

**FOURTH FIVE-YEAR REVIEW REPORT FOR
SYOSSET LANDFILL SUPERFUND SITE
NASSAU COUNTY, NEW YORK**



Prepared by

**U.S. Environmental Protection Agency
Region 2
New York, New York**

A handwritten signature in black ink, appearing to read "John Prince", is written over a horizontal dashed line.

John Prince, Acting Division Director

2/16/17

Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
MCLs	Maximum Contaminant Levels
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
VOCs	Volatile Organic Compounds
WQRs	Water Quality Regulations

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fourth FYR for the Syosset Landfill Superfund Site (the site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The site consists of two separate phases called operable units (OUs). OU1 addresses the identification and abatement of the source of site contamination at the landfill property. OU2 addresses groundwater contamination at the site. OU1 has been completed and is in the operation and maintenance (O&M) phase and is the subject of this review. OU2 is not included in this review because a no action remedy was selected.

The Syosset Landfill Superfund site FYR was led by Sherrel Henry, EPA Remedial Project Manager (RPM). Participants included Peter Mannino (EPA Western New York Remediation Section Chief), Kathryn Flynn (EPA Hydrogeologist), Marian Olsen (EPA Human Health Risk Assessor), Charles Nance (EPA Ecological Risk Assessor), and Cecilia Echols (EPA Community Involvement Coordinator (CIC)). Cynthia Whitfield, representative for the New York State Department of Environmental Conservation (NYSDEC) also assisted in the preparation of this report. The Town of Oyster Bay (the Town) was notified of the initiation of the FYR. The review began on 10/3/2016.

Site Background

The site is located at 150 Miller Place in Syosset, in the Town of Oyster Bay, Nassau County, New York (see Site Location Map, Figure 1, Appendix C). The site is rectangular in shape and covers approximately 38 acres. The offices and facilities for the Town's Department of Public Works are located adjacent to the landfill to the east and occupy 15 acres. The Town controls access to the site, and the entire landfill area is enclosed by a six-foot high chain-link fence. The site is bounded by the Long Island Expressway and Miller Place to the southeast, property formerly occupied by Cerro Conduit Company to the southwest, and the Long Island Railroad to the northwest. A residential area and the South Grove Elementary School border the site to the northeast. The landfill is located in a densely populated residential and industrial area. The total population of Syosset is estimated to be 18,800 people. All the residents around the Syosset Landfill obtain drinking water from public supply wells. The site is relatively flat and at a similar

elevation to the surrounding area. These or similar uses are expected to continue well into the future.

The landfill was formerly owned by the Town but in August 2013, the residents of the Town approved a permissive referendum authorizing the Town to sell the landfill to Syosset Park Development, LLC, which was formerly known as Oyster Bay Realty LLC. A company affiliated with Syosset Park Development purchased the adjacent Cerro Property in 2014. The tentative plans being discussed with the public to implement a redevelopment project at the Cerro Property call for a commercial and residential area, with the site serving largely as an adjacent park, open space, and parking. In July 2016, Syosset Park Development, LLC entered into Administrative Settlement Agreement and Order on Consent for a Removal Action, Index Number, CERCLA-0202016-2009 for EPA to oversee the redevelopment project on the site property. As of the date of this FYR, the Town is still the owner of the site.

The Town operated the landfill from approximately 1933 to 1975. Between 1933 and about 1967, no restrictions were imposed on the types of wastes accepted at the landfill. Categories and types of wastes included: commercial, industrial, residential, demolition, agricultural, sludge material and ash. After about 1967, waste disposal at the landfill became restricted, though disposal of wastes (including industrial wastes) continued. Types of waste disposed included heavy metals, solvents, organics, oils, plasticizers, and polychlorinated biphenyls.

The site was placed on the Superfund National Priorities List (NPL) in September 1983.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Syosset Landfill		
EPA ID: NYD000511360		
Region: 2	State: NY	City/County: Syosset/Nassau
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? Yes	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA [If "Other Federal Agency", enter Agency name]:		
Author name (Federal or State Project Manager): Sherrel D. Henry		
Author affiliation: EPA		
Review period: 10/3/2016 - 1/18/2017		
Date of site inspection: 11/22/2016		
Type of review: Statutory		
Review number: 4		
Triggering action date: 1/18/2012		
Due date (five years after triggering action date): 1/18/2017		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In January 1983, Environmental Resources Management-Northeast (ERM) prepared a report summarizing the results of a groundwater study performed for the Nassau County Department of Health (NCDOH). The report concluded that the groundwater quality was being impacted by landfill leachate. Elevated heavy metal concentrations including arsenic, cadmium, chromium and lead were detected at levels exceeding New York State Primary Drinking Water Standards. One public drinking water well located down gradient of the site was closed due to taste and odor problems.

As noted above, OU1 addresses the identification and abatement of the source of site contamination at the landfill property. From April 1987 until September 1989, the field

investigation for the OU1 remedial investigation (RI) was performed, which included drilling and installing groundwater monitoring wells, collecting groundwater and soil samples for laboratory analyses, a landfill dimension study, and a subsurface gas study. Based on the results of the RI, which measured the levels of volatile organic compounds (VOCs), semi-volatile organic compounds, pesticides, and metals in various site media, EPA performed a risk assessment for the site.

The results of the risk assessment conducted during the RI indicated that ingestion of contaminated groundwater at the site is the primary pathway of concern. Potential exposure routes include: 1) exposures to organic compounds and metals from ingestion of or contact with contaminated groundwater in the vicinity of the site; 2) inhalation exposures to volatile organic compounds emitted from contaminated soils; and 3) inhalation exposures to volatile organic compounds released from contaminated groundwater during showering. The carcinogenic risk associated with the site fell within the acceptable EPA risk range of 10^{-4} to 10^{-6} . However, EPA determined that the target risk for the site should be on the order of 1×10^{-6} , given the size and proximity of potentially exposed neighboring populations to the landfill and the likelihood of exposures. The hazard index (HI) for noncarcinogenic effects from the site is less than one for adults and for chronic exposures to contaminated groundwater for children. However, the sub-chronic HI for children from ingestion of contaminated groundwater was 2.61 which exceeded the goal of protection of a $HI = 1$ established under the NCP.

