FINAL REVISION

Draft Environmental Impact Statement

Amsterdam Materials Recycling Project
Edson Road
City of Amsterdam, Montgomery County, New York

Lead Agency:
Amsterdam Industrial Development Agency (AIDA)
Amsterdam City Hall
61 Church Street
Amsterdam, New York 12010

February 20, 2007

Project Sponsor:

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Troy, New York 12182

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VOLUME 3
APPENDICES D-K

Appendix D
Wetlands Delineation Report

Wetland Delineation Report

Amsterdam Materials Recycling

City of Amsterdam

Montgomery County, New York

December 2003

THE Chazen COMPANIES

Prepared for:

Amsterdam Recycling, LLC

Wetland Delineation Report

Amsterdam Materials Recycling

City of Amsterdam

Montgomery County, New York

THE Chazen COMPANIES

Prepared by:

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1.0 INTRODUCTION

This wetland delineation was prepared for Amsterdam Recycling Material, L.L.C. The project site will consist of a 39± acre parcel of land in the Edson Industrial Park (AIDA) in the City of Amsterdam. The AIDA's industrial park is located north of NYS Route 5 and the Mohawk River, in the southeast corner of the City of Amsterdam, West of County Route 8 (Widow Susan Drive) and south and east of NYS Route 67. The project bounds lie in the City of Amsterdam, Montgomery County, New York. Figure 1, "Site Location Map," illustrates the site on the USGS Amsterdam, Topographic Quadrangle.

2.0 EXISTING CONDITIONS

2.1 Topography

The project area is located approximately 310 to 440 feet above sea level. The highest elevations occur along the northern project boundary and slope down toward the southern property boundary reaching its lowest points at points where an active rail line abuts the southern project boundary. The southern third of site is very steep. Elevations decrease from 400 to 310 feet with in the last third of the site.

Three ravines transect the site and are oriented north to south. Small, intermittent streams flow through these ravines toward the Mohawk River. The ravines are steeply sloped, in some areas obtaining a sloped bank of 60 degrees or more. Figure 1, "Site Location Map," depicts the topography on site as it is sourced from the Amsterdam USGS Topographic Quadrangle.

2.2 Soils

According to the Montgomery County Soil Survey, the site contains four soil mapping units within its bounds as illustrated on Figure 2, "Soil Survey." The following section provides a description of these soils.

Darien silt loam, 3 to 8 percent slopes (DaB) and 8 to 15 percent slopes (DaC): The Darien series consists of very deep, somewhat poorly drained soils formed in Wisconsinan age till on till plains and moraines. This soil is listed in New York State as having the potential for hydric inclusions. A typical profile for Darien soils may appear as:

> **Ap**-- 0 to 9 inches, very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable;

many fine roots; 10 percent rock fragments dominated by shale; slightly acid; abrupt smooth boundary. (6 to 12 inches thick.)

Eg-- 9 to 11 inches, grayish brown (2.5Y 5/2) silt loam; weak fine subangular blocky structure; friable; common fine roots; common distinct light olive brown (2.5Y 5/6) masses of iron accumulation within the matrix; 10 percent rock fragments dominated by shale; slightly acid; clear wavy boundary. (0 to 7 inches thick.)

Bt1-- 11 to 19 inches, olive brown (2.5Y 4/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky structure; firm; grayish brown (2.5Y 5/2) ped faces; common discontinuous grayish brown (2.5Y 5/2) clay films on all faces of peds; few fine and common medium roots; many medium distinct dark yellowish brown (10YR 4/4) and light olive brown (2.5Y 5/6) masses of iron accumulation within the matrix; common medium distinct grayish brown (2.5Y 5/2) iron depletions in the matrix; 10 percent rock fragments dominated by shale; neutral; gradual wavy boundary.

Lansing Silt Loam, 15 to 25 percent slopes (LaD): The Lansing series consists of very deep, well drained soils formed in till. They are nearly level to rolling and steep soils on till plains. This soil is not listed as either a hydric soil or a soil with the potential for hydric inclusions. A typical profile for Lansing soils may appear as:

Ap-- 0 to 6 inches; dark grayish brown (10YR 4/2) gravelly silt loam; moderate medium and fine granular structure; friable; many fine and medium roots; 15 percent rock fragments; slightly acid; abrupt smooth boundary. (6 to 11 inches thick.)

BE-- 6 to 17 inches; yellowish brown (10YR 5/4) gravelly silt loam; weak fine and medium subangular blocky structure; friable; many fine and common medium roots; many fine pores; 10 percent brown (10YR 4/3) interiors of peds; few dark grayish brown (10YR 4/2) vertical worm casts in upper part; 20 percent rock fragments; moderately acid; gradual irregular boundary. (2 to 12 inches thick.)

Lansing Mohawk Silt Loam, very steep (LMF): This soil complex has areas of entirely Lansing soils and entirely Mohawk soils and combinations of both. Sizes range from a few acres to over 20 acres. This soil is highly erodable and contains numerous areas where streams carved ravines as they flow toward the Mohawk River. Neither the Lansing nor the Mohawk Soils are listed as either hydric soils or soils with the potential for hydric inclusions.

Lansing soils are previously described above.

Mohawk soils: The Mohawk series consists of very deep, well drained soils with a dark surface layer. These soils formed in till with a high component of black or dark gray shale. These soils are on glaciated upland foot slopes and along the toee of slopes.

Ap-- 0 to 8 inches; very dark grayish brown (10YR 3/2) moist and crushed or broken, grayish brown (10YR 5/2) dry and crushed, silt loam; strong medium and fine granular structure; friable; many roots; slightly acid; clear smooth boundary. (6 to 9 inches thick.)

BA-- 8 to 11 inches; brown (10YR 4/3) uncrushed, brown (10YR 5/3) crushed, pale brown (10YR 6/3) crushed and dry; silt loam; moderate fine subangular blocky structure; friable; many fine tubular vertical pores without clay linings; many fine and common medium roots; peds have distinct pressure faces but no clay films; many earthworm channels; slightly acid; gradual wavy boundary. (6 to 14 inches thick.)

Bw-- 11 to 19 inches; brown (10YR 4/3) crushed, silt loam; strong fine subangular blocky structure; friable; peds have very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1) faces without apparent clay films; many fine roots penetrate the peds, which can be suspended on the roots like a string of beads; many fine pores, which have smooth interiors that are like clay coats, neutral; diffuse boundary. (6 to 10 inches thick.)

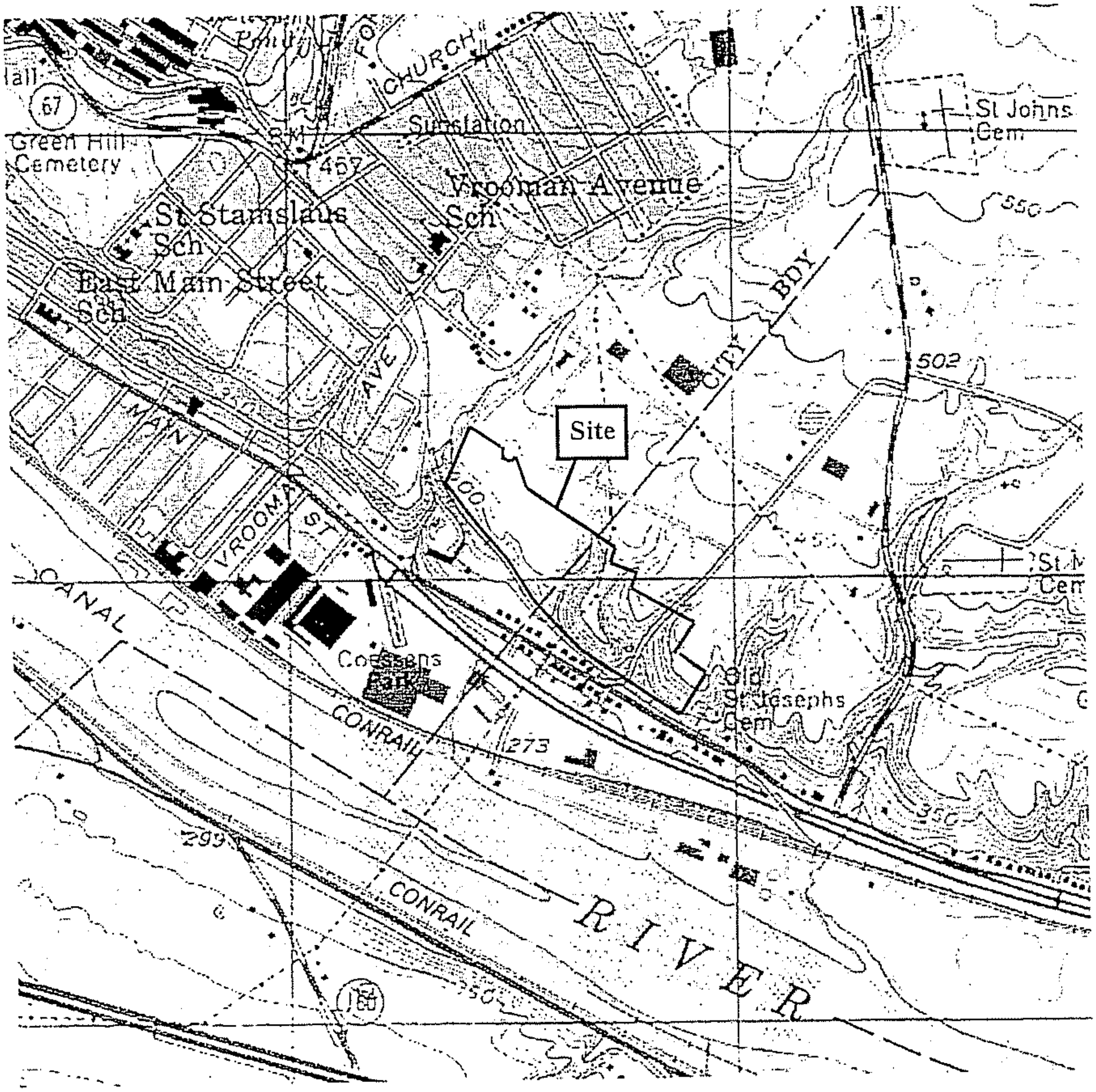

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FIGURE 1

SITE LOCATION MAP

USGS 7.5 Minute Series Amsterdam, NY Topographic Quadrangle

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Orange County Office:
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Newburgh, NY 12550
Phone: (845) 567-1133

Chazen Project No. 90303.00

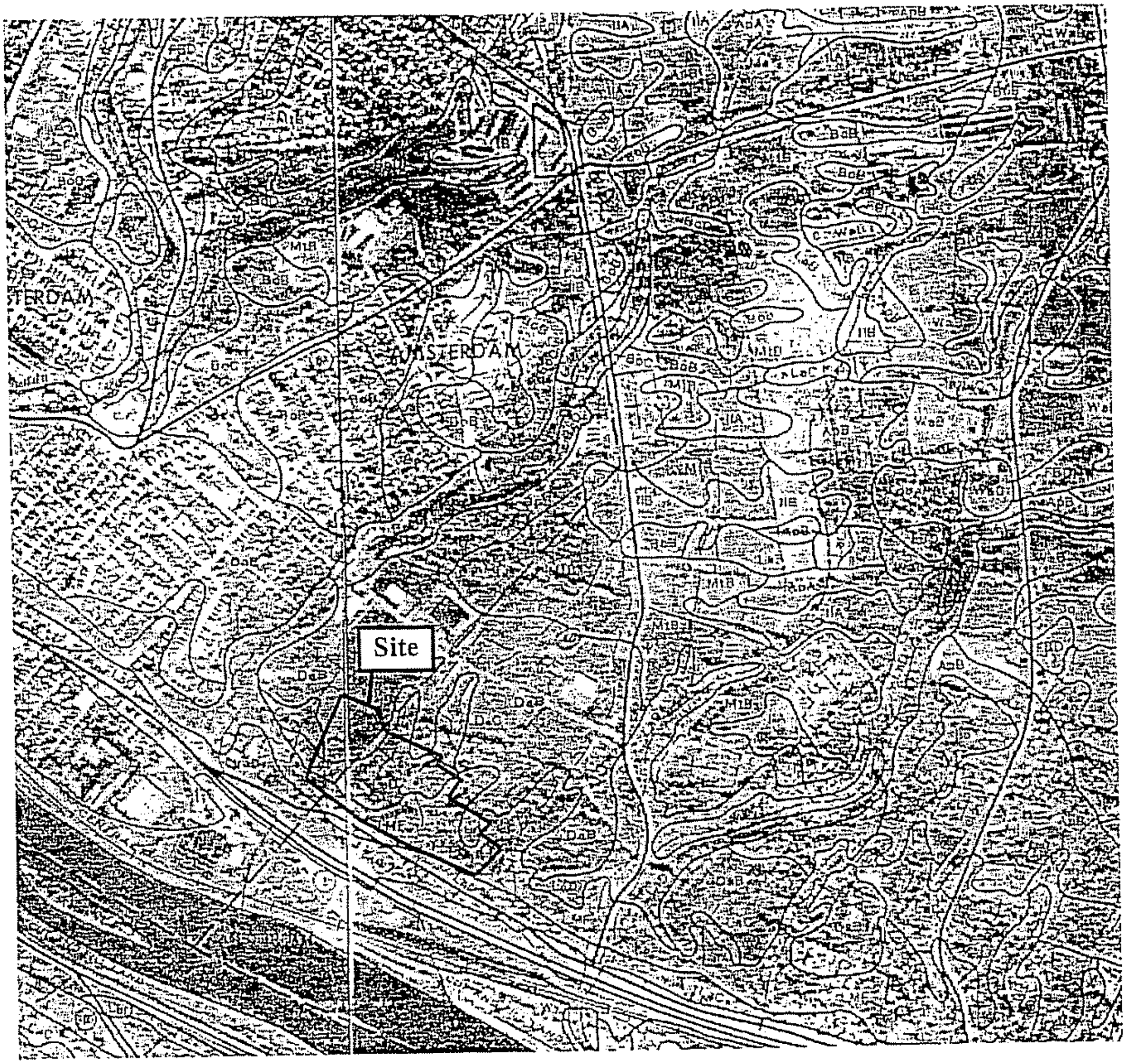

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FIGURE 2

SOILS MAP

NRCS Soil Survey for Montgomery County

Capital District Office:
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2.3 Hydrology and Wetland Mapping

There is no National Wetlands Inventory (NWI) Wetland mapping available for this site; the US Fish and Wildlife Service have not completed mapping for Montgomery County, NY.

According to the NYSDEC wetland mapping, Figure 3, "NYSDEC Wetland Mapping," no State regulated wetlands are present on site.

The USGS 7.5 minute series topographic mapping for the Amsterdam Quadrangle illustrates that three ravines are located on the site. The USGS 7.5 minute series topographic mapping does not illustrate any stream corridors within those ravines. The only stream corridor illustrated is located to the west of the project site. However, the Soil Survey indicates that these ravines contain intermittent tributaries. These tributaries flow from north to south across the eastern, central and western portions of the site. All three intermittent corridors flow through steeply-banked eroded cobbled/sand/gravel bottomed beds into culverts at the southern boundary of the site. They continue off site to the south emptying into the Mohawk River. No other bodies of water are mapped on for the project site.

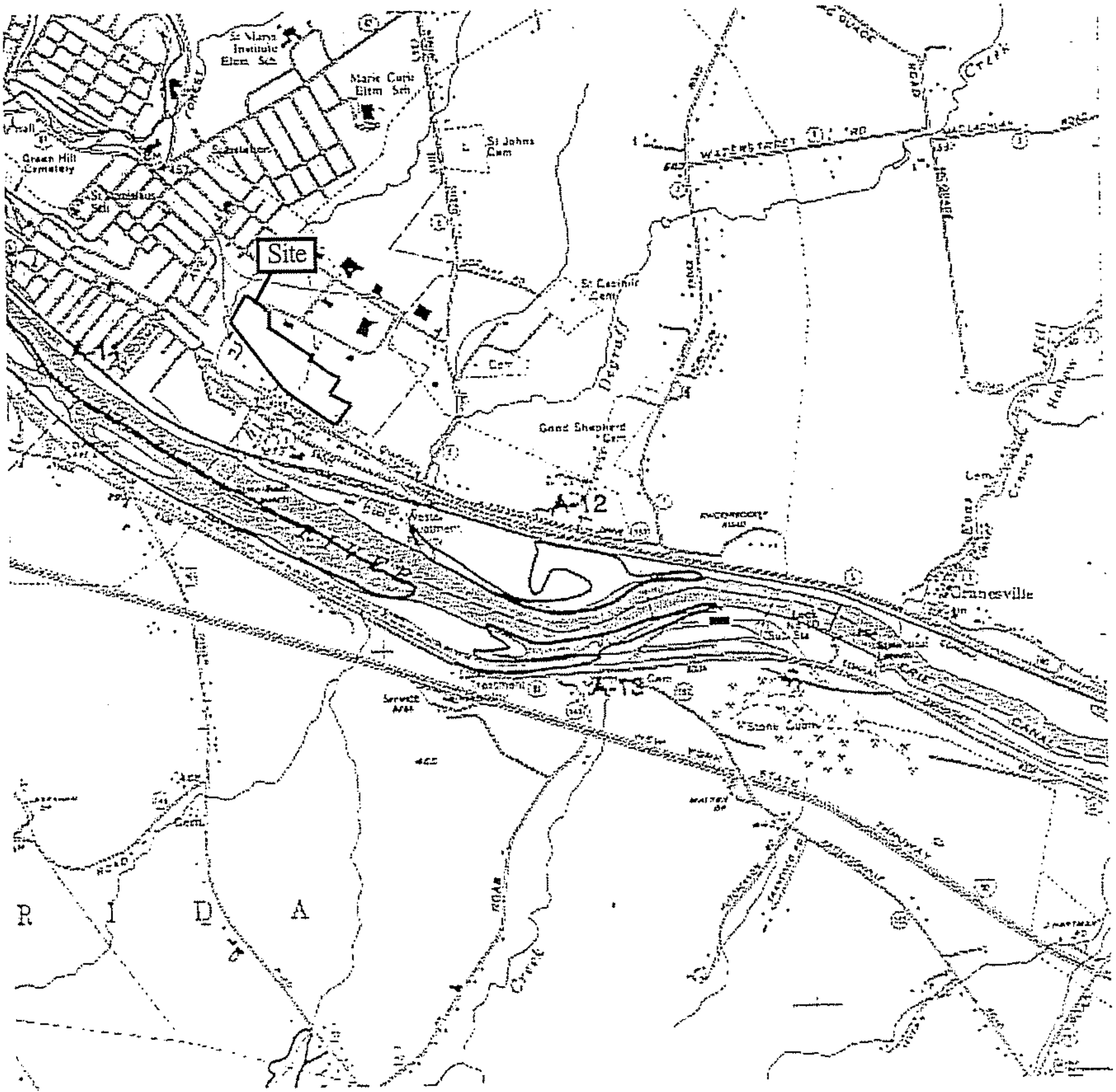

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FIGURE 3

NYSDEC WETLANDS MAP

NYSDEC Wetlands Mapping for Montgomery County, NY

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2.4 Vegetative Communities

According to Reschke's definitions there are three major vegetative cover types present on site. These three communities include northern successional hardwood forest, northern hardwood red maple swamp (stream corridor) and shrub swamp.

Northern Successional Hardwood Forest: The upland successional hardwoods habitat occupies the upland throughout the site. This is a hardwood or mixed forest that occurs on sites that have been cleared for farming, logging or otherwise disturbed. According to Reschke, the dominant trees are usually any two or more of the following: quaking aspen (*Populus tremuloides*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), paper birch (*Betula papyrifera*), gray birch (*B. populifolia*), green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*). Most of these species are found to some degree at this site. There was a significant amount of tartarian honeysuckle (*Lonicera tatarica*) and multiflora rose (*Rosa multiflora*) in the shrub layer. The herbaceous layer contained a few Christmas ferns (*Polystichum achrostichoides*) and seedlings of white pine and various oaks (*Quercus* spp.).

Red Maple Hardwood Swamp: Reschke defines this community as a hardwood swamp that occurs in poorly drained depressions, usually on inorganic soils. This is a broadly defined community with many regional and edapich variants. In any one stand red maple (*Acer rubrum*) is dominant or it is codominat with one or more hardwoods including American elm (*Ulmus americana*), swamp white oak (*Quercus bicolor*) and green ash (*Fraxinus pennsylvanica*). Characteristic shrubs may include spicebush (*Lindera benzoin*) and various dogwoods (*Cornus* spp.). For this site the red maple swamps were confined to the deep ravines on site. They were not as densely vegetated as is typical of this community.

Shrub Swamp: Reschke defines this community as an inland wetland dominated by shrubs that occurs along the shore of a lake or river, in a wet depression or valley not associated with lakes, or as a transition zone between a marsh, fen, or bog and a swamp or upland community. Some common vegetation includes, various dogwoods, arrow wood (*Viburnum recognitum*), alders (*Ulnus* spp.) and saplings of red maple, green ash and other hardwoods. This shrub community may contain some trees however these trees represent less than 50 percent of the vegetative cover of the community. This community is restricted to a small area near the northern property boundary where it connects to a larger wetland through a narrow drainage channel to the larger ravine in the southwestern portion of the site.

3.0 METHODOLOGY

Mr. Bill Mullin of the Chazen Companies conducted the wetland delineation of this site during May 2003. The delineation was established in the field using the three-parameter approach described in the 1987, US Army Corps of Engineers' Wetland Delineation Manual. The boundary was established using flagging marked with consecutively numbered wetland flags along a wetland boundary.

At representative points along the wetland boundary, data were collected in the wetlands and uplands to document the existing vegetation, soils and hydrology. This information was later transferred onto the data sheets contained in Appendix A, "Wetland Data Sheets."

Using a Dutch auger, soil samples were taken to approximately 16 to 18 inches deep at representative points along the boundary to characterize soils. Soil colors were documented using a Munsell Soil Color Chart. To assess hydrology, each area was evaluated for inundation, saturation, drainage channels, watermarks, and or other field indicators (or lack thereof).

Vegetation found at each of the sampling locations was described in terms of the dominant species in the overstory, under story/shrub, vine, and herbaceous layers. Overstory vegetation represents the canopy tree species greater than 6 inches in diameter. Under story/shrub vegetation is comprised of woody tree species between 2 and 6 inches in diameter, and saplings and shrubs less than 2 inches in diameter and 3 to 12 feet in height. Ground layer vegetation consists of both woody and herbaceous vegetation less than 3 feet in height. The indicator status of each dominant plant species was determined using the "National List of Plant Species that Occur in Wetlands – Northeast (Region 1)" (Reed, 1988).

Isolated Wetlands: Isolated wetlands are defined as those wetland areas that do not have an identifiable surface water connection to a tributary to navigable waters of the United States. For example, wetlands that do not have a defined outflow into a drainage that connects to a stream would be considered isolated wetlands. During the field investigation, each wetland was examined to determine if there was a surface hydrological connection in a defined channel that flowed outward from the wetland into one of the stream tributaries on the site. The presence or lack of a connection to adjacent wetlands or interstate commerce was noted for purposes of identifying and documenting isolated wetlands under the recent US Supreme Court ruling in SWANCC v. ACOE.

Photographs were taken of the site at the wetland and upland data points, and at other representative locations throughout the site. These photographs are found in Appendix B, "Site Photographs and Wetland Data Points."

4.0 RESULTS AND DISCUSSION

This section discusses each wetland or wetland group identified on the site, its location on the site, and numbers of flags in the line(s), and the soil, hydrological and vegetative characteristics of the wetland.

The wetlands on the site are generally confined to three narrow, intermittent stream corridors. Figure 4, *Wetlands Survey*, identifies the wetland areas delineated on the project site.

Wetland A: Wetland A is one of the three main ravine/stream corridors located to the east of the project site. While this wetland is not included in the project area, it is part of the AIDA property, and was delineated for this project to have full information regarding the potential to avoid or minimize activities on the site. Wetland A is vegetated with red maple, green ash and American elm in the overstory, several dogwood species and tartarian honeysuckle in the shrub layer. The under-story was relatively sparse containing a few sensitive ferns and touch me nots (*Impatiens capensis*). Soils within the ravine were loose loams, which were highly eroded in many areas. Erosion was caused by seasonal high waters from snow melt off and rain storm events. Wetland A is 0.66 acre in size.

Wetlands B/F/E: Wetland B/F/E is the second of the three main ravine/stream corridors on site; it is located on the central portion of the site. It is similarly vegetated as Wetland A with red maple, green ash and American elm in the overstory, several dogwood species and tartarian honeysuckle in the shrub layer. The under-story was relatively sparse containing a few sensitive ferns and touch me nots. Soils within the ravine were loose loams, which were highly eroded in many areas. Erosion was caused by seasonal high waters from snow melt off and intense rain storm events. This wetland totals 0.865 acre. Portions of this wetland are located off-site. In addition, the AIDA placed a road across this ravine in a location north of flags B-14 and B-15. The road impacted approximately 75 linear feet of stream, and had a total area of approximately 0.026 acre. The filling has been stopped and the area stabilized.

Wetland C: Wetland C, located in the western portion of the site, contains both a ravine wetland similar to those described above, along with a more circular shrub wetland pocket located within the east side of this Wetland. The pocket of shrub wetland is actually man-made as a result of excavation in the area. A small drainage connects the shrub area to the ravine. The shrub portion of Wetland C is dominated by several dogwood species, saplings of red maple, green ash and American elm. The herbaceous layer within Wetland C was far denser than those of the ravines. Sensitive fern, skunk cabbage, several sedges (*Carex* spp.) and touch me nots are present within the herbaceous layer. This shrub wetland had soils that were clay loams to loams that were saturated to the surface. Wetland C is 0.71 acre in area.

Wetland D: Wetland D is the third of the main ravine/stream corridors on site; it is located in the middle of the site. Similar to Wetlands A and B, it is vegetated with red maple, green ash and American elm in the overstory, several dogwood species and tartarian honeysuckle in the shrub layer. The understory was relatively sparse containing a few sensitive ferns and touch me nots. Soils within the ravine were loose loams, which were highly eroded in many areas. Erosion was caused by seasonal high waters from snow melt off and intense rain storm events. Wetland D is 0.34 acre in area.

Wetland AA: Wetland line AA is a 31 flag wetland that is similar to the other wetlands on site. It contains a small intermittent stream with a narrow wetland edge. Wetland AA is a red maple hardwood swamp. It is vegetated with red maple, American elm, green ash and American hornbeam in the overstory; various dogwoods (*Cornus* spp.) arrowwood and tartarian honeysuckle occupy the shrub layer. The herbaceous layer is composed of skunk cabbage, sensitive fern, cinnamon fern, sedge species (*Carex* spp.) and poison ivy. The soils were loams and sandy gravel that were saturated to the surface and intermittently inundated through out. The wetland totals 0.20 acres.

The total area of these wetlands is 2.575 acre. As noted previously, Wetland A (at 0.66 acre) is not within the 39.3 acre site, and portions of Wetlands AA, F and E are located off-site. Therefore, the 39 acre site contains approximately 2.1 acres of wetlands.

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USDI, Fish and Wildlife Service. National Wetlands Inventory Maps, for Amsterdam Quadrangle.

NYSDEC, Freshwater Wetlands Map, Montgomery County, Amsterdam Quadrangle.

USDA Natural Resources Conservation Service. National Cooperative Soil Survey. Official Soil Descriptions from the National Soils Database. Website at statlab.iastate.edu/soils.osd.

Table 1. Flora of the Amsterdam Materials Recycling Site and Indicator Status

Common Name[i]	Scientific Name	Indicator Status[ii]
Trees		
red maple	*Acer rubrum*	FAC
sugar maple	*Acer saccharum*	FACU-
tree-of-heaven	*Ailanthus altissima*	NL
American hornbeam	*Carpinus caroliniana*	FAC
shag-bark hickory	*Carya ovata*	FACU
American beech	*Fagus grandifolia*	FACU
green ash	*Fraxinus pennsylvanica*	FACW
red cedar	*Juniperus virginiana*	FACU
white pine	*Pinus strobus*	FACU
black cherry	*Prunus serotina*	FACU
white oak	*Quercus alba*	FACU
northern red oak	*Quercus rubra*	FACU-
black locust	*Robinia pseudoacacia*	FACU-
weeping willow	*Salix babylonica*	FACW-
black willow	*Salix nigra*	FACW+
American basswood	*Tilia americana*	FACU
hemlock	*Tsuga canadensis*	FACU
American elm	*Ulmus americana*	FACW-
Shrubs		
speckled alder	*Alnus rugosa*	FACW
European barberry	*Berberis vulgaris*	FACU
trumpet-creeper	*Campsis radicans*	FAC
oriental bittersweet	*Celastrus orbiculata*	FACU
gray dogwood	*Cornus foemina* spp. *racemosa*	FAC-
red osier	*Cornus stolonifera*	FACW+
winged burning bush	*Euonymus alata*	NL
American witch-hazel	*Hamamelis virginiana*	FACU+
tartarian honeysuckle	*Lonicera tatarica*	FACU
Virginia creeper	*Parthenocissus quinquefolia*	FACU
common buckthorn	*Rhamnus cathartica*	FACU+
smooth sumac	*Rhus glabra*	NL
staghorn sumac	*Rhus typhina*	NL
multiflora rose	*Rosa multiflora*	FACU
old-field blackberry	*Rubus allegheniensis*	FACU-
common red raspberry	*Rubus idaeus*	FAC-
American yew	*Taxus canadensis*	FAC

poison ivy	*Toxicodendron radicans*	FAC
northern arrow-wood	*Viburnum recognitum*	FACW-
wild grape	*Vitis* sp.	---
riverbank grape	*Vitis riparia*	FACW
Forbs and Ferns		
common yarrow	*Achillea millefolium*	FACU
garlic mustard	*Alliaria petiolata*	FACU-
meadow onion	*Allium canadense*	FACU
field garlic	*Allium vineale*	FACU-
annual ragweed	*Ambrosia artemisiifolia*	---
dogbane	*Apocynum* spp.	FACU-
common burdock	*Arctium minus*	---
common milkweed	*Asclepias syriaca*	FACU-
nodding beggar-ticks	*Bidens cernua*	OBL
chicory	*Cichorium intybus*	NL
thistle	*Cirsium* sp.	---
bedstraw	*Galium* sp.	---
spotted touch-me-not	*Impatiens capensis*	FACW
touch-me-not	*Impatiens* sp.	FACW
creeping jennie	*Lysimachia nummularia*	FACW-
purple loosestrife	*Lythrum salicaria*	FACW+
alfalfa	*Medicago sativa*	NL
white sweet-clover	*Melilotus alba*	FACU-
yellow sweet-clover	*Melilotus officinalis*	FACU-
sweet-clover	*Melilotus* sp.	FACU-
common pokeweed	*Phytolacca americana*	FACU+
common plantain	*Plantago major*	FACU
may-apple	*Podophyllum peltatum*	FACU
arrow-leaf tear-thumb	*Polygonum sagittatum*	OBL
bouncing-bet	*Saponaria officinalis*	FACU-
Canada goldenrod	*Solidago canadensis*	FACU
rough-leaf goldenrod	*Solidago patula*	OBL
wrinkled goldenrod	*Solidago rugosa*	FAC
goldenrod	*Solidago* sp.	---
skunk-cabbage	*Symplocarpus foetidus*	OBL
common dandelion	*Taraxacum officinale*	FACU-
red clover	*Trifolium pratense*	FACU-
white clover	*Trifolium repens*	FACU-
field horsetail	*Equisetum arvense*	FAC
meadow horsetail	*Equisetum pratense* (rare)	FACW
scouring rush	*Equisetum hyemale* spp. *affine*	FACW
stinging nettle	*Urtica dioica*	FACU

sensitive fern	*Onoclea sensibilis*	FACW
cinnamon fern	*Osmunda cinnamomea*	FACW
royal fern	*Osmunda regalis*	OBL
Christmas fern	*Polystichum achrostichoides*	FACU-
bracken fern	*Pteridium aquilinum*	FACU
Grasses and Sedges		
meadow foxtail	*Alopecurus pratensis*	FACW
sedge	*Carex* sp.	---
yellow sedge	*Carex flava*	OBL
tussock-sedge	*Carex stricta*	OBL
orchard grass	*Dactylis glomerata*	FACU
fall panic grass	*Panicum dichotomiflorum*	FACW-
timothy	*Phleum pratense*	FACU
common reed	*Phragmites australis*	FACW

[i] Scientific and common names and wetland indicator categories are from Reed (1988) and Tiner et al. (1995). Taxonomy for plants not listed in Reed (1988) is from Mitchell and Tucker (1997).

[ii] indicator category codes:
- OBL = Obligate Wetland
- FACW = Facultative Wetland
- FAC = Facultative
- FACU = Facultative Upland
- NL = not listed

A + or a - appended to an indicator category code indicates a somewhat greater (+) or lesser (-) tendency to be found in wetlands.

Table 1. Flora of the Amsterdam Materials Recycling Site and Indicator Status

Common Name[i]	Scientific Name	Indicator Status[ii]
Trees		
red maple	*Acer rubrum*	FAC
sugar maple	*Acer saccharum*	FACU-
tree-of-heaven	*Ailanthus altissima*	NL
American hornbeam	*Carpinus caroliniana*	FAC
shag-bark hickory	*Carya ovata*	FACU
American beech	*Fagus grandifolia*	FACU
green ash	*Fraxinus pennsylvanica*	FACW
red cedar	*Juniperus virginiana*	FACU
white pine	*Pinus strobus*	FACU
black cherry	*Prunus serotina*	FACU
white oak	*Quercus alba*	FACU
northern red oak	*Quercus rubra*	FACU-
black locust	*Robinia pseudoacacia*	FACU-
weeping willow	*Salix babylonica*	FACW-
black willow	*Salix nigra*	FACW+
American basswood	*Tilia americana*	FACU
hemlock	*Tsuga canadensis*	FACU
American elm	*Ulmus americana*	FACW-
Shrubs		
speckled alder	*Alnus rugosa*	FACW
European barberry	*Berberis vulgaris*	FACU
trumpet-creeper	*Campsis radicans*	FAC
oriental bittersweet	*Celastrus orbiculata*	FACU
gray dogwood	*Cornus foemina* spp. *racemosa*	FAC-
red osier	*Cornus stolonifera*	FACW+
winged burning bush	*Euonymus alata*	NL
American witch-hazel	*Hamamelis virginiana*	FACU+
tartarian honeysuckle	*Lonicera tatarica*	FACU
Virginia creeper	*Parthenocissus quinquefolia*	FACU
common buckthorn	*Rhamnus cathartica*	FACU+
smooth sumac	*Rhus glabra*	NL
staghorn sumac	*Rhus typhina*	NL
multiflora rose	*Rosa multiflora*	FACU
old-field blackberry	*Rubus allegheniensis*	FACU-
common red raspberry	*Rubus idaeus*	FAC-
American yew	*Taxus canadensis*	FAC

poison ivy	*Toxicodendron radicans*	FAC
northern arrow-wood	*Viburnum recognitum*	FACW-
wild grape	*Vitis* sp.	---
riverbank grape	*Vitis riparia*	FACW
Forbs and Ferns		
common yarrow	*Achillea millefolium*	FACU
garlic mustard	*Alliaria petiolata*	FACU-
meadow onion	*Allium canadense*	FACU
field garlic	*Allium vineale*	FACU-
annual ragweed	*Ambrosia artemisiifolia*	---
dogbane	*Apocynum* spp.	FACU-
common burdock	*Arctium minus*	---
common milkweed	*Asclepias syriaca*	FACU-
nodding beggar-ticks	*Bidens cernua*	OBL
chicory	*Cichorium intybus*	NL
thistle	*Cirsium* sp.	---
bedstraw	*Galium* sp.	---
spotted touch-me-not	*Impatiens capensis*	FACW
touch-me-not	*Impatiens* sp.	FACW
creeping jennie	*Lysimachia nummularia*	FACW-
purple loosestrife	*Lythrum salicaria*	FACW+
alfalfa	*Medicago sativa*	NL
white sweet-clover	*Melilotus alba*	FACU-
yellow sweet-clover	*Melilotus officinalis*	FACU-
sweet-clover	*Melilotus* sp.	FACU-
common pokeweed	*Phytolacca americana*	FACU+
common plantain	*Plantago major*	FACU
may-apple	*Podophyllum peltatum*	FACU
arrow-leaf tear-thumb	*Polygonum sagittatum*	OBL
bouncing-bet	*Saponaria officinalis*	FACU-
Canada goldenrod	*Solidago canadensis*	FACU
rough-leaf goldenrod	*Solidago patula*	OBL
wrinkled goldenrod	*Solidago rugosa*	FAC
goldenrod	*Solidago* sp.	---
skunk-cabbage	*Symplocarpus foetidus*	OBL
common dandelion	*Taraxacum officinale*	FACU-
red clover	*Trifolium pratense*	FACU-
white clover	*Trifolium repens*	FACU-
field horsetail	*Equisetum arvense*	FAC
meadow horsetail	*Equisetum pratense* (rare)	FACW
scouring rush	*Equisetum hyemale* spp. *affine*	FACW
~~stinging nettle~~	~~*Urtica dioica*~~	~~FACU~~

sensitive fern	*Onoclea sensibilis*	FACW
cinnamon fern	*Osmunda cinnamomea*	FACW
royal fern	*Osmunda regalis*	OBL
Christmas fern	*Polystichum achrostichoides*	FACU-
bracken fern	*Pteridium aquilinum*	FACU
Grasses and Sedges		
meadow foxtail	*Alopecurus pratensis*	FACW
sedge	*Carex* sp.	---
yellow sedge	*Carex flava*	OBL
tussock-sedge	*Carex stricta*	OBL
orchard grass	*Dactylis glomerata*	FACU
fall panic grass	*Panicum dichotomiflorum*	FACW-
timothy	*Phleum pratense*	FACU
common reed	*Phragmites australis*	FACW

[i] Scientific and common names and wetland indicator categories are from Reed (1988) and Tiner et al. (1995). Taxonomy for plants not listed in Reed (1988) is from Mitchell and Tucker (1997).

[ii] indicator category codes:
OBL = Obligate Wetland
FACW = Facultative Wetland
FAC = Facultative
FACU = Facultative Upland
NL = not listed
A + or a - appended to an indicator category code indicates a somewhat greater (+) or lesser (-) tendency to be found in wetlands.

Appendix A:
Wetland Data Sheets

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site: AMR   Community ID: up   Date: 14-May-03
Applicant/Owner: AMR, LLC   Transect ID: County: Montgomery
Investigator Mullin   Plot ID: A 6   State: NY

A. Do normal circumstances exist on this site? ☑ Yes ☐ No
B. Is this site significantly disturbed (Atypical Situation) ☐ Yes ☑ No
C. Is the area a potential Problem Area? ☐ Yes ☑ No
(If needed, explain on reverse)

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer saccharum*	Tree	FACU-
2. *Carpinus caroliniana*	Tree	FAC
3. *Prunus serotinia*	Shrub	FACU
4. *Alliaria petiolata*	Herb	FACU-
5. *Podophyllum peltatum*	Herb	FACU
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 20%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
  ___ Stream, Lake or Tide Guage
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations
- Depth of Surface Water ________ (in,)
- Depth to Free Water in pit: ________ (in,)
- Depth to Saturated Soil ________ (in,)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required)
- ___ Oxidized Root Channels in Upper 12"
- ___ Water Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (explain in Remarks Section)

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site: AMR
Applicant/Owner: AMR, LLC
Investigator: Mullin

Community ID: up
Transect ID:
Plot ID: A 6

Date: 14-May-03
County: Montgomery
State: NY

SOILS

Map Unit Name: (Series and Phase):
Taxonomy (Subgroup):

Drainage Class:
Field Observations:
Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-16		10 YR 3/3		sandy loam

Hydric Soils Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks Section)

Remarks:

Soils at this point are in the upland category

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☐ Yes	☑ No
Wetland Hydrology Present?	☐ Yes	☑ No
Hydric Soils Present?	☐ Yes	☑ No

Is this Sampling Point within a Wetland? ☐ Yes ☑ No

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site: AMR | Community ID: wet | Date: 14-May-03
Applicant/Owner: AMR, LLC | Transect ID: | County: Montgomery
Investigator: Mullin | Plot ID: A 6 | State: NY

A. Do normal circumstances exist on this site? ☑ Yes ☐ No
B. Is this site significantly disturbed (Atypical Situation) ☐ Yes ☑ No
C. Is the area a potential Problem Area? ☐ Yes ☑ No
(If needed, explain on reverse)

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer rubrum*	Tree	FAC
2. *Carpinus caroliniana*	Tree	FAC
3. *Impatiens capensis*	Herb	FACW
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 100%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
 ___ Stream, Lake or Tide Guage
 ___ Aerial Photographs
 ___ Other
___ No Recorded Data Available

Field Observations
 Depth of Surface Water ______ (in,)
 Depth to Free Water in pit: ______ (in,)
 Depth to Saturated Soil 6 (in,)

Wetland Hydrology Indicators:
Primary Indicators:
 ___ Inundated
 X Saturated in Upper 12 Inches
 ___ Water Marks
 X Drift Lines
 ___ Sediment Deposits
 X Drainage Patterns in Wetlands
Secondary Indicators (2 or more required)
 X Oxidized Root Channels in Upper 12"
 ___ Water Stained Leaves
 ___ Local Soil Survey Data
 ___ FAC-Neutral Test
 ___ Other (explain in Remarks Section)

Remarks:

deep ravined with intermittent stream corridor

SOILS

Map Unit Name:
(Series and Phase):
Taxonomy (Subgroup):

Drainage Class:
Field Observations:
Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-8		10 YR 3/3		loam
8-17		10 YR 3/2	10% 10 YR 4/4	loam

Hydric Soils Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
X Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ☑ Yes ☐ No
Wetland Hydrology Present? ☑ Yes ☐ No
Hydric Soils Present? ☑ Yes ☐ No

Is this Sampling Point within a Wetland? ☑ Yes ☐ No

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site: AMR
Applicant/Owner: AMR, LLC
Investigator: Mullin

Community ID: up
Transect ID:
Plot ID: B 16

Date: 14-May-03
County: Montgomery
State: NY

A. Do normal circumstances exist on this site? ☑ Yes ☐ No
B. Is this site significantly disturbed (Atypical Situation) ☐ Yes ☑ No
C. Is the area a potential Problem Area? ☐ Yes ☑ No
(If needed, explain on reverse)

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer rubrum*	Tree	FAC
2. *Rhamnus cathartica*	Shrub	FACU+
3.		
4. *Hamamelis virginiana*	Shrub	FACU+
5. *Podophyllum peltatum*	Herb	FACU
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 25%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
 ___ Stream, Lake or Tide Guage
 ___ Aerial Photographs
 ___ Other
___ No Recorded Data Available

Field Observations
 Depth of Surface Water ________ (in,)
 Depth to Free Water in pit: ________ (in,)
 Depth to Saturated Soil ________ (in,)

Wetland Hydrology Indicators:
 Primary Indicators:
 ___ Inundated
 ___ Saturated in Upper 12 Inches
 ___ Water Marks
 ___ Drift Lines
 ___ Sediment Deposits
 ___ Drainage Patterns in Wetlands
 Secondary Indicators (2 or more required)
 ___ Oxidized Root Channels in Upper 12"
 ___ Water Stained Leaves
 ___ Local Soil Survey Data
 ___ FAC-Neutral Test
 ___ Other (explain in Remarks Section)

Remarks:

SOILS

Map Unit Name: (Series and Phase): ____

Taxonomy (Subgroup): ____

Drainage Class: ____

Field Observations: ____

Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-8		10 YR 3/3		sandy loam
8-16		10 YR 3/2		sandy loam

Hydric Soils Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☐ Yes	☑ No
Wetland Hydrology Present?	☐ Yes	☑ No
Hydric Soils Present?	☐ Yes	☑ No

Is this Sampling Point within a Wetland? ☐ Yes ☑ No

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site:	AMR	Community ID:	wet	Date:	14-May-03
Applicant/Owner:	AMR, LLC	Transect ID:		County:	Montgomery
Investigator	Mullin	Plot ID:	B-16	State:	NY

A. Do normal circumstances exist on this site?	☑ Yes	☐ No
B. Is this site significantly disturbed (Atypical Situation)	☐ Yes	☑ No
C. Is the area a potential Problem Area? (If needed, explain on reverse)	☐ Yes	☑ No

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer rubrum*	Tree	FAC
2. *Ulmus americana*	Tree	FACW-
3. *Impatiens capensis*	Herb	FACW
4. *Acer saccharum*	Tree	FACU-
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 75%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
- ___ Stream, Lake or Tide Guage
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations

Depth of Surface Water		(in,)
Depth to Free Water in pit:		(in,)
Depth to Saturated Soil	5	(in,)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- X Saturated in Upper 12 Inches
- ___ Water Marks
- X Drift Lines
- X Sediment Deposits
- X Drainage Patterns in Wetlands

Secondary Indicators (2 or more required)
- X Oxidized Root Channels in Upper 12"
- ___ Water Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (explain in Remarks Section)

Remarks:

intermittent stream in centrally located ravine

SOILS

Map Unit Name: ______
(Series and Phase): ______
Taxonomy (Subgroup): ______

Drainage Class: ______
Field Observations: ______
Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-6		10 YR 2/2		loam
6-15		10 YR 2/2	10 YR 4/6	loam

Hydric Soils Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
_X_ Gleyed or Low-Chroma Colors

___ Concretions
___ High Organic Content
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☑ Yes	☐ No
Wetland Hydrology Present?	☑ Yes	☐ No
Hydric Soils Present?	☑ Yes	☐ No

Is this Sampling Point within a Wetland? ☑ Yes ☐ No

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site:	AMR	Community ID:	up	Date:	14-May-03
Applicant/Owner:	AMR, LLC	Transect ID:		County:	Montgomery
Investigator	Mullin	Plot ID:	C-5	State:	NY

A. Do normal circumstances exist on this site? ☑ Yes ☐ No

B. Is this site significantly disturbed (Atypical Situation) ☐ Yes ☑ No

C. Is the area a potential Problem Area? ☐ Yes ☑ No
(If needed, explain on reverse)

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer rubrum*	Tree	FAC
2. *Rhamnus cathartica*	Shrub	FACU+
3. *Hamamelis virginiana*	Shrub	FACU+
4. *Lonicera tatarica*	Shrub	FACU
5. *Podophyllum peltatum*	Herb	FACU
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 20%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
 ___ Stream, Lake or Tide Guage
 ___ Aerial Photographs
 ___ Other
___ No Recorded Data Available

Field Observations
 Depth of Surface Water ________ (in,)
 Depth to Free Water in pit: ________ (in,)
 Depth to Saturated Soil ________ (in,)

Wetland Hydrology Indicators:
 Primary Indicators:
 ___ Inundated
 ___ Saturated in Upper 12 Inches
 ___ Water Marks
 ___ Drift Lines
 ___ Sediment Deposits
 ___ Drainage Patterns in Wetlands
 Secondary Indicators (2 or more required)
 ___ Oxidized Root Channels in Upper 12"
 ___ Water Stained Leaves
 ___ Local Soil Survey Data
 ___ FAC-Neutral Test
 ___ Other (explain in Remarks Section)

Remarks:

SOILS

Map Unit Name: ______ Drainage Class: ______

(Series and Phase): ______ Field Observations: ______

Confirm Mapped Type: ☐ Yes ☐ No

Taxonomy (Subgroup): ______

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-7		10 YR 3/3		sandy loam
7-17		10 YR 3/4		sandy loam

Hydric Soils Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☐ Yes	☑ No
Wetland Hydrology Present?	☐ Yes	☑ No
Hydric Soils Present?	☐ Yes	☑ No

Is this Sampling Point within a Wetland? ☐ Yes ☑ No

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site: AMR
Applicant/Owner: AMR, LLC
Investigator: Mullin

Community ID: wet
Transect ID:
Plot ID: C-5

Date: 14-May-03
County: Montgomery
State: NY

A. Do normal circumstances exist on this site? ☑ Yes ☐ No
B. Is this site significantly disturbed (Atypical Situation) ☐ Yes ☑ No
C. Is the area a potential Problem Area? ☐ Yes ☑ No
(If needed, explain on reverse)

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer rubrum*	Tree	FAC
2. *Carpinus caroliniana*	Tree	FAC
3. *Impatiens capensis*	Herb	FACW
4. *Cornus stolonifera*	Shrub	FACW+
5. *Fraxinus pennsylvanica*	Shrub	FACW
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 100%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
  ___ Stream, Lake or Tide Guage
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations
  Depth of Surface Water _____ (in,)
  Depth to Free Water in pit: _____ (in,)
  Depth to Saturated Soil 1 (in,)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
X Saturated in Upper 12 Inches
___ Water Marks
X Drift Lines
___ Sediment Deposits
X Drainage Patterns in Wetlands
Secondary Indicators (2 or more required)
X Oxidized Root Channels in Upper 12"
___ Water Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (explain in Remarks Section)

Remarks:

shallow depressionial shrub wetland

SOILS

Map Unit Name: ______ Drainage Class: ______
(Series and Phase): ______ Field Observations: ______
Taxonomy (Subgroup): ______ Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-5		10 YR 3/3		clay loam
5-16		10 YR 3/2	15% 10 YR 4/4	clay loam

Hydric Soils Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☑ Yes	☐ No
Wetland Hydrology Present?	☑ Yes	☐ No
Hydric Soils Present?	☑ Yes	☐ No

Is this Sampling Point within a Wetland? ☑ Yes ☐ No

Remarks:

SOILS

Map Unit Name: ____________________ Drainage Class: ____________________
(Series and Phase): ____________________ Field Observations: ____________________
Taxonomy (Subgroup): ____________________ Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-6		10 YR 3/3		sandy loam
6-16		10 YR 2/3		sandy loam

Hydric Soils Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☐ Yes	☑ No
Wetland Hydrology Present?	☐ Yes	☑ No
Hydric Soils Present?	☐ Yes	☑ No

Is this Sampling Point within a Wetland? ☐ Yes ☑ No

Remarks:

DATA FORM
ROUTINE WETLANDS DETERMINATION
(1987 ACOE Wetlands Delineation Manual)

Project/Site: AMR | Community ID: wet | Date: 14-May-03
Applicant/Owner: AMR, LLC | Transect ID: | County: Montgomery
Investigator Mullin | Plot ID: AA-13 | State: NY

A. Do normal circumstances exist on this site? ☑ Yes ☐ No
B. Is this site significantly disturbed (Atypical Situation) ☐ Yes ☑ No
C. Is the area a potential Problem Area? ☐ Yes ☑ No
(If needed, explain on reverse)

VEGETATION

DOMINANT PLANT SPECIES:	STRATUM	INDICATOR
1. *Acer rubrum*	Tree	FAC
2. *Onoclea sensibilis*	Herb	FACW
3. *Impatiens capensis*	Herb	FACW
4. *Cornus stolonifera*	Shrub	FACW+
5. *Fraxinus pennsylvanica*	Shrub	FACW
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC -): 100%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks Section)
  ___ Stream, Lake or Tide Guage
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations
- Depth of Surface Water: 2 (in,)
- Depth to Free Water in pit: surface (in,)
- Depth to Saturated Soil: surface (in,)

Wetland Hydrology Indicators:

Primary Indicators:
- X Inundated
- X Saturated in Upper 12 Inches
- X Water Marks
- X Drift Lines
- X Sediment Deposits
- X Drainage Patterns in Wetlands

Secondary Indicators (2 or more required)
- ___ Oxidized Root Channels in Upper 12"
- ___ Water Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (explain in Remarks Section)

Remarks:

stream bed and bank

SOILS

Map Unit Name: ______
(Series and Phase): ______
Taxonomy (Subgroup): ______

Drainage Class: ______
Field Observations: ______
Confirm Mapped Type: ☐ Yes ☐ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concentrations, Structure, etc.
0-4		10 YR 3/2		sandy loam
4-16		10 YR 2/2	5% 10 YR 4/3	sandy loam

Hydric Soils Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks Section)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☑ Yes	☐ No
Wetland Hydrology Present?	☑ Yes	☐ No
Hydric Soils Present?	☑ Yes	☐ No

Is this Sampling Point within a Wetland? ☑ Yes ☐ No

Remarks:

Appendix B:
Photographs of Site

Photo #1
Description: View looking north along from the center line of wetland D. Note the lack of vegetation and the rock and stone covering the ground.

Photo #2
Description: View looking west along Wetland D of upland ravine bank.

E

Appendix E
Correspondence

Amsterdam Police Department

Thomas V.N. Brownell
CHIEF OF POLICE

Guy Park Avenue Ext.
Amsterdam, New York 12010

Phone (518) 842-1100
Fax (518) 843-2767

May 19, 2003

Tamara S. Girard
Chazen Environmental Services, Inc.
20 Gurley Avenue
Troy, New York 12182

Dear Ms. Girard,

I am in receipt of your letter dated May 6, 2003 (copy attached). In response to your inquires, please be advised of the following:

The number of response vehicles in our Department is 20.

The number of Police Personnel in our Department is 39.

I believe that we will certainly be able to provide adequate Police service to this project.

If you require anything further on this issue, please do not hesitate to contact me.

Sincerely,

Thomas V.N. Brownell
Chief of Police

Cc: Mayor Duchessi
File

TVNB/ko

AMSTERDAM FIRE DEPARTMENT

Public Safety Building
Guy Park Ave. Ext.
Amsterdam, NY 12010

Richard A. Liberti
Fire Chief

Phone: 518-843-1312

Fax: 518-843-7396
e-mail: afdchief@superior.net

Battalion Chief J. Michael Mancini
Battalion Chief John B. Wilary
Battalion Chief Anthony Duchessi
Battalion Chief Joseph Puglisi

Lieutenant Walter Martin
Lieutenant Michael DePasquale
Lieutenant Andrew Castler
Lieutenant Richard DePasquale
Lieutenant Peter McNamara
Lieutenant John Paris
Lieutenant Michael Whitty
Lieutenant Mark Prevendoski

May 21, 2003

Tamara S. Girard, M.P.H.
Chazen Companies
20 Gurley Ave.
Troy, NY 12182

RE: AIDA Site
Chazen Project No. 90303.00

Dear Tamara S. Girard:

This department has the following apparatus:

Engine 1 - 1992 Beck, 1500 GPM, 500 Gal. Class A Pumper
Engine 3 - 1978 IH, 1750 GPM, 750 Gal. Class A Pumper
Truck 1 - 1996 Central States, 75' Aerial, 1500 GPM, 300 Gal. Quint
Tower 4 - 2002 Central States, 104' Aerial Platform, 2000 GPM, 500 Gal. Quint
Rescue 10 - 2000 Central States, 1500 GPM, 500 Gal. Class A Pumper
Car 207 - 1994 Jeep
Support 1 - 1994 Chevrolet CK31003

Uniformed employees: 35

The above project will have little impact on this department and creates no unusual challenges.

Sincerely,

Richard A. Liberti
Fire Chief

Greater Amsterdam Volunteer Ambulance Corps Inc.

P.O. Box 11, Amsterdam, New York 12010, Phone (518) 843-1150, Fax (518) 842-2559, www.gavac.org

Thomas P. Pasquarelli Jr. - Executive Director

Maynard Waite - Field Supervisor
Gene Myers - Field Supervisor

Kimberley Nikolaus - Field Supervisor
Karen Newkirk - Administrative Assistant

May 20, 2003

The Chazen Companies
20 Gurley Avenue
Troy, NY 12182

Dear Ms. Girard:

Recently I received a survey regarding the C & D landfill located in the City of Amsterdam (Project #90303.00) asking some questions about our agency and if we would be able to provide the necessary coverage for the Emergency Medical Service and Ambulance Transport. This will not be a problem for our agency. The Greater Amsterdam Volunteer Ambulance Corps, Inc. has over 50 members, with a staff consisting of both paid and volunteer members. We operate six (6) Advanced Life Support ambulances twenty-four (24) hours a day, three hundred and sixty five (365) days a year.

Again, the Greater Amsterdam Volunteer Ambulance Corps, Inc. will not have any problems servicing the needs of this project. Should you need any further information please feel free to call me at 518-843-1150.

Sincerely,

Thomas P. Pasquarelli Jr.
Executive Director

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189 518-237-8643

Bernadette Castro
Commissioner

October 16, 2003

Tamara S. Girard
Chazen Engineering
20 Gurley Ave
Troy, New York 12182

Re: SEQRA
Amsterdam Materials Recycling Facility/NY 5
Amsterdam, Montgomery County
03PR04048

Dear Ms. Girard:

Thank you for requesting the comments of the Office of Parks, Recreation and Historic Preservation (OPRHP). We have reviewed the project in accordance with the New York State Parks, Recreation and Historic Preservation Law, Section 14.09.

Based upon this review, it is the OPRHP's opinion that your project will have No Impact upon cultural resources in or eligible for inclusion in the State and National Registers of Historic Places.

If further correspondence is required regarding this project, please be sure to refer to the OPRHP Project Review (PR) number noted above.

Sincerely,

Ruth L. Pierpont

Ruth L. Pierpont
Director

RLP:cmp

United States Department of the Interior

FISH AND WILDLIFE SERVICE
3817 Luker Road
Cortland, NY 13045

May 12, 2003

Ms. Tamara S. Girard
Environmental Scientist
Chazen Environmental Services, Inc.
20 Gurley Avenue
Troy, NY 12182

Dear Ms. Girard:

This responds to your letter of May 5, 2003, requesting information on the presence of Federally listed or proposed endangered or threatened species in the vicinity of the undeveloped portion of the Amsterdam Industrial Park on Edson Street in the City and Town of Amsterdam, Montgomery County, New York.

Except for occasional transient individuals, no Federally listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area. In addition, no habitat in the project impact area is currently designated or proposed "critical habitat" in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Therefore, no further Endangered Species Act coordination or consultation with the U.S. Fish and Wildlife Service (Service) is required. Should project plans change, or if additional information on listed or proposed species or critical habitat becomes available, this determination may be reconsidered. The most recent compilation of Federally listed and proposed endangered and threatened species in New York* is available for your information.

The above comments pertaining to endangered species under our jurisdiction are provided pursuant to the Endangered Species Act. This response does not preclude additional Service comments under other legislation.

For additional information on fish and wildlife resources or State-listed species, we suggest you contact the appropriate New York State Department of Environmental Conservation regional office(s),* and:

New York State Department of Environmental Conservation
New York Natural Heritage Program Information Services
625 Broadway
Albany, NY 12233
(518) 402-8935

Since wetlands may be present, you are advised that National Wetlands Inventory (NWI) maps may or may not be available for the project area. However, while the NWI maps are reasonably accurate, they should not be used in lieu of field surveys for determining the presence of wetlands or delineating wetland boundaries for Federal regulatory purposes. Copies of specific NWI maps can be obtained from:

Cornell Institute for Resource Information Systems
302 Rice Hall
Cornell University
Ithaca, NY 14853
(607) 255-4864

Work in certain waters of the United States, including wetlands, may require a permit from the U.S. Army Corps of Engineers (Corps). If a permit is required, in reviewing the application pursuant to the Fish and Wildlife Coordination Act, the Service may concur, with or without recommending additional permit conditions, or recommend denial of the permit depending upon potential adverse impacts on fish and wildlife resources associated with project construction or implementation. The need for a Corps permit may be determined by contacting the appropriate Corps office(s).*

If you require additional information or assistance please contact Michael Stoll at (607) 753-9334.

Sincerely,

Mark W. Clough
Acting For

David A. Stilwell
Field Supervisor

*Additional information referred to above may be found on our website at: http://nyfo.fws.gov/es/esdesc.htm.

cc: NYSDEC, Schenectady, NY (Environmental Permits)
NYSDEC, Albany, NY (Natural Heritage Program)
COE, New York, NY

New York State Department of Environmental Conservation
Division of Fish, Wildlife & Marine Resources
New York Natural Heritage Program
625 Broadway, 5th floor, Albany, New York 12233-4757
Phone: (518) 402-8935 • **FAX:** (518) 402-8925
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

May 20, 2003

Tamara Girard
Chazen Environmental Services
20 Gurley Ave
Troy, NY 12182

Dear Ms. Girard:

In response to your recent request, we have reviewed the New York Natural Heritage Program databases with respect to the proposed Environmental Assessment of the Amsterdam Industrial Development - 43 acre parcel, site as indicated on the map you provided, located in the Town of Amsterdam, Montgomery County.

> We have no records of <u>known</u> occurrences of rare or state-listed animals or plants, significant natural communities, or other significant habitats, on or in the immediate vicinity of your site.

The absence of data does not necessarily mean that rare or state-listed species, natural communities or other significant habitats do not exist on or adjacent to the proposed site. Rather, our files currently do not contain any information which indicates their presence. For most sites, comprehensive field surveys have not been conducted. For these reasons, we cannot provide a definitive statement on the presence or absence of rare or state-listed species, or of significant natural communities. This information should not be substituted for on-site surveys that may be required for environmental assessment.

Our databases are continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

This response applies only to known occurrences of rare or state-listed animals and plants, significant natural communities and other significant habitats maintained in the Natural Heritage Databases. Your project may require additional review or permits; for information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the appropriate NYS DEC Regional Office, Division of Environmental Permits, at the enclosed address.

Sincerely,
Betty Ketcham
Betty A. Ketcham, Information Services
New York Natural Heritage Program

Encs.
cc: Reg. 4, Wildlife Mgr.
PLEASE NOTE: Kindly use the above letterhead address when requesting information.

Appendix F
Cultural Resources Report

Phase I Archaeological Investigations of the Amsterdam Materials Recycling Project Town of Amsterdam Montgomery County, New York

Prepared for:
The Chazen Companies
20 Gurley Avenue
Troy, New York 12182

Prepared by:
Susan Gade and Tim Lloyd, Ph.D.
Landmark Archaeology, Inc.
6242 Hawes Road
Altamont, New York 12009-4606

Susan Gade, Principal Investigator

LA# 60
August 2003

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I. INTRODUCTION

This report presents the results of a Phase I archaeological study conducted for the proposed Amsterdam Materials Recycling Project located in the town of Amsterdam, Montgomery County, New York (Figure 1). The investigation was conducted by Landmark Archaeology, Inc., who was retained as a consultant by The Chazen Companies of Troy, New York. The Amsterdam Materials Recycling Project encompasses approximately 43 acres.

The Phase I study was conducted to: (a) inspect the project area and precisely define the spatial boundaries of any archaeological resources in relation to the limits of the project area, (b) assess the potential of the project area for deeply buried cultural deposits, (c) conduct surface and limited subsurface investigations of the resources which are either partially or completely in the area of the proposed construction, and (d) provide recommendations for those archaeological resources which may be impacted by proposed development activities. These tasks were conducted to provide federal and state reviewing agencies with the appropriate documentation to evaluate the effect of the proposed project on historic and/or prehistoric cultural resources. The investigation was performed in compliance with Section 14.09 of the New York Parks, Recreation and Historic Preservation Law and with 36 CFR Part 800 of the Federal Code.

The Phase I study was conducted in two stages, a Phase IA literature review and a Phase IB intensive-level identification survey. The purpose of the Phase IA investigation was to assess the potential for National Register of Historic Places (NRHP) properties to exist within the project area. Research tasks associated with the Phase IA study consisted of a literature review and records search at the Office of Parks, Recreation and Historic Preservation (OPR&HP). The Phase IB study consisted of an intensive-level identification survey consisting of shovel test excavations within the area proposed for development.

The following technical report presents the results of the Phase I survey conducted in June 2003. Susan Gade served as Principal Investigator for the project, and she supervised all aspects of the investigation. Ms. Gade holds a M.S. degree in anthropology from the University of Wisconsin-Milwaukee. Background research for the investigation was completed by Pamela Dubitsky. Fieldwork was conducted by Tim Lloyd, Ph.D., field supervisor, with field technician Sam Sheehan. The report is written by Ms. Gade and Mr. Lloyd, with editorial assistance and graphic production by Pamela Dubitsky. All field notes, photographs and records associated with the project are on file at Landmark Archaeology, Inc., 6242 Hawes Road, Altamont, New York.

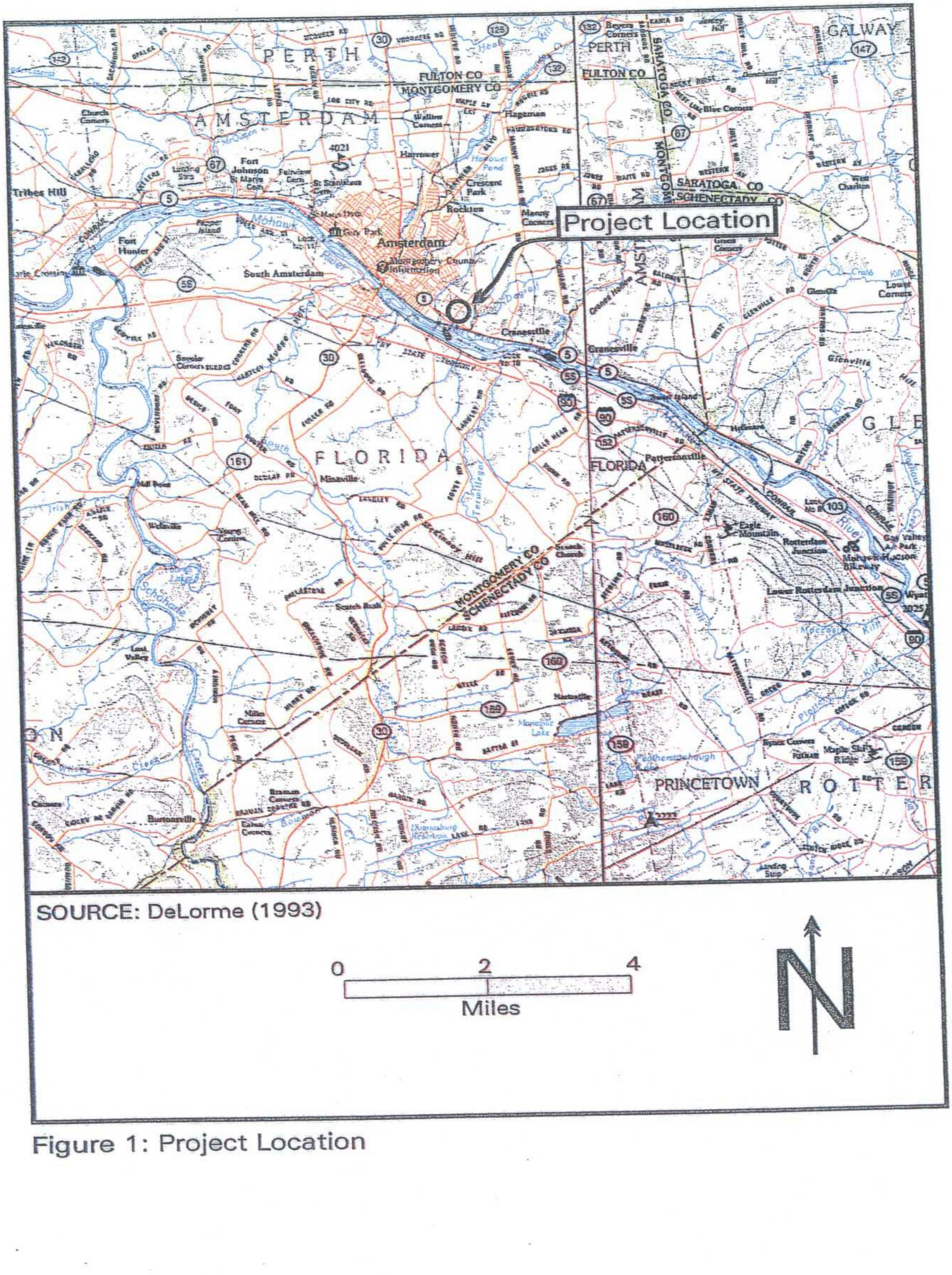
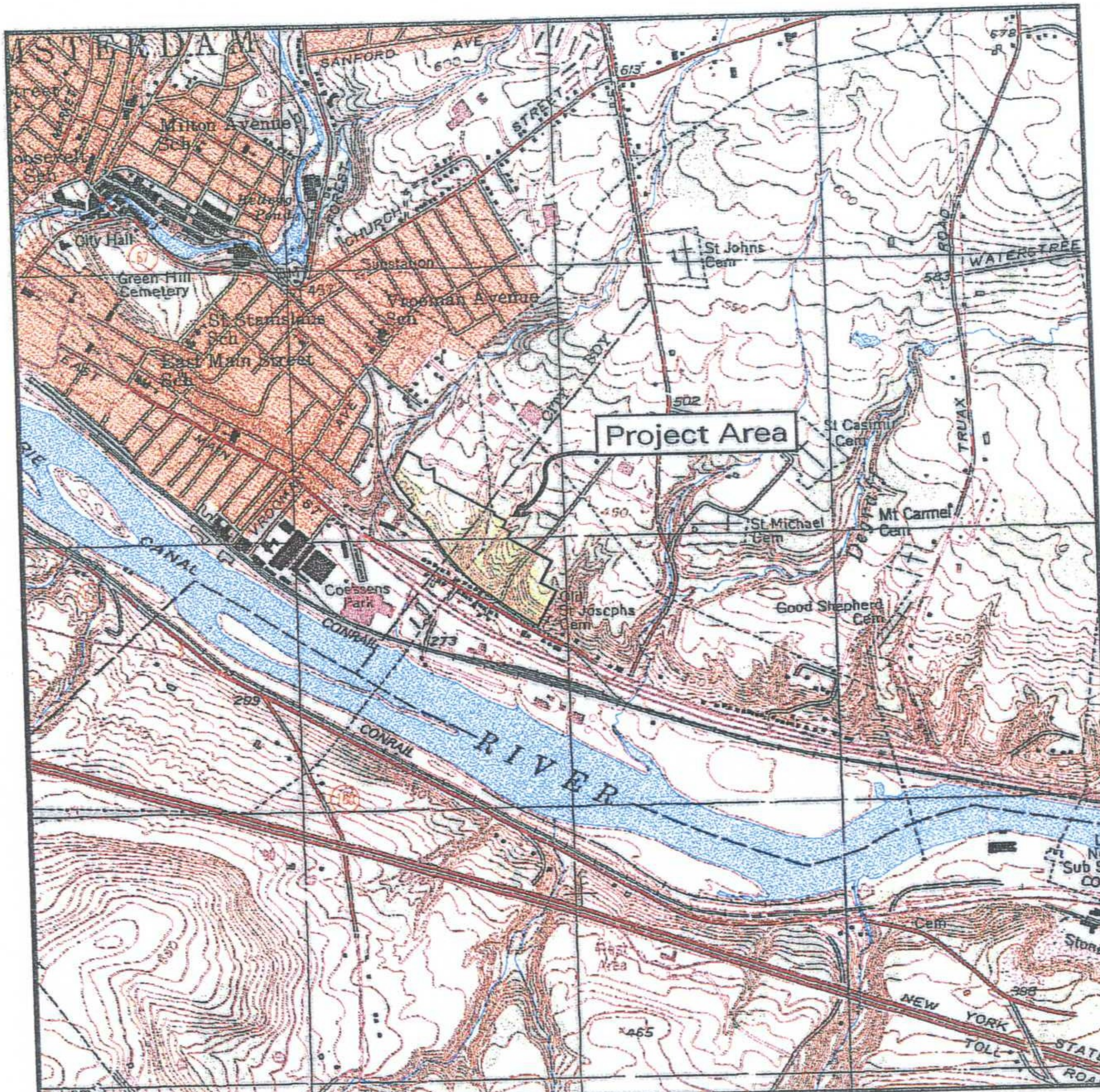


Figure 1: Project Location

II. PROJECT DESCRIPTION

The proposed project is a materials recycling plant located in the town of Amsterdam, Montgomery County, New York. The western portion of the project area is within the city limits of Amsterdam (Figure 2). At the time of the Phase I survey, project plans were not available. The project area is approximately 43 acres in size. The parcel is located immediately south of a large industrial park. It is bounded on the north by several commercial buildings in this park which are located on the south side of Sam Stratton Road. The parcel is bounded on the south by a rail line which runs parallel to East Main Street/Chapman Drive. This street runs along the bluff base of the Mohawk River Valley. Undeveloped terrain is located to the east and west of the parcel. The parcel is bisected by Niagara Mohawk right-of-way which runs north/south through the project area. The right-of-way is not proposed for development.

There are no standing structures within the project boundaries. There are numerous structures in view of the project area that are 50 years of age or older. One of these structures is located on the north side of East Main Street near the southwest boundary of the project area (Appendix A: Figure 1, Plate 1). Several structures of comparable age line the north side of East Main Street/Chapman Drive, near the southern boundary of the project area (Appendix A: Plates 2 and 3). All of these structures are outside of the proposed development. The railroad tracks are located north of the structures along East Main Street/Chapman Drive (see Figure 2; Appendix A: Plate 4), and pass along the southern project boundary.



SOURCE: Amsterdam, NY (1980)
USGS 7.5' Series Quad

0 .5 1
Miles

N

Figure 2: Project Area and Topographic Features

III. DESCRIPTION OF PROJECT AREA

The project area is located in eastern New York in eastern Montgomery County. This part of New York lies just north of the Mohawk River and it is within the physiographic region known as the Ontario Lowlands. This region is characterized by drumlin fields that were formed from glacial till (Isachsen et al. 2000:189). Bedrock in the region are late Cambrian and early Ordovician in age and consist of sandstone, dolostone, siltstone, and limestone (Rogers et al. 1990).

The project parcel encompasses heavily dissected uplands overlooking the Mohawk River. It contains slightly sloping terrain, primarily along the northern portion of the parcel, and steep slopes of the valley wall along the north side of the Mohawk River. Elevations in the project area range from 315 feet amsl near the southeastern project boundary to 440 feet amsl near the northwestern project boundary. Several low-order unnamed drainages, small tributaries to the Mohawk River, have carved deep ravines through the parcel.

Approximately two-thirds of the project area is characterized by slope in excess of 15 degrees. The remaining areas encompass gently sloping summits or shoulderslopes. Approximately 90 percent of the parcel is heavily wooded, or covered by thick brush (Figure 3), which resulted in limited surface visibility. At the time of fieldwork, two areas in the eastern portion of the project area had been graded by heavy machinery (Figure 3; Appendix A: Plates 5-7). These areas exhibited no surface soils and they were devoid of vegetation.

Four soils are mapped the project area: Darien silt loam of varying slopes (DaB, DaC), Lansing silt loam (LaD), and Lansing and Mohawk silt loam, very steep (LMF) (Davis and Landry 1978). The western one-third of the project area is mapped as Darien silt loam, the central and southeastern portions are mapped as Lansing silt loam, and the remainder of the project area is mapped as Lansing and Mohawk silt loam (Figure 4). Lansing and Mohawk series soils consist of areas of Lansing soils and Mohawk soils mapped together. All these soils formed in glacial till and they are found on glacial till plains and sideslopes. Table 1 provides summary information on the soils mapped within the project boundaries.

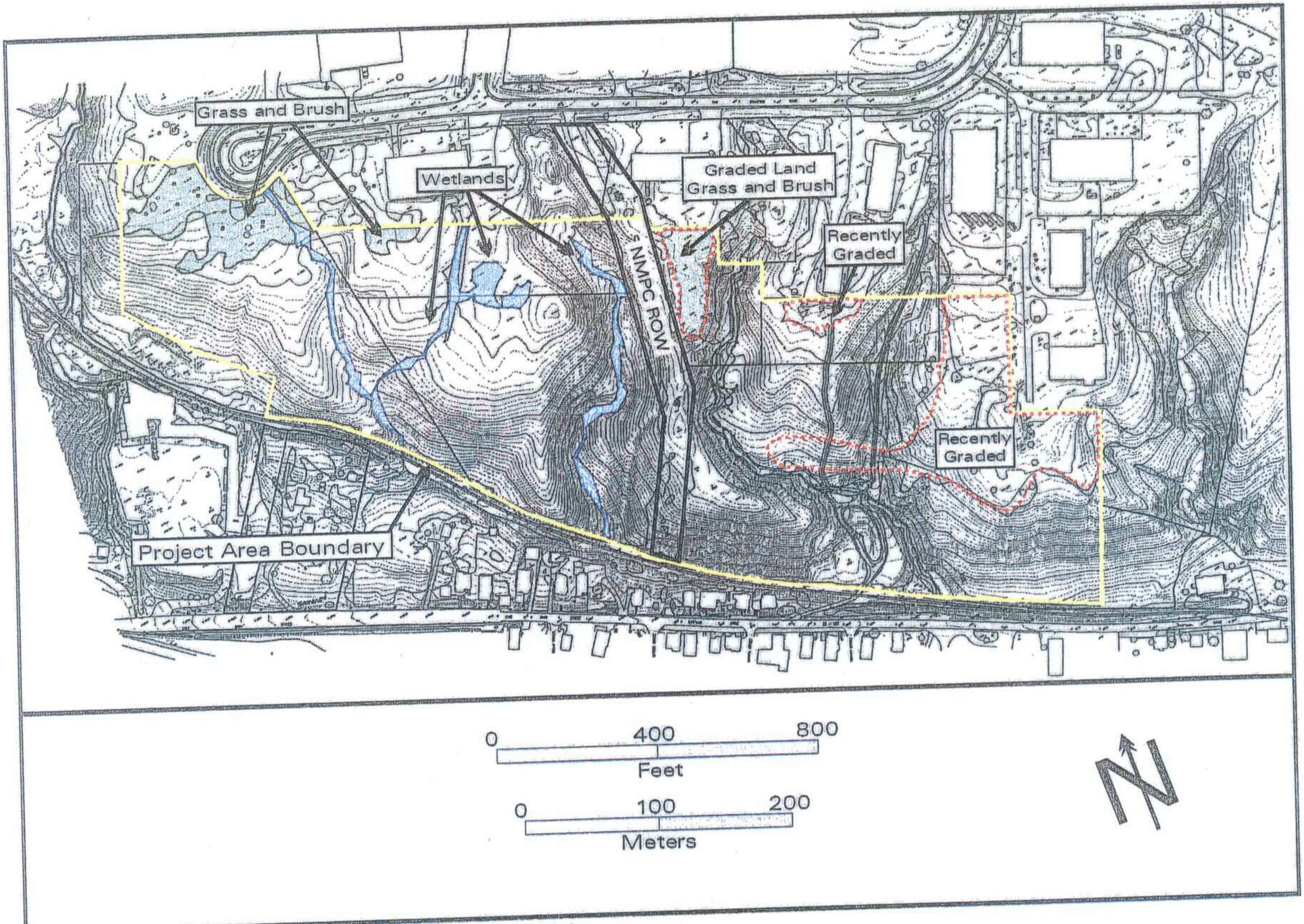
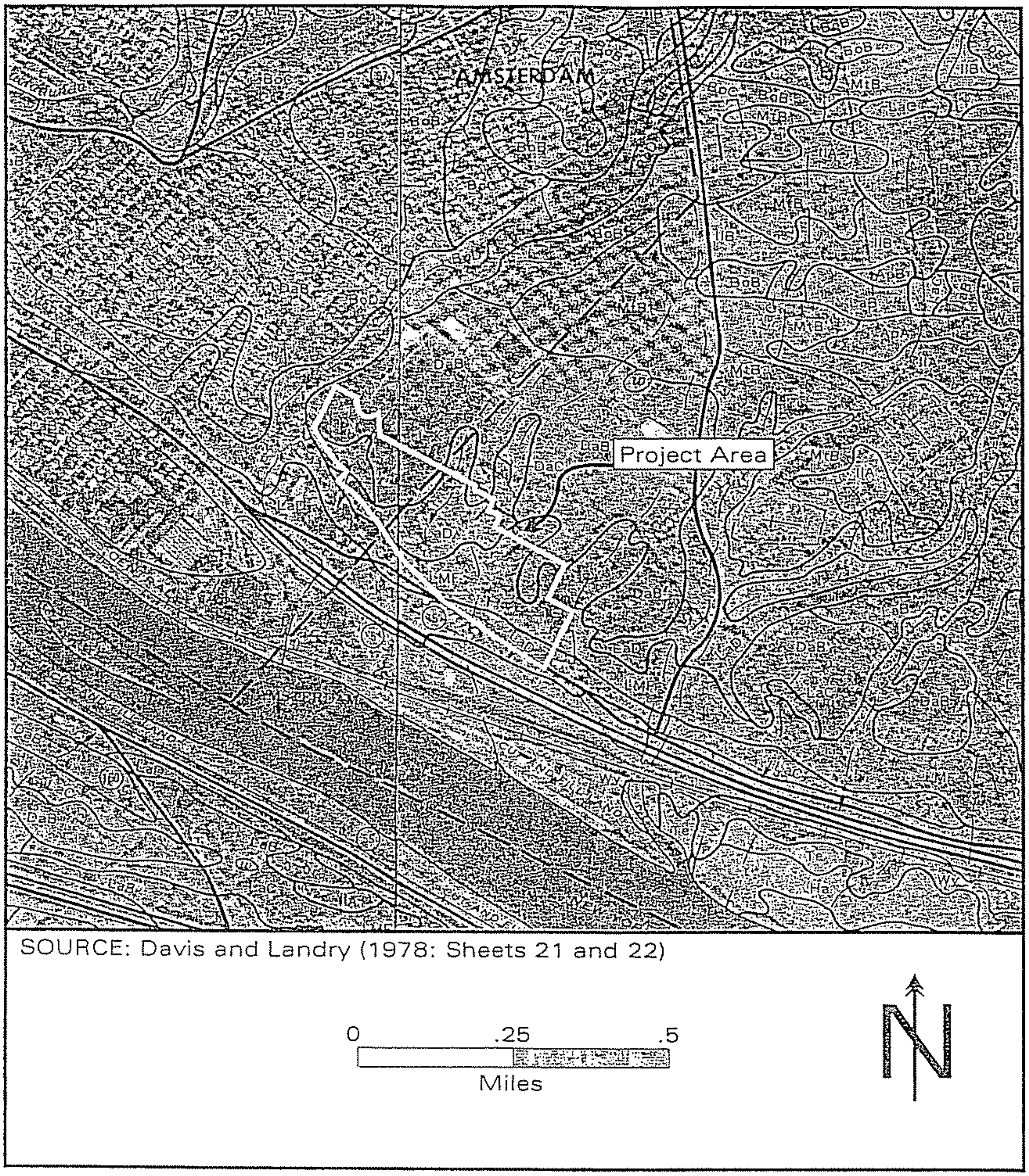


Figure 3: Project Area and Survey Conditions



SOURCE: Davis and Landry (1978: Sheets 21 and 22)

Figure 4: Mapped Soils

Table 1
Summary of Soils Mapped in the Project Area

Soil Series	Symbol	Slope	Drainage Class	Parent Material	Landscape Position
Darien silt loam	DaB	3-8%	Somewhat poorly drained	Glacial till	Uplands
Darien silt loam	DaC	8-15%	Somewhat poorly drained	Glacial till	Sideslopes
Lansing silt loam	LaD	15-25%	Well drained	Glacial till	Sideslopes
Lansing and Mohawk silt loam, very steep	LMF	Steep	Well drained	Glacial till	Uplands

SOURCE: Davis and Landry (1978)

IV. PHASE IA INVESTIGATIONS

A. RESEARCH OBJECTIVES

The goal of the Phase IA study was to assess the potential for the presence of significant archaeological resources within the project area. The study was designed to gather data regarding archaeological potential through archival research and a preliminary field inspection. All pertinent archaeological and historical literature and state records applicable to the project area were reviewed during the Phase IA investigation.

Site assessments are based on NRHP criteria of significance (36CFR60.6, *Federal Register* 1976). The criteria are:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and

a. that are associated with events that have made a significant contribution to the broad patterns of our history; or

b. that are associated with the lives of persons significant in our past; or

c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction, or

d. that has yielded, or may be likely to yield, information important in prehistory or history.

Typically, Criterion d is the most applicable criterion for evaluation of archaeological resources.

B. BACKGROUND RESEARCH

Background research was conducted for the purpose of compiling baseline information related to the prehistory, history, geomorphology, environment, and land use history of the project area. These sources provided information regarding NRHP eligible sites in the area and data with which to evaluate the project's archaeological potential.

Background research consisted of consulting official site records at the OPR&HP, the New York State Museum (NYSM) site files at the OPR&HP, and historic maps at the New York State Library. Historic maps were used to identify land use history and potential for historic resources within the project area. A *GIS* database search also was conducted at OPR&HP to determine the presence of NRHP properties within or near the project area.

