. doi:10.1300/J102v01n03_06.

Sweetkind, Julie., Mary Lynette Larsgaard, and Tracey. Erwin. 2006. “Digital Preservation of Geospatial Data.” *Library Trends* 55 (2): 304–314.

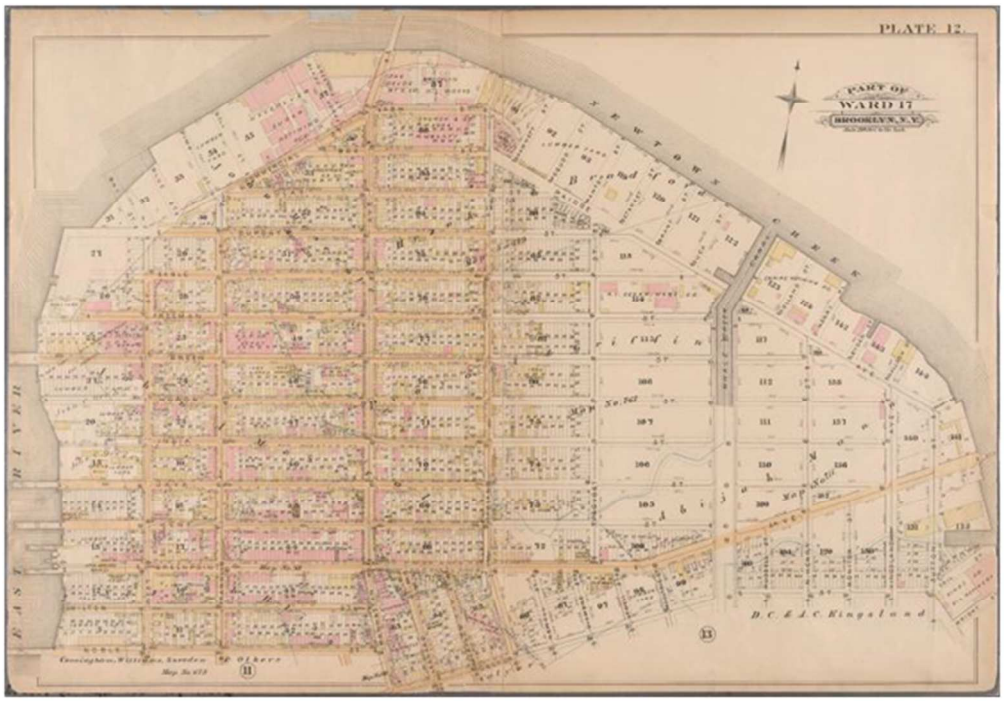
Tarbell, Ida M, and Danny Schechter. 2009. *The History of the Standard Oil Company in Two Volumes*. New York: COSIMOClassics.

Williamson, Harold Francis, and Arnold Daum. 1959. *The American Petroleum Industry; the Age of Illumination, 1859-1899,*. Evanston Ill.: Northwestern University Press.

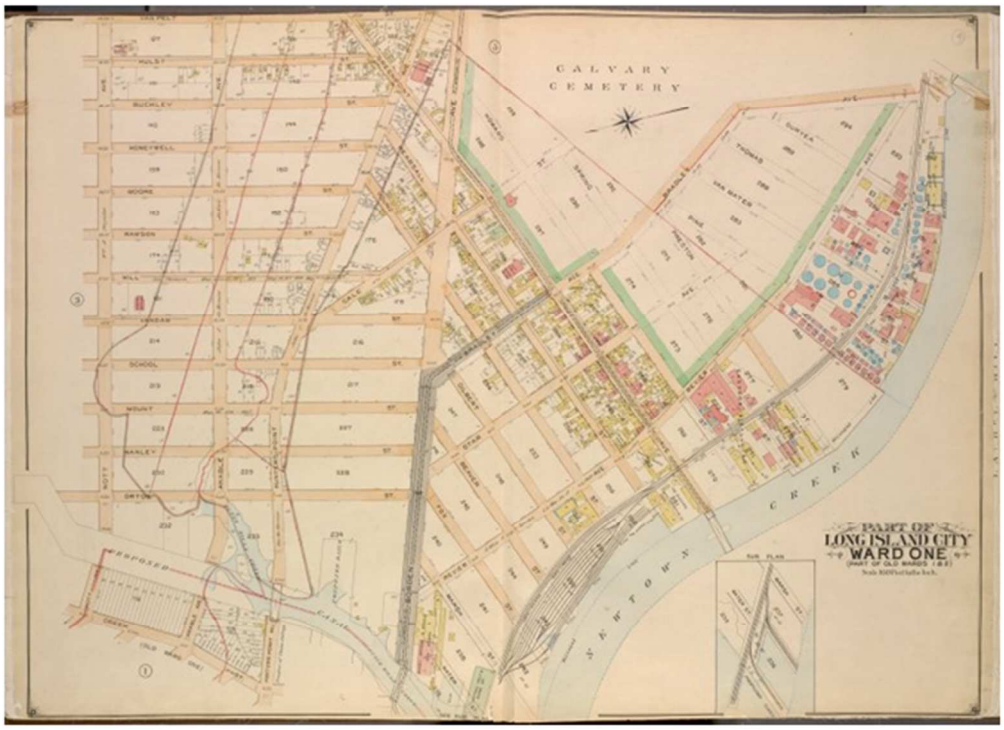
Wrigley, Robert L. 1949. “The Sanborn Map as a Source of Land Use Information for City Planning.” *Land Economics* 25 (2) (May 1): 216–219. doi:10.2307/3144766.