The second operable unit addresses the nature and extent of migration of contaminants from the landfill property into nearby groundwater. Between October 1992 and March 1994, the OU2 RI was conducted by the Town and included installation of monitoring wells and soil borings; groundwater monitoring well and subsurface gas monitoring well sampling, collection of water level measurements and ambient air sampling. The purpose of the off-site groundwater study was to determine the extent and thickness of a leachate plume emanating from the landfill. The purpose of the off-site gas study was to determine the extent of off-site subsurface gas migration from the landfill. The results of the RI found the following contaminants of concern (COCs) in groundwater: 1,1-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride, arsenic and selenium. Based on discussions with the NCDOH, it was determined that residents obtain their drinking water from a municipal water supply and that private residential wells are not being used for potable purposes. Therefore, present-use scenarios for groundwater were not evaluated in this assessment. In addition, the use of groundwater in the vicinity of the landfill was unlikely because Nassau County controls groundwater withdrawal. As a result, the baseline risk assessment concluded that the COCs found in on-site and off-site groundwater did not pose a significant threat to human health or the environment and, therefore, further remediation was not necessary.

Ecological assessments of the adverse effects of the COCs on ecosystems was not conducted during the RI because the site is located in a densely populated residential and industrial area. Further, this area is not known to contain ecologically significant habitats, agricultural land, historic or landmark sites which are directly or potentially affected. There are no surface water body or wetlands on or adjacent to the site. Therefore, it was determined that the site is not adversely impacting ecological receptors.

Response Actions

The landfill was closed on January 27, 1975 because of a suspected groundwater pollution problem. In 1981, the Town installed a passive gas venting system along the property line shared by the landfill and the South Grove Elementary School to prevent off-site gas migration. The system consisted of a gravel-filled gas venting trench and a series of polyvinyl chloride gas vent riser pipes on both sides of the gas venting trench. The effectiveness of the trench was verified by comparing the levels of gas contaminants within the riser pipes on both sides of the trench. Typically, contaminant levels on the school side of the trench were low, while levels on the landfill side of the trench were higher. A Combustible Gas Indicator was used to monitor for methane.

Remedy Selection

OU1 ROD

The goal of the remedial action for the OU1 Record of Decision (ROD), issued on September 27, 1990, was to prevent, reduce, or control further migration of contaminants to the groundwater to the extent practicable.

The major components of the selected remedy included the following:

- Implementing New York State landfill closure requirements as specified in 6 New York Code, Rules and Regulations (NYCRR) Part 360, solid waste management facilities regulations, which included construction of a geosynthetic membrane cap on the top surface of the landfill;
- Providing long-term air and groundwater quality monitoring;
- Monitoring and maintaining the passive gas venting system installed under a previously implemented response action, including routine inspection and repairs;
- Establishing institutional controls in the form of deed restrictions on future uses of the landfill;
- Installing an additional passive gas venting system, designed so that it can easily be converted to an active system should conversion become necessary; and
- Maintaining the existing boundary fence around the perimeter of the landfill property to continue to restrict access to the landfill.

In addition, because leachate indicator chemicals were identified in groundwater beneath and down gradient of the landfill, the ROD also specified that a supplemental RI be conducted to study the potential off-site impacts of the landfill, designated as OU2.

OU2 ROD

OU2 addresses the nature and extent of the migration of contaminants from the landfill property into nearby groundwater. EPA, in consultation with the State of New York, determined that because groundwater contamination was limited and did not pose a significant threat to human health or the environment, further remediation was not necessary. This determination was based

on the OU2 RI and the successful implementation of the OU1 remedy. The OU1 remedy required the development and implementation of an environmental monitoring program at the site. The environmental monitoring program, performed as part of the OU1 remedy, takes into account sampling for both on- and off-site groundwater, ambient air, and landfill gas which further ensures that the OU1 and OU2 remedies remain protective of human health and the environment.

On March 28, 1996, EPA issued a ROD for OU2 calling for no further action. The OU2 ROD also states that although groundwater sampling results indicate the infrequent occurrence of exceeding maximum contaminant levels (MCLs), the majority of contaminants do not exceed MCLs or the NYS Drinking Water Standards in the groundwater. The NYSDEC will further investigate the probable source(s) of the high levels of the VOCs detected in Well RW-12I and take action, as appropriate.

Status of OU1 Implementation

In 1990, EPA concluded consent decree (CD) negotiations with the Town related to the performance of the remedial design (RD), remedial construction, operation, maintenance, and monitoring of the remedy selected in the OU1 ROD. On February 20, 1991, the CD was entered in United States District Court for the Eastern District of New York. The Town hired Lockwood, Kessler & Bartlett, Inc. (LKB) to perform the RD and Remedial Action (RA).

The implemented remedy consists of a landfill cover system, a gas venting system, long-term O&M of the cap and gas venting system, institutional controls (ICs), and implementation of an on-site and off-site groundwater monitoring program.

The capping system consists of three types of cap surface cover over a 60 mil High Density Polyethylene (HDPE) geomembrane and gas venting layer. Three different surface covers were placed over the cap for use in particular areas of the site based on the anticipated future site uses. The site was divided into five different facilities as shown in Appendix C, Figure 2, Syosset Landfill Cover System Location Plan. The asphalt surface cover was utilized in the Highway Division's Salt Storage Facility and Vehicle Parking Facility as well as the Sanitation Division Vehicle Parking Facility (areas designated as C, D, and E, respectively, on Figure 2). The recycled concrete surface was utilized in both the Highway Divisions' Storage Facility and the Miscellaneous Equipment Storage Facility (areas designated as A and B, respectively, on Figure 2). The vegetative cover surface was utilized in a buffer area along the northern property line in Areas A, B and C.

In November 1994, the Town initiated the first of two construction contracts. The first contract consisted of a Preload Program. The Preload material remained on-site for a period of three months until primary settlement was achieved. Following primary settlement, the excess clean fill material was removed. The Preload Program also involved construction of approximately 35% of the remediation program including the following: site preparation activities, reshaping landfill material, and installing drainage and gas venting systems. The Preload Program was completed in August 1996.

The second construction contract consisted of a Capping and Closure Program that immediately followed the completion of the Preload program. The landfill cap and gas venting sand layer were placed on top of the cap subgrade which was constructed under the Preload program. Other elements of the Capping and Closure Program involved the installation of the remaining perimeter gas control system, the construction of the ridge landfill gas vent wells, the construction of a vegetated perimeter buffer zone along the northern property line, and the completion of the perimeter drainage ditch system. The Capping and Closure Program was completed in November 1997. EPA conducted a final inspection with NYSDEC and the Town on November 5, 1997. In October 1999, EPA issued its approval of the RA Report, signifying that the RA had been completed in accordance with the ROD and RD, and the project entered the operation, maintenance, and monitoring phase.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Landfill	Yes	Yes	Syosset Landfill	Establishing institutional controls in the form of deed restrictions on future uses of the landfill.	Environmental Easement/ Restrictive Covenants, placed on the real property in March 2004.
Groundwater	No	No	Groundwater	Restrict future groundwater use at the site	ICs in the form of existing state and local regulations will be relied upon to restrict future groundwater use at the site. Specifically, the NYSDOH State Sanitary Code regulates and prevent the installation of wells at a hazardous waste site in the state.