C. PREHISTORIC AND HISTORIC OVERVIEW

Paleoindian Period (circa 12,000 - 10,000 BP)

The first human settlers in the Northeastern United States arrived approximately 12,000 years ago, as the Wisconsin glacial period was coming to an end (Snow 1980:101-102). The retreat of glacial ice allowed small groups of people to migrate northward into New York State and the surrounding region, primarily along major river valleys (Ritchie and Funk 1973:6). These highly mobile groups created a variety of chipped stone tools for hunting and processing game, including distinctive "fluted" projectile points. Paleoindian peoples probably subsisted on large migratory game animals such as mastodon and caribou, as well as smaller animals and plants available in the Early Holocene environment (Ritchie and Funk 1973:7; Snow 1980:150). Ritchie and Funk (1973) have divided Paleoindian sites into two basic types: camps and quarry-workshops (333). Although Paleoindian sites are relatively rare in the Northeast, both site types have been identified in New York State (Ritchie and Funk 1973:333-335; Snow 1980:127-155).

Archaic Period (10,000 - 3700 BP)

The Archaic period represents a growth in population and a shift in subsistence and settlement that corresponds to changing environmental conditions in the Northeast (Ritchie and Funk 1973:37; Snow 1980:155-156). The Archaic is divided into three subperiods: Early (10,000-8000 BP), Middle (8000-6000 BP), and Late (6000-3700 BP) (Snow 1980).

Throughout the Early and Middle Archaic, the evolution of a warmer and more diverse forested landscape led to a generalized economy of hunting, fishing, and gathering plant foods (Fagan 2000:353; Ritchie and Funk 1973:337). These subsistence activities can be seen in the appearance of new technologies that enabled the exploitation of small mammals and aquatic resources (Dincauze 1976; Ritchie and Funk 1973; Snow 1980). Sites interpreted as semi-permanent residences suggest that a "central based wandering" settlement pattern emerged at this time (Snow 1980:183).

By the Late Archaic, the climate and environment in the Northeast had become similar to modern conditions. During this subperiod there is evidence for significant population increase and the development of a wide variety of regional projectile point types. These data indicate that populations had become regionally differentiated, with distinct contemporary projectile point "traditions" existing throughout the Northeast (Cassedy 1999; Snow 1980). Settlements became more stable as many Late Archaic peoples coalesced into large semi-permanent camps during the warm months, and dispersed into smaller hunting camps during the winter (Ritchie and Funk 1973; Snow 1980).

Transitional Period (3700 - 3000 BP)

The Transitional Period is marked by new styles of projectile points, including "broad semilozenge" and "fishtail" types (Ritchie 1994:150). The appearance of carved steatite (soapstone) vessels, which are heavy and difficult to transport, suggests that a more sedentary lifestyle emerged during this period (Cassedy 1999:128; Snow 1980:235, 240).

Woodland Period (1000 BP – European Contact)

The Woodland Period is characterized by the adoption of pottery and domesticated plants, as well as more permanent settlements, intensive exchange networks, and an increase in social complexity (Fagan 2000:403). The Woodland Period is divided into three subperiods: Early Woodland (2700-2000 BP), Middle Woodland (2000-1000 BP), and Late Woodland (1000 BP - European Contact).

Pottery first appears in the Northeast during the Transitional Period, but it becomes used widely in the Early Woodland (Ritchie and Funk 1973:96). These early ceramic vessels, although somewhat crude, indicate the growing efficiency of food preparation and the increased exploitation of wild seeds and nuts (Fagan 2000:404-405; Snow 1980). Another feature of the Early Woodland period is a complex mortuary ceremonialism which includes the construction of burial mounds in some parts of New York State (Ritchie 1994:179).

The Middle Woodland is distinguished by the improvement of pottery technology and the use of several distinct types of stamped and impressed decorative elements. Elbow and platform pipes also appear in New York State during this period, and are associated with an elaborate system of mortuary customs (Ritchie 1994:180).

Late Woodland cultures are characterized by the introduction of corn agriculture. The cultivation of corn formed the basis of a reliable subsistence system that enabled populations in the Northeast to expand (Ritchie 1994:180). Pottery technology continued to improve, but less emphasis was placed on decoration during the Late Woodland. Treatment of the dead was not as elaborate at this time as it had been previously (Ritchie 1994:180; Englebrecht 1993:27-28).

Relatively late in the Woodland occupation of New York (ca. AD 900), the Iroquois became the predominant cultural group in the central and western portions of the state (Snow 1996:19). The Iroquois formed permanent village settlements consisting of 30 to over 100 longhouses that often were surrounded by a palisade (Fenton 1978:306; Snow 1996; Tuck 1978). These groups practiced slash and burn agriculture growing a combination of corn, beans, and squash in cleared fields near their villages. Seasonal hunting also played an important role in the Iroquois economy (Fenton 1978:297-298).

Historic Period (after 1650)

European settlement began in Amsterdam during the American Revolution. This location offered water power from the Chuctanunda Creek near its confluence with the Mohawk River and here a mill village developed in what was to become the city of Amsterdam. Albert Vedder built gristmills and sawmills in this location, and the early settlement, Veddersburg, was named after him (Spafford 1824:27). The town of Amsterdam was incorporated in 1793 (Donlon 1980: 61).

In the early 1800s, the construction of Mohawk Turnpike, which followed the Mohawk River, facilitated transport in the region, and strengthened Amsterdam's mill-based economy (Donlon 1980:29). The Erie Canal, which opened in 1821, crossed the Mohawk River at Port Jackson, via an aqueduct at Amsterdam (Spafford 1824:27). In 1836 the Schenectady and Utica Railroad route was completed through the village of Amsterdam, which had been established in 1831. The various arteries of transportation that passed through Amsterdam added to the growth of the town (Donlon 1980:61). By the late nineteenth century, the city of Amsterdam had become incorporated, and factories based on steam power and turbine technology sprouted up along the railroad (Donlon 1980:101).

At the turn of the twentieth century, Amsterdam was a prosperous manufacturing city, specializing in carpet, broom, button, and spring manufacturing, as well as iron working (Donlon 1980:85). In 1915, the Erie Canal was emptied, and never refilled. It eventually was backfilled in 1918. The depression of the 1930s hit Amsterdam, in addition the rest of the country, and the town never returned to its status as a large manufacturing center (Donlon 1980:59).

D. RESULTS OF PHASE IA INVESTIGATIONS

Based on the records examined at OPR&HP, there are no NRHP properties within or adjacent to the project area. Examination of site files revealed that there are no archaeological sites recorded within the project limits, but there are 30 sites recorded within two miles of the project area (Table 2). Fourteen of these sites are prehistoric, 15 are historic, and one site has both prehistoric and historic components. The majority of the sites are located within the bottomland of the Mohawk River. A prehistoric site (NYSM# 8959) is recorded immediately south of the project area and it is described as "trail". While the exact boundaries of this site are not known at present, records illustrate its location as extending into the eastern portion of the project area.

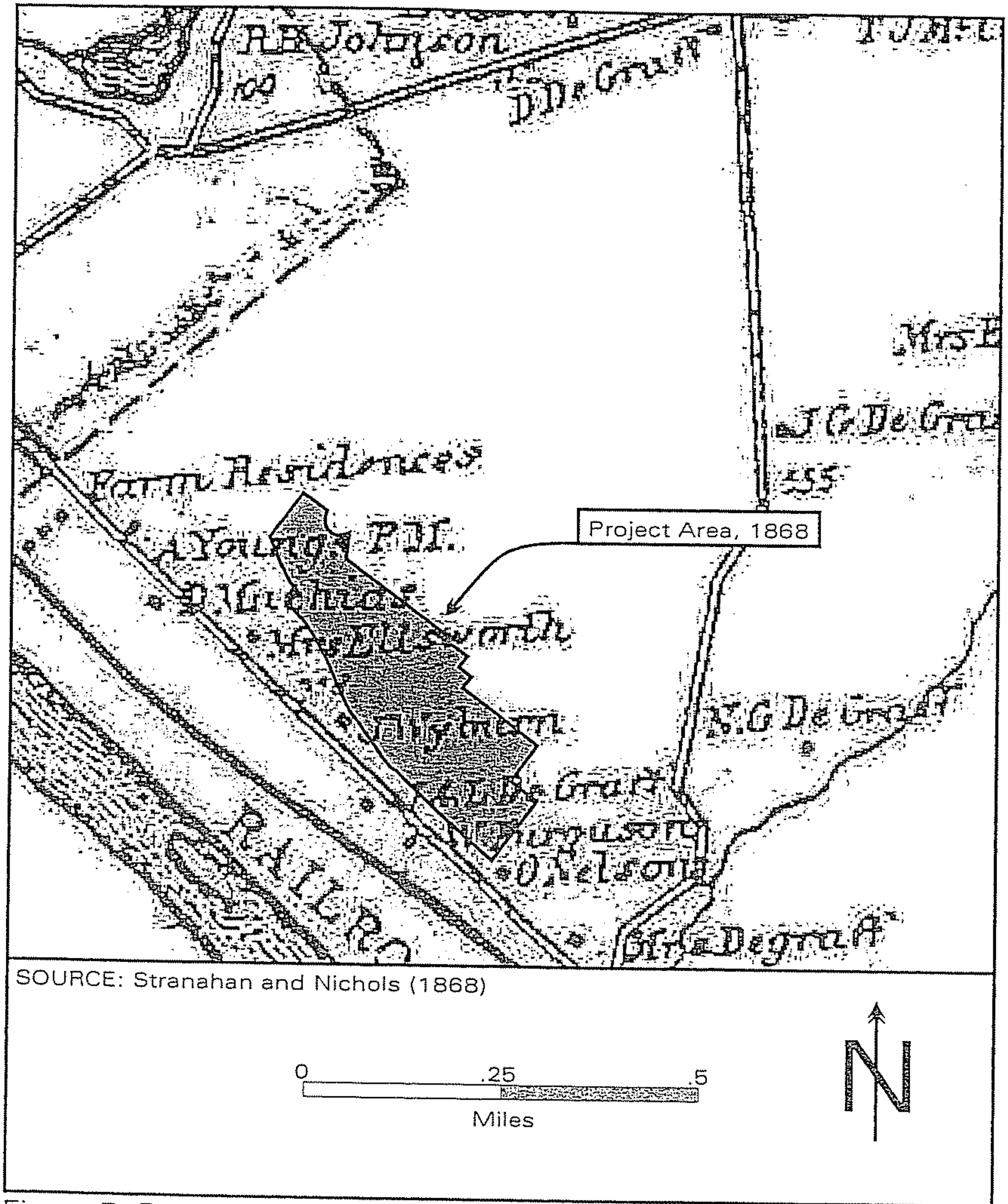
A historic map for the year 1868 (Stranahan and Nichols 1868) was reviewed during the Phase IA research (Figure 5). Several structures are located along a road, possible the location of State Route 5, south of the project area, but no structures are within the project area. The railroad along the river is shown along the same alignment as it follows today. The railroad line that runs along the southern boundary of the project area is not illustrated on the 1868 map.

E. ARCHAEOLOGICAL POTENTIAL

Potential for the presence of prehistoric archaeological sites is considered to be high for a small portion of the project area. This portion encompasses the relatively level to slightly sloping terrain in the northwestern part of the project parcel. Relatively flat summits overlooking the Mohawk River are favorable locations for prehistoric occupation. Well-drained soils, which characterize the central portion of the project area, are also favorable conditions for occupation. Hill summits are considered erosional settings, and therefore, there is no potential for deeply buried sites in the project area. If archeological deposits are present, they would be within the surface soils. The steep slopes which characterize the majority of the project area are considered to have no potential for intact archaeological deposits. The bluff line exhibited no exposed cliff faces and the parcel did not contain recessed rock exposures for use as rockshelters.

Table 2
Previously Recorded Sites Within Two Miles of the Project Area

OPR&HP #	NYSM #	Reported By:	Site Identifier/Description	Time Period
A057-01-0009	1574	SUNY Albany, 1989	De Graaf Rockhouse	Prehistoric
A057-01-0010	1575	SUNY Albany, 1989	NO INFO	Prehistoric
A057-01-0011	1576	SUNY Albany, 1989	Truax	Prehistoric
A05701.000106		S. Hanny, 1998	Durham Project #77 Willow Rapid	Historic
A05701.000107		S. Hanny, 1998	Durham Project #189 Euau's Kill	Historic
A05701.000116		S. Hanny, 1998	Durham Project #199, Manny Inn	Historic
A05701.000117		S. Hanny, 1998	Durham Project #24 V Dam	Historic
A05704.000111		S. Hanny, 1998	Durham Project #110 Philips	Historic
A05704.000112		S. Hanny, 1998	Durham Project #113 Stanton	Historic
A057-40-0005		Hartgen, Emery, Ballen, Fisher, 1976	Industrial Component	Historic
A057-40-0006		D. DeMicco, 1975	Johnson Site	Prehistoric, Historic
A057-40-0007		D. DeMicco, 1975	Atlas Knitting Company	Historic
A057-40-0008		D. DeMicco, 1975	Shuttleworth Dyeing Company	Historic
A057-40-0043		J.W. Bouchard, 1982	Erie Canal, stone culvert between Cleveland Avenue and Mohawk River	Historic
A057-40-0044		J.W. Bouchard, 1982	Erie Canal, aqueduct and canal at South Chuctanunda Creek	Historic
A057-40-0045	1946	SUNY Albany, 1989	Johnson	Prehistoric
A057-40-0046	1569	SUNY Albany, 1989	Picture Rocks	Prehistoric
A057-40-0047	1570	SUNY Albany, 1989	Brookside	Prehistoric
A057-40-0048	1573	SUNY Albany, 1989	Amsterdam Flats	Prehistoric
A057-40-0049	1580	SUNY Albany, 1989	NO INFO	Prehistoric
A05740.000263		S. Hanny, 1998	Durham Project #38 Painted Rocks	Historic
A05740.000264		S. Hanny, 1998	Durham Project #112 Lime Kiln	Historic
A05740.000320		J. Levandowski, 1999	Subi-1973, Amsterdam Site	Historic
	4003	A.C. Parker, 1922	Cache	Prehistoric
	4011	A.C. Parker, 1922	Village, Pits	Prehistoric
	6217	Snow, 1989	Claus Mansion	Historic
	6931	A.C. Parker, 1922	Traces of Occupation	Prehistoric
	6932	A.C. Parker, 1922	Camp	Prehistoric
	8355	A.C. Parker, 1922	Trail	Prehistoric
	8959	NO INFO	Trail	Prehistoric



SOURCE: Stranahan and Nichols (1868)

Figure 5: Project Area, 1868

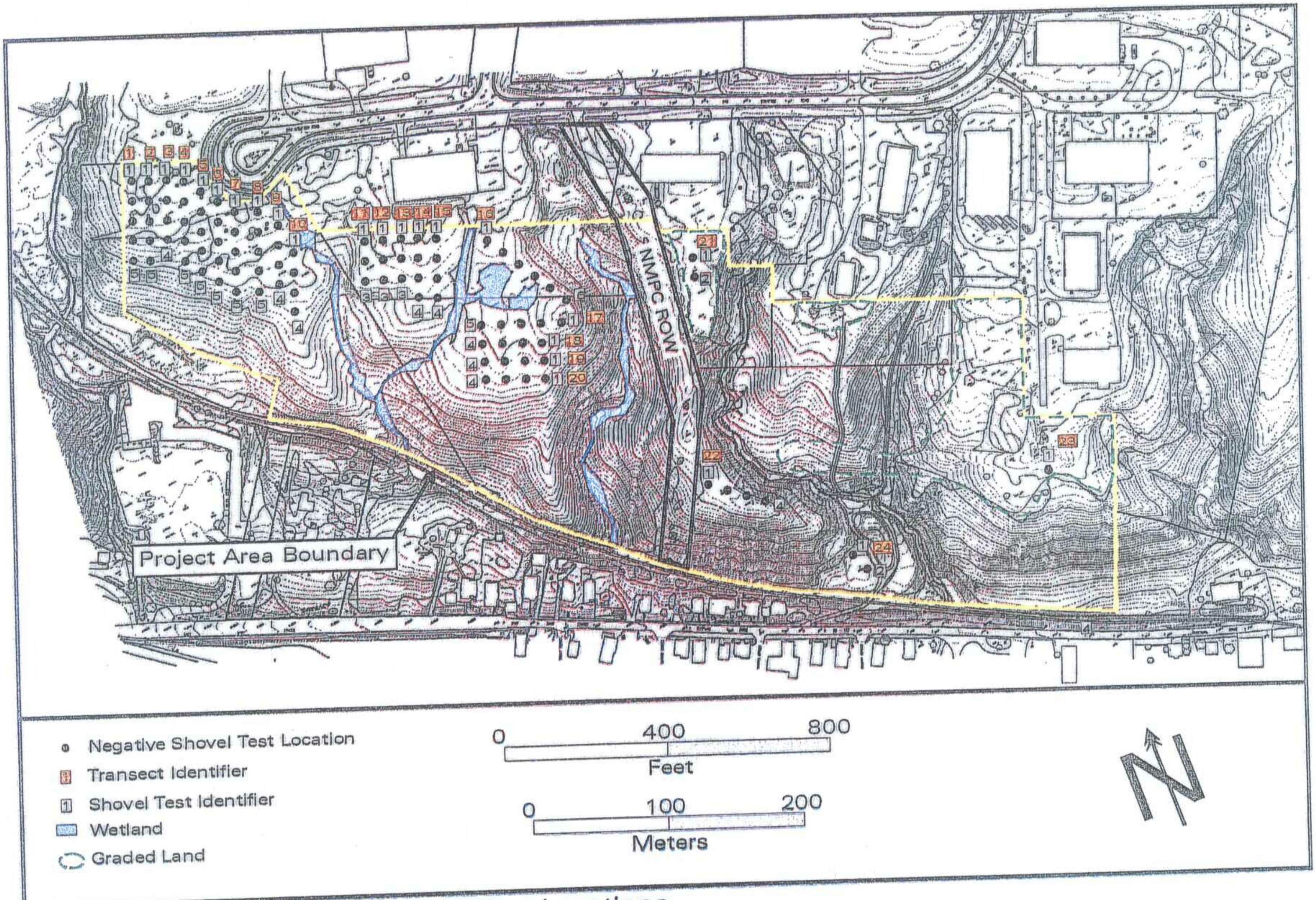


Figure 6: Project Area and Shovel Test Locations

Disturbance was observed in Transect 2, STP 4, Transect 3, STP 3 and 4, and Transect 4, STP 4 and 5. These tests revealed a clay loam mottled fill typically yellowish brown (10YR 5/6) with brown (10YR 4/3) and dark gray (10YR 4/1) in color. These five tests are in the vicinity of a concrete slab with a manhole cover (Appendix A: Plate 8). This disturbance likely is associated with the installation of a storm drain in this area.

A mottled clay loam fill was noted in Transect 7, STP 1 and Transect 8, STP 1. These two shovel tests are in close proximity to the cul-de-sac at the western end of Sam Stratton Road, and the disturbance in these tests may be related to road construction.

Transects 11 through 16 were positioned south of the western-most commercial building on the south side of Sam Stratton Road. Mottled fills were encountered in Transect 11, STP 1; Transect 12, STP 1-3; Transect 13, STP 1; and Transect 16, STP 1 and 2. Given the close proximity of these shovel tests to the commercial structure, the disturbance probably is a result of activities related to building construction.

Transect 21

Transect 21 was established across a flat, linear summit, near the north-central portion of the project area (see Figure 6). At the time of fieldwork, this location was covered by grass and brush. The landform appeared unnaturally level. There was a small grass-covered mound at the southern end of the landform, and another mound at the eastern side (Appendix A: Plate 9). Tests revealed that the A soil along this terrain had been removed and B soils were encountered at the surface. The mounds most likely represent the stripped A soils. No artifacts were found in the tests on Transect 21.

Transect 22

Transect 22 was established across a narrow interfluve summit near the south-central portion of the project area (see Figure 6). Tests documented the area to contain a thin A horizon (12-19 cm) (10YR 4/2) over a silty clay loam (10YR 5/4) B soils. No artifacts were encountered in the tests on Transect 22.

Transect 23

Much of the gently sloping terrain in the eastern portion of the project area had been graded by heavy machinery (see Figure 3). One shovel test (Tr. 23, STP 1) was excavated in a small area (5x15 meters) which appeared to be an undisturbed location (see Figure 6; Appendix A: Plate 10). The test revealed an intact A-B soil sequence, but no artifacts were found. The surrounding graded areas were devoid of vegetation with B-horizon soils exposed at the surface. A pedestrian survey of these graded areas found no artifacts or evidence of features.

Transect 24

Transect 24 was established over a small flat location along the southern project boundary, near the railroad tracks. Both of the shovel tests encountered fill presumably related to construction of the railroad.

VI. SUMMARY AND RECOMMENDATIONS

The Phase I archaeological study conducted for the proposed Amsterdam Materials Recycling Project consisted of background research and an intensive level field effort. The project area encompassed approximately 43 acres in the town of Amsterdam, Montgomery County, New York. The investigation was conducted by Landmark Archaeology, Inc., who was retained as a consultant by The Chazen Companies of Troy, New York.

Background research revealed that there are no NRHP properties or archaeological sites located within the project boundaries. Historic maps show no structures within the project area. Potential for archaeological sites was considered high only in the northwestern part of the project parcel where terrain was relatively level. The majority of the project area, however, encompassed steep slopes with no potential for intact archaeological remains. The bluff line exhibited no exposed cliff faces and the parcel did not contain recessed rock exposures for use as rockshelters.

Phase I fieldwork entailed the excavation of shovel test pits across the gently sloping portions of the project area, with the exception of those areas that had been graded by heavy machinery. Graded areas were subjected to a pedestrian survey. In total, 96 shovel tests were excavated in the project area. No archaeological sites were identified during the Phase I investigation.

Based on the results of this investigation, the proposed project will have no effect on significant archaeological resources, and no additional archaeological research appears warranted. Project clearance from an archaeological perspective is recommended. It should be noted, however, that no field technique is completely adequate to define all cultural resources in a particular location. Therefore, should historic or prehistoric resources be detected during the course of the proposed project, the New York OPR&HP must be notified immediately so that the significance of the discovery can be determined.

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APPENDIX A

Photographs

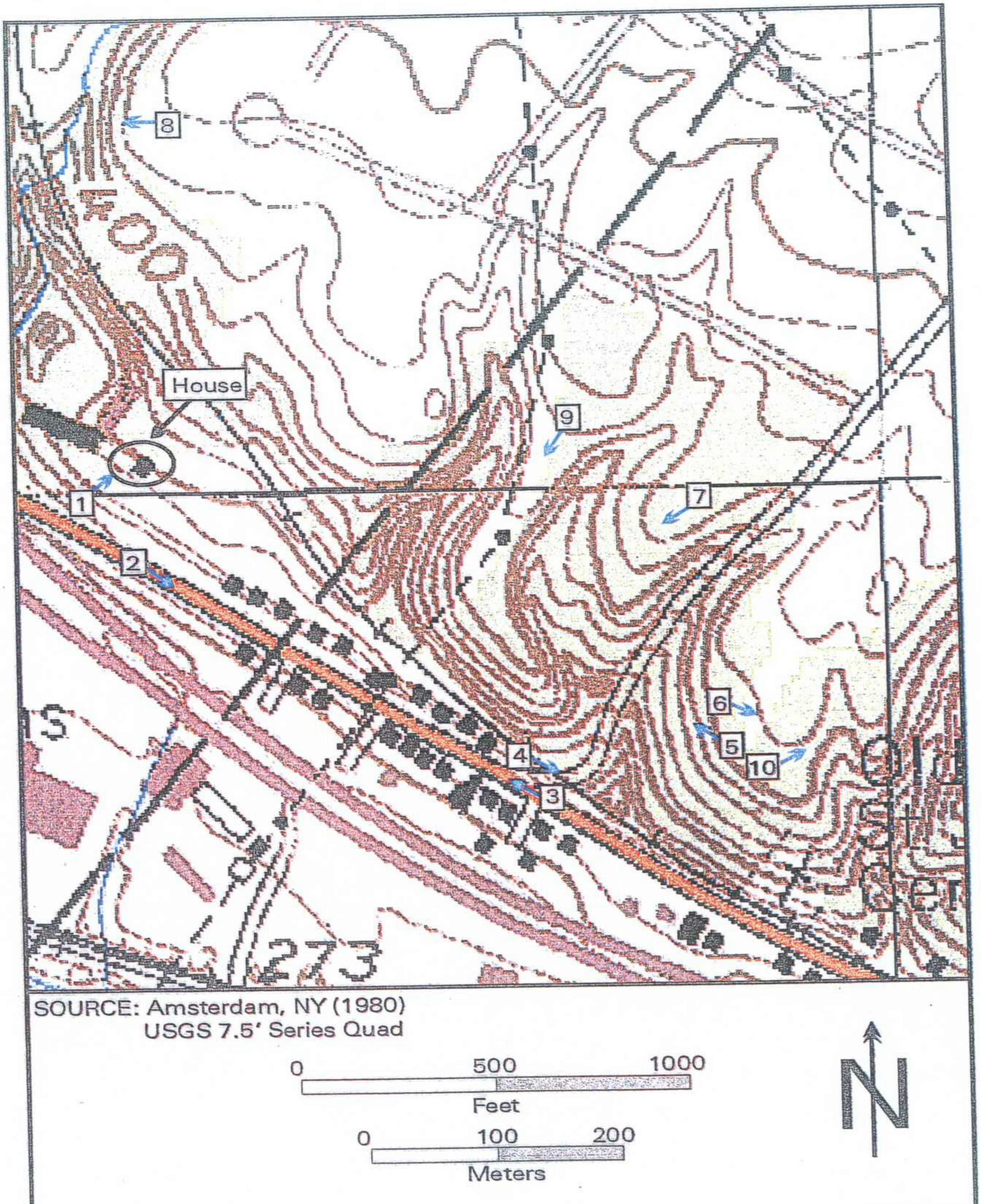

Figure 1:Photo Key

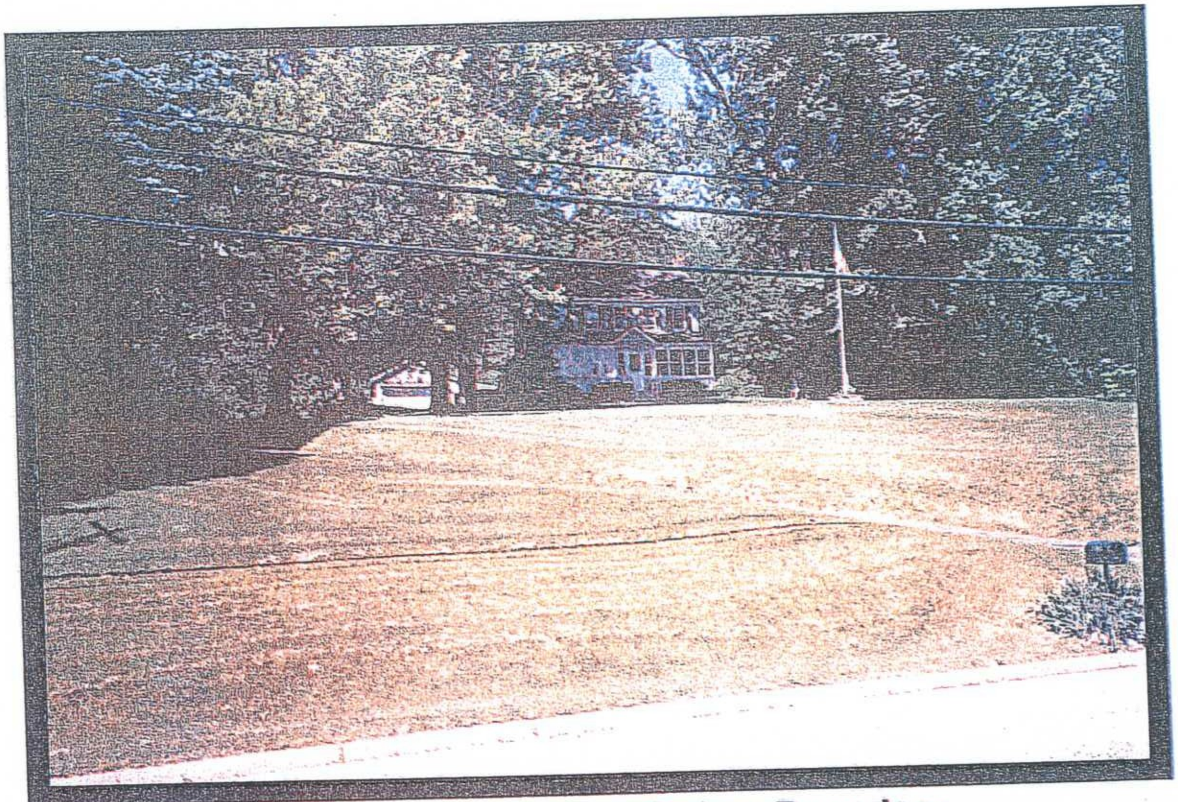

PLATE 1: House Near Southwest Project Boundary,
View to Northeast.

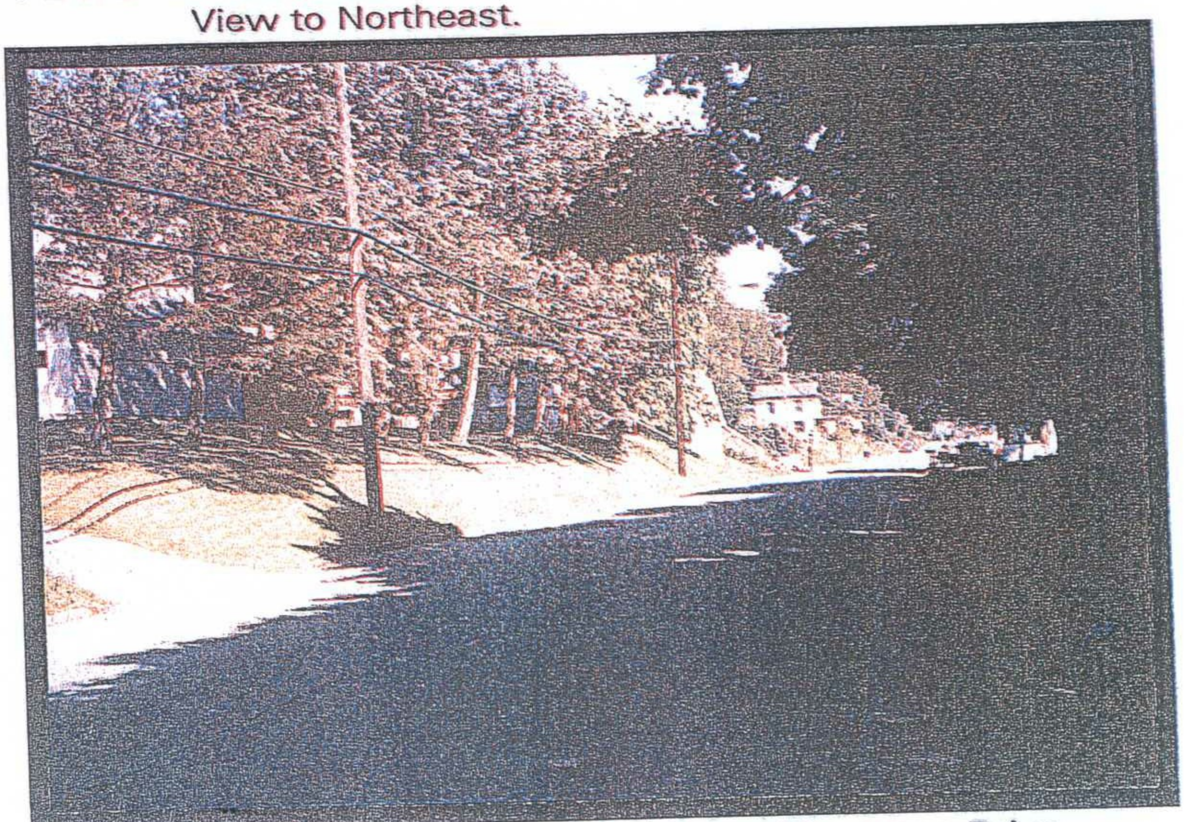

PLATE 2: Houses Along East Main Street/Chapman Drive,
View to Southeast.

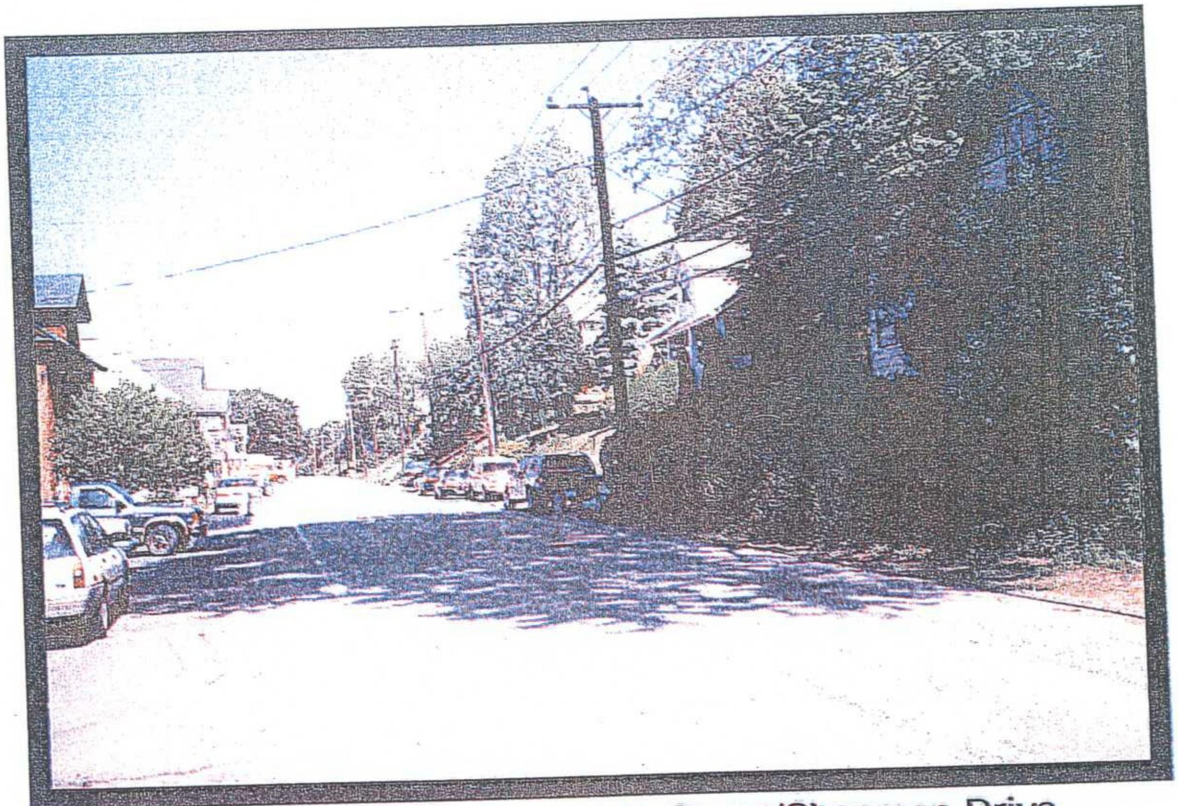

PLATE 3: Houses Along East Main Street/Chapman Drive, View to Northwest.

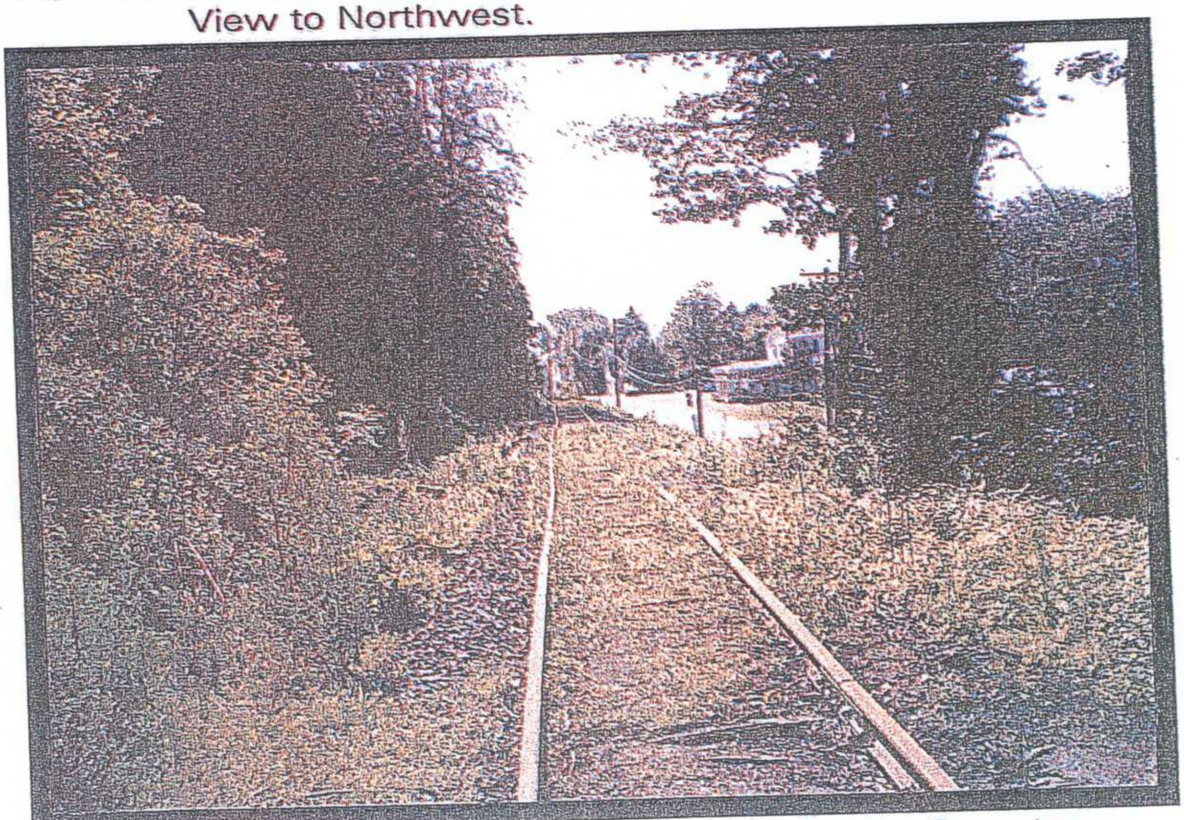

PLATE 4: Railroad Tracks Along Southern Project Boundary, View to Southeast.

PLATE 5: Graded Area on Eastern Side of Parcel,
View to Northwest.

PLATE 6: Graded Area on Eastern Border, View to Southeast.

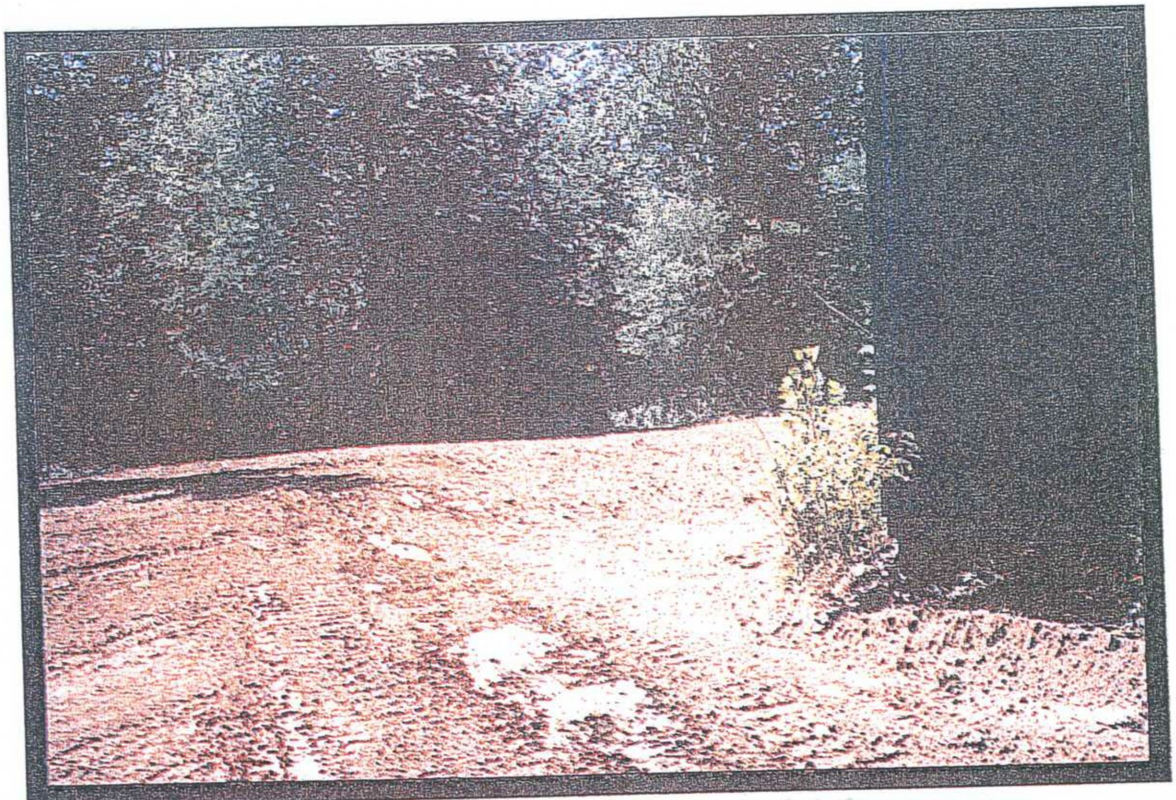

PLATE 7: Graded Area South of Commercial Structure, View to Southwest.

PLATE 8: Concrete Slab with Manhole Cover, View to West.

PLATE 9: Phase IB Shovel Testing on Transect 21,
View to Southwest.

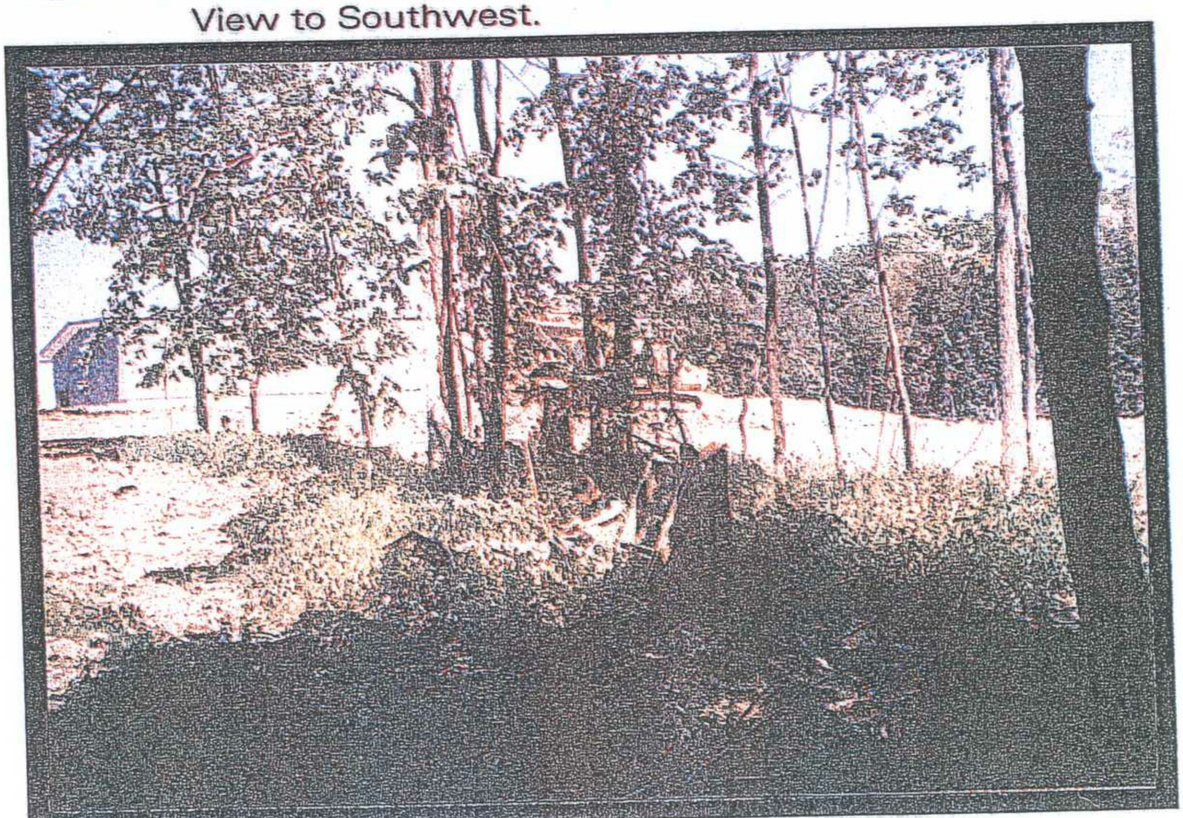

PLATE 10: Phase IB Shovel Testing on Transect 23,
View to Northeast.

APPENDIX B

Shovel Test Descriptions

Amsterdam Materials Recycling Project
Landmark Archaeology, Inc. #60

Munsell		10YR 4/2	10YR 5/4	10YR 5/6 with 10YR 4/3 and 10YR 4/1	Comments
Soil Description Key		1	2	3	
STRAT		A	B	Mottled Fill	
Transect 1	1	0-24	24-53		
	2	0-21	21-48		
	3	0-22	22-43		
	4	0-17	17-40		
	5	0-22	22-41		
Transect 2	1	0-26	26-41		
	2	0-28	28-44		
	3	0-16	16-40		
	4			0-36	
	5	0-20	20-41		
Transect 3	1	0-21	21-35		
	2	0-16	16-33		
	3			0-47	
	4			0-35	
Transect 4	1	0-20	20-45		
	2	0-29	29-40		
	3	0-31	31-39		
	4			0-44	
	5			0-47	
Transect 5	1	0-11	11-39		
	2	0-13	13-47		
	3	0-28.	28-44		
	4	0-40	40-52		
	5	0-28	28-48		
Transect 6	1	0-12	12-40		
	2	0-16	16-43		
	3	0-30	30-53		
	4	0-23	23-47		
	5	0-16	16-49		
Transect 7	1			0-61	
	2	0-24	24-36		
	3	0-28	28-40		
	4	0-28	28-42		
	5	0-29	29-52		
Transect 8	1			0-46	
	2	0-28	28-40		
	3	0-33	33-43		
	4	0-28	28-41		
	5	0-26	26-43		

Soil Description	
1	Silt loam
2	Silty clay loam
3	Clay loam

Amsterdam Materials Recycling Project
Landmark Archaeology, Inc. #60

Soil Description	
1	Silt loam
2	Silty clay loam
3	Clay loam

Munsell		10YR 4/2	10YR 5/4	10YR 5/6 with 10YR 4/3 and 10YR 4/1	Comments
Soil Description Key		1	2	3	
STRAT		A	B	Mottled Fill	
Transect 9	1	0-39	39-49		
	2	0-30	30-45		
	3	0-28	28-40		
	4	0-26	26-40		
Transect 10	1	0-25	25-38		
	2	0-25	25-36		
	3	0-21	21-38		
	4	0-25	25-42		
Transect 11	1			0-55	
	2	0-19	19-36		
	3	0-14	14-34		
Transect 12	1			0-57	
	2			0-46	
	3			0-63	
Transect 13	1		44-55	0-44	
	2	0-34	34-47		
	3	0-52	52-62		
Transect 14	1	0-27	27-41		
	2	0-29	29-43		
	3	0-30	30-45		
	4	0-26	26-46		
Transect 15	1	0-27	27-43		
	2	0-29	29-41		
	3	0-30	30-39		
	4	0-28	28-44		
Transect 16	1		0-55		
	2		0-58		
	3	0-14	14-37		
	4	0-25	25-40		
	5	0-10	10-41		
	6	0-27	27-41		
Transect 17	1	0-27	27-46		
	2	0-38	38-52		
	3	0-30	30-40		
	4	0-24	24-42		
	5	0-30			Roots at base

Amsterdam Materials Recycling Project
Landmark Archaeology, Inc. #60

Munsell		10YR 4/2	10YR 5/4	10YR 5/6 with 10YR 4/3 and 10YR 4/1	Comments
Soil Description Key		1	2	3	
STRAT		A	B	Mottled Fill	
Transect 18	1	0-19	19-41		
	2	0-21	21-40		
	3	0-21	21-39		
	4	0-22	22-41		
Transect 19	1	0-22	22-39		
	2				Wet
	3	0-24	24-34		
	4	0-22	22-37		
Transect 20	1	0-28	28-44		
	2	0-24	24-44		
	3	0-12	12-33		
	4	0-22	22-37		
Transect 21	1		0-36		
	2		0-34		
Transect 22	1	0-18	18-39		
	2	0-19	19-39		
	3	0-12	12-29		
	4	0-12	12-30		
Transect 23	1	0-27	27-40		
Transect 24	1				Railroad Fill 0-41
	2				Railroad Fill 0-39

Soil Description	
1	Silt loam
2	Silty clay loam
3	Clay loam

G

Appendix G
Visual Analysis

Visual Analysis
For

Amsterdam Materials Recycling

City of Amsterdam
Montgomery County, New York

December 2003

THE
Chazen
COMPANIES

Prepared for:

Amsterdam Materials Recycling
20 Gurley Avenue
Troy, NY 12186
PH (518) 272-8142

Project No. 90303.00

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

This Visual Analysis has been prepared for major activities associated with the development of a construction material recycling and disposal facility in the City of Amsterdam, Montgomery County, New York. A site location map has been included in Appendix A.

The Visual Analysis report and plans have been prepared in compliance with the New York State Department of Environmental Conservation (NYSDEC) guidelines for assessing and mitigating visual impacts. These guidelines define visual and aesthetic impacts, describes when a visual assessment is necessary and how to assess visual impacts, and defines avoidance, mitigation and offset measures that compensate for negative visual impacts.

Within these guidelines are State regulatory concerns, which are separate from local concerns, definitions of important technical concepts and a mechanism for complying with provisions of the State Environmental Quality Review Act (SEQR) with respect to environmental aesthetics.

The foundation of the policy is that many places have been recognized for their beauty and designated through Federal or State political processes that place a value on environmental aesthetics. Recognition of these aesthetic resources also occurs at local levels through zoning, planning or other public means by designating the resource as historical, scenic, or having aesthetic qualities.

Generally, this analysis was performed to identify and mitigate potential impacts to Federal, State and local aesthetic resources that may be impacted by the proposed project. The procedure to analyze the potential impacts is to inventory aesthetic resources, create visual assessments, assess the significance of the impact, and present alternative mitigation strategies for the proposed facility to eliminate, mitigate or compensate for adverse aesthetic effects.

To evaluate the potential for the proposed Amsterdam Material Recycling (AMR), L.L.C. project to have visual impacts, The Chazen Companies performed a visual analysis. A viewshed analysis indicated that one visual receptor, located along I-90, approximately 4,700'/.9 miles from the project area within the middleground viewshed, presents the greatest potential for visual impacts. A visual simulation performed of this viewpoint indicates that the proposed project is not anticipated to result in a significant adverse visual impact.

Given the area topography, vegetation, presence of structures and other features, the proposed project does not present adverse visual impacts to other receptors located within the 2.5-mile viewshed. Although the visual analysis indicates that the proposed project is not anticipated to result in a significant adverse visual impact, the project will implement certain mitigation measures to minimize potential visual impacts.

2.0 INTRODUCTION

The Chazen Companies (TCC) have completed a Visual Analysis for the development and operation of a construction material recycling facility in the City of Amsterdam, Montgomery County, New York. The applicant, Amsterdam Material Recycling (AMR), L.L.C., proposes to develop a construction material recycling and disposal facility on an existing industrial park owned by the Amsterdam Industrial Development Agency (AIDA).

The project site is a (±) 39.0 acre undeveloped property currently owned by the Amsterdam Industrial Development Agency (AIDA) located within the Edson Street Industrial Park. Generally, the project site is located south of Sam Stratton Drive (an internal road within the industrial park) and north of East Main Street/Chapman Drive. The project is bound by an unnamed stream to the west and contains approximately 275-feet of frontage along East Main Street. The central site area is traversed by a 100-foot wide Niagara Mohawk overhead power line transmission easement which comprises approximately 2.5-acres of the project site.

Project construction will primarily consist of site grading, paving, storm drainage, water supply and sewage collection to facilitate the development of the material recycling center and construction and demolition material landfill. A proposed site plan has been included in Appendix B.

This report considers the potential adverse visual impacts associated with the intended development with the purpose of:

1. Assessing the existing and proposed visual quality and character of the surrounding environments;

2. Properly designing, locating and maintaining the proposed facility to minimize impacting significant visual resources; and

3. Mitigating potential visual impacts and offsetting existing aesthetic issues identified within the viewshed of the proposed project, during and after construction and upon completion.

To demonstrate this, TCC performed a number of visual assessment studies that illustrate the potential visual impacts the facility will have on the existing context and environs. These assessments show how the proposed site fits within the existing context, where the site is visible from and how visible the site is from surrounding areas. Provided in this document is a photographic inventory of aesthetic resources, proposed condition simulations of the site, a 2.5 mile graphic viewshed map, and a line-of-sight profile through the proposed site. Also included are mitigation measures that address the potential adverse visual impacts that may result from the proposed construction and completion of the project.

The following sections will describe the existing site characteristics, proposed modifications to the existing site, and the potential visual impacts generated from the development.

3.0 SITE DESCRIPTION

3.1 Land Use

The project site is primarily undeveloped land covered by brushy and forested areas. No existing buildings or structures were identified on the subject site.

3.2 Topography

A review of the United States Geologic Survey (USGS) topographic map (Amsterdam Quadrangle) indicates that elevations on the project site range from approximately 440-feet above mean sea level (MSL) along the northwestern portion of the site to approximately 330-feet above MSL along the southeastern portion. Long ravines are present on the central and eastern portions of the site. The ravines are areas of concavely-sloped vegetated terrain with grades generally greater than 15 percent. Site mapping indicates that approximately 45 percent of the project site contains slopes of 15 percent or greater. The project site is located approximately 0.23 miles south of the Mohawk River and surrounding properties generally slope south towards the Mohawk River.

Site elevations defined on the USGS topographic map are consistent with elevations determined during a survey of the site performed in May 2003 by The Chazen Companies (TCC).

3.3 Vegetation

The 39.0 area site is predominantly covered with deciduous trees that stand approximately (±) 55 feet tall. The tree cover is typical of the upstate New York climate consisting of Maples, Ashes, Oaks, Beach, Eastern Cottonwood and a few other Northern trees. The stand of trees on site is dense and consists of canopy trees, understory trees, and lower growing ground cover. Project construction and operation on site will result in the disturbance of site vegetation. The vegetative community types to be impacted under the proposed action include success ional northern hardwoods.

4.0 VISUAL IMPACT ASSESSMENT

The purpose of the assessment is to understand and interpret the character and quality of the existing landscape and visual context of the proposed development to inform and guide the project design, and determine any resulting effects and their significance.

In order to understand the visual context of the proposed facility, a visual envelope is established within 2.5 mile radius of the site that shows the surrounding context. Within the visual envelope are a number of view points and visual receptors that may be affected by the proposed development. Once defined, a graphic viewshed map will illustrate the potential visible areas surrounding the proposed facility and will be the foundation of the visual impact assessment. A graphic viewshed map has been included in Appendix C.

4.1 Existing Visual Environment

The existing landscape of the foreground, within a 0.25-mile radius of the project site, consists of what is generally characterized as urban/industrial lands. The foreground is located within the immediate proximity of the project.

The middle ground viewshed, which is defined as the area between 0.25 and a 1-mile radius of the project site, is characterized by a mixture of woodlands, urban/industrial and rural residential uses located along the road corridors.

The background, which lies within a 1-mile to 2.5 mile radius of the project, consists of rural residential uses, woodlands and urban lands. The majority of the city of Amsterdam lies within the 2.5 mile viewshed with rural residential uses located outside of the viewshed envelope.

The vegetation within the 2.5 mile viewshed radius is consistent with the land uses in the viewshed. Large areas of dense, mixed deciduous and evergreen woodland exist throughout the study area. However, the City of Amsterdam is urban in nature, with very little vegetation. Field reconnaissance indicates that vegetative cover identified on the USGS and view shed maps is not representative of actual conditions south of the site. The rural landscape outside of the city limits, particularly south of the subject site within the background viewshed, are spattered with deciduous and evergreen vegetation not identified on the view shed map or USGS Amsterdam Quadrangle.
These vegetative areas, although small, limit some views within the background area.

South of the facility is the Mohawk River – Erie Canal corridor. The river is dominate in the viewshed from the south along the New York State Thruway corridor and is considered a complex viewshed with large structures, smoke stack towers, and large signage. These features further reduce the impact of the proposed project on the surrounding area.

4.2 Viewshed Methodology

To examine theoretical visibility (where views might be seen, or might be expected to be seen) of the proposed project within the 2.5-mile viewshed radius, a visibility/viewshed analysis was performed. The visibility analysis examined potential visibility of the project site, at the post-closure phase, given topography of the proposed landfill, topography of the surrounding terrain, and areas of continuous tree cover within the 2.5-mile radius visibility analysis zone. Geographic Information Systems (GIS) software (Environmental Systems Research Institute's (ESRI's) ArcMap 8.3 with the 3-D Analyst and Spatial Analyst Extensions) was used to calculate the theoretical visibility of the proposed landfill in the City of Amsterdam within the 2.5-mile radius of the proposed project site. The datasets and software applications used to conduct the viewshed analysis are described in further detail in Section 4.2.1. For the purpose of calculating the visibility of the landfill, four points along the top of the closed landfill cell were designated as observation points, and areas of continuous tree cover were assigned a height of 55 feet. The results of the visibility calculation yielded a digital raster dataset, that is, a digital grid of uniform cell size, in which the value of each grid cell is the number of the four points along the top of the landfill that are visible from each particular grid cell. For example, if the value of the grid is zero, then the landfill is not visible; if the value is 3, then 3 of the 4 points along the top of the landfill are visible.

The post-closure phase of the project, which assumes that the landfill cell is closed, capped and vegetated, is considered to be a worst-case scenario presenting the greatest potential for visibility within the 2.5-mile viewshed. Under this worst-case scenario, areas which present theoretical visibility of the proposed project were identified and are graphically illustrated in Appendix C.

4.2.1 Datasets That Were Used To Calculate The Visibility Of The Proposed Landfill

This section describes the datasets that were used to conduct the visibility analysis and discusses the function of each:

1. USGS Digital Elevation Models (DEM) - Each DEM dataset represents the topography of a 1:24,000-scale USGS 7.5' Quadrangle. The data are stored in grid format with an x-y (horizontal) resolution of 10 meters. The value of each grid cell is the ground elevation as interpolated from the USGS topographic contour map. According to the USGS, the horizontal and vertical accuracy of these datasets are as follows:

Horizontal positional accuracy is based upon the use of USGS source quadrangles which are compiled to meet National Map Accuracy Standards (NMAS). NMAS horizontal accuracy requires that at least 90 percent of points tested are within 0.02 inches of the true position. The digital data are estimated to contain a horizontal positional error of less than or equal to 0.003 inches standard error in the two component directions relative to the source quadrangle.

Vertical positional accuracy is based upon the use of USGS source quadrangles which are compiled to meet National Map Accuracy Standards (NMAS). NMAS vertical accuracy requires that at least 90 percent of well defined points tested be within one half contour interval of the correct value. Comparison to the graphic source is used as control to assess digital positional accuracy.

The DEMs of the USGS 7.5' Quadrangles within the 2.5-mile radius visibility analysis zone were used as the source of the existing topography surrounding the proposed landfill. The contour interval of these DEM's is 10 feet.

2. Digital Site Plan– A Site Plan of the proposed landfill was created by professional surveyors and engineers and stored in AutoCAD format. The site plan delineates the scale and location of features such as the landfill boundary, building footprints, parking lots, and roads. The AutoCAD file was georeferenced and converted directly to GIS format for incorporation into the GIS database. This dataset was used to define the "footprint" of the proposed landfill.

3. Digital Grading Plan - A topographic survey of the proposed landfill site was created by professional surveyors and engineers and stored in AutoCAD format. The topographic survey delineated the final topography of the proposed landfill and two other areas. The AutoCAD file was georeferenced and converted directly to GIS format for incorporation into the GIS database. This dataset was used to modify the existing topography as defined by the USGS DEM in order to account for the topography of the proposed landfill and two other areas.

4. Continuous Tree Cover – Areas of continuous tree cover within a 2.5-mile radius of the proposed landfill was obtained from digital image files of USGS 1:24,000 scale topographic maps (Amsterdam 7.5' Quadrangle, photo revised, 1980; Pattersonville 7.5' Quadrangle, 1954). This information was incorporated into the GIS in order to account for the impact of vegetation on the visibility of the proposed landfill. Each area of continuous tree cover was

assigned a uniform height of 55 feet for the purpose of calculating the visibility of the proposed landfill.

4.3 Visual Analysis Protocol

In order to evaluate the visual impact of the proposed facility, it was first necessary to determine representative key visual receptors within the viewshed which may be impacted by the proposed project (see Appendix D). Three criteria were used to select these visual receptors. They were:

- The first selection criterion was a requirement that the viewpoint have good visibility of the proposed facility.
- The second selection criterion was a requirement that the viewpoints have a reasonably high frequency of viewers and/or long view duration by a viewer at the viewpoint.
- The third selection criterion was a requirement that the viewer at each viewpoint potentially benefit from the existing visual quality from the viewpoint. For example, people who might benefit from the quality of a view in areas of schools, religious places, public places, and any other significant public recreation area.

Based on the three part selection criteria, (±) 40 key viewpoints were identified, as shown on the attached Viewpoint Location Map. These viewpoints were identified by use of topographic mapping to identify where views of the facility might be seen, or might be expected to be seen, and by locating views in the immediate vicinity of the facility. The Viewshed Map distinguishes the areas from which, based on topography and vegetation, the proposed facility would not be visible.

The (±) 40 viewpoints include 2 foreground viewpoints, 11 middleground and 26 background viewpoints. Foreground viewpoints are locations within the immediate proximity to the viewed object. These views are characterized by an ability to clearly identify details and scale relative to human proportions.

Middleground viewpoints range in distance from a viewed object of a few thousand feet to approximately a mile from the viewpoint. On clear days, details can usually be seen with the human eye; however, scale relative to human proportions is often difficult to clearly comprehend. The viewshed from middleground viewpoints is generally broad enough to include many dominant objects in the landscape in addition to the object being evaluated.

Background viewpoints are viewpoints typically located at such a distance from the object being evaluated that the views are characterized by a noticeable graying or flattening of colors and reduced detail due to atmospheric conditions and distance. Details are difficult to make out and scale is proportional only to other large, adjacent objects. Human scale elements such as cars, benches, people, etc. appear very small and without clear definition.

Once the viewpoints were selected, each viewpoint was examined in the field to determine representative locations from which to photograph the facility location. From each location a photograph was taken using an Olympus c-700 Ultra Zoom 2.1 Megapixel Digital Camera. A 55mm lens was used to photograph the site from these locations. The 55mm lens was selected as it most closely replicates the lens quality of the human eye. The camera was held at standing height (approximately 5 feet above ground surface). Photographs were taken on November 30, 2003. Weather and atmospheric conditions on the day the photograph inventory was conducted were clear and partly cloudy which produced good quality photographs.

As described in Section 4.4, the ± 40 viewpoints identified with the 2.5-mile viewshed were further analyzed to determine their significance with respect to potential visual impacts.

4.4 Existing Views

Each viewpoint was analyzed for the impact of the proposed facility. Site reconnaissance and the photographic inventory indicate that out of the 40 viewpoints, 9 viewpoints have potential views of the proposed facility, and are considered as possible visual receptors. The remaining viewpoints where either completely blocked by topography or man-made structures, or screened by vegetation. The nine visual receptors are described below and are identified on the Photograph Location Map and the photograph inventory included as Appendix D.

- Viewpoint 13 (Photo 13) - View of the proposed site from Viewpoint 13, along 5S/155, approximately 3,300'/.62 miles from the project area, with a filtered view of the subject site. The existing view is screened by a treeline line that is located in the forground of the photo, which has a large smoke stack that stands above the horizonline. The smoke stack is the most dominate feature of the photo. Some building structures are slightly visible through the treeline. It is anticipated that the proposed development will have no significant negative visual impact from this viewpoint.

- Viewpoint 18 (Photo 18) - View of the proposed site from Viewpoint 18, along Patterson Road, approximately 12,400'/2.35 miles from the project area, with a distant view of the subject site. The existing view looks out over the city of Amsterdam and the country side. The most dominate features of the photo are the utility poles, road, and a few houses located in the middleground. At this distance, it is anticipated that the proposed development will have no significant negative visual impact from this viewpoint.

- Viewpoint 19 (Photo 19) - View of the proposed site from Viewpoint 19, along Langley Road, approximately 10,500'/2.0 miles from the project area, with a distant view of the subject site. The existing view looks out over the city of Amsterdam and the country side. The most dominate features of the photo are the treeline in the middleground and the horizon line. At this distance, it is anticipated that the proposed development will have no significant negative visual impact from this viewpoint.

- Viewpoint 20 (Photo 20) - View of the proposed site from Viewpoint 20, along Thayer Road, approximately 9,000'/1.7 miles from the project area, with a distant view of the subject site. The existing view looks out over the city of Amsterdam and the country side. The most dominate feature of the photo is the change in color and patterns of land use. At this distance, it is anticipated that the proposed development will have no significant negative visual impact from this viewpoint.

- Viewpoint 21 (Photo 21) - View of the proposed site from Viewpoint 21, along Belldons Road, approximately 13,200'/2.5 miles from the project area, with a distant view of the subject site. The existing view looks out over the city of Amsterdam and the country side. The most dominate feature of the photo is a large barn located in the forground. At this location, the change in color and patterns of land use are less evident and do not appear as bold and significant as seen in previous viewpoints. It is anticipated that the proposed development will have no significant negative visual impact from this viewpoint.

- Viewpoint 22 (Photo 22) - View of the proposed site from Viewpoint 22, along Fuller/Belldons, approximately 10,000'/1.9 miles from the project area, with a distant view of the subject site. The existing view looks out over the city of Amsterdam and the country side. The most dominate features of the photo are the trees and utility poles located in the forground. Here, the change in color and patterns of land use are more evident and appear bold and significant. It is anticipated that the proposed development will have no significant negative visual impact from this viewpoint.

- Viewpoint 23 (Photo 23) - View of the proposed site from Viewpoint 23, along I-90, approximately 6,100'/1.1 miles from the project area, with a closer view of the subject site. The existing view looks out over the city of Amsterdam and the I-90 transportation corridor. The most dominate features of the photo are roads, smoke stacks and change in color and pattern of land use. It is anticipated that the proposed development will have minor visual impact from this viewpoint.

- Viewpoint 27 (Photo 27) - View of the proposed site from Viewpoint 27, along Erie/30, approximately 6,200'/1.2 miles from the project area, with a closer view of the subject site. The existing view looks out over the city of Amsterdam and the Mohawk River. The most dominate features of the photo are the utilities, smoke stacks and change in color and pattern of land use. It is anticipated that the proposed development will have minor visual impacts from this viewpoint.

- Viewpoint 40 (Photo 40) - View of the proposed site from I-90, approximately 4,700'/.9 miles from the project area, with a closer view of the subject site. The existing view looks out over a residential area and the Mohawk River. The most dominate features of the photo are the utilities, smoke stacks and change in color and pattern of land use. It is anticipated that the proposed development will have minor visual impacts from this viewpoint.

Views of the proposed site were not visible from:

- Viewpoints 1-12, 14-17, 24-26, 28-39 are either blocked by topography or man-made structures, or completely screened by vegetation. These views will have no visual impacts associated with the development of the proposed facility.

Of the 9 visual viewpoints, viewpoint 40 (Photo 40) was considered to have the greatest potential for visual impact associated with the proposed facility. This viewpoint is located along Interstate I-90 and therefore is associated with the highest number of potential viewers and presents the longest duration of view, as compared to the other viewpoints. Additionally, given the area topography and vegetation, this viewpoint has the highest visibility of the project site from the surrounding viewshed. Given these conditions, this viewpoint was identified as a potential critical visual receptor and, as described in Section 4.5, was further evaluated to determine the visual impact.

4.5 Visual Simulation

To visualize, anticipate, simulate and evaluate potential changes to the visual quality of the local environment at the proposed project site, a visual simulation was performed for visual viewpoint 40, which is identified as the most significant critical receptor and is considered to be representative of the worst-case scenario for visual impacts. Photographs of the site were taken from this viewpoint on July 1, 2003. Proposed site conditions were overlain on the existing photograph of this viewpoint and were projected, using computer modeling software, onto a superimposed photograph of existing conditions to produce a simulated view of the proposed project during the following two development site conditions:

- Operational Phase: This phase assumes the following conditions:

  1). Property graded and developed with proposed structures.
  2). Landfill cell partially filled with C&D debris to the elevation limit with that portion of the cell covered and vegetated. The remaining portion of the landfill cell is open and the exposed bedrock within the cell is visible.

- Post-Closure Phase: This phase assumes the following conditions:
  1). Project has reached its completion.
  2). The landfill has been filled, capped and a vegetative cover has been established with the structures removed.

The existing conditions view and visual simulations of the Operational Phase and the Post-Closure Phase are including in Appendix E. The photographs depicted in this report are intended to provide only a general conception of what the proposed facility may look like. The actual apparent color and form of a facility can be greatly affected by environmental variables, including but not limited to, atmospheric pressure, temperature, haze, smog, cloud cover, and the intensity and direction of the light source.

The visual simulation indicates that the proposed project will not result in a significant adverse visual impact, either during operational or post-closure phases. Although no adverse visual impacts are anticipated, mitigation measures will be implemented to minimize potential visual impacts. Proposed mitigation measures are identified in Section 5.0 of this report.

4.6 SEQR Visual EAF

In accordance with the State Environmental Quality Review (SEQR), a Visual Environmental Assessment Form (EAF) was completed for the proposed project to examine the visual context, exposure and visibility of the proposed project. The Visual EAF indicates that the project is not within the viewshed of the 9 of the 15 listed areas of visual concern, such as a Wildlife Refuge or a parcel of land dedicated to and available to the public for use, enjoyment and appreciation of natural or man-made scenic qualities and that the project will not result in a significant adverse visual impact. A copy of the Visual EAF is included as Appendix F.

5.0 CONCLUSION

To evaluate the potential for the proposed Amsterdam Material Recycling (AMR), L.L.C, project to present visual impacts, The Chazen Companies performed a visual analysis. A viewshed analysis indicated that one visual receptor, located along I-90, approximately 4,700'/.9 miles from the project area within the middleground viewshed, presents the greatest potential for visual impacts. A visual simulation performed of this viewpoint indicates that the proposed project is not anticipated to result in a significant adverse visual impact.

Given the area topography, vegetation, presence of structures and other features, the proposed project does not present adverse visual impacts to other receptors located within the 2.5-mile viewshed. Furthermore, as the parcel consists of over 39 acres and the project is proposed on a hillside. The tallest portion of the landfill mound will not exceed the height of any structures within the immediate vicinity. This provides considerable reduction in the visibility of the proposed facility. Potential visual impacts of the project are limited. Such potential visual impacts are limited for some locations in part by changes in elevation, the presence of existing and proposed vegetation, and the presence of other residential and commercial development.

Although the visual analysis indicates that the proposed project is not anticipated to result in a significant adverse visual impact, the project will implement certain mitigation measures to minimize potential visual impacts.

The recommendations for reducing potential visual impacts of the proposed facility are:

- Establish vegetative screening through controlled plantings of deciduous, evergreen trees and shrubs. The majority of the planting will be established on the southern portion of the site between the adjacent residences and the Amsterdam Materials Recycling property at East Main Street and Chapman Drive. Tree plantings in these areas will consist of mature, nursery grown trees and shrubs that have a fast growth rate and year round foliage. The proposed plantings will be arranged to simulate forested conditions with canopy trees, understory trees, and groundcover. All material used in conjunction with the proposed planting plan will be native, indigenous plants.

- To mitigate the loss of visual buffers for residents and commercial properties located south of the site along East Main Street, landscape plantings, raised berms and selective tree clearing and grading are proposed. The proposed plant material will be located where it will achieve the greatest level of visual screening. Additionally, the use of vegetated earth berms around the project site will also help to enhance existing visual buffers by blocking the view through topography and by adding height to the proposed plantings.

- Construction activities and grading limits will clearly be marked in the field. Tree protection barriers, erosion control fabric, silt fencing, retaining walls, and other suitable material that will eliminate the loss of visual buffers will be recommended and employed in the final design of the proposed facility.

- The design and layout of the proposed facility will also serves as a mitigation measure for potential visual impacts. Berms will be placed around the recycling center to create a visual buffer as well as to minimize the migration of dust and the generation of noise from recycling operations. Additionally, the landfill design will result in a relatively flat area following closure and the proposed action will not result in a typical "landfill mound".

- The final closure of the proposed landfill will be planted with grasses, therefore blending into the surroundings of the proposed location. The upper portion of the proposed facility could potential be utilized as a park and host additional benefits to its practical purpose of disposing waste. Additionally, the recycling area will be restored to the original condition upon final closure. This area will no longer need to function or operate as intended, such that the building structures will be removed entirely and the large berm surrounding the facility will be removed to create space for other buildable purposes.

- At the time this visual analysis was performed, all deciduous vegetation had lost their foliage. Although the facility may be partially visible from some of the viewpoints during the time of year when no leaf cover is available, foliage will provide additional screening during leaf-on season.

- It is recommended that the Applicant screen to the maximum extent practicable, the facility using rapid growing evergreen trees such as White Pine or Norway Spruce. If the growth of this vegetation is unrestricted, it has the ability to grow to heights ranging from 80 to 100 feet.

Therefore, based on the findings of this viewshed analysis, including those views considered significant, changes to those views which were considered to be significant, and recommended design measures there are no further design measures which are recommended.

Appendix A:
Site Location Map

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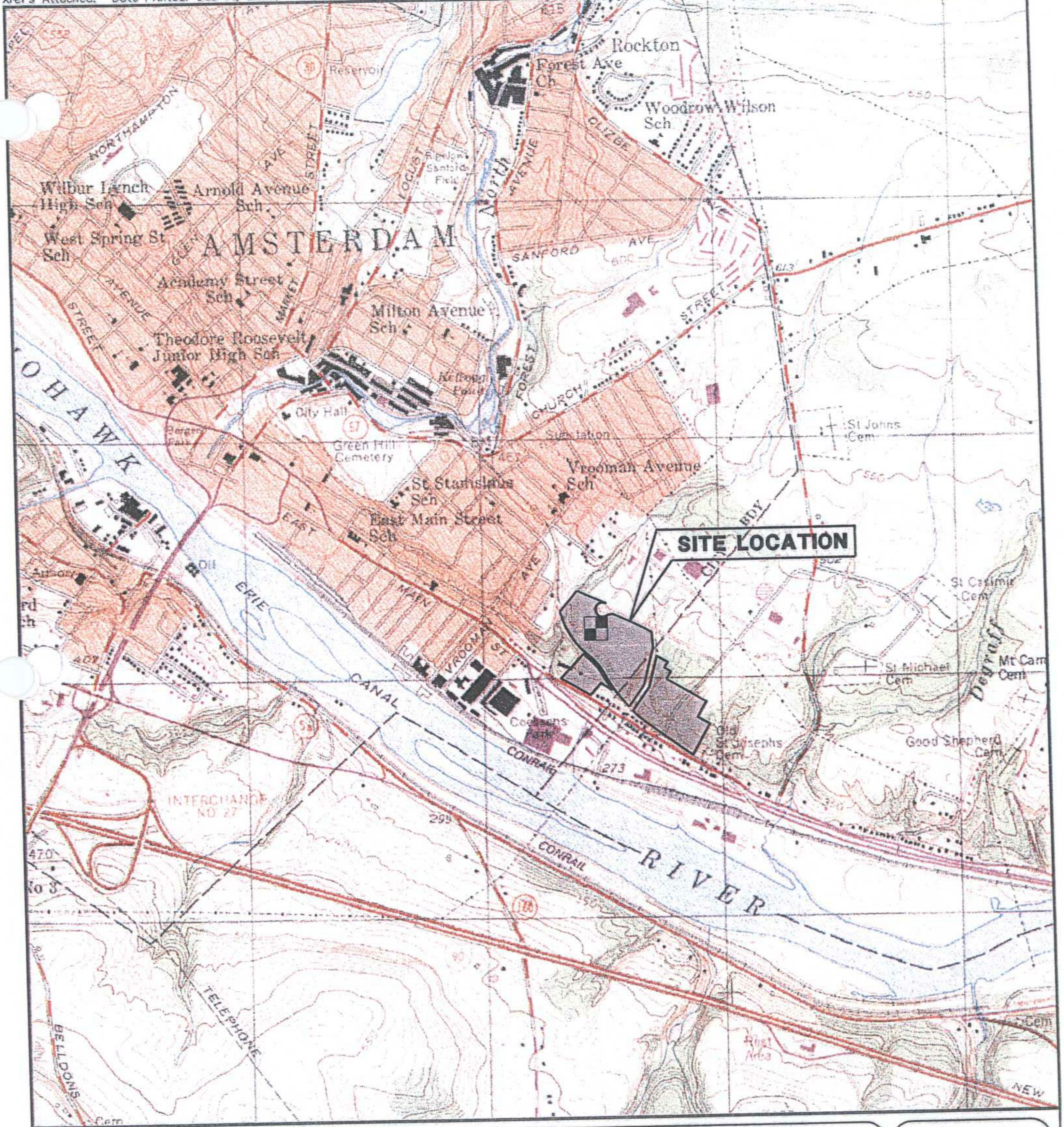

AMSTERDAM MATERIALS RECYCLING

LOCATION MAP
AMSTERDAM MATERIALS RECYCLING
AIDA - EDSON STREET

CITY OF AMSTERDAM, MONTGOMERY COUNTY, N.Y.

drawn	GMT
checked	CL
date	11/5/03
scale	Scale: N.T.S.
project no.	90303.00
sheet no.	IG-A

90303.00

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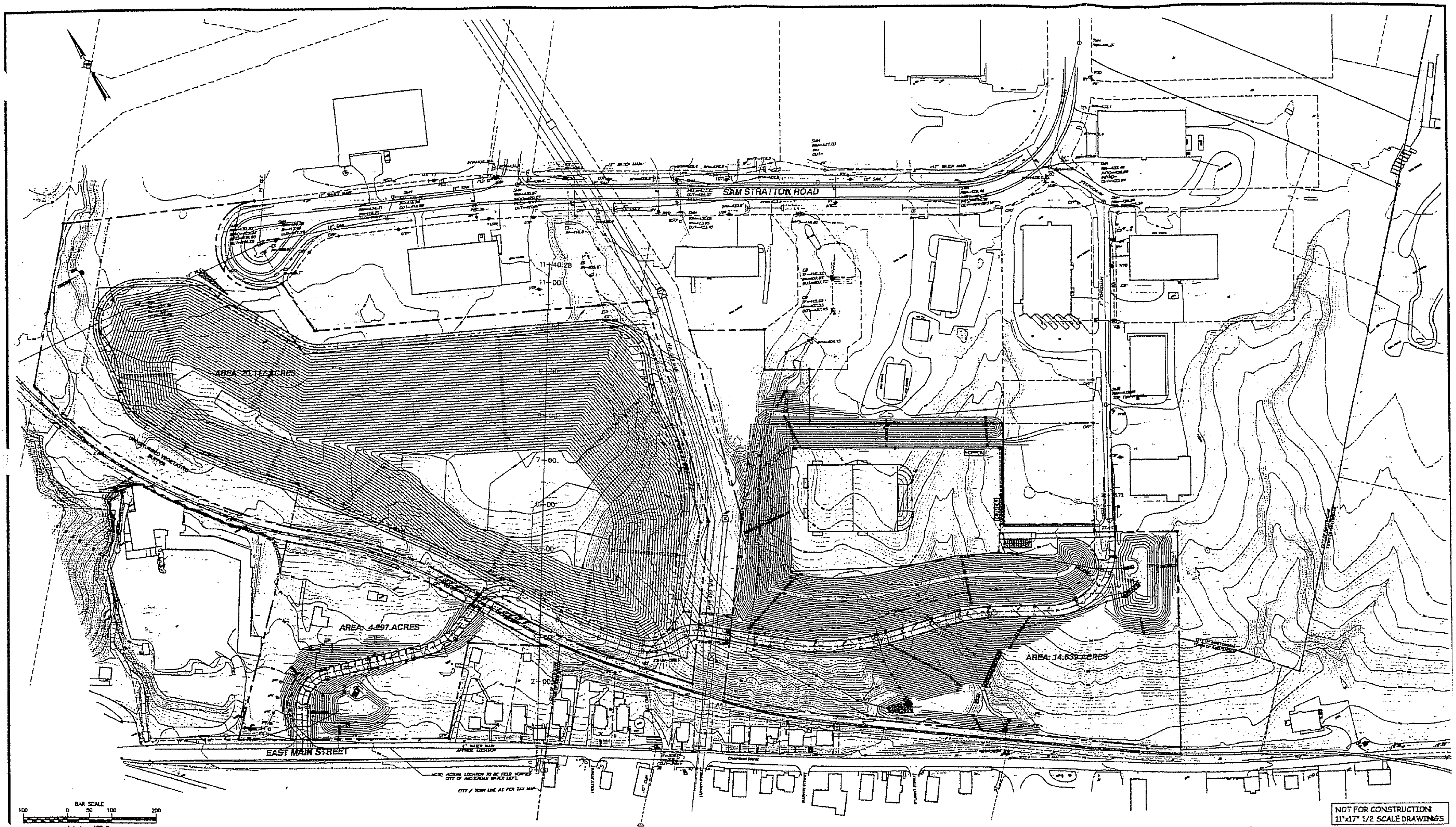
Appendix B:
Proposed Site Plan



NOT FOR CONSTRUCTION
11"x17" 1/2 SCALE DRAWINGS

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Planners
Environmental Scientists

CHAZEN ENGINEERING & LAND SURVEYING CO., P.C.

rev.	date	description

AMSTERDAM MATERIALS RECYCLING

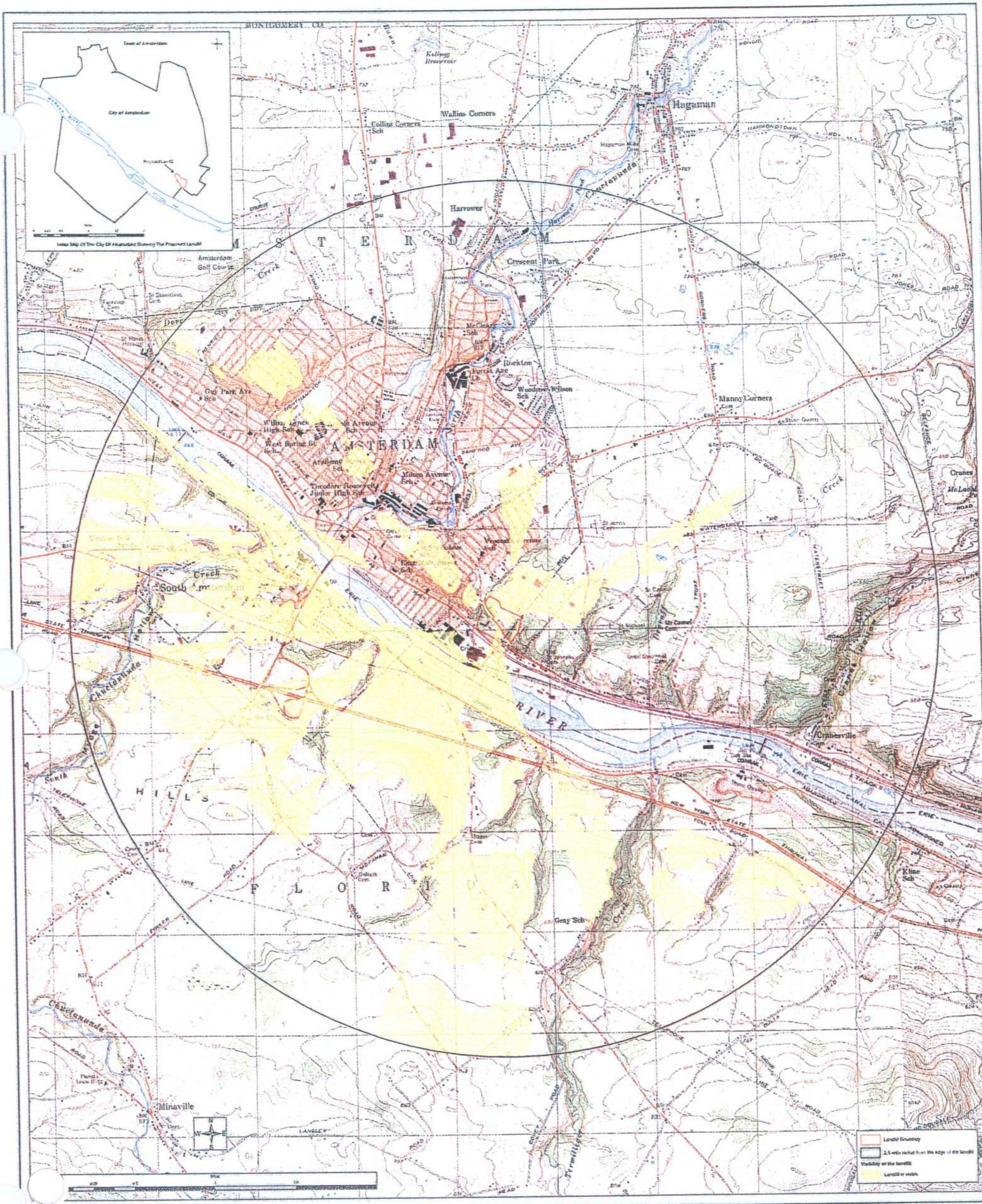
PROPOSED SITE PLAN

AMSTERDAM MATERIALS RECYCLING
AIDA - EDSON STREET

CITY OF AMSTERDAM, MONTGOMERY COUNTY, NEW YORK

drawn	checked
DMT	JEM
date 12/5/03	scale AS SHOWN
project no. 90303.00	
sheet no. FIG-B	

Appendix C:
Viewshed Map



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Visibility Analsis For The Proposed Amsterdam Landfill

City of Amsterdam
Montgomery County, New York

Created by:
Date:
Scale:
Project #:

Appendix D:
Photograph Location Map

Drawing Name: S:\9\90300-90399\90303_00\Eng\SEQR\Documents\DEIS APPENDICES\Appendix G_Visual Analysis\DEIS\visual.dwg
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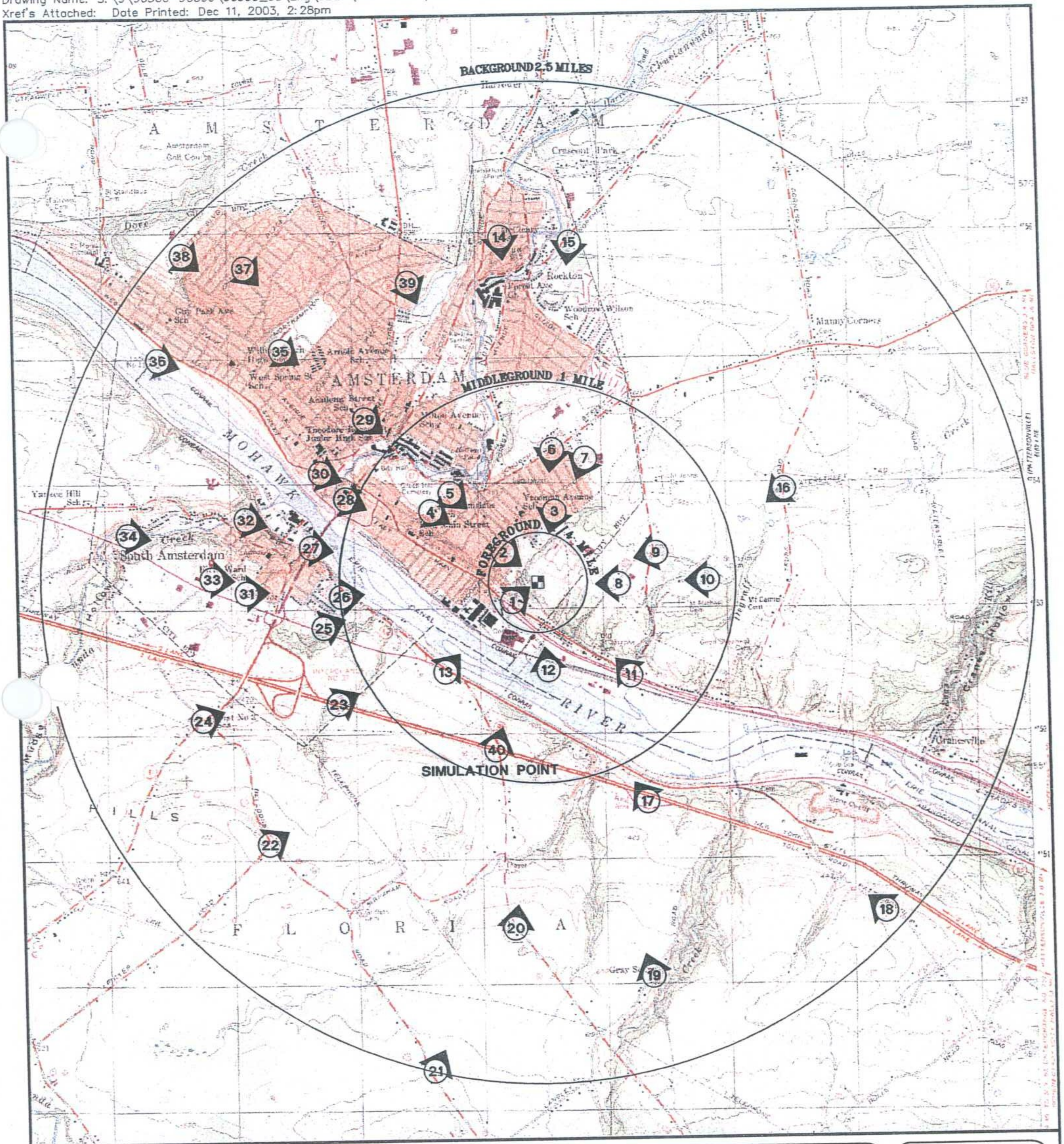

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date	11/5/03	scale	Scale: N.T.S.
project no.	90303.00		
sheet no.			

