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FYN PAINT & LACQUER CO., INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

REMEDIAL INVESTIGATION REPORT
SITE ID #V00380-2

Prepared For

Fyn Paint & Lacquer Co., Inc.

January 2008
Revised: October 2008

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1.0 INTRODUCTION

The following Remedial Investigation Report (RIR) was completed on behalf of the Fyn Paint & Lacquer Co., Inc. (Fyn) by Leggette, Brashears & Graham, Inc. (LBG). The RIR was completed in accordance with the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) requirements for the investigation of soil, groundwater and soil gas contamination. Fyn has entered into the NYSDEC Voluntary Cleanup Program (VCP), and is listed as the volunteer for Site ID #V00380-2, Index No. W2-0873-00-10. The investigation activities summarized in this RIR were conducted on the Fyn property (230 Kent Avenue), Consolidated Edison (Con Ed) property (214 Kent Avenue) as well as areas surrounding these properties, and were conducted in accordance with NYSDEC approved Work Plans. This investigation area is illustrated on the Site Area Map shown on figure 1.

The primary investigation area (Fyn and Con Ed properties) is located between Metropolitan Avenue to the north, North First Street to the south, Kent Avenue to the east and River Street to the west. This RIR summarizes the results of several investigations previously submitted to the NYSDEC (1998 to 2003) as well as environmental remedial investigation activities performed by LBG following the submission of the Supplemental Investigation Work Plan (Addendum I - Revised) submitted in April 2005. These additional activities conducted in 2005-2006 consist of soil sampling, installation of additional monitoring wells/groundwater extraction wells, a soil vapor survey, groundwater monitoring and aquifer testing. In 2007 two additional groundwater monitoring rounds were performed; a soil vapor intrusion investigation consisting of indoor air, sub-slab soil vapor, soil vapor and outdoor ambient air sampling was completed at the Site and surrounding properties; and, the onsite interim remedial measure consisting of a groundwater extraction and treatment system and a free-phase product recovery

system was installed and activated. The results of these investigation activities are summarized in the sections below.

The objective of the remedial investigation was to characterize the extent and degree of contamination present at the Site in order to develop a remedial action capable of effectively reducing and/or eliminating the risk presented to human health and the environment. The objective of the interim remedial measure was to minimize the risk presented to human health and the environment by the onsite contamination pending completion of the remedial investigation and implementation of the final remedial action.

2.0 AREA DESCRIPTION

The Fyn Paint & Lacquer Co., Inc. is located in an industrial/commercial area at the intersection of Kent Avenue and North First Street in the Borough of Brooklyn, New York City. The Fyn Paint site consists of a one story industrial/warehouse building. The facility is currently utilized as a paint and lacquer factory. The vicinity of the property consists of industrial, commercial and residential properties.

The footprint of the building is approximately 5,000 ft^2 (square feet) on the first floor and approximately 3,500 ft^2 on the balcony. The building's heating system is provided by steam heat and the electrical service enters the building from Kent Avenue. A small basement is used for the heating oil tank, furnace and controls for the sprinkler system and air compressor. The site is connected to the New York City municipal sewer system.

Adjacent to the north of the Fyn building is a Con Ed property located at 214 Kent Avenue, heretofore referred to as the Con Ed property. This property consists of one story building (currently vacant) and an associated parking lot. The building has an approximate footprint area of 7,500 ft^2 and the associated parking lot has an approximate footprint area of 3,500 ft^2. This property is/was associated with the Con Ed North First Street Terminal (NFST) which historically occupied an area between the East River, North Third Street, Grand Street and Kent Avenue. The NFST was used until April 1, 1998 for storage and distribution via pipeline of #6 oil. A total of over 31 million gallons of #6 oil was stored in six (6) above-

ground storage tanks (ASTs) and in one 10,000-gallon underground storage tank (UST) which was located in the parking lot of 214 Kent Avenue.

3.0 GEOLOGY AND HYDROGEOLOGY

The Site is located in the Atlantic Coastal Plain physiographic province. The geology of this province is comprised of interbedded layers of sand, clay and marl. The marine deposits are Cretaceous and Quaternary. The drift deposits are derived from glacial activity that occurred during the Pleistocene. The total thickness of the marine and glacial deposits in Kings County ranges from 0 foot in northwest Brooklyn to 1,100 feet thick in northeastern Brooklyn.

The topography of the area is generally level. The vicinity of the Site is approximately 11 to 15 ft msl (feet above mean sea level). The ground surface at the Site consists of poured concrete and asphalt pavement. The shallow sediments beneath the Site consist of medium and coarse grained brown sand with some silt and trace gravel. In general, the subsurface beneath the area consists of interbedded layers of sand, gravel, clay and silt to approximately 75 feet below ground surface. Bedrock beneath the Site is approximately 75 feet below ground surface. The regional direction of groundwater flow beneath the Site is westerly, toward the East River.

4.0 BACKGROUND

The Fyn Paint property located at 230 Kent Avenue and the Con Ed property located adjacent to the Site at 214 Kent Avenue are located above the residual subsurface contaminant source area. A Site Area Map is shown on figure 1.

4.1 Surrounding Properties History

To develop a more complete historical profile of the Site, LBG requested a search of fire insurance maps from the Environmental Data Resources, Inc. (EDR) Sanborn map database. Sanborn maps, originally created to aid insurance underwriters in assessing the potential for fire risk, also contain information on a structure's use and the location of any fuel and chemical storage areas on a site.

A search of the fire insurance maps consisted of reviewing maps for the Site for the years 1887, 1904, 1905, 1916, 1918, 1935, 1941, 1942, 1950, 1951, 1965, 1980, 1986, 1991 and 1996. The Sanborn maps for the above-referenced years are included in Appendix I on the attached CD.

1887 The Site is listed as being occupied by Hardy Vorhees & Co. Lumber Yard. The main roads surrounding the Site (Kent Avenue, North First Street, River Street and Metropolitan Avenue) are the same as those that exist currently. The property adjacent to the north is occupied by C.W. Wilson Lumber Yard. The block to the west of the Site is also owned by Hardy Vorhees & Co. (lumber yard) and C.W. Wilson (lumber yard). Surrounding properties to the north, east and south are primarily stores and residential dwellings. Additional properties of note are listed as follows: several machine shops to the north; an iron foundry to the east; and, two factories to the south. The majority of the area surrounding the Site appears to be undeveloped.

1904 The Site is used for steel storage. The owner of the Site is not listed, however; the Con Edison property (adjacent to the north) is listed as being occupied by M. Samuel and Sons Metals. Adjacent to the west is the M.M. Miller Agent Coal Pocket and Storage Yard. Surrounding properties to the north include the American Coffee Co. (2 large gasoline tanks shown) and the American Sugar Refining Co. Adjacent to the south is the T.M. Duche & Sons Licorice Mfg. Further to the South is the American Sugar Refining Co. Brooklyn Plant (numerous storage tanks of unknown contents). The properties to the east are not presented for this year.

1905 This map presents properties to the east of the Site (not included on the 1904 maps). Properties adjacent to the east of the site are primarily stores and residential dwellings. Additionally, adjacent to the east of the Site are Coal Sheds. Surrounding properties of note to the east include: stores and residential dwellings; a fur company; a copper smith; a lumber shed and brewing companies.

1916 The Site is shown as being occupied by Thos W. Kiley Co. and used for steel storage. The property adjacent to the north is still occupied by M. Samuel and Sons Metals.

The adjacent property to the west is now shown as being vacant. Surrounding properties to the north and east remain mostly unchanged from the 1904 maps. Adjacent properties to the east remain stores, residential dwellings and the E.H. Meyers Coal Yards. Adjacent and surrounding properties to the south are not provided for this year.

1918 The Site is not shown on this Sanborn Map. This map shows properties to the south of the Site. No information is given for the property adjacent to the south which appears to be vacant. Surrounding properties of note are listed as follows: American Sugar Refining Co. Brooklyn Plant, the U.S. Government Shipping Board, a laundry company and several iron and steel storage/manufacturing facilities.

1935 The Site is not shown on this Sanborn Map. This map shows properties to the south of the Site. The occupant of the property adjacent to the south is illegible on this map. Surrounding properties to the south include: Seaman Trucking Co., a laundry company, the American Sugar Refining Co. and several iron and steel storage/manufacturing facilities. Of note, the majority of the properties presented on this map are illegible due to poor map quality.

1941 The Site is still occupied/owned by the Thos. W. Kiley Co. The property adjacent to the north is still occupied by M. Samuel and Sons Metals. The property adjacent to the west of the Site is occupied by the Great American Fuel Corporation which has several tanks and coal bins. Surrounding properties to the north include the Sweet Life Food Corp. (which has a filling station on the block north of the Site), the American Sugar Refining Co. (which has a chemical storage area), and Austin Nichols & Co. Whole Grocers/Clark Chapin Bushnell, Inc. (details illegible).

1942 The Site is not shown on this Sanborn Map. This map shows properties to the east of the Site. Properties adjacent to the east of the Site are primarily iron storage yards. Surrounding properties to the east include: a vinegar manufacturing facility, the Old Dutch Mustard Co., several wire storage warehouses, a filling station (on Wythe), a lumber shed and miscellaneous commercial/industrial operations.

1950 The Site is not shown on this Sanborn Map. This map shows properties to the south of the Site. The occupant of the property adjacent to the south is not listed, however it is

listed as having been built in 1920. On the same block there is a boiler room as well as bottling facility. To the southwest, the property is occupied by Charles Pfizer Co., Inc. and there are several tanks (a 2,000,000-gallon and a 3,000,000-gallon molasses tank, and a 100,000-gallon Sulphur tank). To the southeast there is a Lacquer Storage facility (Grand and Kent), several waste paper and rag facilities, a metal stamping facility, a painting and auto refinishing facility, an electro-plating facility, a shellac mixing facility, a laundry facility and a filling station and the American Sugar Refining Co. properties.

1951 The Site is now listed as Paint and Lacquer Manufacturing. The property adjacent to the north is still occupied by M. Samuel and Sons Metals. The adjacent property to the west shows no occupant with the exception of four tanks (contents not listed) and Coal Pockets. Properties to the north are occupied by the Brooklyn Terminal Stores, Inc. (gasoline tanks), a valve and pipe warehouse, and a filling station (tanks). Further to the north are the Lehigh Warehouse and Transportation Co., Inc. and several rail yards. Properties to the east include a broom manufacturing facility, steel storage yards, a pipe shop, the Old Dutch Mustard Co. (and associated vinegar manufacturing), a 10,000-gallon tank of unknown contents, various hardware and wire storage facilities, a bottling warehouse, a filling station, the Imperial Plating Co., an auto parts rebuilding facility and several garages with gasoline tanks.

1965 These maps show the Site and the adjacent property to the north as they are today, however the occupant of the property adjacent to the north is the NEPCO Terminal Corp. (which contains a machine/boiler room and a foam tank room). The properties to the west and northwest are owned by the NEPCO Terminal Corp. and are improved with several Bunker Fuel Oil #6 storage tanks ranging from 2,325,000 gallons to 6,000,000 gallons in capacity. Further to the north are several rail yards. The properties to the east include a private garage and plastics storage facility (adjacent) as well as other storage yards, a gas tank in a private parking lot (75 Metropolitan Avenue), the Old Dutch Mustard Co. (and associated vinegar manufacturing), a 10,000-gallon tank (sprinkler tank), a filling station/auto repair facility and the Imperial Plating Co. Prop-

erties to the south and southwest are the same as in 1950 Sanborn (including the Charles Pfizer Co., Inc. property, the lacquer storage building, filling station, garages, electroplating and metal stamping).

1980 These maps shows no apparent changes from the 1986 Sanborn map for the Site or the properties to the north, south and west of the Site. Properties to the east appear unchanged from the 1965 map with the exception that there are several steel storage tanks located at 57 North 1st Street.

1986 These maps show no significant changes from the 1980 Sanborn maps.

1991 These maps show no significant changes from the 1986 Sanborn maps.

1996 These maps show no significant changes from the 1991 Sanborn maps with the exception that there are additional tanks (unknown contents due to poor map reproduction quality) at the Old Dutch Mustard Co. property.

Several noticeable areas of concern are evident from the Sanborn maps. The Site has historically been used for lumber storage, steel storage and from at least 1951 for Paint and Lacquer Manufacturing.

In addition to the past occupants at the Site, there have also been several occupants on adjacent and surrounding properties, which have potentially negatively impacted the environmental status of the Site. These include but are not limited to Major Oil Storage Facilities (MOSFs), numerous machine shops, the Old Dutch Mustard Co. facility, the Imperial Plating Co., the Charles Pfizer Co., Inc. property, a lacquer storage building, several properties with listed gasoline tanks, metal manufacturing facilities, a fur company, a laundry company, an iron foundry, filling stations, a metal stamping facility, a painting and auto refinishing facility, an electro-plating facility, a shellac mixing facility as well as numerous properties with no listed owner/occupant descriptions. This review of available historical Sanborn Fire Insurance Maps shows that the entire area within the immediate vicinity of the Site has a history of substantial industrial/commercial activity capable of having negatively impacted the subsurface (soil, soil vapor and/or groundwater) surrounding and beneath the Site. Properties upgradient (east) of the Site should be investigated as potential contributors to subsurface contamination.

4.2 Con Ed Property Historical Investigations

Information provided by Con Edison indicated that in 1996, product containing volatile organic compounds (VOCs) was encountered in soil borings advanced for the cathodic protection installation associated with the Con Edison 10,000-gallon UST, which had historically been used to store No. 6 fuel oil. The VOCs detected in soil included toluene, ethylbenzene and xylenes totaling 876,000 mg/l (milligrams per liter). NYSDEC Spill Number 96-04977 was assigned to Con Edison Fuel Depot in association with the contamination identified adjacent to the UST. The potential spiller was named as the adjacent paint factory by the Con Edison representative who reported the spill. Although this contamination was discovered in 1996 and Con Ed informed NYSDEC that Fyn Paint was a potential contaminant source, the owner of Fyn Paint & Lacquer Co., Inc. was not notified of the spill and/or their potential involvement by NYSDEC and/or Con Ed. The material spilled was reported as polychlorinated biphenols (PCB) oil, lead and toluene observed in soil samples. The NYSDEC spill report is in Appendix II on the attached CD. The 10,000-gallon UST was abandoned in place by Con Edison. No information is available regarding the UST abandonment procedure. To confirm the results, additional borings were proposed to be advanced in the vicinity of the UST to characterize the subsurface conditions in the area.

Previous Phase I Environmental Site Assessments (ESAs) performed for the two properties identified a number of Recognized Environmental Conditions (REC). These RECs included ASTs and USTs; areas where mycelium was disposed; buried heating coils from a sulfuric acid barge; a lead lined containment basin; groundwater, subsurface and shallow soil conditions as well as toxic or hazardous material containers.

A Phase II ESA, performed for Con Edison by Lawler, Matusky & Skelly Engineers, LLP (LMS), was completed on January 14, 2000. This investigation covered the NFST and the former Pfizer property located to the south of Con Edison. Presently, the former Pfizer site is owned by the New York State Power Authority (see figure 1).

A storm drain outside one building and a manhole within the building were sampled. The results of both these samples showed that six semivolatile organic compounds (SVOCs) and eleven metals were detected above the NYSDEC Recommended Soil Cleanup Objectives

(RSCOs). There were no exceedances of the maximum concentrations for metals using the EPA Toxicity Characteristic Leaching Procedure (TCLP) method.

Soil borings were advanced into the water table at the former oil storage area and former Pfizer site. Laboratory analysis of the soil sample indicated VOC concentrations above the NYSDEC RSCOs. Results for the metal analyses identified ten metals with concentrations above NYSDEC RSCOs.

Groundwater samples were collected from four monitoring wells which previously existed onsite (MW-1, MW-2, MW-3 and MW-4) in addition to performing an additional thirteen soil borings. Of the four previously existing monitoring wells, only one (MW-4) contained VOCs in groundwater in concentrations exceeding the NYSDEC Class GA standards. Seven metals were detected above their respective groundwater quality standards while no SVOCs or PCBs were detected in the four monitoring wells. Groundwater samples collected from the soil borings were generally consistent with the soil samples collected from the same location.

LMS proposed several conceptual remediation alternatives for this area, all of which relied on various assumptions regarding the extent of contamination. The primary recommendation was to further delineate the subsurface contamination onsite. Other proposed remediation alternatives included: "hot spot" soil excavation; no action/natural attenuation; and, an air sparging/soil-vapor extraction/vapor treatment system.