Youngblood, Dawn. 2006. “Map Use Across the Disciplines.” *Journal of Map and Geography Libraries* 2 (2): 33–66. doi:10.1300/J230v02n0204.

Western end of Newtown Creek to Manhattan Avenue. From Higginson's Insurance Maps of the city of Brooklyn L.I. Surveyed, Drawn & Published by J.H. Higginson. 1868. Volume 4.
178x133mm (96 x 96 DPI)

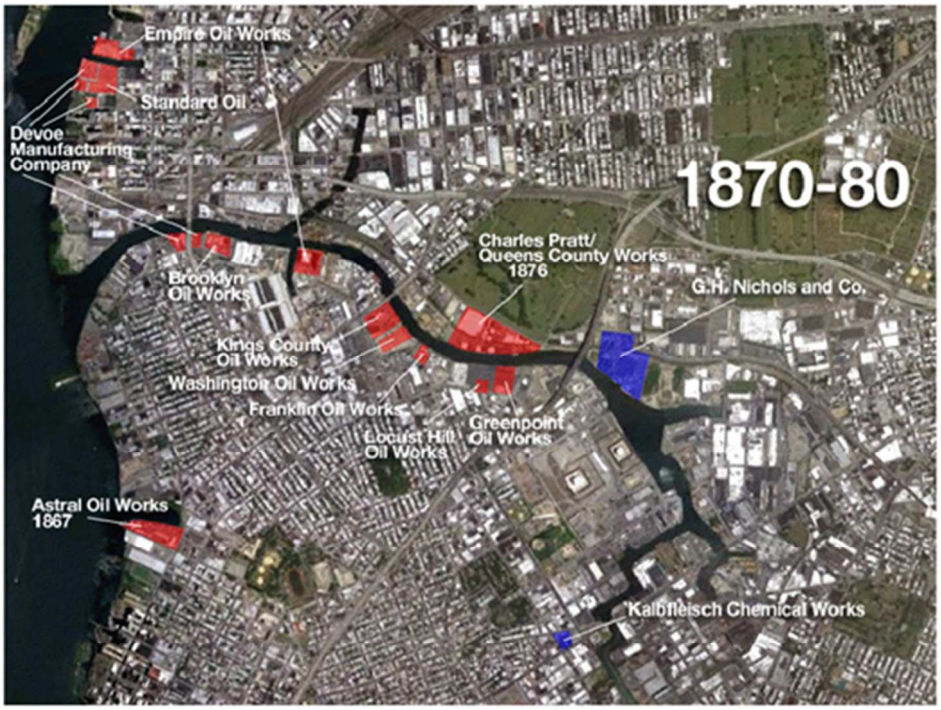


From Robinson's atlas of the city of Brooklyn, New York: embracing all territory within its corporate limits; from official records private plans and actual surveys by and under the supervision of E. Robinson and R.H. Pidgeon, civil engineers, published by E. Robinson 82 and 84 Nassau Street, New York, 1886.
178x124mm (96 x 96 DPI)



Atlas of the borough of Queens, city of New York: based upon official plans and maps on file in the various city offices; supplemented by careful field measurements and personal observations / by and under the supervision of Hugo Ullitz. > First and second wards: Long Island City and Newtown. 1903.
179x129mm (96 x 96 DPI)

Cartoon image of various products of Charles Pratt and Company
166x92mm (96 x 96 DPI)



Relative locations of sulfuric acid producers and oil refiners along Newtown Creek.
147x112mm (96 x 96 DPI)