AMSTERDAM MATERIALS RECYCLING

PHOTOGRAPH LOCATION MAP
AMSTERDAM MATERIALS RECYCLING
AIDA - EDSON STREET

CITY OF AMSTERDAM, MONTGOMERY COUNTY, N.Y.

90303.00

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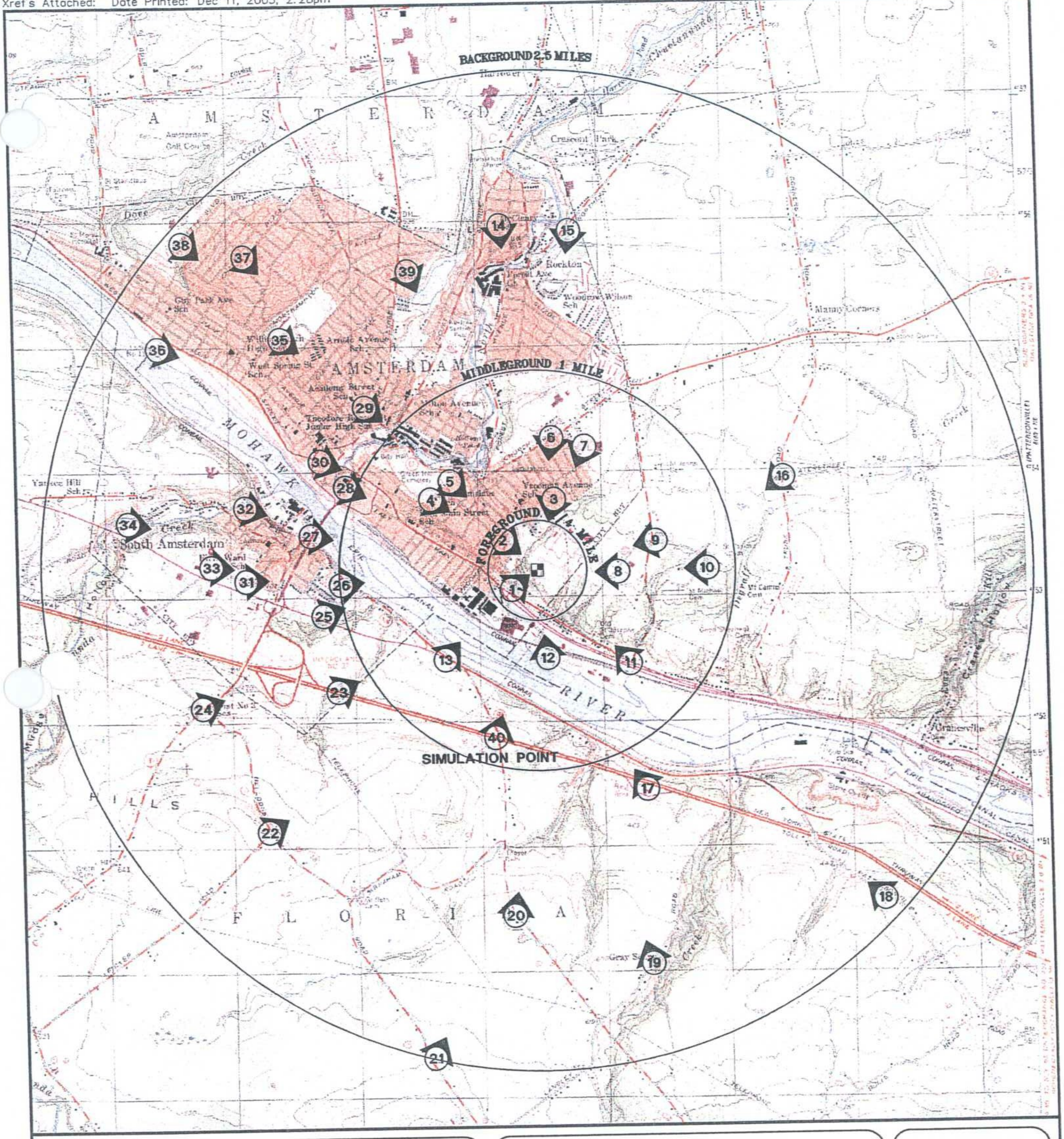

AMSTERDAM MATERIALS RECYCLING

PHOTOGRAPH LOCATION MAP
AMSTERDAM MATERIALS RECYCLING
AIDA - EDSON STREET

CITY OF AMSTERDAM, MONTGOMERY COUNTY, N.Y.

drawn GMT | checked CL
date 11/5/0
scale Scale: N.T.S.
project no. 303.00
sheet no.
90303.00

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Phone: (518) 812-0513

Photo #1
Description: View from Route 5/157 looking North-East

Photo #2
Description: View from Hibbard/Vrooman looking South-East

Photo #3
Description: View from Mason/Crane looking South

Photo #4
Description: View from (St. Stanislaus School) Cornell Street looking South-East

Photo #5
Description: View from Hibbard/Cornell looking South-East

Photo #6
Description: View from Julia/67 looking South

Photo #7
Description: View from (Marie Curie Elementary) Brice Street looking South

Photo #8
Description: View from Edson/Sam-Stratton looking East

Photo #9
Description: View from Edson/CR8 looking East

Photo #10
Description: View from Cemetery Rd. looking East

Photo #11
Description: View from CR157/CR8 looking North-West

Photo #12
Description: View from Coessens Park looking North

Photo #13
Description: View from 5S/155 looking North-East

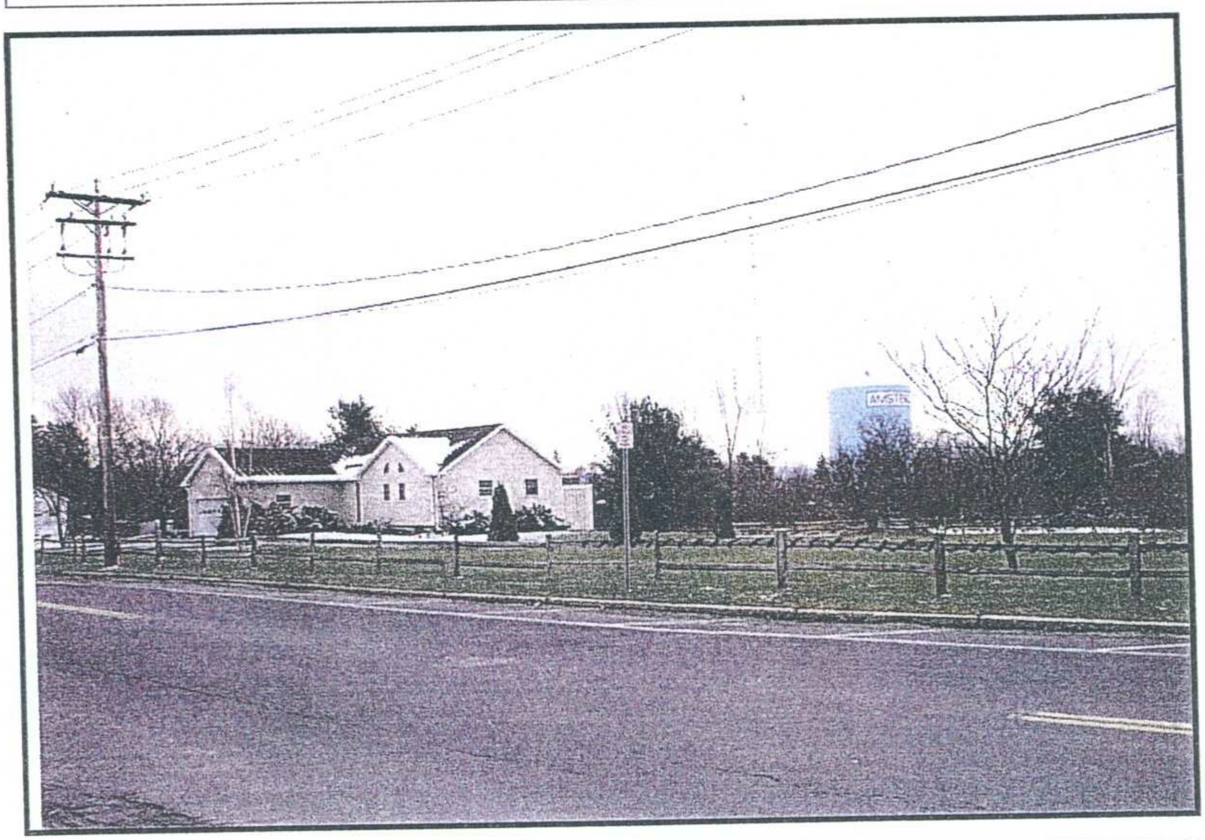

Photo #14
Description: View from (Amsterdam High) Saratoga Ave. looking South

Photo #15
Description: View from (Tecler Elementary) Northern Blvd. looking South

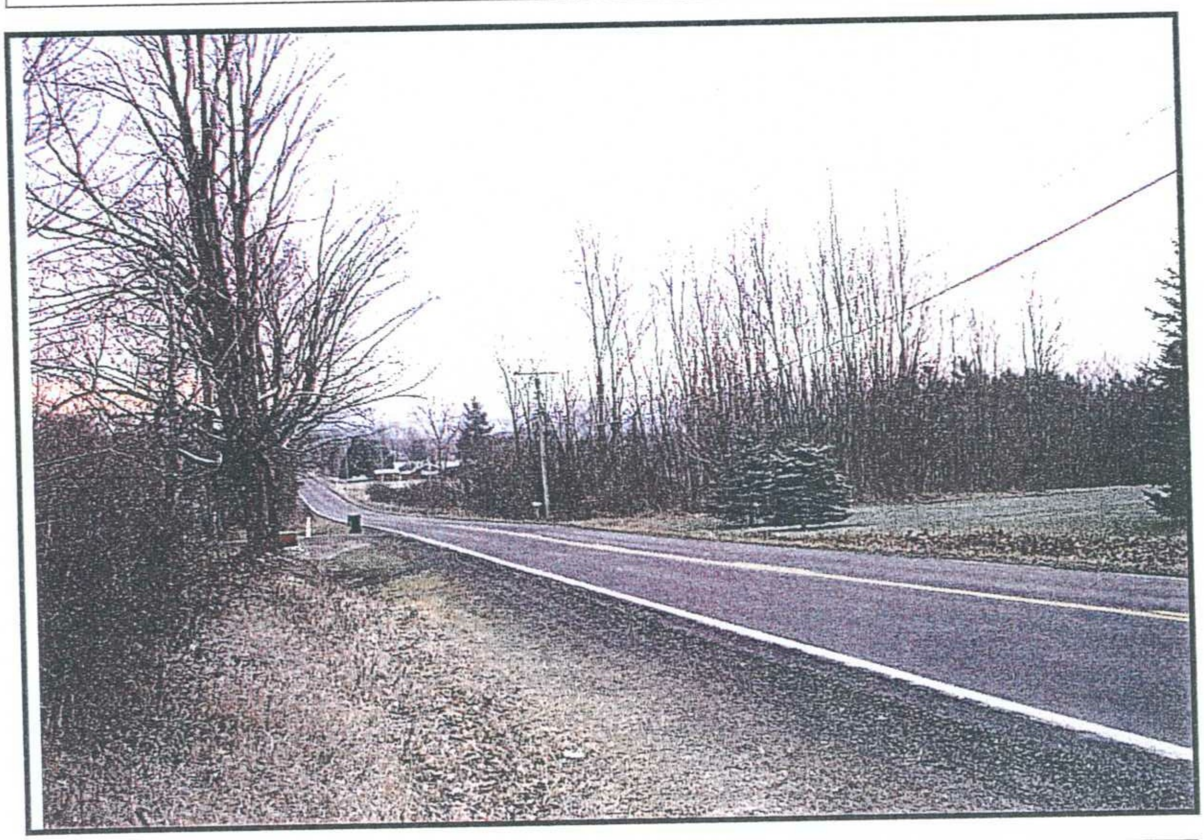

Photo #16
Description: View from Waterstreet/Truax looking South-West

Photo #17
Description: View from (Rest Stop) I-90 West bound looking North-West

Photo #18
Description: View from Patterson Rd. looking North-West

Photo #19
Description: View from (Grey School) Langley Rd. looking North-West

Photo #20
Description: View from Thayer Rd. looking North

Photo #21
Description: View from Belldons Rd. looking North-East

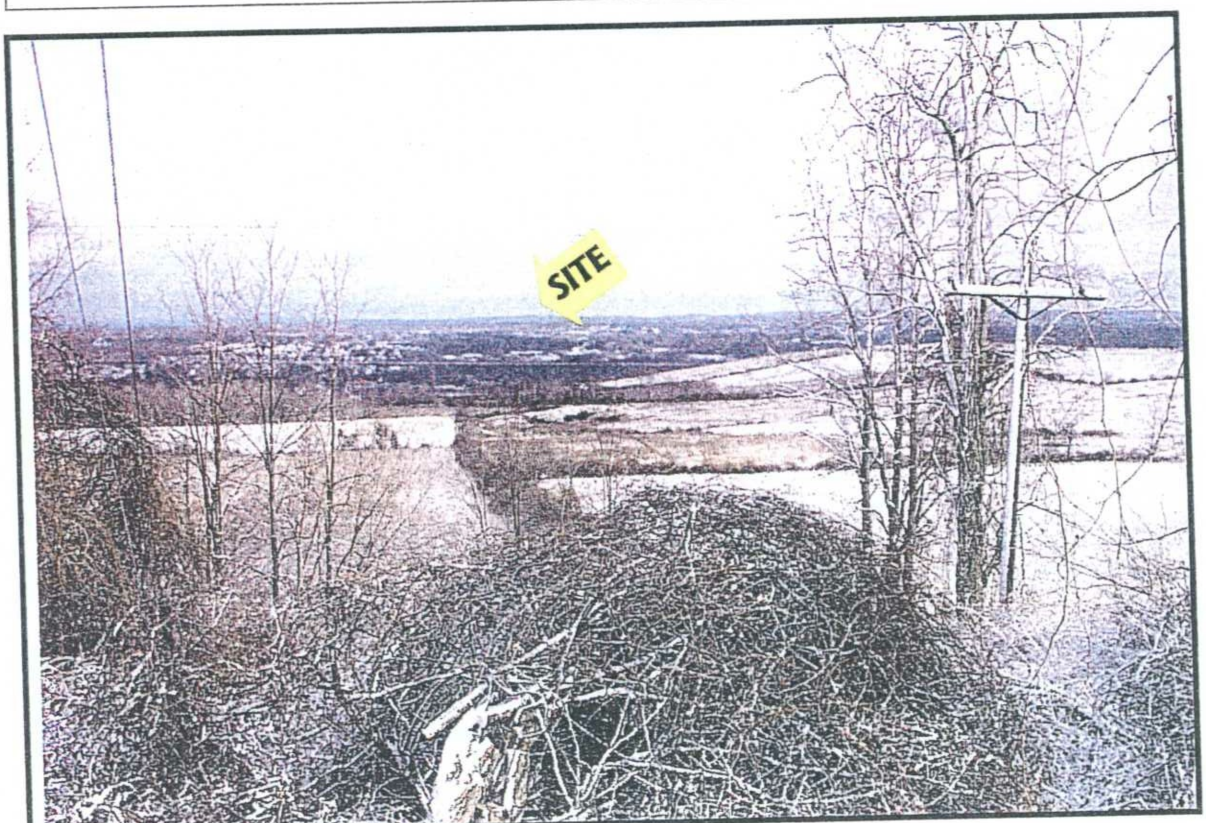

Photo #22
Description: View from Fuller/Belldons looking North-East

Photo #23
Description: View from (Rest Area) I-90 East bound looking North-East

Photo #24
Description: View from 30/CR147 looking North-East

Photo #25
Description: View from 5S/Greco looking East

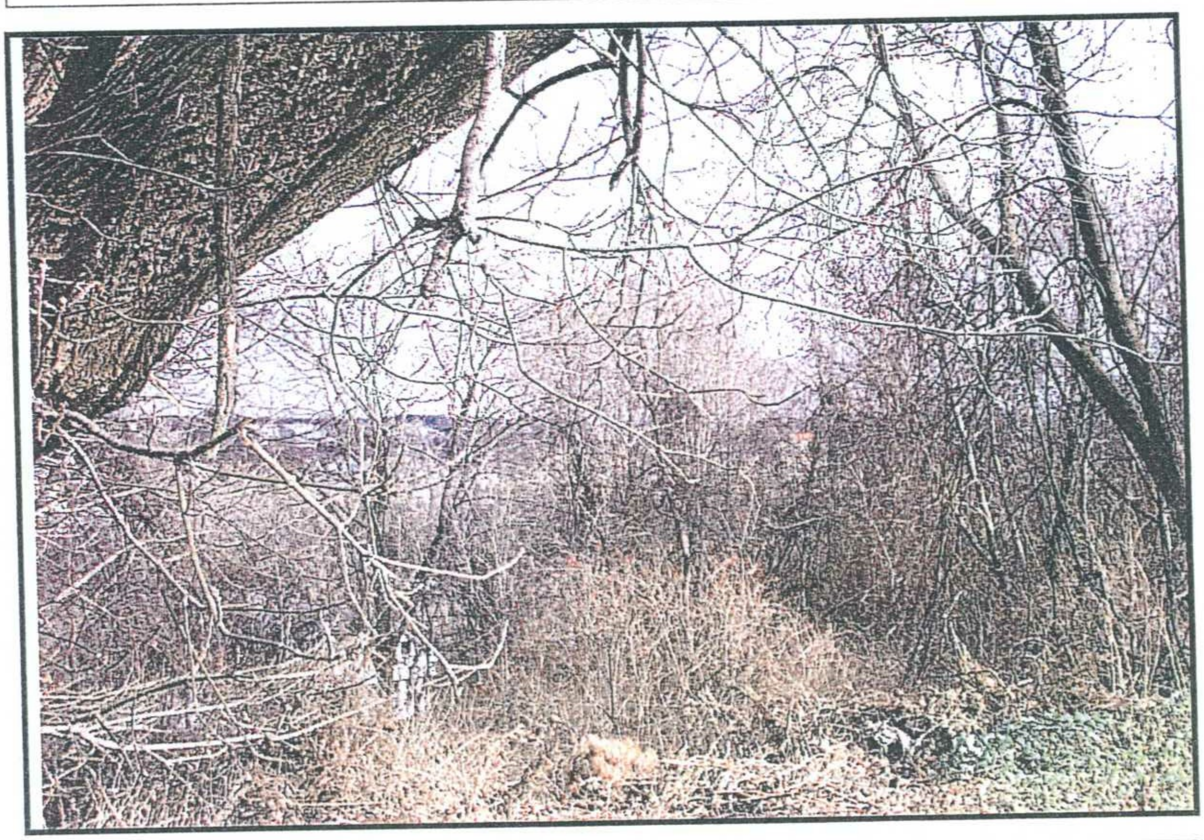

Photo #26
Description: View from Saint Paul looking East

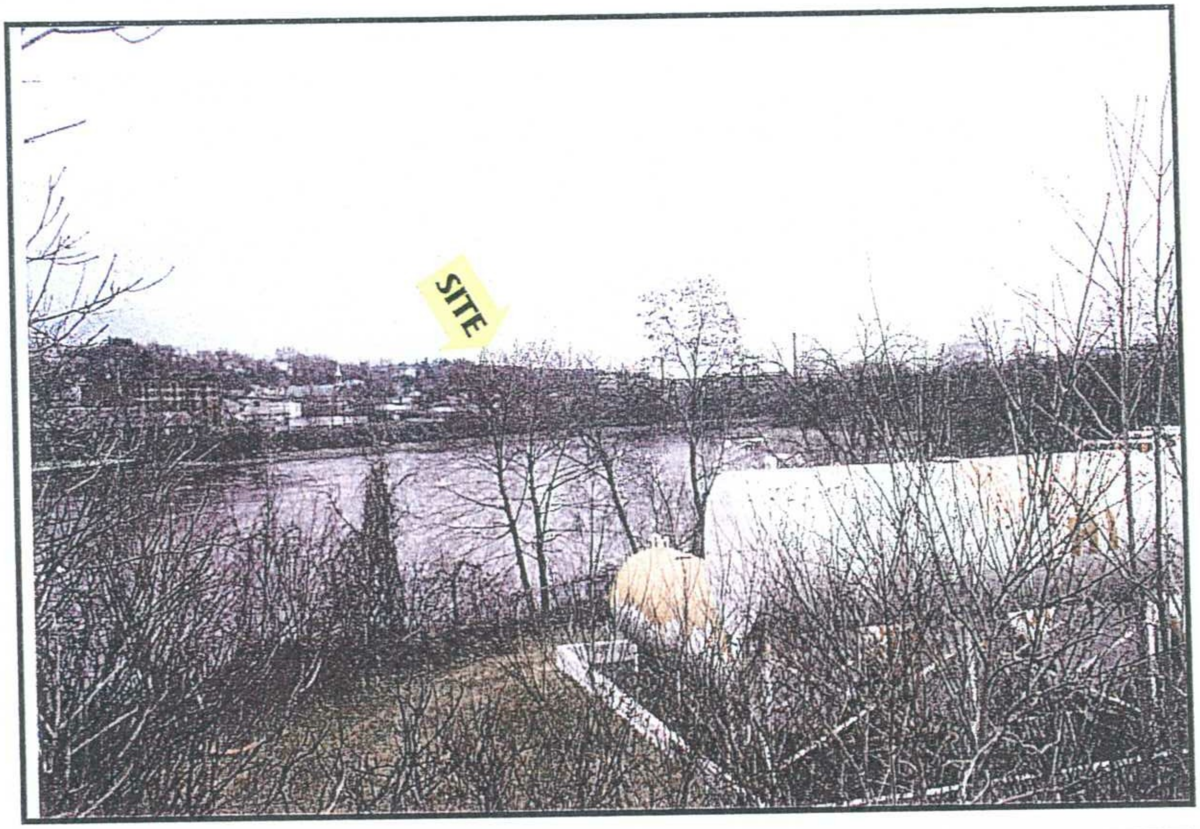

Photo #27
Description: View from Erie/30 looking East

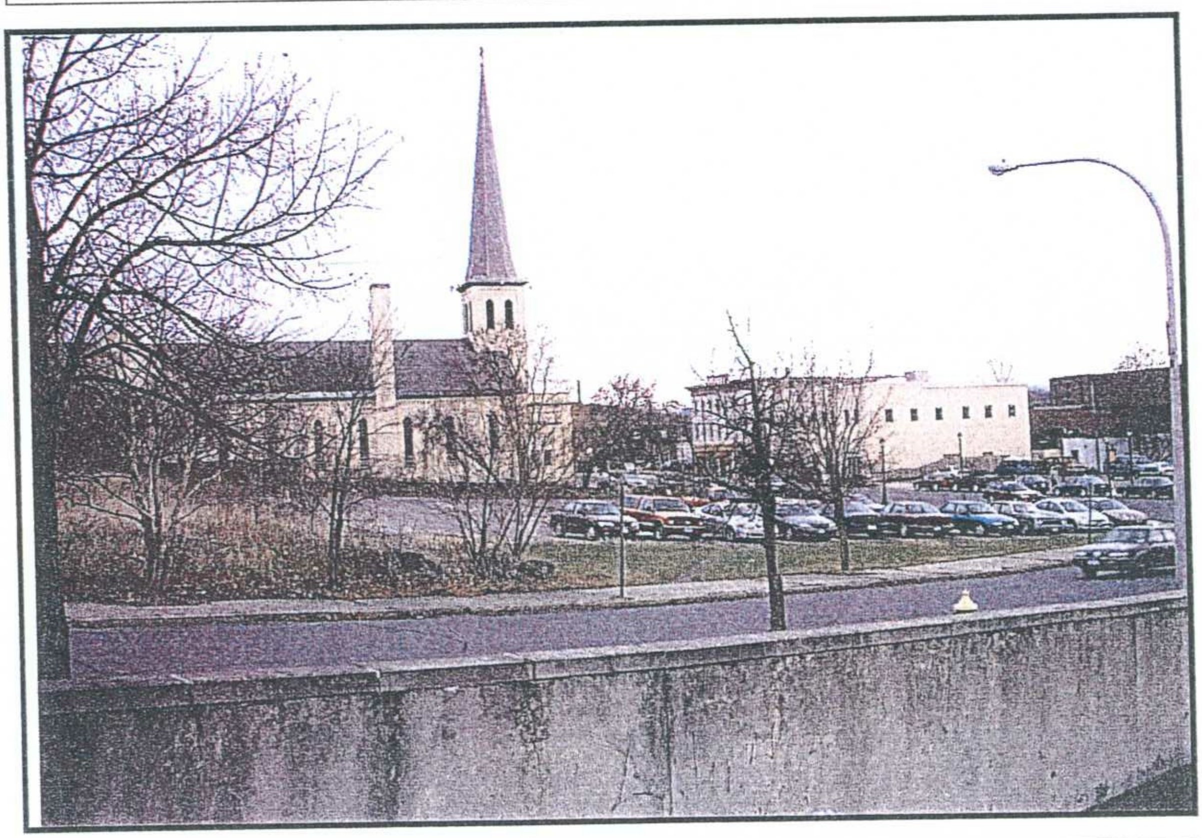

Photo #28
Description: View from Carter Park Mall looking South-East

Photo #29
Description: View from Thomas/Academy looking South-East

Photo #30
Description: View from Bergen Park looking South-East

Photo #31
Description: View from (Barkley Elementary) DeStefano St. looking East

Photo #32
Description: View from Erie/Broad looking East

Photo #33
Description: View from DeStefano/5S looking East

Photo #34
Description: View from Florida/5S looking East

Photo #35
Description: View from (McNulty Elementary) Brandt Pl. looking South-East

Photo #36
Description: View from Lock #11 looking South-East

Photo #37
Description: View from Chapel/Western looking South-East

Photo #38
Description: View from (Bacon Elementary) Henrietta Blvd. looking South-East

Photo #39
Description: View from 30/Deal looking South-East

Photo #40
Description: View from I-90/Thayler looking North

Appendix E:
Photo-Sim & Cross Section

The Chazen Companies
December 2, 2003

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AMSTERDAM MATERIALS RECYCLING FACILITY
EXISTING CONDITIONS VIEW
LOOKING NORTH FROM I-90

Prepared For:

AMSTERDAM MATERIALS RECYCLING, LLC

JULY 17, 2003

THE Chazen COMPANIES
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Troy, NY 12182
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Fax: 518-235-8051

AMSTERDAM MATERIALS RECYCLING FACILITY
EXISTING CONDITIONS VIEW
LOOKING NORTH FROM I-90

Prepared For:

AMSTERDAM MATERIALS
RECYCLING, LLC

JULY 17, 2003

THE
Chazen
COMPANIES
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Troy, NY 12182
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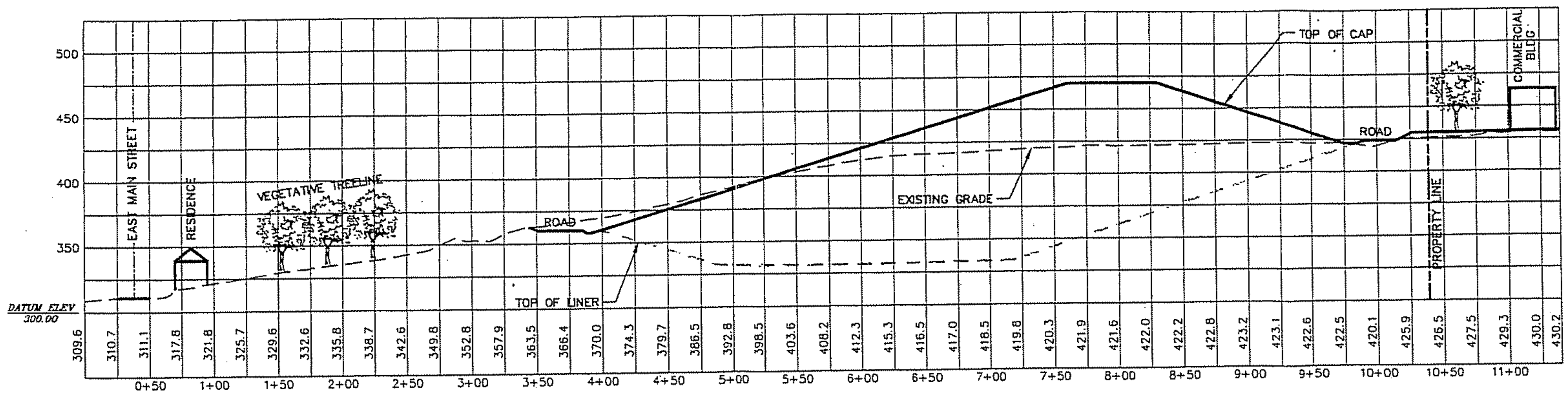
Fax: 518-235-8051

AMSTERDAM MATERIALS RECYCLING FACILITY
PROPOSED OPERATIONAL VIEW SIMULATION
LOOKING NORTH FROM I-90

Prepared For:

AMSTERDAM MATERIALS
RECYCLING, LLC

JULY 17, 2003



1/E **CROSS SECTION PROFILE STA. 0+00 TO 11+40**

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 50'

BAR SCALE 50 0 25 50 100
1 inch = 50 ft.

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Planners
Environmental Scientists

CHAZEN ENGINEERING & LAND SURVEYING CO., P.C.

rev.	date	description

AMSTERDAM MATERIALS RECYCLING

PROFILE AT EAST MAIN STREET

AMSTERDAM MATERIALS RECYCLING
AIDA - EDSON STREET

CITY OF AMSTERDAM, MONTGOMERY COUNTY, NEW YORK

drawn	checked
GMT	JEM
date 12/5/03	scale AS SHOWN
project no. 90303.00	
sheet no. FIG-E	

Appendix F: Visual EAF

The Chazen Companies
December 2, 2003

Appendix B
State Environmental Quality Review
Visual EAF Addendum

This form may be used to provide additional information relating to Question 11 of Part 2 of the Full EAF.

(To be completed by Lead Agency)

Visibility	***Distance Between Project and Resource (in Miles)*** 0-1/4	1/4-1/2	1/2-3	3-5	5+
1. *Would the project be visible from:*					
• *A parcel of land which is dedicated to and available to the public for the use, enjoyment and appreciation of natural or man-made scenic qualities?*	☐	☐	☒	☐	☐
• *An overlook or parcel of land dedicated to public observation, enjoyment and appreciation of natural or man-made scenic qualities?*	☐	☐	☐	☐	☒
• *A site or structure listed on the National or State Registers of Historic Places?*	☐	☐	☐	☐	☒
• *State Parks?*	☐	☐	☐	☐	☒
• *The State Forest Preserve?*	☐	☐	☐	☐	☒
• *National Wildlife Refuges and state game refuges?*	☐	☐	☐	☐	☒
• *National Natural Landmarks and other outstanding natural features?*	☐	☐	☐	☐	☒
• *National Park Service lands?*	☐	☐	☐	☐	☒
• *Rivers designated as national or State Wild, Scenic or Recreational?*	☒	☐	☐	☐	☐
• *Any transportation corridor of high exposure, such as part of the Interstate System, or Amtrak?*	☒	☐	☐	☐	☐
• *A governmentally established or designated interstate or inter-county foot trail, or one formally proposed for establishment or designation?*	☐	☐	☐	☐	☒
• *A site, area, lake, reservoir or highway designated as scenic?*	☐	☐	☐	☐	☒
• *Municipal park, or designated open space?*	☐	☒	☐	☐	☐
• *County road?*	☐	☒	☐	☐	☐
• *State road?*	☐	☒	☐	☐	☐
• *Local road?*	☒	☐	☐	☐	☐

2. *Is the visibility of the project seasonal? (i.e., screened by summer foliage, but visible during other seasons)*

   ☐ *Yes* ☒ *No*

3. *Are any of the resources checked in question 1 used by the public during the time of year during which the project will be visible?*

   ☒ *Yes* ☐ *No*

DESCRIPTION OF EXISTING VISUAL ENVIRONMENT

4. *From each item checked in question 1, check those which generally describe the surrounding environment.*

	Within * ¼ mile	Within * 1 mile
Essentially undeveloped	☒	☐
Forested	☒	☐
Agricultural	☐	☐
Suburban residential	☒	☐
Industrial	☒	☐
Commercial	☐	☒
Urban	☐	☒
River, Lake, Pond	☐	☒
Cliffs, Overlooks	☐	☒
Designated Open Space	☐	☒
Flat	☐	☐
Hilly	☒	☐
Mountainous	☐	☐
Other	☐	☐

NOTE: add attachments as needed

5. *Are there visually similar projects within:*

* ½ mile	☐ Yes	☒ No
* 1 mile	☐ Yes	☒ No
* 2 miles	☐ Yes	☒ No
* 3 miles	☐ Yes	☒ No

** Distance from project site are provided for assistance. Substitute other distances as appropriate.*

EXPOSURE

6. *The annual number of viewers likely to observe the proposed project is ? 14,000,000*
NOTE: When user data is unavailable or unknown, use best estimate.

CONTEXT

7. *The situation or activity in which the viewers are engaged while viewing the proposed action is:*

Activity[1]	FREQUENCY Daily	Weekly	Holidays/Weekends	Seasonally
Travel to and from work	☒	☐	☐	☐
Involved in recreational activities	☒	☐	☐	☐
Routine travel by residents	☒	☐	☐	☐
At a residence	☒	☐	☐	☐
At worksite	☒	☐	☐	☐
Other ______________	☐	☐	☐	☐

[1] *Exposure (6): Average number of people who travel I-90 – based on Albany Corridor Study 2002 (40,000 daily).*

Appendix H
Noise Study

Noise Analysis Report

Amsterdam Materials Recycling Project

City of Amsterdam

Montgomery County, New York

December 2005

Crescent
Environmental

Prepared by:

Crescent Environmental Engineering, P.C.
301 Nott Street
Schenectady, NY 12305

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1.0 INTRODUCTION

This Noise Analysis Report has been prepared to assess the potential noise impacts associated with the proposed development of a construction and demolition (C&D) debris[1] material recycling and disposal facility on a 39.0 ± acre portion of the Edson Street Industrial park owned by the Amsterdam Industrial Development Agency (AIDA), in the City of Amsterdam, Montgomery County, NY. AIDA intends to sell or lease the property to Amsterdam Materials Recycling, LLC (AMR), who will operate and manage the facility.

The AIDA's industrial park is located north of NYS Route 5 and the Mohawk River, in the southeast corner of the City of Amsterdam, West of County Route 8 (Widow Susan Drive) and south and east of NYS Route 67. The project site is located in the southern portion of the industrial park, to the south of Sam Stratton Road. The project is currently a vegetated undeveloped parcel, the central portion of which is traversed by a 100-foot wide Niagara Mohawk overhead powerline transmission easement.

2.0 PURPOSE

The purpose of this study is to assess any noise impact associated with the proposed project. Ambient noise measurements were taken at the proposed site in the City of Amsterdam. Under proposed conditions, the facility will utilize crushing and grinding equipment to break down the recyclable materials, a compactor to compress the materials in the landfill, and large trucks to transport materials. The trucking activities and the onsite equipment is assumed to be the dominant noise source. In order to consider the potential noise impacts of the proposed facility, proposed noise levels generated by the proposed equipment were incorporated into the model to predict future noise levels. A discussion of the results of the study and comparison of existing and proposed conditions is provided.

3.0 METHODOLOGY

A tripod mounted Bruel & Kjaer model 2238 sound meter with Enhanced SLM Software BZ 7125 was used to take the measurements. The meter was calibrated at the beginning of each day of use. All measurements are presented using the A-weighted scale, which most closely simulates the response of the human ear. Measurements were analyzed using Noise Explorer Type 7815

[1] Construction and demolition debris consists of the waste generated during construction, renovation, and demolition projects and includes a wide array of materials such as wood, concrete, steel, brick, and gypsum.

software. Measurements were taken for 1-hour intervals for ambient noise readings and for a minimum of 12 minute intervals to measure equipment noise levels, which is sufficient time to establish and characterize the sound environment. Ambient noise readings were measured in equivalent noise level or Leq. Leq is the average noise level over the measurement time period.

The Enhance Software provides level and cumulative distributions and can measure up to seven L_N values (L_N is the percentile level expressing the level that has been exceeded for the N% of the measurement time). The statistic software is used to filter out periods of abnormally high or low noise level.

4.0 PRE-DEVELOPMENT CONDITIONS

Ambient noise measurements were taken on August 12, 2003, August 13, 2003, and August 14, 2003 at fifteen locations at the proposed site in the City of Amsterdam, New York (See Figure 1, Appendix A). The weather was mostly cloudy, humid and approximately 85 degrees Fahrenheit. All ambient noise measurements were taken at the outer property boundaries of the proposed site and sound meter was aimed towards the center of the proposed site for all readings. The locations and measured noise levels are summarized in the following tables. The complete results by location with a statistical analysis are found in Appendix A. All results are in A-weighted decibels.

Table 1 - Pre-Development Measurement Summary

Location	Start Time	Date	Description
1	10:57 AM	8/12	Along cul-de-sac at northwest corner of site
2	12:04 PM	8/12	Northwest corner of site
3	1:09 PM	8/12	West corner of site along train tracks
4	4:19 PM	8/14	Southwest edge of site along train tracks
5	10:20 AM	8/14	Southwest edge of site
6	9:51 AM	8/13	Southwest corner of site
7	10:54 AM	8/13	Southern edge of site adjacent to existing residence
8	1:26 PM	8/13	Southern edge of site along train tracks
9	5:27 PM	8/14	Southern edge of site, adjacent to existing overhead powerline easement, along train tracks
10	12:11 PM	8/13	Southern edge of site along train tracks
11	2:46 PM	8/13	Southeast corner of site
12	1:15 PM	8/14	Northeast corner of site
13	12:05 PM	8/14	Northern edge of site
14	2:20 PM	8/14	Northern edge of site
15	9:03 AM	8/14	Northern edge of site

Table 2 – Pre-Development Measurement Data

Location	Lmin(dBA)	Leq (dBA)	Lmax(dBA)	L_{90} (dBA)	Dominant Noise Source
1	49.4	55.4	79.6	53.1	Vehicle traffic
2	52.4	53.9	73.9	53.4	Brook, woods
3	51.9	53.5	74.0	52.4	Brook, woods
4	50.4	56.8	84.5	51.7	Industry, vehicle traffic
5	49.0	55.0	82.8	50.9	Industry, vehicle traffic
6	51.4	61.4	90.0	54.1	Vehicle traffic
7	48.5	56.7	82.4	51.7	Vehicle traffic
8	46.1	56.1	74.1	48.7	Vehicle traffic
9	45.5	54.5	82.6	49.6	Vehicle traffic
10	46.4	56.3	82.4	49.0	Vehicle traffic
11	47.3	62.5	89.4	50.5	Vehicle traffic
12	49.1	58.1	87.3	51.1	Woods, vehicle traffic
13	47.4	54.7	82.0	49.0	Woods
14	53.6	56.5	80.9	54.6	Woods, blower on building
15	49.7	55.2	80.1	51.6	Woods

5.0 PREDICTED NOISE GENERATION & ATTENUATION

The proposed project is anticipated to generate noise during the construction phase and during the operational phase. During construction, the primary noise sources will be generated by the rock crushing operations, excavating equipment, interior haul trucks and off-site haul trucks. During the facility operation, the primary noise sources will be generated by recyclable processing equipment (crusher, grinder), landfill compactor, and haul trucks.

Noise produced during landfill construction will occur over a six-month period. Noise produced from facility operations will occur over the life of the facility, estimated at between 6-10 years. The stationary noise sources during both construction and operation will be contained within an excavated or bermed area. As discussed below, measurements of noise levels from similar equipment within a berm showed significant reductions in sound level.

To establish the noise generation levels for typical stationary equipment, field measurements were taken to obtain generated noise levels for the concrete crusher and the tub grinder. The measurements were taken at sites that contain equipment similar to the proposed site. The L1 was used as the proposed sound level generation. The L1(value is exceeded 1% of the time) value most closely represents the maximum constant noise level generated by the machine. The maximum noise level, or Lmax, was produced by short machine motions (i.e. loading of crusher) that do not represent the constant noise level. The complete results by location with a statistical analysis are found in Appendix C.

During construction, the stationary sources associated with rock crushing will be located below grade, within the excavated cell area. During facility operation, the Materials Recycling Area will be surrounded by a 20-foot high earthen berm. The excavated area and the berm will provide noise level attenuation. Noise readings for the tub grinder were taken at the existing Colonie Landfill located in Cohoes, New York on State Route 9. The site contains an earthen berm similar to the proposed site. Two (2) measurements were taken at a distance of 210 feet from the unit, one without the berm attenuation and one with the berm attenuation. The berm was determined to provide approximately 15 dBA of noise level attenuation. The results are shown in Appendix C.

The estimated noise level generated by the landfill compactor was obtained from the Caterpillar® equipment company. The 826 G Series II is a midsized landfill compactor that is similar to the proposed site equipment. The generated noise levels were provided by Caterpillar® and are shown in Appendix C.

The noise level for Heavy Trucks and Heavy Equipment was taken from the NYSDEC. Each piece of equipment to be considered and their predicted noise generation is shown in Table 3.

Table 3 – Predicted Noise Generation

Equipment	Noise Level Generation	Noise Data Source
Concrete Crusher	91 dBA @ 60 feet	Field Measurements
Tub Grinder	91 dBA @ 60 feet	Field Measurements
Landfill Compactor	80 dBA @ 50 feet	Caterpillar®
Heavy Equipment (Grader))	85 dBA @ 50 feet	NYSDEC
Heavy Truck	91 dBA @ 50 feet	NYSDEC

For stationary equipment, noise level is known to decrease with distance from the source. The decrease normally changes in inverse proportion to the square of the distance. At distances greater than 50 feet from a noise source, every doubling of the distance produces a 6 dB reduction in noise level. For example, if the noise level is 50 dBA at 100 feet from the source, the noise level is calculated to be 44 dBA at 200 feet from the source.

For mobile equipment, noise levels were estimated using the Federal Highway Administration Traffic Noise Model (FHWA, TNM) Lookup Program, Software Version 2.1, 11/21/05. This software provides estimated noise levels from traffic sources for the specified vehicle, speed and receptor distance.

The total noise level from multiple noise sources can also be added. When two noise levels are present a noise value is added to the highest noise level present. The value is dependant on the difference between the two present noise levels. This process can be applied for multiple noise sources, beginning with the lowest noise level source and working towards the highest. Table 4 shows the appropriate values to be added.

Table 4– Approximate Addition of Noise Levels[3]

Difference Between Two Sound Levels	Add to the Higher of the Two Sound Levels
1 dB or less	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB

6.0 CONSTRUCTION PHASE NOISE ESTIMATES

The predominate construction-phase noise sources are anticipated to result from the stationary sources related to the crusher operation and the mobile sources related to operating heavy equipment and trucks.

To estimate worst-case conditions, both stationary and mobile noise sources are included in the assessment as follows:

Stationary Sources (Rock Crushing Operation)

- Rock crusher;
- Two pieces of heavy equipment (e.g. excavator, loader); and
- Dedicated haul truck;

Based upon the noise generation levels in Table 3 and the additive factors presented in Table 4, a cumulative noise generation for the stationary equipment is calculated at 95 dBA at a distance of 50 feet. As the stationary sources will be located within the excavated landfill cell, a 15 dBA reduction factors is applied consistent with field measurements of similar conditions, resulting in a overall noise generation level of 80 dBA at a distance of 50 feet for the stationary construction sources.

Mobile Sources

- Construction equipment/interior haul trucks; and

[3] Assessing and Mitigating Noise Impacts, New York State Department of Environmental Conservation, June 3, 2003.

- Off-site haul trucks.

It is difficult to accurately predict the noise impacts from mobile equipment during the construction phase since the equipment is not operated in any predictable pattern. To accommodate this uncertainty, this noise assessment assumes that each monitoring point will experience a worst-case noise event from a mobile construction source at a rate of 10 passes per hour. This noise event may consist of an interior haul truck passing the monitoring location or a piece of heavy equipment operating in proximity to the monitoring location. For this analysis, these mobile sources are assumed to be operating along the proposed perimeter roads within the site, although during actual construction, the mobile noise sources will be operating within the interior of the site, much further removed from the monitoring locations. The off-site haul trucks are assumed to be operating along the southern access road at a maximum rate of 70 trucks per 9-hour day (8 trucks per hour, 16 truck-trips per hour)).

These assumptions were used to estimate noise levels for mobile equipment using the Federal Highway Administration Traffic Noise Model (FHWA, TNM) Lookup Program, Software Version 2.1, 11/21/05. The results of the modeling calculations are provided in Appendix B.

With these conservative assumptions, the noise impact at each receptor was estimated assuming that during the construction phase, a receptor was simultaneously impacted by the following sources:

1. Stationary rock crushing sources located within the excavated cell area;

2. On-site excavating equipment and interior haul trucks operating at the nearest points along the perimeter road at a rate of 10 passing trucks/ heavy equipment per hour; and,

3. Peak truck volume on the southern access road for the off-site transportation of crushed rock products at a rate of 16 passing trucks per hour.

The process mentioned above was used to calculate the proposed noise level at all fifteen noise locations (See Figure 2, Appendix B) at the estimated distances presented in table 5. The results are summarized in Tables 6 and 7.

Table 5– Construction Phase Distance Measurements

Location	Crushing Operation	Heavy Equipment/ Interior Trucking	Off-site Trucking
1	650	50	880
2	1100	180	1180
3	1060	160	900
4	720	80	500
5	560	170	240
6	870	130	130
7	500	70	70
8	500	50	50
9	730	120	120
10	920	140	340
11	1620	380	1100
12	1300	150	1300
13	840	480	1000
14	540	180	740
15	300	50	600

Table 6 – Construction Phase Estimated Noise Levels

Location	Crushing Operation	Heavy Equipment/ Interior Trucking	Off-Site Trucking
1	58.3	59.8	43.9
2	53.8	52.0	43.7
3	54.1	52.7	43.7
4	57.2	56.7	47.7
5	59.6	52.3	52.3
6	55.0	53.9	55.9
7	60.5	57.5	59.5
8	60.5	59.8	61.8
9	57.1	54.3	56.4
10	55.1	53.5	55.5
11	49.9	47.4	43.7
12	52.3	53.1	43.7
13	55.7	46.0	43.7
14	59.9	52.0	45.1
15	65.0	59.8	46.1

The total noise level from multiple noise sources can also be added. When two noise levels are present a noise value is added to the highest noise level present. The value is dependant on the difference between the two present noise levels. This process can be applied for multiple noise sources, beginning with the lowest noise level source and working towards the highest (see Table 4).

The process mentioned above was used to predict the noise level at all fifteen noise locations. Leq was calculated by adding the noise levels estimated in Table 6 produced by the stationary equipment, on-site mobile equipment and trucks, and trucks used for shipping crushed rocks off-site. Lmax was calculated based on the noise levels generated by the trucks shipping crushed rocks off-site reduced according to the distance to the receptor location. The results are summarized in Table 7.

Table 7 – Construction Phase Estimated Combined Noise Levels

Location	Leq (dBA)	Lmax (dBA)	Dominant Noise Source
1	61.8	91.0	Crushing Operation, Interior Heavy Equipment
2	55.8	79.9	Crushing Operation, Interior Heavy Equipment
3	56.1	80.9	Crushing Operation, Interior Heavy Equipment
4	60.2	86.9	Crushing Operation, Interior Heavy Equipment
5	60.6	80.4	Crushing Operation, Interior Heavy Equipment
6	60.9	82.7	Combined
7	64.3	88.1	Combined
8	65.5	91.0	Combined
9	61.4	83.4	Combined
10	59.5	82.1	Crushing Operation, Interior Heavy Equipment
11	52.9	73.4	Crushing Operation, Interior Heavy Equipment
12	56.3	81.5	Crushing Operation, Interior Heavy Equipment
13	56.7	71.4	Crushing Operations
14	60.9	79.9	Crushing Operations
15	66.0	91.0	Crushing Operations

7.0 OPERATIONAL PHASE NOISE ESTIMATES

The predominate operation-phase noise sources are anticipated to result from the stationary sources related to the crusher and grinder operations within the recycling center and the mobile sources related to the heavy trucks and the landfill compactor.

To estimate worst-case conditions, both stationary and mobile noise sources are included in the assessment as follows:

Stationary Sources (Recycling Center Operations)

- Rock crusher;
- Wood Grinder;

Since the stationary sources will be operated within a 20-foot bermed area, the noise generation levels in Table 3 have been reduced by 15 dBA consistent with field measurements of similar conditions.

Mobile Sources

- Landfill Compactor; and
- Haul trucks.

It is difficult to accurately predict the noise impacts from mobile equipment during the operational phase since the equipment is not operated in any predictable pattern. To accommodate this uncertainty, this noise assessment assumes that each monitoring point will experience a worst-case noise event from the landfill compactor at a rate of 10 times per hour. For this analysis, this mobile source is assumed to be operating along the proposed perimeter roads within the site although during actual operation, the compactor will generally be operating within the interior of the site, much further removed from the monitoring locations. The off-site haul trucks are assumed to be operating along the southern access road and landfill perimeter road at a maximum rate of 48 trucks per 8-hour day. (6 trucks per hour, 12 truck-trips per hour).

These assumptions were used to estimate noise levels for mobile equipment using the Federal Highway Administration Traffic Noise Model (FHWA, TNM) Lookup Program, Software Version 2.1, 11/21/05. The results of the modeling calculations are provided in Appendix B.

With these conservative assumptions, the noise impact at each receptor was estimated assuming that during the operational phase, a receptor was simultaneously impacted by the following sources:

1. Stationary crushing and grinding sources located within the bermed area of the Recycling Center;
2. Landfill compactor operating at the nearest points along the perimeter road at a rate of 10 passes per hour; and,

3. Peak truck volume on the southern access road and landfill perimeter road at a rate of 12 passing trucks per hour.

The process mentioned above was used to calculate the proposed noise level at all fifteen noise locations (See Figure 2, Appendix B) at the estimated distance presented in Table 8. The results are summarized in Tables 9 and 10.

With these conservative assumptions, the noise impacts at each receptor during the operational phase were estimated assuming that a receptor was simultaneously impacted by the peak truck volume during the operational phase, nearby heavy mobile equipment, and background noises from fixed operating equipment.

Table 8 – Operational Phase Distance Measurements

	Distance From Measurement Location (feet)			
Location	**Heavy Truck**	**Crusher**	**Grinder**	**Compactor**
1	50	1600	1500	80
2	180	2100	2000	220
3	160	2050	2050	200
4	80	1700	1700	120
5	170	1400	1500	210
6	130	1550	1700	620
7	70	1100	1200	250
8	50	800	1000	80
9	120	400	750	220
10	140	350	650	430
11	380	600	800	1220
12	150	350	300	970
13	480	300	100	520
14	180	700	550	220
15	50	1200	1100	70

Table 9– Operational Phase Estimated Noise Levels

	Calculated Noise Level (dBA)			
Location	**Heavy Truck**	**Crusher**	**Grinder**	**Compactor**
1	59.8	47.6	48.1	59.8
2	52.0	45.2	45.6	52.0
3	52.7	45.4	45.4	52.7
4	56.7	47.1	47.1	56.7
5	52.3	48.7	48.1	52.3
6	53.9	47.9	47.1	53.9
7	57.5	50.8	50.1	57.5
8	59.8	53.6	51.6	59.8
9	54.3	59.6	54.1	54.3
10	53.5	60.7	55.4	53.5
11	47.4	56.1	53.6	47.4
12	53.1	60.7	62.1	53.1
13	46.0	62.1	71.6	46.0
14	52.0	54.7	56.8	52.0
15	59.8	50.1	50.8	59.8

The total noise level from multiple noise sources can also be added. When two noise levels are present a noise value is added to the highest noise level present. The value is dependant on the difference between the two present noise levels (see Table 2).

The process mentioned above was used to predict the noise level at all fifteen noise locations. Leq was calculated by adding the noise levels produced by the stationary sources and the mobile sources. Lmax was calculated based on the noise levels generated by the trucks reduced according to the distance to the receptor location. The results are summarized in Table 10.

Table 10 –Operational Phase Estimated Combined Noise Levels

Location	Leq (dBA)	Lmax (dBA)	Dominant Noise Source
1	63.8	91.0	Heavy truck, Heavy Equipment
2	56.0	79.9	Heavy truck, Heavy Equipment
3	56.7	80.9	Heavy truck, Heavy Equipment
4	60.7	86.9	Heavy truck, Heavy Equipment
5	57.3	80.4	Heavy truck, Heavy Equipment
6	57.9	82.7	Heavy truck, Heavy Equipment
7	61.5	88.1	Heavy truck, Heavy Equipment
8	61.8	91.0	Heavy truck, Heavy Equipment
9	62.6	83.4	Heavy Truck, Crusher
10	62.7	82.1	Heavy Truck, Crusher
11	59.1	73.4	Heavy Truck, Crusher
12	65.7	81.5	Crusher, Grinder
13	71.6	71.4	Grinder
14	60.7	79.9	Heavy Truck, Crusher, Grinder
15	63.8	91.0	Heavy Truck, Compactor

7.0 GUIDELINES

The solid waste management regulations in 6 NYCRR Part 360-1.14(p) mandate that noise levels resulting from equipment or operations at a facility be controlled to prevent transmission of noise levels beyond the property line at locations zoned or otherwise authorized for residential purposes to exceed the following equivalent steady-state noise levels (Leq):

Table 11 – NYSDEC Residential Leq

	7 am – 10 pm	10 pm – 7 am
Rural	57 dBA	47 dBA
Suburban	62 dBA	52 dBA
Urban	67 dBA	57 dBA

The New York State Department of Environmental Conservation (NYSDEC) published a guidance document titled Assessing and Mitigating Noise Impacts (June, 2003) provides guidance on assessing adverse impacts from noise on landfill facilities. NYSDEC guidance identifies an increase of 10 dBA as a condition that may warrant further consideration and/or mitigation.

The guidance states ambient noise levels in industrial or commercial areas may exceed 65 dBA with a high end of approximately 79 dBA. In these instances, mitigation measures utilizing best management practices should be used in an effort to ensure minimum impacts.

The City of Amsterdam does not currently have a noise ordinance.

8.0 DISCUSSION

8.1 Construction Phase

In summary, Table 12 shows the pre-development and construction phase Leq and Lmax noise levels at all locations, and the increase from the Pre-Development values, if any.

Table 12 –Leq and Lmax – Pre-Development Vs. Construction Phase

	Leq (dBA)			Lmax (dBA)		
Location	**Pre**	**Post**	**Increase**	**Pre**	**Post**	**Increase**
1	55.4	61.8	6.4	79.6	91.0	11.4
2	53.9	55.8	1.9	73.9	79.9	6.0
3	53.5	56.1	2.6	74.0	80.9	6.9
4	56.8	60.2	3.4	84.5	86.9	2.4
5	55.0	60.6	5.6	82.8	80.4	-
6	61.4	60.9	-	90.0	82.7	-
7	56.7	64.3	7.6	82.4	88.1	5.7
8	56.1	65.5	9.4	74.1	91.0	16.9
9	54.5	61.4	6.9	82.6	83.4	0.8
10	56.3	59.5	3.2	82.4	82.1	-
11	62.5	52.9	-	89.4	73.4	-
12	58.1	56.3	-	87.3	81.5	-
13	54.7	56.7	2	82.0	71.4	-
14	56.5	60.9	4.4	80.9	79.9	-
15	55.2	66.0	10.8	80.1	91.0	10.9

The hours of construction of the proposed facility will be between 7:30 AM and 4:30 PM. The calculated construction phase noise levels are compared to NYSDEC recommended noise levels for the proposed hours of construction. Table 13 shows the land use of the bordering property, the NYSDEC recommended Leq, the calculated post-development Leq, and any values in excess of the recommended Leq value.

Table 13 – Leq – NYSDEC Vs. Construction phase

		Leq (dBA)		
Location	**Bordering Property Description**	**NYSDEC**	**Post**	**Exceed (dBA)**
1	Industrial	65.0-79.0	61.8	-
2	Urban Residential	67.0	55.8	-
3	Commercial	65.0-79.0	56.1	-
4	Commercial	65.0-79.0	60.2	-
5	Commercial	65.0-79.0	60.6	-
6	Commercial	65.0-79.0	60.9	-
7	Urban Residential	67.0	64.3	-
8	Urban Residential	67.0	65.8	-
9	Urban Residential	67.0	61.4	-
10	Urban Residential	67.0	58.5	-
11	Commercial	65.0-79.0	52.9	-
12	Industrial	65.0-79.0	56.3	-
13	Industrial	65.0-79.0	56.7	-
14	Industrial	65.0-79.0	60.9	-
15	Industrial	65.0-79.0	66.0	-

8.2 Operational Phase

In summary, Table 14 shows the pre-development and post-development Leq and Lmax noise levels at all locations, and the increase from the Pre-Development values, if any.

Table 14 –Leq and Lmax – Pre-Development Vs. ~~Operational Phase~~ Const-

	Leq (dBA)			Lmax (dBA)		
Location	**Pre**	**Post**	**Increase**	**Pre**	**Post**	**Increase**
1	55.4	63.8	8.4	79.6	91.0	11.4
2	53.9	56.0	2.1	73.9	79.9	6.0
3	53.5	56.7	3.2	74.0	80.9	6.9
4	56.8	60.7	3.9	84.5	86.9	2.4
5	55.0	57.3	2.3	82.8	80.4	-
6	61.4	57.9	-	90.0	82.7	-
7	56.7	61.5	4.8	82.4	88.1	5.7
8	56.1	61.8	5.7	74.1	91.0	16.9
9	54.5	62.6	8.1	82.6	83.4	0.8
10	56.3	62.7	6.4	82.4	82.1	-
11	62.5	59.1	-	89.4	73.4	-
12	58.1	65.7	7.6	87.3	81.5	-
13	54.7	71.6	16.9	82.0	71.4	-
14	56.5	60.7	4.2	80.9	79.9	-
15	55.2	63.8	8.6	80.1	91.0	10.9

The hours of operation of the proposed facility will be between 8 AM and 4:30 PM. The calculated post-development noise levels are compared to NYSDEC recommended noise levels for the proposed hours of operation. Table 13 shows the land use of the bordering property, the NYSDEC recommended Leq, the calculated post-development Leq, and any values in excess of the recommended Leq value.

Table 15 – Leq – NYSDEC Vs. Operational Phase

		Leq (dBA)		
Location	Bordering Property Description	NYSDEC	Post	Exceed (dBA)
1	Industrial	65.0-79.0	63.8	-
2	Urban Residential	67.0	56.0	-
3	Commercial	65.0-79.0	56.7	-
4	Commercial	65.0-79.0	60.7	-
5	Commercial	65.0-79.0	57.3	-
6	Commercial	65.0-79.0	57.9	-
7	Urban Residential	67.0	61.5	-
8	Urban Residential	67.0	61.8	-
9	Urban Residential	67.0	62.6	-
10	Urban Residential	67.0	62.7	-
11	Commercial	65.0-79.0	59.1	-
12	Industrial	65.0-79.0	65.7	-
13	Industrial	65.0-79.0	71.6	-
14	Industrial	65.0-79.0	60.7	-
15	Industrial	65.0-79.0	63.8	-

9.0 CONCLUSION

As noted in Table 13 and Table 15, under the worst-case construction and operational phase noise scenarios, no residential receptors will be subjected to noise levels above the Regulatory thresholds of NYSDEC Part 360-1.14(p) and no industrial/commercial receptors will subjected to noise levels above the recommended guidance levels of the NYSDEC Program Policy.

Although the NYSDEC regulatory and policy noise threshold are not exceeded, certain receptors, as shown in Table 12 and Table 14 are estimated to experience an increase in Leq noise levels over existing pre-development conditions.

As discussed in the NYSDEC Policy, increase in the Leq of between 3 and 6 dBA may have a potential for adverse noise impacts for only the most sensitive receptors. Sound increases of more than 6 dBA may require closer analysis of impact potential, and increases of 10 dBA deserve consideration of avoidance or mitigation.

Construction Phase

Examination of the data in Table 12 shows that during the construction phase, the estimated increase of the Leq is less than 3 dBA for 6 of the receptors (2,3,6,11,12, and 13), between 3 dBA and 6 dBA for 4 receptors (4,5,10, and 14), and greater than 6 dBA for 5 receptors (1,7,8,9, and 15). Most significantly, the residential property lines to the south of the proposed access road, represented by receptors 7, 8, and 9 are estimated to experience an increase in the Leq of 6.9 dBA to 9.4 dBA. The predominant source of this noise is the truck traffic associated with the off-site shipping of crushed rock and the operation of the crusher..

Operational Phase

Examination of the data in Table 14 shows that during the operational phase, the estimated increase of the Leq is less than 3 dBA for 4 of the receptors (2,5,6, and 11), between 3 dBA and 6 dBA for 5 receptors (3,4,7,and 14), and greater than 6 dBA for 6 receptors (1,9,10,12, 13, and 15). Most significantly, the residential property lines to the south of the access road, represented by receptors 9 and 10 are estimated to experience an increase in the Leq of 6.4 dBA to 8.1 dBA. The predominant source of this noise is the truck traffic associated with the delivery of waste materials to the facility and the operation of the stationary equipment within the recycling center.

Although the estimated noise impacts at the property boundary are less than the NYSDEC regulatory and policy guidelines for solid waste facilities, the following measures are proposed to mitigate the potential noise impacts of greater than 6 dBA increase in the Leq estimated at the residential property lines to the south of the facility:

- The applicant will construct a traffic noise barrier along the southern access road to reduce the noise impacts on the residential properties. The barrier will be approximately 1000 feet long and 10 feet high. The sound barrier will run from the approximate location of Receptor #7 to west of Receptor # 10.

- The applicant will construct a 20-foot high earthen berm around the recycling center operation to contain the noise from the stationary equipment. The location of the stationary equipment will be adjusted within the bermed area to minimize the noise impacts along the residential properties near the southern border. If necessary, the crusher and grinder will not be operated simultaneously;

- The applicant will specify the use of high performance mufflers and other sound deadening measures on landfill equipment. This will include the use of strobes or similar devices as opposed to back-up alarms. If necessary, less noisy equipment such as a standard dozer will be used to compact the waste.

- The applicant will specify a performance standard of no more than a 10 decibel increase, measured as a one hour Leq, at all residential property lines. In order to achieve this standard, the applicant will conduct test measurements during periods of typical operation. Should the 10 decibel threshold be exceeded, the applicant will undertake measures to lessen the impact. These may include the incorporation of additional sound barriers or other devices having a similar effect, modification of equipment locations, or modification of equipment operating parameters.

- Construction hours will be limited to 7:30 AM – 4:30 PM and operational hours to 8 AM – 4:30 PM Monday thru Friday.

To address the potential increase in noise levels at the residential property boundaries to the south of the facility, a traffic noise barrier is proposed along the new southern access road. The proposed barrier will be approximately 1000 feet long and will run along the southern edge of the access road from approximately Receptor 7 to west of Receptor 10. To estimate the impact and sufficiency of this mitigation measure, additional modeling was performed to estimate the impact of the barrier in reducing noise from the interior equipment/truck traffic and off-site shipping traffic along the access road.

In Table 16 below for the construction phase, the noise impacts for the crushing operation remain the same, and the impacts for the interior equipment/trucking and off-site trucking are reduced to account for the traffic noise barrier in accordance with the modeling results in Appendix B.

In Table 17 below for the operational phase, the noise impacts for the crushing and grinding operations remain the same, and the impacts for the landfill compactor and waste hauling trucking are reduced to account for the traffic noise barrier in accordance with the modeling results in Appendix B.

Table 16 – Construction Phase Estimated Noise Levels with Traffic Noise Barrier (Residential Receptors)

	Calculated Noise Levels (dBA)		
Location	Crushing Operation	Heavy Equipment/ Interior Trucking	Off-Site Trucking
7	60.5	55.8	53.1
8	60.5	56.8	53.8
9	57.1	53.5	54.0
10	55.1	52.8	50.1

Table 17 – Operational Phase Estimated Noise Levels with Traffic Noise Barrier (Residential Receptors)

	Calculated Noise Level (dBA)			
Location	Heavy Truck	Crusher	Grinder	Compactor
7	51.1	50.8	50.1	51.1
8	51.7	53.6	51.6	51.7
9	51.9	59.6	54.1	51.9
10	52.6	60.7	55.4	52.6

These individual noise sources are combined and compared to the conditions without a traffic noise barrier in Table 18 for the construction phase and Table 19 for the operational phase.

Table 18 –Construction Phase Combined Noise Estimates with and without Traffic Noise Barrier

	Leq (dBA) w/o Barrier			Leq (dBA) w/ Barrier		
Location	**Pre**	**Post**	**Increase**	**Pre**	**Post**	**Increase**
7	56.7	64.3	7.6	56.7	62.5	5.8
8	56.1	65.8	9.7	56.1	62.5	6.4
9	54.5	61.4	6.9	54.5	60.1	5.6
10	56.3	59.5	3.2	56.3	58.1	1.8

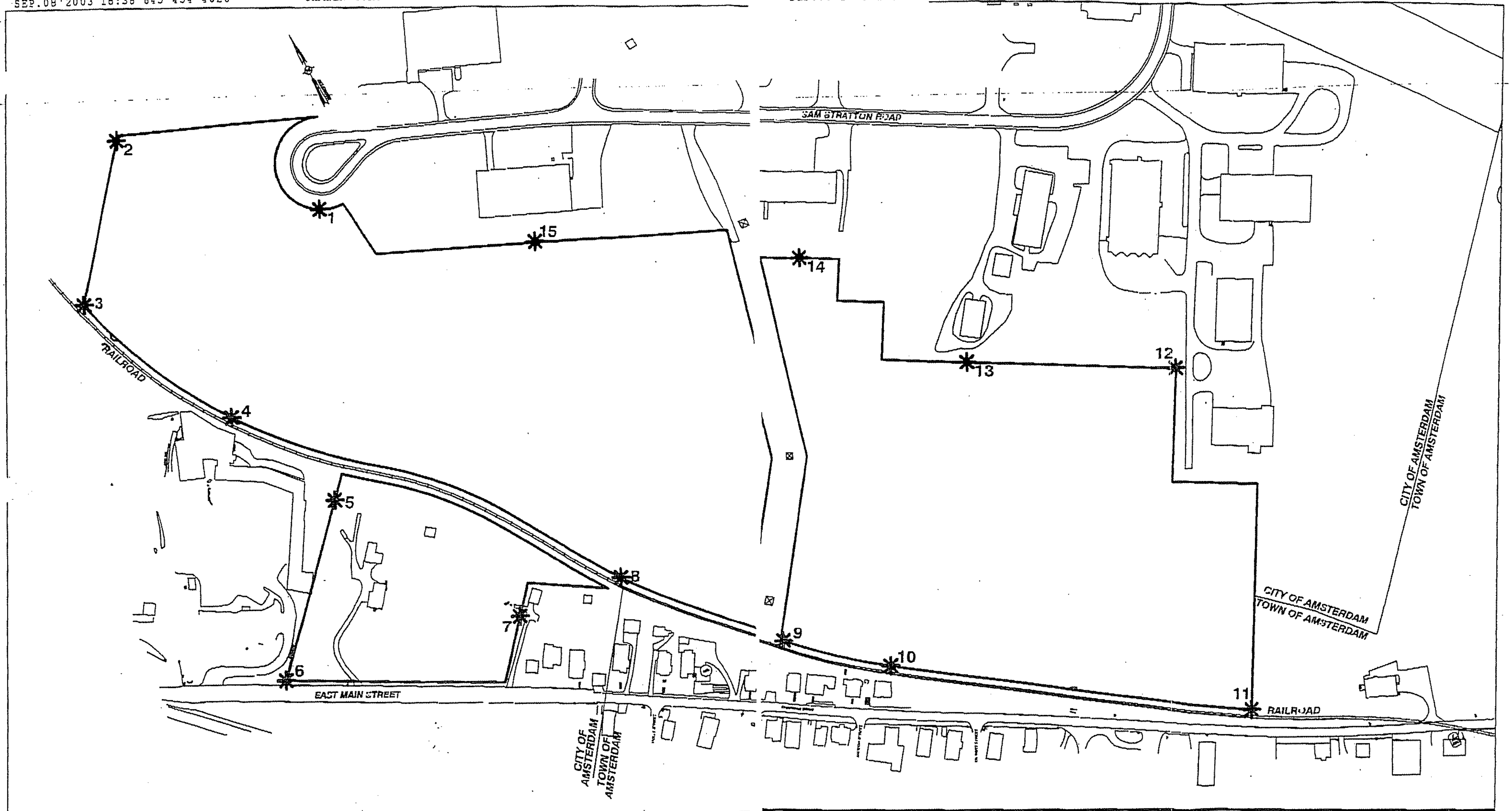
Table 19 –Operational Phase Combined Noise Estimates with and without Traffic Noise Barrier

	Leq (dBA) w/o Barrier			Leq (dBA) w/ Barrier		
Location	**Pre**	**Post**	**Increase**	**Pre**	**Post**	**Increase**
7	56.7	61.5	4.8	56.7	57.1	0.4
8	56.1	61.8	5.7	56.1	60.1	4
9	54.5	62.6	8.1	54.5	61.6	7.1
10	56.3	62.7	6.4	56.3	62.7	6.4

As shown above, the proposed traffic noise barrier reduces the estimated noise impacts associated with traffic to the residential properties to the south. With the exception of Receptor 8 during the construction phase and Receptors 9 and 10 during the operational phase, the remaining locations are below the levels (i.e. increase of between 3-6 dBA) indicated in NYSDEC Program Policy as having a potential for adverse impacts only in cases for the most sensitive receptors. The predicted impacts for Receptors 8, 9 and 10 slightly exceed this range, but are below the 10 dBA threshold indicating the need for additional avoidance and mitigation measures.

The construction phase noise impacts at Receptor 8 are primarily related to the close proximity of access road to the property line in this area. However, the railroad tracks immediately south of the property line provide an additional buffer zone for further noise attenuation before reaching any actual residential receptors. The operational phase predicted impacts for Receptors 9 and 10 are related primarily to the operation of the crusher in the recycling center. These impacts are reduced by the berm around the recycling center and the traffic noise barrier along the access road. If necessary, the crusher location can be moved to the north side of the recycling center and simultaneous operation of the grinder and crusher can be avoided to further reduce impacts to the residential properties.

Appendix A:
Pre-Development Noise Analysis



THE Chazen COMPANIES

Engineers/Surveyors
Planners
Environmental Scientists

CHAZEN ENGINEERING & LAND SURVEYING CO., P.C.

