-DRAFT-

37 OTSEGO STREET

BROOKLYN, NEW YORK

Remedial Action Work Plan

AKRF Project Number: 230011
NYSDEC BCP Project Number: C224300

Prepared for:
New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau C
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JUNE 2023

CERTIFICATIONS

I, Rebecca Kinal, P.E., certify that I am currently a New York State registered Professional Engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

Rebecca A. Kinal	XX/XX/2023	DRAFT
NYS Professional Engineer # 082046	Date	Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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Acronym	Definition
AKRF	AKRF, Inc.
AOC	Area of Concern
AWQSGVs	Ambient Water Quality Standards and Guidance Values
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
bgs	Below Ground Surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
C&D	Construction and Demolition
CAMP	Construction Air Monitoring Plan
CFR	Code of Federal Regulations
Cis-1,2-DCE	Cis-1,2-dichloroethylene
COC	Certificate of Completion
CAP	Corrective Action Plan
CPP	Citizen Participation Plan
CQAP	Construction Quality Assurance Plan
DMM	Division of Materials Management
DPP	Direct-Push Probe
ECL	Environmental Conservation Law
ECs/ICs	Engineering Controls and Institutional Controls
ELAP	NYS Environmental Laboratory Approval Program
EM	Electromagnetic
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
FER	Final Engineering Report
FWRIA	Fish and Wildlife Resources Impact Analysis
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations Emergency Response
ISCO	In-Situ Chemical Oxidation
ISS	In-Situ Solidification
IRM	Interim Remedial Measure
LBP	Lead-Based Paint
LNAPL	Light Non-Aqueous Phase Liquid
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per meter cubed
mg/kg	milligrams per kilogram
ng/L	nanograms per liter
NYC DOHMH	New York State Department of Health and Mental Hygiene
NYC OER	New York City Office of Environmental Remediation

Acronym	Definition
NYC VCP	New York City Voluntary Cleanup Program
NYCDEP	New York City Department of Environmental Protection
NYCRR	New York Codes Rules and Regulations
NYS DEC	New York State Department of Environmental Conservation
NYS DEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Housing
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety Administration
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PE	Professional Engineer
PFAS	Per- and Polyfluoroalkyl Substances
PID	Photo Ionization Detector
PGWSCO	Protection of Groundwater Soil Cleanup Objective
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RCA	Recycled Concrete Aggregate
RD	Remedial Design
RE	Remedial Engineer
RI	Remedial Investigation
RIR	Remedial Investigation Report
Roux	Roux Environmental Engineering and Geology, D.P.C.
RRGVs	Restricted Residential Use Guidance Values
RRSCOs	Restricted Residential Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SCOs	Soil Cleanup Objectives
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SSDS	Sub-Slab Depressurization System
SVOC	Semivolatile Organic Compound
SWPPP	Storm Water Pollution Prevention Plan
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List

Acronym	Definition
USCS	Unified Soils Classification System
USGS	United States Geological Survey
UST	Underground Storage Tank
UUGVs	Unrestricted Use Guidance Values
UUSCOs	Unrestricted Use Soil Cleanup Objectives
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Site Description and Physical Setting

This Remedial Action Work Plan (RAWP) has been prepared by AKRF, Inc. (AKRF) on behalf of Columbia SF LLC (the "Volunteer") for the 37 Otsego Street site, hereafter referred to as the "Site." The approximately 100,000-square foot Site is located at 37 Otsego Street in the Red Hook neighborhood of Brooklyn and is also identified as Brooklyn Block 579, Lot 1 on the Borough of Brooklyn Tax Map. BH Ruth Red Hook LLC entered into a Brownfield Cleanup Agreement (BCA) (BCA Index No. C224300-02-20) with the New York State Department of Environmental Conservation (NYSDEC) in February 2020 as a volunteer applicant to investigate and remediate the Site. On January 20, 2022, the lease interest for the Site was transferred to Columbia SF LLC, and the BCA was amended (March 2022) to remove the original applicant and add the new lessee as the Volunteer applicant/remedial party to the BCA.

The Site comprises an approximately 60,000-square foot one-story building (no basement) and an approximately 40,000-square foot outdoor paved parking lot. The building is largely vacant with the exception of a construction storage area in the eastern extent of the building and an associated office. The Site is bordered by Creamer Street followed by a demolition company and school bus parking to the south; Columbia Street followed by a commercial and manufacturing use building to the east; Otsego Street followed by a warehouse to the west; and Lorraine Street followed by residential buildings to the north. The greater surrounding area north of the Site is predominantly residential, with interspersed warehouse and industrial uses, as well as some commercial uses to the east, south, and west. The Site location is shown on Figure 1, and a Site plan is provided as Figure 2.

Summary of Past Uses and Site History

Historical records indicate that the Site had been used for commercial and manufacturing purposes since approximately 1904. Based on the historical Sanborn Fire Insurance Maps and City Directories, portions of the current building on the eastern portion of the Site appear to have been constructed as early as 1940 with historical industrial and automotive uses, including: a Department of Sanitation garage, a printing facility, a motor freight station between 1928 and the mid-1980's (with four gasoline tanks noted on the eastern side of the building between 1938 and 1969), miscellaneous warehouses, commercial and retail uses including a grocery, a bank, and a laundry. The western portion of the Site historically contained a forge and machine works between 1904 and 1928, developed with a filling station with a parking lot by 1950, and lumber storage between 1969 and 1977.

During AKRF's Phase II Investigation completed at the Site in December 2015, evidence of petroleum contamination was noted in the western portion (current parking lot) of the Site, including petroleum odors, elevated photoionization detector (PID) readings, and an approximately 0.2-foot thick layer of light non-aqueous phase liquid (LNAPL) above the water table. Based on these findings, a spill was reported to the NYSDEC spill hotline, and Spill No. 1509420 was assigned to the Site on December 15, 2015. This spill is currently open.

Summary of Remedial Investigation

Soil, groundwater, and soil vapor were investigated as part of a Remedial Investigation (RI) conducted at the Site by Roux Environmental Engineering and Geology, D.P.C. (Roux) in June 2020. The RI was conducted in accordance with the NYSDEC-approved Remedial Investigation Work Plan (RIWP) dated August 13, 2019 (revised February 25, 2020), and the findings were documented in Roux's August 2022 Remedial Investigation Report (RIR), which was subsequently approved by NYSDEC in a letter dated March 22, 2023. The RI included: a geophysical investigation; the advancement of 15 soil borings with continuous sample collection and laboratory analysis of 55 soil/fill samples [including three quality assurance/quality control (QA/QC) samples]; the installation of seven temporary groundwater monitoring

and three permanent groundwater monitoring wells with collection and laboratory analysis of 13 groundwater samples (7 from new and existing permanent groundwater monitoring wells and 6 from temporary monitoring wells) (including 1 QA/QC sample); the installation of seven temporary soil vapor points with collection and laboratory analysis of seven soil vapor samples; and the performance of a groundwater monitoring well elevation survey to determine groundwater flow direction beneath the Site.

Soil/fill sample analytical results were compared to NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs), Restricted Residential Soil Cleanup Objectives (RRSCOs), and Protection of Groundwater SCOs (PGWSCOs). Groundwater sample analytical results were compared to NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs). Concentrations of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) in soil and groundwater were compared to the guidance values presented in the June 2021 *NYSDEC Sampling, Analysis and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs.* Although there are currently no regulatory or published guidance values for volatile organic compounds (VOCs) in soil vapor, soil vapor data was used to assess the potential for exposure to receptors and to help define the nature and extent of contamination at the Site.

Field Findings

Field observations indicated that the Site is underlain by a continuous layer of historic fill material consisting of sand, gravel, brick, concrete, asphalt, and wood ranging in thickness from roughly 5 to 15 feet below ground surface (ft bgs) underlain by a layer of low permeability silt, clay, and fine sand. Organic material (peat) was encountered at depths ranging from approximately 12 to 19 ft bgs. Field evidence of gross petroleum contamination, including petroleum-like odors, PID readings of up to 2,650 parts per million (ppm), and LNAPL at depths ranging from 14 to 20 ft bgs was observed in select borings advanced in the western portion of the Site. LNAPL was also noted in temporary groundwater monitoring well RTW-7.

Soil

Six petroleum-related VOCs (1,2,4-trimethylbenzene, acetone, benzene, ethylbenzene, naphthalene, and total xylenes) were detected at concentrations ranging from 0.051 milligrams per kilogram (mg/kg) to 230 mg/kg (naphthalene), above their NYSDEC UUSCOs and/or RRSCOs. The highest concentrations were noted in the samples collected from the saturated soil at depths ranging from 8 to 16 ft bgs.

Twelve semivolatile organic compounds (SVOCs) were detected above their respective UUSCOs and/or RRSCOs at concentrations ranging from 0.49 to 110 mg/kg (phenanthrene). The naphthalene detections were related to the petroleum spill at the Site. The remaining detected compounds were primarily polycyclic aromatic hydrocarbons (PAHs), a class of SVOCs, which are typically found in urban fill (identified across the Site).

Nine metals were detected above their respective UUSCOs and/or RRSCOs at concentrations ranging from 0.217 to 4,090 mg/kg (lead). Three pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected above their respective UUSCOs in up to three samples, but below their respective RRSCOs. Herbicides and polychlorinated biphenyls (PCBs) were not detected above laboratory reporting limits in any soil samples.

Per- and polyfluorinated substances (PFAS) compounds were detected in 2 samples and at concentrations ranging from 0.895 to 0.913 micrograms per kilogram (µg/kg), exceeding their Unrestricted Use Guidance Values (UUGVs) but well below the Restricted Residential Use Guidance Values (RRGVs).

Groundwater

Ten petroleum-related VOCs (1,2,4,5-tetramethylbenzene, 1,2,4-trimethylbenzene, benzene, cymene, ethylbenzene, isopropyl benzene, naphthalene, n-propylbenzene, o-xylene, and total xylenes) were detected at concentrations ranging from 6 micrograms per liter (µg/L) to 3,600 µg/L (naphthalene), above their

NYSDEC AWQSGVs. The highest concentrations were noted in the samples collected from the western portion of the Site.

Eleven SVOCs were detected above their respective AWQSGVs at concentrations ranging from 0.02 to 2,500 µg/L (naphthalene). The detected compounds were primarily PAHs.

Eight metals (total and/or dissolved) were detected above their respective AWQSGVs at concentrations ranging from 2.24 to 777,000 µg/L (dissolved sodium). Pesticides, herbicides, and total PCBs were not detected above laboratory reporting limits in any soil samples. The total and dissolved metals exceedances in groundwater are attributed to sediment entrained in the samples and/or naturally occurring or background conditions.

PFAS compounds were detected at concentrations ranging from 4.26 to 147 nanograms per liter (ng/L) (PFOA), exceeding their NYSDEC PFAS Screening Levels.

Soil Vapor

Up to 30 VOCs were detected in soil vapor samples collected during the RI. VOCs typically associated with petroleum, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 2-hexanone, 2,2,4-trimethylpentance, 4-ethyltoluene, benzene, cyclohexane, ethylbenzene, m,p-xylenes, ethanol, tert-butyl alcohol, methyl ethyl ketone, n-heptane, n-hexane, o-xylene, toluene, were detected at concentrations ranging from 1.2 to 3,010 micrograms per cubic meter (µg/m^3) (methyl ethyl ketone in sample RSV-5). Non-petroleum-related VOCs, including acetone, carbon disulfide, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethene, dichlorodifluoromethane, ethyl acetate, isopropanol, styrene, tetrachloroethylene (PCE), trichloroethylene (TCE), and trichlorofluoromethane, were detected at concentrations ranging from 0.458 to 11,700 µg/m^3 (acetone in sample RSV-6).

The analytical results for soil, groundwater, and soil vapor samples collected during the RI are summarized in Tables 2 through 14 of the RIR provided in Appendix C2 of this RAWP. Concentration maps showing compounds detected above applicable standards for soil and groundwater, along with all soil vapor detections, are provided as Figures 6 through 8 in the RIR. The soil and groundwater concentrations above applicable standards are provided in In-Text Tables I-II and III-IV, respectively. Soil vapor detections are provided in In-Text Table V.

Soil/Fill Sample Summary

A summary of RI soil/fill detections exceeding their respective UUSCOs and/or RRSCOs is shown below in In-Text Table I.

In-Text Table I
RI Soil Analytes Detected Above NYSDEC UUSCOs and/or RRSCOs

Analyte	Sample ID	UUSCO (mg/kg)	RRSCO (mg/kg)	PGWSCOs (mg/kg)	Result (mg/kg)
1,2,4-Trimethylbenzene	RXSB-19 (16-18)	3.6	52	3.6	6
Acetone	RXSB-11 (14-16)	0.05	100	0.05	0.32
	RXSB-13 (6-8)				0.08
	RXSB-13 (8-10)				0.32
	RXSB-13 (14-16)				0.24
	RXSB-13 (16-18)				0.14
	RXSB-16 (2-4)				0.079
	RXSB-18 (14-16)				0.051
	RXSB-18 (14-16) (FD)				0.058
	RXSB-19 (7-9)				0.072
	RXSB-20 (8-10)				0.16
	RXSB-20 (18-20)				0.12
	RXSB-21 (7-9)				0.072
	RXSB-22 (7-9)				0.056
Benzene	RXSB-19 (14-16)	0.06	4.8	0.06	0.093
Ethylbenzene	RXSB-19 (14-16)	1	41	1	4.4
	RXSB-19 (16-18)				2.3
	RXSB-20 (14-16)				1.6
	RXSB-20 (16–18)				1.2
Naphthalene (VOC)	RXSB-19 (14-16)	12	100	12	30
	RXSB-19 (16-18)				**230**
	RXSB-19 (18-20)				53
	RXSB-20 (14-16)				36
	RXSB-20 (16–18)				13
	RXSB-21 (14–16)				55
Xylenes (Total)	RXSB-19 (14-16)	0.26	100	1.6	2.3
	RXSB-19 (16-18)				0.64
	RXSB-20 (14-16)				0.79
	RXSB-20 (16-18)				0.67
Acenaphthene	RXSB-21 (7-9)	20	100	98	28
	RXSB-21 (14-16)				35
Benzo(a)anthracene	RXSB-13 (14-16)	1	1	1	**2.1**
	RXSB-18 (14-16)				**2.4**
	RXSB-20 (8-10)				**1.4**
	RXSB-21 (7-9)				**18**
	RXSB-21 (14-16)				**8.3**
	RXSB-23 (0.5-1)				**5.6**
	RXSB-24 (0.5-1)				**3.2**
Benzo(a)pyrene	RXSB-18 (14-16)	1	1	22	**2.3**
	RXSB-21 (7-9)				**16**
	RXSB-21 (14-16)				**5.4**
	RXSB-23 (0.5-1)				**5.9**
	RXSB-24 (0.5-1)				**1.9**

Analyte	Sample ID	UUSCO (mg/kg)	RRSCO (mg/kg)	PGWSCOs (mg/kg)	Result (mg/kg)
Benzo(b)fluoranthene	RXSB-13 (14-16) RXSB-18 (14-16) RXSB-21 (7-9) RXSB-21 (14-16) RXSB-23 (0.5-1) RXSB-24 (0.5-1)	1	1	1.7	**1.7** **2.7** **18** **5.6** **7** **2.2**
Benzo(k)fluoranthene	RXSB-21 (7-9) RXSB-21 (14-16) RXSB-23 (0.5-1)	0.8	3.9	1.7	**5.7** 1.6 2.1
Chrysene	RXSB-13 (14-16) RXSB-18 (14-16) RXSB-20 (8-10) RXSB-21 (7-9) RXSB-21 (14-16) RXSB-23 (0.5-1) RXSB-24 (0.5-1)	1	3.9	1	**5.4** 2.4 1.2 **16** **7.6** **5.2** 3
Dibenzo(a,h)anthracene	RXSB-13 (14-16) RXSB-21 (7-9) RXSB-21 (14-16) RXSB-23 (0.5-1)	0.33	0.33	1,000	**0.72 J** **1.6** **0.49 J** **0.83**
Fluorene	RXSB-21 (4-6)	30	100	386	40
Indeno(1,2,3-cd)pyrene	RXSB-13 (14-16) RXSB-18 (14-16) RXSB-21 (7-9) RXSB-21 (14-16) RXSB-23 (0.5-1) RXSB-24 (0.5-1)	0.5	0.5	8.2	**0.67 J** **1.3** **9.4** **2.7** **3.9** **0.97**
Naphthalene	RXSB-19 (14-16) RXSB-19 (16-18) RXSB-20 (8-10)	12	100	12	41 54 34
Phenol	RXSB-20 (8-10)	0.33	100	0.33	0.39 J
Phenanthrene	RXSB-21 (14-16)	100	100	1,000	**110**
4,4'-DDD	RXSB-23 (0.5-1)	0.0033	13	14	0.00898
4,4'-DDE	RXSB-23 (0.5-1)	0.0033	8.9	17	0.0151
4,4'-DDT	RXSB-21 (7-9) RXSB-21 (14-16) RXSB-23 (0.5-1)	0.0033	7.9	136	0.00686 0.0073 0.0239

Analyte	Sample ID	UUSCO (mg/kg)	RRSCO (mg/kg)	PGWSCOs (mg/kg)	Result (mg/kg)
Arsenic	RXSB-11 (6-8)	13	16	16	**16.9**
	RXSB-12 (6-8)				**18.8**
	RXSB-13 (6-8)				**34.7**
	RXSB-13 (8-10)				**18.4**
	RXSB-13 (14-16)				**30.9**
	RXSB-13 (18-20)				14.1
	RXSB-14 (14-16)				13.9
	RXSB-17 (11-13)				**16.9**
	RXSB-17 (14-16)				**22.2**
	RXSB-18 (14-16)				14.2
	RXSB-18 (14-16) FD				**49.8**
	RXSB-19 (7-9)				**37.2**
	RXSB-20 (8-10)				**18.5**
	RXSB-21 (7-9)				14.1
	RXSB-22 (7-9)				13.1
	RXSB-22 (14-16)				**76.7**
	RXSB-23 (0.5-1)				**19.9**
	RXSB-24 (0.5-1)				**155**
Barium	RXSB-13 (14-16)	350	400	820	362 J
	RXSB-15 (6-8)				**662**
	RXSB-18 (14-16)				357
	RXSB-22 (14-16)				**548**
Chromium	RXSB-22 (14-16)	30	180	–	64.6
Copper	RXSB-12 (6-8)	50	270	1,720	154
	RXSB-13 (6-8)				133
	RXSB-13 (8-10)				90.1
	RXSB-14 (7-9)				98.2
	RXSB-14 (14-16)				284 J
	RXSB-15 (15 (6-8)				126
	RXSB-17 (11-13)				54
	RXSB-17 (14-16)				63.4
	RXSB-18 (14-16) FD				171
	RXSB-19 (7-9)				113
	RXSB-20 (8-10)				67.2
	RXSB-20 (16-18)				72.4
	RXSB-21 (7-9)				94
	RXSB-22 (7-9)				89.3
	RXSB-22 (14-16)				**974**
	RXSB-23 (0.5-1)				83.3
	RXSB-24 (0.5-1)				120

Analyte	Sample ID	UUSCO (mg/kg)	RRSCO (mg/kg)	PGWSCOs (mg/kg)	Result (mg/kg)
Lead	RXSB-11 (6-8)	63	400	450	181
	RXSB-12 (6-8)				**806**
	RXSB-13 (6-8)				**496**
	RXSB-13 (8-10)				**469**
	RXSB-14 (7-9)				341
	RXSB-14 (14-16)				**455 J**
	RXSB-14 (16-18)				123
	RXSB-15 (6-8)				**3,490**
	RXSB-15 (14-16)				103
	RXSB-15 (16-18)				208
	RXSB-16 (2-4)				224
	RXSB-16 (14-16)				**4,090**
	RXSB-16 (16-18)				91.4
	RXSB-17 (11-13)				341
	RXSB-17 (14-16)				246
	RXSB-18 (9-11)				104
	RXSB-18 (14-16)				**2,600**
	RXSB-18 (14-16) FD				**835**
	RXSB-19 (7-9)				357
	RXSB-20 (8-10)				**490**
	RXSB-21 (7-9)				**1,150**
	RXSB-21 (14-16)				114
	RXSB-22 (7-9)				**514**
	RXSB-22 (14-16)				**1,830**
	RXSB-23 (0.5-1)				248
	RXSB-24 (0.5-1)				**1,170**

Analyte	Sample ID	UUSCO (mg/kg)	RRSCO (mg/kg)	PGWSCOs (mg/kg)	Result (mg/kg)
Mercury	RXSB-11 (6-8)	0.18	0.81	0.73	0.771
	RXSB-11 (8-10)				0.314
	RXSB-12 (6-8)				**6.67**
	RXSB-13 (6-8)				**43.4**
	RXSB-13 (8-10)				**2.5**
	RXSB-13 (14-16)				0.417
	RXSB-14 (7-9)				0.529
	RXSB-14 (14-16)				**1.92**
	RXSB-15 (6-8)				**2.2**
	RXSB-15 (14-16)				0.272
	RXSB-15 (16-18)				**2.36**
	RXSB-16 (2-4)				**1.4**
	RXSB-16 (14-16)				0.797
	RXSB-16 (16-18)				0.383
	RXSB-17 (11-13)				**1.33**
	RXSB-17 (14-16)				**1.82**
	RXSB-18 (14-16)				**1.66**
	RXSB-18 (14-16) FD				**6.11**
	RXSB-19 (7-9)				0.476
	RXSB-20 (8-10)				**26.4**
	RXSB-20 (14-16)				0.367
	RXSB-21 (7-9)				**5.41**
	RXSB-21 (14-16)				**1.17**
	RXSB-21 (16-18)				0.217
	RXSB-22 (7-9)				**3.06**
	RXSB-22 (14-16)				**26.3**
	RXSB-23 (0.5-1)				0.779
	RXSB-24 (0.5-1)				**3.49**
Nickel	RXSB-10A (2-4)	30	310	130	36.1
	RXSB-13 (6-8)				33.5
	RXSB-13 (8-10)				34.4
	RXSB-13 (14-16)				33.9
	RXSB-18 (14-16) FD				37.4
	RXSB-19 (14-16)				35.6
	RXSB-20 (14-16)				60.2
	RXSB-21 (14-16)				37.3
	RXSB-22 (14-16)				75
Selenium	RXSB-13 (6-8)	3.9	180	4	6.19
	RXSB-15 (6-8)				4.08
	RXSB-21 (7-9)				40.7
	RXSB-24 (0.5-1)				91.9

Analyte	Sample ID	UUSCO (mg/kg)	RRSCO (mg/kg)	PGWSCOs (mg/kg)	Result (mg/kg)
Zinc	RXSB-12 (6-8)	109	10,000	2,480	600
	RXSB-13 (6-8)				223
	RXSB-13 (8-10)				217
	RXSB-14 (7-9)				178
	RXSB-14 (14-16)				510 J
	RXSB-15 (6-8)				557
	RXSB-15 (14-16)				159
	RXSB-16 (14-16)				559
	RXSB-17 (11-13)				133
	RXSB-17 (14-16)				140
	RXSB-18 (9-11)				150
	RXSB-18 (14-16)				302
	RXSB-18 (14-16) FD				475
	RXSB-19 (7-9)				191
	RXSB-20 (8-10)				160
	RXSB-21 (7-9)				352
	RXSB-22 (7-9)				250
	RXSB-22 (14-16)				1,550
	RXSB-23 (0.5-1)				464
	RXSB-24 (0.5-1)				254

Notes:
Exceedances of RRSCOs are highlighted with bold font.
Exceedances of PGWSCOs are highlighted with underlined font.
J – The concentration is an estimated value
Sample RXSB-18 (14-16) FD is a blind duplicate of RXSB-18 (14-16)

A summary of RI soil/fill PFAS detections exceeding their respective Unrestricted Use Guidance Values (UUGVs) and Restricted Residential Use Guidance Values (RRGVs) is shown below in In-Text Table II.

In-Text Table II
RI Soil PFAS Concentrations Detected Above NYSDEC UUGVs and/or RRGVs

Analyte	Sample ID	UUGV (µg/kg)	RRGV (µg/kg)	Result (µg/kg)
Perfluorooctanesulfonic acid (PFOS)	RXSB-13 (8-10)	0.88	44	0.913 J
Perfluorooctanoic acid (PFOA)	RXSB-20 (8-10)	0.66	33	0.895

Notes:
J – The concentration is an estimated value

Groundwater Sample Summary

A summary of RI groundwater detections exceeding their respective AWQSGVs is shown in In-Text Table III.

In-Text Table III
RI Groundwater Analytes Detected Above NYSDEC AWQSGVs

Analyte	Sample ID	AWQSGV (µg/L)	Result (µg/L)
1,2,4,5-tetramethylbenzene	MW-3_R MW-4 RXSB-1_R	5	6.1 J 13 J 15 J
1,2,4-trimethylbenzene	MW-4 RXSB-1_R	5	20 J 47
Benzene	MW-5 RXSB-1_R	1	8.3 J 22
Cymene	MW-4	5	9.1 J
Ethylbenzene	MW-3_R MW-4 MW-5 RXSB-1_R	5	11 222 J 86 J 170
Isopropyl benzene	MW-3_R MW-4 MW-5 RXSB-1_R	5	6 J 18 J 40 J 46
Naphthalene (VOC)	MW-3_R MW-4 MW-5 RXSB-1_R	10	460 820 3,600 1,800
N-propylbenzene	MW-3_R MW-4 MW-5 RXSB-1_R	5	7.6 J 16 J 45 J 38
O-xylene	RXSB-1_R	5	10 J
Acenaphthene	MW-3_R MW-4 MW-5 RXSB-1_R	20	22 96 140 45
Benzo(a)anthracene	RTW-1 RTW-2 RTW-3 RTW-6	0.002	0.12 0.03 J 0.05 J 0.12
Benzo(a)pyrene	RTW-1 RTW-2 RTW-3 RTW-6	ND	0.1 0.03 J 0.05 J 0.09 J
Benzo(b)fluoranthene	RTW-1 RTW-2 RTW-3 RTW-4 RTW-6	0.002	0.13 0.04 J 0.06 J 0.02 J 0.12
Benzo(k)fluoranthene	RTW-1 RTW-2 RTW-3 RTW-6	0.002	0.04 J 0.02 J 0.03 J 0.05 J
Biphenyl	MW-3_R MW-4 RXSB-1_R	5	8.9 20 12

Analyte	Sample ID	AWQSGV (µg/L)	Result (µg/L)
Chrysene	RTW-1	0.002	0.16
	RTW-2		0.03 J
	RTW-3		0.08 J
	RTW-4		0.02 J
	RTW-6		0.13
	RXSB-1_R		0.29 J
Fluorene	MW-4	50	52
	MW-5		69
Indeno(1,2,3-cd)pyrene	RTW-1	0.002	0.08 J
	RTW-2		0.03 J
	RTW-3		0.05 J
	RTW-6		0.09 J
Naphthalene (SVOC)	MW-3_R	10	220
	MW-4		500
	MW-5		2,500
	RXSB-1_R		860
Phenol	RTW-2	1	4.4 J
Arsenic (Total)	RTW-1	25	27.12
Iron (Total)	MW-3_R	300	439 J
	MW-4		1,420
	MW-9 FD		429 J
	RTW-1		13,000
	RTW-2		46,400
	RTW-3		16,600
	RTW-4		25,100
	RTW-5		42,300
	RTW-6		15,400
	RXSB-1_R		667
Iron (Dissolved)	MW-3_R	300	451 J
	MW-4		1,470
	MW-9 FD		423 J
	RTW-1		1,070
	RTW-2		7,530
	RTW-3		8,340
	RTW-4		1,720
	RTW-5		19,200
	RTW-6		5,710
	RXSB-1_R		672
Lead (Total)	RTW-1	25	35.98
	RTW-2		127.7
	RTW-6		42.63
Magnesium (Total)	MW-3_R	35,000	60,100
	MW-4		66,200
	MW-5		54,000
	RTW-2		93,700
	RTW-4		66,800
	RTW-5		37,600
	RTW-6		43,400
	RXSB-1_R		52,200

Analyte	Sample ID	AWQSGV (µg/L)	Result (µg/L)
Magnesium (Dissolved)	MW-3_R	35,000	60,300
	MW-4		68,000
	MW-5		54,700
	RTW-2		94,700
	RTW-4		55,100
	RTW-6		44,000
	RXSB-1_R		50,800
Manganese (Total)	MW-3_R	300	1,856 J
	MW-4		534.2
	MW-5		1,128
	MW-9		638.9
	MW-9 FD		656.9
	RTW-1		675.4
	RTW-2		1,814
	RTW-3		1,268
	RTW-4		2,445
	RTW-5		2,092
	RTW-6		1,422
	RXSB-1_R		1,853
Manganese (Dissolved)	MW-3_R	300	1,789 J
	MW-4		555.5
	MW-5		1,127
	MW-9		652.3
	MW-9 FD		648.5
	RTW-1		580.3
	RTW-2		1,778
	RTW-3		1,234
	RTW-4		1,895
	RTW-5		1,938
	RTW-6		1,421
	RXSB-1_R		1,800
Mercury (Total)	RTW-2	0.7	2.24
Nickel (Dissolved)	RTW-2	100	132.1
Sodium (Total)	MW-3_R	20,000	341,000
	MW-4		380,000
	MW-5		495,000
	MW-9		144,000
	MW-9 FD		147,000
	RTW-1		144,000
	RTW-2		773,000
	RTW-3		225,000
	RTW-4		341,000
	RTW-5		362,000
	RTW-6		424,000
	RXSB-1_R		434,000

Analyte	Sample ID	AWQSGV (µg/L)	Result (µg/L)
Sodium (Dissolved)	MW-3_R	20,000	341,000
	MW-4		387,000
	MW-5		499,000
	MW-9		145,000
	MW-9 FD		146,000
	RTW-1		146,000
	RTW-2		777,000
	RTW-3		226,000
	RTW-4		299,000
	RTW-5		342,000
	RTW-6		433,000
	RXSB-1_R		425,000

Notes:
J – The concentration is an estimated value.
Sample MW-9 FD is a blind duplicate of MW-9.
ND = Non-detection.

A summary of RI groundwater PFAS detections exceeding their respective NYSDEC Screening Levels is shown in In-Text Table IV.

In-Text Table IV
RI Groundwater PFAS Concentrations Detected Above NYSDEC Screening Levels

Analyte	Sample ID	NYSDEC PFAS Screening Level (ng/L)	Result (ng/L)
Perfluorooctanesulfonic acid (PFOS)	MW-5	2.7	11.8
	MW-9		25.8
	MW-9 FD		26.4
	MW-10		5.67
	MW-11		4.26
Perfluorooctanoic acid (PFOA)	MW-3_R	6.7	76.1
	MW-4		66.9
	MW-5		76.2
	MW-9		37.3
	MW-9 FD		40.2
	MW-10		147
	MW-11		75.2
	RXSB-1_R		66.6

Notes:
Sample MW-9 FD is a blind duplicate of MW-9.

Soil Vapor Sample Summary

A summary of RI soil vapor detections is shown in In-Text Table V.

In-Text Table V
RI VOC Detections in Soil Vapor Samples

Analyte	Sample(s)	Concentration ($\mu g/m^3$)
1,2,4-Trimethylbenzene	RSV-1	12.8
	RSV-2	6.19
	RSV-3	8.9
	RSV-4	5.7
	RSV-7	4.51
1,3,5-Trimethylbenzene (Mesitylene)	RSV-1	3.91
	RSV-2	2.13
	RSV-3	2.65
	RSV-4	1.89
	RSV-7	1.54
1,3-Butadiene	RSV-5	13.1
	RSV-6	13.2
2,2,4-Trimethylpentane	RSV-1	6.63
	RSV-2	2.99
	RSV-3	2.41
	RSV-4	4.66
	RSV-7	3.33
2-Hexanone	RSV-5	902
	RSV-6	857
4-Ethyltoluene	RSV-1	2.09
	RSV-2	1.25
	RSV-3	1.35
Acetone	RSV-1	13.1
	RSV-2	5.27
	RSV-3	29.9
	RSV-4	10.9
	RSV-5	11,000
	RSV-6	11,700
Benzene	RSV-1	7.12
	RSV-2	1.34
	RSV-4	1.2
	RSV-6	6.84
Carbon disulfide	RSV-1	29.2
	RSV-2	10.5
	RSV-4	3.86
	RSV-6	16.8
Chloroethane	RSV-7	1.25
Chloroform	RSV-1	11.4
	RSV-2	12.7
	RSV-3	1.54
	RSV-7	6.49
Chloromethane	RSV-3	0.458
	RSV-7	2.21
Cis-1,2-Dichloroethylene	RSV-2	0.916

Analyte	Sample(s)	Concentration ($\mu g/m^3$)
Cyclohexane	RSV-1	6.51
	RSV-2	2.68
	RSV-3	1.36
	RSV-4	58.2
	RSV-6	38.6
	RSV-7	4.44
Dichlorodifluoromethane	RSV-1	4.2
	RSV-2	5,290
	RSV-3	45.8
	RSV-4	692
	RSV-7	4.23
Ethanol	RSV-5	520
	RSV-6	518
Ethyl Acetate	RSV-3	43.6
Ethylbenzene	RSV-1	13.7
	RSV-2	6.17
	RSV-3	4.6
	RSV-4	3.84
	RSV-7	5.82
Isopropanol	RSV-3	3.02
	RSV-5	575
	RSV-6	516
M,P-Xylenes	RSV-1	33.8
	RSV-2	18.1
	RSV-3	13.4
	RSV-4	10.4
	RSV-7	14.4
Methyl ethyl ketone (MEK)	RSV-1	4.72
	RSV-3	1.77
	RSV-4	2.5
	RSV-5	3,010
	RSV-6	2,900
N-Heptane	RSV-1	14.2
	RSV-2	9.26
	RSV-3	2.31
	RSV-4	6.31
	RSV-5	45.1
	RSV-6	41.4
	RSV-7	32.1
N-Hexane	RSV-1	16.3
	RSV-2	7.26
	RSV-3	15.3
	RSV-4	5.85
	RSV-5	36.3
	RSV-6	66.3
	RSV-7	79.6

Analyte	Sample(s)	Concentration ($\mu g/m^3$)
O-Xylene (1,2-Dimethylbenzene)	RSV-1	16.2
	RSV-2	7.82
	RSV-3	5.3
	RSV-4	5.95
	RSV-7	6.12
Styrene	RSV-7	1.16
Tert-butyl Alcohol	RSV-1	2.49
	RSV-4	2.26
	RSV-5	755
	RSV-6	761
Tetrachloroethylene (PCE)	RSV-1	8.14
	RSV-2	7.19
	RSV-3	2.43
	RSV-4	3.16
	RSV-7	4.85
Toluene	RSV-1	57.7
	RSV-2	18.6
	RSV-3	5.99
	RSV-4	10.7
	RSV-7	19.6
Trichloroethylene (TCE)	RSV-1	8.65
	RSV-4	1.36
	RSV-7	1.52
Trichlorofluoromethane	RSV-1	12.2
	RSV-2	80.4
	RSV-3	54.2
	RSV-4	11
	RSV-7	43.8

Qualitative Human Health Exposure Assessment (QHHEA)

A Qualitative Human Health Exposure Assessment (QHHEA) was included in the RIR. The Site currently consists of a mostly vacant commercial/warehouse building on the eastern portion of the lot and asphalt-paved parking area on the western portion of the lot. The Site is currently vacant, with the exception of a small portion of the building (on the eastern extent of the structure) that is currently used for the staging of construction materials with an associated small office with a locked gate. The majority of the Site is capped with the warehouse slab and asphalt pavement, and is fenced. Therefore, ingestion, inhalation, or dermal contact with contaminants via soil/fill, groundwater, and/or soil vapor is not a concern with respect to current conditions.

Based on the results of the QHHEA, this RAWP, which includes a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) to protect on-site workers and the surrounding community, would be implemented during future redevelopment work to ensure that the potential exposure pathways identified do not become complete. The RAWP addresses the contaminated soil/fill, groundwater, and soil vapor identified at the Site, and includes provisions for the installation/implementation of certain engineering and institutional controls (ECs and/or ICs, respectively) to address residual contamination that may remain following remediation.

Summary of the Remedy

The proposed Track 4 remedy for the Site includes the following:

1. Demolition and abatement (e.g., asbestos, universal waste, etc.) of the existing Site building.
2. An *in-situ* solidification (ISS) program will be implemented in the western portion of Site to address the gross petroleum-contaminated soil and to close-out Spill No. 1509420. It is anticipated that soil mixing for the ISS will be conducted in an approximately 25,000 square foot area down to approximately 28 feet below ground surface (bgs). An approximately 6-foot soil cut will need to be excavated in this area to contain the ISS spoils and increased soil volume created by the soil mixing. The target ISS area is shown on Figure 3.
3. Implementation of a quality assurance/quality control program in accordance with NYSDEC requirements and groundwater monitoring to demonstrate the effectiveness of the ISS treatment program.
4. Excavation and removal of soil/fill in the upper 2 feet across the Site to achieve a Track 4 cleanup. The anticipated limits of remedial excavation are shown on Figure 4. In addition, soil/fill from any potential metal hot-spots or petroleum contaminated soil (outside of ISS area and 2-foot cut) identified during the waste classification sampling and/or during the remedial action will also be excavated and removed from the Site. The total soil volume removed during the remedial excavation will be included in the Final Engineering Report (FER).
5. Removal and off-site disposal of any petroleum storage tanks, fill ports, and vents and any associated grossly contaminated soil, if encountered, in accordance with applicable regulations.
6. Screening for indications of contamination (by visual means, olfactory, and monitoring with a PID) of all excavated soil during any intrusive Site work.
7. A CAMP will be implemented during all intrusive Site activities to monitor levels of VOCs and particulates within the active work-zones and around the perimeter of the Site.
8. Characterization and off-site disposal of all materials removed from the Site in accordance with all federal, state, and local rules and regulations for handling, transport, and disposal. Waste disposal facilities will be selected based on data collected to date and waste classification sampling. Based on the requirements of the selected facilities, additional soil waste classification samples may be collected and analyzed as needed to obtain approval for soil disposal.
9. Approximately 115 documentation samples will be collected from bottom and sidewalls of the remedial excavation and analyzed to evaluate the performance of the remedy with respect to attainment of Track 4 RRSCOs. Documentation sample frequency will be based on the sampling frequency outlined in Section 5.4(e)10 of DER-10 and in Section 6.2 of this RAWP. The proposed endpoint sample locations are shown on Figure 4.
10. Import of clean fill or stone to replace the excavated soil and establish the design grades. On-site reuse of excavated soil at the Site is not anticipated.
11. An active sub-slab depressurization system (SSDS) will be installed beneath the proposed new building foundation slab(s) [a separate system (3 total) for each new proposed building] to prevent vapor intrusion.
12. A composite cover system will be constructed across the Site consisting of a minimum 6-inch thick concrete building slab underlain by a minimum 6-inch gas permeable aggregate layer beneath all building areas, and a minimum of two feet of imported clean soil/fill in landscaped areas meeting the requirements of 6 NYCRR Part 375-6.7(d). A soil import request form will be prepared and submitted to NYSDEC BCP Project Manager for review and approval prior to material import.

13. If localized dewatering and/or support of excavation is needed to complete the remedial actions (or to install the foundation and utilities for the new building), they will be implemented in accordance with all federal, state, and local regulations.
14. An Environmental Easement (EE) will be recorded with the New York City Office of the Registrar. The EE will: require the remedial parties/Site owners to complete and submit a periodic certification of institutional controls (ICs) and engineering controls (ECs) to NYSDEC in accordance with NYCRR Part 375-1.8 (h)(3); allow for the future redevelopment and use of the Site for restricted residential use as defined by Part 375-1.8(g), although land use is subject to local zoning laws; prohibit the use of groundwater as a source of potable or process water without necessary water quality treatment, as determined by New York State Department of Health (NYSDOH); and require compliance with a site-specific, NYSDEC-approved Site Management Plan (SMP).
15. An SMP will be implemented that identifies all use restrictions and ECs for the Site and details the steps and media-specific requirements necessary to ensure the ICs and ECs remain in place and effective.
16. All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable federal, state, and local rules and regulations.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RAWP and the NYSDEC-issued Decision Document. All deviations from the RAWP and/or Decision Document will be promptly reported to NYSDEC for approval and fully explained in the FER.

REMEDIAL ACTION WORK PLAN

1.0 INTRODUCTION

This Remedial Action Work Plan (RAWP) has been prepared by AKRF, Inc. (AKRF) on behalf of Columbia SF LLC (the "Volunteer") for the 37 Otsego Street site, hereafter referred to as the "Site." The approximately 100,000-square foot Site is located at 37 Otsego Street in the Red Hook neighborhood of Brooklyn and is also identified as Brooklyn Block 579, Lot 1 on the Borough of Brooklyn Tax Map. BH Ruth Red Hook LLC entered into a Brownfield Cleanup Agreement (BCA) (BCA Index No. C224300-02-20) with the New York State Department of Environmental Conservation (NYSDEC) in February 2020 as a volunteer applicant to investigate and remediate the Site. On January 20, 2022, the lease interest for the Site was transferred to Columbia SF LLC, and the BCA was amended (March 2022) to remove the original applicant and add the new lessee as the Volunteer applicant/remedial party to the BCA.

This Remedial Action Work Plan (RAWP) summarizes the nature and extent of contamination as determined from data gathered during various investigations completed at the Site, including: the Phase II Investigation, performed by AKRF, Inc. in December 2015; the Site Investigation (SI), performed by Roux in June 2016; and the Remedial Investigation (RI), performed by Roux in June 2020. The RAWP provides an evaluation of a Track 1 cleanup and other applicable Remedial Action alternatives, their associated costs, and the recommended and preferred remedy. The remedy described in this document is consistent with the procedures defined in DER-10 and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all applicable federal, state, and local laws, regulations and requirements. The NYSDEC and New York State Department of Health (NYSDOH) have determined that the Site is not a significant threat to human health and the environment. The RI for this Site did not identify fish and wildlife resources.

Following submission of the RAWP, an In-Situ Solidification (ISS) Treatability Study will be completed and a separate ISS Treatability Report detailing the ISS design will be prepared. It is anticipated that the draft ISS Treatability Report will be submitted in late 2023.

1.1 Site Location and Description

The Site is located in Kings County, Brooklyn, New York and is identified as Block 579, Lot 1, on the Borough of Brooklyn Tax Map. The Site is situated on an approximately 100,000-square foot area bounded to the north by Lorraine Street followed by residential buildings; to the east by Columbia Street followed by commercial buildings; to the south by Creamer Street followed by a demolition company and school bus parking; and to the west by Otsego Street followed by a warehouse. Demolition of the existing building is anticipated to begin in January 2024. A boundary map was attached to the BCA as required by Environmental Conservation Law (ECL) Title 14 Section 27-1419. The approximately 2.3-acre property is fully described in Appendix A – Metes and Bounds. A Site Location map is provided as Figure 1, and a Site and Sample Location Plan is provided as Figure 2.

1.2 Contemplated Redevelopment Plan

The Remedial Action (RA) to be performed under the RAWP is intended to make the Site protective of human health and the environment consistent with the contemplated end use. The proposed redevelopment plan and end use are described here to provide the basis for this assessment. However, the RA contemplated under this RAWP may be implemented independent of the proposed redevelopment plan.

The proposed redevelopment plan consists of the demolition of the existing structure and construction of three new 8-story buildings (Buildings A through C) with an approximately 12,000 square foot landscaped area. Building A will contain 210 units of senior housing and approximately

4,580 square feet of space for senior services; Building B will contain 81 units for senior housing, supportive offices, recreation space, and bicycle storage room; and Building C will contain 110 units for senior housing and 258 units of family housing, approximately 1,080-square feet of community space, and a 31-space accessory parking garage. There will be no basement level, as the Site is located within a high-risk flood zone. Preliminary proposed redevelopment plans are included in Appendix B.

1.3 Description of Surrounding Property

The Site is bounded to the north by Lorraine Street followed by residential buildings; to the east by Columbia Street followed by commercial buildings; to the south by Creamer Street followed by a demolition company and school bus parking; and to the west by Otsego Street followed by a warehouse. Based on the NYC Department of City Planning's Zoning Map information, the Site is zoned R6 (residential) with commercial overlay, C1-3. The surrounding area is predominantly industrial and residential, with some commercial uses. Potential nearby sensitive receptors include residential buildings, schools, and day care facilities. The Erie Basin is located approximately 1,500 feet south of the Site.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Site was investigated in accordance with the NYSDEC-approved Remedial Investigation Work Plan (RIWP) dated August 13, 2019 (revised February 25, 2020). The investigation was completed by Roux in June 2020, and the findings were included in the August 2022 Remedial Investigation Report (RIR). The RIR was reviewed and approved by NYSDEC in a letter dated March 22, 2023.

2.1 Summary of Remedial Investigation

The RI included the following scope of work:

- A geophysical investigation was completed across the accessible portions of the Site to investigate the potential presence of underground storage tanks (USTs) and/or buried aboveground storage tanks (ASTs) from past on-site uses, and to clear boring locations of underground utilities.
- The advancement of 15 soil borings with collection and laboratory analysis of 55 samples [including three quality assurance/quality control (QA/QC) samples]. The samples were analyzed for volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) Method 8260, semi-volatile organic compounds (SVOCs) by EPA Method 8270, herbicides by EPA Method 8151, pesticides by EPA Method 8081, polychlorinated biphenyls (PCBs) by EPA Method 8082, target analyte list (TAL) metals by EPA Method 6000/7000 series plus cyanide and hexavalent chromium, and emerging contaminants [1,4-dioxane by EPA Method 8270 and per- and polyfluoroalkyl substances (PFAS) by EPA Method 537 (modified)].
- The installation of seven temporary groundwater monitoring and three permanent groundwater monitoring wells with collection and laboratory analysis of 13 groundwater samples (7 from new and existing permanent groundwater monitoring wells and 6 from temporary monitoring wells) (including 1 QA/QC sample). A groundwater sample could not be collected from one of the temporary wells (RTW-7) due to presence of light non-aqueous phase liquid (LNAPL). The groundwater samples were analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, herbicides by EPA Method 8151, pesticides by EPA Method 8081, TAL metals by EPA Method 6000/7000 series, and emerging contaminants [1,4-dioxane by EPA Method 8270D Selective Ion Monitoring (SIM) and PFAS by EPA Method 537 (modified)].
- The installation of seven temporary soil vapor points with collection and laboratory analysis of seven soil vapor samples. The soil vapor samples were analyzed for VOCs by EPA Method TO-15
- The performance of a groundwater monitoring well elevation survey to determine groundwater flow direction beneath the Site.

2.2 Remedial Investigation Findings

Field observations indicated that the Site is underlain by a continuous layer of historic fill material consisting of sand, gravel, brick, concrete, asphalt, and wood ranging in thickness from roughly 5 to 15 feet below ground surface (ft bgs) underlain by a layer of low permeability silt, clay, and fine sand. Organic material (peat) was encountered at depths ranging from approximately 12 to 19 ft bgs. Field evidence of gross petroleum contamination, including petroleum-like odors, PID readings of up to 2,650 parts per million (ppm), and LNAPL at depths ranging from 14 to 20 ft bgs was observed in select borings advanced in the western portion of the Site. LNAPL was also identified in one of the temporary groundwater monitoring well (RTW-7) installed during the RI.

The results of the soil samples exhibited multiple exceedances of the NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs) and/or Restricted Residential Soil Cleanup Objectives (RRSCOs) and Protection of Groundwater Soil Cleanup Objective (PGWSCOs) for VOCs in the western portion of the Site, likely associated with the petroleum impacts as well as multiple exceedances for SVOCs above NYSDEC UUSCOs, RRSCOs, and PGWSCOs indicative of urban fill, metals likely associated with contaminated historic fill, and low concentrations of pesticides commonly found in urban areas, and PFAS that were likely attributable to background levels common in urban areas.

The groundwater results of the newly installed temporary well points and three additional monitoring wells indicated no VOC contamination was present at these locations, with the exception of separate-phase product in one temporary well point (RTW-7). Petroleum-related VOCs exceeded AWQSGVs in existing monitoring wells located on the western portion of the Site. Some SVOC exceedances above the AWQSGVs was likely due to sediment present in the samples. Four detections of naphthalene were present in monitoring wells above the AWQSGV, which was also detected in soil, and therefore, a likely source of the groundwater contamination. The metals exceedances above NYSDEC AWQSGVs were deemed naturally occurring or due to sediment in samples from contaminated historic fill and are not a source of groundwater impacts. The PFAS results in groundwater were associated with background levels common in urban environments.

The soil vapor results detected certain chlorinated VOCs including PCE, TCE and cis-1,2-DCE, but with the absence of these compounds detected in soil and groundwater, it was concluded that the detections were associated with regional conditions rather than an on-site contaminant source. Petroleum-related VOCs were detected in the soil vapor results noted to be likely associated with the soil and groundwater impacts from Spill No. 1509420.

The analytical results for soil, groundwater, and soil vapor samples collected during the RI are summarized in Tables 2 through 14 of the RIR provided in Appendix C2 of this RAWP. Concentration maps showing compounds detected above applicable standards for soil and groundwater, along with all soil vapor detections, are provided as Figures 6 through 8 of the RIR (Appendix C2). A more detailed summary of RI findings is provided in Section 2.6 of this RAWP.

2.3 Significant Threat

The NYSDEC and NYSDOH have determined that the Site is not a significant threat to human health and the environment.

2.4 Site History

2.4.1 Past Uses and Ownership

Historical records indicate that the Site had been used for commercial and manufacturing purposes since approximately 1904. Based on the historical Sanborn Fire Insurance Maps and City Directories presented in the February 2023 Phase I Environmental Site Assessment (ESA), portions of the current building on the eastern portion of the Site appear to have been constructed as early as 1940 with historical industrial and automotive uses, including: a Department of Sanitation garage, a printing facility, a motor freight station between 1928 and the mid-1980s (with four gasoline tanks noted on the eastern side of the building between 1938 and 1969), miscellaneous warehouses, commercial and retail uses including a grocery, a bank, and a laundry. The western portion of the Site historically contained a forge and machine works between 1904 and 1928, developed with a filling station with a parking lot by 1950, and lumber storage between 1969 and 1977.

Known Site owners have included: Creamer Realty Corp prior to 1971; Sam Barasch, Frank Picciolo and Thomas Picciolo from 1971 to 1988; Alwayne Construction Corp. from

1988 to 2001; Bogopa-Columbia, Inc. from 2001 to 2004, Royal Farms, Inc. from 2004 to 2015; 498-516 Columbia Street, LLC from 2015 to 2019; BH Ruth Red Hook LLC from June 2019 to present-day.

2.4.2 Previous Investigations

Phase I Environmental Site Assessment (ESA), 37 Otsego Street, AKRF, Inc., January 2016

AKRF performed a Phase I ESA in December 2015 in accordance with ASTM Standard E1527-13, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Practice* (the standard used at that time). The main objective of the Phase I ESA was to identify recognized environmental conditions (RECs), vapor encroachment concerns (VECs), and other environmental concerns that may have affected the Site. Assessment findings included:

- Historical Sanborn maps and city directory listings for the property indicated historical use at the Site that consisted of commercial and manufacturing uses, including a machine shop, iron works, metal forging, a filling station, printing company, a motor freight station and warehouse. The surrounding area was historically developed with residential, industrial, and commercial properties, including a grease factory, copper works, iron yard, varnish works, junk yards, paint manufacturing, residential apartment buildings, garage, and filling stations. These historic on-site and off-site uses could have affected groundwater and/or soil vapor beneath the Site.
- Based on review of historic records, the northwest corner of the Site may have been utilized as a gasoline service station. Records also showed underground storage tanks (USTs) on the eastern portion of the Site. Potential buried debris from former on-site structures could contain historic fill of unknown origin and/or abandoned USTs.
- Regulatory database listings were identified for numerous facilities near the Site, including two active spill cases on adjacent blocks. One active spill, located on the north-adjacent block directly upgradient of the Site, included 3,500 gallons of fuel oil spilled in 1995. The second active spill included a detection of fuel oil related contaminants in soil and groundwater in 2013 on the southwest-adjacent block, downgradient from the Site.

Based on the findings of the Phase I ESA, AKRF recommended conducting a Subsurface (Phase II) Investigation at the Site.

Subsurface (Phase II) Investigation, 37 Otsego Street, AKRF, Inc., January 2016

AKRF conducted a subsurface (Phase II) investigation at the Site to determine whether current or former on- or off-site activities have adversely affected the Site. Field activities were performed on December 15 and 16, 2015, and included a geophysical survey and the advancement of 13 borings, with the collection of 17 soil samples, six groundwater samples, six soil vapor samples, and one ambient air sample were collected for laboratory analysis.

Soil encountered in the borings, which were advanced to a maximum depth of approximately 15 feet below grade, generally consisted of sandy fill materials including brick, concrete, glass, plastic, micaceous schist, coal slag, wood, and rock fragments. Groundwater was encountered within temporary well points at approximately 8 to 10 feet below. Elevated PID readings of up to a maximum of 192 ppm and evidence of NAPL were noted in the borings advanced in the parking lot (western part of the Site).

Analytical results, compared to NYSDEC 6 NYCRR Part 375-6.4 Soil Cleanup Objectives (SCOs), specifically the NYSDEC RRSCOs and UUSCOs, indicated that SVOCs, metals, PCBs and pesticides were detected in the shallow soil samples from across the Site and are typical of historic fill. It was noted that elevated concentrations of certain metals, particularly lead, in the shallow soil may require handling and disposal as hazardous waste during the excavation phase of the future proposed development.

It was noted that NAPL (petroleum contamination) identified in the western portion of the Site would require remediation in accordance with NYSDEC requirements for spill closure.

Solvent-related and gasoline-related soil vapor concentrations were identified in the northern sidewalk, with detections of compounds that were not identified at elevated concentrations in the Site soil or groundwater. It was noted that soil vapor concentration may be from an on-site or off-site source.

The geophysical survey did not identify any anomalies consistent with the presence of a buried tank; however, it was noted that USTs may still be present in areas inaccessible to the survey or undetected due to geophysical interference from Site structures or heterogeneous fill material. Numerous active and closed status spills were also identified in the Site vicinity as part of the Phase I study.

AKRF's Phase II concluded that the findings of the investigation identified the presence of petroleum contamination, primarily in the western portion of the Site (the current parking lot) likely attributed to former on-site uses. NAPL was observed on the groundwater table, and the NYSDEC was notified of the observed spill (Spill Number 1509420 was issued for the Site in December 2015). Based on the results of the investigation, it was noted that spill investigation and remediation plans should be developed and implemented under the oversight of NYSDEC. In addition, a plan should be prepared in conjunction with the Site redevelopment plans to address any residual petroleum contamination, soil excavation and stockpiling, soil disposal and transportation; groundwater handling/treatment; dust control; and contingency measures should petroleum storage tanks or other contamination be unexpectedly encountered. AKRF noted that the plan should also include measures for worker and community health and safety monitoring/protection during remedial activities requiring ground disturbance, including personal protective equipment, dust control, air monitoring, and emergency response procedures.

NYSDEC Correspondence between NYSDEC and AKRF, 37 Otsego Street, AKRF, Inc., January 2016

Correspondence between Hiralkumar Patel of the DEC and AKRF was reviewed regarding spill remediation activities. Additionally, AKRF confirmed that two monitoring wells that were located on the Site were not installed by AKRF, as no permanent monitoring wells were installed during AKRF's Phase II Investigation.

Investigation Work Plan, Roux Environmental Engineering and Geology, D.P.C. (Roux), June 2016 and Subsurface Investigation Summary Report (SISR), Roux, September 2016

Roux completed a subsurface investigation (SI) in July 2016 in order to further investigate the extent of previously identified petroleum impacts associated with NYSDEC Spill Number 1509420 in soil and groundwater and to assess whether or not the historic off-site Lorraine Street Spill (Spill Number 9510807) affected subsurface conditions at the Site. Investigation activities were conducted in accordance with the NYSDEC-approved Investigation Work Plan dated June 20, 2016. Based on the investigation results, Roux

identified two distinct areas of contamination at the Site: 1) impacts in the northwest portion of the Site appeared consistent with degraded fuel oil/diesel fuel; and 2) impacts in the southwest portion of the Site appeared consistent with gasoline. A Subsurface Investigation Summary Report (SISR), dated September 12, 2016, was prepared and submitted to the NYSDEC. The field investigation included completion of 10 soil, installation of five monitoring wells within the parking lot (RXSB-1, MW-2 through MW-5), the collection of one petroleum fingerprint analysis sample, collection of 20 soil samples, and collection of five groundwater samples.

Analytical results of soil sample (MW-3) indicated that three petroleum related VOCs (1,2,4-trimethylbenzene, ethylbenzene and total xylenes) exceeded their respective RRSCO in the 15-17 foot below grade surface (bgs) interval. Analytical data for SVOCs indicated detections above the RRSCOs for 15 SVOCs in depths ranging from 7 to 17 feet bgs, noted to be typical of degraded petroleum and/or historic fill.

Groundwater analytical results indicated VOC exceedances of AWQSGVs in MWs RXSB-1, MW-2, MW-3 and MW-4, with MW-2 (at the northeastern end of the parking lot) and MW-3 (at the southern-central portion of the parking lot) being the most contaminated. Additionally, all five groundwater samples had detected SVOCs concentrations exceeding their respective AWQSGVs. In MW-5, the only SVOC exceedance was naphthalene. The petroleum fingerprint analysis results were consistent with a combination of weathered No. 2 fuel oil/diesel fuel.

A supplemental off-Site investigation was performed to evaluate if contamination was migrating on or off-Site. In October 2016, two monitoring wells were installed upgradient of the Site along Lorraine Street (MW-6 and MW-7), and one monitoring well (MW-8) was installed downgradient of the plume on the south side of Creamer Street. Groundwater results from the off-site wells indicated contamination was not migrating on-site or off-site.

As required by the NYSDEC, an interim remedial measure (IRM) was implemented starting on November 22, 2016. This IRM consisted of gauging all Roux-installed monitoring wells on a biweekly basis. All wells with sufficient LNAPL thickness were manually bailed according to the reports. During the course of the IRM, a reported quantity of 0.3 gallons of LNAPL were recovered from monitoring well MW-2, and 1 gallon of LNAPL was recovered from monitoring well MW-3.

Additionally, a monitoring well was observed in the far northwest corner of the Site during Roux's investigation, which was not previously documented.

NYSDEC Correspondence between NYSDEC and Roux, 37 Otsego Street, AKRF, Inc., November 2016

Correspondence between the NYSDEC Spills Case Manager and Roux was reviewed regarding the gauging data and analytical summary tables from groundwater sampling in October 2016. NYSDEC indicated that as product was detected, additional investigation work was required including an interim remedial measure to recover free-phase petroleum product. Biweekly monitoring and recovery of gauging from on-site wells and the delineation of soil and groundwater contamination surrounding MW-2 and MW-3 were advised by NYSDEC.

Corrective Action Plan (CAP), Roux, January 2017 and Periodic Monitoring Reports, Roux, November 2017, March 2018, July 2018

According to Roux's August 2022 Remedial Investigation Report, on January 27, 2017, Roux submitted a CAP for the Site, on behalf of former Site owner at the time. The proposed remedy consisted of the removal of LNAPL by means of manual bailing and absorbent socks and the injection of a chemical oxidation compound to treat petroleum impacts located between 9 and 18 ft below ground surface. The CAP was approved by NYSDEC on April 28, 2017.

In July 2017, Roux injected the chemical oxidant RegenOx™ in accordance with the CAP at 28 locations in two treatment areas (Treatment Area 'A' and Treatment Area 'B') in the parking lot of the Site. Treatment Area 'A' had 15 proposed injection points over 6,500 square feet (SF), and Treatment Area 'B' had 13 proposed injection points over 5,500 SF.

Five groundwater sampling events were conducted after the injection event on July 25, 2017, October 26, 2017, January 25, 2018, May 17, 2018, and November 6, 2018. The results showed improvement regarding dissolved phase VOC and SVOCs; however, Roux noted that residual dissolved phase contamination remained beneath the Site.

Roux also prepared an In Situ Chemical Oxidation Injection Program Cover Letter and Application to the USEPA Underground Injection Control (UIC) Program dated May 2017.

Periodic Monitoring Reports were submitted in November 2017, March 2018, and July 2018, which summarized the IRM work that had been completed to date, including monitoring well gauging, product recovery, injection details, and groundwater sampling events.

Hot Spot Excavation Work Plan, Roux, January 2019

Letter correspondence dated January 2019 from the NYSDEC to Roux regarding the implementation of the Hot Spot Excavation Work Plan was reviewed.

Roux collected additional soil samples at the Site on August 9, 2018, to further characterize soil conditions. The soil sample results identified that the highest concentrations of VOCs in the soil were localized to two main source areas in the western parking lot area referred to as: 1) Hot Spot A, located around soil boring RXSB-1R and 2) Hot Spot B, located around soil borings MW-3R/RXSB-8R. Hot Spot A was approximately 40 ft by 48 ft, and Hot Spot B was approximately 74 ft by 43 ft. Both Hot Spots contained petroleum-impacted soil from an approximate depth of 8 to 17 ft bgs.

In January 2019, in order to address the two Hot Spots, which had not been fully remediated by the efforts performed to date, Roux prepared a Hot Spot Excavation Work Plan for the excavation and off-site disposal of contaminated soils from the two Hot Spots within the western parking lot portion of the Site in order to attempt to remove the ongoing source of the groundwater contamination.

In accordance with the NYSDEC-approved Hot Spot Excavation Work Plan, between February 4 and May 23, 2019, Roux conducted a limited Hot Spot Excavation at the Site consisting of excavation and off-Site disposal of soil within Hot Spots A and B, and application of Persulfox® within the open excavation of each Hot Spot.

Following the Hot Spot Excavation, sidewall samples were collected from approximately 8 to 10 ft bgs from each sidewall of Hot Spots A and B. Approximately 378 cubic yards (CY) (567 tons) and 760 CY (1,140 tons) of non-hazardous soil was removed for disposal from Hot Spots A and B, respectively.

The open Hot Spot excavations were then backfilled with approximately 1,500 CY (2,249 tons) of clean stone to approximately 7 ft bgs (above the water table) and then was subsequently brought to grade with the remaining overburden soil.

Monitoring wells RXSB-1 and MW-3 were reinstalled and named RXSB-1R and MW-3R as they were destroyed during the Hot Spot Excavations.

All on-site monitoring wells were sampled (MW-2, MW-4, MW-5, and the reinstalled RXSB-1 and MW-3) on April 11, 2019. Groundwater results indicated improvement; however, all on-site monitoring wells continued to have petroleum-related VOC and SVOC concentrations in exceedance of the AWQSGVs. Roux concluded that the data suggested that there is a continuing source of groundwater contamination at the Site that was not excavated during the Hot Spot excavations.

Remedial Investigation Report (RIR), Roux, August 2022

Roux completed a site-wide Remedial Investigation (RI) in June 2020 following the execution of a Brownfield Cleanup Agreement (BCA) for the Subject Property (BCP Site ID Number C224300) to further delineate the nature and extent of contamination at the Subject Property in accordance with a NYSDEC-approved Remedial Investigation Workplan (RIWP). The RI included an additional 15 soil borings across the site and the collection of 55 soil samples, the installation of seven temporary well points and three permanent monitoring wells and seven soil vapor samples.

Field observations indicated that the Site is underlain by a continuous layer of historic fill material consisting of sand, gravel, brick, concrete, asphalt, and wood ranging in thickness from roughly 5 to 15 ft bgs underlain by a layer of low permeability silt, clay, and fine sand. Organic material (peat) was encountered at depths ranging from approximately 12 to 19 ft bgs.

The results of the soil samples exhibited multiple exceedances of the NYSDEC UUSCOs and PGWSCOs for VOCs in the western portion of the Site, likely associated with the petroleum impacts as well as multiple exceedances for SVOCs above NYSDEC UUSCOs, RRSCOs and PGWSCOs indicative of urban fill, metals likely associated with contaminated historic fill, and low concentrations of pesticides commonly found in urban areas, and PFAS that were likely attributable to background levels common in urban areas. It was noted that total lead concentrations were detected at elevated concentrations across the Site, with some concentrations exceeding the RRSCO by three orders of magnitude on the central and eastern portions of the site (with the highest detections primarily between the 14 to 16 ft bgs sampling intervals).

The groundwater results of the newly installed temporary well points and three additional monitoring wells indicated VOC contamination was not present at these locations, with the exception of separate-phase product in one temporary well point. Petroleum-related VOCs exceeded AWQSGV in the existing monitoring wells located on the western portion of the Site. The remaining SVOC exceedances above the AWQSGVs was likely due to sediment present in the samples. Four detections of naphthalene were present in monitoring wells above the AWQSGV, which was also detected in soil samples, and therefore, a possible source of the groundwater contamination. The metals exceeding the NYSDEC AWQSGVs were deemed naturally occurring or due to sediment in samples from contaminated historic fill and not a source of groundwater impacts. The PFAS results in groundwater were associated with background levels common in urban environments.

The soil vapor results detected certain chlorinated VOCs including PCE, TCE and cis-1,2-DCE, but with the absence of these compounds detected in soil and groundwater, it was concluded that the detections were associated with regional conditions rather than an on-site contaminant source. Petroleum-related VOCs were detected in the soil vapor results noted to be likely associated with the soil and groundwater impacts from Spill No. 1509420. No indoor air samples were collected as part of the investigation.

NYC Department of Environmental Protection (DEP), Asbestos Assessment Report, Avi Jay Inc., September 2, 2022

Aaron Dancy, a DEP Certified Asbestos Investigator employed by Avi Jay Inc., completed a NYC DEP Asbestos Abatement Report ACP5 form on September 2, 2022. The ACP listed the scope of work to be full building demolition and indicated the entire building was free of asbestos containing material (ACM). The inspection was completed on August 29, 2022, and included samples of 13 interior materials (floor tile, sheetrock, ceiling tile and grout), six façade materials (stucco and mortar), and nine roofing materials (membrane, flashing, and felt paper). The samples were analyzed by Metro Analytical Laboratories and reported as no asbestos present.

Phase I ESA, AKRF, Inc., March 2023

A Phase I ESA was completed for the Site by AKRF, Inc. in March 2023. The assessment was performed in conformance with ASTM Standard E1527-21 (Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process) and ASTM Standard E2600-15 (Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions). The A summary of the assessment findings is presented below:

Recognized Environmental Conditions (RECs)/Vapor Encroachment Conditions (VECs)

Active Spill No.1509420

- The Site was listed on the NY Spills database with active status Spill No.1509420, which was reported in December 2015 during AKRF's Phase II Investigation. Subsequent remedial actions to address the active spill included:
    - Roux completed subsequent remedial activities at the Site between 2016 and 2022, including a supplemental Subsurface Investigation in September 2016 with oversight from the NYSDEC Spills Case Manager to further delineate petroleum contamination associated with Spill No. 1509420, and to investigate potential off-site contaminant sources including a nearby petroleum spill. Based on the results of the supplemental investigation, Roux identified two discrete areas of separate-phase and dissolved petroleum contamination on the northwestern and southwestern portions of the Site, respectively.
    - Roux installed additional monitoring wells in the surrounding sidewalks in October 2016 at the request of NYSDEC to evaluate off-site groundwater conditions; laboratory analysis of the samples collected from the off-site monitoring wells indicated that petroleum contamination was not migrating on- or off-site. NYSDEC required the implementation of an interim remedial measure (IRM) starting in November 2016, which included bi-weekly gauging of on-site monitoring wells with manual removal (via bailers) of LNAPL from affected monitoring wells.

- Subsequent remedial activities were performed under the January 2017 Corrective Action Plan (CAP) submitted to NYSDEC by Roux, and included quarterly groundwater sampling; the placement of Oxygen Releasing Compound (ORC) filter socks in monitoring wells to facilitate bioremediation of petroleum compounds; and the in-situ injection of a chemical oxidant to treat subsurface LNAPL contamination. Post-injection groundwater sampling events performed in 2017 and 2018 indicated modest reductions in dissolved VOCs and SVOCs in groundwater, however, it was noted that dissolved and free-phase petroleum contamination remained beneath the western parking lot area.
- To address the residual petroleum contamination, Roux completed the excavation of two discrete "hot spot" areas between February 2019 and May 2019, including the removal of petroleum-contaminated soil for off-site disposal and additional applications of a chemical oxidant to the excavation areas in accordance with a NYSDEC-approved workplan. Field documentation by Roux indicated that the excavation depth targeted the primary interval of petroleum-impacted soil from an approximate depth of 8 to 17 feet below ground surface. Post-excavation groundwater sampling indicated a reduction in dissolved VOC and SVOC concentrations, although certain compounds remained above NYSDEC Part 703.5 Class GA AWQSGVs, drinking water criteria.
- The Site was accepted into the NYSDEC BCP (discussed below) and would undergo remediation pursuant to the requirements of the program; NYSDEC file records indicated that the management of the Spill case would be transferred to the BCP project manager and the spill would achieve closure once a Certificate of Completion (COC) was issued for the Subject Property under the BCP.

New York Brownfield Cleanup Program (BCP)

- Roux completed a site-wide RI following the execution of a Brownfield Cleanup Agreement (BCA) for the Site (BCP Site ID Number C224300) to further delineate the nature and extent of contamination at the Subject Property in accordance with a NYSDEC-approved RIWP.

Historical Petroleum Bulk Storage Operations

- Based on review of historic land use maps, the northwestern portion of the Site contained a gasoline service station in 1950. Sanborn maps depicted four gasoline underground storage tanks (USTs) on the eastern portion of the Site between 1938 and 1969. The Site was listed in the petroleum bulk storage (PBS) database. During the Site reconnaissance, two apparent fuel oil vent pipes were identified on the eastern exterior wall of the building, along Columbia Street, which may be related to potential historical USTs. The potential exists for historic USTs to be present beneath the Site that may be encountered during redevelopment activities.

Nearby Industrial and Automotive Facilities

- Historic manufacturing and automotive uses were noted on the surrounding blocks in historic Sanborn maps and city directories, including: auto repair shops, filling stations, fuel oil service yards, scrap and junk yards, a grease factory, stove works, foundry, machine shop, copper works, tin melting and can plant, iron yard, varnish works, paint works, metal works, and flavoring, dying and coloring manufacturing. Existing uses on the adjacent blocks included: bus parking and demolition company on the south-adjacent block, a junk yard on the southwest-adjacent block, heating, ventilation, and

air conditioning (HVAC) manufacturing on the west-adjacent block, and vacant manufacturing and warehouse spaces on the east and southeast-adjacent blocks. Regulatory database listings for numerous facilities near the Site, including two spill cases on adjacent blocks were identified. Such uses may have affected regional subsurface conditions.

Copies of the previous environmental investigations are provided in Appendices C1 and C2 of this RAWP.

2.4.3 Sanborn Maps

Historical fire insurance (Sanborn) maps for the Site were obtained and reviewed by AKRF for indications of past uses on or near the Site that may have resulted in the use or disposal of hazardous materials or the generation of hazardous waste. Maps from 1886 to 2007 were reviewed. All Sanborn maps available for this Site were reviewed prior to the preparation of this RAWP and are included in Appendix D.

Historical Sanborn maps indicated that the Site was first developed (western portion) by 1904 and with the current structure by 1969. Historic uses on the included machine works (from 1904 to 1915), garage (1938), filling station (1950), printing company (from 1950 to 1969), and motor freight station and warehouse (from 1977 to 2007).

Uses on adjacent and nearby blocks included auto repair shops, gas tanks, filling stations, fuel oil service, scrap and junk yards, a grease factory, stove works, foundry, machine shop, copper works, tin melting and can plant, iron yard, varnish works, paint works, metal works, and flavoring, dying and coloring manufacturing.

2.5 Geological Conditions

2.5.1 Stratigraphy

Based on previous investigations, the Site is underlain by a continuous layer of historic fill material consisting of sand, gravel, brick, glass, concrete, asphalt, and wood ranging in thickness from roughly 5 to 15 ft bgs underlain by a layer of low permeability silt, clay, and fine sand. Organic material (peat) was encountered at depths ranging from approximately 12 to 19 ft bgs. Bedrock was not encountered during the subsurface investigations completed at the Site.

2.5.2 Hydrogeology

Groundwater was measured at depths ranging from approximately 8.3 to 9.7 ft bgs in the monitoring wells installed during the RI activities. Based on the monitoring well elevation survey and the depth to water measurements, the Site is relatively flat and groundwater is assumed to flow in a southwesterly direction toward the Erie Basin, located approximately 1,500 feet south of the Site.

2.6 Contamination Conditions

The data compiled during previous investigations and the RI were compared to the following Standards, Criteria, and Guidance (SCGs) to determine the nature and extent of the contamination area associated with the Site:

- **Soil** – NYSDEC UUSCOs and RRSCOs; Unrestricted Use Guidance Values (UUGVs) and Restricted Residential Use Guidance Values (RRGVs) for Perfluorooctanoic Acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS).
- **Groundwater** – NYSDEC Class GA AWQSGVs – TOGS 1.1.1; PFAS Screening Levels.

- **Soil Vapor** – There are currently no regulatory or published guidance values for VOCs in soil vapor; however, soil vapor data was used to assess the potential for exposure to receptors and to help define the nature and extent of contamination at the Site.

2.6.1 Conceptual Model of Site Contamination

The affected media for the existing releases at the Site include soil, groundwater, and soil vapor. The primary contaminants of concerns (CoCs) at the Site include petroleum-related VOCs and SVOCs, PAHs, pesticides, PFAS, and metals in soil/fill; petroleum-related VOCs and SVOCs, PFAS, and metals in groundwater; and chlorinated solvent- and petroleum-related VOCs in soil vapor.

Evidence of gross petroleum contamination (including LNAPL) was first observed in the western portion of the Site during AKRF's 2015 Phase II Investigation and the NYSDEC was notified of the observed spill, and Spill Number 1509420 was issued for the Site. Based on hydrocarbon fingerprint analysis of the LNAPL, it was identified as a combination of weathered No. 2 fuel oil/diesel fuel. Multiple investigations and limited/targeted remediation (including soil excavation and removal, and ISCO) were conducted at the Site between 2016 and 2020 (details in Section 2.4.2 for details) to address the petroleum contamination. However, gross petroleum contamination still remains in the subsurface and covers an approximately 25,000 square foot area in the western portion of the Site. The petroleum contamination extends below the water table and down to approximately 20 ft bgs.