Systems Operations/Operation & Maintenance

The O&M Manual prepared by LKB, dated April 2003, requires the inspection, monitoring and maintenance of the various components of the capping and closure system on a regular basis throughout the post-closure period. The frequency and scope of the monitoring and maintenance tasks are generally based on the post-closure monitoring and maintenance requirements stipulated under 6 NYCRR Part 360. Specifically, the activities currently include the following:

- Annual groundwater quality monitoring at 11 monitoring wells to ensure that the landfill cover systems continue to function to prevent groundwater contamination;

- Annual groundwater elevation monitoring at 20 monitoring wells to determine if changes occur in the direction of groundwater flow;
- Quarterly inspection of the landfill cover systems to insure that damage due to erosion has not occurred;
- Quarterly inspection of the landfill drainage system, with one inspection after a significant rainfall event (i.e., five-year frequency);
- Quarterly inspection and monitoring of the landfill gas venting system; and
- Submittal of annual reports summarizing the results of the O&M activities.

Landfill gas is being monitored for methane levels. Groundwater samples are analyzed for organics and inorganics identified in samples during the OU1 and OU2 RIs.

Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR and the current status of those recommendations.

Table 2: Protectiveness Determinations/Statements from the 2012 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The implemented remedy for the Syosset Landfill Superfund Site protects human health and the environment. There are no exposure pathways that could result in unacceptable risks and none are expected, as long as the Site use does not change and the implemented engineered and institutional controls are properly operated, monitored, and maintained.
Site wide	Protective	The implemented remedy for the Syosset Landfill Superfund Site protects human health and the environment. There are no exposure pathways that could result in unacceptable risks and none are expected, as long as the Site use does not change and the implemented engineered and institutional controls are properly operated, monitored, and maintained.

There were no issues and recommendations identified in the last FYR.

The residents of the Town approved a permissive referendum authorizing the Town to sell the landfill to Syosset Park Development, LLC. The tentative plans being discussed with the public is to implement a redevelopment project at the adjacent property for a commercial and residential area, with the site serving largely as an adjacent park, open space, and parking. In July 2016, Syosset Park Development, LLC entered into Administrative Settlement Agreement and Order on Consent for a Removal Action, Index Number, CERCLA-0202016-2009 for EPA to oversee the redevelopment project on the site property.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement

On November 14, 2016, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 38 Superfund sites in New York and New Jersey, including the Syosset Landfill Superfund site. The announcement can be found at the following web address: https://www.epa.gov/sites/production/files/2016-11/documents/five_year_reviews_fy2017_final.pdf.

In addition to this notification, a notice of the commencement of the FYR was sent to local public officials. The notice was provided to the Town on November 16, 2016 with a request that the notice be posted on the Town of Oyster Bay webpage. The purpose of the public notice was to inform the community that the EPA would be conducting the fourth five-year review to ensure that the remedy implemented at the site remains protective of public health and is functioning as designed. In addition, the notice included the RPM and the CIC address and telephone numbers for questions related to the FYR process or the site. Once the FYR is completed, the results will be made available on EPA's Syosset Landfill site webpage and at the local site repository located at the Syosset Public Library, 225 South Oyster Bay Road, Syosset, New York. In addition, efforts will be made to reach out to stakeholders and local public officials to inform them of the results.

Data Review

The long-term monitoring program, which is being implemented by the Town, includes the annual collection of groundwater samples and groundwater level measurements from selected wells; quarterly inspection of the landfill cover and drainage systems; and quarterly inspection and monitoring of the gas venting system for methane gas. This five-year review covers the sampling period from 2011 through 2015. The OUI ROD identified the more stringent of the federal MCLs and the New York State Water Quality Regulations (WQRs) as the groundwater remediation goals for the site. However, the standard that would apply is more stringent of the two groundwater quality standards.

Groundwater Quality Data

The Town is required to perform annual groundwater sampling at the site to monitor groundwater flow and quality conditions to ensure that the selected remedy for the site continues

to function as intended. The post-closure groundwater monitoring well network consists of the following 11 wells (see Groundwater Monitoring Well Location Plan, Figure 3, Appendix C):

- SY-6 (up gradient);
- SY-2R, SY-2D, SY-3, SY-3D and SY-3DD (on-site down gradient wells); and
- PK-10S, PK-10I, PK-10D, RW-12I and RW-12D (off-site down gradient wells).

All samples taken were analyzed for VOCs, inorganic parameters, and NYSDEC Part 360 leachate indicator parameters.

Results of VOC Analyses

Analysis of samples collected on-site between 2011 and 2015 indicates that most VOC constituents were either not detected or detected at concentrations below groundwater quality standards. VOCs were detected in three of the six on-site wells (SY-3, SY-3D, and SY-3DD). The 2015 total VOC results are compared to previous results in Table 3. As evidenced in Table 3, relative to 2014, total VOC concentrations were slightly higher in every well except on-site downgradient wells SY-2R and SY-2D, but are still consistent with prior results. Since 2003, no exceedances of the VOC groundwater quality standards have occurred in an on-site well.

Results from the 2011 to 2015 annual groundwater sampling events revealed detection of eight VOCs in two off-site wells (RW-12I and RW-12D) above WQRs. A summary of these data is provided in Table 4. Contaminants exceeding their respective WQRs include 1,1-dichloroethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,4-dichlorobenzene, benzene, chlorobenzene, *cis*-1,2-dichloroethene and vinyl chloride. For the most part, the same VOCs were detected in each well however the highest concentration of most of the VOCs occurred in the deeper well (RW-12D). Four of the eight contaminants (1,1-dichloroethane, 1,2-dichlorobenzene, chlorobenzene, and 1,4-dichlorobenzene) were detected during all sampling events. Three of the eight contaminants (*cis*-1,2-dichloroethene, 1,2-dichloroethane and vinyl chloride) were detected in the 2011, 2012 and 2013 annual sampling events. Benzene was only detected in RW-12I and only during the 2011 and 2012 annual sampling events. Total VOC concentrations detected above the WQRs in wells RW-12I and RW-12D ranged from 22 micrograms per liter (ug/L) to 60.5 ug/L and 22.2 ug/L to 69.7 ug/L, respectively. However, the fact that the VOCs detected at off-site downgradient well cluster RW-12 are not present in the on-site downgradient wells indicates that they may not be landfill-related as was outlined in the 1996 ROD. This well is adjacent to an industrial area located west of the Long Island Railroad tracks, and therefore, the VOCs detected in this well may not be attributable to the landfill. Off-site downgradient wells PK-10S, PK-10I, and PK-10D have had documented landfill impacts in previous years, but no VOCs were detected above standards during this FYR period. Long-term monitoring data indicate that the landfill is not a significant source of VOCs to groundwater.

