

REVISED FOCUSED FEASIBILITY  
STUDY  
LYNDONVILLE-WEST AVENUE SITE  
LYNDONVILLE, NEW YORK

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## EXECUTIVE SUMMARY

The purpose of this Focused Feasibility Study (FFS) is to evaluate and recommend selected remedial action alternatives for the Lyndonville West Avenue site. The evaluation process included the following:

- ❑ Summary of site investigations and description of the nature and extent of contamination
- ❑ Identification of remedial action objectives (RAOs), scope of remedial actions, and potential state compliance guidelines (SCGs) for each area of concern
- ❑ Identification and screening of potential remedial technologies for each area of concern
- ❑ Detailed and comparative analysis of site-wide remedial action alternatives (RAAs)
- ❑ Recommendation of a RAA

Based on previous investigations, the following areas of concern were evaluated:

- ❑ The former landfill
- ❑ The drainage swale between sample boring S-22 and the storm sewer inlet
- ❑ The long term collection and disposal of leachate produced by the landfill

The RAAs developed for the detailed analysis were:

- ❑ RAA1— Landfill Cover (Existing Gravel), GCL Cover for Northern Slope, and Drainage Swale Removal
- ❑ RAA2—Landfill Cap (Asphalt), GCL Cover for Northern Slope, and Drainage Swale Removal
- ❑ RAA3 – Landfill Cap (Asphalt/GCL), GCL Cover for Northern Slope, and Drainage Swale Removal
- ❑ RAA4—Landfill and Drainage Swale Removal

RAA2—Landfill Cap (Asphalt), GCL Cover for Northern Slope, and Drainage Swale Removal is the recommended alternative for the site. This RAA includes:

- ❑ An asphalt cap and GCL (north slope) for the landfill
- ❑ Removal of soil in the drainage swale
- ❑ Continued operation of the leachate collection and disposal system
- ❑ Site fencing along the north slope of the landfill
- ❑ Site access and deed restrictions

This alternative was selected because it provides the most effective remedy when considering and balancing all of the evaluation criteria. Although not the lowest cost alternative that would be protective of human health and the environment, RAA2 is cost effective, quickly implemented, and protective of human health and the environment. Implementation of this alternative will increase overall protection of human health and the environment by further reducing the potential for direct contact exposure to landfill material, removing the drainage swale soil, and eliminating migration of landfill leachate. This alternative accomplishes the site RAOs with minimal potential short-term impacts to on-site workers, current operations, and the local community.

## 1.0 INTRODUCTION

### 1.1 Purpose and Scope of the Focused Feasibility Study (FFS)

This Focused Feasibility Study (FFS) for the Lyndonville West Avenue Site (Site Code #8-37-002) has been prepared in accordance with Administrative Order on Consent (AOC) Index #B8-0474-99-02, between DuPont and New York State Department of Environmental Conservation (NYSDEC). The purpose of the FFS is to evaluate and recommend remedial action alternatives for the site. The alternative evaluation process used is consistent with NYSDEC guidance and the SRI/FFS work plan [DuPont Corporate Remediation Group (CRG), 1999] and includes the following steps:

- ❑ Summary of site investigations and description of the nature and extent of contamination (Section 1)
- ❑ Identification of remedial action objectives (RAOs), scope of remedial actions, and potential state compliance guidelines (SCGs) for each area of concern at the site (Section 2)
- ❑ Identification and screening of potential remedial technologies for each area of concern at the site (Section 3)
- ❑ Detailed analysis of site-wide RAAs (Section 4)
- ❑ Comparative analysis of site-wide RAAs (Section 5)
- ❑ Recommendation of a RAA (Section 6)

### 1.2 Site Description and Background

The Lyndonville West Avenue Site consists of several properties in the northwestern portion of the Village of Lyndonville, New York (see Figure 1). Current boundaries for the site and adjacent properties are shown in Figure 2. Activities at the Lyndonville West Avenue site date back to the early 1900s with the development of fruit storage and processing facilities and construction of the Rome, Watertown, and Ogdensburg (RW&O) railroad. Industrial activities on the properties date back prior to the mid-1920s (Bel Adhesive Inc. and the Housel Packing Company). Barry Lime and Sulphur Company, Inc. began operations at the property in the early 1920s with the production of lime and sulfur solutions and dust mixtures. DuPont purchased Barry Lime and Sulphur in 1943 and continued with the formulation of agricultural sprays and dusts until approximately 1954.

Waste lime and sulfur sludge from Barry Lime and Sulphur Company and DuPont was disposed in a landfill, which is now part of the property currently owned by H.H. Dobbins, Inc. (Dobbins). At the time the landfill was created, the property was owned by Lyndonville Ice and Cold Storage. It has also been alleged that the landfill was used by other local facilities for the disposal of rotting fruit and by-products of fruit processing operations.

Surface runoff for a large area south of the former railroad line drains eastward to a topographic low point just south of the landfill. A storm sewer line was constructed through the landfill materials over the years to avoid drainage problems as landfilling activities continued (See Figure 3). The storm line was connected to the West Avenue industrial sewer in 1975 (See Figure 4). The West Avenue industrial sewer was constructed in the early 1920s specifically to handle relatively large industrial wastewater streams from West Avenue industrial facilities and general stormwater flow.

Residents along certain sections of West Avenue have complained of sulfide odors emanating from storm sewer grates along West Avenue for many years. Numerous investigations were conducted by various regulatory agencies between 1978 and 1993. For the most part, these investigations focused on collecting soil, surface-water, and stormwater samples within the stormwater drainage system for the greater West Avenue area. Detectable but relatively low concentrations of arsenic, copper, DDT, DDD, and DDE were found to be widespread and possibly representative of background conditions within a historically agricultural area. Statements concluding that the site did not pose any significant threat to human health or the environment are documented during the late 1970s and early 1980s.

The site was reclassified from a class "2A" to a class "2" site on the New York State (NYS) Registry in March 1994. Notifications requesting site investigation were distributed in 1995 to Primary Responsible Parties (PRPs) including Monroe Electronics, Dobbins Ramage, Bowman Apple Products Company, and DuPont (see Figure 2). DuPont was the only PRP to respond to the notifications.

Scopes of work for both a Supplemental Environmental Assessment (SEA) and Supplemental Remedial Investigation (SRI) were negotiated and implemented by DuPont. DuPont conducted the SEA in 1997 to identify the source of the odors and characterize the site. Findings of the SEA revealed that the largest contributor to nuisance sulfur odors along West Avenue was leachate generated from the landfill, which discharged to the West Avenue storm sewer.

In 2000 and 2001, DuPont and the town of Lyndonville installed additional stormwater controls to reduce the volume of landfill leachate and eliminate discharge of leachate to the West Avenue storm sewer system (See Figure 5). Since the elimination of the discharge of leachate to the West Avenue storm sewer system in 2001, there have been no more complaints of sulfide odors by residents. In 2000, the town of Lyndonville (with funding by DuPont) installed a stormwater diversion system upgradient of the landfill.

This system eliminated the major source of stormwater from entering the landfill. DuPont completed construction of a leachate collection system in January 2001. This system collects and stores the landfill leachate pending transport to an off-site treatment and disposal facility. Operation of this system since January 2001 has eliminated discharge of the leachate to the West Avenue storm sewer. In 2001, a SRI was implemented and completed by DuPont. The SRI focused on the collection of data to evaluate remedial alternatives for the site and to address areas not characterized during previous investigations. The SRI report was approved by NYSDEC in November 2001.

### 1.2.1 Site Location and Physical Settings

The Lyndonville West Avenue Site includes several properties in the northwestern portion of the Village of Lyndonville, Orleans County, New York. Current and historic land use in and around the Village of Lyndonville is predominantly agriculturally based. The site includes properties located south of West Avenue and adjacent to an east-west trending former RW&O railroad line, west of North Main Street (Route 63). Several industrial facilities, predominantly fruit processing and storage operations, are currently located on the south side of West Avenue including Nakano Foods Inc., Bowman Apple Products Company Inc., Dobbins, and B/F Energy. Current boundaries for the site and adjacent properties are shown in Figure 2.

Moving west to east along West Avenue, Nakano Foods is a production facility for vinegar products. Predecessors to Nakano Foods include Lyndonville Vinegar and the Speas Company. Historically, Bowman Apple Company and its predecessors, including Indian Summer, Pillsbury, and Lyndonville Canning Company, have utilized the property as both a fruit processing and storage facility. Dobbins (also known as Thruway Produce) currently operates a fruit cold storage and packaging facility. Dobbins-Ramage, a predecessor to Dobbins did operate an apple juice processing plant through the 1970s and early 1980s. Lyndonville Ice and Cold Storage owned the current Dobbins property dating back to the early 1920s. The B/F Energy property (also known as Barclay/Fowler), located to the east of Dobbins is used as an aboveground home heating oil storage and distribution facility. Crosby-Whipple is the only known predecessor of B/F Energy dating back to the early 1900s.

Land ownership records acquired by DuPont indicate that the property now owned by Monroe Electronics was three separate parcels prior to DuPont ownership. Land records also indicate that industrial and food processing activities (i.e., cider mill property, Bel Adhesive Inc., Housel Packing Company) had occurred on the property prior to acquisition by Barry Lime and Sulphur. Barry Lime and Sulphur acquired one of the original three parcels in November 1927 from Mark and Mabel Barry. Barry Lime and Sulphur Company, Inc. acquired a second parcel in October 1929 through bankruptcy proceedings for Housel Packing Company. DuPont purchased Barry Lime and Sulphur and assumed operations at the facility in October 1943. DuPont purchased a third small parcel from Frank Housel in August 1949. A review of Village tax roles confirm that no other parcels, other than those located south of the former RW&O railroad line, were owned by Barry Lime and Sulphur or DuPont. Village tax roles confirm that the landfill area was the property of Lyndonville Ice and Cold Storage as early as the early 1920s.

DuPont sold all three of their parcels to the First United Methodist Church of Lyndonville in March 1955. The First United Methodist Church of Lyndonville sold the property to Clarence Klaus in January 1957. The property was sold to the Lyndonville Properties, Inc. in December 1965. Normak Sportswear leased the property from 1966 until 1971 when the property was finally sold to Mr. Robert Vosteen of Monroe Electronics, the current property owner.

The former RW&O railroad property south of both Nakano Foods and Bowman Apple is currently owned by Nakano Foods. Dobbins owns the section of railroad line south of their main property.

### 1.2.2 Geology/Hydrogeology

The site is located in the gently sloping plains of the Central Lowland Physiographic Province between the Lockport Escarpment and Lake Ontario. This province is characterized by low, relatively flat-lying topography resulting from preglacial erosion of bedrock and subsequent modification during glacial and interglacial periods. As such, the overburden deposits are dominantly glacial in origin, ranging from flat-lying fine-grained lacustrine clays to coarse grained, localized, relict shoreline deposits.

Regionally, the Arkport very fine sandy loam, being derived from deltaic sandy deposits in former glacial lakes characterizes soils in the vicinity. Characteristics of this soil include slow runoff, slight to moderate potential for erosion, fine to very fine sand composition, and good drainage.

Natural overburden deposits beneath the study area were characterized during the advancement of soil borings and installation of monitoring wells the SEA. Three major stratigraphic units were identified during the SEA (see Figure 6):

- ❑ Relatively uniform tan/brown to tan/red fine to medium sand (less than 1 to 13 feet in thickness)
- ❑ Mottled brown/tan/gray low permeability lacustrine clay (8 to 9 feet in thickness)
- ❑ A brown/red rock and sand glacial till (3 to 4 feet in thickness)

The uppermost fine grained sand is characteristic of extensive deltaic sand plain deposits which extend north of an east-west trending ancestral beach ridge roughly coincident with Ridge Road (NYS Route 104) approximately 6 miles south of Lyndonville. The deltaic sand deposit varies in thickness across the study area from being non-existent in the topographic low point just north of the landfill to over 13 feet thick along the southern border of the study area adjacent to Housel Avenue. Typical thickness of this sand deposit beneath the landfill is one to two feet.