During the RI, field evidence of gross contamination was noted in soil/fill, including petroleum-like odors, PID readings of up to 2,650 ppm, and LNAPL in borings at depths ranging from 14 to 20 ft bgs (in RI borings RXSB-19, RXSB-21, and RXSB-24). The identified petroleum-related VOC and SVOC contamination is attributed to the petroleum spill. The elevated concentrations of PAHs, pesticides, and metals are attributable to historic fill material encountered throughout the Site. The concentrations of PAHs and metals in soil/fill across the Site are variable, which is expected based on the heterogeneity of the fill. Detected PFAS concentrations can be attributed to historic fill material and are not related to any historic Site operations.

LNAPL was observed in one of the temporary monitoring wells (RTW-7) installed in the western portion of the Site, during the RI. Petroleum-related VOCs and SVOCs were detected in exceedance of the AWQSGVs in groundwater samples collected exclusively from the western portion of the Site suggesting the petroleum contamination is limited to this area. No petroleum-related compounds were detected in the groundwater samples collected from the off-site monitoring wells installed in the adjacent sidewalks (upgradient and downgradient), indicating that petroleum contamination is not migrating off-Site. PAHs and metals were detected above AWQSGVs in the groundwater samples. Excluding naphthalene, the PAH exceedances are attributable to sediment present in the samples and are not representative of dissolved impacts in groundwater. Although metals were detected above AWQSGVs in groundwater across the entire Site, these concentrations are typical of groundwater quality in Brooklyn and are expected in an area that formerly contained marshland and was filled with materials of unknown origin. Because the concentrations of metals were detected in both the total and dissolved samples, these detections are most likely related to regional groundwater quality and or naturally occurring background conditions. Detected PFAS concentrations are attributable to an off-site source and/or background conditions.

Solvent-related and petroleum-related VOCs were detected at varying concentrations in the soil vapor samples collected Site-wide. The detections are related to off-gassing from the VOCs in groundwater and/or historical manufacturing/industrial uses or background conditions on-Site and off-Site.

2.6.2 Description of Areas of Concern

The following environmental issues are considered areas of concern (AOCs) for the Site:

- Gross Petroleum Contamination/Open NYSDEC Spill Case – Evidence of gross petroleum contamination was identified in soil/fill and groundwater in the western portion of the Site (area of the spill) during previous investigations (2015 through 2019) and during the 2020 RI. The contamination was first identified in 2015 during AKRF's Phase II Investigation and the spill was reported to NYSDEC, and Spill Case No. 150942 was assigned.
- Underground Storage Tanks – Although several tanks were closed and removed from the former gasoline service station and other historic commercial uses at the Site, there is a potential for unknown tanks which may be encountered during remedial excavation.
- Historical Fill/Contaminated Soil – Historical fill material was observed throughout the Site extending up to 15 ft bgs. VOCs, SVOCs, pesticides, and metals in soil/fill were detected at concentrations above their respective UUSCO and/or RRSCOs in soil samples collected from within the fill layer.
- Elevated concentrations of petroleum-related VOCs identified in the soil vapor samples.

2.6.3 Identification of Standards, Criteria and Guidance

The following remedial SCGs apply to the project and are the performance criteria used to determine whether if the Remedial Action Objectives (RAOs) have been met:

- Soil – 6 NYCRR Part 375, UUSCOs and RRSCOs (December 2006); NYCRR Part 371 - Identification and Listing of Hazardous Wastes; 6 NYCRR Part 376 - Land Disposal Restrictions; and NYCRR Part 360 - Solid Waste Management Facilities. NYSDEC Sampling, Analysis and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, issued in April 2023.
- Groundwater – 6 NYCRR Parts 700-706 - Water Quality Standards (June 1998), and TOGS 1.1.1 AWQS and Guidance Values and Groundwater Effluent Limitations. NYSDEC's April 2023 PFAS Screening Levels, and the August 2020 NYS MCL screening level for 1,4-dioxane.

In addition, the following SCGs are applicable to the remedial program at the BCP Site:

- NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation (May 2010)
- NYSDEC Draft Brownfield Cleanup Program Guide (May 2004)
- NYSDOH Generic Community Air Monitoring Plan (CAMP)
- NYSDEC DER-23 (January 2010)
- 6 NYCRR Part 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998)

- 6 NYCRR Subpart 374-1 – Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (November 1998)
- 6 NYCRR Subpart 374-3 – Standards for Universal Waste (November 1998)
- 6 NYCRR Part 375 – Environmental Remediation Programs (December 2006)
- 6 NYCRR Parts 595-599, 613, 370, 374-2 – Bulk Storage of Petroleum Tanks and Chemicals; Management of Used Oil (October 2015; November 2015)
- 6 NYCRR Part 360 – Solid Waste Management
- 40 CFR Part 280 – Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks
- 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response
- 40 CFR Part 144 – Underground Injection Control Program
- NYSDEC Sampling, Analysis, and Assessment of PFAS (April 2023).

Additional regulations and guidance may be applicable, relevant, and appropriate to the remedial alternatives and will be complied with in connection with implementation of the remedial program. However, the previous list is intended to represent the principal, but not necessarily exclusive, SCGs that should be considered in evaluating the remedial alternatives for the Site. SCGs for the Site are provided in Appendix E.

2.6.4 On-Site Soil/Fill Contamination

2.5.4.1 Summary of Soil/Fill Data

Petroleum-related VOCs were detected above their respective UUSCOs and/or RRSCOs in 17 soil samples and one blind duplicate collected during the RI, including: 1,2,4-trimethylbenzene (6 mg/kg), acetone (0.051 to 0.32 mg/kg), benzene (0.093 mg/kg), ethylbenzene (1.2 to 4.4 mg/kg), naphthalene (13 to 230 mg/kg), and total xylenes (0.64 to 2.3 mg/kg).

SVOCs were detected above their respective UUSCOs and/or RRSCOs in nine soil samples and one blind duplicate collected during the RI, including: acenaphthene (28 to 35 mg/kg), benzo(a)anthracene (1.4 to 18 mg/kg), benzo(a)pyrene (1.9 to 16 mg/kg), benzo(b)fluoranthene (1.7 to 18 mg/kg), benzo(k)fluoranthene (1.6 to 5.7 mg/kg), chrysene (1.2 to 16 mg/kg), dibenzo(a,h)anthracene (0.49 to 1.6 mg/kg), fluorene (40 mg/kg), indeno(1,2,3-cd)pyrene (0.67 to 9.4 mg/kg), naphthalene (34 to 54 mg/kg), phenol (0.39 mg/kg), and phenanthrene (110 mg/kg).

The pesticides 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected in three soil samples at concentrations ranging from 0.00686 mg/kg to 0.0239 mg/kg, above their respective UUSCOs, but well below the RRSCOs. Herbicides and PCBs were not detected above the UUSCOs in any of the samples.

Metals were detected above their respective UUSCOs and/or RRSCOs in 31 soil samples and one blind duplicate collected during the RI, including: arsenic (13.1 to 155 mg/kg), barium (357 to 662 mg/kg), chromium (64.6 mg/kg), copper (54 to 974 mg/kg), lead (91.4 to 4,090 mg/kg), mercury (0.217 to 43.4 mg/kg), nickel (33.5 to 75 mg/kg), selenium (4.08 to 91.9 mg /kg), and zinc (133 to 1,550 mg/kg).

The PFAS compounds PFOS and PFOA were detected above their UUGVs but below the RRGVs in two samples at concentrations ranging from 0.895 µg/kg to 0.913 µg/kg.

2.5.4.2 Comparison of Soil/Fill with SCGs

The results of the laboratory data collected during the RI indicate that soil/fill is a media of concern. The following contaminants of concern were detected above the 6 NYCRR Part 375 UUSCOs in the on-site soil/fill:

- VOCs – 1,2,4-trimethylbenzene, acetone, benzene, ethylbenzene, naphthalene, and total xylenes.
- SVOCs – acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenol, and phenanthrene.
- Pesticides – 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.
- Metals – arsenic, barium, copper, lead, mercury, nickel, and zinc.
- PFAS – PFOS and PFOA.

The following contaminants of concern were also detected above the 6 NYCRR Part 375 RRSCOs in the on-site soil/fill:

- VOCs – naphthalene.
- SVOCs – naphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and phenanthrene.
- Metals – arsenic, barium, copper, lead, and mercury.

Soil data collected during the RI is summarized in Tables 2 through 7 of the RIR included in Appendix C2 of this RAWP. A concentration map indicating the sample locations with exceedances of UUSCOs and RRSCOs from the RI is provided as Figure 6 of the RIR.

2.6.5 On-Site and Off-Site Groundwater Contamination

Summary of Groundwater Data

Petroleum-related VOCs were detected above their respective AWQSGVs in four on-site groundwater samples collected during the RI, including: 1,2,4,5-tetramethylbenzene [6.1 to 15 micrograms per liter (µg/L)], 1,2,4-trimethylbenzene (20 to 47 µg/L), benzene (8.3 to 22 µg/L), cymene (9.1 µg/L), ethylbenzene (11 to 222 µg/L), isopropyl benzene (6 to 46 µg/L), naphthalene (460 to 3,600 µg/L), n-propylbenzene (7.6 to 38 µg/L), and o-xylene (10 µg/L).

SVOCs were detected above their respective AWQSGVs in 10 on-site groundwater samples collected during the RI, including: acenaphthene (22 to 140 µg/L), benzo(a)anthracene (0.03 to 0.12 µg/L), benzo(a)pyrene (0.03 to 0.1 µg/L), benzo(b)fluoranthene (0.02 to 0.13 µg/L), benzo(k)fluoranthene (0.02 to 0.05 µg/L), biphenyl (8.9 to 20 µg/L), chrysene (0.02 to 0.29 µg/L), fluorene (52 to 69 µg/L), indeno(1,2,3-cd)pyrene (0.03 to 0.09 µg/L), naphthalene (220 to 2,500 µg/L), and phenol (4.4 µg/L).

Herbicides, pesticides, and PCBs were not detected above their AWQSGVs in any of the samples.

Metals were detected above their respective AWQSGVs in all of the on-site groundwater samples collected during the RI, including: arsenic (27.12 µg/L total), iron (429 to 46,400 µg/L total and 423 to 19,200 µg/L dissolved), lead (35.98 to 127.7 µg/L total), magnesium (37,600 to 93,700 µg/L total and 44,000 to 94,700 µg/L dissolved), manganese (534.2 to 2,445 µg/L total and 555.5 to 1,938 µg/L dissolved), mercury (2.24 µg/L total), nickel (132.1 µg/L dissolved), and sodium (144,000 to 773,000 µg/L total and 145,000 to 777,000 µg/L dissolved).

PFOS and PFOA were detected above their guidance values in four on-site groundwater samples collected during the RI. PFOS was detected above the guidance value of 2.7 nanograms per liter (ng/L) at concentrations ranging between 4.26 and 26.4 ng/L and PFOA was detected above its guidance value of 6.7 ng/L at concentrations ranging between 37.3 and 147 ng/L. 1,4-Dioxane was not detected above the laboratory reporting limit in any of the groundwater samples analyzed for this parameter.

Comparison of Groundwater with SCGs

The results of the laboratory data collected during the RI indicate that groundwater is a media of concern. The following contaminants of concern were detected above the AWQS in groundwater:

- VOCs – 1,2,4,5-tetramethylbenzene, 1,2,4-trimethylbenzene, benzene, cymene, ethylbenzene, isopropylbenzene, naphthalene, n-propylbenzene, and total xylenes.
- SVOCs – acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, and phenol.
- Metals – arsenic, iron, lead, magnesium, manganese, mercury, nickel, and sodium.
- PFAS – PFOS and PFOA.

Groundwater data collected during the RI is summarized in Tables 8 through 13 of the RIR provided in Appendix C2 of this RAWP. A concentration map indicating the locations of exceedances of AWQSGVs from the RI is provided as Figure 7 of the RIR.

2.6.6 On-Site Soil Vapor Contamination

Summary of Soil Vapor Data

Up to 30 VOCs were detected in soil vapor samples collected during the RI. VOCs typically associated with petroleum, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 2,2,4-trimethylpentance, 4-ethyltoluene, benzene, ethylbenzene, m,p-xylenes, methyl ethyl ketone, n-heptane, n-hexane, o-xylene, toluene, were detected at concentrations ranging from 1.2 to 3,010 µg/m^3 (methyl ethyl ketone in sample RSV-5). Solvent-related VOCs, including 2-hexanone, acetone, carbon disulfide, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethene, cyclohexane, dichlorodifluoromethane, ethanol, ethyl acetate, isopropanol, styrene, tert-butyl alcohol, PCE, TCE, and trichlorofluoromethane, were detected at concentrations ranging from 0.458 to 11,700 µg/m^3 (acetone in sample RSV-6).

Soil vapor data collected during the RI is summarized in Table 14 of the RIR included in Appendix C2 of this RAWP. A concentration map indicating the locations of soil vapor detections is provided as Figure 8 of the RIR.

2.7 Qualitative Human Health Exposure Assessment

The objective of the Qualitative Human Health Exposure Assessment (QHHEA) is to identify potential receptors and pathways for human exposure to the CoCs that are present at, or migrating from, the Site. The identification of exposure pathways describes the route that the CoC takes to travel from the source within different environmental media to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

The RI was sufficient to complete a QHHEA. The QHHEA was performed to determine whether the Site poses an existing or future health hazard to the Site's exposed or potentially exposed population. The sampling data was evaluated to determine whether there is any health risk by characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. This QHHEA was prepared in accordance with Appendix 3B and Section 3.3 (b) 8 of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation. The full QHHEA, which describes the environmental media, contaminants of concern, potential routes of exposure, potential receptors, and existence of human health exposure pathways, is included in Section 6.0 of the RIR provided in Appendix C2 of this RAWP.

2.8 Overall Human Health Exposure Assessment

The approximately 100,000-square foot Site is currently improved by one single-story (no basement) mostly vacant commercial/warehouse building on the eastern portion of the lot and asphalt-paved parking area on the western portion of the lot. The Site is currently vacant, with the exception of a small portion of the building (on the eastern extent of the structure) that is currently used for the staging of construction materials with an associated small office. The Site is secured with a fence, and the majority of the Site is capped with the warehouse slab or asphalt pavement. Therefore, ingestion, inhalation, or dermal contact with contaminants via soil/fill, groundwater, and/or soil vapor is not a concern with respect to current conditions.

Based on the results of the QHHEA, this RAWP, which includes a Health and Safety Plan (HASP) to protect on-site workers, would be implemented during future redevelopment work to ensure that the potential exposure pathways identified do not become complete. The RAWP also includes a CAMP compliant with Appendices 1A and 1B of DER-10. The RAWP addresses the contaminated soil/fill, groundwater, and soil vapor identified at the Site, and includes provisions for the installation/implementation of certain engineering and institutional controls (ECs and/or ICs, respectively) to address residual contamination that may remain following remediation.

2.9 Fish & Wildlife Remedial Impact Analysis

Based on the requirements stipulated in Section 3.10 of DER-10, an on-site and off-site Fish and Wildlife Resources Impact Analysis (FWRIA) is not warranted for this Site.

2.10 Interim Remedial Actions

NAPL Removal, Treatment, and Confirmatory Sampling

As required by the NYSDEC, an Interim Remedial Measure (IRM) was implemented at the Site between November 2016 and May 2018, which included gauging all Roux-installed monitoring wells on a biweekly basis (eventually decreasing to quarterly as approved by NYSDEC). All wells with sufficient LNAPL thickness were manually bailed and a total of approximately 0.803 gallons of LNAPL were recovered from monitoring well MW-2, and approximately 3.0 gallon of LNAPL was recovered from monitoring well MW-3 over the duration of the IRM.

On January 17, 2017, Roux prepared and submitted a Corrective Action Plan (CAP) to NYSDEC to address the identified petroleum contamination in the western portion of the Site. The proposed remedy consisted of physical removal of LNAPL by means of manual bailing and absorbent socks,

and injection of a chemical oxidation compound to treat petroleum impacted soil between 9 to 18 ft bgs. The CAP was approved by NYSDEC on April 28, 2017. In July 2017, Roux injected the chemical oxidant RegenOx™ in accordance with the CAP at 28 locations in two treatment areas (Treatment Area 'A' and Treatment Area 'B') identified in the western portion of the Site. Treatment Area 'A' had 15 injection points over a 6,500 square foot area (SF) and Treatment Area 'B' had 13 injection points over a 5,500 SF area. The treatment areas are shown on Figure 2. Following the injections, groundwater samples were collected one week after the injections (in July 2017) and four rounds of quarterly sampling were completed between October 2017 and November 2018. The sample results showed reductions in concentrations of dissolved phase VOCs and SVOCs; however, contamination remained beneath the Site. Periodic Monitoring Reports summarizing the IRM work completed at the Site were submitted to NYSDEC by Roux in November 2017, March 2018, and July 2018.

Supplemental Sampling and Hot Spot Excavation

Additional soil sampling completed at the Site in August 2018 identified two hot-spots with elevated concentrations of VOCs. The two hot-spot areas in the western portion of the Site were identified as: the approximately 1,900 SF "Hot Spot A" located around soil boring RXSB-1R; and the approximately 3, 200 SF "Hot Spot B" located around soil borings MW-3R/RXSB-8R. Both Hot Spots contained petroleum-impacted soil from an approximate depth of 8 to 17 ft bgs.

In January 2019, Roux prepared and submitted a Hot Spot Excavation Work Plan to NYSDEC for the excavation and off-site disposal of contaminated soils from the two Hot Spots. In accordance with the NYSDEC-approved Hot Spot Excavation Work Plan, and between February 4 and May 23, 2019, Roux conducted limited excavation at the Site to remove petroleum-contaminated soil from the two hot-spots. In addition, Persulfox® was applied to the saturated soil within the open excavation of each hot-spot. Following the excavation and prior to backfilling, sidewall samples were collected from approximately 8 to 10 ft bgs from each of the four sidewalls of the two hot-spots. Approximately 378 cubic yards (CY) and 760 CY of non-hazardous soil was removed for disposal from Hot Spots A and B, respectively. The excavations were then backfilled with approximately 1,500 CY (2,249 tons) of clean stone to approximately 7 ft bgs (above the water table) and then was subsequently brought to grade with the remaining overburden soil.

Monitoring wells RXSB-1 and MW-3 were destroyed during the excavation and had to be re-installed and named RXSB-1R and MW-3R, respectively. All on-site monitoring wells (MW-2, MW-4, MW-5, and the reinstalled RXSB-1 and MW-3) were sampled (April 2019) after the soil excavation and removal and the sample results showed improvement; however, all on-site monitoring wells continued to have petroleum-related VOC and SVOC concentrations in exceedance of the AWQSGVs.

2.11 Remedial Action Objectives

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) have been identified for this Site.

2.11.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater.

RAOs for Environmental Protection

- Remove the source of ground or surface water contamination.

2.11.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.11.3 Soil Vapor

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

3.1 Evaluation of Remedial Alternatives

This section includes a review of remediation alternatives that were considered for the remedy phase of the BCP. The purpose of completing the alternatives analysis is to identify, evaluate, and select a remedy to address the on-site contamination. The RAOs for soil include excavation and removal or ISS to address grossly contaminated petroleum source(s) to prevent the potential for exposure and contaminant migration. The RAOs for groundwater include removal of contamination source(s), to the extent practicable, and to prevent exposure to groundwater contamination. The RAOs for soil vapor include preventing soil vapor from entering the proposed new Site buildings. The following performance measures were used to complete the evaluation of remedial alternatives:

- Protection of human health and the environment;
- Compliance with standards, criteria, and guidelines (SCGs);
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community Acceptance; and
- Land use.

The following remedial SCGs apply to the project, and are the performance criteria used to determine if the RAOs have been met:

- 6 NYCRR Part 375-6 Soil Cleanup Objectives;
- NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, issued in April 2023;
- The August 2020 NYS MCL screening level for 1,4-dioxane;
- New York State Groundwater Quality Standards – 6 NYCRR Part 703;
- NYSDEC Ambient Water Quality Standards and Guidance Values – TOGS 1.1.1;
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation –May 2010
- NYSDEC Draft Brownfield Cleanup Program Guide – May 2004;
- New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan
- NYS Waste Transporter Permits – 6 NYCRR Part 364;
- NYS Solid Waste Management Requirements – 6 NYCRR Parts360-366 and Part 369;
- DER-23 (January 2010);
- 6 NYCRR Part 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998);

- 6 NYCRR Subpart 374-1 – Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (November 1998);
- 6 NYCRR Subpart 374-3 – Standards for Universal Waste (November 1998);
- 6 NYCRR Part 375 – Environmental Remediation Programs (December 2006);
- 6 NYCRR Part 612 – Registration of Petroleum Storage Facilities (February 1992)
- 6 NYCRR Part 613 – Handling and Storage of Petroleum (February 1992)
- 6 NYCRR Part 614 – Standards for New and Substantially Modified Petroleum Storage Tanks (February 1992)
- 40 CFR Part 280 – Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks
- 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response
- 40 CFR Part 144 – Underground Injection Control Program

Additional regulations and guidance may be applicable, relevant, and appropriate to the remedial alternatives and will be complied with during implementation of the remedial program. However, this list is intended to represent the principal SCGs, which should be considered in evaluating the remedial alternatives for the Site.

Remedial Alternative 1 – No Further Action

This alternative consists of allowing the BCP Site to remain in its current condition. No remedial activities would occur under this remedy.

1. Protection of human health and the environment – Not satisfied, as the on-site contamination would not be remediated, and the existing and potential on-site exposure pathways would not be addressed.
2. Compliance with SCGs – Not satisfied, as contaminants would remain in soil (at concentrations that exceed NYSDEC Part 375 UUSCOs and RRSCOs), groundwater (at concentrations that exceed NYSDEC AWQSGVs), and soil vapor. Additionally, NYSDEC Spill Case No. 1509420 would remain open.
3. Short-term effectiveness and impacts – Not satisfied, as there would be no measures in place to protect workers or the surrounding community from potential exposure to existing contaminated soil, groundwater, or vapors if redevelopment were to occur.
4. Long-term effectiveness and permanence – Not satisfied, as potential exposure pathways identified in the QHHEA would remain after Site redevelopment activities begin.
5. Reduction of toxicity, mobility, or volume of contaminated material – Not satisfied, as the contaminated material would remain in place.
6. Implementability – Very feasible, as no personnel or regulatory approvals would be needed, and contaminant reduction would occur only through natural attenuation.
7. Cost effectiveness – Very cost effective to proceed with no further action; however, this criterion is not satisfied, as it requires a comparison of cost to long- and short-term effectiveness and toxicity reduction, which would not be achieved.
8. Community acceptance – Not satisfied, as this alternative will allow the contamination to remain in place.

9. Land use – Not satisfied, the Site currently comprises an almost vacant building, and an asphalt paved parking lot. Its current use does not contribute to expanding affordable housing and community services in the surrounding area.

Remedial Alternative 2 – Track 1 Unrestricted Use Soil Cleanup Objectives (UUSCOs)

This alternative would include removal and/or treatment of all on-site contaminated soil and groundwater on-site to remove gross contamination and comply with UUSCOs and AWQSGVs. This would include, but is not limited to, excavation and/or treatment of all soil beneath the Site that exceeds the UUSCOs and in-situ groundwater treatment.

1. Protection of Human Health and the Environment – Partially satisfied, as all soil above UUSCOs would be removed and groundwater treatment would be conducted to restore it to pre-release conditions. These actions would also result in the removal of grossly contaminated soil and potential on-site sources of VOCs in soil vapor. However, this alternative would not address soil vapor intrusion in the new Site buildings from potential off-site sources of contaminants in soil vapor.
2. Compliance with SCGs – Partially satisfied, as all soil above UUSCOs would be removed and groundwater treatment would be conducted to restore it to pre-release conditions, thus removing potential on-site sources of VOCs in soil vapor. In addition, grossly contaminated soil would be removed to achieve closure of Spill No. 1509420. However, this alternative would not address soil vapor intrusion in the new Site buildings from potential off-site sources of contaminants in soil vapor.
3. Short-term Effectiveness and Impacts – Effective if the extensive support of excavation (SOE) and dewatering systems can be successfully installed to remove all contaminated soil from the Site. There is, however, a risk of short-term impacts to Site workers and the community, as the process of excavating large volumes of contaminated soil may cause the release of particulates and organic vapors. This risk can be controlled by employing a CAMP and a HASP during remediation and construction.
4. Long-term Effectiveness and Permanence – Partially satisfied, as all soil above UUSCOs would be removed, and VOCs and SVOCs in groundwater would be remediated to comply with AWQSGVs, which would lead to a reduction of soil vapor concentrations and could allow for unrestricted use of the Site. However, this alternative would not address soil vapor intrusion associated with potential off-site sources.
5. Reduction of Toxicity, Mobility, or Volume of Contaminated Material – As all soil above UUSCOs at the Site would be removed and contaminated groundwater would be treated, the toxicity, mobility, and the volume of on-site contaminants would be greatly reduced.
6. Implementability – This alternative would be implementable, but would require extensive excavation across the entire Site to remove all soil/fill soil to a minimum depth of 30 ft bgs, to remove all soil above the UUSCOs. This would require installation of SOE along the entire Site perimeter and large-scale dewatering and treatment of extracted groundwater prior to discharge. In addition, a large quantity of backfill materials will be required to bring the Site grade back up for construction purposes.
7. Cost Effectiveness – A Track 1 cleanup for the Site would not be a cost-effective alternative, as it would require extensive excavation beyond what would be required for site redevelopment, including SOE around the entire Site perimeter, excavation of soil/fill site-wide to a minimum depth of 30 ft bgs, and large-scale dewatering and groundwater treatment.

Under this alternative, it is estimated that approximately 110,000 cubic yards of contaminated soil would be excavated and disposed of off-site. For cost estimates, it is assumed that up to 20 percent of the soil (approximately 22,000 cubic yards) will be excavated and removed as non-hazardous petroleum contaminated soil. Approximately 104,000 cubic yards of clean fill would then have to be imported prior to bring the Site elevation back up to sub-grade (approximately 2 foot below existing) to allow for construction of the new building in a high-risk flood zone. Based on these assumptions, a cost breakdown for the estimated Site preparation costs associated with this remedial action, including installation of SOE, dewatering, and associated environmental engineering/oversight fees is provided in the In-Text Table VI below.

Table VI
Remedial Alternative 2 Cost Breakdown

Task	Unit Cost	Total Cost
Excavation, Transportation and Disposal (T&D) of Petroleum Contaminated Soil and Backfill	$300 per cubic yards	$6,600,000
Excavation, Transportation and Disposal (T&D) of Contaminated Soil (non-petroleum) and Backfill	$200 per cubic yards	$17,600,000
SOE Installation	Estimated Total	$5,000,000
Dewatering	Estimated Total	$2,000,000
Engineering and Consulting Costs	Estimated Total	$3,000,000
	TOTAL COST	**$34,200,000**

8. Community Acceptance – Partially satisfied. Although this alternative would be protective of human health and the environment, it would have extended impacts on the community during the longer construction period required for the Site-wide excavation activities, including increased truck traffic in the neighborhood during load-out of excavated materials.
9. Land Use – Satisfied, as this alternative would result in the cleanup of the Site for unrestricted use, which would allow for any type of future redevelopment that is permitted by zoning.

Remedial Alternative 3 – Track 2 and Track 4 Restricted-Residential Soil Cleanup Objectives

Alternative 3 would include the following:

- Excavation and removal of all soil in the petroleum contaminated area (western portion of the Site) down to 20 ft bgs in an approximately 25,000 square foot area to remediate and address gross contamination (Track 2 Cleanup), and excavation and off-site disposal of all soil/fill in the upper 2 feet from the remainder of the Site to allow for placement of a final Site cover system (Track 4 Cleanup). In addition, any additional petroleum contaminated soil identified during redevelopment excavation and any potential metal hotspots and/or hazardous waste identified above the water table would be excavated and removed.
- Implementation of an in-situ chemical oxidation (ISCO) groundwater treatment program in the western portion of the Site (if required) to address any remaining petroleum contamination following soil/fill excavation and removal.
- Import of clean fill to replace the excavated soil and establish the designed grades.

- Implementation of ECs and ICs, including the installation of an active sub-slab depressurization system (SSDS), groundwater monitoring, and installation of a composite cover system in the Track 4 area.

A Track 2 and Track 4 Cleanup would allow for ICs and ECs to be implemented for long-term management of the Site and to prevent future exposure to any residual contamination. As such, an Environmental Easement (EE) would be recorded for the Site to implement the controls and a Site Management Plan (SMP) would be prepared to specify future soil handling requirements, including provisions for the management and inspection of the ECs that may be necessary, and instructions for maintaining Site access controls, NYSDEC notification, groundwater treatment (if required) and land use restrictions. Periodic inspection and reporting would be required to verify that the restrictions and requirements included in the EE remain in place and effective.

1. Protection of Human Health and the Environment – Satisfied, as the entire source of petroleum contamination would be removed and/or treated in-situ, any potential metal hot-spots and/or hazardous waste will be excavated and removed, groundwater treatment will be conducted, and any contact or exposure to residual contamination would be eliminated by the site-wide cover system, EE, and ECs.
2. Compliance with SCGs – Satisfied, as RAOs will be achieved by removal and/or in-situ treatment of petroleum contaminated soil, excavation and removal of any potential metal hot-spots and/or hazardous waste, installation of an SSDS, groundwater treatment to reduce VOC and SVOC concentrations, and site-wide cover system to prevent exposure to any remaining contaminants.
3. Short-term Effectiveness and Impacts – Partially satisfied. This alternative would be effective in reducing contaminant levels in the short term, since the source of petroleum contamination would be removed via excavation and/or treated in-situ, and any potential metal hot spots and/or hazardous waste will be removed. However, there will be short-term impacts due to extensive excavation of petroleum contaminated soil, nuisance odors/vapors, dewatering, and SOE installation during remedial work. Mitigation measures, including a HASP and CAMP, would protect and limit exposure of workers and the surrounding community to contaminated soil, particulates, groundwater, and/or soil vapors during remediation activities.
4. Long-term Effectiveness and Permanence – Satisfied, as source of petroleum contamination would be removed via excavation and/or treated in-situ, and any potential metal hot-spots and/or hazardous waste will be excavated and removed, the installation and maintenance of ECs (including installation of a Site-wide cover system and SSDS), and the implementation of ICs would address any residual contamination and limit exposure of future occupants to any remaining contaminated soil/fill, groundwater, and/or soil vapor, thus achieving the RAOs.
5. Reduction of Toxicity, Mobility, or Volume of Contaminated Material – Satisfied, as the petroleum contaminated area will be completely removed and/or treated in-situ, and any potential metal hot-spots and/or hazardous waste will be excavated and removed, contaminated soil in the upper 2 feet will be excavated and removed Site-wide, and any remaining petroleum contamination in the groundwater will be addressed via ISCO. Placement of a final Site cover would further reduce mobility of remaining contaminants by preventing leaching from stormwater infiltration. Operation and maintenance of an SSDS would reduce mobility of soil vapor contaminants with respect to migrating into on-site and off-site structures.
6. Implementability – This alternative would be implementable, but challenging, as it would require extensive SOE and dewatering to facilitate excavation of petroleum area down to 20 ft bgs in an approximately 25,000 square foot area and ISCO to treat any remaining

contamination in groundwater. In addition, a large quantity of backfill materials will be required to bring the Site grade back up for construction purposes.

7. Cost Effectiveness – Not Satisfied, as this alternative has considerable costs when compared to Alternative 4 considered for this Site.

   Under this alternative, it is estimated that approximately 18,500 cubic yards of petroleum contaminated soil and approximately 5,500 cubic yards of soil/fill would be removed Site-wide (to remove upper two feet of soil, Track 4 area). Approximately 16,600 cubic yards of clean fill would then have to be imported prior to bring the Site elevation back up to sub-grade (approximately 2 foot below existing) to allow for construction of the new building in a high-risk flood zone. In addition, an ISCO treatment will be completed to address remaining petroleum contamination, SSDS will be installed, SOE and dewatering will be conducted to facilitate remediation. Based on these assumptions, a breakdown of the approximate remedial costs to implement this alternative is provided in In-Text Table VII.

Table VII
Remedial Alternative 3 Cost Breakdown

Task	Unit Cost	Total Cost
Excavation, Transportation and Disposal (T&D) of Petroleum Contamination Soil and Backfill	$300 per cubic yards	$5,550,000
Excavation, Transportation and Disposal (T&D) of Soil From Upper Two Feet From Remainder of the Site and Backfill	$200 per cubic yards	$1,100,000
SOE Installation	Estimated Total	$1,000,000
Dewatering	Estimated Total	$750,000
ISCO	Estimated Total	$250,000
SSDS Installation	Estimated Total	$600,000
Engineering and Consulting Costs	Estimated Total	$1,650,000
	TOTAL COST	**$9,900,000**

8. Community Acceptance – Partially satisfied. This alternative would be protective of human health and the environment: however, it will likely have less community acceptance due to short-term impacts related to extensive soil excavation, nuisance odors/vapors, SOE installation, and dewatering.

9. Land use – Satisfied, as this alternative would result in the cleanup of the Site for restricted residential use, which would allow for redevelopment of the Site. Redevelopment of the Site will eliminate the current concerns in connection with the Site's current blighted condition.

Remedial Alternative 4 – Track 4 Restricted Residential Soil Cleanup Objectives

Alternative 4 would include the following:

- Excavation and off-site disposal of all soil in the upper 2 feet of the Site to allow for placement of a final Site cover system.

- Implementation of an In-Situ Solidification (ISS) program in the western portion of the Site to fully encapsulate and solidify any LNAPL and the known extent of petroleum contamination in an approximately 25,000 square foot area down to 28 ft bgs. Note that the known petroleum contamination extends to approximately 20 ft bgs but the Site is underlain by soft sediment/native clay up to a depth of approximately 25 ft bgs, as such and based on geotechnical considerations, ISS would need to be extended to approximately 28 ft bgs to prevent liquification of the soft sediment below and to limit settlement of the concrete block/mass created by ISS.
- Import of clean fill to replace the excavated soil and establish the designed grades.
- Implementation of ECs and ICs, including the installation an active sub-slab depressurization system (SSDS) and installation of a composite cover system.

A Track 4 cleanup would allow for ICs and ECs to be implemented for long-term management of the Site and to prevent future exposure to any residual contamination. As such, an EE would be recorded for the Site to implement the controls, and a SMP would be prepared to specify future soil handling requirements, including provisions for the management and inspection of the ECs that may be necessary, and instructions for maintaining Site access controls, NYSDEC notification, and land use restrictions. Periodic inspection and reporting would be required to verify that the restrictions and requirements included in the EE remain in place and effective.

1. Protection of Human Health and the Environment – Satisfied, as the entire extent of the known petroleum contaminated area will be treated via ISS, any potential metal hot-spots and/or hazardous waste will be removed, and any contact or exposure to residual contamination would be eliminated by the site-wide cover system, EE, and ECs.
2. Compliance with SCGs – Satisfied, as RAOs would be achieved by solidifying the entire known extent of petroleum contaminated soil to render the associated contaminants immobile, and installation of a SSDS and site-wide cover system to prevent exposure to any remaining contaminants.
3. Short-term Effectiveness and Impacts – Satisfied, as this alternative would be effective in reducing contaminant levels in the short term, since the source contamination would be treated/encapsulated *in situ* and any potential metal hot spots and/or hazardous waste will be excavated and removed. Mitigation measures, including a HASP and CAMP, would protect and limit exposure of workers and the surrounding community to contaminated soil, particulates, groundwater, and/or soil vapors during remediation activities. Solidifying the contaminated soil *in situ* (rather than excavating it for off-site disposal) would reduce complexity and duration of the remedial work and the potential for airborne particulates and VOC emissions/nuisance odors.
4. Long-term Effectiveness and Permanence – Satisfied, as removal/treatment of known petroleum contamination, the installation and maintenance of ECs (including installation of a site-wide cover system and SSDS), and the implementation of ICs would address any residual contamination and limit exposure of future occupants to any remaining contaminated soil/fill, groundwater, and/or soil vapor, thus achieving the RAOs.
5. Reduction of Toxicity, Mobility, or Volume of Contaminated Material – Satisfied, as the volume of contaminants at the Site would be reduced by removal of contaminated fill material in the upper 2 feet of the Site. In addition, the mobility of NAPL and petroleum contamination in the western portion of the Site would be eliminated by treatment via ISS. Placement of a final Site cover would further reduce mobility of remaining contaminants by preventing leaching from stormwater infiltration.

6. Implementability – Satisfied, as contaminated soil/fill removal and ISS could be completed in a relatively short timeframe, and the equipment and personnel needed to perform the proposed remedial action are readily available. The soil/fill to be excavated and disposed of off-site is expected to be classified as non-hazardous petroleum-contaminated material, regulated soil/fill, and/or hazardous lead contaminated material. Disposal facilities for these types of materials are readily available.
7. Cost Effectiveness – Satisfied, as this alternative has moderate costs when compared to other alternatives considered for this Site.

   Under this alternative, it is estimated that approximately 20,500 cubic yards of soil will be treated via ISS, approximately 7,500 cubic yards of soil/fill would be removed (to remove upper 2 feet of soil) from the remainder of the Site, and approximately 3,500 cubic yards of additional soil will be excavated and removed as part of the 6-foot bench cut required for ISS. In addition, approximately 3,000 cubic yards of clean fill will be imported to establish design grades. An SSDS will be installed below the building slabs. Based on the assumption, a cost breakdown is provided in In-Text Table VIII.

Table VIII
Remedial Alternative 4 Cost Breakdown

Task	Unit Cost	Total Cost
Excavation, Transportation and Disposal (T&D) of Contaminated Soil (including ISS Bench Cut) and Backfill	$200 per cubic yards	$2,200,000
In-Site Solidification (ISS)	$200 per cubic yards of soil treatment volume	$4,100,000
SSDS Installation	Estimated Total	$600,000
Engineering and Consulting Costs	Estimated Total	$1,200,000
	TOTAL COST	**$8,100,000**

8. Community Acceptance – Satisfied. This alternative will remediate the entire petroleum contaminated area and would be protective of human health and the environment. The Site would also be transformed from a vacant property with an unused warehouse into a new residential complex.
9. Land use – Satisfied, as this alternative would result in the cleanup of the Site for restricted residential use, which would allow for redevelopment of the Site. Redevelopment of the Site will eliminate the current concerns in connection with the Site's current blighted condition.

3.2 Selection of the Preferred Remedy

Remedial Alternative 1 (no action) allows the Site to remain in its current condition. This remedial alternative was reviewed and found to be unacceptable, since it would not achieve the RAOs. Therefore, this remedial alternative is not considered a feasible solution.

Remedial Alternative 2 (Track 1) was found to be unacceptable since it is not cost-effective, difficult to implement from a remediation perspective, and off-site sources of contamination could represent vapor intrusion concerns.

Remedial Alternative 3 (Track 2 and Track 4) is implementable but it has very high short-term impacts during extensive construction/remedial excavation and will likely have a lesser community acceptance when compared to Alternative 4. In addition, this alternative has higher costs when compared to other alternatives (except Remedial Alternative 2). After careful consideration with respect to the evaluation criteria listed, Remedial Alternative 3 was found to be unacceptable.

Remedial Alternative 4 (Track 4) is implementable and has moderate costs when compared to the other remedial alternatives proposed. This alternative will address and remediate the full extent of the known petroleum contamination area, will have lesser short-term impacts, can be completed in shorter timeframe, will not require any additional engineering controls or treatments to address the contamination, and will likely have a higher community acceptance. After careful consideration with respect to the evaluation criteria listed, Remedial Alternative 4 has been determined to be the preferred remedy, since it adequately addresses the subsurface contamination in a cost-effective approach.

3.2.1 Zoning

Based on the NYC Department of City Planning's Zoning Map information, the Site is zoned R6 (residential) with commercial overlay, C1-3. Tax parcel information provided by the NYCDOB online Buildings Information System (BIS) indicated that the occupancy codes for the Site is: K1 (Store Building).

3.2.2 Applicable Comprehensive Community Master Plans or Land Use Plans

The proposed redevelopment plan consists of the demolition of the existing structures and construction of three new 8-story buildings (Buildings A through C) with an approximately 12,000 square foot landscaped area. Building A will contain 210 units of senior housing and approximately 4,580 square feet of space for senior services; Building B will contain 81 units for senior housing, supportive offices, recreation space, and bicycle storage room; and Building C will contain 110 units for senior housing and 258 units of family housing, approximately 1,080-square feet of community space, and a 31-space accessory parking garage. There will be no basement level, as the Site is located within a high-risk flood zone.

This remediation and redevelopment project represents a key piece in the continued revitalization of Brooklyn. Current issues in the area include underutilization of land, ongoing remediation site-by-site of area-wide contamination, and potential remediation and construction-related concerns, including handling contaminated soil and generation of vapors and/or dust during excavation activities, truck traffic, and noise. The project would also provide affordable housing units that would contribute to the goals of the City to increase affordable housing development.

3.2.3 Surrounding Property Uses

The surrounding area is predominantly industrial and residential, with some commercial uses. The proposed new residential building is consistent with the current zoning.

3.2.4 Citizen Participation

Roux prepared a Citizen Participation Plan (CPP) for the Site in April 2020. The CPP provides for ongoing updates to the public regarding the investigation and remediation and allows for involvement regarding the environmental investigation and cleanup of the Site.

3.2.5 Environmental Justice Concerns

The Site is located in an Environmental Justice area with a substantial Spanish-speaking population. All future factsheets issued for the Site will be translated into the Spanish language (in accordance with the CPP).

3.2.6 Land Use Designations

The proposed redevelopment plan complies with the current land use designation for this Site. The proposed future use of the Site includes affordable housing and commercial uses. This use is consistent with anticipated land use designations for the Site.

3.2.7 Population Growth Patterns

The population of the City of New York is expected to increase in the future. This project will help provide necessary affordable housing units to meet that need. Approximately 660 units will be designated as affordable housing.

3.2.8 Accessibility to Existing Infrastructure

The Site and surrounding area are served by public transit services, including New York City Transit (NYCT) bus service (B57 and B61) and the Smith-9th Street Subway Station (F and G line service). The area is supplied with municipal sewers and water, electric, telephone, natural gas, and fiber-optic lines.

3.2.9 Proximity to Cultural Resources

Many cultural resources are easily accessed from the Site via public transportation including Governor's Island, The Waterfront Museum, Prospect Park, the Brooklyn Museum, and the Brooklyn Botanic Garden.

3.2.10 Proximity to Natural Resources

New York City Parks (Coffey Park and Red Hook Waterfront) are within walking distance from the Site. A ferry to Governor's Island is also located within walking distance from the Site. Other natural resources are easily accessible from the Site via public transportation.

3.2.11 Off-Site Groundwater Impacts

Regional groundwater flows in a westerly direction. The results of the RI documented petroleum-related VOCs and SVOCs in the groundwater in the western portion of the Site; however, there were no exceedances of petroleum-related compounds detected in the off-site monitoring wells installed on the adjacent sidewalk, indicating that there is no off-site migration of the petroleum contamination from this area. Groundwater is not a source of drinking water in Brooklyn.

3.2.12 Proximity to Floodplains

The Site is located in a high-risk flood zone (zone AE). The development design does not include a basement level.

3.2.13 Geography and Geology of the Site

The Site is approximately 10 feet above mean sea level (msl). The nearest surface water body to the Site is the Erie Basin, located approximately 1,500 feet to the south.

Based on previous investigations, historic fill material (sand, gravel, brick, concrete, asphalt, and wood) was observed in the soil borings extending to approximately 5 to 15

feet below ground surface. The fill material was underlain by low permeability silt, clay, and fine sand to approximately 20 feet below grade. Organic material (peat) was encountered at depths ranging from approximately 12 to 19 ft below ground surface. The RI soil borings were advanced to a maximum depth of 20 ft bgs and bedrock was not encountered.

3.2.14 Current Institutional Controls

Currently, there are no known Institutional Controls at the Site.

3.3 Summary of Selected Remedial Actions

The selected RAs will include:

1. Demolition and abatement (e.g., asbestos, universal waste, etc.) of the existing Site building.
2. An in-situ solidification (ISS) program will be implemented in the western portion of Site to address the gross petroleum-contaminated soil and to close-out Spill No. 1509420. It is anticipated that soil mixing for the ISS will be conducted in an approximately 25,000 square foot area down to approximately 28 feet below ground surface (bgs). An approximately 6-foot soil cut will need to be excavated in this area to contain the ISS spoils and increased soil volume created by the soil mixing. The target ISS area is shown on Figure 3.
3. Implementation of a quality assurance/quality control program in accordance with NYSDEC requirements and groundwater monitoring to demonstrate the effectiveness of the ISS treatment program.
4. Excavation and removal of soil/fill in the upper 2 feet across the Site to achieve a Track 4 cleanup. The anticipated limits of remedial excavation are shown on Figure 4. In addition, soil/fill from any potential metal hot-spots or petroleum contaminated soil (outside of ISS area and 2-foot cut) identified during the waste classification sampling and/or during the remedial action will also be excavated and removed from the Site. The total soil volume removed during the remedial excavation will be included in the Final Engineering Report (FER).
5. Removal and off-site disposal of any petroleum storage tanks, fill ports, and vents and any associated grossly contaminated soil, if encountered, in accordance with applicable regulations.
6. Screening for indications of contamination (by visual means, olfactory, and monitoring with a PID) of all excavated soil during any intrusive Site work.
7. A CAMP will be implemented during all intrusive Site activities to monitor levels of VOCs and particulates within the active work-zones and around the perimeter of the Site.
8. Characterization and off-site disposal of all materials removed from the Site in accordance with all federal, state, and local rules and regulations for handling, transport, and disposal. Waste disposal facilities will be selected based on data collected to date and waste classification sampling. Based on the requirements of the selected facilities, additional soil waste classification samples may be collected and analyzed as needed to obtain approval for soil disposal.
9. Approximately 115 documentation samples will be collected from bottom and sidewalls of the remedial excavation and analyzed to evaluate the performance of the remedy with respect to attainment of Track 4 RRSCOs. Documentation sample frequency will be based on the sampling frequency outlined in Section 5.4(e)10 of DER-10 and in Section 6.2 of this RAWP. The proposed endpoint sample locations are shown on Figure 4.

10. Import of clean fill or stone to replace the excavated soil and establish the design grades. On-site reuse of excavated soil at the Site is not anticipated.
11. An active sub-slab depressurization system (SSDS) will be installed beneath the proposed new building foundation slab(s) [a separate system (3 total) for each new proposed building] to prevent vapor intrusion.
12. A composite cover system will be constructed across the Site consisting of a minimum 6-inch thick concrete building slab underlain by a minimum 6-inch gas permeable aggregate layer beneath all building areas, and a minimum of two feet of imported clean soil/fill in landscaped areas meeting the requirements of 6 NYCRR Part 375-6.7(d). A soil import request form will be prepared and submitted to NYSDEC BCP Project Manager for review and approval prior to material import.
13. If localized dewatering and/or support of excavation is needed to complete the remedial actions (or to install the foundation and utilities for the new building), they will be implemented in accordance with all federal, state, and local regulations.
14. An Environmental Easement (EE) will be recorded with the New York City Office of the Registrar. The EE will: require the remedial parties/Site owners to complete and submit a periodic certification of institutional controls (ICs) and engineering controls (ECs) to NYSDEC in accordance with NYCRR Part 375-1.8 (h)(3); allow for the future redevelopment and use of the Site for restricted residential use as defined by Part 375-1.8(g), although land use is subject to local zoning laws; prohibit the use of groundwater as a source of potable or process water without necessary water quality treatment, as determined by New York State Department of Health (NYSDOH); and require compliance with a site-specific, NYSDEC-approved Site Management Plan (SMP).
15. An SMP will be implemented that identifies all use restrictions and ECs for the Site and details the steps and media-specific requirements necessary to ensure the ICs and ECs remain in place and effective.
16. All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable federal, state, and local rules and regulations.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RAWP and the NYSDEC-issued Decision Document. All deviations from the RAWP and/or Decision Document will be promptly reported to NYSDEC for approval and fully explained in the FER.

4.0 WASTE CLASSIFICATION

All work in this section will include implementation of the QAPP, provided in Appendix F, and the Site-specific HASP and CAMP, provided in Appendix G, which includes on-site and community air monitoring procedures.

4.1 Waste Classification Sampling

The proposed remedy includes excavation of soil/fill to a minimum of 2 feet below ground surface across the entirety of the Site. Additionally, soil/fill within the footprint of proposed *in-situ* solidification (ISS) areas will be excavated an additional depth of 4 feet (total 6 feet below ground surface) to accommodate the "swell" generated during ISS mixing activities. The proposed remedial excavation areas and the associated excavation depths are shown on Figure 4. Approximately 11,000 cubic yards of soil/fill material are estimated to be disposed of off-site as part of the remedy. Note that this quantity is approximate and upon further investigation, more remedial excavation may be required.

Soil pre-characterization sampling will be conducted across the Site to characterize the soil for acceptance at properly-permitted disposal facilities. The proposed testing will include sampling and laboratory analyses intended to satisfy the analytical requirements of numerous soil disposal/receiving facilities in New Jersey, New York, and Pennsylvania. Typical facilities require one sample per 800 cubic yards of material, therefore, a minimum of 14 samples consisting of a grab and five-point composite would be collected via borings advanced to varying depths across the Site to characterize the material in-place prior to the start of excavation. However, it is possible that once a specific facility is selected, additional testing and/or laboratory analysis may be required.

The grab samples will be analyzed for VOCs plus 10 tentatively identified compounds (TICs) by EPA Method 8260. The five-point composite samples will be analyzed for SVOCs plus 20 TICs by EPA Method 8270; TAL metals and trivalent chromium; toxicity characteristic leaching procedure (TCLP) Resource Conservation and Recovery Act (RCRA) eight metals plus copper, nickel, and zinc; PCBs by EPA Method 8082; pesticides by EPA 8081; cyanide; extractable petroleum hydrocarbons; total cyanide, total petroleum hydrocarbons; hexavalent chromium; ignitability; corrosivity; and reactivity. In addition, one sample for paint filter by EPA Method 9095 will also be collected. TerraCore® sampling devices or equivalent will be used to collect the grab samples. It is noted that additional samples and or analysis may be required based on the results of this sampling and/or the chosen disposal facilities requirements. Category A deliverables will be provided by the laboratory.

4.2 Waste Classification Report

A letter report will be prepared following completion of the waste classification sampling event and receipt of the laboratory data. The report will provide a summary of the analytical results and detail regarding the proposed soil disposal facilities. The report will include analytical data tables for all reported constituent compounds, a sample location map, and an interpretation of the data.

5.0 REMEDIAL ACTION PROGRAM

5.1 Governing Documents

5.1.1 Site Specific Health & Safety Plan

A Site-specific HASP and associated CAMP have been prepared for the Site and are included as Appendix G. All remedial work performed under this RAWP will be in compliance with governmental requirements, including Site and worker safety requirements mandated by the federal Occupational Health and Safety Administration (OSHA). Community air monitoring will be conducted during all intrusive Site activities in compliance with the NYSDOH Generic CAMP and the Site-Specific CAMP. Work zone monitoring will be performed for the health and safety of workers in accordance with action levels and guidance outlined in the Site-specific HASP.

The requirements of this RAWP and its appendices pertain to all remediation work performed at the Site until the issuance of a Certificate of Completion (COC). The Volunteer and associated parties preparing the remedial documents submitted to the state, and those performing the construction work, are completely responsible for the preparation of an appropriate HASP and for the appropriate performance of work according to that plan and applicable laws.

Confined space entry is not anticipated for this project. If confined space entry becomes necessary, work will comply with all OSHA requirements to address the potential risk posed by combustible and toxic gases.

5.1.2 Quality Assurance Project Plan (QAPP)

Any sampling associated with this project will be conducted in accordance with the QAPP included in Appendix F, which details field screening and sampling methodologies, and sample submittal and reporting requirements. The QAPP includes the project team responsible for implementing the remediation requirements and provisions set forth in this RAWP.

5.1.3 Construction Quality Assurance Plan (CQAP)

The Construction Quality Assurance Plan (CQAP), provided as Appendix H, provides a detailed description of the observation and testing activities that will be used to monitor construction quality and confirm that remedial construction is in conformance with the remediation objectives and specifications.

5.1.4 Soil/Materials Management Plan (SMMP)

A Soil/Materials Management Plan (SMMP) is included in Section 6.4 of this RAWP. The SMMP includes detailed plans for managing all soils/materials that are disturbed at the Site, including excavation, handling, storage, transport, and disposal. It also includes all of the procedures that will be applied to assure effective, nuisance-free performance in compliance with all applicable federal, state, and local laws and regulations.

5.1.5 Storm-Water Pollution Prevention Plan

Erosion and sediment controls implemented at the Site will conform to requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control Erosion. Sediment control measures will be installed at the Site prior to conducting any ground-intrusive work. These measures will be installed according to all applicable or relevant and appropriate Federal, State, and Local laws. The measures will provide for

abatement and control of environmental pollution arising from proposed remediation and construction activities. The control measures will include procedures for perimeter Site controls, stabilized construction pads at each construction entrance, equipment decontamination, drainage inlet protection, and particulate suppression. The Remedial Engineer (RE), or her representative, will conduct routine inspections, and any repairs and/or maintenance of control measures will be completed in a timely fashion to maintain the controls in proper working order. Further, all vehicles leaving the Site will be inspected to ensure that no soil adheres to the wheels or undercarriage, and any such materials will be removed at a tire wash station located at the Site exit. Any situation involving material spilled in transit or mud and particulates tracked off-site will be remedied.

5.1.6 Community Air Monitoring Plan (CAMP)

Community air monitoring will be performed via a minimum of two tripod-mounted (also known as fixed) stations at the perimeter of the Site (i.e., one downwind and one upwind) during soil remediation, ISS, any tank removal activities, and any other intrusive activities with the potential of disturbing contaminated soil. These locations are adjustable, and the exact location of the tripod-mounted stations will be selected depending on the nature and location of the Site activities and wind direction. On the perimeter of the work zone, air monitoring will be performed periodically (at a minimum once per hour) on a roving basis with hand-held equipment based upon wind direction and the location of the intrusive work. The CAMP was prepared as part of the Site-specific HASP, which is provided in Appendix G.

5.1.7 Contractors Site Operations Plan (SOP)

The RE, or a designated person under direct supervision of the RE, will review all plans and submittals for this remedial project (including those listed above and contractor and sub-contractor document submittals) and confirm that they are and will be in compliance with this RAWP. The RE is responsible to ensure that all later document submittals for this remedial project, including contractor and subcontractor document submittals, are in compliance with this RAWP. All remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

5.1.8 Citizen Participation Plan

A certification of mailing will be sent by the Volunteer to the NYSDEC project manager following the distribution of all Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed; (2) the date they were mailed; (3) a copy of the Fact Sheet; (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all of applicable project documents.

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The approved CPP for this project is attached in Appendix I. Document repositories have been established at the following locations and contain all applicable project documents:

Table IX
Document Repositories

Document Repository	Contact Information	Hours of Operation
Brooklyn Community Board 6	Peter D. Fleming, Chairperson 250 Baltic Street Brooklyn, NY 11201 (718) 643-3027	Monday – Friday: 9 am – 5pm
Brooklyn Public Library-Red Hook Branch	Joyce Kowpak, Managing Librarian 7 Wolcott Street Brooklyn, NY 11231 (718) 935-0203	Monday: 10 am - 6 pm Tuesday: 1 am - 8 pm Wednesday: 10 am - 6 pm Thursday: 10 am - 8 pm Friday: 10 am - 6 pm Saturday: 10 am - 5 pm Sunday: Closed
NYSDEC Online Document Repository	https://www.dec.ny.gov/data/DecDocs/C224300/	

5.2 General Remedial Construction Information

5.2.1 Project Organization

A list of the personnel responsible for implementation of the RAWP is presented in Table X.

Table X
Project Organization

Organization	Responsibility	Name
NYSDEC	Project Manager	Sadique Ahmed
Columbia SF LLC	Volunteer Representative	Samuel Braver
L.A.B. Validation Corp.	DUSR Preparer	Lori A. Beyer
AKRF	Remedial Engineer	Rebecca A. Kinal, P.E.
	QA/QC Officer	Marc Godick
	Project Manager	Ashutosh Sharma
	Site Safety Officer	Stephen Schmid
	Field Monitors	Hank Westly and Brian Quinn

Resumes of key personnel responsible for implementation of the RAWP are included in Attachment A of the QAPP (Appendix F).

5.2.2 Remedial Engineer

The RE for this project will be Rebecca Kinal, P.E. The RE is a registered professional engineer licensed by the State of New York. The RE will have primary direct responsibility for implementation of the remedial program for the 37 Otsego Street (NYSDEC BCA Index No. C224300-02-20, Site No. C224300). The RE will certify in the FER that the remedial activities were observed by qualified environmental professionals under her supervision and that the remediation requirements set forth in the RAWP and any other

relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. Other RE certification requirements are listed later in this RAWP.

A designated person under the direct supervision of the RE will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, ISS, air monitoring, emergency spill response services, import of backfill material, and management of waste transport and disposal. The RE, or a person under the direct supervision of the RE, will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The RE, or designated personnel under the direct supervision of the RE, will review all pre-remedial plans submitted by contractors for compliance with this RAWP and will certify compliance in the FER.

The RE will provide the FER certifications listed in Section 13.1 of this RAWP.

5.2.3 Remedial Action Construction Schedule

A schedule for performance of the remedial work is included in Section 14.0.

5.2.4 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings (NYCDOB) construction code requirements or according to specific variances issued by that agency. NYSDEC will be notified by the Volunteer of any variances issued by the NYCDOB. NYSDEC reserves the right to deny alternate remedial construction hours.

5.2.5 Site Security and Traffic Control

The Site will be completely closed from public access by using secured construction fencing. No unauthorized personnel will be able to access the Site. During off hours, the active portions of the Site will be completely enclosed within a locked gate. If necessary, 24 hour on-site security will be provided by a third-party security company.

It is not anticipated that traffic will be disrupted beyond normal contractor vehicle traffic going to and from the Site during construction. Any sidewalk closures that are required during the course of construction/remediation activities will be conducted in accordance with New York City Department of Transportation (NYCDOT) permits.

5.2.6 Contingency Plan

A contingency plan has been developed to describe the procedures to be followed upon discovery of an unknown source of contamination or areas of concern that may require remediation (USTs, stained soil, drums, etc.). The identification of an unknown source structure or unexpected contaminated media discovered by screening during invasive Site work will be promptly communicated by phone to NYSDEC's project manager. These findings will also be included in daily and periodic reports. If USTs or other previously unidentified contaminant sources are found during on-site remedial excavation or development-related construction, sampling will be performed on product, sediment and surrounding soil, etc. Chemical analytical work will be for full scan parameters [target compound list (TCL) VOCs and SVOCs, TCL pesticides, PCBs, and TAL metals]. These analyses will not be limited to Commissioner's Policy (CP)-51 parameters where tanks are identified without prior approval by NYSDEC.

5.2.7 Worker Training and Monitoring

All those who enter the work area while intrusive activities are being performed must recognize and understand the potential hazards to health and safety. All construction personnel upon entering the Site must attend a brief training meeting, its purpose being to:

- Make workers aware of the potential hazards they may encounter;
- Instruct workers on how to identify potential hazards;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- Make workers aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Construction personnel will be responsible for identifying potential hazards in the work zone. The project manager will be responsible for ensuring that the training is conducted. Others who enter the Site must be accompanied by a suitably-trained construction worker. In addition, any Site workers within the "work/exclusion zone" during handling of any identified hazardous waste will have received the OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and will be under a medical monitoring program.

5.2.8 Agency Approvals

The Volunteer has addressed all environmental requirements for this Site. All permits or government approvals required for remedial construction have been, or will be, obtained prior to the start of remedial construction.

The planned end use for the Site is in conformance with the current zoning for the property as determined by New York City Department of Planning. A Certificate of Completion will not be issued for the project unless conformance with zoning designation is demonstrated.

A complete list of all local, regional, and national governmental permits, certificates or other approvals or authorizations required to perform the remedial and development work will be included in the FER. This list includes a citation of the law, statute or code to be complied with, the originating agency, and a contact name and phone number in that agency. This list will be updated in the FER.

All planned remedial or construction work in regulated wetlands and adjacent areas will be specifically approved by the NYSDEC Division of Natural Resources to ensure that it meets the requirements for substantive compliance with those regulations prior to the start of construction. Nothing in the approved RAWP or its approval by NYSDEC should be construed as an approval for this purpose.

5.2.9 NYSDEC BCP Signage

Signs are optional for BCP sites and will be discussed with the NYSDEC project manager. If a sign is displayed, it will follow NYSDEC specifications for design and content, provided by the NYSDEC project manager.

5.2.10 Pre-Construction Meeting with NYSDEC

A pre-construction meeting with the NYSDEC will be scheduled prior to the start of major construction activities.

5.2.11 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in the HASP, provided in Appendix G. This document defines the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

5.3 Site Preparation

Prior to conducting any intrusive activities for Site remediation, the work zone(s), designated entry points, soil stockpile staging areas, decontamination zones, and truck routes will be established, as applicable. The Site plan will be updated as necessary to reflect any changes in operations during the course of the intrusive work. Particulate control measures, if necessary, will be implemented. Additional details of Site preparation activities are provided in the following sections.

5.3.1 Mobilization

Site mobilization involving security setup, equipment mobilization, utility mark outs and marking and staking excavation areas will be performed prior to undertaking any Site remediation activities.

5.3.2 Erosion and Sedimentation Controls

Erosion and sediment control measures will be installed at the Site prior to conducting any ground-intrusive work. These measures will be installed according to all applicable or relevant and appropriate federal, state, and local laws. The measures will provide for abatement and control of environmental pollution arising from proposed remediation and construction activities. The control measures will include procedures for perimeter Site controls, stabilized construction pads at each construction entrance, equipment decontamination, drainage inlet protection, and particulate suppression. The RE, or her designated representative, will conduct routine inspections, any repairs and/or maintenance of control measures will be completed in a timely fashion to maintain the controls in proper working order. All vehicles leaving the Site will be inspected to ensure that no soil adheres to the wheels or undercarriage of the vehicle leaving the Site. Any situations involving material spilled in transit or mud and dust tracked off-site will be remedied. The access routes will be inspected for road conditions, overhead clearance, and weight restrictions.

5.3.3 Stabilized Construction Entrance(s)

A crushed stone path will be constructed by the general contractor at all truck entrances for the Site. All trucks will drive over this path prior to leaving so that they do not get re-contaminated prior to departure from the Site. A laborer with a hose connected to a NYC fire hydrant will check the trucks as they leave. The hose will be used to wash off soil from the truck tires and body as it leaves the Site, as necessary. A fire hydrant permit must be obtained from the NYC Department of Environmental Protection (NYCDEP) prior to use.

5.3.4 Utility Marker and Easements Layout

The Volunteer and its contractors are solely responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. The Volunteer and its contractors must obtain any local, state, or federal permits or approvals pertinent to such work that may be required to perform work under this RAWP. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements.

The presence of utilities and easements on the Site has been investigated by the RE, or a designated person under her supervision. It has been determined that no risk or impediment to the planned work under this RAWP is posed by utilities or easements on the Site.

5.3.5 Sheeting and Shoring

Appropriate management of structural stability of on-site or off-site structures during on-Site activities include excavation is the sole responsibility of the Volunteer and its contractors. The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. The Volunteer and its contractors must obtain any local, state, or federal permits or approvals that may be required to perform work under this RAWP. Further, the Volunteer and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved RAWP.

5.3.6 Equipment and Material Staging

Staging and storage of equipment and materials will be contained within the secured Site or within a secured area on the street/sidewalk in accordance with a NYCDOT permit. By the nature of the work involved in this project, equipment and materials will be moved to different areas within the secured Site as work progresses.

5.3.7 Decontamination Area

A decontamination area will be established adjacent to the work areas. The floor of the decontamination area will be covered with 6-mil plastic sheeting as necessary and bermed to prevent spreading of decontamination fluids or potential discharge to the ground surface.

All equipment in direct contact with known or potentially contaminated material will be either dedicated or decontaminated prior to handling less-contaminated material or removal from the Site. All liquids used in the decontamination procedure will be collected, stored and disposed of in accordance with Federal, State, and Local regulations. Personnel performing this task will wear the proper personal protective equipment, as prescribed in the HASP.

5.3.8 Site Fencing

The Site will be secured with a locking fence that will be placed around the entire perimeter. During all remedial activities access to the Site will be limited and all persons entering the Site will be required to sign a log book and meet all applicable health and safety requirements. The Site will be secured during non-working hours. Throughout the project, security patrols will be implemented during working and non-working hours.

5.3.9 Demobilization

Restoration of the excavation work will include backfilling and general site earthwork to prepare for construction of the foundation elements. Upon completion of the remedial excavation work, any waste materials (i.e., plastic sheet, absorbent pads, etc.) and the decontamination pad will be removed from the Site for proper disposal.

5.4 Reporting

All daily and monthly reports will be included in the FER.

5.4.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day following the reporting period and will include:

- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and exported from the Site;
- References to alphanumeric map for Site activities;
- A summary of any and all complaints with relevant details (names, phone numbers). All complaints will also be communicated to the NYSDEC Project Manager when they occur;
- A summary of CAMP finding, including excursions;
- An explanation of notable Site conditions;
- A look-ahead schedule for anticipated upcoming activities; and
- Photographs of the BCP Site documenting daily activities.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RAWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily reports will include a description of daily activities keyed to an alpha-numeric map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public.

A Site map that shows a predefined alphanumeric grid for use in identifying locations described in reports submitted to NYSDEC is attached in Figure 5. The NYSDEC assigned project number will appear on all reports.

5.4.2 Monthly Reports

Monthly reports prepared in accordance with DER-10 Section 5.7(b) will be submitted to NYSDEC and NYSDOH Project Managers by the tenth day of the month following the reporting period and will include, at a minimum:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e., tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

5.4.3 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of the Site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area and Site structures before, during and after remediation. Photos will be included in the daily reports as needed, and a comprehensive collection of photos will be included in the FER.

Job-site record keeping for all remedial work will be appropriately documented. These records will be maintained on-site at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

5.4.4 Complaint Management Plan

A log of all complaints from the public regarding nuisance or other Site conditions will be compiled by the project director. All complaints will be reported as they occur as well as in the daily reports.

5.4.5 Deviations from the Remedial Action Work Plan

All deviations from the RAWP will require prior approval from NYSDEC. At a minimum, a summary of the deviations will include the following:

- Reasons for deviating from the approved RAWP;
- Approval process to be followed for changes/editions to the RAWP; and
- Effect of the deviations on overall remedy.

6.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

Based on data collected to date, removal of materials from the Site will include: (1) the top 2 feet of contaminated soil/fill across the entirety of the Site; (2) an additional 4 feet of contaminated soil/fill within proposed ISS area (total excavation in this area will go down to 6 ft bgs); (3) removal of any storage tanks, fill ports, piping, and vents (if encountered); and (4) removal of building materials generated during demolition. It is estimated that approximately 11,000 cubic yards of soil and fill material will be removed from the Site as part of remediation and disposed of at a facility(ies) licensed to accept such material. Note that these quantities are approximations and upon further investigation, more remedial excavation may be required. If such a discovery occurs, any additional remediation necessary to attain the selected remedy will be reflected in the FER. Proposed disposal facilities will be submitted to NYSDEC after completion of waste characterization sampling. Additional soil/fill will be excavated as part of Site development activities for installation of the new building foundation, plumbing, and other utilities. The proposed extent of remedial excavation is shown on Figure 4.

6.1 Soil Cleanup Objectives

The applicable SCOs for the Site are the RRSCOs for all parameters and PGWSCOs for petroleum-related VOCs.

Soil and materials management on-site and off-site will be conducted in accordance with the SMMP as described below.

Tables 2 through 7 of the RIR are provided in Appendix C2 of this RAWP, which summarize all soil sample data collected from the RI that exceed the SCOs proposed for this Remedial Action. A concentration map that shows all soil samples collected from the RI that exceed the SCOs proposed for this Remedial Action is provided as Figure 6 of the RIR.

UST closures will, at a minimum, conform to criteria defined in DER-10.

6.2 Remedial Performance Evaluation (Post-Excavation Endpoint Sampling)

Endpoint samples will be collected from the bottom and along the sidewalls of all remediation excavations (excluding the ISS area) to document any contaminants in soil/fill to remain at the Site as described in this section. Confirmatory sampling to verify the effectiveness of the ISS program (core sampling) is described in Section 7.0.

6.2.1 Endpoint Sampling Frequency

According to the sampling frequency outlined in Section 5.4 of DER-10, endpoint sampling for the general remedial excavation will include one bottom soil sample for every 900 square feet across the Site and one sidewall sample for every 30 linear feet around the perimeter of the Site. Approximately 115 soil endpoint samples will be collected Site-wide (no samples will be collected from the ISS treatment area).

6.2.2 Methodology

The excavation documentation samples will be collected using decontaminated or dedicated sampling equipment, and placed directly into pre-sterilized laboratory-issued containers. Samples collected within 24 hours of achieving final excavation depths will be collected from the 0- to 6-inch interval. Samples collected more than 24 hours after achieving final excavation depths will be collected from the 6- to 12-inch interval by removing the top 6 inches of material prior to sample collection.

The sample containers will be properly labeled and immediately placed on ice within a cooler. Sample time, date, and location will be recorded on a chain of custody. The samples

will be submitted to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory for analysis of VOCs by EPA Method 8260, SVOCs by EPA Method 8270, pesticides by EPA Method 8081, PCBs by EPA Method 8082, TAL metals by EPA Method 6000/7000 series, 1,4-dioxane by EPA Method 8270, and PFAS by EPA Method 1633. The laboratory will follow the NYSDEC – Analytical Services Protocol (ASP) dated 1995, and Category B deliverables will be issued. Further details regarding the specific sampling methodology and analytical procedures are presented in the QAPP, included as Appendix F.

6.2.3 Reporting of Results

The analytical results of the documentation samples will be tabulated and compared to UUSCOs and RRSCOs for all parameters, and PGWSCOs for petroleum-related VOCs only. The tabulated data and the laboratory reports will be included in the FER. All analytical data will be submitted to NYSDEC in electronic data deliverable (EDD) format via the Environmental Quality Information System (EQuIS™).

6.2.4 QA/QC

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision, and completeness requirements will be addressed by the laboratory for all data generated. Collected samples will be appropriately packaged, placed in coolers, and shipped or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved to maintain a temperature of 4 °C. Decontamination of non-dedicated sampling equipment will consist of the following: gently tap or scrape to remove adhered soil; rinse with tap water; wash with Simple Green/Alconox® detergent solution and scrub; rinse with tap water; rinse with distilled or deionized water; prepare field blanks by pouring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers.

One trip blank, one field blank, one blind duplicate sample, and one matrix spike/matrix spike duplicate (MS/MSD) will be collected per every 20 samples or Sample Delivery Group (SDG) and submitted for analysis during the endpoint sampling event. The field blank(s), blind duplicate(s), and MS/MSD(s) will include all of the parameters included in the sample analysis while the trip blanks will be analyzed for VOCs only. Additional QA/QC information is provided in the QAPP, provided as Appendix F.

6.2.5 Data Usability Summary Report (DUSR)

A qualified, third-party data validator will review the documentation sample laboratory reports and prepare a DUSR. The validated data will be submitted to the NYSDEC database in EDD format via EQuIS™. DUSRs and validated data will be included in the FER.

6.2.6 Reporting of Endpoint Data in FER

The FER will include a detailed description of endpoint sampling activities, data summary tables, concentration map showing endpoint sample locations and concentrations, DUSR, and laboratory reports. Chemical labs used for all endpoint sample results and contingency sampling will be NYSDOH Environmental Laboratory Accreditation Program (ELAP) certified.

Endpoint sampling, including bottom and sidewall sampling, will be performed in accordance with DER-10 sample frequency requirements. Sidewall samples will be

collected a minimum of every 30 linear feet. Bottom samples will be collected at a rate of one for every 900 square feet. The FER will provide a mapped and tabulated summary of all endpoint sample results and exceedances of SCOs.

6.3 Estimated Material Removal and Import Quantities

The removal of materials from the Site for will include: (1) the top 2 feet of contaminated soil/fill across the entirety of the Site; (2) an additional 4 feet of contaminated soil/fill within proposed ISS area to allow for ISS swell; (3) removal of any storage tanks, piping, fill ports, and vents (if encountered); and (4) removal of building materials from demolition. It is estimated that up to approximately 11,000 cubic yards of soil/fill will be excavated for remedial purposes. Note that these quantities are approximations and upon further investigation, more remedial excavation may be required. If such a discovery occurs, any additional remediation necessary to attain the selected remedy will be reflected in the FER. Proposed disposal facilities will be submitted to NYSDEC after completion of waste characterization sampling and selection of the remedial contractors. Additional soil/fill will be excavated and removed for redevelopment purposes for construction of building foundation elements, plumbing, and other utilities. The proposed remedial excavation areas and the associated excavation depths are indicated on Figure 4.

The estimated quantity of soil to be imported into the Site for backfill of remedial excavations and to facilitate installation of the final Site-wide cover in exterior areas of the Site is approximately 3,000 cubic yards. On-site reuse of excavated soil at the Site is not anticipated.

The final soil disposal and clean fill import quantities will be included in the FER.

6.4 Soil/Materials Management Plan

The SMMP describes the procedures to be performed during the handling of soil/fill materials on-site during all intrusive work.

6.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by a qualified environmental professional or experienced field geologist under the direction of the RE during all remedial and development excavations into known or potentially contaminated material. Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the COC.

All primary contaminant sources (including but not limited to any tanks and hotspots) identified during Waste Characterization, RI, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. This information will be provided on maps in the FER.