Results of Inorganic (Metal) Analyses

Samples were analyzed for both total (unfiltered) and dissolved (filtered) target analyte list (TAL) parameters, and total cyanide. Results from the 2015 sampling event indicated detection of 19 inorganic parameters. Six contaminants (aluminum, barium, cadmium, cobalt, copper, and lead) were only detected sporadically and/or at concentrations lower than MCLs and WQRs. The

highest concentration of one other parameter, zinc, was detected above WQRs in up gradient well SY-6. The remaining twelve inorganic parameters were arsenic, beryllium, chromium, mercury, nickel, calcium, iron, magnesium, manganese, potassium, selenium and sodium. A summary of the results of total and dissolved inorganics concentrations detected above groundwater quality standards (MCLs and/or WQRs) are provided in Table 5 and Table 6, respectively.

Total and dissolved concentrations of arsenic were detected in on-site downgradient well SY-3 at concentrations higher than the more stringent federal MCL of 10 ug/L and the WQR of 25 ug/L. Comparison of the total and dissolved results for this well indicates that approximately 89 percent of the arsenic is in dissolved form. The only other detections of arsenic occurred in off-site wells PK-10D, RW-12I and RW-12D, and were limited to estimated concentrations significantly lower than the groundwater quality standards.

Beryllium was only detected in on-site downgradient well SY-2R, at total and dissolved concentrations approximately three times higher than the 3 ug/L groundwater standard. Comparison of the total and dissolved results for this well indicates that approximately 91 percent of the beryllium is in the dissolved form.

Chromium was detected in off-site downgradient Well PK-10D at a total concentration slightly greater than the 50 ug/L groundwater standard, but was only detected at a very low, estimated concentration in the dissolved sample from this well. As such, the chromium exceedance in the dissolved sample appears to be sediment-related. Chromium was also detected in the background well and several other downgradient wells, but only at very low, estimated concentrations. Mercury was detected at a concentration approximately three times greater than the groundwater standard of 1 ug/L in both total and dissolved samples from off-site down gradient well PK-10D. Its presence is attributed to groundwater quality conditions at this location rather than the landfill because mercury has not been detected in any of the on-site wells.

Nickel was detected in on-site well SY-2R at estimated total and dissolved concentrations approximately 20 percent greater than the 100 ug/L groundwater standard. Comparison of the total and dissolved results for this well indicates that approximately 94 percent of the nickel is in dissolved form. Nickel was also detected in the background well and off-site downgradient wells, but only at low, estimated concentrations that are much lower than the WQRs.

Selenium was detected in the unfiltered sample from on-site well SY-3 at an estimated concentration that is slightly greater than the 10 ug/L groundwater standard. Selenium was not detected in the filtered sample from this well. Selenium was also detected at low, estimated concentrations in the unfiltered and filtered samples from off-site well PK-10D, and in the filtered samples from on-site well SY-2R and off-site well RW-12I. These detections are lower than the groundwater standard.

Calcium, iron, magnesium, manganese, potassium and sodium were each detected in one or more downgradient well at concentrations more than two times greater than in up gradient well SY-6. Except for sodium, which had a more widespread occurrence, the highest concentrations of these parameters occurred in wells SY-3, SY-3D, PK-10I and RW-12I and/or RW-12D.

Comparison of the results for the on-site and off-site downgradient wells indicates that landfill-related off-site impacts are minimal. For example, arsenic was only detected at a significant concentration in one on-site downgradient well. The highest concentrations of iron, manganese and sodium also occurred in on-site downgradient wells, whereas the highest concentrations of calcium, magnesium and potassium occurred in off-site well RW-12I. These contaminants detected in well RW-12I do not have primary MCLs and were not considered COCs for the site. These differences in the results for the on-site downgradient wells and off-site downgradient well RW-12I also suggest that the detections of these parameters in well cluster RW-12 are not landfill-related. The only landfill-related exceedances were for arsenic and selenium in Well SY-3, and beryllium and nickel in well SY-2R. These exceedances appear to be limited to the downgradient landfill boundary as exceedances for these parameters were not detected in the deeper on-site downgradient wells at these two clusters, or in the off-site downgradient wells.

The results from the 2011 through 2014 annual sampling event revealed similar detections of metals/inorganic contaminants as those identified in the 2015 event discussed above. One notable differences between the 2015 results and the previous monitoring events was that thallium although detected in 2012-2014 was not detected in any of the wells in 2015.

Results of Leachate Indicator Parameters Analyses

The leachate indicator parameters included alkalinity, ammonia, biological oxygen demand (BOD), bromide, chloride, chemical oxygen demand (COD), color, total hardness, nitrate, phenols, sulfate, total dissolved solids (TDS), total kjeldahl nitrogen (TKN), and total organic carbon (TOC).

Results from the 2015 leachate sampling event revealed that when compared to up gradient well SY-6, the concentrations of every leachate indicator parameter (except bromide, nitrate, total phenols and sulfate) were noticeably higher in on-site downgradient wells SY-3 and/or SY-3D. These two wells monitor the shallow and intermediate zones of the Magothy Aquifer, respectively, at the downgradient landfill boundary. Elevated levels of leachate-related contaminants were not detected in Well SY-3DD, which monitors the deep zone of the Magothy Aquifer at the down gradient landfill boundary. At well cluster SY-2, only chloride and TDS were detected in both wells at noticeably higher concentrations than in the up gradient well. These results are consistent with the leachate parameter trends since 1993, which have been stable or declining.

Comparison of the leachate parameter results for the up gradient and on-site down gradient wells to groundwater quality standards and guidelines indicates that down gradient landfill-related exceedances were limited to: chlorine and TDS in wells SY-2R and SY-2D; ammonia, color and TDS in wells SY-3 and SY-3D; and chloride in well SY-3D. Exceedances for total phenols also occurred in these four on-site downgradient wells but they are not landfill-related because a higher total phenol concentration occurred in the up gradient well. No landfill-related exceedances occurred in on-site downgradient well SY-3DD.

Based on comparison of the leachate indicator parameter results for the on-site and off-site wells, the majority of the parameters detected at elevated concentrations in the on-site downgradient

wells are detected at similar concentrations in off-site downgradient well PK-10I, indicating landfill-related impacts in this well. However, this comparison also indicates that certain parameters (e.g., alkalinity, ammonia, BOD, COD, hardness, nitrate, sulfate, TKN and TOC) were detected at higher concentrations in one or both wells at well cluster RW-12 than in the on-site downgradient wells.

The results from the 2011 through 2015 annual sampling events indicate that contaminants for which exceedances are detected have been stable or decreasing over time in every well, which indicates groundwater quality conditions down gradient of the landfill are improving.