4.3 Fyn Paint Property (230 Kent Avenue) Historical Property Investigation

The Fyn Paint & Lacquer Co., Inc. Site is a facility which produces paints and lacquers. This facility is a NYSDEC registered Chemical Bulk Facility (ID #2-000151), and is an active RCRA facility and Large Quantity Generator of hazardous waste (EPA ID #001270867).

In January 1999 on behalf of Fyn, Fenley & Nicol Environmental performed the closure of three (3) steel 550-gallon USTs; four (4) steel 1,100-gallon USTs; and one (1) steel 1,500-gallon UST at the Site. The tanks had been historically used to store acetone, toluene and xylene. The locations of the abandoned Site USTs are shown on figure 2.

Following the tank abandonment in February 1999, 8 soil borings were drilled inside of the Fyn Paint building. Selected soil samples were analyzed in the laboratory. The laboratory

analysis indicated the presence of ethylbenzene, toluene, o-xylene, m/p xylene and acetone. A UST closure report was prepared by Fenley & Nicol Environmental on March 23, 1999 and was submitted to the NYSDEC. The report concluded that the contamination encountered in the eastern UST area at the Site is indicative of historical leaking UST fill pipes and that additional investigation will be necessary in order to define the extent of soil and groundwater contamination at the Fyn Paint site. Based on the soil analytical results, NYSDEC assigned Spill #98-15508 to the Site.

In November and December 2000, Fenley & Nicol Environmental conducted a limited subsurface investigation in order to determine the groundwater quality beneath the Fyn Paint building. Three temporary groundwater sampling wells (TW-1, TW-2 and TW-3) as well as eight soil borings (B-1 to B-8) were installed in the vicinity of the former USTs. The locations of these temporary groundwater sampling wells and soil borings are shown on figure 2. Laboratory analysis of the groundwater samples collected from TW-1, TW-2 and TW-3 identified several VOCs at elevated concentrations (primarily acetone, xylene, toluene, ethylbenzene, 2-butanone and methylene chloride). The highest concentrations of VOCs detected were: acetone (10,558,250 ug/l [micrograms per liter] in TW-3), xylene (452,653 ug/l in TW-3), toluene (241,037 ug/l in TW-1), ethylbenzene (74,258 ug/l in TW-3), 2-butanone (35,826 ug/l in TW-2) and methylene chloride (7,784 ug/l in TW-1). Additionally, laboratory analysis of the groundwater samples collected from the eastern UST area (B-1, B-2 and the pipe area) identified several VOCs at elevated concentrations (primarily acetone, xylene, toluene, ethylbenzene and 2-butanone). The highest concentrations of VOCs detected were: acetone (780,000 ug/kg [micrograms per kilogram] in B-1), xylene (22,000,000 ug/kg in the pipe area), toluene (2,800,000 ug/kg in the pipe area), ethylbenzene (4,400,000 ug/kg in the pipe area) and 2-butanone (4,500 ug/kg in B-2).

5.0 FYN PAINT SUBSURFACE REMEDIAL INVESTIGATIONS

5.1 2001 Subsurface Investigation

In April 2001, LBG was retained by Fyn Paint & Lacquer Co., Inc. to perform a subsurface investigation and subsequent data evaluation of contamination conditions related to

the Fyn Paint Site and adjacent Con Edison site. The purpose of this work was to better define the direction of groundwater flow in the area; obtain additional data regarding the quality of soil and groundwater beneath the area; evaluate potential contributors to the subsurface contamination in the area; evaluate the proposed remediation cost estimate prepared by Con Edison; and prepare a conceptual remedial plan.

Following completion of the initial environmental investigation activities performed by LBG, it was determined that a more comprehensive investigation would be required to fully delineate and characterize the contamination both on-Site and off-Site, as well as to develop an appropriate remedial action to address said contamination. Summaries of the investigations and remedial actions performed by LBG are presented below.

In 2001, LBG conducted a subsurface investigation at the Fyn Paint factory and the adjacent areas including the Con Edison North First Street Facility. The purpose of the investigation was to evaluate the soil and groundwater quality beneath Fyn Paint, Con Edison and the areas surrounding these two facilities.

The subsurface investigation program consisted of the following:

- review the existing environmental data;
- drilling of soil borings by Geoprobe and installation of 1-inch diameter monitor wells;
- drilling and installation of 4-inch diameter monitor wells;
- collection of soil and groundwater samples;
- laboratory analysis of soil and groundwater samples;
- monitor wells and Geoprobe points survey; and,
- data evaluation and preparation of report.

5.1.1 Drilling and Soil Sampling

On May 3 and May 4, 2001, LBG personnel supervised the drilling of Soil Borings GP-1, GP-2, GP-3 and GP-4. The soil borings were drilled using the Geoprobe drilling technique. The boring locations are shown on figure 3. During the drilling, soil samples were collected continuously using a 4-foot macrocore sampling device.

Each soil sample was visually examined by an LBG hydrogeologist, described on a geologic log and screened for the presence of petroleum hydrocarbon components using a photoionization detector (PID). The soil sample which exhibited the highest headspace-vapor concentration was submitted to American Analytical Laboratories (American) for analysis by EPA Methods 8260 and 8270.

On May 8 and May 9, 2001, LBG personnel supervised the drilling of Soil Borings MW-5, MW-6, MW-7 and MW-8. The soil borings were drilled using the hollow-stem auger drilling technique. Boring locations are shown on figure 3. Soil samples were collected at 5-foot intervals with a split-spoon sampler, logged, screened with a PID and packaged for laboratory analysis by EPA Methods 8260 and 8270.

On May 30, 2001, LBG personnel supervised the drilling of Soil Borings CE-1, CE-2, CE-3 and CE-4, shown on figure 3. The borings were also completed by using the Geoprobe drilling technique. Soil samples were collected continuously using a 4-foot macrocore sampling device. Soil samples were logged, screened with a PID and the sample from each boring with the highest PID reading was split with Mr. Edward Schwetz of LMS, consultants for Con Ed and LBG's portion was packaged for laboratory analysis by EPA Methods 8260 and 8270. The drilling and installation of monitor wells was also observed by Mr. Schwetz of LMS.

5.1.2 Monitor Well Installation

On May 3 and 4, 2001 and May 30, 2001, LBG personnel supervised the installation of Microwells GP-1, GP-2, GP-3, CE-1, CE-2, CE-3 and CE-4, each immediately after the completion of its respective soil boring. Boring GP-4 was not completed as a microwell because no water was encountered during drilling. Each microwell is constructed with a 5-foot length of 1-inch diameter, 0.020-slot, PVC well screen. The top of the well screen is between 5 feet (GP-2) and 11 feet (GP-3) below grade. A 1-inch diameter, PVC riser pipe extends from the top of the screen to the surface. Each well is completed at grade with a bolt-down roadbox and a locked plug.

Geologic logs and well construction diagrams are included in Appendix III on the attached CD.

On May 8 and 9, 2001, LBG personnel supervised the installation of Monitor Wells MW-5, MW-6, MW-7 and MW-8, following the completion of its respective soil boring. Monitor Wells MW-1, MW-2, MW-3 and MW-4 were previously installed by Con Edison as part of NYSDEC's licensing requirement of the NFST property, a major oil storage facility. Monitor Wells MW-5, MW-6, MW-7 and MW-8 are each constructed with a 10-foot length of 4-inch diameter, 0.020-slot, PVC well screen and 4-inch diameter, PVC riser pipe extending from the top of the well screen to grade. The screened formation interval varied; MW-5 is screened from 10-20 ft bg (feet below grade), MW-8 from 15-25 ft bg and MW-6 and MW-7 are screened from 20-30 ft bg.

The annular space around the MW-5, MW-6, MW-7 and MW-8 well screens were filled with No. 2 sand from the bottom of the boring to 2 feet above the top of the screen. A 1-foot thick bentonite seal was placed above the sand pack and the remaining annular space was filled with drill cuttings.

The location of microwells and 4-inch diameter monitor wells are shown on figure 3.

Each well was completed at grade with a bolt-down roadbox set in concrete and a locking plus. Geologic logs and well construction diagrams are included in Appendix III on the attached CD.

5.1.3 Top of Casing Elevation Survey

On June 20, 2001, LBG personnel conducted a top of casing survey of all monitor wells and microwells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, GP-1, GP-2, GP-3, CE-1, CE-2, CE-3 and CE-4). The elevations were adjusted to the Brooklyn Topographic Datum on the basis of a previously established elevation on Monitor Well MW-3. Top of casing elevations are included in Appendix IV on the attached CD.

5.1.4 Fluid-Level Measurement and Groundwater Sampling

On June 6, 2001, LBG personnel measured fluid levels and total depths in MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, CE-1, CE-2, CE-3, CE-4, GP-1, GP-2 and GP-3. The measurements were used to calculate the volume of standing water within each well.

On June 6 and 7, 2001, LBG personnel sampled the above referenced wells with the exception of CE-3 and GP-3 which were dry. All groundwater level measurements and sampling was observed by Mr. Schwetz of LMS. Three well volumes of groundwater were removed from each well, either with a dedicated polyethylene bailer or with a previously decontaminated, submersible pump. All purge water was contained for later disposal. After the groundwater level within each well recovered, groundwater samples were collected with a dedicated polyethylene bailer. The groundwater was equally distributed (split samples) between the bottles supplied to LBG by American and bottles supplied by Mr. Schwetz.

All LBG groundwater samples were relinquished to American, onsite, on June 7, 2001. They were analyzed for VOCs and SVOCs by Environmental Protection Agency (EPA) Methods 8260 and 8270. In addition, groundwater from MW-4 and free product samples from CE-1 and CE-2 were analyzed/fingerprinted by Gas Chromatography Flame Ionization Detector (GC-FID) techniques.

5.1.5 Results of 2001 Subsurface Investigation

On the basis of soil samples collected during the drilling, overburden beneath the site consists of generally medium to fine sand and silt. Occasionally, a small amount of gravel was encountered. Bedrock was not encountered to the maximum depth drilled.

Static groundwater levels in all 4-inch diameter monitor wells, as measured on June 6, 2001, ranged between 2.80 ft btoc (feet below top of casing) (MW-3) and 15.82 ft btoc (MW-7). Groundwater flow is westward toward the East River. The average hydraulic gradient across the study area is 0.01.

5.1.5.1 Soil Quality

The results of laboratory analysis indicated that the highest concentrations of VOCs in soil is in the vicinity of CE-1, CE-2, CE-3 (Con Ed parking lot adjacent to Fyn Paint) and GP-3 (beneath Fyn Paint). Xylenes, acetone, ethylbenzene and toluene were the most prevalent VOCs detected in the soil samples collected. Xylene was detected in the CE-1 soil sample at a concentration of 3,200,000 ug/kg, ethylbenzene was detected in the CE-1 soil sample at a concentration of 1,300,000 ug/kg, toluene was detected in the CE-1 soil sample at a concentration of 550,000 ug/kg and acetone was detected in the GP-3 soil sample at a concentration of 640,000 ug/kg. In addition to the xylenes, acetone, ethylbenzene and toluene, tetrachloroethene (PCE) was detected in both CE-1 and CE-2 at concentrations of 8,200 ug/kg and 2,300 ug/kg, respectively. Tables summarizing the soil laboratory results are included in Appendix V on the attached CD. Copies of the full laboratory reports are on file with LBG and are available upon request.

5.1.5.2 Groundwater Quality

The results of laboratory analysis indicated that groundwater from all 13 wells sampled contained detectable VOC concentrations. The highest concentrations of dissolved VOCs were encountered in groundwater sampled from CE-1 and CE-2. Xylenes were the VOC detected at the highest concentrations which were 1,200,000 ug/l and 1,400,000 ug/l in CE-1 and CE-2, respectively. Other detected VOCs included toluene (maximum concentration of 450,000 ug/l in CE-2), ethylbenzene (maximum concentration of 440,000 ug/l in CE-2) and acetone (maximum concentration of 120,000 ug/l in CE-2). Additionally, PCE was detected at a maximum concentration of 1,400 ug/l in CE-2.

Free-phase product was measured in CE-1 and CE-2 on June 7, 2001, at thicknesses of 0.84 foot and 0.02 foot, respectively. The free-phase product was removed from both wells during sampling on June 7, 2001. On June 20, 2001, measurements of these wells indicated that the free product thickness in CE-1 had recovered to 0.01 foot

and there was no free product in CE-2. On July 12, 2001, CE-2 had no water or product in it and CE-1 had a free-product thickness of 0.14 foot.

Detected VOC concentrations in the groundwater sample collected from the downgradient Well MW-4 ranged from 18,000 ug/l to 3,400 ug/l and included acetone, toluene, ethylbenzene and xylene. Acetone, toluene, ethylbenzene and xylene were also detected in groundwater samples from MW-6 and MW-7 (upgradient from the Con Ed and Fyn properties) at concentrations ranging from 6 ug/l to 200 ug/l. Xylene was detected in all wells sampled.

A summary of laboratory results showing VOC concentrations in groundwater samples is included in Appendix VI on the attached CD.

5.2 2003 Subsurface Investigation

In 2003, LBG conducted, on behalf of Fyn Paint, a Supplemental Remedial Investigation at the Site.

5.2.1 Drilling and Soil Sampling

Between July 21 and August 8, 2003, 11 soil borings were completed by Aquifer Drilling & Testing, Inc. (ADT) under LBG supervision. With the exception of Boring MW-16, all drilling was accomplished using the hollow-stem auger method. Two attempts were made to drill the MW-16 boring with an auger but an impassable subsurface obstruction was encountered. MW-16 was completed using a mud-rotary technique. All boring locations were cleared for subsurface utilities and obstructions either by vacuum truck or hand digging, prior to the start of drilling. Soil was sampled in advance of the auger using a 2-foot split-spoon sampling device. The split spoon was cleaned with alconox and water and rinsed with water between samples.

Soil samples were visually inspected, recorded on a geologic log and screened for the presence of VOCs with a PID. The soil sample collected from above the groundwater interface was placed in laboratory-supplied containers for analysis. If the soil sample exhibiting the highest PID response did not correspond with this interface

sample, it too was packaged for laboratory analysis. In some instances where VOCs were detected in soil sampled below the groundwater table, a soil sample was analyzed to determine the vertical extent of contamination.

Soil was sampled at 2 to 5-foot intervals to the groundwater in MW-10 and MW-11 and continuously to where practical beneath the groundwater in all other borings. Geologic logs and well construction diagrams are included in Appendix III on the attached CD. All soil samples were sent to Toxikon Corporation (Toxikon) of Bedford, Massachusetts for analysis of VOCs, SVOCs, PCBs, pesticides, cyanide and Target Analyte List (TAL) metals by methods outlined in the EPA SW-846 publication.

5.2.2 Soil Cuttings Analysis and Disposal

Soil cuttings generated during drilling were transferred to DOT approved 55-gallon steel drums and stored temporarily inside the Fyn building pending removal for disposal. Several soil samples from these drums were composited and sent to American Analytical Laboratories for analysis of disposal characteristics in accordance with the disposal facility. The drums were removed from the Fyn building on August 14 and August 28, 2003 by American Environmental Assessment Corporation of Wyandanch, New York. Soil was disposed at Vexor Technology, Inc. of Medina, Ohio. Laboratory analyses and manifests are on file at LBG and are available for review upon request.

5.2.3 Monitor Well Installation

Following the completion of soil borings, a monitor well was installed in each borehole. Because of subsurface obstructions, no monitor wells were installed in Soil Boring MW-9 or the first two MW-16 borings. All monitor wells installed during the Supplemental Investigation with the exception of MW-16, are constructed of 4-inch diameter, Schedule 40, 0.020-slot PVC well screen and 4-inch diameter, Schedule 40 PVC riser pipe. MW-16 was constructed with 2-inch diameter PVC screen and riser pipe. Twenty feet of well screen was set in each boring with the exception of

MW-12 where a subsurface obstruction necessitated that 15 feet of screen be used. The annular space surrounding each well screen was filled with No. 2 quartz filter sand from the bottom of the boring to 2 feet above the top of the well screen. A bentonite seal was placed above the sand pack. Wells were completed at grade with a well plug and 8-inch diameter street box. Geologic logs showing the soil characterization, PID concentrations and well construction specifications for soil borings are presented in Appendix III on the attached CD. The newly-installed monitor wells were developed to remove fine material from the sand pack and from within the well screen by surging them with a PVC bailer and evacuating turbid well water with a suction pump or bailer. Approximately 50 gallons of development water was removed from each new well. All development water was contained in 55-gallon drums inside the Fyn building and disposed in the same manner, and on the same dates as the drill cuttings.