Screening will be performed by qualified environmental professionals. Resumes for personnel responsible for field screening (i.e., those representing the RE) of invasive work for unknown contaminant sources during remediation and development work are included in the QAPP in Appendix F, and updated resumes will be provided to NYSDEC for additional personnel assigned to the Site.

6.4.2 Stockpile Methods

Soil stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Soil stockpiles will be continuously encircled with silt fences. Hay bales will be used as needed near catch basins, surface waters and other discharge points. Water will be available on-site at suitable supply and pressure for use in dust control.

6.4.3 Materials Excavation and Load Out

The RE or a qualified environmental professional under her supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP.

The presence of utilities and easements on the Site has been investigated by the RE. It has been determined that no risk or impediment to the planned work under this RAWP is posed by utilities or easements on the Site.

Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate federal, state, local, and NYSDOT requirements (and all other applicable transportation requirements). A truck wash will be operated on-site. A designated person under the direct supervision of the RE will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site until the remedial construction is complete. Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-Site sediment tracking.

A designated person under the direct supervision of the RE will be responsible for ensuring that all egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during Site remediation and development. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site -derived materials.

The Volunteer and associated parties preparing the remedial documents submitted to the NYSDEC and parties performing this work, are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The RE or a designated person under her supervision will ensure that Site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this RAWP.

Each hotspot and structure to be remediated (e.g., USTs, vaults and associated piping, transformers, etc.) will be removed and endpoint remedial performance sampling completed before excavations related to Site development commence proximal to the hotspot or structure.

Development-related grading cuts and fills will not be performed without NYSDEC approval and will not interfere with, or otherwise impair or compromise, the performance of remediation required by this plan.

Mechanical processing of historical fill and contaminated soil on-site is prohibited. All primary contaminant sources (including but not limited to tanks and hotspots) identified during Waste Characterization, Remedial Investigation, and Remedial Action will be

surveyed by a surveyor licensed to practice in the State of New York. The survey information will be shown on maps to be reported in the FER.

6.4.4 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, state, and federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Proposed in-bound and out-bound truck routes to the Site are shown in Figure 6. All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes. These are the most appropriate routes and take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off- Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site. Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during Site remediation and development. Queuing of trucks will be performed on-Site in order to minimize off-Site disturbance. Off-Site queuing will be prohibited.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used. All trucks will be washed prior to leaving the Site. If deemed necessary based on inspection.

6.4.5 Materials Disposal Off-Site

The disposal facility(ies) information will be reported to the NYSDEC project manager after completion of waste classification testing and prior to commencing the off-site disposal activities. Based on the waste classification results, a properly permitted waste disposal facility will be selected for off-site disposal. The disposal facility information including location will be reported to the NYSDEC Project Manager prior to commencing the disposal activities.

The total quantity of material expected to be disposed off-Site is 11,000 cubic yards of non-hazardous soil/fill material generated from the remedial action. Additional construction and demolition (C&D) debris will be removed from the Site following demolition of the existing structure. Final disposal quantities for each waste stream will be included in the FER. Grossly contaminated petroleum contaminated soil (approximately 20,500 cubic yards) will be encapsulated on-site via ISS.

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be disposed in accordance with all local, state (including 6 NYCRR Part 360) and federal regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC's Project Manager. Unregulated off-site management of materials from this Site is prohibited without formal NYSDEC approval. Material that does not meet Track 1 UUSCOs is prohibited from being taken to a New York State recycling facility (6 NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the RE for each disposal location used in this project to fully demonstrate and document that the disposal of material

derived from the Site conforms with all applicable laws: (1) a letter from the RE or BCP Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of the RE. The letter will include as an attachment a summary of all chemical data for the material being transported (including waste characterization data); and (2) a letter from all receiving facilities stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6 NYCRR Part 360-1.2. Historical fill and contaminated soils from the Site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from the Site are considered by the Division of Materials Management (DMM) in NYSDEC to be C&D materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may also be sent to a permitted C&D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DMM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DMM, special procedures will include, at a minimum, a letter to the C&D facility that provides a detailed explanation that the material is derived from a DER remediation Site, that the soil material is contaminated and that it must not be redirected to on-site or off-site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the RE. The letter will include as an attachment a summary of all chemical data for the material being transported.

The FER will include an accounting of the destination of all material removed from the Site during this Remedial Action, including excavated soil, contaminated soil, historic fill, solid waste, and hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will also be presented in a tabulated form in the FER.

A bill of lading system or equivalent will be used for off-site movement of non-hazardous wastes and contaminated soils. This information will be reported in the FER. Hazardous wastes derived from on-site will be stored, transported, and disposed of in full compliance with applicable local, state, and federal regulations. Appropriately licensed haulers will be used for material removed from this Site and will be in full compliance with all applicable local, state, and federal regulations.

Waste characterization will be performed for off-site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

6.4.6 Materials Reuse On-Site

Chemical criteria for on-Site reuse of material has been established by NYSDEC and consist of the Part 375 RRSCOs and PGWSCOs for petroleum-related VOCs. Although not anticipated, if any excavated materials are planned for reuse on-site, they will be segregated and stockpiled from materials slated for off-site disposal. Stockpiles will be placed on and covered with polyethylene sheeting. The stockpiled soil will be sampled

and analyzed in accordance with Table 5.4(e)10 on page 161 of DER-10 Technical Guidance for Investigation and Remediation. All of the materials to be reused on the Site will comply with RRSCOs and PGWSCOs (for petroleum-related VOCs). The RE, or designated person under her direct supervision, will ensure that procedures defined for materials reuse in this RAWP are followed and that unacceptable material will not remain on-site.

Acceptable demolition material proposed for reuse on-site, if any, will be sampled for asbestos. Concrete crushing or processing on-site is prohibited. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site is prohibited for reuse on-site.

Following implementation of the ISS for the petroleum contaminated soil, some of the solidified material will be chipped to accommodate utilities and foundation elements during the Site redevelopment. Such materials may be reused on-site below the composite cover system without any additional testing.

Contaminated on-site material, including historic fill and contaminated soil, and excess/ chipped ISS materials, removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. This will be expressed in the final SMP and FER.

6.4.7 Fluids Management

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable local, state, and federal regulations. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP, inclusive of appropriate pre-treatment and discharge permitting.

Dewatered fluids will not be recharged back to the land surface or subsurface of the Site without prior approval by NYSDEC. Dewatering fluids will be managed off-site. Discharge of water generated during remedial construction to surface waters (i.e., a local pond, stream or river) is prohibited without a State Pollutant Discharge Elimination System (SPDES) permit.

6.4.8 Demarcation

After the completion of soil removal, ISS, and any other invasive remedial activities and prior to backfilling, a land survey will be performed by a New York State licensed surveyor. The survey will define the top elevation of residual contaminated soils. A physical demarcation layer, consisting of orange snow fencing material or equivalent material (such as a waterproofing/vapor barrier) will be placed on this surface to provide a visual reference. This demarcation layer will constitute the top of the 'Residuals Management Zone', the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the SMP. The survey will measure the grade covered by the demarcation layer before the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer placed on this grade surface will constitute the physical and written record of the upper surface of the 'Residuals Management Zone' in the SMP. A map showing the survey results will be included in the FER and the SMP.

6.4.9 Backfill from Off-Site Sources

All materials proposed for import onto the Site will be approved by the RE or her designee and will be in compliance with provisions in this RAWP prior to receipt at the Site. Material

from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

Prior to import, soil will be segregated and tested at the source facility for analysis of VOCs, SVOCs, PCBs, pesticides, TAL metals, 1,4-dioxane, and PFAS at the frequency outlined in Table 5.4(e)10 on page 161 of DER-10 Technical Guidance for Investigation and Remediation. Soil exceeding the UUSCO for 1,4-dioxane will not be imported, per DER 10: Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil, Subdivision 5.4(e). In accordance with the April 2023 NYSDEC-issued PFAS sampling protocol ["Guidelines for Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs"], if PFOA or PFOS are detected in any sample at or above 33 parts per billion (ppb) and 44 ppb, respectively, the material will not be reused or imported unless a Site-specific exemption is provided based on synthetic precipitation leaching procedure (SPLP) testing. If the SPLP results exceed 10 parts per trillion (ppt) for either PFOA or PFOS (individually), the soil will not be reused or imported. Analytical results will be compared to Table 375-6.8(b) of 6 NYCRR Part 375 and submitted to NYSDEC via a Request to Import/Reuse Soil or Fill form for review and approval prior to importation and placement on-site. All imported soils will meet NYSDEC approved backfill or cover soil quality objectives for this Site. These NYSDEC approved backfill or cover soil quality objectives are the lower of the protection of groundwater or the protection of public health soil cleanup objectives for Restricted Residential Use as set forth in Table 375-6.8(b) of 6 NYCRR Part 375. Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in the approved RAWP or its approval by NYSDEC should be construed as an approval for this purpose.

The FER will include the following certification by the RE: "I certify that all import of soils from off-site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan".

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Nothing in this Remedial Action Work Plan should be construed as an approval for this purpose. Solid waste will not be imported onto the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers.

6.4.10 Stormwater Pollution Prevention

The erosion and sediment controls employed at the Site will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control Erosion and sediment control measures. The measures will be installed prior to conducting any ground-intrusive work. These measures will be installed according to all applicable or relevant and appropriate federal, state, and local laws.

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. All undercutting or erosion of the silt fence toe anchor shall be repaired

immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the RAWP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Silt fencing or hay bales will be installed around the entire perimeter of the remedial construction area.

6.4.11 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-site remedial excavation or development related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals, TCL VOCs and SVOCs, TCL pesticides, and PCBs). These analyses will not be limited to CP-51 parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

Identification of unknown or unexpected contaminated media identified by screening during invasive Site work will be promptly communicated by phone to NYSDEC's Project Manager. These findings will be also included in daily and periodic electronic media reports.

6.4.12 Community Air Monitoring Plan

A Site-specific HASP containing a CAMP has been prepared for this Site and is provided ain Appendix G. Community air monitoring and real-time air monitoring at the perimeter of the exclusion zone will be conducted during all intrusive Site activities in accordance with the NYSDOH Generic CAMP and as described in Section 2.6 of Appendix G. A minimum of one upwind and one downwind CAMP station will be in operation during all intrusive activities. The CAMP requirements may be modified in consultation with NYSDEC for activities involving minimal soil disturbance (e.g., site preparation, pile installation, etc.)

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

6.4.13 Odor, Dust, and Nuisance Control Plan

The FER will include the following certification by the RE: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan."

6.14.13.1 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site. Specific odor control methods to be used on a routine basis will include use of a PID to screen for VOCs and olfactory observations by a field technician. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer's RE, who is responsible for certifying the FER.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and (f) use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

6.4.13.2 Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-site work, will include, at a minimum, the items listed below:

- Water will be available on-site at suitable supply and pressure for use in dust control.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water spraying.

6.4.13.3 Other Nuisances

A plan for rodent control will be developed and utilized by the contractor prior to and during Site clearing and Site grubbing, and during all remedial work. A plan will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to NYCDEP noise control standards.

7.0 REMEDIAL ACTION: IN-SITU SOLIDIFICATION OF GROSSLY CONTAMINATED SOIL

ISS will be conducted to solidify and physically encapsulate LNAPL and gross petroleum-contaminated soil in the area shown on Figure 3. It is anticipated that the ISS program will consist of dividing the treatment area into smaller grids and mixing specifically-designed cement grout with the existing soils in each grid down to the target treatment depth. The mixing will be conducted using a drill rig equipped with a large-diameter auger and/or via "bucket-mixing" using an excavator with an extended reach arm. Prior to ISS activities, each treatment grid will be pre-cleared (excavated) to approximately 6 ft bgs to create a contained working area and to accommodate the "swell" generated during ISS mixing activities. Soil/fill excavated as part of the pre-clearing process will be characterized and disposed of off-site in accordance with Section 4.0.

Based on the historic investigations and RI findings and the known extent of petroleum contamination, it is anticipated that ISS treatment would be required for an approximately 25,000 square foot area, and the target treatment depth will be approximately 28 feet bgs, for an estimated treatment volume of 20,500 cubic yards. It is noted that although the gross contamination has been noted down to 20 ft bgs, the Site is underlain by soft sediment/native clay up to a depth of approximately 25 ft bgs, as such and based on geotechnical considerations, ISS would need to be extended to approximately 28 ft bgs to prevent liquification of the soft sediment below and to limit settlement of the concrete block/mass created by ISS.

Prior to implementation of ISS treatment, a treatability study will be conducted to determine appropriate ISS design mix necessary to achieve ISS performance criteria. An ISS Treatability Study Work Plan will be prepared by the Contractor, in consultation with the Remedial Engineer, and submitted to NYSDEC for review prior to the start of work. The ISS treatability study will be conducted based upon the recommended approach defined in the Interstate Technology Regulatory Council (ITRC) Technical/Regulatory Guidance for Development of Performance Specifications for Solidification/Stabilization. It is anticipated that soil cores will be advanced to collect representative samples of LNAPL and grossly contaminated source materials for submission to a laboratory for ISS design mix evaluation. Additionally, groundwater samples will be collected from each of the three off-site permanent monitoring wells (MW-7, MW-10, and MW-11), installed in the adjacent sidewalks (in the western portion of the Site) during the RI, to establish background concentrations prior to start of Site remediation.

An ISS Treatability Study Report detailing results and conclusions (e.g., the ISS design mix) will be prepared by the Contractor and submitted to the Remedial Engineer and NYSDEC for review prior to the start of ISS treatment. The ISS Treatability Study Report will also be included in the FER.

The cement mix design and ISS performance criteria will be specified in the ISS Treatability Study Report; however, it is anticipated that the target criteria will include: a maximum hydraulic conductivity of 1×10^{-6} cm/sec (which is approximately one to two orders of magnitude lower than the estimated hydraulic conductivity of native sand and silt identified below the groundwater table at the Site); and a minimum compressive strength of 50 pounds per square inch (psi).

The effectiveness of the ISS will be confirmed by QA/QC verification sampling conducted during and after ISS treatment. One core borehole will be completed at a minimum frequency of one core per 5,000 square feet of treated material (minimum of five core boreholes) for visual observation of complete mixing, and to confirm lack of gross contamination/NAPL and other performance criteria specified in the final ISS design. In addition, a sample will be collected for every 500 cubic yards of treated material to confirm target hydraulic conductivity and minimum compressive strength. The ISS QA/QC sampling program will be conducted in accordance with the NYSDEC ISS QA/QC coring requirements provided in Appendix J.

Based on the target 22-foot treatment interval (6 to 28 ft bgs) and an anticipated 20% increase in overall volume following ISS treatment, it is anticipated that the grout/soil mixture will completely fill the 6-foot

deep pre-cleared excavation area up to existing and proposed Site grade. Therefore, some of the solidified soil-grout mix will need to be excavated or "chipped out" to facilitate Site development. Excess chipped materials may be reused below the composite cover system in accordance with Section 6.4.6.

Following implementation of the ISS treatment program, three monitoring wells will be installed along the sidewalks surrounding the treatment area as shown on Figure 9. The wells will be sampled for VOCs by EPA Method 8260 and SVOCs by EPA Method 8270 to monitor the effectiveness of the ISS treatment program. A minimum of four rounds of groundwater sample collection will be implemented at the Site, one round per quarter within the first year following remediation (including at least one prior to receipt of the Certification of Completion and one or more under Site Management).

8.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

Since residual contaminated soil and soil vapor will exist beneath the Site after the remedy is complete, Engineering and Institutional Controls (ECs and ICs) are required to protect human health and the environment. These ECs and ICs are described hereafter. Long-term management of EC/ICs and of residual contamination will be executed under a Site-specific SMP that will be developed and included in the FER.

ECs will be implemented to protect public health and the environment by appropriately managing residual contamination. The Controlled Property (the Site) will have two primary EC systems. These are: (1) an active SSDS; and (2) a composite cover system consisting of concrete building slabs, and a minimum 2-foot thickness clean soil cover in the exterior landscaped areas.

The FER will report residual contamination on the Site in tabular and map form. This will include presentation of exceedances of both Track 1 UUSCOs and Track 4 RRSCOs.

9.0 ENGINEERING CONTROL: COMPOSITE COVER SYSTEM

Exposure to residual contaminated soils will be prevented by an engineered, composite cover system that will be constructed on the Site. This composite cover system will be comprised of (1) a minimum 2-foot clean fill cover with demarcation barrier in all landscaped areas, and (2) minimum 6-inch thick concrete building slab underlain by a minimum 20-mil waterproofing/vapor barrier membrane in areas within the building footprints. A schematic showing the composite cover system to be implemented as part of the remedy is provided as Figure 7.

A Soil Management Plan will be included in the SMP and will outline the procedures to be followed in the event that the composite cover system and underlying residual contamination are disturbed after the RA is complete. Maintenance of this composite cover system will be described in the SMP in the FER.

10.0 ENGINEERING CONTROL: SUB-SLAB DEPRESSURIZATION SYSTEM

An active SSDS will be installed to mitigate the potential for sub-slab vapor intrusion into each of the proposed new building (3 total). The SSDS will induce a negative pressure (i.e., vacuum) beneath each of the proposed new building slabs. Slotted piping will extend horizontally throughout the treatment area and will be connected, via solid aboveground piping, to a roof-mounted blower(s) and ultimately the effluent vapors will be exhausted to the atmosphere via discharge stacks. The design also includes the installation of a sufficient number of vacuum monitoring points to verify that there is negative pressure underneath each building slab.

As the design details have not been finalized, this RAWP specifies that an active SSDS will be designed and installed for each of the proposed new buildings (3 separate SSDS systems will be installed). The SSDS details will be submitted to NYSDEC and NYSDOH for review as a separate design document once the final design drawings have been prepared. The proposed extent of the SSDS is shown on Figure 8. The proposed SSDS layout and standard design details are further discussed below.

10.1 SSDS Components

Each proposed SSDS to be installed for the proposed new building (total 3 separate systems) as part of the Site remedy will consist of, but not limited to:

- Multiple runs of 4-inch diameter slotted Schedule 40 PVC pipe vapor collection piping beneath the building foundation slabs connecting to 4-inch diameter solid Schedule 40 PVC piping penetrating the slab.
- Transition from 4-inch solid PVC to 6-inch or 8-inch galvanized steel or cast iron interior riser pipes extending to the building roof.
- Roof-mounted suction fans connecting to the risers and discharging to galvanized steel exhaust stacks.
- A minimum 6-inch thick ¾-inch gas-permeable aggregate (GPA) layer underlain by a non-woven geotextile fabric beneath the entire building slab.
- Communication and pipe sleeves through concrete foundation elements, as necessary.
- Condensate drains, as necessary.
- Multiple vapor monitoring points (VMPs) installed beneath the building slab.
- Accessories, including: cleanouts, sample ports, vacuum indicators/pressure gauges, flow meters, butterfly valves, and differential pressure switches; and
- A control panel equipped with a telemetry system to notify select personnel of alarm conditions.

During construction, non-woven geotextile fabric overlain by a minimum 6-inch layer of ¾-inch gas permeable aggregate (GPA) stone bedding meeting the gradation requirements of #5 aggregate in ASTM C33 will be installed below each building slab, and under, around, and above all SSDS piping to promote favorable conditions for ventilation of vapors. VMPs will be installed to facilitate collection of sub-slab vapor samples and/or vacuum measurements if required in the future during Site management. The exhaust stacks will be at least 25 feet away from any air intakes or windows and/or in accordance with local and state building codes. The building roof will have limited accessibility.

The installation of a minimum 20-mil vapor barrier under the entire building slab is expected to enhance vacuum capabilities beneath the proposed building slabs and further assist in the prevention of sub-slab vapor infiltration into indoor air.

10.2 SSDS Confirmatory Testing

Following building completion and as part of SSDS startup, each system will be balanced and vacuum readings will be collected to assess induced vacuum conditions throughout the building sub-slab (for each building) and determine the efficacy of the SSDS. Adequate sub-slab vacuum will be determined via VMP vacuum readings of 0.004 inches of water (inH_2O) or higher. If sub-slab vacuum readings indicate minimum vacuum readings less than the target operating conditions, the SSDSs will be rebalanced by adjusting the applied vacuum and air flow rate conditions at the individual SSDS lines until acceptable induced vacuum conditions are observed at each of the VMPs.

10.3 SSDS Operations and Maintenance (O&M)

After successful SSDS startup and balancing, the SSDS (for each building) will be routinely inspected to ensure proper operation. Routine inspections will consist of individual SSDS riser pipe gauge readings and suction fan inspections. More detailed system O&M protocols, including instructions for periodic maintenance and annual certification, will be included in the SMP.

11.0 CRITERIA FOR COMPLETION OF REMEDIATION/ TERMINATION OF REMEDIAL SYSTEMS

11.1 Composite Cover System

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

11.2 Sub-Slab Depressurization System (SSDS)

Operation of the active SSDS (3 separate systems, one for each building) will not be discontinued without written approval by NYSDEC and NYSDOH. A proposal to discontinue the active SSDS may be submitted by the property owner based on confirmatory data that justifies such request. The system will remain in place and operational until permission to discontinue use is granted in writing by NYSDEC and NYSDOH.

12.0 INSTITUTIONAL CONTROLS

After the remedy is complete, the Site will have residual contamination remaining in place. ECs for the residual contamination have been incorporated into the remedy to render the overall Site remedy protective of public health and the environment. Two elements have been designed to ensure continual and proper management of residual contamination in perpetuity: an Environmental Easement (EE) and a Site Management Plan (SMP).

All as-built drawings, diagrams, calculation and manufacturer documentation for treatment systems will be presented in the FER. A Site-specific Environmental Easement will be recorded with New York County to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Environmental Easement and the grantor's successors and assigns adhere to all ECs and ICs placed on this Site by this NYSDEC-approved remedy. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The SMP describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Environmental Easement. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Environmental Easement and grantor's successors and assigns.

12.1 Environmental Easement

An Environmental Easement (EE), as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-Site after the Remedial Action is complete. As part of this remedy, an Environmental Easement approved by NYSDEC will be filed and recorded with the New York County Office of the City Register. The Environmental Easement will be submitted as part of the FER.

The EE renders the Site a Controlled Property. The EE must be recorded with the Kings County Office of the City Register before the Certificate of Completion can be issued by NYSDEC. A series of ICs are required under this remedy to implement, maintain and monitor these EC systems, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restricting the use of the Site to residential, commercial, and industrial uses only. These IC are requirements or restrictions placed on the Site that are listed in, and required by, the EE. ICs can, generally, be subdivided between controls that support ECs, and those that place general restrictions on Site usage or other requirements. ICs in both of these groups are closely integrated with the SMP, which provides all of the methods and procedures to be followed to comply with this remedy.

The ICs that support ECs are:

- Compliance with the Environmental Easement by the Grantee and the Grantee's successors and adherence of all elements of the SMP is required;
- All ECs must be operated and maintained as specified in this SMP;
- A composite cover system consisting of a vapor barrier/waterproofing system and concrete building slabs and below-grade walls must be inspected, certified and maintained as required in the SMP;
- All ECs on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- A soil vapor mitigation system consisting of an SSDS beneath the building slabs must be inspected, certified, operated, and maintained as required by the SMP;

- Data and information pertinent to Site Management for the Controlled Property must be reported at the frequency and in a manner defined in the SMP; and
- ECs may not be discontinued without an amendment or extinguishment of the EE.

Adherence to these ICs for the Site is mandated by the EE and will be implemented under the SMP (discussed in the next section). The Controlled Property (Site) will also have a series of Institutional Controls in the form of Site restrictions and requirements. The Site restrictions that apply to the Controlled Property are:

- Vegetable gardens and farming on the Controlled Property are prohibited;
- Use of groundwater underlying the Controlled Property is prohibited without treatment rendering it safe for intended purpose;
- All future activities on the Controlled Property that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the SMP;
- The Controlled Property may be used for restricted residential, commercial, and industrial use only, provided the long-term Engineering and Institutional Controls included in the SMP are employed;
- The Controlled Property may not be used for a higher level of use, such as residential or unrestricted use without an amendment or extinguishment of this Environmental Easement; and
- Grantor agrees to submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow. This statement must be certified by an expert that the NYSDEC finds acceptable.

12.2 Site Management Plan

Site management is the last phase of remediation and begins with the approval of the FER and issuance of the Certificate of Completion for the remedy. The SMP is submitted as part of the FER but will be written in a manner that allows its removal and use as a complete and independent document. Site management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the EE and the SMP are performed.

The SMP will be prepared in accordance with DER-10, Section 6.2, and guidelines provided by NYSDEC. The SMP is intended to provide a detailed description of the procedures required to manage any residual contamination left in place at the Site following completion of the remedy in accordance with the BCA with NYSDEC. The SMP will identify all use restrictions and ECs for the Site, and detail the steps and media-specific requirements necessary to ensure the ICs and ECs remain in place and effective, including, but not limited to, the following:

- An excavation plan for future excavation in any areas with remaining contamination;
- A monitoring plan to assess the performance and effectiveness of the remedy;

- Operations and Maintenance plans for ECs; and
- Th steps necessary for the periodic reviews and certifications of the ICs and ECs.

12.3 Periodic Review

Site management activities, reporting, and EC/IC certification will be provided in a Periodic Review Report (PRR), which will be prepared in accordance with Section 6.3 of DER-10. The initial periodic review will be conducted no more than 18 months after issuance of the Certificate of Completion. Subsequent periodic reviews will be annual, unless otherwise determined by NYSDEC. The PRR will include: (1) the Site monitoring data and the results of Site inspection(s) to document the basis for the IC/EC certification; (2) recommendations for continued need for ECs/ICs; and (3) a provision for any failure of ICs/ECs, and the corrective measure to be implemented.

13.0 FINAL ENGINEERING REPORT

A FER will be submitted to NYSDEC following implementation of the RA defined in this RAWP. The FER provides the documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The FER will provide a comprehensive account of the locations and characteristics of all material removed from the Site including the surveyed map(s) of all sources. The FER will include as-built drawings for all constructed elements, calculation and manufacturer documentation for treatment systems, certifications, manifests, bills of lading as well as the complete SMP (formerly the Operation and Maintenance Plan). The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP and associated design documents. The FER will provide a tabulated summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10.

Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance and monitoring tasks defined in the SMP and Environmental Easement. This determination will be made by NYSDEC in the context of the FER review.

The FER will include written and photographic documentation of all remedial work performed under this remedy and an itemized tabulated description of actual costs incurred during all aspects of the Remedial Action. The FER will provide a thorough summary of all residual contamination left on the Site after the remedy is complete. Residual contamination includes all contamination that exceeds the Track 1 Unrestricted Use SCOs and Track 4 RRSCOs in 6NYCRR Part 375-6. Tables and maps that show exceedances from UUSCOs and RRSCOs for all soil/fill remaining at the Site after the RA will be included in the FER. The FER will provide an explanation for why the material was not removed as part of the RA.

The FER will provide a thorough summary of all residual contamination that exceeds the SCOs defined for the Site in the RAWP and must provide an explanation for why the material was not removed as part of the Remedial Action. A table that shows residual contamination in excess of Site SCOs and a map that shows residual contamination in excess of Site SCOs will be included in the FER.

The FER will include an accounting of the destination of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the Site.

Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital form on electronic media (PDF).

13.1 Certifications

The following certification will appear in front of the Executive Summary of the FER. The certification will be signed by the Remedial Engineer, Rebecca A. Kinal, who is a Professional Engineer registered in New York State This certification will be appropriately signed and stamped. The certification will include the following statements:

I, Rebecca Kinal, P.E., am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 37 Otsego Street Site (NYSDEC BCA Index No. C224300-02-20, Site No. C224300).

I certify that the Site description presented in this FER is identical to the Site descriptions presented in the Environmental Easement, the Site Management Plan, and the Brownfield Cleanup Agreement for the 37 Otsego Street Site and related amendments.

I certify that the Remedial Action Work Plan dated [month day year] and Stipulations [if any] in a letter dated [month day year] and approved by the NYSDEC were implemented and that all requirements in those documents have been substantively complied with.

I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and all operation and maintenance requirements applicable to the Site are contained in an Environmental Easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded. A Site Management Plan has been submitted by the Volunteer for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the Site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by the NYSDEC.

I certify that the export of all contaminated soil, fill, water or other material from the property was performed in accordance with the Remedial Action Work Plan, and were taken to facilities licensed to accept this material in full compliance with all federal, state, and local laws.

I certify that all import of soils from off-Site, including source approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.

I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology and soil screening methodology defined in the Remedial Action Work Plan.

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law.

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

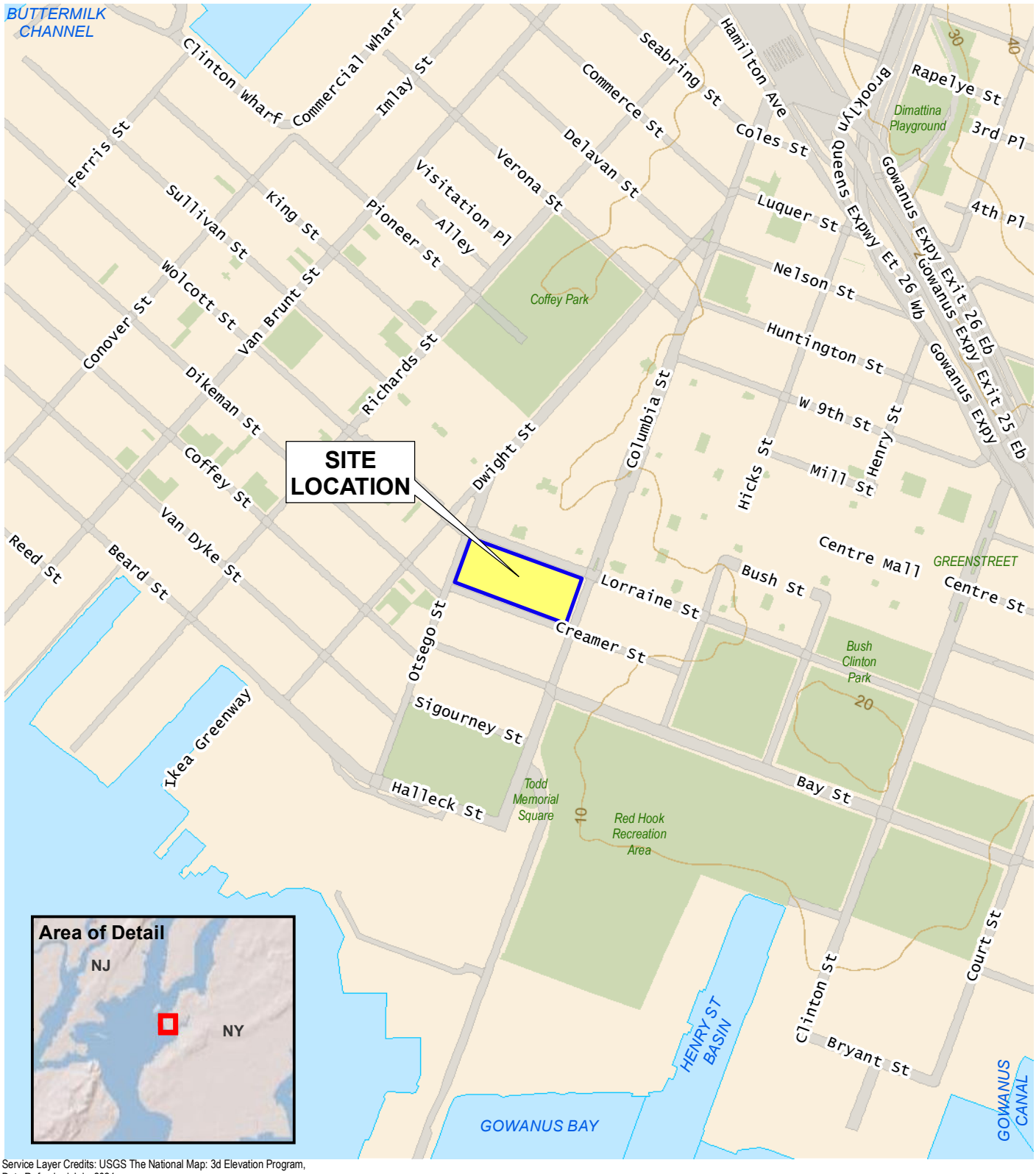
14.0 SCHEDULE

The estimated schedule prepared for the project is provided in Table X below. The actual schedule may vary depending on factors such as, contractor availability, Site constraints, complexity of data collected, and access coordination. The NYSDEC project manager will be notified of significant changes to the schedule.

Table X
Proposed Project Schedule

Activity	Time to Complete
Prepare and submit draft Remedial Action Work Plan (RAWP)	June 2023
Initiate 45-day Public Comment Period (Environmental News Bulletin, Newspaper)	June 2023
45-day Public Comment Period Ends	July 2023
Receive comments on Draft RAWP	August 2023
Submit Final RAWP to NYSDEC	August 2023
NYSDEC Approved RAWP and Issues Decision Document (DD)	September 2023
Issue Remedial/Construction Notice Fact Sheet	September 2023
Submit ISS Treatability Study Work Plan	September 2023
ISS Treatability Study Work Plan Approved by NYSDEC	October 2023
ISS Treatability Study Field Work Completed	November 2023
ISS Treatability Study Report Submitted to NYSDEC for Review	December 2023
Building Demolition and Begin Redevelopment (Construction) with Implementation of RAWP	January 2024
Approval of the ISS Treatability Study Report by NYSDEC	January 2024
Initiate Remedial Activities in Accordance with the RAWP	January 2024
Submittal of Environmental Easement Package	May 2025
Draft Site Management Plan (SMP) Submitted to NYSDEC	July 2025
Draft Final Engineering Report (FER) and Fact Sheet	September 2025
NYSDEC and NYSDOH Approval of SMP	November 2025
Approval of FER and Issue Certificate of Completion (COC)	December 2025

FIGURES



Service Layer Credits: USGS The National Map: 3d Elevation Program, Data Refreshed July, 2021

0 600 1,200

SCALE IN FEET

AKRF

440 Park Avenue South, New York, NY 10016

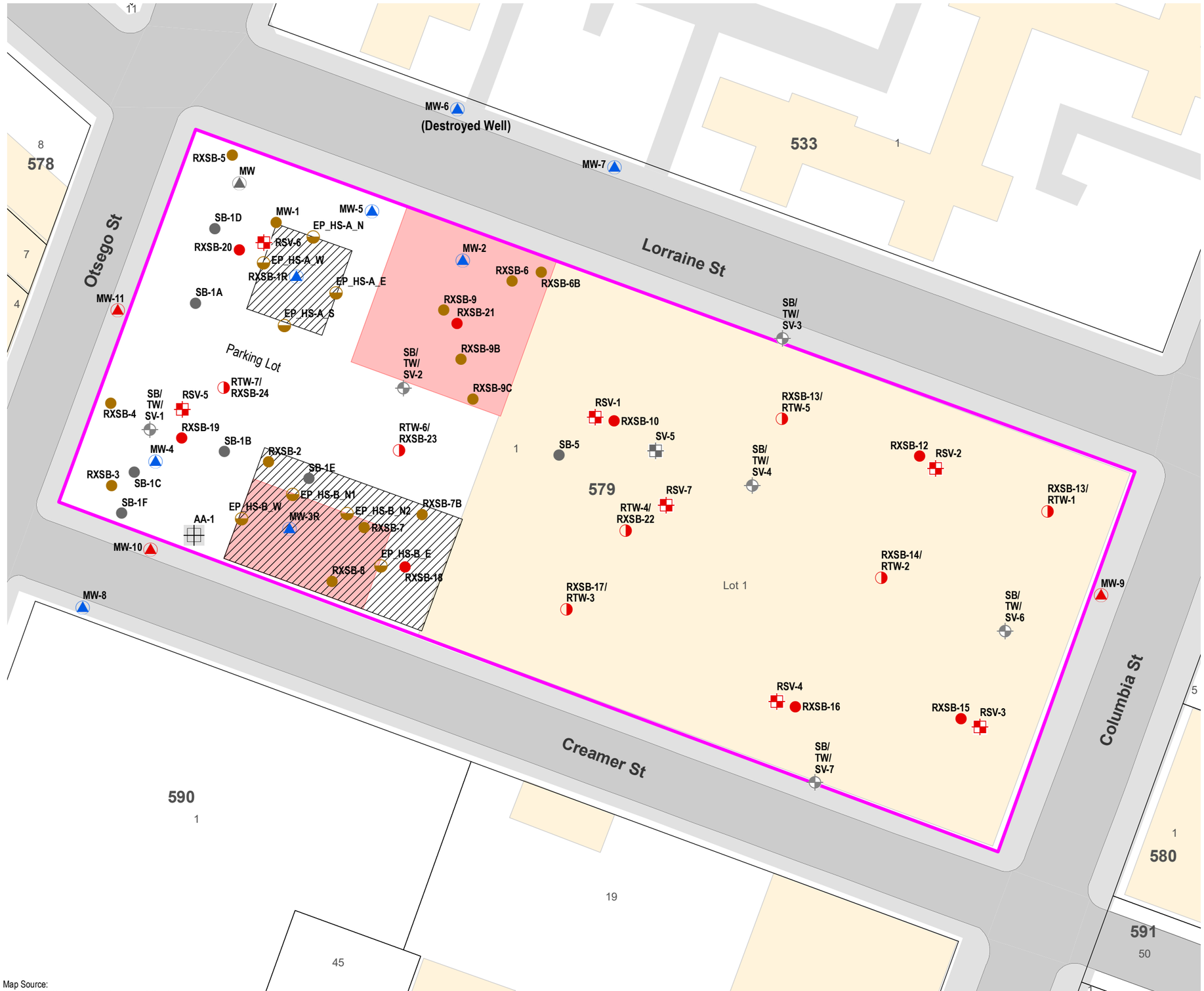
37 Otsego Street
Brooklyn, New York

BCP SITE LOCATION

DATE
5/18/2023

PROJECT NO.
230011

FIGURE
1



LEGEND

- BCP PROJECT SITE BOUNDARY
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 579 — BLOCK NUMBER
- EXISTING BUILDING
- HOT SPOT REGENOX INJECTION TREATMENT AREA (ROUX, 2017)
- HOT SPOT EXCAVATION AREA (ROUX, 2017)
- MONITORING WELL (AKRF)
- SOIL BORING (AKRF)
- SOIL BORING/TEMPORARY WELL/SOIL VAPOR POINT (AKRF)
- AMBIENT AIR (AKRF)
- SOIL VAPOR POINT (AKRF)
- MONITORING WELL (ROUX)
- SOIL BORING (ROUX)
- ENDPOINT SAMPLE (ROUX)
- SOIL BORING (ROUX)
- SOIL BORING/TEMPORARY WELL (ROUX)
- MONITORING WELL (ROUX)
- SOIL VAPOR POINT (ROUX)

0 25 50 100

SCALE IN FEET

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF
440 Park Avenue South, New York, NY 10016

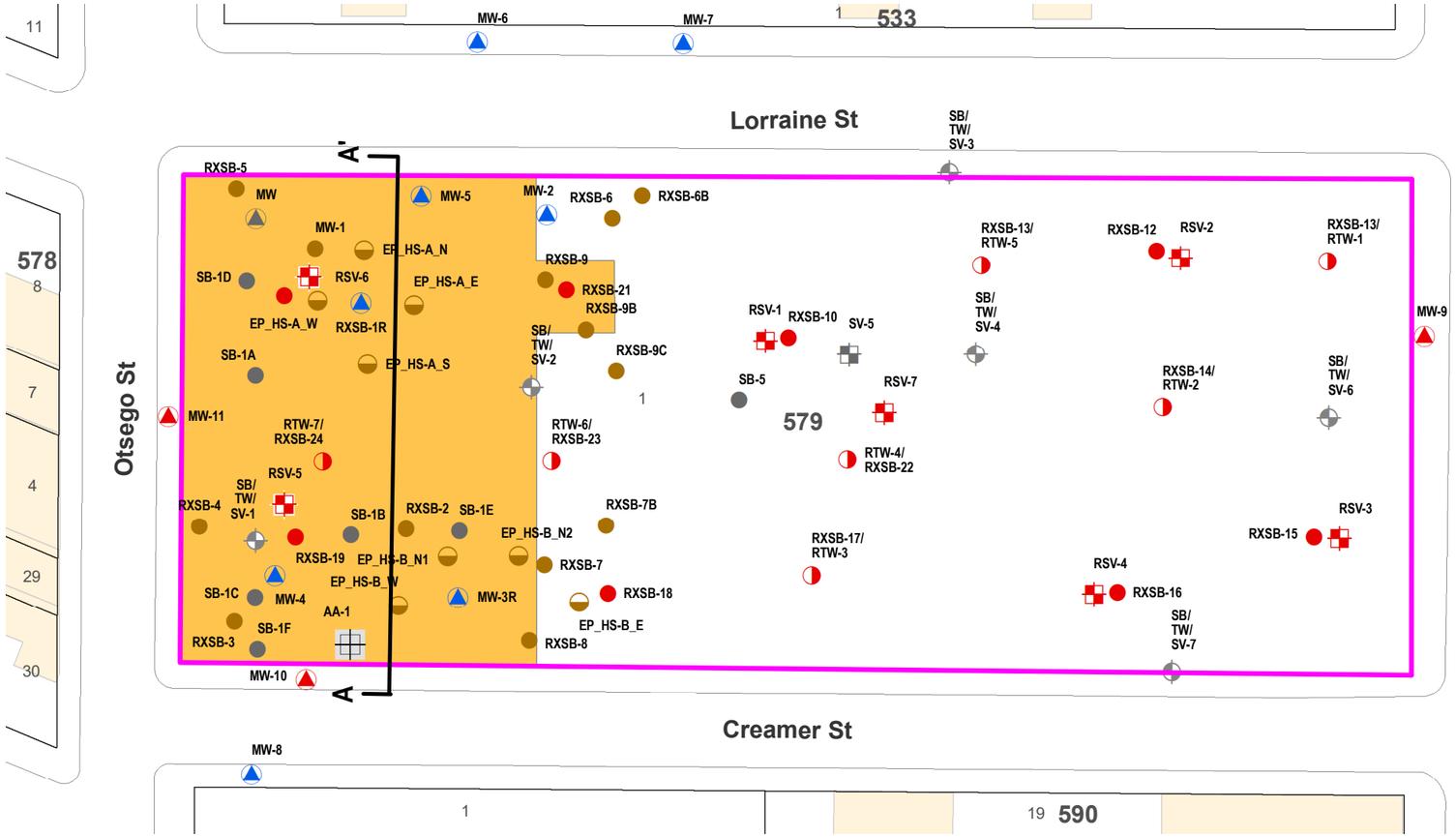
37 Otsego Street
Brooklyn, New York

SITE PLAN AND SAMPLING LOCATIONS

DATE
5/30/2023

PROJECT NO.
230011

FIGURE
2

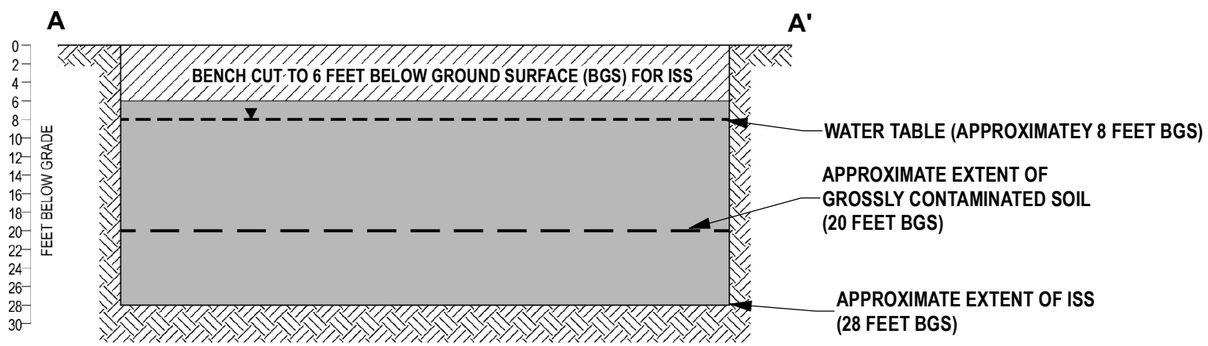


LEGEND

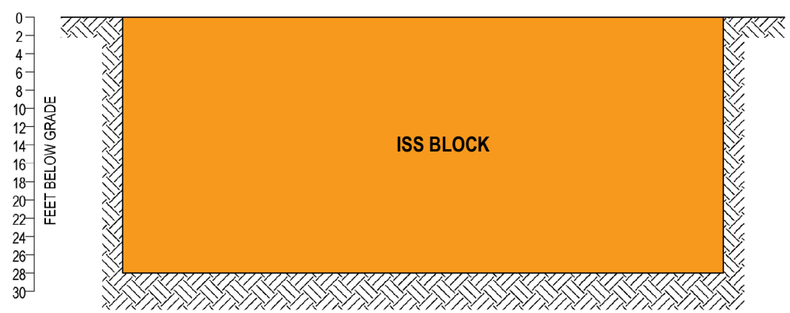
- BCP PROJECT SITE BOUNDARY
- 579 BLOCK NUMBER
- 1 LOT BOUNDARY AND TAX LOT NUMBER
- MONITORING WELL (AKRF)
- SOIL BORING (AKRF)
- SOIL BORING/TEMPORARY WELL/SOIL VAPOR POINT (AKRF)
- AMBIENT AIR (AKRF)
- SOIL VAPOR POINT (AKRF)
- MONITORING WELL (ROUX)
- SOIL BORING (ROUX)
- ENDPOINT SAMPLE (ROUX)
- SOIL BORING (ROUX)
- SOIL BORING/TEMPORARY WELL (ROUX)
- MONITORING WELL (ROUX)
- SOIL VAPOR POINT (ROUX)
- APPROXIMATE EXTENT OF IN-SITU SOLIDIFICATION (ISS) AREA

0 30 60 120

SCALE IN FEET



Cross Section Detail prior to ISS A-A'
not to scale



Cross Section Detail After ISS A-A'
not to scale

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF
440 Park Avenue South, New York, NY 10016

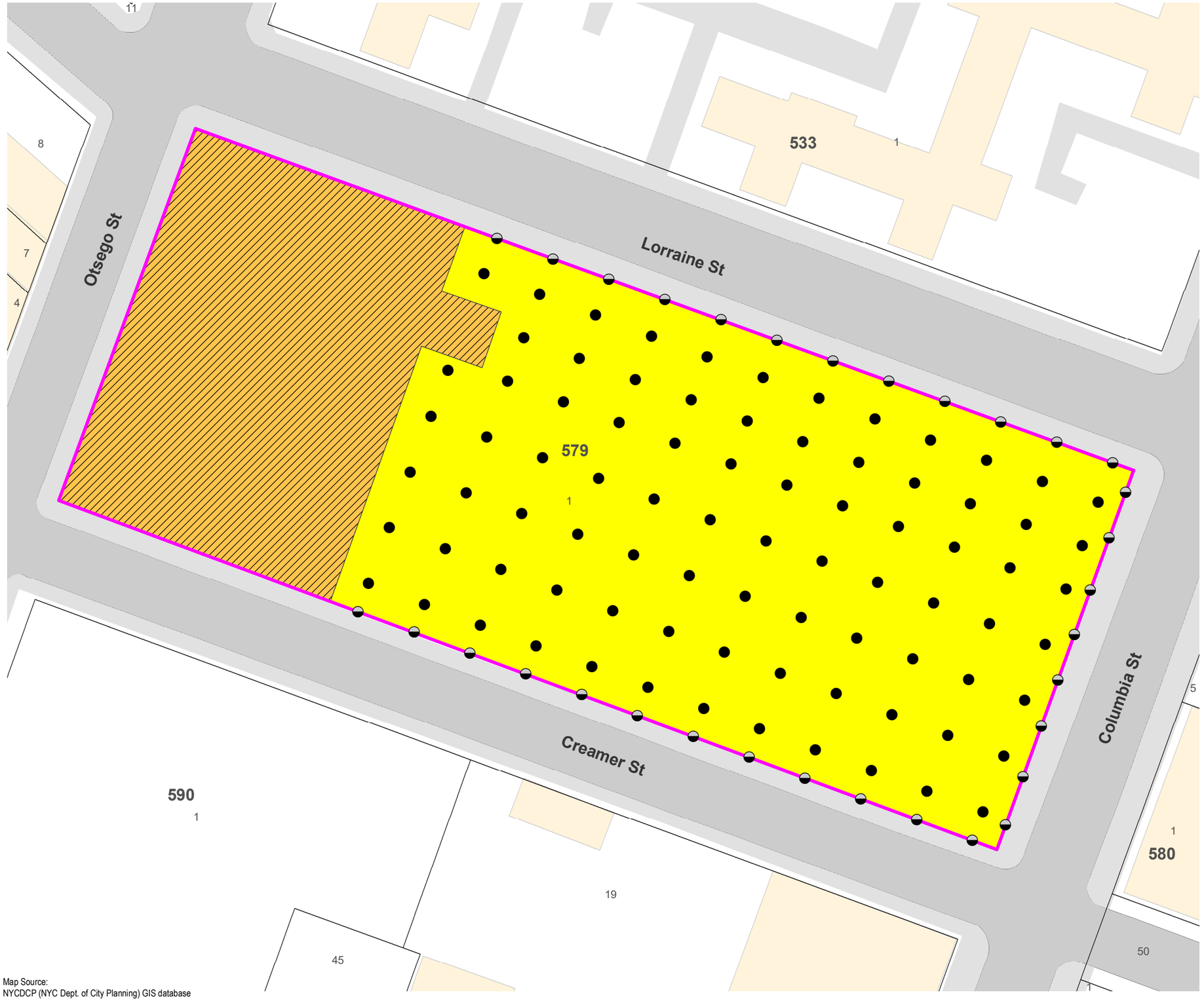
37 Otsego Street
Brooklyn, New York

PROPOSED IN-SITU SOLIDIFICATION PLAN

DATE
5/30/2023

PROJECT NO.
230011

FIGURE
3



LEGEND

- BCP PROJECT SITE BOUNDARY
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 579 — BLOCK NUMBER
- APPROXIMATE EXTENT OF IN-SITU SOLIDIFICATION (ISS) AREA
- REMEDIAL EXCAVATION TO APPROXIMATELY 2 FEET BELOW GRADE TO ACHIEVE A TRACK 4 CLEANUP
- REMEDIAL EXCAVATION TO 6 FEET BELOW GRADE FOR THE BENCH CUT REQUIRED AS PART OF THE IN-SITU SOLIDIFICATION (ISS) TREATMENT
- PROPOSED BOTTOM ENDPOINT SAMPLE LOCATION
- PROPOSED SIDEWALL ENDPOINT SAMPLE LOCATION

Note:
No excavation bottom or sidewall samples will be required in the ISS Treatment Area.

0 25 50 100
SCALE IN FEET

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF
440 Park Avenue South, New York, NY 10016

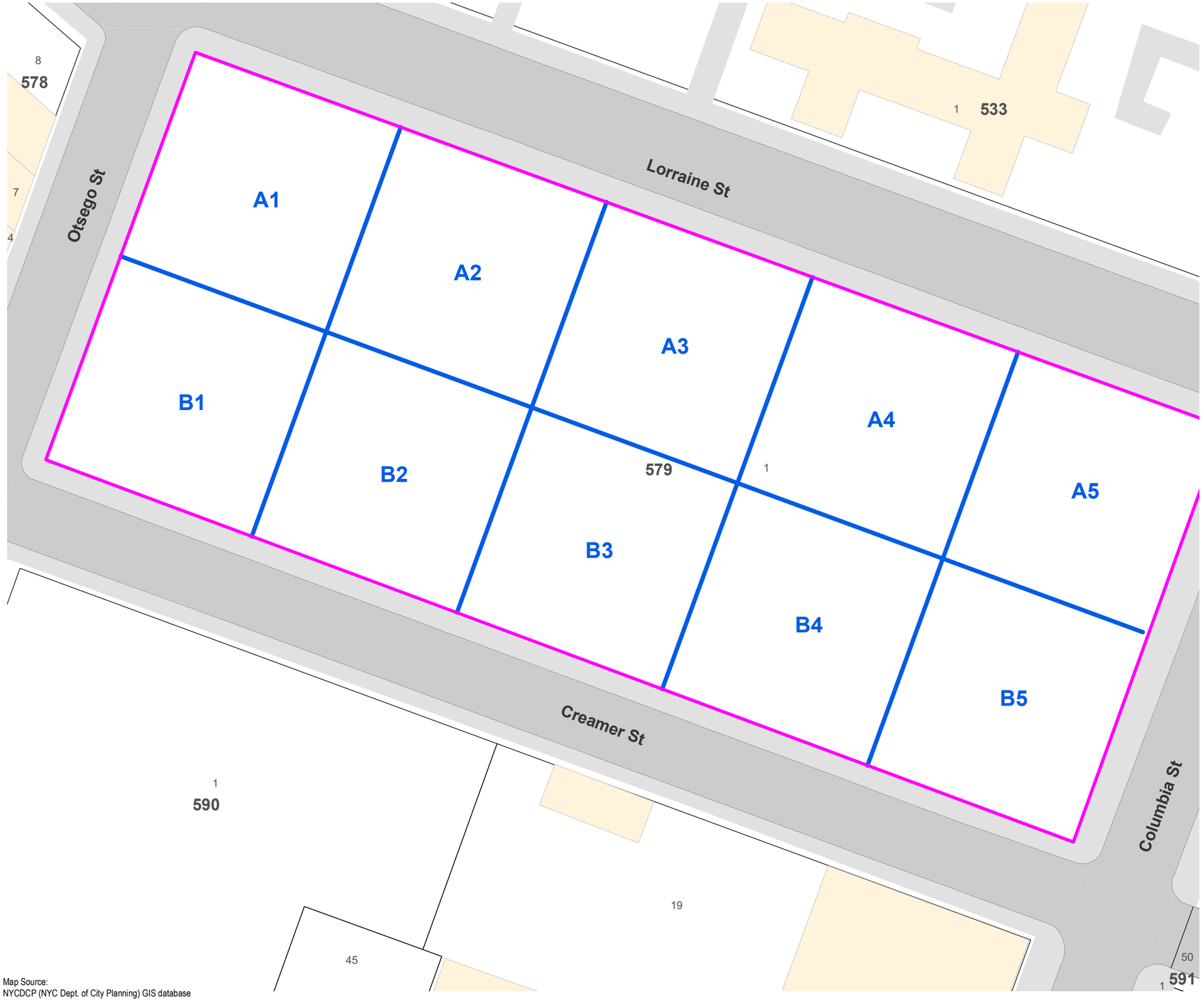
37 Otsego Street
Brooklyn, New York

REMEDIAL EXCAVATION EXTENT AND ENDPOINT SAMPLING PLAN

DATE
5/30/2023

PROJECT NO.
230011

FIGURE
4



LEGEND

- BCP PROJECT SITE BOUNDARY
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 579 — BLOCK NUMBER
- ALPHANUMERIC GRID

0 25 50 100

SCALE IN FEET

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF
440 Park Avenue South, New York, NY 10016

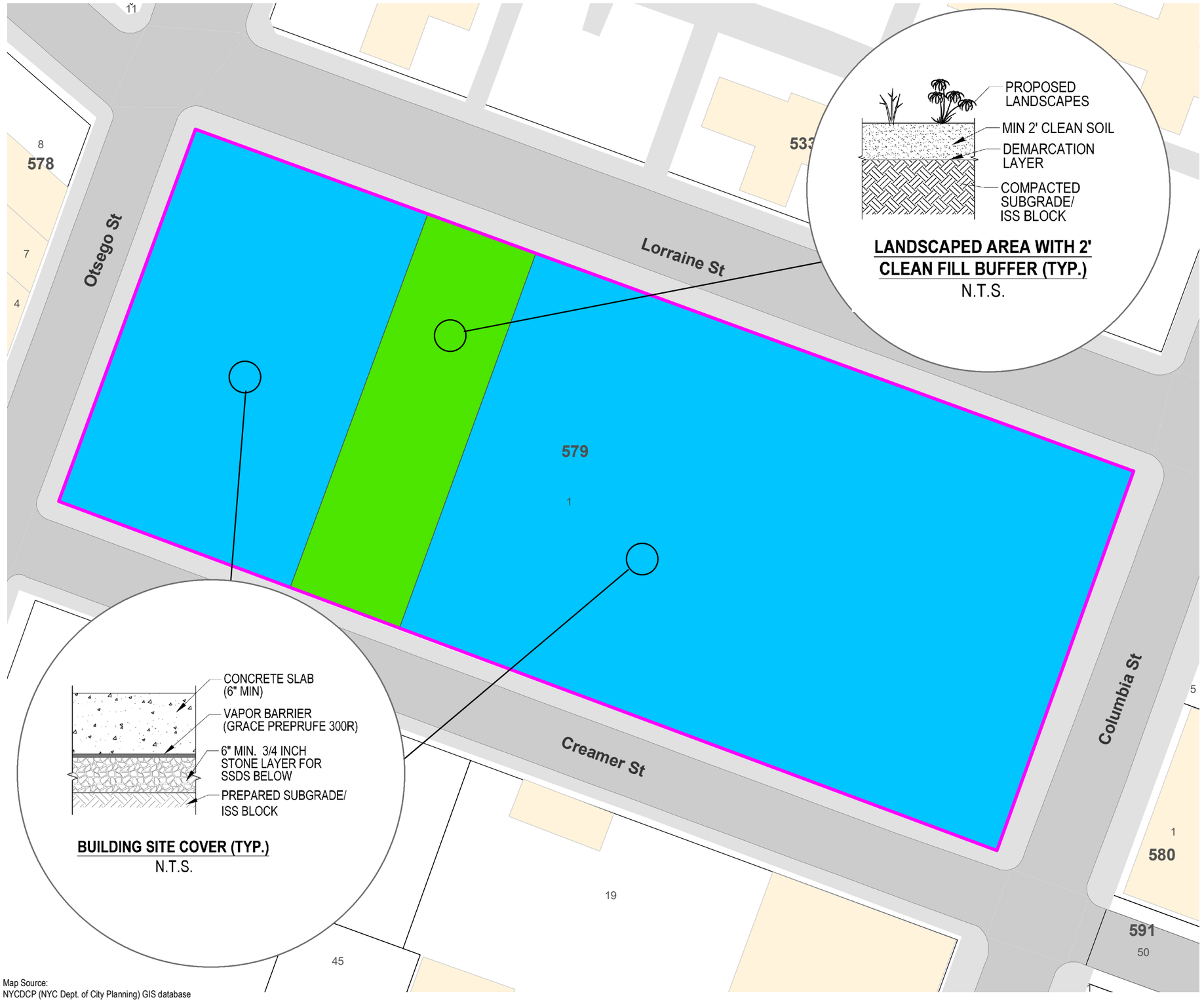
37 Otsego Street
Brooklyn, New York

ALPHANUMERIC GRID

DATE
5/30/2023

PROJECT NO.
230011

FIGURE
5



Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

LEGEND

- BCP PROJECT SITE BOUNDARY
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 579 — BLOCK NUMBER
- MINIMUM 6-INCH THICK CONCRETE SLAB WITH VAPOR BARRIER AND 6-INCH GRAVEL LAYER FOR SSDS BELOW
- PERMEABLE PAVERS/LANDSCAPED AREA WITH MINIMUM 2-FOOT CLEAN SOIL

0 25 50 100
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

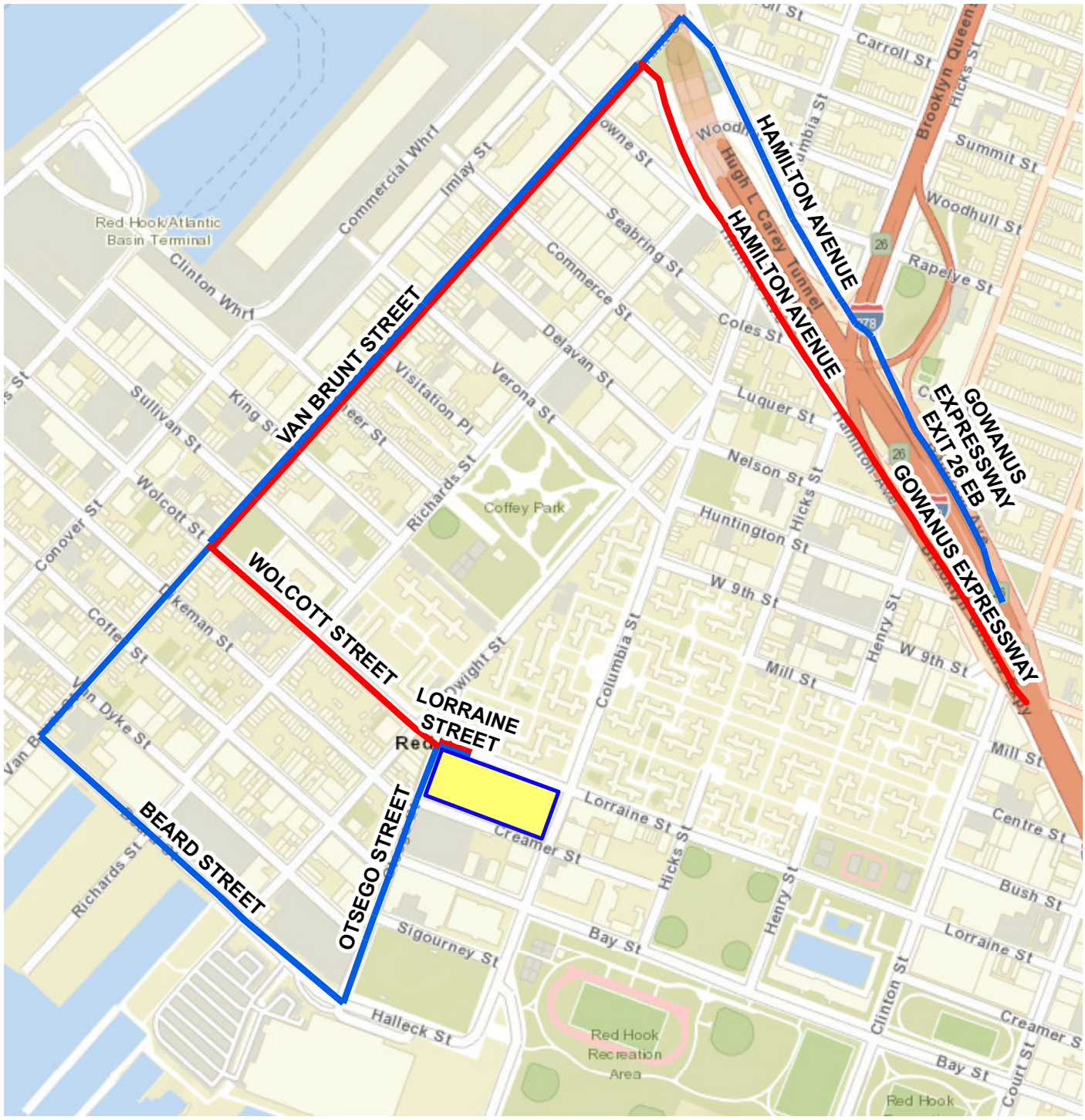
37 Otsego Street
Brooklyn, New York

PROPOSED SITE COVER SYSTEM

DATE
6/1/2023

PROJECT NO.
230011

FIGURE
6



LEGEND

- BCP PROJECT SITE BOUNDARY
- ENTER TRUCK ROUTE FROM I-278 BQE
- EXIT TRUCK ROUTE TO I-278 BQE
- BOTH ENTER AND EXIT ON SAME ROAD

Service Layer Credits:
ESRI World Street Map 2023
City of New York Department of Transportation, April, 2019, New York City Truck Routes: New York City

0 1,000 2,000

SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

37 Otsego Street
Brooklyn, New York

TRUCK ROUTE MAP

DATE
5/22/2023

PROJECT NO.
230011

FIGURE
7

LEGEND

- BCP PROJECT SITE BOUNDARY
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 579 — BLOCK NUMBER
- EXTERIOR LANDSCAPED AREA
- EXTENT OF SSDS AND VAPOR BARRIER MEMBRANE WITH GAS PERMEABLE AGGREGATE (GPA) BELOW

0 25 50 100

SCALE IN FEET

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF
440 Park Avenue South, New York, NY 10016

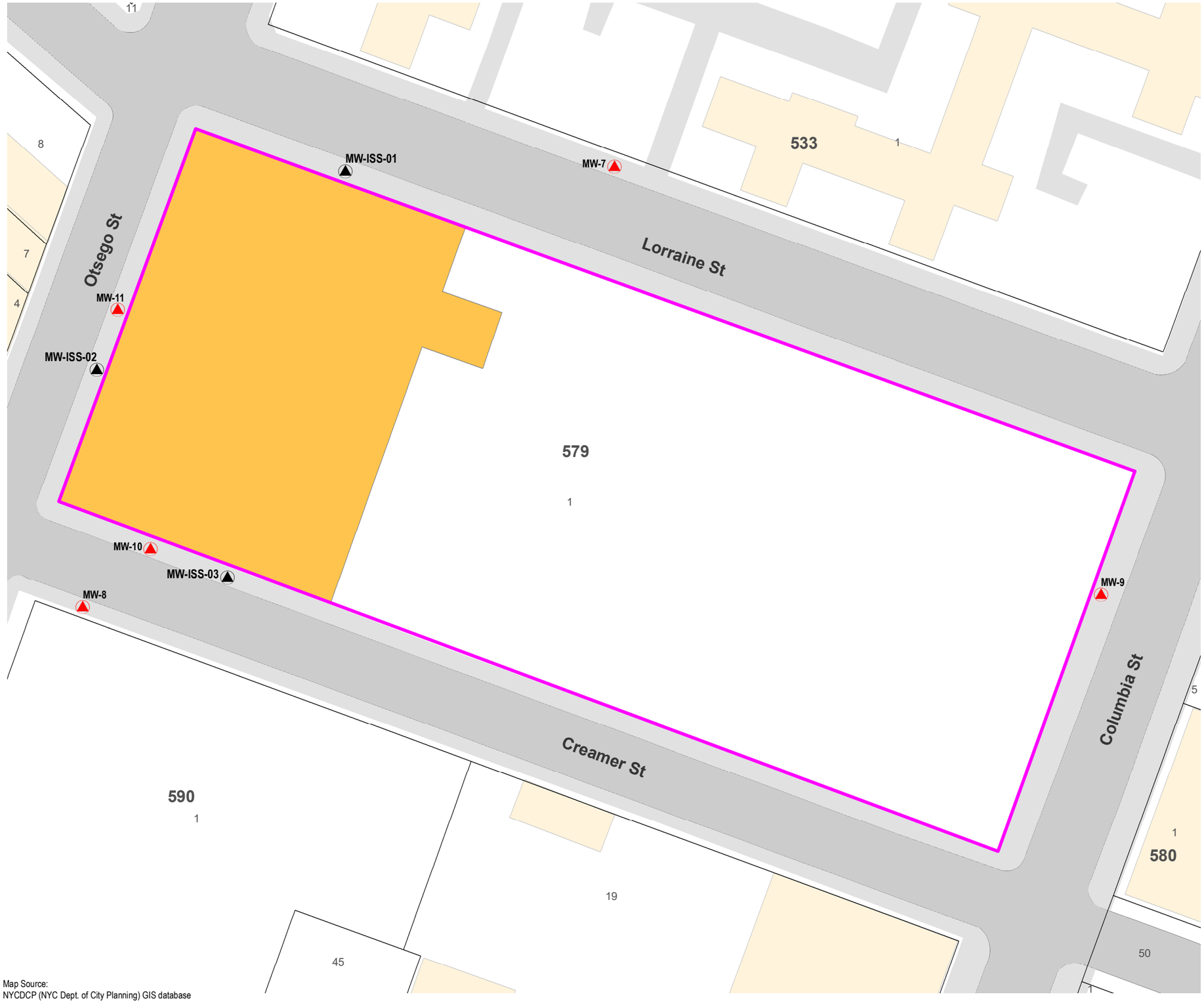
37 Otsego Street
Brooklyn, New York

EXTENT OF SUB-SLAB DEPRESSURIZATION SYSTEM (SSDS)

DATE
5/30/2023

PROJECT NO.
230011

FIGURE
8



LEGEND

- BCP PROJECT SITE BOUNDARY
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 579 — BLOCK NUMBER
- BUILDING
- APPROXIMATE EXTENT OF IN-SITU SOLIDIFICATION (ISS) AREA
- EXISTING OFF-SITE MONITORING WELL (ROUX)
- PROPOSED OFF-SITE MONITORING WELL

0 25 50 100

SCALE IN FEET

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF
440 Park Avenue South, New York, NY 10016

37 Otsego Street
Brooklyn, New York

PROPOSED OFF-SITE MONITORING WELL LOCATIONS

DATE
6/1/2023

PROJECT NO.
230011

FIGURE
9

APPENDIX A

METES AND BOUNDS

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

This page is part of the instrument. The City Register will rely on the information provided by you on this page for purposes of indexing this instrument.The information on this page will control for indexing purposes in the event of any conflict with the rest of the document.

2022020100778001001E3750

RECORDING AND ENDORSEMENT COVER PAGE **PAGE 1 OF 5**

Document ID: 2022020100778001 Document Date: 01-21-2022 Preparation Date: 02-01-2022
Document Type: ASSIGNMENT OF LEASE
Document Page Count: 4

PRESENTER:
INFINITY LAND SERVICES LLC **IL11573**
AS AGENT FOR FIDELITY NATIONAL TITLE
INSURANCE CO
2361 NOSTRAND AVENUE, SUITE 802
BROOKLYN, NY 11210
718-338-4200

RETURN TO:
COLUMBIA SF LLC
670 MYRTLE AVENUE
SUITE 438
BROOKLYN, NY 11205

PROPERTY DATA

Borough	Block	Lot	Unit	Address
BROOKLYN	579	1	Entire Lot	498-516 COLUMBIA STREET

Property Type: COMMERCIAL REAL ESTATE

CROSS REFERENCE DATA

CRFN_____ *or* DocumentID_____ *or* _____ Year_____ Reel____ Page_____ *or* File Number_____

PARTIES

PARTY 1:
BH RUTH RED HOOK LLC
498-516 COLUMBIA STREET
BROOKLYN, NY 11231

PARTY 2:
COLUMBIA SF LLC
498-516 COLUMBIA STREET
BROOKLYN, NY 11231

FEES AND TAXES

Mortgage :

Mortgage Amount:	$	0.00
Taxable Mortgage Amount:	$	0.00
Exemption:		
TAXES: County (Basic):	$	0.00
City (Additional):	$	0.00
Spec (Additional):	$	0.00
TASF:	$	0.00
MTA:	$	0.00
NYCTA:	$	0.00
Additional MRT:	$	0.00
TOTAL:	$	0.00
Recording Fee:	$	57.00
Affidavit Fee:	$	0.00

Filing Fee: $ 100.00
NYC Real Property Transfer Tax: $ 189,767.81
NYS Real Estate Transfer Tax: $ 46,991.75

RECORDED OR FILED IN THE OFFICE OF THE CITY REGISTER OF THE CITY OF NEW YORK
Recorded/Filed 02-04-2022 16:31
City Register File No.(CRFN): **2022000055468**

City Register Official Signature

ASSIGNMENT AND ASSUMPTION OF LEASE

THIS ASSIGNMENT AND ASSUMPTION OF LEASE is made and entered into as of the 31st day of January, 2022 by BH RUTH RED HOOK LLC, a New York limited liability company ("Grantor"), whose address is 55 Inip Drive, Suite 102, Inwood, New York to COLUMBIA SF LLC, a New York limited liability company, ("Grantee"), whose taxpayer identification number is [redacted] and whose address is at 670 Myrtle Avenue, Suite 438, Brooklyn, New York 11205. Wherever used herein, the terms "Grantor" and "Grantee" shall include all of the parties to this instrument and their successors and assigns.

W I T N E S S E T H:

GRANTOR, for and in consideration of Ten and No/100 Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, has assigned, granted, bargained and sold, and by these presents does hereby assign, grant, bargain and sell to Grantee and Grantee's heirs, successors and assigns forever, that certain lease more particularly described on Exhibit "A" attached hereto and made a part hereof (the "Lease") and Subleases more particularly described on Exhibit "B" attached hereto and made a part hereof (the "Subleases").

SUBJECT TO those matters set forth in Exhibit "C" hereto.

TOGETHER WITH all the tenements, hereditaments and appurtenances thereunto belonging or in anywise appertaining.

TO HAVE and to hold the Lease and pursuant to its terms.

GRANTEE hereby assumes all obligations of Grantor under the Lease and the Subleases and under the Brownfield Cleanup Agreement (BCA) Index No. C224300-02-20 executed with the New York State Department of Environmental Conservation (NYSDEC) on March 2, 2020 for the 37 Otsego Site BCP Site No. C224300. Grantee hereby indemnifies and agrees to defend and hold harmless Grantor from and against any and all liabilities, obligations, claims, costs and expenses whatsoever which Grantor may incur or suffer arising under, or accruing or on account of the Lease or Subleases or the BCA on and after the date hereof. Grantor shall indemnify and hold harmless Grantee from and against any and all liabilities, obligations, claims, costs and expenses whatsoever which Grantee may incur or suffer arising under, or accruing or on account of the Lease or the Subleases prior to the date hereof, including but not limited to any environmental liability for failure to perform the remaining work required pursuant to the BCA to finalize the environmental investigation and perform the remediation required by the NYSDEC pursuant to the BCA in order to achieve a Certificate of Completion ("COC") and maintain the COC.

[Signature page follows]

IN WITNESS WHEREOF, Grantor and Grantee have hereunto set their hands and seals as of the day and year first above written.

GRANTOR:

BH RUTH-RED-HOOK LLC

By: _____
Name: Dov Tratner
Title: Authorized Signatory

GRANTEE:

COLUMBIA SF LLC

By: _____
Name:
Title:

STATE OF NEW YORK :
: ss.:
COUNTY OF Queens:

On the 24 day of January, 2022 before me, the undersigned, personally appeared Dov Tratner, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name(s) is(are) subscribed to within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted executed the instrument.

_____
Notary Public

* EPHRAIM D. BERGER
Notary Public, State of New York
No. 02BE4822768
Qualified in Queens County
Commission Expires June 30, 2022

STATE OF NEW YORK :
: ss.:
COUNTY OF _____ :

* Ephraim D. Berger
Notary Public State of New York
No. 02BE4822768
Qualified in Queens County
Commission Expires June 30, 2022.