Groundwater Level Data

The objective of the groundwater elevation monitoring program is to assess whether changes have occurred in the direction of groundwater flow. Based on the results of the groundwater elevation monitoring performed from 2011 to 2015, there are no significant changes to the direction of groundwater flow and the monitoring well network is adequate for determining the groundwater gradient.

Landfill Cover System Inspection

For landfill inspections, NYSDEC and EPA rely on the post-closure summary reports, which are submitted by the Town on an annual basis. Over the years, both NYSDEC and EPA have found these reports to be factually accurate. The landfill cover system is inspected on a quarterly basis for asphalt pavement cracks, surface material erosion, insufficient vegetative cover growth, erosion of vegetative cover, and areas of surface settlement. The results of these inspections are reported in the Annual Post-Closure Summary Reports, Volume 1, Appendix A.-Cover System Inspection Report.

The findings of the November 17, 2015 inspection, which are reported in the June 2016 Annual Post-Closure Summary Report, indicated that several of the paved, recycled concrete and vegetative cover areas of the landfill cap have developed minor surface cracks. Furthermore, two areas were identified where pooling of water occurs after rainfall. On November 21, 2016, the Town submitted a landfill cover system repair report which documented that all repairs were completed. The repairs were verified during the site inspection on November 22, 2016; it was observed that all surface cracks had been sealed and pooling of water was not observed.

Landfill Drainage System Inspection

The storm water drainage system consists of perimeter drainage ditches which collect storm water runoff from the landfill and transmits it to storm drains which discharge into three Nassau County recharge basins. The perimeter drainage ditches consist of rip-rap lined and asphalt-lined perimeter collection ditches that intercept runoff at the foot of the landfill.

The results of the quarterly inspections are reported in the Annual Post-Closure Summary Reports, Volume 1, Appendix B.-Drainage System Inspection Report. The findings of the November 17, 2015 inspection, which are included in the June 2016 Annual Post-Closure

Summary Report, indicated that the majority of the rip-rap lined drainage ditches have been filled with silt and are over vegetated. The apparent cause of most of the ditch situation seems to be from the erosion of materials stored in stockpiles on-site.

On November 21, 2016, the Town submitted a landfill drainage system repair report which documented that all repairs were completed. During the site inspection on November 22, 2016, the repairs were verified and the drainage ditches were observed clear of all vegetation and silt material.

Landfill Gas Venting System Inspection and Methane Monitoring

The landfill gas venting system consists of 38 property line gas vent wells, 16 perimeter gas vent wells, and 26 landfill ridge gas vent wells. Inspection of the gas vents revealed that the upper portion of one of the property line gas vents was detached from the well casing pipe.

The results of the quarterly inspections are reported in the Annual Post-Closure Summary Reports, Volume 1, Appendix C.-Gas Venting System Inspection Report. The findings of the November 17, 2015 inspection, which are included in the June 2016 Annual Post-Closure Summary Report, indicated that one of the 54 property line and perimeter gas vent wells inspected was damaged. The upper sections of the gas vent wells were detached from the well casing pipe at grade and the upper portion was lying on the ground. Each ridge vent well is protected by either an eight or 10-foot diameter concrete leaching ring. The Town's quarterly checklist, dated November 2015, indicated damage to two of the 26 ridge vent wells: one had a broken well casing and the other had damage to the concrete ring.

On November 21, 2016, the Town submitted a landfill gas venting system repair report which documented that all repairs to the gas venting system were completed. The repairs were verified during the site inspection on November 22, 2016; it was observed that all of the reported damage to the ridge and property line vents had been repaired.

The gas vents are monitored for methane gas on a quarterly basis in accordance with the requirements of the O&M Manual to determine compliance with 6 NYCRR Part 360 provisions for levels of combustible gas. The O&M Manual stipulates that if monitoring indicates the existence of combustible gas in excess of the lower explosive limit (i.e., 5% gas-in-air) within the property line gas vent, subsurface borehole monitoring for methane gas must be conducted at the property line. As noted in the November 2015 quarterly report, no methane gas was detected in any of the vents. The gas monitoring conducted in 2015 compared to the results in 2014 indicates that the site is continuing to meet the regulatory requirements for levels of gas at the property line. Therefore, the passive gas venting system is operating successfully to prevent off-site gas migration.

Site Inspection

The inspection of the site was conducted on 11/22/2016. In attendance were Sherrel Henry, EPA RPM, Kathryn Flynn, EPA Hydrogeologist, Elizabeth Leilani Davis, EPA Site Attorney, Cynthia Whitfield, NYDEC Project Manager, Andrea Dinatale, NYSDEC Site Attorney, Sunita Chakraborti, Town Current Project Manager, Matthew Russo, Town Former Project Manager and Terry Heneveld, Town Consultant. The purpose of the inspection was to assess the protectiveness of the remedy.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

The landfill cover system was constructed to minimize storm water infiltration, vent landfill gases passively, provide a permanent barrier between the site's fill material and the land surface.

In general, the landfill cover system is well-maintained and operating as designed. However, routinely areas of the concrete and asphalt cover system tend to settle, as evidenced by cracks and subsidence noted in the June 2016 Annual Post-Closure Summary Report. Some of these areas are associated with truck traffic, weathering of construction joints and differential settlement. In addition, areas of the vegetative cover system routinely develop surface material erosion (i.e., ruts) which appears to be caused by storm water runoff. These locations are monitored and are repaired on a regular basis as part of routine maintenance. The repairs were verified during the site inspection on November 22, 2016 and documented in the landfill cover system repair report, dated November 21, 2016.

The post-closure monitoring of landfill gas during the FYR period in the perimeter and property line gas vent wells continues to meet the requirements of 6NYCRR Part 360, confirming that the existing site-wide passive gas venting system continues to prevent off-site gas migration.

Groundwater monitoring data continue to indicate no detections of VOCs or low detections below the applicable and relevant requirements (ARARs) except at off-site well RW-12I and RW-12D. Concentrations of arsenic and selenium are below groundwater standards at each of the off-site wells.

Based on review of the groundwater monitoring data and the site inspection, the remedy is functioning as intended by the ROD.

IC Implementation

The OUI ROD recommended that the Town implement institutional controls in the form of deed restrictions on future uses of the landfill. Institutional controls were implemented under a restrictive covenant placed on the site. Counsel for the Town provided EPA with a copy of the cover page of the Consent Decree bearing the stamp of the Nassau County Clerk's Office,

showing that the Consent Decree was recorded in that office on December 6, 1990. The Town's Counsel also provided EPA with a copy of the restrictive covenants placed on the real property at the site by the Town. The Covenants were filed with the land records on March 23, 2004. These items complete the institutional controls requirement of the 1990 OUI ROD.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary:

There have been no changes in the physical condition of the site since the last FYR that would change the protectiveness of the remedy. The Town controls access to the site, and the entire landfill area is enclosed by a six-foot high chain-link fence. The landfill cap is maintained and serves as a barrier to potential exposures. Exposures to the site are limited based on location within an industrial area, fencing around the landfill to limit or prevent access, and signage. The ongoing procedures of inspecting the fence for damage and making repairs as appropriate continue to limit access to the site.