5.2.4 Soil Quality

The lab analysis showed the highest concentrations of VOCs (toluene, xylene, ethylbenzene, acetone, isopropylbenzene and naphthalene) in soil was collected from the soil boring completed for the installation of monitoring well MW-15, which is located on the east-northeast corner of the Fyn Paint building along Kent Avenue (see figure 3). MW-11 and MW-12 also had significantly elevated levels of toluene, xylene and ethylbenzene detected in the soil. Of note, the majority of the laboratory detection limits were above the Technical and Administrative Guidance Memorandum (TAGM) recommended soil cleanup objectives due to the dilution factor which was necessary on account of the extremely high concentrations of toluene, xylene and ethylbenzene. Tables summarizing soil quality laboratory results for historical soil samples collected from the Site are included in Appendix V on the attached CD.

5.2.5 Groundwater Quality

In 2003, analysis of groundwater samples indicated that twelve wells contained dissolved VOCs at concentrations above NYSDEC Technical and Operational Guidance

Series (TOGS) Groundwater Quality Standards (GWQS). In addition, several chlorinated solvents such as PCE, trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) were detected in groundwater samples collected from MW-5, MW-6 and MW-7. The source of the chlorinated solvents in groundwater could not be identified during the subsurface investigation; however, the highest concentration of PCE identified throughout the Site in soil and groundwater were found in CE-1 and CE–2 (see Sections 5.1.5.1 and 5.1.5.2, above) located on Con Ed property in June 2001. Summary tables showing the historical groundwater elevations for wells both onsite and offsite are included in Appendix IV on the attached CD and summary tables of laboratory results for the historical groundwater sampling events conducted for the Site are included in Appendix VI on the attached CD.

Also in 2003, free-phase product was observed in MW-15, CE-1 and MW-9A and had been observed in CE-2 in the past. The greatest thickness was near MW-15. The product appeared to be confined to the area beneath the north wall of the Fyn building and an unknown portion of the Con Ed parking lot north of Fyn. Following the completion of the 2003 investigation, the free-phase product was bailed from the effected wells and stored temporarily inside the Fyn building pending offsite disposal. It should be noted that the original estimate of product thickness detected in MW-15 on August 4, 2003 (approximately 5 feet) was erroneous and the field observations indicate that the interface probe was not functioning properly due to the nature of the product. Following the measurement, approximately four gallons of product was bailed from the well (in addition to some water). A calculation based on the well volume and the boring volume indicates that based on the volume of product bailed from the well, approximately two feet of product was present in MW-15 on August 4, 2003. The borehole volume calculations for MW-15 are included in Appendix VII on the attached CD. This product thickness measurement is also more consistent with the product thicknesses observed in MW-15 on August 22, 2003 and September 22, 2003 (see Appendix VII on the attached CD). Following the initial product bailing activities, product was regularly bailed from MW-15 (every several weeks) and temporarily stored in a

55-gallon drum onsite pending offsite disposal. A summary of product thickness measurements for MW-15 and MW-9A as well as a summary of product/water bailed from each well from May 2004 to January 2005 is included in Appendix VII on the attached CD.

5.2.6 Soil Vapor Survey (2003)

An initial soil vapor sampling round was conducted in July 2003. The soil vapor sampling points are shown on figure 4. The results of this investigation indicated that VOCs were present in soil-gas samples collected from both the perimeter and interior of the Fyn building. VOCs were detected in every soil-gas sample as well as the ambient air sample. The most prevalent VOC in the soil gas was acetone and was detected at concentrations up to 1,180,000 ppbv (parts per billion by volume) [Sample AS-6]. Other VOCs detected at high concentrations were toluene, xylenes and isopropanol. Additionally, an ambient air sample was collected from inside the Fyn building. The ambient air sample had VOC concentrations that correlated with the soil gas samples, where the compounds detected in the highest concentrations included acetone, toluene and isopropanol. Summary tables of laboratory results for the historical soil vapor/ambient air sampling events conducted for the Site are included in Appendix VIII on the attached CD.

5.3 2003 Site Inspection of Fyn Facility

At the request of the NYSDEC, a site inspection was completed at the Fyn Paint facility. The purpose of the inspection was to obtain an inventory of the materials used for preparing paint, to obtain data regarding the paint preparation process and to evaluate any potential leaks and/or spills at the facility. The results of the Site Inspection were that: the property was being used for storage of processed chemicals and finished products (paint blends); no USTs are in use at the site; the USTs were abandoned in place in 1999; all fill boxes were sealed at the same time; no drainage or other pathway for leaks of chemicals to underground

were observed at the first floor; and, the first floor appears to be generally well kept. A copy of this inspection is attached as Appendix IX on the attached CD.

5.4 2004 Site Groundwater Sampling and Analysis

In February 2004, LBG performed a groundwater sampling round, sampling all of the available monitoring wells on and surrounding the Fyn Paint Site. The results of this groundwater sampling round indicate that the same primary contaminants observed in the dissolved phase throughout the Site, remain at similar concentrations with the exception of MW-4 which showed a significant decrease in VOC concentrations. Additionally, CE-2 and MW-9A were not sampled due to the presence of free-phase product observed on the water table. As such, there is no 2004 groundwater data to correlate with the previous sampling. A summary table showing the results of the groundwater sampling round is included in Appendix VI on the attached CD.

5.5 2005 Subsurface Investigation

In 2005, following the NYSDEC approval of the "Supplemental Investigation Work Plan (Addendum I – Revised)", LBG conducted an additional subsurface investigation on behalf of Fyn Paint. The investigation consisted of:

- supplementary environmental site audit;
- monitor well installation and soil sampling;
- development of the newly installed groundwater wells;
- abandonment of the micro-wells on the Con Ed parking lot;
- soil quality analysis;
- groundwater sampling and analysis;
- a soil vapor survey; and,
- a groundwater pumping test.

5.5.1 Supplemental Environmental Site Audit

In January 2005 an additional site visit was conducted at Fyn Paint in response to an NYSDEC letter dated December 16, 2004. This environmental audit included the following:

- compiling a list of all materials stored in 55-gallon drums located in the factory building; and,
- inspection of onsite drains and pipes and exposure and inspection of all piping located on the first and second floor and basement.

A copy of this report, detailing this investigation, is included in Appendix IX on the attached CD.

5.5.2 Drilling and Soil Sampling

In 2005, Fyn Paint installed eight (8) additional groundwater monitoring wells (MW-20, MW-21, MW-22, MW-23, MW-24, MW-25, MW-26 and MW-27) and two (2) groundwater extraction wells (EW-1 and EW-2). The wells were installed by JNM Environmental under LBG supervision. All drilling was accomplished using the hollow-stem auger method. The locations of these wells are shown on figure 3. Prior to installing the wells, the locations were cleared by hand to a depth of 6 ft bg. This hand clearing was performed to ensure that no subsurface utilities are located at the proposed well locations. Prior to installing the wells, soil samples were collected from each location using the Geoprobe drilling method. Discrete samples were collected from each well location to accurately determine the vertical extent of soil contamination. The soil samples were examined in the field by an LBG hydrogeologist. Geologic logs showing the soil characterization, PID concentrations and subsequent well construction specifications for soil borings are presented in Appendix III on the attached CD. The soil sample which exhibited the highest PID concentration for each boring was placed into laboratory supplied containers and stored in a cooler with ice. The soil samples were then submitted to a New York State certified laboratory (AMRO Envi-

ronmental Laboratories Corporation), under chain-of-custody procedure, for analysis of VOCs by EPA Method 8260.

Following the soil sampling, the monitoring wells were installed using the hollow-stem auger drilling method. The monitoring wells and extraction wells (well screen and riser) were constructed of 2-inch diameter and 4-inch diameter stainless steel, respectively (MW-20 was constructed with 2-inch diameter PVC due to its distance from the source area). Well construction specifications are included on the geologic log for each well. The annular space surrounding each well screen was filled with No. 2 quartz filter sand from the bottom of the boring to 2 feet above the top of the well screen. A 2-foot bentonite cap was placed above the filter sand and the remaining annular space was backfilled with clean sand. The only variation from this installation method is with MW-27 where the remaining annular space above the bentonite cap was filled with a bentonite/cement grout. Wells were completed at grade with a well plug and 8-inch diameter street box. The soil sampling and well installation activities in the Con Ed parking lot indicated that there are several significant subsurface structures, obstacles, impediments, and/or obstructions present in the subsurface. Monitor well geologic logs are presented in Appendix III on the attached CD.

5.5.3 Development of the Newly Installed Groundwater Wells

Following the installation of the eight monitoring and two extraction wells, they were all developed. The wells were developed using a reciprocating pump with a check valve in conjunction with a suction pump. The purpose of the monitor well development was to ensure removal of fine grained sediments (fines) from the vicinity of the well screen. This allows the water to flow freely from the formation into the well, and also reduces the turbidity of the water during sampling. All purge water was temporarily stored in 55-gallon steel drums pending offsite disposal.

5.5.4 Abandonment of the Micro-Wells on the Con Ed Parking Lot

In addition to the installation of new wells, the three micro-wells on the Con Ed parking lot (CE-1, CE-2 and CE-3) were removed and the locations backfilled with clean sand and an asphalt cap. Of note, the three micro-wells, which were constructed of 1-inch diameter PVC, were no longer competent wells as the PVC had been compromised due to the nature of the contamination. The screens were closed and the risers were no longer rigid because the PVC had softened. This observation confirmed the selection of stainless steel screen and riser for the newly installed monitoring and groundwater extraction wells at the Site.

5.5.5 Soil Quality Analysis

Soil samples collected prior to the installation of these wells indicated that the highest soil contamination is present in the east end of the Con Ed parking lot. The highest VOC concentrations were found in MW-22 with acetone detected at a concentration of 19,000 ug/kg, total xylenes detected at a concentration of 7,000,000 ug/kg, toluene detected at a concentration of 4,000,000 ug/kg and ethylbenzene detected at a concentration of 1,500,000 ug/kg. VOCs in MW-23 were found in the following concentrations: toluene at 770,000 ug/kg, ethylbenzene at 520,000 ug/kg and total xylenes at 3,050,000 ug/kg. Tables summarizing soil quality laboratory results for historical soil samples collected from the Site are included in Appendix V on the attached CD.

5.5.6 Groundwater Sampling and Analysis

All of the newly installed wells and the previously installed wells were then included in the quarterly groundwater monitoring program. However, several wells (MW-6, MW-13, MW-15 and MW-25) were not included in the groundwater sampling program as they were either destroyed by city sidewalk repair activities, there was no access or they were abandoned or destroyed. These wells are identified on the summary tables showing the historical groundwater elevations for wells both onsite and offsite are included in Appendix IV on the attached CD.

Groundwater monitoring was performed in December 2005. The laboratory results for the groundwater samples indicate the continued presence of VOCs in the groundwater beneath the area and that the major contaminants at the Site continue to be toluene, xylenes, acetone and ethylbenzene.

Summary tables showing the historical groundwater elevations for wells both onsite and offsite are included in Appendix IV on the attached CD and summary tables of laboratory results for the historical groundwater sampling events conducted for the Site are included in Appendix VI on the attached CD.

5.5.7 Soil Vapor Survey (2005)

A second soil vapor survey was performed in 2005, both onsite and surrounding the Site, to evaluate the potential impact to adjacent properties. The soil vapor sampling locations are shown on figure 4. Two compounds, PCE and TCE, were detected at concentrations exceeding the NYSDOH air guidance value established for indoor air quality in eight of the eleven sample locations SG-1, SG-2, SG-5, SG-7, SG-8, SG-9, SG-10 and CE SG-6; however, these values are not applicable to regulating soil vapor concentrations. The highest concentrations of PCE and TCE were detected in SG-10, located in the Con Ed parking lot. Several other VOCs were detected above the laboratory detection limits, however; there are no established NYSDOH air guidance values for these compounds. Summary tables showing laboratory results for the historical soil vapor/ambient air sampling events conducted for the Site are included in Appendix VIII. A "Soil Vapor Survey Report" was submitted in February 2006 and a response to NYSDEC and NYSDOH comments on this report was submitted to both agencies in August 2006.

5.6 2006 Groundwater Pumping Test

In order to evaluate the feasibility of groundwater remediation using a pump and treat system, a pumping test was conducted from EW-1 (a 4-inch diameter stainless steel well constructed inside of the Con Ed parking lot adjacent to the northeast corner of the Fyn Paint

building). The purpose of the test was to determine the radius of influence on the groundwater table and to obtain data necessary for designing the groundwater extraction system. The field data indicates a water-table aquifer in the overburden on top of surficial bedrock. The pumping test was conducted on April 4 and 5, 2006 from EW-1 at a rate of 4.75 gpm (gallons per minute) for approximately 18 hours. The groundwater from the well was pumped in a 10,000-gallon fractionation tank. The water from the fractionation tank was disposed of offsite by Con Ed. Prior to and during the pumping test, groundwater levels were measured in the pumping well and surrounding Monitor Wells MW-21, MW-22, MW-23, MW-27, MW-7, MW-16, MW-24, MW-11, EW-2, MW-4, MW-14, MW-8 and MW-9A. Prior to, during and after the 18-hour pumping test, depth to groundwater was measured and drawdown was calculated in the pumping well and selected monitor wells. Based on groundwater level measurements recorded during the pumping test, a 4.75 gpm pumping rate from Extraction Well EW-1 is capable of influencing the groundwater table for a radius of at least 60 feet downgradient (EW-1 to MW-23). The field data for the groundwater pumping test are included in Appendix X on the attached CD. This result demonstrates that a groundwater pumping rate of 4.75 gpm has the potential to induce a cone of depression sufficient to draw free-phase product for extraction from the subsurface and to control further migration of groundwater with dissolved VOCs. The pumping test results indicated that the groundwater remediation at the Site can be accomplished by the pump and treat technology.

Based on the historical subsurface investigations performed at the Site, the baseline regional hydraulic gradient at the Site is approximately 0.05 foot per foot to the west (toward the East River). Additionally, based on an evaluation of the data collected from the subsurface investigation, the estimated hydraulic conductivity in the subsurface at the Site is 2.7 feet/day. The pumping test data for EW-1, MW-21 and MW-24 (presented in tabular form) as well as time-drawdown graphs and resulting transmissivity values (as calculated by the AqTeSolv computer software which was developed for the analysis of aquifer tests) are included in Appendix X on the attached CD.

5.7 2006-2007 Groundwater Monitoring Rounds

In May 2006, September 2006, December 2007, March 2007 and October 2007, groundwater monitoring rounds were performed at the Site. The laboratory results for the groundwater samples indicate the continued presence of VOCs in the groundwater beneath the area and that the major contaminants at the Site continue to be toluene, xylenes and ethylbenzene. The acetone concentration in the October 2007 groundwater samples were all non detectable and showed a significant decreasing trend following the implementation of the IRM groundwater pump and treat system (see Section 7.0 below). In addition to the groundwater contamination, free-phase product was observed in Monitoring Wells MW-21, MW-22 and MW-9A. During the September 2006 sampling round, the product was drawn into Monitoring Wells MW-21 and MW-22 as a result of the low-flow groundwater sampling from each respective well.

Summary tables showing the historical groundwater elevations for wells both onsite and offsite are included in Appendix IV on the attached CD and summary tables of laboratory results for the historical groundwater sampling events conducted for the Site are included in Appendix VI on the attached CD.

The laboratory analysis data from monitoring wells located on the west side of River Street (MW-4, MW-5, MW-12, MW-14 and MW-20) showed non-detectable levels and/or a general decrease in concentrations of the five major contaminants (acetone, benzene, toluene, ethylbenzene and xylene) between December 2006 and October/November 2007. Non-detectable levels of the five major contaminants were also observed in MW-1, MW-2, MW-3 and MW-10 in groundwater samples collected in March and October/November 2007. Laboratory data for groundwater samples collected from monitor wells located on North First Street showed non-detectable concentrations of the five major contaminants in groundwater samples from MW-8 and MW-26 from December 2006 to October/November 2007.