On the ____ day of _____, 20__ before me, the undersigned, personally appeared _____, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name(s) is(are) subscribed to within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted executed the instrument.

_____
Notary Public

IN WITNESS WHEREOF, Grantor and Grantee have hereunto set their hands and seals as of the day and year first above written.

GRANTOR:

BH RUTH RED HOOK LLC

By: _____
Name:
Title:

GRANTEE:

COLUMBIA SF LLC

By: _____
Name: Solomon Feder
Title: Member

STATE OF NEW YORK :
: ss.:
COUNTY OF _____ :

On the ____ day of _____, 20__ before me, the undersigned, personally appeared _____, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name(s) is(are) subscribed to within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted executed the instrument.

_____
Notary Public

STATE OF NEW YORK :
: ss.:
COUNTY OF Kings :

On the 18th day of January, 2022 before me, the undersigned, personally appeared Solomon Feder, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name(s) is(are) subscribed to within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted executed the instrument.

_____
Notary Public

ISAAC HIRSCH
NOTARY PUBLIC, STATE OF NEW YORK
Registration No. 01HI6264479
Qualified in Kings County
Commission Expires July 02, 2024

INFINITY
LAND SERVICES

as agent for Fidelity National Title Insurance Company

Title No: IL11573

Schedule A (Legal Description)

ALL that certain plot, piece or parcel of land, situate, lying and being in the Borough of Brooklyn, County of Kings, City and State of New York, bounded and described as follows:

BEGINNING at the corner formed by the intersection of the southerly side of Lorraine Street with the westerly side of Columbia Street;

RUNNING THENCE southerly along Columbia Street, 200 feet to Creamer Street;

THENCE westerly along Creamer Street, 500 feet to Otsego Street;

THENCE northerly along Otsego Street, 200 feet to Lorraine Street;

THENCE easterly along Lorraine Street, 500 feet to the point or place of **BEGINNING**

FOR INFORMATIONAL PURPOSES ONLY: 498-516 Columbia Street, Brooklyn, NY 11231;
21-39 Otsego Street, Brooklyn, NY 11231 a/k/a Block 579 Lot 1 on the KINGS County Tax Map.

For conveyancing only:
TOGETHER with all the right, title and interest of the party of the first part, of, in and to the land lying in the street in front of and adjoining said premises.

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

2022020100778001001SF9D1

SUPPORTING DOCUMENT COVER PAGE **PAGE 1 OF 1**

Document ID: 2022020100778001 Document Date: 01-21-2022 Preparation Date: 02-01-2022
Document Type: ASSIGNMENT OF LEASE

SUPPORTING DOCUMENTS SUBMITTED:

	Page Count
DEP CUSTOMER REGISTRATION FORM FOR WATER AND SEWER BILLING	1
SMOKE DETECTOR AFFIDAVIT	2

The City of New York
Department of Environmental Protection
Bureau of Customer Services
59-17 Junction Boulevard
Flushing, NY 11373-5108

Customer Registration Form for Water and Sewer Billing

Property and Owner Information:

(1) **Property receiving service: BOROUGH: BROOKLYN** **BLOCK: 579** **LOT: 1**

(2) **Property Address: 498-516 COLUMBIA STREET, BROOKLYN, NY 11231**

(3) **Owner's Name:** **COLUMBIA SF LLC**

Additional Name:

Affirmation:

☑ Your water & sewer bills will be sent to the property address shown above.

Customer Billing Information:

Please Note:

A. Water and sewer charges are the legal responsibility of the owner of a property receiving water and/or sewer service. The owner's responsibility to pay such charges is not affected by any lease, license or other arrangement, or any assignment of responsibility for payment of such charges. Water and sewer charges constitute a lien on the property until paid. In addition to legal action against the owner, a failure to pay such charges when due may result in foreclosure of the lien by the City of New York, the property being placed in a lien sale by the City or Service Termination.

B. Original bills for water and/or sewer service will be mailed to the owner, **at the property address or to an alternate mailing address.** DEP will provide a duplicate copy of bills to one other party (such as a managing agent), however, any failure or delay by DEP in providing duplicate copies of bills shall in no way relieve the owner from his/her liability to pay all outstanding water and sewer charges. Contact DEP at (718) 595-7000 during business hours or visit www.nyc.gov/dep to provide us with the other party's information.

Owner's Approval:

The undersigned certifies that he/she/it is the owner of the property receiving service referenced above; that he/she/it has read and understands Paragraphs A & B under the section captioned "Customer Billing Information"; and that the information supplied by the undersigned on this form is true and complete to the best of his/her/its knowledge.

Print Name of Owner: COLUMBIA SF LLC By: Solomon Feder

Signature: _____ Member Date (mm/dd/yyyy) 01/18/2022

Name and Title of Person Signing for Owner, if applicable:

2022011700060101

AFFIDAVIT OF COMPLIANCE
WITH SMOKE DETECTOR REQUIREMENT FOR ONE- AND TWO-FAMILY DWELLINGS

State of New York }
County of } **SS.:**

The undersigned, being duly sworn, depose and say under penalty of perjury that they are the grantor and grantee of the real property or of the cooperative shares in a cooperative corporation owning real property located at

498-516 COLUMBIA STREET , ,
Street Address Unit/Apt.

BROOKLYN New York, 579 1 (the "Premises");
Borough Block Lot

That the Premises is a one or two family dwelling, or a cooperative apartment or condominium unit in a one- or two-family dwelling, and that installed in the Premises is an approved and operational smoke detecting device in compliance with the provisions of Article 6 of Subchapter 17 of Chapter 1 of Title 27 of the Administrative Code of the City of New York concerning smoke detecting devices;

That they make affidavit in compliance with New York City Administrative Code Section 11-2105 (g). (The signatures of at least one grantor and one grantee are required, and must be notarized).

BH RUTH RES HOOK LLC
Name of Grantor (Type or Print)

By: Dov Tratner Member
Signature of Grantor

Sworn to before me
this 24th day of January 2022

EPHRAIM D. BERGER
Notary Public, State of New York
No. 02BL4622768
Qualified in Queens County
Commission Expires June 30, 20 22

Name of Grantee (Type or Print)

Signature of Grantee

Sworn to before me
this _____ day of _____ 20 ____

These statements are made with the knowledge that a willfully false representation is unlawful and is punishable as a crime of perjury under Article 210 of the Penal Law.

NEW YORK CITY REAL PROPERTY TRANSFER TAX RETURNS FILED ON OR AFTER FEBRUARY 6th, 1990, WITH RESPECT TO THE CONVEYANCE OF A ONE- OR TWO-FAMILY DWELLING, OR A COOPERATIVE APARTMENT OR A CONDOMINIUM UNIT IN A ONE- OR TWO-FAMILY DWELLING, WILL NOT BE ACCEPTED FOR FILING UNLESS ACCOMPANIED BY THIS AFFIDAVIT.

2022011700060101

AFFIDAVIT OF COMPLIANCE
WITH SMOKE DETECTOR REQUIREMENT FOR ONE- AND TWO-FAMILY DWELLINGS

State of New York }
County of } SS.:

The undersigned, being duly sworn, depose and say under penalty of perjury that they are the grantor and grantee of the real property or of the cooperative shares in a cooperative corporation owning real property located at

498-516 COLUMBIA STREET , ,
Street Address Unit/Apt.

BROOKLYN New York, 579 1 (the "Premises");
Borough Block Lot

That the Premises is a one or two family dwelling, or a cooperative apartment or condominium unit in a one- or two-family dwelling, and that installed in the Premises is an approved and operational smoke detecting device in compliance with the provisions of Article 6 of Subchapter 17 of Chapter 1 of Title 27 of the Administrative Code of the City of New York concerning smoke detecting devices;

That they make affidavit in compliance with New York City Administrative Code Section 11-2105 (g). (The signatures of at least one grantor and one grantee are required, and must be notarized).

Name of Grantor (Type or Print)	COLUMBIA SF LLC * Name of Grantee (Type or Print)
Signature of Grantor	Signature of Grantee * By: Solomon Fealer, Member
Sworn to before me this ____ day of ____ 20__	Sworn to before me this 18th day of January 20 22

ISAAC HIRSCH
NOTARY PUBLIC, STATE OF NEW YORK
Registration No. 01HI6264479
Qualified in Kings County
Commission Expires July 09, 2024

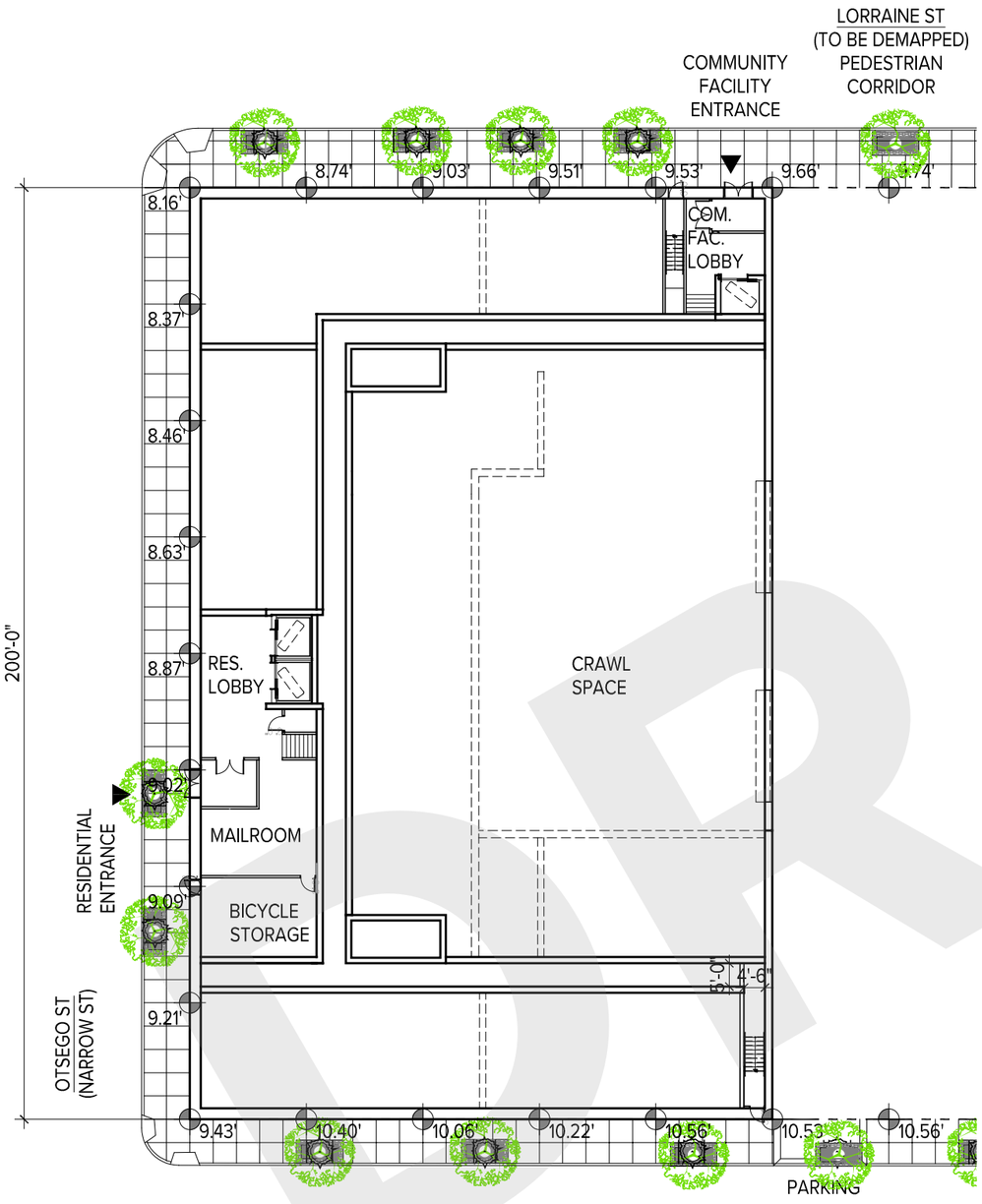
These statements are made with the knowledge that a willfully false representation is unlawful and is punishable as a crime of perjury under Article 210 of the Penal Law.

NEW YORK CITY REAL PROPERTY TRANSFER TAX RETURNS FILED ON OR AFTER FEBRUARY 6th, 1990, WITH RESPECT TO THE CONVEYANCE OF A ONE- OR TWO-FAMILY DWELLING, OR A COOPERATIVE APARTMENT OR A CONDOMINIUM UNIT IN A ONE- OR TWO-FAMILY DWELLING, WILL NOT BE ACCEPTED FOR FILING UNLESS ACCOMPANIED BY THIS AFFIDAVIT.

2022011700060101

APPENDIX B

PROPOSED REDEVELOPMENT PLANS



SCHEMATIC GROUND FLOOR PLAN:
SCALE: 1/32" = 1'-0"

SCHEMATIC 1ST FLOOR PLAN:
SCALE: 1/32" = 1'-0"

LEGEND

- 0 BR APARTMENTS
- 1 BR APARTMENTS

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:
Address Line 1
Address Line 2
New York, NY 10018 Phone

DATE	SUBMISSIONS / REVISIONS

SHEET TITLE: SCHEMATIC GROUND 7 1ST FLOOR PLANS

SHEET NUMBER: A-100.00

MAP

A-100.00

PROJ. # P-22110

APARTMENT DISTRIBUTION			
	0 BR.	1 BR.	TOTAL
1ST FLOOR	7	7	14
2ND FLOOR	17	11	28
3RD FLOOR	20	11	31
4TH FLOOR	20	11	31
5TH FLOOR	20	11	31
6TH FLOOR	20	11	31
7TH FLOOR	19	3	22
8TH FLOOR	19	3	22
TOTAL	142	68	210
PERCENTAGE	68%	32%	100%

LEGEND

0 BR APARTMENTS

1 BR APARTMENTS

SCHEMATIC 2ND FLOOR PLAN:
SCALE: 1/32" = 1'-0"

N

LEGEND

0 BR APARTMENTS

1 BR APARTMENTS

SCHEMATIC 3RD THRU 6TH FLOOR PLAN:
SCALE: 1/32" = 1'-0"

N

PROPOSED NEW / MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:
Address Line 1
Address Line 2
New York, NY 10018 Phone

DATE	SUBMISSIONS / REVISIONS

SHEET TITLE: SCHEMATIC 2ND & 3RD-6TH FLOOR PLANS

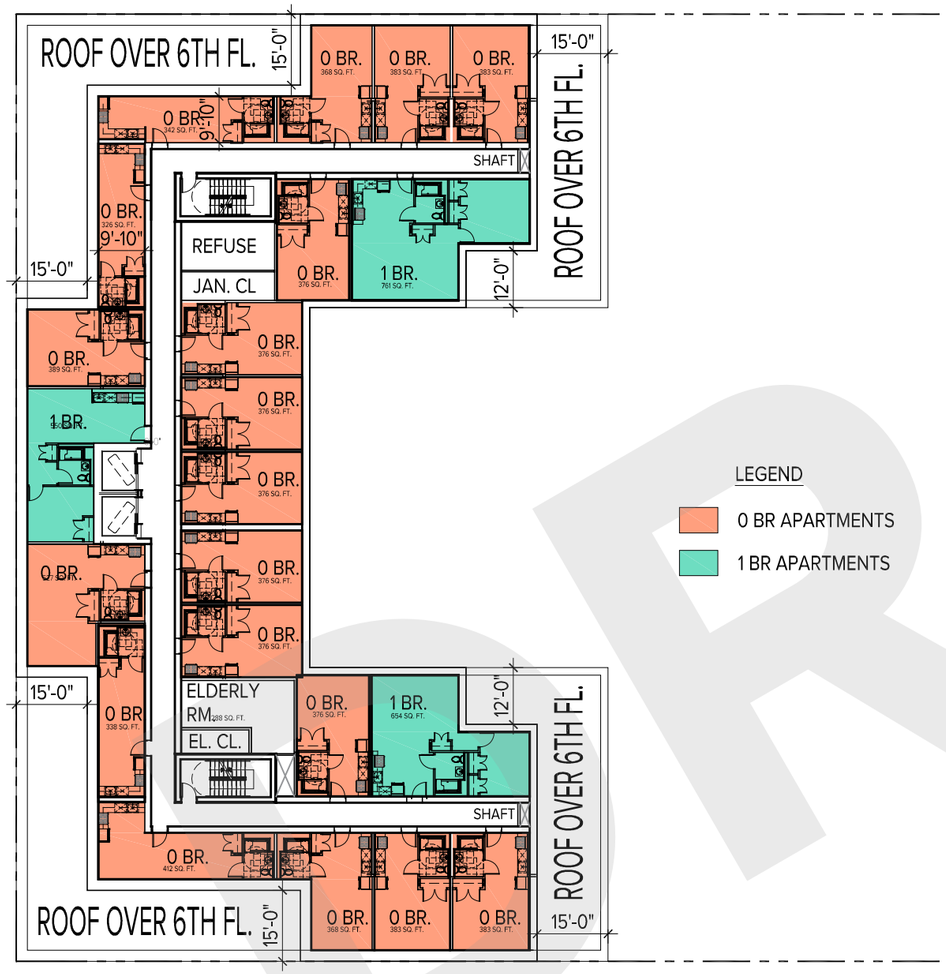
SHEET NUMBER: A-102.00

MAP

02

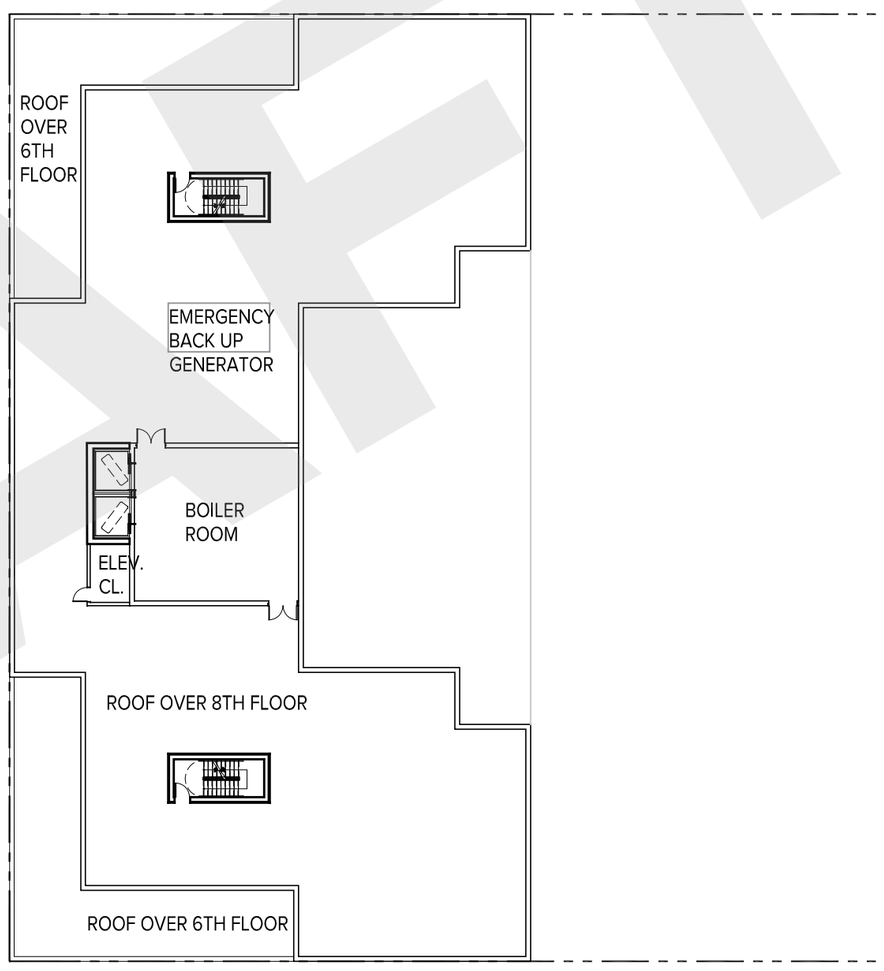
A-102.00

PROJ. # P-22110



SCHEMATIC 7TH & 8TH FLOOR PLAN:
SCALE: 1/32" = 1'-0"

N



SCHEMATIC ROOF FLOOR PLAN:
SCALE: 1/32" = 1'-0"

N

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:

Address Line 1
Address Line 2
New York, NY 10018 Phone

DATE	SUBMISSIONS / REVISIONS

SHEET TITLE: SCHEMATIC 7TH-8TH & ROOF FLOOR PLANS

SHEET NUMBER: A-104.00

MAP

03

A-104.00

PROJ. # P-22110

BUILDING A UNIT DISTRIBUTION				
	0 BR.	1 BR.	2 BR.	TOTAL
1ST FLOOR	7	7	0	14
2ND FLOOR	17	11	0	28
3RD FLOOR	20	11	0	31
4TH FLOOR	20	11	0	31
5TH FLOOR	20	11	0	31
6TH FLOOR	20	11	0	31
7TH FLOOR	19	3	0	22
8TH FLOOR	19	3	0	22
TOTAL	**142**	**68**	**0**	**210**
PERCENTAGE	68%	32%	0%	100%

BUILDING B UNIT DISTRIBUTION				
	0 BR.	1 BR.	2 BR.	TOTAL
1ST FLOOR	5	1	0	6
2ND FLOOR	4	4	1	9
3RD FLOOR	8	3	1	12
4TH FLOOR	8	3	1	12
5TH FLOOR	8	3	1	12
6TH FLOOR	8	3	1	12
7TH FLOOR	9	0	0	9
8TH FLOOR	9	0	0	9
TOTAL	**59**	**17**	**5**	**81**
PERCENTAGE	73%	21%	6%	100%

BUILDING C UNIT DISTRIBUTION				
	0 BR.	1 BR.	2 BR.	TOTAL
1ST FLOOR	8	8	7	23
2ND FLOOR	14	16	17	47
3RD FLOOR	16	18	17	51
4TH FLOOR	16	18	17	51
5TH FLOOR	16	18	17	51
6TH FLOOR	16	18	17	51
7TH FLOOR	23	12	10	45
8TH FLOOR	23	12	10	45
TOTAL	**132**	**120**	**112**	**364**
SUPPORTIVE UNITS	**68**	**17**	**28**	**113**
PERCENTAGE	60%	15%	25%	
ELLA UNITS	**64**	**103**	**84**	**251**
PERCENTAGE	25%	41%	33%	

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231
BUILDING B & C

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:

Address Line 1
Address Line 2
New York, NY 10018 Phone

DATE	SUBMISSIONS / REVISIONS
01_11_2023	ISSUED TO OWNERSHIP FOR REVIEW

SHEET TITLE: UNIT DISTRIBUTION CHART

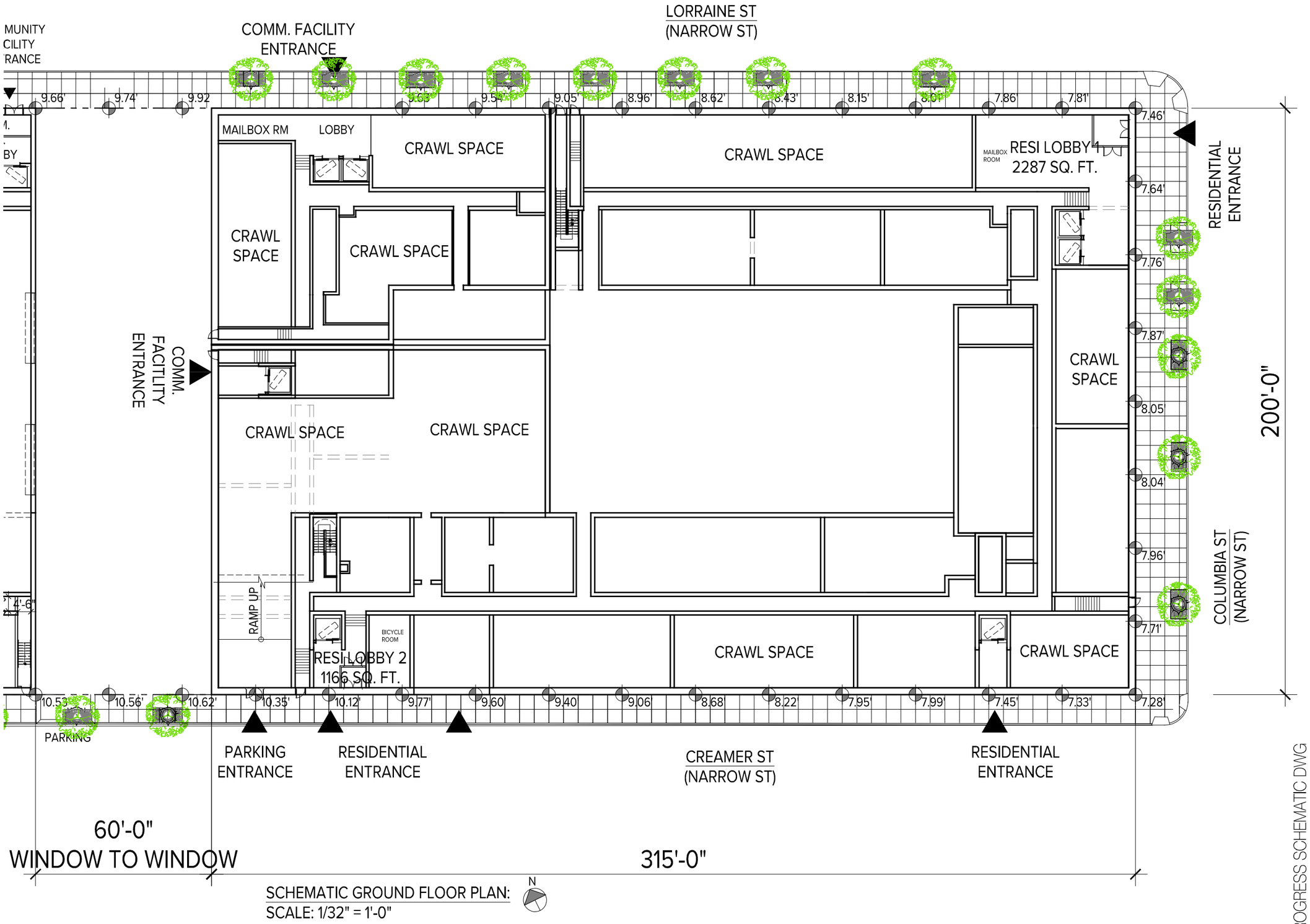
SHEET NUMBER: A-001.00

MAP

PROGRESS SCHEMATIC DWG

A-001.00

PROJ. # P-22110



SCHEMATIC GROUND FLOOR PLAN:
SCALE: 1/32" = 1'-0"

PROGRESS SCHEMATIC DWG

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231
BUILDING B & C

BLOCK: 579 LOT: 1

Architect:
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SHEET TITLE: SCHEMATIC GROUND FLOOR PLAN

SHEET NUMBER: A-100.00

MAP

A-100.00

PROJ. # P-22110

LEGEND

- 0 BR APARTMENTS
- 1 BR APARTMENTS
- 2 BR APARTMENTS

SCHEMATIC 1ST FLOOR PLAN:
SCALE: 1/32" = 1'-0"

PROGRESS SCHEMATIC DWG

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231
BUILDING B & C

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

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DATE	SUBMISSIONS / REVISIONS
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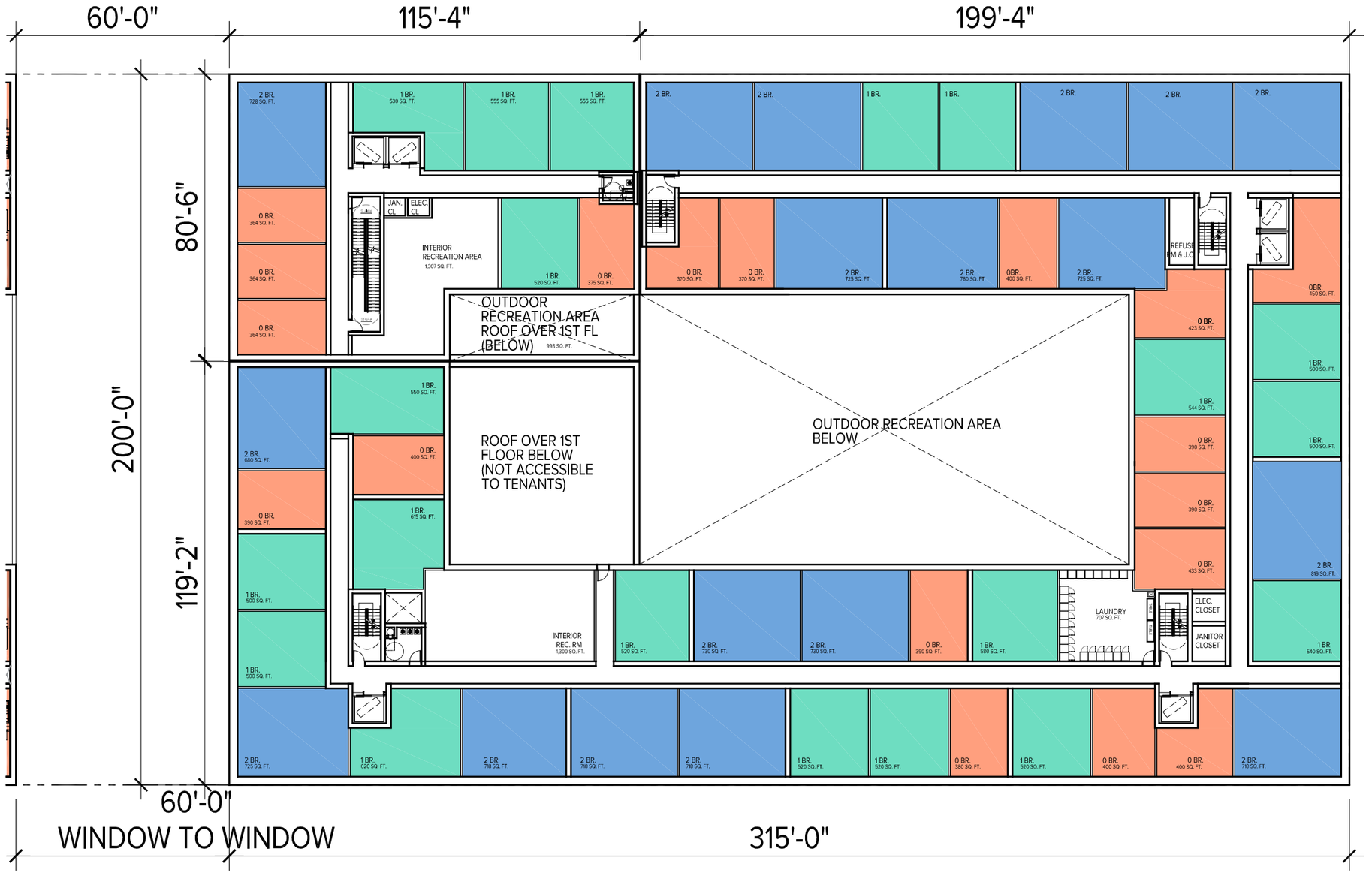
SHEET TITLE: SCHEMATIC 1ST FLOOR PLAN - OPTION A

SHEET NUMBER: A-101.00

MAP

A-101.00

PROJ. # P-22110



SCHEMATIC 2ND FLOOR PLAN:
SCALE: 1/32" = 1'-0"

N

LEGEND

- 0 BR APARTMENTS
- 1 BR APARTMENTS
- 2 BR APARTMENTS

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231
BUILDING B & C

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:
Address Line 1
Address Line 2
New York, NY 10018 Phone

DATE	SUBMISSIONS / REVISIONS
01_11_2023	ISSUED TO OWNERSHIP FOR REVIEW

SHEET TITLE: SCHEMATIC 2ND FLOOR PLAN

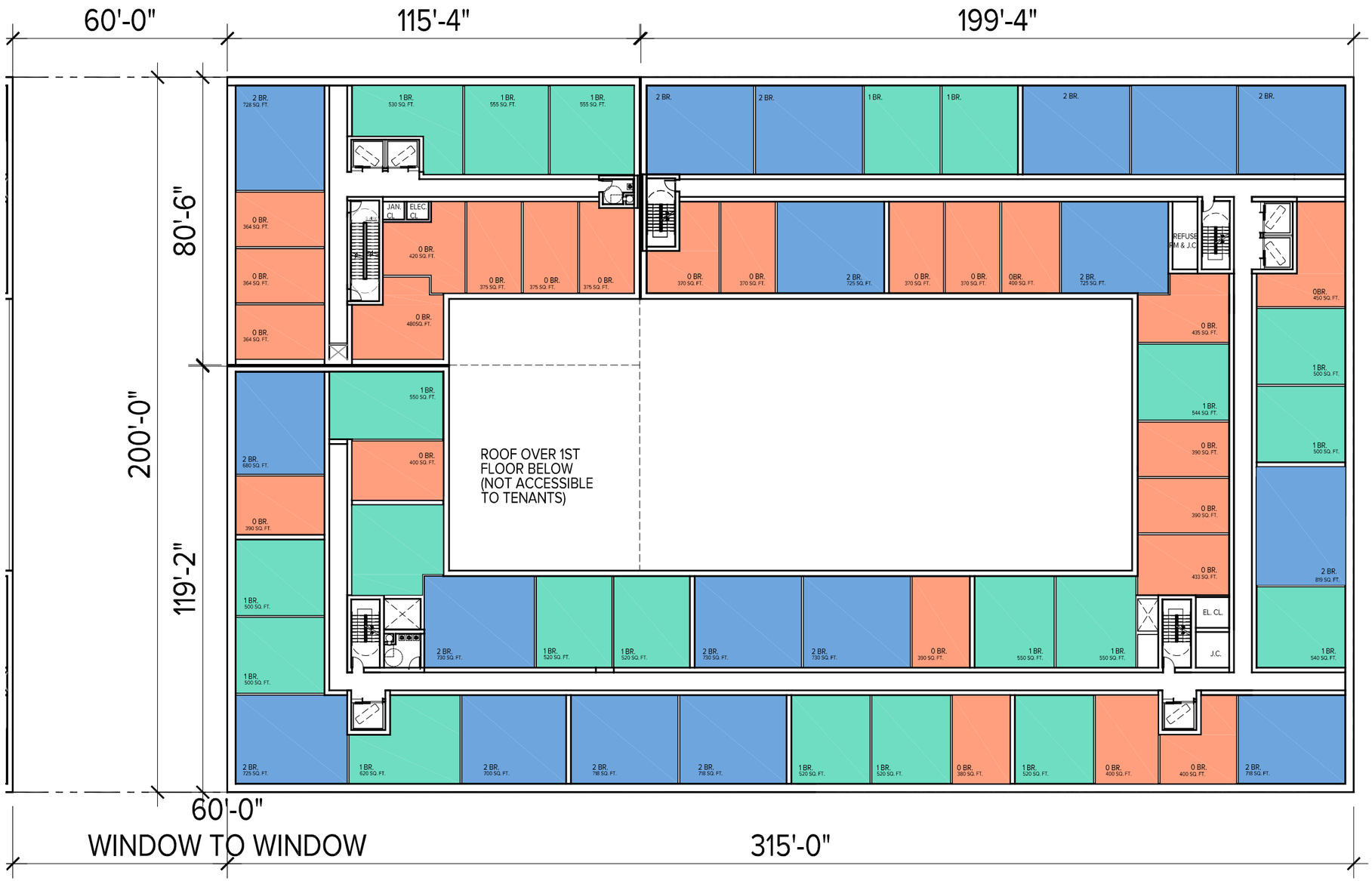
SHEET NUMBER: A-102.00

MAP

PROGRESS SCHEMATIC DWG

A-102.00

PROJ. # P-22110



SCHEMATIC 3RD THRU 6TH FLOOR PLAN:
SCALE: 1/32" = 1'-0"

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LEGEND

- 0 BR APARTMENTS
- 1 BR APARTMENTS
- 2 BR APARTMENTS

PROPOSED NEW MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231
BUILDING B & C

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

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OWNER/DEVELOPER:

Address Line 1
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New York, NY 10018 Phone

01_11_2023	ISSUED TO OWNERSHIP FOR REVIEW
DATE	SUBMISSIONS / REVISIONS

SHEET TITLE: SCHEMATIC 3RD - 6TH FLOOR PLAN

SHEET NUMBER: A-103.00

MAP

PROGRESS SCHEMATIC DWG

A-103.00

PROJ. # P-22110

PROPOSED NEW / MIXED USE DEVELOPMENT FOR:

498

498 COLUMBIA ST, BROOKLYN, NY, 11231
BUILDING B & C

BLOCK: 579 LOT: 1

Architect:
AUFGANG.
74 Lafayette Avenue Suite
301 Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:
Address Line 1
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New York, NY 10018 Phone

DATE	SUBMISSIONS / REVISIONS
01_11_2023	ISSUED TO OWNERSHIP FOR REVIEW

SHEET TITLE: SCHEMATIC 7TH-8TH FLOOR PLAN

SHEET NUMBER: A-104.00

MAP

PROGRESS SCHEMATIC DWG

A-104.00

PROJ. # P-22110

APPENDIX C1

PREVIOUS ENVIRONMENTAL REPORTS

(EXCLUDING REMEDIAL INVESTIGATION REPORT)

APPENDIX C2

REMEDIAL INVESTIGATION REPORT

APPENDIX D

HISTORICAL (SANBORN) FIRE INSURANCE MAPS

37 Otsego Street

37 Otsego Street

Brooklyn, NY 11231

Inquiry Number: 7239520.3

January 31, 2023

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

01/31/23

Site Name:

37 Otsego Street
37 Otsego Street
Brooklyn, NY 11231
EDR Inquiry # 7239520.3

Client Name:

AKRF, Inc.
440 Park Avenue, South 7th Floor
New York, NY 10016
Contact: Jessica Holm

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The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # C820-4046-83C5

PO # 230011

Project 37 Otsego Street

Maps Provided:

2007	1995	1981	1915
2006	1993	1980	1904
2005	1992	1979	1886
2004	1991	1977	
2003	1988	1969	
2002	1987	1950	
2001	1986	1938	
1996	1982	1928	

Sanborn® Library search results

Certification #: C820-4046-83C5

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ☑ Library of Congress
- ☑ University Publications of America
- ☑ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Sanborn Sheet Key

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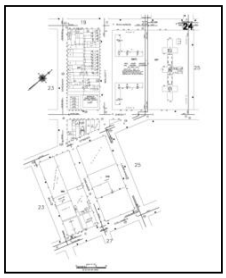
2007 Source Sheets



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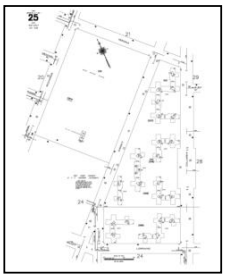
2007



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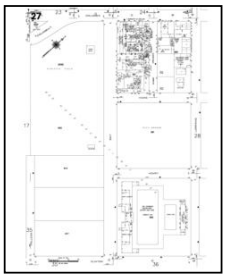

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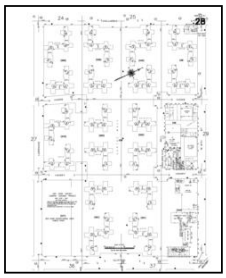

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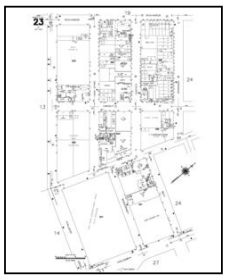

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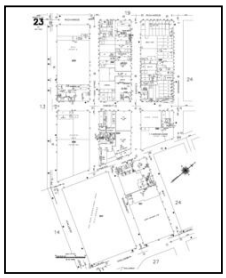
2007

2006 Source Sheets



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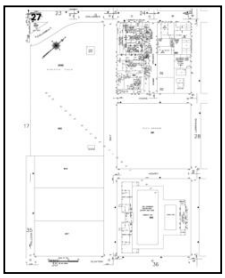

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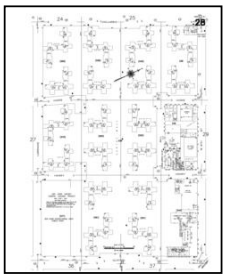

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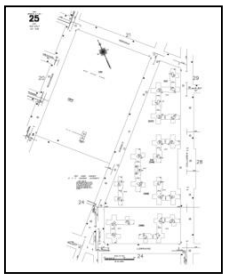

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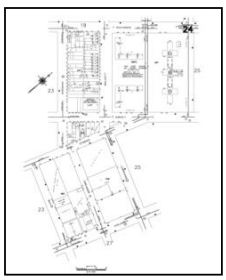

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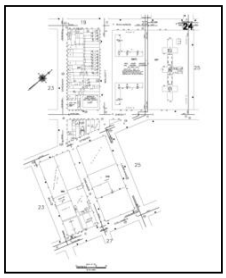

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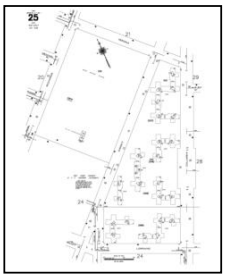

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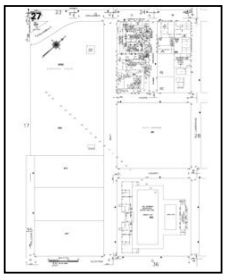

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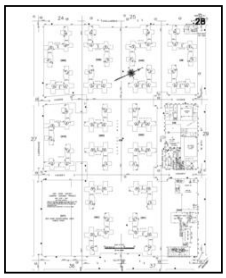

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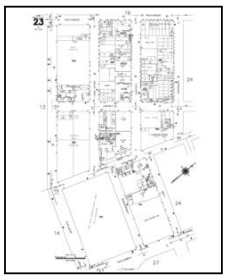

Volume 1, Sheet 23
2005

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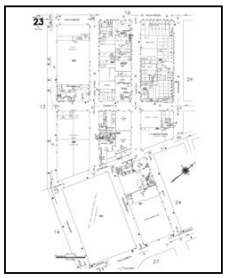

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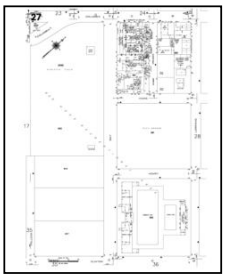

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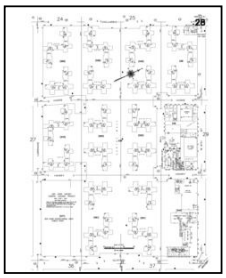

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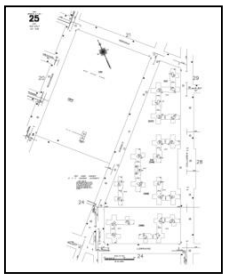

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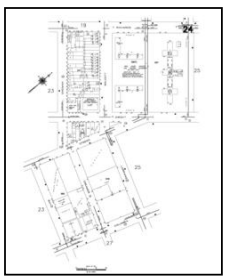

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2004

Sanborn Sheet Key

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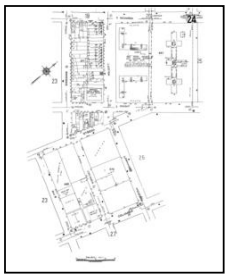

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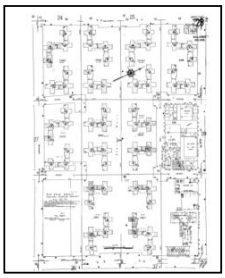

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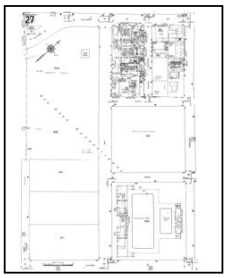

Volume 1, Sheet 27
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Volume 1, Sheet 25
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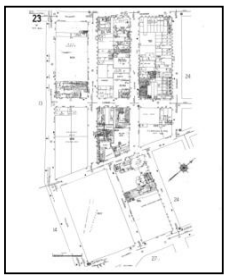
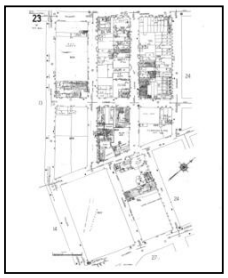


Volume 1, Sheet 23
2003

2002 Source Sheets



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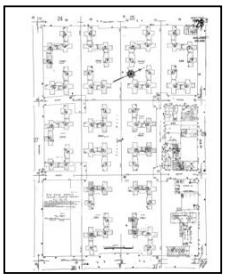

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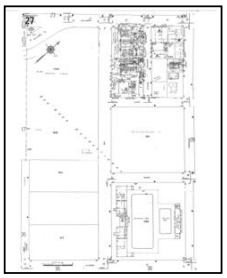

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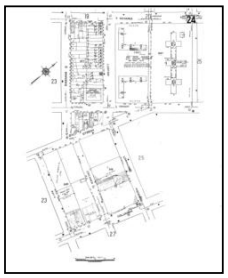

Volume 1, Sheet 24
2002

Volume 1, Sheet 25
2002

Sanborn Sheet Key

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2001 Source Sheets


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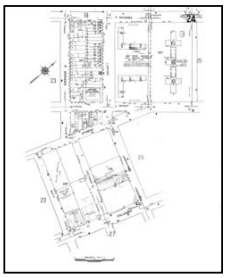
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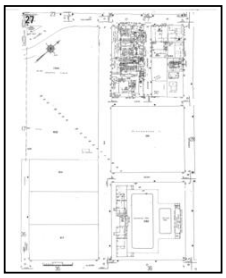
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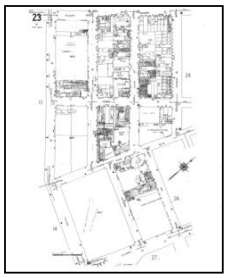
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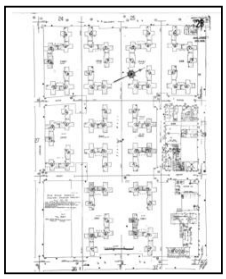
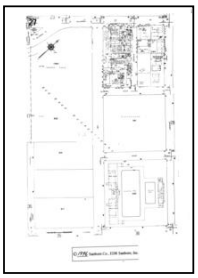
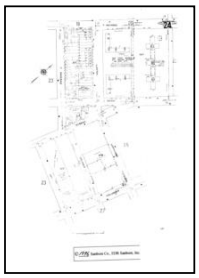

Volume 1, Sheet 28
2001

1996 Source Sheets


Volume 1, Sheet 23
1996

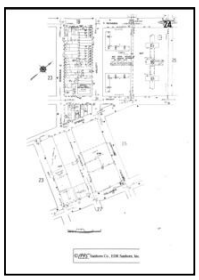

Volume 1, Sheet 27
1996


Volume 1, Sheet 28
1996


Volume 1, Sheet 24
1996


Volume 1, Sheet 25
1996

1995 Source Sheets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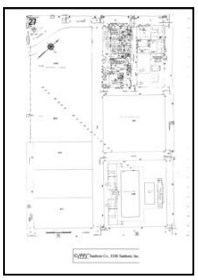
1995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1995


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1995


Volume 1, Sheet 23
1995


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1995

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1993 Source Sheets


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1993


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1993


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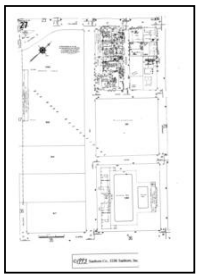
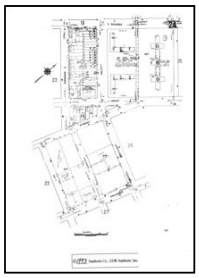
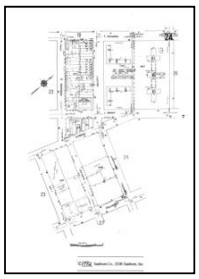
1993

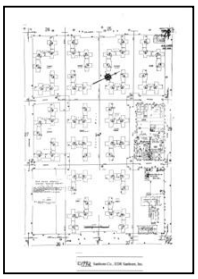

Volume 1, Sheet 27
1993


Volume 1, Sheet 24
1993

1992 Source Sheets


Volume 1, Sheet 24
1992


Volume 1, Sheet 25
1992


Volume 1, Sheet 28
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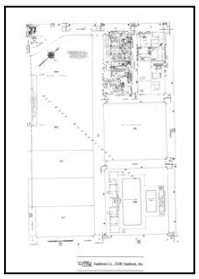
Volume 1, Sheet 27
1992


Volume 1, Sheet 23
1992

1991 Source Sheets


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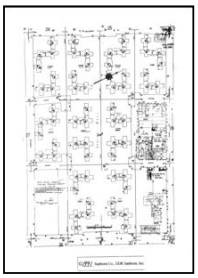
1991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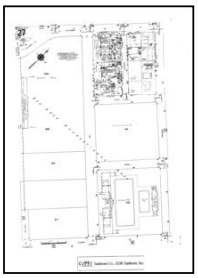
1991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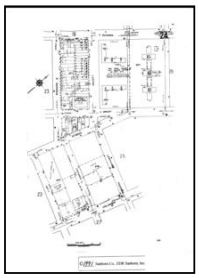
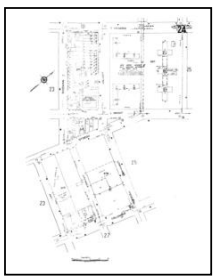
1991


Volume 1, Sheet 25
1991


Volume 1, Sheet 24
1991

1988 Source Sheets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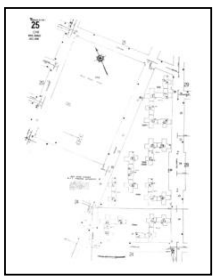
1988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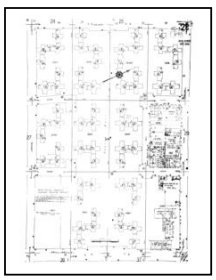
1988


Volume 1, Sheet 27
1988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1988


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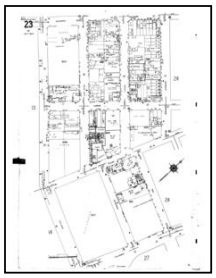
1988

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1987 Source Sheets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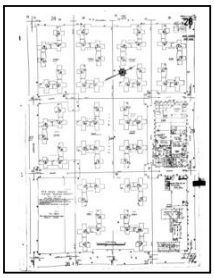
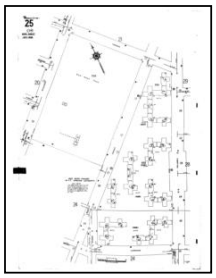
1987


Volume 1, Sheet 28
1987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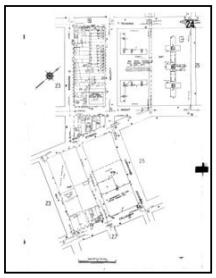
1987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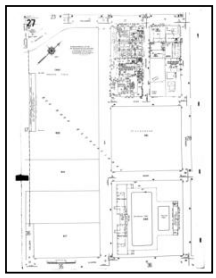
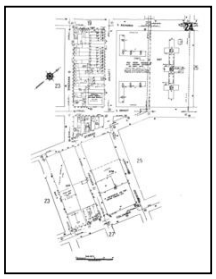
1987


Volume 1, Sheet 27
1987

1986 Source Sheets


Volume 1, Sheet 24
1986

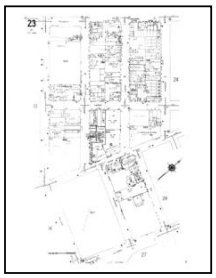

Volume 1, Sheet 25
1986


Volume 1, Sheet 27
1986


Volume 1, Sheet 28
1986


Volume 1, Sheet 23
1986

1982 Source Sheets


Volume 1, Sheet 23
1982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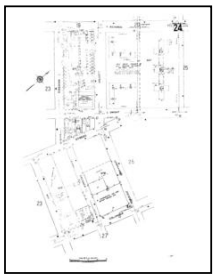
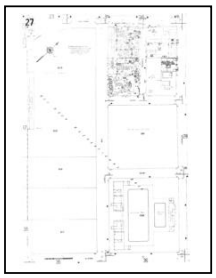
1982


Volume 1, Sheet 24
1982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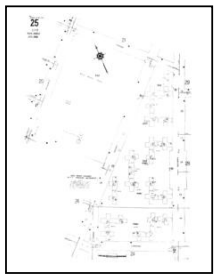
1982


Volume 1, Sheet 25
1982

1981 Source Sheets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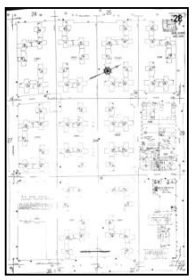
1981


Volume 1, Sheet 23
1981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1981


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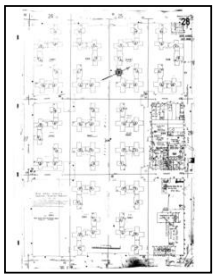
1981

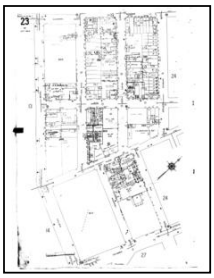

Volume 1, Sheet 27
1981

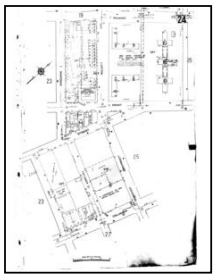
Sanborn Sheet Key

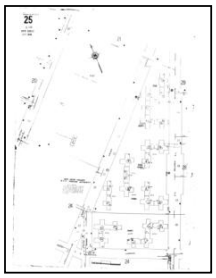
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

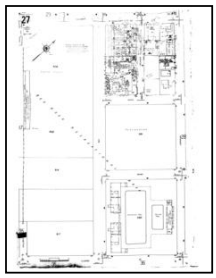
1980 Source Sheets


Volume 1, Sheet 28
1980

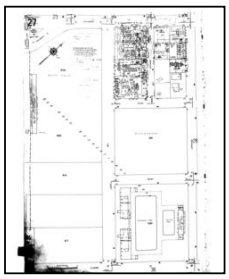

Volume 1, Sheet 23
1980

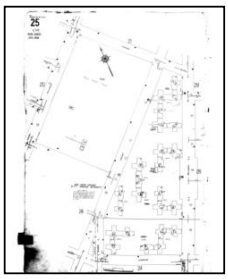

Volume 1, Sheet 24
1980


Volume 1, Sheet 25
1980


Volume 1, Sheet 27
1980

1979 Source Sheets


Volume 1, Sheet 27
1979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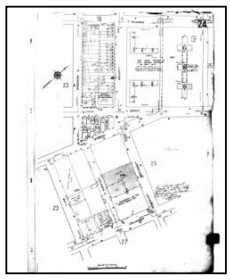
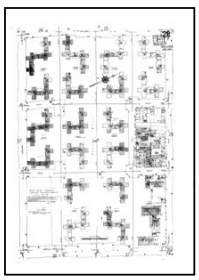
1979


Volume 1, Sheet 24
1979


Volume 1, Sheet 23
1979


Volume 1, Sheet 28
1979

1977 Source Sheets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1977


Volume 1, Sheet 24
1977


Volume 1, Sheet 23
1977

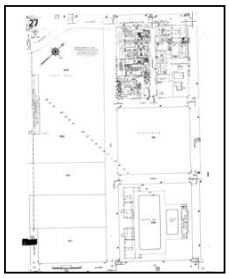

Volume 1, Sheet 25
1977


Volume 1, Sheet 27
1977

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1969 Source Sheets


Volume 1, Sheet 27
1969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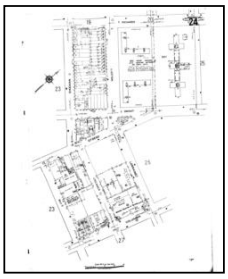
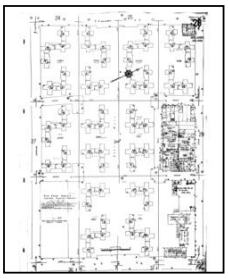
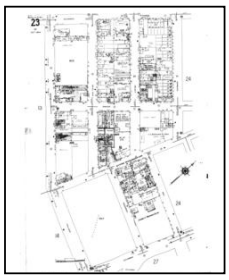
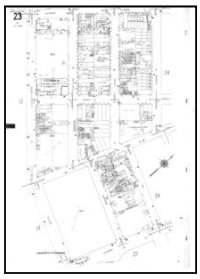
1969

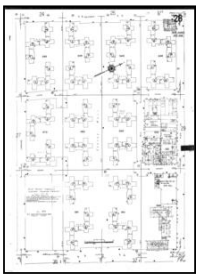

Volume 1, Sheet 24
1969


Volume 1, Sheet 28
1969


Volume 1, Sheet 23
1969

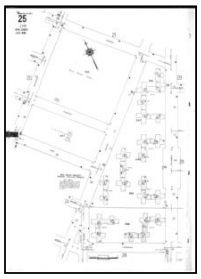
1950 Source Sheets


Volume 1, Sheet 23
1950


Volume 1, Sheet 28
1950

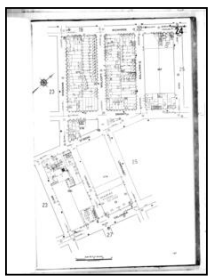

Volume 1, Sheet 24
1950


Volume 1, Sheet 27
1950


Volume 1, Sheet 25
1950

1938 Source Sheets


Volume 1, Sheet 25
1938


Volume 1, Sheet 24
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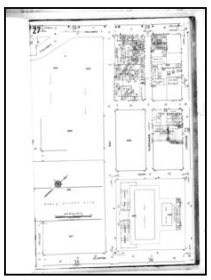
Volume 1, Sheet 27
1938


Volume 1, Sheet 28
1938


Volume 1, Sheet 23
1938

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1928 Source Sheets

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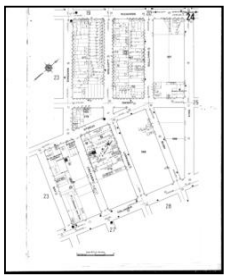
1928

1915 Source Sheets



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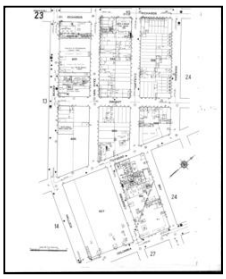
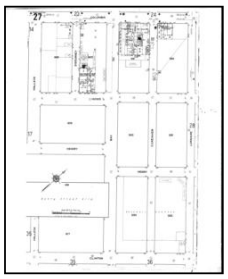
1915



Volume 1, Sheet 23
1915

Volume 1, Sheet 28
1915



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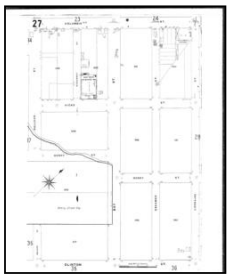
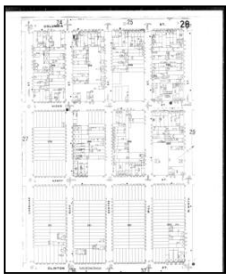
1915

1904 Source Sheets



Volume 1, Sheet 27
1904



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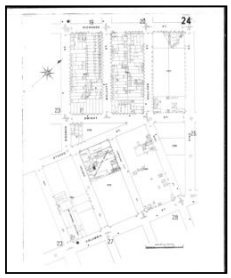
1904

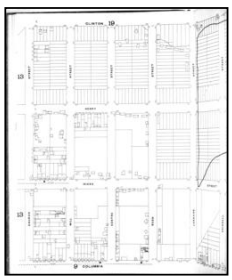
Volume 1, Sheet 23
1904



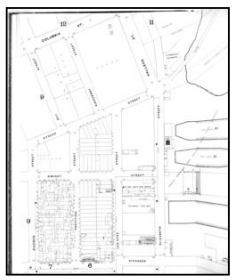
Volume 1, Sheet 24
1904

1886 Source Sheets

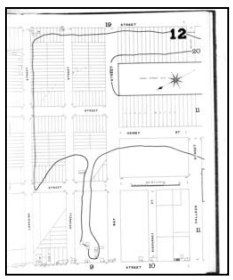
Volume 1, Sheet 9
1886



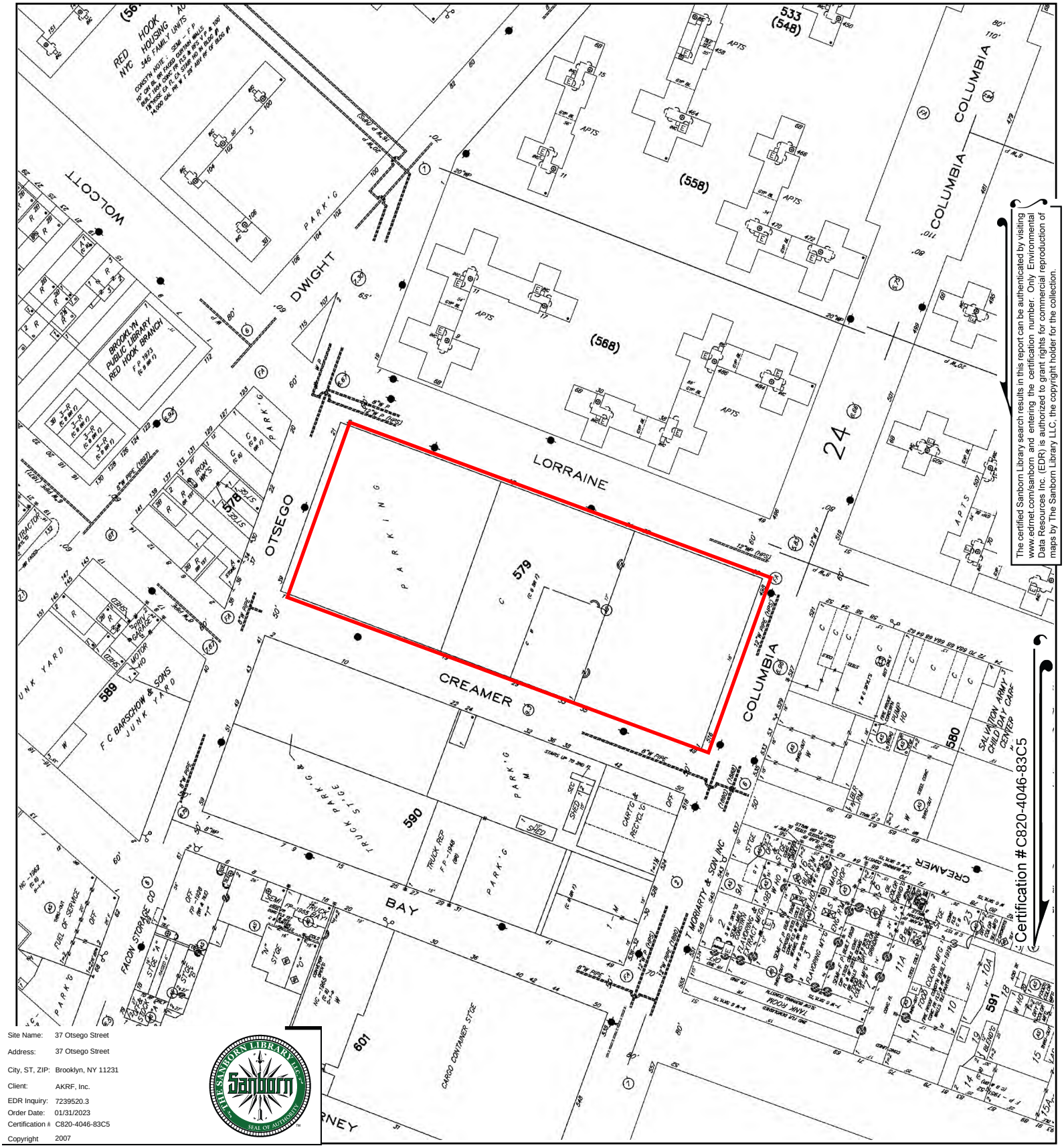
Volume 1, Sheet 12
1886



Volume 1, Sheet 10
1886



Volume 1, Sheet 12
1886



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Volume 1, Sheet 24

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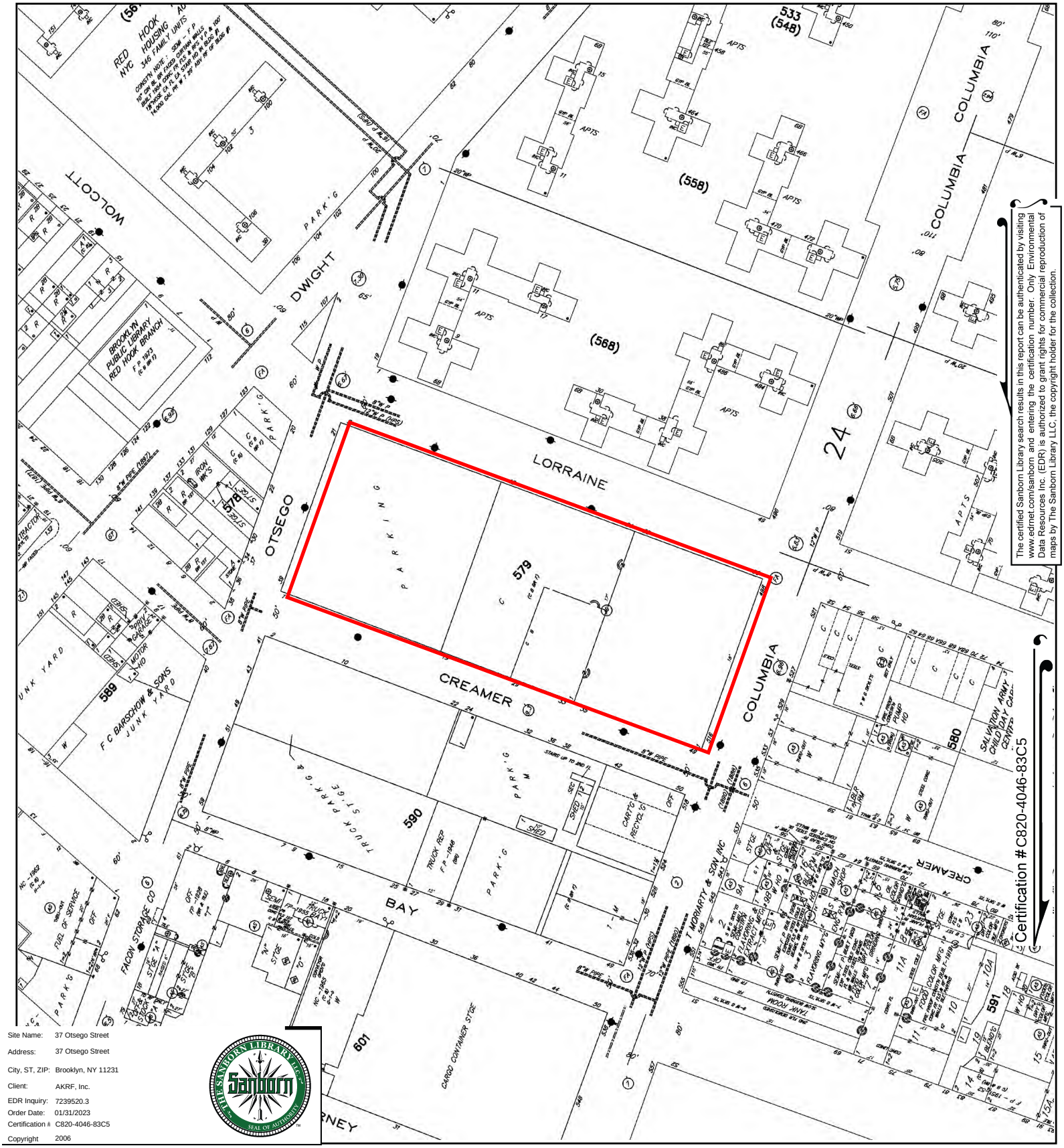

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Volume 1, Sheet 28
Volume 1, Sheet 27
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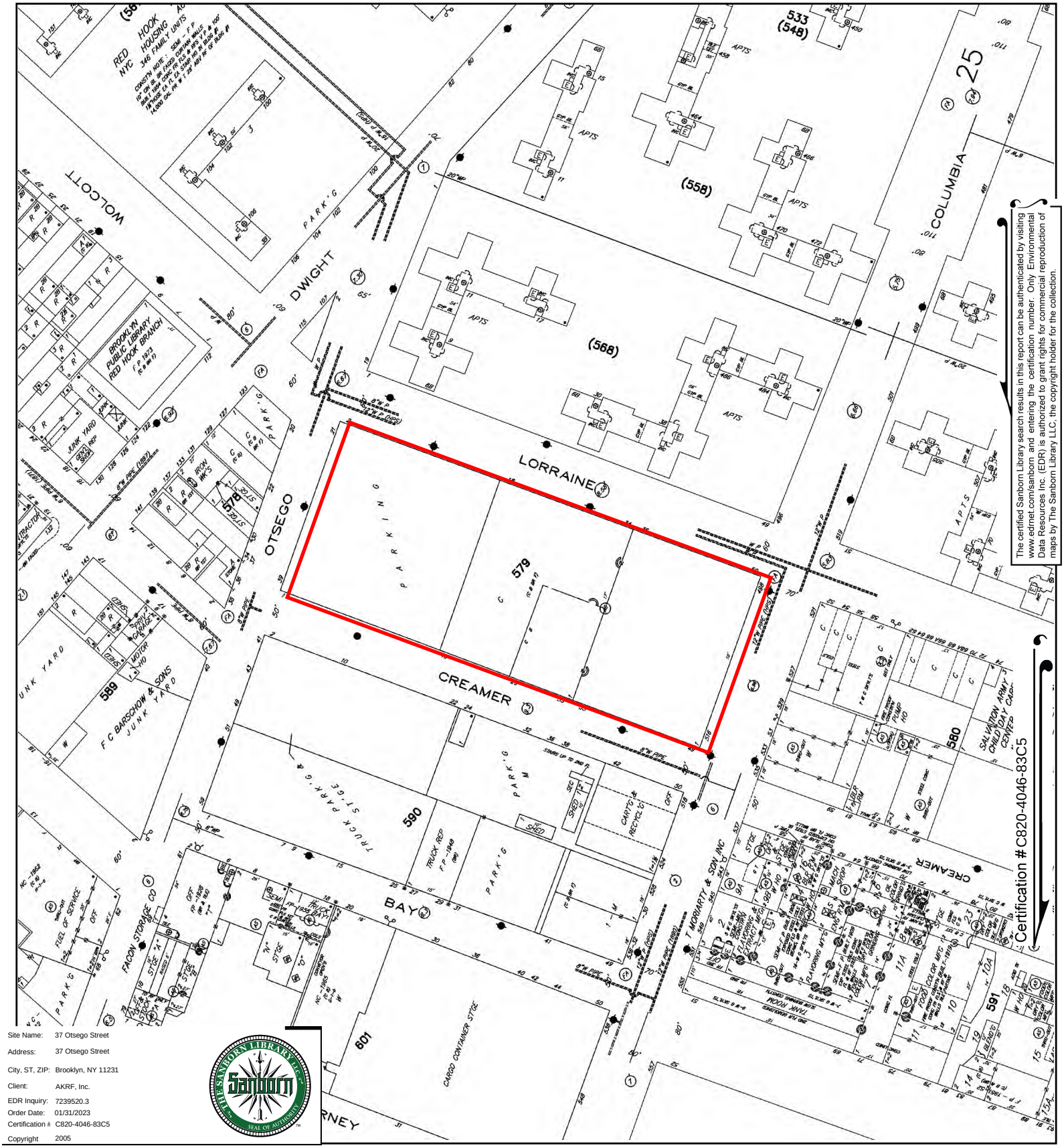

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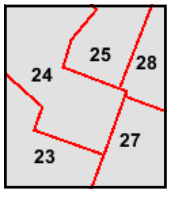

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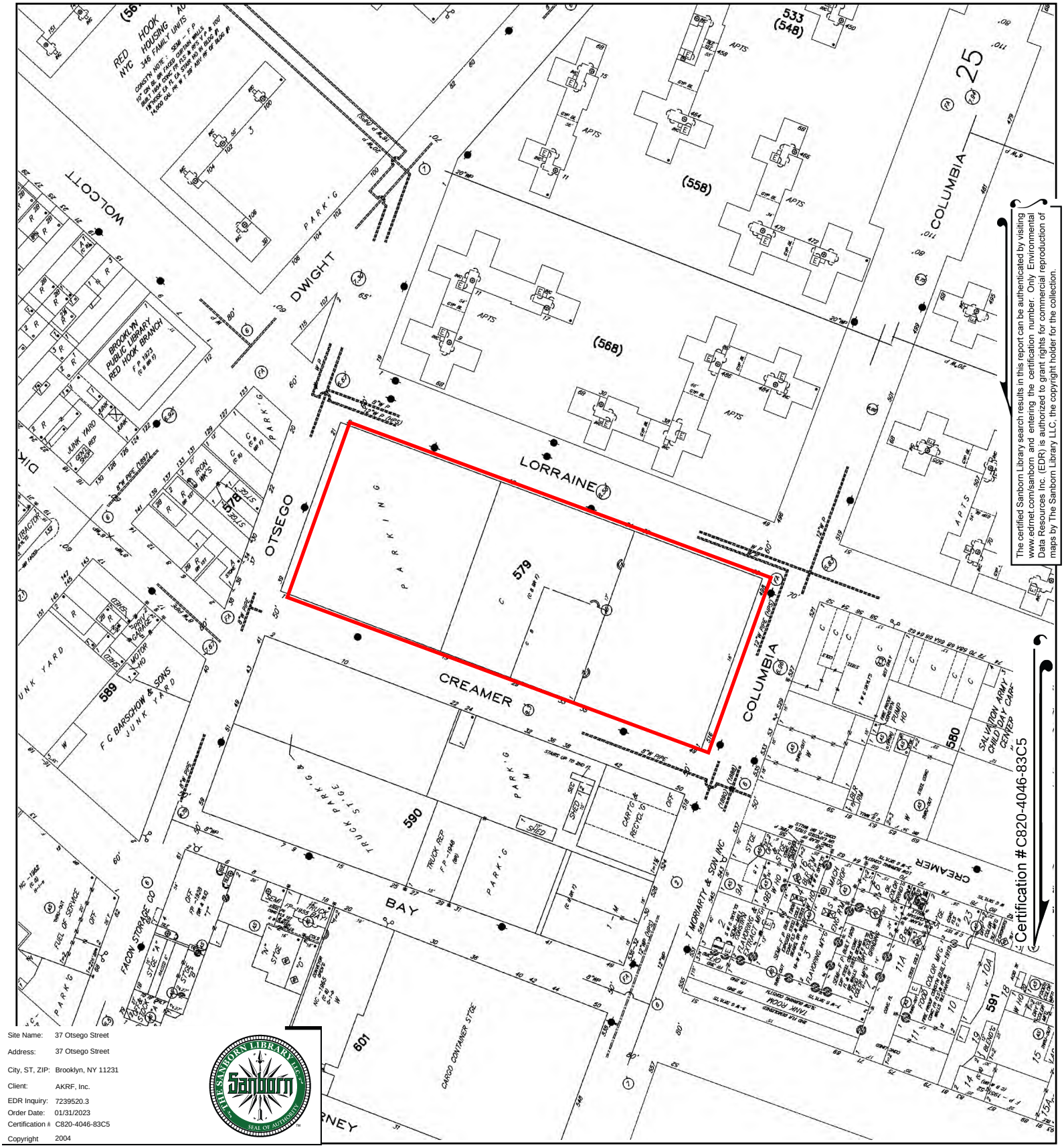