Soil and groundwater use at the site are not expected to change during the next five years and are consistent with the risk assessments used to support the decision e.g., industrial land use, and future off-site residential groundwater and land use.

The ROD established the MCL for arsenic in groundwater as the cleanup criteria for site groundwater. There have been no changes in the MCL for arsenic and the MCL remains protective. The toxicity value for arsenic is being updated through the Integrated Risk Information System (IRIS), EPA's consensus toxicity system and any changes will be considered in the next FYR.

Soil vapor intrusion was not further evaluated based on the recommendation in the 2002 Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soil (EPA530-D-02-004) that states "where contaminants are found in groundwater at depths greater than 100 feet, evaluation of soil vapor intrusion is not appropriate". On-site wells are at depths of 100 feet or greater.

There have been no changes in EPA's guidance for conducting Superfund risk assessments since the last FYR. The Vapor Intrusion Guidance was updated, however, the update does not change the overall conclusions from the previous FYR that if current site access controls, zoning and future deed restrictions change, analysis of vapor intrusion is not needed. In addition, the main COC was arsenic, which is not volatile, and the cap design includes a gas venting layer with one vent per acre.

Since the last FYR, exposure assumptions were updated with the release of the 2014 OSWER Directive # 9200.1-120. Updates included changes in exposure assumptions for bodyweight for the adult, skin surface area for the adult and child, drinking water ingestion rate for the young child, and other parameters. These changes do not change the conclusions of the risk assessment or the protectiveness of the remedy.

Overall, based on the past remedial actions and ongoing monitoring at the site, the remedy remains protective under the industrial scenario.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would call into question the protectiveness of the remedy. There have been no changes at the site resulting from natural disasters or climate change impacts.

VI. ISSUES/RECOMMENDATIONS

This report did not identify any issue or make any recommendation for the protection of public health or the environment which was not included or anticipated by the site decision documents. However, this report includes suggestions for improving, modifying, and/or adjusting some of these activities (see Other Findings, below).

OTHER FINDINGS

The Town submitted a letter to EPA and NYDEC requesting reductions in the frequencies of the post-closure inspection and monitoring. The following are recommendations that were identified during the FYR and may improve management of O&M activities, but do not affect current and/or future protectiveness:

- Groundwater sampling and water level measurements will be performed every fifth quarter, instead of annually, which will provide monitoring once in each season/quarter during the Five Year Review period;
- Landfill cover systems inspection will be reduced from quarterly to semi-annually;
- Landfill drainage system inspection will be reduced from quarterly to semi-annually, with one inspection after a significant rainfall event (i.e., five-year frequency);
- Landfill gas venting system inspection and perimeter/property line gas vent wells monitoring will be reduced from quarterly to semi-annually; and
- O&M activities results will continue to be summarized and submitted in annual reports.

As documented in the Annual Post-Closure Summary Reports, the landfill cover system over time can develop asphalt pavement cracks, surface material erosion, insufficient vegetative cover growth, erosion of vegetative cover and areas of surface settlement. In addition, varying amounts of siltation and vegetative growth occurs over time in the majority of the rip rap lined drainage ditches. The following are additional recommendations that may improve management of the cover system and the drainage system, respectively, but do not affect current and/or future protectiveness:

- Pavement cracks and ruts caused by erosion should be periodically sealed and filled;
- Uneven areas should be re-graded to maintain designed surface slopes;
- Landfill surface slope should be maintained to promote storm water runoff;
- Erosion control techniques should be implemented around the material stockpiles to prevent the transport of silt and sediment from the piles to the drainage ditches; and

- Silt and vegetation that accumulates in drainage ditches and other portions of the drainage system should be periodically removed.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
<i>Operable Unit:</i> OU1	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date:</i>
<i>Protectiveness Statement:</i> The remedy at OU1 is protective of human health and the environment.		

Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date:</i>
<i>Protectiveness Statement:</i> The remedies implemented for the site are protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Syosset Landfill Superfund site is required five years from the completion date of this review.

APPENDIX A-REFERENCE LIST

Documents, Data, and Information Reviewed in Completing the Five-Year Review:

Document Title, Author	Date
OU1 Record of Decision, Syosset Landfill site, EPA	September 1990
OU2 Record of Decision, Syosset Landfill site, EPA	March 1996
EPA Guidance for conducting Five-Year Reviews.	June 2001
Annual Post-Closure Summary Report (Volumes 1 and 2), PRP	June 2012 – June 2016

APPENDIX B-TABLES

Table 3: Comparison of 2015 Groundwater Monitoring Total VOC Results to Previous Years (1993, 2003, 2005-2015) Total VOC Results

Well Number	Dec.1993	Jul.2003	Dec.2005	Dec.2006	Dec.2007	Nov.2008	Dec.2009	Dec.2010	Nov.2011	Dec.2012	Dec.2013	Dec.2014	Dec.2015
	Total VOC	Total VOC	Total VOC	Total VOC	Total VOC	Total VOC	Total VOC	Total VOC	Total VOC lbs	Total VOC	Total VOC	Total VOC	Total VOC
Up gradient Well													
SY-6	0.0	3.6	1.2	1.4	0.0	0.0	0.65	0.5	1.8	0.4	0.0	0.0	0.5
On-Site Down Gradient Groundwater Monitoring Wells													
SY-2R	0.60	3.60	0.0	0.20	0.0	4.20	0.0	0.0	0.0	0.0	0.72	0.0	0.0
SY-2D	7.90	2.80	4.90	3.90	2.10	1.50	0.0	0.0	0.3	0.0	0.2/0.0**	0.0	0.0
SY-3	10.70	23.90	0.70	1.60	5.50	74	1.30	1.8	4.5/0.8*	0.0	1.26	0.0	0.74
SY-3D	11.40	20.90	6	3.80	3.90	2.20	1.90	8.0	2.9	0.7/0.0*	0.42	0.0	1.58
SY-3DD	0.0	10	0.0	0.60	0.0	0.0	1.90	11.2	2.9	0.44	0.0	0.0	2.03
Off-Site Down Gradient Groundwater Monitoring Wells													
PK-10S	13.90	218	0.30	0.50	0.0	102	0.50	0.0	0.0	0.0	0.0	0.0	1.1
PK-10I	15.6	33.4	17	15	11	13.6	7.7	5.3	3.4	2.7	4.3	2.2	4.3
PK-10D	6.50	21.8	1.80	2.0	3.1	10.2	5.1	5.4	4.4	3.9	1.7	2.7	4.3
RW-12I	260	154	134	88	72.6	72.2	62.4	66.4	53.1	69.5	62.5	30.7	41.0
RW-12D	31.9	200	111	73	65.8	87.6	60.8	41.3	64.0	80.5	64.4	34.8	63.2

Notes: Totals include estimated concentrations, totals for 2003-2010 include TICs.