Based on groundwater quality data which demonstrates a general decrease in concentration of the five major chemicals, it was determined that additional downgradient groundwater remediation on River Street area could be implemented by pumping groundwater from EW-2. The groundwater will be treated using the existing IRM treatment system. The

groundwater remediation from EW-2 will be evaluated after 6 months of operation and additional remedial technology may be implemented, if required.

When evaluating the data from past sampling rounds, the plume migration seems to have been minimal with the concentrations of the primary contaminants of concern being confined beneath the Fyn Paint and Con Ed properties with migration to the south (just across North First Street) and to the west (just across River Street). Figures illustrating the approximate dissolved phase plume extents for sampling events in 2004, 2004, 2005, 2006 and 2007 are presented in Appendix XI on the attached CD.

5.8 2007 Soil Vapor Intrusion Investigation

Based on the presence of VOCs detected in the soil vapor surrounding the Site during the second soil vapor sampling event (performed in 2005), subsequent soil vapor intrusion (SVI) sampling was requested by the NYSDEC. This sampling was requested to be performed at the Fyn Paint building and the Con Ed building as well as at several properties surrounding the Site (properties to the north, south and east of the Site). Prior to the commencement of the SVI sampling, both verbal and written access requests were submitted to several property owners in the neighborhood. While several property owners granted access for the SVI sampling, some property owners refused to grant access to their properties for SVI sampling. Of note, one property owner (Menna Drum Corp. located to the east across Kent Avenue) verbally approved the SVI sampling at their properties (211, 215 and 221 Kent Avenue); however, after the sampling event started the owner refused to allow the sampling to continue and demanded the sampling summa containers be purged before leaving their property. LBG complied. As a result, no SVI samples were collected for these properties. Additionally, the NYSDEC was notified about the access refusals and attempted to assist LBG with obtaining access to multiple properties. Following NYSDEC action, the owner of the property to the south of the Site (240 Kent Avenue) granted LBG access for SVI sampling.

The SVI investigation was conducted in accordance with the *NYSDOH Center for Environmental Health, Bureau of Environmental Exposure Investigation Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006*. A copy of this guidance document is included in Appendix XII on the attached CD. The SVI investigation consisted of collecting sub-slab soil vapor and indoor air samples from: the Fyn Paint building (1 of each

sample from the first floor and 1 of each sample from the basement); the Con Ed building (1 of each sample); the basement of 210 Kent Avenue, a property located north of the Site on the north side of Metropolitan Avenue (1 of each sample); the basement of 229 Kent Avenue (the Fyn Paint office), a property located southeast of the Site on the east side of Kent Avenue (1 of each sample); and 240 Kent Avenue a property located adjacent to the south of the Site on the south side of North 1st Street (1 indoor air sample and 3 sub-slab soil vapor samples). The sub-slab soil vapor and indoor air sampling locations are shown on figure 5. In addition to the sub-slab soil vapor samples and indoor air samples, soil vapor samples were collected from the existing soil vapor points previously installed on and surrounding the Site (SG-2, SG-3, SG-8, SG-9 and SG-10) and, ambient outdoor air samples were collected to evaluate background air quality in the area during each round of SVI sampling and soil vapor sampling. The purpose of the SVI investigation was to determine the following:

- potential for current human exposure;
- potential for future human exposure; and,
- need for measures to be implemented for removal of vapors from the subsurface.

All activities conducted in conjunction with the SVI investigation were conducted in adherence to the site's Health and Safety Plan (HASP) which was used for the implementation of the Site Investigation activities. A copy of the HASP is included in Appendix XIII on the attached CD.

5.8.1 Soil Vapor Intrusion Sampling Procedure (Protocol)

Soil vapor sampling was conducted at the Site and surrounding properties beneath the concrete slab on grade or lowest building level at each location. The soil vapor samples were collected from existing soil vapor points and newly installed temporary sub-slab soil vapor points.

The sub-slab soil vapor sampling points were used to collect samples from the Site and buildings surrounding the Site. For all of the sampling locations (with the exception of CE-SG-6 which was already installed) the following procedure was used for the installation of temporary sub-slab soil vapor sampling points:

- for temporary sub-slab soil vapor points, a 1/4-inch concrete core drill was be used to penetrate the slab/floor to install sampling tubing;
- the temporary sub-slab soil vapor points consisting of 1/8-inch internal diameter polyethylene tubing was installed within each drill hole with the intake set at 0-2 inches below the bottom of the existing slab/floor; and,
- the tubing was sealed in the hole using a cement/bentonite grout.

A diagram illustrating a typical temporary sub-slab soil vapor sampling point is shown on page 28; figure 2.4 (C) of the *NYSDOH Center for Environmental Health, Bureau of Environmental Exposure Investigation Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006*. A copy of this guidance document is included in Appendix XII on the attached CD.

After the installation, sub-slab soil vapor samples were collected from the temporary sub-slab soil vapor points and/or the existing soil vapor points using the following procedures:

- for existing soil vapor sampling points and CE-SG-6, the tubing was connected to the sampling point using a locking cap with an integrated sampling port to which the tubing was connected;
- dedicated polyethylene tubing was connected to the sub-slab soil vapor sampling points and soil vapor sampling points via air-tight quick-connect fittings;
- approximately three volumes of air/soil vapor was purged from each sampling point and the sampling tubing using a peristaltic pump;
- flow rates for purging was maintained as less than 0.2 liters per minute;
- a soil vapor sample was collected from each point via an airtight fitting connected to a dedicated 6 liter capacity Summa canister fitted with a regulator set to allow a flow rate of 0.05 liter per minute (l/min);
- in order to ensure that sub-slab soil vapor samples are not diluted by surface/indoor air, a propane tracer gas was used (introduced into a tent made of polyethylene sealed with bentonite grout and installed surrounding the sampling point) to validate the surface seal at greater than

the required 10% to 20% of the sub-slab soil vapor sampling locations and soil vapor sampling locations; and,

- soil vapor samples were submitted to Lancaster Laboratories (a NYSDOH Environmental Laboratory Approval Program [ELAP] certified laboratory) located in Lancaster, Pennsylvania under chain-of-custody procedures for analysis of VOCs by EPA Method TO-15.

Indoor air sampling was conducted at the Site in all areas where sub-slab soil vapor samples are collected. This sampling will be used to characterize the concentration and extent of VOCs present indoors at the Site during the sub-slab sampling period. The indoor air quality sampling was conducted in accordance with the *NYSDOH Center for Environmental Health, Bureau of Environmental Exposure Investigation Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006.*

The indoor air samples were collected from each building area concurrent with the sub-slab soil vapor samples from the same building area. The sub-slab soil vapor sample locations and associated indoor air sampling locations are shown on figure 5. The indoor air sampling will be used to characterize the indoor air quality and also to evaluate the relationship between the indoor air concentrations and the sub-slab soil vapor concentrations beneath the concrete slab.

The indoor air samples were collected from each building area using the following procedures:

- a six liter Summa canister was placed approximately three (3) feet above the ground surface; and,
- each Summa canister was fitted with a dedicated regulator set with a sampling flow rate of 6-liters over an eight (8) hour period.

Outdoor ambient air samples were collected from locations situated along the perimeter of the investigation area during each sampling event. These locations are shown of figure 5. The same Work Scope, Sampling Procedure and Analytical method used for the indoor air sampling was followed for the outdoor ambient air sampling.

This sampling was performed concurrently with the sampling of the sub-slab soil vapor, soil vapor and/or indoor air sampling of one of the building areas.

Figure 5 shows the locations of the sub-slab soil vapor sampling points and soil vapor sampling points as well as the locations of the indoor air samples and outdoor ambient air samples.

The sampling was conducted by experienced technicians and the sub-slab soil vapor samples, soil vapor samples, indoor air samples and outdoor air samples were collected and maintained under chain-of-custody procedures. All necessary sampling information was included on the chain-of-custody forms. Additionally, during the sampling site and sampling conditions were observed and recorded on field sheets. These field sheets (included in Appendix VIII) document the following information pertinent to each sampling event:

- sample identification;
- date and time of sample collection;
- identity of samplers;
- sampling method and equipment;
- measurement parameters for sampling equipment,; and,
- volume of soil vapor extracted.

The samples were analyzed for VOCs by EPA Method TO-15 and the sampling results identify the reporting limits. The analytical method (where necessary) was modified to include propane for sub-slab soil vapor samples and soil vapor samples collected using tracer gas. Additionally, the indoor air samples were analyzed by EPA Method TO-15 in Selected Ion Monitoring (SIM) mode to achieve required sensitivity for selected compounds. The SIM mode ensured that TCE and vinyl chloride achieved a minimum reporting limit of 0.25 ug/m^3 (micrograms per cubic meter) and that PCE had a minimum reporting limit of 1 ug/m^3.

Analytical results for VOCs in indoor air will be evaluated based on the NYSDOH indoor air quality guidance values for the compounds which the NYSDOH have established guidance values (PCE, TCE, carbon tetrachloride and 1,1,1-TCA).

Additionally, indoor air contaminants for which a decision matrix has not been developed will be compared to typical background ranges (90th percentile) of VOCs compiled by the NYSDOH in the 2001 Building Assessment and Survey Evaluation (BASE) database. This summary table is included in Appendix XIV on the attached CD. The NYSDOH decision matrices *(NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006", pages 48-55)* will be used as a "general framework" in evaluating the potential necessity for mitigation activities in relation to VOCs detected in the indoor air samples. The decision matrices compare indoor air concentrations of VOCs with soil gas concentrations in samples collected from the same location. As noted above, these matrices will provide a "general framework" for potential mitigation activities because they were developed for TCE and PCE, respectively, based on their specific chemical toxicological properties.

5.8.2 Quality Assurance/Quality Control (QA/QC)

During sample collection, extreme care was taken in order to ensure that high quality data were obtained. The sampling team avoided fueling vehicles, using permanent marking pens or any other materials containing VOCs which could cause sample interference in the field.

An additional QA/QC measure was performing tracer gas sampling at greater than the required 10% to 20% of the sub-slab soil vapor sampling locations and soil vapor sampling locations throughout the investigation. The tracer gas (propane) was applied in accordance with the NYSDOH Center for Environmental Health, Bureau of Environmental Exposure Investigation Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006. It should be noted that for all sampling locations where the tracer gas was used to verify the seal with the sampling points, the propane concentrations (if detected in the laboratory analytical) were below the maximum allowable 10% by volume, thereby validating the field sampling procedures.

The QA/QC protocol for sample collection and laboratory analysis was followed. All sampling devices were clean and chain-of-custody forms were maintained. Sub-slab soil vapor samples, soil vapor samples, indoor air samples and outdoor ambi-

ent air samples were analyzed by EPA Method TO-15 Category B Deliverables. Sampling methods, sample preservation requirements and sampling handling times were conducted in accordance with NYSDEC and United States Environmental Protection Agency (USEPA) standard operating procedures and industry standards. The table below summarizes the sampling standards.

Sample Collection Area	Media	Analytical Method	Holding Time	Preservation
Sub-slab soil vapor samples, soil vapor samples, indoor air samples and outdoor ambient air samples	Air	EPA Method TO-15 Category B Deliverables (Select Samples for Propane Tracer)	NA	Avoid extreme heat or cold

As previously indicated, the samples were analyzed by an NYSDOH laboratory with a current ELAP certification.

5.8.3 Soil Vapor Intrusion Sampling Results

As a result of the remedial investigation activities, a characterization of the soil vapor and indoor air quality at the Site and at properties surrounding the Site has been completed.

On February 13, 15 and 16, 2007, March 1, 2007 and May 16, 2007, LBG conducted the soil vapor intrusion investigation sampling at the Site and surrounding properties. This investigation was performed in an effort to determine if the subsurface contamination includes elevated levels of VOCs in the soil vapor and, if present, if it is negatively impacting the indoor air quality at the Site or surrounding properties. These samples were collected from the newly installed temporary sub-slab soil vapor sampling points and previously installed soil vapor sampling points as well as indoor and outdoor sampling locations. The sampling locations for the soil vapor intrusion sampling survey are shown on figure 5.

Based on the results of the laboratory analysis, the sub-slab soil vapor VOC concentrations were compared against the indoor air VOC concentrations from the same

sampling area. These VOC concentrations were then compared using the NYSDOH indoor air guidance values (if available) as well as the NYSDOH Soil Vapor/Indoor Air Matrices (which correlates soil vapor concentrations and indoor air for TCE, PCE, 1,1,1-TCA and carbon tetrachloride) to evaluate the recommended course of action for each sampling location. The indoor air guidance values as well as the Soil Vapor/Indoor Air Matrix 1 and Matrix 2 are included in the NYSDOH Center for Environmental Health, Bureau of Environmental Exposure Investigation *Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006*, attached in Appendix XII on the attached CD. The recommended courses of action and a description of each area as follows:

- *No further action:* Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.
- *Take reasonable and practical actions to identify source(s) and reduce exposures:* The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Re-sampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.
- *Monitor:* Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-

conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

- *Mitigate:* Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.
- *Monitor/Mitigate:* Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site specific conditions.

5.8.3.1 Fyn Paint Building

The laboratory analysis of the soil vapor samples concluded that several VOCs were detected in the soil vapor beneath the Fyn Paint building. The highest concentrations of VOCs in the soil vapor were detected beneath the basement floor of the Fyn Paint building. The compounds which were detected at the highest concentrations included: total xylenes (186,000 ug/m^3); toluene (180,000 ug/m^3); heptane (110,000 ug/m^3); ethylbenzene (36,000 ug/m^3); hexane (10,000 ug/m^3); and acetone (6,400 ug/m^3). Overall, similar compounds were detected at lower concentrations be-

neath the 1st floor of the Fyn Paint building. Many other VOCs were detected in the soil vapor, however at lower concentrations.

It should be noted that none of the indoor air samples collected contained concentrations of PCE or TCE above the established NYSDOH indoor air guidance values. The 1st floor indoor air sample did however contain methylene chloride at a concentration of 120 ug/m^3, which exceeds the established NYSDOH indoor air guidance value of 60 ug/m^3.

Based on the NYSDOH Soil Vapor/Indoor Air Matrices (which correlates soil vapor concentrations and indoor air for TCE, PCE, 1,1,1-TCA and carbon tetrachloride), the recommended course of action for the Fyn Paint building consists of: *Monitor* based on the TCE detected in the soil vapor (<54 ug/m^3 in 1st Floor Sub-Slab) and indoor air (<0.107 ug/m^3) in the 1st floor; and, *Monitor/Mitigate* based on the TCE detected in the soil vapor (<210 ug/m^3 in Basement Sub-Slab) and indoor air (0.322 ug/m^3) and *Monitor* based on the PCE detected in the soil vapor (<270 ug/m^3 in Basement Sub-Slab) and indoor air (1.7 ug/m^3) in the basement of the building. It should be noted however that the Fyn Paint building is an active manufacturing facility and that indoor air concentrations are below established Occupational Safety and Health Administration (OSHA) limits.

Summary tables showing the VOC concentrations detected in the soil vapor, sub-slab soil vapor, indoor air and outdoor ambient air from the 2007 sampling round are presented on tables included in Appendix VIII on the attached CD. A copy of the laboratory reports are on file at LBG and are available for review upon request.

5.8.3.2 Con Ed Property

The laboratory analysis of the soil vapor samples concluded that several VOCs were detected in the soil vapor beneath the Con Ed property. The concentrations of VOCs detected in the soil vapor in this area were on average several orders of magnitude lower than those detected in the Fyn Paint building. The exception being chlorinated solvents which were detected at higher concentrations on the Con Ed property.

TCE and PCE were detected in SG-10 at concentrations of 100 ug/m^3 and 590 ug/m^3, respectively. Many other VOCs were detected in the soil vapor, however at concentrations at or just above the laboratory detection limit.

It should be noted that none of the indoor air samples collected contained concentrations of PCE, TCE or methylene chloride above the established NYSDOH indoor air guidance values. Additionally, based on the NYSDOH Soil Vapor/Indoor Air Matrices (which correlates soil vapor concentrations and indoor air for TCE, PCE, 1,1,1-TCA and carbon tetrachloride), the recommended course of action for the Con Ed property (with respect to addressing soil vapor and soil vapor intrusion concerns) consists of *no further action* for TCE, 1,1,1-TCA and PCE. Although the carbon tetrachloride concentrations were below the laboratory detection limit, the recommended course of action for the Con Ed property (as a result of the laboratory detection limit not being below 0.25 ug/m^3) *is taking reasonable and practical action to identify source(s) and reduce exposure*.