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AMSTERDAM MATERIALS RECYCLING

NOISE SURVEY
PRE-DEVELOPMENT CONDITIONS

CITY OF AMSTERDAM
DUTCHESS COUNTY, NEW YORK

drawn: AVW	check:
date: 09/08/03	scale: 1"=200'
project no. 90303.00	
figure no. 1	

Date Printed: Sa... 2003, 5:38pm

Location 1

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/12/2003 10:57:16 AM
End Time:		08/12/2003 11:57:16 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

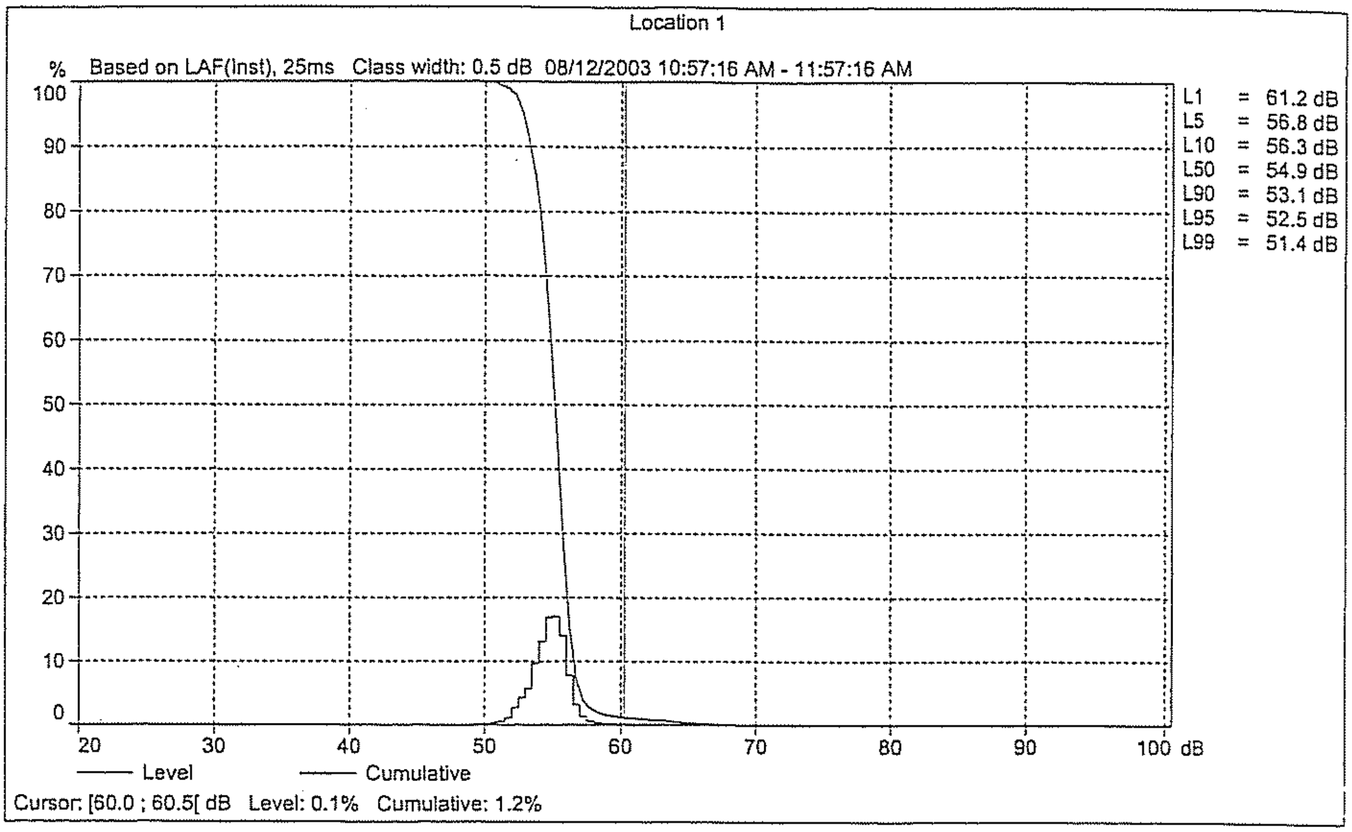
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 1

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				49.4	55.4	79.6	53.1
Time	10:57:16 AM	11:57:16 AM	1:00:00				
Date	08/12/2003	08/12/2003					



Location 1
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/12/2003 10:57:16 AM - 11:57:16 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 61.2 dB
L5 = 56.8 dB
L10 = 56.3 dB
L50 = 54.9 dB
L90 = 53.1 dB
L95 = 52.5 dB
L99 = 51.4 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.1% Cumulative: 1.2%

Location 2

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/12/2003 12:04:48 PM
End Time:		08/12/2003 01:04:48 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

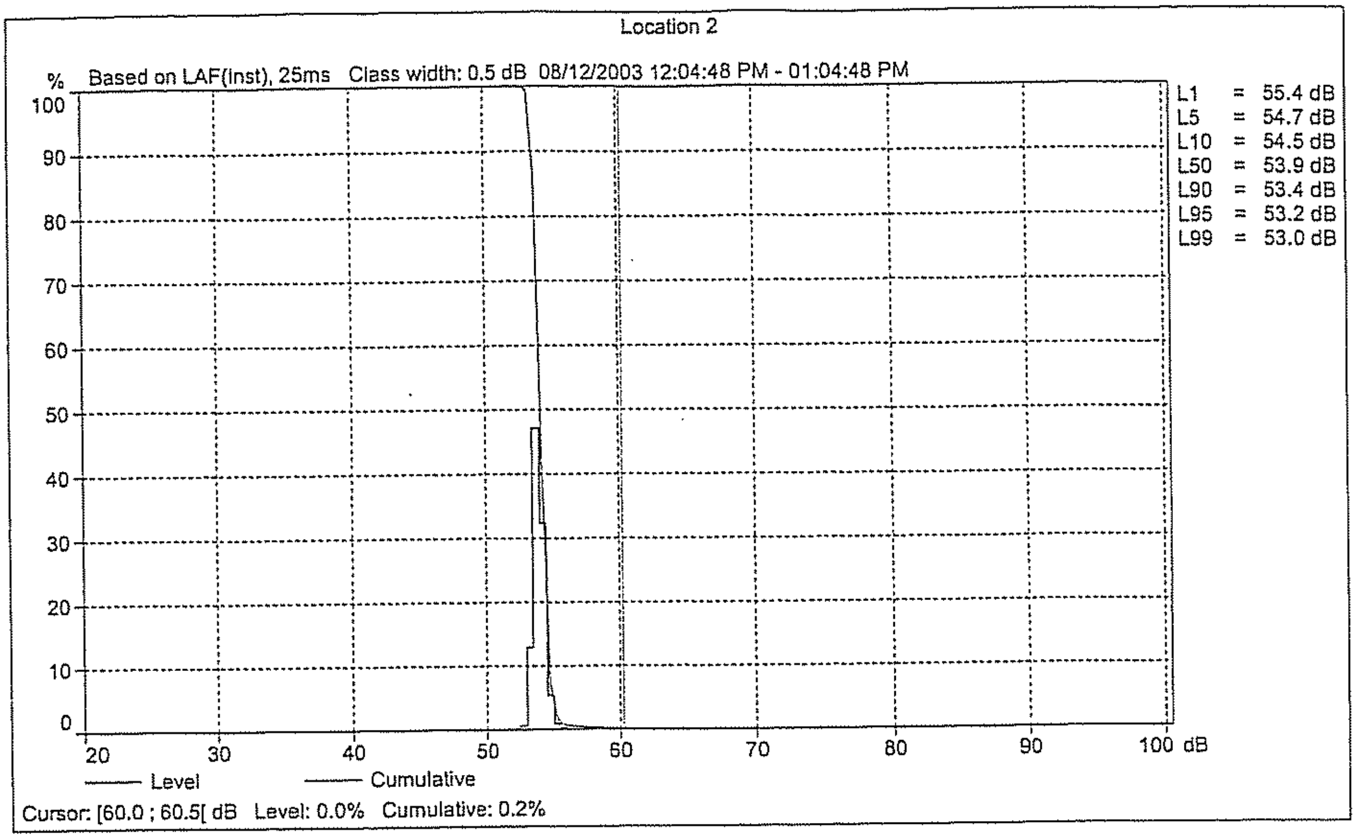
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 2

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				52.4	53.9	73.9	53.4
Time	12:04:48 PM	01:04:48 PM	1:00:00				
Date	08/12/2003	08/12/2003					


Location 2
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/12/2003 12:04:48 PM - 01:04:48 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 55.4 dB
L5 = 54.7 dB
L10 = 54.5 dB
L50 = 53.9 dB
L90 = 53.4 dB
L95 = 53.2 dB
L99 = 53.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.0% Cumulative: 0.2%

Location 3

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/12/2003 01:09:23 PM
End Time:		08/12/2003 02:09:23 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

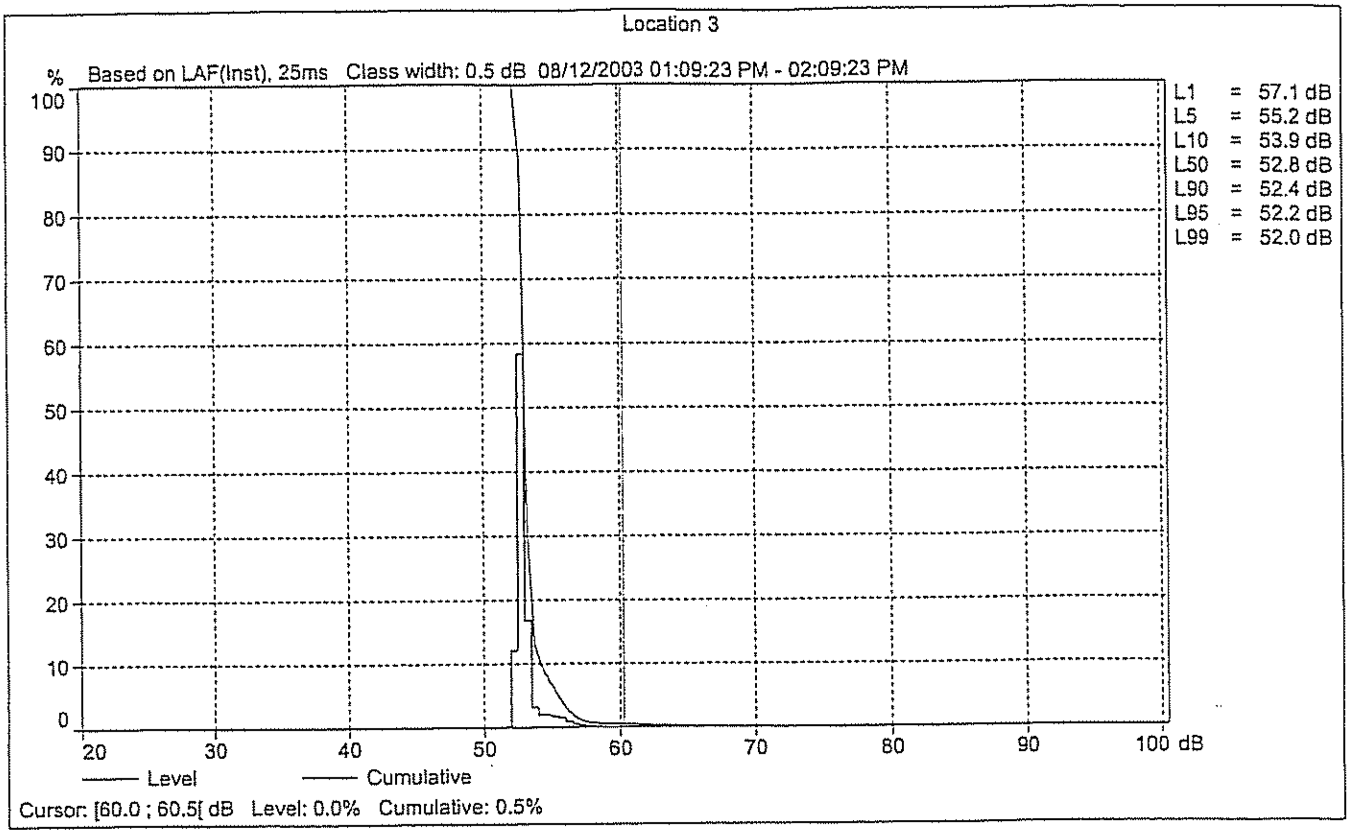
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 3

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				51.9	53.5	74.0	52.4
Time	01:09:23 PM	02:09:23 PM	1:00:00				
Date	08/12/2003	08/12/2003					


Location 3
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/12/2003 01:09:23 PM - 02:09:23 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 57.1 dB
L5 = 55.2 dB
L10 = 53.9 dB
L50 = 52.8 dB
L90 = 52.4 dB
L95 = 52.2 dB
L99 = 52.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.0% Cumulative: 0.5%

Location 4

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 04:19:17 PM
End Time:		08/14/2003 05:19:17 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

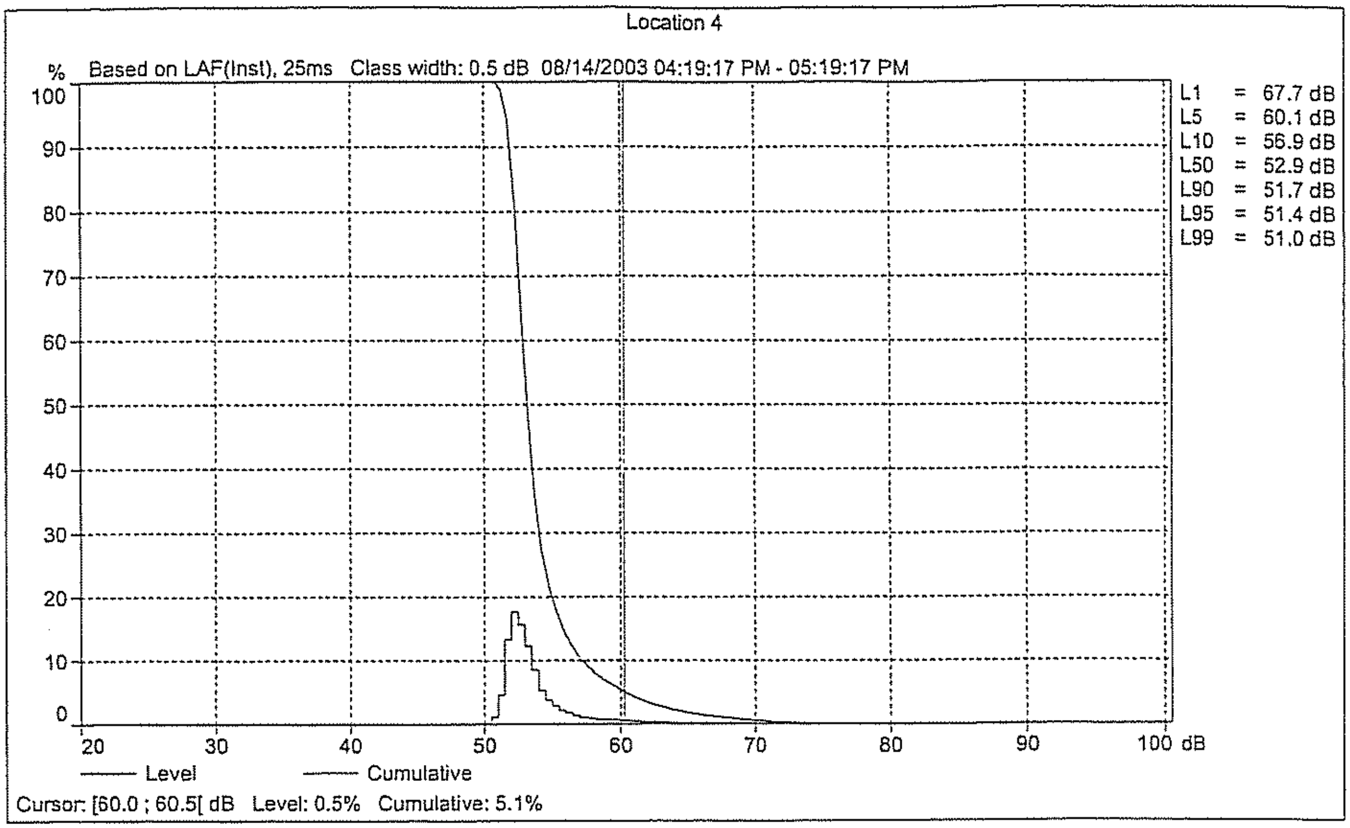
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 4

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				50.4	56.8	84.5	51.7
Time	04:19:17 PM	05:19:17 PM	1:00:00				
Date	08/14/2003	08/14/2003					



Location 4
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 04:19:17 PM - 05:19:17 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 67.7 dB
L5 = 60.1 dB
L10 = 56.9 dB
L50 = 52.9 dB
L90 = 51.7 dB
L95 = 51.4 dB
L99 = 51.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.5% Cumulative: 5.1%

Location 5

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 10:20:01 AM
End Time:		08/14/2003 11:20:01 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

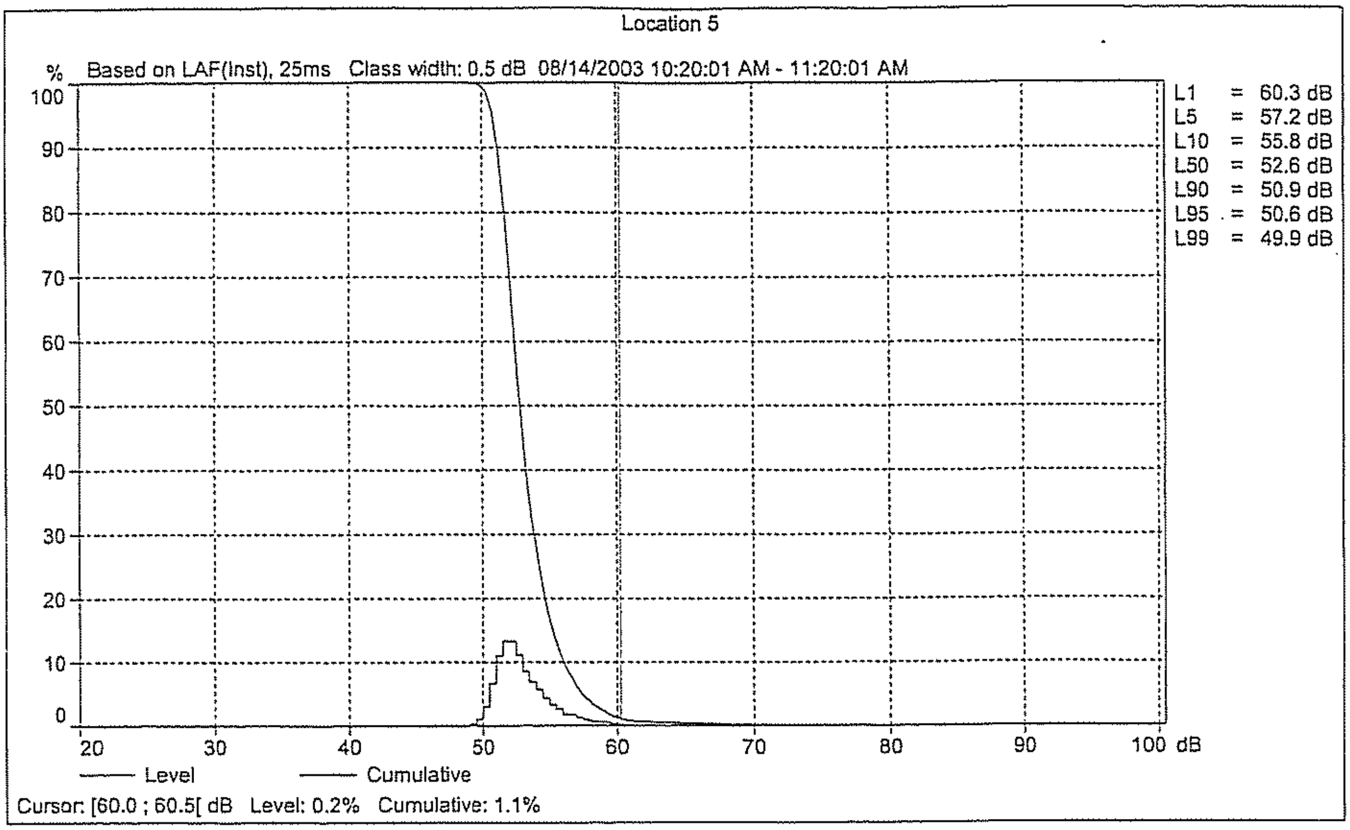
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 5

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				49.0	55.0	82.8	50.9
Time	10:20:01 AM	11:20:01 AM	1:00:00				
Date	08/14/2003	08/14/2003					


Location 5
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 10:20:01 AM - 11:20:01 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 60.3 dB
L5 = 57.2 dB
L10 = 55.8 dB
L50 = 52.6 dB
L90 = 50.9 dB
L95 = 50.6 dB
L99 = 49.9 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.2% Cumulative: 1.1%

Location 6

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 09:51:27 AM
End Time:		08/13/2003 10:51:27 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

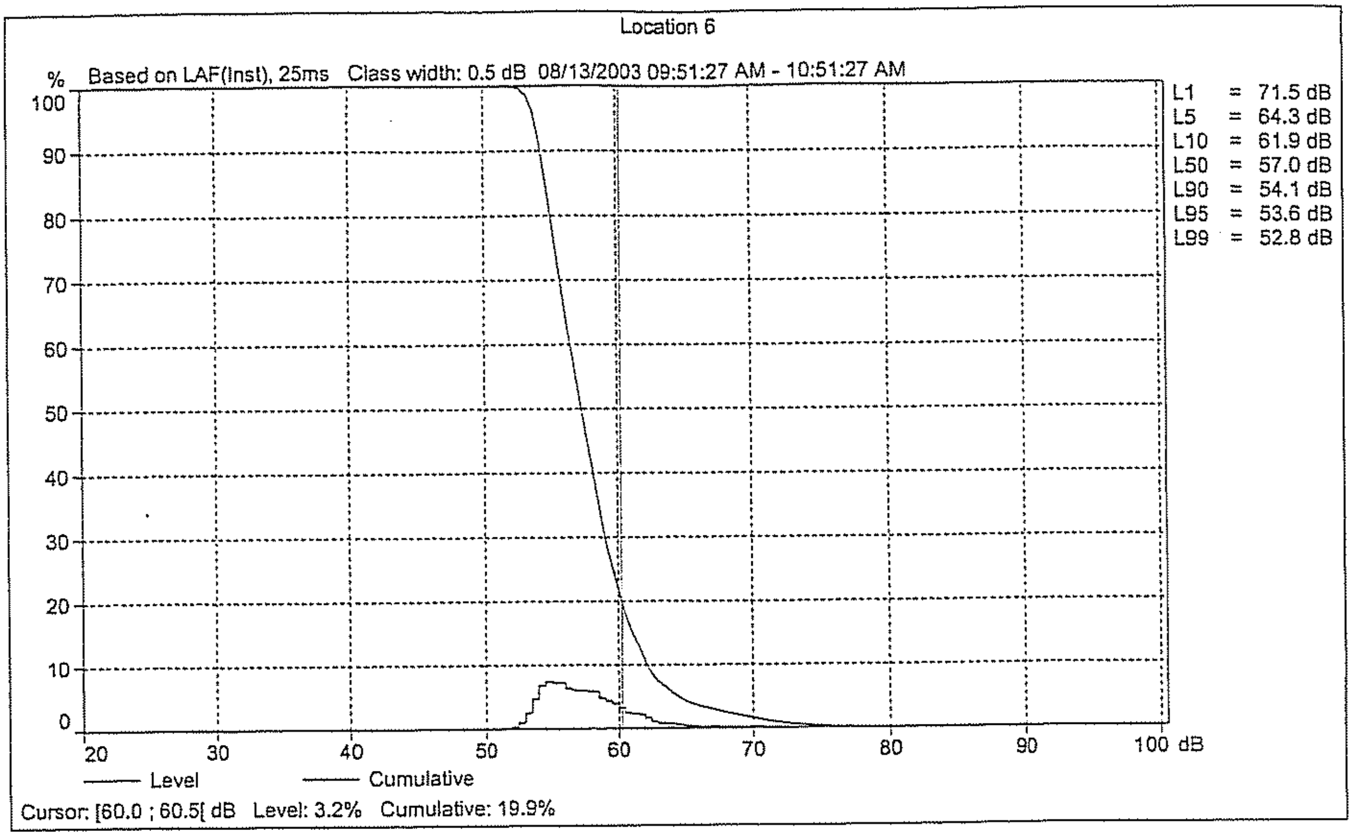
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 6

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				51.4	61.4	90.0	54.1
Time	09:51:27 AM	10:51:27 AM	1:00:00				
Date	08/13/2003	08/13/2003					


Location 6
%
Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 09:51:27 AM - 10:51:27 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 71.5 dB
L5 = 64.3 dB
L10 = 61.9 dB
L50 = 57.0 dB
L90 = 54.1 dB
L95 = 53.6 dB
L99 = 52.8 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 3.2% Cumulative: 19.9%

Location 7

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 10:54:41 AM
End Time:		08/13/2003 11:54:41 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

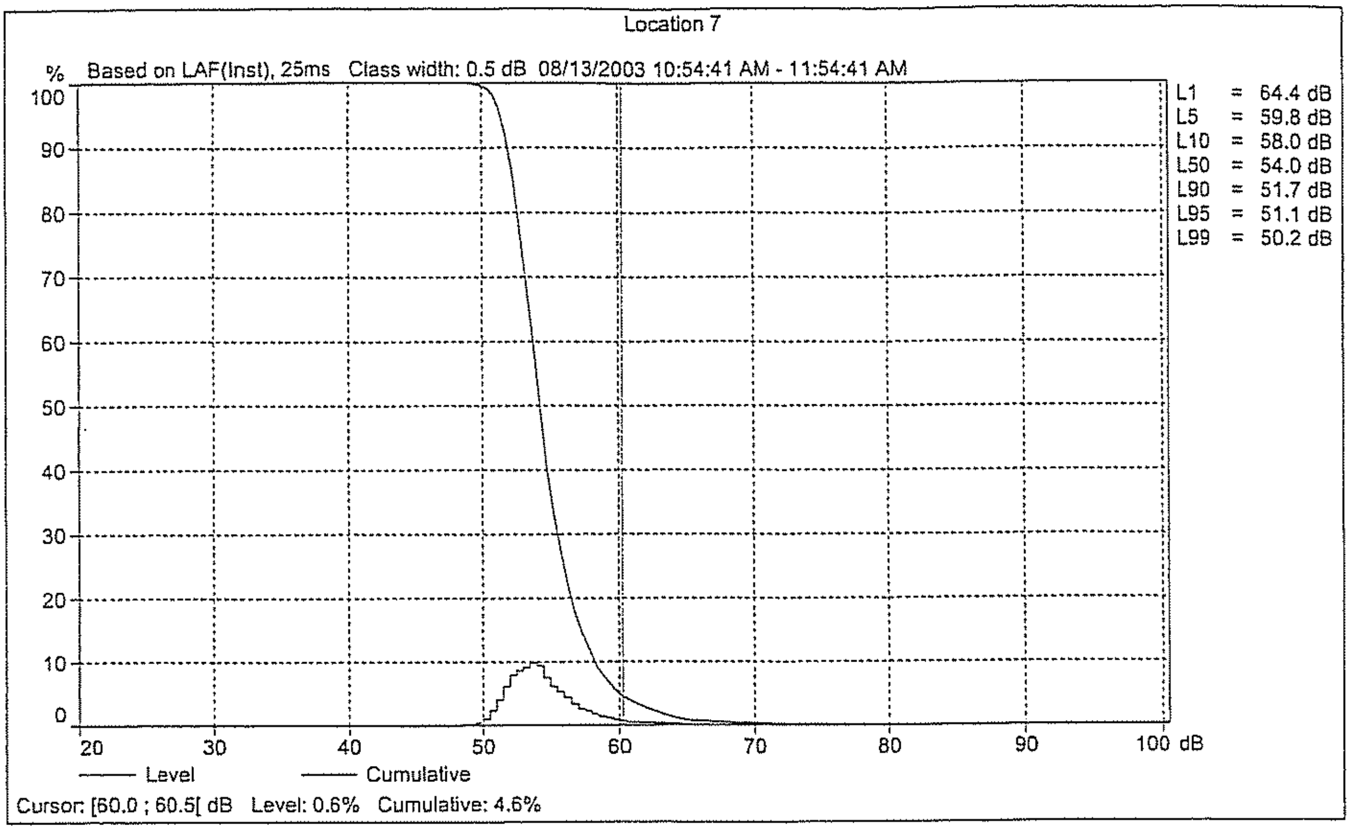
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 7

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				48.5	56.7	82.4	51.7
Time	10:54:41 AM	11:54:41 AM	1:00:00				
Date	08/13/2003	08/13/2003					



Location 7
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 10:54:41 AM - 11:54:41 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 64.4 dB
L5 = 59.8 dB
L10 = 58.0 dB
L50 = 54.0 dB
L90 = 51.7 dB
L95 = 51.1 dB
L99 = 50.2 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.6% Cumulative: 4.6%

Location 8

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 01:26:26 PM
End Time:		08/13/2003 02:26:26 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

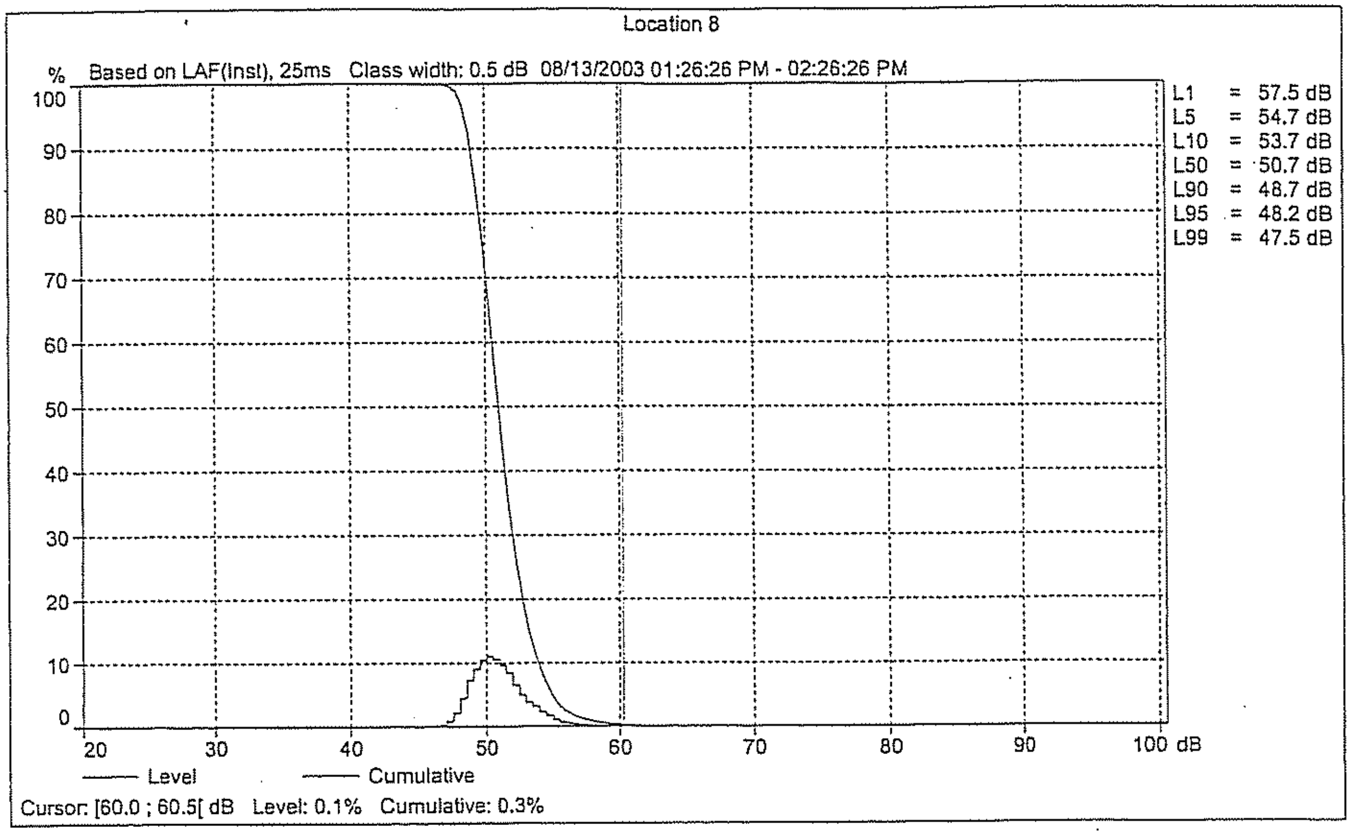
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 8

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				46.1	51.6	74.1	48.7
Time	01:26:26 PM	02:26:26 PM	1:00:00				
Date	08/13/2003	08/13/2003					



Location 8
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 01:26:26 PM - 02:26:26 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 57.5 dB
L5 = 54.7 dB
L10 = 53.7 dB
L50 = 50.7 dB
L90 = 48.7 dB
L95 = 48.2 dB
L99 = 47.5 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.1% Cumulative: 0.3%

Location 9

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 05:27:56 PM
End Time:		08/14/2003 06:27:56 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

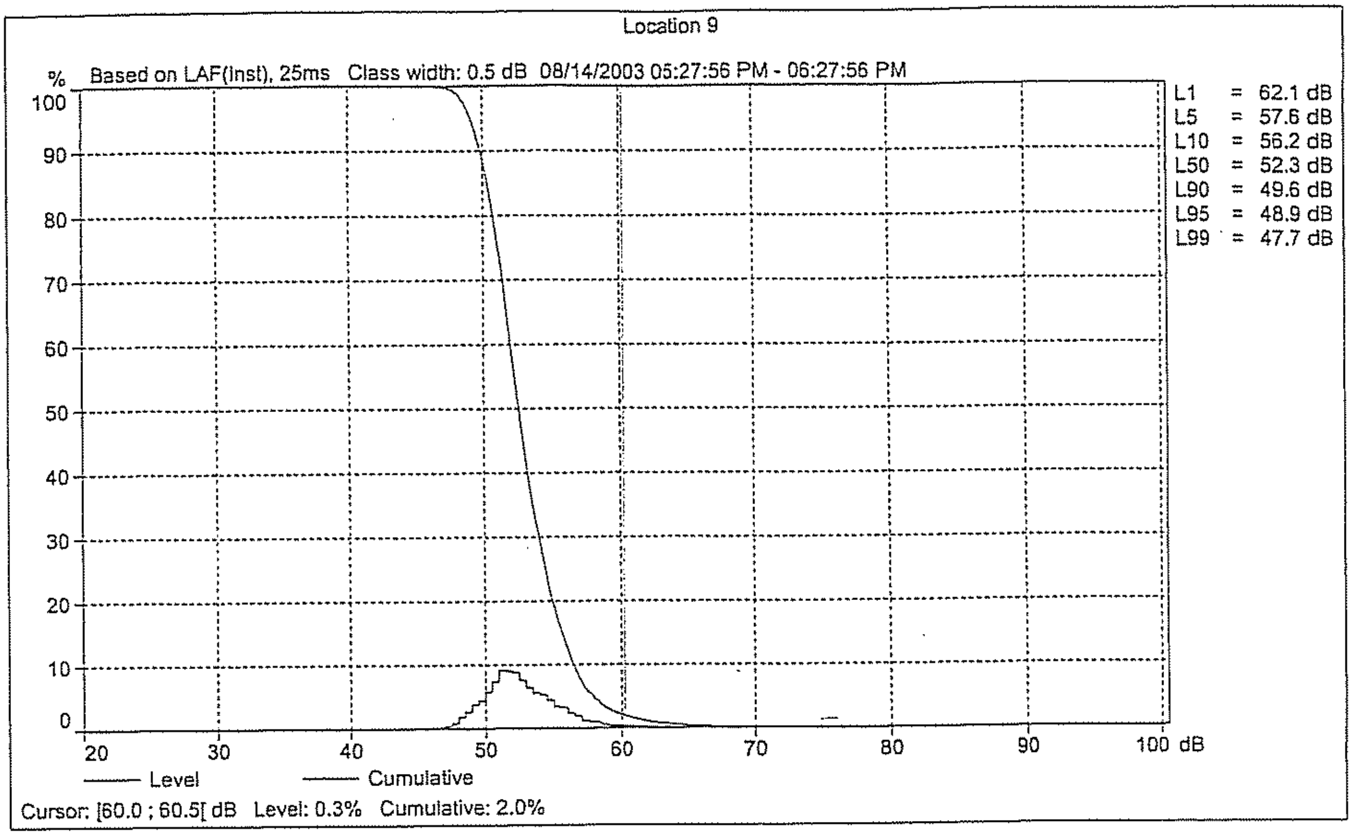
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 9

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				45.5	54.5	82.6	49.6
Time	05:27:56 PM	06:27:56 PM	1:00:00				
Date	08/14/2003	08/14/2003					



Location 9
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 05:27:56 PM - 06:27:56 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 62.1 dB
L5 = 57.6 dB
L10 = 56.2 dB
L50 = 52.3 dB
L90 = 49.6 dB
L95 = 48.9 dB
L99 = 47.7 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.3% Cumulative: 2.0%

Location 10

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 12:11:37 PM
End Time:		08/13/2003 01:11:37 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

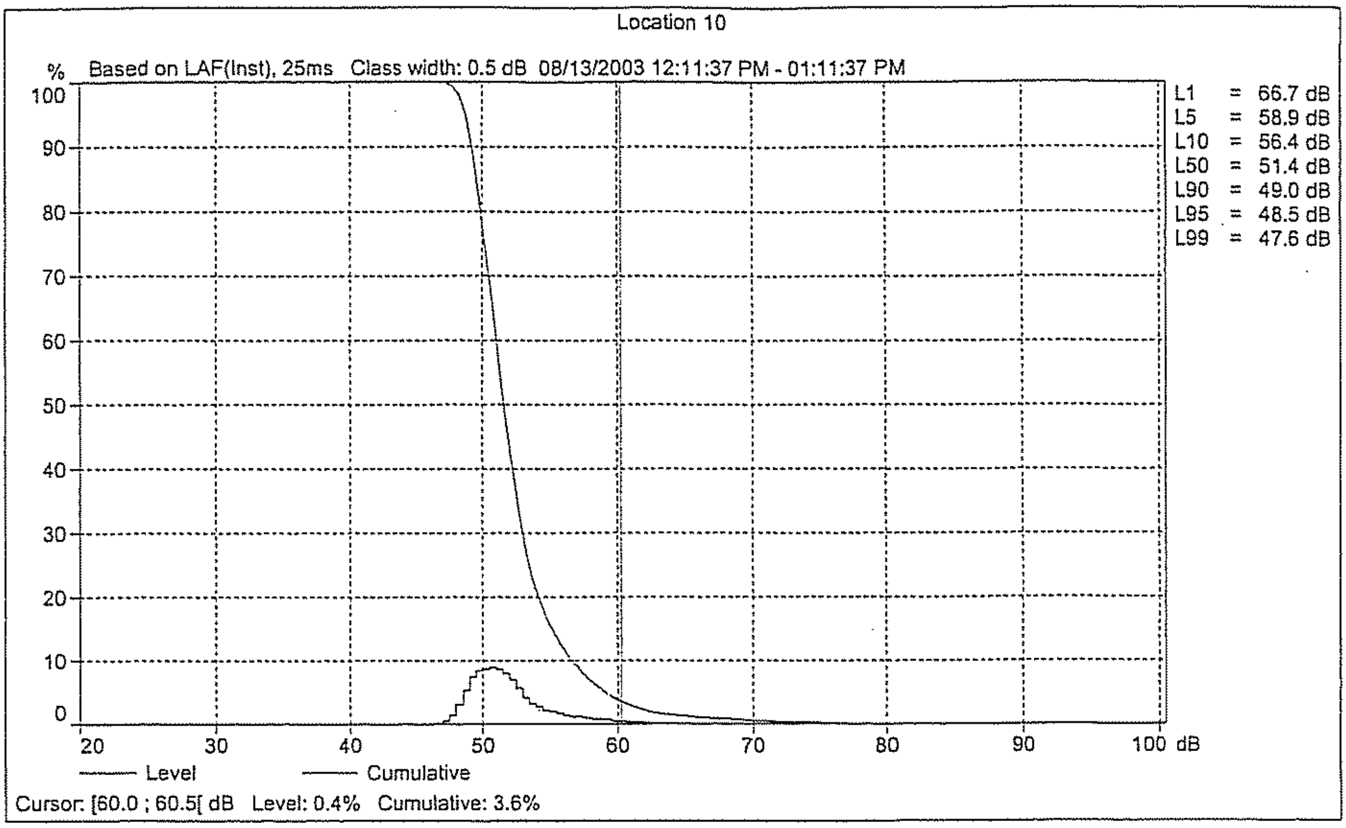
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 10

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				46.4	56.3	82.4	49.0
Time	12:11:37 PM	01:11:37 PM	1:00:00				
Date	08/13/2003	08/13/2003					



Location 10
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 12:11:37 PM - 01:11:37 PM
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 dB
L1 = 66.7 dB
L5 = 58.9 dB
L10 = 56.4 dB
L50 = 51.4 dB
L90 = 49.0 dB
L95 = 48.5 dB
L99 = 47.6 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.4% Cumulative: 3.6%

Location 11

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 02:46:13 PM
End Time:		08/13/2003 03:46:13 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

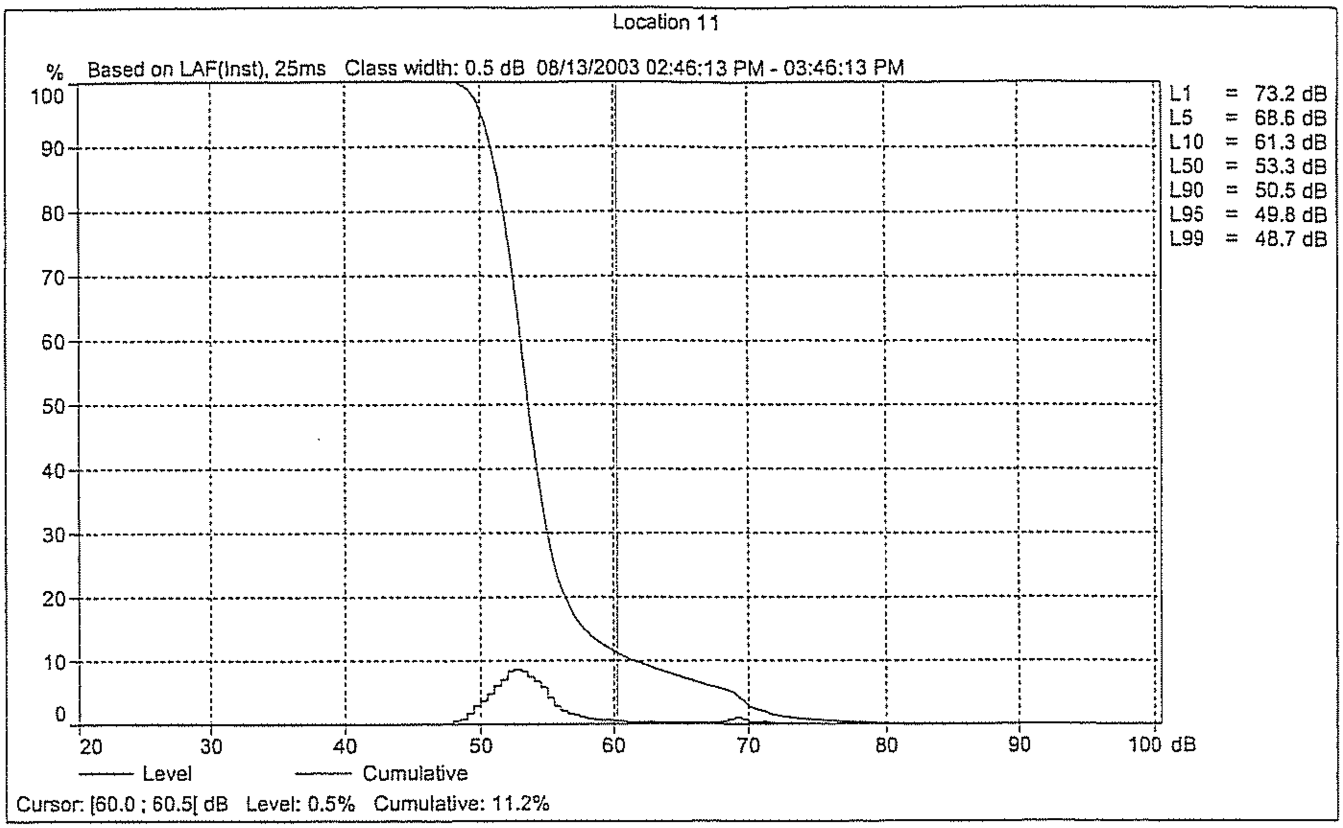
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 11

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				47.3	62.5	89.4	50.5
Time	02:46:13 PM	03:46:13 PM	1:00:00				
Date	08/13/2003	08/13/2003					



Location 11
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 02:46:13 PM - 03:46:13 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 73.2 dB
L5 = 68.6 dB
L10 = 61.3 dB
L50 = 53.3 dB
L90 = 50.5 dB
L95 = 49.8 dB
L99 = 48.7 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.5% Cumulative: 11.2%

Location 12

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 01:15:14 PM
End Time:		08/14/2003 02:15:14 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

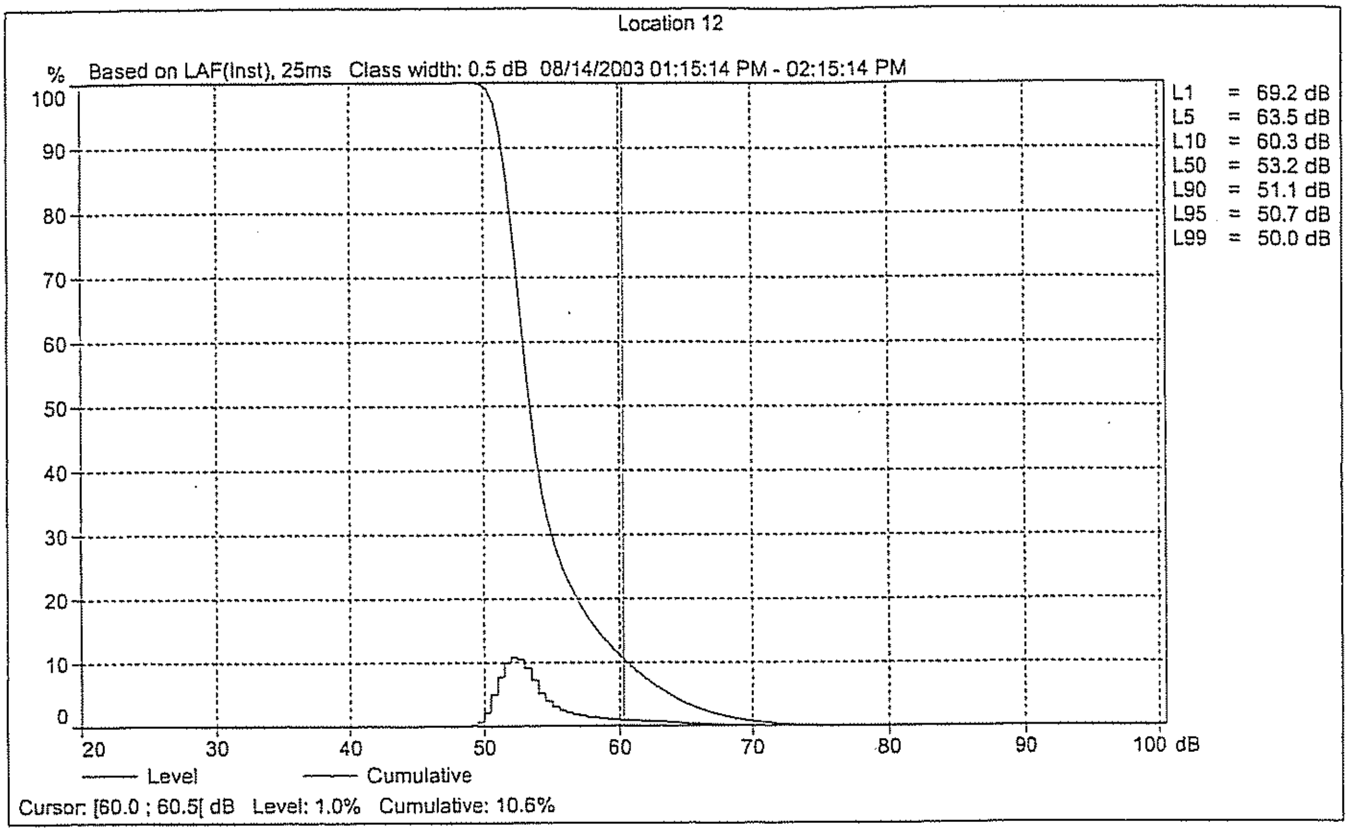
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 12

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				49.1	58.1	87.3	51.1
Time	01:15:14 PM	02:15:14 PM	1:00:00				
Date	08/14/2003	08/14/2003					


Location 12
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 01:15:14 PM - 02:15:14 PM
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 dB
L1 = 69.2 dB
L5 = 63.5 dB
L10 = 60.3 dB
L50 = 53.2 dB
L90 = 51.1 dB
L95 = 50.7 dB
L99 = 50.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 1.0% Cumulative: 10.6%

Location 13

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 12:05:31 PM
End Time:		08/14/2003 01:05:31 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

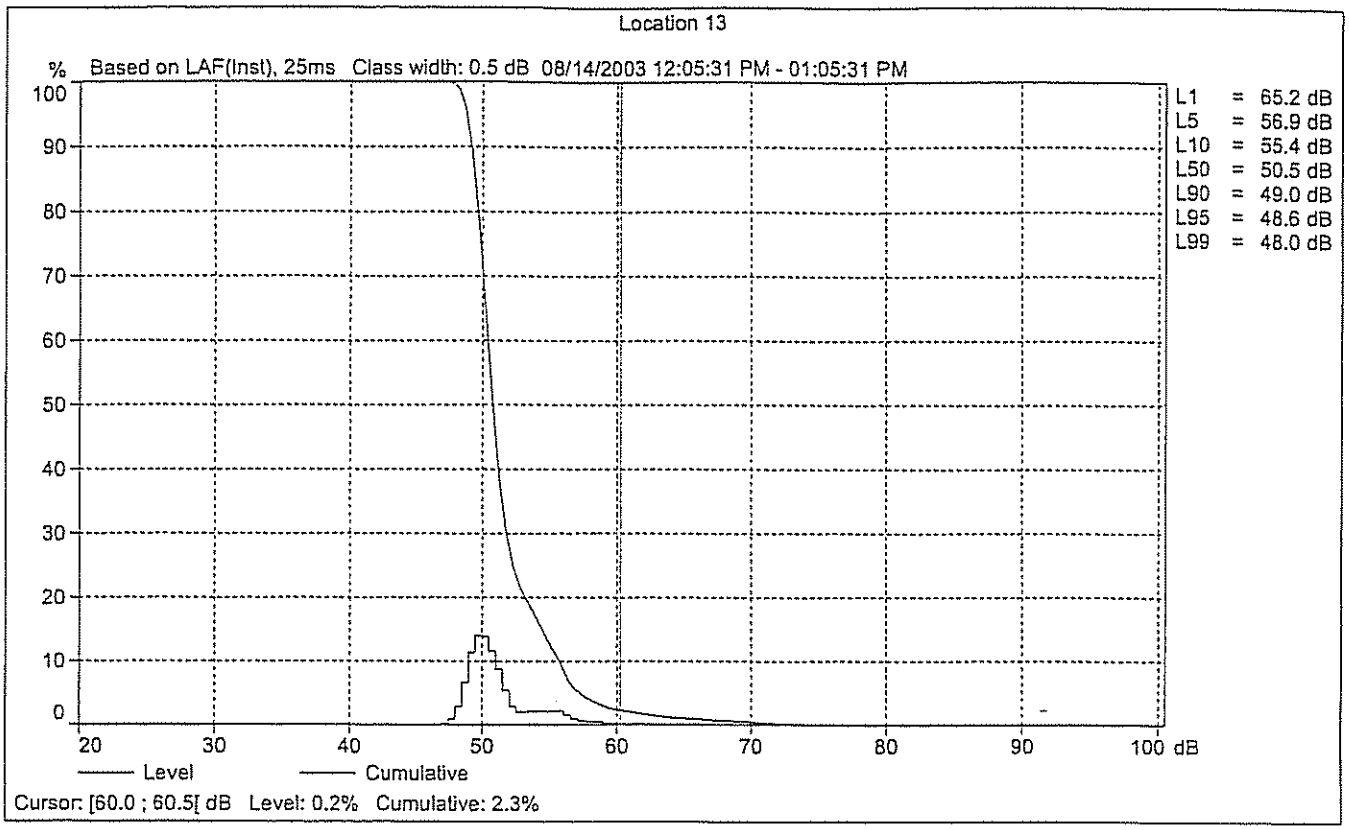
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 13

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				47.4	54.7	82.0	49.0
Time	12:05:31 PM	01:05:31 PM	1:00:00				
Date	08/14/2003	08/14/2003					


Location 13
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 12:05:31 PM - 01:05:31 PM
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 dB
L1 = 65.2 dB
L5 = 56.9 dB
L10 = 55.4 dB
L50 = 50.5 dB
L90 = 49.0 dB
L95 = 48.6 dB
L99 = 48.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.2% Cumulative: 2.3%

Location 14

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 02:20:05 PM
End Time:		08/14/2003 03:20:05 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

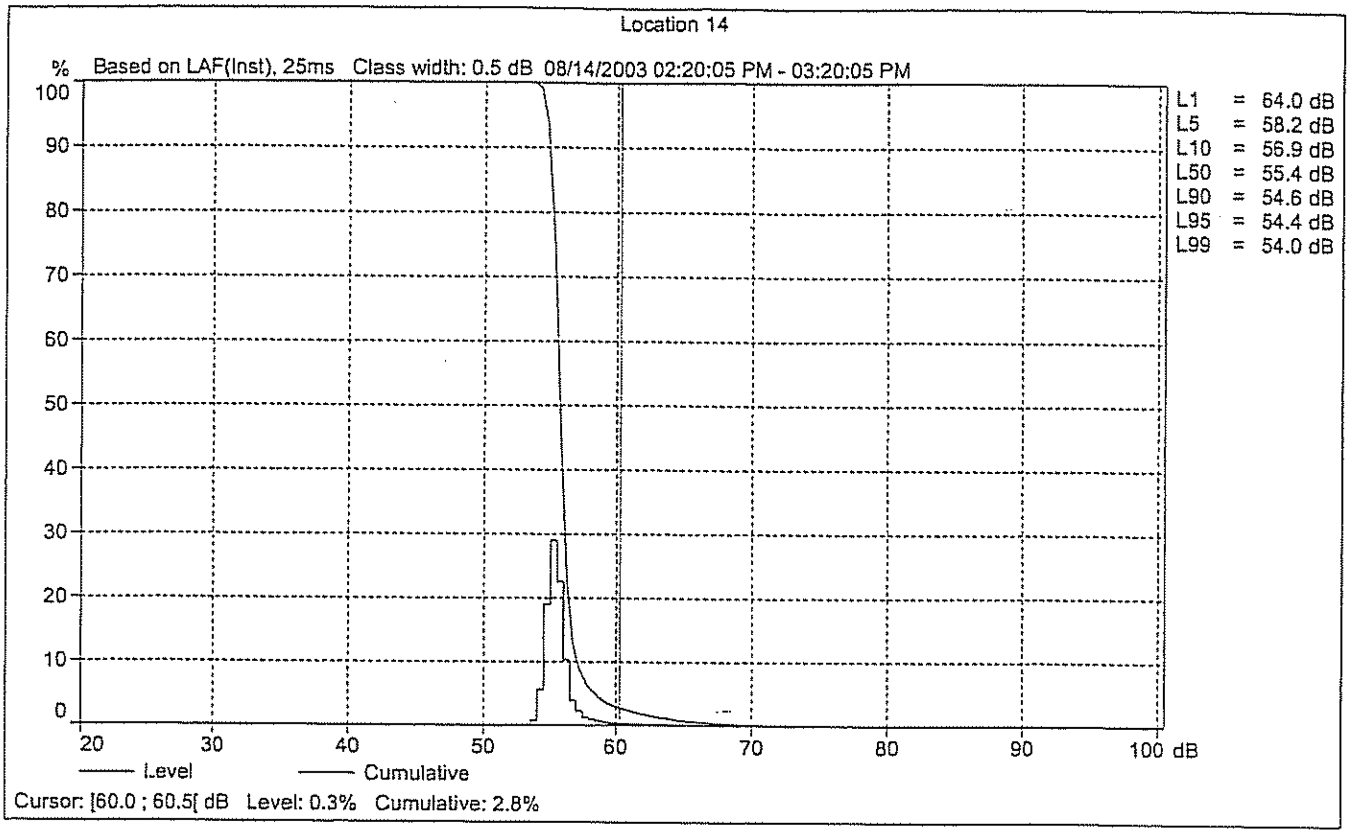
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 14

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				53.6	56.5	80.9	54.6
Time	02:20:05 PM	03:20:05 PM	1:00:00				
Date	08/14/2003	08/14/2003					


Location 14
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 02:20:05 PM - 03:20:05 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 64.0 dB
L5 = 58.2 dB
L10 = 56.9 dB
L50 = 55.4 dB
L90 = 54.6 dB
L95 = 54.4 dB
L99 = 54.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.3% Cumulative: 2.8%

Location 15

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 09:03:38 AM
End Time:		08/14/2003 10:03:38 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

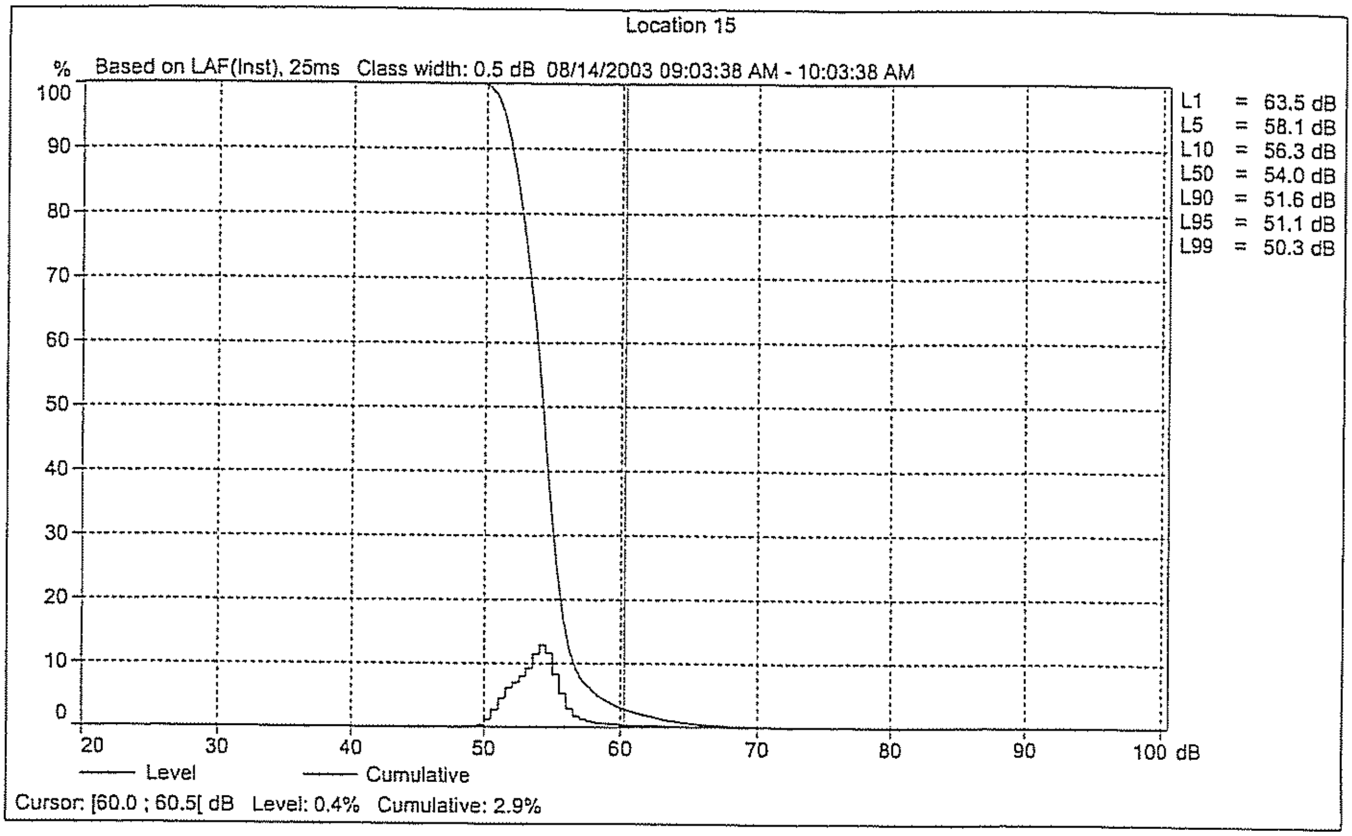
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

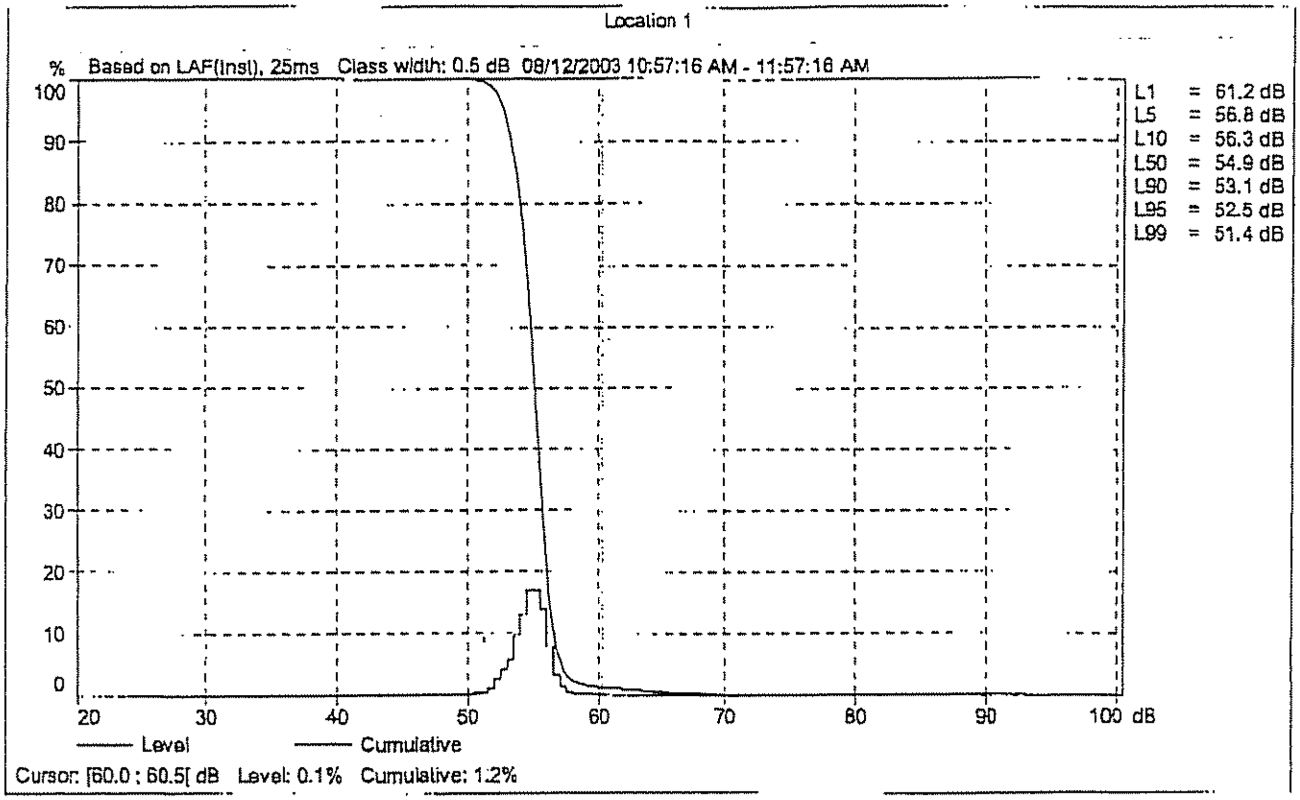
Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 15

	Start time	End time	Elapsed time	LAIMin [dB]	LAeq [dB]	LAIMax [dB]	LAF90 [dB]
Value				49.7	55.2	80.1	51.6
Time	09:03:38 AM	10:03:38 AM	1:00:00				
Date	08/14/2003	08/14/2003					



Location 15
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 09:03:38 AM - 10:03:38 AM
L1 = 63.5 dB
L5 = 58.1 dB
L10 = 56.3 dB
L50 = 54.0 dB
L90 = 51.6 dB
L95 = 51.1 dB
L99 = 50.3 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.4% Cumulative: 2.9%


Location 1
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/12/2003 10:57:16 AM - 11:57:16 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 61.2 dB
L5 = 56.8 dB
L10 = 56.3 dB
L50 = 54.9 dB
L90 = 53.1 dB
L95 = 52.5 dB
L99 = 51.4 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.1% Cumulative: 1.2%

Location 2

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/12/2003 12:04:48 PM
End Time:		08/12/2003 01:04:48 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

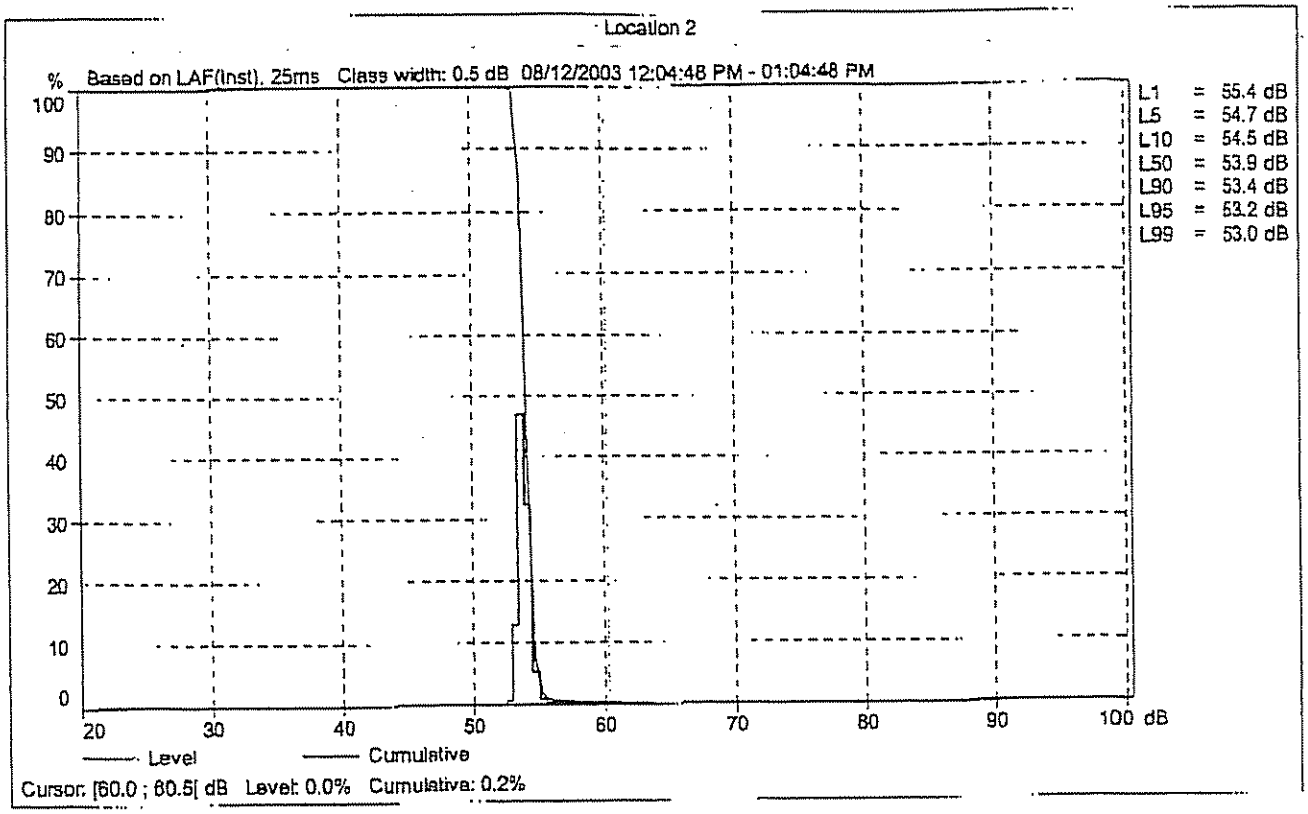
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 2

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]
Value				0.0	53.9	73.9	52.4
Time	12:04:48 PM	01:04:48 PM	1:00:00				
Date	08/12/2003	08/12/2003					


Location 2
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/12/2003 12:04:48 PM - 01:04:48 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 55.4 dB
L5 = 54.7 dB
L10 = 54.5 dB
L50 = 53.9 dB
L90 = 53.4 dB
L95 = 53.2 dB
L99 = 53.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.0% Cumulative: 0.2%

Location 3

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/12/2003 01:09:23 PM
End Time:		08/12/2003 02:09:23 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

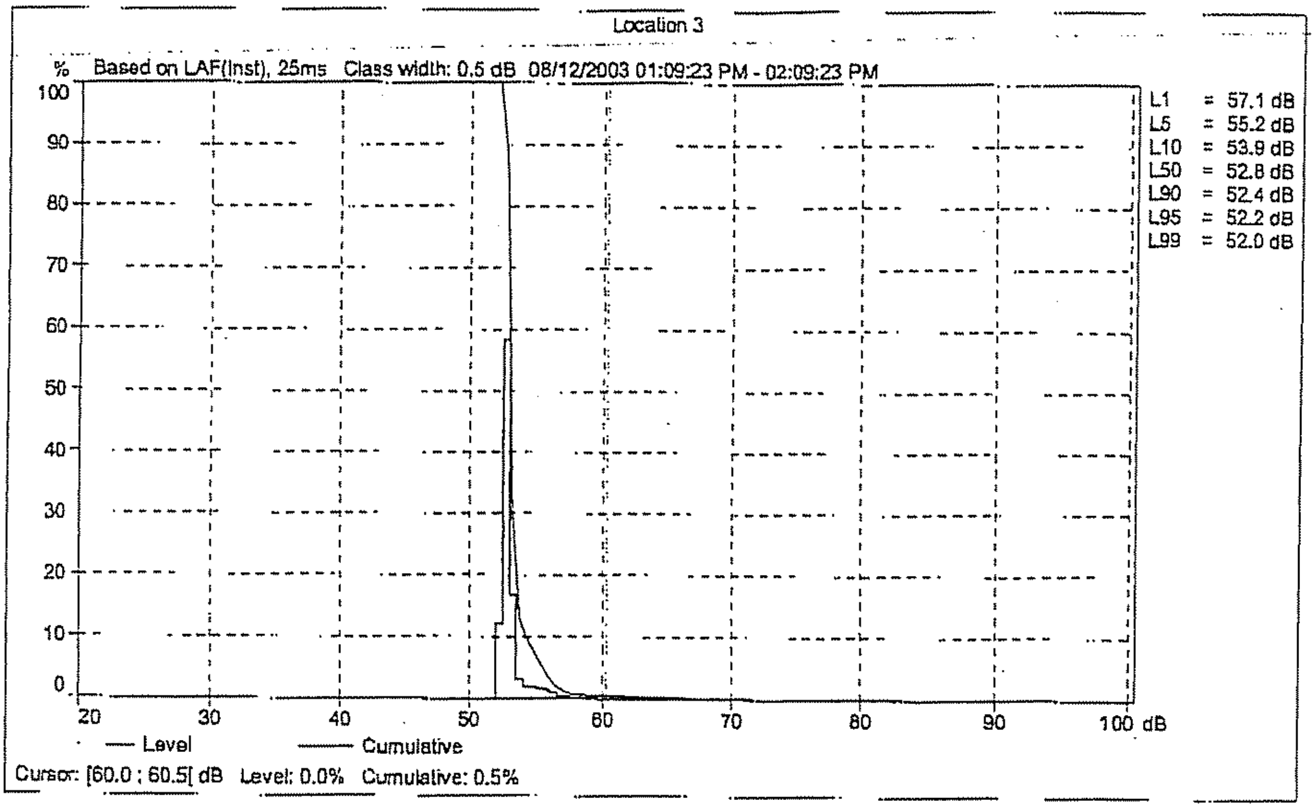
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 3

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	53.5	74.0	51.9	52.4
Time	01:09:23 PM	02:09:23 PM	1:00:00					
Date	08/12/2003	08/12/2003						


Location 3
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/12/2003 01:09:23 PM - 02:09:23 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 57.1 dB
L5 = 55.2 dB
L10 = 53.9 dB
L50 = 52.8 dB
L90 = 52.4 dB
L95 = 52.2 dB
L99 = 52.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.0% Cumulative: 0.5%

Location 4

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 04:19:17 PM
End Time:		08/14/2003 05:19:17 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

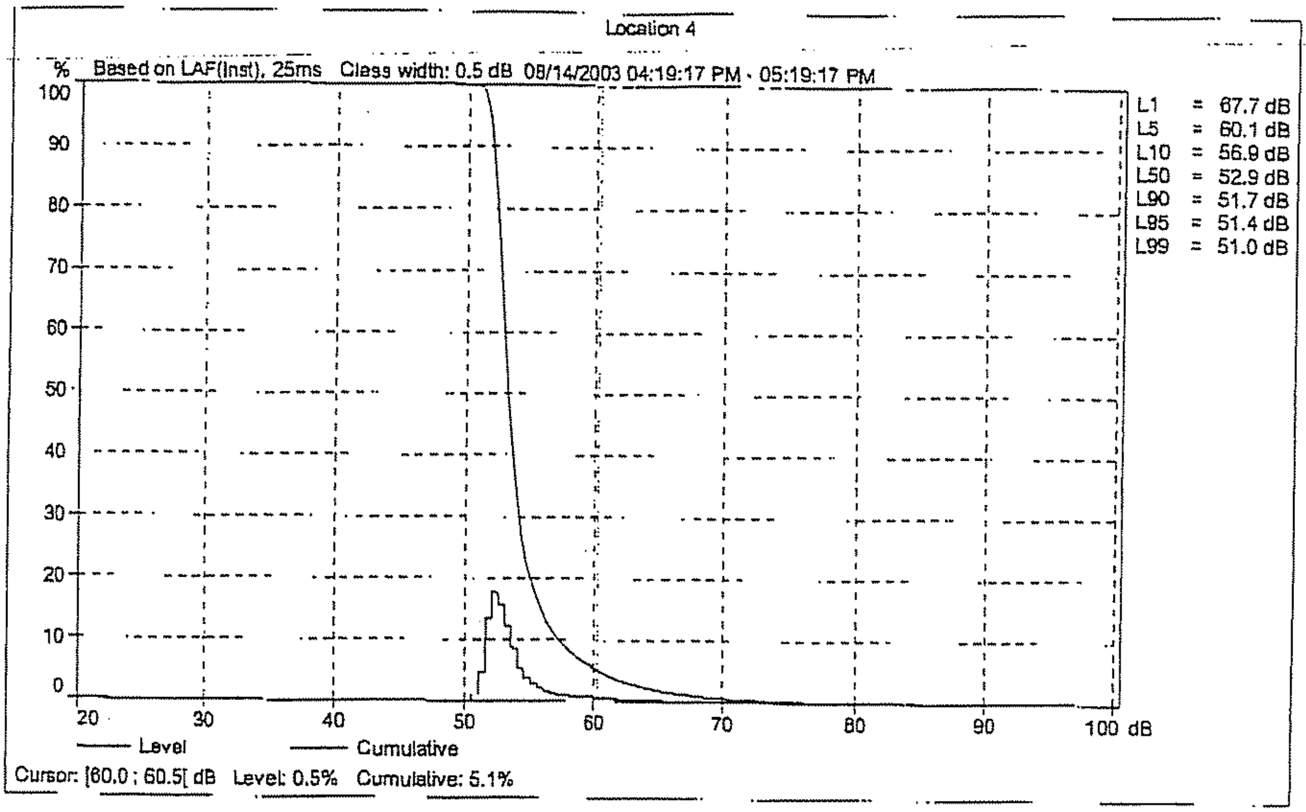
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 4

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				1.4	56.8	84.5	50.4	51.7
Time	04:19:17 PM	05:19:17 PM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 4
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 04:19:17 PM - 05:19:17 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 67.7 dB
L5 = 60.1 dB
L10 = 56.9 dB
L50 = 52.9 dB
L90 = 51.7 dB
L95 = 51.4 dB
L99 = 51.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.5% Cumulative: 5.1%

Location 5

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 10:20:01 AM
End Time:		08/14/2003 11:20:01 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

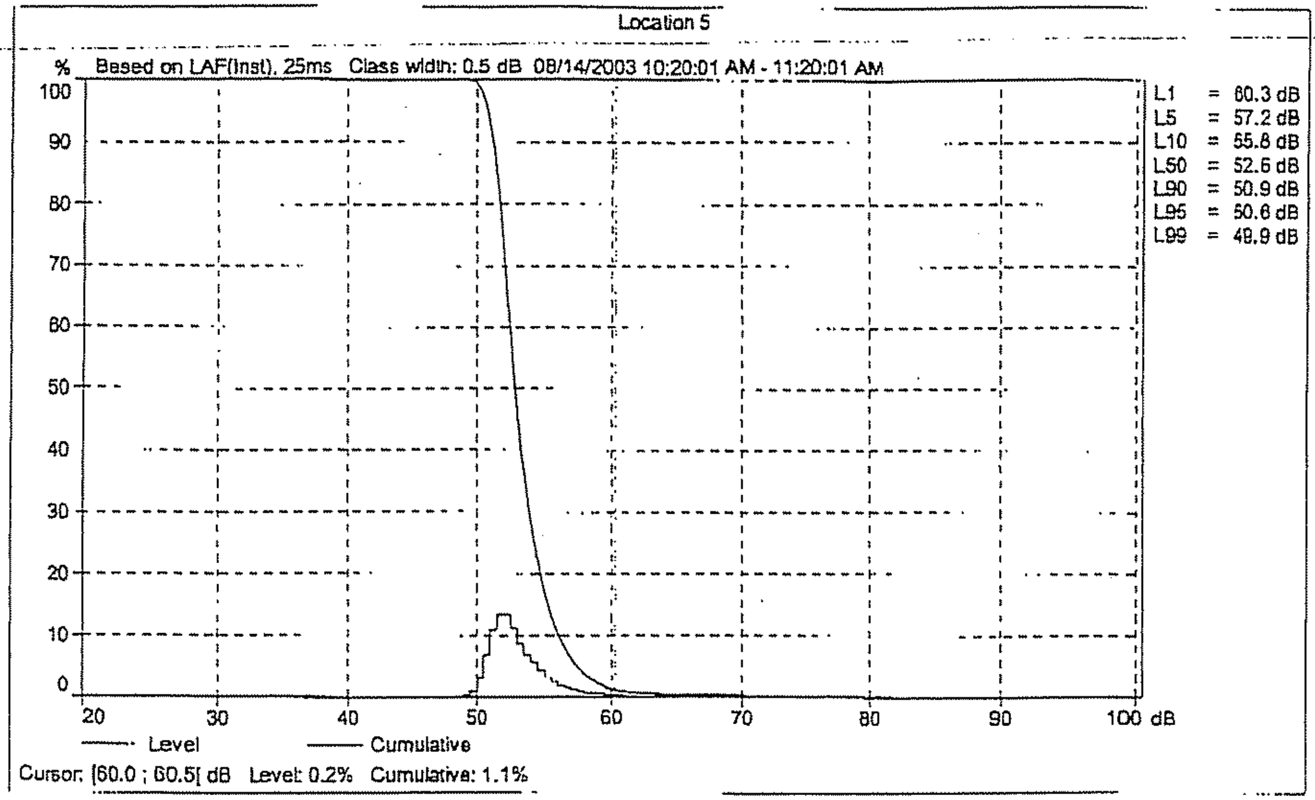
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 5

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	55.0	82.8	49.0	50.9
Time	10:20:01 AM	11:20:01 AM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 5
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 10:20:01 AM - 11:20:01 AM
L1 = 60.3 dB
L5 = 57.2 dB
L10 = 55.8 dB
L50 = 52.6 dB
L90 = 50.9 dB
L95 = 50.6 dB
L99 = 48.9 dB
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.2% Cumulative: 1.1%

Location 6

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 09:51:27 AM
End Time:		08/13/2003 10:51:27 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

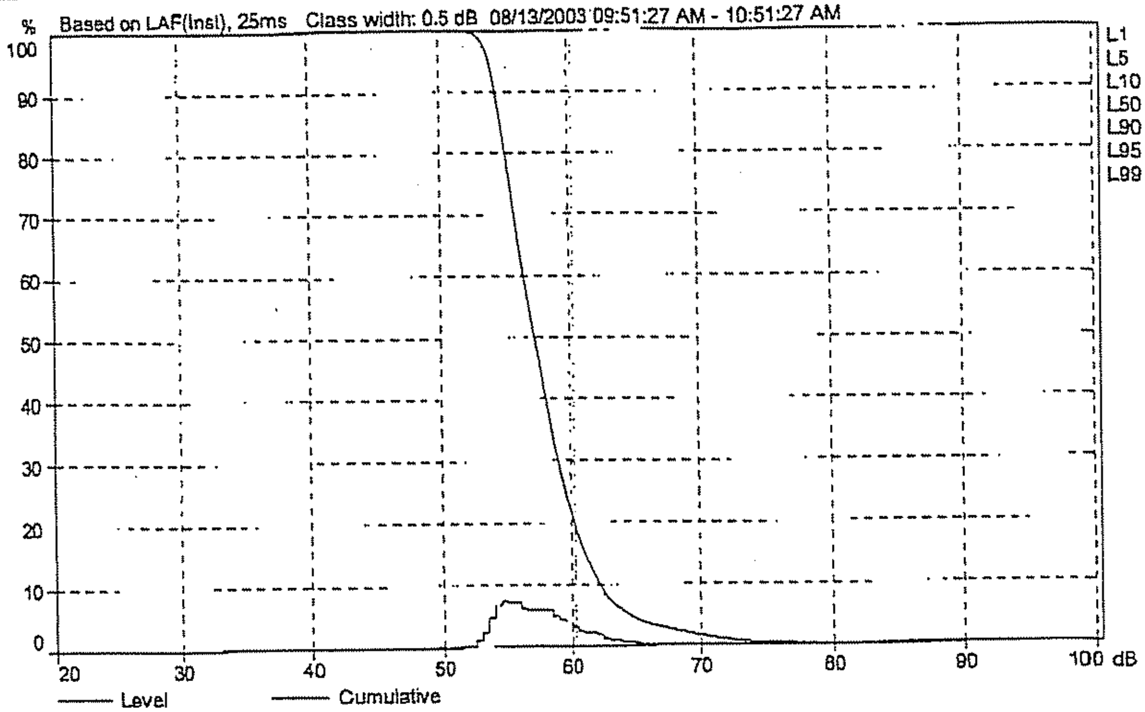
Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 6

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	61.4	90.0	51.4	54.1
Time	09:51:27 AM	10:51:27 AM	1:00:00					
Date	08/13/2003	08/13/2003						

Location 6



L1	=	71.5 dB
L5	=	64.3 dB
L10	=	61.9 dB
L50	=	57.0 dB
L90	=	54.1 dB
L95	=	53.6 dB
L99	=	52.8 dB

Cursor: [60.0 : 60.5[dB Level: 3.2% Cumulative: 19.9%

Location 7

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 10:54:41 AM
End Time:		08/13/2003 11:54:41 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

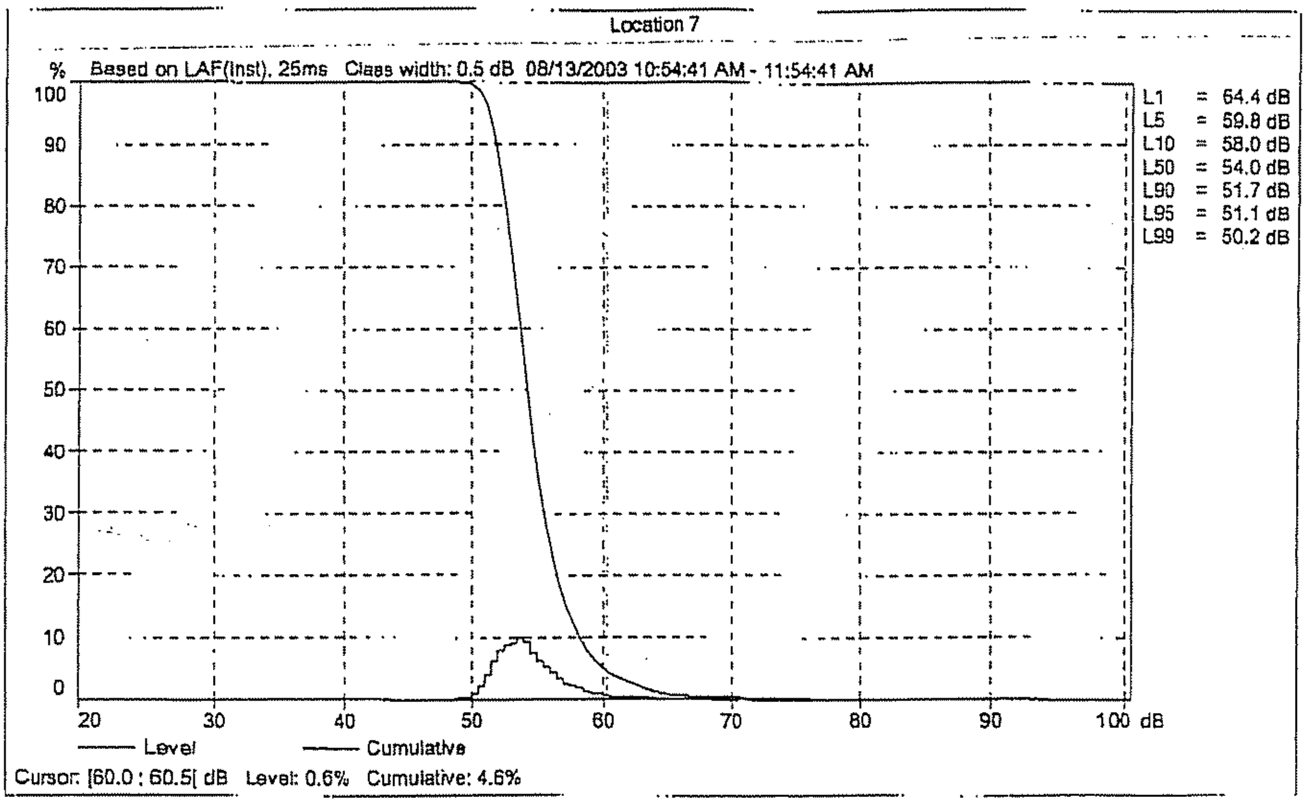
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 7

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	56.7	82.4	48.5	51.7
Time	10:54:41 AM	11:54:41 AM	1:00:00					
Date	08/13/2003	08/13/2003						


Location 7
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 10:54:41 AM - 11:54:41 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 64.4 dB
L5 = 59.8 dB
L10 = 58.0 dB
L50 = 54.0 dB
L90 = 51.7 dB
L95 = 51.1 dB
L99 = 50.2 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.6% Cumulative: 4.6%

Location 8

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 01:26:26 PM
End Time:		08/13/2003 02:26:26 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

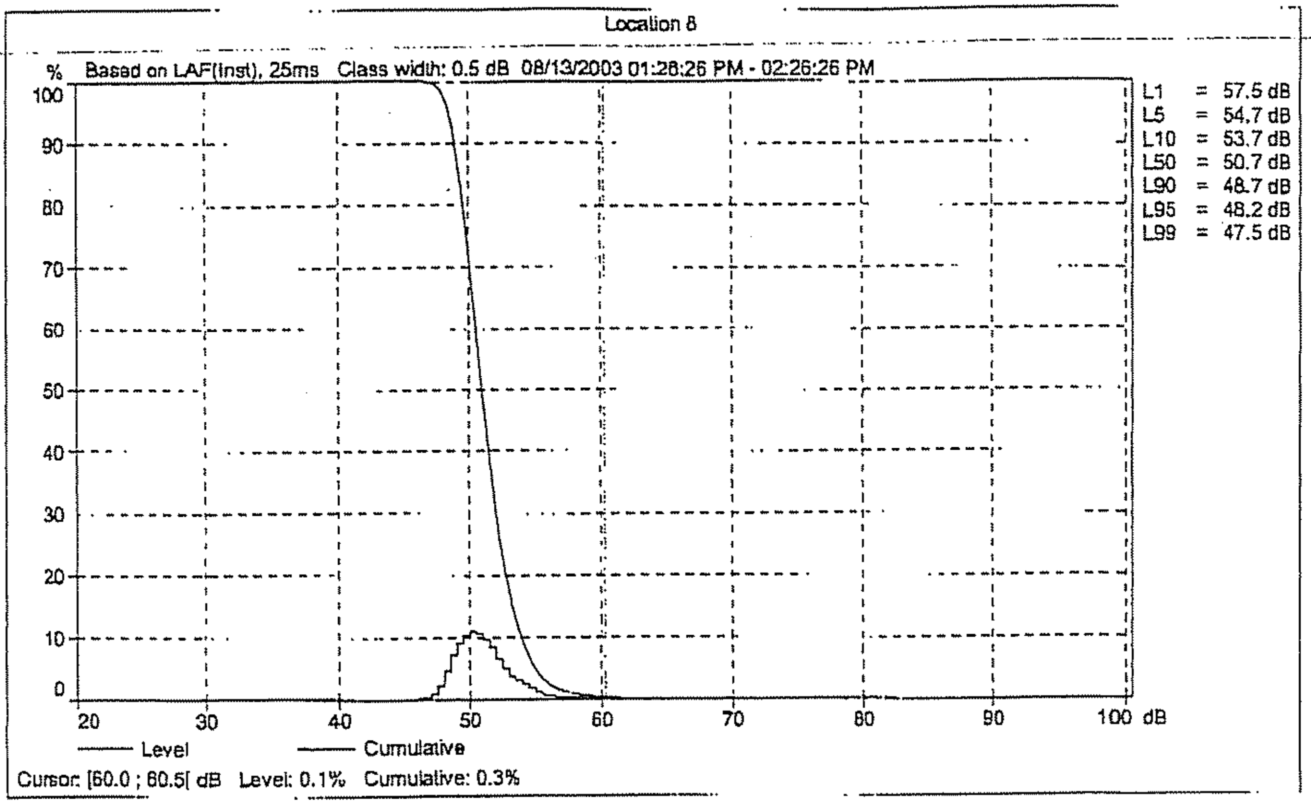
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 8

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	51.6	74.1	46.1	48.7
Time	01:26:26 PM	02:26:26 PM	1:00:00					
Date	08/13/2003	08/13/2003						


Location 8
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 01:26:26 PM - 02:26:26 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 57.5 dB
L5 = 54.7 dB
L10 = 53.7 dB
L50 = 50.7 dB
L90 = 48.7 dB
L95 = 48.2 dB
L99 = 47.5 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.1% Cumulative: 0.3%

Location-9

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 05:27:56 PM
End Time:		08/14/2003 06:27:56 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