* =Results for duplicate sample

Table 4: VOCs Detected in Off-Site Monitoring Wells Compared to Federal MCLs and NYSDEC WQRs

Parameters	MCL (ug/L)	WQRs ((ug/L)	RW-12I					RW-12D				
			2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
1,2-dichlorobenzene	600	3	7.6	9.1	7.9	3.8	5.6	6.9	8.0	7.6	3.7	6.2
1,4-dichlorobenzene	75	3	11.0	12.9	11.7	5.7	8.1	6.6	10.3	9.0	5.0	9.8
1,1-dichloroethane	5	5	-	5.2	-	-	-	8.1	8.4	6.7	-	5.5
1,2-dichloroethane	5	0.6	-	-	-	-	-	1.1	1.2	1.2	-	-
Benzene	5	1	1.1	1.2	-	-	-	-	-	-	-	-
Chlorobenzene	100	5	21.0	26.7	24.7	12.5	15.6	19	28.4	24.5	13.5	24.9
Cis-1,2-dichloroethene	70	5	-	5.4	-	-	-	9.3	9.6	7.9	-	-
Vinyl chloride	2	2	-	-	-	-	-	4.7	3.8	2.6	-	-
Total VOCs			40.7	60.5	44.3	22	29.3	55.7	69.7	51.9	22.2	46.4

Footnote:

Contaminants detected in the RW-12I and RW-12D were found not to be from the landfill

Table 5: Total Inorganic results from the 2015 Annual Monitoring Report detected in monitoring wells above federal MCLs and/or NYSDEC WQRs.

Analyte	Primary Drinking Water Standard - MCL (ug/L)	NYSDEC WQR (ug/L)	Upgradient Well SY-6	Downgradient Wells								
				On-Site					Off-Site			
				SY-2R	SY-2D	SY-5 ²	SY-3	SY-3D	PK-10I	PK-10D	RW-12I	RW-12D
Arsenic *	10 ^{**}	25					47.5J					
Beryllium				9.2								
Calcium		-	37,800	35,900	19,100	19,500	32,500	49,200	53,400	33,300	90,100	80,000
Chromium										61.5		
Iron	300 *	300	537				28,400	20,500		473		
Magnesium		35,000 ^{GV}	9,800	9,250	5,340	5,350	14,000	16,200	15,500	10,600	49,100	26,200
Manganese	50 *	300	61.3		1,200	1,220	3,690	842	2,230			
Mercury	2	1								1.7		
Nickle				127								
Potassium			<5,000	4,200J	7,190	7,390	14,600	26,800	20,900	1,330J	98,600	6,210
Selenium							10.3J					
Sodium		20,000		224,000	148,000	151,000	120,000	379,000	335,000	59,200	177,000	155,000
Zinc		2,000 ^{GV}	3,120									

Notes:

ug/L = micrograms per Liter.

1 = NYSDEC Part 703 Ambient Water Quality Standard or Guidance Value (GV) for Class GA (Potable) groundwater.

2 = Duplicate sample collected from Well SY-2D.

J = Estimated concentration.

Bold = Exceeds groundwater-quality standard or guidance value.

* = RCRA/PPL metal.

** = USEPA MCL, revised downward from 50 ug/L effective January 2006. NYSDEC TOGS 1.1.1 Ambient Water Quality Standard is 25 ug/L.

Table 6: Dissolved Inorganic results from the 2015 Annual Monitoring Report detected in monitoring wells above federal MCLs and/or NYSDEC WQRs.

Analyte	Primary Drinking Water Standard - MCL (ug/L)	NYSDEC WQR (ug/L)	Upgradient Well SY-6	Downgradient Wells								
				On-Site					Off-Site			
				SY-2R	SY-2D	SY-5 ²	SY-3	SY-3D	PK-10I	PK-10D	RW-12I	RW-12D
Arsenic*	10**	25					42.3 J					
Beryllium		3 ^{GV}		8.4								
Calcium												
Chromium												
Iron	300 *	300	367				26,300	20,300				
Magnesium		35,000 ^{GV}										48,800
Manganese	50 *	300			1,200	1,200	3,640	841	2,230			
Mercury	2	1										
Nickle				120								
Potassium												
Selenium												
Sodium		20,000		221,000	151,000	150,000	121,000	378,000	337,000	59,800	157,000	176,000
Zinc		2,000 ^{GV}	2,880									

Notes:

ug/L = micrograms per Liter.

1 = NYSDEC Part 703 Ambient Water Quality Standard or Guidance Value (GV) for Class GA (Potable) groundwater.

2 = Duplicate sample collected from Well SY-2D.

J = Estimated concentration.

Bold = Exceeds groundwater-quality standard or guidance value.

* = RCRA/PPL metal.

** = USEPA MCL, revised downward from 50 ug/L effective January 2006. NYSDEC TOGS 1.1.1 Ambient Water Quality Standard is 25 ug/L.