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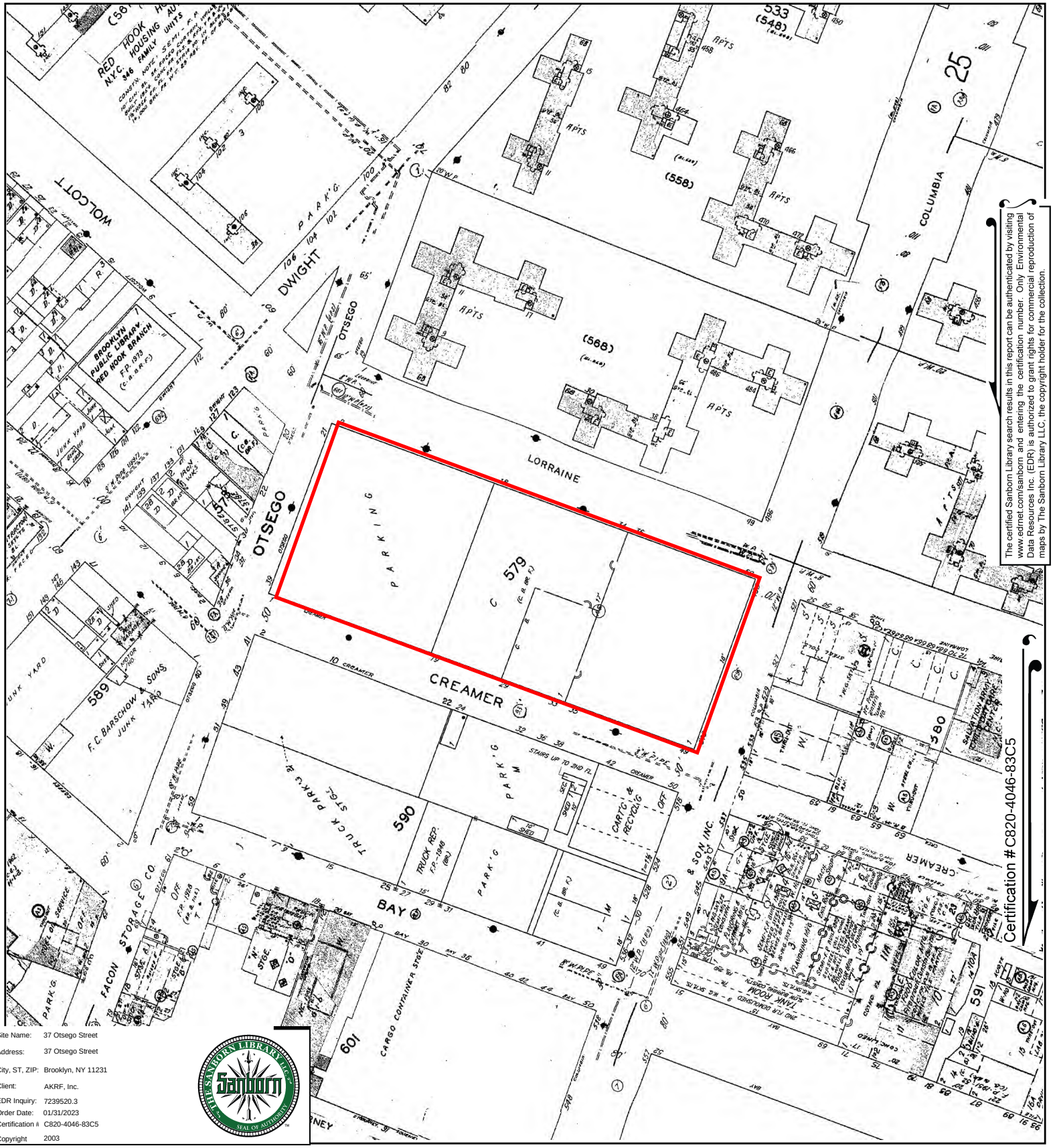

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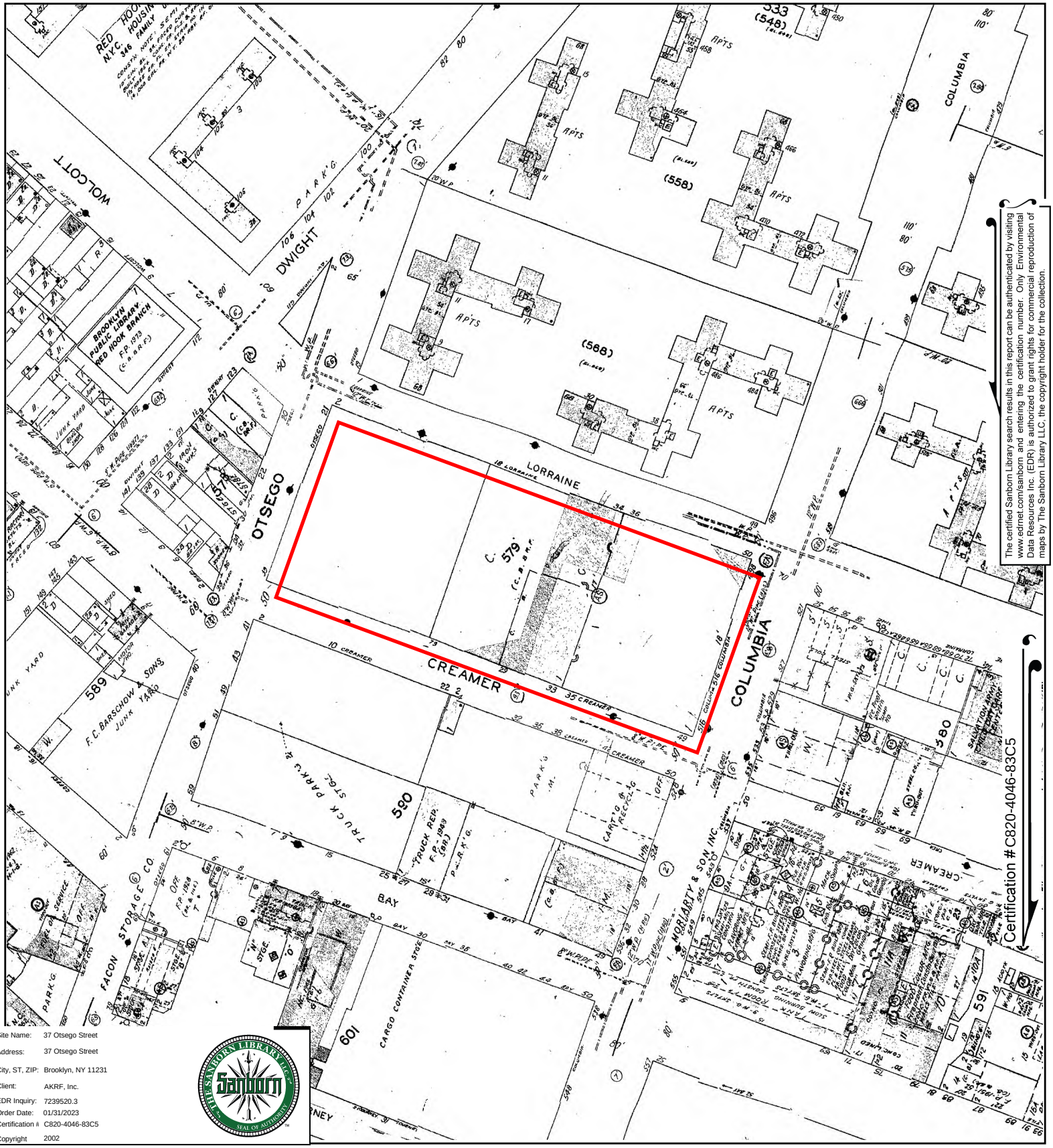

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Volume 1, Sheet 28
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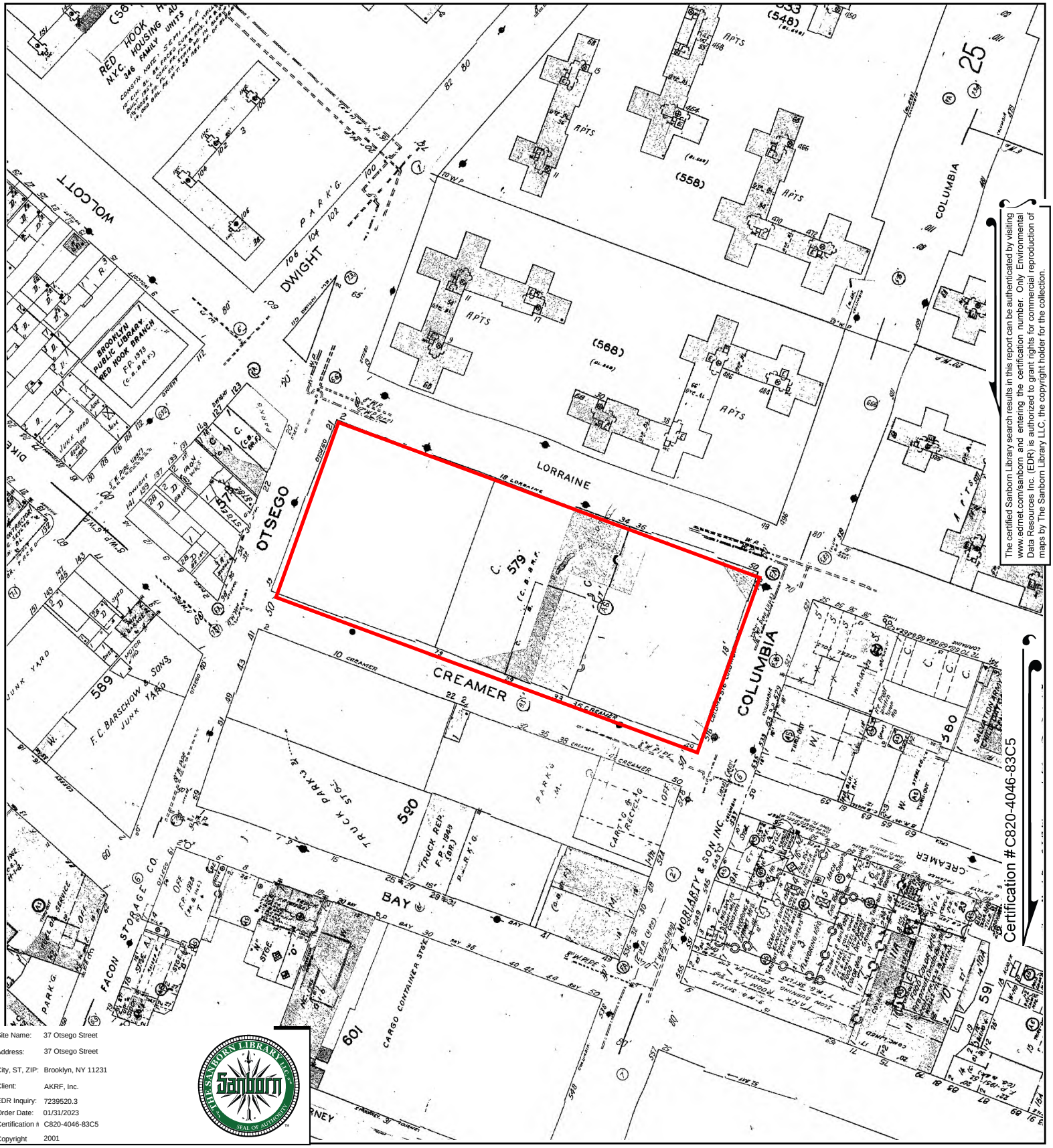

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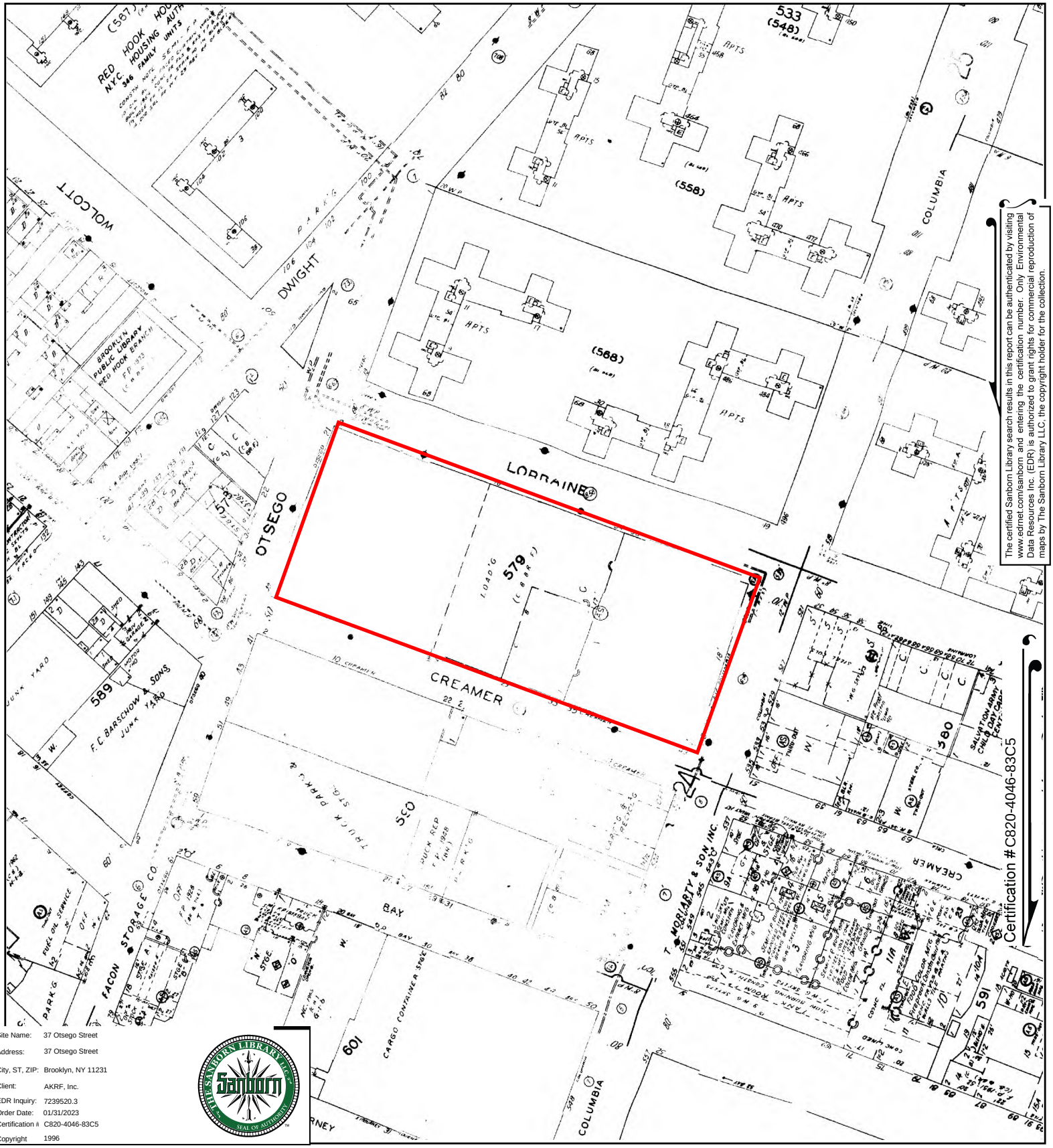

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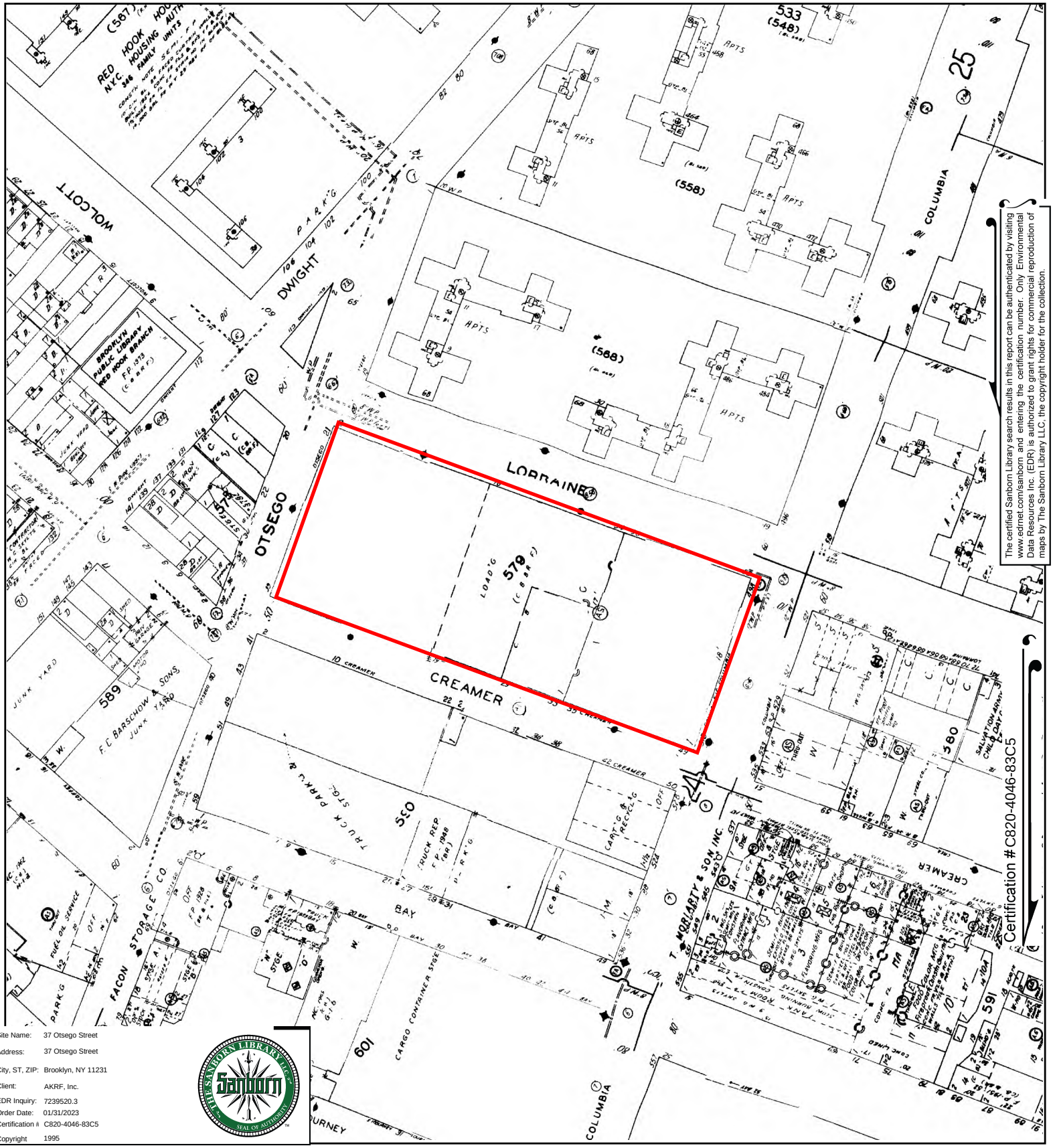

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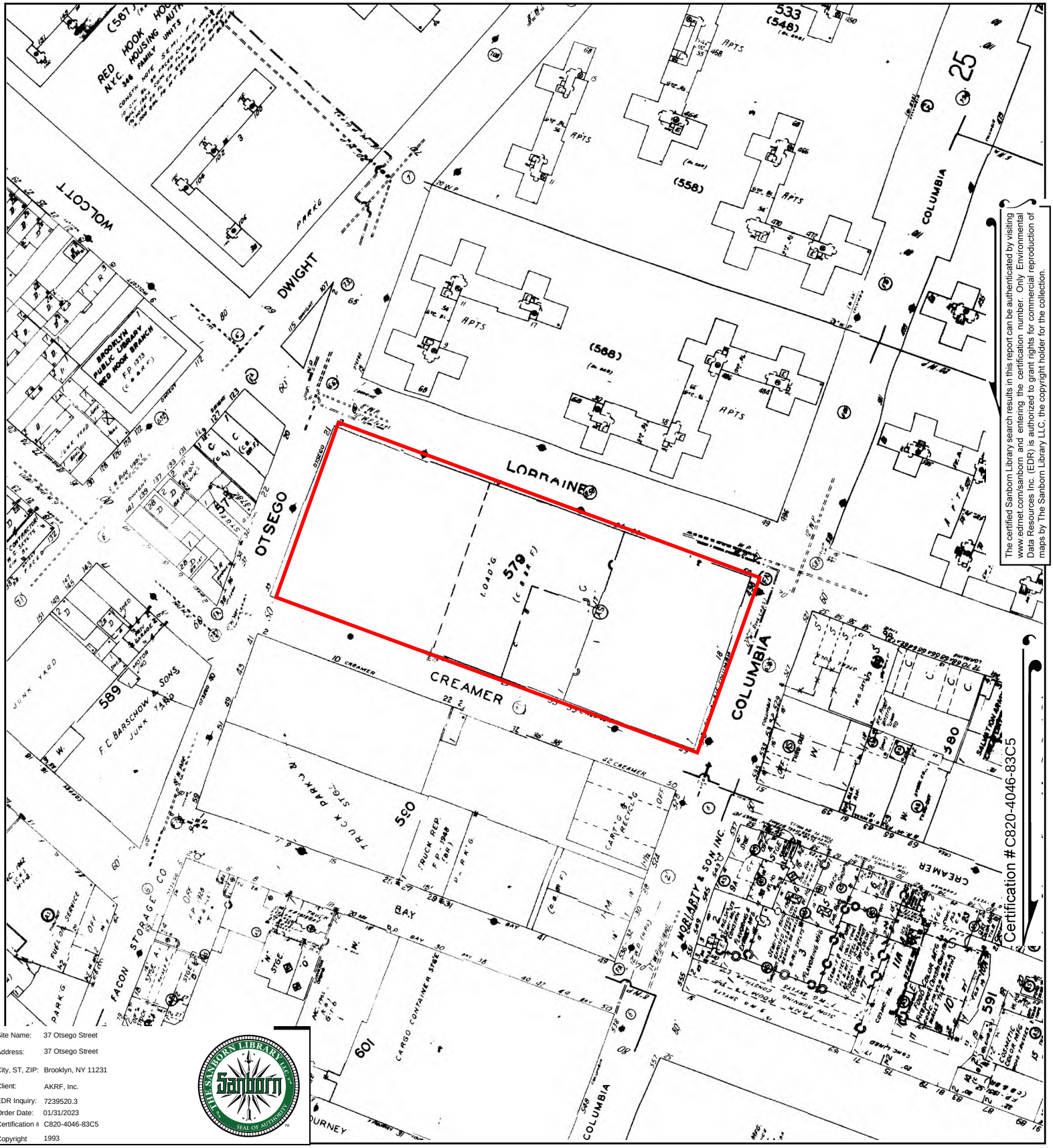

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Copyright	1993

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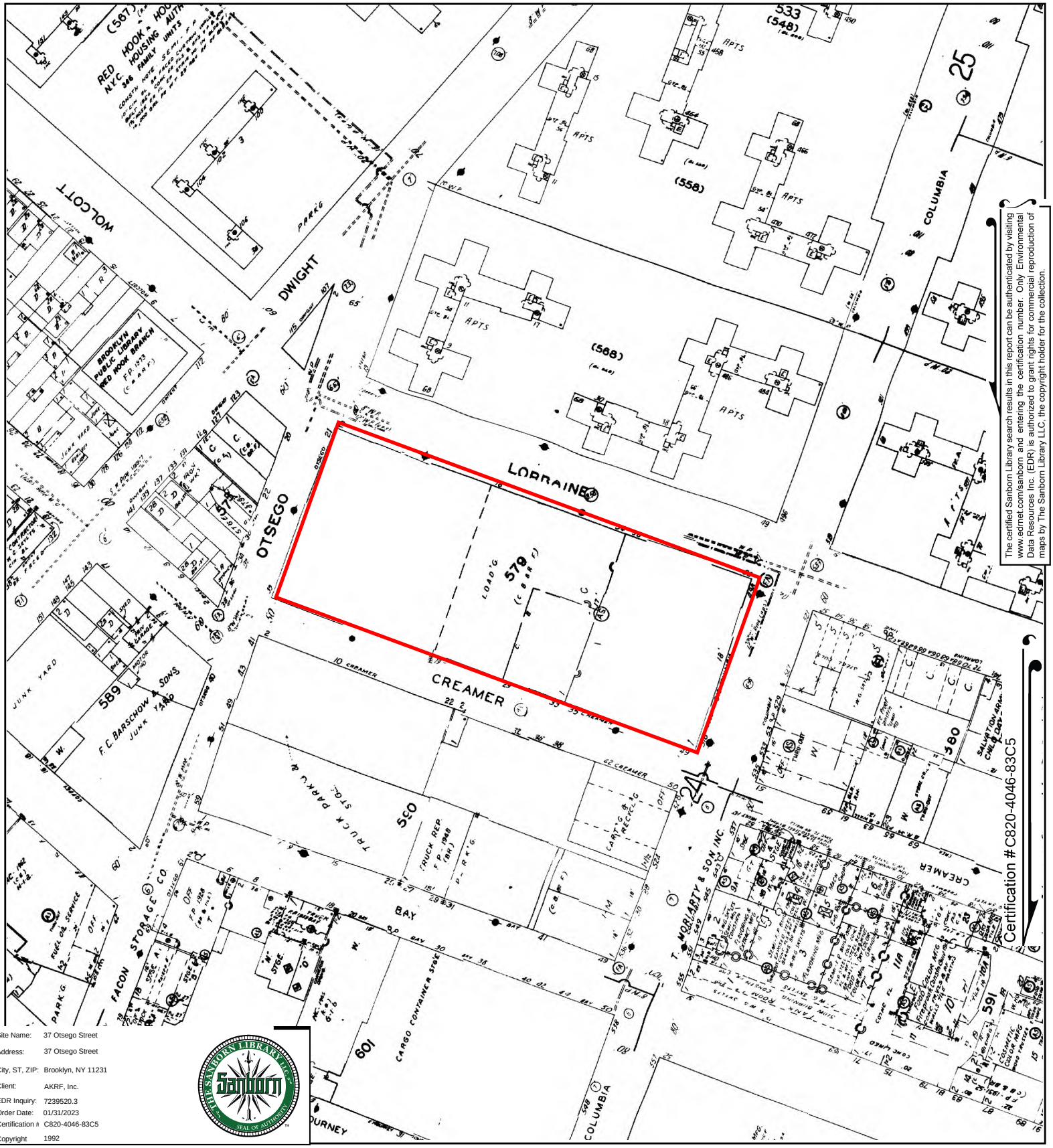

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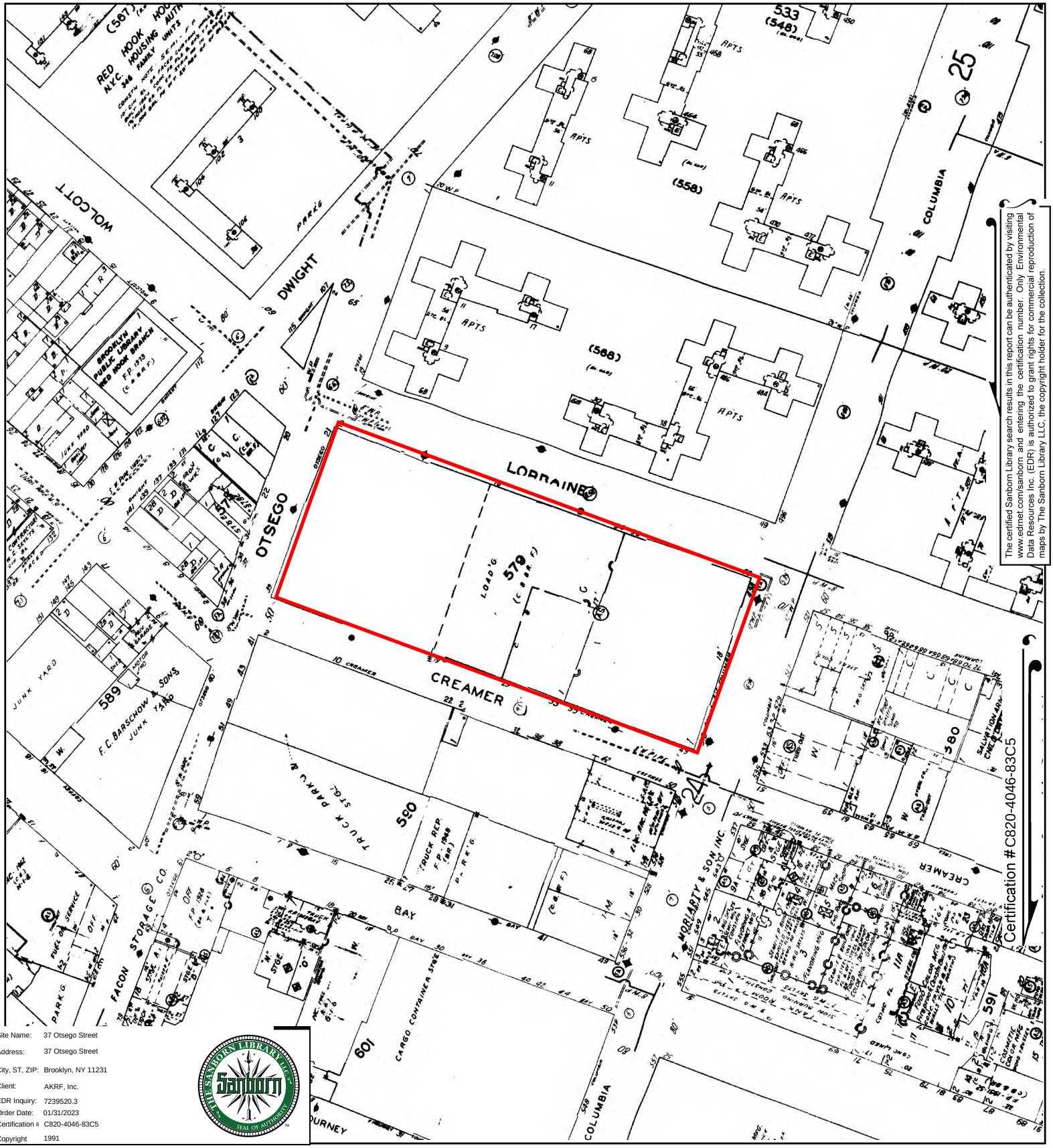

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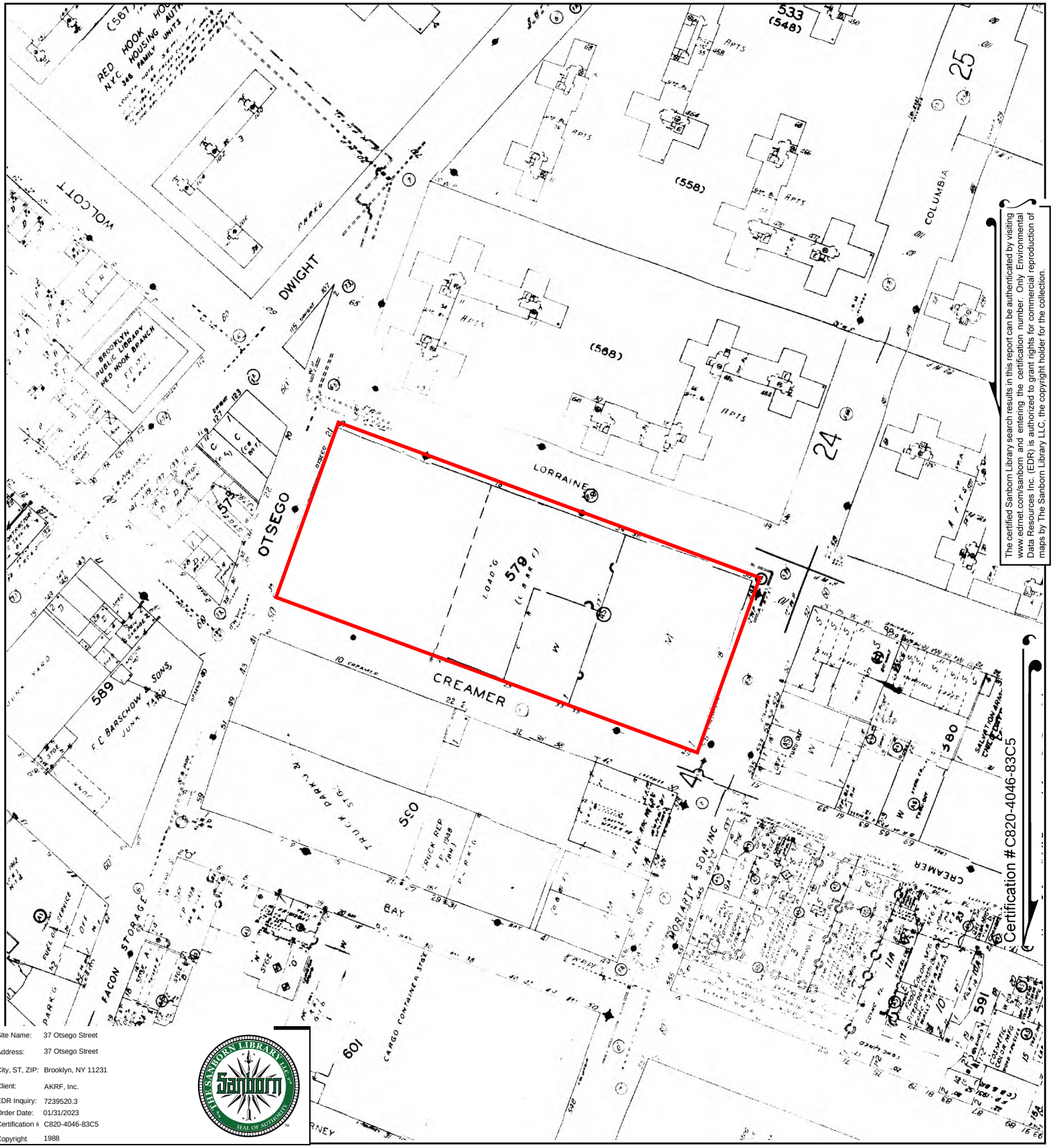

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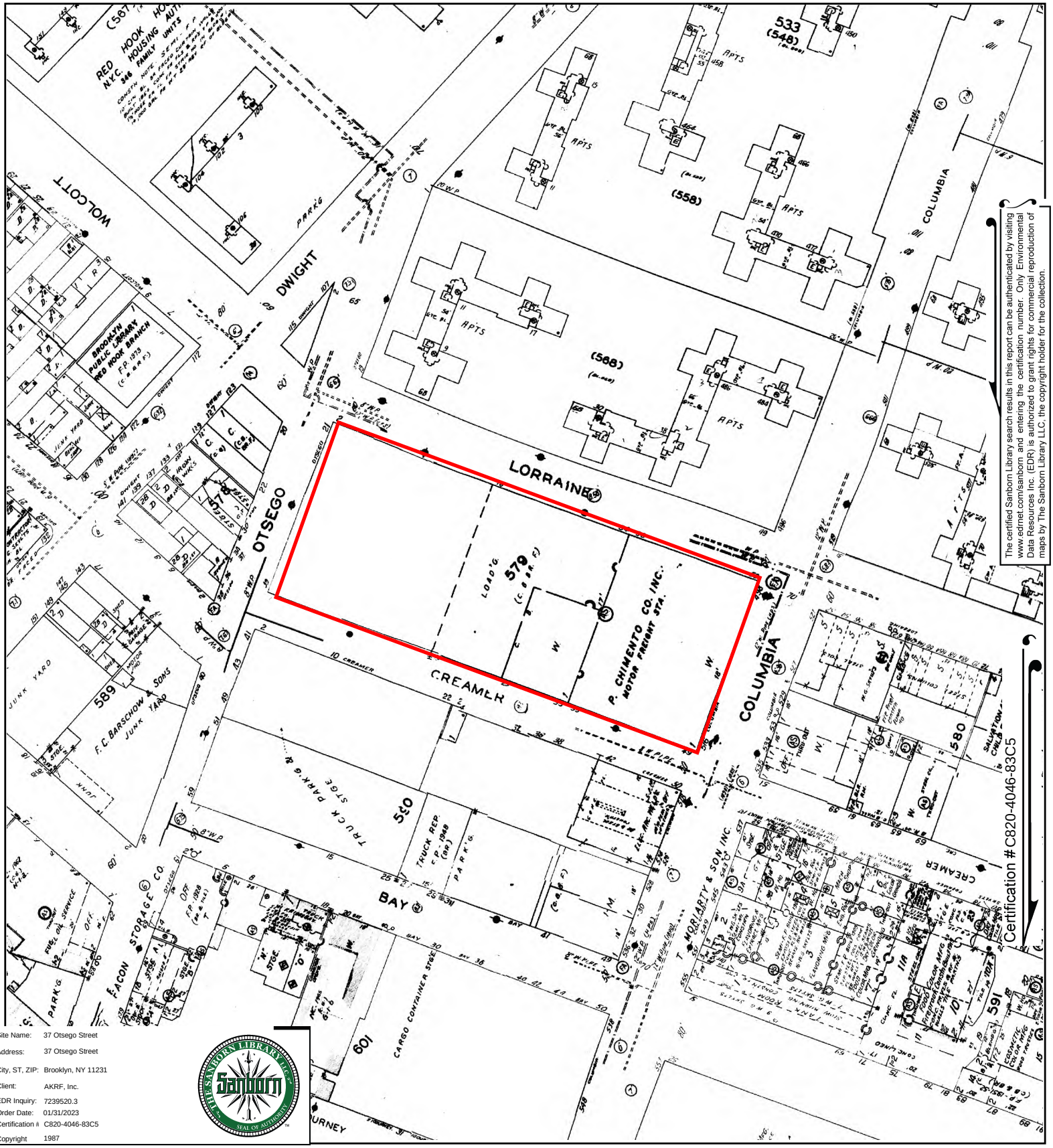

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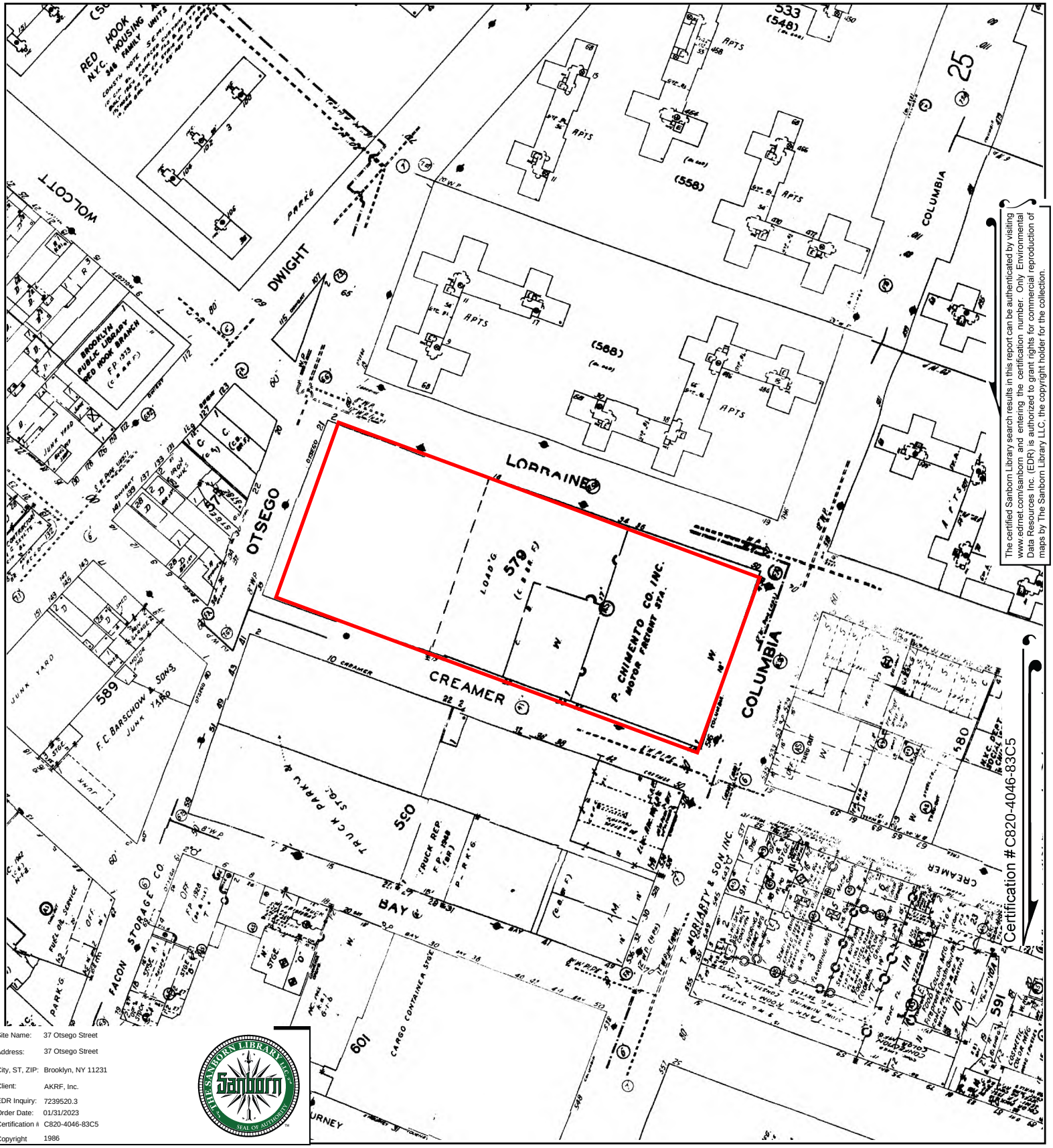

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Copyright	1986

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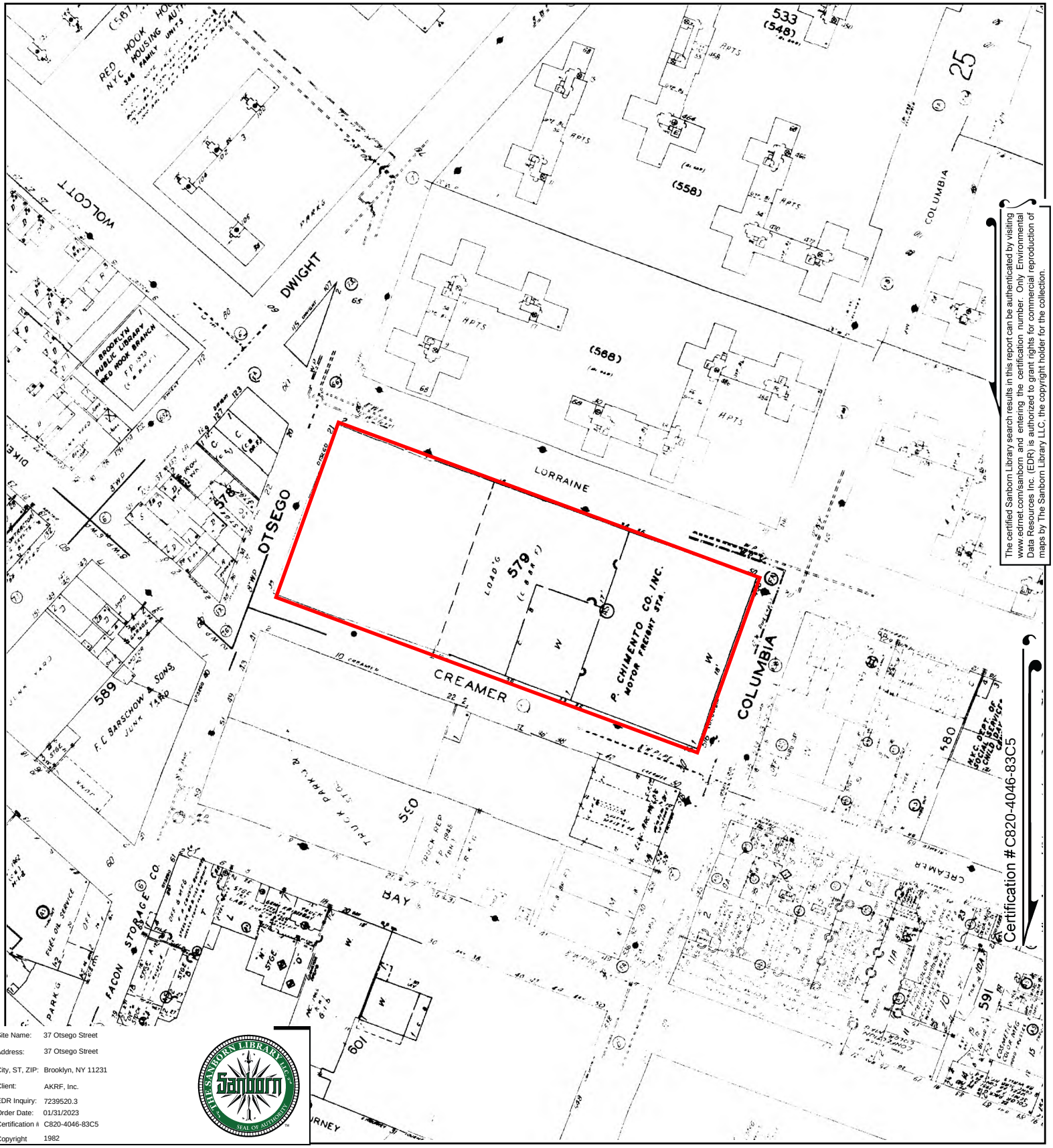

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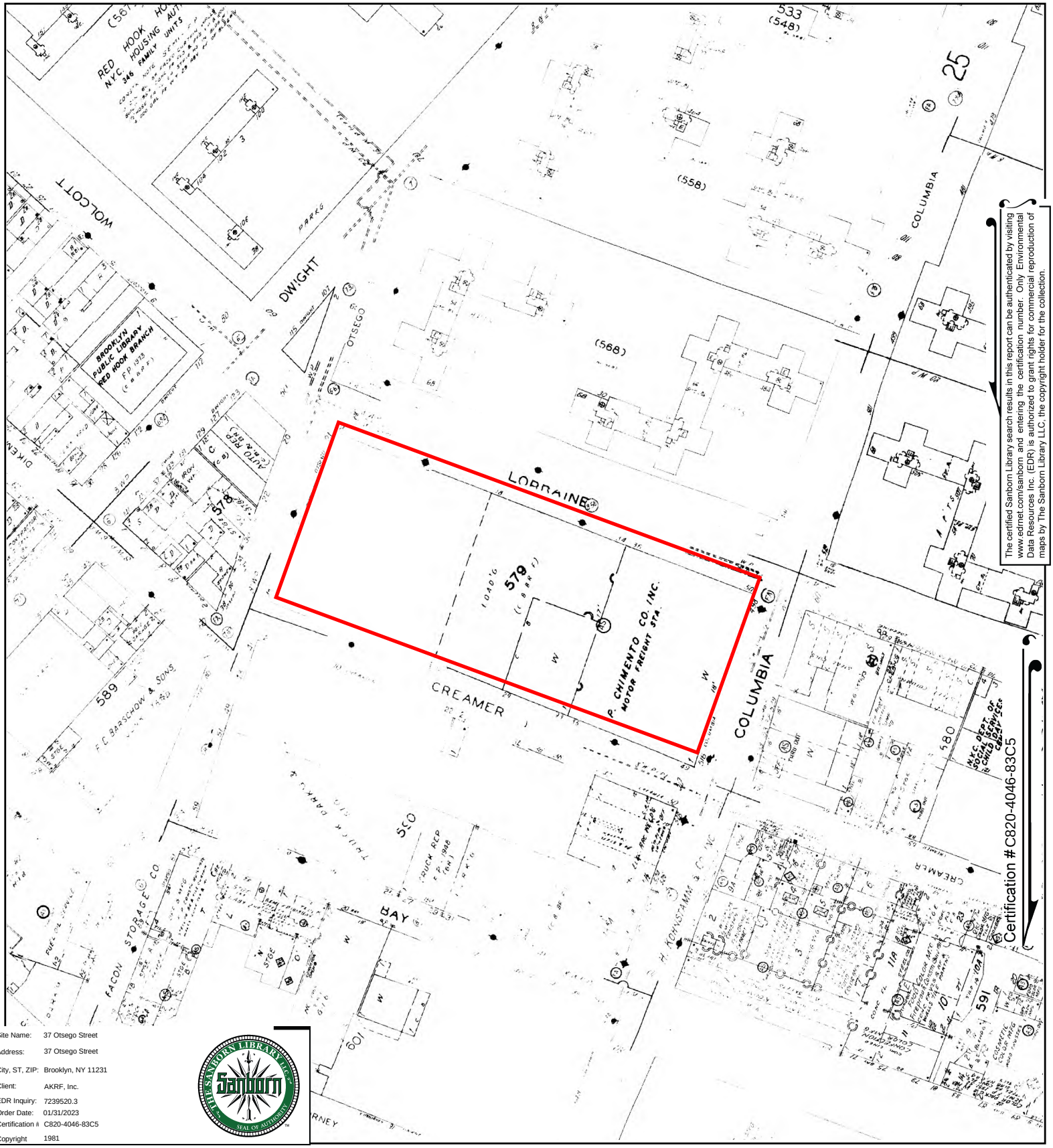

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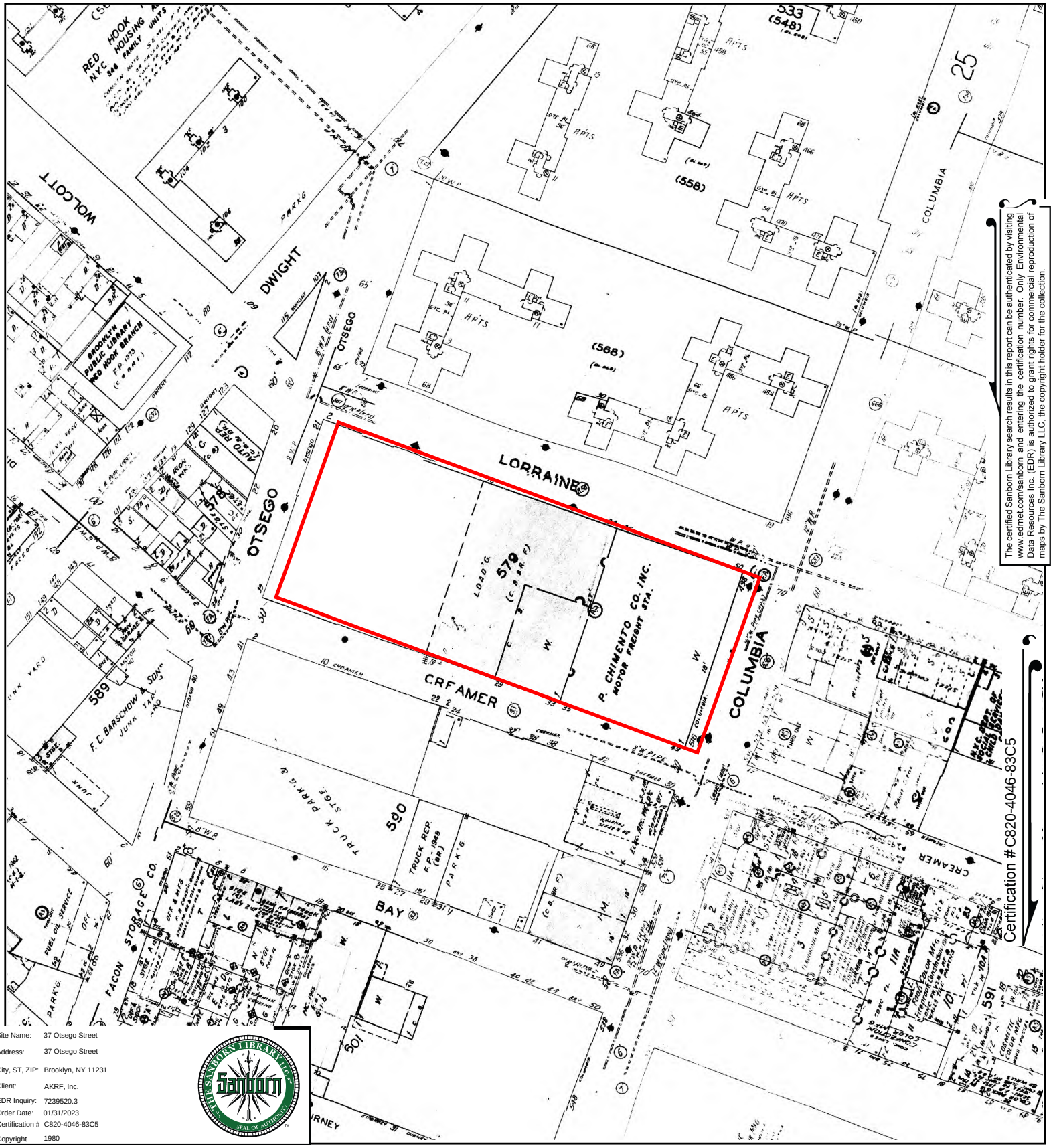

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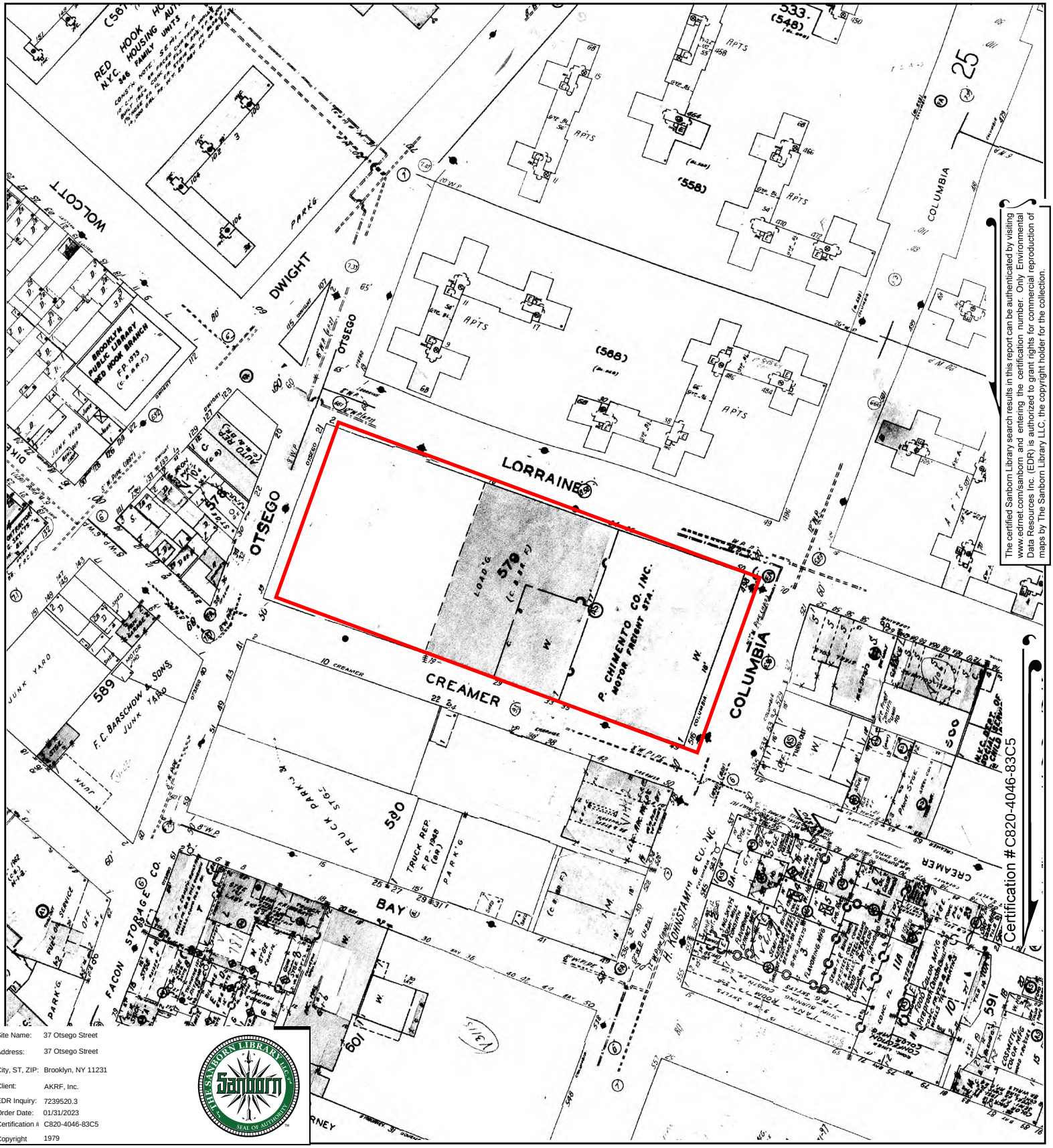

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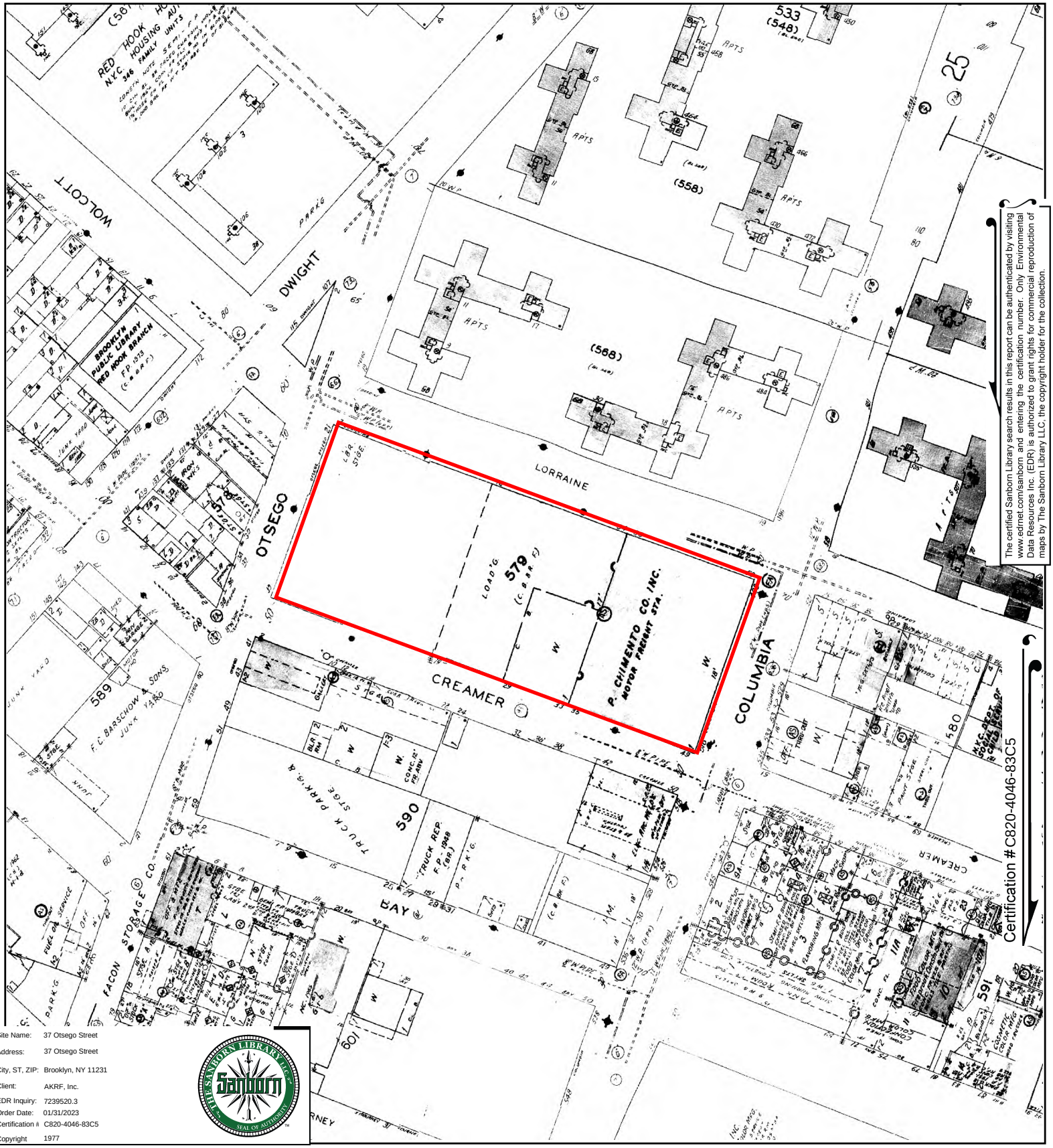

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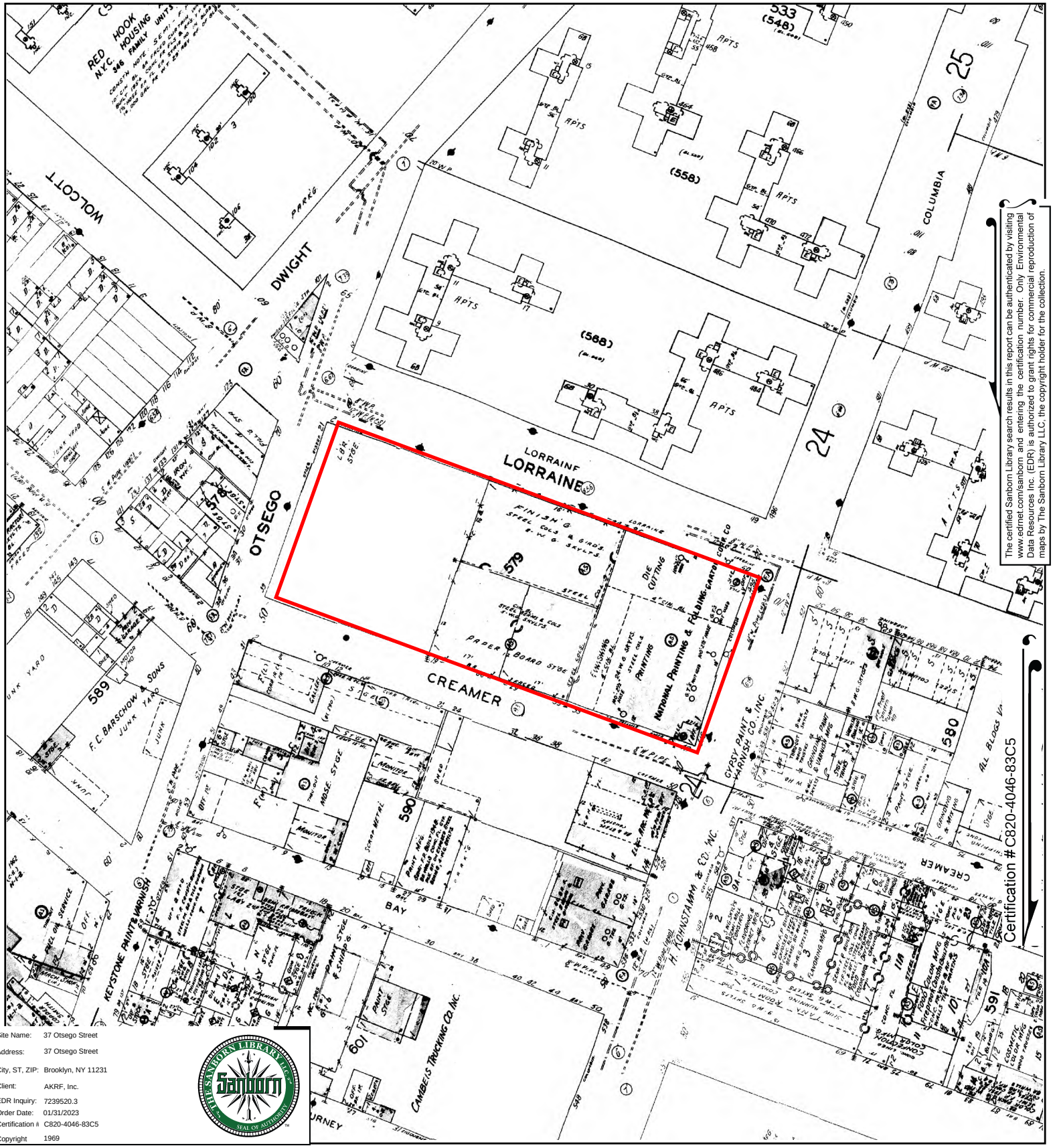

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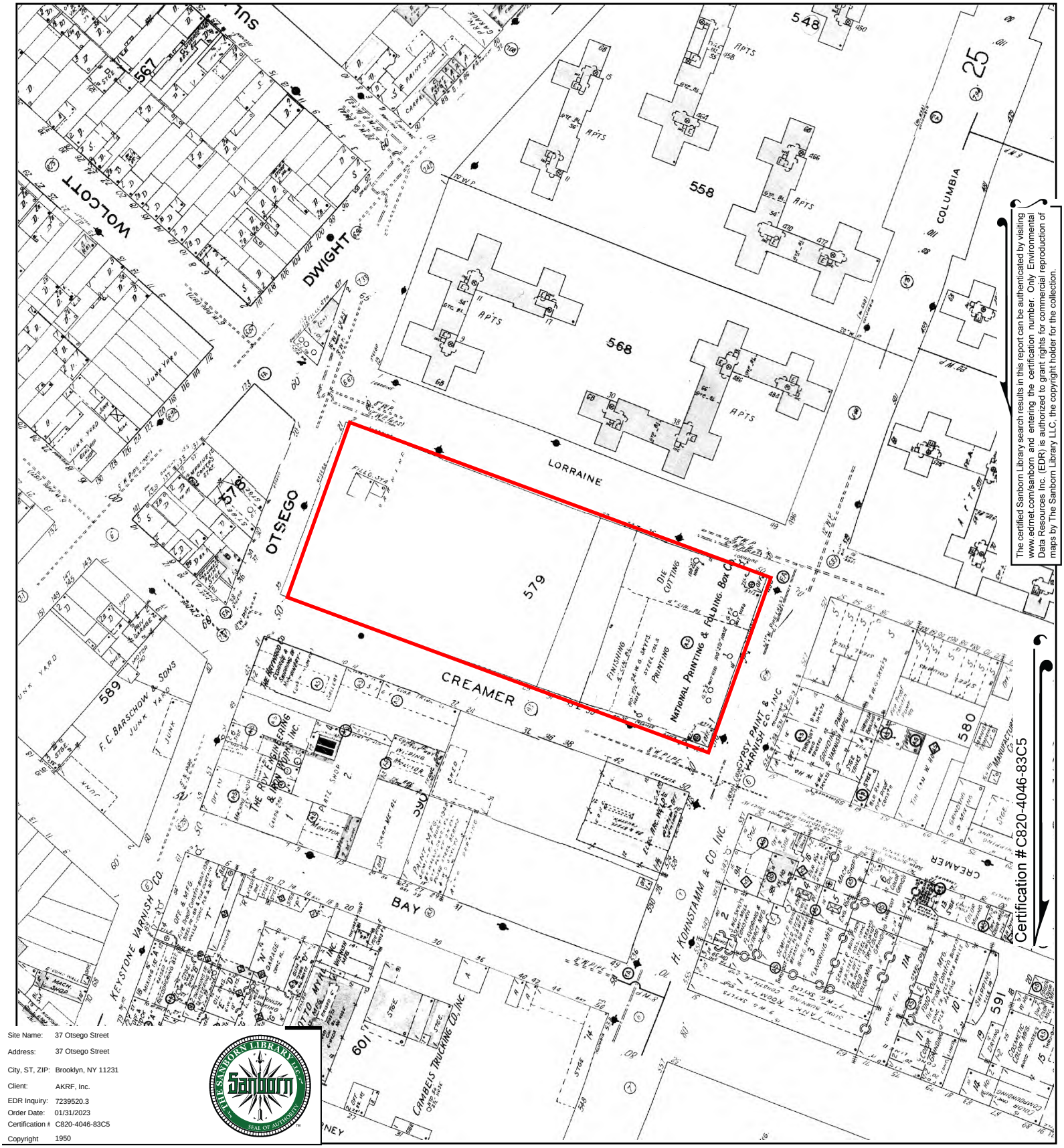

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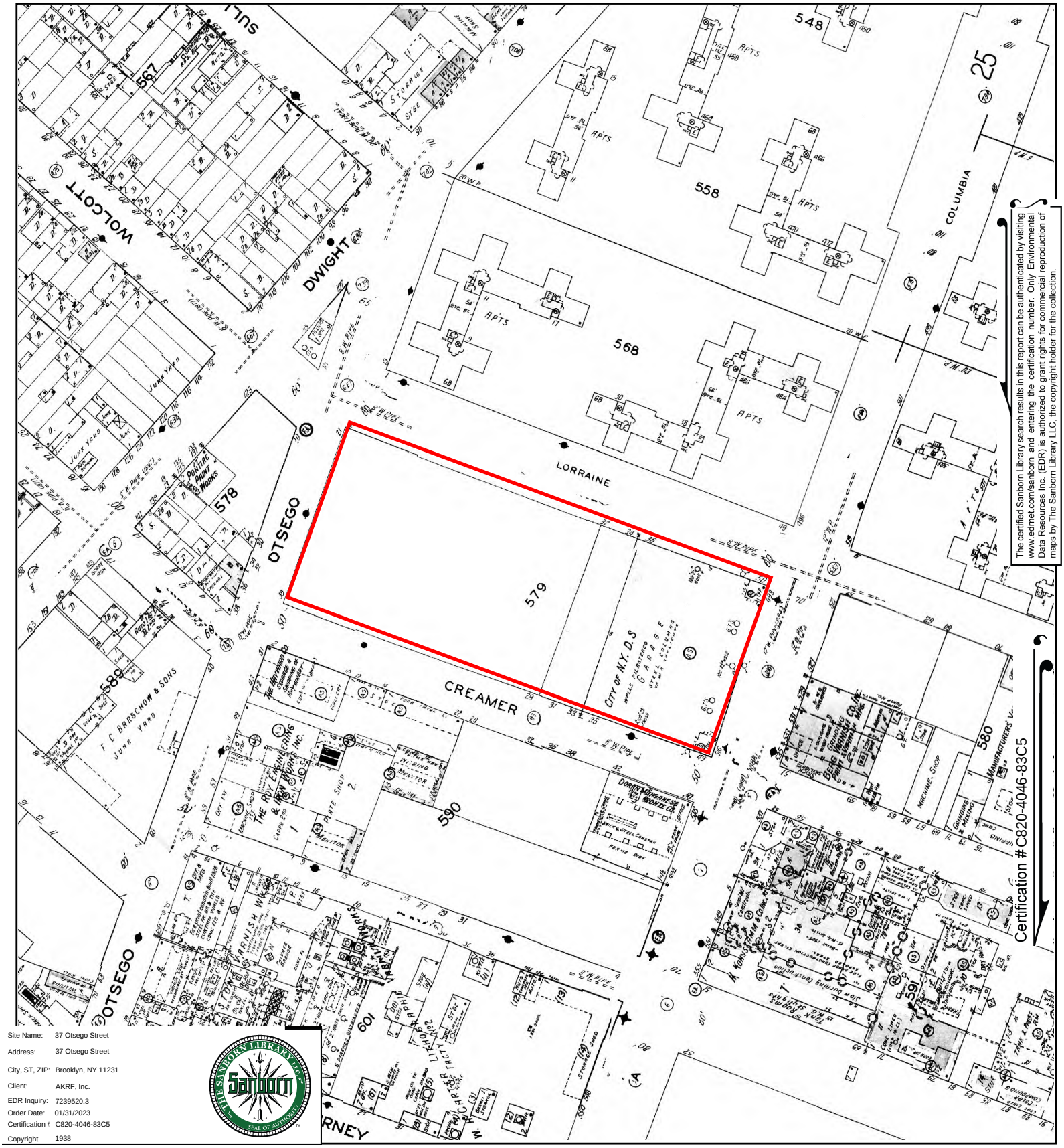