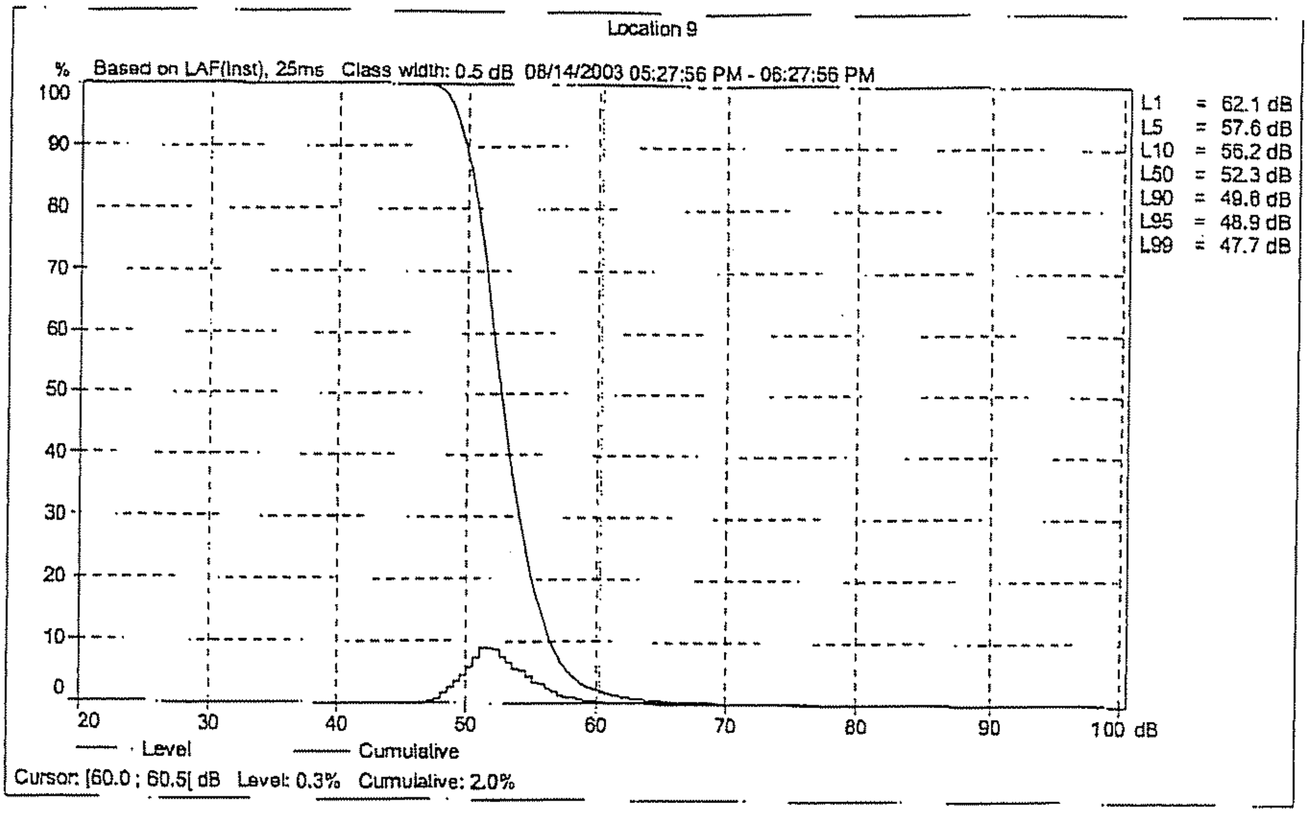
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
-Microphone:		2200428

Location 9

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.3	54.5	82.6	45.5	49.6
Time	05:27:56 PM	06:27:56 PM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 9
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 05:27:56 PM - 06:27:56 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 62.1 dB
L5 = 57.6 dB
L10 = 56.2 dB
L50 = 52.3 dB
L90 = 49.8 dB
L95 = 48.9 dB
L99 = 47.7 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.3% Cumulative: 2.0%

Location 10

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 12:11:37 PM
End Time:		08/13/2003 01:11:37 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

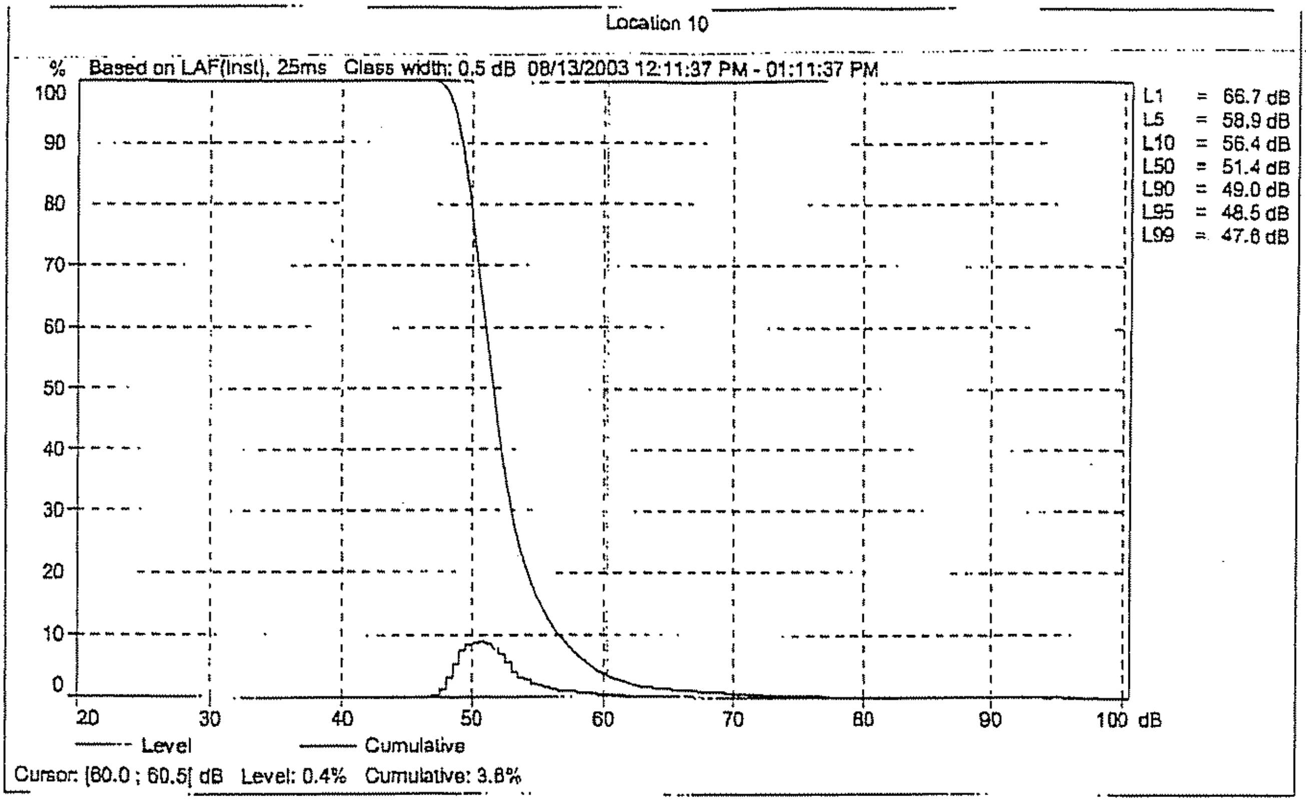
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 10

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.2	56.3	82.4	46.4	49.0
Time	12:11:37 PM	01:11:37 PM	1:00:00					
Date	08/13/2003	08/13/2003						


Location 10
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 12:11:37 PM - 01:11:37 PM
L1 = 66.7 dB
L5 = 58.9 dB
L10 = 56.4 dB
L50 = 51.4 dB
L90 = 49.0 dB
L95 = 48.5 dB
L99 = 47.6 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.4% Cumulative: 3.8%

~~Location 11~~

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/13/2003 02:46:13 PM
End Time:		08/13/2003 03:46:13 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

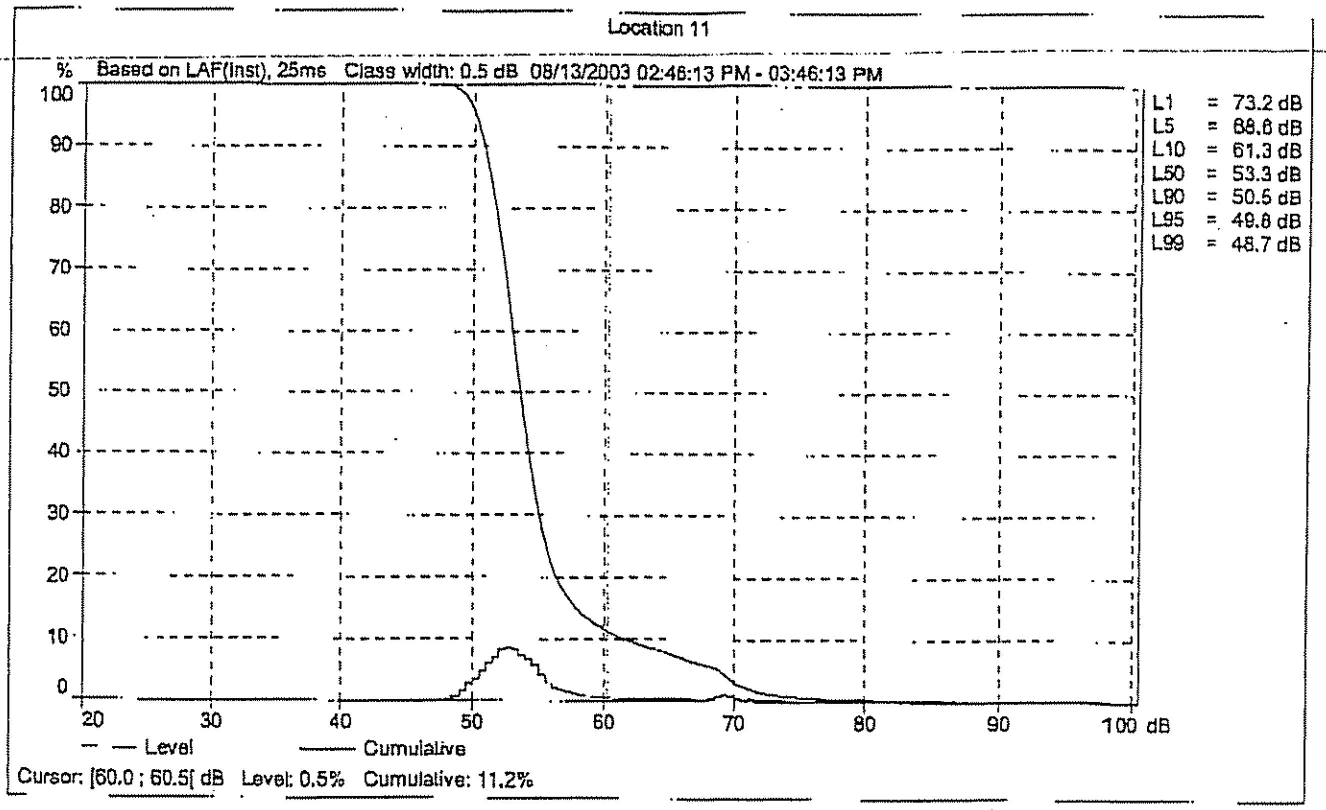
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 11

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	62.5	89.4	47.3	50.5
Time	02:46:13 PM	03:46:13 PM	1:00:00					
Date	08/13/2003	08/13/2003						


Location 11
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/13/2003 02:46:13 PM - 03:46:13 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 73.2 dB
L5 = 68.6 dB
L10 = 61.3 dB
L50 = 53.3 dB
L90 = 50.5 dB
L95 = 49.8 dB
L99 = 48.7 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.5% Cumulative: 11.2%

Location 12

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 01:15:14 PM
End Time:		08/14/2003 02:15:14 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

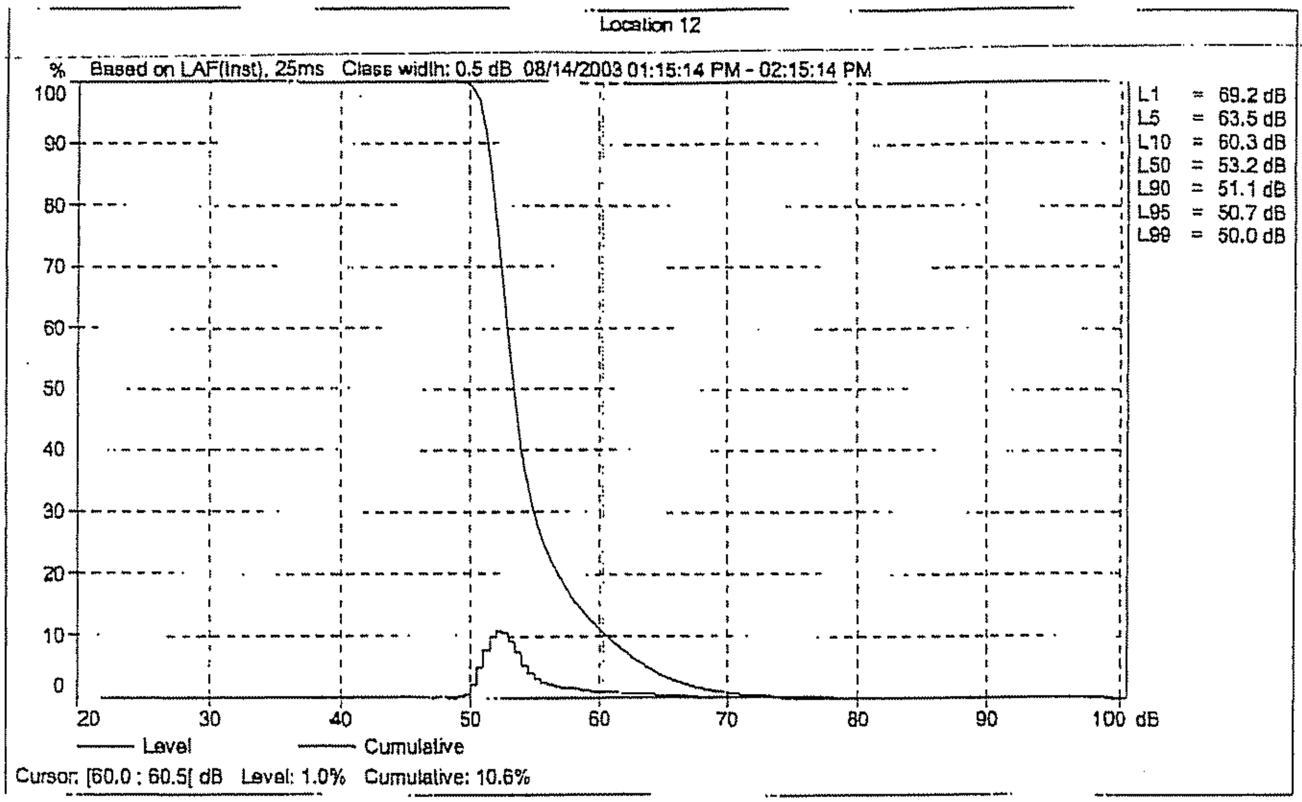
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 12

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				2.2	58.1	87.3	49.1	51.1
Time	01:15:14 PM	02:15:14 PM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 12
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 01:15:14 PM - 02:15:14 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 69.2 dB
L5 = 63.5 dB
L10 = 60.3 dB
L50 = 53.2 dB
L90 = 51.1 dB
L95 = 50.7 dB
L99 = 50.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 1.0% Cumulative: 10.6%

Location 13

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 12:05:31 PM
End Time:		08/14/2003 01:05:31 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

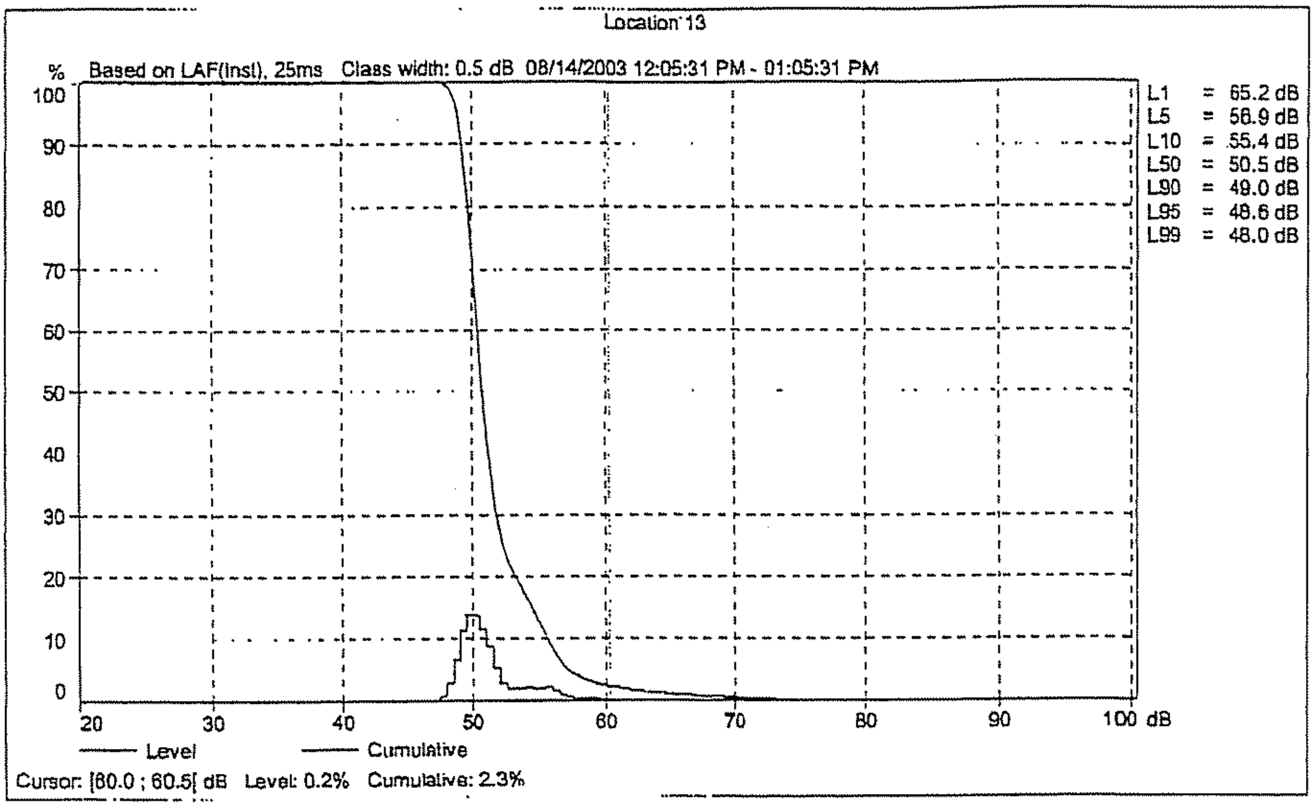
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 13

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	54.7	82.0	47.4	49.0
Time	12:05:31 PM	01:05:31 PM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 13
%
Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 12:05:31 PM - 01:05:31 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 65.2 dB
L5 = 58.9 dB
L10 = 55.4 dB
L50 = 50.5 dB
L90 = 49.0 dB
L95 = 48.6 dB
L99 = 48.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.2% Cumulative: 2.3%

Location 14

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 02:20:05 PM
End Time:		08/14/2003 03:20:05 PM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

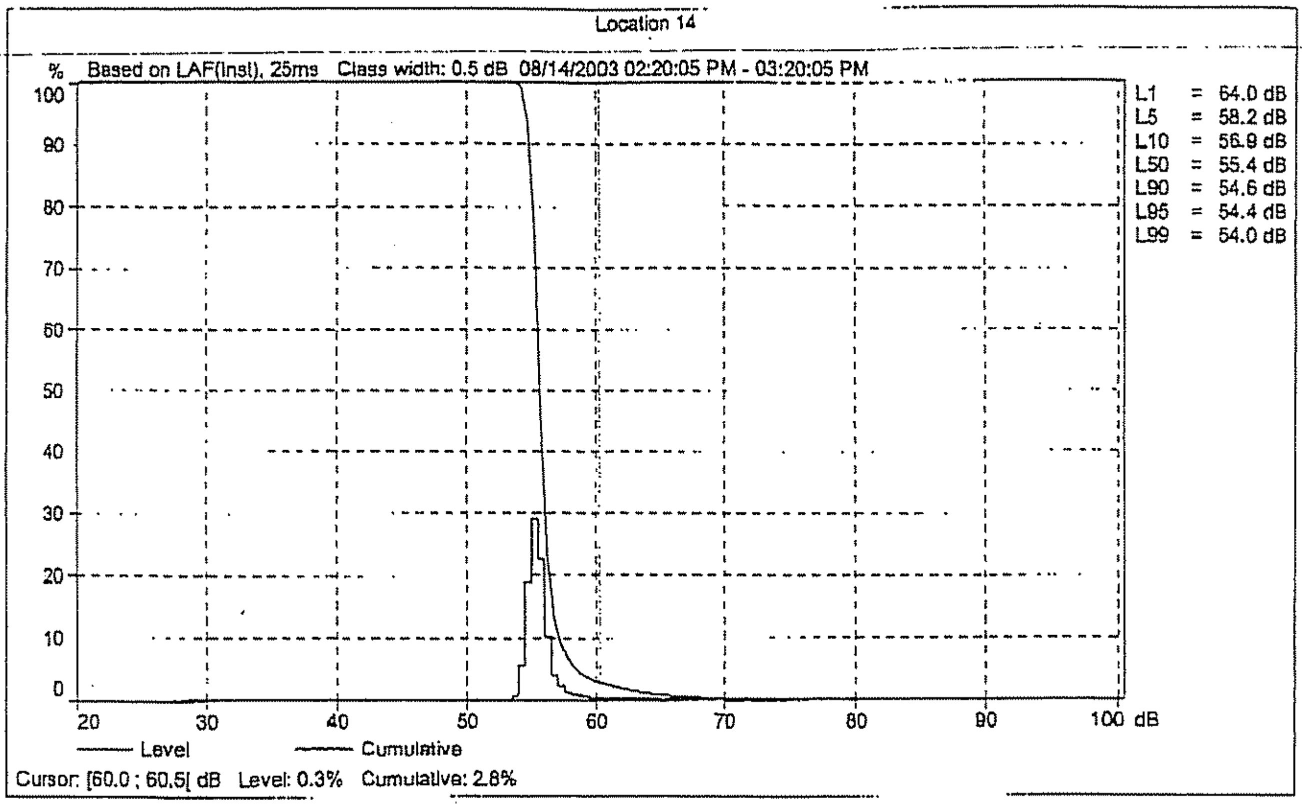
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 14

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.7	56.5	80.9	53.6	54.6
Time	02:20:05 PM	03:20:05 PM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 14
%
Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 02:20:05 PM - 03:20:05 PM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 64.0 dB
L5 = 58.2 dB
L10 = 56.9 dB
L50 = 55.4 dB
L90 = 54.6 dB
L95 = 54.4 dB
L99 = 54.0 dB
Level
Cumulative
Cursor: [60.0 ; 60.5[dB Level: 0.3% Cumulative: 2.8%

Location 15

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/14/2003 09:03:38 AM
End Time:		08/14/2003 10:03:38 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

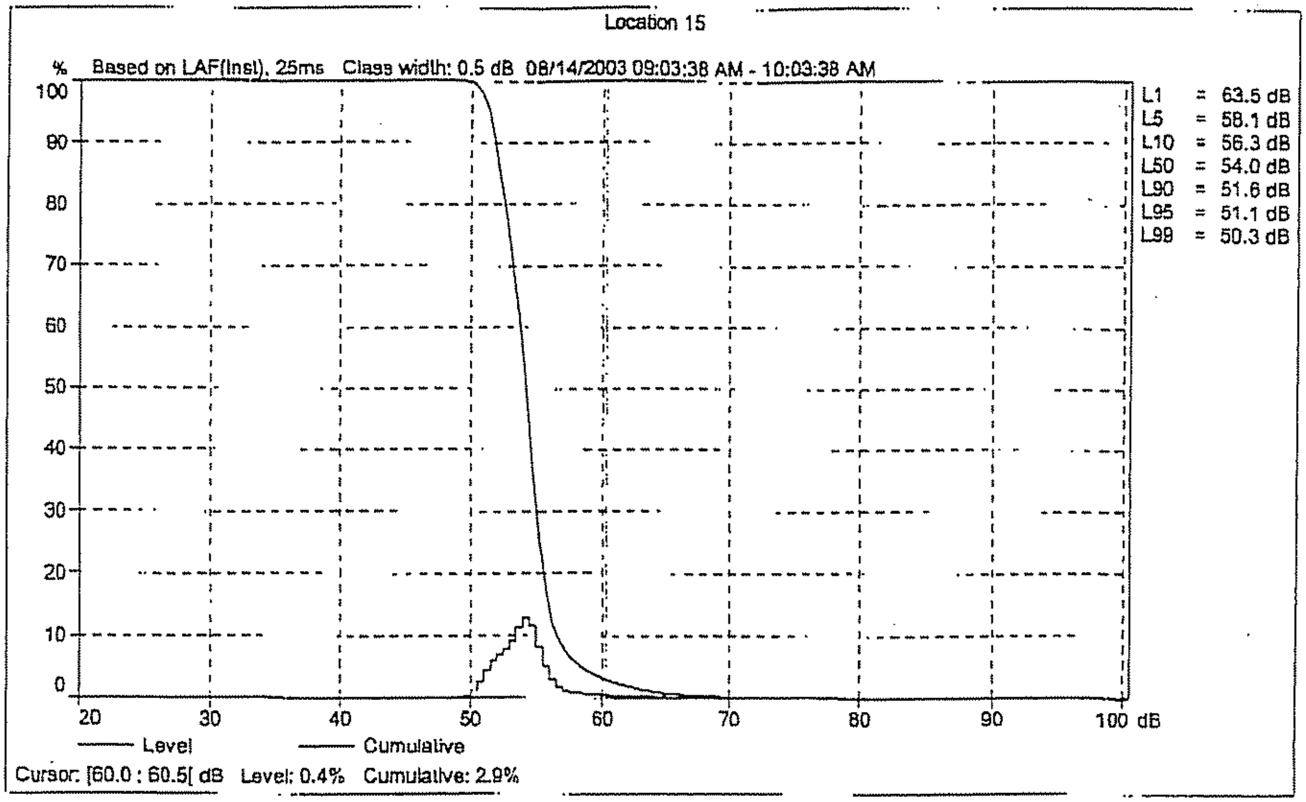
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

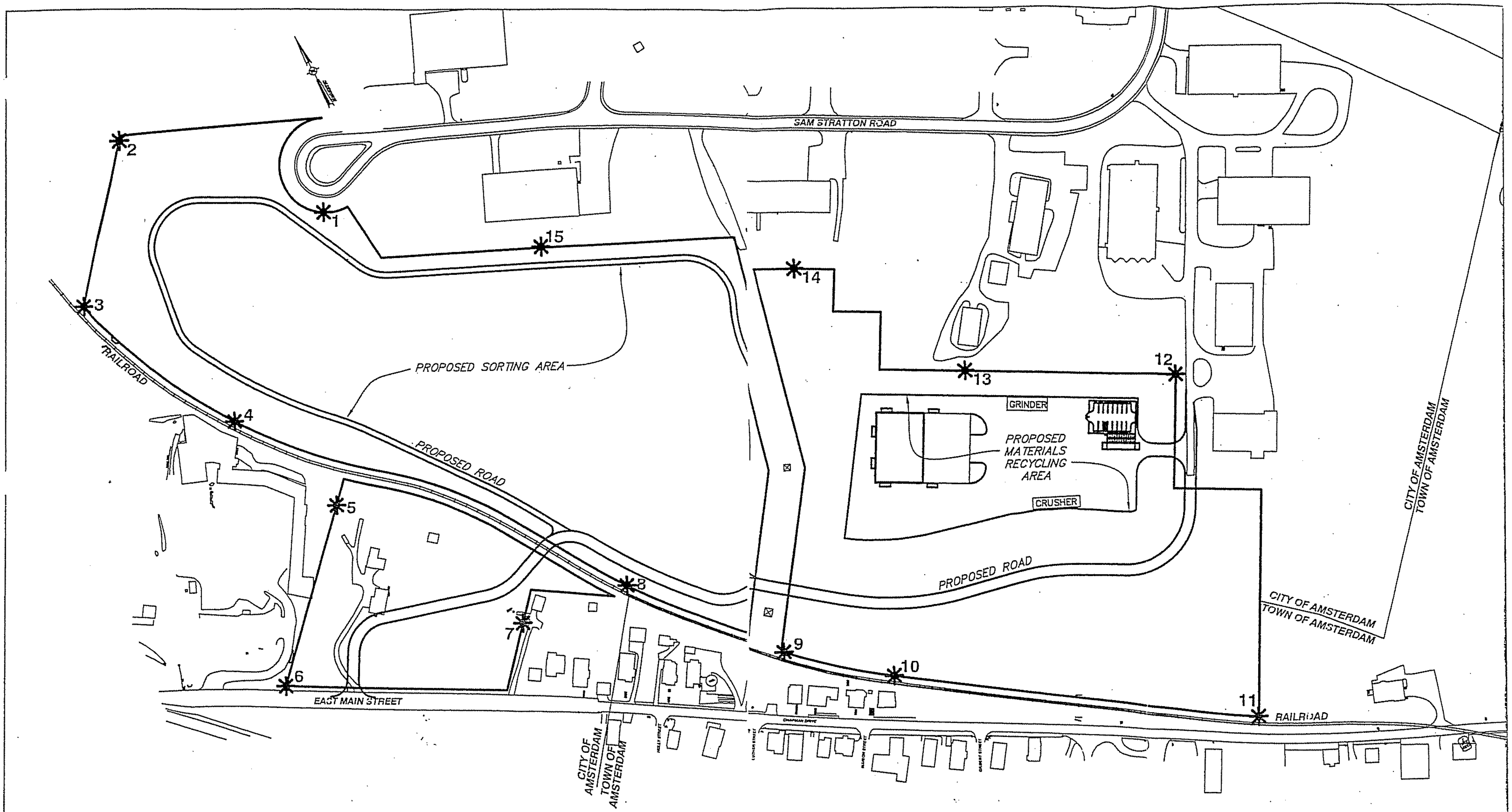
Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 15

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.4	55.2	80.1	49.7	51.6
Time	09:03:38 AM	10:03:38 AM	1:00:00					
Date	08/14/2003	08/14/2003						


Location 15
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/14/2003 09:03:38 AM - 10:03:38 AM
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100 dB
L1 = 63.5 dB
L5 = 58.1 dB
L10 = 56.3 dB
L50 = 54.0 dB
L90 = 51.6 dB
L95 = 51.1 dB
L99 = 50.3 dB
Level
Cumulative
Cursor: [60.0 : 60.5[dB Level: 0.4% Cumulative: 2.9%

Appendix B:
Post-Development Noise Analysis



THE *Chazen* COMPANIES

Engineers/Surveyors
Planners
Environmental Scientists

CHAZEN ENGINEERING & LAND SURVEYING CO., P.C.

Dutchess County Office: 21 Fox Street, Poughkeepsie, NY 12601, Phone: (845) 454-3980

Capital District Office: 20 Gurley Avenue, Troy, New York 12182, Phone: (518) 235-8050

Orange County Office: 263 Route 17K, Newburgh, New York 12550, Phone: (845) 567-1133

North Country Office: 110 Glen Street, Glens Falls, New York 12801, Phone: (518) 812-0513

AMSTERDAM MATERIALS RECYCLING

NOISE SURVEY
POST-DEVELOPMENT CONDITIONS

CITY OF AMSTERDAM
DUTCHESS COUNTY, NEW YORK

drawn:	check:
AVW	
date: 09/08/03	scale: 1"=200'
project no. 90303.00	
figure no. 2	

Xref's Attached:
Date Printed: Sep 08, [illegible] 5:39pm

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Operational Phase, Heavy Equipment/Interior Trucks (10 per hour, 5 mph)

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	0.0
Average automobile speed (mph):	0.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	10.0
Average heavy truck speed (mph):	5.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 59.8

DESCRIPTION OF RECEIVER # 2

Distance from center of 12-ft wide, single lane roadway (ft): 180.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.0

DESCRIPTION OF RECEIVER # 3

Distance from center of 12-ft wide, single lane roadway (ft): 160.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.7

DESCRIPTION OF RECEIVER # 4

Distance from center of 12-ft wide, single lane roadway (ft): 80.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 56.7

DESCRIPTION OF RECEIVER # 5

Distance from center of 12-ft wide, single lane roadway (ft): 170.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.3

DESCRIPTION OF RECEIVER # 6

Distance from center of 12-ft wide, single lane roadway (ft): 130.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 53.9

DESCRIPTION OF RECEIVER # 7

Distance from center of 12-ft wide, single lane roadway (ft): 70.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 57.5

DESCRIPTION OF RECEIVER # 8

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 59.8

DESCRIPTION OF RECEIVER # 9

Distance from center of 12-ft wide, single lane roadway (ft): 120.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 54.3

DESCRIPTION OF RECEIVER # 10

Distance from center of 12-ft wide, single lane roadway (ft): 140.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 53.5

DESCRIPTION OF RECEIVER # 11

Distance from center of 12-ft wide, single lane roadway (ft): 380.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 47.4

DESCRIPTION OF RECEIVER # 12

Distance from center of 12-ft wide, single lane roadway (ft): 150.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 53.1

DESCRIPTION OF RECEIVER # 13

Distance from center of 12-ft wide, single lane roadway (ft): 480.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 46.0

DESCRIPTION OF RECEIVER # 14

Distance from center of 12-ft wide, single lane roadway (ft): 180.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.0

DESCRIPTION OF RECEIVER # 15

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 59.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Operational Phase, Waste Trucks, No Barrier

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	0.0
Average automobile speed (mph):	0.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	12.0
Average heavy truck speed (mph):	10.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

1

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 58.6

DESCRIPTION OF RECEIVER # 2

2

Distance from center of 12-ft wide, single lane roadway (ft): 180.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 50.6

DESCRIPTION OF RECEIVER # 3

3

Distance from center of 12-ft wide, single lane roadway (ft): 160.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 51.3

DESCRIPTION OF RECEIVER # 4

4

Distance from center of 12-ft wide, single lane roadway (ft): 80.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 55.5

DESCRIPTION OF RECEIVER # 5

5

Distance from center of 12-ft wide, single lane roadway (ft): 170.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 51.0

DESCRIPTION OF RECEIVER # 6

6

Distance from center of 12-ft wide, single lane roadway (ft): 130.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.5

DESCRIPTION OF RECEIVER # 7

7

Distance from center of 12-ft wide, single lane roadway (ft): 70.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 56.2

DESCRIPTION OF RECEIVER # 8

8

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 58.6

DESCRIPTION OF RECEIVER # 9

9

Distance from center of 12-ft wide, single lane roadway (ft): 120.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 53.0

DESCRIPTION OF RECEIVER # 10

10

Distance from center of 12-ft wide, single lane roadway (ft): 140.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.1

DESCRIPTION OF RECEIVER # 11

11

Distance from center of 12-ft wide, single lane roadway (ft): 380.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 46.0

DESCRIPTION OF RECEIVER # 12

12

Distance from center of 12-ft wide, single lane roadway (ft): 150.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 51.7

DESCRIPTION OF RECEIVER # 13

13

Distance from center of 12-ft wide, single lane roadway (ft): 480.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 44.6

DESCRIPTION OF RECEIVER # 14

14

Distance from center of 12-ft wide, single lane roadway (ft): 180.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 50.6

DESCRIPTION OF RECEIVER # 15

15

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 58.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Operational Phase, Waste Trucks, Residential Receptors, With Barrier

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	0.0
Average automobile speed (mph):	0.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	10.0
Average heavy truck speed (mph):	5.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * BARRIER INFORMATION * * * *

Distance from center of 12-ft wide, single lane roadway to barrier (ft):
32.8
Barrier height (ft): 9.8

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

Receptor 7

Distance from center of 12-ft wide, single lane roadway (ft):	70.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA):	51.1
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	57.5
A-weighted Barrier Insertion Loss (dBA):	6.4

DESCRIPTION OF RECEIVER # 2

Receptor 8

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA):	51.7
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	59.8
A-weighted Barrier Insertion Loss (dBA):	8.1

DESCRIPTION OF RECEIVER # 3

Receptor 9

Distance from center of 12-ft wide, single lane roadway (ft): 120.0

A-weighted Hourly Equivalent Sound Level with Barrier   (dBA): 51.9
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 54.3
A-weighted Barrier Insertion Loss (dBA):   2.4

DESCRIPTION OF RECEIVER #   4

Receptor 10

Distance from center of 12-ft wide, single lane roadway (ft):   140.0
A-weighted Hourly Equivalent Sound Level with Barrier   (dBA): 52.6
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 53.5
A-weighted Barrier Insertion Loss (dBA):   0.9

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Construction Phase, Rock Trucks, 16 VPH, No Barrier

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	0.0
Average automobile speed (mph):	0.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	16.0
Average heavy truck speed (mph):	5.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

Distance from center of 12-ft wide, single lane roadway (ft): 880.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 43.9

DESCRIPTION OF RECEIVER # 2

Distance from center of 12-ft wide, single lane roadway (ft): 900.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 43.7

DESCRIPTION OF RECEIVER # 3

Distance from center of 12-ft wide, single lane roadway (ft): 900.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 43.7

DESCRIPTION OF RECEIVER # 4

Distance from center of 12-ft wide, single lane roadway (ft): 500.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 47.7

DESCRIPTION OF RECEIVER # 5

Distance from center of 12-ft wide, single lane roadway (ft): 240.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 52.3

DESCRIPTION OF RECEIVER # 6

Distance from center of 12-ft wide, single lane roadway (ft): 130.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 55.9

DESCRIPTION OF RECEIVER # 7

Distance from center of 12-ft wide, single lane roadway (ft): 70.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 59.5

DESCRIPTION OF RECEIVER # 8

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 61.8

DESCRIPTION OF RECEIVER # 9

Distance from center of 12-ft wide, single lane roadway (ft): 120.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 56.4

DESCRIPTION OF RECEIVER # 10

Distance from center of 12-ft wide, single lane roadway (ft): 140.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 55.5

DESCRIPTION OF RECEIVER # 11

Distance from center of 12-ft wide, single lane roadway (ft): 900.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 43.7

DESCRIPTION OF RECEIVER # 12

Distance from center of 12-ft wide, single lane roadway (ft): 900.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 43.7

DESCRIPTION OF RECEIVER # 13

Distance from center of 12-ft wide, single lane roadway (ft): 900.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 43.7

DESCRIPTION OF RECEIVER # 14

Distance from center of 12-ft wide, single lane roadway (ft): 740.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 45.1

DESCRIPTION OF RECEIVER # 15

Distance from center of 12-ft wide, single lane roadway (ft): 600.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 46.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Construction Phase Rock Trucks, 16 VPH, Residential Receptors, with Barrier

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	0.0
Average automobile speed (mph):	0.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	16.0
Average heavy truck speed (mph):	5.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * BARRIER INFORMATION * * * *

Distance from center of 12-ft wide, single lane roadway to barrier (ft):
32.8
Barrier height (ft): 9.8

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

Receptor 7

Distance from center of 12-ft wide, single lane roadway (ft): 70.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA): 53.1
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 59.5
A-weighted Barrier Insertion Loss (dBA): 6.4

DESCRIPTION OF RECEIVER # 2

Receptor 8

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA): 53.8
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 61.8
A-weighted Barrier Insertion Loss (dBA): 8.0

DESCRIPTION OF RECEIVER # 3

Receptor 9

Distance from center of 12-ft wide, single lane roadway (ft): 120.0

A-weighted Hourly Equivalent Sound Level with Barrier (dBA): 54.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 56.4
A-weighted Barrier Insertion Loss (dBA): 2.4

DESCRIPTION OF RECEIVER # 4

Receptor 10

Distance from center of 12-ft wide, single lane roadway (ft): 140.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA): 54.7
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 55.5
A-weighted Barrier Insertion Loss (dBA): 0.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Construction Phase, Interior Equipment/Trucks, 10 VPH, w/ Barrier

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	0.0
Average automobile speed (mph):	0.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	10.0
Average heavy truck speed (mph):	5.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * BARRIER INFORMATION * * * *

Distance from center of 12-ft wide, single lane roadway to barrier (ft): 32.8
Barrier height (ft): 6.6

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

Receptor 7

Distance from center of 12-ft wide, single lane roadway (ft): 70.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA): 55.8
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 57.5
A-weighted Barrier Insertion Loss (dBA): 1.7

DESCRIPTION OF RECEIVER # 2

Receptor 8

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level with Barrier (dBA): 56.8
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 59.8
A-weighted Barrier Insertion Loss (dBA): 3.0

DESCRIPTION OF RECEIVER # 3

Receptor 9

Distance from center of 12-ft wide, single lane roadway (ft): 120.0

```
A-weighted Hourly Equivalent Sound Level with Barrier    (dBA): 53.5
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 54.3
A-weighted Barrier Insertion Loss (dBA):                         0.8

DESCRIPTION OF RECEIVER #   4

Receptor 10

Distance from center of 12-ft wide, single lane roadway (ft):         140.0
A-weighted Hourly Equivalent Sound Level with Barrier    (dBA): 52.8
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 53.5
A-weighted Barrier Insertion Loss (dBA):                         0.7
```

Appendix C:
Equipment Noise Generation Data

Location 1

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/12/2003 10:57:16 AM
End Time:		08/12/2003 11:57:16 AM
Elapsed Time:		1:00:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		20.0-100.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/12/2003 10:56:04 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.7 dB
Microphone:		2200428

Location 1

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]
Value				0.0	55.4	79.6	49.4
Time	10:57:16 AM	11:57:16 AM	1:00:00				
Date	08/12/2003	08/12/2003					

Appendix C:
Equipment Noise Generation Data

Straight Blade

Width Over End Bits	4502 mm	14.77 ft
Moldboard Length	4287 mm	14.06 ft
Height	1898 mm	6.23 ft
Lift Speed at Rated RPM	440 m/sec	1.42 ft/sec
Cutting Edges (2), Reversible, End Section Length (Each)	1773.4 mm	5.83 ft
Cutting Edges (2), Reversible, Width × Thickness	254 mm × 25 mm	10 in × 1 in
End Bits (2), Self-sharpening, Length (Each)	472 mm	19 in
End Bits (2), Self-sharpening, Width × Thickness	254 mm × 25 mm	10 in × 1 in

- See your Cat dealer for other blade options.

Service Refill Capacities

Fuel Tank	630 L	166.5 gal
Cooling System	83 L	21.9 gal
Crankcase	34 L	9 gal
Transmission	62 L	16.4 gal
Differentials and Final Drives – Front	90 L	23.8 gal
Differentials and Final Drives – Rear	90 L	23.8 gal
Hydraulic Tank	88 L	23.2 gal

Weights

Maximum Operating Weight	36 907 kg	81,498 lb

- Machine configured with heaviest options, 80 kg (176 lb) operator and full fuel tank.

826G Series II

Cab

ROPS/FOPS	Meets SAE and ISO standards.

- Caterpillar cab and Rollover Protective Structure/Falling Object Protective Structure (ROPS/FOPS) are standard in North America, Europe and Japan.
- Standard air conditioning system contains environmentally-friendly R134a refrigerant.
- ROPS meets SAE J394, SAE 1040 APR88 and ISO 3471-1986 standards.
- FOPS meets SAE J231 JAN81 and ISO 3449-194 standards.

Sound Performance

Standards	Meets ANSI/SAE and ISO standards.

- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT88 is 80 dB(A), for the cab offered by Caterpillar, when properly installed, maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.
- The exterior sound pressure level for the standard machine measured at a distance of 15 m (49.2 ft) according to the test procedures specified in SAE J88 JUN86 mid-gear-moving operation is 80 dB(A).
- The sound power level for the following configurations when measured according to the static test procedure and conditions specified in ISO 6393:1988 are:
  - Standard Configuration 111 dB(A)
  - Optional Sound Suppression 109 dB(A)

Dimensions

Width over Wheels	3800 mm	12.47 ft
Width over Endbits (Blade)	4502 mm	14.77 ft
Turning Radius – Inside	3221 mm	10.58 ft
Turning Radius – Outside	7333 mm	24.06 ft

Tub Grinder @ 60' w/o Berm Attenuation

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/27/2003 02:14:49 PM
End Time:		08/27/2003 02:26:50 PM
Elapsed Time:		0:12:01
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		50.0-130.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

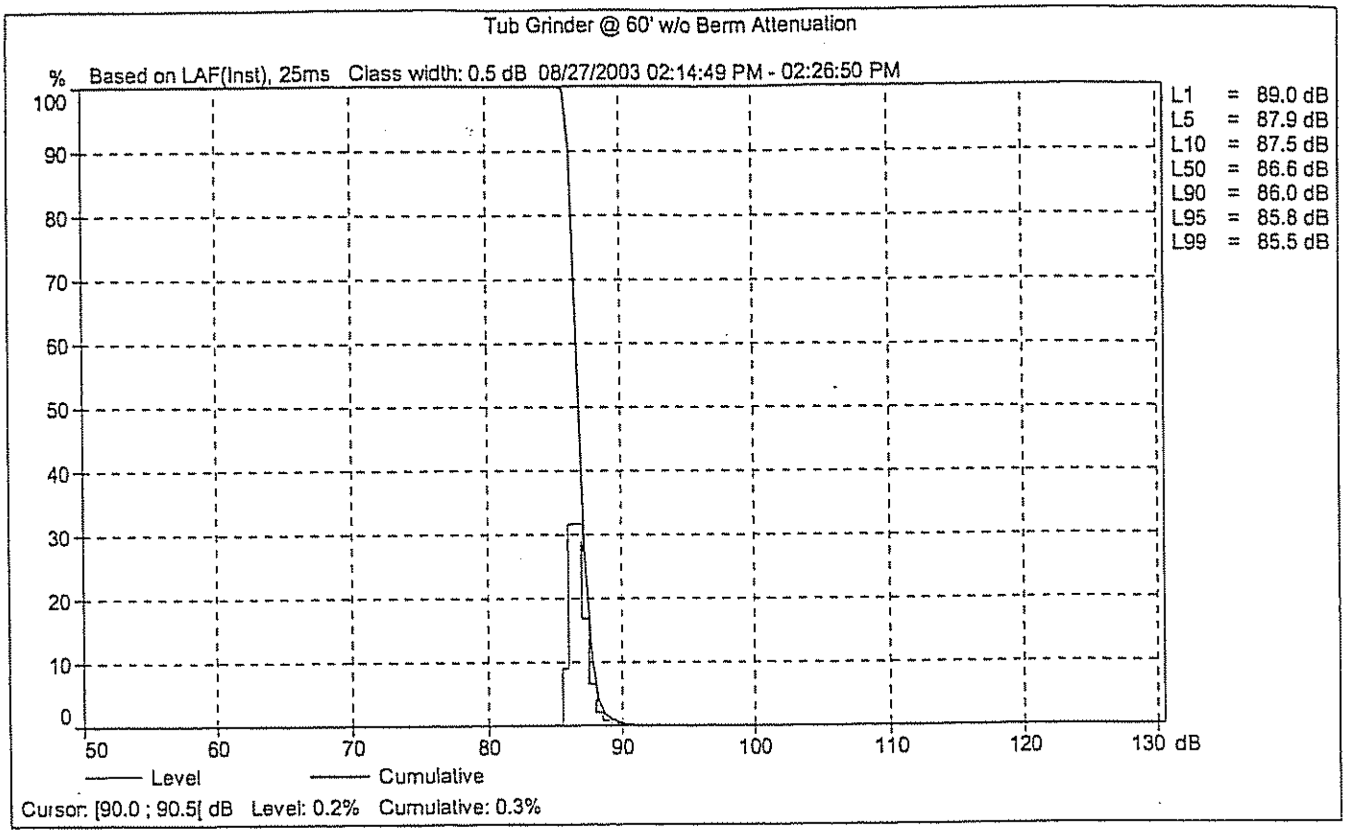
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/27/2003 02:13:44 PM
Calibration Level:		94.0 dB
Sensitivity:		-28.8 dB
Microphone:		2200428

Tub Grinder @ 60' w/o Berm Attenuation

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	86.7	95.0	84.5	86.0
Time	02:14:49 PM	02:26:50 PM	0:12:01					
Date	08/27/2003	08/27/2003						


Tub Grinder @ 60' w/o Berm Attenuation
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/27/2003 02:14:49 PM - 02:26:50 PM
100
90
80
70
60
50
40
30
20
10
0
50
60
70
80
90
100
110
120
130 dB
L1 = 89.0 dB
L5 = 87.9 dB
L10 = 87.5 dB
L50 = 86.6 dB
L90 = 86.0 dB
L95 = 85.8 dB
L99 = 85.5 dB
Level
Cumulative
Cursor: [90.0 ; 90.5[dB Level: 0.2% Cumulative: 0.3%

Tub Grinder @ 210' with Berm Attenuation

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/27/2003 02:41:37 PM
End Time:		08/27/2003 02:53:39 PM
Elapsed Time:		0:12:02
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		30.0-110.0 dB

.	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

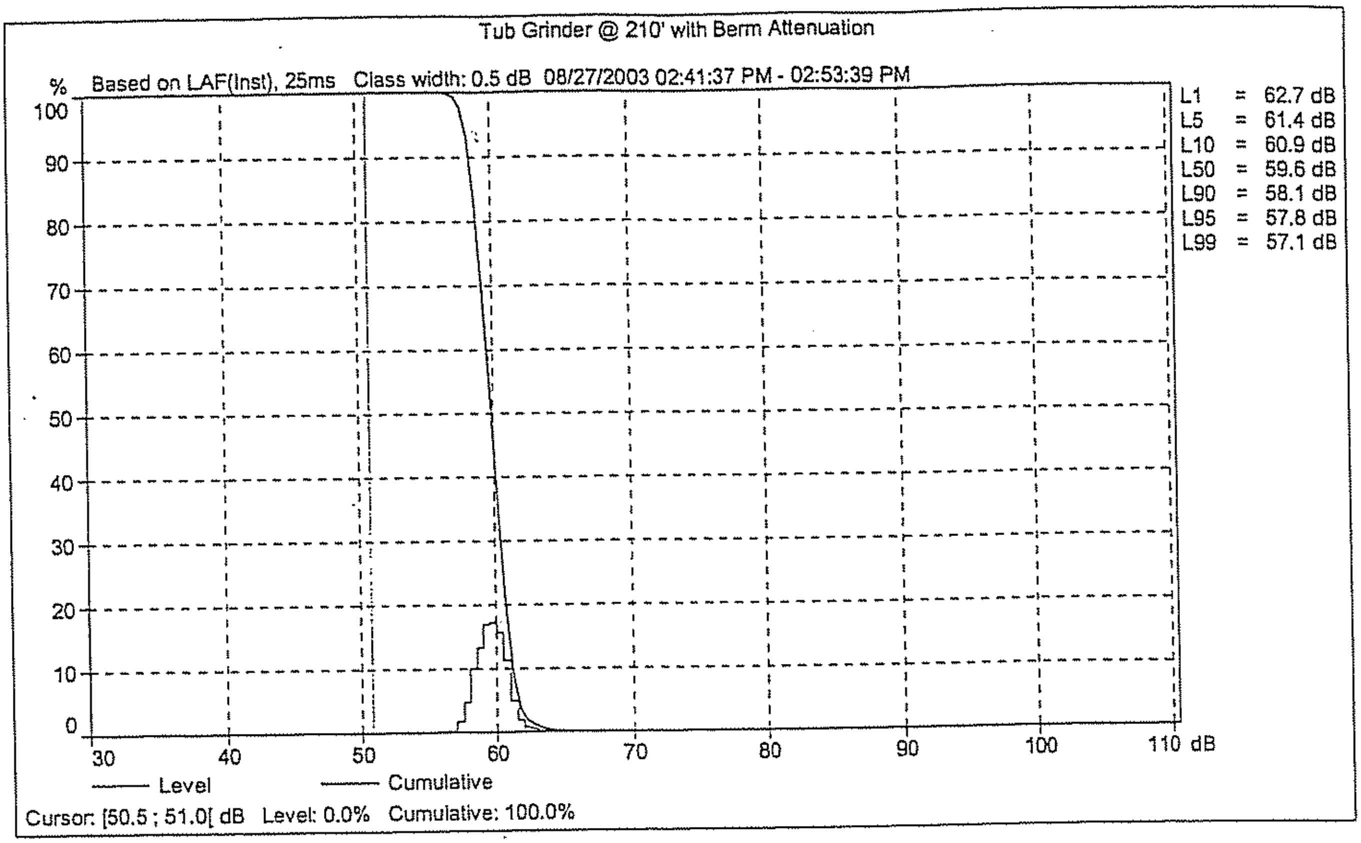
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/27/2003 02:13:44 PM
Calibration Level:		94.0 dB
Sensitivity:		-28.8 dB
Microphone:		2200428

Tub Grinder @ 210' with Berm Attenuation

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	59.6	71.2	56.4	58.1
Time	02:41:37 PM	02:53:39 PM	0:12:02					
Date	08/27/2003	08/27/2003						



Tub Grinder @ 210' with Berm Attenuation
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/27/2003 02:41:37 PM - 02:53:39 PM
100
90
80
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90
100
110 dB
L1 = 62.7 dB
L5 = 61.4 dB
L10 = 60.9 dB
L50 = 59.6 dB
L90 = 58.1 dB
L95 = 57.8 dB
L99 = 57.1 dB
Level
Cumulative
Cursor: [50.5 ; 51.0[dB Level: 0.0% Cumulative: 100.0%

Tub Grinder @ 210' w/o Berm Attenuation

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		08/27/2003 02:27:55 PM
End Time:		08/27/2003 02:39:55 PM
Elapsed Time:		0:12:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		50.0-130.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

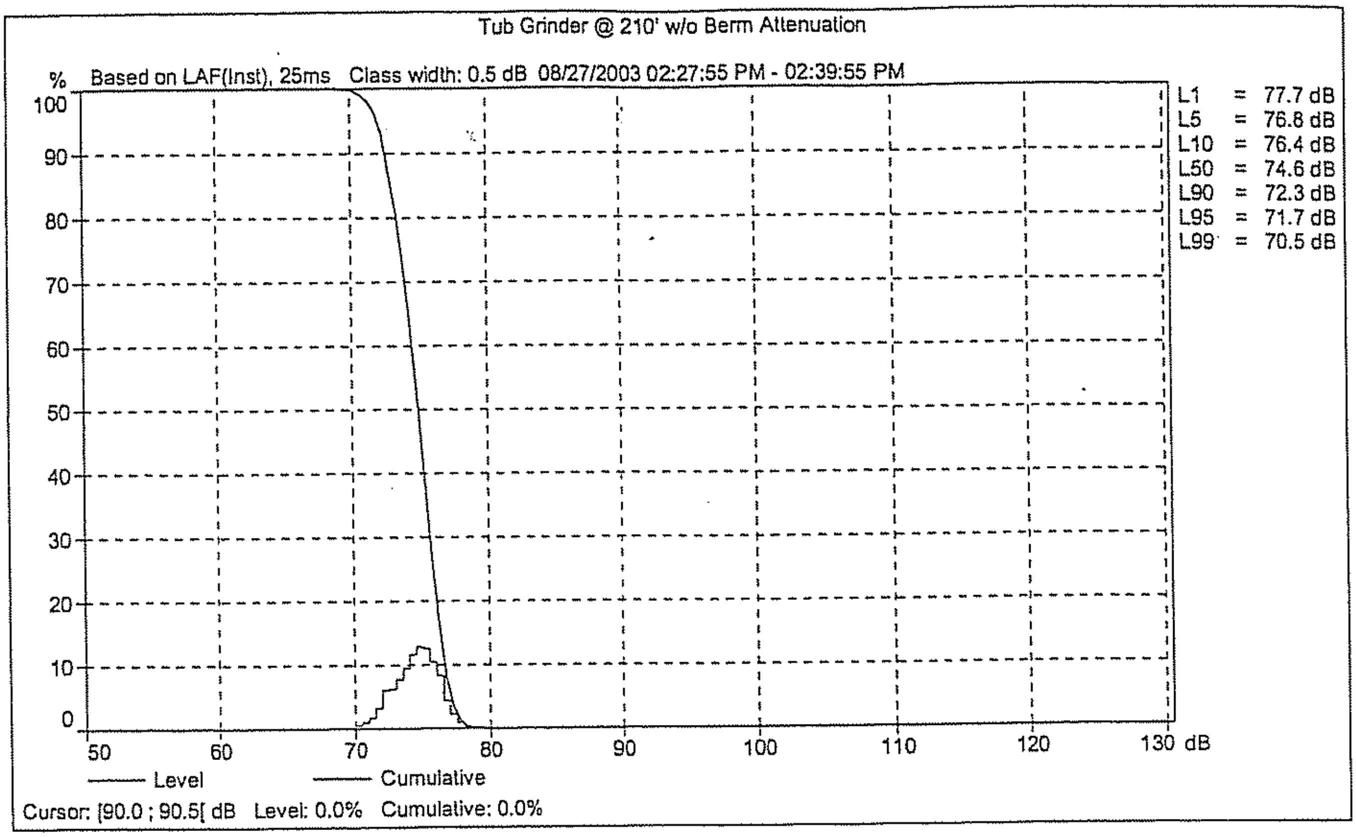
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/27/2003 02:13:44 PM
Calibration Level:		94.0 dB
Sensitivity:		-28.8 dB
Microphone:		2200428

Tub Grinder @ 210' w/o Berm Attenuation

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.0	74.6	84.1	68.8	72.3
Time	02:27:55 PM	02:39:55 PM	0:12:00					
Date	08/27/2003	08/27/2003						



Tub Grinder @ 210' w/o Berm Attenuation
% Based on LAF(Inst), 25ms Class width: 0.5 dB 08/27/2003 02:27:55 PM - 02:39:55 PM
100
90
80
70
60
50
40
30
20
10
0
50 60 70 80 90 100 110 120 130 dB
L1 = 77.7 dB
L5 = 76.8 dB
L10 = 76.4 dB
L50 = 74.6 dB
L90 = 72.3 dB
L95 = 71.7 dB
L99 = 70.5 dB
Level
Cumulative
Cursor: [90.0 ; 90.5[dB Level: 0.0% Cumulative: 0.0%

Crusher @ 60'

Instrument:		2238
Application:		BZ7125 version 1.1
Start Time:		09/04/2003 10:54:00 AM
End Time:		09/04/2003 11:09:00 AM
Elapsed Time:		0:15:00
Bandwidth:		Broad band
Detector 1/2	RMS	Peak
Range:		30.0-110.0 dB

	Time	Frequency
Detector 1:	S F I	A
Detector 2:	Peak	L
Statistic	F	A

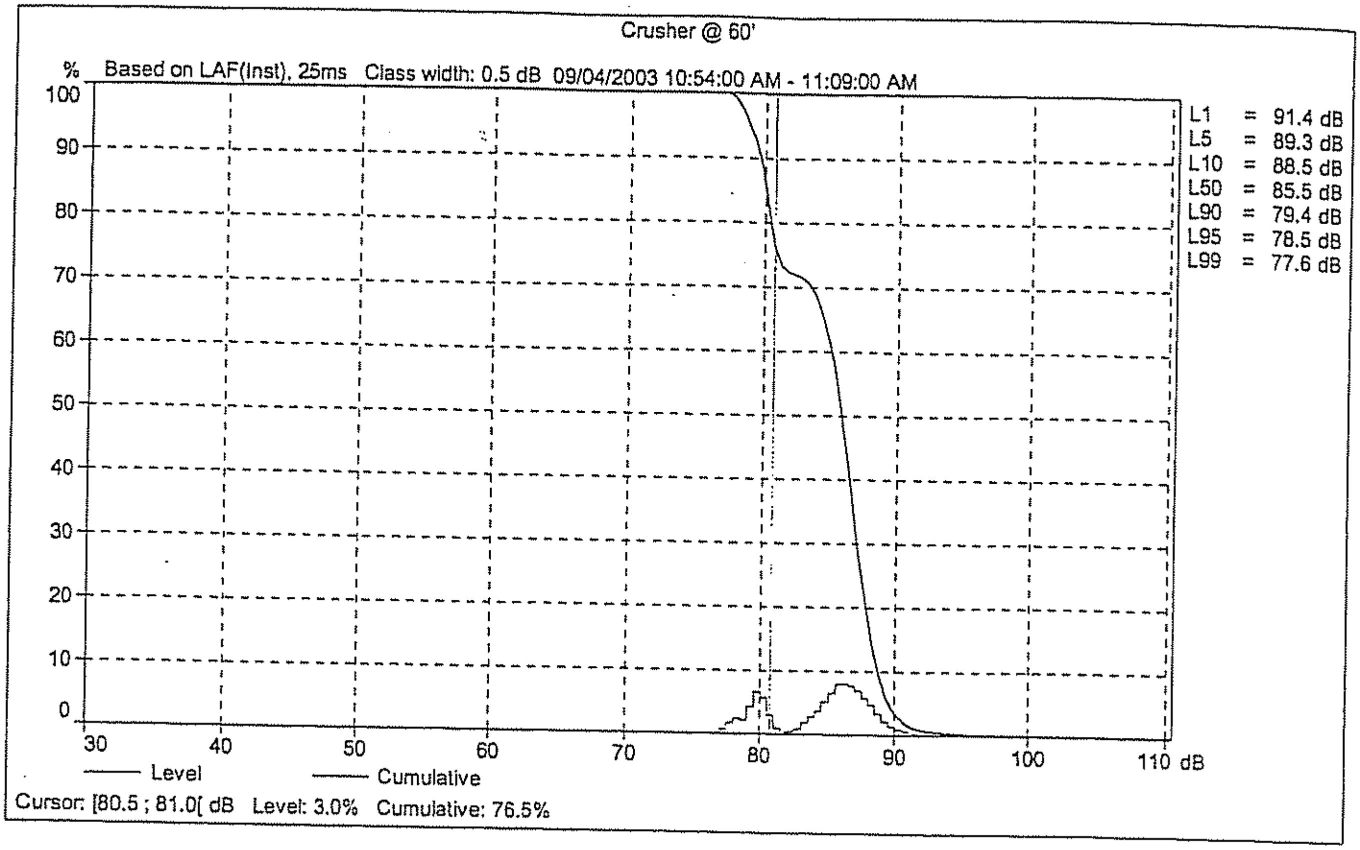
Criterion Level:		100.0 dB
Threshold:		0.0 dB
Exchange Rate		3 and 4
Exposure Time:		7:30:00
Peaks Over:		140.0 dB

Instrument Serial Number:		2201765
Microphone Serial Number:		2200428
Input:		Microphone
Windscreen Correction:		Off
S. I. Correction:		Frontal

Calibration Time:		08/27/2003 02:13:44 PM
Calibration Level:		94.0 dB
Sensitivity:		-28.8 dB
Microphone:		2200428

Crusher @ 60'

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAIMax [dB]	LAIMin [dB]	LAF90 [dB]
Value				0.6	86.0	107.6	77.2	79.4
Time	10:54:00 AM	11:09:00 AM	0:15:00					
Date	09/04/2003	09/04/2003						


Crusher @ 60'
% Based on LAF(Inst), 25ms Class width: 0.5 dB 09/04/2003 10:54:00 AM - 11:09:00 AM
100
90
80
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90
100
110 dB
L1 = 91.4 dB
L5 = 89.3 dB
L10 = 88.5 dB
L50 = 85.5 dB
L90 = 79.4 dB
L95 = 78.5 dB
L99 = 77.6 dB
Level
Cumulative
Cursor: [80.5 ; 81.0[dB Level: 3.0% Cumulative: 76.5%

Appendix I
Traffic Impact Analysis Report

Traffic Impact Study

Amsterdam Materials Recycling

City of Amsterdam, New York

CME Project #03-079

Prepared for:

Chazen Companies
20 Gurley Ave
Troy, New York 12180

Prepared by:

CME
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Albany, New York 12205-1683
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December 2, 2003

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CHAPTER I
INTRODUCTION

This report summarizes the results of the Traffic Impact Study for the proposed Amsterdam Materials Recycling facility located in the City of Amsterdam, Montgomery County, New York. The purpose of this study is to evaluate the traffic impact of this project and determine the roadway and intersection requirements that are necessary to provide adequate access to the site and through the study area.

A. Proposed Development

The Amsterdam Landfill project consists of two phases of development. Phase I involves the construction of a Construction-Demolition Landfill to be operational for five years. The landfill is located on the north side of East Main Street south of the Edson Street Industrial Park. Access to the site is proposed via two new driveways, a truck access driveway intersecting East Main Street from the north, and employee access from Sam Stratton Road. It is anticipated that Phase I of the project will be open and in operation from 2005 to 2010. Phase II of the project, construction of the connector road, is expected to connect East Main Street and Sam Stratton Road using the two site driveways. Anticipated road opening is 2010 after the closure of the landfill. Refer to Figure 1.1 for the project location.

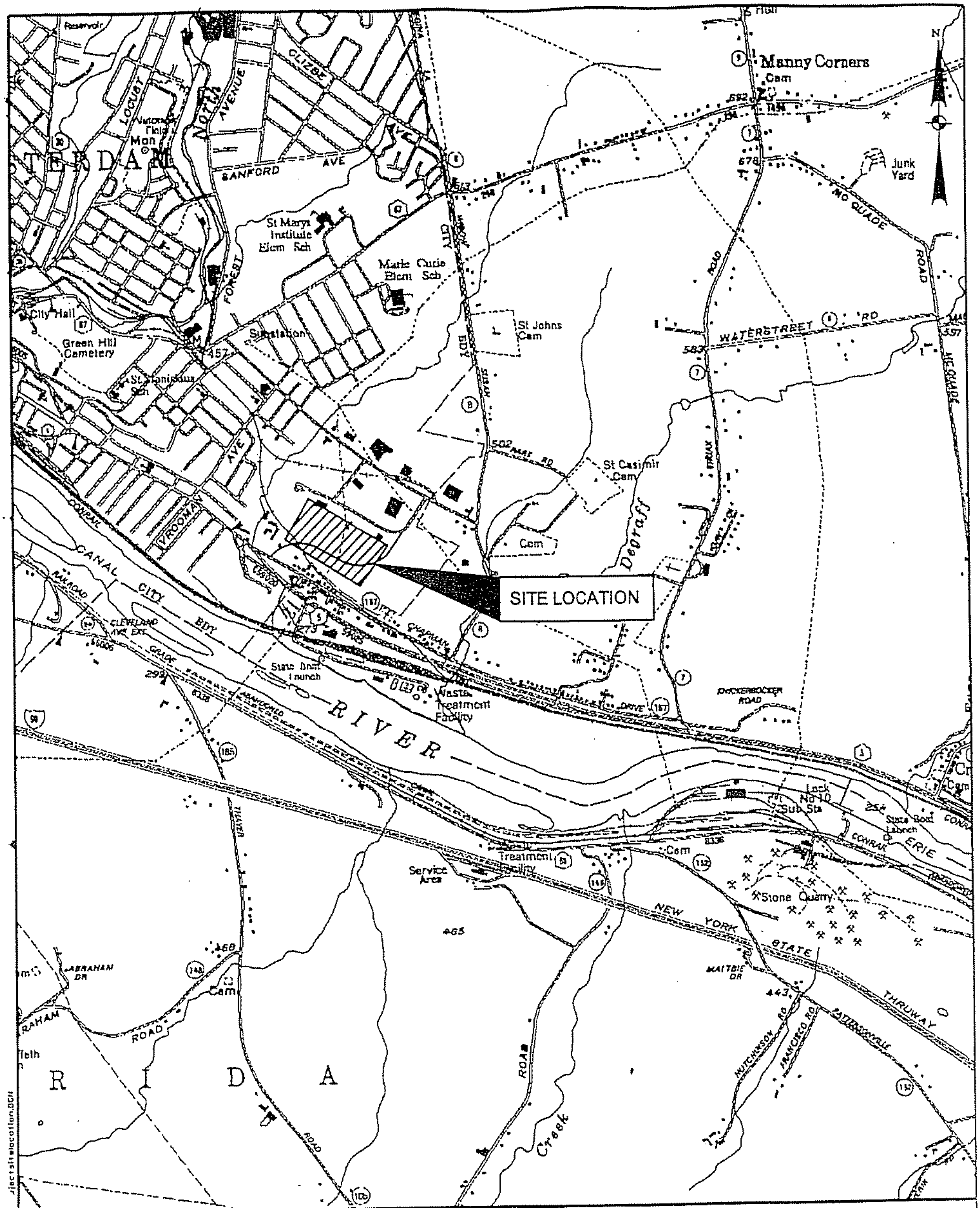
B. Study Area

The study area is shown on Figure 1.1 and the analysis intersection are listed below:

- NYS Route 5/East Main Street/Park Drive
- Chapman Drive (CR 157)/Widow Susan Road (CR 8)
- NYS Route 5/Chapman Drive/Truax Road (CR 7)
- Edson Street/Sam Stratton Road West
- Edson Street/Sam Stratton Road East

C. Study Methodology

The potential traffic impact of the project was determined by documenting the existing traffic conditions in the area, projecting future traffic volumes, adding the peak hour trip generation of the site, and comparing the operating condition of the study area intersection after completion of the project.



PROJECT SITE LOCATION

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079 | DATE: 7/03 | FIGURE: 1.1

CHAPTER II

EXISTING CONDITIONS

A. Roadways Serving the Site

- NYS Route 5 – NYS Route 5 travels in an east-west direction through Montgomery County and is classified as an urban principal arterial near the project site. NYS Route 5 is a divided highway generally providing two 12-foot travel lanes in each direction with 10-foot paved shoulders and has a posted speed limit of 55 mph. The speed limit changes to 30 mph at the city limits near the project site.

- East Main Street – East Main Street is a local roadway extending in an east-west direction through the City of Amsterdam to the City Line where it becomes Chapman Drive. East Main Street overlaps NYS Route 5 within the City of Amsterdam. Near the project site, East Main Street is in poor condition.

- Chapman Drive (CR 157) – Chapman Drive, also designated CR 157 is a local roadway extending in an east-west direction between the Amsterdam City Line and Truax Road and has a posted speed limit of 40 mph. Chapman Drive has experienced noticeable wear over time and is in poor condition. Currently, there are truck restrictions posted stating, "No Trucks Except Local Delivery" at each end of Chapman Drive. Montgomery County has plans for a one and one half-inch asphalt overlay on Chapman Drive during the summer of 2003.

- Widow Susan Road (CR 8) – Widow Susan Road, also designated CR 8, extends in a general north-south direction. Widow Susan Road consists of a single 11-foot travel lane in each direction with two to three-foot gravel shoulders. There is no posted speed limit. Near Chapman Drive, Widow Susan Road has a 10% grade. Widow Susan Road also has truck restrictions from Chapman Drive to NYS Route 67.

- Truax Road (CR 7) – Truax Road, also designated CR 7, extends in a north-south direction from NYS Route 5 to NYS Route 67. Truax Road consists of a single 12-foot travel lane in each direction with zero to one-foot shoulders, has a 10% grade near Chapman Drive, and has a posted speed limit of 45 mph.

- Edson Street – Edson Street is a local roadway extending in an east-west direction from NYS Route 67 to Widow Susan Road. Edson Street is 27 feet wide with a single travel lane in each direction and has a posted speed limit of 30 mph.

- Sam Stratton Road – Sam Stratton Road is a local roadway that forms a loop connecting to and from Edson Street, in a southerly direction. Sam Stratton Road is used to service industrial park tenants along the road.

B. Study Area Intersections

- NYS Route 5/East Main Street/Park Drive – This intersection actually consists of two closely spaced intersections to connect eastbound and westbound NYS Route 5. The southern intersection is a four-way intersection of NYS Route 5 East, East Main Street, the NYS Route 5 connection, and Park Drive with Stop control on the northbound Park Drive approach and Yield control on the southbound connection approach. The northbound, eastbound and southbound approaches provide a single shared lane for all turning movements.

  The northern intersection is a four-way intersection of NYS Route 5 West, East Main Street, and the NYS Route 5 connection with Stop control on the southbound East Main Street approach and Yield control on the northbound connection approach. The East Main Street, NYS Route 5 West, and connection approaches to the intersection provide a single lane for shared turning movements.

- Chapman Drive (CR 157)/Widow Susan Road (CR 8) – This is a T-intersection with Stop control on the southbound Widow Susan Road approach. Each intersection approach provides a single lane for shared turning movements.

- NYS Route 5/Chapman Drive (CR 157)/Truax Road (CR 7) – This intersection is comprised of two closely spaced T-intersections. The northern intersection of Truax Road and Chapman Drive provides Stop control on the westbound Chapman Drive approach. Each approach to the intersection provides a single lane for shared turning movements.

  The south intersection consists of the Truax Road and NYS Route 5. Stop control is provided on the southbound Truax Road approach, which also provides a single lane for shared turning movements. The eastbound approach provides two through lanes and a left-turn lane and the westbound approach provides two through lanes and a right-turn lane.

- Edson Street/Sam Stratton Road West – This is a T-intersection with a parking lot driveway opposite Sam Stratton Road West creating a fourth leg. The northbound Sam Stratton Road West approach to the intersection is Stop controlled and each approach to the intersection provides a single lane for shared turning movements.

- Edson Street/Sam Stratton Road East – This is a T-intersection with a parking lot driveway opposite Sam Stratton Road East creating a 4-way intersection. Stop control is provided on the northbound Sam Stratton Road East approach to the intersection. Each approach provides a single lane for shared turning movements.

C. Existing Traffic

Weekday turning movement traffic counts were conducted at the study area intersections on June 16, 17, and 18, 2003 during the morning and afternoon peak periods from the hours of 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m. The raw traffic volumes are contained in Appendix A. These peak hour traffic counts provide existing traffic conditions at the study area intersections as summarized on Figures 2.1 and 2.2, and form the basis for all traffic forecasts. For purposes of this study, intersection analysis was conducted during the intersection peak hour to represent the worst-case scenario.

<u>Summary of Existing Conditions</u>

The following observations are noted from the traffic count data:

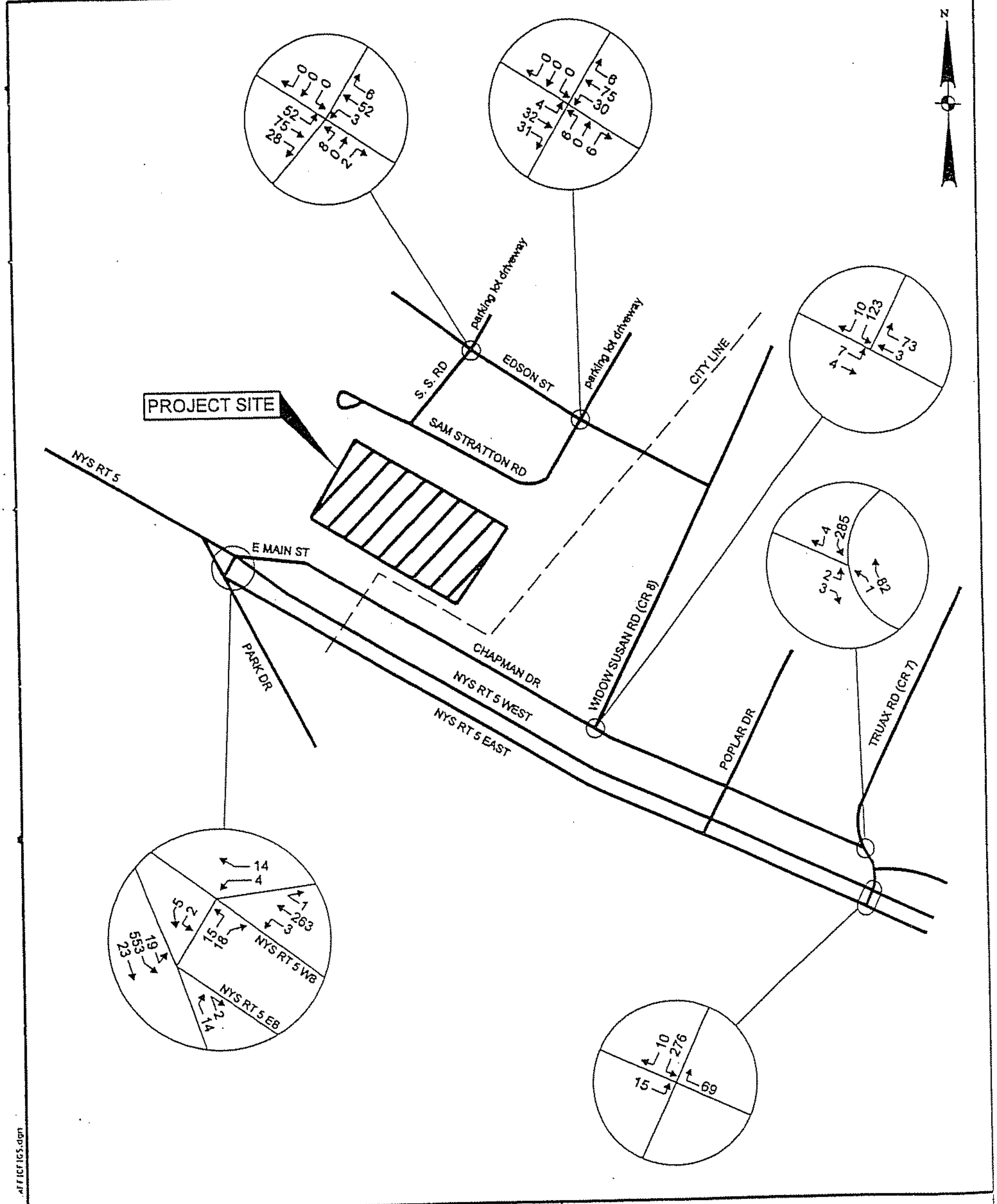
- The morning peak hour generally occurred from 7:00 a.m. to 8:00 a.m. at the NYS Route 5/East Main Street/Park Drive, Chapman Drive/Widow Susan Road (CR 8), and NYS Route 5/Chapman Drive/Truax Road (CR 7) intersections. The morning peak hour occurred from 6:15 a.m. to 7:15 a.m. at the Edson Street intersections.

- The afternoon peak hour generally occurred from 4:15 p.m. to 5:15 p.m. at the NYS Route 5/East Main Street/Park Drive, Chapman Drive/Widow Susan Road (CR 8), and NYS Route 5/Chapman Drive/Truax Road (CR 7) intersections. The afternoon peak hour generally occurred from 3:00 p.m. to 4:00 p.m. at the Edson Street intersections.

- The two-way traffic volume on East Main Street at the proposed truck access site driveway is 37 vehicles during the morning peak hour and 42 vehicles during the afternoon peak hour.

- The average heavy vehicle turning movement percentage in the study area was less than 4% during the morning peak hour and 5% during the afternoon peak hour.

- The westbound heavy vehicle percentage from Chapman Drive is approximately 11% during the morning peak hour and 4% during the afternoon peak hour.



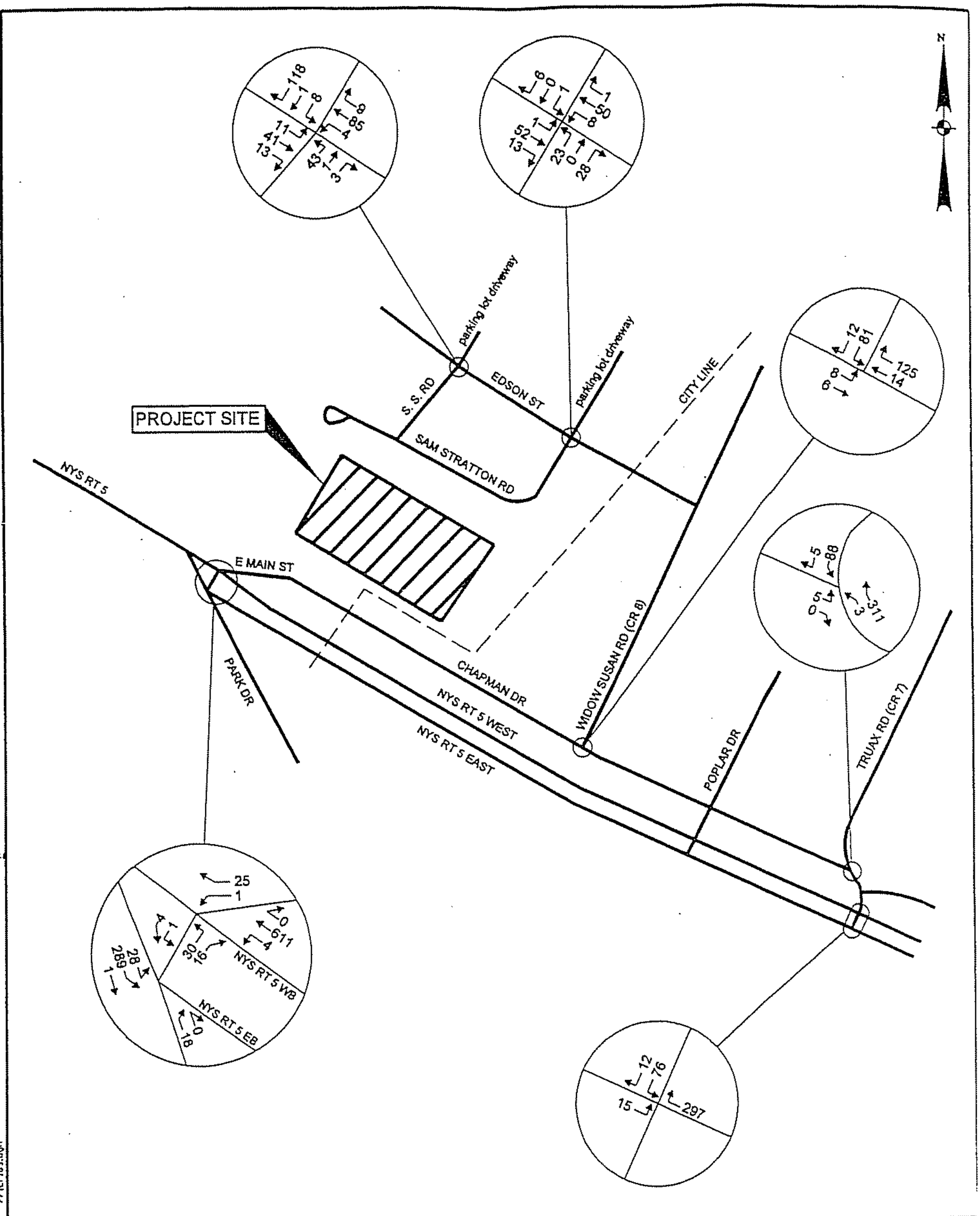
2003 EXISTING TRAFFIC VOLUMES
AM PEAK HOUR

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079 | DATE: 7/03 | FIGURE: 2.1

f:\projects\03-079\Cadd...\traffic\FIGS.dgn



2003 EXISTING TRAFFIC VOLUMES
PM PEAK HOUR

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079	DATE: 7/03	FIGURE: 2.2

CHAPTER III

TRAFFIC FORECASTS

A. Introduction

To evaluate the impact of the Amsterdam Materials Recycling facility, design year 2005 traffic projections were prepared. This corresponds to the year the facility is expected to be fully constructed and operational. The impact of the connector road is analyzed in Chapter V.

B. No-Build Traffic Volumes

A regression analysis of traffic volumes on NYS Route 5 indicated that there has been some growth in the area over the last 10 years. Based on this data, an annual growth factor of two percent was applied to the existing traffic volumes to estimate 2005 No-Build volumes, which can be found on Figures 3.1 and 3.2.

C. Trip Generation

Trip generation determines the quantity of traffic expected to travel to/from a given site. Based on operational data provided by the project sponsor, 36 trucks are expected at the site daily or 72 truck trips per day. Over a nine-hour day, one fuel truck is expected per day and four dump trucks (eight dump truck trips) are expected per hour. Therefore, the facility anticipates an average of approximately ten truck trips per hour (five entering and five exiting). In addition to the truck trips, 15 employees are expected at the site. All 15 employees will enter the facility during the AM peak hour and exit during the PM peak hour. The trip generation estimate is summarized in Table 3.1.