A mottled brown/gray lacustrine clay was observed beneath the deltaic sand throughout the entire study area. Two soil borings from the SEA were advanced to a depth beyond the clay unit to further characterize overburden stratigraphy. Although the depth at which the clay was encountered varied, elevation data reveal that the top of the clay unit mimics the generally eastward slope of ground surface toward Johnson Creek. The thickness of the lacustrine clay was relatively uniform (8 to 9 feet). A transitional contact between the deltaic sand and the lacustrine clay, marked by an interbedded sand and varved clay zone, was observed at several locations. Although no permeability measurements were made, the clay unit is physically consistent with very low permeability (less than  $1 \times 10^{-7}$  cm/sec) lacustrine clays in the western New York area. A perched water zone was identified within the deltaic sand unit above the lacustrine clay.

A sharp contact was observed at several locations between the lacustrine clay and underlying glacial till. The glacial till consisted of a poorly sorted gravel and sand unit deposited in front of the retreating ice margin at the end of the Wisconsin glacial age. As observed at MW-2, the only borehole advanced to bedrock, the till was approximately 3 to 4 feet in thickness.

Weathered red shales of the Upper Ordovician age Queenston Formation were encountered at approximately 26.8 feet below ground surface at MW-2, the only borehole advanced to bedrock.

Regional groundwater flow is presumably north toward Lake Ontario. The water bearing nature of the Queenston Shale was not evaluated because of the presence of a widespread clay aquitard, which prevents downward flow to deeper aquifers. Locally, shallow groundwater flow is toward the east and appears to mimic surface topography.

With the exception of MW-4, a perched water-bearing zone was observed above the glaciolacustrine clay unit at all locations. The lacustrine clay unit was encountered within inches of ground surface at the MW-4 location. Hydraulic head measurements were collected on August 4, 1997. A piezometric surface contour map was produced from the water levels and determined that shallow groundwater flow is toward the east.

### 1.2.3 Stormwater Drainage

As part of the SEA, a detailed topographic map was prepared using aerial surveying techniques to assess surface-water drainage patterns around the site. Additional field surveying was conducted to improve topographic resolution of the drainage swale where vegetation obstructed the aerial survey. The following paragraphs summarize the stormwater drainage findings from the SEA.

Regionally, stormwater runoff flows east toward Johnson Creek. Local to the site, stormwater runoff from areas north of Housel Avenue drain to the north, toward the east-west trending drainage swale that runs parallel to the former railroad line. A detailed survey and ground reconnaissance conducted during the SEA indicated that the intermittent drainage system adjacent to the former railroad line (between Nakano and Dobbins) is divided into three distinct hydrologic segments:

- ❑ The first segment drained surface water east to a box culvert behind Dobbins
- ❑ The second segment drained surface water to a topographical low containing a collapsed culvert behind Bowman Apple
- ❑ The third segment drained surface water flow west behind Nakano Foods

Installation of the first storm sewer pipe through the landfill occurred during the first phase of fill disposal in the landfill, from the late 1920s to the 1950s. Sewer piping was installed south and east of Dobbins underneath the landfill to accommodate storm flow in the east west trending swale. The storm flow in the swale drained to a box culvert underneath the railroad bed and into a storm sewer underneath the landfill. From approximately the mid-1950s until 1975, storm flow, which passed beneath the landfill, would discharge to an open ditch on the north side of the landfill before flowing into the West Avenue industrial sewer (See Figure 3). In 1975, the remaining section of open ditch was piped and directly connected to the West Avenue industrial sewer (See Figure 4). It is not known what party completed this final storm sewer installation and connection to the West Avenue industrial sewer. However, the pipe was further buried during the second phase of fill disposal when the area was leveled using materials excavated during installation of the new Village sanitary sewer system in 1979.

There are three main sewers, which serve West Avenue: the old sanitary sewer, the new sanitary sewer, and the industrial sewer.

The old sanitary sewer served as a combined storm and sanitary system along West Avenue for many years. It was not decommissioned in 1979 following installation of the new sanitary sewer in an effort to improve storm drainage in the West Avenue area. Sewer dye tests conducted at five residences (four on West Avenue and one on North Main Street) confirm that four-inch drains located in basements along West Avenue are connected to the old sanitary system. The new sanitary system, installed in 1979, is a completely closed system.

The industrial sewer has served as the main route for storm drainage along West Avenue since the early 1900s. Prior to the early 1920s, the industrial sewer was an open ditch, which ran along the south side of West Avenue. Responding to complaints around the poor condition of the ditch, Lyndonville Canning, a predecessor to Bowman Apple and the primary user of the ditch for wastewater discharges, agreed to install a storm sewer pipe along West Avenue, across North Main Street and extending east with ultimate discharge to Johnson Creek. In accordance with a 1922 agreement, maintenance of the industrial sewer remains the responsibility of Bowman Apple.

The Town of Lyndonville installed a stormwater diversion system upgradient of the landfill in 2000 (See Figure 5). This system diverts stormwater upgradient of the landfill to the Main Street storm sewer. The stormwater line under the landfill was also disconnected from the West Avenue storm sewer in 2001 with the construction of the leachate collection system. The landfill leachate is currently collected in a closed manhole and pumped to a holding tank pending transport to an off-site treatment and disposal facility.

#### **1.2.4 Surrounding Land Use and Populations**

Lyndonville is a small rural village of approximately 960 residents and is located in the Town of Yates, approximately seven miles north of Medina, New York and approximately three miles south of Lake Ontario. The north side of West Avenue is primarily single-family residential homes. Several single-family residences are also located just to the north of the Dobbins property. Residential units dominate the south side of West Avenue, east of B/F Energy toward North Main Street. Monroe Electronics, an electronic parts manufacturer, is the only industry of note and is located north of Housel Avenue adjacent to the south edge of the abandoned railroad line.

The Town of Yates and Village of Lyndonville potable water supply is obtained from a surface-water intake on Lake Ontario approximately three miles from the site. It has been estimated that approximately 15 residents within three miles of the site continue to use private wells as a potable water source. Reportedly, the closest private well is approximately 0.45 miles from the site.

## 1.3 Summary of Previous Investigations and Remedial Actions

The section presents information of previous investigations and remedial actions at the site.

### 1.3.1 Previous Investigations

NYSDEC; New York State Department of Health (NYSDOH); Orleans County Department of Health (OCDOH); and the United States Environmental Protection Agency (USEPA) conducted numerous investigations at the site between 1978 and 1993. These investigations focused on sampling sediment, soils, and surface water upgradient and downgradient of the landfill and establishing site background concentrations. All of these investigations revealed similar results. Exceedances of New York State water quality standards and elevated concentrations in soil, typically for arsenic, were indicated within limited areas of the railroad drainage swale behind Dobbins. Lower concentrations of arsenic and several pesticides were reported at most other locations. However, concentrations at background locations were also elevated, indicating that relatively high arsenic and pesticide concentrations may represent background conditions in this agriculturally dominated area.

The site classification was changed from a class "2A" to a class "2" in March 1994 and correspondence was sent to PRPs in April 1995 regarding funding remedial investigation of the site. Following negotiations with the NYSDEC, DuPont agreed to conduct the SEA, and an AOC between the NYSDEC and DuPont was signed in April 1997. Overall, the SEA was intended to evaluate site conditions and fill data gaps from the previous investigations. The SEA findings and past investigation findings were intended to provide sufficient data to evaluate the need for additional remedial actions, as warranted.

DuPont implemented and completed the SEA in 1997. The SEA report conclusions included the following (CRG, 1998):

- ❑ The drainage swale along the former railroad bed contained soils with concentrations of DDT, DDD, DDE and arsenic above New York Technical and Administrative Guidance Memorandum (TAGM) #4046 guidance criteria.
- ❑ Arsenic and copper were detected at uniform concentrations (approximately 300 mg/kg for arsenic and 400 mg/kg for copper) within lime dominated fill materials in the landfill. Pesticides were either not detected or were detected at very low concentrations in composite samples of the lime fill material. Deep samples collected at all soil boring locations indicated that downward migration of contaminants had not occurred. Toxicity Characteristic Leaching Potential (TCLP) results for composite lime fill samples were below toxicity characteristic regulatory levels. As such, the lime fill materials are not a characteristic hazardous waste.
- ❑ The presence of pesticides and metals in background surface water samples suggests that there may be other contributing factors in the area, including the historic and widespread use of pesticides and metals for agricultural purposes.

- ❑ Lime fill materials disposed in the landfill are a possible source for the observed hydrogen sulfide gas occurrences; other fill materials disposed in the landfill may also be potential sources.
- ❑ Analytical results for groundwater samples did not indicate that groundwater has been impacted by any site-related activities at the former DuPont facility or the landfill.

In 2001, DuPont implemented and completed a SRI at the Lyndonville West Avenue Site. Together, the SEA and the SRI investigation data characterized the site to the extent that potential remedial actions could be evaluated. The SRI report included an evaluation of data collected during the SEA and the SRI, as well as all the data collected by the various agencies in previous investigations. The SRI report also included conclusions and recommendations for future activities at the Lyndonville West Avenue Site.

The SRI report conclusions are summarized as follows (CRG, 2001):

- ❑ Arsenic concentrations above background exist in the drainage swale between Monroe Electronics and the former box culvert south of the Dobbins facility. Arsenic concentrations generally decrease with increasing depth.
- ❑ Sediment at the terminus of the West Avenue industrial sewer has not been impacted above background levels by upgradient soil/sediment sources in the swale or by leachate that was produced by the landfill and discharged to the storm sewer before the leachate collection system was installed.
- ❑ Groundwater data obtained from a temporary monitoring well indicate that site specific constituents are below groundwater standards near the swale and that groundwater does not appear to be a migration pathway for arsenic originating from the swale sediment.
- ❑ Prior removal of soil and Krenite cans from the Krenite area was successful as soil samples collected in this area had no reported detections of 4,6 dinitro-2-methyl phenol, the main ingredient in Krenite.
- ❑ Former site operations or current soil conditions have not impacted groundwater.

Based on the SRI, SEA, and previous investigation findings, it was concluded that no further sampling or evaluations were needed for soil, sediment, or groundwater at the Lyndonville West Avenue Site to evaluate potential remedial actions. The SRI report included the following recommended scope for the FFS:

- ❑ Evaluation of remedial actions for the length of the drainage swale between sample boring S-22 and the storm sewer inlet
- ❑ Evaluation of remedial actions for the former landfill
- ❑ Evaluation of the long term collection and disposal of leachate produced by the landfill

DuPont submitted a FFS for the Lyndonville West Avenue Site to NYSDEC on April 12, 2002. NYSDEC responded with comments on the FFS on July 23, 2002. In response to agency comments on delineation criteria for arsenic, DuPont collected an additional

ninety-nine soil samples in and around the drainage swale in October 2002. The samples were collected to:

- ❑ Horizontally and vertically delineate arsenic in the drainage swale
- ❑ Horizontally and vertically delineate arsenic in the former Krenite area
- ❑ Supplement previously collected background soil samples
- ❑ Calculate the 95% Upper Confidence Limit (UCL) method concentration for arsenic based on existing background samples

On March 13, 2003, DuPont submitted the 2002 Soil Delineation Sampling report (CRG, 2003) to NYSDEC. NYSDEC responded to the report on May 20, 2003 (NYSDEC, 2003). This revised FFS incorporates agency comments received on May 20, 2003.