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Copyright	1938

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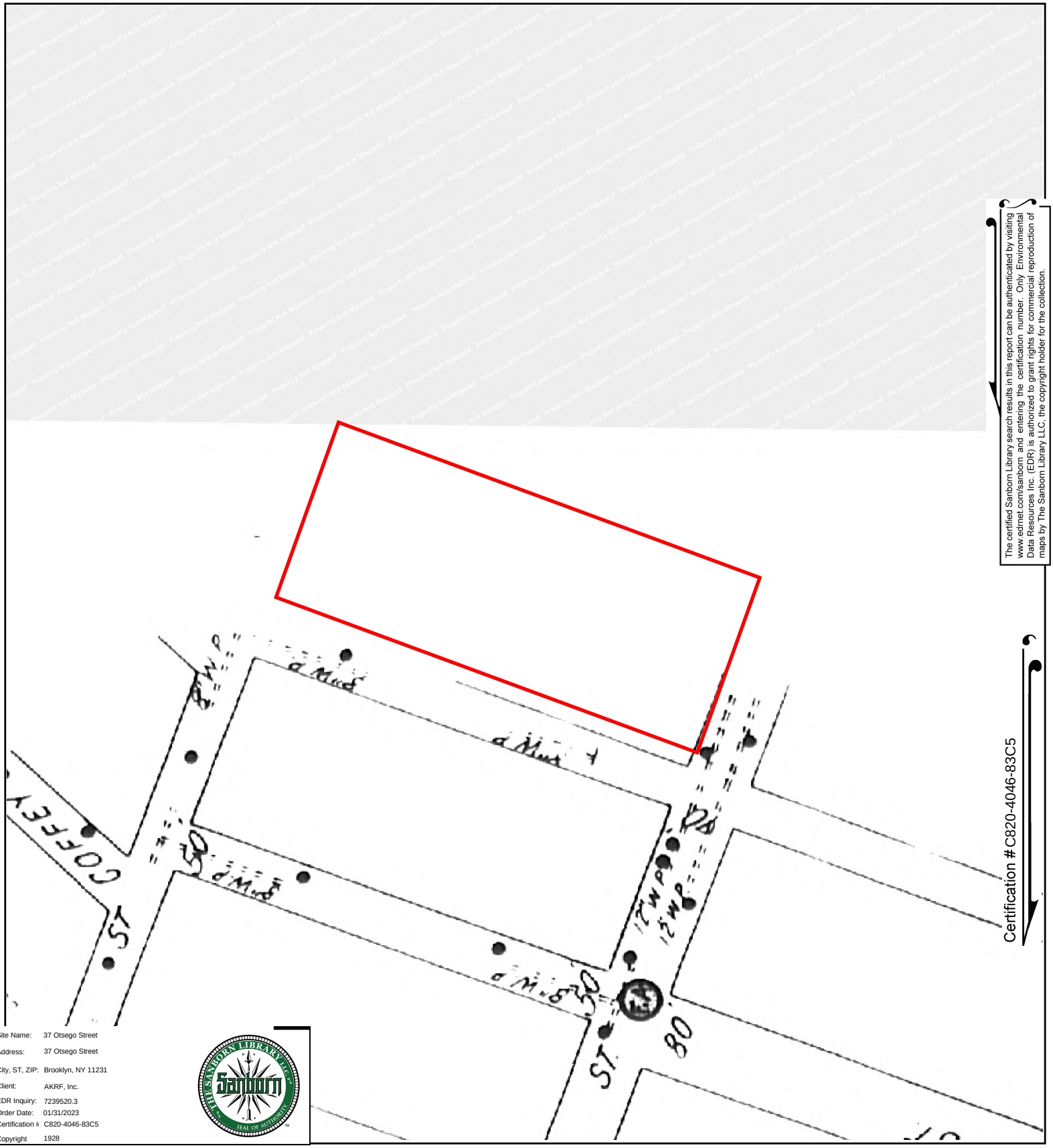

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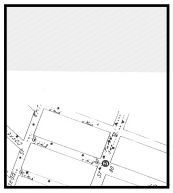

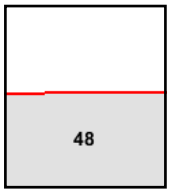

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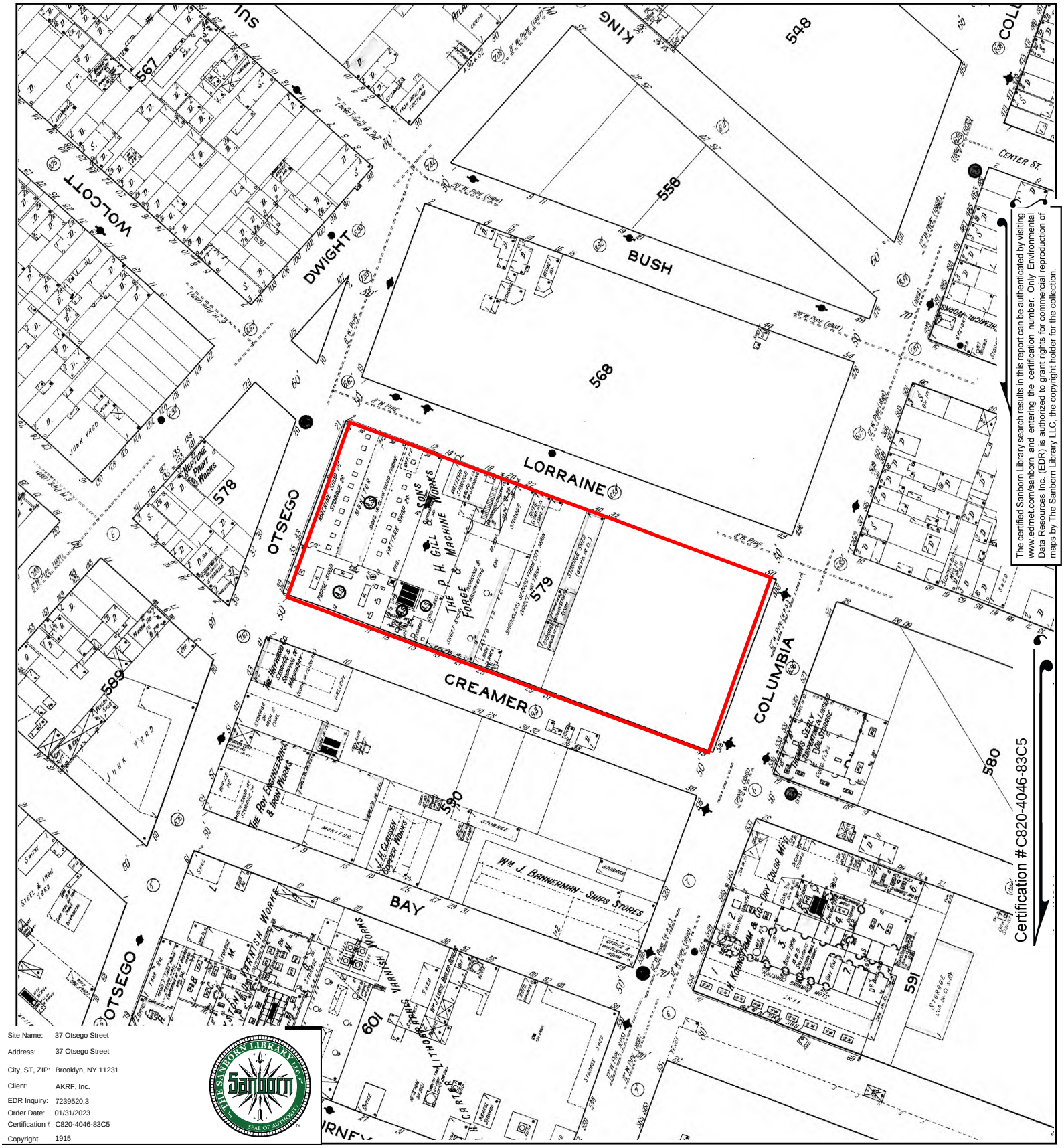

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City, ST, ZIP:	Brooklyn, NY 11231
Client:	AKRF, Inc.
EDR Inquiry:	7239520.3
Order Date:	01/31/2023
Certification #:	C820-4046-83C5
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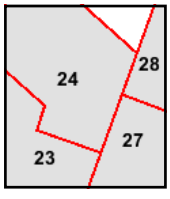

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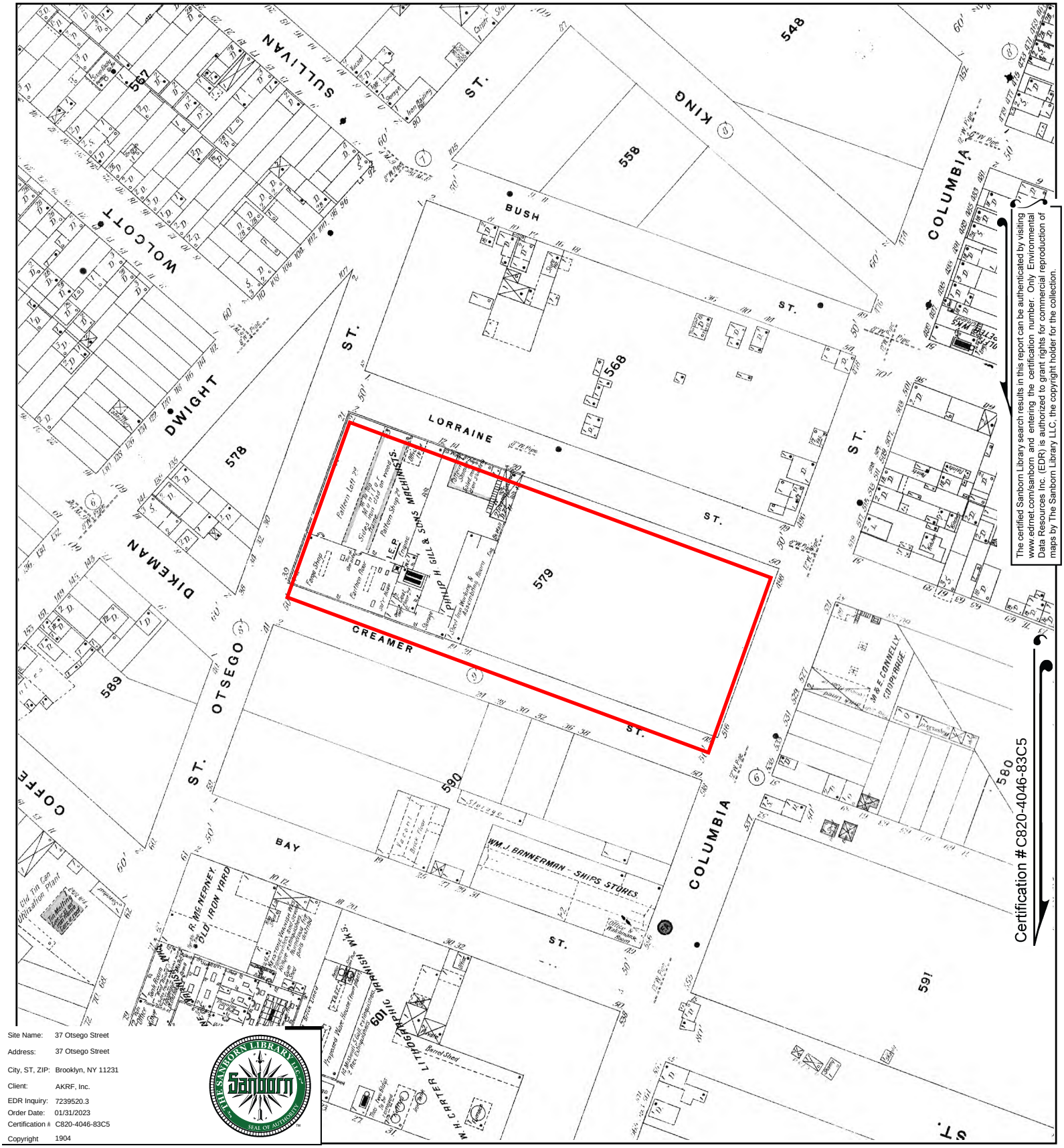

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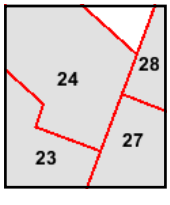

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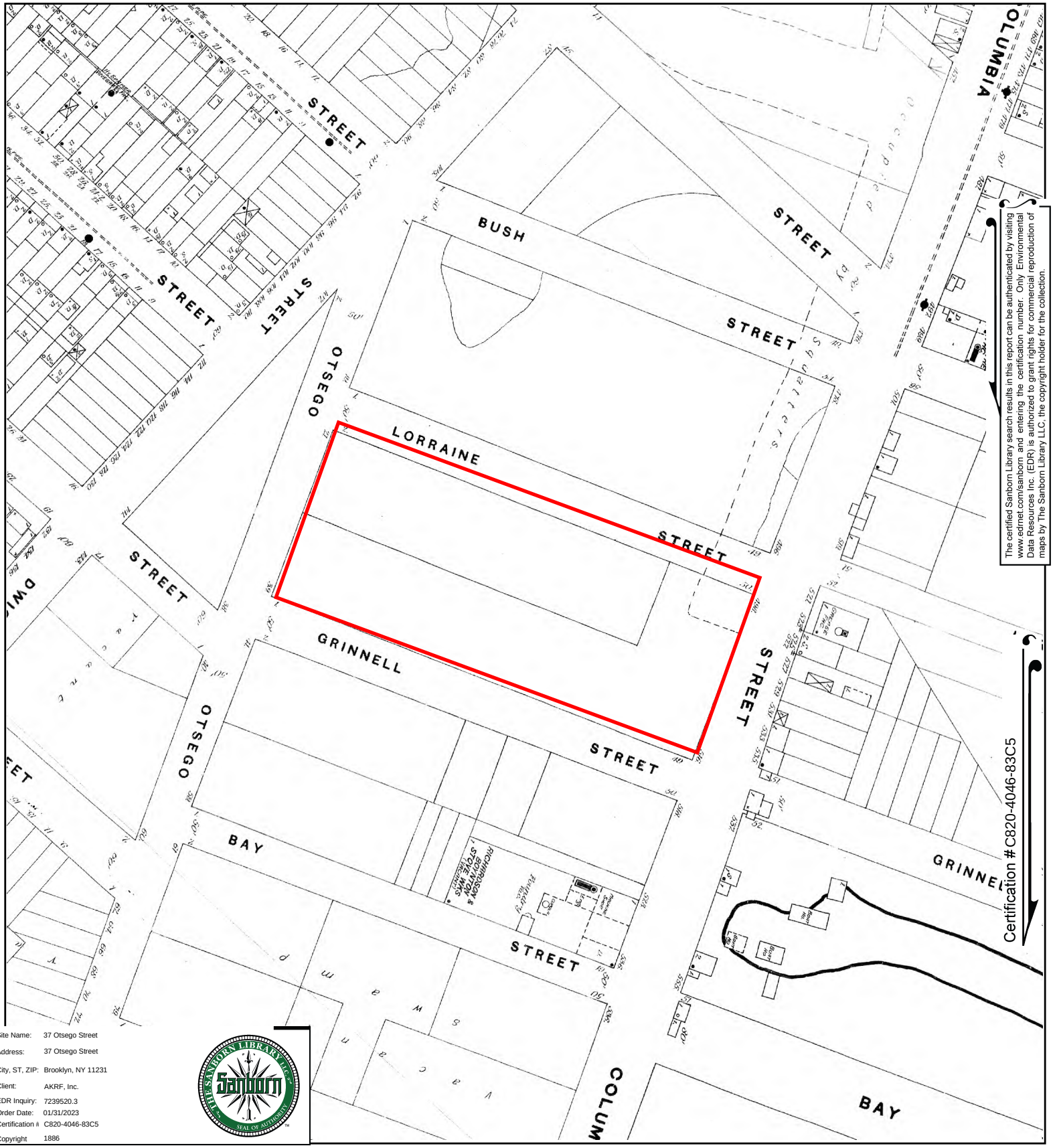

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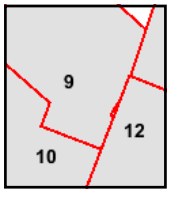

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APPENDIX E

STANDARDS, CRITERIA, AND GUIDANCE

APPENDIX E

1.0 SCGS FOR SITE CHARACTERIZATION AND REMEDIAL INVESTIGATION

The following standards and criteria typically will apply to Site Characterizations and Remedial Investigations conducted in New York State:

- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes
- 6 NYCRR Part 375 – Environmental Remediation Programs
- 6 NYCRR Parts 700-706 - Water Quality Standards
- 6 NYCRR Part 182 - Endangered & Threatened Species of Fish & Wildlife
- 6 NYCRR Part 608 - Use and Protection of Waters
- 6 NYCRR Part 661 - Tidal Wetlands - Land Use Regulations
- 6 NYCRR Part 663 - Freshwater Wetlands Maps and Classification
- 6 NYCRR Part 257 - Air Quality Standards
- 10 NYCRR Part 5 of the State Sanitary Code - Drinking Water Supplies (May 1998)
- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response
- 6 NYCRR Part 175 - Special Licenses and Permits--Definitions and Uniform Procedures
- PFAS – Concentrations of PFAS in soil and groundwater will be compared to the NYSDEC guidance document titled, *Sampling, Analysis and Assessment Of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs*, issued in April 2023.
- 1,4-Dioxane – Concentrations of 1,4-dioxane in groundwater will be compared to the August 2020 New York State (NYS) Maximum Contaminant Level (MCL) screening level.

The following guidance typically applies to Site Characterizations and Remedial Investigations conducted in New York State:

- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations
- Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (October 1994)
- Technical Guidance for Screening Contaminated Sediments (January 1999)
- Niagara River Biota Contamination Project: Fish Flesh Criteria for Piscivorous Wildlife (July 1987)
- Wildlife Toxicity Assessment for Cadmium in Soils (May 1999)
- Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants
- NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006)
- DER Interim Strategy for Groundwater Remediation at Contaminated Sites in New York State

2.0 SCGS FOR REMEDY SELECTION

The following standards and criteria typically apply to the remedy selection process conducted in New York State:

- 6 NYCRR Part 375 - Environmental Remediation Programs
- 6 NYCRR Part 376 - Land Disposal Restrictions
- 6 NYCRR Part 608 - Use and Protection of Waters
- 6 NYCRR Part 661 - Tidal Wetlands - Land Use Regulations
- 6 NYCRR Part 663 - Freshwater Wetlands - Permit Requirements
- 6 NYCRR Parts 700-706 - Water Quality Standards
- 19 NYCRR Part 600 - Waterfront Revitalization and Coastal Resources

The following guidance typically applies to the remedy selection process conducted in New York State:

- TAGM 4044 - Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills (March 1992)
- TAGM 4051 - Early Design Strategy (August 1993)
- Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook (June 1998)
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels (August 1997)
- Freshwater Wetlands Regulations - Guidelines on Compensatory Mitigation (October 1993)
- Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants
- Technical Guidance for Screening Contaminated Sediments (January 1999)
- USEPA Office of Solid Waste and Emergency Response Directive 9355.047FS Presumptive Remedies: Policy and Procedures (September 1993)
- USEPA Office of Solid Waste and Emergency Response Directive 9355.048FS Presumptive Remedies:
- Site Characterization and Technology Selection for CERCLA sites with Volatile Organic Compounds in Soils (September 1993)
- USEPA Office of Solid Waste and Emergency Response Directive 9355.049FS Presumptive Remedy for CERCLA Municipal Landfills (September 1993)
- *Sampling, Analysis and Assessment Of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs* (April 2023)

3.0 SCGS FOR UNDERGROUND STORAGE TANK CLOSURE

The following standards and criteria typically apply to UST closures conducted in New York State:

- 6 NYCRR Part 612 - Registration of Petroleum Storage Facilities (February 1992)
- 6 NYCRR Part 613 - Handling and Storage of Petroleum (February 1992)
- 6 NYCRR Part 614 - Standards for New and Substantially Modified Petroleum Storage Tanks (February 1992)
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes (November 1998)
- 6 NYCRR Subpart 374-2 - Standards for the Management of Used Oil
- 6 NYCRR Parts 700-706 - Water Quality Standards
- 40 CFR Part 280 - Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks

The following guidance typically applies to UST closures conducted in New York State:

- Spill Response Guidance Manual
- Permanent Closure of Petroleum Storage Tanks
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels (August 1997)
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations
- Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants
- NYSDOH Environmental Health Manual CSFP-530 - “Individual Water Supplies - Activated Carbon Treatment Systems”

4.0 SCGS FOR REMEDIAL ACTION

The following standards and criteria typically apply to Remedial Actions conducted in New York State:

- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response
- 40 CFR Part 144 - Underground Injection Control Program
- 10 NYCRR Part 67 – Lead
- 12 NYCRR Part 56 - Industrial Code Rule 56 (Asbestos)
- 6 NYCRR Part 175 - Special Licenses and Permits--Definitions and Uniform Procedures
- 6 NYCRR Part 361 - Siting of Industrial Hazardous Waste Facilities
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes (November 1998)
- 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998)

- 6 NYCRR Subpart 373-4 - Facility Standards for the Collection of Household Hazardous Waste and Hazardous Waste from Conditionally Exempt Small Quantity Generators (November 1998)
- 6 NYCRR Subpart 374-1 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (November 1998)
- 6 NYCRR Subpart 374-3 - Standards for Universal Waste (November 1998)
- 6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites (as amended January 1998)
- 6 NYCRR Part 376 - Land Disposal Restrictions
- 19 NYCRR Part 600 - Waterfront Revitalization and Coastal Resources
- 6 NYCRR Part 608 - Use and Protection of Waters
- 6 NYCRR Part 661 - Tidal Wetlands - Land Use Regulations
- 6 NYCRR Part 663 - Freshwater Wetlands - Permit Requirements
- 6 NYCRR Parts 700-706 - Water Quality Standards (June 1998)
- 6 NYCRR Part 750 through 758 - Implementation of NPDES Program in NYS ("SPDES Regulations")
- Technical Guidance for Screening Contaminated Sediments (January 1999)

The following guidance typically applies to Remedial Actions conducted in New York State:

- TAGM 4013 - Emergency Hazardous Waste Drum Removal/ Surficial Cleanup Procedures (March 1996)
- TAGM 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels (January 1994)
- TAGM 4059 - Making Changes To Selected Remedies (May 1998)
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels (August 1997)
- Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook (June 1998)
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations
- TOGS 1.3.8 - New Discharges to Publicly Owned Treatment Works
- TOGS 2.1.2 - Underground Injection/Recirculation (UIR) at Groundwater Remediation Sites
- Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants
- State Coastal Management Policies
- OSWER Directive 9200.4-17 - Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (November 1997)
- NYSDOH Environmental Health Manual CSFP-530 - "Individual Water Supplies - Activated Carbon Treatment Systems"

5.0 SCGS FOR SITE MANAGEMENT

The following standards and criteria typically apply to Site Management activities conducted in New York State:

- 6 NYCRR Part 175 - Special Licenses and Permits--Definitions and Uniform Procedures

The following guidance typically applies to Site Management activities conducted in New York State:

- Groundwater Monitoring Well Decommissioning Procedures (May 1995)
- The activity is a component of a program selected by a process complying with the public participation requirements of section 1.10, to the extent applicable.
- NYSDOH Environmental Health Manual CSFP-530 - "Individual Water Supplies - Activated Carbon Treatment Systems"

APPENDIX F

QUALITY ASSURANCE PROJECT PLAN

37 OTSEGO STREET
BROOKLYN, NEW YORK

Quality Assurance Project Plan

BCP Site Number: C224300
AKRF Project Number: 230011

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor
Albany, New York 12233

On Behalf Of:

Columbia SF LLC
670 Myrtle Avenue Suite 438
Brooklyn, New York 11205

Prepared by:

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New York, New York 10016
(212) 696-0670

JUNE 2023

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IN-TEXT TABLES

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of all environmental sampling under the Remedial Action Work Plan (RAWP) at the project site located at 37 Otsego Street in Brooklyn, New York (hereafter referred to as "the Site"). The approximately 100,000-square foot Site is also identified on the New York City Tax Map as Brooklyn Borough Tax Block 579, Lot 1. The objective of the QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) of environmental investigative, sampling, and remedial activities conducted during Site remediation and excavation. Adherence to the QAPP will ensure that defensible data will be obtained while completing the remedial work.

2.0 PROJECT TEAM

The project team will be drawn from AKRF professional and technical personnel and AKRF's subcontractors. All field personnel and subcontractors will have completed a 40-hour training course and updated 8-hour refresher course that meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Part 1910. The following sections describe the key project personnel and their responsibilities.

2.1 Quality Assurance/Quality Control (QA/QC) Officer

The QA/QC Officer will be responsible will be responsible for adherence to this QAPP and will review the procedures with all personnel prior to commencing any fieldwork and conduct periodic Site visits to assess implementation of the procedures. Mr. Marc Godick will serve as the QA/QC officer for the RAWP. Mr. Godick's resume is included in Attachment A.

2.2 Project Manager

The project manager will be responsible for directing and coordinating all elements of the IRM. He will prepare reports and participate in meetings with the Site owner and/or the NYSDEC. Ashutosh Sharma will serve as the project manager for the RAWP. Mr. Sharma's resume is included in Attachment A.

2.3 Remedial Engineer

The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program and will certify in the Final Engineering Report (FER) that the remedial activities were observed by qualified environmental professionals under her supervision and that the remediation requirements set forth in the Remedial Action Work Plan (RAWP) and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. The Remedial Engineer for this project will be Rebecca Kinal, P.E. Ms. Kinal's resume is included in Attachment A.

2.4 Field Team Leader

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP). He will report to the Project Manager on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified, responsible person, able to act professionally and promptly during soil disturbing activities. Stephen Schmid will be the field team leader for the RAWP. Mr. Schmid's resume is included in Attachment A.

2.5 Laboratory Quality Assurance/Quality Control Officer

The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. He/she will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued. He/she will conduct a final check on the analytical calculations and sign off on the laboratory reports. The laboratory QA/QC officer will be determined upon selection of a contract laboratory(s) for the RAWP.

All data will be validated by an independent third-party data validator and data usability summary reports (DUSRs) will be prepared. The third-party data validator will be Lori Beyer of L.A.B. Validation Corporation of East Northrop, New York, and her resume is included in Attachment A.

3.0 STANDARD OPERATING PROCEDURES

The following sections describe the standard operating procedures (SOPs) for the remedial activities performed under the RAWP. During these operations, safety monitoring will be performed as described in the project HASP and all field personnel will wear appropriate personal protective equipment.

3.1 Tank Removal

In the event that tanks are confirmed or encountered at the Site, the tank(s) and any appurtenances will be cleaned, removed and disposed of in accordance with accepted industry standards and applicable Federal, State, and local regulatory agency requirements. Tank and soil removal from the vicinity of discovered underground storage tanks will be conducted in consultation with the NYSDEC.

Typical tank removal procedures are summarized below:

1. Open fill cap or vent pipe and measure for product. Collect a sample of the product. Tank contents will be sampled in accordance with applicable federal, state and local requirements and tested in accordance with the requirements of the receiving facility. Proper disposal of tank contents at an approved facility will be dictated by sample results.
2. Excavate to expose the tank. Vacuum liquid tank contents and pumpable tank bottom residue.
3. Excavate around the tank with care to avoid release of tank and piping contents. Hand excavation around the tank may be necessary. The sides of all excavated areas will be properly stabilized in accordance with OSHA regulations. Continuously monitor the excavated areas in the worker breathing zone for the presence of flammable, toxic or oxygen deficient atmosphere with a photoionization (PID), a combustible gas indicator (CGI), and an oxygen meter, as applicable.
4. Inert the tank of flammable vapors using dry ice and verify using an oxygen meter (less than 7 percent) or other industry-approved method [e.g., National Fire Protection Association (NFPA) and/or American Petroleum Institute (API)]. An access hole will be cut in the tank and the tank will be thoroughly cleaned of residual liquids and sludges.
5. Entry of the tank, if necessary, shall be conducted in conformance with OSHA confined space requirements.
6. Remaining fuels, loose slurry, sludge materials and wastewater will be collected in DOT-approved drums, sampled and analyzed for disposal characterization. After disposal

characterization, waste material will be removed and disposed of in accordance with applicable regulations.

7. Remove the tank and all associated piping from the ground and clean the outside of the tank. The tank and piping will be rendered "not reusable," removed from the Site and disposed of according to applicable regulations with proper documentation. Remove and dispose of all concrete tank support structures or vaults as encountered.
8. After tank removal, examine for evidence of petroleum releases in accordance with NYSDEC requirements.
9. Suspect materials will be field-screened with a PID. If soil contamination is present, excavate and remove contaminated soil from the tank areas in accordance with the RAWP. Material will be excavated until field screening with a PID yields concentrations of less than 20 parts per million (ppm) and until there are no remaining visible signs of contamination or odors. Endpoint sampling will be conducted as directed by the NYSDEC.
10. Photo-document all procedures and record all procedures in a bound field notebook.

3.2 Soil Sampling

3.2.1 Soil Screening

During soil excavation and any potential tank removal activities, the excavated material will be inspected by AKRF field personnel for evidence of contamination (i.e., separate phase liquid, staining, sheening and/or odors) and field-screened using a PID calibrated at the start of each day in accordance with the manufacturer's instructions. In the event that contamination is discovered during excavation, the excavation will be expanded laterally and in depth until there is no evidence of contamination.

3.2.2 Soil Sampling

Depending upon conditions encountered during excavation and monitoring of the Site, soil sampling may be required. Any soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Collect an aliquot of soil from each sampling location and place in a labeled sealable plastic bag. The bag should be labeled with the soil boring number and the depth the sample was collected. Place the plastic bag in a chilled cooler to await selection of samples for laboratory analysis.
- After selecting which samples will be analyzed in the laboratory, fill the required laboratory-supplied sample jars with the soil from the selected sampling location or labeled sealable plastic bags. Seal and label the sample jars as described in Section 4.6.1 of this QAPP and place in an ice-filled cooler.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.5 of this QAPP.
- Record boring number, sample depth and sample observations (evidence of contamination, PID readings, soil classification) in field log book and boring log data sheet, if applicable.

3.3 Excavation Backfill

Any imported soil will meet the backfill and cover soil quality standards established in 6 NYCRR 375-6.7(a). Approval will also be based on an evaluation of the land use, protection of groundwater, and protection of ecological resources criteria. Soil will be considered appropriate for use as on-site imported backfill if contaminant concentrations are below the lesser of the 6 NYCRR Part 375 Restricted Residential Use Soil Cleanup Objectives (RRSCOs) and the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs). Soil that meets the 'exempt' fill requirements under 6 NYCRR Part 360, but does not meet backfill or cover soil objectives for this Site, will not be imported to the Site without prior approval by NYSDEC. Solid waste will not be imported to the Site.

Native material from a virgin quarry source need not be sampled prior to use as backfill on the Site. All other imported material will be tested via collection of one composite sample per 1,000 cubic yards of material from each source. Samples will be analyzed for volatile organic compounds (VOCs) by EPA Method 8260, semi-volatile organic compounds (SVOCs) by EPA Method 8270, target analyte list (TAL) metals by EPA Method 6000/7000 series, polychlorinated biphenyls (PCBs) by EPA Method 8082, pesticides by EPA Method 8081, 1,4-dioxane by EPA Method 8270, and per- and polyfluoroalkyl substances (PFAS) compounds by EPA Method 1633.

3.4 Materials Reuse On-Site

If required, soil that does not exhibit evidence of contamination during field screening, and is free of demolition debris will be stockpiled and tested at a frequency of one sample per 1,000 cubic yards and characterized if reuse is contemplated. Organic matter (wood, roots, stumps, etc.) or other solid is prohibited for reuse on-site. Each sample will be tested for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, TAL metals by EPA Method 6000/7000 series, 1,4-dioxane by EPA Method 8270, and PFAS compounds by EPA Method 1633. Samples will be shipped to the laboratory with appropriate chain of custody documentation. The samples will be analyzed in a laboratory following New York State Department of Health (NYSDOH) Analytical Services Protocol (ASP) Category B deliverables.

3.5 Decontamination of Sampling Equipment

All non-disposable sampling equipment (hand augers, sampling spoons, etc.) will be either dedicated or decontaminated between sampling locations. The decontamination procedure will be as follows:

1. Scrub using tap water/Alconox® mixture and bristle brush.
2. Rinse with tap water.
3. Scrub again with tap water/Alconox® and bristle brush.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment, if possible.

Decontamination will be conducted within 5-gallon buckets to capture decontamination water.

4.0 SAMPLING AND LABORATORY PROCEDURES

4.1 Soil Sampling

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Field screen the sample for evidence of contamination (e.g., odors, staining) using visual and olfactory methods and screen for VOCs using a PID equipped with a 10.6 electron Volt (eV) lamp, which has been calibrated to the manufacturer's specifications.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in the field logbook and boring log data sheet, if applicable.
- Collect an aliquot of soil from each proposed sample location, place into the required laboratory-supplied sample containers as described in Section 4.4 of this QAPP, label the sample in accordance with Section 4.6.1 of this QAPP, and place in an ice-filled cooler for shipment to the laboratory.
- Conduct soil sampling for per- and polyfluoroalkyl substances (PFAS) in accordance with the April 2023 *NYSDEC Sampling, Analysis and Assessment Of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs.*
- Complete the chain of custody (COC) paperwork and seal the cooler.
- Decontaminate non-dedicated sampling equipment between sample locations in accordance with Section 3.5 of this QAPP and properly dispose of dedicated sampling equipment.

4.2 Groundwater Sampling

Groundwater sampling will be conducted in accordance with the United States Environmental Protection Agency (EPA) low-flow methodology. Groundwater sampling will be conducted according to the following procedures:

- Remove the well plug and immediately measure the vapor concentrations in the well headspace with a PID equipped with a 10.6 eV lamp, which has been calibrated to the manufacturer's specifications.
- Measure the depth to water and total well depth, and check for the presence of non-aqueous phase liquid (NAPL) using an electronic oil/water interface probe. Measure the thickness of NAPL, if any, and record in the field logbook and field data sheet, if applicable. If present, collect a sample of NAPL using a disposable plastic weighted bailer or similar collection device. Groundwater samples will not be collected from wells containing measurable NAPL.
- Connect dedicated tubing to either a submersible or bladder pump and lower the pump such that the intake of the pump is set at the midpoint of the water column within the screened interval of the well. Connect the discharge end of the tubing to the flow-through cell of a multi-parameter meter (Horiba or equivalent). Connect tubing to the output of the cell and place the discharge end of the tubing in a 5-gallon bucket.
- Activate the pump at the lowest flow rate setting.
- Measure the depth to water within the well once pump is activated. The pump flow rate may be increased such that the water level measurements do not change by more than 0.3 foot as compared to the initial static reading. The well-purging rate should be adjusted to produce a smooth, constant (laminar) flow rate and eliminate excessive turbulence in the well. The

expected targeted purge rate will be approximately 0.5 liters per minute and will be no greater than 3.8 liters per minute.

- Transfer discharged water from the 5-gallon buckets to 55-gallon drums designated for well-purge water.
- During purging, collect periodic samples and analyze for water quality indicators (e.g., turbidity, pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue purging the well until turbidity is less than 50 nephthalometric turbidity units (NTUs) and water quality indicators have stabilized to the extent practicable. The criteria for stabilization will be three successive readings for the following parameters and criteria:
  - Dissolved Oxygen: +/- 0.3 milligram per Liter (mg/L)
  - Turbidity: <50 NTU
  - ORP/Eh: +/- 10 millivolts (mV)
  - Specific Conductance: +/- 3% millisievert per centimeter (mS/cm)
  - PH: +/- 0.1 pH units
- If the water quality parameters do not stabilize and/or turbidity is greater than 50 NTUs within two hours, purging may be discontinued. Efforts to stabilize the water quality for the well must be recorded in the field logbook, and samples may then be collected as described herein.
- After purging, disconnect the tubing to the inlet of the flow-through cell. Collect groundwater samples directly from the discharge end of the tubing, place into the required laboratory-supplied sample containers as described in Section 4.4 of this QAPP, label the sample in accordance with Section 4.6.1 of this QAPP, and place in an ice-filled cooler for shipment to the laboratory.
- Collect one final field sample and analyze for turbidity and water quality parameters (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity).
- Record all measurements (depth to water, depth to NAPL, water quality parameters, turbidity), calculations (well volume), and observations in the field logbook and field data sheet, if applicable.
- Complete the COC paperwork and seal the cooler.
- Once sampling is complete, remove the pump and tubing from the well. Decontaminate non-dedicated sampling equipment between sample locations in accordance with Section 3.5 of this QAPP and properly dispose of dedicated sampling equipment.

4.3 Soil Vapor/Indoor Air/Ambient Air Sampling

If required, the soil vapor/indoor air/ambient air sampling will be conducted in accordance with NYSDOH Final Guidance on Soil Vapor Intrusion, October 2006. Samples will be collected in either Tedlar® bags or SUMMA® canisters. Soil vapor sampling will be conducted as follows:

- Install a shroud over the vapor sampling point tubing and seal to the surface along the perimeter using duct tape or non-VOC putty, as appropriate.
- Puncture the shroud and pull the vapor sampling point tubing through the shroud to allow for sample collection. Seal the puncture as necessary with duct tape or modeling clay.

- Pierce a second hole in the shroud, and insert new, dedicated silicone tubing through the hole, connecting the other end of the tubing to a helium tank/canister to allow introduction of helium tracer gas. Seal the puncture as necessary with duct tape/modeling clay.
- Connect the vapor sampling point tubing to the inlet port of a low-flow air pump (Gilian GilAir Plus or equivalent). Connect the low-flow air pump discharge port to a Tedlar™ bag.
- Calculate and purge the soil gas sampler of approximately three sampling point volumes using the low-flow air pump and Tedlar bag. The air withdrawal flow rate will be maintained to the extent practicable at less than 0.2 liters per minute to better control the physical extent from which soil vapor is being drawn from.
- Field screen the sample within the Tedlar™ bag using a calibrated PID and a helium detector (MGD 2002 or equivalent). If elevated concentrations (greater than 1% or 10,000 parts per million) of helium are detected, inspect the surface seal and add hydrated bentonite/modeling clay or make other necessary modifications to reinforce the seal.
- After purging the vapor sampling point, disconnect the sampling point tubing from the low-flow air pump and plug/cap the tubing prior to conducting the vapor sampling.

Following successful testing of the surface seal, the following procedures shall be implemented to collect each soil vapor sample:

- Connect sampling point tubing to the inlet of the SUMMA® canister flow controller/vacuum gauge assembly, which is calibrated for sample collection over a specified sampling period.
- Open the canister valve and record the initial reading from the vacuum gauge on the assembled canister. Record the corresponding time in the field logbook and field data sheet.
- Begin routine sampling measurement collection, including time, sample canister vacuum, and ambient PID reading in vicinity of sample location. Record the routine measurements in the field logbook and field data sheet.
- At the end of the sampling period and always prior to the canister reaching "zero" vacuum, close the canister valves, remove the flow controller/vacuum gauge assemblies, cap canisters with threaded caps, label the sample in accordance with Section 4.6.1 of this QAPP, and complete the COC paperwork.

Indoor air and ambient air sampling will be conducted as follows:

- Identify sample locations and establish a method of elevating the SUMMA® canisters to approximately 4 feet above grade (approximate breathing level).
- Remove the threaded cap from the inlet port of the canister and install the flow controller/vacuum gauge assembly.
- Open the canister valve and record the initial reading from the vacuum gauge on the assembled canister. Record the corresponding time in the field logbook and field data sheet.
- Begin routine sampling measurement collection, including time, sample canister vacuum, and ambient PID reading in vicinity of sample location. Record the routine measurements in the field logbook and field data sheet.
- At the end of the sampling period and always prior to the canister reaching "zero" vacuum, close the canister valves, remove the flow controller/vacuum gauge assemblies, cap canisters with threaded caps, label the sample in accordance with Section 4.6.1 of this QAPP, and complete the COC paperwork

4.4 Laboratory Methods

Eurofins Environment Testing of Edison, New Jersey, a NYSDOH ELAP-certified laboratory subcontracted to AKRF, will be used for all chemical analyses in accordance with the DER-10 2.1(b) and 2.1(f) with Category B Deliverables. Table 1 summarizes the laboratory methods that will be used to analyze field samples and the sample container type, preservation, and applicable holding times.

Table 1
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil	Volatile Organic Compounds (VOCs)	8260C	(3) EnCore® or TerraCore® Samplers and 2 oz. Plastic Jar	≤ 4 ºC	48 hours to extract, 14 days to analyze
	Semivolatile Organic Compounds (SVOCs)	8270D	8 oz. Glass Jar	≤ 4 ºC	14 days to extract, 40 days to analyze
	Total Analyte List (TAL) Metals	6000/7000 Series, 6010C, and 7196A	8 oz. Glass Jar	≤ 4 ºC	6 months holding time; Mercury 28 days holding time; Hexavalent chromium 30 days to extract, 7 days to analyze
	Pesticides	8081B	8 oz. Glass Jar	≤ 4 ºC	14 days to extract, 40 days to analyze
	Polychlorinated Biphenyls (PCBs)	8082A	8 oz. Glass Jar	≤ 4 ºC	14 days to extract, 40 days to analyze
	1,4-Dioxane	8270D	4 oz. Glass Jar	≤ 4 ºC	14 days to extract, 40 days to analyze
	PFAS	1633	4 oz. HDPE Plastic Jar	≤ 4 ºC	14 days to extract, 40 days to analyze
Groundwater	VOCs	8260C	3 40 mL Glass Vials	HCl to pH < 2 and ≤ 4 ºC	48 hours to extract; 14 days to analyze
	SVOCs	8270D	2,000 mL Amber Jar	≤ 4 ºC	7 days to extract; 40 days to analyze
	TAL Metals	6000/7000 Series, 6010C, and 7196A	2,000 mL Amber Jar	HNO_3 to pH <2	6 months for metals; 28 days for mercury
	Pesticides	8081B	2,000 mL Amber Jar	≤ 4 ºC	7 days to extract; 40 days to analyze
	PCBs	8082A	2,000 mL Amber Jar	≤ 4 ºC	7 days to extract; 40 days to analyze
	1,4-Dioxane	8270D plus Selective Ion Monitoring (SIM)	(2) 250 mL Amber Bottles	≤ 4 ºC	7 days to extract, 40 days to analyze
	PFAS	1633	(2) 250 mL HDPE Plastic Bottles	≤ 4 ºC	14 days to extract, 40 days to analyze
Soil Vapor/Indoor Air/Ambient Air	VOCs	TO-15	6 L SUMMA® Canister or Tedlar™ Bag	None	14 days to analyze

Notes:
EPA – United States Environmental Protection Agency
HDPE – High-Density Polyethylene
QA/QC samples will be submitted for laboratory analysis at a frequency of at least 1 QA/QC sample set per 20 samples per media per sample delivery group (SDG).
Sample frequency will be determined based on the field activity being conducted, as described in the RAWP.

4.5 Quality Control (QC) Sampling

In addition to the laboratory analysis of the samples, additional analysis will be included for QC measures, as required by the Category B sampling techniques. The QC samples will include field blank, trip blank, matrix spike/matrix spike duplicate (MS/MSD), and blind duplicate samples at a frequency of one sample per 20 field samples collected or per sample delivery group (SDG). QC samples will be analyzed for the same parameters as the accompanying samples, with the exception of trip blanks, which will be analyzed for the VOC list only. In addition, an equipment blank sample will also be collected (one per day) during groundwater sampling.

4.6 Sample Handling

4.6.1 Sample Identification

All samples will be consistently identified in all field documentation, COC documents, and laboratory reports. All samples will be amended with the collection date at the end of the sample name in a year, month, day (YYYYMMDD) format. Blind duplicate sample nomenclature will consist of: the sample type, followed by an "X" and a sequential number of the blind duplicate collected within the SDG and the matrix; and trip and field blanks will consist of "TB-" and "FB-", respectively, followed by a sequential number of the trip/field blank collected within the SDG and the matrix. MS/MSD sample nomenclature will consist of the parent sample name only but triplicate sample volume will be collected and the COC comment section will explain that the additional volume is for running the MS/MSD. In accordance with NYSDEC Environmental Quality Information System (EQuIS™) protocol, special characters will not be used for sample nomenclature and sample IDs below 10 will be amended with a "0". Sample nomenclature examples are provided in Table 2.

Table 2
Sample Nomenclature

Sample Description	Sample Designation
Groundwater sample collected from monitoring well MW-01 on June 15, 2023	MW-01_20230615
Blind duplicate groundwater sample collected from monitoring well MW-01 on June 15, 2023	MW-X01_20230615
Field blank associated with sampling event on June 15, 2023	FB-01_20230615

4.6.2 Waste Characterization Soil Sampling

In addition to the nomenclature detailed in Section 4.6.1, waste characterization soil samples will be identified with "WC-", followed by the waste classification grid identification and the depth below grade that the sample was collected from. Five-point composite samples will be amended with "C-" and grab samples will be amended with "G-". Table 3 provides examples of the sampling identification scheme for waste characterization soil samples.

Table 3
Waste Characterization Sample Nomenclature

Sample Description	Sample Designation
Waste classification composite sample collected between grade and 5 feet below grade in grid A1 on June 15, 2023	WC-A1-C_0-5_20230615
Waste classification grab sample collected from 3 feet below grade in grid A1 on June 15, 2023	WC-A1-G_3_20230615

4.6.3 Endpoint Soil Sampling

In addition to the nomenclature detailed in Section 4.6.1, endpoint soil samples will be identified with "EP-", followed by the endpoint sample number in sequential order that it was collected and the depth below grade that the sample was collected from. Table 4 provides examples of the sampling identification scheme for the proposed post-excavation endpoint samples.

Table 4
Endpoint Sample Nomenclature

Sample Description	Sample Designation
Excavation endpoint soil sample EP-01 collected from 15 feet below grade on June 15, 2023	EP-01_15_20230615
Blind duplicate of excavation endpoint soil sample EP-01 collected from 15 feet below grade on June 15, 2023	EP-X01_15_20230615
Second blind duplicate collected from excavation endpoint soil sample EP-21 from 15 feet below grade on June 15, 2023	EP-X02_15_20230615

4.6.4 Hot Spot / Tank Excavation Soil Sampling

In addition to the nomenclature detailed in Section 4.6.1, any confirmatory endpoint soil samples collected from a hot spot excavation or previously unknown tank excavation will be identified by the type of excavation, followed by the excavation grid area, cardinal direction of the sidewall, and the depth below grade that the sample was collected from. The sample(s) collected from the bottom of the excavation will be amended with a "B-", followed by the number of bottom samples collected from the excavation in sequential order and the depth below grade that the sample was collected from. Table 5 provides examples of the sampling identification scheme for any hotspot or tank excavation samples.

Table 5
Hot Spot / Tank Excavation Sample Nomenclature

Sample Description	Sample Designation
Soil sample collected from the northern sidewall of hotspot excavation #1 at 8 feet below grade on June 15, 2023	EX1-N_8_20230615
Soil sample collected from the bottom of hotspot excavation #1 at 10 feet below grade on June 15, 2023	EX1-B_10_20230615

Sample Description	Sample Designation
Blind duplicate of soil sample collected from the eastern sidewall of the hotspot excavation #1 at 8 feet below grade on June 15, 2023	EX-DUP_8_20230615

4.6.5 Import Soil Sampling

In addition to the nomenclature detailed in Section 4.6.1, import soil samples will be identified with "ISP-", followed by the import sample number in sequential order that it was collected. Table 6 provides examples of the sampling identification scheme for import soil samples.

Table 6
Import Sample Nomenclature

Sample Description	Sample Designation
Import soil sample ISP-01 collected on June 15, 2023	ISP-01_20230615
Blind duplicate of import soil sample ISP-01 collected on May June, 2023	ISP-X01_20230615

4.6.6 Soil Vapor, Indoor Air and Ambient Air Sampling (if required)

In addition to the nomenclature detailed in Section 4.6.1, soil vapor samples will be identified with "SV-", indoor air samples will be identified with "IA-", and ambient air samples will be identified with "AA-" followed by the import sample number in sequential order that it was collected. Table 7 provides examples of the sampling identification scheme for import soil samples.

Table 7
Soil Vapor/Indoor Air/Ambient Air Nomenclature

Sample Description	Sample Designation
Indoor Air sample IA-01 collected on July 15, 2023	IA-01_20230715
Soil Vapor Air sample SV-01 collected on July 15, 2023	SV-01_20230715
Ambient Air sample AA-01 collected on July 15, 2023	AA-01_20230715

Sample Labeling and Shipping

All sample containers will be affixed with labels containing the following information:

- Project identification, including Site name, BCP Site number, Site address;
- Sample identification;
- Date and time of collection;
- Analysis(es) to be performed; and
- Sampler's initials.

Once the samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. All

samples will be shipped to the laboratory at least twice per week. At the start and end of each workday, field personnel will add ice to the cooler(s) as needed.

The samples will be prepared for shipment by placing each sample in laboratory-supplied glassware, then wrapping each container in bubble wrap to prevent breakage, and adding freezer packs and/or fresh ice in sealable plastic bags. The COC paperwork will be properly completed by the sampler in ink, and all sample shipment transactions will be documented with signatures, and the date and time of custody transfer. Samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. All coolers shipped to the laboratory will be sealed with mailing tape and a COC seal to ensure that the samples remain under strict COC protocol.

Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC paperwork. The COC paperwork will contain the following information: project name; names of sampling personnel; sample number; date and time of collection; sample matrix; signatures of individuals involved in sample transfer; and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

Field Instrumentation

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the Site for referencing proper operation, maintenance, and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate, and corrective actions taken. The PID will be equipped with a 10.6 eV lamp and will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas in accordance with the manufacturer's standards.

Quality Assurance (QA)

All soil, groundwater, and soil vapor/indoor/ambient air laboratory analytical data will be reviewed by a third-party validator and DUSRs will be prepared to document the usability and validity of the data. The Final Engineering Report (FER) will include a detailed description of endpoint sampling activities, data summary tables, concentration map showing endpoint sample locations and concentrations, DUSRs, and laboratory reports.

ATTACHMENT A

RESUMES OF PROJECT QA/QC OFFICER, REMEDIAL ENGINEER, PROJECT MANAGER, FIELD TEAM LEADER, AND THIRD-PARTY DATA VALIDATOR

MARC S. GODICK, LEP

SR. VICE PRESIDENT

Marc S. Godick, a Senior Vice President of the firm, has over 30 years of experience in the environmental consulting industry. Mr. Godick has broad-based environmental experience includes expertise in brownfield redevelopment, site assessment, remedial investigation, design and implementation of remedial measures, compliance assessment, and litigation support.

Education

M.E., Engineering Science/Environmental Engineering, Pennsylvania State University, 1998

B.S., Chemical Engineering, Carnegie Mellon University, 1989

Licenses/Certifications

Licensed Environmental Professional (License # 396) – State of Connecticut – 2003 - Present

40 Hour HAZWOPER and Annual Refresher Training, 1990 - Present

Supervisors of Hazardous Waste Operations (8 Hour), 1990

Professional Memberships

Chairman, Village of Larchmont/Town of Mamaroneck Coastal Zone Management Commission, 1997 – Present

Member, Westchester County Stormwater Advisory Board, 2011 – Present

Chairman/Member, Westchester County Soil and Water Conservation District, 2005 - 2010

Board of Directors, Sheldrake Environmental Center, Larchmont, New York, 2006 - 2008

Member, NYSDEC Risk-Based Corrective Action (RBCA) Advisory Group for Petroleum-Impacted Sites, 1997

Community Leadership Alliance, Pace University School of Law, 2001

Years of Experience

Year started in company: 2002

Year started in industry: 1990

RELEVANT EXPERIENCE

New York City Department of Design and Construction, East Side Coastal Resiliency, Manhattan, NY

Mr. Godick leads the environmental investigation and related support for a multidisciplinary design team selected by the New York City agency partnership of DDC, DPR, and ORR for the Feasibility Study and Pre-Scoping Services for East Side Coastal Resiliency (ESCR) project. The AKRF Team is providing design services, for 100+ year storm protection with anticipated sea level rise along the east side of Lower Manhattan. The ESCR subsurface exploration program involved a review of available utility plans and environmental reports involving manufactured gas plant (MGP) and potential petroleum-related contamination along a 2.5 mile study area from Montgomery Street to East 25th Street to develop a Subsurface Investigation Work Plan, which was approved by the NYCDEP.

The program included both public and private utility mark-out services across vast areas of the project site containing critical infrastructure to enable the installation of numerous shallow and deep borings and groundwater wells. Mr. Godick supervised the implementation of the investigation, which was completed in two phases. He was also responsible for the interpreting the wide-range of chemical parameters to evaluate critical cost and environmental impacts for the City and design team, and to prepare technical reports for submission and approval by the NYCDEP to satisfy for City Environmental Quality Review (CEQR) requirements. In addition, he continues to support the design and environmental review team, including preparation of the Hazardous Materials chapter for the Environmental Impact Statement, estimating cost impacts to the project for design and cost

recovery purposes, and developing a Soil Management Plan. Mr. Godick also managed a hydrogeologic modeling study to evaluate potential hydraulic and contaminant migration impacts associated with construction of the proposed flood control structure. Mr. Godick continues to coordinate with the NYC team, NYSDEC, and Con Edison to ensure that the design incorporates appropriate remedial measures to be implemented prior to and/or in conjunction with construction.

Remedial Design, Gowanus Canal First Street Turning Basin, New York City Department of Design and Construction (DDC)

Mr. Godick is managing the remedial design for restoration of the filled-in former First Street Turning Basin in Brooklyn, New York. The remediation is being conducted as part of an Order of Consent between the City of New York and EPA for the Gowanus Canal Superfund Site. The remedial design will include removal of fill and sediment within the fill-in basing in an approximately 475-foot by 50-foot area. The restored basin will provide enhanced waterfront access to the community and a boat launch for canoes and kayaks. Design considerations include geotechnical concerns related to adjacent buildings and new and existing bulkheads; soil and water management; landscape design; and access/construction logistics. The design in anticipated to be completed in late 2017.

Remediation & Litigation Support, 3200 Jerome Avenue, Bronx, NY (Former PS 151)

Mr. Godick managed the investigation and remediation of a former public school in the Bronx under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP). The site was contaminated with trichloroethylene (TCE) from historic operations at the property prior to use as a school. The remedial investigation included soil, groundwater, and vapor intrusion assessment both on-site and off-site. The remedial design included excavation of the source area, in-situ chemical oxidation of groundwater, and installation of a sub-slab depressurization system (SSDS) to address to potential vapor intrusion. Implementation of the remedy was complete in late 2014. The completed remediation allows for future multi-family residential, educational, childcare, and/or medical uses. Mr. Godick also provided litigation support in connection with a cost recovery claim against the former operator of the site.

Remediation & Litigation Support, Queens West Project, Avalon Bay Communities, Queens, NY

For over 20 years, AKRF has played a key role in advancing the Queens West development, which promises to transform an underused industrial waterfront property into one of largest and most vibrant mixed-use communities just across the East River from the United Nations. AKRF prepared an Environmental Impact Statement (EIS) that examines issues pertaining to air quality, land use and community character, economic impacts, historic and archaeological resources, and infrastructure. As part of this project, Mr. Godick managed one of the largest remediation projects completed under the NYSDEC BCP at the time that was contaminated by coal tar and petroleum. The remedy included the installation of a hydraulic barrier (sheet pile cut off wall), excavation of contaminated soil under a temporary structure to control odors during remediation, a vapor mitigation system below the buildings, and implementation of institution controls. The investigation, remediation design, and remedy implementation, and final sign-off (issuance of Certificate of Completion) were completed in two years. Total remediation costs were in excess of $13 million. Following completion of the remediation, Mr. Godick developed a cost allocation model and provided litigation support for a cost recovery action against a former operator of the site, including participation in a deposition as a fact witness prior to settlement between the parties.

On-Call Environmental Consulting Services (Various Locations), New York City Mayor's Office of Environmental Remediation (OER) (administered by NYCEDC)

Mr. Godick is managing an on-call contract with the OER for brownfields environmental assessment and remediation. The work has included conducting Phase I environmental site assessments (ESAs) and multi-media sampling of soil, groundwater, and soil vapor for various sites funded by EPA grants. The work plans and investigation reports were completed in accordance with OER and EPA requirements. AKRF also developed a remedial plan for a former gas station site in the Bronx and implemented a remedial plan for capping a park site in Staten Island. In addition, Mr. Godick is providing support to OER and an affordable housing developer to expedite an application for entry into the New York State Department of Environmental Conservation

(NYSDEC) Brownfield Cleanup Program (BCP), as well as preparation and implementation of the remedial investigation and remedial plan.

On-Call Environmental Consulting (Various Locations), New York City School Construction Authority

Mr. Godick is managing an on-call contract with the SCA for environmental assessment, remedial design, and plumbing disinfection. For new school sites, initial due diligence involves conducting Phase I environmental site assessments (ESAs) and multi-media sampling of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school and remediation requirements and associated costs. Once design for a school is underway, AKRF would prepare remediation plans and construction specifications and oversee the construction activities. For existing school sites, the work can involve conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, investigation and remediation of spills, and development of remediation cost estimates. AKRF also oversees plumbing disinfection work, which is required prior to new plumbing being placed into service. The assignments involve reviewing and commenting on disinfection plans, supervision of the disinfection and confirmation testing, and preparation of a report documenting the work was conducted in accordance with the specifications and applicable requirements. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours. Mr. Godick also manages AKRF's potable water sampling (for lead) work for SCA, including providing recommendations for mitigating exceedances.

Remediation, Former Industrial Laundry/Dry Cleaning Plant, 2350 Fifth Avenue. New York, NY

Mr. Godick managed the assessment, cleanup and post-remedial operations, maintenance and monitoring of the only NYSDEC listed inactive hazardous waste (State Superfund) site in Manhattan, a former laundry/dry cleaning plant in Harlem. Remedial investigation included evaluation of soil, groundwater, soil vapor, indoor air, and building materials. Interim remediation included the removal of contaminated building materials and operation of a sub-slab vapor extraction system retrofitted into the existing building. Mr. Godick coordinated with the regulatory agencies, site owner and occupants; and managed the investigation, remedial design, and remedial implementation activities. Phase 1 of the Remedial Action Work Plan consisted of further removal of contaminated building materials. Phase 2 of the remediation included a sub-slab depressurization system (SSDS) retrofitted into the existing building, soil vapor extraction (SVE) system, and chemical oxidation injection. Remedial action work was completed in 2014 and documented in a Final Engineering Report. NYSDEC issued Certificate of Completion in January 2015 and the site has been reclassified to a "Class 4" site (site properly closed – requires continued management). Mr. Godick continues to manage the project, including operations, maintenance and monitoring of the SSDS and SVE system under the NYSDEC-approved Site Management Plan.

606 West 57th Street, New York, NY, TF Cornerstone

AKRF has been retained by TF Cornerstone to provide environmental services for the proposed redevelopment of a portion of the block bounded by Eleventh and Twelfth Avenues and West 56th and 57th Streets. The proposed actions included a zoning map amendment, zoning text amendments, a special permit, and an authorization to facilitate development of approximately 1.2 million square feet of residential and retail space. AKRF prepared an Environmental Impact Statement (EIS) for the New York City Department of City Planning (DCP) to analyze the effects of the proposed actions and development of the proposed building. The EIS addressed the full range of environmental impacts associated with the proposed development.

Mr. Godick was responsible for the elements of the EIS pertaining to hazardous materials, including coordination of a Phase I ESA and summarizing pertinent site information for the hazardous materials and construction chapters. Mr. Godick provided pre-acquisition support to TF Cornerstone, which included development of a remedial cost estimate report to outline remediation cost during site development. Mr. Godick also managed work related to the subsurface investigation, localized remediation (chemical injection and limited excavation beneath the building basement) and regulatory closure of a petroleum spill on a portion of the project site to satisfy NYSDEC requirements. After EIS certification, Mr. Godick coordinated approvals with NYCOER, the regulatory agency overseeing remedial measures related to the redevelopment of the site. The Site has an (E) Designation and is participating in the New York City Voluntary Cleanup Program. Mr. Godick managed the preparation of a Phase II Investigation Work Plan, Remedial Investigation Report, Remedial Action Work Plan (RAWP), and contractor

specifications for soil management and tank and hydraulic lift removal. Mr. Godick managed implementation of the remediation in accordance with the RAWP.

164 Kent Avenue, Brooklyn, NY (AKA Northside Piers and 1 North 4th Place), RD Management, L&M Development, Toll Brothers, and Douglaston Development

The project was a multi-phase development consisting of a large waterfront block in the Williamsburg Rezoning Area. The project site has been developed with a mixed-use residential-commercial high rise towers with an esplanade and a pier along the East River. AKRF provided acquisition and development support, including performing Phase I and II environmental site assessments and development of remedial cost estimates for development, and preparation of Remedial Action Plans (RAPs) and Construction Health and Safety Plan (CHASPs) for approval by DEP and OER. AKRF provided assistance with construction oversight during soil handling activities and managing the Community Air Monitoring Plan (CAMP) activities. Closure reports were prepared and the project is fully built-out and occupied.

Site Investigation–Over 20 Facilities, Con Edison, New York, NY

Mr. Godick managed site investigations associated with petroleum, dielectric fluid, and PCB releases at over 20 Con Edison facilities including service centers, substations, generating stations, and underground transmission and distribution systems. Site investigations have included due diligence site reviews, soil boring installation, monitoring well installation, hydrogeologic testing, and water quality sampling. Risk-based closures were proposed for several sites.

Underground Storage Tank Closure and Site Remediation–Program Management, Con Edison, New York, NY

Mr. Godick provided technical assistance to Con Edison in developing technical submittals and budgets associated with tank closures at over 50 facilities. Technical summaries were prepared for submittal of contractor-prepared closure reports to the NYSDEC. The summaries included a review of historic pre-closure assessments, tank closure data, and provided recommendations for additional assessment, remediation or closure. Subsequently, a three-year program budget was developed for implementation of the UST investigation/remedial program, which Con Edison utilized for internal budgeting purposes.

Site Investigation–7 World Trade Center Substation, Con Edison, New York, NY

Mr. Godick managed the site investigation at the former 7 World Trade Center Substation in an effort to delineate and recover approximately 140,000 gallons of transformer and feeder oil following the collapse of the building. The project involved coordination with several crews, Con Edison, and other site personnel.

Site Investigation–Former Manufactured Gas Plant (MGP) Facilities, Con Edison, New York, NY

Mr. Godick managed site investigations at four former manufactured gas plant (MGP) facilities. The investigations were completed at Con Edison substations, a flush pit facility, and a service center to support remedial design and expansion at select locations. The findings from these characterizations were used by Con Edison to make appropriate changes to the design specifications and to plan for appropriate handling of impacted materials and health and safety protocols during future construction activities.

National Grid – Halesite Manufactured Gas Plant Site Remediation, Town of Huntington, NY

Mr. Godick managed the remedial design and engineering work associated with remediation of National Grid's former MGP located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surrounded by commercial and residential properties, and half the property where the remediation was conducted was a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Mr. Godick was responsible for the development of the remedial work plans, design/construction documents, landscape architecture, confirmatory sampling, air monitoring, supervision, and preparation of close-out documentation in accordance with NYSDEC requirements.

Verizon, Investigation & Remediation, Various Locations, NY, PA and DE

Mr. Godick managed over 50 environmental investigations and remediation projects related to petroleum releases at various facilities. Responsibilities included annual budgeting, day-to-day project management, development and

implementation of soil and ground water investigation workplans, ground water modeling, risk evaluation, remedial action work plans, remedial design, system installation, waste disposal, well abandonment, and operation and maintenance. Many of the assessment and remedial projects followed a risk-based approach. Remedial technologies implemented included air sparging, soil vapor extraction, bioremediation, pump and treat, soil excavation, and natural attenuation.

Storage Tank Management, Verizon, Various Locations, NY, PA, DE, and MA

Mr. Godick managed the removal and replacement of underground and aboveground storage tank systems for Verizon in New York, Pennsylvania, Delaware, and Massachusetts. Responsibilities included the management of design, preparation of specifications, contractor bidding, construction oversight, project budget, and documentation. For selected AST sites, managed the development of Spill Control, Contingency and Countermeasures (SPCC) plans.

Litigation Support, Cost Recovery Action, Gowanus Superfund Site, New York

Mr. Godick provided technical support to one of the 40+ potential responsible parties (PRPs) associated with a Federal Superfund site in New York State, which included conducting a liability assessment for the various parties and development of a cost allocation model.

Litigation Support, Cost Recovery Action, New York State Superfund Site

Mr. Godick provided technical support for the former owner of a New York State Superfund site in upstate New York. The owner of the property brought a cost recovery action against our client as a PRP. Mr. Godick completed a technical review of the draft Remedial Investigation/Feasibility Study prepared by the opposing party's consultant to develop a more cost effective remedial strategy and to better position the client for liability allocation as part of future settlement negotiations. Mr. Godick also developed a cost allocation report that included a model for settlement negotiations, as well as participated in mediation.

Litigation Support & Remediation, Former Service Station, Brooklyn, New York

Mr. Godick took over management of remediation of an inactive service station (formerly conducted by another firm). His approach outlined additional characterization and remediation efforts which resulted in successful closure of the spill by NYSDEC within two years. Mr. Godick testified as an expert witness at a hearing in the New York State Supreme Court of Kings County to determine the adequacy of the remediation efforts.

Litigation Support, Cost Recovery Action, Town of Carmel, New York

Mr. Godick served as an expert witness representing the owner of a property in a landlord-tenant dispute, which was used as a gasoline station and oil change facility. Mr. Godick prepared exhibits, testified, and participated in meetings with NYSDEC to support the landlord's claim that the oil change tenant's practices were poor and were adversely affecting the environment and the overall facility systems at the site.

Litigation Support, Cost Recovery Action, New York State Petroleum Spill Site, New York, NY

Mr. Godick provided technical support for the former owner of a New York City multi-unit residential apartment building. The State of New York brought a cost recovery action against our client as a result of a previous spill from a former underground storage tank. Mr. Godick reviewed invoices and project documentation to dispute work performed by the NYSDEC, which provided the basis for settlement at a fraction of the initial claim.

Litigation Support, Class Action Lawsuit, Confidential Client, NJ

Mr. Godick provided technical support for a class action suit involving a petroleum-impacted community water supply in southern New Jersey. The technical assistance included analysis of expert testimony and coordination with legal counsel in preparing for cross-examination of the opposing party's lead expert witness.

Cost Analysis, Environmental Insurance Claims, Various Locations

Mr. Godick provided technical support for cost analyses completed for a large national insurance company related to several former MGP and other industrial sites. Responsibilities included evaluation and development of cost-effective remedial strategies, as well as compilation of detailed costs for remedial action implementation and closure.

REBECCA KINAL, P.E.

VICE PRESIDENT

Rebecca Kinal has over 20 years of experience in the assessment and remediation of soil and groundwater contamination and other hazardous/non-hazardous waste problems. Ms. Kinal's experience includes environmental due diligence, soil and groundwater investigations, leaking underground storage tank studies, soil gas/vapor intrusion surveys, and oversight of small- and large-scale remediation programs, including design of groundwater remediation systems and vapor mitigation systems. She has directed numerous Phase I and Phase II investigations and remediation programs, many of them in conjunction with commercial/residential developers, law firms, lending institutions, and public agencies. She is experienced in the cleanup of contaminated properties under New York State Brownfield Cleanup Program (BCP) regulations and the New York City "E-designation" program. As a part of this work, her duties have included technical and report review, proposal writing, scheduling, budgeting, and acting as liaison between clients and regulatory agencies, and project coordination with federal, state, and local authorities.

BACKGROUND

Education

M.S., Hydrogeology, Rensselaer Polytechnic Institute, 1995

B.S., Civil Engineering, Lafayette College, 1992

Licenses/Certifications

State of New York, P.E. Registration No. 082046, 2004

Years of Experience

Year started in company: 2000

Year started in industry: 1996

RELEVANT EXPERIENCE

White Plains Mall/Hamilton Green

Ms. Kinal managed environmental due diligence and remediation planning for the project, which included Phase I and II environmental assessments, a petroleum Spill investigation, preparation of remediation cost estimates, and application to the NYSDEC BCP.

New York City School Construction Authority On-Call Contracts for Environmental Consulting Services, Various Sites, NY

Ms. Kinal serves as the project manager for AKRF's on-call hazardous materials consulting contract with the New York City School Construction Authority for over 8 years. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments, (ESAs) and subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plan, contract specifications, and design drawings. The work has also included conducting indoor air quality testing, vapor intrusion assessments, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours.

USTA National Tennis Center, Queens, NY

AKRF prepared an EIS for the New York City Departments of City Planning (DCP) and Environmental Protection (DEP) as co-lead agencies to analyze the expansion of the National Tennis Center, which includes multiple improvements and construction projects at the USTA campus over several years. As part of the EIS requirements, AKRF prepared a Remedial Action Plan for implementation during the proposed project's construction. In accordance with the RAP, vapor mitigation systems were incorporated into the design for several of the proposed structures at the facility, including two new stadiums, a new transportation center, and several practice court facilities. Ms. Kinal prepared the specifications and design drawings for the vapor mitigation and is providing on-going construction support to review contractor submittals and inspect the vapor barrier and sub-slab depressurization system installations.

Montefiore Medical Center, Various Locations, NY

Ms. Kinal provides due diligence assistance to Montefiore Medical Center (MMC) for the ongoing expansion of their facilities, primarily in the Bronx and Westchester County. She conducts and manages environmental due diligence tasks related to their property transactions, including Phase I Environmental Site Assessments (ESAs), Phase II investigations, and geophysical surveys. She also assists MMC in making decisions with respect to environmental risk issues.

Queens West Development Project, Long Island City, NY

For over 20 years, AKRF has played a key role in advancing the Queens West development, which promises to transform an underused industrial waterfront property into one of largest and most vibrant mixed-use communities just across the East River from the United Nations. AKRF has prepared an Environmental Impact Statement that examines issues pertaining to air quality, land use and community character, economic impacts, historic and archaeological resources, and infrastructure. As part of the project, AKRF also undertook the largest remediation ventures completed to date under the NYSDEC Brownfields Cleanup Program (BCP). Ms. Kinal helped prepare the Remedial Work Plan (RWP) and oversaw the remediation of Parcel 9, a 1.8-acre former industrial site. Remediation includes installation of a sheet pile containment wall, excavation of coal tar- and petroleum-contaminated soil under a temporary structure to control odors during remediation, vapor mitigation for the future buildings, and institutional controls. Upon completion of the remediation activities, Ms. Kinal managed the preparation of a Final Engineering Report (FER) to document the clean-up activities. The NYSDEC issued a Certificate of Completion (COC) for the Parcel 9 site in December 2006. Ms. Kinal continues to oversee post-remediation monitoring and site management activities to ensure that the remedy remains in-place and effective.

Roosevelt Union Free School District, Roosevelt, NY

Ms. Kinal managed environmental investigation and remediation activities for the sites of three new elementary schools and a new middle school in Roosevelt, New York. Remediation activities include removal/closure of contaminated dry wells and underground petroleum storage tanks, and excavation and off-site disposal of petroleum- and pesticide-contaminated soil. Remediation of the new middle school site, which also included a sub-slab depressurization system, was conducted through coordination with the NYSDEC, NYSDOH, New York State Education Department (NYSED), and the local school district. Upon completion of the remediation and school construction, Ms. Kinal managed confirmatory indoor air testing and preparation of a Final Engineering Report to document the site clean-up. The NYSDEC issued a Certificate of Completion and the school was open for the Fall 2008 semester as planned.

Proposed NYC Public School Campus, Bronx, NY

Ms. Kinal provided environmental consulting services to the selected environmental remediation contractor for this former manufactured gas plant in the Mott Haven neighborhood of the Bronx, which was remediated under the NYSDEC BCP. These services included: preparation of an in situ sampling plan and excavation plan for waste

characterization and disposal; supervision of waste characterization sampling activities; development and implementation of a community air monitoring program during all remediation activities; and daily reporting to the NYC School Construction Authority.

National Grid – Halesite Manufactured Gas Plant Site, Town of Huntington, NY

Ms. Kinal served as the project manager for the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surround by commercial and residential properties, and half the property where the remediation was conducted is a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Ms. Kinal developed the remedial work plans, design/construction documents, and managed environmental oversight of the remedial work, including waste characterization and tracking, confirmatory endpoint sampling, air monitoring, and reporting to the NYSDEC. After the remediation work was completed, Ms. Kinal prepared appropriate close-out documentation in accordance with NYSDEC requirements.

Shell Service Station, Millwood, NY

Ms. Kinal planned and oversaw a Phase I Environmental Site Assessment and Phase II Subsurface Investigation of this active gasoline station in northern Westchester County. The Phase I/Phase II investigations were performed for the potential buyer of the property who wished to redevelop it with a more modern service station and convenience store. Ms. Kinal also prepared a conceptual remediation plan to address several areas of petroleum contamination identified during the Phase II. The plan, which was approved by NYSDEC, will be implemented in conjunction with the site redevelopment activities to achieve closure for several spills reported at the site.

Pelham Plaza Shopping Center Site Investigation & Remediation, Pelham Manor, NY

Ms. Kinal managed a Site Investigation at Pelham Plaza, an approximately ten-acre site that formerly contained a manufactured gas plant. The site was investigated under a voluntary clean-up agreement entered into with the NYSDEC by the site owner. The site investigation included advancing over 100 soil borings with continuous soil sampling to bedrock, installing monitoring and recovery wells, and conducting test pitting both indoor and outdoor locations to collect soil and groundwater samples and determine the extent of Non-Aqueous Phase Liquid (NAPL). The investigation also included: soil gas sampling to determine contaminant concentrations in the vapors beneath the foundation of an on-site retail store; sediment sampling in an adjacent creek to identify off-site impacts; and a tidal survey to determine tidal influence on groundwater levels at the site. Ms. Kinal also oversaw interim remedial measures, which include biweekly pumping of recovery wells to remove dense NAPL (DNAPL) from the site subsurface.

Shaws Supermarket Redevelopment Project, New Fairfield, CT

Ms. Kinal managed the Remedial Investigation (RI) for an approximately nine-acre shopping center site that was contaminated by releases from former dry cleaning operations. The site was being redeveloped with a new supermarket and separate retail stores. The investigation included the installation of monitoring wells in the intermediate overburden aquifer and bedrock aquifer, sampling of existing and newly installed wells, geophysical logging in bedrock wells, and pump testing in intermediate and bedrock wells. Ms. Kinal prepared a Remedial Action Work Plan (RAWP) based on results from the RI, which included a groundwater pump and treat system to contain a plume of perchlorethylene (PCE)-contaminated groundwater, and excavation and disposal of contaminated soil in the presumed source area. Following CTDEP approval of the RAWP, Ms. Kinal prepared bid specifications for soil excavation and remediation system installation, and oversaw their implementation. Ms. Kinal also prepared NPDES permit applications for discharges from construction dewatering and the groundwater remediation system, and conducted associated discharge monitoring.

Yankee Stadium, Bronx, NY

Ms. Kinal performed the hazardous materials analysis for the Draft Environmental Impact Statement for the proposed new Yankee Stadium. The analysis included a Phase I Environmental Site Assessment of the entire project area and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included geophysical surveys to search for potential underground storage tanks; and soil, soil gas, and groundwater sampling at over 40 locations to determine potential environmental impacts during and after the proposed construction. Ms. Kinal also developed an extensive community air monitoring plan and oversaw its implementation during deconstruction of the old Yankee Stadium.