Table 3.1 - Summary of Trip Generation

Trip Type	AM Peak Hour			PM Peak Hour		
	Enter	Exit	Total	Enter	Exit	Total
Trucks	5	5	10	5	5	10
Employee	15	0	15	0	15	15
Total	20	5	25	5	20	25

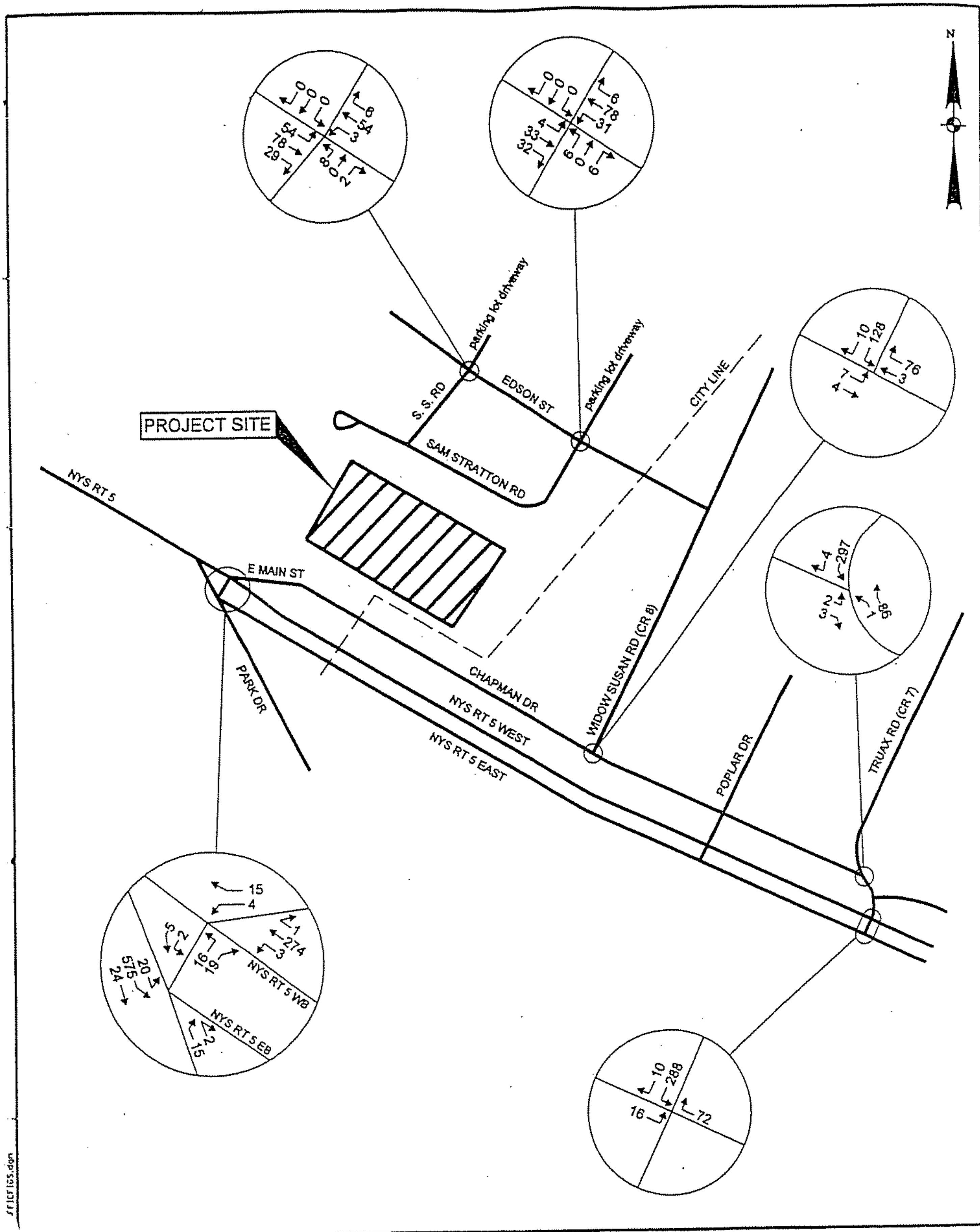
The Amsterdam Materials Recycling is expected to generate 25 trips during the AM peak hour of adjacent street traffic with 20 trips entering and 5 trips exiting. During the PM peak hour of adjacent street traffic, the facility is expected to generate 25 trips with 5 trips entering and 20 trips exiting.

D. Trip Distribution

Trip distribution describes where traffic originates or where traffic is destined. Truck traffic generated by the development was distributed based on the probable travel routes. It is expected that 60% of the truck traffic will access the site from the City of Amsterdam and points west using NYS Route 5 East. Approximately 20% will access the site from Saratoga County and points northeast on Widow Susan Road, and the remaining 20% will access the site from NYS Route 5 West. Employee traffic generated by the development was distributed based on existing travel patterns in the area. It is anticipated that 55% of the facility employees will travel to/from the west on Edson Road. Twenty percent will travel to/from the south on Widow Susan Road and the remaining 25% are expected to travel to/from the north on Widow Susan Road.

E. Trip Assignment

The site generated traffic was assigned to the study area intersections according to the trip distribution patterns discussed above. The trip assignment is based on one point of access to the site on East Main Street for truck access, and one point of access to the site on Sam Stratton Road for employees. The resulting site generated traffic volumes for trucks and employees are shown on Figures 3.3 and 3.4 respectively. The site generated traffic was added to the 2005 No-Build traffic volumes to develop the 2005 Build traffic volumes. The Build traffic volumes for the AM and PM peak hour conditions are shown on Figures 3.5 and 3.6.

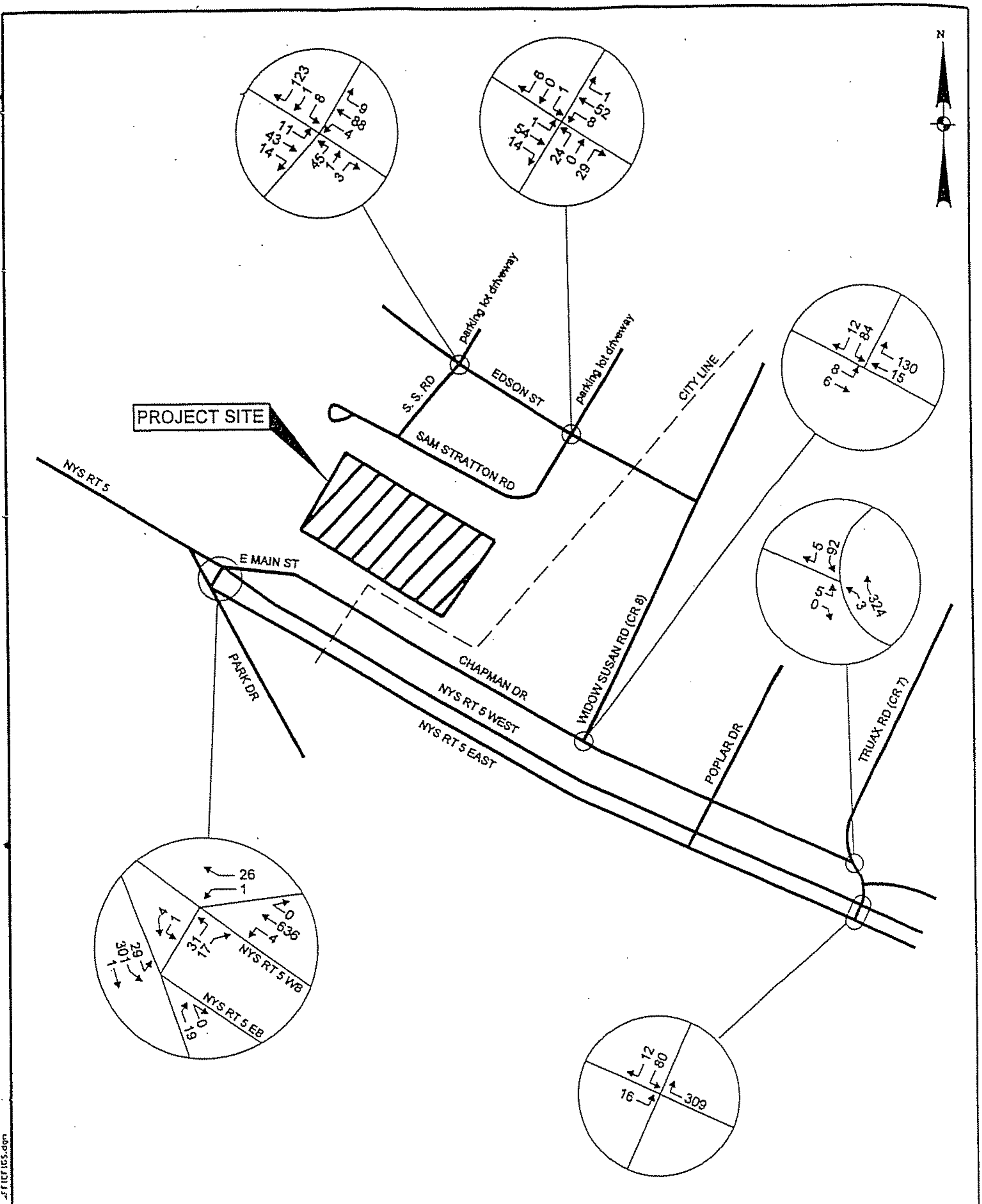


2005 NO-BUILD TRAFFIC VOLUMES
AM PEAK HOUR

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079 | DATE: 7/03 | FIGURE: 3.1

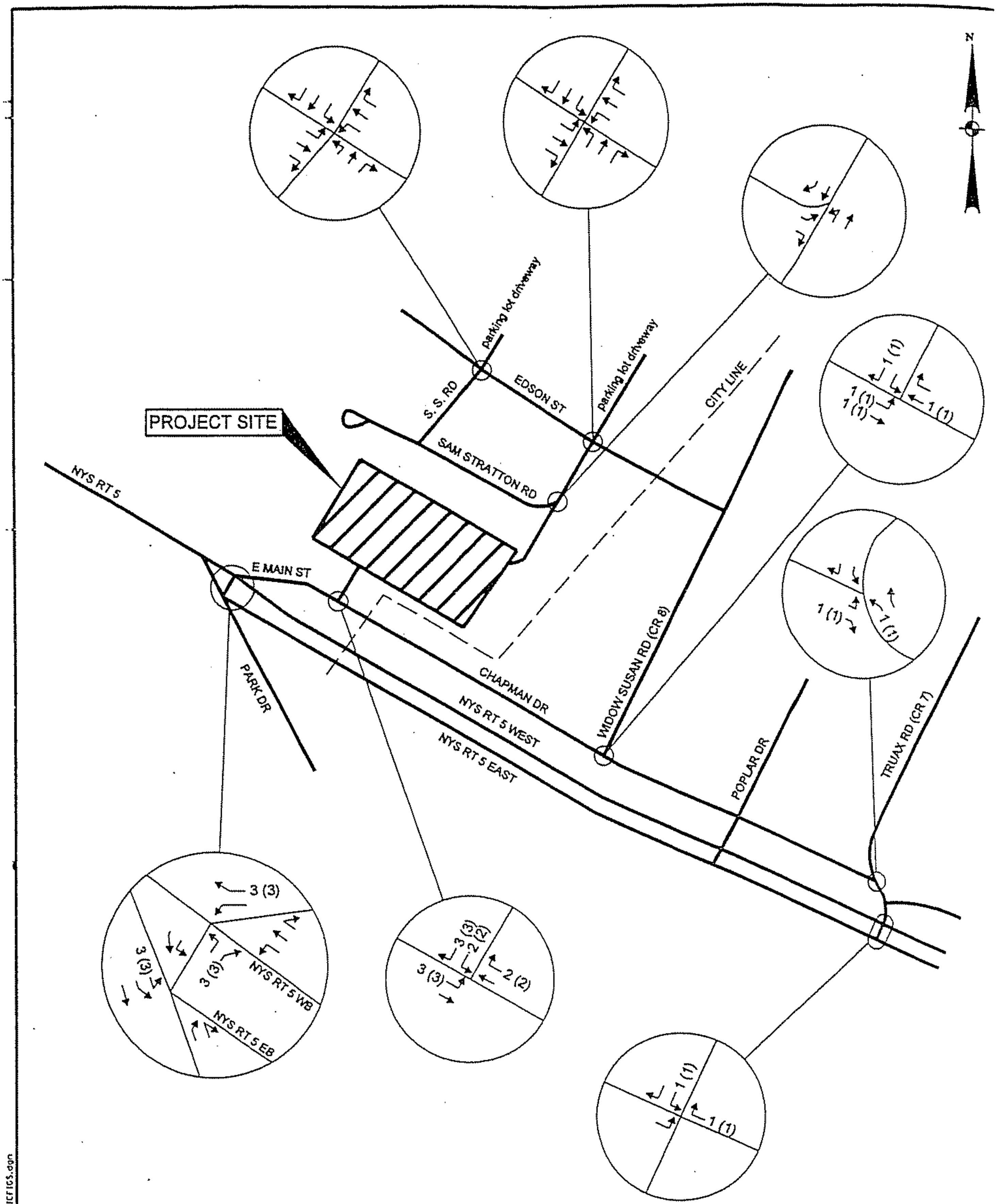


2005 NO-BUILD TRAFFIC VOLUMES
PM PEAK HOUR

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

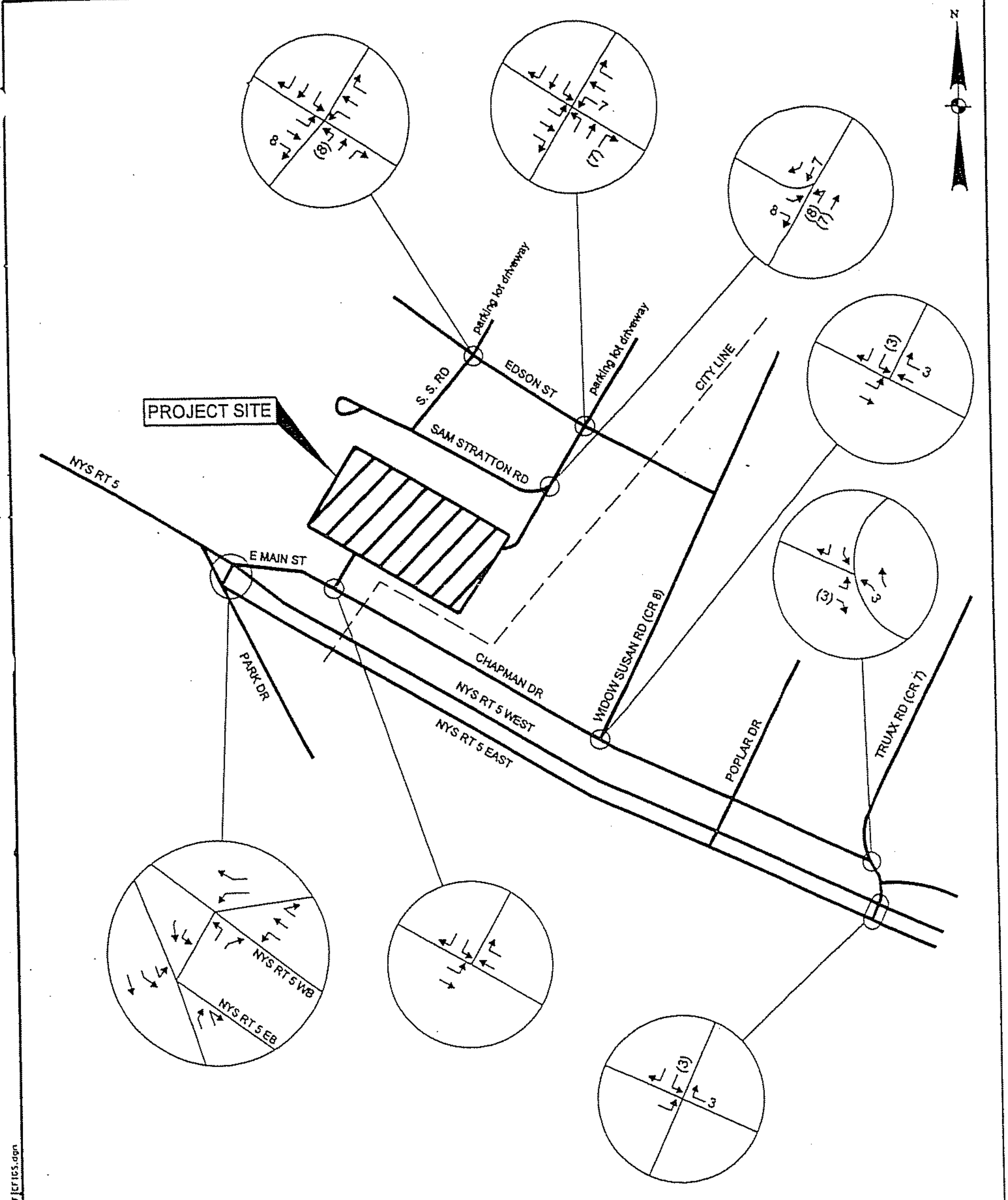
PROJECT: 03-079 | DATE: 7/03 | FIGURE: 3.2



XX(XX) = AM(PM)

TRUCK TRIP ASSIGNMENT	CME CREIGHTON MANNING ENGINEERING, LLP 4 AUTOMATION LANE, ALBANY, NY 12205
MATERIALS RECYCLING FACILITY CITY OF AMSTERDAM, NY	PROJECT: 03-079 | DATE: 7/03 | FIGURE: 3.3

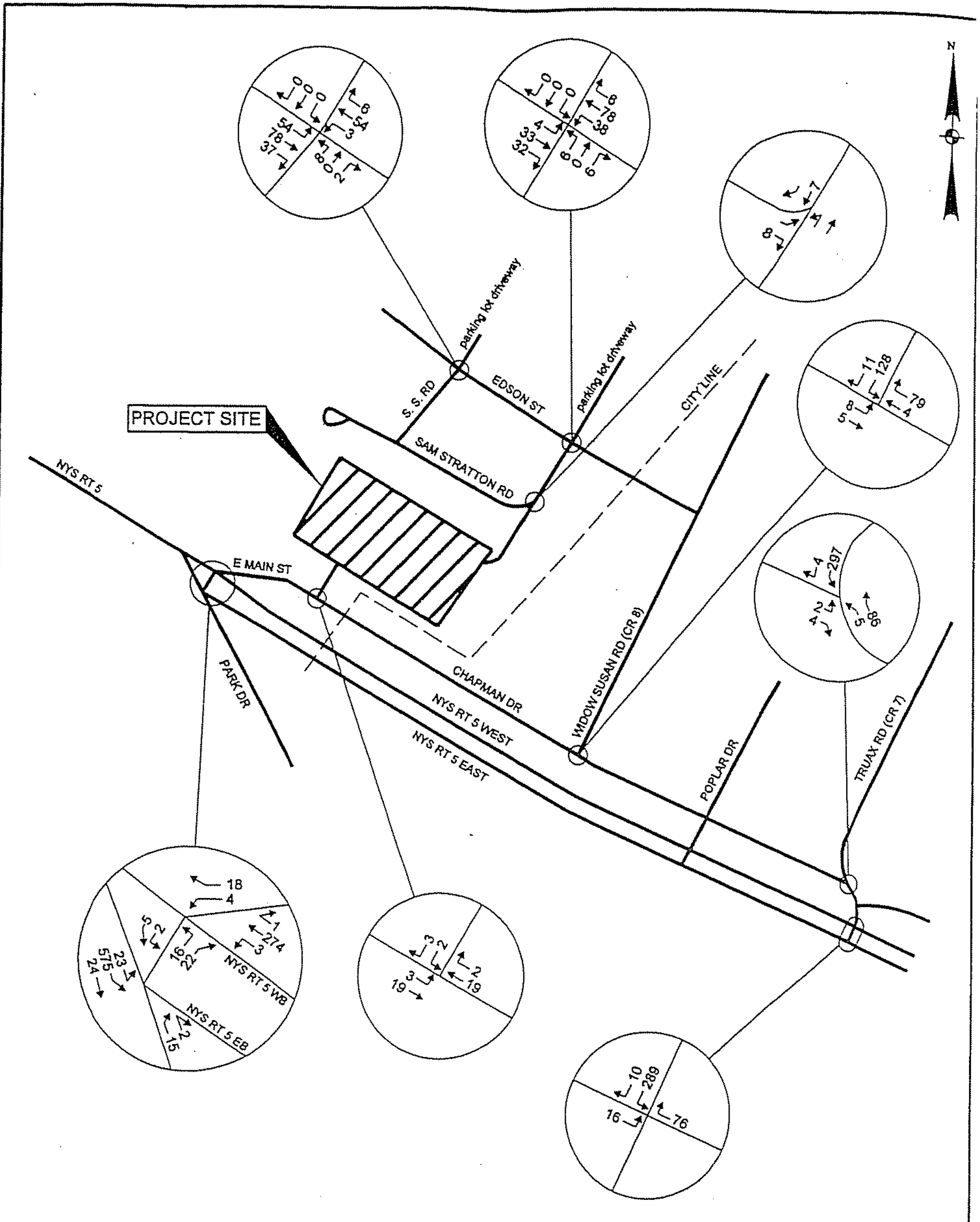
f:\projects\03-079\Cadd\...FICFIGS.dgn



XX(XX) = AM(PM)

EMPLOYEE TRIP ASSIGNMENT	CME CREIGHTON MANNING ENGINEERING, LLP 4 AUTOMATION LANE, ALBANY, NY 12205		
MATERIALS RECYCLING FACILITY CITY OF AMSTERDAM, NY	PROJECT: 03-079	DATE: 7/03	FIGURE: 3.4

f:\projects\03-079\Cadd\ FIGFIG5.dgn

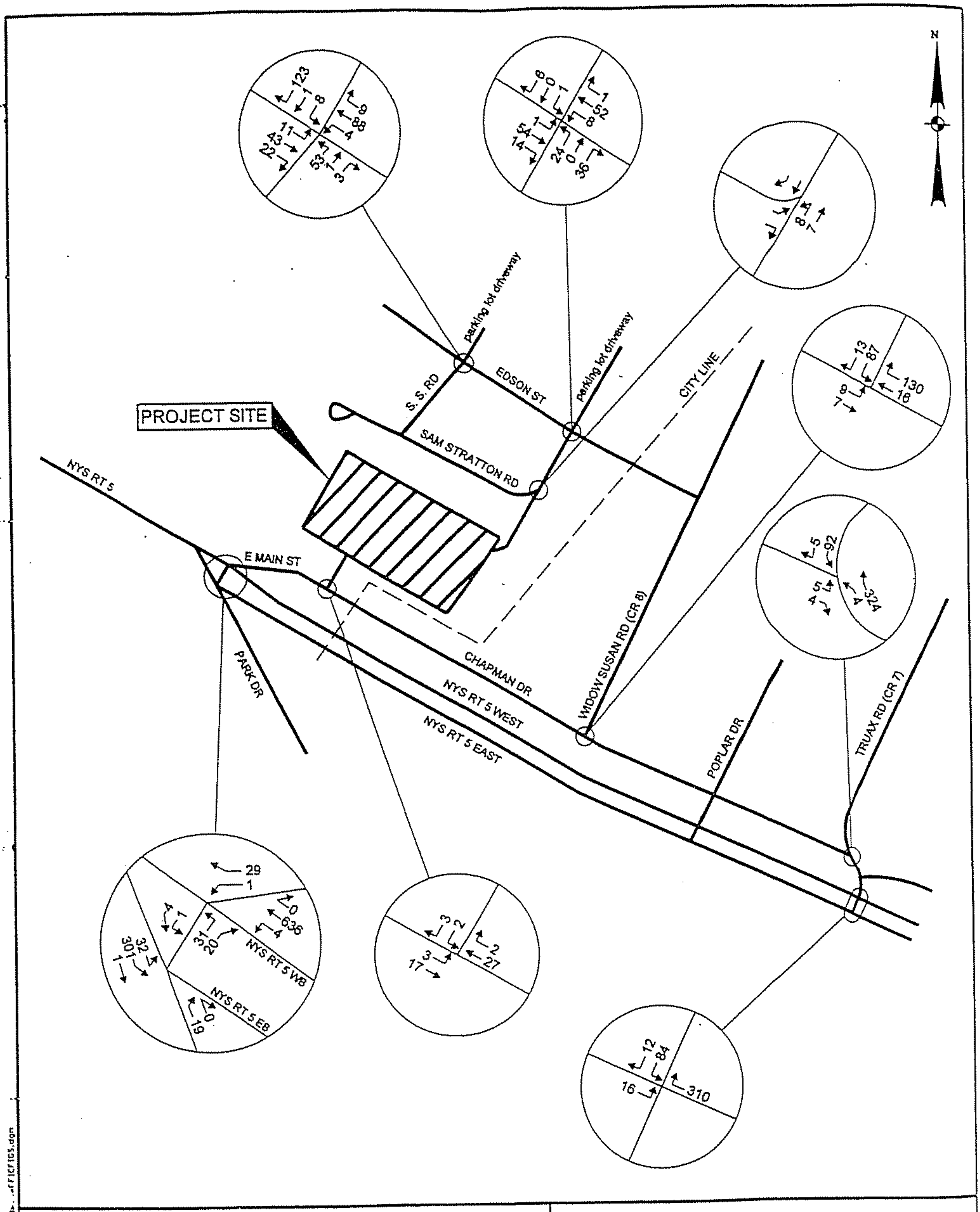


2005 BUILD TRAFFIC VOLUMES
AM PEAK HOUR

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079 | DATE: 7/03 | FIGURE: 3.5



2005 BUILD TRAFFIC VOLUMES
PM PEAK HOUR

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079	DATE: 7/03	FIGURE: 3.6

CHAPTER IV

ANALYSIS

This chapter identifies the relative impact of site-generated traffic and the network and intersection improvements if any, that may be needed within the study area to accommodate the peak hour traffic from the project.

A. Capacity/Level of Service Analysis

Intersection Level of Service (LOS) and capacity analysis relate traffic volumes to the physical characteristics of an intersection. Intersection evaluations were conducted using the latest version of the highway capacity software (HCS version 4.1C) which automates the procedures contained in the *2000 Highway Capacity Manual*. Appendix B contains detailed descriptions of LOS criteria for unsignalized intersections and the detailed HCS Level of Service reports.

The relative impact of the proposed facility can be determined by comparing the level of service during the 2005 design year for the No-Build and Build traffic volume conditions. Table 4.1 shows the results of the Level of Service calculations.

Table 4.1 – Unsignalized Intersection Level of Service Summary

Intersection		AM Peak Hour			PM Peak Hour		
		2003 Existing	2005 No-Build	2005 Build	2003 Existing	2005 No-Build	2005 Build
Rt 5 E / E Main St / Park Dr							
EB	LTR	A (7.2)	A (7.2)	A (7.2)	A (7.3)	A (7.3)	A (7.3)
NB	TR	C (15.6)	C (16.1)	C (16.2)	B (12.1)	B (12.3)	B (12.4)
SB	LT	C (15.6)	C (16.0)	C (16.2)	B (11.7)	B (11.8)	B (11.9)
Rt 5 W / E Main St							
WB	LTR	A (7.2)	A (7.2)	A (7.2)	A (7.2)	A (7.2)	A (7.2)
NB	LT	B (11.4)	B (11.6)	B(11.7)	C (18.0)	C (18.9)	C (19.3)
SB	TR	B (10.5)	B (10.6)	B (10.6)	B (13.5)	B (13.9)	B (14.0)
E Main St / Truck Access							
EB	LT	—	—	A (8.2)	—	—	A (8.2)
SB	LR			A (9.5)			A (9.6)
Chapman Dr / Widow Susan Rd (CR 8)							
EB	LT	A (7.6)	A (7.6)	A (7.6)	A (7.8)	A (7.8)	A (7.8)
SB	LR	A (9.7)	A (9.8)	A (9.9)	A (9.8)	A (9.8)	A (9.9)
Chapman Dr / Truax (CR 7)							
NB	LT	A (7.9)	A (7.9)	A (8.0)	A (7.4)	A (7.4)	A (7.4)
EB	LR	B (10.6)	B (10.7)	B (10.7)	B (11.8)	B (12.1)	B (10.8)
Truax (CR 7) / Rt 5							
EB	L	A (8.6)	A (8.6)	A (8.7)	B (11.1)	B (12.3)	B (12.3)
SB	LR	F (58.1)	F (76.8)	F (79.1)	D (29.6)	D (33.2)	D (34.5)
Edson Rd / Sam Stratton W							
EB	LTR	A (7.5)	A (7.5)	A (7.5)	A (7.6)	A (7.5)	A (7.5)
WB	LTR	A (7.5)	A (7.5)	A (7.5)	A (7.4)	A (7.4)	A (7.4)
NB	LTR	B (11.2)	B (11.3)	B (11.3)	C (22.8)	D (25.1)	D (27.3)
SB	LTR	—	—	—	B (13.3)	B (13.4)	B (13.4)
Edson Rd / Sam Stratton E							
EB	LTR	A (7.5)	A (7.5)	A (7.5)	A (7.3)	A (7.3)	A (7.3)
WB	LTR	A (7.5)	A (7.5)	A (7.5)	A (8.0)	A (7.4)	A (7.4)
NB	LTR	A (9.8)	A (9.9)	B (10.0)	A (9.8)	A (9.8)	A (9.8)
SB	LTR	—	—	—	A (8.7)	A (8.7)	A (8.8)
Sam Stratton / Employee Access							
NB	LT	—	—	A (7.2)	—	—	A (7.2)
EB	LR			A (8.4)			—

EB, WB, NB, SB = Eastbound, Westbound, Northbound, Southbound
L, T, R = Left, Through, Right
X (Y.Y) = Level of Service (Delay, seconds per vehicle)

The following results are evident from this analysis:

- NYS Route 5 East/East Main Street/Park Drive/NYS Route 5 connector – The approaches to this intersection currently operate at good levels of service for both peak hours. These levels of service are expected to continue through the 2005 no-build and build conditions.

- Route 5 West/East Main Street/NYS Route 5 connector – The approaches to this intersection currently operate at good levels of service for both peak hours. These levels of service are expected to continue through the 2005 no-build and build conditions.

- East Main Street/Truck Access Driveway – The eastbound and southbound approaches to this intersection are expected to operate at LOS A during both peak hours of the build condition.

- Chapman Drive/Widow Susan Road (CR 8) – The eastbound and southbound approaches to this intersection currently operate at good levels of service for both peak hours. These levels of service are expected to continue through the no-build and build conditions.

- Chapman Drive/Truax Road (CR 7) – The northbound and eastbound approaches to this intersection operate at good levels of service. These levels of service are expected to continue through the no-build and build conditions.

- Truax Road (CR 7)/NYS Route 5 – The eastbound left-turn approach to this intersection currently operates at LOS A during the AM peak hour and LOS B during the PM peak hour. This level of operation is expected to continue through the no-build and build conditions. The southbound Truax Road approach operates with less than 60 seconds delay during the AM peak hour and under 30 seconds of delay during the PM peak hour. The level of service is expected to remain the same for both peak hours during no-build and build conditions. Between the no-build and build conditions, average delay will increase by less than three seconds per vehicle during the AM peak hour and approximately one second per vehicle during the PM peak hour.

- Edson Street/Sam Stratton Road West – The approaches to this intersection currently operate at good levels of service during both peak hours. During the no-build and build conditions, the approaches are expected to operate at adequate levels of service.

- Edson Street/Sam Stratton Road East – All approaches to this intersection currently operate at good levels of service. These levels of service are expected to continue through the no-build and build conditions.

- Sam Stratton Road/Employee Access Driveway – The northbound and eastbound approaches to this intersection are expected to operate at good LOS A during both peak hours of the build condition.

B. Truck Access

The above analysis assumed that trucks would use the local roads of Chapman Drive, Widow Susan Road, and East Main Street to access the project site. A review of these roads identified the following:

- The steep down grade of 10% on Widow Susan Road makes it difficult for trucks to stop at the intersection with Chapman Drive.
- The southbound approach of Widow Susan Road at the intersection with Chapman Drive requires the radius to be increased to accommodate right-turning trucks.
- The steep down grade of 10% on Truax Road makes it difficult for trucks to stop at the intersection with Chapman Drive.
- Chapman Drive is in poor condition and appears to require extensive work to accommodate trucks. The county has plans to repave Chapman Drive during the summer of 2003 from the Amsterdam City Line to Truax Road. The scope of work planned on Chapman Drive will not increase the structural integrity of the road to accommodate the truck traffic anticipated at the site.
- There are truck restrictions stating "No Trucks Except Local Delivery" at each end of Chapman Drive and on Widow Susan Road near it's intersection with NYS Route 67.

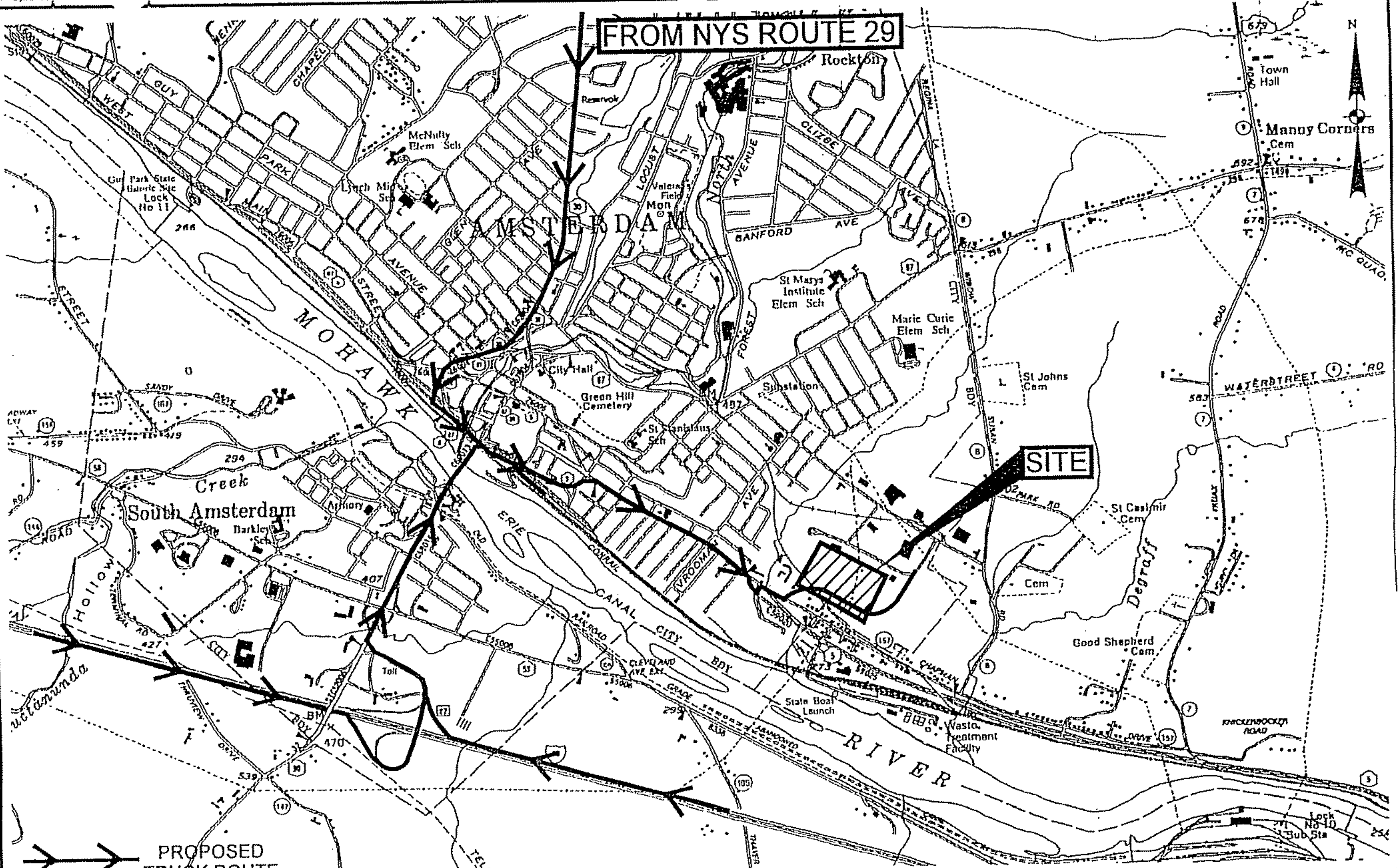
To mitigate the potential impact on these local roads and avoid likely improvements needed to accommodate truck traffic, it is proposed to establish a designated truck route to the site. All truck traffic to the site would be go through the NYS Route 5 East/East Main Street/Park Drive and NYS Route 5 West/East Main Street intersections and turn left into the site from East Main Street. Level of service calculations indicate there is sufficient capacity at these intersections to accommodate the additional anticipated five truck trips per hour (36 truck trips per day).

Trucks travelling from the east on NYS Route 5 West cannot navigate the right turn from NYS Route 5 West to East Main Street, therefore alternative westbound truck routes are proposed. The truck routes, shown on Figure 4.1 and 4.2, are identified as follows:

- From the West – Trucks should travel through the City of Amsterdam on NYS Route 5 East and access the site from East Main Street.

- From Saratoga County – Trucks should travel along NYS Route 29 to the junction with NYS Route 30 and finally to NYS Route 5 East and into the site from East Main Street.

- From the East – Trucks should travel to the City of Amsterdam on Interstate 90 via Exit 27. Access to the site is from East Main Street via NYS Route 30 North to NYS Route 5 East. As an alternative to Interstate 90, trucks travelling from the east on NYS Route 5 West can pass the site and loop around in the City of Amsterdam using NYS Route 5 West, NYS Route 67 West, and NYS Route 5 East. Access to the site is gained from NYS Route 5 East to East Main Street.

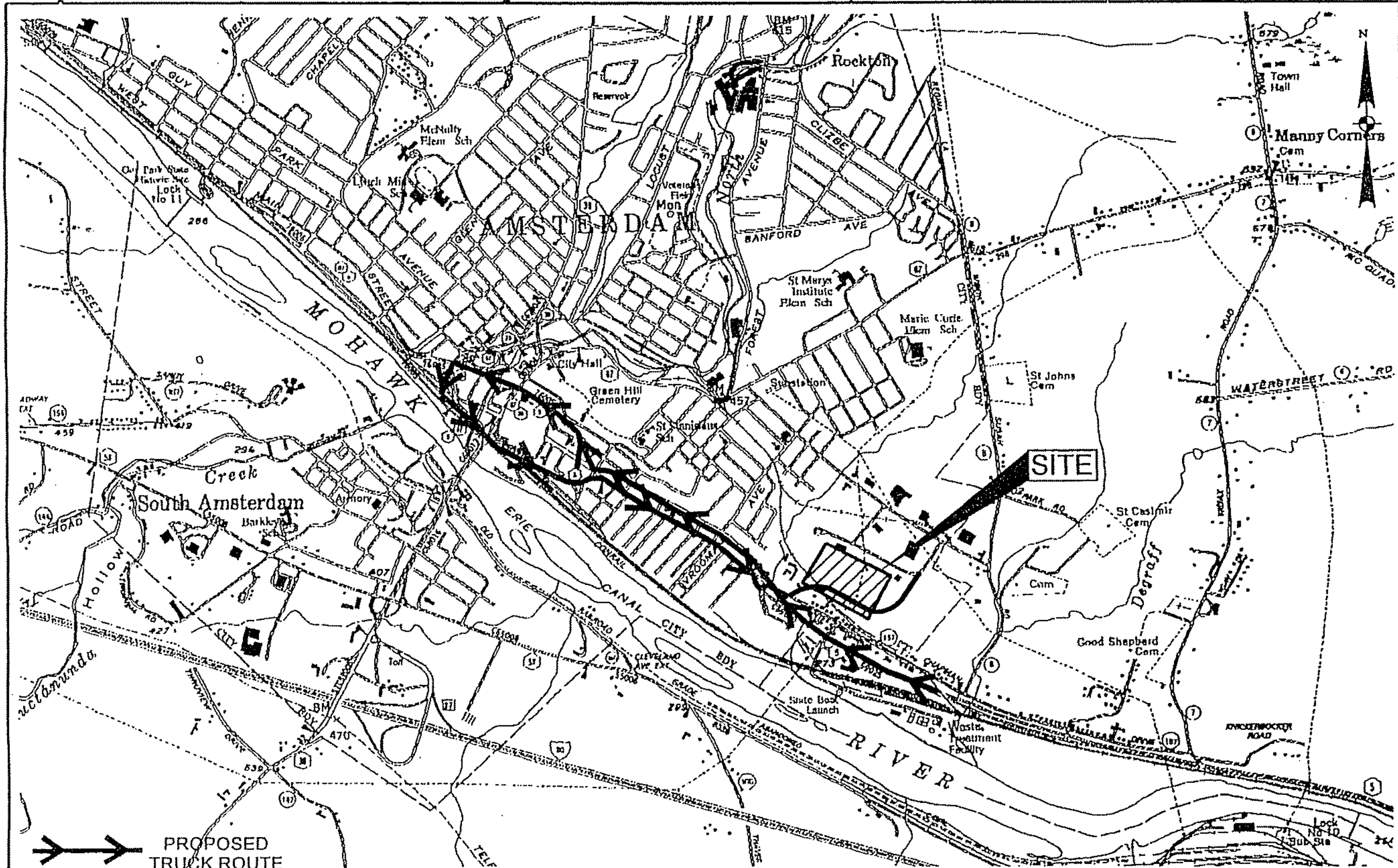


PROPOSED TRUCK ROUTE

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CME
CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079	DATE: 12/03	FIGURE: 4.1



ALTERNATE ROUTE 5 WESTBOUND
TRUCK ROUTE

MATERIALS RECYCLING FACILITY
CITY OF AMSTERDAM, NY

CREIGHTON MANNING ENGINEERING, LLP
4 AUTOMATION LANE, ALBANY, NY 12205

PROJECT: 03-079	DATE: 7/03	FIGURE: 4.2

CHAPTER V

CONNECTOR ROAD

At the closure of the Amsterdam Materials Recycling facility, a connector road between East Main Street and Sam Stratton Road will be opened to through traffic. Design year 2010 traffic projections were prepared to evaluate the proposed connector road.

Traffic was redistributed to the proposed connector road based on expected travel changes in the area. A portion of the traffic accessing the Edson Street Industrial Park from the City of Amsterdam was redistributed to the connector road through the NYS Route 5/East Main Street intersections.

Table 5.1 summarizes the level of service for the proposed connector road at the NYS Route 5/East Main Street intersections. These are the only study intersections expected to see increased traffic volumes as a result of the connector road.

Table 5.1 – Unsignalized Level of Service Summary

Intersection		2010 Build	
		AM Peak Hour	PM Peak Hour
Rt 5 E / E Main St / Park Dr			
EB	LTR	A (7.3)	A 97.3)
NB	TR	C (19.4)	B (13.2)
SB	LT	C (19.2)	B (12.6)
Rt 5 W / E Main St			
WB	LTR	A (7.2)	A (7.2)
NB	LT	B (12.7)	D (26.3)
SB	TR	B (10.9)	C (16.7)

EB, NB, SB = Eastbound, Northbound, Southbound
L, T, R = Left, Through, Right
X (Y.Y) = Level of Service (Delay, seconds per vehicle)

When the connector road opens in 2010, the NYS Route 5 East/East Main Street/Park Drive intersection approaches are expected to operate at LOS C or better. The Route 5 West/East Main Street intersection approaches are expected to operate at LOS D or better. No improvements are warranted.

CHAPTER VI

CONCLUSIONS

Based on the results of this traffic impact study completed for the proposed Amsterdam Materials Recycling facility and East Main Street/Sam Stratton Road connector, the following conclusions and recommendations are presented:

- The proposed development involves the construction of a Construction and Demolition Landfill for five years of operation and at the closure of the landfill a road connecting Chapman Drive and Sam Stratton Road.

- For purposes of this analysis the landfill is expected to be operational from 2005 to 2010. The connector road will open in 2010.

- The peak hour trip generation estimate for the landfill is 25 trips (20 entering and 5 exiting) during the weekday AM peak hour and 25 trips (5 entering and 20 exiting) during the weekday PM peak hour of adjacent street traffic.

- Access to the site will be provided via two new driveways. An employee entrance will be provided from Sam Stratton Road East and a truck access driveway is planned on East Main Street.

- The small number of new trips being added to the existing roadway network by the landfill will not have an impact on the surrounding traffic operations.

- To avoid Chapman Drive and other truck restricted roads in the area, all trucks using the landfill will use a designated truck route consisting primarily of state roads and touring routes within the city. All trucks will access the site heading eastbound on East Main Street.

By implementing the proposed truck route, the project will have an insignificant impact on traffic. With project completion, all study area intersections are expected to operate in a manner similar to the no-build condition.

Appendix A – Turning Movement Counts

Amsterdam Materials Recycling
City of Amsterdam – Montgomery County, New York

Creighton Manning Engineering, L.L.P.
4 Automation Lane
Albany, N.Y. 12205-1683
Turning Movement Counts

Project : Amsterdam Landfill
C[illegible]d by: MDN
L[illegible]ion : Amsterdam, NY
Other :

Site Code : 03-079-1
Start Date: 06/18/03
File I.D. : TM3079A1
Page : 1

Passengers, Heavy Vehicles

Start Time	E Main St/rt 5/Chapman Dr Westbound Left	Thru	Rght	RTOR	rt 5 E/rt 5 W link Northbound Left	Thru	Rght	RTOR	rt 5 Eastbound Left	Thru	Rght	RTOR	Total-	RTOR=	
6:00am	0	0	0	0	3	23	0	0	1	1	0	0	28	0	28
6:15	0	0	0	0	2	33	0	0	5	0	0	0	40	0	40
6:30	2	5	0	0	1	37	0	0	3	3	0	0	51	0	51
6:45	1	4	0	0	3	44	0	0	1	6	0	0	59	0	59
Hour Total	3	9	0	0	9	137	0	0	10	10	0	0	178	0	178
7:00am	3	4	0	0	0	48	0	0	4	7	0	0	66	0	66
7:15	0	3	0	0	0	78	0	0	6	5	0	0	92	0	92
7:30	0	7	0	0	2	73	1	0	2	3	0	0	88	0	88
7:45	1	0	0	0	1	64	0	0	3	3	0	0	72	0	72
Hour Total	4	14	0	0	3	263	1	0	15	18	0	0	318	0	318
8:00am	1	1	0	0	1	54	0	0	5	1	0	0	63	0	63
8:15	0	5	0	0	2	54	0	0	4	4	0	0	69	0	69
8:30	0	6	0	0	1	48	0	0	2	3	0	0	60	0	60
8:45	0	2	0	0	1	49	0	0	4	7	0	0	63	0	63
Hour Total	1	14	0	0	5	205	0	0	15	15	0	0	255	0	255
G.	8	37	0	0	17	605	1	0	40	43	0	0	751	0	751
% of Total	1.1%	4.9%	0.0%	0.0%	2.3%	80.6%	.1%	0.0%	5.3%	5.7%	0.0%	0.0%		0.0%	100.0%
Apprch %	6.0%				83.0%				11.1%						
% of Apprch	17.8%	82.2%	0.0%	0.0%	2.7%	97.1%	.2%	0.0%	48.2%	51.8%	0.0%	0.0%			

Peak Hour Analysis By Entire Intersection for the Period: 06:00am to 08:45am on 06/18/03

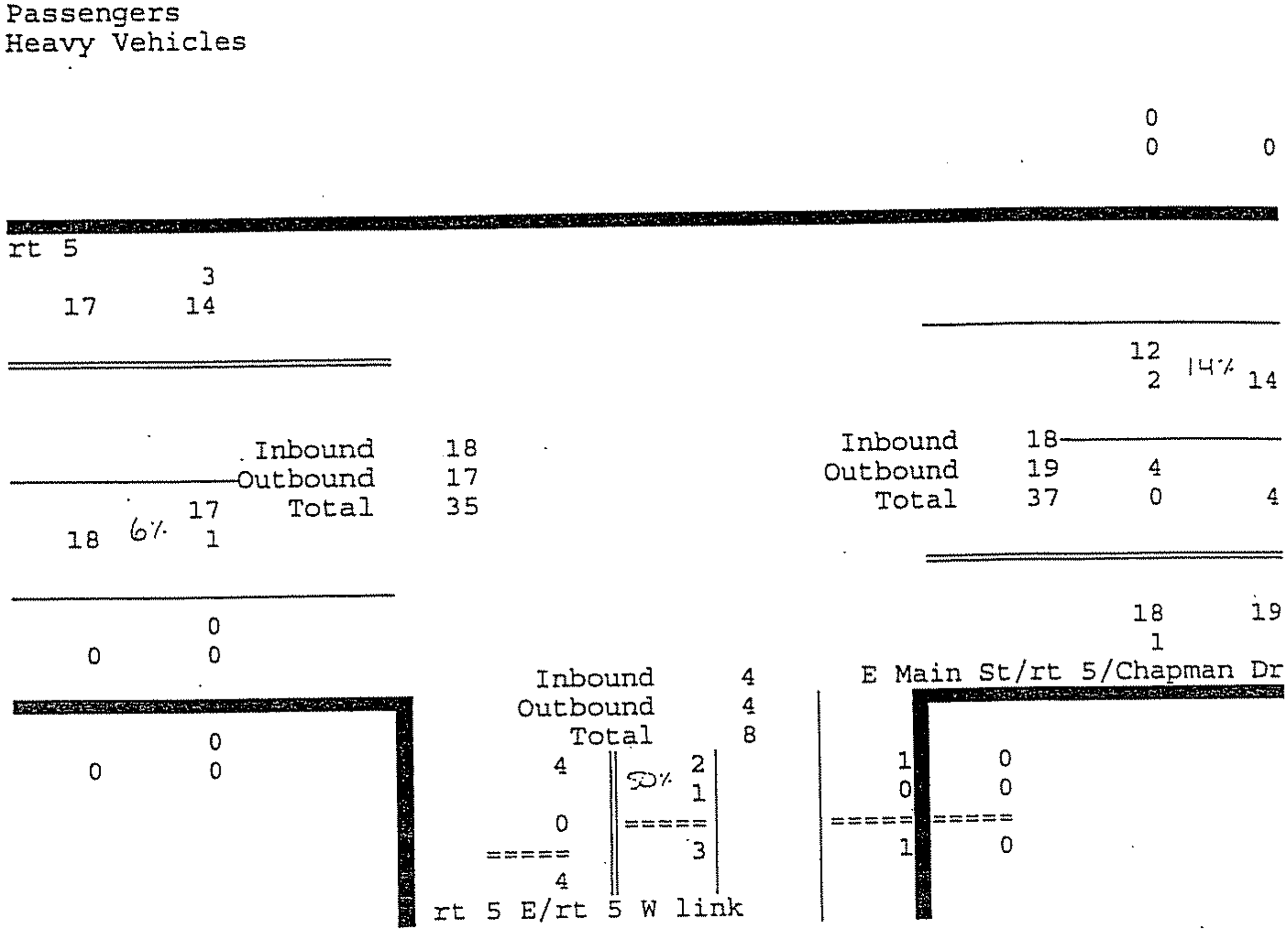
Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Left	Thru	Rght	Total	RTOR	Percentages Left	Thru	Rght
Southbound		07:00am	.0	0	0	0	0	0	0.0	0.0	0.0
Westbound	E Main St/rt 5/Chapman		.643	4	14	0	18	0	22.2	77.7	.0
Northbound	rt 5 E/rt 5 W link		.856	3	263	1	267	0	1.1	98.5	.3
Eastbound	rt 5		.750	15	18	0	33	0	45.4	54.5	.0

Project : Amsterdam Landfill
Cr ·d by: MDN
Lo .ion : Amsterdam, NY
Other :

Creighton Manning Engineering, L.L.P.
4 Automation Lane
Albany, N.Y. 12205-1683
Turning Movement Counts

Site Code : 03-079-1
Start Date: 06/18/03
File I.D. : TM3079A1
Page : 2

Passengers, Heavy Vehicles



Site 2 AM Count

Creighton Manning Engineering

AMSTERDAM LANDFILL
Cr ed by: SMD
Lc ion : AMSTERDAM, NY
Other :

Site Code : 00030792
Start Date: 06/18/03
File I.D. : TM3079A2
Page : 1

Passenger Cars, Heavy Vehciles

Start Time	Route 5 Connector/Turn Aro Southbound Left	Thru	Rght	Route 5 Westbound Left	Thru	Rght	Rt. to Coess. Park Northbound Left	Thru	Rght	Route 5 Eastbound Left	Thru	Rght	Total
6:00am	0	3	0	0	0	0	0	1	0	1	97	4	106
6:15	0	2	0	0	0	0	0	4	1	1	172	7	187
6:30	0	1	0	0	0	0	0	3	0	3	158	24	189
6:45	0	3	0	0	0	0	0	0	0	7	119	27	156
Hour Total	0	9	0	0	0	0	0	8	1	12	546	62	638
7:00am	1	2	0	0	0	0	0	5	1	7	123	2	141
7:15	0	0	0	0	0	0	0	5	0	6	136	7	154
7:30	1	1	0	0	0	0	0	3	0	2	154	6	167
7:45	0	1	0	0	0	0	0	1	1	4	120	8	135
Hour Total	2	4	0	0	0	0	0	14	2	19	533	23	597
8:00am	0	2	0	0	0	0	0	4	0	2	115	3	126
8:15	1	1	0	0	0	0	0	4	0	5	87	2	100
8:30	0	1	0	0	0	0	0	0	0	5	90	2	98
8:45	0	1	0	0	0	0	0	2	1	9	71	0	84
Hour Total	1	5	0	0	0	0	0	10	1	21	363	7	408
G:	3	18	0	0	0	0	0	32	4	52	1442	92	1643
% of Total	.2%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	.2%	3.2%	87.8%	5.6%	
Apprch %	1.3%						2.2%			96.5%			
% of Apprch	14.3%	85.7%	0.0%	0.0%	0.0%	0.0%	0.0%	88.9%	11.1%	3.3%	90.9%	5.8%	

Peak Hour Analysis By Entire Intersection for the Period: 06:00am to 08:45am on 06/18/03

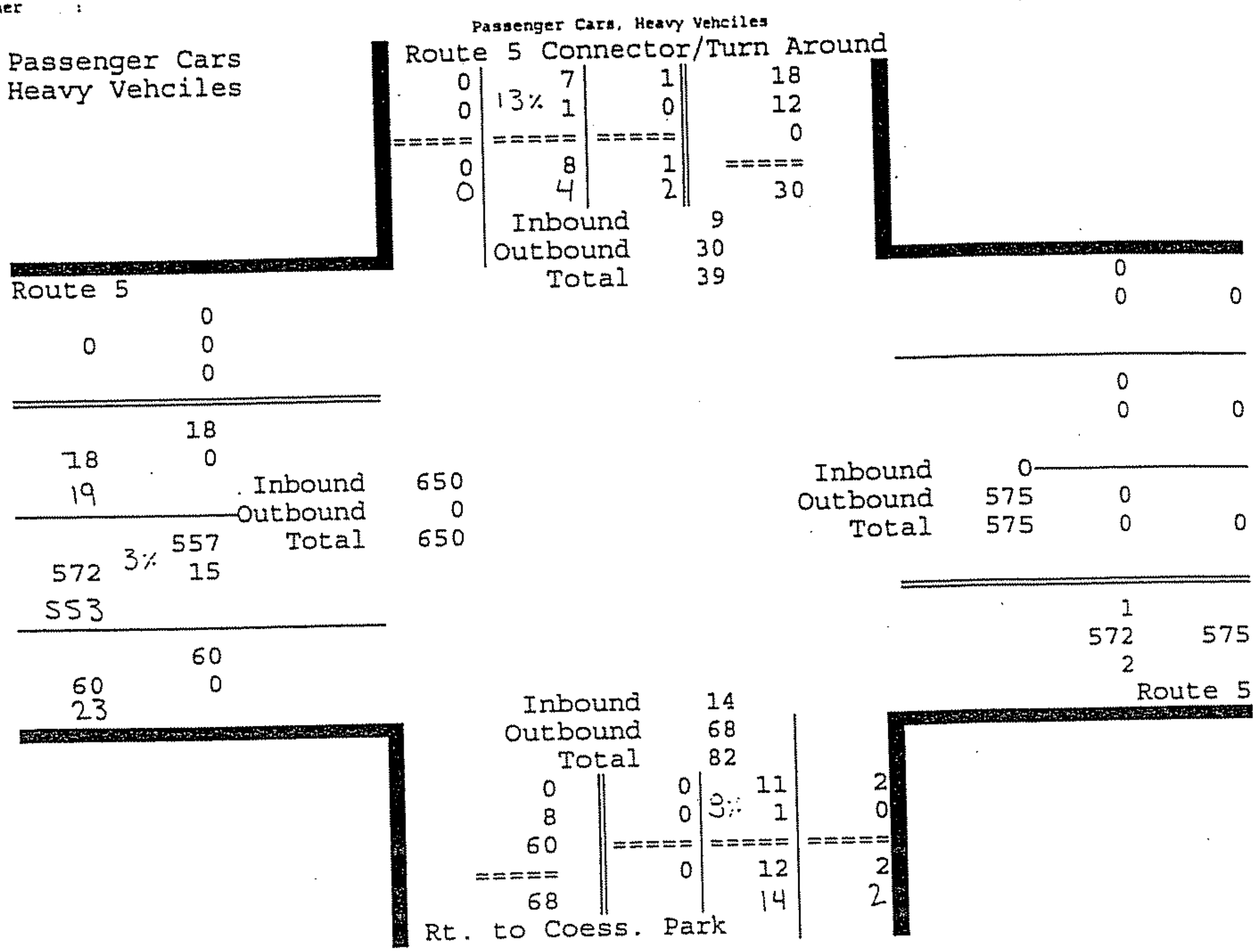
Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Left	Thru	Rght	RTOR	Total	Percentages Left	Thru	Rght	RTOR
Southbound	Route 5 Connector/Turn	06:15am	.750	1	8	0	0	9	11.1	88.8	.0	.0
Westbound	Route 5		.0	0	0	0	0	0	0.0	0.0	0.0	0.0
Northbound	Rt. to Coess. Park		.583	0	12	2	0	14	.0	85.7	14.2	.0
Eastbound	Route 5		.878	18	572	60	0	650	2.7	88.0	9.2	.0

Creighton Manning Engineering

AMSTERDAM LANDFILL
Cr ed by:SMD
L ion :AMSTERDAM, NY
Other :

Site Code : 00030792
Start Date: 06/18/03
File I.D. : TM3079A2
Page : 2

Passenger Cars, Heavy Vehciles



Creighton Manning Engineering, L.L.P.
4 Automation Lane
Albany, N.Y. 12205-1683
Turning Movement Counts

Project : Amsterdam Landfill
Cr ed by: DTP
Lo. .ion : Amsterdam, NY
Other :

Site Code : 03-079-3
Start Date: 06/18/03
File I.D. : TM3079A3
Page : 1

Passengers, Heavy Vehicles

Start Time	Widow Susan Rd Southbound Left	Thru	Rght	RTOR	Chapman Dr Westbound Left	Thru	Rght	RTOR	Chapman Dr Eastbound Left	Thru	Rght	RTOR	Total-	RTOR-	
6:00am	20	0	1	0	0	0	2	0	1	0	0	0	24	0	24
6:15	18	0	0	0	0	1	2	0	0	3	0	0	24	0	24
6:30	32	0	6	0	0	1	10	0	4	2	0	0	55	0	55
6:45	25	0	3	0	0	0	8	0	5	1	0	0	42	0	42
Hour Total	95	0	10	0	0	2	22	0	10	6	0	0	145	0	145
7:00am	26	0	4	0	0	1	8	0	2	0	0	0	41	0	41
7:15	29	0	1	0	0	0	24	0	1	0	0	0	55	0	55
7:30	39	0	3	0	0	1	18	0	3	1	0	0	65	0	65
7:45	29	0	2	0	0	1	23	0	1	3	0	0	59	0	59
Hour Total	123	0	10	0	0	3	73	0	7	4	0	0	220	0	220
8:00am	29	0	1	0	0	0	16	0	0	0	0	0	46	0	46
8:15	15	0	3	0	0	1	10	0	1	0	0	0	30	0	30
8:30	12	0	2	0	0	1	10	0	2	1	0	0	28	0	28
8:45	18	0	3	0	0	3	6	0	4	1	0	0	35	0	35
Hour Total	74	0	9	0	0	5	42	0	7	2	0	0	139	0	139
G:	292	0	29	0	0	10	137	0	24	12	0	0	504	0	504
% of Total	57.9%	0.0%	5.8%	0.0%	0.0%	2.0%	27.2%	0.0%	4.8%	2.4%	0.0%	0.0%		0.0%	100.0%
Apprch %	63.7%				29.2%				7.1%						
% of Apprch	91.0%	0.0%	9.0%	0.0%	0.0%	6.8%	93.2%	0.0%	66.7%	33.3%	0.0%	0.0%			

Peak Hour Analysis By Entire Intersection for the Period: 06:00am to 08:45am on 06/18/03

Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Left	Thru	Rght	Total	RTOR	Percentages Left	Thru	Rght
Southbound	Widow Susan Rd	07:15am	.792	126	0	7	133	0	94.7	.0	5.2
Westbound	Chapman Dr		.865	0	2	81	83	0	.0	2.4	97.5
Northbound			.0	0	0	0	0	0	0.0	0.0	0.0
Eastbound	Chapman Dr		.562	5	4	0	9	0	55.5	44.4	.0

Creighton Manning Engineering, L.L.P.
4 Automation Lane
Albany, N.Y. 12205-1683
Turning Movement Counts

Project : Amsterdam Landfill
Cr[illegible]d by: DTP
L[illegible]ion : Amsterdam, NY
Other :

Site Code : 03-079-3
Start Date: 06/18/03
File I.D. : TM3079A3
Page : 2

Passengers, Heavy Vehicles

Passengers
Heavy Vehicles

Widow Susan Rd

0 | 14% 6 | | 2% 124 | 5
0 | 1 | | 2 |
===== | ===== | | ===== | 81
0 | 7 | | 126 | =====
| 10 | | 123 | 86

Inbound 133
Outbound 86
Total 219

0
0 0

Chapman Dr

80 1%
1 81
73

9 2
7

20% 4
5 1
7

Inbound 9
Outbound 9
Total 18

4
4 0
4

2
0 2
3

Inbound 83
Outbound 130
Total 213

126
4 130

Chapman Dr

0
0 0

Site 4 AM Count 6/19

Creighton Manning Engineering

Amsterdam Landfill
Co---ed by:SMD
L. .on :Amsterdam, NY
Other :

Site Code : 00030794
Start Date: 06/19/03
File I.D. : TM3079A4
Page : 1

Passenger Cars, Heavy Vehicles

Start Time	Edson St. Westbound Left	Thru	Rght	Sam Stratton Rd. Northbound Left	Thru	Rght	Edson St. Eastbound Left	Thru	Rght	Total
6:00am	1	5	0	0	0	0	0	8	0	14
6:15	0	9	0	1	0	0	0	20	3	33
6:30	1	24	0	4	0	1	1	16	10	57
6:45	2	18	0	3	0	1	0	30	8	62
Hour Total	4	56	0	8	0	2	1	74	21	166
7:00am	0	7	0	0	0	0	0	9	7	23
7:15	1	4	0	0	0	0	0	16	8	29
7:30	0	9	0	3	0	1	0	18	10	41
7:45	0	7	0	2	0	1	0	33	4	47
Hour Total	1	27	0	5	0	2	0	76	29	140
8:00am	0	12	0	1	0	0	0	13	1	27
8:15	1	9	0	1	0	0	1	9	3	24
8:30	0	10	0	1	0	0	0	7	8	26
8:45	1	7	0	6	0	0	0	6	2	22
Hour Total	2	38	0	9	0	0	1	35	14	99
G:	7	121	0	22	0	4	2	185	64	405
% of Total	1.7%	29.9%	0.0%	5.4%	0.0%	1.0%	.5%	45.7%	15.8%	
Apprch %	31.6%			6.4%			62.0%			
% of Apprch	5.5%	94.5%	0.0%	84.6%	0.0%	15.4%	.8%	73.7%	25.5%	

Peak Hour Analysis By Entire Intersection for the Period: 06:00am to 08:45am on 06/19/03

Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Left	Thru	Rght	RTOR	Total	Percentages Left	Thru	Rght	RTOR
Southbound		06:15am	.0	0	0	0	0	0	0.0	0.0	0.0	0.0
Westbound	Edson St.		.610	3	58	0	0	61	4.9	95.0	.0	.0
Northbound	Sam Stratton Rd.		.500	8	0	2	0	10	80.0	.0	20.0	.0
Eastbound	Edson St.		.684	1	75	28	0	104	.9	72.1	26.9	.0

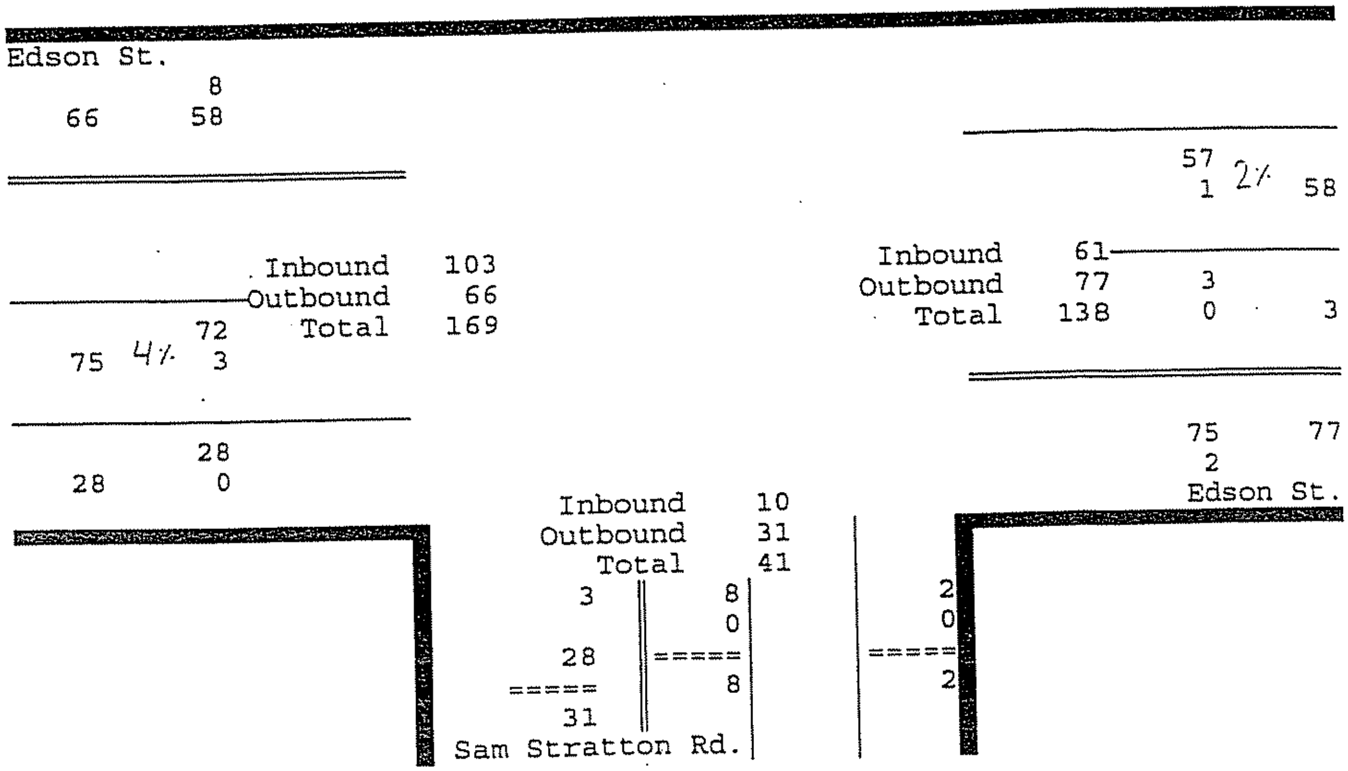
Creighton Manning Engineering

Amsterdam Landfill
Created by:SMD
Location :Amsterdam, NY
Other :

Site Code : 00030794
Start Date: 06/19/03
File I.D. : TM3079A4
Page : 2

Passenger Cars, Heavy Vehicles

Passenger Cars
Heavy Vehicles



6/19
Site 4 AM Count People going rt. into lot before intersection of interest

Creighton Manning Engineering

Amsterdam Landfill
Co[illegible]d by:SMD
Lo[illegible]on :Amsterdam, NY
Other :

Site Code : 00030794
Start Date: 06/19/03
File I.D. : TM3079A4
Page : 1

PC's turning rt. pl

Start Time	Edson St. Westbound Left	Thru	Rght	Sam Stratton Rd. Northbound Left	Thru	Rght	Edson St. Eastbound Left	Thru	Rght	Total
*** Break ***										
6:15	0	0	0	0	0	0	7	0	0	7
6:30	0	0	0	0	0	0	21	0	0	21
6:45	0	0	0	0	0	0	24	0	0	24
Hour Total	0	0	0	0	0	0	52	0	0	52
*** Break ***										
Grand	0	0	0	0	0	0	52	0	0	52
% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	
Apprch %							100.0%			
% of Apprch	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	

Peak Hour Analysis By Entire Intersection for the Period: 06:00am to 08:45am on 06/19/03

Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Left	Thru	Rght	RTOR	Total	Percentages Left	Thru	Rght	RTOR
[illegible]thbound		06:00am	.0	0	0	0	0	0	0.0	0.0	0.0	0.0
Westbound	Edson St.		.0	0	0	0	0	0	0.0	0.0	0.0	0.0
Northbound	Sam Stratton Rd.		.0	0	0	0	0	0	0.0	0.0	0.0	0.0
Eastbound	Edson St.		.542	52	0	0	0	52	100.0	.0	.0	.0

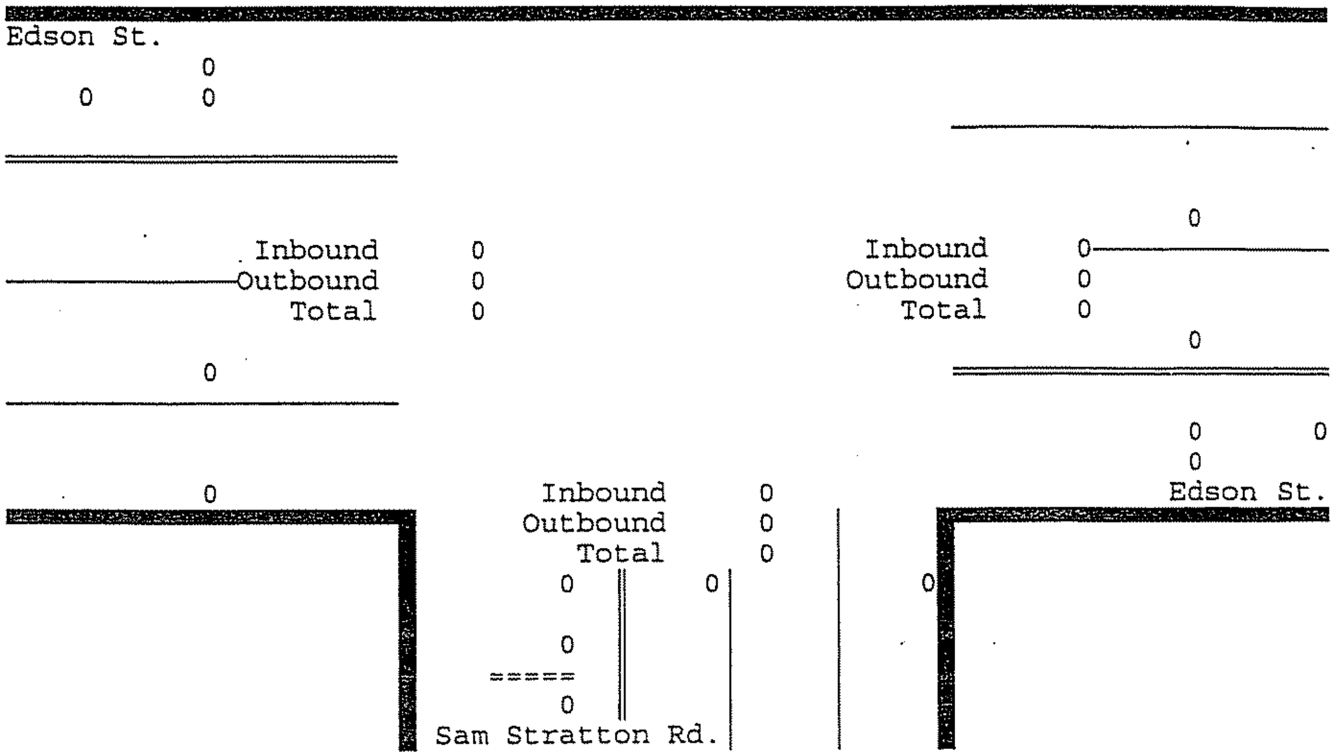
Creighton Manning Engineering

Amsterdam Landfill
C· ·rd by:SMD
L· ·ion :Amsterdam, NY
Other :

Site Code : 0003079[illegible]
Start Date: 06/19/03
File I.D. : TM3079A[illegible]
Page : 2

PC's turning rt. pl

PC's turning rt. pl



Creighton Manning Engineering, L.L.P.
4 Automation Lane
Albany, N.Y. 12205-1683
Turning Movement Counts

Project : Amsterdam Landfill
Cc ·d by: JM
Lo. .ion : Amsterdam, NY
Other :

Site Code : 03-079-5
Start Date: 06/19/03
File I.D. : TM3079A5
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Passengers, Heavy Vehicles

Start	dirt road Southbound				Edson St Westbound				Sam Stratton (EAST) Northbound				Edson St Eastbound						
Time	Left	Thru	Rght	RTOR	Left	Thru	Rght	RTOR	Left	Thru	Rght	RTOR	Left	Thru	Rght	RTOR	Total-	RTOR=	
6:00am	0	0	1	0	1	4	2	0	0	0	4	0	1	3	3	0	19	0	19
6:15	0	0	0	0	1	8	0	0	1	0	0	0	0	12	6	0	28	0	28
6:30	0	0	0	0	12	33	1	0	3	0	4	0	1	6	8	0	68	0	68
6:45	0	0	0	0	14	26	4	0	2	0	1	0	3	7	15	0	72	0	72
Hour Total	0	0	1	0	28	71	7	0	6	0	9	0	5	28	32	0	187	0	187
7:00am	0	0	0	0	3	8	1	0	0	0	1	0	0	7	2	0	22	0	22
7:15	0	0	1	0	3	1	1	0	2	0	1	0	1	13	2	0	25	0	25
7:30	0	0	1	0	9	7	4	0	1	0	0	0	2	11	5	0	40	0	40
7:45	0	0	0	0	21	5	2	0	1	0	3	0	5	22	8	0	67	0	67
Hour Total	0	0	2	0	36	21	8	0	4	0	5	0	8	53	17	0	154	0	154
8:00am	1	0	5	0	6	4	0	0	2	0	3	0	2	11	1	0	35	0	35
8:15	1	0	3	0	4	6	0	0	1	0	3	0	1	6	1	0	26	0	26
8:30	0	0	1	0	1	7	1	0	2	0	2	0	1	2	5	0	22	0	22
8:45	0	0	3	0	2	3	1	0	2	0	3	0	0	4	1	0	19	0	19
Hour Total	2	0	12	0	13	20	2	0	7	0	11	0	4	23	8	0	102	0	102
G.	2	0	15	0	77	112	17	0	17	0	25	0	17	104	57	0	443	0	443
% of Total	.5%	0.0%	3.4%	0.0%	17.4%	25.3%	3.8%	0.0%	3.8%	0.0%	5.6%	0.0%	3.8%	23.5%	12.9%	0.0%		0.0%	100.0%
Apprch %	3.8%				46.5%				9.5%				40.2%						
% of Apprch	11.8%	0.0%	88.2%	0.0%	37.4%	54.4%	8.3%	0.0%	40.5%	0.0%	59.5%	0.0%	9.6%	58.4%	32.0%	0.0%			

Peak Hour Analysis By Entire Intersection for the Period: 06:00am to 08:45am on 06/19/03

		Start	Peak Hr	.... Volumes			....		.... Percentages		
Direction	Street Name	Peak Hour	Factor	Left	Thru	Rght	Total	RTOR	Left	Thru	Rght
Southbound	dirt road	06:15am	.0	0	0	0	0	0	0.0	0.0	0.0
Westbound	Edson St		.603	30	75	6	111	0	27.0	67.5	5.4
Northbound	Sam Stratton (EAST)		.429	6	0	6	12	0	50.0	.0	50.0
Eastbound	Edson St		.670	4	32	31	67	0	5.9	47.7	46.2

Creighton Manning Engineering, L.L.P.
4 Automation Lane
Albany, N.Y. 12205-1683
Turning Movement Counts

Project : Amsterdam Landfill
Co ed by: JM
Lo ion : Amsterdam, NY
Other :

Site Code : 03-079-5
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Passengers, Heavy Vehicles

Passengers
Heavy Vehicles

dirt road

0 0 0 0 4
0 0 0 0 0
===== ===== ===== ===== 6
0 0 0 0 =====
10

Inbound 0
Outbound 10
Total 10

0
0 0

Edson St

6
81 75
0

4
4 0

Inbound 67
Outbound 81
Total 148

32
32 0

31
31 0

0
0 0

6
0 6

75
0 75

Inbound 111
Outbound 38 30
Total 149 0 30

0
32 38
6
Edson St

Inbound 12
Outbound 61
Total 73

30 6 0 6 0
0 0 0 0 0
31 ===== ===== ===== =====
===== 6 0 6 0
61

Sam Stratton (EAST)

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	AMM
Agency/Co.	CME, CHPCR8exam
Date Performed	7/3/03
Analysis Time Period	AM Peak of AST

Site Information

Intersection	Chapman / CR 8 (Widow Susan)
Jurisdiction	Town of Amsterdam
Analysis Year	2003 Existing

Project Description: Amsterdam Landfill, 03-079

East/West Street: Chapman Drive

North/South Street: CR 8 (Widow Susan)

Intersection Orientation: East-West

Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	7	4	0	0	3	73
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	12	7	0	0	3	83
Percent Heavy Vehicles	20	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	123	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.79	1.00	0.79
Hourly Flow Rate, HFR	0	0	0	155	0	12
Percent Heavy Vehicles	0	0	0	2	0	14
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	12						167	
C (m) (vph)	1404						925	
v/c	0.01						0.18	
95% queue length	0.03						0.66	
Control Delay	7.6						9.7	
LOS	A						A	
Approach Delay	--	--					9.7	
Approach LOS	--	--					A	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Chapman / CR 7 (Truax)
Agency/Co.	CME, CHPCR7exam	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	AM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street: Chapman Drive	North/South Street: CR 7 (Truax)
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	82	0	0	285	4
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	1	102	0	0	327	4
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	2	0	3
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.38	1.00	0.38
Hourly Flow Rate, HFR	0	0	0	5	0	7
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	1						12	
C (m) (vph)	1240						655	
v/c	0.00						0.02	
95% queue length	0.00						0.06	
Control Delay	7.9						10.6	
LOS	A						B	
Approach Delay	--	--				10.6		
Approach LOS	--	--				B		

>

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	CR 7 (Truax) / Rt 5 exit
Agency/Co.	CME, CR7R5exam	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	AM Peak of AST		

Project Description *Amsterdam Landfill*

East/West Street: *CR 7 (Truax) / Knickerbocker*	North/South Street: *Route 5 exit*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	2	286	0	0	0
Peak-Hour Factor, PHF	1.00	0.87	0.87	0.50	0.50	1.00
Hourly Flow Rate, HFR	0	2	328	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	83	0	1	0	0	0
Peak-Hour Factor, PHF	0.69	1.00	0.69	1.00	1.00	1.00
Hourly Flow Rate, HFR	120	0	1	0	0	0
Percent Heavy Vehicles	6	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (vph)		0		121				
C (m) (vph)		1241		816				
v/c		0.00		0.15				
95% queue length		0.00		0.52				
Control Delay		7.9		10.2				
LOS		A		B				
Approach Delay	--	--	10.2					
Approach LOS	--	--	B					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Route 5 E,W / Exit
Agency/Co.	CME, R5ER5Wexam	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079	
East/West Street: Route 5	North/South Street: Exit
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	15	542	0	0	343	69
Peak-Hour Factor, PHF	0.90	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR	16	602	0	0	381	76
Percent Heavy Vehicles	13	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	276	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.87	1.00	0.87
Hourly Flow Rate, HFR	0	0	0	317	0	11
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (vph)	16						328	
C (m) (vph)	1026						367	
v/c	0.02						0.89	
95% queue length	0.05						8.92	
Control Delay	8.6						58.1	
LOS	A						F	
Approach Delay	--	--				58.1		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMM*	Intersection	*Edson / Sam Stratton W*
Agency/Co.	*CME, EDSSSWexam*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/3/03*	Analysis Year	*2003 Existing*
Analysis Time Period	*AM Peak of AST*		

Project Description *Amsterdam Landfill, 03-079*

East/West Street:	*Edson*	North/South Street:	*Sam Stratton W*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	52	75	28	3	52	6
Peak-Hour Factor, PHF	0.68	0.68	0.68	0.61	0.61	0.61
Hourly Flow Rate, HFR	76	110	41	4	85	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	8	0	2	0	0	0
Peak-Hour Factor, PHF	0.50	0.50	0.50	1.00	1.00	1.00
Hourly Flow Rate, HFR	16	0	4	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	76	4		20			0	
C (m) (vph)	1513	1442		603				
v/c	0.05	0.00		0.03				
95% queue length	0.16	0.01		0.10				
Control Delay	7.5	7.5		11.2				
LOS	A	A		B				
Approach Delay	--	--		11.2				
Approach LOS	--	--		B				

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Edson / Sam Stratton E
Agency/Co.	CME, EDSSSEexam	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Edson	North/South Street: Sam Stratton E
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	32	31	30	75	6
Peak-Hour Factor, PHF	0.67	0.67	0.67	0.60	0.60	0.60
Hourly Flow Rate, HFR	5	47	46	49	124	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	6	0	6	0	0	0
Peak-Hour Factor, PHF	0.43	0.43	0.43	1.00	1.00	1.00
Hourly Flow Rate, HFR	13	0	13	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	5	49		26			0	
C (m) (vph)	1464	1514		773				
v/c	0.00	0.03		0.03				
95% queue length	0.01	0.10		0.10				
Control Delay	7.5	7.5		9.8				
LOS	A	A		A				
Approach Delay	--	--		9.8				
Approach LOS	--	--		A				

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Rt 5 E / Rt 5 connector
Agency/Co.	CME, R5EEMSexpm	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2003 Existing
Analysis Time Period	PM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street: Rt 5 East / E Main	North/South Street: Rt 5 connector / Park Drive
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	28	289	1	0	0	0
Peak-Hour Factor, PHF	0.92	0.92	0.92	1.00	1.00	1.00
Hourly Flow Rate, HFR	30	314	1	0	0	0
Percent Heavy Vehicles	5	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration	LTR					
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	18	0	1	4	0
Peak-Hour Factor, PHF	1.00	0.48	0.48	0.75	0.75	1.00
Hourly Flow Rate, HFR	0	37	0	1	5	0
Percent Heavy Vehicles	0	4	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR				TR	LT		
v (vph)	30				37	6		
C (m) (vph)	1604				541	543		
v/c	0.02				0.07	0.01		
95% queue length	0.06				0.22	0.03		
Control Delay	7.3				12.1	11.7		
LOS	A				B	B		
Approach Delay	--	--	12.1			11.7		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMM*	Intersection	*Rt 5 W / E Main*
Agency/Co.	*CME, R5WCHPexpm*	Jurisdiction	*City of Amsterdam*
Date Performed	*7/15/03*	Analysis Year	*2003 Existing*
Analysis Time Period	*PM Peak of AST*		

Project Description *Amsterdam Landfill, 03-079*

East/West Street: *Route 5 W / E Main*	North/South Street: *Chapman / Rt 5 connector*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*0*	*0*	*0*	*4*	*611*	*0*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.94*	*0.94*	*0.94*
Hourly Flow Rate, HFR	*0*	*0*	*0*	*4*	*650*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*1*	*0*
Configuration				*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*30*	*16*	*0*	*0*	*1*	*25*
Peak-Hour Factor, PHF	*0.64*	*0.64*	*1.00*	*1.00*	*0.59*	*0.59*
Hourly Flow Rate, HFR	*46*	*25*	*0*	*0*	*1*	*42*
Percent Heavy Vehicles	*0*	*6*	*0*	*0*	*0*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LTR*	*LT*					*TR*
v (vph)		*4*	*71*					*43*
C (m) (vph)		*1623*	*347*					*464*
v/c		*0.00*	*0.20*					*0.09*
95% queue length		*0.01*	*0.76*					*0.30*
Control Delay		*7.2*	*18.0*					*13.5*
LOS		*A*	*C*					*B*
Approach Delay	--	--	*18.0*			*13.5*		
Approach LOS	--	--	*C*			*B*		

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Chapman / CR 8 (Widow Susan)
Agency/Co.	CME, CHPCR8expm	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	PM Peak of AST		

Project Description *Amsterdam Landfill, 03-079*

East/West Street: *Chapman Drive* | North/South Street: *CR 8 (Widow Susan)*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	6	0	0	14	125
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.83	0.83
Hourly Flow Rate, HFR	9	7	0	0	16	150
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	81	0	12
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.83	1.00	0.83
Hourly Flow Rate, HFR	0	0	0	97	0	14
Percent Heavy Vehicles	0	0	0	10	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	9						111	
C (m) (vph)	1424						869	
v/c	0.01						0.13	
95% queue length	0.02						0.44	
Control Delay	7.5						9.7	
LOS	A						A	
Approach Delay	--	--				9.7		
Approach LOS	--	--				A		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Chapman / CR 7 (Truax)
Agency/Co.	CME, CHPCR7expm	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	PM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street: Chapman Drive	North/South Street: CR 7 (Truax)
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	3	311	0	0	88	5
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.91	0.91
Hourly Flow Rate, HFR	3	388	0	0	96	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	5	0	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.63	1.00	0.63
Hourly Flow Rate, HFR	0	0	0	7	0	0
Percent Heavy Vehicles	0	0	0	0	0	50
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	3						7	
C (m) (vph)	1504						539	
v/c	0.00						0.01	
95% queue length	0.01						0.04	
Control Delay	7.4						11.8	
LOS	A						B	
Approach Delay	--	--				11.8		
Approach LOS	--	--				B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMM*	Intersection	*CR 7 (Truax) / Rt 5 exit*
Agency/Co.	*CME, CR7R5expm*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/3/03*	Analysis Year	*2003 Existing*
Analysis Time Period	*PM Peak of AST*		