### 1.3.2 Constituent Nature and Extent

A primary objective of the Lyndonville SEA and the SRI was to provide a characterization of constituents present in the landfill and site media including soil, groundwater, surface water, and sediment. The analytical program included full Target Compound List (TCL)/Target Analyte List (TAL) for select samples and media. Investigations also included air sampling and water sampling in the storm sewer system along West Avenue because of concerns associated with odors emanating from the storm grates.

Results from these site investigations indicated soil was the primary media of concern for the site. Specifically, soil concentrations for several constituents were detected above TAGM #4046 soil cleanup guidance values, both in the drainage swale and the landfill material. It was concluded that groundwater had not been impacted by the former site operations/activities or by current soil conditions. Surface water and sediments were also not impacted and were not a potential migration pathway for constituents.

For soil in the drainage swale and landfill, arsenic, DDT, DDD, and DDE were identified as constituents of potential concern during historical investigations of the site (prior to investigations conducted by DuPont). Since background concentrations for these constituents are elevated for the region, background concentration ranges were established and then used in the evaluation of site-specific data. Other information used to evaluate the site data included soil clean-up guidance values (TAGM #4046), the NYSDOH 1997 Fact Sheet, and data collected from media specific background sampling locations (i.e., SEA background sampling locations).

The constituent nature and extent for the areas of concern evaluated in this focused feasibility study are summarized in the following sections.

#### **Drainage Swale**

During the SEA, surface soil samples were collected from several distinct hydrologic sections of the drainage swale. This soil data indicated that several metals (arsenic, copper, and mercury) exceeded TAGM #4046 screening concentrations and site-specific background concentrations in the area of sampling locations SS-04, SS-05, and SS-07. DDT, DDD, and DDE only exceeded area background concentrations at SS-04. These

sampling locations are located between Monroe Electronics and the box culvert south of the Dobbins facility. This area (around SS-04) is along the former railroad line and is heavily vegetated. Native soil in the swale has high total organic carbon content. Naturally occurring organic material tends to act as a natural sink for pesticides and metals. In addition, surface runoff from rain events pond in this section of the drainage swale. Therefore, any suspended solids (i.e., soil, natural organic materials) would settle out in this area.

A more extensive sampling program was implemented during the SRI to further delineate this area. Fifty-six soil samples were taken at regular distance intervals and at discrete depths (0 to 2 inches, 2 to 12 inches, and 1 to 2 feet) within the drainage swale. Arsenic was analyzed as the primary indicator parameter during the SRI. The SRI soil data indicated that arsenic was detected above the existing specific background arsenic concentration range. In general, arsenic concentrations were found to decrease with increasing depth.

In response to agency comments on the April 12, 2002 FFS, DuPont collected an additional ninety-five soil samples in and around the drainage swale to horizontally and vertically delineate arsenic in the swale. Also, an additional four background soil samples were collected to supplement SEA background sample data. The results were presented in the Soil Delineation Sampling Report and are summarized in the following paragraphs (CRG, 2003).

The drainage swale was delineated horizontally for arsenic by collecting surface soil samples (0-0.5 ft interval) across the swale at fifty linear foot intervals along the length of the swale, from the top of bank. If the swale depth (measured from swale centerline to top of bank) was greater than 5.0 feet in depth, two perimeter samples were collected as follows:

- Within the swale, 4.5 feet above the swale bottom
- Top of Bank

The drainage swale was delineated vertically for arsenic by collecting soil samples at previously sampled SRI boring locations from deeper depth intervals. Samples were collected from 1-foot subsurface intervals from desired depth intervals in the borings.

An additional four background soil samples were collected from areas adjacent to the drainage swale and analyzed for arsenic. Two samples were collected in the former railroad bed adjacent to the drainage swale. The railroad bed samples were collected 300 feet upgradient and 300 feet downgradient of identified arsenic contamination in the swale. The remaining two soil samples were collected from two low-lying areas in the adjacent open field, south of the drainage swale.

The 95% UCL arsenic concentration was recalculated based on the existing background sampling and the additional four background samples collected in April 2001. The calculated 95% UCL for arsenic at the Lyndonville-West Avenue site is 49.91 mg/kg (Appendix A). The following are conclusions about arsenic in the drainage swale when using an arsenic concentration criteria of 49.91 mg/kg:

- Arsenic in the drainage swale has been delineated to below the 95% UCL vertically

- ❑ For areas in and adjacent to old orchards (top of swale bank), it is common for the background levels of arsenic to be elevated above natural background levels (NYSDEC, 2003)
- ❑ Limits of remedial action for the drainage swale have been delineated vertically below the arsenic 95% UCL calculated from background soil samples and horizontally by topographic boundaries as stated by NYSDEC (NYSDEC, 2003)

### **Landfill**

During the SEA, four soil borings were completed to characterize the fill material within the landfill. Arsenic and copper were detected at uniform concentrations (approximately 300 mg/kg for arsenic and 400 mg/kg for copper) within lime dominated fill materials in the landfill. These metals were limited to subsurface lime fill materials, where potential exposure is unlikely. Pesticides were either not detected or were detected at very low concentrations in composite samples of the lime fill material. Deep samples collected at all soil boring locations indicated that no downward migration of contaminants has occurred. Groundwater samples collected during and subsequent to the SEA were all below drinking water standards, further indicating mobility of constituents from the waste material has been limited to the general vicinity of the landfill.

### **Leachate**

Historic surface and subsurface drainage water sample results were summarized in the SEA. Landfill leachate characteristics are most likely representative of previous samples collected from the old landfill manhole. Additionally, DuPont collected samples to characterize leachate while evaluating potential treatment and disposal options. These analyses indicated elevated levels of arsenic in the landfill leachate. Low levels of pesticides (DDT, DDD, DDE) were also detected in landfill leachate. However, pesticides were also detected at similar concentrations in background samples, suggesting other contributing factors (CRG, 1998).

Surface water samples collected downgradient of the landfill and at the discharge point in Johnson Creek do not indicate any impact from historic storm sewer discharges. However, in response to sulfur odor complaints, DuPont and the town of Lyndonville implemented remedial actions to eliminate migration of landfill leachate to the West Avenue storm sewer and Johnson Creek (See Section 1.3.3).

### **1.3.3 Previous Remedial Actions**

To date DuPont has funded or implemented three remedial actions at the Lyndonville West Avenue Site. These remedial actions concentrated on the management of leachate, which is generated from the landfill, and primarily address sulfide odors produced by the landfill leachate.

Prior to these remedial actions, stormwater at the site collected in the east-west trending drainage swale adjacent to the railroad bed, upgradient from the landfill. This storm flow then drained through a box culvert under the railroad bed and into an existing 18-inch storm sewer located underneath the landfill. Stormwater migrating through the landfill would come into contact with the lime and sulfur waste in the landfill. The combined

stormwater and leachate stream would then discharge to the West Avenue storm sewer system.

The remedial actions implemented by DuPont and the town of Lyndonville included the following:

- ❑ Installing a junction box for leachate from the landfill
- ❑ Diverting stormwater flow upgradient of the landfill
- ❑ Collecting leachate for off-site disposal

In 1999, DuPont installed a sewer junction box that connected the 18-inch storm sewer underneath the landfill and a 6-inch PVC sewer lateral pipe to the industrial sewer. This junction box eliminated the remaining open ditch section connecting the 18-inch and 6-inch sewer lines.

In 2000, the Town of Lyndonville (with funding by DuPont) installed a stormwater diversion system upgradient of the landfill. This system eliminated a major source of stormwater from entering the landfill. Stormwater was diverted around the landfill by grouting the box culvert and installing a new storm sewer pipe within the drainage swale. The stormwater from the new pipe, which no longer comes in contact with landfill material, is discharged to the Main Street storm sewer system.

In 2001, as part of the leachate collection system construction project, the 18-inch storm line from the landfill was connected to a new manhole. The 18-inch connection to the junction box was then grouted to eliminate discharge of leachate to the West Avenue storm sewer system. The junction box continues to serve as a collection point of storm drainage from the adjacent residential properties.

In 2001, an additional remedial action was installed to eliminate discharge of the leachate to the West Avenue storm sewer. The primary components of the leachate collection system are a leachate collection manhole and leachate storage tank (see Figure 5). The existing storm sewer line underneath the landfill is connected to the leachate collection manhole. The storm sewer line downgradient of the new manhole was grouted to prevent any leachate from entering the West Avenue storm sewer system. Leachate is pumped from the new manhole to an aboveground leachate storage tank. The leachate storage tank vent is equipped with carbon canisters to remove sulfide odors. The leachate is pumped to a tanker truck and transported to the Publicly Owned Treatment Works (POTW) in Niagara Falls, New York for treatment and disposal.

## **2.0 IDENTIFICATION OF REMEDIAL ACTION SCOPE AND OBJECTIVES**

This section presents the remedial action scope and objectives for the site. The remedial action scope and objectives were developed considering contaminants of concern, contaminant-specific cleanup criteria, and realistic exposure pathways. The RAOs for the site were established with the primary goal of protecting human health and the environment. Based on these RAOs, the remedial scope was developed to identify media, areal extent, and volume for areas of concern.

This section also lists and discusses New York State SCGs that may be applicable to the remedial actions evaluated for the site. Remedial action schedules are discussed generally in this section and specifically for each alternative evaluated in Sections 3 to 5 of this report.

### **2.1 Determination of Remedial Action Objectives (RAOs)**

New York TAGM #4030, *Selection of Remedial Actions at Inactive Hazardous Waste Sites*, and TAGM #4046, *Determination of Soil Cleanup Objectives and Cleanup Levels*, provide guidance on developing RAOs for evaluation of remedial alternatives (NYSDEC 1990 and 1994). For this FFS, RAOs were developed based on contaminants and media of interest and realistic exposure pathways. The primary areas of concern identified, based on previous investigations, are: soil in the drainage swale; soil and waste in the landfill; and leachate from the landfill. Remedial alternatives developed will be evaluated against the RAOs to determine if potential threats to human health and the environment have been reduced or eliminated for the areas of concern.

For soil in the drainage swale and landfill, arsenic, DDT, DDD, and DDE were identified as constituents of potential concern during historical investigations of the site (prior to investigations conducted by DuPont). Because background concentrations for these constituents are elevated for the region, background concentration ranges were established and then used in the evaluation of site-specific data. Because metals are found naturally in soil and elevated background metal levels were detected in previous investigations at the site and surrounding areas, recommended soil action levels for metals are based on background. A background range for arsenic was established for the site during the SEA. Per NYSDEC comment letter dated July 23, 2002, and the collection of an additional four background soil samples, DuPont calculated a 95% UCL utilizing the background levels to aid in vertical delineation of the drainage swale (NYSDEC, 2002). The 95% UCL calculations are presented in Appendix A. While copper and mercury were also detected in this area exceeding background concentrations, any remedial action conducted in the drainage swale or landfill for arsenic will effectively address these other metals. Likewise, since DDT, DDD, and DDE concentrations only exceeded area background concentrations at SS-04 in the drainage swale and landfill, remedial actions to address arsenic in these areas will also address these compounds.

For the landfill leachate, specific contaminant cleanup criteria were not established because the primary exposure pathway has been eliminated through previous remedial actions. However, a qualitative RAO was established for leachate, primarily to prevent future migration and exposure to leachate.

Based on these considerations, the specific RAOs for the site are as follows:

- ❑ Prevent or reduce the potential for human exposure by direct contact to soil within the drainage swale and landfill material.
- ❑ Prevent or reduce the potential for erosion and migration of drainage swale soil and landfill material.
- ❑ Prevent or reduce the potential for off-site migration of and exposure to landfill leachate.

## **2.2 Determination of Remedial Scope**

Consistent with the RAOs, a determination of the scope of the remedial actions was established to identify media, areal extent, and volume for areas of concern. The areal extent for the media of concern was established considering the remedial action level for arsenic. The volume of material expected for different alternatives will vary based on exposure potential and migration concerns.