Avalon on the Sound, New Rochelle, NY

Ms. Kinal oversaw environmental investigation and soil remediation during the construction of two luxury high-rise apartment buildings and an associated parking garage. Investigation activities included an electromagnetic survey to search for possible underground storage tanks, and subsurface sampling to characterize soil and groundwater. Remediation activities included removing underground storage tanks, excavating and disposing of soil contaminated with volatile and semi-volatile organic compounds, and collecting end-of-excavation confirmation samples.

Davids Island Environmental Audit, New Rochelle, NY

Ms. Kinal managed the hazardous materials portion of the audit of this undeveloped island site, including a Phase I Environmental Site Assessment (ESA) and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included collecting soil samples from more than 100 locations and analyzing them for targeted compounds, including volatile organic compounds, semi-volatile compounds, metals, pesticides, and polychlorinated biphenyls (PCBs). Ms. Kinal also oversaw an electromagnetic (EM) survey conducted to identify the location of suspected underground storage tanks on the island. Based on soil sample results, Ms. Kinal estimated the volume of contaminated soil requiring remediation and prepared cost estimates for soil excavation and for transportation and disposal of contaminated soil and hazardous materials.

Outlet City Site Investigation, Queens, NY

Ms. Kinal prepared a work plan for remedial investigation of the Outlet City site, a property in Long Island City that was formerly occupied by a manufacturer of industrial cleaners and pharmaceuticals. The site is being investigated and remediated under the NYSDEC voluntary clean-up program. In preparing the work plan, Ms. Kinal evaluated results from several previous investigations and conducted a limited groundwater sampling program to determine future data needs for designing remediation of creosote-contaminated soil and groundwater. The work plan included additional soil and groundwater sampling, a tidal survey to determine tidal influence on groundwater levels, and pilot free product recovery testing. Ms. Kinal also helped design a venting system for an on-site basement and performed exposure calculations for the vented vapors.

Yonkers Waterfront Redevelopment Project, Yonkers, NY

For this redevelopment along Yonkers' Hudson River waterfront, Ms. Kinal supervised the remediation of Parcels H and I that were contaminated with hazardous soil. During the remediation process, she reviewed the subcontractor health and safety plans, delineated the areas of excavation, and oversaw field activities to ensure compliance with the specifications and appropriate regulations. This property was remediated under the NYSDEC Environmental Restoration Program (ERP).

Ashutosh Sharma

Senior Technical Director

Ashutosh Sharma is an Environmental Scientist with over 15 years of experience in the environmental consulting field. He has managed and implemented investigations and remedial measures for various properties, including those under different regulatory programs such as the New York State Department of Environmental Conservation's (NYSDEC) Voluntary Cleanup Program and Brownfield Cleanup Program, New York State's Spill Response Program, the Mayor's Office of Environmental Remediation (OER) E-Designation Program. Mr. Sharma has extensive experience in Phase I and Phase II (subsurface) site assessment and remedial investigation, remediation and cleanup of contaminated sites, and construction oversight. He has experience with subsurface soil, groundwater and sub-slab air/vapor sampling procedures, coordinating and running Community Air Monitoring Plans (CAMP) and is familiar with relevant United States Environmental Protection Agency (USEPA), New York State Department of Environmental Conservation (NYSDEC), and New York City Department of Environmental Protection (NYCDEP) environmental laws and regulations.

Background

Education

M.S., Environmental Science, New Jersey Institute of Technology, 2007
B.Tech, Dr. B.R. Ambedkar National Institute of Technology, India, 2005

Years of Experience

Year started in industry: 2007
Year started in company: 2007

Relevant Experience

New York City School Construction Authority: On Call Environmental Consulting
Under an on-call contract, AKRF provides the New York City School Construction Authority (NYCSCA) with hazardous materials consulting services. Mr. Sharma has provided assistance with various environmental assessment tasks including Phase II (Subsurface) Environmental Site Investigations (soil, groundwater and soil gas investigations); Indoor Air Quality (IAQ) and Vapor Intrusion (VI) Assessments; and Underground Storage Tank (UST) investigations. He evaluates the results of the investigations in the context of applicable environmental regulations to assist the project manager and/or project engineer in developing recommendations for remedial actions. Mr. Sharma also provided assistance with the lead in drinking water and plumbing disinfection tasks under the current on-call contract. AKRF also oversees plumbing disinfection work, which is required prior to new plumbing being placed into service. The assignments involve reviewing and commenting on disinfection plans, supervision of the disinfection and confirmation testing, and preparation of reports documenting the work was conducted in accordance with the specifications and applicable requirements. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours.

RXR Realty, NY: Multiple Projects

AKRF has worked with RXR Realty on multiple projects and provided services for completion of Phase I Environmental Site Assessments (ESAs), implemented Phase II Environmental Site Investigations (ESI) and soil waste characterization sampling. Mr. Sharma acted as project manager, overseeing field personnel

implementing the Phase I ESA site reconnaissance the subsurface investigations, as well as completing reports for delivery to the client.

Larkin Plaza, Yonkers, NY

RXR SoYo Exalta LLC enrolled in the New York State Brownfield Cleanup Program (NYS BCP) to investigate and remediate the property located at 25 Warburton Avenue in Yonkers, NY. Mr. Sharma assisted the client in preparing the application to enroll the site in the NYS BCP program.. Mr. Sharma acted as the project manager for the project and prepared the Remedial Investigation Work Plan (RIWP). the Remedial Investigation Report (RIR), the Interim Remedial Measure Work Plan (IRMWP), the Remedial Action Work Plan (RAWP), the Interim Remedial Measures Construction Completion Report and the Site Management Plan (SMP) for the BCP site. Mr. Sharma also managed the field implementation of the remedial investigation and site cleanup activities during the development. Mr. Sharma maintained constant communication with the NYS Department of Environmental Conservation (NYSDEC) project manager and the client during the site redevelopment.

810 Fulton Street, Brooklyn, NY

RXR 810 Fulton Owner LLC developed the property located at 810 Fulton Street in Brooklyn. Mr. Sharma acted as project manager, overseeing field personnel implementing the requirements of the NYC Office of Environmental Remediation (OER)-approved Remedial Action Plan (RAP). Mr. Sharma also coordinated with the OER on behalf of the client on the day to day activities during the remedial action. Mr. Sharma also completed reports for delivery to the client and OER.

Lambert Houses, Bronx, NY

988 East 180th Street Housing Development Fund Corporation enrolled in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate the property located at 988 East 180th Street in the Bronx. Mr. Sharma acted as the deputy project manager overseeing field personnel implementing the construction oversight during site redevelopment, and coordinated with the client and their subcontractors. Mr. Sharma prepared the spill investigation work plan, coordinated spill cleanup and prepared the spill closure report to address the petroleum spill encountered during site redevelopment.

Melrose Commons Site C, Bronx, NY

The Bridge Inc. enrolled in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate the property located at 988 East 18th Street in the Bronx. Mr. Sharma acted as the deputy project manager overseeing field personnel implementing the construction oversight during site redevelopment, and coordinated with the client and their subcontractors. Mr. Sharma prepared the remedial closure report for delivery to the client.

Essex Crossing Sites 1, 2, 3, 4, 5, 6, and 8, Manhattan, NY

AKRF provided various services during the redevelopment of the Essex Crossing sites in the lower east of Manhattan. Mr. Sharma acted as the deputy project manager overseeing field personnel implementing the construction oversight during site redevelopment, and coordinated with the client and their subcontractors. Mr. Sharma also coordinated spill cleanups and prepared the spill closure reports to address the multiple petroleum spills encountered during redevelopment. Mr. Sharma also coordinated with the client and the New York City Department of Housing & Preservation (HPD) during the implementation of the NYC Department of Environmental Protection (DEP)-approved Remedial Action Plan (RAP). Mr. Sharma also completed reports for delivery to the client.

NYU Langone Medical Center (NYULMC) – Kimmel Pavilion, New York, NY

New York University Langone Medical Center enrolled in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate the property located at 424 East 34th Street in Manhattan. The proposed development consisted of a new medical facility. Mr. Sharma acted as the deputy project manager overseeing field personnel implementing the construction oversight during site redevelopment, and coordinated with the client and their subcontractors.

551 Tenth Avenue, New York, NY

Extell 4110 LLC enrolled in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate the property located at 547-551 Tenth Avenue in Manhattan. The property was developed with a 52-story residential building with one sub-grade level. Mr. Sharma provided construction oversight during site excavation, spill remediation, coordination and management of soil removal and fill material imports, oversight of the on-site air monitoring program, identification and proper management of contamination encountered during excavation work, and maintenance of critical paperwork and preparation of the final closure report.

Zerega Avenue – Phase I, Phase II and Wetland Survey, Bronx, NY

AKRF was contracted by EDC to conduct perform environmental services at an approximately 255,000-square foot project area located at 530 to 590 Zerega Avenue, Bronx, New York. The work included a Phase I Environmental Site Assessment (ESA), and Phase II Environmental Site Investigation which included preparation of a site-specific health and safety plan, a geophysical survey and utility mark-outs, and the collection and analysis of soil, groundwater, soil vapor, indoor air and ambient air samples. Mr. Sharma provided assistance with subsurface soil, groundwater and soil gas investigation as part of the Phase II investigation of the project site.

Rego Park Home Depot, Queens, NY

Solvent contamination was encountered during retail development of a former industrial property in Rego Park, Queens, New York. The site work included an extensive investigation and a multi-phase remediation performed under the NYSDEC Voluntary Cleanup Program (BCP). Remediation included removal of aboveground and underground storage tanks (ASTs and USTs) and hotspot soil removal. An Air Sparging/Soil Vapor Extraction (AS/SVE) groundwater remediation system designed by AKRF was installed as part of the building construction. Continued remediation work included upgrading and expanding the AS/SVE system after the store was opened. AKRF prepared the Final Engineering Report and obtained closure with a Release and Covenant Not to Sue issued by NYSDEC in 2013. AKRF continues operations, maintenance, and monitoring under the NYSDEC-approved Site Management Plan. Mr. Sharma assisted with ongoing operation, maintenance and monitoring of the AS/SVE system.

TF Cornerstone – 606 West 57th Street, New York, NY

AKRF has been retained by TF Cornerstone to provide environmental services for the proposed redevelopment of a portion of the block bounded by Eleventh and Twelfth Avenues and West 56th and 57th Streets. The proposed actions include a zoning map amendment, zoning text amendments, a special permit, and an authorization to facilitate development of approximately 1.2 million square feet of residential and retail space. AKRF is currently preparing an Environmental Impact Statement (EIS) for the New York City Department of City Planning (DCP) to analyze the effects of the proposed actions and development of the proposed building. The EIS will address the full range of environmental impacts associated with the proposed development. As part of the project's review, AKRF also prepared documents and graphics submitted to DCP under its Blue PRint program, a pre-application process that presents basic project information to DCP and clarifies major issues prior to the filing of a land use- or zoning-related application. The process is intended to standardize the pre-application process and expedite DCP's overall project review. Mr. Sharma also provided contractor oversight for the spill remediation activities as requested by the NYSDEC.

Whitney Museum of American Art, NY

Mr. Sharma provided assistance with subsurface soil and groundwater investigation, construction oversight and soil disposal management during the remediation phase of the project. The project included the construction of an approximately 230,000-square foot museum building with one sub-grade level with exhibition galleries, administrative offices, accessory use (café and bookstore), storage space, and an approximately 4,000-square foot restaurant.

Yankee Stadium Demolition, Bronx, NY

The New York City Economic Development Corporation (NYCEDC) project included demolition of the old Yankee Stadium and construction of a ball field known as Heritage Field. Mr. Sharma provided air monitoring and remedial action plan (RAP) oversight during the demolition and soil disturbance work.

East River Science Park, New York, NY

The New York City Economic Development Corporation (NYCEDC) proposed to construct two seventeen-story buildings to serve as a biomedical research center. The space between the two towers included an elevated atrium and an outdoor plaza on top of a parking garage. Mr. Sharma provided construction oversight during site excavation, coordination and management of soil removal and fill material imports, oversight of the on-site air monitoring program, identification and proper management of contamination encountered during excavation work, and maintenance of critical paperwork and preparation of the final closure report.

W 61st Street Site, NY

Mr. Sharma provided assistance with construction oversight during site excavation activities and helped prepare the final closure report for the site which, as part of the Brownfield Cleanup Program (BCP), was slated for redevelopment as two residential buildings with a courtyard and a tennis court.

164 Kent Avenue, Brooklyn, NY

The project was a multi-phase development consisting of a large waterfront block in the Williamsburg Rezoning Area. The project site has been developed with a mixed-use residential-commercial high rise towers with an esplanade and a pier along the East River. AKRF provided acquisition and development support, including performing Phase I and II environmental site assessments, and preparation of Remedial Action Plans (RAPs) and Construction Health and Safety Plan (CHASPs) for approval by DEP and OER. AKRF provided assistance with construction oversight during soil handling activities and managing the Community Air Monitoring Plan (CAMP) activities. To date, closure reports have been prepared and occupancy achieved for three of the four buildings. Mr. Sharma provided construction oversight during soil handling activities and running the Community Air Monitoring Plan (CAMP).

285 Jay Street, Brooklyn, NY

Under contract with the Dormitory Authority of the State New York (DASNY), AKRF completed a Phase II Subsurface investigation at the site of a proposed CUNY educational building to satisfy New York City E-designation requirements. As part of the work AKRF performed at the site, Mr. Sharma conducted sub-surface soil and groundwater investigation work and coordinated with the driller and the property owner for successful completion of the work. Mr. Sharma prepared the remedial closure report for delivery to the client.

MTA Long Island Railroad, East Side Access Project, New York, NY

The Metropolitan Transportation Authority (MTA) sponsored the East Side Access project to connect the Long Island Railroad to the Grand Central Terminal, thereby allowing Long Island commuters direct access to the East Side of Manhattan. Mr. Sharma provided assistance with the execution of the Community Air Monitoring Plan (CAMP) at various locations during the construction phase.

Adam Clayton Powell Jr. Boulevard, New York, NY

AKRF performed a Phase II study to meet the requirements of the New York City Department of Environmental Protection (NYCDEP) and to determine whether subsurface conditions had been affected by the on-site and/or off-site petroleum storage tanks and to ascertain whether current or former on- or off-site activities had adversely affected the subject property. Mr. Sharma conducted sub-surface soil and groundwater investigation at the abandoned site slated for future development. He was responsible for coordinating with the driller and the property owner for successful completion of the work.

STEPHEN SCHMID

SENIOR ENVIRONMENTAL SCIENTIST

Stephen Schmid is an Environmental Scientist in AKRF's Hazardous Materials Department with over 8 years of experience. He has experience in Phase I site assessments, construction oversight and remediation, potable water sampling, and conducting environmental sampling programs (Phase II subsurface investigations Remedial Investigations, waste characterization sampling, groundwater monitoring, and indoor air quality/vapor intrusion surveys) and asbestos surveying and monitoring. Mr. Schmid is a 2011 graduate from the University of New Hampshire, where he studied marine and freshwater biology, and environmental conservation. Prior to joining AKRF Mr. Schmid conducted fieldwork, water sampling and analysis in addition to assisting in a study of lakes in the North Eastern United States.

BACKGROUND

Education

BS Marine & Freshwater Biology, University of New Hampshire, Durham, NH

Licenses/Certifications

40 Hour OSHA HAZWOPER

30 Hour OSHA Construction Health and Safety

10 Hour OSHA Construction Health and Safety

NYS Asbestos Project Monitor, Air Sampling Technician, and Inspector

NYC Asbestos Investigator

Years of Experience

Year started in company: 2012

Year started in industry: 2011

RELEVANT EXPERIENCE

New York City School Construction Authority (SCA), Environmental Consulting Hazardous Materials Services

AKRF has undertaken various assignments under several hazardous materials on-call contracts, including environmental assessment, remedial design, and plumbing disinfection consulting tasks. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments (ESAs) and multi-media subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plans, design of sub-slab depressurization systems (SSDS) and contract specifications, and construction oversight. The work has also included conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours. Mr. Schmid has performed and been involved in all of the above mentioned tasks.

Avalon Bay Communities, Avalon Yonkers Remediation and Redevelopment, Yonkers, NY

Mr. Schmid was the field lead during redevelopment efforts and implementation of the Remedial Action Work Plan (RAWP) and Site Management Plan (SMP), for three New York State Department of Environmental Conservation (NYSDEC) Brownfield redevelopment projects along the Hudson River. Mr. Schmid was responsible for overseeing the installation and monitoring performance of the active sub-slab depressurization system, vapor barrier, groundwater treatment (dewatering) system, in situ soil stabilization (ISS) treatment of contamination beneath the water table and a slurry wall. Additionally Mr. Schmid oversaw the hot spot removal of contaminated soils, construction of NAPL recovery wells, UST removal and site-wide engineered cover systems. As the field leader Mr. Schmid was frequently in direct communication with NYSDEC regarding redevelopment and remedial activities at the site. Further, Mr. Schmid was responsible for assisting in the environmental reporting required with close-out of the remedial work.

New York City Department of Design & Construction (NYCDDC), East Side Coastal Resiliency (ESCR), New York, NY

AKRF was retained by the NYCDDC to provide a multi-disciplinary design for the protection of Lower Manhattan against another catastrophic hurricane. The main components of the design include levees/berms and retaining/cut-off walls to mitigate and limit surging flood waters from entering Lower Manhattan. A large portion of the project's subsurface has been impacted by manufactured gas plant (MGP)-related contamination. To support the design, AKRF performed extensive investigation along the proposed flood-protection alignment, including both public and private utility mark-outs and installation of 250+ borings and 30+ temporary groundwater wells. Mr. Schmid's responsibilities included assisting in the preparation of the Subsurface Investigation Work Plans, coordination between various subcontractors and agencies, and performing the associated field investigation activities including soil characterization and soil and groundwater sampling. Following sampling activities Mr. Schmid oversaw the closure of boring holes in a manner that would ensure MGP related contamination was not further spread.

Willets Point, Queens, NY

AKRF supported the New York City Economic Development Corporation (EDC) with Phase 1 of the Willets Point Redevelopment Plan, which includes the demolition of existing structures. Mr. Schmid performed pre-demolition asbestos-containing materials and universal waste surveys of approximately 70 structures throughout the 23-acre area site in Queens along with an AKRF licensed NYC asbestos investigator.

Adelaar, Monticello, NY

The project is a multi-phase development consisting a mixed-use residential-commercial hotel, casino, water park and entertainment village. AKRF provided acquisition and development support, including performing Phase I and II environmental site assessments. Mr. Schmid provided assistance with Phase I assessments, oversight during remedial soil handling activities and conducted inspections in accordance with the Stormwater Pollution and Prevention Plans.

250 North 10th Street, LLC., Residential Redevelopment Site, Brooklyn, NY

AKRF was retained to investigate and remediate this former industrial property in the Williamsburg section of Brooklyn, New York in connection with site redevelopment. The site is approximately 50,000 square feet, and redevelopment included a six-story residential building and parking garage. The work was completed to satisfy the requirements of the NYC E-designation Program and NYC Voluntary Cleanup Program (NYC VCP). Mr. Schmid conducted construction oversight and community air monitoring during the removal of contaminated soil in accordance with an OER-approved Remedial Action Work Plan.

L.A.B. Validation Corp., 14 West Point Drive, East Northport, New York 11731

Lori A. Beyer

SUMMARY: General Manager/Laboratory Director with a solid technical background combined with Management experience in environmental testing industry. Outstanding organizational, leadership, communication and technical skills. Customer focused, quality oriented professional with consistently high marks in customer/employee satisfaction.

EXPERIENCE:

1998-Present L.A.B. Validation Corporation, 14 West Point Drive, East Northport, NY
President

- Perform Data Validation activities relating to laboratory generated Organic and Inorganic Environmental Data.

1998-Present American Analytical Laboratories, LLC. 56 Toledo Street, Farmingdale, NY
Laboratory Director/Technical Director

- Plan, direct and control the operation, development and implementation of programs for the entire laboratory in order to meet AAL's financial and operational performance standards.
- Ensures that all operations are in compliance with AAL's QA manual and other appropriate regulatory requirements.
- Actively maintains a safe and healthy working environmental that is demanded by local laws/regulations.
- Monitors and manages group's performance with respect to data quality, on time delivery, safety, analyst development/goal achievement and any other key performance indices.
- Reviews work for accuracy and completeness prior to release of results to customers.

1996-1998 Nytest Environmental, Inc. (NEI) Port Washington, New York
General Manager

- Responsible for controlling the operation of an 18,000 square foot facility to meet NEI's financial and operational performance standards.
- Management of 65 FTEs including Sales and Operations
- Ensure that all operations are in compliance with NEI's QA procedures
- Ensures that productivity indicators, staffing levels and other cost factors are held within established guidelines
- Maintains a quantified model of laboratory's capacity and uses this model as the basis for controlling the flow of work into and through the lab so as to ensure that customer requirements and lab's revenue and contribution targets are achieved.

1994-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Technical Project Manager

- Responsible for the coordination and implementation of environmental testing programs requirements between NEI and their customers
- Supervise Customer Service Department
- Assist in the development of major proposals
- Complete management of all Federal and State Contracts and assigned commercial contracts
- Provide technical assistance to the customer, including data validation and interpretation
- Review and implement Project specific QAPP's.

1995-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Corporate QA/QC Officer

- Responsible for the implementation of QA practices as required in the NJDEP and EPA Contracts
- Primary contact for NJDEP QA/QC issues including SOP preparation, review and approval
- Responsible for review, verification and adherence to the Contract requirements and NEI QA Plan

1992-1994 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Manager

- Responsible for the accurate compilation, review and delivery of analytical data to the company's customers. Directly and effectively supervised a department of 22 personnel.
- Managed activities of the data processing software including method development, form creation, and production
- Implement new protocol requirements for report and data management formats
- Maintained control of data storage/archival areas as EPA/CLP document control officer

1987-1991 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Specialist

- Responsible for the review of GC, GC/MS, Metals and Wet Chemistry data in accordance with regulatory requirements
- Proficient with USEPA, NYSDEC, NJDEP and NEESA requirements
- Review data generated in accordance with SW846, NYSDEC ASP, EPA/CLP and 40 CFR Methodologies

1986-1987 Nytest Environmental, Inc (NEI) Port Washington, New York
GC/MS VOA Analyst

EDUCATION:

1982-1985 State University of New York at Stony Brook, New York; BS Biology/Biochemistry
1981-1982 University of Delaware; Biology/Chemistry
5/91 Rutgers University; Mass Spectral Data Interpretation Course, GC/MS Training
8/92 Westchester Community College; Organic Data Validation Course
9/93 Westchester Community College; Inorganic Data Validation Course

Westchester Community College

Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

ORGANIC DATA VALIDATION COURSE (35 HOURS)

Dr. John Samuelian

Date AUGUST 1992

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Westchester Community College

Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

INORGANIC DATA VALIDATION

Instructor: Dale Boshart

Date MARCH 1993

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

July 8, 1992

Ms. Elaine Sall
Program Coordinator
Westchester Community College
Valhalla, NY 10595-1698

Dear Elaine,

Thank you for your letter of June 29, 1992. I have reviewed the course outline for organic data validation, qualifications for teachers and qualifications for students. The course that you propose to offer would be deemed equivalent to that which is offered by EPA. The individuals who successfully complete the course and pass the final written exam would be acceptable to perform the task of organic data validation for the Department of Environmental Conservation, Division of Hazardous Waste Remediation.

As we have discussed in our conversation of July 7, 1992, you will forward to me prior to the August course deadline, the differences between the EPA SOW/90 and the NYSDEC ASP 12/91. You stated these differences will be compiled by Mr. John Samulian.

I strongly encourage you to offer an inorganic data validation course. I anticipate the same list of candidates would be interested in an inorganic validation course as well, since most of the data to be validated consists of both organic and inorganic data.

Thank you for you efforts and please contact me if I can be of any further assistance.

Sincerely,

Maureen P. Serafini

Maureen P. Serafini
Environmental Chemist II
Division of Hazardous Waste
Remediation

The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

October 2, 1992

Ms. Lori Beyer
3 sparkill Drive
East Northport, NY 11731

Dear Ms. Beyer:

Congratulations upon successful completion of the Organic Data Validation course held August 17 - 21, 1992, through Westchester Community College, Professional Development Center. This course has been deemed by New York State Department of Environmental Conservation as equivalent to EPA's Organic Data Validation Course.

Enclosed is your Certificate. Holders of this Certificate are deemed competent to perform organic data validation for the New York State DEC Division of Hazardous Waste Remediation.

The Professional Development Center at Westchester Community College plans to continue to offer courses and seminars which will be valuable to environmental engineers, chemists and related personnel. Current plans include a TCLP seminar on November 17th and a conference on Environmental Monitoring Regulations on November 18th.

We look forward to seeing you again soon at another environmental program or event. Again, congratulations.

Very truly yours,

Passing Grade is 70%
Your Grade is 99%

Elaine Sall
Program Coordinator

ES/bf

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

June 21, 1993

Dear Ms. Beyer:

Enclosed is your graded final examination in the Inorganic Data Validation course you completed this past March. A score of 70% was required in order to receive a certificate of satisfactory completion. Persons holding this certificate are deemed acceptable to perform Inorganic Data Validation for the New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation.

I am also enclosing a course evaluation for you to complete if you have not already done so. The information you provide will greatly aid us in structuring further courses. We wish to make these course offerings as relevant, targeted and comprehensive as possible. Your evaluation is vital to that end.

Congratulations on your achievement. I look forward to seeing you again at another professional conference or course. We will be co-sponsoring an environmental monitoring conference on October 21, 1993 with the New York Water Pollution Control Association, Lower Hudson Chapter, at IBM's Yorktown Heights, NY site. Information regarding this event will be going out in August.

Very truly yours,

Elaine Sall

Elaine Sall
Program Coordinator

ES/bf

Enclosures

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

APPENDIX G

HEALTH AND SAFETY PLAN AND COMMUNITY AIR MONITORING PLAN

37 OTSEGO STREET

BROOKLYN, NEW YORK

Health and Safety Plan and
Community Air Monitoring Plan

BCP Site Number: C224300
AKRF Project Number: 230011

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor
Albany, New York 12233

On Behalf Of:

Columbia SF LLC
670 Myrtle Avenue Suite 438
Brooklyn, New York 11205

Prepared by:

AKRF, Inc.
440 Park Avenue South, 7th Floor
New York, New York 10016
212-696-0670

JUNE 2023

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ATTACHMENTS

1.0 INTRODUCTION

This Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) were prepared by AKRF, Inc. (AKRF) on behalf of Columbia SF LLC (the "Volunteer") for the project site located at 37 Otsego Street in Brooklyn, New York (hereafter referred to as "the Site"). The approximately 100,000-square foot Site is also identified on the New York City Tax Map as Brooklyn Borough Tax Block 579, Lots 1. The Site comprises a mostly vacant one-story building and an asphalt paved parking lot. The Site is bordered by Creamer Street followed by a demolition company and school bus parking to the south, Columbia Street followed by a commercial use building to the east, Otsego Street followed by a warehouse to the west, and Lorraine Street followed by residential buildings to the north. The surrounding area is predominantly residential, with interspersed warehouse and industrial uses, as well as some commercial uses to the east, south, and west. The Site is currently enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) BCP Site No. C224300.

Historical records indicate that the Site had been used for commercial and manufacturing purposes since approximately 1904. Based on the historical Sanborn Fire Insurance Maps and City Directories presented in the February 2023 Phase I Environmental Site Assessment (ESA), portions of the current building on the eastern portion of the Site appear to have been constructed as early as 1940 with historical industrial and automotive uses, including: a Department of Sanitation garage, a printing facility, a motor freight station between 1928 and the mid-1980's (with four gasoline tanks noted on the eastern side of the building between 1938 and 1969), miscellaneous warehouses, commercial and retail uses including a grocery, a bank, and a laundry. The western portion of the Site historically contained a forge and machine works between 1904 and 1928, developed with a filling station with a parking lot by 1950, and lumber storage between 1969 and 1977.

Based on an evaluation of the data and information from investigations/assessments conducted to date, contaminants of concern at the Site include petroleum-related volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals in soil/fill; petroleum-related VOCs and SVOCs in groundwater; and chlorinated solvent- and petroleum-related VOCs in soil vapor. Field evidence of gross petroleum contamination was observed in the western portion of the Site, including petroleum-like odors, photoionization detector (PID) readings greater than 2,000 parts per million (ppm), and light non-aqueous phase liquid (LNAPL) in both soil and groundwater. The gross petroleum contamination is associated with the on-site "open" status NYSDEC Spill Case No. 1509420. The proposed Remedial Actions for the Site include: *in situ* solidification (ISS) of the grossly-contaminated petroleum soil; excavation and off-site disposal of contaminated soil/fill; installation of a sub-slab depressurization systems (three separate systems, one for each new proposed building) under the new building foundations, and installation of a composite cover system across the entirety of the Site.

This HASP and CAMP does not discuss routine health and safety issues common to general construction and excavation, including, but not limited to, slips, trips, falls, shoring, and other physical hazards. All AKRF employees are directed that all work must be performed in accordance with the AKRF's Generic HASP and all Occupation Safety and Health Administration (OSHA)-applicable regulations for the work activities required for the project. All project personnel are furthermore directed that they are not permitted to enter Permit Required Confined Spaces (as defined by OSHA). For issues unrelated to contaminated materials, all non-AKRF employees are to be bound by all applicable OSHA regulations as well as any more stringent requirements specified by their employer in their corporate HASP or otherwise. AKRF is not responsible for providing oversight for issues unrelated to contaminated materials for non-employees. This oversight shall be the responsibility of the employer of that worker or other official designated by that employer.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Check all that apply		
(**X**) Organic Chemicals	(**X**) Inorganic Chemicals	( ) Radiological
(**X**) Biological	( ) Explosive/Flammable	( ) Oxygen Deficient Atm.
(**X**) Heat Stress	(**X**) Cold Stress	( ) Carbon Monoxide
Comments: No personnel are permitted to enter permit-required confined spaces.		

2.1.2 Physical Characteristics

Check all that apply		
(**X**) Liquid	(**X**) Solid	( ) Sludge
(**X**) Vapors	( ) Unknown	( ) Other
Comments:		

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	() Asbestos	( ) Metals	(**X**) Petroleum	( ) Other DF	( ) Pharm
( ) Pesticides	( ) Tailings	( ) POTW	(**X**) Other Chlorinated Organic Solvents	( ) Motor or Hydraulic Oil	( ) Hospital
(**X**)Petroleum	(**X**) Other	( ) Other		(**X**) Gasoline	( ) Rad
( ) Inks	Fill material			(**X**) Fuel Oil	( ) MGP
( ) PCBs				( ) Waste Oil	( ) Mold
(**X**) Metals					( ) Cyanide
(**X**)Other: SVOCs					

2.1.4 Chemicals of Concern

Chemical	REL/PEL/STEL	Health Hazards
Acetone	REL : 590 mg/m^3 PEL: 2,400 mg/m^3	Nose, throat, lung, and eye irritation; headaches; light-headedness; confusion; increased pulse rate; nausea; vomiting; unconsciousness and possibly coma; skin irritation; kidney, liver, and nerve damage; and increased birth defects.
Arsenic	REL : 0.002 mg/m^3 PEL: 0.010 mg/m^3	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen].
Barium	REL: 0.5 mg/m^3 PEL: 0.5 mg/m^3	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.
Benzene	REL: 0.1 ppm N STEL: 1 ppm PEL: 1 ppm O STEL: 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen].
Chromium	REL = 0.5 mg/m^3 PEL = 0.5 mg/m^3	Irritation eyes, skin; sensitization dermatitis; lung fibrosis (histologic)
Copper	REL: 1 mg/m^3 PEL: 1 mg/m^3	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; In Animals: lung, liver, kidney damage; anemia.
Ethylbenzene	REL: 100 ppm N STEL: 125 ppm PEL: 100 ppm	Irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects.
Fuel Oils	REL: 100 mg/m^3	Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid).
Lead	REL: 0.050 mg/m^3 PEL: 0.050 mg/m^3	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension.
Manganese	REL : 1 mg/m^3 PEL : 0.2 mg/m^3	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage.

Chemical	REL/PEL/STEL	Health Hazards
Mercury	REL: 0.05 mg/m^3 REL C: 0.1 mg/m^3 PEL: 0.1 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.
Naphthalene	REL : 15 ppm PEL : 10 ppm	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Nickel	REL: 0.015 mg/m^3 PEL: 1 mg/m^3	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen].
PAHs	REL: 0.1 mg/m^3 PEL: 0.2 mg/m^3	Effects reported from occupational exposure to PAHs include chronic bronchitis, chronic cough irritation, bronchogenic cancer, dermatitis, cutaneous photosensitization, and pilosebaceous reactions. Reported health effects associated with chronic exposure to coal tar and its by-products (e.g., PAHs): Skin: erythema, burns, and warts on sun-exposed areas with progression to cancer. The toxic effects of coal tar are enhanced by exposure to ultraviolet light. Eyes: irritation and photosensitivity. Respiratory system: cough, bronchitis, and bronchogenic cancer. Gastrointestinal system: leukoplakia, buccal-pharyngeal cancer, and cancer of the lip. Hematopoietic system: leukemia (inconclusive) and lymphoma. Genitourinary system: hematuria and kidney and bladder cancers.
Phenol	REL = TWA 5 ppm (19 mg/m^3) [skin] PEL = TWA 5 ppm (19 mg/m^3) [skin]	Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching
Selenium	REL: 0.2 mg/m^3 PEL: 0.2 mg/m^3	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; In Animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage.
Xylene	REL: 100 ppm N STEL: 150 ppm PEL: 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Zinc	REL: 5 mg/m^3 REL C: 15 mg/m^3 N STEL: 10 mg/m^3 PEL: 5 mg/m^3 (ZnO fume); 15 mg/m^3 (ZnO dust)	Chills, elevated body temperature, myalgia, cough, fatigue, chest pain, stomach cramps, nausea, anemia, changes in cholesterol levels, and vomiting.

Chemical	REL/PEL/STEL	Health Hazards
Notes: REL: Recommended exposure limit (NIOSH) PEL: Permissible exposure limits (OSHA) STEL: Short-term exposure limit N: NIOSH O: OSHA C: Ceiling		

The potential health effects from these known and suspected on-site contaminants are provided in Attachment A.

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the field team leader, field technician, and Site Safety Officer (SSO). This individual will be responsible for the implementation of this HASP. The field team leader will work under the direction of a Qualified Environmental Professional (QEP) and will be experienced in the implementation of air monitoring and hazardous materials sampling programs.

2.3 Training

All personnel who perform environmental oversight activities in the work area while intrusive activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety. All field personnel must attend a training program, whose purpose is to:

- Make them aware of the potential hazards they may encounter;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety and make them aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the field crew will be instructed in these objectives before he/she goes onto the Site. A Site safety meeting will be conducted at the start of the project and will be conducted daily, as necessary, to account for changes in Site conditions. Additional meetings shall be conducted, as necessary, for new personnel working at the Site.

2.4 Medical Surveillance Program

All AKRF and subcontractor personnel performing field work involving subsurface disturbance at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin Site activities associated with handling and management of hazardous waste (if encountered). The medical release shall consider the type of work to be performed and the required PPE. The medical examination will, at a minimum, be provided annually and upon termination of hazardous waste Site work.

2.5 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may changed by SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Appropriate barriers will be set up to secure the area and prevent any unauthorized personnel from approaching within 10 feet of the work area.

Site Work Zones

Task	Exclusion Zone	CRZ	Support Zone
Soil Excavation and Storage Tank Removal (if any) Areas	10 feet from excavation border and excavation equipment or vehicles	20 feet from excavation border and excavation equipment or vehicles	As Needed
Soil Mixing for ISS	10 feet from ISS soil mixing grid/area	20 feet from ISS soil mixing grid/area	As Needed

2.6 Air Monitoring

The purpose of the air monitoring program is to identify any exposure of the field personnel to potential environmental hazards in the soil and soil vapor. Results of the air monitoring will be used to determine the appropriate response action, if needed.

2.6.1 Work Zone Air Monitoring

Real time air monitoring of VOCs and particulates will be performed in the work zone during all intrusive Site activities. Work zone air monitoring for VOCs will be performed with a PID equipped with a 10.6 electron Volt (eV) lamp. The PID will be calibrated with 100 ppm isobutylene standard gas, in accordance with the manufacturer's specifications, at the start of each work day. Work zone air monitoring for particulates will be conducted using a TSI SidePak AM520™ or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}).

The SSO shall set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. Measurements will be taken prior to commencement of work and continuously during the work. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The action levels and required responses are listed in the following table:

Instrument	Action Level	Response Action
PID	Less than 10 ppm in breathing zone	Level D or D-Modified
	Between 10 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm. Re-access Site conditions and response actions if elevated PID readings remain.
Dust Trak	Less than 0.25 mg/m^3 above background in breathing zone	Level D or D-Modified
	More than 0.25 mg/m^3 above background in breathing zone	Stop work. Resume work when readings are less than 1.25 mg/m^3.
mg/m^3 = milligrams per cubic meter ppm = parts per million		

2.6.2 Community Air Monitoring Plan

Community air monitoring will be conducted during all intrusive Site activities in compliance with the New York State Department of Health (NYSDOH) Generic CAMP. Real-time air monitoring for VOCs and particulates at the perimeter of the exclusion zone will be performed as described below.

2.6.2.1. Roving Air Monitoring

VOC Monitoring

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of excavation endpoint soil samples. Periodic monitoring may include obtaining measurements upon arrival at a location and upon leaving the location.

Continuous monitoring for VOCs will be conducted during all ground intrusive activities, including excavation, in and tank removal (if any) activities. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored continuously at the downwind perimeter of the exclusion zone. Monitoring will be conducted with a PID equipped with a 10.6 eV lamp capable of calculating 15-minute running average concentrations.

More frequent intervals of monitoring will be conducted if required, as determined by the SSO. All PID readings will be recorded and available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, will also be recorded.

Particulate Monitoring

Continuous monitoring for particulates will be conducted during all ground intrusive activities, which will involve the measurement of respirable dust. Community air monitoring for dust particulates will be conducted using a TSI SidePak AM520™ or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}). The dust monitor will be capable of calculating 15-minute running average concentrations and

equipped with an audible alarm to indicate exceedance of action levels. Background readings and any readings that trigger response actions will be recorded in the field logbook, which will be available on-site for NYSDOH and/or NYSDEC review.

2.6.2.2. Fixed Air Monitoring Stations

Fixed air monitoring stations will be set up at the upwind and downwind perimeters of the exclusion zone (2 total) during all ground intrusive activities and will continuously log VOC and particulate levels. Each fixed monitoring station will be fully enclosed and equipped with the following:

- A PID equipped with a 10.6 eV lamp capable of calculating 15-minute running average VOC concentrations;
- A TSI 8530 DustTrak II or equivalent dust monitor capable of measuring the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}) and calculating 15-minute running average particulate concentrations; and
- A Netronix™ Thiamus™ ICU-820 or equivalent Global System for Mobile Communication (GSM)/Global Positioning System (GPS) device capable of recording air monitoring and location data.

Each monitoring station will be capable of sending e-mail alerts to the SSO to indicate an exceedance of action levels. Additionally, the SSO will conduct an inspection of the monitoring stations on at least an hourly basis. Upon completion of Site activities, all air monitoring data will be available to download via the iEnvironet® website. All air monitoring data recorded at the fixed monitoring stations will be available for NYSDOH and/or NYSDEC review and will be included in the Final Engineering Report (FER).

2.6.2.3. Community Air Monitoring Action Levels

VOC Action Levels

The following actions will be taken based on organic vapor levels measured:

- If total organic vapor levels exceed 5 ppm above background for the 15-minute average at the exclusion zone perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the exclusion zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less—but in no case less than 20 feet—is below 5 ppm above background for the 15-minute average.
- If the total organic vapor level is above 25 ppm at the perimeter of the exclusion zone, activities will be shutdown.

Particulate Action Levels

The following actions will be taken based on particulate levels measured:

- If the downwind particulate concentrations are greater than 0.1 milligram per cubic meter (mg/m^3) above background (upwind concentrations), and no other obvious source is apparent, then it will be assumed that the elevated particulate concentrations are a result of Site activities. In such instances, particulate suppression measures will be implemented and monitoring will be continued. Work will be allowed to continue with dust suppression if downwind particulate levels do not exceed 0.15 mg/m^3 above the background (upwind concentration) and provided that no visible dust is migrating from the work area.
- If particulate levels persist at 0.15 mg/m^3 above the background, work must be stopped until dust suppression measures bring particulate levels to below 0.15 mg/m^3 above background.

Major Vapor Emission Response Plan

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the Site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or vapor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-foot zone).

If either of the following criteria is exceeded in the 20-foot zone, then the Major Vapor Emission Response Plan shall automatically be implemented:

- Sustained organic vapor levels approaching 1 ppm above background for a period of more than 30 minutes; or
- Organic vapor levels greater than 5 ppm above background for any time period.

Upon activation, the following activities shall be undertaken as part of the Major Vapor Emission Response Plan:

- NYSDEC, NYSDOH, and local police authorities will be immediately contacted by the SSO and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SSO and;
- All emergency contacts will go into effect, as appropriate.

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates will reflect the nearest potentially exposed individuals and the location of ventilation system intakes for

nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices will be considered to prevent exposures related to the work activities and to control dust and odors. Consideration will be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring would occur within the occupied structure(s). Background readings in the occupied spaces will be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.
- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m^3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mg/m^3 or less at the monitoring point.
- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions will be pre-determined, as necessary.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review.

2.6.3 Personal Protection Equipment

The personal protection equipment required for various kinds of site investigation tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

AKRF field personnel and other site personnel shall wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in this section.

Personal Protection Equipment Requirements

LEVEL OF PROTECTION & PPE		**All Tasks**
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig/excavator) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig/excavator) (**X**) Nitrile Gloves (**X**) Tyvek for drill operator if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator OR (**X**) Full Face Respirator ( ) Full-Face Powered Air Purifier Respirator (PAPR)	() Particulate Cartridge () Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 25 ppm for a 15-minute average (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breath or any odors detected).		

2.7 General Work Practices

To protect their health and safety, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the Site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the Site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit, fire extinguisher, and disposable eye washes. A muster point location will be made known to all parties on Site during the Site safety meeting. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be driven to the NYU Langone – Cobble Hill in Brooklyn by on-site personnel. Directions to the hospital are provided below, and a hospital route map is attached.

3.1 Hospital Directions

Hospital Name:	NYU Langone – Cobble Hill
Phone Number:	(646) 754-7900
Address/Location:	70 Atlantic Avenue, Brooklyn, NY 11201
Directions:	1. Turn LEFT from the site onto Wolcott Street. 2. Turn RIGHT onto Van Brunt Street. 3. Turn RIGHT onto Union Street. 4. Turn LEFT onto Hicks Street. 5. Turn RIGHT onto Amity Street. The Emergency Department will be on the LEFT.

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF, Inc.	Rebecca Kinal	Remedial Engineer	914-922-2362 (office)
	Marc Godick	QA/QC Officer	914-922-2356 (office)
	Ashutosh Sharma	Project Manager	646-388-9865 (office)
	Steve Schmid	SSO	914-400-9736 (cell)
Columbia SF LLC	Samuel Braver	BCP Volunteer Representative	718-288-3757 (cell)
New York State Department of Environmental Conservation	Sadique Ahmed	Project Manager	518-368-5120
New York State Department of Health	Johnathan Robinson	Project Manager	518-402-7881
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

APPROVAL

Signed: _____ Date: _____

AKRF Project Manager

Signed: _____ Date: _____

AKRF Health and Safety Officer

Below is an affidavit that must be signed by all workers who enter the site. A copy of the HASP must be on-site at all times and will be kept by the SSO.

AFFIDAVIT

I,_____(name), of_____(company name), have read the Health and Safety Plan (HASP) for the 37 Otsego Street Site. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signed: _____ Company: _____ Date: _____
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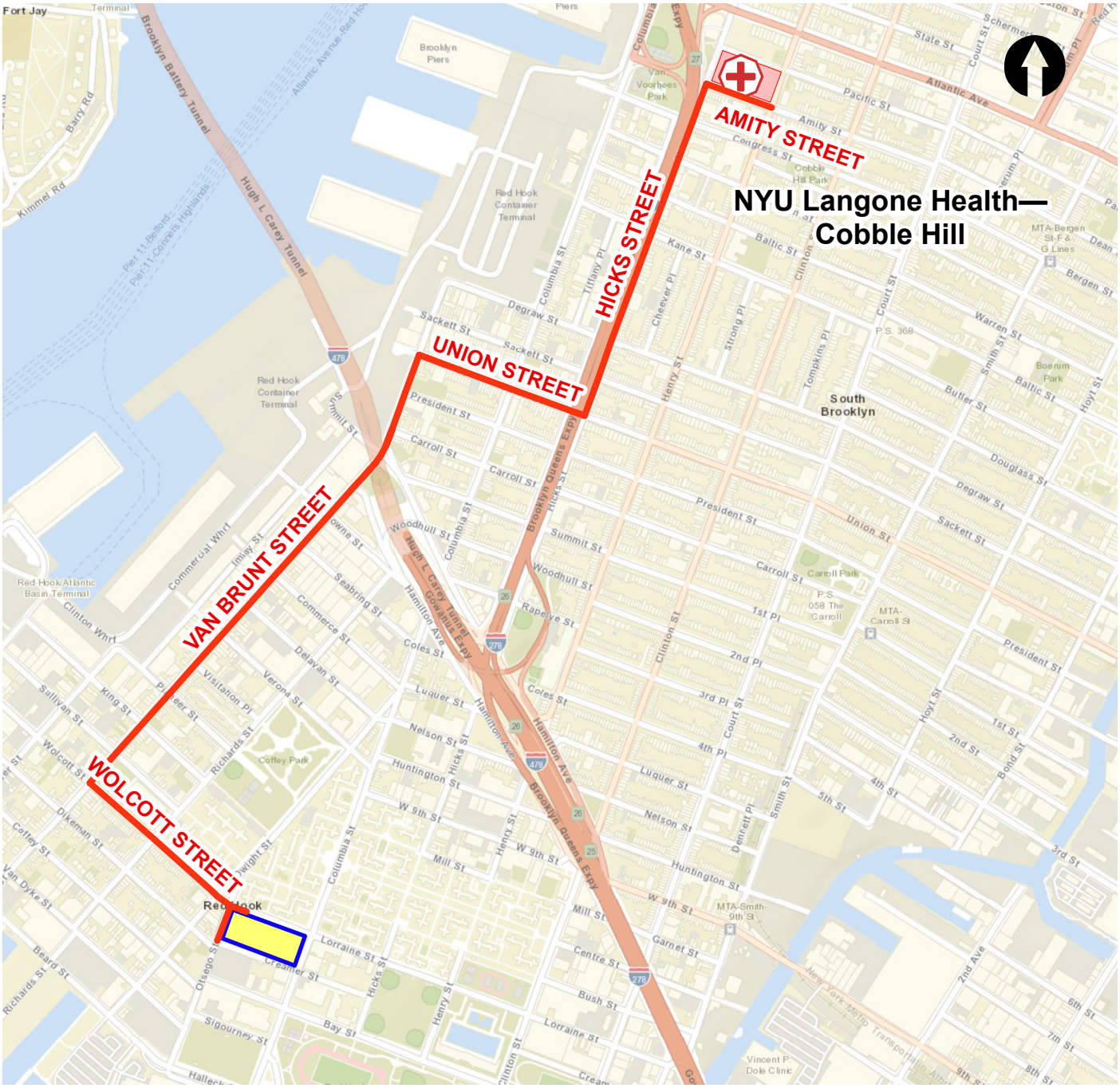
FIGURE 1
HOSPITAL ROUTE MAP



Service Layer Credits: ESRI World Street Map 2023

LEGEND

- BCP PROJECT SITE BOUNDARY
- ROUTETOHOSPITAL
- HOSPITAL LOCATION

NYU Langone Health—Cobble Hill
Emergency Department
70 Atlantic Ave,
Brooklyn, NY

ER on Amity Street

Phone 1-646-754-7900

0 1,000 2,000

SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

37 Otsego Street
Brooklyn, New York

HOSPITAL ROUTE MAP

DATE
5/25/2023

PROJECT NO.
230011

FIGURE
1

ATTACHMENT A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ACETONE
CAS # 67-64-1

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about acetone. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to acetone results mostly from breathing air, drinking water, or coming in contact with products or soil that contain acetone. Exposure to moderate-to-high amounts of acetone can irritate your eyes and respiratory system, and make you dizzy. Very high exposure may cause you to lose consciousness. This chemical has been found in at least 572 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is acetone?

(Pronounced ăs′ĭ-tōn′)

Acetone is a manufactured chemical that is also found naturally in the environment. It is a colorless liquid with a distinct smell and taste. It evaporates easily, is flammable, and dissolves in water. It is also called dimethyl ketone, 2-propanone, and beta-ketopropane.

Acetone is used to make plastic, fibers, drugs, and other chemicals. It is also used to dissolve other substances.

It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in vehicle exhaust, tobacco smoke, and landfill sites. Industrial processes contribute more acetone to the environment than natural processes.

What happens to acetone when it enters the environment?

- A large percentage (97%) of the acetone released during its manufacture or use goes into the air.
- In air, about one-half of the total amount breaks down from sunlight or other chemicals every 22 days.
- It moves from the atmosphere into the water and soil by rain and snow. It also moves quickly from soil and water back to air.
- Acetone doesn't bind to soil or build up in animals.
- It's broken down by microorganisms in soil and water.
- It can move into groundwater from spills or landfills.
- Acetone is broken down in water and soil, but the time required for this to happen varies.

How might I be exposed to acetone?

- Breathing low background levels in the environment.
- Breathing higher levels of contaminated air in the workplace or from using products that contain acetone (for example, household chemicals, nail polish, and paint).
- Drinking water or eating food containing acetone.
- Touching products containing acetone.
- For children, eating soil at landfills or hazardous waste sites that contain acetone.
- Smoking or breathing secondhand smoke.

How can acetone affect my health?

If you are exposed to acetone, it goes into your blood which then carries it to all the organs in your body. If it is a small amount, the liver breaks it down to chemicals that are not harmful and uses these chemicals to make energy for normal body functions. Breathing moderate- to-high levels

of acetone for short periods of time, however, can cause nose, throat, lung, and eye irritation; headaches; light-headedness; confusion; increased pulse rate; effects on blood; nausea; vomiting; unconsciousness and possibly coma; and shortening of the menstrual cycle in women.

Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in your mouth. Skin contact can result in irritation and damage to your skin.

The smell and respiratory irritation or burning eyes that occur from moderate levels are excellent warning signs that can help you avoid breathing damaging levels of acetone.

Health effects from long-term exposures are known mostly from animal studies. Kidney, liver, and nerve damage, increased birth defects, and lowered ability to reproduce (males only) occurred in animals exposed long-term. It is not known if people would have these same effects.

How likely is acetone to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified acetone for carcinogenicity.

Acetone does not cause skin cancer in animals when applied to the skin. We don't know if breathing or swallowing acetone for long periods will cause cancer. Studies of workers exposed to it found no significant risk of death from cancer.

Is there a medical test to show whether I've been exposed to acetone?

Methods are available to measure the amount of acetone in your breath, blood, and urine. The test can tell you how much acetone you were exposed to, although the amount that people have naturally in their bodies varies with each person. The tests can't tell you if you will experience any health effects from the exposure.

The test must be performed within 2-3 days after exposure because acetone leaves your body within a few days. These tests are not routinely performed at your doctor's office, but your doctor can take blood or urine samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that spills of 5,000 pounds or more of acetone be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum concentration limit in workplace air of 1,000 parts of acetone per million parts of air (1,000 ppm) for an 8-hour workday over a 40-hour week to protect workers. The National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit of 250 ppm in workplace air for up to a 10-hour workday over a 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.
Evaporate: To change into a vapor or a gas.
Ingesting: Taking food or drink into your body.
Long-term: Lasting one year or longer.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for acetone. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology ToxFAQs™ December 2003

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found at 1,014 of the 1,598 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

❑ Arsenic cannot be destroyed in the environment. It can only change its form.
❑ Arsenic in air will settle to the ground or is washed out of the air by rain.
❑ Many arsenic compounds can dissolve in water.
❑ Fish and shellfish can accumulate arsenic, but the arsenic in fish is mostly in a form that is not harmful.

How might I be exposed to arsenic?

❑ Eating food, drinking water, or breathing air containing arsenic.
❑ Breathing contaminated workplace air.
❑ Breathing sawdust or burning smoke from wood treated with arsenic.
❑ Living near uncontrolled hazardous waste sites containing arsenic.
❑ Living in areas with unusually high natural levels of arsenic in rock.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the

appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

How likely is arsenic to cause cancer?

Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

How can arsenic affect children?

We do not know if exposure to arsenic will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to inorganic arsenic.

It is likely that health effects seen in children exposed to high amounts of arsenic will be similar to the effects seen in adults.

How can families reduce the risk of exposure to arsenic?

❑ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
❑ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

Is there a medical test to show whether I've been exposed to arsenic?

There are tests to measure the level of arsenic in blood, urine, hair, or fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels or arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or canceled many uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration has set limits of 10 μg arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

Source of Information

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Arsenic. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ASBESTOS
CAS # 1332-21-4

Division of Toxicology ToxFAQs™ **September 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about asbestos. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, individual susceptibility and personal habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to asbestos usually occurs by breathing contaminated air in workplaces that make or use asbestos. Asbestos is also found in the air of buildings that are being torn down or renovated. Asbestos exposure can cause serious lung problems and cancer. This substance has been found at 83 of the 1,585 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is asbestos?

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibers that are strong and flexible enough to be spun and woven and are heat resistant. Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products products may contain asbestos.

What happens to asbestos when it enters the environment?

Asbestos fibers can enter the air or water from the breakdown of natural deposits and manufactured asbestos products. Asbestos fibers do not evaporate into air or dissolve in water. Small diameter fibers and particles may remain suspended in the air for a long time and be carried long distances by wind or water before settling down. Larger diameter fibers and particles tend to settle more quickly.

Asbestos fibers are not able to move through soil. Asbestos fibers are generally not broken down to other compounds and will remain virtually unchanged over long periods.

How might I be exposed to asbestos?

We are all exposed to low levels of asbestos in the air we breathe. These levels range from 0.00001 to 0.0001 fibers per milliliter of air and generally are highest in cities and industrial areas.

People working in industries that make or use asbestos products or who are involved in asbestos mining may be exposed to high levels of asbestos. People living near these industries may also be exposed to high levels of asbestos in air.

Asbestos fibers may be released into the air by the disturbance of asbestos-containing material during product use, demolition work, building or home maintenance, repair, and remodeling. In general, exposure may occur only when the asbestos-containing material is disturbed in some way to release particles and fibers into the air.

Drinking water may contain asbestos from natural sources or from asbestos-containing cement pipes.

How can asbestos affect my health?

Asbestos mainly affects the lungs and the membrane that surrounds the lungs. Breathing high levels of asbestos fibers for a long time may result in scar-like tissue in the lungs and in the pleural membrane (lining) that surrounds the lung. This disease is called asbestosis and is usually found in workers exposed to asbestos, but not in the general public. People with asbestosis have difficulty breathing, often a cough, and in severe cases heart enlargement. Asbestosis is a serious disease and can eventually lead to disability and death.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Breathing lower levels of asbestos may result in changes called plaques in the pleural membranes. Pleural plaques can occur in workers and sometimes in people living in areas with high environmental levels of asbestos. Effects on breathing from pleural plaques alone are not usually serious, but higher exposure can lead to a thickening of the pleural membrane that may restrict breathing.

How likely is asbestos to cause cancer?

The Department of Health and Human Services (DHHS), the World Health Organization (WHO), and the EPA have determined that asbestos is a human carcinogen.

It is known that breathing asbestos can increase the risk of cancer in people. There are two types of cancer caused by exposure to asbestos: lung cancer and mesothelioma. Mesothelioma is a cancer of the thin lining surrounding the lung (pleural membrane) or abdominal cavity (the peritoneum). Cancer from asbestos does not develop immediately, but shows up after a number of years. Studies of workers also suggest that breathing asbestos can increase chances of getting cancer in other parts of the body (stomach, intestines, esophagus, pancreas, and kidneys), but this is less certain. Early identification and treatment of any cancer can increase an individual's quality of life and survival.

Cigarette smoke and asbestos together significantly increase your chances of getting lung cancer. Therefore, if you have been exposed to asbestos you should stop smoking. This may be the most important action that you can take to improve your health and decrease your risk of cancer.

How can asbestos affect children?

We do not know if exposure to asbestos will result in birth defects or other developmental effects in people. Birth defects have not been observed in animals exposed to asbestos.

It is likely that health effects seen in children exposed to high levels of asbestos will be similar to the effects seen in adults.

How can families reduce the risk of exposure to asbestos?

Materials containing asbestos that are not disturbed or deteriorated do not, in general, pose a health risk and can be left alone. If you suspect that you may be exposed to asbestos in your home, contact your state or local health department or the regional offices of EPA to find out how to test your home and how to locate a company that is trained to remove or contain the fibers.

Is there a medical test to show whether I've been exposed to asbestos?

Low levels of asbestos fibers can be measured in urine, feces, mucus, or lung washings of the general public. Higher than average levels of asbestos fibers in tissue can confirm exposure but not determine whether you will experience any health effects.

A thorough history, physical exam, and diagnostic tests are needed to evaluate asbestos-related disease. Chest x-rays are the best screening tool to identify lung changes resulting from asbestos exposure. Lung function tests and CAT scans also assist in the diagnosis of asbestos-related disease.

Has the federal government made recommendations to protect human health?

In 1989, EPA banned all new uses of asbestos; uses established before this date are still allowed. EPA established regulations that require school systems to inspect for damaged asbestos and to eliminate or reduce the exposure by removing the asbestos or by covering it up. EPA regulates the release of asbestos from factories and during building demolition or renovation to prevent asbestos from getting into the environment.

EPA has proposed a concentration limit of 7 million fibers per liter of drinking water for long fibers (lengths greater than or equal to 5 μm). The Occupational Safety and Health Administration has set limits of 100,000 fibers with lengths greater than or equal to 5 μm per cubic meter of workplace air for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Toxicological Profile for Asbestos. Update. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BARIUM AND COMPOUNDS

CAS # 7440-39-3

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about barium and barium compounds. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to barium occurs mostly in the workplace or from drinking contaminated water. Ingesting drinking water containing levels of barium above the EPA drinking water guidelines for relatively short periods of time can cause gastrointestinal disturbances and muscle weakness. Ingesting high levels for a long time can damage the kidneys. Barium and barium compounds have been found in at least 798 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is barium?

Barium is a silvery-white metal which exists in nature only in ores containing mixtures of elements. It combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds.

Barium compounds are used by the oil and gas industries to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, ceramics, glass, and rubber.

Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens to barium when it enters the environment?

❏ Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil.
❏ The length of time that barium will last in air, land, water, or sediments depends on the form of barium released.
❏ Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment.
❏ Barium compounds, such as barium chloride, barium nitrate, or barium hydroxide, that dissolve easily in water usually do not last in these forms for a long time in the environment. The barium in these compounds that is dissolved in water quickly combines with sulfate or carbonate that are naturally found in water and become the longer lasting forms (barium sulfate and barium carbonate).
❏ Fish and aquatic organisms can accumulate barium.

How might I be exposed to barium?

❏ Ingesting small amounts present in your food and water or breathing air containing very low levels of barium.
❏ Living in areas with unusually high natural levels of barium in the drinking water.
❏ Working in a job that involves barium production or use.
❏ Living or working near waste sites where barium has been disposed of.

How can barium affect my health?

The health effects of the different barium compounds depend on how well the compound dissolves in water or in the stomach contents. Barium compounds that do not dissolve well, such as barium sulfate, are not generally harmful.

BARIUM AND COMPOUNDS
CAS # 7440-39-3

Barium has been found to potentially cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the EPA drinking water standards for relatively short periods of time. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died.

How likely is barium to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure.

How can barium affect children?

We do not know whether children will be more or less sensitive than adults to barium toxicity. A study in rats that swallowed barium found a decrease in newborn body weight; we do not know if a similar effect would be seen in humans.

How can families reduce the risks of exposure to barium?

The greatest potential source of barium exposure is through food and drinking water. However, the amount of barium in foods and drinking water are typically too low to be of concern.

Is there a medical test to determine whether I've been exposed to barium?

There is no routine medical test to determine whether you have been exposed to barium. Doctors can measure barium in body tissues and fluids, such as bones, blood, urine, and feces, using very complex instruments. These tests cannot be used to predict the extent of the exposure or potential health effects.

The geometric mean barium level measured in the U.S. general population aged 6 and older is reported by the Centers for Disease Control and Prevention (CDC) as 1.44 μg/g creatinine (measured in urine).

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2.0 milligrams of barium per liter of drinking water (2.0 mg/L), which is the same as 2 ppm.

The Occupational Safety and Health Administration (OSHA) has set Permissible Exposure Limits (PELs) of 0.5 milligrams of soluble barium compounds per cubic meter of workplace air (0.5 mg/m^3) for 8 hour shifts and 40 hour work weeks. The OSHA limits for barium sulfate dust are 15 mg/m^3 of total dust and 5 mg/m^3 for respirable fraction.

The National Institute for Occupational Safety and Health (NIOSH) has set Recommended Exposure Limits (RELs) of 0.5 mg/m^3 for soluble barium compounds. The NIOSH has set RELs of 10 mg/m^3 (total dust) for barium sulfate and 5 mg/m^3 (respirable fraction).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Barium and Compounds (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.
- A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHROMIUM

CAS # 7440-47-3

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2008

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

❑ Chromium can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
❑ Chromium does not usually remain in the atmosphere, but is deposited into the soil and water .
❑ Chromium can easily change from one form to another in water and soil, depending on the conditions present.
❑ Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

❑ Eating food containing chromium(III).
❑ Breathing contaminated workplace air or skin contact during use in the workplace.
❑ Drinking contaminated well water.
❑ Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

How likely is chromium to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Reseach on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens. In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?

It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Some developmental effects have been observed in animals exposed to chromium(VI).

How can families reduce the risks of exposure to chromium?

❑ Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.

❑ Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.

❑ Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

Is there a medical test to determine whether I've been exposed to chromium?

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However , increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to chromium in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.0005 mg/m ^{3} chromium(VI), 0.5 mg/m ^{3} chromium(III), and 1.0 mg/m ^{3} chromium(0) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Chromium (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmenta l quality department if you have any more questions or concerns.

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COPPER

CAS # 7440-50-8

Division of Toxicology ToxFAQs™ September 2002

This fact sheet answers the most frequently asked health questions (FAQs) about copper. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Copper is a reddish metal that occurs naturally in the environment. It also occurs naturally in plants and animals. Low levels of copper are essential for maintaining good health. High levels can cause harmful effects such as irritation of the nose, mouth and eyes, vomiting, diarrhea, stomach crumps, and nausea. Copper has been found in at least 884 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is copper?

Copper is a reddish metal that occurs naturally in rocks, soil, water, and air. Copper also occurs naturally in plants and animals.

Metallic copper can be easily molded or shaped. Metallic copper can be found in the U.S. penny, electrical wiring, and some water pipes. Metallic copper is also found in mixtures (called alloys) with other metals such as brass and bronze. Copper is also found as part of other compounds forming salts. Copper salts occur naturally, but are also manufactured. The most common copper salt is copper sulfate. Most copper compounds are blue-green in color. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens to copper when it enters the environment?

❑ Copper can enter the environment from the mining of copper and other metals and from factories that make or use metallic copper or copper compounds.

❑ It can also enter the environment through domestic waste water, combustion of fossil fuels and wastes, wood production, phosphate fertilizer production, and natural sources (e.g., windblown dust from soils, volcanoes, decaying vegetation, forest fires, and sea spray).

❑ Copper in soil strongly attaches to organic material and minerals.

❑ Copper that dissolves in water becomes rapidly bound to particles suspended in the water.

❑ Copper does not typically enter groundwater.

❑ Copper carried by particles emitted from smelters and ore processing plants is carried back to the ground by gravity or in rain or snow.

❑ Copper does not break down in the environment.

How might I be exposed to copper?

❑ Breathing air, drinking water, eating food, and by skin contact with soil, water, or other copper-containing substances.

❑ Some copper in the environment can be taken up by plants and animals.

❑ Higher exposure may occur if your water is corrosive and you have copper plumbing and brass water fixtures. ❑ You may be exposed to higher amounts of copper if you drink water or swim in lakes or reservoirs recently treated with copper to control algae or receive cooling water from a power plant that may have high amounts of dissolved copper.

❑ Using some garden products (e.g., fungicides) to control plant diseases.

❑ Living near bronze and brass production facilities may expose you to higher copper levels in soil.

❑ You may breathe copper-containing dust or have skin contact if you work in the industry of mining copper or

processing the ore. You may breathe high levels if you grind or weld copper metal.

How can copper affect my health?

Copper is essential for good health, but high amounts can be harmful. Long-term exposure to copper dust can irritate your nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea.

Drinking water with higher than normal levels of copper may cause vomiting, diarrhea, stomach cramps, and nausea. Intentionally high intakes of copper can cause liver and kidney damage and even death.

How likely is copper to cause cancer?

We do not know whether copper can cause cancer in humans. The EPA has determined that copper is not classifiable as to carcinogenicity.

How can copper affect children?

Exposure to high levels of copper will result in the same type of effects in children and adults. Studies in animals suggest that the young children may have more severe effects than adults; we do not know if this would also be true in humans. There is a very small percentage of infants and children who are unusually sensitive to copper.

We do not know if copper can cause birth defects or other developmental effects in humans. Studies in animals suggest that ingestion of high levels of copper may cause a decrease in fetal growth.

How can families reduce the risk of exposure to copper?

❑ The greatest potential source of copper exposure is through drinking water, especially in water that is first drawn in the morning after sitting in copper pipes and brass faucets overnight.

❑ To reduce exposure, run the water for at least 15-30 seconds before using it.

❑ If you are exposed to copper at work, you may carry copper home on your skin, clothes, or tools. You can avoid this by showering, and changing clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to copper?

Copper is normally found in all tissues of the body, blood, urine, feces, hair, and nails. High levels of copper in these samples can show that you have been exposed to higher than normal levels of copper. Tests to measure copper levels in the body are not routinely available at the doctor's office because they require special equipment. These tests cannot tell the extent of exposure or whether you will experience harmful effects.

Has the federal government made recommendations to protect human health?

The EPA has determined that drinking water should not contain more than 1.3 milligrams of copper per liter of water (1.3 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.1 mg per cubic meter (0.1 mg/m^3) of copper fumes (vapor generated from heating copper) and 1 mg/m^3 of copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) in workroom air during an 8-hour work shift, 40-hour workweek.

The Food and Nutrition Board of the Institute of Medicine recommends dietary allowances (RDAs) of 340 micrograms (340 µg) of copper per day for children aged 1-3 years, 440 µg/day for children aged 4-8 years, 700 µg/day for children aged 9-13 years, 890 µg/day for children aged 14-18 years, and 900 µg/day for adults.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Copper (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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DDT, DDE, AND DDD

CAS # 50-29-3, 72-55-9, 72-54-8

Division of Toxicology ToxFAQs™ **September 2002**

This fact sheet answers the most frequently asked health questions (FAQs) about DDT, DDE, and DDD. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to DDT, DDE, and DDD occurs mostly from eating foods containing small amounts of these compounds, particularly meat, fish and poultry. High levels of DDT can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby. DDT, DDE, and DDD have been found in at least 441 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are DDT, DDE, and DDD?

DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries.

DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that contaminate commercial DDT preparations. DDE has no commercial use. DDD was also used to kill pests, but its use has also been banned. One form of DDD has been used medically to treat cancer of the adrenal gland.

What happens to DDT, DDE, and DDD when they enter the environment?

❑ DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries.

❑ DDE enters the environment as contaminant or breakdown product of DDT; DDD also enters the environment as a breakdown product of DDT.

❑ DDT, DDE, and DDD in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.

❑ They stick strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms; half the DDT in soil will break down in 2-15 years, depending on the type of soil.

❑ Only a small amount will go through the soil into groundwater; they do not dissolve easily in water.

❑ DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals.

How might I be exposed to DDT, DDE, and DDD?

❑ Eating contaminated foods, such as root and leafy vegetables, fatty meat, fish, and poultry, but levels are very low.

❑ Eating contaminated imported foods from countries that still allow the use of DDT to control pests.

❑ Breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals.

❑ Infants fed on breast milk from mothers who have been exposed.

❑ Breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

How can DDT, DDE, and DDD affect my health?

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months.

A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to

breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in breast milk had an increased chance of having premature babies.
In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Also in animals, short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction.

How likely are DDT, DDE, and DDD to cause cancer?

Studies in DDT-exposed workers did not show increases in cancer. Studies in animals given DDT with the food have shown that DDT can cause liver cancer.
The Department of Health and Human Services (DHHS) determined that DDT may reasonable be anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) determined that DDT may possibly cause cancer in humans. The EPA determined that DDT, DDE, and DDD are probable human carcinogens.

How can DDT, DDE, and DDD affect children?

There are no studies on the health effects of children exposed to DDT, DDE, or DDD. We can assume that children exposed to large amounts of DDT will have health effects similar to the effects seen in adults. However, we do not know whether children differ from adults in their susceptibility to these substances.
There is no evidence that DDT, DDE, or DDD cause birth defects in people. A study showed that teenage boys whose mothers had higher DDE amounts in the blood when they were pregnant were taller than those whose mothers had lower DDE levels. However, a different study found the opposite in preteen girls. The reason for the discrepancy between these studies is unknown.
Studies in rats have shown that DDT and DDE can mimic the action of natural hormones and in this way affect the development of the reproductive and nervous systems. Puberty was delayed in male rats given high amounts of DDE as juveniles. This could possibly happen in humans. A study in mice showed that exposure to DDT during the first weeks of life may cause neurobehavioral problems later in life.

How can families reduce the risk of exposure to DDT,DDE, and DDE?

❑ Most families will be exposed to DDT by eating food or drinking liquids contaminated with small amounts of DDT.
❑ Cooking will reduce the amount of DDT in fish.
❑ Washing fruit and vegetables will remove most DDT from their surface.
❑ Follow health advisories that tell you about consumption of fish and wildlife caught in contaminated areas.

Is there a medical test to show whether I've been exposed to DDT, DDE, and DDD?

Laboratory tests can detect DDT, DDE, and DDD in fat, blood, urine, semen, and breast milk. These tests may show low, moderate, or excessive exposure to these compounds, but cannot tell the exact amount you were exposed to, or whether you will experience adverse effects. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m^3) in the workplace for an 8-hour shift, 40-hour workweek.
The Food and Drug Administration (FDA) has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for DDT/DDE/DDD (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ETHYLBENZENE
CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕth′ əl bĕn′ zēn′)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- ❏ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- ❏ When lead is released to the air, it may travel long distances before settling to the ground.
- ❏ Once lead falls onto soil, it usually sticks to soil particles.
- ❏ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- ❏ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
- ❏ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
- ❏ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
- ❏ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❏ Avoid exposure to sources of lead.

❏ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❏ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❏ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❏ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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MANGANESE

CAS # 7439-96-5

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2008**

This fact sheet answers the most frequently asked health questions (FAQs) about manganese. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Manganese is a trace element and eating a small amount from food or water is needed to stay healthy. Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food. At high levels, it can cause damage to the brain. Manganese has been found in at least 869 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is manganese?

Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese occurs naturally in most foods and may be added to some foods.

Manganese is used principally in steel production to improve hardness, stiffness, and strength. It may also be used as an additive in gasoline to improve the octane rating of the gas.

What happens to manganese when it enters the environment?

❑ Manganese can be released to the air, soil, and water from the manufacture, use, and disposal of manganese-based products.

❑ Manganese cannot break down in the environment. It can only change its form or become attached to or separated from particles.

❑ In water, manganese tends to attach to particles in the water or settle into the sediment.

❑ The chemical state of manganese and the type of soil determine how fast it moves through the soil and how much is retained in the soil.

❑ The manganese-containing gasoline additive may degrade in the environment quickly when exposed to sunlight, releasing manganese.

How might I be exposed to manganese?

❑ The primary way you can be exposed to manganese is by eating food or manganese-containing nutritional supplements. Vegetarians who consume foods rich in manganese such as grains, beans and nuts, as well as heavy tea drinkers, may have a higher intake of manganese than the average person.

❑ Certain occupations like welding or working in a factory where steel is made may increase your chances of being exposed to high levels of manganese.

❑ Manganese is routinely contained in groundwater, drinking water, and soil at low levels. Drinking water containing manganese or swimming or bathing in water containing manganese may expose you to low levels of this chemical.

How can manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.

The most common health problems in workers exposed to high levels of manganese involve the nervous system. These health effects include behavioral changes and other nervous system effects, which include movements that may become slow and clumsy. This combination of symptoms when sufficiently severe is referred to as "manganism". Other less severe nervous system effects such as slowed hand movements have been observed in

some workers exposed to lower concentrations in the work place.

Nervous system and reproductive effects have been observed in animals after high oral doses of manganese.

How likely is manganese to cause cancer?

The EPA concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer.

How can manganese affect children?

Studies in children have suggested that extremely high levels of manganese exposure may produce undesirable effects on brain development, including changes in behavior and decreases in the ability to learn and remember. We do not know for certain that these changes were caused by manganese alone. We do not know if these changes are temporary or permanent. We do not know whether children are more sensitive than adults to the effects of manganese, but there is some indication from experiments in laboratory animals that they may be.

Studies of manganese workers have not found increases in birth defects or low birth weight in their offspring. No birth defects were observed in animals exposed to manganese.

How can families reduce the risks of exposure to manganese?

❏ Children are not likely to be exposed to harmful amounts of manganese in the diet. However, higher-than-usual amounts of manganese may be absorbed if their diet is low in iron. It is important to provide your child with a well-balanced diet.

❏ Workers exposed to high levels of airborne manganese in certain occupational settings may accumulate manganese dust on their work clothes. Manganese-contaminated work clothing should be removed before getting into your car or entering your home to help reduce the exposure hazard for yourself and your family.