Summary tables showing the VOC concentrations detected in the soil vapor, sub-slab soil vapor, indoor air and outdoor ambient air from the 2007 sampling round are presented on tables included in Appendix VIII on the attached CD. A copy of the laboratory reports are on file at LBG and are available for review upon request.

5.8.3.3 Surrounding Properties

The laboratory analysis of the soil vapor samples concluded that several VOCs were detected in the soil vapor beneath surrounding buildings to the north, east and south of the Site (210, 229 and 240 Kent Avenue). The concentrations of VOCs detected in the soil vapor in these sampling locations are on average several orders of magnitude lower than those detected in the Fyn Paint building. The highest concentrations of VOCs in the soil vapor samples collected from these locations were: aliphatic hydrocarbons [pentane (1,700 ug/m^3), hexane (5,000 ug/m^3) and heptane (640 ug/m^3)] as well as benzene (100 ug/m^3), vinyl chloride (100 ug/m^3) and acetone (99 ug/m^3) detected beneath the basement floor of 240 Kent Avenue to the south of the Site; chlo-

rinated solvents [TCE (120 ug/m^3) and PCE (20 ug/m^3)] detected beneath the basement floor of 229 Kent Avenue to the east of the Site; and, acetone (28 ug/m^3) detected beneath the basement floor of 210 Kent Avenue to the north of the Site. Many other VOCs were detected in the soil vapor at these sampling locations, however at lower concentrations.

It should be noted that none of the indoor air samples collected contained concentrations of PCE or methylene chloride above the established NYSDOH indoor air guidance values. Additionally, only 229 Kent Avenue had an indoor air concentration of TCE above the established NYSDOH indoor air guidance value; however, the SIM analysis (low detection limit) showed the indoor air to contain TCE at a concentration of <0.107 ug/m^3 which is below the established NYSDOH indoor air guidance value of 5 ug/m^3. Additionally, there were a few VOCs which were detected in indoor air samples at concentrations which are higher than the 90th percentile values established by the NYSDOH 2001 "Study of VOCs in Air of Fuel Oil Heated Homes". These VOCs were acetone (210 Kent Avenue), methylene chloride (229 Kent Avenue), hexane (210 Kent Avenue), chloroform (210 and 229 Kent Avenue) and 2-butanone (240 Kent Avenue). It should also be noted that the outdoor air sample collected during the sampling of 210 and 229 Kent Avenue contained TCE at a level exceeding the 90th percentile values established by the NYSDOH 2001 "Study of VOCs in Air of Fuel Oil Heated Homes" but below the established NYSDOH indoor air guidance value of 5 ug/m^3.

Based on the NYSDOH Soil Vapor/Indoor Air Matrices (which correlates soil vapor concentrations and indoor air for TCE, PCE, 1,1,1-TCA and carbon tetrachloride), the most conservative recommended course of action for each of the properties surrounding the Fyn Paint building (210, 229 and 240 Kent Avenue) are as follows:

- *Taking reasonable and practical action to identify source(s) and reduce exposure* at 210 Kent Avenue based on the TCE detected in the soil vapor (4.8 ug/m^3 in the Sub-Slab) and indoor air 0.43 ug/m^3) as well as a

result of the laboratory detection limit of carbon tetrachloride not being below 0.25 ug/m^3;

- Monitor/Mitigate at 229 Kent Avenue based on the TCE detected in the soil vapor (120 ug/m^3 in the Sub-Slab) and indoor air (82 ug/m^3). It should be noted that if the TCE concentration for the indoor air using the SIM mode (low detection limit) was <0.107 ug/m^3, a concentration which when compared with the sub-slab concentration would make the NYSDOH recommended course of action *taking reasonable and practical action to identify source(s) and reduce exposure. Taking reasonable and practical action to identify source(s) and reduce exposure* would also be the course of action as a result of the laboratory detection limit of carbon tetrachloride not being below 0.25 ug/m^3.
- *Taking reasonable and practical action to identify source(s) and reduce exposure* at 240 Kent Avenue based on the TCE detected in the soil vapor samples (<11 ug/m^3 in the Sub-Slab #2 and 4.8 ug/m^3 in the Sub-Slab #3) and indoor air (0.914 ug/m^3) as well as a result of the laboratory detection limit of carbon tetrachloride not being below 0.25 ug/m^3.

Summary tables showing the VOC concentrations detected in the soil vapor, sub-slab soil vapor, indoor air and outdoor ambient air from the 2007 sampling round are presented on tables included in Appendix VIII on the attached CD. A copy of the laboratory reports are on file at LBG and are available for review upon request.

6.0 CONTAMINANT FATE AND TRANSPORT

There are several factors that affect contaminant migration in the matrices at the Site (soil, groundwater and soil vapor). Each of these factors will be evaluated and the difficulties and concerns associated with the presence of contamination in the subsurface will be presented.

The onsite and offsite contamination, as delineated through historical subsurface investigations, consists of VOCs present in the soil, groundwater as well as in the soil vapor. Al-

though SVOCs were detected in historical soil and groundwater samples at the Site and surrounding properties, only VOCs were observed at concentrations that were significantly above maximum contaminant levels established by the NYSDEC. The results of laboratory analysis of soil, groundwater and soil vapor samples collected from the Site have indicated that contaminants associated with the Fyn Paint chemicals as well as chemicals not listed as having been used as part of the Fyn Paint operations (specifically chlorinated solvents) are present beneath the Site and surrounding properties.

Primary routes of migration for VOCs within the area of the Site are; dissolved phase contamination flow within the groundwater; and, migration of soil vapors (resulting from volatilization of residual contamination in the subsurface soils as well as VOCs in groundwater). The migration of the dissolved phase contamination is related to the natural hydraulic flow of the groundwater. The migration of the VOCs in the soil vapor however is not constrained by hydrogeologic factors. The analytical results of groundwater samples collected at downgradient groundwater monitor wells indicate that the contaminated groundwater has not reached the East River and as such, it is not negatively impacting the surface water and/or sediment within the East River.

6.1 Contaminant Fate

The fate of the VOCs detected at the Site (primarily xylene, toluene, ethylbenzene and acetone) may be impacted by the presence of one another in the subsurface. Information regarding this potential effect each of these VOCs has on each other (primarily acetone with the remaining hydrocarbons) has not specifically been evaluated. Further, field measurements and field observations of these VOCs at similarly impacted sites are apparently not available. Water solubility is one of the most important factors controlling fate and transport of organic contaminants. Where highly soluble polar solvent materials that can hydrogen-bond with water are quickly distributed and diluted (acetone), insoluble non-polar solvent materials (xylene, toluene and ethylbenzene) are more likely to adsorb on solids, or accumulate in biota. Degradation processes are also concentration-dependent, so insoluble contaminants are more slowly transformed. An estimate of solubility, therefore, is a crucial first step to modeling fate and

behavior. Soluble polar solvents in water can act as *co-solvents* if present above ~10% by associating with hydrophobic organic substances, increasing the observed solubility. At lower concentrations, the polar solvent still increases solubility slightly by changing the structure of water around the non-polar substance (the *co-solute effect)*. At still lower concentrations, the two substances exist in water at their respective solubility limits without interacting. Based on the solubility of the acetone, once it reaches the groundwater table, it is fully miscible with the groundwater (capable of mixing in any ratio without separation of two phases). A main problem in determining the solubility of the remaining primary contaminants (xylene, toluene and ethylbenzene) is how to accurately determine compositions of mixed solvents.

Based on these factors, contaminant fate will be evaluated through comparison of past and future groundwater monitoring rounds performed at the Site as well as evaluation of performance data of additional remedial alternatives installed and proposed for installation at the Site (groundwater pump and treat, source area excavation, air sparging and soil vapor extraction). Evaluation of the performance data for these systems will allow a contaminant mass removal estimate to be calculated.

6.2 Contaminant Transport

After release to the subsurface, the VOCs migrated downward by gravity toward the water table. Due to the density of the chemicals used in association with the Fyn Paint operations (all are light non-aqueous phase liquids [LNAPL]), upon reaching the water table, the VOCs would float. This has been demonstrated through historical gauging of onsite and offsite groundwater monitoring wells. All of the detected free-phase product has been of the LNAPL type and no dense non-aqueous phase liquid (DNAPL) has been measured.

6.2.1 Soil

Due to the fact that the Site and the surrounding area are primarily paved with limited recharge areas, downward percolation with water can be considered a minimal contributor to transport. As such, transport within the vadose zone was by gravity and lateral diffusion throughout the pore spaces. Preferential pathways encountered during

vertical migration would have accentuated lateral migration. A portion of the contaminants likely remains in the pore space due to the capillary attraction. Additionally, any free-phase product which reached the water table will spread laterally (primarily in the direction of the hydraulic gradient which is toward the East River).

6.2.2 Groundwater

The transport of dissolved phase VOCs in groundwater (mass or solute transport) is dependent on the properties of the VOCs as well as the site specific hydraulic properties. The primary variable for dissolved phase contaminant transport is the groundwater flow. This determines the direction which the contamination plume will spread. A contributing factor to the transport of the VOCs is advection which is a function of the quantity of the groundwater flowing within the subsurface. As the resulting plume moves downgradient, the plume widens (spreads laterally) and concentrations decrease away from the source. Additionally, dissolved phase VOCs will move from an area of greater concentration (source area) to an area where it is less concentrated, also know as diffusion. Diffusion will occur as long as a concentration gradient exists, irrespective of movement of the groundwater. Based on the historical subsurface investigations performed at the Site, the baseline regional hydraulic gradient at the Site is approximately 0.05 foot per foot to the west (toward the East River). Additionally, based on an evaluation of the data collected from the subsurface investigation, the estimated hydraulic conductivity in the subsurface at the Site is 2.7 feet/day.

6.2.3 Soil Vapor

Similarly to transport in groundwater, transport in the gas phase may also be described by advection and dispersion. In most cases mechanical dispersion (contaminant distribution by air flow velocity variations) is ignored because gas velocities are generally too small due to steady state conditions (no forced air flow in the subsurface). As such, the effects of diffusion are generally much greater than dispersion in the gas phase. Additionally, based on this "steady state" condition, soil vapor migration direc-

tion cannot be determined without quantitative sampling. This sampling has been performed at the Site and surrounding properties and results of the investigation are summarized in Section 5.7 above. Molecular diffusion coefficients are approximately four orders of magnitude greater in the gas than in the liquid phase. As such, residual contamination in the vadose zone will impact soil vapor faster than residual contamination impacting the groundwater (from the smear zone and/or free-phase product).

7.0 INTERIM REMEDIAL MEASURES

The initial Interim Remedial Measure (IRM) at the Site consisted of free-phase Non-Aqueous Phase Liquid (NAPL) recovery. Free-phase product was first measured in CE-1 and CE-2 on June 7, 2001, at thicknesses of 0.84 foot and 0.02 foot, respectively. The free-phase product was removed from both wells during sampling on June 7, 2001. On June 20, 2001, measurements of these wells indicated that the free product thickness in CE-1 had recovered to 0.01 foot and there was no free product in CE-2. On July 12, 2001, CE-2 had no water or product in it and CE-1 had a free-product thickness of 0.14 foot. The product removed from these wells was temporarily stored in a 55-gallon drum onsite pending offsite disposal.

In 2003, free-phase product was observed in MW-15, CE-1 and MW-9A. The greatest thickness was in MW-15. The majority of the product appeared to be confined to the area beneath the northeast corner of the Fyn Paint factory and an unknown portion of the Con Ed parking lot north of the Fyn Paint factory. Following the initial product bailing activities, product was regularly bailed from MW-15 (every several weeks from May 2004 to January 2005) and temporarily stored in a 55-gallon drum onsite pending offsite disposal. The manual bailing activities performed from 2001 to 2005 generated approximately 40 gallons of free-phase product and approximately 100 gallons of contaminated groundwater.

Subsequently, IRM equipment consisting of a groundwater extraction and treatment system and a free-phase product recovery system was installed at the Site. The IRM component installation was completed in February 2007 and following receipt of the NYC Department of Environmental Protection (NYCDEP) discharge permit the treatment system was

started in April 2007. The IRM installation activities were completed in accordance with the work plan submitted to the NYSDEC in August 2006.

The IRM was designed to be protective of human health and the environment in the short and long-term until the final site compliance is achieved. The objective of the IRM is the following:

- removal of free-phase product using product skimmer/ferret pumps;
- prevent migration of contaminated groundwater using groundwater extraction, treatment, and discharge; and,
- monitoring (system and groundwater) to evaluate and determine potential additional remedial alternatives.

The IRM installation began with trenching activities which were conducted on the Con Ed parking lot located at 214 Kent Avenue (adjacent to the north of the Fyn Paint building). The trenching activities were performed by American Environmental Assessment Corp. of Wyandanch, New York with oversight and supervision by LBG. All activities associated with the IRM trenching activities were conducted in accordance with the Site Specific HASP and other addendums prepared and utilized for the Interim Remedial Measures Work Plan submitted to the NYSDEC in June 2006. A copy of the HASP is included in Appendix XIII on the attached CD.

The trenches were saw-cut through the existing concrete and asphalt. The trenches were 5 feet wide. The locations of the trenches (for MW-21, MW-22 and EW-1) are shown on figure 6. The trenches were excavated to a depth of 3.75 ft bg. All soil excavated from the trenches was placed into an onsite roll-off pending disposal. Following all excavation activities, the excavated soil stockpile was sampled and sent to a New York State approved laboratory for waste characterization analysis, as per Con Ed requirements. After the trenches were excavated to the final depth, a base layer of pea gravel (approximately 5-inches thick) was installed along the base of the excavation. A 4-inch diameter schedule 40 PVC pipe conduit was then installed in the excavation. Illustrations of the trench piping and well heads for both the groundwater extraction well (EW-1) and the two monitoring/product recovery wells (MW-21 and MW-22) are shown on figures 7 and 8. After the conduit piping was installed in the

trenches, the piping was covered with approximately 1.5 feet of pea gravel. The pea gravel backfill was then covered in a layer of filter fabric and the remainder of the excavation was backfilled with clean fill. A trench cross section is illustrated in figure 9. As per the Con Ed requirement, the fill was certified as clean by the supplier. After the trench was backfilled, it was compacted and then capped with an asphalt layer. The site was inspected after the trenching activities to ensure that no additional settling had taken place. Following receipt of the laboratory analysis for waste characterization, the excavated soil was disposed of off-site by Con Ed. After the installation of the conduit trenches, the groundwater treatment system and product recovery system was installed. Both systems consist of pneumatic pumps installed within the wells, EW-1 (for groundwater) and MW-21 and MW-22 (for product). The pumps were set based on the measured depths to groundwater and/or product and the connected tubing was installed within the trenched conduit piping to the inside of the Fyn Paint building. Both systems are powered by a 3 horsepower explosion-proof air compressor located within the Fyn Paint building.

The groundwater extraction and treatment system is composed of the following: a pneumatic submersible groundwater extraction pump; a low-profile air stripper and associated explosion-proof regenerative blower; a vapor exhaust stack; a transfer pump, a liquid phase carbon unit; all associated piping; and, a control panel. The groundwater is currently being extracted using a 4-inch diameter stainless steel vertical Extraction Well (EW-1). The location of this well is shown on figure 3.

The groundwater is pumped from the extraction well (through polyethylene and steel piping) to a low-profile air stripper which is equipped with the blower, cleanout holes, gauges and switches to control the operation. As the water flows through the air stripper, air is forced through it using an explosion-proof regenerative blower. After treatment through the air stripper, the groundwater is then run through a liquid phase carbon polish and then discharged to the sanitary sewer utilizing the transfer pump. A process flow diagram for the groundwater extraction and treatment system is shown on figure 10.

The product pumps are set up with independent control boxes and cycle at set time intervals to allow maximum product accumulation/recovery. The product is pumped through

chemical rated tubing and stored in steel 55-gallon drums. A process flow diagram for the product recovery system is shown on figure 11.

Detailed equipment specifications for all IRM equipment is outlined in the Interim Remedial Measures Work Plan submitted to the NYSDEC in June 2006 and will also be included in the Remedial Work Plan submitted along with this report.

Following the first year of system operation (April-December 2007) a *Summary of 2007 Treatment System Operation* was prepared and submitted to the NYSDEC in December 2007.