Based upon the findings of previous investigations conducted at the Lyndonville West Avenue Site, the SRI recommended addressing the following areas of concern in the FFS:

- ❑ The drainage swale between sample boring S-22 and the storm sewer inlet
- ❑ The former landfill
- ❑ The leachate produced by the landfill

The location and areal extent of the drainage swale and landfill are shown in Figure 2. The estimated volumes for the drainage swale soil and landfill material presented in the following sections are in-place volumes. The volume of landfill leachate was estimated by correlating existing leachate generation with regional rainfall data.

### **2.2.1 Drainage Swale**

The primary potential receptor who may come into contact with soil in the area of the drainage swale would be trespassers. There are no controls (i.e., fences) in place to eliminate access to these areas. The primary exposure pathway would be direct contact with surface soil. However, dense vegetation and steep slopes limit potential exposure in this area.

The drainage swale between Monroe Electronics and the box culvert south of the Dobbins facility was extensively sampled and the extent of arsenic above site background concentrations was delineated during the SRI, and again in 2002. Arsenic concentrations exceeding site background were detected in the surface soil (0 to 1 foot). While the concentrations generally decreased with depth, exceedance of background concentrations did occur in the 1 to 2-foot sample depth and the 2 to 3-foot sample depth at some

locations. All boring locations within the drainage swale were delineated vertically to below the 95% UCL. Figures 7 and 8 present drainage swale sample locations and proposed excavation boundaries and depths. As shown in Figures 7 and 8, additional excavation has also been proposed adjacent to the swale in the former Krenite area to remove some additional soil with elevated arsenic concentrations in conjunction with the drainage swale excavation.

The horizontal extent of the proposed drainage swale excavation limits are shown in Figures 7 and 8. The proposed drainage swale vertical excavation limits were determined such that remaining arsenic levels will be below the 95% UCL calculated from background soil samples and will be below 1 to 3.5 feet of clean soil.

The volume of soil to be removed from the drainage swale is estimated at 1,189 cubic yards. This volume estimate was calculated using:

- ❑ Drainage swale length of 1,100 feet
- ❑ Vertical delineation to below the 95% UCL based on background samples
- ❑ Drainage swale width demarcated topographically

### **2.2.2 Landfill**

The boundaries and extent of the landfill were determined from evaluations of historic aerial photographs, soil borings logs from the SEA, and existing topography at the site. Historical photographs indicate the landfill was located on the current Dobbins property, adjacent to the drainage swale and east of the main building on the Dobbins property (see Figure 2). The landfill appears to be located directly under the exiting garage on the Dobbins property. The area was a natural low spot that was filled with waste and trash. Based on soil borings through the landfill conducted during the SEA, the waste layer is thicker on the southern property boundary (adjacent to the former railroad) and is essentially non-existent on the northern landfill boundary.

The entire landfill area has been filled to provide a level grade and the current property owner has placed a gravel cover over the entire area to facilitate storage operations. The fill and gravel cover is approximately 2 feet in the southern boundary and 8 feet in the northern boundary of the landfill.

Arsenic and copper were detected within the lime-dominated fill materials of the landfill at concentrations exceeding background concentrations. Because the area has been leveled with fill and gravel and the constituents were only detected in the subsurface (2 to 8 feet below ground surface), the potential for direct contact exposure with the waste materials is unlikely. It is also unlikely that excavation activities would be initiated for any purposes because the area is currently used for commercial storage operations. Previous investigations and samples collected during the leachate remedial actions indicate elevated arsenic concentrations along the northern toe of the landfill. Therefore, the areal extent and volumes of the landfill will include this area.

The areal extent of the landfill is approximately 2 acres (87,120 square feet). The average depth of the landfill is approximately 5 feet. Waste thickness ranged from 2 to

12 feet. The entire volume of landfill material will be considered for this evaluation. However, only the volume of waste will be used for estimating off-site disposal costs. The remaining fill and gravel were assumed suitable for re-use for bringing the area back to grade. The in-place volume of the entire landfill, including fill and gravel, is approximately 36,000 cubic yards. The in-place volume of waste material is approximately 24,200 cubic yards.

### **2.2.3 Leachate Collection and Disposal**

Surface water infiltrating through the landfill and the generation of leachate is a potential point of exposure. However, this potential exposure has been eliminated since leachate is currently collected and stored, pending transport to an off-site treatment and disposal facility.

The volume of leachate generated is dependent on the amount of rainfall that infiltrates through the landfill. The stormwater diversion system installed in 2000 eliminated a significant amount of the stormwater that came in contact with landfill material. The leachate collection system was also installed in 2001 to collect rainwater that infiltrates through the landfill. The leachate collection system has been running since January 2001. Approximately 721,000 gallons have been collected and disposed off-site through August 31, 2003. The annual rainfall for Lyndonville over this period was estimated at an average of approximately 26 inches per year. Rainfall in the area of western New York ranges from 31.9 inches (Rochester) to 38.7 inches (Niagara Falls) with an average rainfall of 35.3 inches. Therefore, for purposes of this evaluation, an average annual leachate generation rate of 300,000 gallons was assumed.

## **2.3 Identification of SCGs**

The identification of New York State SCGs incorporates all relevant, applicable, and appropriate requirements to achieve the remedial action objectives and scope. The list of Potential SCGs identified for the Lyndonville site is shown in Table 1. SCGs fall into the following three broad categories:

- ❑ Chemical-specific SCGs
- ❑ Location-specific SCGs
- ❑ Action-specific SCGs

Chemical-specific SCGs govern the extent of site remediation and may be actual concentration based remediation levels. Chemical-specific SCGs may provide the basis for calculating remediation levels. Examples of chemical-specific SCGs are TAGM soil cleanup levels.

Action-specific SCGs pertain to the implementation of a remediation technology. Examples of action-specific SCGs include monitoring requirements, effluent discharge limitations, hazardous waste manifesting requirements, and occupational health and safety requirements.

Location-specific SCGs are considered for natural or man-made site features. Examples of natural site features include wetlands, rivers, and floodplains. An example of man-made features includes the presence of historic districts.

The identified SCGs for Lyndonville, a description of alternative applicability, and a description of potential measures to obtain compliance are summarized in the following sections. Compliance with SCGs for each alternative is discussed in Sections 4 and 5 of this report.

### **2.3.1 New York Surface Water and Groundwater Quality Standards and Effluent Standards**

These regulations provide criteria established by New York State for surface water and groundwater quality along with water discharge standards.

Previous investigations determined that there are no current groundwater or surface water issues at Lyndonville. The remedial action implementation will employ temporary erosion control measures to ensure compliance with surface water standards. The overall impact to surface water quality will also be minimized through proper material handling, construction sequencing, and implementation of temporary erosion control measures.

### **2.3.2 New York State Pollutant Discharge Elimination System**

This regulation provides permitting procedures and discharge limitations of effluent discharges to surface water.

Discharge limits, if applicable, will be met for all on-site storm water discharges to surface water including water released from excavated material.

### **2.3.3 New York Wetlands Regulations**

This regulation protects the New York State wetlands from adverse environmental impact caused by development.

DuPont has reviewed New York State wetland maps and determined that there are no identified wetlands on the Lyndonville site. Therefore, the remedial action implementation will not impact any wetlands.

### **2.3.4 New York Hazardous Waste Regulations**

These regulations establish standards for hazardous waste treatment, storage, transportation, and disposal.

Previous investigations indicate the landfill materials and soil in the drainage swale, if removed, will be likely classified as non-hazardous materials. However, more extensive sampling would be required for the landfill material prior to any alternative involving removal of this material. For purposes of this FFS evaluation, it was assumed 50 percent of the landfill material could be classified as hazardous waste for the arsenic toxicity characteristic. The remedial action implementation will include material characterization to ensure proper material classification.

**2.3.5 New York Solid and Hazardous Waste Regulations (Air Quality Standards)**

These regulations establish air quality standards for New York State.

During remedial action implementation, dust and odors may be generated; however, the generation is expected to be minimal. The remedial action implementation will employ proper air monitoring measures to ensure compliance with the New York State Air Quality Standards.

**2.3.6 New York Part 360 Regulations – Solid Waste Management Facilities**

These regulations establish the standards for a solid waste management facility for New York State. These regulations also provide criteria for landfill closure.

DuPont has integrated the intent of the New York Part 360 Regulations into the RAA2 and RAA3. The intent of the New York Part 360 Regulations will be further discussed in Section 3.1 - Landfill Remedial Technologies Screening.

**2.3.7 New York Solid and Hazardous Waste Regulations (Solid and Hazardous Waste Disposal)**

These regulations establish solid and hazardous waste disposal standards for New York State.

Previous investigations indicate the landfill and swale materials, if removed, will be classified as non-hazardous materials. However, more extensive sampling would be required for the landfill material prior to any alternative involving removal of this material. For purposes of this FFS evaluation, it was assumed 50 percent of the landfill material could be classified as hazardous waste for the arsenic toxicity characteristic. The remedial action implementation will include material characterization to ensure proper material classification and disposal.

**2.3.8 New York Solid and Hazardous Waste Regulations (Waste Transporter Permit)**

These regulations establish solid and hazardous waste transporter permitting requirements.

Previous investigations indicate the landfill and swale materials, if removed, will be classified as non-hazardous materials. However, more extensive sampling would be required for the landfill material prior to any alternative involving removal of this material. For purposes of this FFS evaluation, it was assumed 50 percent of the landfill material could be classified as hazardous waste for the arsenic toxicity characteristic. The remedial action implementation will require all waste transporters to obtain the proper waste transportation permits for non-hazardous waste.

**2.3.9 Well Permitting Procedures**

These procedures establish for permitting of well installation.

Previous investigations have included the installation of multiple monitoring wells. The remedial action implementation will utilize the existing monitoring wells. DuPont does not anticipate the installation of new monitoring wells.

### **2.3.10 City of Niagara Falls Sewer Discharge Permit**

This regulation establishes constituent criteria for discharges to Publicly Owned Treatment Works (POTWs).

The existing leachate collection system will continue to collect landfill leachate for disposal at the City of Niagara Falls POTW. The historic analytical leachate data establishes compliance with the City of Niagara POTW Discharge Permit criteria.

### **2.3.11 New York Occupational Safety and Health**

This regulation establishes criteria for worker occupational safety and health in New York State.

DuPont will employ proper safety and health procedures to ensure compliance with the New York Occupational Safety and Health. Proper protection equipment, material handling, construction sequencing, and implementation of temporary erosion and sediment control measures will minimize the potential worker risk during remedial action implementation.

### **2.3.12 Federal Occupational Safety and Health**

This regulation establishes criteria for worker occupational safety and health in New York State.

DuPont will employ proper safety and health procedures to ensure compliance with the Federal Occupational Safety and Health. Proper protection equipment, material handling, construction sequencing, and implementation of temporary erosion and sediment control measures will minimize the potential worker risk during remedial action implementation.

### **2.3.13 Hazardous Material Transportation Act**

These regulations establish procedures for packaging, marking, labeling, manifesting, and mode of transportation of materials identified as hazardous by the Department of Transportation.

Previous investigations indicate the landfill materials and soil in the drainage swale, if removed, will be classified as non-hazardous materials. Material characterization will be covered under the New York Solid and Hazardous Waste (NYCRR 364) guidelines. The remedial action implementation will require all transporters obtain the proper waste transportation permits.

**2.3.14 NYSDEC Technical and Administrative Guideline Memorandum (#4030 and #4046)**

These regulations determine the cleanup objectives and standards for New York State. Compliance with these standards will be evaluated for each alternative in Sections 4 and 5 of this report.