Project Description	*Amsterdam Landfill*		
East/West Street:	*CR 7 (Truax) / Knickerbocker*	North/South Street:	*Route 5 exit*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*0*	*0*	*88*	*0*	*2*	*0*
Peak-Hour Factor, PHF	*1.00*	*0.91*	*0.91*	*0.50*	*0.50*	*1.00*
Hourly Flow Rate, HFR	*0*	*0*	*96*	*0*	*4*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*312*	*0*	*0*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.78*	*1.00*	*0.78*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR	*400*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (vph)		*0*		*400*				
C (m) (vph)		*1510*		*957*				
v/c		*0.00*		*0.42*				
95% queue length		*0.00*		*2.09*				
Control Delay		*7.4*		*11.4*				
LOS		*A*		*B*				
Approach Delay	--	--	*11.4*					
Approach LOS	--	--	*B*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Route 5 E,W / Exit
Agency/Co.	CME, R5ER5Wexpm	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	PM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Route 5	North/South Street: Exit
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	15	285	0	0	754	297
Peak-Hour Factor, PHF	0.90	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR	16	316	0	0	837	330
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	76	0	12
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.87	1.00	0.87
Hourly Flow Rate, HFR	0	0	0	87	0	13
Percent Heavy Vehicles	0	0	0	2	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (vph)	16						100	
C (m) (vph)	606						244	
v/c	0.03						0.41	
95% queue length	0.08						1.89	
Control Delay	11.1						29.6	
LOS	B						D	
Approach Delay	--	--				29.6		
Approach LOS	--	--				D		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Edson / Sam Stratton W
Agency/Co.	CME, EDSSSWexpm	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	PM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Edson	North/South Street: Sam Stratton W
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	11	41	13	4	85	9
Peak-Hour Factor, PHF	0.68	0.68	0.68	0.54	0.54	0.54
Hourly Flow Rate, HFR	16	60	19	7	157	16
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	43	1	3	8	1	118
Peak-Hour Factor, PHF	0.62	0.62	0.62	0.29	0.29	0.29
Hourly Flow Rate, HFR	69	1	4	27	3	406
Percent Heavy Vehicles	2	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	16	7		74			436	
C (m) (vph)	1416	1532		275			864	
v/c	0.01	0.00		0.27			0.50	
95% queue length	0.03	0.01		1.06			2.90	
Control Delay	7.6	7.4		22.8			13.3	
LOS	A	A		C			B	
Approach Delay	--	--		22.8			13.3	
Approach LOS	--	--		C			B	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Edson / Sam Stratton E
Agency/Co.	CME, EDSSSEexpm	Jurisdiction	Town of Amsterdam
Date Performed	7/3/03	Analysis Year	2003 Existing
Analysis Time Period	PM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Edson	North/South Street: Sam Stratton E
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	52	13	8	50	1
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.88	0.88	0.88
Hourly Flow Rate, HFR	1	69	17	9	56	1
Percent Heavy Vehicles	0	--	--	60	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	23	0	28	1	0	6
Peak-Hour Factor, PHF	0.39	0.39	0.39	0.56	0.56	0.56
Hourly Flow Rate, HFR	58	0	71	1	0	10
Percent Heavy Vehicles	11	0	3	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	1	9		129			11	
C (m) (vph)	1560	1213		875			979	
v/c	0.00	0.01		0.15			0.01	
95% queue length	0.00	0.02		0.52			0.03	
Control Delay	7.3	8.0		9.8			8.7	
LOS	A	A		A			A	
Approach Delay	--	--		9.8			8.7	
Approach LOS	--	--		A			A	

2005 No-Build

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Rt 5 E / Rt 5 connector
Agency/Co.	CME, R5EEMSnbam	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 No-Build
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Rt 5 East / E Main	North/South Street: Rt 5 connector / Park Drive
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	20	575	24	0	0	0
Peak-Hour Factor, PHF	0.88	0.88	0.88	1.00	1.00	1.00
Hourly Flow Rate, HFR	22	653	27	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration	LTR					
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	15	2	2	5	0
Peak-Hour Factor, PHF	1.00	0.58	0.58	0.75	0.75	1.00
Hourly Flow Rate, HFR	0	25	3	2	6	0
Percent Heavy Vehicles	0	8	0	13	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR				TR	LT		
v (vph)	22				28	8		
C (m) (vph)	1636				353	334		
v/c	0.01				0.08	0.02		
95% queue length	0.04				0.26	0.07		
Control Delay	7.2				16.1	16.0		
LOS	A				C	C		
Approach Delay	--	--	16.1			16.0		
Approach LOS	--	--	C			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Rt 5 W / E Main
Agency/Co.	CME, R5WCHPnbam	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 No-Build
Analysis Time Period	AM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Route 5 W / E Main	North/South Street:	Chapman / Rt 5 connector
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	0	0	3	274	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.86	0.86	0.86
Hourly Flow Rate, HFR	0	0	0	3	318	1
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration				LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	16	19	0	0	4	15
Peak-Hour Factor, PHF	0.75	0.75	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR	21	25	0	0	5	20
Percent Heavy Vehicles	0	6	0	0	0	14
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LTR	LT					TR
v (vph)		3	46					25
C (m) (vph)		1623	591					673
v/c		0.00	0.08					0.04
95% queue length		0.01	0.25					0.12
Control Delay		7.2	11.6					10.6
LOS		A	B					B
Approach Delay	--	--	11.6			10.6		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Chapman / CR 8 (Widow Susan)
Agency/Co.	CME, CHPCR8nbam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	AM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Chapman Drive	North/South Street:	CR 8 (Widow Susan)
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	7	4	0	0	3	76
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	12	7	0	0	3	87
Percent Heavy Vehicles	20	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	128	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.79	1.00	0.79
Hourly Flow Rate, HFR	0	0	0	162	0	12
Percent Heavy Vehicles	0	0	0	2	0	14
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	12						174	
C (m) (vph)	1399						923	
v/c	0.01						0.19	
95% queue length	0.03						0.69	
Control Delay	7.6						9.8	
LOS	A						A	
Approach Delay	--	--				9.8		
Approach LOS	--	--				A		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Chapman / CR 7 (Truax)
Agency/Co.	CME, CHPCR7nbam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	AM Peak of AST		
Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Chapman Drive	North/South Street:	CR 7 (Truax)
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	86	0	0	297	4
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	1	107	0	0	341	4
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	2	0	3
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.38	1.00	0.38
Hourly Flow Rate, HFR	0	0	0	5	0	7
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	1						12	
C (m) (vph)	1225						641	
v/c	0.00						0.02	
95% queue length	0.00						0.06	
Control Delay	7.9						10.7	
LOS	A						B	
Approach Delay	--	--					10.7	
Approach LOS	--	--					B	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SMD*	Intersection	*CR 7 (Truax) / Rt 5 exit*
Agency/Co.	*CME, CR7R5nbam*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/14/03*	Analysis Year	*2005 No-Build*
Analysis Time Period	*AM Peak of AST*		

Project Description *Amsterdam Landfill*

East/West Street: *CR 7 (Truax) / Knickerbocker*	North/South Street: *Route 5 exit*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*0*	*2*	*298*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*1.00*	*0.87*	*0.87*	*0.50*	*0.50*	*1.00*
Hourly Flow Rate, HFR	*0*	*2*	*342*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*87*	*0*	*1*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.69*	*1.00*	*0.69*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR	*126*	*0*	*1*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (vph)		*0*		*127*				
C (m) (vph)		*1226*		*808*				
v/c		*0.00*		*0.16*				
95% queue length		*0.00*		*0.56*				
Control Delay		*7.9*		*10.3*				
LOS		*A*		*B*				
Approach Delay	--	--	*10.3*					
Approach LOS	--	--	*B*					

HCS2000™

Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Route 5 E,W / Exit
Agency/Co.	CME, R5ER5Wnbam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Route 5 | North/South Street: Exit

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	563	0	0	357	72
Peak-Hour Factor, PHF	0.90	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR	17	625	0	0	396	80
Percent Heavy Vehicles	13	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	288	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.87	1.00	0.87
Hourly Flow Rate, HFR	0	0	0	331	0	11
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (vph)	17						342	
C (m) (vph)	1009						351	
v/c	0.02						0.97	
95% queue length	0.05						10.78	
Control Delay	8.6						76.8	
LOS	A						F	
Approach Delay	--	--					76.8	
Approach LOS	--	--					F	

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Edson / Sam Stratton W
Agency/Co.	CME, EDSSSWnbam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	AM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street:	Edson	North/South Street:	Sam Stratton W
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	54	78	29	3	54	6
Peak-Hour Factor, PHF	0.68	0.68	0.68	0.61	0.61	0.61
Hourly Flow Rate, HFR	79	114	42	4	88	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	8	0	2	0	0	0
Peak-Hour Factor, PHF	0.50	0.50	0.50	1.00	1.00	1.00
Hourly Flow Rate, HFR	16	0	4	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	79	4		20			0	
C (m) (vph)	1509	1436		592				
v/c	0.05	0.00		0.03				
95% queue length	0.17	0.01		0.10				
Control Delay	7.5	7.5		11.3				
LOS	A	A		B				
Approach Delay	--	--		11.3				
Approach LOS	--	--		B				

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SMD*	Intersection	*Edson / Sam Stratton E*
Agency/Co.	*CME, EDSSSEnbam*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/14/03*	Analysis Year	*2005 No-Build*
Analysis Time Period	*AM Peak of AST*		

Project Description *Amsterdam Landfill, 03-079*

East/West Street:	*Edson*	North/South Street:	*Sam Stratton E*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	33	32	31	78	6
Peak-Hour Factor, PHF	0.67	0.67	0.67	0.60	0.60	0.60
Hourly Flow Rate, HFR	5	49	47	51	129	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	6	0	6	0	0	0
Peak-Hour Factor, PHF	0.43	0.43	0.43	1.00	1.00	1.00
Hourly Flow Rate, HFR	13	0	13	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	5	51		26			0	
C (m) (vph)	1458	1510		763				
v/c	0.00	0.03		0.03				
95% queue length	0.01	0.10		0.11				
Control Delay	7.5	7.5		9.9				
LOS	A	A		A				
Approach Delay	--	--	9.9					
Approach LOS	--	--	A					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMM*	Intersection	*Rt 5 E / Rt 5 connector*
Agency/Co.	*CME, R5EEMSnbpm*	Jurisdiction	*City of Amsterdam*
Date Performed	*7/15/03*	Analysis Year	*2005 No-Build*
Analysis Time Period	*PM Peak of AST*		

Project Description	*Amsterdam Landfill, 03-079*		
East/West Street:	*Rt 5 East / E Main*	North/South Street:	*Rt 5 connector / Park Drive*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	29	301	1	0	0	0
Peak-Hour Factor, PHF	0.92	0.92	0.92	1.00	1.00	1.00
Hourly Flow Rate, HFR	31	327	1	0	0	0
Percent Heavy Vehicles	5	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration	LTR					
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	19	0	1	4	0
Peak-Hour Factor, PHF	1.00	0.48	0.48	0.75	0.75	1.00
Hourly Flow Rate, HFR	0	39	0	1	5	0
Percent Heavy Vehicles	0	4	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR				TR	LT		
v (vph)	31				39	6		
C (m) (vph)	1604				529	532		
v/c	0.02				0.07	0.01		
95% queue length	0.06				0.24	0.03		
Control Delay	7.3				12.3	11.8		
LOS	A				B	B		
Approach Delay	--	--	12.3			11.8		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Rt 5 W / E Main
Agency/Co.	CME, R5WCHPnbpm	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 No-Build
Analysis Time Period	PM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Route 5 W / E Main	North/South Street:	Chapman / Rt 5 connector
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	0	0	4	636	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.94	0.94	0.94
Hourly Flow Rate, HFR	0	0	0	4	676	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration				LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	31	17	0	0	1	26
Peak-Hour Factor, PHF	0.64	0.64	1.00	1.00	0.59	0.59
Hourly Flow Rate, HFR	48	26	0	0	1	44
Percent Heavy Vehicles	0	6	0	0	0	4
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LTR	LT					TR
v (vph)		4	74					45
C (m) (vph)		1623	332					448
v/c		0.00	0.22					0.10
95% queue length		0.01	0.84					0.33
Control Delay		7.2	18.9					13.9
LOS		A	C					B
Approach Delay	--	--	18.9			13.9		
Approach LOS	--	--	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Chapman / CR 8 (Widow Susan)
Agency/Co.	CME, CHPCR8nbpm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	PM Peak of AST		

Project Description *Amsterdam Landfill, 03-079*

East/West Street: *Chapman Drive*	North/South Street: *CR 8 (Widow Susan)*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	6	0	0	15	130
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	14	10	0	0	17	149
Percent Heavy Vehicles	20	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	84	0	12
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.79	1.00	0.79
Hourly Flow Rate, HFR	0	0	0	106	0	15
Percent Heavy Vehicles	0	0	0	2	0	14
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	14						121	
C (m) (vph)	1310						864	
v/c	0.01						0.14	
95% queue length	0.03						0.49	
Control Delay	7.8						9.8	
LOS	A						A	
Approach Delay	--	--				9.8		
Approach LOS	--	--				A		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SMD*	Intersection	*Chapman / CR 7 (Truax)*
Agency/Co.	*CME, CHPCR7nbpm*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/14/03*	Analysis Year	*2005 No-Build*
Analysis Time Period	*PM Peak of AST*		

Project Description *Amsterdam Landfill, 03-079*

East/West Street: *Chapman Drive*	North/South Street: *CR 7 (Truax)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	3	324	0	0	92	5
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	3	404	0	0	105	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	5	0	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.38	1.00	0.38
Hourly Flow Rate, HFR	0	0	0	13	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	3						13	
C (m) (vph)	1493						520	
v/c	0.00						0.03	
95% queue length	0.01						0.08	
Control Delay	7.4						12.1	
LOS	A						B	
Approach Delay	--	--				12.1		
Approach LOS	--	--				B		

>

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SMD*	Intersection	*CR 7 (Truax) / Rt 5 exit*
Agency/Co.	*CME, CR7R5nbpm*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/14/03*	Analysis Year	*2005 No-Build*
Analysis Time Period	*PM Peak of AST*		

Project Description *Amsterdam Landfill*

East/West Street: *CR 7 (Truax) / Knickerbocker* | North/South Street: *Route 5 exit*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*0*	*0*	*92*	*0*	*2*	*0*
Peak-Hour Factor, PHF	*1.00*	*0.87*	*0.87*	*0.50*	*0.50*	*1.00*
Hourly Flow Rate, HFR	*0*	*0*	*105*	*0*	*4*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*325*	*0*	*0*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.69*	*1.00*	*0.69*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR	*471*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (vph)		*0*		*471*				
C (m) (vph)		*1499*		*942*				
v/c		*0.00*		*0.50*				
95% queue length		*0.00*		*2.86*				
Control Delay		*7.4*		*12.6*				
LOS		*A*		*B*				
Approach Delay	--	--	*12.6*					
Approach LOS	--	--	*B*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Route 5 E,W / Exit
Agency/Co.	CME, R5ER5Wnbpm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	PM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Route 5	North/South Street: Exit
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	286	0	0	785	309
Peak-Hour Factor, PHF	0.90	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR	17	317	0	0	872	343
Percent Heavy Vehicles	13	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	80	0	12
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.87	1.00	0.87
Hourly Flow Rate, HFR	0	0	0	91	0	13
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (vph)	17						104	
C (m) (vph)	512						229	
v/c	0.03						0.45	
95% queue length	0.10						2.19	
Control Delay	12.3						33.2	
LOS	B						D	
Approach Delay	--	--				33.2		
Approach LOS	--	--				D		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Edson / Sam Stratton W
Agency/Co.	CME, EDSSSWnbpm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	PM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Edson	North/South Street:	Sam Stratton W
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	11	43	14	4	88	9
Peak-Hour Factor, PHF	0.68	0.68	0.68	0.61	0.61	0.61
Hourly Flow Rate, HFR	16	63	20	6	144	14
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	45	1	3	8	1	123
Peak-Hour Factor, PHF	0.50	0.50	0.50	0.29	0.29	0.29
Hourly Flow Rate, HFR	90	2	6	27	3	424
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	16	6		98			454	
C (m) (vph)	1434	1527		276			880	
v/c	0.01	0.00		0.36			0.52	
95% queue length	0.03	0.01		1.54			3.03	
Control Delay	7.5	7.4		25.1			13.4	
LOS	A	A		D			B	
Approach Delay	--	--	25.1			13.4		
Approach LOS	--	--	D			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Edson / Sam Stratton E
Agency/Co.	CME, EDSSSEnbpm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 No-Build
Analysis Time Period	PM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Edson	North/South Street:	Sam Stratton E
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	54	14	8	52	1
Peak-Hour Factor, PHF	0.67	0.67	0.67	0.88	0.88	0.88
Hourly Flow Rate, HFR	1	80	20	9	59	1
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	24	0	29	1	0	6
Peak-Hour Factor, PHF	0.43	0.43	0.43	0.56	0.56	0.56
Hourly Flow Rate, HFR	55	0	67	1	0	10
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	1	9		122			11	
C (m) (vph)	1556	1505		876			972	
v/c	0.00	0.01		0.14			0.01	
95% queue length	0.00	0.02		0.48			0.03	
Control Delay	7.3	7.4		9.8			8.7	
LOS	A	A		A			A	
Approach Delay	--	--	9.8			8.7		
Approach LOS	--	--	A			A		

2005 Build

2010 Build

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMM*	Intersection	*Rt 5 E / Rt 5 connector*
Agency/Co.	*CME, R5EEMSbuam*	Jurisdiction	*City of Amsterdam*
Date Performed	*7/15/03*	Analysis Year	*2005 Build*
Analysis Time Period	*AM Peak of AST*		

Project Description *Amsterdam Landfill, 03-079*	
East/West Street: *Rt 5 East / E Main*	North/South Street: *Rt 5 connector / Park Drive*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	23	575	24	0	0	0
Peak-Hour Factor, PHF	0.88	0.88	0.88	1.00	1.00	1.00
Hourly Flow Rate, HFR	26	653	27	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration	LTR					
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	15	2	2	5	0
Peak-Hour Factor, PHF	1.00	0.58	0.58	0.75	0.75	1.00
Hourly Flow Rate, HFR	0	25	3	2	6	0
Percent Heavy Vehicles	0	8	0	13	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR				TR	LT		
v (vph)	26				28	8		
C (m) (vph)	1636				349	330		
v/c	0.02				0.08	0.02		
95% queue length	0.05				0.26	0.07		
Control Delay	7.2				16.2	16.2		
LOS	A				C	C		
Approach Delay	--	--	16.2			16.2		
Approach LOS	--	--	C			C		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Rt 5 W / E Main
Agency/Co.	CME, R5WCHPbuam	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street:	Route 5 W / E Main	North/South Street:	Chapman / Rt 5 connector
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	0	0	3	274	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.86	0.86	0.86
Hourly Flow Rate, HFR	0	0	0	3	318	1
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration				LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	16	22	0	0	4	18
Peak-Hour Factor, PHF	0.75	0.75	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR	21	29	0	0	5	24
Percent Heavy Vehicles	0	6	0	0	0	14
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LTR	LT					TR
v (vph)		3	50					29
C (m) (vph)		1623	589					676
v/c		0.00	0.08					0.04
95% queue length		0.01	0.28					0.13
Control Delay		7.2	11.7					10.6
LOS		A	B					B
Approach Delay	--	--	11.7			10.6		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Chapman / Truck Access
Agency/Co.	CME, CHPTRAbuam	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street: Chapman Drive	North/South Street: Truck Access
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	3	19	0	0	19	2
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	3	23	0	0	23	2
Percent Heavy Vehicles	100	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	2	0	3
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	0	0	0	2	0	3
Percent Heavy Vehicles	0	0	0	100	0	100
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	3						5	
C (m) (vph)	1133						798	
v/c	0.00						0.01	
95% queue length	0.01						0.02	
Control Delay	8.2						9.5	
LOS	A						A	
Approach Delay	--	--				9.5		
Approach LOS	--	--				A		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Chapman / CR 8 (Widow Susan)
Agency/Co.	CME, CHPCR8buam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Chapman Drive	North/South Street:	CR 8 (Widow Susan)
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	5	0	0	4	79
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	14	8	0	0	4	90
Percent Heavy Vehicles	20	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	128	0	11
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.79	1.00	0.79
Hourly Flow Rate, HFR	0	0	0	162	0	13
Percent Heavy Vehicles	0	0	0	2	0	14
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	14						175	
C (m) (vph)	1394						912	
v/c	0.01						0.19	
95% queue length	0.03						0.71	
Control Delay	7.6						9.9	
LOS	A						A	
Approach Delay	--	--				9.9		
Approach LOS	--	--				A		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Chapman / CR 7 (Truax)
Agency/Co.	CME, CHPCR7buam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Chapman Drive	North/South Street: CR 7 (Truax)
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	86	0	0	297	4
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	6	107	0	0	341	4
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	2	0	4
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.38	1.00	0.38
Hourly Flow Rate, HFR	0	0	0	5	0	10
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	6						15	
C (m) (vph)	1225						648	
v/c	0.00						0.02	
95% queue length	0.01						0.07	
Control Delay	8.0						10.7	
LOS	A						B	
Approach Delay	--	--					10.7	
Approach LOS	--	--					B	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	CR 7 (Truax) / Rt 5 exit
Agency/Co.	CME, CR7R5buam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description	Amsterdam Landfill		
East/West Street:	CR 7 (Truax) / Knickerbocker	North/South Street:	Route 5 exit
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	2	299	0	0	0
Peak-Hour Factor, PHF	1.00	0.87	0.87	0.50	0.50	1.00
Hourly Flow Rate, HFR	0	2	343	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	91	0	1	0	0	0
Peak-Hour Factor, PHF	0.69	1.00	0.69	1.00	1.00	1.00
Hourly Flow Rate, HFR	131	0	1	0	0	0
Percent Heavy Vehicles	6	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (vph)		0		132				
C (m) (vph)		1225		807				
v/c		0.00		0.16				
95% queue length		0.00		0.58				
Control Delay		7.9		10.3				
LOS		A		B				
Approach Delay	--	--	10.3					
Approach LOS	--	--	B					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Route 5 E,W / Exit
Agency/Co.	CME, R5ER5Wbuam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Route 5	North/South Street: Exit
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	563	0	0	361	76
Peak-Hour Factor, PHF	0.90	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR	17	625	0	0	401	84
Percent Heavy Vehicles	13	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	289	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.87	1.00	0.87
Hourly Flow Rate, HFR	0	0	0	332	0	11
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (vph)	17						343	
C (m) (vph)	1001						349	
v/c	0.02						0.98	
95% queue length	0.05						10.97	
Control Delay	8.7						79.1	
LOS	A						F	
Approach Delay	--	--				79.1		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Edson / Sam Stratton W
Agency/Co.	CME, EDSSSWbuam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Edson	North/South Street:	Sam Stratton W
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	54	78	37	3	54	6
Peak-Hour Factor, PHF	0.68	0.68	0.68	0.61	0.61	0.61
Hourly Flow Rate, HFR	79	114	54	4	88	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	8	0	2	0	0	0
Peak-Hour Factor, PHF	0.50	0.50	0.50	1.00	1.00	1.00
Hourly Flow Rate, HFR	16	0	4	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	79	4		20			0	
C (m) (vph)	1509	1422		587				
v/c	0.05	0.00		0.03				
95% queue length	0.17	0.01		0.11				
Control Delay	7.5	7.5		11.3				
LOS	A	A		B				
Approach Delay	--	--	11.3					
Approach LOS	--	--	B					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Edson / Sam Stratton E
Agency/Co.	CME, EDSSSEbuam	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	AM Peak of AST		

Project Description	Amsterdam Landfill, 03-079		
East/West Street:	Edson	North/South Street:	Sam Stratton E
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	33	32	38	78	6
Peak-Hour Factor, PHF	0.67	0.67	0.67	0.60	0.60	0.60
Hourly Flow Rate, HFR	5	49	47	63	129	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	6	0	6	0	0	0
Peak-Hour Factor, PHF	0.43	0.43	0.43	1.00	1.00	1.00
Hourly Flow Rate, HFR	13	0	13	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	5	63		26			0	
C (m) (vph)	1458	1510		743				
v/c	0.00	0.04		0.03				
95% queue length	0.01	0.13		0.11				
Control Delay	7.5	7.5		10.0+				
LOS	A	A		B				
Approach Delay	--	--	10.0+					
Approach LOS	--	--	B					

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*SMD*
Agency/Co.	*CME, SSRESDbuam*
Date Performed	*7/14/03*
Analysis Time Period	*AM Peak of AST*

Site Information

Intersection	*Sam Stratton / Employee Drwy*
Jurisdiction	*City of Amsterdam*
Analysis Year	*2005 Build*

Project Description *Amsterdam Landfill, 03-079*

East/West Street: *Sam Stratton Rd* — North/South Street: *Employee Drwy/Sam Stratton E*

Intersection Orientation: *North-South* — Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	0	0	0	7	0
Peak-Hour Factor, PHF	0.75	0.75	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR	0	0	0	0	9	0
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	0	0	8
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.75	1.00	0.75
Hourly Flow Rate, HFR	0	0	0	0	0	10
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	0						10	
C (m) (vph)	1611						1073	
v/c	0.00						0.01	
95% queue length	0.00						0.03	
Control Delay	7.2						8.4	
LOS	A						A	
Approach Delay	--	--				8.4		
Approach LOS	--	--				A		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Rt 5 E / Rt 5 connector
Agency/Co.	CME, R5EEMSbupm	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description: Amsterdam Landfill, 03-079

East/West Street: Rt 5 East / E Main	North/South Street: Rt 5 connector / Park Drive
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	32	301	1	0	0	0
Peak-Hour Factor, PHF	0.92	0.92	0.92	1.00	1.00	1.00
Hourly Flow Rate, HFR	34	327	1	0	0	0
Percent Heavy Vehicles	5	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration	LTR					
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	19	0	1	4	0
Peak-Hour Factor, PHF	1.00	0.48	0.48	0.75	0.75	1.00
Hourly Flow Rate, HFR	0	39	0	1	5	0
Percent Heavy Vehicles	0	4	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR				TR	LT		
v (vph)	34				39	6		
C (m) (vph)	1604				524	526		
v/c	0.02				0.07	0.01		
95% queue length	0.06				0.24	0.03		
Control Delay	7.3				12.4	11.9		
LOS	A				B	B		
Approach Delay	--	--	12.4			11.9		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMM*	Intersection	*Rt 5 W / E Main*
Agency/Co.	*CME, R5WCHPbupm*	Jurisdiction	*City of Amsterdam*
Date Performed	*7/15/03*	Analysis Year	*2005 Build*
Analysis Time Period	*PM Peak of AST*		

Project Description	*Amsterdam Landfill, 03-079*		
East/West Street:	*Route 5 W / E Main*	North/South Street:	*Chapman / Rt 5 connector*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*0*	*0*	*0*	*4*	*636*	*0*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.94*	*0.94*	*0.94*
Hourly Flow Rate, HFR	*0*	*0*	*0*	*4*	*676*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*1*	*0*
Configuration				*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*31*	*20*	*0*	*0*	*1*	*29*
Peak-Hour Factor, PHF	*0.64*	*0.64*	*1.00*	*1.00*	*0.59*	*0.59*
Hourly Flow Rate, HFR	*48*	*31*	*0*	*0*	*1*	*49*
Percent Heavy Vehicles	*0*	*6*	*0*	*0*	*0*	*4*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LTR*	*LT*					*TR*
v (vph)		*4*	*79*					*50*
C (m) (vph)		*1623*	*331*					*448*
v/c		*0.00*	*0.24*					*0.11*
95% queue length		*0.01*	*0.91*					*0.37*
Control Delay		*7.2*	*19.3*					*14.0*
LOS		*A*	*C*					*B*
Approach Delay	--	--	*19.3*			*14.0*		
Approach LOS	--	--	*C*			*B*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AMM	Intersection	Chapman / Truck Access
Agency/Co.	CME, CHPTRAbupm	Jurisdiction	City of Amsterdam
Date Performed	7/15/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street: Chapman Drive	North/South Street: Truck Access
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	3	17	0	0	27	2
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	3	21	0	0	33	2
Percent Heavy Vehicles	100	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	2	0	3
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	0	0	0	2	0	3
Percent Heavy Vehicles	0	0	0	100	0	100
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	3						5	
C (m) (vph)	1122						787	
v/c	0.00						0.01	
95% queue length	0.01						0.02	
Control Delay	8.2						9.6	
LOS	A						A	
Approach Delay	--	--				9.6		
Approach LOS	--	--				A		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SMD*	Intersection	*Chapman / CR 8 (Widow Susan)*
Agency/Co.	*CME, CHPCR8bupm*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/14/03*	Analysis Year	*2005 Build*
Analysis Time Period	*PM Peak of AST*		

Project Description	*Amsterdam Landfill, 03-079*		
East/West Street:	*Chapman Drive*	North/South Street:	*CR 8 (Widow Susan)*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*9*	*7*	*0*	*0*	*16*	*130*
Peak-Hour Factor, PHF	*0.56*	*0.56*	*1.00*	*1.00*	*0.87*	*0.87*
Hourly Flow Rate, HFR	*16*	*12*	*0*	*0*	*18*	*149*
Percent Heavy Vehicles	*20*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*0*	*0*	*0*	*87*	*0*	*13*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.79*	*1.00*	*0.79*
Hourly Flow Rate, HFR	*0*	*0*	*0*	*110*	*0*	*16*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*14*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (vph)	*16*						*126*	
C (m) (vph)	*1309*						*857*	
v/c	*0.01*						*0.15*	
95% queue length	*0.04*						*0.51*	
Control Delay	*7.8*						*9.9*	
LOS	*A*						*A*	
Approach Delay	--	--				*9.9*		
Approach LOS	--	--				*A*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Chapman / CR 7 (Truax)
Agency/Co.	CME, CHPCR7bupm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description: Amsterdam Landfill, 03-079	
East/West Street: Chapman Drive	North/South Street: CR 7 (Truax)
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	324	0	0	92	5
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR	4	404	0	0	105	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	5	0	4
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.38	1.00	0.38
Hourly Flow Rate, HFR	0	0	0	13	0	10
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	4						23	
C (m) (vph)	1493						647	
v/c	0.00						0.04	
95% queue length	0.01						0.11	
Control Delay	7.4						10.8	
LOS	A						B	
Approach Delay	--	--				10.8		
Approach LOS	--	--				B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	CR 7 (Truax) / Rt 5 exit
Agency/Co.	CME, CR7R5bupm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description *Amsterdam Landfill*

East/West Street:	CR 7 (Truax) / Knickerbocker	North/South Street:	Route 5 exit
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	0	96	0	2	0
Peak-Hour Factor, PHF	1.00	0.87	0.87	0.50	0.50	1.00
Hourly Flow Rate, HFR	0	0	110	0	4	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	326	0	0	0	0	0
Peak-Hour Factor, PHF	0.69	1.00	0.69	1.00	1.00	1.00
Hourly Flow Rate, HFR	472	0	0	0	0	0
Percent Heavy Vehicles	6	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (vph)		0		472				
C (m) (vph)		1493		938				
v/c		0.00		0.50				
95% queue length		0.00		2.89				
Control Delay		7.4		12.7				
LOS		A		B				
Approach Delay	--	--	12.7					
Approach LOS	--	--	B					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Route 5 E,W / Exit
Agency/Co.	CME, R5ER5Wbupm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street: Route 5	North/South Street: Exit
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	286	0	0	786	310
Peak-Hour Factor, PHF	0.90	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR	17	317	0	0	873	344
Percent Heavy Vehicles	13	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	84	0	12
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.87	1.00	0.87
Hourly Flow Rate, HFR	0	0	0	96	0	13
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (vph)	17						109	
C (m) (vph)	511						228	
v/c	0.03						0.48	
95% queue length	0.10						2.37	
Control Delay	12.3						34.5	
LOS	B						D	
Approach Delay	--	--				34.5		
Approach LOS	--	--				D		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Edson / Sam Stratton W
Agency/Co.	CME, EDSSSWbupm	Jurisdiction	Town of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description Amsterdam Landfill, 03-079

East/West Street:	Edson	North/South Street:	Sam Stratton W
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	11	43	14	4	88	9
Peak-Hour Factor, PHF	0.68	0.68	0.68	0.61	0.61	0.61
Hourly Flow Rate, HFR	16	63	20	6	144	14
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	53	1	3	8	1	123
Peak-Hour Factor, PHF	0.50	0.50	0.50	0.29	0.29	0.29
Hourly Flow Rate, HFR	106	2	6	27	3	424
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	16	6		114			454	
C (m) (vph)	1434	1527		273			880	
v/c	0.01	0.00		0.42			0.52	
95% queue length	0.03	0.01		1.96			3.03	
Control Delay	7.5	7.4		27.3			13.4	
LOS	A	A		D			B	
Approach Delay	--	--	27.3			13.4		
Approach LOS	--	--	D			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SMD*	Intersection	*Edson / Sam Stratton E*
Agency/Co.	*CME, EDSSSEbupm*	Jurisdiction	*Town of Amsterdam*
Date Performed	*7/14/03*	Analysis Year	*2005 Build*
Analysis Time Period	*PM Peak of AST*		

Project Description	*Amsterdam Landfill, 03-079*		
East/West Street:	*Edson*	North/South Street:	*Sam Stratton E*
Intersection Orientation:	*East-West*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*1*	*54*	*14*	*8*	*52*	*1*
Peak-Hour Factor, PHF	*0.67*	*0.67*	*0.67*	*0.88*	*0.88*	*0.88*
Hourly Flow Rate, HFR	*1*	*80*	*20*	*9*	*59*	*1*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*24*	*0*	*36*	*1*	*0*	*6*
Peak-Hour Factor, PHF	*0.43*	*0.43*	*0.43*	*0.56*	*0.56*	*0.56*
Hourly Flow Rate, HFR	*55*	*0*	*83*	*1*	*0*	*10*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (vph)	*1*	*9*		*138*			*11*	
C (m) (vph)	*1556*	*1505*		*886*			*969*	
v/c	*0.00*	*0.01*		*0.16*			*0.01*	
95% queue length	*0.00*	*0.02*		*0.55*			*0.03*	
Control Delay	*7.3*	*7.4*		*9.8*			*8.8*	
LOS	*A*	*A*		*A*			*A*	
Approach Delay	--	--	*9.8*			*8.8*		
Approach LOS	--	--	*A*			*A*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SMD	Intersection	Sam Stratton / Employee Drwy
Agency/Co.	CME, SSRESDbupm	Jurisdiction	City of Amsterdam
Date Performed	7/14/03	Analysis Year	2005 Build
Analysis Time Period	PM Peak of AST		

Project Description *Amsterdam Landfill, 03-079*

East/West Street:	Sam Stratton Rd	North/South Street:	Employee Drwy/Sam Stratton E
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	7	0	0	0	0
Peak-Hour Factor, PHF	0.75	0.75	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR	10	9	0	0	0	0
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	
Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	0	0	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.75	1.00	0.75
Hourly Flow Rate, HFR	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph)	10						0	
C (m) (vph)	1623							
v/c	0.01							
95% queue length	0.02							
Control Delay	7.2							
LOS	A							
Approach Delay	--	--						
Approach LOS	--	--						

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Appendix J
Leachate Quality Literature

CONSTRUCTION AND DEMOLITION WASTE LANDFILLS

Prepared for

U.S. Environmental Protection Agency
Office of Solid Waste

by

ICF Incorporated
Contract No. 68-W3-0008

February 1995

*** May 18, 1995 Draft Report ***

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) is currently developing a rule addressing non-municipal facilities (industrial waste facilities, including construction and demolition waste landfills) that may receive hazardous wastes from conditionally exempt small quantity generators (CESQGs), or generators of less than 100 kilograms per month of hazardous waste. This report, prepared in support of EPA's rulemaking, presents information on construction and demolition (C&D) waste landfills, i.e., landfills that receive materials generated from the construction or destruction of structures such as buildings, roads, and bridges. C&D waste landfills are being examined because the Agency believes that the largest potential impact from this rulemaking will be on these facilities.

BACKGROUND

The 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) required EPA to revise the existing standards and guidelines governing the management of household hazardous wastes and hazardous wastes from small quantity generators. EPA responded in 1991 by revising the existing criteria for solid waste disposal facilities and practices (40 CFR Part 257). In 1991 EPA issued revised criteria in 40 CFR Part 258 for municipal solid waste landfills (MSWLFs) that receive household hazardous wastes and CESQG wastes. EPA did not establish revised criteria for non-municipal facilities and subsequently was sued by the Sierra Club. A consent agreement was reached in January 1994, and EPA is now fulfilling the remainder of the HSWA mandate by regulating non-municipal facilities that may receive CESQG wastes. The final rule must be signed by the EPA Administrator by May 15, 1995. The rule will require facilities receiving CESQG wastes to have adequate ground-water monitoring, corrective action requirements, and location restrictions.

COMPOSITION OF C&D WASTE

Information on the composition of C&D waste is presented below. Most of this information was compiled from the literature by the National Association of Demolition Contractors (NADC); a small number of other readily available sources were used as well. These source documents provide only snapshots of the C&D waste stream in specific locations and at specific points (e.g., generation) rather than providing a complete cradle-to-grave picture of C&D wastes nationwide, or of the portion landfilled.

C&D waste is generated from the construction, renovation, repair, and demolition of structures such as residential and commercial buildings, roads, and bridges. The composition of C&D waste varies for these different activities and structures. Overall, C&D waste is composed mainly of wood products, asphalt, drywall, and masonry; other components often present in significant quantities include metals, plastics, earth, shingles, insulation, and paper and cardboard.

C&D debris also contains wastes that may be hazardous. The source documents identify a number of wastes that are referred to using such terms as "hazardous," "excluded," "unacceptable," "problem," "potentially toxic," or "illegal." It is not necessarily true that all of these wastes meet the definition of "hazardous" under Subtitle C of RCRA, but they provide an indication of the types of hazardous wastes that may be present in the C&D waste stream. They can be divided into four categories:

- Excess materials used in construction, and their containers. *Examples: adhesives and adhesive containers, leftover paint and paint containers, excess roofing cement and roofing cement cans;*
- Waste oils, grease, and fluids. *Examples: machinery lubricants, brake fluid, form oil, engine oil;*
- Other discrete items. *Examples: batteries, fluorescent bulbs, appliances;* and
- Inseparable constituents of bulk items. *Examples: formaldehyde present in carpet, treated or coated wood.*

Some of these components are excluded from C&D landfills by state regulations.

C&D LANDFILL LEACHATE QUALITY

Construction and demolition landfill leachate sampling data were collected from states and from the general literature by NADC. Leachate sampling data for 305 parameters sampled for at one or more of 21 C&D landfills were compiled into a database.

Of the 305 parameters sampled for, 93 were detected at least once. The highest detected concentrations of these parameters were compared to regulatory or health-based "benchmarks," or concern levels, identified for each parameter. Safe Drinking Water Act Maximum Contaminant Levels (MCLs) or Secondary Maximum Contaminant Levels (SMCLs) were used as the benchmarks if available. Otherwise, health-based benchmarks for a leachate ingestion scenario were identified; these were either reference doses (RfDs) for non-carcinogens, or 10^{-6} risk-specific doses (RSDs) for carcinogens. Benchmarks were unavailable for many parameters because they have not been studied sufficiently.

Of the 93 parameters detected in C&D landfill leachate, 24 had at least one measured value above the regulatory or health-based benchmark.[1] For each of the parameters exceeding benchmarks (except pH), the median leachate concentration was calculated and compared to its benchmark. The median value was first calculated among the samples taken at each landfill, and then across all landfills at which the parameter was detected. Due to anomalies and inconsistencies among the sampling equipment used at different times and at different landfills, non-detects were not considered in determining median values; i.e., the non-detects were discarded before calculating both individual landfill concentration medians and medians across landfills. Thus, the median leachate concentrations represent the median among the detected values, rather than the median among all values. The median concentration among all values would in most cases have been lower than those calculated here.

Based on (1) the number of landfills at which the benchmark was exceeded and (2) a comparison between the median detected concentration and the benchmark, seven constituents emerge as being potentially problematic. They are listed in the table below. Also shown are the number of landfills at which the constituent was sampled, the

C&D LANDFILL LEACHATE - POTENTIALLY PROBLEMATIC CONSTITUENTS

Constituent	No. Landfills Sampled	No. Landfills Detected	No. Landfills > Benchmark	Ratio of Median to Benchmark
1,2-Dichloroethane	9	3	3	4
Methylene chloride	9	4	3	3
Cadmium	19	14	12	2
Iron	20	20	19	37
Lead	18	15	13	4
Manganese	14	14	13	59
Total dissolved solids	18	17	15	4

[1]In the case of pH, the "exceedances" were actually pH values below the regulatory range.

number of landfills at which the constituent was detected, the number of landfills at which the constituent was detected above its benchmark, and the ratio of the median detected concentration to the benchmark.

For three of the seven parameters listed in the table (iron, manganese, and TDS), the benchmarks are secondary MCLs (SMCLs), which are set to protect water supplies for aesthetic reasons (e.g., taste) rather than for health-based reasons. None of the remaining four parameters exceeds its benchmark by a factor of 10 or more, indicating that concentrations in ground water where monitoring wells or drinking water wells may be located are likely to fall below the health-based benchmarks.

Conclusions regarding C&D landfill leachate quality must be viewed with an understanding of the data limitations. The most important limitation is that the 21 landfills represented in this report comprise just over one percent of the approximately 1,800 C&D landfills in the United States. Thus, the representativeness of the sample is questionable. Other limitations are discussed in the body of the report.

STATE REGULATIONS

State statutes and regulations for C&D landfills were summarized, and similarities and differences between current state requirements for C&D landfills and federal requirements for MSWLFs were evaluated. The following summarizes the key findings:

- **All states regulate off-site C&D landfills to some extent.** Thirteen states require off-site C&D landfills to meet state MSWLF requirements (in many states, these requirements are not as stringent as the federal MSWLF requirements found in 40 CFR Part 258), while the remaining 37 have developed separate regulations that are specific to off-site C&D landfills.[2]

- **Only seven states exempt on-site C&D landfills from regulatory requirements.** Of the remaining 43 states, 11 require on-site C&D landfills to meet state sanitary landfill requirements (in many states, these requirements are not as stringent as 40 CFR Part 258), 8 have developed separate regulations applicable to only on-site landfills, and the remaining 24 have extended the regulations for off-site landfills to on-site landfills.

- **Sixteen states mandate location restrictions, ground-water monitoring, and corrective action for off-site C&D landfills.** These requirements, however, vary in stringency relative to 40 CFR Part 258. For example, **only two states have location restrictions, ground-water monitoring, and corrective action requirements for off-site C&D landfills that are at least as stringent as 40 CFR Part 258.**

- **The most common 40 CFR Part 258 location restrictions that states apply to C&D landfills relate to: airports and bird hazards, wetlands, and floodplains.** Several states have moved beyond federal requirements and <u>prohibit</u> the siting of on-site (eight states) and off-site (nine states) C&D landfills in floodplains. Fewer states have adopted the 40 CFR Part 258 requirements regarding faults, seismic zones, and unstable areas.

- **A majority of states impose additional location restrictions on C&D landfills.** The most common additional restrictions are: near ground and surface waters, and near endangered species habitats.

- **Twenty-nine states (nearly 60 percent) require off-site C&D landfills to monitor ground water.** Of these 29 states, 5 have requirements substantially similar to 40 CFR Part 258, while 24

[2]Ohio expects to have specific C&D management requirements effective by the end of 1995.

have requirements that are less stringent.[3] **The remaining 21 states do not require ground-water monitoring requirements.** Of these 21, however, 12 "may" require ground-water monitoring if the regulatory authority deems it necessary.

- **Twenty-four states (nearly 50 percent) require on-site C&D landfills to monitor ground water.** Of these 24, only 4 have requirements substantially similar to 40 CFR Part 258, while 20 have requirements that are less stringent. **The remaining 26 states do not require ground-water monitoring.** Of these 26, 9 states "may" require ground-water monitoring if the regulatory authority deems it necessary.

- **Twenty-two states have corrective action requirements for off-site C&D landfills.** These states either require the permit applicant to submit a corrective action plan with the permit application, or require the facility owner/operator to submit a plan after a release to ground water is detected.

- **Sixteen states have corrective action requirements for on-site C&D landfills.** Again, these states either require the permit applicant to submit a corrective action plan with the permit application, or require the facility owner/operator to submit a plan after a release to ground water is detected.

- **States also have mandated permit, design and operating, post-closure, and financial assurance requirements for both on-site and off-site C&D landfills.** The most common of these is permitting requirements. Respectively, 45 and 38 states require off-site and on-site C&D landfills to obtain a permit.[4] Thirty-four states require some post-closure time period for off-site landfills (11 require at least 30 years and 23 require less than 30 years). Additionally, 33 states require off-site C&D landfills to obtain financial assurance for closure, while 32 require it for post-closure care.

- **Twenty-four states prohibit <u>all</u> hazardous wastes from disposal at off-site C&D landfills.** In addition, three and four states require that only inert waste and C&D waste be disposed, respectively. Fourteen states do not specifically prohibit disposal of all hazardous wastes at off-site C&D landfills. In general, the regulations for these states note that only waste specified in permit may be accepted, or only "regulated" or "controlled" hazardous waste is prohibited. Finally, five states do not specifically identify any restrictions on waste disposal at off-site C&D landfills.

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[3]Ohio currently does not have ground-water monitoring, but monitoring is expected to be part of C&D management regulations that should be finalized by the end of 1995.

[4]Ohio requires a permit for C&D landfills.

CHAPTER 1
INTRODUCTION

This report presents information on construction and demolition (C&D) waste landfills. These are landfills that receive materials generated predominantly from the construction or destruction of structures such as buildings, roads, and bridges. There are currently over 1,800 C&D waste landfills operating in the United States.

This report was written in support of a rulemaking currently being developed by the U.S. Environmental Protection Agency (EPA). This chapter provides a background discussion of this rulemaking, and then discusses the purpose and organization of this report.

REGULATORY BACKGROUND

The Resource Conservation and Recovery Act (RCRA), passed in 1976, required the Environmental Protection Agency (EPA) to promulgate standards and guidelines for the management of solid wastes. In response to this mandate, EPA promulgated regulations for the management of hazardous wastes under Subtitle C of RCRA, and for non-hazardous wastes under Subtitle D. The Subtitle C standards applied to all facilities generating more than 1,000 kg/mo of hazardous wastes, but conditionally exempted from full regulation facilities generating less than this amount. Subtitle D guidelines address the management of all other solid wastes, such as municipal wastes and non-hazardous industrial wastes (including construction and demolition wastes).

In 1984, Congress passed the Hazardous and Solid Waste Amendments (HSWA), which made several changes to RCRA. One important change was the creation of two categories of small quantity hazardous waste generators: generators of 100 to 1,000 kg/mo, and generators of less than 100 kg/mo. HSWA added specific provisions for the first category, but gave EPA discretion as to whether to promulgate new requirements for the second. EPA has since defined generators of less than 100 kg/mo as conditionally-exempt small quantity generators, or CESQGs. CESQGs are responsible for the proper management of their wastes, but are not required to comply with many of the Subtitle C regulations specified for larger hazardous waste generators.

Another important change imposed by HSWA was the addition of Section 4010 to Subtitle D, requiring EPA to promulgate revised criteria addressing the management of household hazardous wastes and hazardous wastes from small quantity generators. EPA responded in October 1991 by promulgating the revised Municipal Solid Waste Landfill (MSWLF) Criteria (40 CFR Part 258). This partially fulfilled the HSWA mandate by addressing household hazardous wastes and CESQG wastes that are disposed in MSWLFs. After a consent agreement with the Sierra Club on January 28, 1994, EPA is now fulfilling the remainder of the HSWA mandate by regulating CESQG wastes that are disposed in non-municipal facilities. The final rule must be signed by the EPA Administrator by May 15, 1995. The rule will require non-municipal facilities receiving CESQG wastes to have adequate ground-water monitoring, corrective action requirements, and location restrictions.

FOCUS ON C&D LANDFILLS

CESQGs currently send their wastes to many different types of Subtitle D waste management units other than MSWLFs, including the following:

- Commercial Subtitle D industrial waste landfills;
- On-site Subtitle D industrial waste management units such as landfills, surface impoundments, land treatment units, and waste piles; and
- C&D waste landfills.

EPA believes that the only waste management units that may be impacted significantly by this rulemaking are the C&D landfills. The Agency believes that most of the 10 to 20 commercial Subtitle D industrial waste landfills in existence today already have adequate ground-water monitoring, corrective action requirements, and location restrictions. EPA also believes that CESQGs currently disposing of their wastes in on-site Subtitle D waste management units will simply start sending the hazardous portion of their waste stream off site, at relatively low cost.

On the other hand, the rulemaking will have an impact on C&D landfills. C&D landfills are therefore the focus of this report.

SCOPE AND ORGANIZATION OF THIS REPORT

This report examines C&D waste characteristics, C&D landfill leachate quality, and state regulations addressing C&D waste management facilities.

- Chapter 2 discusses the composition of C&D wastes, including any hazardous materials or constituents that are found;

- Chapter 3 presents information on the quality of C&D landfill leachate, based on sampling data taken from landfills around the country; and

- Chapter 4 presents a detailed summary of state regulations pertaining to C&D facilities. It identifies states that have regulations related to ground-water monitoring; corrective action; location restrictions; and facility design, operation, closure, and/or post closure care; and provides the specifics of those requirements.

The first two chapters are based predominantly on information supplied to EPA by the National Association of Demolition Contractors (NADC), supplemented with a small number of other readily available studies. The chapter on state regulations is based on original research performed for this report.

CHAPTER 2
CHARACTERISTICS OF CONSTRUCTION AND DEMOLITION WASTES

This chapter presents information on the composition and characteristics of the C&D waste stream based on four source documents:

- The National Association of Demolition Contractors's (NADC's) *C&D Waste Characterization Database: Volume 1 - Compilation of Report Excerpts* (1994);

- NADC's *C&D Waste Characterization Database: Volume 1 - Compilation of Articles* (1994);

- Hanrahan's *Construction and Demolition Debris Disposal Issues: An Alachua County Perspective* (1994); and

- Lambert and Domizio's *Construction and Demolition Waste Disposal: Management Problems and Alternative Solutions* (1993).

The source documents provide only snapshots of the C&D waste stream in specific locations (e.g., Vermont) and at specific points (e.g., at generation) rather than providing a complete cradle-to-grave picture of the nationwide C&D waste stream, or of the portion that is landfilled. This report reflects that segmented characterization of the waste stream and includes waste characterization information based on generated wastes. In some areas, a large portion of the complete C&D waste stream may be recycled, burned, left on site, or illegally disposed (Apotheker, 1990; Piasecki et al., 1990; Spencer, 1991; Lambert and Domizio, 1993; McGregor et al., 1993); thus, the characterizations presented in this report may be somewhat different from those of the landfilled portion of the waste stream. In Vermont, for example, only about one-third of the waste stream went to landfills in 1989 (Spencer, 1991).

The first section of this chapter discusses factors that influence C&D waste composition and characteristics. The second section provides information on components and their proportions in the C&D waste stream. The final section focuses specifically on the components and constituents of C&D waste that the source documents characterize using the terms "hazardous," "excluded," "contaminants," "chemical constituents that could affect the use of the waste as fuel," "special," "unacceptable," "problem," "potentially toxic," "nonhazardous restrictive," or "illegal." Throughout this chapter these components are referred to as "problematic." These "problematic" wastes are **not** necessarily wastes that are classified as hazardous under RCRA Subtitle C.

FACTORS THAT INFLUENCE C&D WASTE COMPOSITION

C&D wastes are categorized in a variety of ways, and each category produces wastes with different composition and characteristics. For example, road C&D waste differs from bridge waste, which differs from building waste. Whereas road C&D generates large quantities of just a few different waste items (mainly asphalt and concrete), building C&D generates many different waste items in smaller amounts (with wood as the largest single item). Within the category of building C&D waste, the size and type of the building (e.g., an apartment building versus a single-family house) affects the composition of the waste. Even for one building type (e.g., a single-family house), the waste generated depends on the activity conducted (i.e., new construction, renovation, or demolition). For example, construction generally produces "clean," unaltered, and separate waste items (e.g., unpainted wood, new concrete) (MVC, 1992). In contrast, demolition wastes may include more items that have been altered or mixed (e.g., wood painted with lead-based paint, concrete with hazardous waste spilled on it) (MVC, 1992).

Thus, three main factors affect the characteristics of C&D waste (MVC, 1992):

- Structure type (e.g., residential, commercial, or industrial building, road, bridge);
- Structure size (e.g., low-rise, high-rise); and
- Activity being performed (e.g., construction, renovation, repair, demolition).

Additional factors that influence the type and quantity of C&D waste produced include (MVC, 1992; McGregor et al., 1993):

- Size of the project as a whole (e.g., custom-built residence versus tract housing);
- Location of the project (e.g., waterfront versus inland, rural versus urban);
- Materials used in construction (e.g., brick versus wood);
- Demolition practices (e.g., manual versus mechanical);
- Schedule (e.g., rushed versus paced); and
- Contractors' "housekeeping" practices.

Other factors do not affect the type and quantity of C&D waste **produced**, but do affect the type and quantity **reported** in the source documents and therefore in this report. These include:

- How state regulations define what is and is not acceptable as C&D waste;
- Where in the waste stream the C&D waste is measured (e.g., generation point, recycling station, landfill); and
- How the C&D waste is measured (e.g., by volume or weight).

The next section provides information on the components of C&D waste and their proportions in the waste stream.

COMPONENTS OF C&D WASTE

Overall, C&D waste streams are comprised mainly of wood products, asphalt, drywall (gypsum)[5], and masonry (e.g., concrete, bricks). Other notable components include metals, plastics, earth, shingles, and insulation. In one county, waste identified by the source document as "hazardous" has been estimated to comprise 0.4 percent of construction waste by weight (Triangle J Council of Governments, 1993)[6]; this is discussed further in the final section of this chapter. Table 2-1 provides a complete list of components of C&D wastes mentioned in the source documents. The bold print denotes the "problematic" components, i.e., components that the source documents refer to as "hazardous," "excluded," "contaminants," "chemical constituents that could affect the use of the waste as fuel," "special," "unacceptable," "problem," "potentially toxic," "nonhazardous restrictive," or "illegal."

In general, wood comprises one-quarter to one-third of the C&D waste stream. Other generalizations are hard to make because (1) different studies address different segments of the nation's

5 Drywall is excluded from some C&D landfills because anaerobic breakdown of gypsum produces hydrogen sulfide.

6 Hazardous waste percentage estimate is for the 1990 Orange County, North Carolina construction waste stream (SCS Engineers, 1991 as cited in Triangle J Council of Governments, 1993).

TABLE 2-1
COMPONENTS OF C&D WASTE

ASPHALT paving shingles	PAINT **paint containers and waste** **paint products**	WALL COVERINGS **drywall (gypsum)** plaster
EARTH dirt sand, foundry soil	PAPER PRODUCTS cardboard fiberboard, paperboard paper	WOOD cabinets composites millends pallets, shipping skids, and crating lumber particle board plywood siding trees: limbs, brush, stumps, and tops veneer
ELECTRICAL fixtures wiring	PETROLEUM PRODUCTS **brake fluid** **form oil** **fuel tanks** **oil filters** **petroleum distillates** **waste oils and greases**	WOOD CONTAMINANTS **adhesives and resins** **laminates** **paintings and coatings** **preservatives** **stains/varnishes** **other chemical additives**
INSULATION **asbestos** building extruded polystyrene (rigid) **fiberglass (bat)** roofing	PLASTICS buckets pipe (PVC) polyethylene sheets styrofoam sheeting or bags laminate	MISCELLANEOUS **adhesives and adhesive cansaerosol** **cans** **air conditioning units** **appliances ("white goods")** **batteries** **carpeting** **caulk (tubes)** ceiling tiles **driveway sealants (buckets)** **epoxy containers** **fiberglass** fines fireproofing products (overspray) floor tiles **furniture** **garbage** glass **lacquer thinners** leather **light bulbs, fluorescent and HID** light bulbs, other linoleum organic material packaging, foam **pesticide containers** rubber **sealers and sealer tubes** sheathing silicon containers **solvent containers and waste** street sweepings textiles **thermostat switches** **tires** **transformers** water treatment plant lime sludge
MASONRY AND RUBBLE bricks cinder blocks concrete mortar, excess porcelain rock stone tile	ROOF MATERIALS **asbestos shingles** roofing, built up **roofing cement cans** roofing shingles roofing tar tar paper	
METAL aluminum (cans, ducts, siding) brass fixtures, plumbing flashing gutters **mercury from electrical switches** iron **lead** nails pipe (steel, copper) sheet metal steel (structural, banding, decking, rerod) studs, metal wire (e.g., copper)	VINYL siding flooring doors windows	

Source: Summarized from NADC, 1994a and 1994b; Hanrahan, 1994; and Lambert and Domizio, 1993.

C&D waste stream (e.g., road and bridge waste may be excluded from some studies; information in another study may be for waste from construction only or demolition only) and (2) C&D waste composition varies greatly from one category to another. The graphs and tables in this section provide examples of the composition of portions of the C&D waste stream. Note that they vary with location (e.g., Florida versus Vermont) and category of waste (e.g., construction versus demolition). Viewed together, they provide a good overall picture of the North American C&D waste stream, and show important differences among different categories of C&D waste.

C&D Waste Including Road and Bridge Waste (Vermont)

Figure 2-1 provides a picture of the composition of Vermont's complete C&D waste stream by weight, based on a comprehensive C&D generation study. Asphalt comprises approximately one-half of the waste stream, wood one-quarter, and concrete one-sixth (Cosper et al., 1993).

C&D Waste Excluding Road and Bridge Waste (Florida)

Figure 2-2 provides an example of the composition by volume of the C&D waste stream received at a C&D recycling facility in Florida. Although the source document (Cosper et al., 1993) states that the facility accepts "the complete C/D waste stream," it appears that the facility receives the complete **building** C&D waste stream, but does not receive wood or bridge waste, because asphalt is not listed as a component of the waste. Approximately one-third of the waste volume is wood (Cosper et al., 1993). Drywall comprises one-sixth and paper and cardboard together comprise one-sixth of the total volume (Cosper et al., 1993).

Construction-only Waste Versus Demolition-only Waste

Approximately one-third of the construction waste volume in Toronto is wood, and masonry and tile comprise less than one-sixth of the construction waste (Figure 2-3) (THBA, 1991). Demolition waste is also comprised of approximately one-third wood (in the U.S.), but concrete makes up over one-half of demolition waste (Figure 2-4) (Chatterjee-U.S. Army as cited in SPARK, 1991).

C&D Waste by Housing Type

Table 2-2 compares residential construction waste to commercial construction waste in the Twin Cities, Minnesota. Wood comprises one-fifth to one-third of the waste stream in both cases. Concrete, brick, and steel waste are greater from commercial construction than from residential, as would be expected.

COMPONENTS OF C&D WASTE THAT ARE POTENTIALLY "PROBLEMATIC"

Hazardous wastes comprise a small percentage of the C&D waste stream (McGregor et al., 1993), and can potentially cause adverse effects to human health and ecosystems (Lambert and Domizio, 1993). For example, inhalation of urea formaldehyde (a resin used in insulation and as a wood preservative) has caused a health syndrome called "ultra-sensitive allergies" in demolition workers (Lambert and Domizio, 1993). Creosote (a wood preservative) can potentially leach into ground water and discharge into surface water, possibly adversely affecting drinking water or aquatic life if concentrations reach high enough levels (Lambert and Domizio, 1993).

This section describes the "problematic" components and constituents of C&D waste and, where information was available (i.e., for treated and coated wood), the proportion of those constituents in the

FIGURE 2-1
COMPOSITION OF C&D WASTE STREAM IN VERMONT (BY WEIGHT; 1989 DATA)
(Source: C.T. Donovan Associates, 1990)

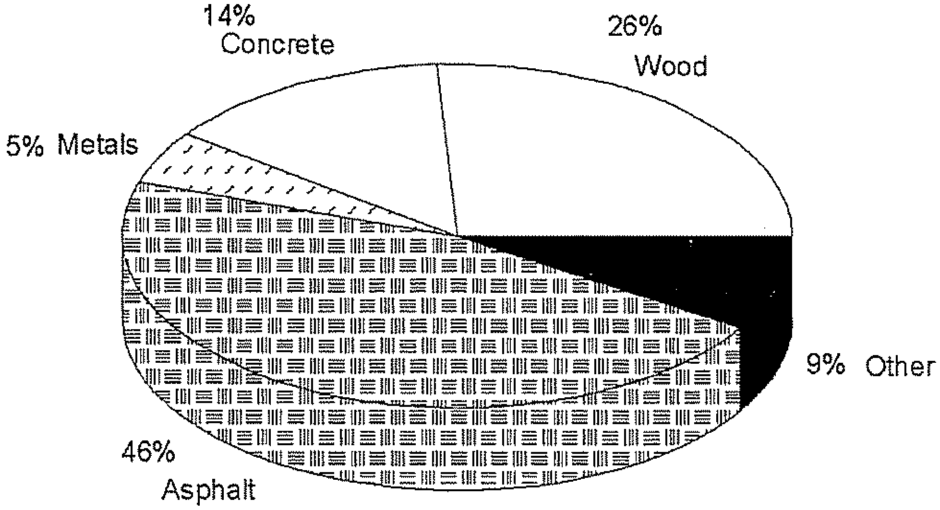

FIGURE 2-2
COMPOSITION OF THE BUILDING C&D WASTE STREAM IN FLORIDA (BY VOLUME)
(Source: Wood, 1992 as cited in Cosper et al., 1993)

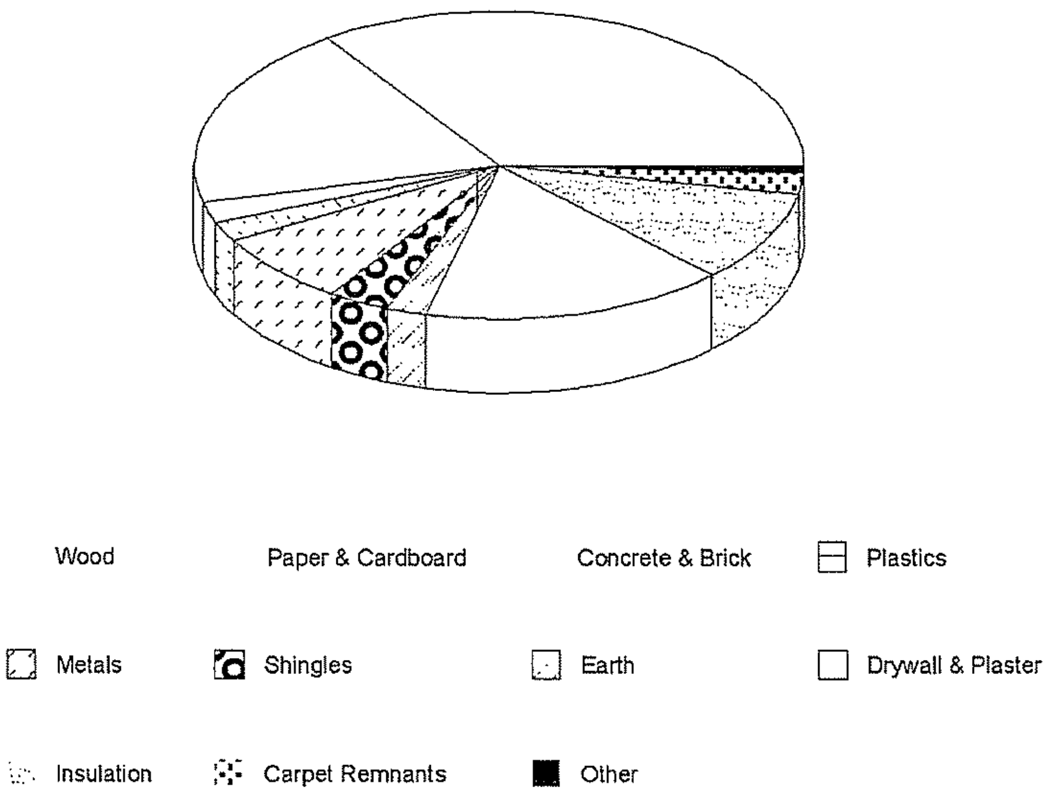

FIGURE 2-3
COMPOSITION OF CONSTRUCTION WASTE IN TORONTO (BY VOLUME)
(Source: THBA, 1991)

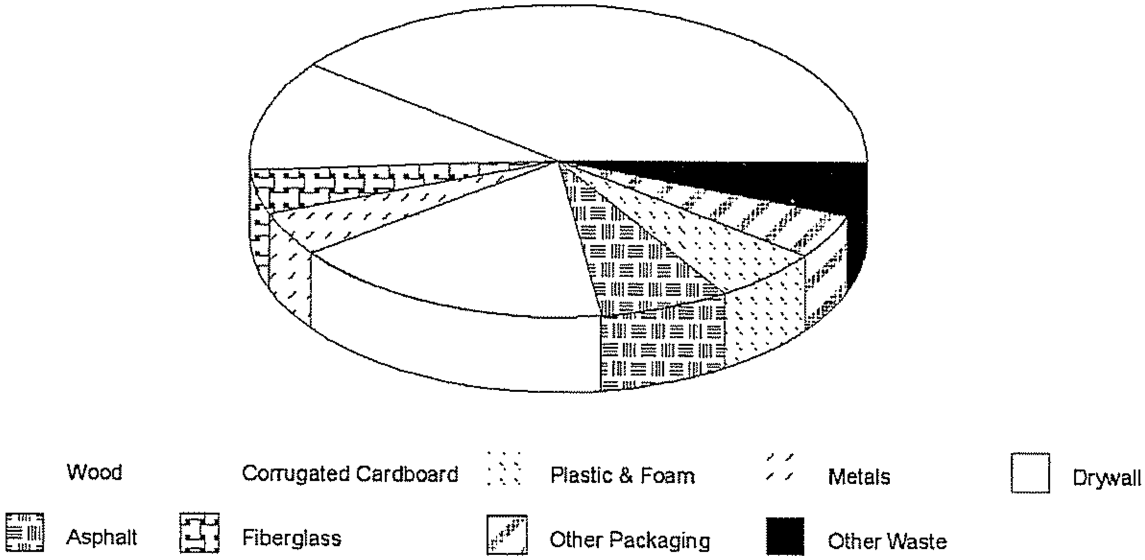

FIGURE 2-4
COMPOSITION OF U.S. DEMOLITION WASTE
(Source: Chatterjee-U.S. Army, as cited in SPARK, 1991)

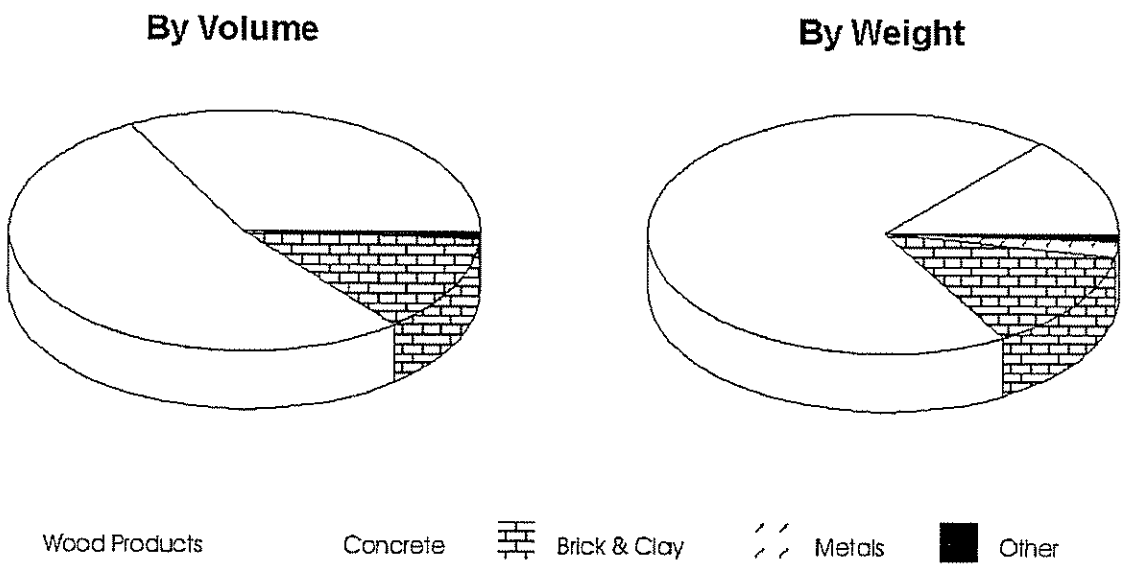

TABLE 2-2
COMPOSITION OF CONSTRUCTION WASTE BY CONSTRUCTION TYPE IN THE TWIN CITIES IN MINNESOTA (BY VOLUME) (Source: Lauer, 1993)

Waste Type	Residential Construction	Commercial Construction
Wood	20-35%	20-30%
Crates & pallets	--	1-5%
Cardboard	5-15%	5-10%
Paper packaging	<1%	~3%
Concrete & block	1-8%	10-20%
Brick	--	1-5%
Drywall	10-20%	5-10%
Electrical wire	<1%	~2%
Shingles	1-8%	--
Fiberboard	1-8%	--
Steel	<1%	1-8%
Plastic sheeting and bags	<1%	~3%
Polystyrene insulation	--	~3%
Overspray from fireproofing products	--	0-5%
Notable other materials (comprising <1% each)		
carpet scrap	<1%	<1%
solvent containers	--	<1%
epoxy containers	--	<1%
silicone containers	--	<1%
plastic laminate	--	<1%
Possible "problem materials"		
driveway sealants	<1%	--
adhesive containers	<1%	<1%
caulking containers	<1%	<1%
paint cans (including frozen or damaged)	<1%	<1%

-- Indicates that the waste was not listed under that category.

waste item. Table 2-3 lists "problematic" components and constituents of C&D waste. These "problematic" wastes are **not** necessarily wastes that are classified as hazardous under RCRA Subtitle C. Some may be "problematic" simply because they are recyclable (e.g., cardboard) or because they are outside the definition of C&D waste as defined by a particular jurisdiction (e.g., garbage).

It is also important to note that wastes that some jurisdictions exclude from C&D landfills or recycling centers are sometimes brought to the C&D disposal areas nonetheless. In some cases these wastes are detected and rejected (Cosper et al., 1993; Lauer, 1993), but in other cases they may not be screened out (Gates et al., 1993), and evidence shows that they are found in C&D landfills (Piasecki et al., 1990).

For discussion purposes, the "problematic" C&D wastes are divided into four categories:

- Excess hazardous materials used in construction and their containers;
- Waste oils and greases and other fluids from machinery;
- Other discrete items; and
- Incidental constituents that are inseparable from bulk C&D wastes (e.g., wood treatment chemicals).

Excess Potentially Hazardous Materials

Construction activities can produce excess "hazardous" materials and "empty" containers containing small quantities of "hazardous" materials. (The source, McGregor et al., 1993, does not define "hazardous," so these wastes may or may not be defined as hazardous under RCRA Subtitle C.) Adhesives and adhesive containers, leftover paint and paint containers, and excess roofing cement and roofing cement cans are a few examples. In some cases construction workers dump leftover paints or solvents on the ground (McGregor et al., 1993). Others may use sawdust, kitty litter, or masking tape to "dry" up empty paint cans and solvent containers (McGregor et al., 1993). "Hazardous" wastes may be disposed of in a dumpster, left at the construction site for a cleanup contractor, self-hauled to a landfill, or returned to the shop[7] (McGregor et al., 1993). Table 2-4 characterizes the 46 pounds of wastes referred to as "hazardous" from construction of a typical 1,850 square-foot single-family residence in Portland, Oregon. Assuming that the total waste weight produced by construction of some 1,810 square-foot houses in Oregon is typical, the 46 pounds would comprise less than 1 percent by weight of the total construction waste (including recycled waste), and less than 10 percent of the landfilled waste.

Machinery Lubricants

Waste oils, greases, and machine fluids are also generated by C&D activities. Examples include brake fluid, form oil, and engine oil (McGregor et al., 1993).

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[7] Based on a survey of twenty builders and subcontractors in Oregon (many of whom are conditionally-exempt small quantity generators (CESQGs)), some CESQGs want more information on how and where to dispose of small quantities of hazardous wastes (McGregor et al., 1993).

TABLE 2-3
"PROBLEMATIC" COMPONENTS OF C&D WASTE
IDENTIFIED BY THE SOURCE DOCUMENTS

Waste Item	Source
CONTAINERS AND EXCESS	
aerosol cans	10
adhesives	3,6,10
caulk	6,8,10
coatings	10
concrete & concrete products	10
containers with liquids	7
driveway sealants	6
drums and containers	2
fuel tanks	2,11
joint compound	10
lacquer thinners	15
paints	3,6,7,10,11,15
pesticides	15
resins	10
roofing cement	10
sealers	10
solvents	10
MACHINERY LUBRICANTS & FUEL	
brake fluid	10
form oil	10
oils and greases, waste	10
oil filters	15
INSEPARABLE CONSTITUENTS OF BULK ITEMS	
asbestos	1,2,3,11,12,14,17
formaldehyde (in carpeting)	2
lead	1,3
lead flashing	16
WOOD CONTAMINANTS	

Waste Item	Source
lead solder	16
petroleum constituents, leachable from asphalt or roofing tars	16
sulfate (in gypsum drywall)	16
wood, pressure-treated	9
WOOD CONTAMINANTS	
Paints and Coatings	
acrylic, acrylic paints	1,4,13,18
lead-based paints	1,4,11,12,14
mercury-based paints	12,14
pigments in paints containing: lead, arsenic, or chromium	4
pigments in paints containing: lead, arsenic, barium, cadmium, zinc, mercury, or chromium	16
water-based paint	13
alkyd	18
alkyd urea	18
polyvinyl acetate	18
polyurethane	18
polyesters	18
nitrocellulose	18
ethyl cellulose	18
butyrate	18
vinyl (PVA/PVC)	18
epoxy (reaction products of epichlorohydrin & polyhydric phenols)	18
melamine	18
polystyrene	18
styrene/butadiene	18
lead	18
stains	1,4,13
varnishes	1,4,13
Laminates	

Waste Item	Source	Waste Item	Source
Preservatives		naphthalene	13,16
arsenic & arsenic-containing water-soluble preservatives	1,4,16	melamine/paper	18
chromium & chromium-containing water-soluble preservatives	1,4,16	phenol/paper	18
acid copper chromate (ACC)	18	polyvinyl chloride	18
copper zinc chloride (CZC)	18	polyester	18
arsenates chromated copper arsenate (CCA) ammoniacal copper arsenate (ACA) ammoniacal copper zinc arsenate copperized chromated zinc arsenate (CuCZA)	18 13,18 18 18 18 18	phenol/melamine/paper	18
copper	16	Other Chemical Additives	
creosote	1,4,12,14	ammonia	18
pentachlorophenol	1,12,14,16	borates	18
petroleum distillates, ignitable	12	phosphates	18
wood preservatives	10	polyesters	18
copper naphthenate (in creosote or petroleum)	18	sulfates ammonium sulfate	 18
copper-8-quinolinolate	18	waxes	18
tributyltin oxide	18	OTHER PROBLEMATIC ITEMS	
Adhesives/Resins		appliances or "white goods"	2,3,5
formaldehyde	13,16	batteries	5,7,8,15
glues	4	cardboard	7
phenol-formaldehyde resins	1,4,13,18	carpeting	2,3
urea	13,18	corrugated container board	2
urea formaldehyde resins	1,4,18	CFCs in conditioning systems	17
melamine formaldehyde	18	fiberglass	11
resorcinol formaldehyde	18	furniture	2,3,5
isocyanates	18	garbage	2,5
epoxy	18	mercury-containing switches, bulbs	1,2,15,17
polyvinyl acetate	18	PCBs in transformers and capacitors	1,2,3,15
casein	18	tires	2,5,7
hot melts (containing polyesters, polyamides, or ethylene vinyl acetate)	18	unrecognizable pulverized or shredded waste components	2

TABLE 2-3 (continued)

NOTES:

(1) Identified as hazardous material found within C&D material (Lambert and Domizio, 1993).

(2) Excluded by NYDEC (Piasecki et al., 1990).

(3) High priority substances that should be excluded (Piasecki et al., 1990).

(4) Construction wood contaminants: chemically contained non-wood materials (Federle, 1992).

(5) Materials unacceptable at Kimmins C&D Recycling Facility (Woods 1992 as cited in Cosper et al., 1993).

(6) Materials that may be considered problem materials (Lauer, 1993).

(7) Problem materials (Gates et al., 1993).

(8) Items detected and rejected (Gates et al., 1993).

(9) Potentially toxic material (O'Brien/Palermini, 1993).

(10) Hazardous wastes generated from new construction (McGregor et al., 1993)

(11) Contaminants in construction waste and demolition debris (Apotheker, 1990)

(12) Potential hazards (per the *Vermont Hazardous Waste Regulations*, a material is defined as hazardous if it is corrosive, toxic, flammable, or reactive) (Spencer, 1991).

(13) C&D wood waste that may contain nonhazardous restrictive materials. In this report "restrictive materials" were defined as nonhazardous material present in some types of C&D waste that may restrict end uses for the waste once it is recycled (Spencer, 1991).

(14) An innocent-looking pile of debris may be illegally laced with these (Woods, 1992).

(15) Wastes that are legally considered hazardous according to state and federal regulations have been observed. Materials of concern that have been observed at C&D sites include the following (Hanrahan, 1994).

(16) Hazardous constituents contained in C&D materials (Hanrahan, 1994).

(17) Special and hazardous wastes (SPARK, 1991).

(18) Chemicals in wood products that may affect their use as fuel (ERL, 1992).

TABLE 2-4
"HAZARDOUS" WASTE GENERATED FROM CONSTRUCTION OF A SINGLE-FAMILY RESIDENCE IN PORTLAND, OREGON
(Source: McGregor et al. 1993)

Waste Generated	Quantity (pounds)	Percent of Hazardous Waste (by weight)
Sealers/caulking tubes	15	33
Adhesives	5	11
Resins	1	2
Joint compound	10	21
Aerosol cans	15	33
Total	46	100

Other Discrete Items

Other discrete items may be problematic for a variety of reasons and may be excluded from C&D landfills by state or county regulations. Batteries and fluorescent light bulbs may be excluded because they contain heavy metals (lead and mercury, respectively). Other items, such as cardboard, may be excluded because they are recyclable. As noted above, supposedly "excluded" items are found at C&D landfills, although some items are spotted and rejected during visual inspections (Cosper et al., 1993; Lauer, 1993; Piasecki et al., 1990).

Inseparable Constituents of Bulk Items

Many C&D wastes contain inseparable hazardous constituents. Examples include carpeting that can leach formaldehyde and treated or coated wood and wood products. Extensive information is available on wood treatments and coatings and their constituents. Wood products may leach hazardous constituents into ground water or release them into the air during landfill fires. In some states, fire suppression capabilities are not required at C&D landfills, and C&D landfill fires have occurred in a number of states (Connelly et al., 1991 as cited in Hanrahan, 1994). Table 2-5 provides the information available from the source documents on the concentrations of some of the "problematic" constituents found in wood products. The proportion of the chemical constituent to the wood product ranges from less than 10 parts per million (ppm) for pentachlorophenol in pallets and skids, to 20 percent for creosote in railroad ties, utility poles, pilings, and docks.

SUMMARY

As noted earlier, this report characterizes segments of the C&D waste stream based on information provided in the source documents. Much information on the waste composition is based on generated C&D wastes, which may differ from the composition of landfilled C&D wastes. Additionally, various factors affect the characteristics of C&D waste that were reported, including structure type and size, and the activity being performed.

TABLE 2-5
AMOUNT OF CHEMICAL CONSTITUENTS IN WOOD PRODUCTS
(Source: ERL, 1992)

Wood Product	Chemical Constituent	Amount of Chemical(s) in Wood Product	Note
pallets and skids, (hardwood/softwood)	pentachlorophenol lindane dimethyl phthalate copper-8-quinolinolate copper naphthenate	< 10 ppm	a
pallets, plywood	phenolic resins	2-4%	a
pallets, glued	epoxy	2-4%	
painted wood, lead-based paint	lead	1400-20,000 ppm (before 1950)	b
painted wood, acrylic-based paint	acrylic acid, styrene, vinyl toluene, nitriles	<0.01%	
painted wood, "metallic" pigments	aluminum powder, copper acetate, phenyl mercuric acetate, zinc chromate, titanium dioxide, copper ferrocyanide	<0.01%	
plywood, interior grade	urea formaldehyde (UF) resins	2-4%	c
plywood, exterior grade	phenol formaldehyde (PF) resins	2-4%	c
oriented strandboard	phenol formaldehyde resins, or PF/isocyanate resins	2-4%	
waterboard "Aspenite"	urea formaldehyde resins or phenolic resins	5-15% UF 2.5% PF, 2% wax	d
overlay panels	phenol formaldehyde resins	4-8%, sometimes up to 10%	
plywood/PVC laminate	urea formaldehyde polyvinyl chloride	2.5% UF 10% PVC	
particleboard	urea formaldehyde resins	5-15% UF	d
particleboard with PVC laminate	UF resins with polyvinyl chloride	4.5% UF 10% PVC	
hardboard	phenolic resins	1.5%	
fencing and decks: pressure treated southern pine	CCA or ACA	1-3%	e
fencing and decks: surface treated	CCA or ACA	1-3%	e
utility poles, laminated beams, freshwater pilings, bridge timbers, decking, fencing	pentachlorophenol	1.2-1.5%	f

Wood Product	Chemical Constituent	Amount of Chemical(s) in Wood Product	Note
railroad ties, utility poles	creosote containing 85% PAHs	14-20%	g
freshwater pilings, docks	creosote - coal tar	15-20%	
marine pilings, docks	creosote/chlorpyrifos	15-20%	

a Hardwood pallets are used primarily in the eastern U.S.; softwood and plywood pallets are used primarily in the western U.S.
b Lead level is highly dependent on the age of the paint; before 1950 lead comprised as much as 50% of the paint film. Legislation in 1976 reduced standard to 0.06% by weight.
c Plywood may be surface-coated with fire retardants, preservatives and insecticides, or pressure-treated with CCA.
d May be sealed with polyurethane or other sealant to prevent offgassing of formaldehyde.
e Dominant wood preservative; actual levels will be lower due to evaporation or leaching after treatment.
f Restricted use due to industry change and concern over dioxin linkage; not permitted for residential uses.
g Losses after treatment estimated to be 20-50% over 10-25 years; not recommended for residential use.

Overall, C&D waste streams are comprised mainly of wood products, asphalt, drywall, and masonry. Other notable components include metals, plastics, earth, shingles, and insulation. Most of the source documents did not provide information on the percentage of C&D waste that is "hazardous." Those that did indicated that "hazardous" waste comprised a small percentage of the total C&D waste stream (e.g., 0.4 percent of construction waste in one county in North Carolina). The source documents did not define "hazardous" or other "problematic" wastes as wastes that are classified as hazardous under RCRA Subtitle C.

The source documents did note that although C&D wastes have traditionally been considered inert and harmless, they have become an issue of concern in the 1990s. This is largely because some C&D wastes that were previously considered harmless are now considered to be "toxic" or to contain "hazardous" materials, such as wood that is coated with lead paint (Piasecki et al., 1990; Lambert and Domizio, 1993). "Problematic" wastes cited by three or more of the reports or articles in the source documents are: adhesives, caulk, paint, wood preservatives, formaldehyde resins, stains and varnishes, appliances, batteries, mercury-containing switches and lights, PCB-containing transformers and capacitors. Again, these "problematic" wastes may or may not qualify as hazardous wastes under RCRA Subtitle C. More attention has also focused on C&D landfills because they may be used to dump hazardous wastes illegally (Piasecki et al., 1990; Lambert and Domizio, 1993).

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CHAPTER 3
LEACHATE QUALITY ANALYSIS

This chapter summarizes available information on construction and demolition (C&D) debris landfill leachate. The methodology is discussed first, followed by the results of the analysis.