APPENDIX C-FIGURES

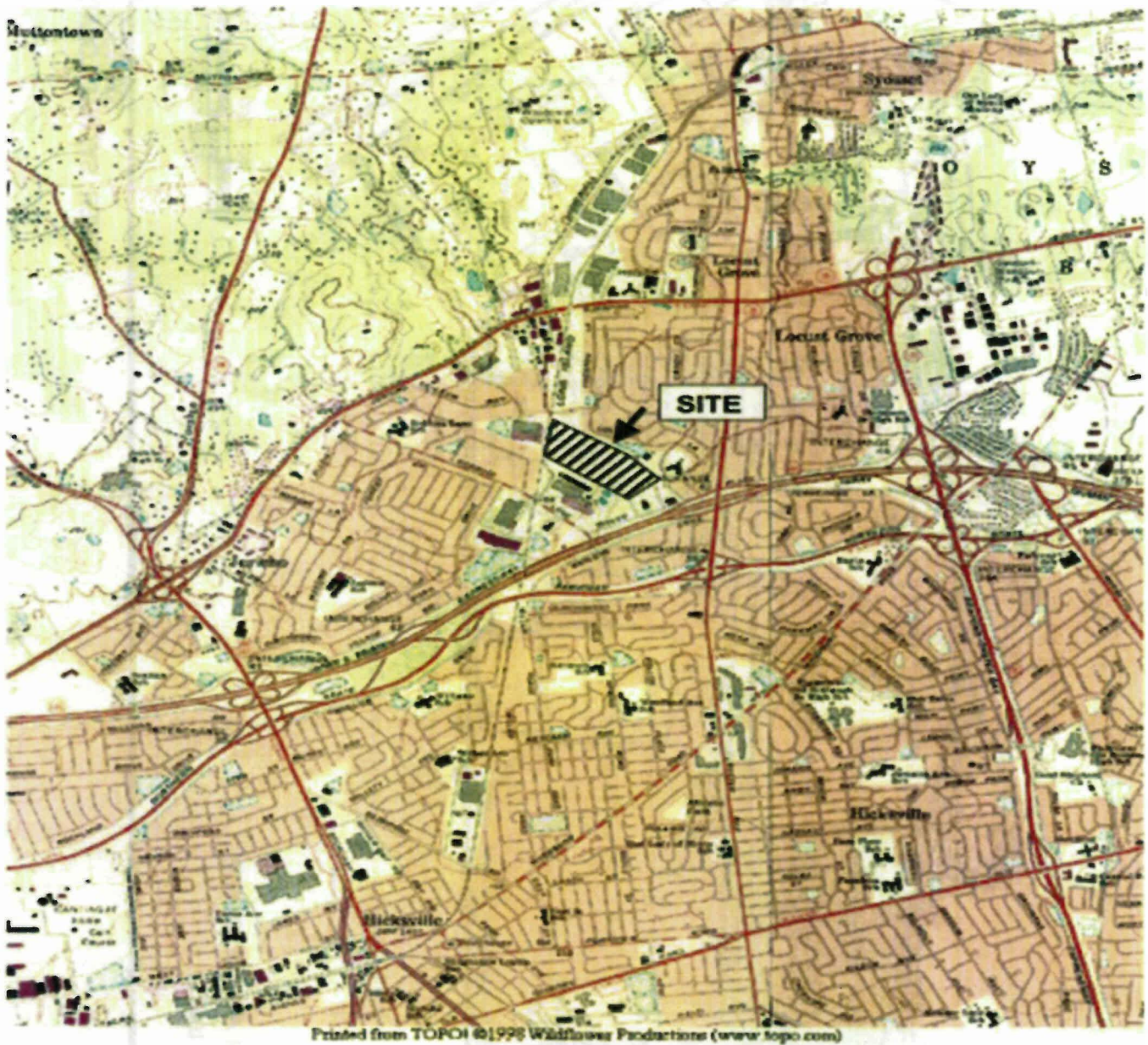


FIGURE 1

UKB

**SITE LOCATION MAP
SYOSSET LANDFILL
SYOSSET, NY**

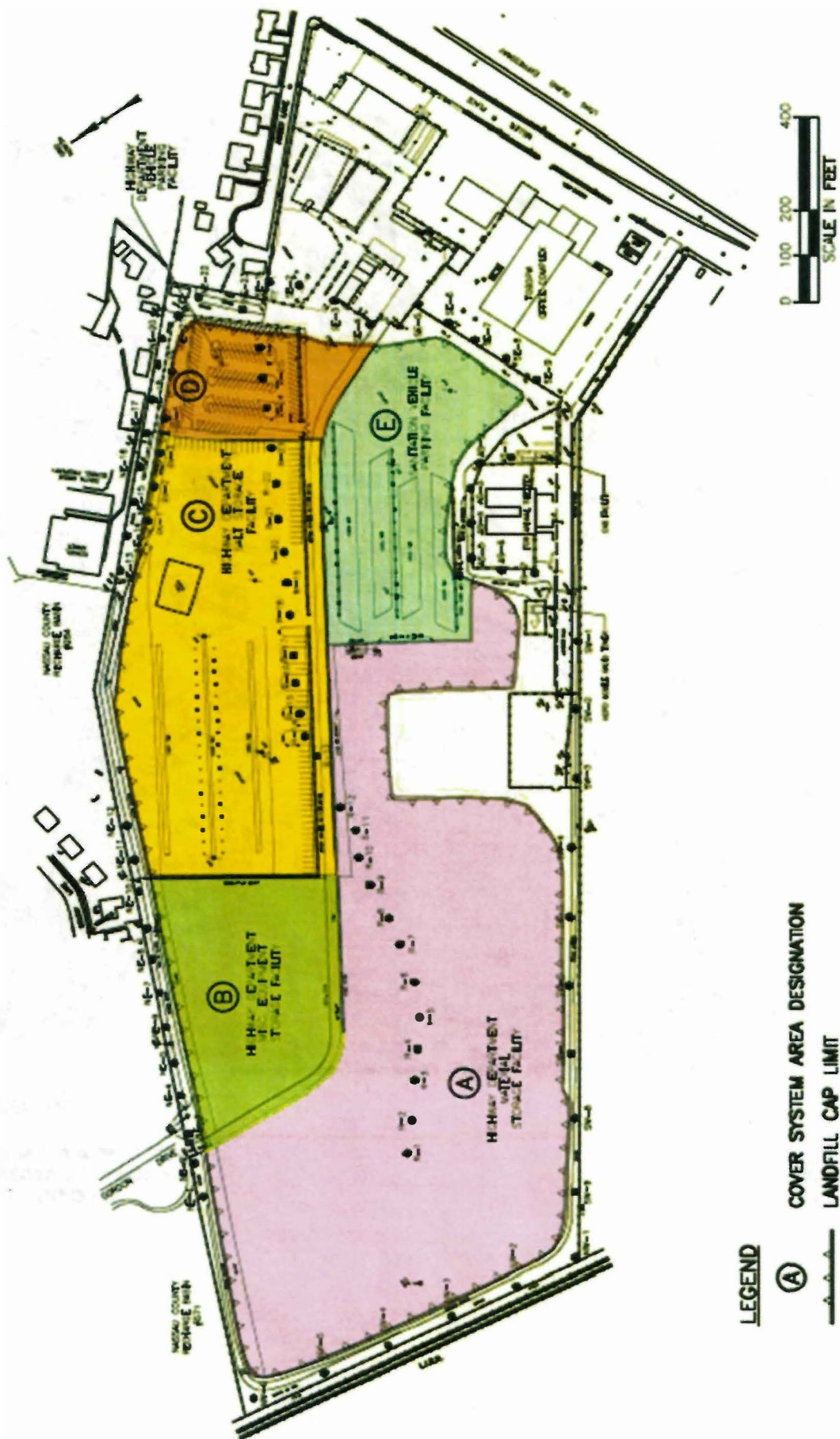


FIGURE 2
SYOSSET LANDFILL
COVER SYSTEM LOCATION PLAN