**2.4 Determination of Remedial Action Schedule**

The remedial action schedule will depend on the alternative selected. Alternative implementation schedules can range from several months to several years, which may include preparation of design documents and permits, permit review and approvals, construction, and operation and maintenance. The time frame required for the individual alternatives are addressed in Sections 3 to 5 of this report. DuPont does not anticipate any additional field activities to implement the remedy, other than on-going leachate collection and disposal, to occur in 2003. The remedial action schedule must be coordinated with the present property owner and existing business operation.

### 3.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

For this part of the evaluation process, applicable remedial technologies were identified to meet the RAOs for each area of concern at the site. Areas of concern were described in Section 2, include the landfill, the drainage swale soil, and landfill leachate. The remedial technologies were developed by identifying general response actions that may achieve the RAOs. Those technologies most applicable for the general response actions were then screened and evaluated considering effectiveness, implementability, and cost. Technologies that passed this screening stage were then assembled into site-wide remedial action alternatives for further evaluation as presented in Section 4 of this report.

#### 3.1 Landfill Remedial Technologies Screening

Technologies evaluated for the landfill focused on additional site controls, containment, and removal general response actions. In-situ and ex-situ treatment technologies were not evaluated for waste materials or soil because the primary constituents of concern are metals, which can be stabilized or immobilized, but cannot be destroyed. Previous investigations have indicated the metals are already immobile, and additional stabilization is not necessary to meet site objectives. Additionally, in-situ or ex-situ treatment would not remove or destroy the metals of concern; therefore, the potential for direct contact would not be eliminated.

For containment response actions, the primary technologies applicable for the landfill are caps and covers. The New York State Part 360 Landfill Requirements state the minimum requirements for the final cover system as the following from top to bottom:

- ❑ Topsoil layer
  - Minimum of 6-inches in thickness
- ❑ Barrier protection layer (BPL)
  - Not less than 24-inches in thickness must be installed on top of the low permeability barrier soil cover
- ❑ Low permeability soil cover barrier layer
  - Must consist of materials which have a maximum remolded coefficient of permeability of  $1 \times 10^{-7}$  cm/s
  - Minimum compacted thickness of 18 inches
  - Placed on a slope of no less than 4% and at a maximum slope of 33%
- ❑ Gas venting layer
  - Minimum thickness of the soil layer must be 12 inches
  - Minimum coefficient of permeability of  $1 \times 10^{-3}$  cm/s
  - Six-inch in diameter riser pipes to be installed a maximum separation of one vent per acre
  - Gas venting risers to be installed at a depth of at least 5 feet into the refuse

In accordance with the New York State Part 360 Section 360-2.13 (w), a variance or an equivalent component design may be proposed to the department for review and evaluation. For the landfill area of the site, certain cap components may not be applicable or an equivalent design may be necessary to facilitate site operations or installation activities. The following paragraphs describe the Part 360 requirements that may require variances or design equivalence for covers applicable to the site.

### **Gas Venting Layer**

Upon the completion of the SEA, the largest contributor to the nuisance of sulfur odors was landfill leachate. The leachate was generated from infiltration through the landfill and discharged into the West Avenue storm sewer. The construction of a leachate collection system in January 2001 has eliminated the discharge of leachate to the West Avenue storm sewer and thus eliminated the sulfur odors. Therefore, a variance may be necessary to eliminate a gas-venting layer because it may create an additional migration pathway for nuisance odors.

### **Low Permeability Soil Barrier Layer**

Based on the existing use of the landfill area, installation of 18-inches of low permeability soil for the barrier layer would not be practical. Installation of 18-inches of low permeability soil would significantly change the elevations of the landfill area. Additionally, alternate barrier layer materials could be more readily implemented and maintained at the site. Therefore, a variance would be necessary to use an alternate barrier layer material, such as gravel, asphalt, or geosynthetic liner, at the site. The existing gravel cover has provided an effective barrier to landfill material. Asphalt would also provide an effective barrier and facilitate the current use of the site. Geosynthetic liner materials are also available which would provide similar performance to low permeability soil. For purposes of this evaluation, a geocomposite clay liner (GCL) was considered representative of the geosynthetic materials available. Therefore, the cap barrier materials evaluated for this site were gravel, asphalt, and GCL.

### **Barrier Protection Layer (BPL)**

The entire landfill area has been previously filled to provide a level grade and there is an existing gravel cover over the entire area to facilitate storage operations. There currently exists a depth of 2 feet of fill and gravel cover in the southern boundary of the landfill and 8 feet of fill and gravel cover in the northern boundary of the landfill. To continue the current use of the site as a storage area, it is advisable to maintain the current elevations. Therefore, variances to the 24-inch BPL may be necessary for the cap option selected.

### **Topsoil**

The entire landfill area has been previously filled to provide a level grade including a gravel cover over the entire area to facilitate current storage operations. Due to the current use of the property, a topsoil layer would not be practical for the majority of the site, except the northern slope. Because a building, storage areas, and roadways are located on the landfill, it would be impractical to maintain a vegetative cover in this portion of the site. Therefore, variances for the topsoil layer would be necessary for the cap option selected.

### **Summary of Landfill Remedial Technologies Evaluated**

Based on these considerations, the following final cover technologies were evaluated for the landfill:

- ❑ Existing gravel cover and GCL for the northern slope
- ❑ Asphalt cap and GCL for northern slope
- ❑ Asphalt and GCL cap for landfill and GCL cover for northern slope
- ❑ Removal of landfill material

#### **3.1.1 Existing Cover and GCL for Northern Slope**

This option for the landfill would use the existing cover and GCL for the northern slope of the landfill. Site access controls and deed restrictions would also be implemented. Site access controls would include a fence along the northern slope adjacent to residential properties, and continued maintenance of the existing landfill cover. The existing fill and gravel cover on the landfill would continue as the main barrier to direct contact. The existing cover is adequate for the top of the landfill and the southern, eastern, and western landfill boundaries. However, the northern slope would be covered with GCL to eliminate the potential for direct contact to soil above the arsenic remedial action level in this area. The installation of a fence would further limit site access and reduce the possibility of trespasser exposure to constituents of concern.

Deed and site activity restrictions would also be required for this option. These restrictions would need to be enforced by the current or future property owner. Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the landfill, such as excavation, would be restricted unless personal protective equipment and other safety measures were in place.

#### **Effectiveness**

This option would be effective in meeting the site RAOs. Maintaining the existing cover and GCL on the northern slope would effectively eliminate the potential for direct contact with landfill material. The installation of a fence would further reduce the possibility of trespasser exposure to constituents of concern. Potential migration of constituents would also be reduced by maintaining the existing fill/gravel cover and installing the GCL on the northern slope. The deed and site restrictions would reduce the potential for exposure of current site workers and future property owners.

#### **Implementability**

This option could be easily implemented at the site. This option requires minimal disturbance of landfill materials; therefore, impacts to the current operations and local community would be minimal. Clearing and grubbing would be required for the northern slope of the landfill but the potential for disturbance of landfill material would be low. Future monitoring would be required to ensure that the cover and fence are in good condition. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

**Cost**

The cost for this option is low compared to the other options for the landfill. Costs would include providing the GCL for the northern slope, installation of the fence along the landfill north slope, legal fees for deed modifications, and monitoring and maintenance for the fence and cover.

**Summary**

This option will be retained for consideration for site-wide RAAs. Further evaluations of the RAAs are provided in Section 4 of this report.

**3.1.2 Asphalt Cap and GCL North Slope Cover**

This option for the landfill would use an asphalt cap and GCL on the northern slope to further reduce the potential for direct contact by trespassers and site workers. This option would also include site access controls and deed restrictions described in the previous option. The asphalt cap would serve as the main barrier to direct contact for the top of the landfill and the southern, eastern, and western landfill boundaries. As with the previous option, the northern slope would be covered with GCL to eliminate the potential for direct contact to soil above the arsenic remedial action level in this area of the site. The installation of a fence along the landfill northern slope would further reduce the possibility of trespasser exposure to constituents of concern. Deed and site activity restrictions would also be required for this option. These restrictions would need to be enforced by the current or future property owner.

Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the landfill, such as excavation, would be restricted unless specific personal protective equipment and other safety measures were in place.

**Effectiveness**

This option would be effective in meeting the site RAOs. Installing the asphalt cap on the landfill and GCL on the northern slope would effectively eliminate the potential for direct contact with landfill material. The installation of a fence would further limit site access and reduce the possibility to trespasser exposure to constituents of concern. Potential migration of constituents would also be reduced by the asphalt cap and GCL on the northern slope. The asphalt cap may also reduce the amount of rainfall infiltrating through the landfill, potentially further reducing the generation of landfill leachate. The deed and site restrictions would reduce potential exposure of current site workers and future property owners.

**Implementability**

The asphalt cap and GCL could be easily implemented at the site. This option requires minimal disturbance of landfill materials; therefore, impacts to the current operations and local community would be minimal. Clearing and grubbing would be required for the northern slope of the landfill, but the potential for disturbance of waste would be low. Future monitoring would be required to ensure that the asphalt cap, soil cover, and fence are in good condition. Asphalt maintenance would be expected to repair cracks or

potholes. Asphalt re-paving may be required on portions of the asphalt cap depending on effects from traffic or weather. However, these repairs can be readily implemented. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

### **Cost**

The cost for this option is moderate compared to the other options for the landfill. Costs would include installing an asphalt cap, GCL cover for the northern slope, fence along the landfill north slope, legal fees for deed modifications, and monitoring and maintenance of the fence and cap. Maintenance of the asphalt cap will be more costly than maintenance of the existing gravel cover.

### **Summary**

This option will be retained for consideration for site-wide RAAs. Further evaluations of the RAAs are provided in Section 4 of this report.

### **3.1.3 GCL Landfill and North Slope Cap**

This option would include an asphalt and GCL cap for the landfill and a GCL cover for the northern slope of the landfill. This option would also include site access controls and deed restrictions described in the previous alternative. The landfill cap would consist of the following components from bottom to top:

- ❑ Existing gravel/fill cover ranging from two to eight feet across the landfill
- ❑ GCL cover
- ❑ Regraded material from existing gravel/fill cover ranging from nine to twelve inches
- ❑ Asphalt cover

The GCL portion of the cap would serve as the main barrier to direct contact for the top of the landfill and the southern, eastern, and western landfill boundaries. The gravel/fill layer and asphalt cover would serve as secondary barrier layers as well as a barrier protection layer for the GCL. The northern slope of the landfill would be covered with a GCL layer to eliminate the potential for direct contact to soil.

This option would also include site access controls and deed restrictions described in the previous option. The installation of a fence along the landfill northern slope would further reduce the possibility of trespasser exposure to constituents of concern. Deed and site activity restrictions would also be required for this option. These restrictions would need to be enforced by the current or future property owner.

Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the landfill, such as excavation, would be restricted unless specific personal protective equipment and other safety measures were in place.

**Effectiveness**

This option would be effective in meeting the site RAOs. Installing the asphalt and GCL cap on the landfill and GCL on the northern slope would effectively eliminate the potential for direct contact with landfill material. The installation of a fence would further limit site access and reduce the possibility to trespasser exposure to constituents of concern. The asphalt and GCL cap along with GCL on the northern slope would also reduce potential migration of constituents. The asphalt cap may also reduce the amount of rainfall infiltrating through the landfill, potentially further reducing the generation of landfill leachate. The deed and site restrictions would reduce potential exposure of current site workers and future property owners.

**Implementability**

The asphalt and GCL cap along with GCL on the northern slope could be implemented at the site with moderate disturbance. This option requires moderate disturbance of landfill materials; therefore, impacts to the current operations and local community would be higher than previous options. Clearing and grubbing would be required for the northern slope of the landfill, but the potential for disturbance of waste would be low. Future monitoring would be required to ensure that the asphalt cap, soil cover, and fence are in good condition. Asphalt maintenance would be expected to repair cracks or potholes. Asphalt re-paving may be required on portions of the asphalt cap depending on effects from traffic or weather. However, these repairs can be readily implemented. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

**Cost**

The cost for this option is moderate compared to the other options for the landfill. Costs would include installing an asphalt and GCL cap, GCL cover for the northern slope, fence along the landfill north slope, legal fees for deed modifications, and monitoring and maintenance of the fence and cap. Maintenance of the asphalt cap will be more costly than maintenance of the existing gravel cover.