This report summarized the status of the treatment system during the 2007 period of operation and presents the laboratory analysis of groundwater samples (pre-treatment and post-treatment) collected during the system sampling rounds performed at the Site. The data evaluation shows that the groundwater pump and treat system is actively removing contaminated groundwater from beneath the Fyn Paint and Con Ed properties. Following initial recovery of free-phase product, no significant free-phase product accumulation has been observed in the product recovery wells.

The free-phase product recovered from CE-1, CE-2, MW-9A and MW-15 was pumped off of the top of the groundwater from the multiple storage drums into one 55-gallon drum (only product). The contaminated groundwater (approximately 100 gallons) was stored in two (2) 55-gallon drums inside the Fyn Paint factory pending disposal. This stored contaminated groundwater (in addition to an additional 60 gallons of groundwater pumped from the product recovery wells) was treated during a carbon change-out event in 2007 by cycling the water through the onsite air stripper and liquid phase carbon units.

Since the activation of the product recovery pumps located in the Con Ed parking lot (MW-21 and MW-22), approximately one (1) gallon of additional product has been recovered from the area beneath the Con Ed parking lot. Of note, during the operation of the groundwater extraction pump and groundwater treatment system, the groundwater table is lowered to the point that the product recovery wells are unable to extract additional product. Additionally, it should be noted that only minimal thicknesses of product have been observed in the product recovery wells since the implementation of the groundwater treatment and product recovery systems.

To date, there are approximately 40 gallons of free-phase product stored onsite in a 55-gallon drum. Once the drum is filled, the product will be disposed of offsite at an approved facility.

8.0 CONCLUSIONS

1. Laboratory analysis of soil samples collected during past subsurface investigation activities indicate the presence of VOCs including toluene, xylene, ethylbenzene, acetone, isopropylbenzene and naphthalene. Concentrations in soil were highest in the CE-1, CE-2, MW-15 (destroyed), MW-11, MW-12, MW-13 MW-22, MW-23 and EW-1 borings. The most negatively impacted soil exists at and below the water table. PID screening indicated little and/or significantly reduced VOCs in soil at depth below the water table.

2. Analysis of groundwater samples collected over several groundwater sampling rounds indicates the presence of dissolved VOCs in most of the groundwater samples onsite. The major groundwater contaminants correlate with the soil quality and consist of toluene, xylene, ethylbenzene and acetone. Greatest VOC impact to groundwater has been observed in the Fyn Paint building (in Fenley & Nicol Environmental temporary groundwater Wells TW-1, TW-2 as well as MW-16), in the Con Ed parking lot (CE-1, CE-2, MW-21, MW-22 and EW-1) and adjacent to these properties (MW-9A and EW-2). Although little soil impact was detected in the MW-9A boring, high concentrations of dissolved VOCs and free-phase product have been historically detected in groundwater samples from this monitor well. Conversely, VOCs observed in MW-13 soil samples were not reflected in groundwater samples.

3. The dissolved VOC plume extends to the northwest to MW-4 and MW-12 but not as far as CE-4, GP-2 or MW-1. Its lateral limit to the west is defined by low levels or no VOCs in MW-8, MW-10 and MW-14. Additionally, past groundwater monitoring rounds (2007) show that the downgradient dissolved phase concentrations have been decreasing or stabilized with minor fluctuations.

4. Free-phase product was historically observed in MW-15 (before it was destroyed as a result of sidewalk repairs), MW-9A, CE-1 and CE-2. The greatest thickness observed was detected in MW-15 (2.07 feet thick on August 22, 2003). However, due to the

nature of the product, thicknesses as measured with the electronic interface probe were suspect. Additionally, product is present in Monitoring Wells MW-21 and MW-22 (when the water table is not drawn down lower than the total depth of the wells) on the Con Ed parking lot. The product appears to be confined to the area beneath the north wall of the Fyn building and within the Con Ed parking lot north of the Fyn building.

5. The subsurface, both at the Site and at surrounding properties, contain several VOCs within the soil vapor, some of which have also been identified in the soil and groundwater. These VOCs are primarily acetone, toluene, xylene, ethylbenzene and benzene in addition to several aliphatic hydrocarbons including pentane, heptane and hexane.

LEGGETTE, BRASHEARS & GRAHAM, INC.

dmd
October 30, 2008
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FIGURES

KENT AVENUE

METROPOLITAN AVENUE

NORTH FIRST STREET

GRAND STREET

RIVER STREET

NORTH THIRD STREET

CON EDISON

PARKING LOT

FYN PAINT & LACQUER CO.

TANK 600
4,880,000–GALLONS

TANK 400
6,000,000–GALLONS

TANK 400
6,000,000–GALLONS

"B" COMPLEX"

TANK 300
6,000,000–GALLONS

TANK 200
2,325,000–GALLONS

TANK 100
6,000,000–GALLONS

NYSPA
POWER GENERATING
FACILITY

EAST RIVER

N

LEGEND

- 10,000–GALLON UST
- CATCH BASIN
- LAMP POST
- CHAIN LINK FENCE
- HYDRANT
- MANHOLE
- SUBSURFACE 12" DIA. HIGH PRESSURE GAS MAIN.
- SUBSURFACE HIGH VOLTAGE TRANSMISSION LINE.

0 60

SCALE IN FEET

FYN PAINT & LACQUER CO., INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

SITE MAP

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
110 Corporate Park Drive
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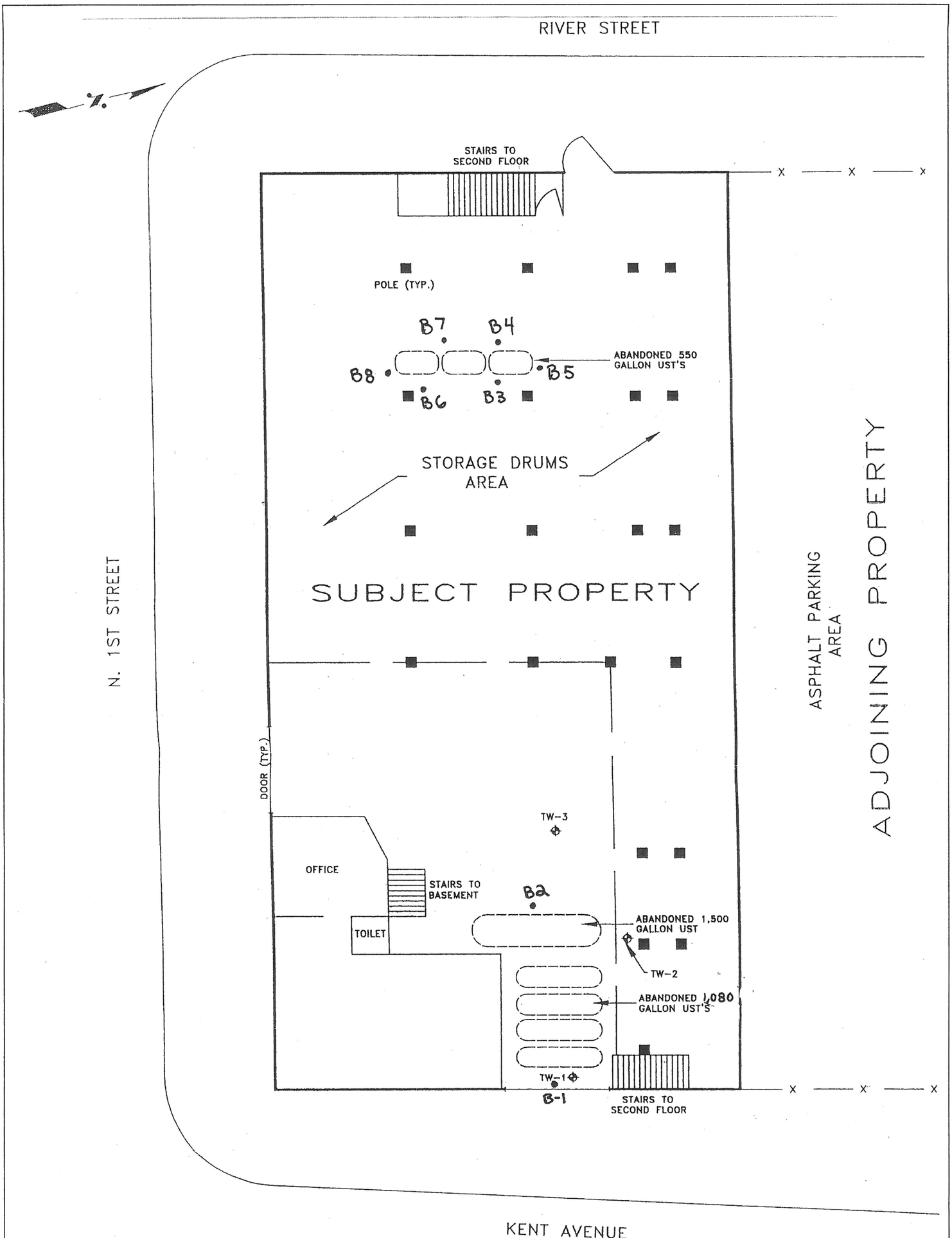
White Plains, NY 10604
(914) 694-5711

DRAWN:	FCS	CHECKED:	PW	DATE:	1/15/06	FIGURE:	1



LEGEND

- ● – Soil Boring
- ◈ – TEMPORARY WELL

10 0 10 20 30

SCALE: 1"=10'-0"

NOTE: This map is obtained from the Fenley & Nicol UST Abandonment and Subsurface Investigation for the Fyn Paint Site.

FYN PAINT AND LACQUER CO., INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

FYN PAINT UST ABANDONMENT AND SAMPLING LOCATION MAP

DATE	REVISED	PREPARED BY:
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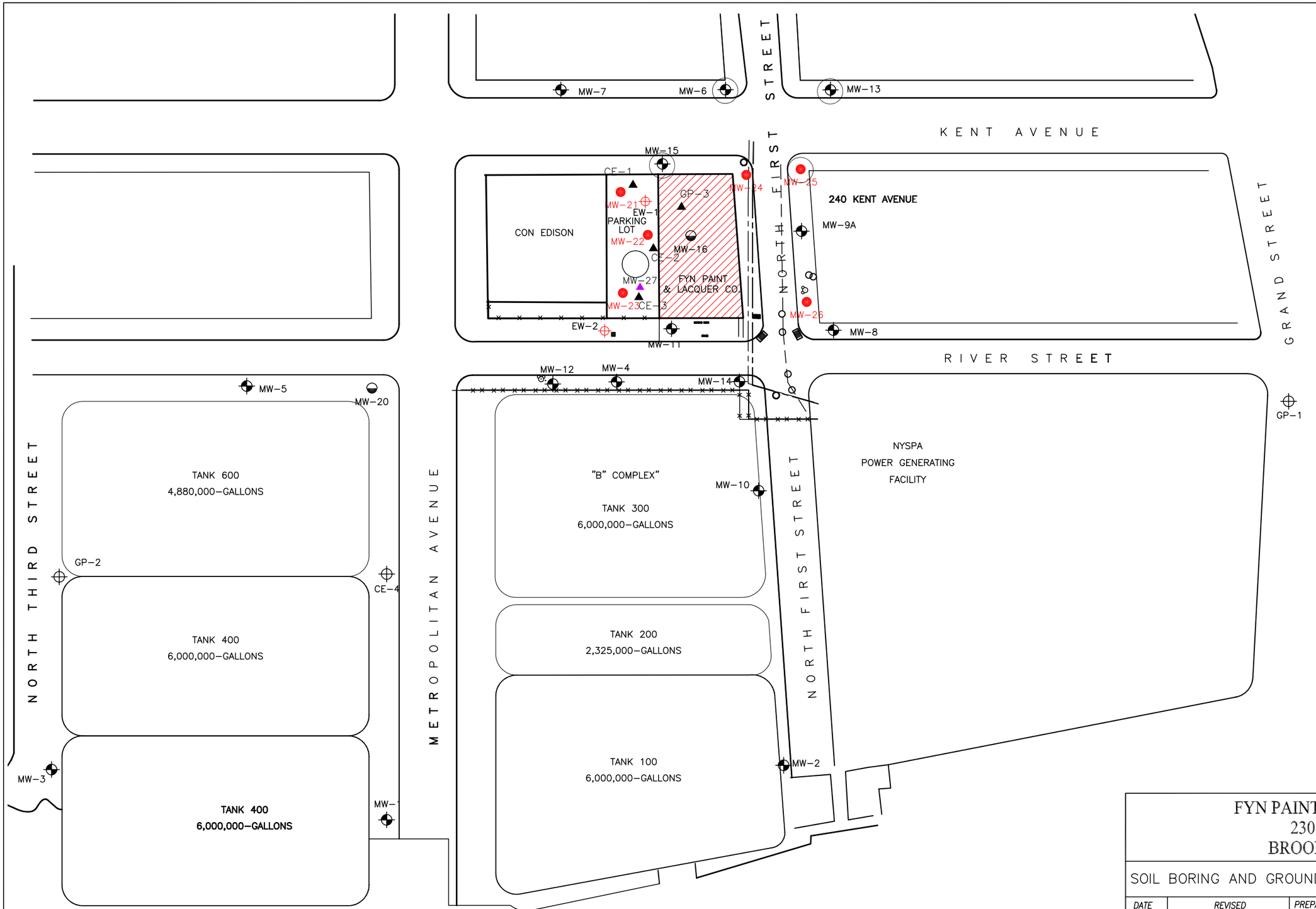
DRAWN:	CHECKED: SG	DATE: 2000	FIGURE: 2



NOTE: MW-6, MW-13, MW-15 and MW-25 were paved over as a result of sidewalk repair/improvement activities

0 60
SCALE IN FEET

FYN PAINT & LACQUER CO., INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

SOIL BORING AND GROUNDWATER MONITOR WELL LOCATION MAP

DATE	REVISED

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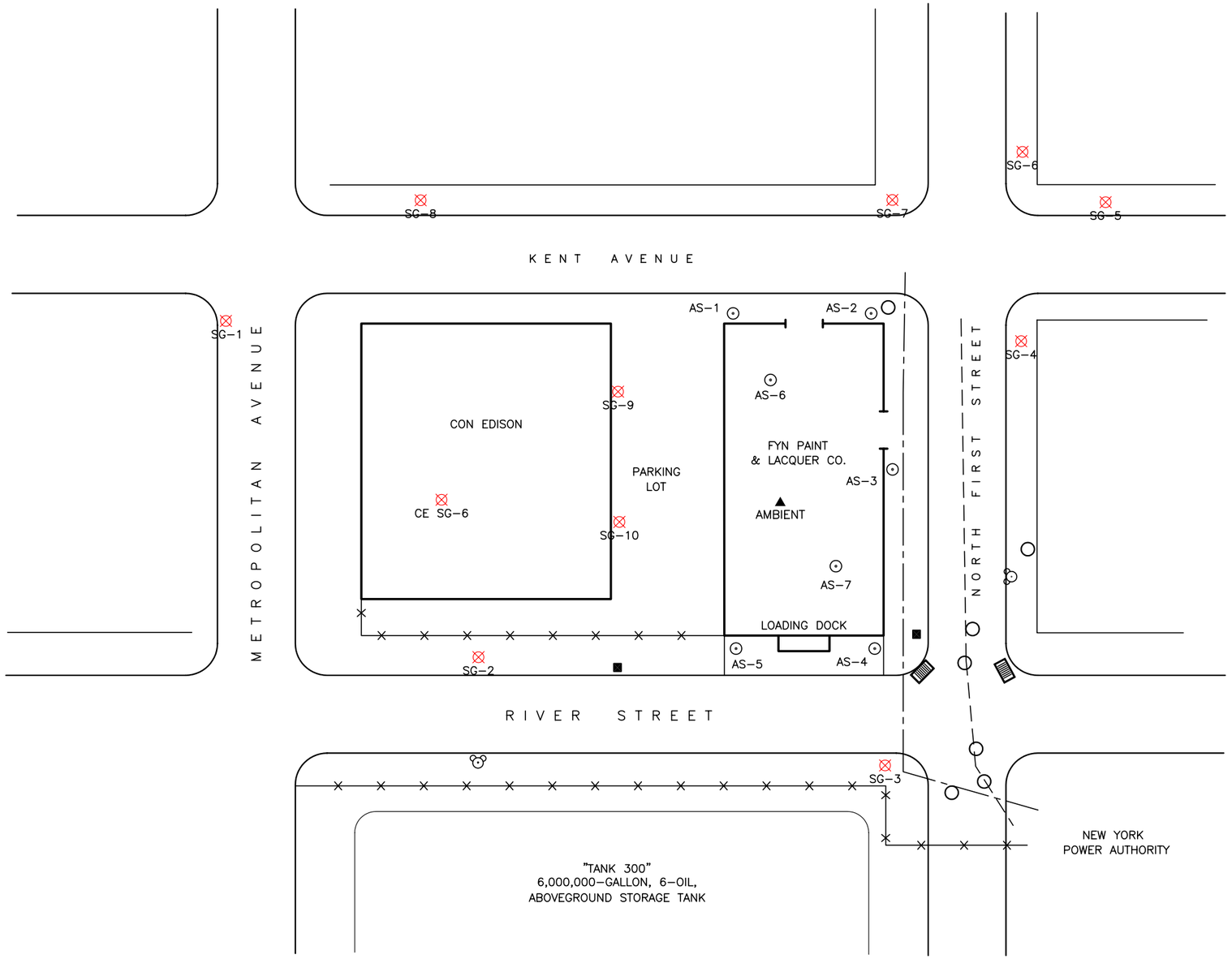
DRAWN:	FCS	CHECKED:	PW	DATE:	1/15/06	FIGURE:	3