Is there a medical test to determine whether I've been exposed to manganese?

Several tests are available to measure manganese in blood, urine, hair, or feces. Because manganese is normally present in our body, some is always found in tissues or fluids.

Because excess manganese is usually removed from the body within a few days, past exposures are difficult to measure with common laboratory tests.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to manganese in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has established that lifetime exposure to 0.3 mg/L manganese is not expected to cause any adverse effects.

The FDA has determined that the manganese concentration in bottled drinking water should not exceed 0.05 mg/L.

The Occupational Health and Safety Administration (OSHA) has established a ceiling limit (concentration that should not be exceeded at any time during exposure) of 5 mg/m^3 for manganese in workplace air.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Manganese (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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MERCURY
CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mŭr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

❏ Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.

❏ Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.

❏ Naphthalene can become weakly attached to soil or pass through soil into underground water.

❏ In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.

❏ Naphthalene does not accumulate in the flesh of animals or fish that you might eat.

❏ 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❏ Breathing low levels in outdoor air.

❏ Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.

❏ Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.

❏ Drinking water from contaminated wells.

❏ Touching fabrics that are treated with moth repellents containing naphthalene.

❏ Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene

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causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❑ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❑ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❑ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❑ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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NICKEL

CAS # 7440-02-0

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about nickel. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Nickel is a naturally occurring element. Pure nickel is a hard, silvery-white metal used to make stainless steel and other metal alloys. Skin effects are the most common effects in people who are sensitive to nickel. Workers who breathed very large amounts of nickel compounds developed chronic bronchitis and lung and nasal sinus cancers. Nickel has been found in at least 882 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is nickel?

Nickel is a very abundant natural element. Pure nickel is a hard, silvery-white metal. Nickel can be combined with other metals, such as iron, copper, chromium, and zinc, to form alloys. These alloys are used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel.

Nickel can combine with other elements such as chlorine, sulfur, and oxygen to form nickel compounds. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions. Nickel is found in all soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor. Nickel and its compounds have no characteristic odor or taste.

What happens to nickel when it enters the environment?

❏ Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators.

❏ In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days.

❏ Nickel released in industrial waste water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese.

❏ Nickel does not appear to accumulate in fish or in other animals used as food.

How might I be exposed to nickel?

❏ By eating food containing nickel, which is the major source of exposure for most people.

❏ By skin contact with soil, bath or shower water, or metals containing nickel, as well as by handling coins or touching jewelry containing nickel.

❏ By drinking water that contains small amounts of nickel.

❏ By breathing air or smoking tobacco containing nickel.

❏ Higher exposure may occur if you work in industries that process or use nickel.

How can nickel affect my health?

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10-20% of the population is sensitive to nickel. People can become sensitive to nickel when jewelry or other things containing it are in direct contact with the skin for a long time. Once a person is sensitized to nickel, further contact with the metal may produce a reaction. The most common reaction is a skin rash at the site of contact. The skin rash may also

occur at a site away from the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it.

People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function. These persons breathed amounts of nickel much higher than levels found normally in the environment.

Workers who drank water containing high amounts of nickel had stomach ache and suffered adverse effects to their blood and kidneys.

Damage to the lung and nasal cavity has been observed in rats and mice breathing nickel compounds. Eating or drinking large amounts of nickel has caused lung disease in dogs and rats and has affected the stomach, blood, liver, kidneys, and immune system in rats and mice, as well as their reproduction and development.

How likely is nickel to cause cancer?

Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds while working in nickel refineries or nickel processing plants. The Department of Health and Human Services (DHHS) has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens. The International Agency for Research on Cancer (IARC) has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The EPA has determined that nickel refinery dust and nickel subsulfide are human carcinogens.

How can nickel affect children?

It is likely that the health effects seen in children exposed to nickel will be similar to those seen in adults. We do not know whether children differ from adults in their susceptibility to nickel. Human studies that examined whether nickel can harm the fetus are inconclusive. Animal studies have found increases in newborn deaths and decreased newborn weight after ingesting very high amounts of nickel. Nickel can be transferred from the mother to an infant in breast milk and can cross the placenta.

How can families reduce the risks of exposure to nickel?

❑ Avoiding jewelry containing nickel will eliminate risks of exposure to this source of the metal.

❑ Exposures of the general population from other sources, such as foods and drinking water, are almost always too low to be of concern.

Is there a medical test to determine whether I've been exposed to nickel?

There are tests available to measure nickel in your blood, feces, and urine. More nickel was measured in the urine of workers who were exposed to nickel compounds that dissolve easily in water than in the urine of workers exposed to nickel compounds that are hard to dissolve. This means that it is easier to tell if you have been exposed to soluble nickel compounds than less-soluble compounds. The nickel measurements do not accurately predict potential health effects from exposure to nickel.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 0.1 milligrams of nickel per liter of water (0.1 mg/L). To protect workers, the Occupational Safety and Health Administration (OSHA) has set a limit of 1 mg of nickel per cubic meter of air (1 mg/m^3) for metallic nickel and nickel compounds in workplace air during an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Nickel (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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PERCHLORATES

CAS # 10034-81-8, 7778-74-7, 7790-98-9, 7601-89-0, 7791-03-9

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2008**

This fact sheet answers the most frequently asked health questions (FAQs) about perchlorates. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Solid perchlorates can be very reactive chemicals that are used mainly in fireworks, explosives, and rocket motors. Consumption of food and water containing perchlorates are the most relevant routes of exposure for the general population. Efforts are being made to determine the relative contribution of perchlorate from food and water. High levels of perchlorates can affect the thyroid gland, which in turn can alter the function of many organs in the body. The fetus and young children can be especially susceptible. Perchlorates have been found in at least 49 of the 1,581 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are perchlorates?

Perchlorates are colorless salts that have no odor. There are five perchlorate salts that are manufactured in large amounts: magnesium perchlorate, potassium perchlorate, ammonium perchlorate, sodium perchlorate, and lithium perchlorate. Perchlorate salts are solids that dissolve easily in water.

One place where perchlorates occur naturally is in western Texas and in saltpeter deposits in Chile, where the saltpeter is used to make fertilizer. Perchlorates can also form naturally in the atmosphere, leading to trace levels of perchlorate in precipitation. Perchlorates can be very reactive chemicals that are used mainly in explosives, fireworks, road flares, and rocket motors. The solid booster rocket of the space shuttle is almost 70% ammonium perchlorate.

Perchlorates are also used for making other chemicals. Many years ago, perchlorates were used as a medication to treat an overactive thyroid gland.

What happens to perchlorates when they enter the environment?

❑ Perchlorates entered the environment where rockets were made, tested, and taken apart.

❑ Perchlorates also enter the environment from fireworks, road safety flares, and through the use and disposal of consumer products such as bleach where perchlorate may be contained as an impurity. There is also evidence that there are natural sources of perchlorates in the environment.

❑ Factories that make or use perchlorates may also release them to soil and water.

❑ Perchlorates will not stay in soil and will wash away with rain water.

❑ Perchlorates will eventually end up in ground water.

❑ We do not know exactly how long perchlorates will last in water and soil, but the information available indicates that it is a very long time.

❑ Efforts to clean up the contamination of soil and water have been and continue to be made.

❑ Perchlorates have been found in many foods and in some drinking water supplies.

How might I be exposed to perchlorates?

❑ Eating food, milk, or drinking water contaminated with perchlorates. Recent studies have shown widespread exposure to low levels of perchlorate by the general population. Efforts are being made to determine the relative contribution of perchlorate from food and water.

❑ Living near factories that make fireworks, flares, or other explosive devices.

❑ Exposure before and after fireworks shows, or exposure during use of certain cleaning products and pool chemicals.

❑ Chewing tobacco may expose you to perchlorates because a variety of tobacco products contain perchlorates.

❑ Living near a waste site or a rocket manufacturing or testing facility that contains high levels of perchlorate in the soil or groundwater may expose you to higher levels.

PERCHLORATES

CAS # 10034-81-8, 7778-74-7, 7790-98-9, 7601-89-0, 7791-03-9

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

How can perchlorates affect my health?

The health effects of perchlorate salts are due to the perchlorate itself and not to the other component (i.e., magnesium, ammonium, potassium, etc.). Perchlorate affects the ability of the thyroid gland to take up iodine. Iodine is needed to make hormones that regulate many body functions after they are released into the blood. Perchlorate's inhibition of iodine uptake must be great enough to affect the thyroid before it is considered harmful. Healthy volunteers who took about 35 milligrams (35 mg) of perchlorate every day for 14 days or 3 mg for 6 months showed no signs of abnormal functioning of their thyroid gland or any other health problem. Studies of workers exposed for years to approximately the same amount of perchlorates found no evidence of alterations in the worker's thyroids, livers, kidneys, or blood. However, there is concern that people exposed to higher amounts of perchlorate for a long time may develop a low level of thyroid activity; the name of this medical condition is hypothyroidism. Low levels of thyroid hormones in the blood may lead to adverse effects on the skin, cardiovascular system, pulmonary system, kidneys, gastrointestinal tract, liver, blood, neuromuscular system, nervous system, skeleton, male and female reproductive system, and numerous endocrine organs. Studies in animals also have shown that the thyroid gland is the main target of toxicity for perchlorate. Perchlorate did not affect reproduction in a study in rats.

Other chemicals such as thiocyanate (in food and cigarette smoke) and nitrate (in some food), are known to inhibit iodide uptake.

How likely are perchlorates to cause cancer?

There are no studies of exposure to perchlorates and cancer in humans. Long-term exposure to perchlorates induced thyroid cancer in rats and mice, but there are reasons to believe that humans are less likely than rodents to develop this type of cancer. The National Academy of Sciences (NAS) concluded that it is unlikely that perchlorates pose a risk of thyroid cancer in humans. Perchlorates have not been classified for carcinogenic effects by the Department of Health and Human Services (DHHS) or the International Agency for Research on Cancer (IARC). The EPA determined that perchlorate is not likely to be carcinogenic to humans, at least at doses below those necessary to alter thyroid hormone homeostasis.

How can perchlorates affect children?

The most sensitive population is fetuses of pregnant women who might have hypothyroidism or iodide deficiency

Infants and developing children may be more likely to be affected by perchlorates than adults because thyroid hormones are essential for normal growth and development.

Perchlorate has been found in breast milk. Studies of thyroid function of babies and young children whose mothers were exposed to perchlorate in their drinking water have not provided convincing evidence of thyroid abnormalities associated with perchlorate.

Studies in animals have shown that perchlorate can alter the thyroid gland in the newborn animals.

How can families reduce the risk of exposure to perchlorates?

❏ Although perchlorate is present in food, milk and drinking water, it is very unlikely that it will be present in the air of the average home or apartment.

❏ Use bottled water if you have concerns about the presence of perchlorates in your tap water.

❏ You may also contact local drinking water authorities and follow their advice.

❏ Prevent children from playing in dirt or eating dirt if you live near a waste site that has perchlorates.

Is there a medical test to show whether I've been exposed to perchlorates?

Perchlorate can be measured in the blood, urine, and breast milk with special tests. In a CDC study, perchlorate was found in urine of all the people who were sampled across the country. Because perchlorate leaves the body fairly rapidly, perchlorate in urine only indicates recent exposure, but as perchlorate is present in some foods and in some drinking water supplies, exposure to perchlorate may be frequent for some people.

Has the federal government made recommendations to protect human health?

EPA adopted a Reference Dose (RfD) for perchlorate in 2005, and issued guidance regarding the cleanup of perchlorate at Superfund sites in 2006. EPA is currently evaluating whether there is a meaningful opportunity to reduce health risk through national drinking water regulation for perchlorate.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Perchlorates. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Perfluoroalkyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about perfluoroalkyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure can occur from ingesting contaminated food or drinking water or breathing contaminated air. Treated carpets can be an important source of exposure for children. Studies in humans suggest an association between increases in blood cholesterol and higher PFOA or PFOS blood levels. High blood levels of PFOA and PFOS may also be associated with increased uric acid levels and liver damage.

What are perfluoroalkyls?

Perfluoroalkyls are a family of human-made chemicals that do not occur naturally in the environment. The two perfluoroalkyls which were made in the largest amounts in the U.S. are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS).

Perfluoroalkyls have been used in surface protection products such as carpet and clothing treatments and coating for paper and cardboard packaging. They have also been used in fire-fighting foams. Companies have stopped production or have begun changing manufacturing practices to reduce releases and the amounts of these chemicals in their products.

What happens to perfluoroalkyls when they enters the environment?

- Perfluoroalkyls can be found in air, soil, and water after release from the manufacture, use, and disposal of products that contain these chemicals, and during the manufacturing process. They may also be formed in the environment when other related chemicals break down.
- They break down very slowly in air, but fall to the ground within days to weeks.
- They do not break down in water or soil and may be carried over great distances.

How might I be exposed to perfluoroalkyls?

- Exposure to perfluoroalkyls is widespread. PFOA, PFOS, perfluorononanoic acid (PFNA), and perfluorohexane sulfonic acid (PFHxS) have been detected in 95-100% of samples of people's blood in 1999-2000 and 2003-2004. More recent monitoring data still show widespread exposure; however, the levels of these substances in people's blood appear to be declining.
- You may be exposed to perfluoroalkyls from the air, indoor dust, food, water, and various consumer products. Food is expected to be the most important source of exposure to perfluoroalkyls such as PFOA and PFOS. Human breastmilk may contribute to the exposure of infants since perfluoroalkyls have been detected in breast milk.
- Carpets treated with perfluoroalkyls can be an important source of exposure for children.
- Workers in facilities that make or use perfluoroalkyls can be exposed to higher amounts and have increased levels of these chemicals in their blood. Some communities near facilities where PFOA and PFOS were previously manufactured were exposed to high levels of these substances in drinking water.

How can perfluoroalkyls affect my health?

A large number of human studies have examined possible relationships between levels of perfluoroalkyls in blood and adverse health effects. It is difficult to interpret these results because they are not consistent; some studies have found an effect and others have not found the same effect. Even though some studies have found associations between serum perfluoroalkyl levels and adverse health effects, it does not mean that perfluoroalkyls caused these effects; they may be due to other factors not considered by researchers. The available human studies suggest that increases in blood cholesterol levels are associated with higher PFOA or PFOS blood levels. There is also some indication that serum PFOA or PFOS may be associated with increased uric acid levels, which may be associated with an increased risk of high blood pressure. PFOA or PFOS exposure may also cause liver damage.

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Perfluoroalkyls

Humans and animals react differently to PFOA and PFOS and not all effects observed in rats and mice may occur in humans. The liver appears to be the most sensitive target in animals ingesting perfluoroalkyls. Studies in mice found that the immune system is a sensitive target of PFOA and PFOS.

How likely are perfluoroalkyls to cause cancer?

There is no conclusive evidence that perfluoroalkyls cause cancer in humans. Some increases in prostate, kidney, and testicular cancers have been seen in individuals exposed to high levels. These results should be interpreted cautiously because the effects were not consistently found and most studies did not control for other potential factors such as smoking.

Rats that ingested PFOA and PFOS for a long time developed tumors. However, some scientists believe that based on the way this happens in rats and the differences between rats and humans, humans should not be expected to get cancer. Others believe that it is possible for perfluoroalkyls to cause cancer in humans.

The International Agency for Research on Cancer and the Department of Health and Human Services have not yet evaluated the carcinogenicity of perfluoroalkyls. The EPA has begun an evaluation.

How can perfluoroalkyls affect children?

No associations between serum PFOA and birth defects were observed in children of mothers living in an area with high PFOA in the water. Some studies of the general population and people living near a PFOA manufacturing facility have found that higher levels of serum PFOA or PFOS are associated with lower infant birth weights. However, the decrease in birth weight is small and may not affect the infant's health. A study of children exposed to high levels of PFOA in drinking water found increases in blood cholesterol, which is similar to the findings in adults.

Birth defects, delayed development, and early deaths have been observed in mouse and rat pups exposed to PFOA or PFOS, but not in animals exposed to perfluorobutyric acid (PFBA) or PFHxS. Scientists believe that some of the effects observed in rats and mice exposed to PFOA or PFOS may not be relevant to humans.

How can families reduce the risk of exposure to perfluoroalkyls?

- Families may choose to use consumer products that do not contain perfluoroalkyls.
- Families whose tap or well water that contains perfluoroalkyls may choose to drink or cook with bottled water or to install activated carbon water filters.

Is there a medical test to show whether I've been exposed to perfluoroalkyls?

Perfluoroalkyls can be measured in blood, but this is not a routine test that can be performed in a doctor's office. Mean serum concentrations of 3.07 and 9.32 µg/L of PFOA and PFOS, respectively, were measured in blood samples from members of the U.S. general population in 2009-2010.

Members of a community whose drinking water was contaminated with PFOA from a nearby industrial facility had a mean serum PFOA concentration of 83.6 µg/L in 2005. Fluorochemical product workers had mean serum PFOA and PFOS levels of 1,760 and 1,320 µg/L, respectively.

The presence of perfluoroalkyls in your blood may indicate that you have been exposed to and absorbed these chemicals into your body. However, it does not necessarily mean that you will suffer adverse health effects.

Has the federal government made recommendations to protect human health?

The EPA has established a provisional drinking water advisory for PFOA and PFOS of 0.4 and 0.2 µg/L, respectively.

References

This ToxFAQs™ information is taken from the 2015 Toxicological Profile for Perfluoroalkyls (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

PHENOL

CAS # 108-95-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2006**

This fact sheet answers the most frequently asked health questions (FAQs) about phenol. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Phenol is both a manufactured chemical and a natural substance. Phenol is used as a disinfectant and is found in a number of consumer products. Skin exposure to high amounts can produce skin burns, liver damage, dark urine, irregular heart beat, and even death. Ingestion of concentrated phenol can produce internal burns. Phenol has been found in at least 595 of the 1,678 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is phenol?

Phenol is both a manufactured chemical and a natural substance. It is a colorless-to-white solid when pure. The commercial product is a liquid. Phenol has a distinct odor that is sickeningly sweet and tarry.

You can taste and smell phenol at levels lower than those that are associated with harmful effects. Phenol evaporates more slowly than water, and a moderate amount can form a solution with water. Phenol can catch fire.

Phenol is used primarily in the production of phenolic resins and in the manufacture of nylon and other synthetic fibers. It is also used in slimicides (chemicals that kill bacteria and fungi in slimes), as a disinfectant and antiseptic, and in medicinal preparations such as mouthwash and sore throat lozenges.

What happens to phenol when it enters the environment?

❏ Following small, single releases, phenol is rapidly removed from the air (generally, half is removed in less than a day).
❏ Phenol generally remains in the soil only about 2 to 5 days.
❏ Phenol can remain in water for a week or more.
❏ Larger or repeated releases of phenol can remain in the air, water, and soil for much longer periods of time.
❏ Small amounts of phenol may be found in organisms that live in contaminated water.
❏ Phenol does not build up in fish, other animals, or plants.

How might I be exposed to phenol?

❏ You may be exposed to phenol if you live near landfills or hazardous waste sites that contain phenol or near facilities manufacturing phenol.
❏ You may be exposed to very low levels in your home because it is found in a number of consumer products, including mouthwashes, gargles, and throat lozenges.
❏ You may be exposed to phenol if you undergo “chemical peels” to remove skin lesions with phenol-containing products or are treated for chronic pain or spasticity with injections of phenol.
❏ Low levels of phenol are found in some foods, including smoked summer sausage, fried chicken, mountain cheese, and some species of fish.
❏ Smoking or inhaling second hand smoke will expose you to phenol.
❏ Low levels of phenol can be present in air and drinking water.

How can phenol affect my health?

Short-term exposure to phenol in the air can cause respiratory irritation, headaches, and burning eyes. People who had skin exposure to high amounts of phenol had skin burns, liver damage, dark urine, irregular heart beat, and

some died. Ingestion of high concentrations of phenol has resulted in internal burns and death. The effects of prolonged exposure to low levels of phenol in air or of ingestion of low levels of phenol are uncertain because almost always there has been simultaneous exposure to other chemicals.

In animals, breathing air with high levels of phenol resulted in irritation of the lungs. Repeated exposures induced muscle tremors and loss of coordination. Exposure to high concentrations of phenol in the air for several weeks caused paralysis and severe injury to the heart, liver, kidneys, and lungs, and in some cases, death. Some animals that drank water with very high concentrations of phenol suffered muscle tremors and loss of coordination.

Phenol can have beneficial effects when used medically as an antiseptic or anesthetic.

How likely is phenol to cause cancer?

It is not known if phenol causes cancer in humans. Cancer developed in mice when phenol was applied to the skin several times per week for the lifetime of the animal. Phenol did not cause cancer in mice or rats that drank water containing it for 2 years. The International Agency for Research on Cancer (IARC) and the EPA have determined that phenol is not classifiable as to its carcinogenicity to humans.

How can phenol affect children?

Children are exposed to phenol in the same way adults are, except for exposures of adults at work. However, children are at greater risk of accidentally ingesting or spilling on their skin home products that contain phenol. Vomiting and lethargy were the most frequent signs of toxicity observed in children who accidentally ingested phenol and were treated at a poison control center.

Phenol has caused minor birth defects and low birth weight in animals generally at exposure levels that also were toxic to the pregnant mothers.

How can families reduce the risks of exposure to phenol?

❑ Avoiding environmental tobacco smoke, which contains phenol, will reduce phenol exposures.
❑ Always store household products and over-the-counter medications that contain phenol in their original labeled containers out of the reach of children.

Is there a medical test to determine whether I've been exposed to phenol?

There is a urine test that can tell if you have been exposed to phenol recently (within 1 or 2 days). However, the test cannot tell if you were exposed only to phenol because many substances are converted to phenol in the body. The test also cannot tell whether adverse health effects might result from the exposure. The test for phenol is not routinely performed at your doctor's office, but your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA lifetime health advisory for phenol in water is 2 milligrams per liter (2 mg/L). EPA requires that spills of 1,000 pounds or more of phenol to the environment be reported to the Agency.

The Occupational Safety and Health Administration (OSHA) has set a limit of 5 parts per million (ppm) in air to protect workers during 8-hour work shifts.

The National Institute for Occupational Safety and Health (NIOSH) recommends a limit of 5 ppm for phenol in workroom air over a 10-hour workday and that the concentration of phenol should not exceed 16 ppm during a 15-minute period.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Phenol (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

SELENIUM

CAS # 7782-49-2

Division of Toxicology ToxFAQs™ **September 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about selenium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: People may be exposed to low levels of selenium daily through food and water. Selenium is a trace mineral needed in small amounts for good health, but exposure to much higher levels can result in neurological effects and brittle hair and deformed nails. Occupational inhalation exposure to selenium vapors may cause dizziness, fatigue, irritation of mucous membranes, and respiratory effects. This substance has been found in at least 508 of the 1,636 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is selenium?

Selenium is a naturally occurring mineral element that is distributed widely in nature in most rocks and soils. In its pure form, it exists as metallic gray to black hexagonal crystals, but in nature it is usually combined with sulfide or with silver, copper, lead, and nickel minerals. Most processed selenium is used in the electronics industry, but it is also used: as a nutritional supplement; in the glass industry; as a component of pigments in plastics, paints, enamels, inks, and rubber; in the preparation of pharmaceuticals; as a nutritional feed additive for poultry and livestock; in pesticide formulations; in rubber production; as an ingredient in antidandruff shampoos; and as a constituent of fungicides. Radioactive selenium is used in diagnostic medicine.

What happens to selenium when it enters the environment?

❏ Selenium occurs naturally in the environment and can be released by both natural and manufacturing processes.
❏ Selenium dust can enter the air from burning coal and oil. This selenium dust will eventually settle over the land and water.
❏ It also enters water from rocks and soil, and from agricultural and industrial waste. Some selenium compounds will dissolve in water, and some will settle to the bottom as particles.
❏ Insoluble forms of selenium will remain in soil, but soluble forms are very mobile and may enter surface water from soils.
❏ Selenium may accumulate up the food chain.

How might I be exposed to selenium?

❏ The general population is exposed to very low levels of selenium in air, food, and water. The majority of the daily intake comes from food.
❏ People working in or living near industries where selenium is produced, processed, or converted into commercial products may be exposed to higher levels of selenium in the air.
❏ People living in the vicinity of hazardous waste sites or coal burning plants may also be exposed to higher levels of selenium.

How can selenium affect my health?

Selenium has both beneficial and harmful effects. Low doses of selenium are needed to maintain good health. However, exposure to high levels can cause adverse health effects. Short-term oral exposure to high concentrations of selenium may cause nausea, vomiting, and diarrhea. Chronic oral exposure to high concentrations of selenium compounds can produce a disease called selenosis. The major signs of selenosis are hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations

in the extremities).
Brief exposures to high levels of elemental selenium or selenium dioxide in air can result in respiratory tract irritation, bronchitis, difficulty breathing, and stomach pains. Longer-term exposure to either of these air-borne forms can cause respiratory irritation, bronchial spasms, and coughing.
Levels of these forms of selenium that would be necessary to produce such effects are normally not seen outside of the workplace.
Animal studies have shown that very high amounts of selenium can affect sperm production and the female reproductive cycle. We do not know if similar effects would occur in humans.

How likely is selenium to cause cancer?

Studies of laboratory animals and people show that most selenium compounds probably do not cause cancer. In fact, studies in humans suggest that lower-than-normal selenium levels in the diet might increase the risk of cancer.
The International Agency for Research on Cancer (IARC) has determined that selenium and selenium compounds are not classifiable as to their carcinogenicity to humans.
The EPA has determined that one specific form of selenium, selenium sulfide, is a probable human carcinogen. Selenium sulfide is not present in foods and is a very different chemical from the organic and inorganic selenium compounds found in foods and in the environment.

How can selenium affect children?

It is likely that the health effects seen in children exposed to selenium will be similar to the effects seen in adults.
However, one study found that children may be less susceptible to the health effects of selenium than adults.
Selenium compounds have not been shown to cause birth defects in humans or in other mammals.

How can families reduce the risk of exposure to selenium?

❑ Certain dietary supplements and shampoos contain selenium; these should be used according to the manufacturer's directions.
❑ Children living near waste sites that contain selenium or coal burning plants should be encouraged to wash their hands before eating and to avoid putting their unwashed hands in their mouths.

Is there a medical test to show whether I've been exposed to selenium?

Low levels of selenium are normally found in body tissues and urine. Blood and urine tests for selenium are most useful for people who have recently been exposed to high levels. Toenail clippings can be used to determine longer-term exposure. These tests are not usually available at your doctor's office, but your doctor can send the samples to a laboratory that can perform the tests. None of these tests, however, can predict whether you will experience any health effects.

Has the federal government made recommendations to protect human health?

The EPA restricts the amount of selenium allowed in public water supplies to 50 parts total selenium per billion parts of water (50 ppb).
The Occupational Safety and Health Administration (OSHA) sets a limit of 0.2 mg selenium/m^3 of workroom air for an 8-hour work shift.
ATSDR and the EPA have determined that 5 micrograms of selenium per kilogram of body weight taken daily would not be expected to cause any adverse health effects over a lifetime of such intake.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Selenium (Update) Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.
- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of

people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ZINC
CAS # 7440-66-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about zinc. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. Zinc has been found in at least 985 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is zinc?

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments.

What happens to zinc when it enters the environment?

❏ Some is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste.
❏ It attaches to soil, sediments, and dust particles in the air.
❏ Rain and snow remove zinc dust particles from the air.
❏ Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers.
❏ Most of the zinc in soil stays bound to soil particles and does not dissolve in water.
❏ It builds up in fish and other organisms, but it does not build up in plants.

How might I be exposed to zinc?

❏ Ingesting small amounts present in your food and water.
❏ Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
❏ Eating too many dietary supplements that contain zinc.
❏ Working on any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. We do not know if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile.

Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. We do not know the long-term effects of breathing high levels of zinc.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity.

How can zinc affect children?

Zinc is essential for proper growth and development of young children. It is likely that children exposed to very high levels of zinc will have similar effects as adults. We do not know whether children are more susceptible to the effects of excessive intake of zinc than the adults.

We do not know if excess zinc can cause developmental effects in humans. Animal studies have found decreased weight in the offspring of animals that ingested very high amounts of zinc.

How can families reduce the risks of exposure to zinc?

❑ Children living near waste sites that contain zinc may be exposed to higher levels of zinc through breathing contaminated air, drinking contaminated drinking water, touching or eating contaminated soil.

❑ Discourage your children from eating soil or putting their hands in their mouths and teach them to wash their hands frequently and before eating.

❑ If you use medicines or vitamin supplements containing zinc, make sure you use them appropriately and keep them out of the reach of children.

Is there a medical test to determine whether I've been exposed to zinc?

There are tests available to measure zinc in your blood, urine, hair, saliva, and feces. These tests are not usually done in the doctor's office because they require special equipment. High levels of zinc in the feces can mean high recent zinc exposure. High levels of zinc in the blood can mean high zinc consumption and/or high exposure. Tests to measure zinc in hair may provide information on long-term zinc exposure; however, the relationship between levels in your hair and the amount of zinc you were exposed to is not clear.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 5 milligrams per liter of water (5 mg/L) because of taste. The EPA requires that any release of 1,000 pounds (or in some cases 5,000 pounds) into the environment be reported to the agency.

To protect workers, the Occupational Safety and Health Administration (OSHA) has set an average limit of 1 mg/m^3 for zinc chloride fumes and 5 mg/m^3 for zinc oxide (dusts and fumes) in workplace air during an 8-hour workday, 40-hour workweek.

Similarly, the National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Zinc (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATTACHMENT B

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

_____

_____

_____

Summary of any job related injuries, illnesses, or near misses that week:

_____

_____

_____

_____

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

_____

_____

_____

Comments:

_____

_____

_____

Name: _____ Company: _____

Signature: _____ Title: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____ _____
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury	___ Illness	___ Near Miss
__ Property Damage	___ Fire	___ Chemical Exposure
__ On-site Equipment	___ Motor Vehicle	___ Electrical
__ Mechanical	___ Spill	___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WITNESS TO ACCIDENT/INCIDENT:

Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____
Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____

INJURED - ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling ___ Non-disabling ___ Fatality

____ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____

NATURE OF INJURY OR ILLNESS: _____

_____

_____

_____

CLASSIFICATION OF INJURY:

__ Abrasions	_____ Dislocations	____ Punctures
__ Bites	_____ Faint/Dizziness	____ Radiation Burns
__ Blisters	_____ Fractures	____ Respiratory Allergy
__ Bruises	_____ Frostbite	____ Sprains
__ Chemical Burns	_____ Heat Burns	____ Toxic Resp. Exposure
__ Cold Exposure	_____ Heat Exhaustion	____ Toxic Ingestion
__ Concussion	_____ Heat Stroke	____ Dermal Allergy
__ Lacerations		

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

_____

Cost of Damage: $ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident (Object, substance, material, machinery, equipment, conditions)

_____

_____

_____

_____

Was weather a factor?:_____

_____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

_____

_____

_____

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

_____

_____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

_____

_____

Modifications:

_____

Was injured using required equipment?:

_____

_____

If not, how did actual equipment use differ from plan?:

_____

_____

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?

_____

_____

_____

_____

_____

ACCIDENT/INCIDENT REPORT REVIEWED BY:

_____ _____

SSO Name Printed SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

_____ _____

Signature Title

_____ _____

Signature Title

_____ _____

Signature Title

ACCIDENT/INCIDENT FOLLOW-UP: Date: _____

Outcome of accident/incident: _____

_____

_____

_____

Physician's recommendations: _____

_____

_____

_____

Date injured returned to work: _____

Follow-up performed by:

_____ _____

Signature Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT C

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATH!

Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

(No Picture) Grip partner's wrist or place both hands around waist

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!

Thumbs up

NO! - NEGATIVE!

Thumbs down

APPENDIX H

CONSTRUCTION QUALITY ASSURANCE PLAN

37 OTSEGO STREET
BROOKLYN, NEW YORK

Construction Quality Assurance Project Plan

AKRF Project Number: 230011
BCP Site Number: C224300

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor
Albany, New York 12233

On Behalf Of:

Columbia SF LLC
670 Myrtle Avenue Suite 438
Brooklyn, New York 11205

Prepared by:

AKRF, Inc.
440 Park Avenue South
New York, New York 10016
(212) 696-0670

JUNE 2023

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1.0 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) describes the protocols and procedures that will be followed during implementation of the Remedial Action Work Plan (RAWP) at the 37 Otsego Street Site located at 37 Otsego Street in Brooklyn, New York (hereafter referred to as "the Site"). The approximately 100,000-square foot Site is identified on the New York City Tax Map as Brooklyn Borough Tax Block 579, Lot 1. The Site is currently enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) (BCP Site No. C224300).

This CQAP supplements the NYSDEC-approved RAWP and provides monitoring, inspection, testing, and documentation protocols and procedures.

The following information is provided:

1. Responsibility, Authority, and Qualifications – The responsibility, authority, and qualifications of the key personnel involved in the project.
2. Inspection and Testing Activities – Inspections and tests that will be used to verify that construction activities meet or exceed all design criteria and federal, state, and local regulations and requirements.
3. Meetings – The requirements for project coordination meetings between all involved parties.
4. Documentation and Reporting – Field documentation and reporting requirements.

2.0 RESPONSIBILITY AND AUTHORITY

Measures will be implemented to ensure that a functional quality control (QC) organization is active during the project and to provide support for the construction QC system in conducting inspections, tests and retesting (in the event of failure of any item of work). This includes oversight of subcontractors and compliance with contract provisions. Construction QC includes, but is not limited to, the inspections and tests required in the Remedial Action Work Plan (RAWP) and approved submittals and will cover all project operations. A consultant hired by the BCP Volunteer (Volunteer) will manage field activities and coordinate the contractor's activities.

2.1 Volunteer

Columbia SF LLC (the Volunteer) is responsible for coordinating the project, including activities of the Site consultant(s), contractor(s) and subcontractor(s), in order to comply with the requirements of the RAWP and regulatory agencies. The Volunteer is also responsible for completing and submitting documentation required by the RAWP, the CQAP, and the Quality Assurance Project Plan (QAPP), and has the authority to accept or reject the materials and workmanship of any subcontractors at the Site.

2.2 Construction Quality Assurance (QA) Officer (Consultant)

The construction QA officer will be an employee of AKRF, Inc. (AKRF) and will perform activities that are necessary to assure the quality of construction. He/she will be on-site as required during construction activities, and will have the authority to take any action necessary to maintain compliance with the RAWP and approved submittals and to monitor construction quality.

Specific responsibilities of the construction QA officer include:

- Supporting the Volunteer and the consultant's field staff;
- Evaluating construction activities and activities of the field staff;
- Verifying that remedial activities are performed in accordance with the RAWP, approved submittals, and federal, state, and local regulations and requirements;
- Verifying that data are properly recorded, validated, reduced, summarized, and inspected;
- Evaluating sampling and monitoring activities;
- Educating the field staff on construction QC requirements and procedures; and
- Scheduling and coordinating inspections.

2.3 Field Team Leader, Field Technician, and Site Safety Officer (Environmental Consultant)

The field team leader will be an employee of AKRF and will be on-site during construction activities. He/she will have authority to take any action necessary to maintain compliance with the RAWP and approved submittals and to maintain construction quality. The field team leader will also act as the field technician and Site Safety Office (SSO).

Specific responsibilities of the field team leader include:

- Reviewing the RAWP for clarity and completeness so that the construction activities can be effectively implemented;
- Verifying that the contractor's work is in accordance with the RAWP, approved submittals, and this CQAP;

- Performing on-site inspection of the work in progress to assess compliance with the RAWP, approved submittals, and this CQAP;
- Calibration, operation, and maintenance of air monitoring instrumentation in accordance with the RAWP and approved submittals;
- Collecting, packaging, and shipping of environmental samples in accordance with the RAWP and QAPP;
- Documenting sample collection in the field logbook and identifying all sample locations in the field logbook and on a Site drawing;
- Preparing and logging manifests for transportation of any non-hazardous and hazardous materials;
- Informing the designated Site personnel and/or AKRF project manager (who will inform the NYSDEC project manager) when/if the concentrations of air contaminants exceed action levels specified in the RAWP;
- Scheduling and coordinating inspections;
- Reporting the results of all observations and tests as the work progresses, and modifying materials and work to comply with the RAWP and approved submittals, as noted below:
    1. Providing daily reports on field construction, material shipments, and inspection results.
    2. Review and interpretation of all data, drawings, and reports.
    3. Identification of all work that should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval.
    4. Rejection of defective work and verification that corrective measures are implemented.
    5. Making observations and records that will aid in the preparation of a report on remedial activities.
- Inspecting each delivery of materials and/or equipment;
- Reporting to the Construction QA Officer the results of all inspections, including work that is not of acceptable quality or that fails to meet the requirements of the RAWP, approved submittals, and this CQAP;
- Maintaining and organizing the field equipment and supply storage area;
- Verifying that testing equipment meets established requirements and that the tests are conducted according to the proper standardized procedures;
- Confirming that testing equipment, personnel, and procedures do not change over time, or making sure that any changes do not adversely impact the inspection process; and
- Confirming that waste treatment or disposal is performed in accordance with applicable federal, state, and local laws and regulations.

3.0 FIELD QUALITY CONTROL (QC) INSPECTIONS, TESTING, AND SAMPLING

The definable features of work are described in the RAWP. This section describes the anticipated inspection, testing, and sampling requirements associated with these definable features of work.

3.1 Mobilization

Inspections will be performed to assure that Site laydown areas, support facilities, surface water controls, and air monitoring systems are established in accordance with the RAWP and approved submittals. In addition, the stakeout of existing utilities in work areas and the maintenance of Site security will be verified. There are no testing and sampling requirements associated with mobilization of the contractor(s).

Each delivery of materials and/or equipment will be inspected relative to approved submittals. Approved materials and/or equipment will be stored at a designated area of the Site.

Equipment will be set up and tested in accordance with the RAWP and approved submittals.

3.2 Soil Excavation

The Soil/Materials Management Plan (SMMP), Section 6.4 of the RAWP, outlines the procedures to be performed during the handling of soil/fill materials on-site during all intrusive work. Inspections will be performed during soil excavation activities including concrete removal, soil excavation, stockpiling, load out, shoring, and re-use and backfilling (if any). Any impacts to building structural elements will be documented and assessed immediately. AKRF will confirm that all soil excavation related work will be conducted as specified in the RAWP, or is equivalent. Air monitoring will be conducted as outlined in the HASP, provided as Appendix G of the RAWP. Soil screening will be conducted as outlined in Section 6.4.1 of the RAWP. Any corrective actions will be summarized in the daily reports.

3.3 Soil Sampling

Soil sampling activities at the Site may include on-site waste classification, endpoint, and reuse sampling, and sampling of clean backfill from off-site sources. Proposed endpoint sample locations are shown on Figure 4 of the RAWP. All soil sampling activities will be conducted in accordance with the QAPP.

The applicable Soil Cleanup Objectives (SCOs) for the Site are the Track 4 Restricted Residential SCOs (RRSCOs).

Soil and materials management on-site and off-site will be conducted in accordance with the SMMP (Section 6.4 of the RAWP).

3.4 Loading of Waste Material for Transportation

Inspections will be conducted to verify that material removed from the Site is properly loaded for transfer to a permitted treatment/disposal facility. Manifests and bills of lading will be maintained and will be included as an Appendix in the Final Engineering Report (FER).

3.5 In-Situ Solidification (ISS)

In-situ solidification (ISS) QA/QC coring of completed ISS treatment area (shown in Figure 3 of the RAWP) will be conducted to verify that ISS design parameters detailed in Section 7.0 of the RAWP have been met. ISS QA/QC coring will be conducted by the Contractor in accordance with the Contractor Site Operations Plan and/or post-RAWP contractor design submittals. The

ISS QA/QC sampling program will be conducted in accordance with the NYSDEC ISS QA/QC coring requirements (provided in Appendix J of the RAWP). ISS QA/QC testing and coring reports will be as an Appendix in the FER.

3.6 Site Restoration

Site restoration will be observed and recorded to verify compliance with the RAWP and approved submittals. The surface will be restored to match the surrounding ground surface.

4.0 MEETINGS

A pre-construction meeting will be held with representatives of NYSDEC, the consultants, and contractor(s) performing the work prior to the start of major construction activities. Additional meetings will be called as necessary if work conditions change or deviations are required.

Project personnel and visitors will be given health and safety briefings periodically by the field team leader to assist Site personnel in safely conducting their work activities. The safety briefings will include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions, as well as periodic reinforcement of previously discussed topics.

5.0 DOCUMENTATION AND REPORTING REQUIREMENTS

The value of this CQAP will be assured by proper documentation. The inspectors will use data sheets, field reports, log forms, schedules, and checklists to document Site work and verify compliance with the RAWP and approved submittals. Documentation will include, at a minimum, the following reports and information:

- Daily field construction reports;
- Photographs;
- Sampling chains of custody;
- Material disposition logs; and
- Any variances to the RAWP and approved submittals.

5.1 Daily Reports

The field team leader will prepare daily reports that identify the following:

- Work force and visitors to the Site;
- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and exported from the Site;
- References to an alphanumeric grid map for Site activities;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of Community Air Monitoring Program (CAMP) findings, including any excursions;
- Any deviations from the RAWP;
- Weather conditions;
- Photographs of the Site and pertinent work; and
- An explanation of notable Site conditions.

5.2 Photographic Log

The photographic log will be kept to document construction activities. The photographic log may also be used to record activities in the daily report. All photographs will have date and time stamps.

5.3 Sampling Documentation

A dedicated project field logbook will be used to document all sampling activities and how they correspond to the RAWP. All observations and field and/or laboratory tests will be recorded in the project field logbook or on separate logs. Recorded field observations may take the form of notes, charts, sketches, and/or photographs (with date and time stamps).

5.4 Material Disposition Tracking

All materials that are taken off-site for disposal will be tracked and final disposition confirmed. Copies of all waste manifests and bills of lading will be maintained by the AKRF project manager.

5.5 Variances to the RAWP

Any required changes to the RAWP will be documented as construction proceeds, if needed. Any material deviations from the NYSDEC-approved RAWP will be communicated to the NYSDEC project manager. NYSDEC approval will be sought prior to proceeding with work deviating materially from the RAWP. In the event of an emergency change to the work plan, the NYSDEC project manager will be consulted immediately.

5.6 Final Engineering Report (FER)

At the completion of the project, the consultant/construction manager will prepare an FER. This report will describe the implementation of the RAWP and will include a summary of the field work, as-built drawings for constructed elements, manifests, bills of lading, test results demonstrating that all mitigation and remedial systems are functioning properly, and photographic documentation. The FER will also include a description of any changes to the proposed Remedial Action (RA) from those provided in the RAWP.

5.7 Document Storage

The field team leader will maintain the current field logbook and all original field paperwork during the performance of work. The AKRF project manager will maintain the field paperwork after completion of the project and will maintain all submittal document files.

APPENDIX I

CITIZEN PARTICIPATION PLAN

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor, Albany, NY 12233-7016
P: (518) 402-9767 I F: (518) 402-9773
www.dec.ny.gov

April 9, 2020

Robert Kovacs, P.G.
ROUX Associates
209 Shafter Street
Islandia, NY 11749

Re: Citizen Participation Plan (CPP)
37 Otsego Street
37 Otsego Street
Brooklyn, Kings,
BCP Site No.: C224300

Dear Robert:

The New York Department of Environmental Conservation (NYSDEC) and Health have reviewed the April 2020 revised Citizen Participation Plan (CPP) related to the 37 Otsego Street BCP Site that was submitted to the Department electronically. Upon review, the Citizen Participation Plan has been determined to be complete and is hereby approved.

You are hereby requested to distribute hard copies of the CPP to the document repositories. Before placing the hard copies in the repositories please delete only the adjacent properties owner's names, contact information including their addresses from the Site contact list (Appendix B).

Please contact me if you have any questions or you require further information.

Sincerely

Sadique Ahmed, P.E.
Project Manager
Remedial Bureau B, Section B

ec: J. Grathwol
J. O'Connell
T. Panzone
S. McLaughlin, NYSDOH
J. Robinson, NYSDOH
L. Shaw, (lshaw@nyenvlaw.com)
S. Klugman, BH Ruth Red Hook LLC., (sklugman@qualitycapitalusa.com)

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
37 Otsego Street

April 2020

C224300
37 Otsego Street
Brooklyn
New York 11231

Contents

* * * * *

Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: **BH Ruth Red Hook, LLC**
Site Name: **37 Otsego Street**
Site Address: **37 Otsego Street, Brooklyn, NY 11231**
Site County: **Kings County**
Site Number: **C224300**

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at:
http://www.dec.ny.gov/chemical/8450.html .

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process

- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process

- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community

- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.
The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html .

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities

through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, the significant threat determination for the site had not yet been made.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at http://www.dec.ny.gov/regulations/2590.html

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

{Instruction to preparer: Edit the table as appropriate if additional citizen participation activities have been conducted and/or are planned beyond the minimum, required citizen participation activities identified.}

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Work Plan (RWP):	
• Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager)	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.

Citizen Participation Activities	Timing of CP Activity(ies)
• Conduct 45-day public comment period	
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

There will be areas on the Site where soil excavation is necessary. Therefore, once the remediation commences, there may be concerns regarding odors, noise or truck traffic coming from the Site. However, these impacts will be mitigated through implementation of a Health and Safety Plan (HASP) and Soil Management Plan approved by the Department, which will be designed to minimize these impacts. A Community Air Monitoring Plan (CAMP) will also be implemented to monitor dust and vapors to ensure the community is not impacted.

The Site is located in an Environmental Justice Area. Environmental Justice is defined as Environmental Justice is the fair and meaningful treatment of all people, regardless of race, income, national origin or color, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies.

Therefore, all future fact sheets will be translated into Spanish. For additional information visit: https://popfactfinder.planning.nyc.gov/profile/1401/census

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

- **Location – 37 Otsego Street, Brooklyn, NY 11231**
- **setting - Urban**
- **site size – 2.3 acres**
- **adjacent properties – Predominantly industrial and residential with some commercial uses**

History of Site Use, Investigation, and Cleanup

Prior to 1900, the Site was undeveloped but was present in an industrial area. As of 1904, the western portion of the Property was occupied by Philip H. Gill & Sons Machinists, and a Sanborn map shows machine shops, sheet iron works,

assembly, and a forge shop on the Site. Historic uses of the Property included a machine shop, iron works, metal forging, and printing facility. The southwest corner of the structure was labeled earthen floor. The machine shop had the same footprint as the current parking lot. The northwest corner of the Property may have been utilized as a gasoline service station. Records also showed underground storage tanks (USTs) on the eastern portion of the Property.

Despite the fact that a significant amount of work has been done on the Site to begin to address the petroleum impacts identified, more remediation is needed to complete the petroleum cleanup work and to remediate of environmental conditions in soil, groundwater and soil vapor. A 2015 site investigation, including the advancement of 13 borings with the collection of 17 soil samples, six groundwater samples, and six soil vapor samples, was the first subsurface investigation performed on the site. The historic fill soils consisted of sandy fill materials including brick, concrete, glass, micaceous schist, plastic, coal slag, wood, and rock fragments. Evidence of petroleum contamination (odors, staining, and liquid phase petroleum) was noted at the groundwater interface. An approximately 0.2-foot thick layer of petroleum liquid was identified in one well. The New York State Department of Environmental Conservation (NYSDEC) Spill Hotline was notified of the spill discovery on December 15, 2015, and Spill Number 1509420 was provided.

The second investigation was focused on the west side of the Site to determine if an upgradient off-site spill on Lorraine Street (Spill Number 9510807) has impacted the subsurface at the Site. This scope of work included: completion of ten soil borings; installation of five monitoring wells (converted from five of the soil borings with three off-site wells); collection of one petroleum fingerprinting analysis sample; collection of twenty soil samples; and collection of five groundwater samples from the monitoring wells. A sheen was observed on the groundwater in several wells and fingerprinting analysis determined it was a combination of weathered No. 2 fuel oil and diesel fuel. Based on this investigation, Roux Associates identified two distinct areas of petroleum contamination at the Site and determined contaminated historic fill was present to depth of 20 below grad surface. Based on this off-Site well investigation, it was determined that contamination is not migrating on-Site or off-Site but is Site-related.

An interim remedial measure (IRM) was implemented starting November 22, 2016 consisting of manually bailing all wells with sufficient petroleum thickness on a biweekly basis. A remedy was then proposed to remove the residual Light Non-Aqueous Phase Liquid (LNAPL) and to treat impacted soil and groundwater consisting of continued bailing and injection of chemical oxidation compound to treat petroleum impacts located between 9 to 18 ft below grade surface. From June 12, 2017 through June 28, 2017, Roux implemented the injection program with chemical oxidant, RegenOx™. However, the groundwater analytical results only showed marginal improvement in the dissolved-phase Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds

(SVOCs) contamination with 10 compounds still exceeding the applicable groundwater standards.

In January 2019, Roux prepared a Hot Spot Excavation Work Plan for the excavation and off-site disposal of contaminated soils from two hot spots within the western parking lot portion of the Site in order to attempt to remove the ongoing source of the groundwater contamination. Despite this additional remedial effort, the Site still remains significantly contaminated and requires a more complete excavation to remove all source of contamination in the soil impacting groundwater and soil vapor.

Based on the investigations conducted to date, the primary contaminants of concern remaining at the site are petroleum, Polycyclic Aromatic Hydrocarbons (PAHs) and metals in soil, petroleum in groundwater, and petroleum and other VOCs in soil vapor. Groundwater was encountered within the temporary well points at approximately 8 to 10 feet below. According to the Roux 2016 Site Assessment Report, soil impacts have been vertically delineated, and do not extend below the low zone of permeability silt/clay found throughout the Site.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a Volunteer. This means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the site and to contamination that has migrated from the site.

The planned redevelopment of the Site is not yet finalized. However, preliminary plans being evaluated include a mixed used residential, community facility, possible school and retail project with a below grade parking facility. The Applicant proposes that the site may be used unrestricted purposes or for restricted residential or commercial purposes.

To achieve this goal, the Applicant will conduct Investigation activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant will conduct an investigation of the site officially called a “remedial investigation” (RI). This investigation will be performed with NYSDEC oversight. The Applicant has developed a remedial investigation workplan, which was subject to public comment along with the application.

The site investigation has several goals:

1) Define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2) Identify the source(s) of the contamination;
3) Assess the impact of the contamination on public health and the environment; and
4) Provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

The Applicant submitted a draft “Remedial Investigation Work Plan” to NYSDEC for review and approval. NYSDEC made the draft plan available to the public review during a 30-day public comment period along with the application.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a “significant threat,” it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely

would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a “Certificate of Completion” (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a “Remedial Work Plan”. The Remedial Work Plan describes the Applicant’s proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a final engineering report that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Sadique Ahmed
Project Manager
NYSDEC Division of Environmental
Remediation
625 Broadway, 12th Floor
Albany, NY 12233-7016
(518) 402-9656

New York State Department of Health (NYSDOH):

~~Johnathon Robinson~~ Johnathan Robinson
Project Manager
NYSDOH
Empire State Plaza
Corning Tower Room 1787
Albany, NY 12237
~~(518) 402-7860~~ 518 402 7881

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Brooklyn Public Library
Red Hook Branch
7 Wolcott Street
Brooklyn, NY 11231
(718) 935-0203
Hours: ~~Temporarily Closed~~ Open

NYC Community Board No. 6, Brooklyn
Attn: Peter D. Fleming
250 Baltic Street
Brooklyn, NY 11201
Phone: (718) 643-3027
Hours: ~~Temporarily Closed~~ Open

Appendix B - Site Contact List

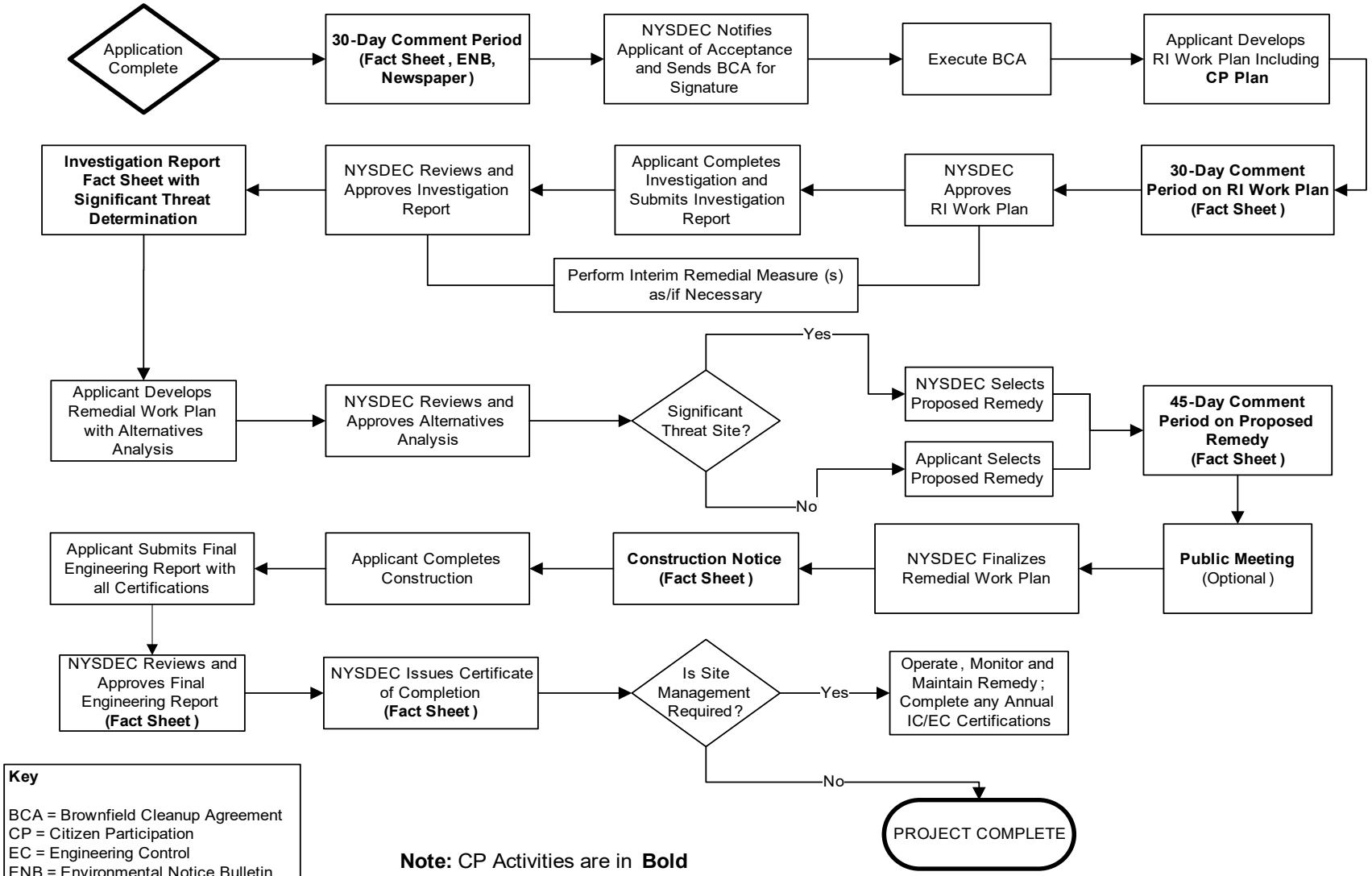
Federal and State Officials		
Hon. Chuck E. Schumer U.S. Senate 780 Third Avenue, Suite 2301 New York, NY 10017	Hon. Kirsten Gillibrand U.S. Senate 780 Third Avenue, Suite 2601 New York, NY 10017	Hon. Nydia Velazquez U.S. House of Representatives 266 Broadway, Suite 201 Brooklyn, New York 11201
Hon. Velmanette Montgomery New York State Senate - 25th District 30 Third Ave., Suite 207 Brooklyn, New York 11201	Nancy T. Sunshine Kings County Clerk 360 Adams Street, Room 189 Brooklyn, New York 11201	Hon. Eric Adams Kings County Executive Borough Hall, 209 Joralemon St. Brooklyn, New York 11201
Marisa Lago Chairperson, NYC Planning Commission 16 Court St., 7th Floor New York, New York	Hon. Bill de Blasio Mayor of New York City City Hall New York, NY 10007	Andrea Hagelgans Strategic Planning Advisor, New York City City Hall New York, NY 10007
Hon. Eric L. Adams Brooklyn Borough President Brooklyn Borough Hall, 209 Joralemon St. Brooklyn, New York 11201	Hon. Felix Ortiz NYS Assemblyman 4907 4th Avenue, Suite 1A Brooklyn, NY 11220	Brooklyn Community Board 6 250 Baltic Street Brooklyn, NY 11201
Media Outlets		
David Kirschner Brooklyn Media Outlet - News 12 1 Media Crossways Woodbury, NY 11201	The New York Daily News Media Outlet 4 New York Plaza New York, NY 10004	Park Slope Courier Media Outlet 1 Metrotech Center North Brooklyn, NY 11201
Public Water Supplier		
Vincent Sapienza Commissioner New York City Department of Environmental Protection 59-17 Junction Blvd. Flushing, NY 11373	Alfonso Carney Chair of New York City Water Board 59-17 Junction Blvd., 8th Floor Flushing, NY 11373	
Schools and Other Organizations		

Anita Skop, Superintendent of Public School S015 Patrick F. Daly 131 Livingston Street Brooklyn, New York 11201	Bumble Bee Daycare CTR 76 Lorraine Street Brooklyn, NY 11231	
Adjacent Property Owners		
Matt S. Friedman Adjacent Property Owner of 38 Otsego St 38 Otsego Street Brooklyn, New York 11231	Marilyn A. Donahue Adjacent Property Owner of 34 Otsego St 34 Otsego Street Brooklyn, New York 11231	133 Dwight St. Realty Adjacent Property Owner of 133 Dwight St 133 Dwight Street Brooklyn, New York 11231
Otsego Properties Inc. Adjacent Property Owner of 131 Dwight St 131 Dwight Street Brooklyn, New York 11231	Otsego Properties Inc. Adjacent Property Owner of 129 Dwight St 129 Dwight Street Brooklyn, New York 11231	Von Crab Athletic Club Adjacent Property Owner of 2 Otsego St 2 Otsego Street Brooklyn, New York 11231
NYC Housing Authority Adjacent Property Owner of 408 Red Hook Ln 408 Redhook Lane Brooklyn, New York 11231	NYC Housing Authority Adjacent Property Owner of 110 Columbia St 110 Columbia Street Brooklyn, New York 11231	Rap Columbia, LLC Adjacent Property Owner of 521 Columbia St 521 Columbia Street Brooklyn, New York 11231
T Moriarty & Son, Inc. Adjacent Property Owner of 529 Columbia St 529 Columbia Street Brooklyn, New York 11231	Grinnell Street Realty Co. Adjacent Property Owner of 0 Creamer St 0 Creamer Street Brooklyn, New York 11231	Grinnell Realty Holding Adjacent Property Owner of 537 Columbia St 537 Columbia Street Brooklyn, New York 11231
TET Real Estate Adjacent Property Owner of 518 Columbia St 518 Columbia Street Brooklyn, New York 11231	Magoo Enterprises Inc. Adjacent Property Owner of 41 Otsego St 41 Otsego Street Brooklyn, New York 11231	Mirabelle Marden Adjacent Property Owner of 40 Otsego St 40 Otsego Street Brooklyn, New York 11231
Community, Civic, Religious and Other Environmental Organizations:		
Red Hook West Houses NYCHA Management Development Office 55 Dwight Street Brooklyn, NY 11231	Red Hook West Houses Senior Center 6 Wolcott Street Brooklyn, NY 11231	Red Hook West Houses NYCHA President - Resident Association 55 Dwight Street Brooklyn, NY 11231

Red Hook East Houses NYCHA Management Development Office 62 Mill Street Brooklyn, NY 11231	Red Hook East Houses NYCHA President - Resident Association 62 Mill Street Brooklyn, NY 11231	Red Hook Gospel Tabernacle 72 Van Dyke Street Brooklyn, NY 11231
Red Hook Initiative 767 Hicks Street Brooklyn, NY 11231	Carroll Gardens Neighborhood Association 201 Columbia Street Brooklyn, NY 11231	

Appendix C - Site Location Map

Appendix D– Brownfield Cleanup Program Process



Key

BCA = Brownfield Cleanup Agreement
CP = Citizen Participation
EC = Engineering Control
ENB = Environmental Notice Bulletin
IC = Institutional Control
RI = Remedial Investigation

Note: CP Activities are in **Bold**

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern (see instructions)

Site Name: 37 Otsego Street

Site Number: C224300

Site Address and County: 37 Otsego Street, Brooklyn, NY

Remedial Party(ies): BH Ruth Red Hook, LLC

Note: For Parts 1. – 3. the individuals, groups, organizations, businesses and units of government identified should be added to the site contact list as appropriate.

Part 1. List major issues of public concern and information the community wants. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and information needs. **Use this information as an aid to prepare or update the Major Issues of Public Concern section of the site Citizen Participation Plan.**
The list of potential impacts contained in the CPP are typical impacts of remediation on brownfield sites

How were these issues and/or information needs identified?
See response above.

Part 2. List important information needed **from** the community, if applicable. Identify individuals, groups, organizations, businesses and/or units of government related to the information needed.
Nothing is needed from the community at this time

How were these information needs identified?
NA

Part 3. List major issues and information that need to be communicated **to** the community. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and/or information.
Communication of each step in the BCP process must be communicated in Fact Sheets and public hearings if required.

How were these issues and/or information needs identified?
This is part of the CPP process

Part 4. Identify the following characteristics of the affected/interested community. This knowledge will help to identify and understand issues and information important to the community, and ways to effectively develop and implement the site citizen participation plan (mark all that apply):

a. Land use/zoning at and around site:
☒ **Residential** ☐ **Agricultural** ☐ **Recreational** ☐ **Commercial** ☐ **Industrial**

b. Residential type around site:
☒ **Urban** ☐ **Suburban** ☐ **Rural**

c. Population density around site:

☒ **High** ☐ **Medium** ☐ **Low**

d. Water supply of nearby residences:
☒ **Public** ☐ **Private Wells** ☐ **Mixed**

e. Is part or all of the water supply of the affected/interested community currently impacted by the site?
☐ **Yes** ☒ **No**

Provide details if appropriate:
Click here to enter text.

f. Other environmental issues significantly impacted/impacting the affected community?
☒ **Yes** ☐ **No**

Provide details if appropriate:
Flooding is an issue in this Red Hook area because the land is low lying and close to Lower NY Bay

g. Is the site and/or the affected/interested community wholly or partly in an Environmental Justice Area?
☒ **Yes** ☐ **No**

h. Special considerations:
☒ **Language** ☐ **Age** ☐ **Transportation** ☐ **Other**

Explain any marked categories in **h:**
Large Hispanic population

Part 5. The site contact list must include, at a minimum, the individuals, groups, and organizations identified in Part 2. of the Citizen Participation Plan under 'Site Contact List'. Are *other* individuals, groups, organizations, and units of government affected by, or interested in, the site, or its remedial program? (Mark and identify all that apply, then adjust the site contact list as appropriate.)

☐ **Non-Adjacent Residents/Property Owners:** Click here to enter text.

☒ **Local Officials:** Click here to enter text.

☒ **Media:** Click here to enter text.

☒ **Business/Commercial Interests:** Click here to enter text.

☐ **Labor Group(s)/Employees:** Click here to enter text.

☐ **Indian Nation:** Click here to enter text.

☐ **Citizens/Community Group(s):** Click here to enter text.

☐ **Environmental Justice Group(s):** Click here to enter text.

☐ **Environmental Group(s):** Click here to enter text.

☒ **Civic Group(s):** Click here to enter text.

☐ **Recreational Group(s):** Click here to enter text.

☐ **Other(s):** Click here to enter text.

Prepared/Updated By: Linda R. Shaw, Esq. **Date:** 3/2/2020

Reviewed Approved By: Thomas V. Panzone **Date:** 4/3/2020

APPENDIX J

NYSDEC ISS QA/QC CORING REQUIREMENTS

NYSDEC In-Situ Solidification QA/QC

1.0 GENERAL

1.1 Introduction

Technology Description

In-situ solidification (ISS) is an established remediation treatment technology which can prevent migration of and exposure to certain contaminants in media including soil, sludge, and sediment. The ISS process is increasingly being used within remedial programs in the New York State Department of Environmental Conservation (Department).

ISS is a process that involves the mixing of reagents with contaminated soil to create a low permeability mass which encapsulates the contamination in the soil in place. Bucket excavators augers, or other technologies are used to mix the contaminated media and one or more reagents, entrapping the contaminated material within a low permeability mass. This reduces or eliminates non-aqueous phase liquid (NAPL) mobility and contaminant migration into exposure pathways, thus eliminating the treated area as a source of future exposure or contamination of groundwater, surface water, or vapor.

Complete mixing of the contaminated soil and the ISS reagents must be achieved for the process to be effective and protective of human health and the environment. Incomplete mixing can result in a non-homogenous mass, untreated areas, or large fractures within the ISS mass, which may allow mobility of NAPL and groundwater within the treated areas.

1.2 Document Purpose

The purpose of this document is to provide a method of Quality Assurance (QA)/Quality Control (QC) to ensure the effectiveness of ISS after field implementation is complete. This includes coring, and testing for hydraulic conductivity and unconfined compressive strength. The use of coring for QA/QC may not be suitable for all ISS projects and other QA/QC methods such as excavation/visual inspection will be considered an option on a case by case basis.

Failure to meet QA/QC goals, particularly incomplete mixing, is of greatest concern when it occurs along the edges of the solidified mass. The Department has noted a tendency for DNAPL to accumulate in permeable soils and sediments immediately above the bedrock surface, creating a potential pathway for DNAPL migration. Such zones can be quite difficult to mix adequately, whether using augers or bucket mixing. Thus, attention is required to ensure that “top of rock” zones are thoroughly solidified, and that this solidification is adequately documented.

To ensure the integrity of the treated material, the Department has identified QA/QC procedures, specifically coring, which are essential to ensure that ISS treatment processes are protective of the environment. This document has been developed to provide guidance on a coring program to be conducted to ensure confidence regarding complete mixing and ISS installation in the remedial area.

2.0 EQUIPMENT

2.1 Coring Drilling Method

To allow early coring information to be used for adjusting ISS operations, it is recommended that coring operations be conducted prior to complete curing of the ISS material. For high-strength material, a rock core is frequently required. Driven split spoons (typically using Direct Push tools but potentially using augers as well) may be used to collect core samples of the ISS material for lower strength materials. Rotosonic and compressed air drilling methods have not been successful in obtaining representative core samples.

Cores must be no longer than five (5) feet. If less than 60% of the core material is recovered from any of the coring runs, one (1) new core hole must be drilled adjacent to the previous location. If the recovery from the adjacent core hole continues to be less than 60%, the contractor may abandon the location. This is not intended to justify an inadequate sampling program. A representative number of successfully completed cores must be provided. Close communication with the Department's project manager (PM) is strongly encouraged to discuss and reach concurrence on the coring program.

2.2 Trenching

While trenching has not been used to date, there could potentially be instances where trenching would be a viable alternative. A trenching plan would have to be submitted to the Department during the remedial design. In the event trenching is proposed after the remedial design phase, but prior to field implementation of the ISS, a minimum of two weeks' notice should be provided to the Department for review of the trenching design.

2.3 Sample Collection for strength and permeability

Samples of the mixed soil will be collected while wet and formed into cylinders in accordance with the approved testing methods (ASTM D5084 for hydraulic conductivity, ASTM D2166 or D1633 for unconfined compressive strength). Samples should be collected every 500 cubic yards. Additional sampling may be appropriate on a site-specific basis in areas of particular concern.

3.0 EXECUTION

3.1.1 Coring Implementation

- One core borehole shall be completed for every 5,000 square feet of ISS treatment area, but not less than two bore holes per treatment area.
- To allow early coring information to be incorporated in adjusting ISS operations, the first coring location shall be completed when the ISS treatment project area is no more than 25 percent complete.
- Core borehole locations shall be biased towards areas with the greatest soil contamination, areas where contamination is in direct contact with the bedrock surface, and/or locations where difficulties in the ISS process were encountered.

- Core boreholes shall be placed in locations where individual treatment columns or cells overlap, to the extent possible.
- Core boreholes should be advanced to at least a foot below the monolith design or bedrock, if encountered. If coring reveals previously undocumented areas of contamination, delineation (and remediation, as necessary) of that contamination may be required outside the QA/QC program.
- Cores shall be archived following coring activities. Cores may be discarded upon final inspection by the Department. Following initial inspection, the Department may require cores to be retained to compare to future cores or to document issues that will need to be resolved.
- To allow any needed corrective actions to commence before the monolith cures to a point making corrective action difficult or impossible, core inspection by the Department will occur as soon as possible but not later than 48 hours of the core's collection.
- In order to identify potential areas of concern for the coring program, documentation on the volume/shrinkage of grout obtained during ISS installation shall be reviewed. Areas where excessive grout was lost during ISS implementation should be targeted for coring.

3.1.2 Trenching Implementation

- If trenching is used, it will be completed at the perimeter of the ISS treatment area and locations within the ISS treatment area. The minimum depth of excavation should be the design depth of the ISS treatment.
- If the bottom of the ISS treatment cannot be visually inspected, the Department may require cores to be collected.
- To allow inspection information to be incorporated in adjusting ISS operations, trenching shall commence when the ISS treatment project area is no more than 25 percent complete.

3.1.3 Sample analysis

- Typically, multiple cylinders are collected at each location for testing unconfined compressive strength. This allows testing after 3-5 days to get an initial indication of the strength of the mix, while reserving cylinders for compliance testing after they have achieved full strength (28 days).
- Cylinders tested for hydraulic conductivity in accordance with the approved plans. The maximum permeability should generally be 1x10-6 cm/sec, as measured using ASTM D 5084-00.

3.2 Performance Evaluations

3.2.1 Visual Inspection

Core samples and related equipment will be visually inspected for the following criteria, and the results recorded:

- Visible NAPL
- Non-mechanical induced cracking within the core
- Percent of core sample recovered

In addition, indirect indications of unmixed NAPL should be recorded, such as:

- NAPL coating on drilling tools
- NAPL in drill wash tub, if water-based drilling methods are employed

3.2.2 Performance Concerns

Performance testing must be completed early enough to identify problems. Substandard results cannot be ignored with the intention to "average-out" the results over the course of project. The purpose of this guidance is to detect installation of an inadequate remedy in time to correct the problems and avoid costly retreatment or repairs to ensure effectiveness of the ISS remedy, the following conditions will warrant further attention and will be documented during ISS implementation:

- A continuous layer or seam of NAPL is noted within the core.
- NAPL coating is visible on drilling tools
- Visible NAPL is noted in the drill wash tub
- Unconfined compressive strength below 50 psi
- Hydraulic conductivity greater than 1.0 x 10-6 cm/sec or project specific goal.
- Large sections (> 1 cf) of unmixed material.

If one or more of the above conditions are noted, the Department must be notified to discuss the severity of the problem, the degree of concern, and whether any corrective action will be necessary.

A notification, by itself, does not necessarily mean a corrective action or additional borings or testing are warranted. For instance, small NAPL blebs may be present within properly mixed areas of the ISS monolith, and coring through such a bleb, especially before the monolith has achieved its maximum strength, could result in NAPL coating on drilling tools and/or NAPL in the drill wash water. The first step to determining whether corrective action is required will be to complete additional borings around the area of concern and determine if identified NAPL within the ISS mass is encapsulated, thus eliminating NAPL mobility and impact to the surrounding environment. The results of all the samples taken within a given treatment area cannot be averaged to show compliance. While each sample must satisfy the definition on its own, a single test showing slightly elevated hydraulic conductivity would not necessarily require corrective action for that cell/column, but evaluation to ensure that it is not a systemic problem is required.

If NAPL is detected in the additional borings, particularly on the edges of the ISS monolith, or at the bottom of the ISS monolith, corrective actions may be necessary in order to fully encapsulate the source area.

3.2.3 Corrective Actions

If the ISS installation is deemed unsatisfactory after a collaborative evaluation of the coring program, measures will be put in-place to address the deficiencies and ensure that the remedy is protective of human health and the environment. Such measures may include:

- Repair, re-mixing, or isolation of the concerned area using jet grouting or other suitable method
- Excavation and disposal of the concerned area, where feasible and practicable.

3.2.4 Core Hole/Trench Abandonment

When a core has been drilled from the top to the bottom elevation of the targeted ISS treatment zone, and samples collected, it will be considered complete. Following completion of each coring location, the borings will be filled with grout using tremie methods.

If trenching is used for QA/QC activities, backfill material should meet the approved ISS specifications.

3.3 Field Documentation and Approvals

3.3.1 Field Documentation

Documentation of the ISS QA/QC activities shall be included with the Final Engineering Report (FER). Documentation will include (but not be limited to):

- Figure depicting boring/trenching locations
- Photographs of each core boring/trench referenced
- Type of drilling method or excavator used
- Field coring/trench logs

3.3.2 Department Approval

The Department should be notified of the ISS QA/QC activities as soon as possible, with a minimum of 72 hours' notice or two business days. Department personnel will attempt to be on-site, unless the remedial party is informed otherwise, to inspect the QA/QC activities and provide informal approval or recommend corrective actions.

Following on-site Department inspection of the ISS QA/QC, email correspondence should be sent to the Department project manager which summarizes observations of the coring results. The Department project manager will provide an email reply within 48 hours confirming that the ISS QA/QC objectives have been met. If the Department project manager does not feel the ISS

QA/QC objectives have been adequately satisfied, the response email will include any additional corrective actions required.

3.3.3. Resolution of Disagreements

In the event there is a disagreement regarding the ISS QA/QC program the remedial party will submit a written request for resolution to the project manager's supervisor. The correspondence shall include the ISS QA/QC activities, relevant documentation, and the nature of the dispute. The project manager's supervisor will meet with the Project Manager, Construction Inspector (if applicable) and the Bureau Director to discuss the request. If necessary, a meeting will be arranged which will include the remedial party, Department project manager, supervisor, and the Bureau Director to discuss the matter.

Following the meeting, the supervisor will send correspondence to the remedial party outlining the Department final decision.