**Summary**

This option will be retained for consideration for site-wide RAAs. Further evaluations of the RAAs are provided in Section 4 of this report.

**3.1.4 Landfill Material Removal**

This option for the landfill would remove waste and impacted soil from the landfill. The excavated material would be transported to an off-site disposal facility. Removal of the material would eliminate the potential for direct contact by trespassers or site workers. This option would not require site access controls or deed restriction described in the previous options because all the material would have been removed from the site. This option would require demolition of the existing Dobbins' building that is currently located on top of the landfill. After removal of material, the area would be brought back to existing grade, and the building would be potentially replaced.

**Effectiveness**

This option would be effective in meeting the site RAOs. Removal of the material would eliminate the potential for direct contact with wastes and surrounding soil exceeding the arsenic remedial action level. Migration of constituents would also be eliminated. Removal of the landfill material will also eliminate leachate production.

**Implementability**

This option would be the most difficult to implement at the site. This option requires extensive disturbance of landfill materials; therefore, current operations and local community would be negatively impacted. Extensive construction and demolition activities would require a significant amount of time to accomplish. Removal and excavation activities will also directly impact Dobbins' current operations. Sulfide odors generated during excavation would need to be controlled by odor suppression foams or other methods. Significant truck traffic through residential communities would also be expected for transporting the material to an off-site disposal facility.

**Cost**

The cost for this option is high compared to the other options for the landfill. Costs would include building demolition, excavation of fill and waste material, waste transport and disposal, and site restoration.

**Summary**

This option will be retained for consideration for site-wide RAAs. Further evaluations of the RAAs are provided in Section 4 of this report.

**3.2 Drainage Swale Technologies Screening**

Technologies evaluated for the drainage swale also focused on additional site controls, containment, and removal general response actions. In-situ and ex-situ treatment technologies were not evaluated for soil because the primary constituents of concern are metals, which can be stabilized or immobilized, but cannot be destroyed. Previous investigations have indicated the metals are already immobile and additional stabilization is not necessary to meet site objectives. Additionally, in-situ or ex-situ treatment would not remove or destroy the metals of concern; therefore, the potential for direct contact would not be eliminated.

For containment response actions, the primary technologies applicable for the swale were also caps and covers. The swale is presently providing stormwater runoff control for approximately 17 acres upgradient of the landfill. The current property owner has expressed an interest in using the eastern portion of the drainage swale for future storage operations. Therefore, options considered should also be consistent with this potential future use for this portion of the swale.

Based on these considerations, the following technologies were evaluated for the drainage swale soil:

- Site access controls and deed restrictions
- Soil cover and erosion control blanket

- ❑ Drainage swale removal and off-site disposal

### 3.2.1 Site Access Controls and Deed Restrictions

This option for the drainage swale would utilize site access controls and deed restrictions to further reduce the potential for direct contact by trespasser and site workers. These restrictions would need to be enforced by the current or future property owner. Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the drainage swale, such as excavation, would be restricted unless specific personal protective equipment and other safety measures were in place.

#### Effectiveness

This option would not be effective in meeting the site RAOs. Dense vegetation and steep slopes currently limit potential exposure in the drainage swale. However, the topography of this area would make it difficult to install and maintain site access controls, such as fencing.

#### Implementability

This option requires minimal disturbance of the swale; therefore, impacts to the current operations or local community would be minimal. Future monitoring would be required to ensure that the fence remains in good condition. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

#### Cost

The cost for this option is low compared to the other options for the drainage swale. Costs would include installation of the fence, legal fees for deed modifications, and monitoring and maintenance for the fence.

#### Summary

This option will not be retained for evaluation of site-wide RAAs because it is not effective in meeting site RAOs. Further evaluations of the RAAs are provided in Section 4 of this report.

### 3.2.2 Soil Cover and Erosion Control Blanket

This option for the drainage swale would include a soil cover for approximately 300 feet of the eastern swale portion and an erosion control blanket for the entire length of the swale. The soil cover and erosion control blanket would provide a barrier to the constituents of concern in the swale soil. This cover material would further reduce the potential for direct contact by trespassers and site workers with drainage swale soil. This option would also include site access controls and deed restrictions described in the previous option. The installation of a fence would further reduce the possibility of trespasser exposure to constituents of concern in the drainage swale. Deed and site activity restrictions would also be required for this option. These restrictions would need to be enforced by the current or future property owner. Deed restrictions would include maintaining the commercial use designation of the property and prohibiting future

residential use of the property. Site activities within the swale, such as excavation, would be restricted unless specific personal protective equipment and other safety measures were in place.

### **Effectiveness**

This option would be moderately effective in meeting the site RAOs. Installing the soil cover and erosion control blanket would effectively reduce the potential for direct contact with drainage swale soil. The installation of a fence would further reduce the possibility of trespasser exposure to constituents of concern. However, dense vegetation and steep slopes currently limit potential exposure in the drainage swale. The topography of this area would make it difficult to install and maintain site access controls such as fencing. The deed and site restrictions would reduce the potential exposure of current site workers and future property owners.

### **Implementability**

This option requires minimal disturbance of soil, therefore impacts to the current operation or local community would be minimal. Future monitoring would be required to ensure that the soil cover, erosion control blanket, and fence are in good condition. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

### **Cost**

The cost for this option is moderate compared to the other options for the drainage swale. Costs would include the fence, soil cover and erosion control blanket installation, legal fees for deed modifications, and monitoring and maintenance for the cover and fence.

### **Summary**

This option will not be retained for evaluation of site-wide RAAs because it is only moderately effective in meeting the site RAOs. Further evaluations of the RAAs are provided in Section 4 of this report.

## **3.2.3 Drainage Swale Removal and Off-site Disposal**

This option for the drainage swale would include removal of soil within the topographic boundaries of the drainage swale and to a vertical depth with arsenic levels below the 95% UCL. The excavated soil would be transported to an off-site disposal facility. Clean fill would be placed in the drainage swale to achieve existing grades. Removal of the drainage swale material would eliminate the potential for direct contact by trespassers and site workers. This option would not require site access controls or deed restrictions described in the previous options because all the materials would have been removed from the site.

### **Effectiveness**

This option would be highly effective within the topographic boundaries of the drainage swale. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and

backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure. Migration of constituents would also effectively be eliminated.

### **Implementability**

This option would be moderately difficult to implement at the site. This option does require fairly aggressive site clearing and excavation activities. However, unlike excavation of the landfill material, these activities could be implemented with minor impacts on site operations and the local community. A temporary gravel road would likely be needed to allow access to the excavation area. Additionally, moderate truck traffic through residential communities would also be expected for transporting the material to an off-site disposal facility.

### **Cost**

The cost for this option is high compared to the other options for the drainage swale. Costs would include excavation of the drainage swale soil, soil transport and disposal, and site restoration.

### **Summary**

This option will be retained for consideration for site-wide RAAs. Further evaluations of the RAAs are provided in Section 4 of this report.

## **3.3 Landfill Leachate**

The landfill leachate is currently collected on-site and transported via tanker trucks to an off-site POTW. The quantity of leachate generated is proportional to the amount of rainfall that infiltrates through the landfill. An economic comparison indicated off-site disposal was preferable over on-site treatment for average leachate flow rates less than 2 gallons per minute (1,051,200 gallons per year). Based on data for the existing collection system, the average flow rate is 0.49 gallons per minute since January 2001 with approximately 26 inches of annual rainfall over this period. Average annual rainfall for this portion of western New York is 35.3 inches per year. Assuming leachate generation rates would be proportional to existing data, this would equate to approximately 300,000 gallons per year. Therefore, off-site disposal is still the preferred option for leachate. Continuation of this system will be considered for development of the site-wide RAAs.

## **4.0 DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES (RAAS)**

This part of the evaluation process provides a detailed analysis of site-wide RAAs. The RAAs were developed by combining technologies retained in the technology screening process described in Section 3. The RAAs developed for the detailed analysis are as follows:

- ❑ RAA1—Landfill Cover (Existing Gravel), GCL Cover for Northern Slope, and Drainage Swale Removal
- ❑ RAA2—Landfill Cap (Asphalt), GCL Cover for Northern Slope, and Drainage Swale Removal
- ❑ RAA3—Landfill Cap (Asphalt/GCL), GCL Cover for Northern Slope, and Drainage Swale Removal
- ❑ RAA4—Landfill and Drainage Swale Removal

RAA1, RAA2, and RAA3 also include site access controls and continued operation of the leachate collection system. RAA4 does not include site access controls or operation of the leachate collection system because all of the material would have been removed from the site.

For the detailed analysis, each RAA was evaluated against the following criteria:

- ❑ Overall protection of human health and the environment (ability to meet RAOs)
- ❑ Compliance with New York SCGs
- ❑ Short-term effectiveness
- ❑ Long-term effectiveness
- ❑ Reduction of toxicity, mobility, and volume
- ❑ Implementability
- ❑ Cost

The following sections describe the components of each RAA and present the detailed analysis against each evaluation criteria for each RAA. Once the alternatives have been individually assessed against the seven evaluation criteria, a comparative analysis will be conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis of alternatives is presented in Section 5 of this report.

## **4.1 RAA1—Landfill Cover (Existing Gravel), GCL Cover for Northern Slope, and Drainage Swale Removal**

To further reduce the potential for direct contact by trespassers and site workers, this RAA would include the existing gravel cover for the landfill, a GCL cover for the north slope of the landfill, removal of the drainage swale soil, utilization of site access controls, and the use of deed restrictions to further reduce the potential for direct contact by trespassers and site workers (See Figure 9). The existing leachate collection system would also be maintained as part of this RAA. Site access controls would include a fence along the northern slope of the landfill area with continued maintenance of the existing landfill fill/gravel cover. The existing fill and gravel cover on the landfill would continue to function as the main barrier to direct contact. The existing cover is adequate for the top of the landfill and the southern, eastern, and western landfill boundaries. However, the northern slope of the landfill would be covered with a GCL cover to eliminate the potential for direct contact to soil above the arsenic background level in this area. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure.

The installation of a fence would further reduce the possibility of trespasser exposure to constituents of concern within the landfill. Deed and site activity restrictions would also be required for this RAA. These restrictions would need to be enforced by the current or future property owner. Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the landfill, such as excavation, would be restricted unless personal protective equipment and other safety measures were in place.

### **4.1.1 Protection of Human Health and the Environment**

This RAA will protect human health and the environment and achieve the RAOs established for the site. As previously mentioned, the current condition of the landfill poses a low potential for direct contact exposure. Site access controls and deed restrictions will further reduce the potential for direct contact exposure. The existing landfill cover and GCL cover on the northern slope would further reduce the potential for contact with landfill materials. The security fence along the northern boundary of the landfill reduces the likelihood of exposure by trespassers and site workers. The GCL cover on the northern slope of the landfill will further minimize potential for direct contact exposure of trespassers. Maintaining the existing fill/gravel cover and installing the GCL cover on the northern slope of the landfill would also reduce potential migration of constituents. The removal of the drainage swale material will prevent contaminant migration and eliminate the potential for direct contact exposure to drainage swale material. Maintaining the existing leachate collection system would control direct contact with leachate and migration of leachate. The deed and site restrictions would reduce the potential for exposure of current site workers and future property owners.