FYN PAINT & LACQUER CO. INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

SOIL VAPOR AND AMBIENT AIR SAMPLE LOCATION MAP

DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
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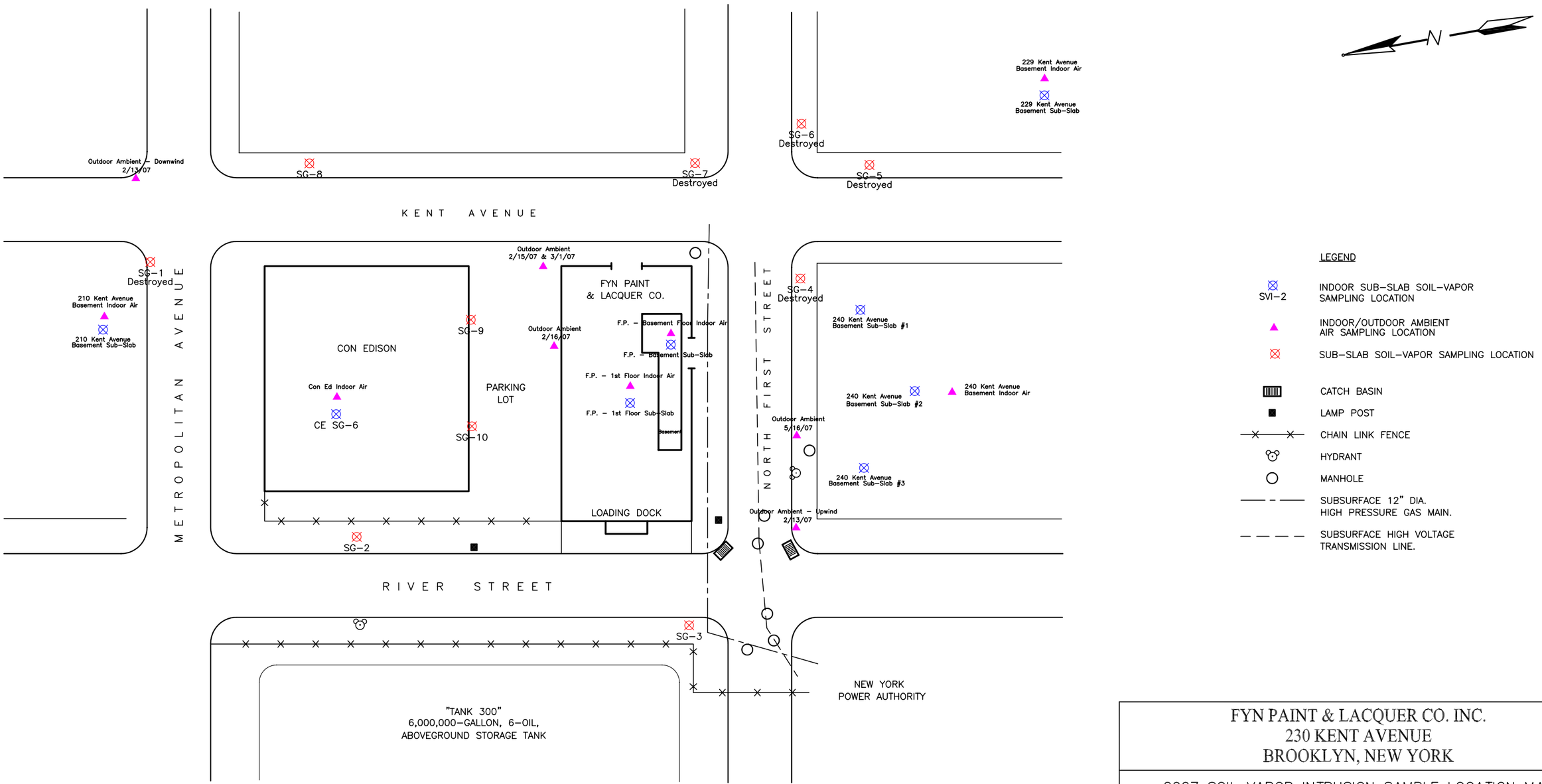
DRAWN:	MRV	CHECKED:	SG	DATE:	12/25/05	FIGURE:	4



NOTE: Tracer Gas Analysis Was Performed At Locations SG–8, CE SG–6, F.P. – Basement Sub–Slab and 210 Kent Ave. Basement Sub–Slab

LEGEND

- SVI–2 — INDOOR SUB–SLAB SOIL–VAPOR SAMPLING LOCATION
- ▲ — INDOOR/OUTDOOR AMBIENT AIR SAMPLING LOCATION
- ⊠ — SUB–SLAB SOIL–VAPOR SAMPLING LOCATION
- CATCH BASIN
- LAMP POST
- CHAIN LINK FENCE
- HYDRANT
- MANHOLE
- SUBSURFACE 12" DIA. HIGH PRESSURE GAS MAIN.
- SUBSURFACE HIGH VOLTAGE TRANSMISSION LINE.

FYN PAINT & LACQUER CO. INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

2007 SOIL VAPOR INTRUSION SAMPLE LOCATION MAP

DATE	REVISED

PREPARED BY:
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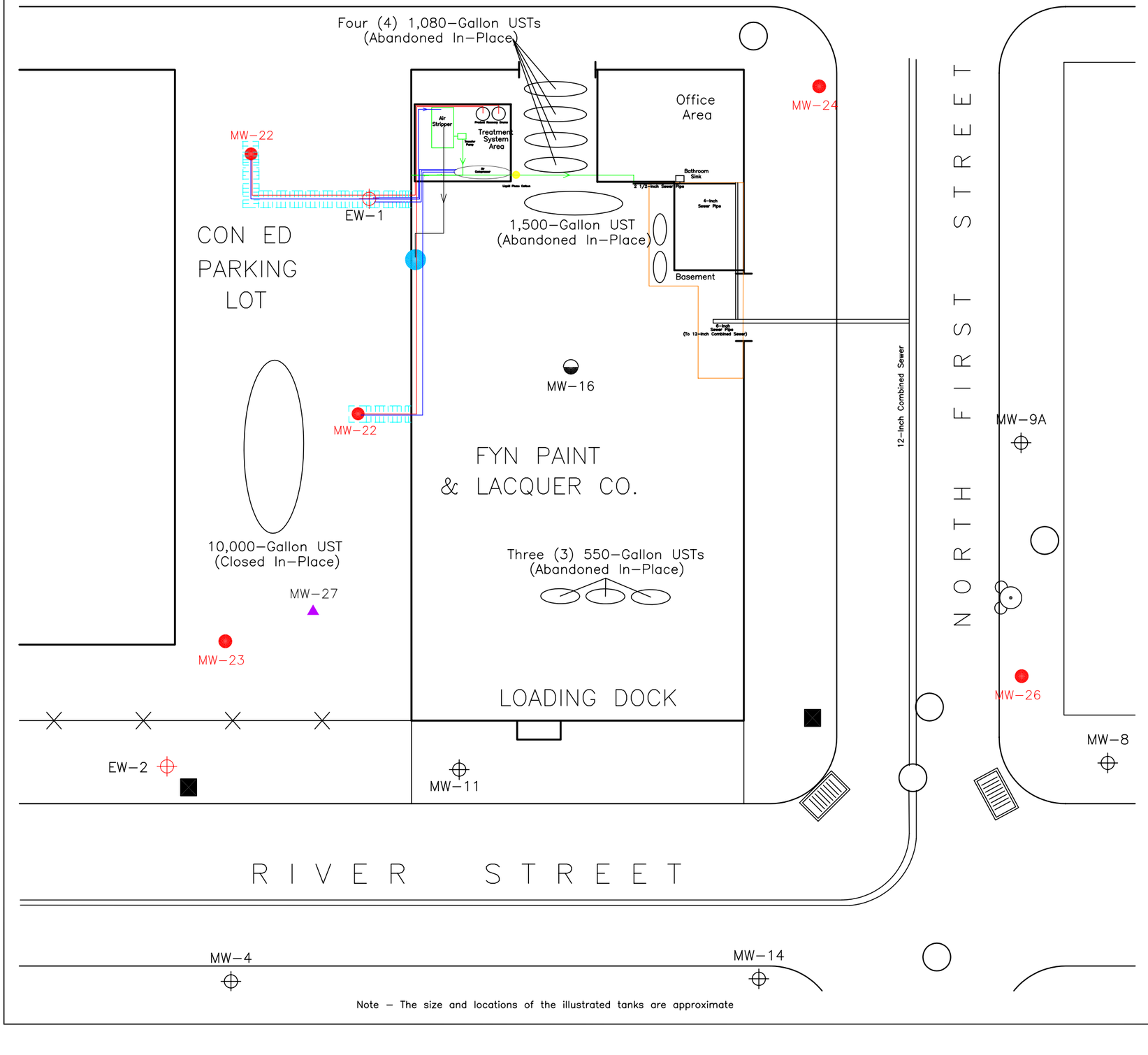
DRAWN:	SG	CHECKED:	SG	DATE:	3/25/07	FIGURE:	5



Note – The size and locations of the illustrated tanks are approximate

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TREATMENT SYSTEM LOCATION AND PIPING LAYOUT

DATE	REVISED

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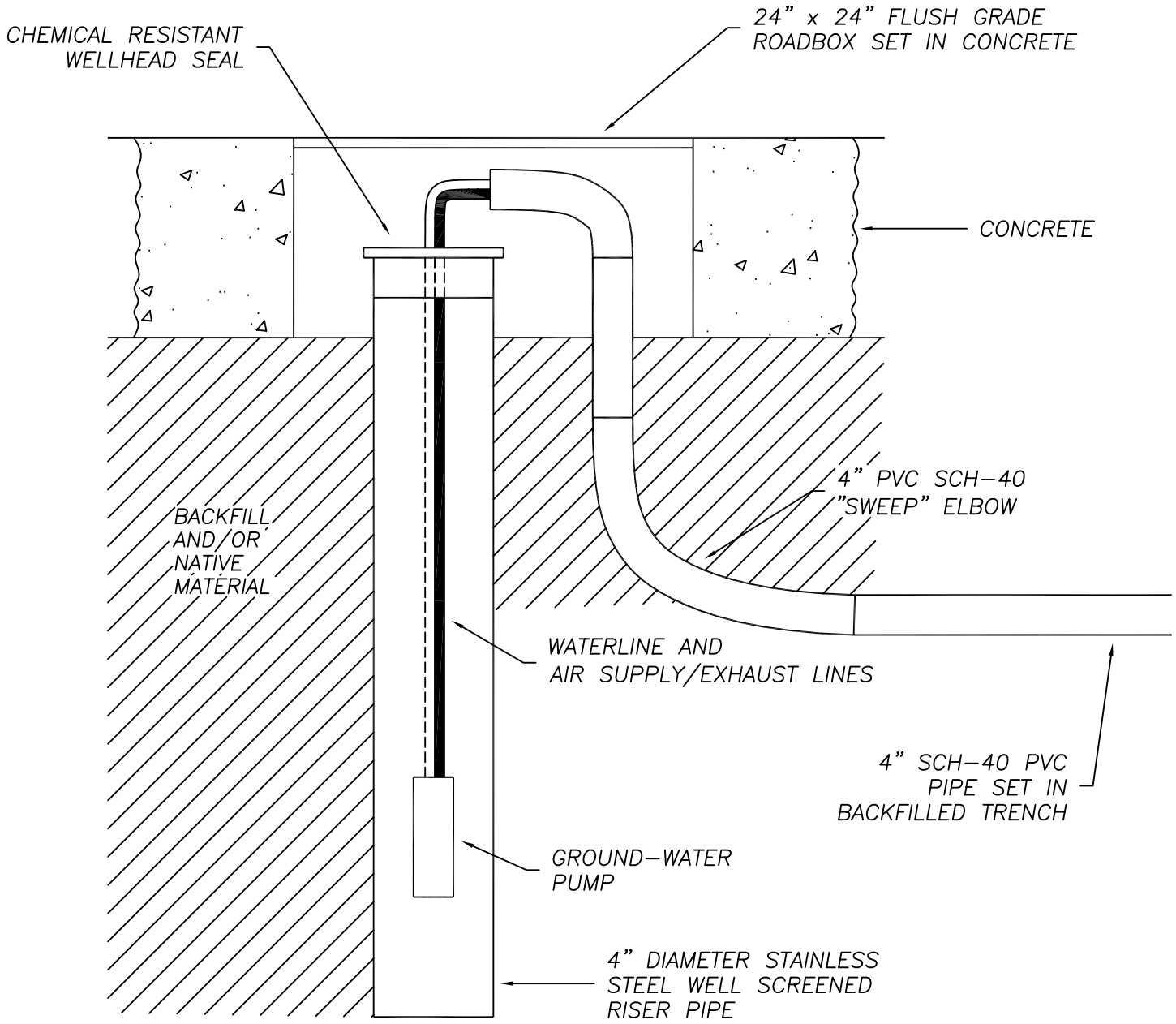
DRAWN:	SG	CHECKED:	SG	DATE:	1/18/08	FIGURE:	6



NOTE: NOT TO SCALE

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230 KENT AVENUE
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GROUNDWATER EXTRACTION WELL PIPING CROSS-SECTION

PREPARED BY:
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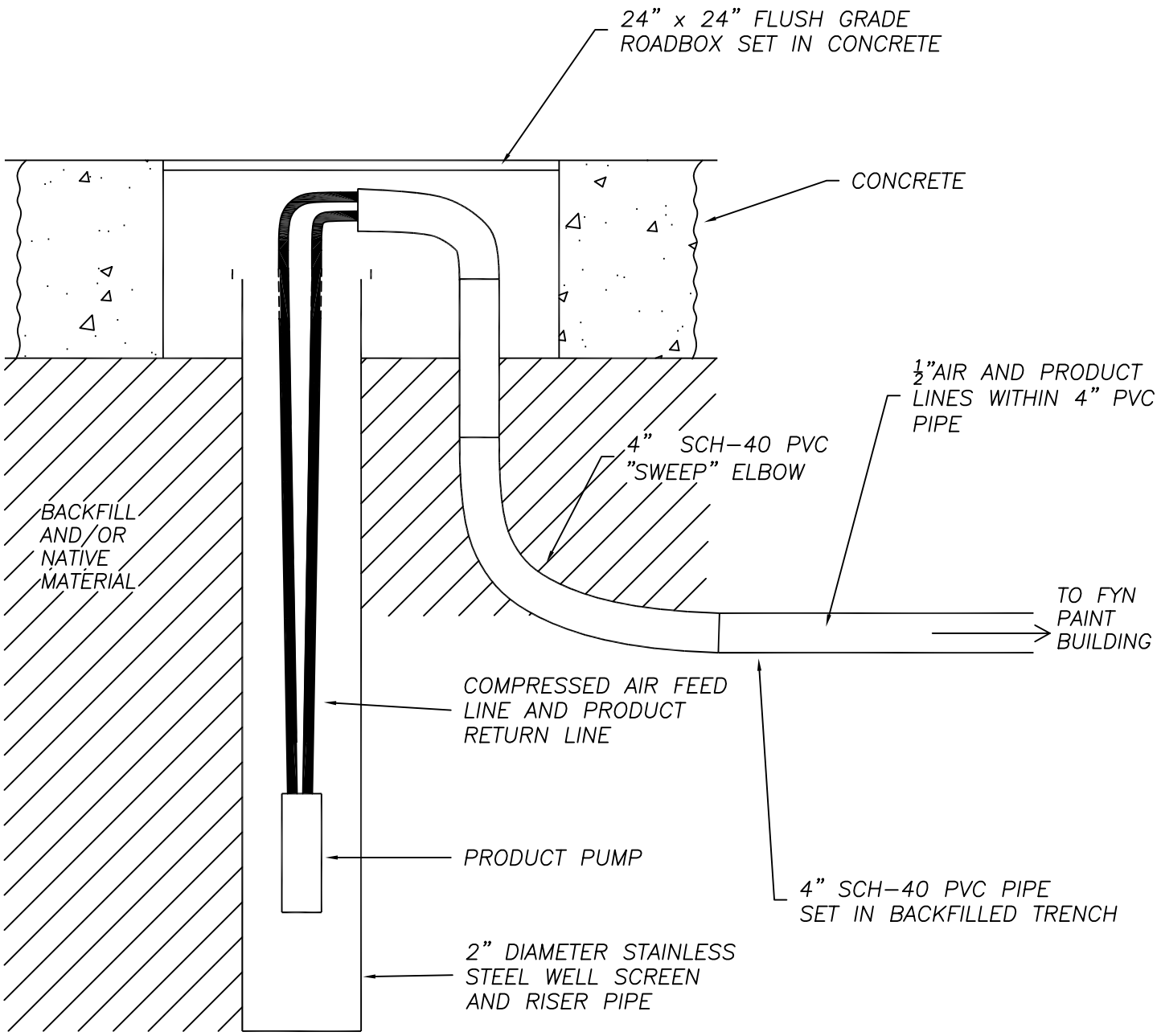
DATE: 10/23/06			
FILE: k:\gw dep wellhead	DRAWN BY: JAM	CHECKED BY: SG	FIGURE: 7

F:\REPORTS\Keane Beane\2008\Remedial Action Work Plan\Figures\AutoCads\Figure 7 - Groundwater Extraction Well Piping Cross Section.dwg



NOTE: NOT TO SCALE

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230 KENT AVENUE
BROOKLYN, NEW YORK

PRODUCT RECOVERY WELL PIPING CROSS-SECTION

PREPARED BY:
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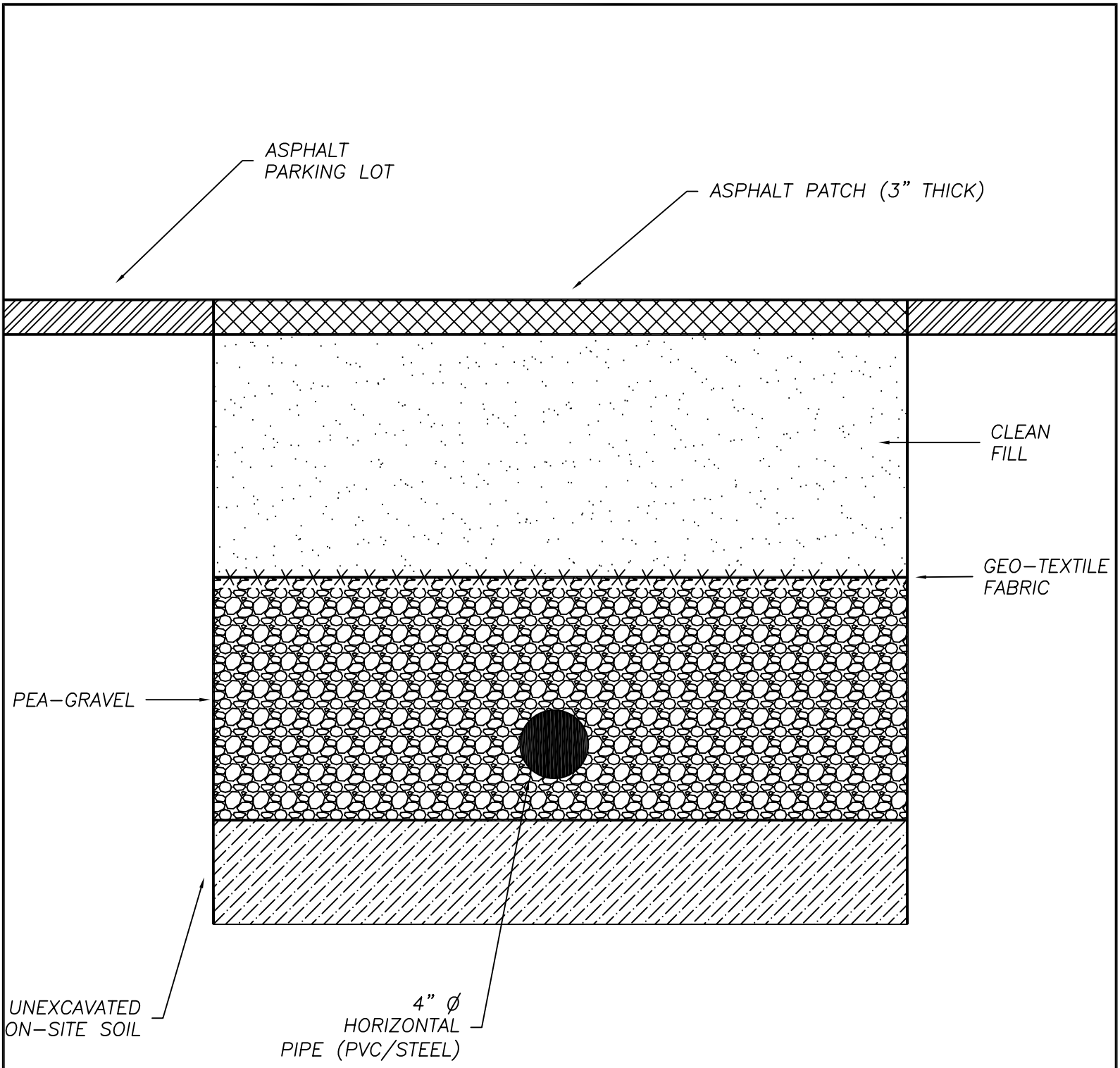
DATE: 10/24/06			
FILE: k:\product recovery	DRAWN BY: JAM	CHECKED BY: SG	FIGURE: 8

F:\REPORTS\Keane Beane\2008\Remedial Action Work Plan\Figures\AutoCads\Figure 8 - Product Recovery Well Piping Cross-Section.dwg



DEPTH = 3.75 ft
WIDTH = 5ft
RATIO = 3:4 (DEPTH TO WIDTH)

0 1

SCALE IN FEET

FYN PAINT & LACQUER CO. INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

PIPE TRENCH DIAGRAM
MW-21, MW-22 & EW-1 CROSS SECTION

PREPARED BY:
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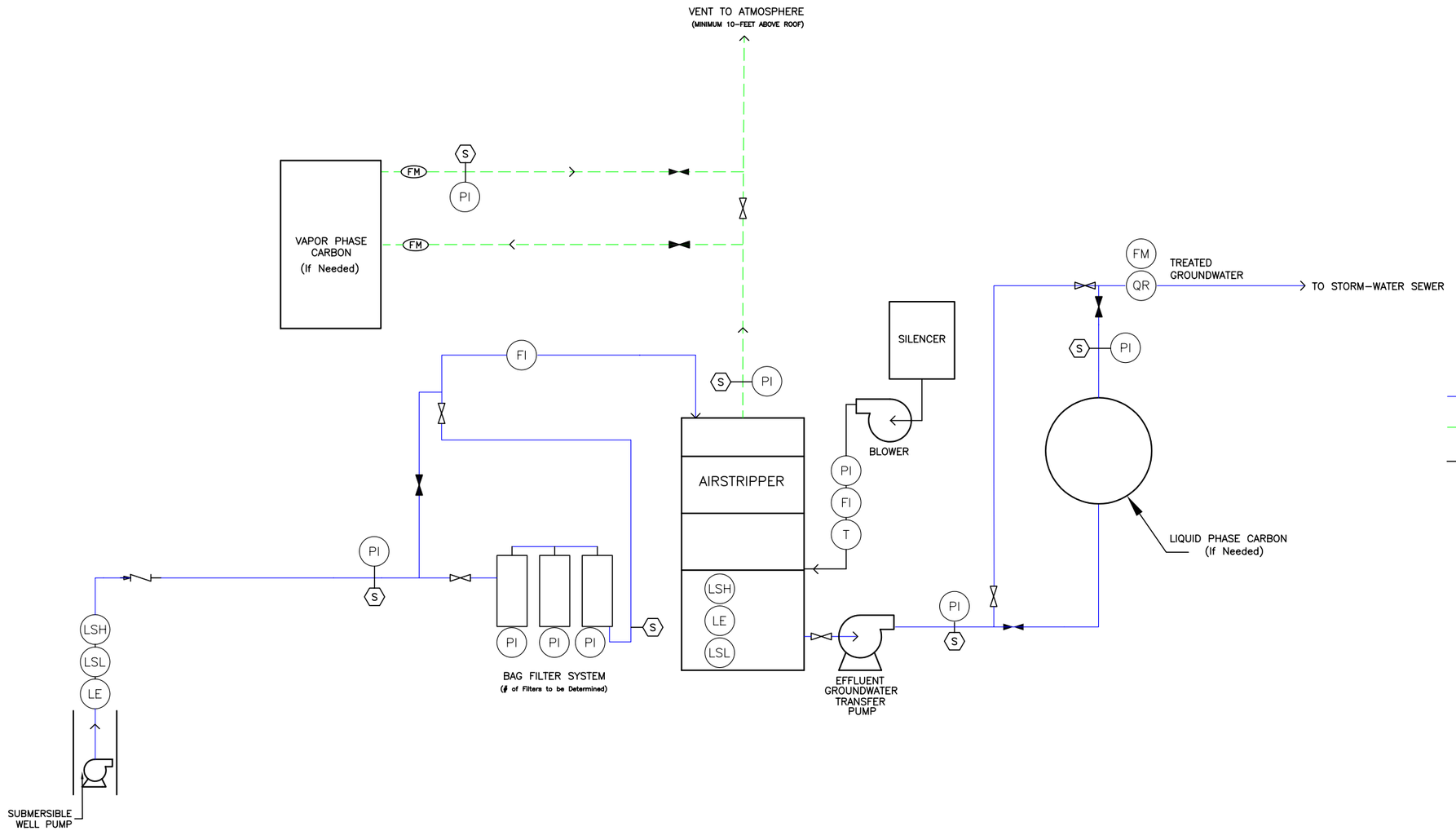
DATE: 10/24/06

FILE: WhitePlains\pipetrench | DRAWN BY: JAM | CHECKED BY: SG | FIGURE: 9

F:\REPORTS\Keane Beane\2008\Remedial Action Work Plan\Figures\AutoCads\Figure 9 - Pipe Trench Diagram.dwg



LEGEND

	PROCESS LINE – WATER
	PROCESS LINE – AIR
	FLOW DIRECTION
FI	FLOW INDICATOR
LE	LEVEL SENSOR
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
PI	PRESSURE INDICATOR
QR	QUANTITY RECORD (TOTALIZER)
S	SAMPLE PORT
FM	FLOW METER
	GATE VALVE – NORMALLY OPEN
	GATE VALVE – NORMALLY CLOSED
	CHECK VALVE

Not to scale

FYN PAINT & LACQUER CO. INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

PROCESS FLOW DIAGRAM
GROUNDWATER TREATMENT SYSTEM - PROCESS AND INSTRUMENTATION

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
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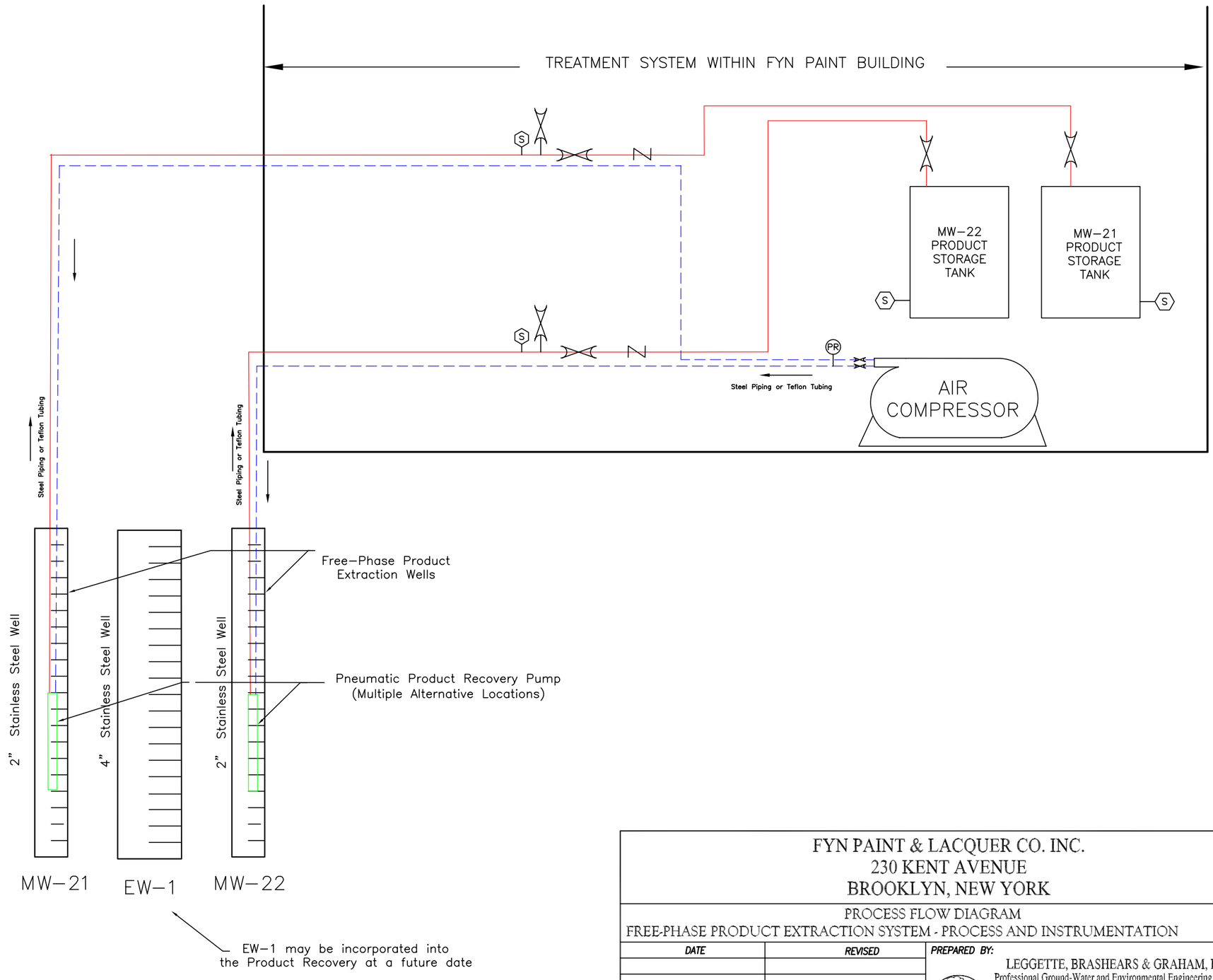
F:\REPORTS\Keane Beane\2008\Remedial Action Work Plan\Figures\AutoCads\Figure 10 - Process Flow Diagram Groundwater.dwg

LEGEND

- SAMPLE PORT
- PRESSURE RELEASE VALVE
- GATE VALVE
- CHECK VALVE
- PROCESS LINE – PRODUCT
- PROCESS LINE – AIR
- FLOW DIRECTION



Not to scale

FYN PAINT & LACQUER CO. INC.
230 KENT AVENUE
BROOKLYN, NEW YORK

PROCESS FLOW DIAGRAM
FREE-PHASE PRODUCT EXTRACTION SYSTEM - PROCESS AND INSTRUMENTATION

DATE	REVISED

PREPARED BY:
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DRAWN:	SCG	CHECKED:	SG	DATE:	1/08/08	FIGURE:	11

F:\REPORTS\Keane Beane\2008\Remedial Action Work Plan\Figures\AutoCads\Figure 11- Process Flow Diagram Free-Phase.dwg