#### **4.1.2 Compliance with New York SCGs**

New York State SCGs potentially applicable to this RAA are presented in Table 1. Remedial activities proposed for this RAA will comply with the SCGs in Table 1, except for TAGM # 4046. This alternative will allow some material within the landfill to remain in place with constituents above background concentrations and TAGM # 4046 soil cleanup guidelines. However, exposure to the constituents of concern will be controlled and reduced by maintaining existing and new site covers and restricting access to areas of concern. As described in Section 3, design equivalents or variances to Part 360 would be required to facilitate site operations. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure.

#### **4.1.3 Short-term Effectiveness**

This alternative requires minimal disturbance of landfilled materials and the short-term impacts to the workers or the community would be minimal. The removal of drainage swale material does require fairly aggressive site clearing and excavation activities. All contractor personnel will be required to wear the appropriate level of personal protection equipment to correspond with the level of exposure. Air monitoring and dust controls could be implemented to ensure that the surrounding residential properties are not exposed to dust from construction activities. The site work could also cause a short period of low impact noise disruptions to the immediate surrounding areas during construction activities.

#### **4.1.4 Long-term Effectiveness and Permanence**

This alternative would require long-term monitoring and maintenance to ensure that the remedial actions are effective. The site cover and fence would require routine inspections to ensure that they remain in good condition. The existing cover has been maintained in good condition by the current owner and is not expected to significantly degrade in the future. Leachate collection will require labor and materials to maintain functional operation of the system.

#### **4.1.5 Reduction of Toxicity, Mobility, and Volume**

This alternative would reduce the volume of contaminants in soil at the site by the removal of the drainage swale material. Also, this RAA will reduce the potential for direct contact to landfilled material. Maintaining the existing and new covers will also reduce mobility of constituents. The volume of leachate has been significantly reduced by the sewer diversion remedial action. Operation of the leachate collection system will continue to control migration of leachate.

#### **4.1.6 Implementability**

Implementation of this alternative does not pose any significant technical difficulties. Implementation of deed restrictions for future site use is administratively feasible.

Fencing and installation of the GCL cover on the northern slope can be accomplished with standard construction practices. Clearing and grubbing would be required for the northern slope of the landfill and drainage swale, but the potential for any disturbance of waste material would be minimal. The removal of the drainage swale does require fairly aggressive excavation activities. However, unlike excavation of landfilled material, these activities could be implemented with minor impacts on site operations and the local community. Future monitoring would be required to ensure that the cover and fence are in good condition. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

#### **4.1.7 Cost**

The present worth cost for this alternative is estimated at \$808,426. The capital cost to implement this alternative is estimated at \$367,656. Annual operation and maintenance costs are estimated at \$54,719. Refer to Table 2 for a detailed cost estimate of this RAA.

## **4.2 RAA2 – Landfill Cap (Asphalt), GCL Cover for Northern Slope, and Drainage Swale Removal**

This RAA would include an asphalt cap for the landfill, a GCL cover for the northern slope of the landfill, and removal of the drainage swale (see Figure 10). This alternative would also include the leachate collection system and site access controls and deed restrictions described in the previous alternative. The asphalt cap would serve as the main barrier to direct contact for the top of the landfill and the southern, eastern, and western landfill boundaries. The existing gravel cover would serve as a secondary barrier layer. As with the previous RAA, the northern slope of the landfill would be covered with a GCL layer to eliminate the potential for direct contact. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure.

The installation of a fence along the northern slope of the landfill would also reduce the possibility of trespasser exposure to constituents of concern. Deed and site activity restrictions would also be required for this option. These restrictions would need to be enforced by the current or future property owner. Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the landfill, such as excavation, would be restricted unless specific personal protective equipment and other safety measures were in place.

### **4.2.1 Protection of Human Health and the Environment**

This RAA will protect human health and the environment and achieve the RAOs established for the site. As previously mentioned, the current condition of the landfill and drainage swale pose a low potential for direct contact exposure. The asphalt cap would reduce the potential for contact with landfill material. Site access controls and

restrictions would further reduce the potential for direct contact exposure. The security fence along the northern boundary of the landfill reduces the likelihood of exposure for trespassers and site workers. Installing the asphalt landfill cap and GCL cover on the northern slope would also reduce potential migration of constituents. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure. Maintaining the existing leachate collection system would control direct contact with leachate and migration of leachate. The deed and site restrictions would reduce the potential for exposure of current site workers and future property owners.

#### **4.2.2 Compliance with New York SCGs**

New York State SCGs potentially applicable to this RAA are presented in Table 1. Remedial activities proposed for this RAA will comply with the SCGs in Table 1, except for TAGM # 4046. This alternative will allow some landfilled material to remain in place with constituents above background concentrations and TAGM # 4046 soil cleanup guidelines. However, exposure to the constituents of interest will be controlled and reduced through installation of asphalt landfill cap and GCL cover on the northern slope. As described in Section 3, design equivalents or variances to Part 360 would be required to facilitate site operations. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure.

#### **4.2.3 Short-term Effectiveness**

This alternative requires minimal disturbance of landfilled material and short-term impacts to the workers or the community would be minimal. The removal of drainage swale material does require fairly aggressive site clearing and excavation activities. All contractor personnel will be required to wear the appropriate level of personal protection equipment to correspond with the level of exposure. Air monitoring and dust controls could be implemented to ensure that the surrounding residential properties are not exposed to dust from construction activities. The site work could also cause a short period of low impact noise disruptions to the immediate surrounding areas during construction activities.

#### **4.2.4 Long-term Effectiveness and Permanence**

The construction of an asphalt landfill cap and GCL cover on the northern slope will reduce the potential for direct contact exposure to landfill material. The long-term integrity of a cap system is proven and reliable. However, this alternative would require long-term monitoring and maintenance to ensure that the remedial actions remain effective. The asphalt cap and fence would require routine inspections to ensure that they remain in good condition. Asphalt paving may require maintenance over time to repair cracks or potholes. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic

95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure. Leachate collection will require labor and materials to maintain functional operation of the system.

#### **4.2.5 Reduction of Toxicity, Mobility, and Volume**

This alternative would reduce the volume of contaminants in soil at the site by the removal of the drainage swale material. Also, this RAA will significantly reduce the potential for direct contact to landfill material and drainage swale material within the natural topographic boundaries. The asphalt cap will also significantly reduce mobility of constituents. The volume of leachate has been significantly reduced by the sewer diversion remedial action. The asphalt cap is also expected to further reduce the amount of rainfall infiltration through the landfill, thereby reducing volume of leachate generated. Operation of the leachate collection system will continue to control migration of leachate.

#### **4.2.6 Implementability**

Implementation of this alternative does not pose any significant technical difficulties. The fence, asphalt cap, and GCL cover can be installed with common construction methods and materials. Construction could be accomplished in a period of approximately 1 to 3 months. Clearing and grubbing would be required for the northern slope of the landfill and drainage swale, but the potential for disturbance of waste would be low. The removal of the drainage swale does require fairly aggressive excavation activities. However, unlike excavation of the landfill material, these activities could be implemented with minor impacts on site operations and the local community. Future monitoring would be required to ensure that the cover and fence remain in good condition. Implementation of deed restrictions for future site use is administratively feasible. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

#### **4.2.7 Cost**

The present worth cost for this alternative is estimated at \$1,028,637. The capital cost to implement this alternative is estimated at \$645,008. Annual operation and maintenance costs are estimated at \$47,625. Refer to Table 3 for a detailed cost estimate of this RAA.

### **4.3 RAA3 – Landfill Cap (Asphalt/GCL), GCL Cover for Northern Slope, and Drainage Swale Removal**

This RAA would include an asphalt and GCL cap for the landfill, a GCL cover for the northern slope of the landfill, and removal of the drainage swale (see Figure 11). This alternative would also include the leachate collection system and site access controls and deed restrictions described in the previous alternative. The landfill cap will consist of the following components from bottom to top:

- ❑ Existing gravel/fill cover ranging from two to eight feet across the landfill

- ❑ GCL cover
- ❑ Regraded material from existing gravel/fill cover ranging from nine to twelve inches
- ❑ Asphalt cover

The GCL would serve as the barrier to direct contact for the top of the landfill and the southern, eastern, and western landfill boundaries. The regraded gravel/fill layer and asphalt cap would serve as secondary barrier layers and as barrier protection layers for the GCL. As with the previous RAA, the northern slope of the landfill would be covered with a GCL layer to eliminate the potential for direct contact. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure.

The installation of a fence along the northern slope of the landfill would also reduce the possibility of trespasser exposure to constituents of concern. Deed and site activity restrictions would also be required for this option. These restrictions would need to be enforced by the current or future property owner. Deed restrictions would include maintaining the commercial use designation for the property and prohibiting future residential use of the property. Site activities within the landfill, such as excavation, would be restricted unless specific personal protective equipment and other safety measures were in place.

#### **4.3.1 Protection of Human Health and the Environment**

This RAA will protect human health and the environment and achieve the RAOs established for the site. As mentioned previously, the current condition of the landfill and drainage swale pose a low potential for direct contact exposure. The asphalt/GCL cap on the landfill and GCL cover on the northern slope would reduce the potential for contact with landfill material. Site access controls and restrictions associated with this alternative action would further reduce the potential for direct contact exposure. The security fence along the northern boundary of the landfill reduces the likelihood of exposure for trespassers and site workers. Installing the new landfill cap and covers would also reduce potential migration of constituents. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure. Maintaining the existing leachate collection system would control direct contact with leachate and migration of leachate. The deed and site restrictions would reduce the potential for exposure of current site workers and future property owners.

#### **4.3.2 Compliance with New York SCGs**

New York State SCGs potentially applicable to this RAA are presented in Table 1. Remedial activities proposed for this RAA will comply with the SCGs in Table 1, except for TAGM # 4046. This alternative will allow some landfilled material to remain in place with constituents above background concentrations and TAGM # 4046 soil cleanup

guidelines. However, exposure to the constituents of interest will be controlled and reduced through installation of asphalt/GCL cap and GCL cover on the northern slope. As described in Section 3, design equivalents or variances to Part 360 would be required to facilitate site operations. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure.

#### **4.3.3 Short-term Effectiveness**

This alternative requires moderate disturbance of landfilled material and creates short-term impacts to the workers or the community. The regrading of the existing gravel/fill cover and installation of the asphalt/GCL cap and GCL cover on the northern slope will result in slightly more short-term impacts due to increased construction activities compared to RAA1 and RAA2. The removal of drainage swale material does require fairly aggressive site clearing and excavation activities. All contractor personnel will be required to wear the appropriate level of personal protection equipment to correspond with the level of exposure. Air monitoring and dust controls could be implemented to ensure that the surrounding residential properties are not exposed to dust from construction activities. The site work could also cause a short period of low impact noise disruptions to the immediate surrounding areas during construction activities.

#### **4.3.4 Long-term Effectiveness and Permanence**

The construction of an asphalt/GCL cap and GCL cover on the northern slope will reduce the potential for direct contact exposure to landfill material exceeding background arsenic levels. The long-term integrity of a cap system is proven and reliable. However, this alternative would require long-term monitoring and maintenance to ensure that the remedial actions remain effective. The asphalt cap and fence would require routine inspections to ensure that they remain in good condition. Asphalt paving may require maintenance over time to repair cracks or potholes. Removal of material within the topographic boundaries of the drainage swale to a vertical depth resulting in arsenic levels below the calculated arsenic 95% UCL and backfilling to the original grade with clean soil would eliminate the potential for direct contact exposure. Leachate collection will require labor and materials to maintain functional operation of the system.

#### **4.3.5 Reduction of Toxicity, Mobility, and Volume**

This alternative would reduce the volume of contaminants in soil at the site by the removal of the drainage swale material. The asphalt/GCL cap will also significantly reduce mobility of constituents. The volume of leachate has been significantly reduced by the sewer diversion remedial action. The asphalt cap/GCL is also expected to further reduce the amount of rainfall infiltration through the landfill, thereby reducing volume of leachate generated. Operation of the leachate collection system will continue to control migration of leachate.

#### **4.3.6 Implementability**

The fence, asphalt/GCL cap, and GCL cover for the northern slope can be installed with common construction methods and materials. However, the construction duration could be completed in a period of approximately 3 to 5 months, which is slightly longer than RAA1 and RAA2. Clearing and grubbing would be required for the northern slope of the landfill and drainage swale, but the potential for disturbance of waste would be low. The removal of the drainage swale does require fairly aggressive excavation activities. Future monitoring would be required to ensure that the cover and fence remain in good condition. Implementation of deed restrictions for future site use is administratively feasible. The deed and site restrictions would need to be enforced by the current or future property owners. This would require legal restrictions within the existing deed and any future deeds for the property.

#### **4.3.7 Cost**

The present worth cost for this alternative is estimated at \$1,179,750. The capital cost to implement this alternative is estimated at \$796,121. Annual operation and maintenance costs are estimated at \$47,625. Refer to Table 4 for a detailed cost estimate of this RAA.

### **4.4 RAA4—Landfill and Drainage Swale Removal**

This RAA would remove material from the landfill and drainage swale (see Figure 12). The excavated material would be transported to an off-site disposal facility. Removal of the material would eliminate the potential for direct contact by trespassers or site workers. This alternative would not require site access controls or deed restrictions described for the previous RAAs because all the material would have been removed from the site. The current leachate collection system would also be shut down due to the removal of landfill material. Removal and excavation activities will directly impact the current Dobbins operations. This RAA would require demolition of the existing Dobbins' building that is currently located on top of the landfill. After removal of material, the landfill and drainage swale areas would be brought back to existing grade, and the building would potentially be replaced.

#### **4.4.1 Protection of Human Health and the Environment**

This RAA will protect human health and the environment and achieve the RAOs established for the site. Removal of landfill materials and impacted soil will eliminate the potential for direct contact exposure. Potential migration of constituents would be eliminated. Potential migration and direct exposure to leachate would also be eliminated.

#### **4.4.2 Compliance with New York SCGs**

New York State SCGs potentially applicable to this RAA are presented in Table 1. Remedial activities proposed for this RAA will comply with the SCGs in Table 1. The most relevant SCGs for implementing this alternative are the TAGM #4046 soil cleanup guidelines. This alternative will remove soil and landfill material above background concentrations and TAGM # 4046 guidelines for constituents of concern. Disposal of the

material in an off-site non-hazardous landfill would comply with New York Solid and Hazardous Waste regulations.

#### **4.4.3 Short-term Effectiveness**

This RAA would cause the most significant short-term impacts of all the alternatives considered. This alternative requires extensive disturbance of waste materials; therefore, current operations and the local community would be negatively impacted. Removal and excavation activities will directly impact Dobbins' current operations. All contractor personnel will be required to wear the appropriate level of personal protection equipment to correspond with the level of exposure. Sulfide odors generated during excavation would need to be controlled by odor suppression foams or other methods to ensure that impacts on the local community are reduced. Significant truck traffic through residential communities would also be expected for transporting the material to an off-site disposal facility. Noise from construction vehicles during remediation may also negatively impact local residents.

#### **4.4.4 Long-term Effectiveness and Permanence**

Removal of landfill material and impacted soil would eliminate direct contact exposure and migration of constituents of concern. There is no long-term monitoring or maintenance activities associated with this alternative.

#### **4.4.5 Reduction of Toxicity, Mobility, and Volume**

This alternative will eliminate the volume of landfill material and impacted soil on-site through excavation and off-site disposal. Leachate volume would also be eliminated by removal of the landfill material.

#### **4.4.6 Implementability**

This RAA would be the most difficult to implement at the site. This alternative will require the excavation of approximately 25,500 cubic yards of landfill and drainage swale material. Extensive construction and demolition activities would require a significant amount of time to accomplish. This removal alternative would be completed within approximately 5 to 9 months. The extent of the landfill includes an area under an existing Dobbins building and an area bordering another existing Dobbins building. Removal and excavation procedures will directly impact the current Dobbins operations and the use of this area during construction. Clearing and grubbing will also be required to implement removal activities. Sulfide odors produced during periods of excavation could also negatively impact the local community. Other potential community impacts include a prolonged construction period, construction noise, and truck traffic increase. There are no other administrative requirements that would restrict implementation of this RAA. There are several non-hazardous and hazardous landfills available that can manage the expected material volumes from this RAA.

#### **4.4.7 Cost**

The present worth cost for this alternative is estimated at \$5,648,432. The capital cost to implement this alternative is estimated at \$5,648,432. There are no annual operation and maintenance costs associated with this alternative. Refer to Table 5 for a detailed cost estimate of this RAA.

## 5.0 COMPARATIVE ANALYSIS OF RAAS

This section presents a comparative analysis of the relative performance of each alternative in relation to each specific evaluation criteria. This comparative analysis identifies the advantages and disadvantages of each alternative for each criterion. A summary of the comparative analysis is provided in Table 6.

### 5.1 Protection of Human Health and the Environment

All of the proposed remedial action alternatives are protective of human health and the environment and meet one or all of the remedial action objectives for the site. RAA1 meets the remedial action objectives by preventing direct contact exposure with the existing landfill cover, GCL cover on the north slope, and drainage swale removal. The potential for direct contact is also reduced by access and deed restrictions for RAA1, RAA2, and RAA3. RAA2, RAA3, and RAA4 meet the remedial action objectives by preventing direct contact exposure and reducing potential migration of impacted material. Landfill material will remain on-site for RAA1, RAA2, and RAA3; however, all of these RAAs will effectively isolate and contain the landfill material thereby increasing the overall protection of human health and the environment. RAA1, RAA2, and RAA3 will control migration of leachate with continued operation of the leachate collection system. Implementation of RAA4 will eliminate the potential for direct contact and migration of constituents of concern by removal of impacted material. However, RAA4 presents potential short-term impacts to the local community and on-site workers.

### 5.2 Compliance with New York SCGs

RAA4 will remove all materials exceeding TAGM #4046 cleanup guidelines. RAA1, RAA2, and RAA3 will leave some landfill material on-site exceeding the TAGM #4046 cleanup guidelines. However, RAA1, RAA2, and RAA3 include components to reduce potential direct contact exposure and migration pathways by capping or covering landfill material and removing material in the drainage swale. As described in Section 3, design equivalents or variances to Part 360 would be required to facilitate site operations. All the RAAs could be accomplished in compliance with all other applicable SCGs.

### 5.3 Short-term Effectiveness

Implementation of RAA4 will result in significant short-term impacts to the community due to increased truck traffic, prolonged construction noise, and potential odors. Implementation of RAA1 will result in minimal short-term impacts to the community due to the north slope GCL cover, fence installation, and drainage swale removal. RAA2 and RAA3 incorporate all components of RAA1 along with an asphalt cap or an asphalt and GCL cap, which will result in some short-term impacts to the community due to the increased truck traffic and potential construction noise.

## 5.4 Long-term Effectiveness and Permanence

RAA4 provides the most permanent and effective long-term remedy through removal of impacted material and soil. RAA4 does not require any long-term monitoring or maintenance. RAA1, RAA2 and RAA3 employ reliable and proven capping and covering methods to achieve the remedial action objectives. With proper maintenance, the caps and covers can be extremely effective in achieving the remedial action objectives for a substantial time period. In addition, drainage swale removal, site access controls, and deed restrictions used for RAA1, RAA2, and RAA3 will further reduce the potential exposure. The leachate collection system required for RAA1, RAA2, and RAA3 can also be easily maintained to ensure continued effectiveness in controlling leachate migration.

## 5.5 Reduction of Toxicity, Mobility, and Volume

RAA4 effectively reduces the toxicity, mobility, and volume of the impacted material by removal activities. RAA1 results in a reduction of mobility with the existing landfill cover, GCL cover for the northern slope, and removal of the drainage swale. RAA2 results in a substantial reduction of the mobility with the asphalt cap, GCL cover for the northern slope of landfill, and removal of the drainage swale. RAA3 also results in a substantial reduction of the mobility with the asphalt and GCL cap, GCL cover for the northern slope of landfill, and removal of the drainage swale. RAA1, RAA2, and RAA3 effectively isolate and contain landfill material to reduce direct contact exposure.

## 5.6 Implementability

All the RAAs can be implemented with standard engineering and construction practices. However, RAA4 would be the most difficult alternative to implement and would cause significant short-term impacts to site operations and the local community. Access and deed restrictions required for RAA1, RAA2, and RAA3 can be accomplished through the legal process.

## 5.7 Cost

The lowest cost alternative is RAA1 with an estimated present worth cost of \$808,426. The highest cost alternative is RAA4 with an estimated present worth cost of \$5,648,432. The present worth cost estimate of RAA2 is \$1,028,637, which is over five times lower than the cost for RAA4.

For alternative comparison purposes, these costs do not include past costs to implement remedial actions at the site. Past costs include evaluations, design, and construction for the leachate remedial actions (approximately \$450,000) and operation of the leachate collection system (approximately \$290,000 from January 2001 through August 2003).

## 6.0 RECOMMENDATION OF RAA

Based on the comparison of remedial action alternatives presented in Sections 4 and 5, RAA2—Landfill Cap (Asphalt) and Drainage Swale Removal is the recommended alternative for the site. This alternative provides an effective remedy with the best balance for all the evaluation criteria. This RAA includes:

- ❑ An asphalt cap and GCL cover (north slope) for the landfill
- ❑ Removal of soil in the drainage swale
- ❑ Continued operation of the leachate collection and disposal system
- ❑ Site fencing along the northern slope of the landfill
- ❑ Site access and deed restrictions

RAA2 can be implemented quickly with immediate benefits to the site. Implementation of this alternative will increase overall protection of human health and the environment by preventing direct contact exposure to landfill material and drainage swale soil. This alternative accomplishes the site remedial action objectives with minimal potential short-term impacts to on-site workers and the local community. RAA2 is also cost effective and provides a reasonable level of protectiveness at a cost that is over five times lower than the estimated cost for the removal alternative (RAA4).

## 7.0 REFERENCES

- DuPont Corporate Remediation Group (CRG). 2003. *Soil Delineation Sampling Report, DuPont, Lyndonville, West Avenue Site, Lyndonville, New York.*
- \_\_\_\_\_. 2001. Supplemental Remedial Investigation Report, Lyndonville – West Avenue Site, Lyndonville, New York.
- \_\_\_\_\_. 1999. SRI/FFS Work Plan, Lyndonville-West Avenue Site, Lyndonville, New York.
- \_\_\_\_\_. 1998. Supplemental Environmental Assessment Report, Lyndonville – West Avenue, Lyndonville, New York.
- \_\_\_\_\_. 1994. Site Remediation Using Geomembranes and Geosynthetic Clay Liners for Barrier System Construction.
- New York State Department of Environmental Conservation (NYSDEC). 2003. Letter dated May 30, 2003 from David Pratt of NYSDEC to Robert Genau of DuPont Corporate Remediation Group.
- \_\_\_\_\_. 2002. Letter dated July 23, 2002 from David Pratt of NYSDEC to Robert Genau of DuPont Corporate Remediation Group.
- \_\_\_\_\_. 1994. *Technical and Administrative Guidance Memorandum (TAGM) #4046 Description of Soil Cleanup Objectives and Cleanup Levels.*
- \_\_\_\_\_. 1990. Technical and Administrative Guidance Memorandum (TAGM) #4030 Selection of Remedial Actions at Inactive Hazardous Waste Sites.
- Daniel, David. Geosynthetic Clay Liners (GCLs) in Landfill Covers. The Thirty-First Annual Solid Waste Exposition, The Solid Waste Association of America, San Jose, California, 1993.

## **TABLES**

## FIGURES

## **APPENDICES**