METHODOLOGY

This analysis is based on construction and demolition debris landfill leachate sampling data presented in two documents assembled by Gershman, Brickner & Bratton, Inc. (GBB) for the National Association of Demolition Contractors (NADC). One document, "C&D Waste Landfills, Leachate Quality Data, Volume 1, Specific State-by-State Responses," presents the results of GBB's efforts to obtain leachate data from state officials. The second document, "C&D Waste Landfills, Leachate Quality Data, Volume 2, Copies of Reports, Articles, and Other Related Data," is a compilation of several reports germane to C&D landfill leachate quality.

In addition to the information compiled by NADC, other studies of C&D debris landfill leachate have been performed. Selected studies are reviewed, and the results compared to this study, in Attachment 3-A.

The methodology for using NADC's data as a basis for characterizing C&D landfill leachate quality comprised the following steps:

- Selecting C&D landfills to include in the analysis;
- Developing a C&D landfill leachate database;
- Compiling parameter-specific regulatory and health-based "benchmarks" to use as a basis for screening potential risks;
- Screening out parameters that were never detected in C&D landfill leachate, or that never exceeded the benchmark;
- Calculating median values (using only detected values) for each parameter detected at a concentration above the benchmark; and
- Calculating the ratio of the parameters' median concentrations to the benchmarks.

Each step is discussed below.

Selecting C&D Landfills

The two reports prepared for NADC by GBB present leachate sampling data for numerous landfills in many states. While much of the information is landfill-specific, some is presented in different formats such as average parameter concentrations across landfills in a given state, or as ranges of concentrations across groups of landfills. To develop the leachate database for this report, only landfill-specific sampling data were used. Thus, this report is based on leachate sampling data for 21 C&D landfills, listed in Table 3-1. For ease in reviewing the database in Attachment 3-B, the abbreviated database code for each landfill is also presented in Table 3-1.

TABLE 3-1
LANDFILLS FROM WHICH LEACHATE DATA WERE EXTRACTED FOR ANALYSIS

Landfill Name	Database Reference
CDI, Colorado	CO
Deep River Bulky Waste Landfill, Connecticut	CT-1
Guilford Bulky Waste Landfill, Connecticut	CT-2
Groton Bulky Waste Landfill, Connecticut	CT-3
Glastonbury Bulky Waste Landfill, Connecticut	CT-4
ITI Trucking Terminal site, Connecticut	CT-5
D & M site, Connecticut	CT-6
Armetta Property, Connecticut	CT-7
Iowa #4 site, Iowa	IA-1
Iowa #5 site, Iowa	IA-2
Brandywine/Cross Trails Rubble Landfill, Maryland	MD
Unnamed Kentucky site from 1991 WMNA study, Kentucky	KY
Unnamed Massachusetts site from 1991 WMNA study, Massachusetts	MA
Unnamed Michigan site from 1991 WMNA study, Michigan	MI
SKB Rich Valley Waste Management Facility, Minnesota	MN
110 Sand & Gravel site, New York	NY-1
Blydenburg Cleanfill, New York	NY-2
South Carolina Landfill #1, South Carolina	SC
Sanifill, Inc. site (high in 3-site range), Texas	TX HI
Sanifill, Inc. site (low in 3-site range), Texas	TX LO
Mt. Olivet Landfill, Washington	WA

Developing a C&D Landfill Leachate Database

Leachate sampling data for the 21 landfills were entered into a database, Attachment 3-B. The database contains sampling data for a total of 305 parameters analyzed for at least once. A blank entry in the database indicates that the parameter was not sampled for at that landfill. In many cases, a parameter was sampled for but not detected at a landfill. Non-detects were handled in one of two ways:

- If a detection limit (say, "X") was given by GBB, "<X" was entered in the database.
- If no detection limit was given, "ND" was entered in the database.

As data were taken from many different landfills (and thus many different sampling laboratories), there were cases in which different names were used to address the same parameter. The differing nomenclatures used by different landfills were reconciled so that all synonyms were joined into one parameter row. In addition, some samples were identified as "total" and others as "dissolved." To be conservative, the "total" values were entered into the database.

Compiling Regulatory and Health-based Benchmarks

The next step was to identify parameter-specific benchmarks, or concern levels, to use as a basis for determining whether the parameter concentrations in leachate are high enough to pose potential risk. Safe Drinking Water Act National Primary and Secondary Drinking Water Standards were used as the benchmarks if these were available; these are referred to in the remainder of this report as Maximum Contaminant Levels (MCLs) or Secondary Maximum Contaminant Levels (SMCLs).[8] Both are enforceable drinking water standards. While MCLs are health-based, SMCLs are based on other factors such as aesthetics. Both MCLs and SMCLs are also based on the availability of treatment technologies and other factors such as availability of data and analytical methods.

For parameters without MCLs or SMCLs, health-based benchmarks for a leachate ingestion scenario were compiled as follows:

- Reference doses (RfDs) were compiled for non-carcinogens. EPA calculates RfDs by dividing animal toxicity values by suitable scaling or uncertainty and modifying factors. The RfDs used in this study were taken from EPA's Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST). The RfDs (mg/kg-day) were then converted to benchmark concentrations in drinking water using EPA's standard exposure assumptions (daily intake of two liters per day, average body weight of 70 kg, and exposure duration of 365 days per year over 70 years).

- Risk-specific doses (RSDs) were calculated for carcinogens based on cancer slope factors (CSFs). A CSF is a measure of the carcinogenic potency of low doses of carcinogens. CSFs represent the upper-bound confidence limit estimate of the excess cancer risk for individuals experiencing a given exposure over a lifetime. EPA calculates CSFs from dose-response curves, which are based on human epidemiological and/or animal bioassay data. For this study, CSFs given in IRIS or HEAST were used, and the standard exposure assumptions listed above, to calculate the drinking water concentration that would correspond to an excess lifetime cancer risk of 10^{-6}.

Many of the parameters detected in C&D landfill leachate have not been studied sufficiently to allow an RfD or a CSF to be developed. For these parameters, no benchmarks were available for this study.

Screening Out Parameters

In this step, the maximum observed value of each parameter was simply compared to its regulatory or health-based benchmark. Parameters that were never observed in C&D landfill leachate at levels above their respective benchmarks were screened out, the rationale being that if the undiluted leachate is "safe to drink," no further analysis is needed. Also excluded from further consideration were parameters that were sampled for but never detected in landfill leachate.

Calculating Median Leachate Concentrations

For each parameter with at least one exceedance over the benchmark, the median leachate concentration was calculated across all landfills at which the parameter was sampled. Medians, rather than averages, were calculated in order to reduce the effect of single, anomalous values.

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[8]Where available, existing MCLs or SMCLs were used; otherwise, proposed values were used.

When calculating the median value for each parameter, the median value for each landfill was first calculated, and then the median value across all landfills was calculated. For example, if parameter X was sampled once at Landfill A, once at Landfill B, and six times or at six locations at Landfill C, the median concentration was calculated based on the Landfill A sample, the Landfill B sample, and the median among the Landfill C samples. Thus, each landfill is represented only once for each parameter, and each landfill is weighted equally.

Due to anomalies and inconsistencies among the sampling equipment used at different times and at different landfills, non-detects were not considered in determining median values. In other words, for those parameters for which a median was calculated, the non-detects were discarded before calculating both individual landfill concentration medians and medians across all landfills. Thus, the median leachate concentrations calculated for this analysis represent the median among the detected values, rather than the median among all values. The median concentration among all values would in most cases have been lower than those calculated here.

Comparing Medians to Benchmarks

The median value for each parameter was then compared to the benchmark for that parameter, if one was available. The results are expressed as the ratio of the median leachate concentration to the benchmark.

RESULTS

As discussed above, the leachate database contains sampling data for 305 parameters analyzed for at one or more of 21 construction and demolition landfills. Of these 305 parameters, 93 were detected at least once. The other 212 parameters, almost all organics, were never detected, and are listed in Table 3-2; many of them were sampled for at only one or two landfills, and often only once or twice at those sites.

All 93 parameters that were detected at least once are listed in Table 3-3, along with the number of landfills at which the parameter was sampled, the number of landfills at which the parameter was detected, the maximum and minimum values for each parameter (here, including non-detects), and the relevant benchmark, if available. Maximum concentrations above the benchmark are shaded. For pH, the minimum pH level below the benchmark range is shaded.

Table 3-4 focuses on the parameters whose maximum concentrations exceeded their benchmarks (i.e., the parameters shaded in Table 3-3). For each parameter, Table 3-4 repeats the number of landfills at which the parameter was sampled and detected, but also shows the number of landfills at which the benchmark was exceeded. Table 3-4 also provides the median value of each parameter across all landfills, each parameter's benchmark, and the ratio of the medians to benchmarks. Again, due to anomalies and inconsistencies among sampling equipment, non-detects were not considered in determining median values.

The results are discussed below.

TABLE 3-2
PARAMETERS ANALYZED FOR BUT NEVER DETECTED

ORGANICS			
Acetonitrile	m-Cresol	Endosulfan II	N'Nitroso-di-n-propylamine
Acetophenone	Cumene	Endrin	N-Nitrosomorpholine
2-Acetylaminofluorene	2,4-D	Endrin aldehyde	N-Nitrosopiperidine
Acrolein	4,4-DDD	Endrin ketone	N'Nitrosopyrolidine
Acrylonitrile	4,4-DDE	Ethyl ether	5-Nitro-o-toluidine
Aldrin	4,4,4-DDT	Ethylmethacrylate	PeCDD
alpha-Chlordane	delta-BHC	Ethyl methane sulfonate	PeCDF
alpha-Endosulfan	Diallate	Ethyl parathion	Pentachlorobenzene
4-Aminobiphenyl	Dibenzo(a,h)anthracene	Famphur	Pentachloronitrobenzene
Aniline	Dibenzofuran	Fluoranthene	Pentachlorophenol
Anthracene	Dibromochloromethane	Fluorene	Pentachlorothane
Aramite	1,2-Dibromo-d-chloropropane	Heptachlor	Phenacetin
Aroclor/PCB 1016	Dibromomethane	Heptachlor epoxide	Phenanthrene
Aroclor/PCB 1221	1,2-Dibromoethane	Hexachlorobenzene	Phenolphthalein Alkalinity
Aroclor/PCB 1232	Di-a-butyl phthalate	Hexachlorobutadiene	p-Phenylemediamine
Aroclor/PCB 1242	Dichloroacetonitrile	Hexachlorocyclopentadiene	Phorate
Aroclor/PCB 1248	1,2-Dichlorobenzene	Hexachloroethane	2-Picoline
Aroclor/PCB 1254	1,3-Dichlorobenzene	Hexachlorophene	Pronamide
Aroclor/PCB 1260	1,4-Dichlorobenzene	Hexachloropropene	Propionitrile, Ethyl cyanide
Benzo-a-anthracene	3-3-Dichlorobenzidine	Hx-CDD	Pyrene
Benzo-a-pyrene	trans-1,4-Dichloro-2-butene	HxCDF	Pyridine
Benzo-b-fluoranthene	Dichlorodifluoromethane	Indeno(1,2,3-cd)pyrene	Safrole
Benzo(k)fluoranthene	1,2-Dichloroethene	Iodomethane	Silvex, 2,4,5-TP
Benzo-g,h-perylene	1,1-Dichloroethene	Isobutanol	Sulfotepp
Benzo-g,h,i-perylene	Dichlorofluoromethane	Isodrin	TCDD
Benzo-k-perylene	2,4-Dichlorophenol	Isophorone	2,3,7,8-TCDD
Benzyl alcohol	2,6-Dichlorophenol	2-Isophorone	TCDF
beta-BHC	trans-1,2-Dichloropropane	Isosafrole	1,2,4,5-Tetrachlorobenzene
beta-Endosulfan	1,2-Dichloropropane	Kepone	1,1,1,2-Tetrachloroethane
Bis(2-chloroethoxy)methane	1,3-Dichloropropane	Lindane	1,1,2,2-Tetrachloroethane
Bis(2-chloroethyl)ether	2,2-Dichloropropane	Methacryonitrile	2,3,4,6-Tetrachlorophenol
Bis(2-chloroisopropyl)ether	trans-1,3-Dichloropropene	Methapyrilene	Tetrahydrofuran
Bis(2-chloro-1-methyl)ether	1,1-Dichloropropene	Methoxychlor	Thionazin
Bis(2-ethylhexyl)phthalate	2,3-Dichloro-1-propene	3-Methylchloanthrene	o-Toluidine
Bromodichloromethane	cis-1,3-Dichloropropene	Methyl methacrylate	Toxaphene
Bromoform	p-(Dimethylamino)azobenzene	Methyl methane sulfonate	1,2,4-Trichlorobenzene
Bromomethane	Dimethaote	2-Methylnaphthalene	1,1,1-Trichloroethane
4-Bromophenyl-phenylether	7/12-Dimethylbenz(a)anthracene	Methyl parathion; Parathion mehtyl	1,1,2-Trichloroethane
Butyl benzyl phthalate	3,3-Dimethylbenzidine	(3&4)-Methylphenol	2,4,5-Trichlorophenol
Carbon tetrachloride	Dimethylphenethylamine	1,4-Naphthoquinone	2,4,6-Trichlorophenol
Carbonate	2,4-Dimethylphenol	1-Naphthylamine	1,2,3-Trichloropropane
Chlordane	Dimethyl phthalate	2-Naphthylamine	1,1,2-Trichlorotrifluoroethane
4-Chloroaniline	1,3-Dinitrobenzene	2-Nitroaniline	o,o,o-Triethyl phosphorothiole
Chlorobenzene	4,6-Dinitro-2-methylphenol	3-Nitroaniline	sym-Trinitrobenzene
Chlorobenzilate	2,4-Dinitrophenol	4-Nitroaniline	Vinyl acetate
2-Chloro-1,3-butadiene, Chloroprene	2,4-Dinitrotoluene	Nitrobenzene	Vinyl chloride
Chlorodibromomethane	2,6-Dinitrotoluene	o-Nitrophenol	INORGANICS
2-Chloroethyl Vinyl Ether	Dinoseb, DNBP	p-Nitrophenol	Antimony
4-Chloro-3-methylphenol	Di-a-octyl phthalate	4-Nitroquininoline-1-oxide	Thallium
4-Chlorophenyl phenyl ether	Di-n-octyl phthalate	N-Nitrosodi-a-butylamine	Tin
2-Chloronaphthalene	1,4-Diomene	N-Nitrosodiethylamine	CONVENTIONAL PARAMETER
2-Chlorophenol	Diphenylamine	N-Nitrosodimethylamine	Total Settled Solids
3-Chloropropene, Allyl Chloride	Endosulfan sulfate	N-Nitrosodimethylethylamine	
Chrysene	Endosulfan I	N-Nitrosodiphenylamine	

TABLE 3-3
FREQUENCY OF DETECTION, RANGE, AND BENCHMARK FOR DETECTED PARAMETERS
(Concentrations in ug/l)

TABLE 3-3. FREQUENCY OF DETECTION, RANGE, AND BENCHMARK FOR DETECTED PARAMETERS (Concentrations in ug/l)

PARAMETER	# LANDFILLS SAMPLED	# LANDFILLS DETECTED	MAXIMUM	MINIMUM	BENCHMARK	
					VALUE	SOURCE
ORGANICS						
Acenaphthene	7	1	3	ND	2000	RfD
Acetone	6	4	5100	ND	4000	RfD
alpha-BHC	6	1	0.12	ND	0.006	10^-6 RSD
Benzene	9	2	2.7	ND	5	MCL
Benzoic acid	4	2	910	ND	–	–
Carbon disulfide	5	2	15	ND	4000	RfD
Chloroethane	9	2	353	ND	–	–
Chloroform	9	1	3	ND	100	MCL
Chloromethane	9	2	43	ND	–	–
cis-1,2-Dichloroethane	2	1	1.4	ND	–	–
1,2-Dichloroethane	9	3	26	ND	5	MCL
1,1-Dichloroethane	9	3	6.2	ND	4000	RfD
1,1-Dichloroethene	9	1	3	ND	7	MCL
trans-1,2-Dichloroethene	4	1	4	ND	100	MCL
Dieldrin	6	1	0.065	ND	0.002	10^-6 RSD
Diethyl phthalate	7	1	16	ND	30000	RfD
Disulfoton	3	1	0.96	ND	1	RfD
Di-n-butyl phthalate	4	1	16	ND	4000	RfD
Ethylbenzene	9	5	18	ND	700	MCL
2-Hexanone (methyl butyl ketone)	5	1	4.8	ND	–	–
Methyl ethyl ketone (MEK)	6	2	2500	ND	20000	RfD
Methylene chloride	9	3	60	ND	5	MCL
2-Methylphenol (o-cresol)	7	2	130	ND	–	–
4-Methyl-2-pentanone	6	2	250	ND	–	–
4-Methylphenol (p-cresol)	5	4	5700	ND	–	–
Naphthalene	7	2	63	ND	1000	RfD
Phenol	8	5	2990	ND	20000	RfD
Styrene	5	1	1.1	ND	100	MCL
Tetrachloroethene	9	1	4.8	ND	5	MCL
Toluene	9	4	240	ND	1000	MCL
Trichloroethene	9	3	20	ND	5	MCL
Trichlorofluoromethane	5	2	20	ND	10000	RfD
2,4,5-T, 2,4,5-Trichlorophenoxyacetic acid	4	2	0.53	ND	50	MCL

TABLE 3-3 (cont.)
FREQUENCY OF DETECTION, RANGE, AND BENCHMARK FOR DETECTED PARAMETERS
(Concentrations in ug/l)

TABLE 3-3. FREQUENCY OF DETECTION, RANGE, AND BENCHMARK FOR DETECTED PARAMETERS (Concentrations in ug/l)

PARAMETER	# LANDFILLS SAMPLED	# LANDFILLS DETECTED	MAXIMUM	MINIMUM	BENCHMARK	
					VALUE	SOURCE
Xylene (total)	8	4	85	ND	10000	MCL
INORGANICS						
Aluminum	1	1	6350	ND	50-200	SMCL
Arsenic	16	12	120	ND	50	MCL
Barium	13	13	8000	ND	2000	MCL
Beryllium	5	1	2.1	ND	4	MCL
Boron	2	2	3900	1400	--	--
Cadmium	19	14	2050	ND	5	MCL
Chromium	16	9	250	ND	100	MCL
Hexavalent Chromium	5	2	4920	ND	--	--
Cobalt	4	1	60.9	ND	--	--
Copper	18	14	620	ND	1000	SMCL
Cyanide	12	9	340	ND	200	MCL
Cyanides (total)	6	4	38	ND	--	--
Iron	20	20	172000	ND	300	SMCL
Filtered Iron	2	2	11000	240	--	--
Lead	18	15	2130	ND	15	Action Level
Magnesium	7	7	460000	ND	--	--
Mercury	15	4	9	ND	2	MCL
Nickel	12	7	170	ND	100	MCL
Potassium	9	9	618000	ND	--	--
Selenium	14	1	5	ND	50	MCL
Silver	12	2	30	ND	100	SMCL
Vanadium	4	2	96	ND	200	RfD
Zinc	15	15	8630	ND	5000	SMCL
CONVENTIONAL PARAMETERS						
Alkalinity	13	13	6520000	ND	--	--
Ammonia	3	3	480000	ND	--	--
Ammonia, Nitrogen	14	13	184000	ND	--	--
Bicarbonate	2	2	7950000	2090000	--	--
Biological Oxygen Demand (BOD) (5-day)	14	13	320000	ND	--	--
Biological Oxygen Demand (BOD) (20-day)	5	5	83000	5000	--	--

TABLE 3-3. FREQUENCY OF DETECTION, RANGE, AND BENCHMARK FOR DETECTED PARAMETERS (Concentrations in ug/l)

PARAMETER	# LANDFILLS SAMPLED	# LANDFILLS DETECTED	MAXIMUM	MINIMUM	BENCHMARK	
					VALUE	SOURCE
Calcium	7	7	600000	ND	--	--
Chemical Oxygen Demand (COD)	18	17	11200000	ND	--	--
Chlorides	20	20	2400000	ND	250000	SMCL
Dissolved Oxygen (%)	1	1	4.8	0.3	--	--
Fluoride	3	2	5000	ND	2000	SMCL
Hardness by Calculation	10	10	2420000	150000	--	--
Manganese	14	14	258000	ND	50	SMCL
Nitrate	14	10	13000	ND	10000	MCL
Nitrate/Nitrite	1	1	290	290	10000	MCL
Nitrite	10	6	47	ND	1000	MCL
Organic Nitrogen	7	7	11000	70	--	--
Total Kjeldahl Nitrogen	3	3	300000	3730	--	--
Oil and Grease	7	6	50000	ND	--	--
Oxidation-Reduction Potential	2	2	580	ND	--	--
pH	18	18	8	6.2	6.5-8.5	SMCL
Total Phenolics	4	3	4900	ND	--	--
Phosphate	2	1	3900	ND	--	--
Phosphorus	5	4	3890	ND	--	--
Total Phosphorus	3	3	1600	100	--	--
Sodium	12	12	1510000	ND	--	--
Solids, volatile	2	2	380000	170000	--	--
Specific Conductance (h)	12	12	25000	220	--	--
Sulfates	16	14	2700000	ND	250000	SMCL
Surfactants	1	1	1100	ND	--	--
Tannin	1	1	120000	120000	--	--
Total Dissolved Solids	18	17	8400000	ND	500000	SMCL
Total Organic Carbon	7	7	1080000	ND	--	--
Total Organic Halogens	3	3	910	740	--	--
Total Suspended Solids	16	15	43000000	ND	--	--
Turbidity (NTU)	3	3	630	ND	--	--

ND = Not Detected
RfD = Reference Dose
10^-6 RSD = 10^-6 Risk-specific Dose

TABLE 3-4
FREQUENCY OF DETECTION ABOVE BENCHMARK AND COMPARISON OF MEDIANS TO BENCHMARKS
(Concentrations in ug/l)

PARAMETER	# LANDFILLS SAMPLED	# LANDFILLS DETECTED	# LANDFILLS > BENCHMARK	MEDIAN*	BENCHMARK		MEDIAN/ BENCHMARK
					VALUE	SOURC	
ORGANICS							
Acetone	6	4	1	230	4000	RfD	0.058
alpha-BHC	6	1	1	0.12	0.006	10^-6	20
1,2-Dichloroethane	9	3	3	19	5	MCL	3.8
Dieldrin	6	1	1	0.065	0.002	10^-6	33
Methylene chloride	9	4	3	15.2	5	MCL	3
Trichloroethene	9	3	1	3.2	5	MCL	0.6
INORGANICS							
Aluminum	1	1	1	245	50-200	SMCL	4.9 (1.2 Min)
Arsenic	16	12	3	19.5	50	MCL	0.39
Barium	13	13	1	340	2000	MCL	0.17
Cadmium	19	14	12	10.5	5	MCL	2.1
Chromium	16	9	3	45	100	MCL	0.45
Cyanide	12	9	2	24.5	200	MCL	0.12
Iron	20	20	19	11003	300	SMCL	37
Lead	18	15	13	55	15	Action	3.7
Mercury	15	4	1	0.5	2	MCL	0.25
Nickel	12	7	2	50	100	MCL	0.5
Zinc	15	15	1	135	5000	SMCL	0.027
CONVENTIONAL							
Chlorides	20	20	4	110000	250000	SMCL	0.44
Fluoride	3	2	1	2700	2000	SMCL	1.4
Manganese	14	14	13	2925	50	SMCL	59
Nitrate	14	10	1	520	10000	MCL	0.052
Sulfates	16	14	6	119000	250000	SMCL	0.48
Total Dissolved	18	17	15	1770000	500000	SMCL	3.5

* Medians of detected values only

Organics

The frequency of detection of organics was generally low compared to metals and conventional parameters. Of the 34 organics listed in Table 3-3, only 8 were detected at half or more of the landfills at which they were sampled: acetone, benzoic acid, cis-1,2-dichloroethane, ethylbenzene, 4-methylphenol, phenol, 2,4,5-T, and xylenes. Six organics exceeded their respective benchmarks at least once, including acetone, alpha-BHC, 1,2-dichloroethane, dieldrin, methylene chloride, and trichloroethene.

Of the six organic constituents found above their benchmarks, Table 3-4 shows that four (acetone, alpha-BHC, dieldrin, and trichloroethene) were detected above their benchmarks at only one landfill. While this is noteworthy, these constituents are not subject to further assessment here because their exceedances cannot be considered representative.

The median leachate concentrations (among the detected values) of both of the remaining constituents -- 1,2-dichloroethane and methylene chloride -- exceed their benchmarks. Neither of them exceeds its benchmark by a factor of 10 or more, however. Assuming that a 100-fold reduction in concentration is achieved between the leachate and a downgradient drinking water well (as would be likely, based on the dilution attenuation factor [DAF] of 100 developed for the Toxicity Characteristic rulemaking), the concentrations would fall well below the benchmarks at the point of exposure. Even if a smaller DAF of 10 is applied (as may be applicable at a monitoring well located closer to the landfill), neither constituent would exceed its benchmark. Again, these medians only account for detected values. Had the non-detects been included, the median concentrations of all but one of the organics would have been in the non-detect range.

Inorganics

Most of the inorganics listed in Table 3-3 were detected at half or more of the landfills at which they were sampled: aluminum, arsenic, barium, boron, cadmium, chromium, copper, cyanide, iron, lead, magnesium, nickel, potassium, vanadium, and zinc. The 11 constituents exceeding their benchmarks included aluminum, arsenic, barium, cadmium, chromium, cyanide, iron, lead, mercury, nickel, and zinc.

As shown in Table 3-4, seven inorganics were detected above their benchmarks at more than one landfill: arsenic, cadmium, chromium, cyanide, iron, lead, and nickel. The median leachate concentrations exceed the benchmarks for only three of these inorganics, however: cadmium, iron, and lead. None of the median leachate concentrations exceeds its benchmark by a factor of 100 or more, and iron is the only constituent whose median exceeds its benchmark by a factor greater than 10. Iron was detected at all 20 landfills at which it was sampled, and was detected above its benchmark at least once at 19 of them. Excluding the few non-detects, the median concentration of iron in leachate is 37 times higher than its drinking water standard, which is a secondary MCL based on taste.

Conventional Parameters

As would be expected, all of the conventional parameters were detected at most, and often all, of the sites at which they were analyzed. The conventional parameters with maximum concentrations exceeding their respective benchmarks included chlorides, fluoride, manganese, nitrate, sulfates, and total dissolved solids (TDS). Only chlorides, manganese, sulfates, and TDS exceeded their benchmarks at more than one landfill. Of these four parameters, only manganese and TDS have medians above the benchmark. The median level of manganese exceeds its SMCL (by 59 times), while the median level of TDS exceeds its SMCL by over three times. In addition to these parameters, more than one landfill had a measured pH value outside of the range of the SMCL for pH.

SUMMARY

Leachate sampling data for 305 parameters sampled for at one or more of 21 C&D landfills were compiled into a database, shown in Attachment 3-B. Of these 305 parameters, 93 were detected at least once. Almost all of the

212 parameters that were never detected were organics; most of the inorganic and conventional parameters sampled for were detected one or more times.

Of the 93 parameters detected in C&D landfill leachate, 24 had at least one measured value above the regulatory or health-based benchmark.[9] For each of the parameters exceeding benchmarks (except pH), the median leachate concentration was calculated and compared to its benchmark. Due to anomalies and inconsistencies among the sampling equipment used at different times and at different landfills, non-detects were not considered in determining median values. Thus, the median leachate concentrations represent the medians among the detected values, rather than the median among all values. The median concentrations among all values would in most cases have been lower than those calculated here.

Based on (1) the number of landfills at which the benchmark was exceeded and (2) a comparison between the median detected concentration and the benchmark, seven parameters emerge as being potentially problematic. The list of these seven parameters, shown below, was developed by eliminating from the original list of 24 parameters (1) any parameter that was detected at only one landfill (this was determined to be not representative) and (2) any parameter whose median leachate concentration did not exceed its benchmark.

<u>organics</u>

- 1,2-dichloroethane
- methylene chloride

<u>inorganics</u>

- cadmium
- iron
- lead

<u>conventional parameters</u>

- manganese
- total dissolved solids (TDS)

For three of the seven parameters listed above (iron, manganese, and TDS), the benchmarks are secondary MCLs (SMCLs), which are set to protect water supplies for aesthetic reasons (e.g., taste) rather than for health-based reasons. None of the remaining four parameters exceeds its benchmark by a factor of 10 or more, indicating that concentrations in ground water where ground-water monitoring or drinking water wells may be located are likely to fall below the health-based benchmarks.

CAVEATS AND LIMITATIONS

All conclusions made from the data presented in this report should be tempered by the following weaknesses in the samples used to calculate some of the leachate characteristics:

- First, the sample size is much smaller than the universe of C&D landfills nationwide. The 21 landfills represented in this report comprise just over one percent of the approximately 1,800 C&D landfills in the United States. Thus, the representativeness of the sample is questionable.

- Many of the parameters discussed in this report were only sampled at one or two landfills, and such data cannot be considered representative of 1,800 landfills.

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[9] In the case of pH, the "exceedances" were actually pH values <u>below</u> the regulatory range.

- The medians calculated in this report do not account for non-detects. Although the medians would be more meaningful if the non-detects could be factored in, this report attempts to capture the impact of the non-detects by presenting both the frequency of detection and the frequency of detection above benchmarks.

- Some landfills do not characterize (or give an incomplete characterization of) the waste at their sites. Thus, in some cases, the respondents' assertions that their landfills are comprised of C&D wastes is the only basis for including the landfill in the database.

- The data relied upon were assembled recently by only one organization, using limited data gathering techniques.

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ATTACHMENT 3-A

OTHER STUDIES OF C&D LANDFILL LEACHATE

ATTACHMENT 3-A
OTHER STUDIES OF C&D LANDFILL LEACHATE

This attachment summarizes the results of selected studies of C&D landfill leachate and compares them to the results of the analysis presented in Chapter 3 of this report (the "NADC/ICF analysis").

THE WMX REPORT

This section compares the results of the NADC/ICF analysis with those of the 1993 *Construction and Demolition (C&D) Landfill Leachate Characterization Study* published by WMX Technologies, Incorporated (the "WMX report"). The WMX report evaluated leachate from four landfills (in Kentucky, Michigan, Massachusetts, and Wisconsin) for all or part of a three-year period (1991 to 1993).[10] Samples from the four landfills were analyzed for 219 organics, 19 inorganics, and 13 conventional parameters.[11] The NADC/ICF analysis evaluated 21 landfills, including the 1991 results from WMX's Kentucky, Michigan, and Massachusetts landfills. Because the NADC/ICF analysis was based on data compiled from various studies, there were significant differences in the parameters sampled for at the 21 landfills. In total, the NADC/ICF analysis covered 242 organics, 26 inorganics, and 37 conventional parameters.[12]

As the remainder of this section will show, the results of the NADC/ICF analysis and the WMX report are quite similar. Below, the two studies are compared in terms of the following factors:

- The number and percent of parameters detected;
- Parameters detected at concentrations exceeding regulatory and/or health-based benchmarks; and
- Parameters that are potentially problematic (i.e., detected at more than one landfill and have median leachate concentrations above a benchmark).

This information is summarized in Table 3A-1 and discussed in the remaining sections.

Organics

In both the NADC/ICF and WMX reports, the percent of organics detected in C&D leachate was low compared to inorganics and conventional parameters. In the NADC/ICF analysis, 14 percent of the organics sampled for were detected (34 out of 242), compared to 15 percent (33 of 219) in the WMX report.

TABLE 3A-1
COMPARISON OF NADC/ICF AND WMX STUDIES[a]

Parameter Type	Number of parameters detected/sampled	Parameters with maximum concentrations exceeding benchmarks	Parameters that are potentiall (ratio of median leachate concentr:

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[10] Results from an Ohio landfill sampled in 1991 and included in an earlier WMX report were discarded because WMX later discovered that steel mill slag had been used in the leachate collection system and had contaminated the leachate.

[11] Although iron was categorized as a conventional parameter by the WMX report, it is counted here as an inorganic parameter to be consistent with the NADC/ICF analysis.

[12] This includes some double-counting of parameters because similar parameters were reported differently in different studies. For example, nitrate and nitrite were reported separately in one study but together in another study, so the ICF analysis counts three separate categories: nitrate, nitrite, and nitrate/nitrite.

CONTINUED RESEARCH INTO THE CHARACTERISTICS OF LEACHATE FROM CONSTRUCTION AND DEMOLITION WASTE LANDFILLS

July 2000

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BDL	Below Detection Limit
CCA	Chromated Copper Arsenate
C&D	Construction and Demolition
COD	Chemical Oxygen Demand
DAF	Dilution Attenuation Factor
DI	Deionized Water
EPA	Environmental Protection Agency
FLAA	Flame Atomic Absorption
GFAA	Graphite Furnace Atomic Absorption
IC	Ion Chromatograph
MSW	Municipal Solid Waste
mg/L	milligrams per liter
NPOC	Non-Purgeable Organic Carbon
PAH	Polycyclic Aromatic Hydrocarbon
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
VOC	Volatile Organic Compound
μg/L	Micrograms per Liter

1. INTRODUCTION

This document reports results from a research project entitled "Continued Research into the Characterization of Leachate from Construction and Demolition (C&D) Waste Landfills." Research investigating the characteristics of C&D waste leachate has been ongoing at the University of Florida since 1996, and work continues in this area. The information presented here only includes a presentation and discussion of the information gathered during the applicable project period (April 1998 through June 1999). Background information regarding the issue of leachate from C&D waste landfills can be found in previous project reports and other documents. The reader is referred to two previously published reports by the Florida Center for Solid and Hazardous Waste Management: *The Management and Environmental Impact of Construction and Demolition Waste* (Townsend and Kibert, 1997) and *Characterization of Leachate from Construction and Demolition Waste Landfills* (Townsend et al., 1998). A summary of C&D waste leachate research from these two reports was also published in the refereed literature (Townsend et al., 1999).

The research presented and discussed in this report is from two separate but related studies. In the first study, waste collected from residential construction activities in Alachua County, Florida, was disposed in four lined test landfill cells. The waste in the test cells was subjected to a 161-day period of rainfall exposure, and the resulting leachate was collected and analyzed. This field study was the subject of a Master of Engineering Thesis, and complete details of the research can be found in Weber (1999). In the second part of the study, simulated columns of landfilled C&D waste were examined. The column experiments differed from previous column experiments in that additional waste components were added to investigate heavy metal leachability. The columns were also configured to simulate the leaching of deeper (20 feet) C&D waste. The laboratory study was the subject of a Doctoral Dissertation and detailed information can be found in Jang (2000).

The report begins in Chapter 2 with the presentation and discussion of the study of simulated leachate from the residential construction waste field test cells. Chapter 3 presents the results of the laboratory studies of the simulated C&D waste leachate. Finally, Chapter 4 provides summaries and conclusions to the research.

2. LEACHATE STUDY FROM RESIDENTIAL CONSTRUCTION WASTE

2.1 INTRODUCTION

Laboratory experiments have been performed on relatively small volumes of known components of the C&D waste stream. While these experiments provide a fundamental understanding of leaching from C&D waste, they are controlled by the laboratory environment and limited by size reduction and sample volume. The results, however beneficial, might not mimic the exact conditions found in full-scale C&D landfills. Field-scale studies provide leachate characterization data resulting from conditions more representative of actual C&D waste landfills.

Four field test cells constructed with plastic liners were filled with construction waste from surrounding residential housing development. The objective of this field test cell study was to collect leachate samples produced from actual residential waste and analyze the leachate for many parameters, including conventional water quality parameters, volatile and semi-volatile organic compounds, and metals. This chapter presents the methods used and the results of research conducted to examine the characteristics of leachate resulting from residential construction waste leachate in the field test cells. More detailed information can be found in Weber (1999).

2.2 METHODOLOGY FOR A FIELD CELL STUDY

The methodology developed for the field study consisted of designing and building waste test cells, filling the cells with residential construction waste, sampling the leachate from the test cells, recording field measurements, and analyzing the samples in the laboratory. Construction of the test cells was conducted in accordance with an applicable permit modification for the Alachua County Southwest Landfill. Standard Methods for the Analysis of Water and Wastewater (APHA, 1995) and EPA SW-846 methodology (US EPA, 1994) was followed for laboratory analysis in accordance with the Florida Department of Environmental Protection (FDEP) approved QA/QC Plan #960218.

2.2.1 Location, Design, and Construction of Field Test Cells

The field test cells were located at the Southwest Landfill in Alachua County, Florida (Figure 2-1). The test cells were constructed on top of the existing Class III landfill (Figure 2-2). Each test cell measured approximately 30 ft by 20 ft in area. The depth of each cell was approximately 6 ft at the maximum waste depth. The cells were required to have an impermeable liner and to provide a method of draining and collecting leachate. A single piece of 60-mil high-density polyethylene (HDPE) donated by Comanco, Inc. lined the bottom and sides of each cell. A 30-cm (1-ft) drainage layer of sand was then placed on the bottom of each cell to protect the liner from punctures and to permit the leachate to move along the bottom.

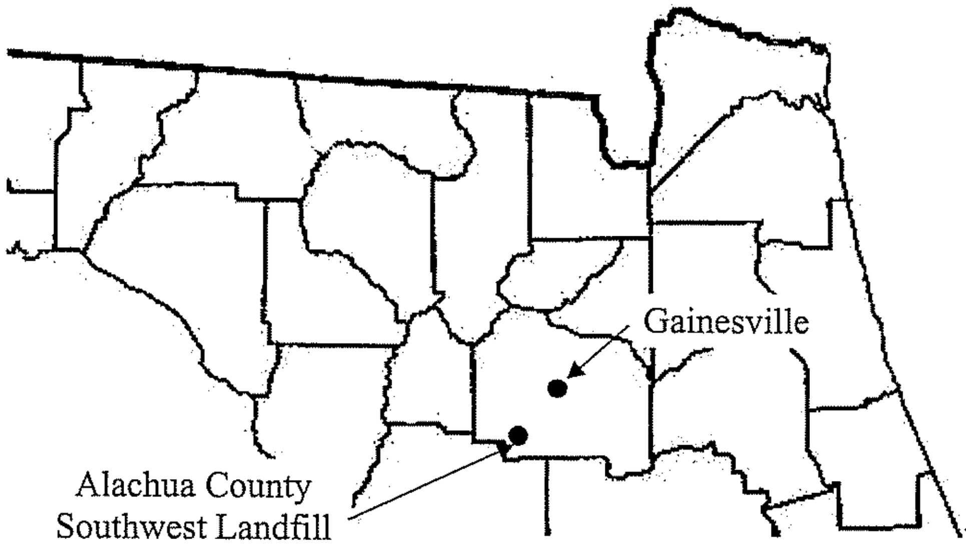


Figure 2-1 Alachua County Landfill Location

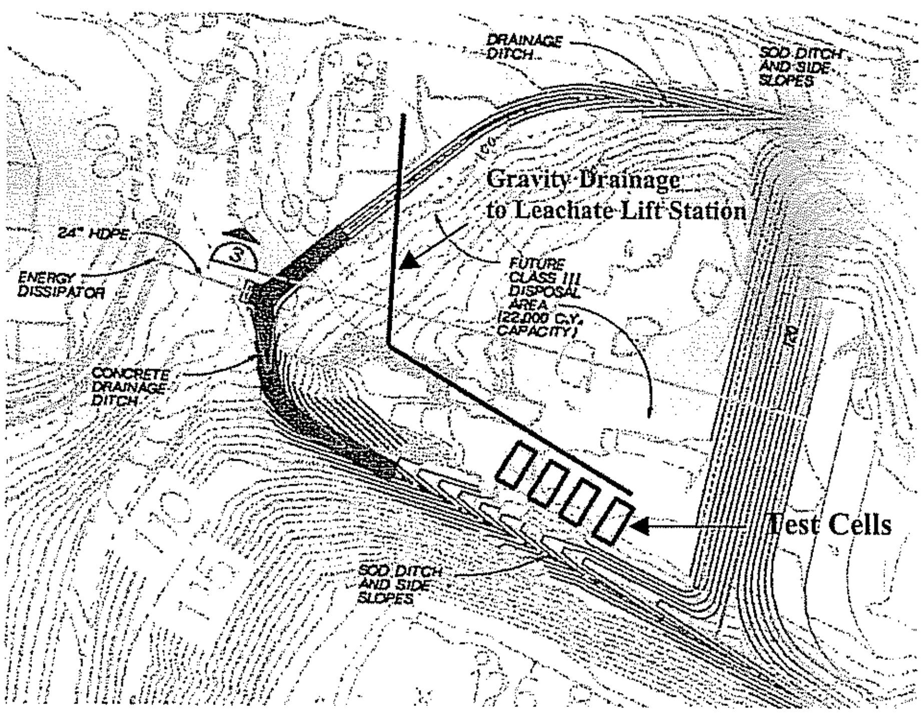


Figure 2-2 Site Map of Residential Construction Waste Test Cells Area

The bottoms of the cells were sloped at a 10% grade. A 3-in. diameter polyvinyl chloride (PVC) pipe was placed vertically at the center of the bottom slope of each cell. Leachate was pumped out of the cells through this pipe. Detailed drawings are provided in the previous report (Townsend et. al., 1998).

2.2.2 Waste Loading

Residential construction waste was the most common type of C&D debris available on a routine basis in the test area. Consequently, residential construction waste was selected as the waste material to be evaluated. While the composition of residential construction waste also depends on when sampling occurs in the construction process, the smaller volume of residential waste generated at a site (relative to commercial construction and demolition) allowed the collection and placement of a more representative sample of the waste stream from a given source.

Volume calculations indicated that the cells would hold four 20-yd^3 containers of construction debris. Three cells were filled with waste that had the restricted materials removed (e.g. paint, paint thinner, food waste) by a landfill attendant (spotter). The fourth cell represented a scenario where restricted waste was not removed.

Boone Waste of Gainesville volunteered to haul roll-off boxes from residential construction sites in the Gainesville area to the Alachua County Southwest Landfill. The roll-offs were weighed on tipping scales and dumped on top of the Class III cell. The piles of debris were kept separate from each other before placement in a cell. The visible constituents of the waste piles were recorded. Table 2-1 presents the items observed in the residential construction waste.

Table 2-1 Items Observed in Residential Construction Waste Loads

Alcohol solvents	Diapers	Metal fencing	Roofing tar
Asphalt	Dirt	Metal molding	Scrap lumber
Beverage bottles	Drywall	Metal straps	Sealant Tubes
Bricks	Electrical wire	Mortar	Shingles
Carburetor air filter	Empty motor oil bottles	Paint cans	Stucco
Cardboard	Empty paint cans	Paint thinner	Styrofoam
Carpet	Empty paper concrete bags	Paper	Thick elastic asphalt-asbestos
Carpet Padding	Fiberglass insulation	Particle board	Used motor oil filters
Caulk tubes	Food containers	Plywood	Vinyl acrilic masonry filler
Ceramic Tile	Food waste	Polyurethane	Wood pallets
Cinder blocks	Land clearing debris	PVC pipe	Wood stains

The waste piles were then spotted for materials that are restricted from C&D landfills by the Florida department of environmental protection (FDEP). After the material on the outside of the pile was spotted, the piles were mixed with a front-end loader and spotted again. Table 2-2 shows the common constituents removed from the waste piles.

Table 2-2 Commonly Removed Materials

Drink Containers	Motor Oil Filters
Empty paint thinner containers	Paint cans (empty and partially empty)
Food Waste	PVC glue
Household garbage	Wood stain containers
Motor Oil Bottles	

The waste was then loaded into the test cells using the front-end loader (in the order it was received at the landfill). The waste continued to be spotted during this operation to further remove unwanted material from the interior of the pile. As more waste was added, the front-end loader pushed it forward in the cell. The weight and characteristics of the waste that went into each test cell was recorded.

The front-end loader drove over the material to lightly compact it. Because only a one-foot layer of sand protected the liner, using a compactor or a large bulldozer to compact the waste might have punctured the liner. A thin layer of sand was then applied to the cell using a front-end loader. The sand layer was as thin as 2-inches when applied but was sufficient to cover the waste and control litter.

2.2.3 Leachate Collection and Sampling

Leachate sampling was conducted according to the FDEP standard operating procedures (FDEP, 1992). Leachate was collected from each cell's collection sump using a dedicated Teflon bailer and non-powdered latex gloves were worn to minimize cross-contamination. Sampling of Cell 1 and Cell 2 began on June 11, 1998 and continued to November 12, 1998, a total of 161 days. Waste was not available for Cell 3 and Cell 4 when rain first fell on Cell 1 and Cell 2. Thus, sampling did not begin on Cell 3 and Cell 4 until July 16, 1998, a total of 140 days.

A submersible centrifugal pump (Whale Model 574) was used to pump leachate from the cells twice a week to ensure that the leachate sump contained fresh leachate. This also kept the ponded leachate contact with the material to a minimum. The cells were pumped out and then sampled on Tuesday and subsequently drained on Thursday. During the experiment, two hurricanes passed over the area producing large amounts of rain. During those occasions the draining began on Monday and continued until Thursday in order to pump the cells dry.

Prior to sampling, the sampling ports were purged by removing five times the volume of leachate contained in the sampling sump. This ensured fresh leachate from the surrounding area was sampled. The bailer was lowered to the bottom of the port and retrieved with leachate. Samples were then collected for volatile organic compounds (VOCs), semi-volatile compounds (semi-VOCs), metals, and conventional water quality parameters. Samples were collected in order of their sensitivity to disturbances. VOC samples were taken first, followed by semi-VOC, conventional water quality parameters, metals, and field parameters. In accordance with the FDEP Standard Operating Procedures (SOP), all sampling equipment and containers were decontaminated in the Solid and Hazardous Waste Laboratory at the University of Florida.

VOC samples were collected every three weeks from each cell for the first two months. To collect VOC samples the bailer was carefully lowered into and leachate was retrieved from the sump. The leachate sample was then carefully poured down the side of the 40-mL VOC vial to prevent aeration of the sample. The vial was capped with a Teflon-lined cover and inverted to insure threw were no air bubbles in the vial (zero-head space). Semi-VOC samples were collected every three weeks throughout the experiment and were collected in the same manner as VOCs but in one-liter glass containers.

Samples were then collected for conventional water quality parameter analysis. Two separate samples were collected to accommodate different analyses. One sample was preserved with concentrated sulfuric acid (H_2SO_4) ($pH<2$) and the other was not preserved. Samples were collected for metals next. These samples required preservation with concentrated nitric acid (HNO_3). The pH was measured after collecting the preserved samples to ensure a pH below two. Field parameters such as pH, conductivity, dissolved oxygen, and temperature, were then recorded.

One trip blank for each sample type was collected each sampling trip. Trip blanks were filled with deionized water and preserved as needed prior to leaving the laboratory. Field blanks and equipment blanks were collected during the experiment to check any external contamination such as air contaminants. Field blanks were filled with deionized water from a Teflon carboy carried into the field. Equipment blanks were collected by filling the sampling bailer with deionized water from the Teflon carboy and then filling the sample containers as if the water was a leachate sample. The blank samples were prepared and preserved in the same manner as the leachate samples. All samples and blanks were stored on ice while in the field, transferred to a refrigerated room at the University of Florida Solid and Hazardous Waste Laboratory, and stored at 4°C until analyzed.

After completing the sampling, the number of times the cell was bailed was summed and the total volume of leachate removed from the cell was calculated. Then the leachate sump was pumped dry using the centrifugal pump lowered into the sampling port. The pump drained the leachate through plastic tubing attached to a flow totalizer. The leachate flowed into the drain header pipe situated in front of each cell. The header pipe lead to the condensate collection sump at the site. After the sump was pumped dry, the power was disconnected and the final reading was recorded from the totalizer. Subtracting the totalizer initial reading from the final totalizer reading provided the total number of gallons purged from the sump. The pumped volume added to the bailed volume gave the volume removed from the cell during sampling. Each cell was sampled in sequence using this methodology.

2.2.4 Leachate Analysis

Leachate samples were analyzed following commonly accepted methods for analysis of water and wastewater. Most parameters were selected for their regulatory relevance (e.g. organic pollutants, heavy metals). Other parameters such as ions and chemical oxygen demand help assess the overall chemical characteristics of the leachate and identify waste decomposition processes in the test cells.

2.2.4.1 Conventional Water Quality Parameters

The conventional water quality parameters analyzed were chemical oxygen demand (COD), non-purgeable organic carbon (NPOC), cations, anions, ammonia, total dissolved solids (TDS), and alkalinity. The FDEP requires C&D landfills to analyze monitoring well samples for TDS, ammonia, and some cations/anions. The remaining parameters provide a general idea of water quality. Table 2.3 presents the analytical methods used for these parameters.

Table 2-3 Analytical Methods for Conventional Parameter

Parameters	Methods
Temperature	Standard Method 2550[a]
pH	Standard Method 4500-H^+ [a]
Conductivity	Standard Method 2510[a]
COD	Standard Method 5220C[a]
NPOC	Standard Method 53101B[a]
Cations	Ion Chromatography – Dionex Manual[b]
Anions	EPA SW 846- Method 9056[c]
Ammonia	Standard Method 4500-NH_3 D[a]
TDS	Standard Method 2540C[a]
Alkalinity	Standard Method 2320B[a]

[a] APHA, 1995
[b] Source: Dionex, 1995
[c] US EPA, 1994

2.2.4.2 Volatile and Semi-Volatile Organic Compounds

Analysis of VOCs were carried out using Tekmar LSC-2 purge-and trap equipment attached to Hewlett Packard 5890 gas chromatograph and HP 5985 mass spectrometer (US EPA SW 846 Method 8260A). Leachate for semi-VOCs was extracted using a separatory funnel liquid-liquid extraction (US EPA SW 846 Method 3510B) followed by gas chromatography/mass spectrometry (GC/MS) analysis (US EPA SW 846 Method 8270B) using a Perkin-Elmer GC Model 8500 attached to an ion trap detector (Perkin-Elmer ITD Model 6210).

2.2.4.3 Metal Analysis

Metal analysis was conducted by flame atomic absorption, graphite atomic absorption (Perkin-Elmer 5100 AA Spectrometer), and manual cold vapor extraction atomic absorption after appropriate sample digestion (SW846-3010A, or SW846-3020A). The analytical methods used for metals are shown in Table 2.4.

Table 2-4 Analytical Methods of Metals

Metals	Technique	Method
Arsenic	GFAA[a]	EPA SW846-7060A
Aluminum	FLAA[b]	EPA SW846-7020
Barium	FLAA	EPA SW846-7080A
Cadmium	GFAA	EPA SW846-7131
Chromium	FLAA	EPA SW846-7190
	GFAA	EPA SW846-7191
Copper	FLAA	EPA SW846-7210
	GFAA	EPA SW846-7211
Iron	FLAA	EPA SW846-7280
Lead	FLAA	EPA SW846-7420
	GFAA	EPA SW846-7421
Manganese	GFAA	EPA SW846-7461
Mercury	FLAA	EPA SW846-7470A
Selenium	GFAA	EPA SW846-7740
Nickel	FLAA	EPA SW846-7520
Zinc	FLAA	EPA SW846-7950

a. Graphite Furnace Atomic Absorption Spectrophotometry
b. Flame Atomic Absorption Spectrophotometry

2.2.4.4 Precipitation Measurements

During the project, rainfall data was recorded with two instruments. The Alachua County Southwest Landfill's rain gage was used from 6/11/98 through 8/18/98. The gage was located approximately 300 ft away from the test cells and provided an approximate rainfall. From 8/18/99 throughout the end of the experiment, rainfall data was collected by a weather station (Rain Wise, Inc. Weather Log System 10) installed adjacent to the test cells. Rainfall data from the weather station was collected every 30 minutes.

2.3 LEACHATE RESULTS

This section details the results from the field test cell experiments conducted during this project. It includes results from leachate generation, field parameters, conventional water quality parameters, VOCs, Semi-VOCs, and metals. Statistical analysis (a General Linear Model) was performed for the chemical parameters to determine differences among cells.

2.3.1 Leachate Generation

Leachate was produced when precipitation occurred and percolated through the waste in the cells. As leachate was removed from the cells, the volume was recorded. Figure 2-3 through Figure 2-6 show the volumes of leachate generated from each cell. The highest leachate generation was observed between 9/24/98 and 10/1/98 after Hurricane Georges passed. The second occurred when Hurricane Earl passed. The leachate was pumped out of the cells as soon as possible to maintain the unsaturated conditions of the cells.

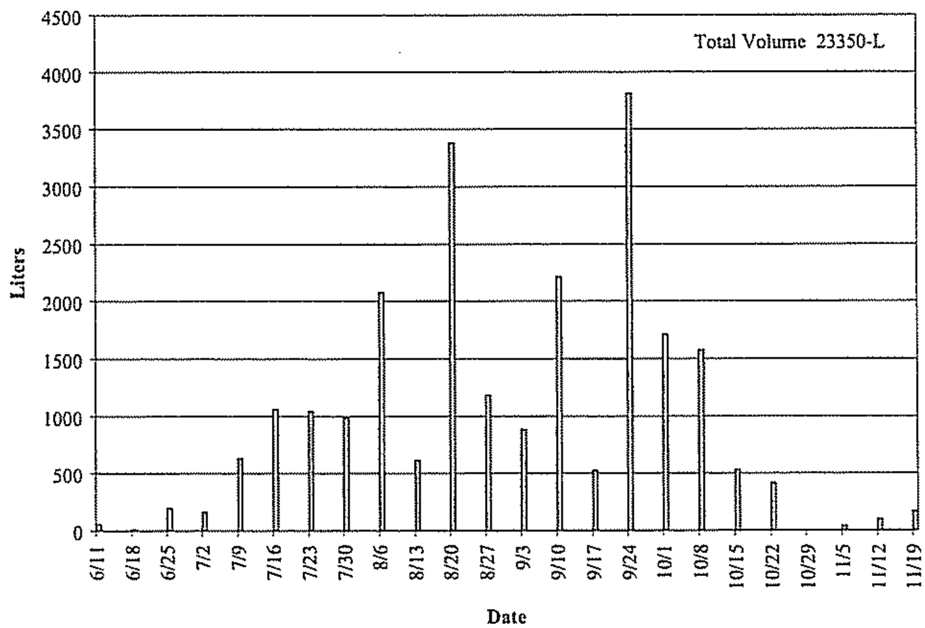


Figure 2-3 Leachate Production in Cell 1

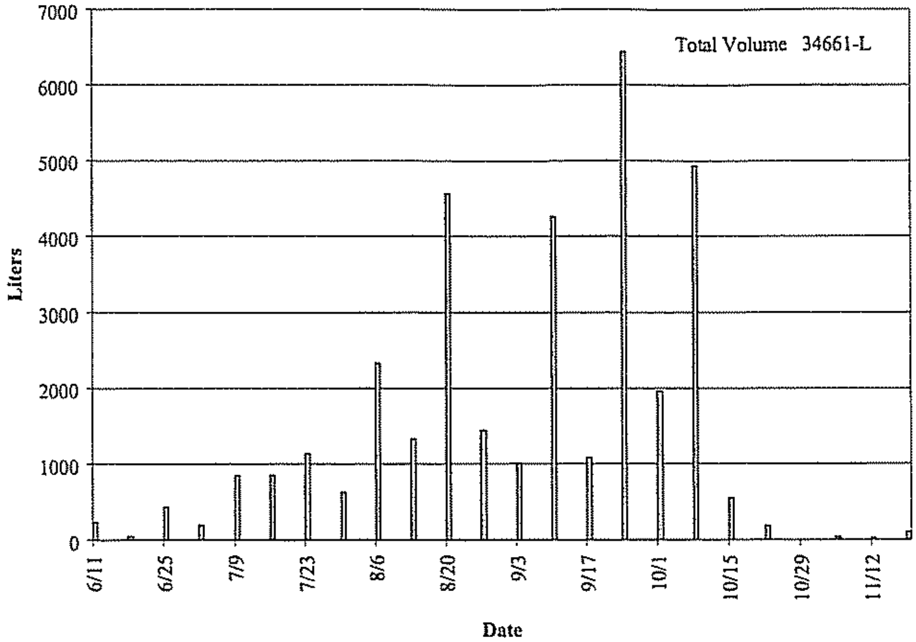


Figure 2-4 Leachate Production in Cell 2

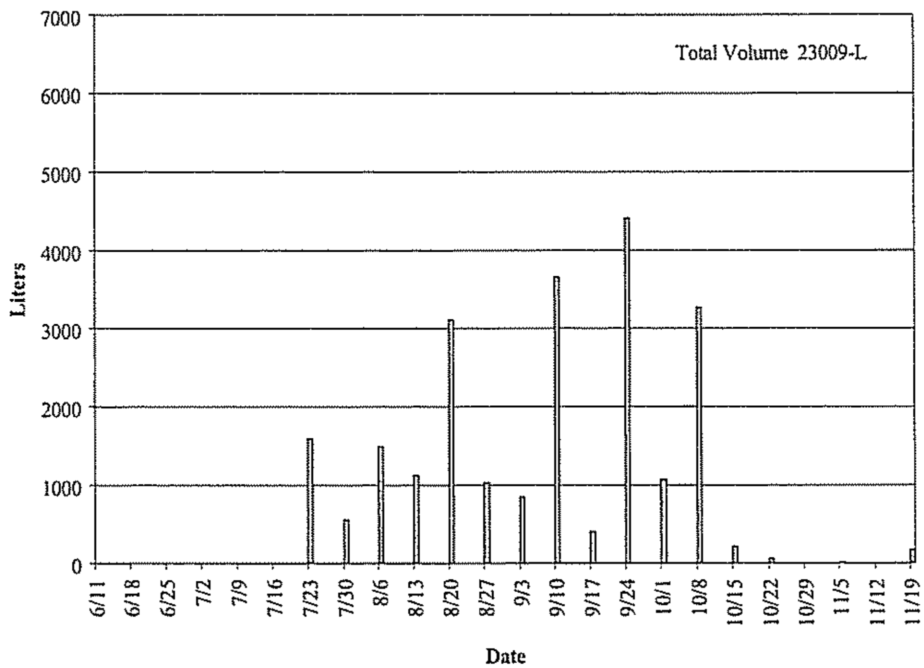


Figure 2-5 Leachate Production in Cell 3

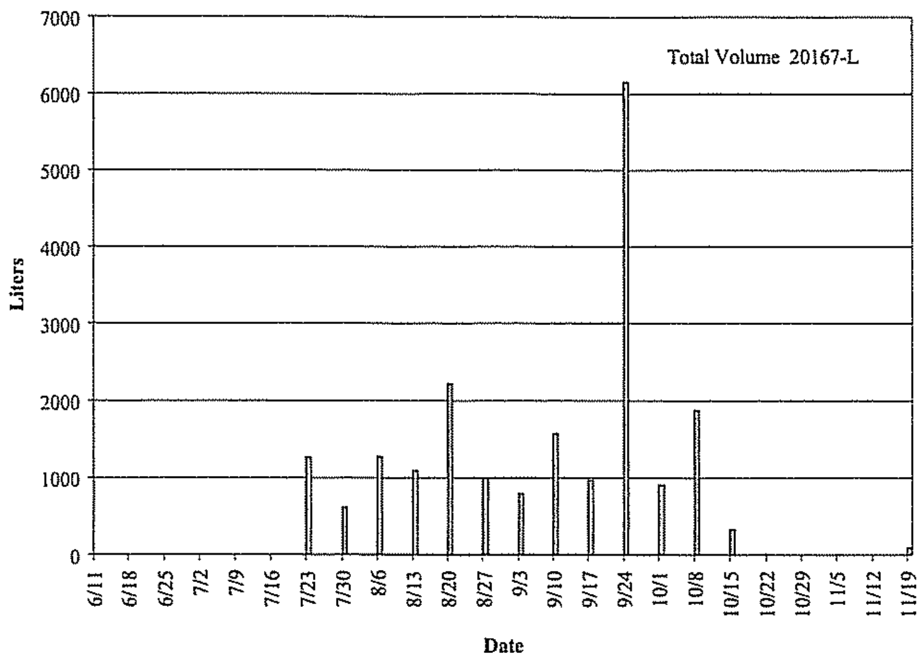


Figure 2-6 Leachate Production in Cell 4

2.3.2 Field Parameters

Field parameters measured included temperature, pH, conductivity, and dissolved oxygen. Leachate temperature from the cells ranged from 23.0 °C (November) to 30.7 °C (August). The pH of the cells is presented in Figure 2-7. The leachate pH was neutral, ranging from 6.14 to 7.9. No statistcal difference of pH was observed among the cells (p-value = 0.48). Conductivity ranged from 1.12-mS to 3.11-mS (Figure 2-8). Cell 1 and cell 4 conductivity was consistently higher than the other cells. Cell 2 conductivity showed a decreasing trend with time, while the other cell remained fairly constant. Dissolved oxygen ranged from 0.06 mg-O_2/L to 1.58 mg-O_2/L with an average value of 0.5 mg-O_2/L for all samples (Figure 2-9). The low DO data suggests that all the cells were typically under anearobic conditions throughout the experiment.

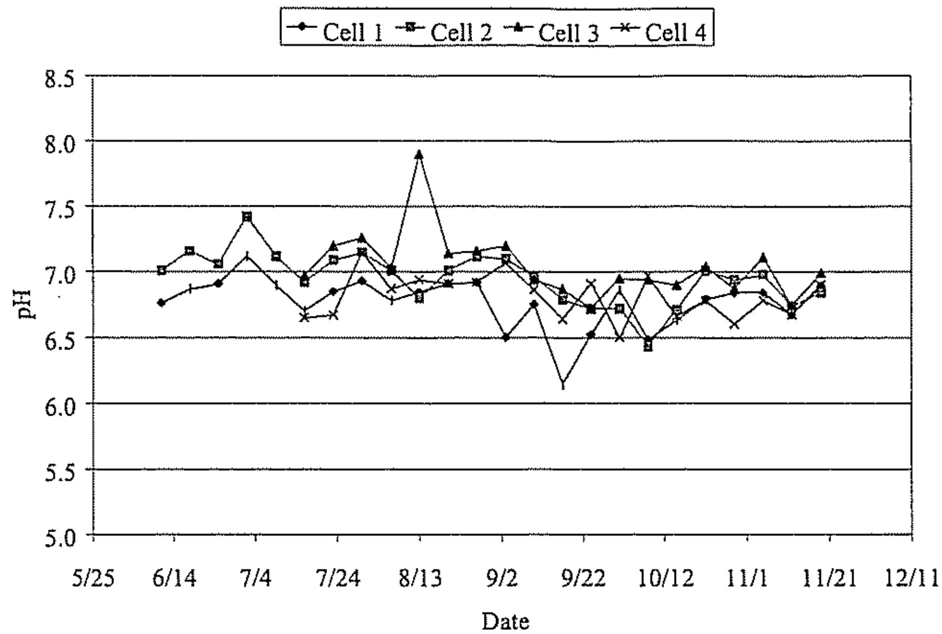


Figure 2 -7 pH Results in Field Test Cells

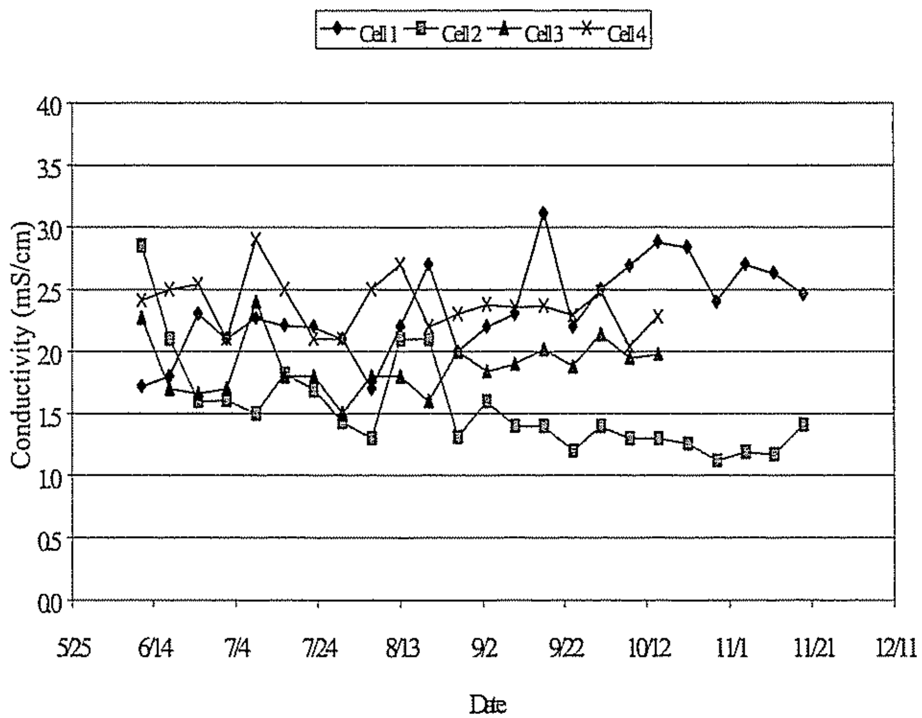


Figure 2-8 Conductivity Results in Field Test Cells

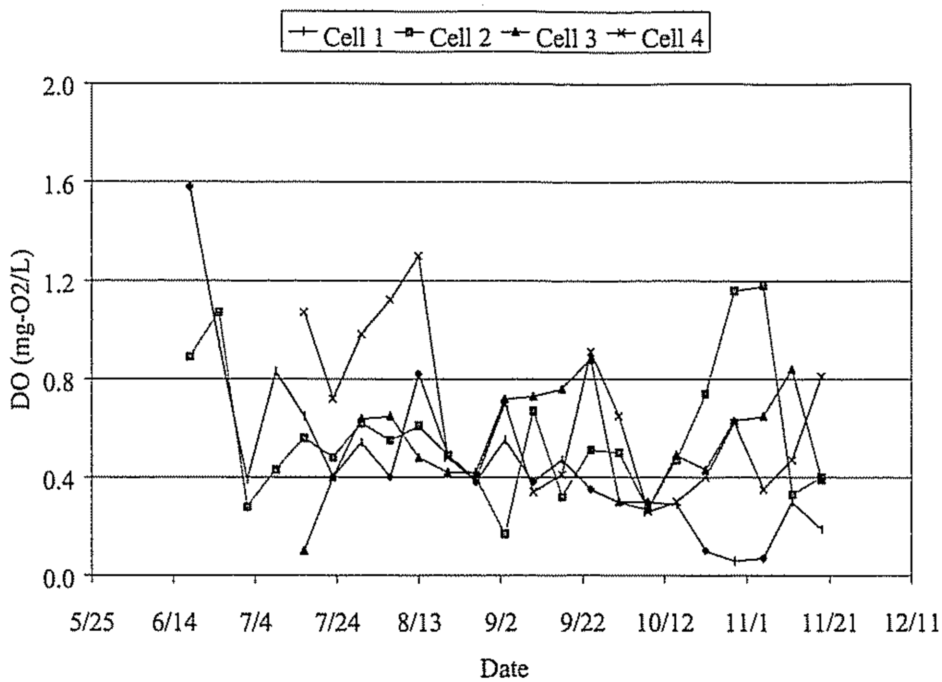


Figure 2-9 Dissolved Oxygen Results in Field Test Cells

2.3.3 Conventional water quality parameters

Conventional water quality parameters included total dissolved solid (TDS), ammonia, anions, cations, alkalinity, chemical oxygen demand (COD), and non-purgeable organic carbon (NPOC). The results of TDS are presented in Figure 2-10. The concentrations ranged from 970 mg/L in Cell 2 to 3,310 mg/L in Cell 4. All cell concentrations remained fairly constant, showing similar leaching trends of conductivity as shown in Figure 2-8. Cell 1 and Cell 4 concentrations were significantly higher than the other two cells (Cell 2 and Cell 3) (p-value < 0.01). Cell 2 TDS concentrations were significantly lower than the other cells (p-value < 0.01). The samples contained very little ammonia. The concentration ranged from below the detection limit of 1.0 NH_3-N mg/L ammonia to 4.1 NH_3-N mg/L (data not shown).

A total of six anions (fluoride, chloride, nitrate, nitrite, bromide, and sulfate) were analyzed. Only chloride and sulfate were detected in the samples. Chloride concentrations ranged from 7.0 mg/L in Cell 4 to 36.8 mg/L in Cell 2 (Figure 2-11). This range is considerably low compared to that of MSW leachate (100 mg/L to 3,000 mg/L) (Tchobanoglous et al., 1993). The concentrations of the cells decreased over time and the cells were not significantly different (p-value $= 0.14$).

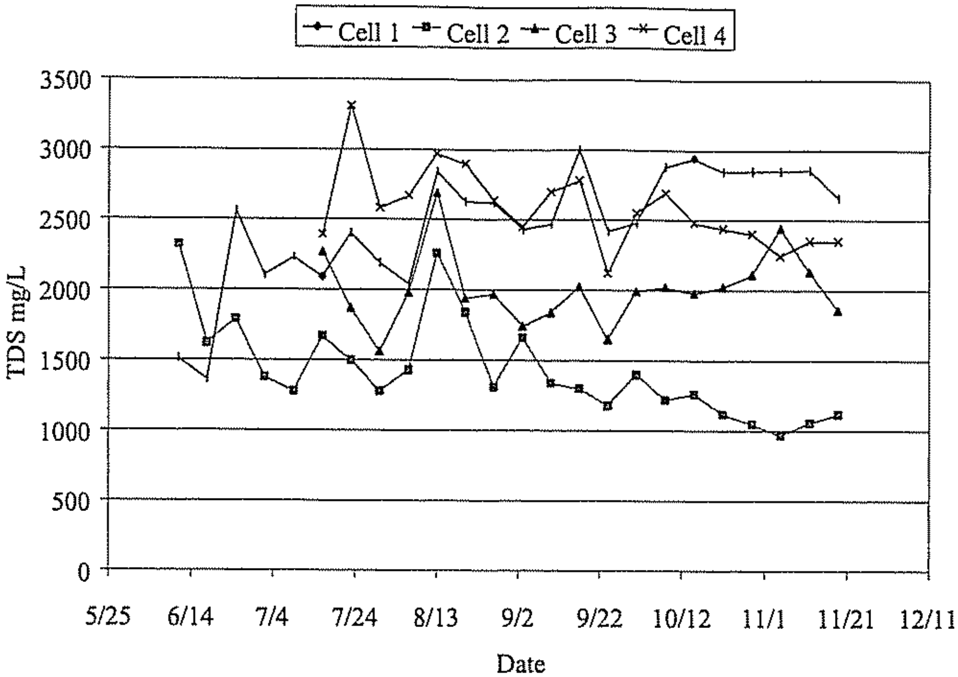


Figure 2-10 Total Dissolved Solids Results in Field Test Cells

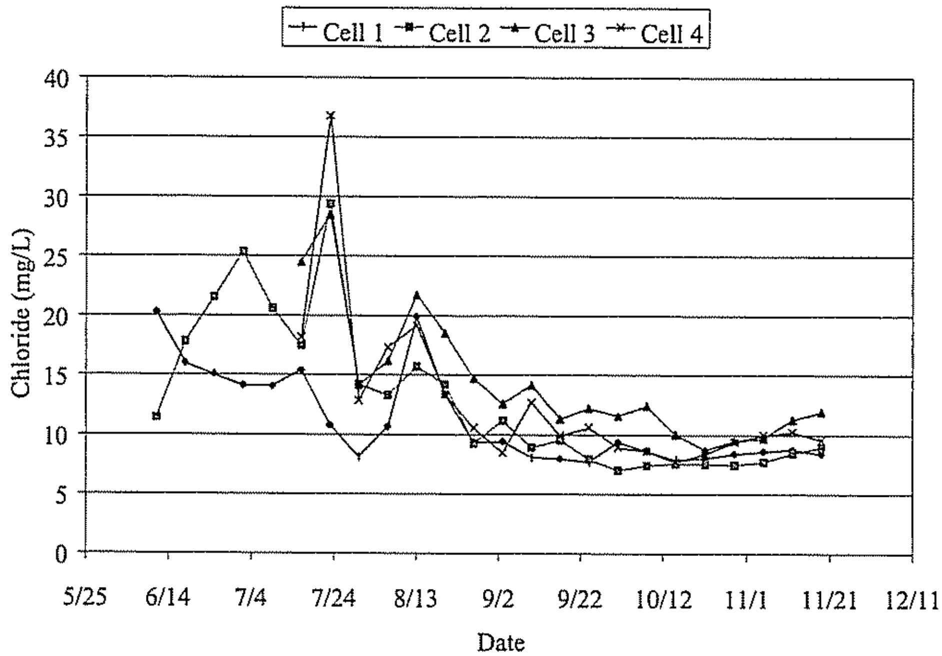


Figure 2-11 Chloride Results in Field Test Cells

Figure 2-12 presents the results of sulfate. Sulfate concentrations remained relatively constant over time, ranging from 310 mg/L in Cell 2 to 1,370 mg/L in Cell 4. Cell 4 was significantly higher than the other cells over time (p-value < 0.01). Cell 2 was significantly lower than the other cells over time (p-value < 0.01). All concentrations exceeded the secondary groundwater guidance concentration of 250 mg/L.

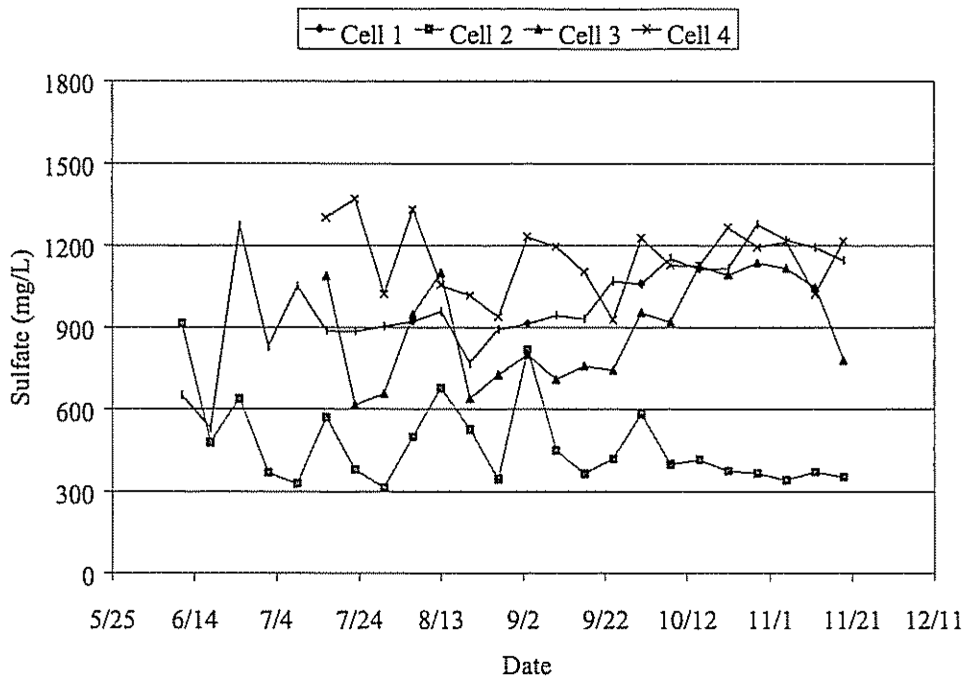


Figure 2-12 Sulfate Results in Field Test Cells

The cation analyses consisted of calcium, magnesium, potassium, and sodium. Calcium concentrations ranged from 225 mg/L in Cell 2 to 690 mg/L in Cell 3 (Figure 2-13). The concentrations of all the cells remained relatively constant over time. Cell 2 was significantly lower than the other cells (p-value < 0.01). The calcium trend was similar to that observed with sulfate. Figure 2-14 presents the results of potassium. The concentrations ranged from 12.5 mg/L in Cell 1 to 62.7 mg/L in Cell 3. The graph displays a slight downward trend in potassium concentrations with two similar spikes on 7/16/98 and 8/13/98. Magnesium concentrations range from 25.6 mg/L in Cell 3 to 182.8 mg/L in Cell 1 (Figure 2-15). The concentrations in Cell 1 fluctuated over time and were higher than the other cells, especially for the first two months. All other cells remained relatively constant concentrations throughout the experiment. Figure 2-16 shows the concentrations of sodium, ranging from 18.8 mg/L in Cell 4 to 100.3 mg/L in Cell 1. All cells exhibited a downward trend, after which the concentrations leveled off.

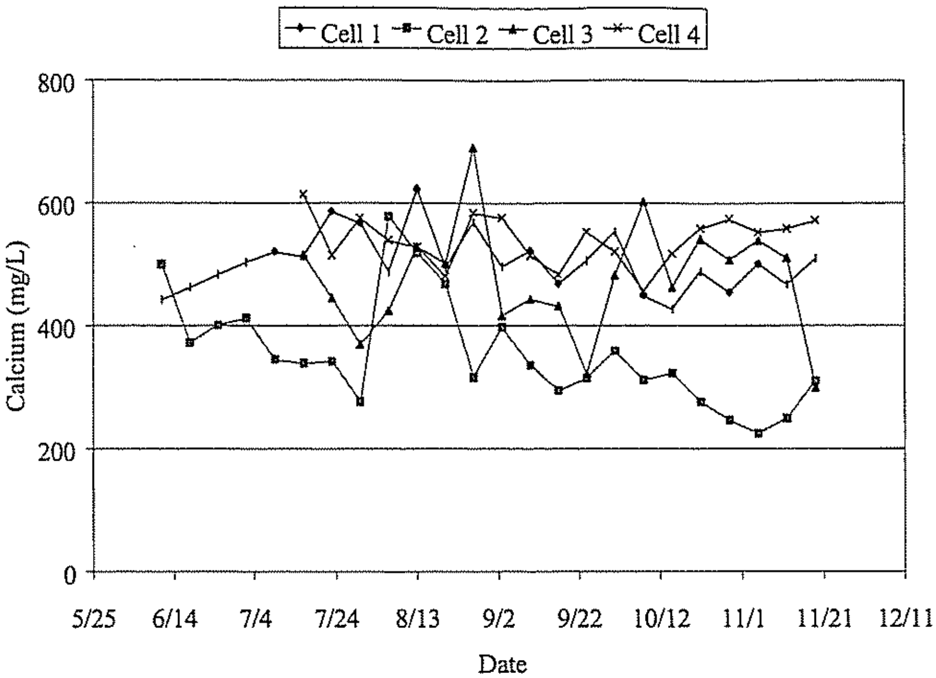


Figure 2-13 Calcium Results in Field Test Cells

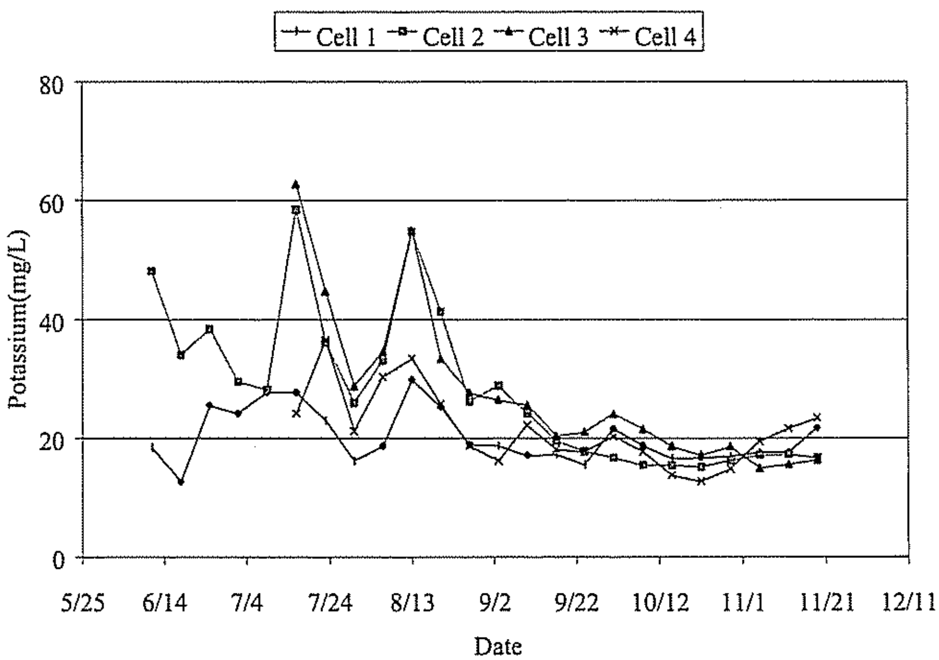


Figure 2-14 Potassium Results in Field Test Cells

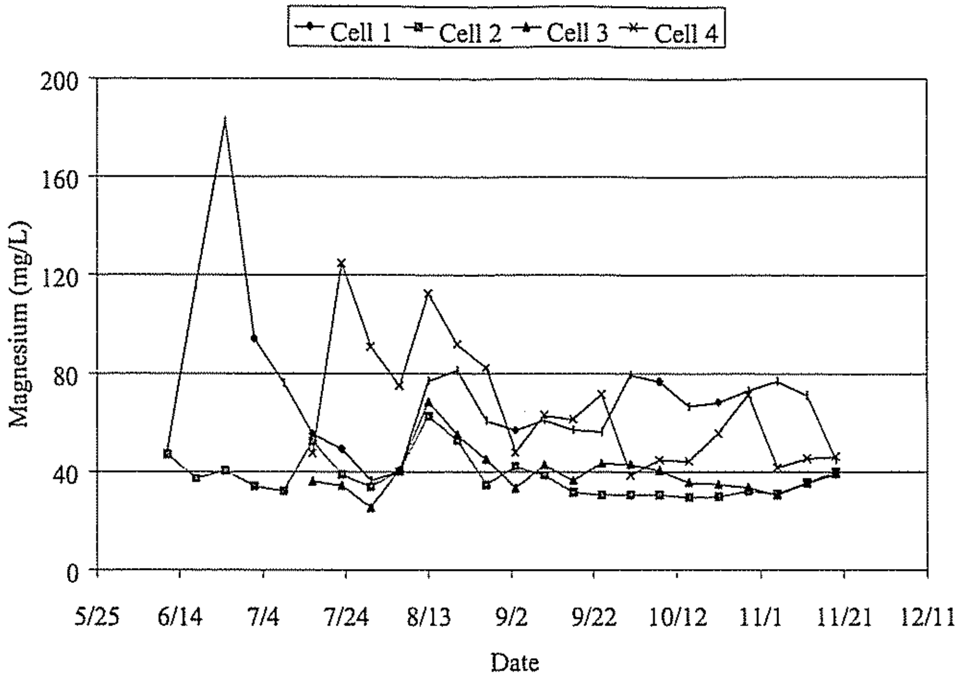


Figure 2-15 Magnesium Results in Field Test Cells

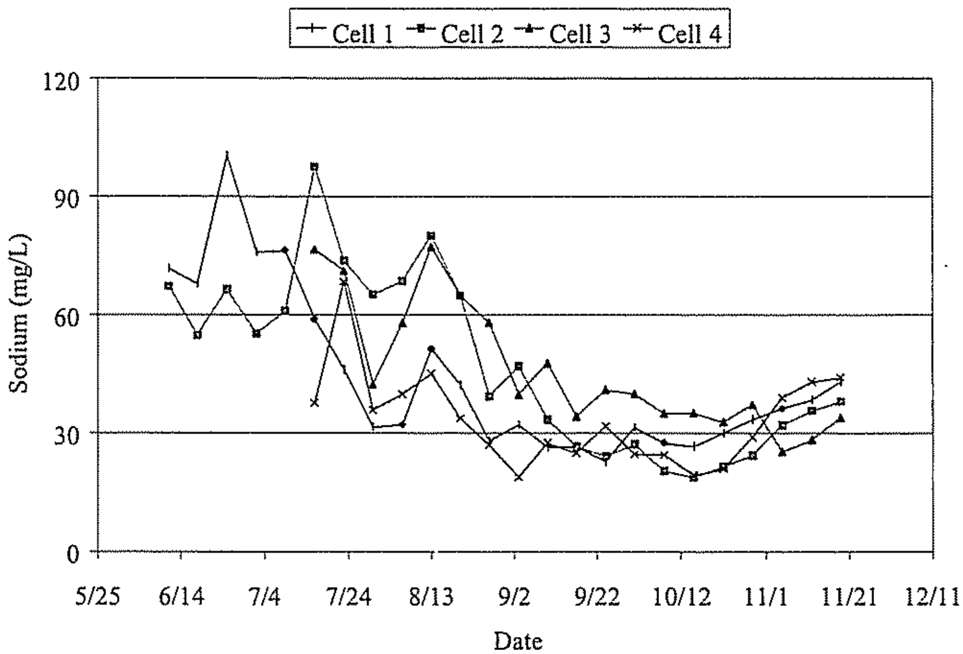


Figure 2-16 Sodium Results in Field Test Cells

The results of alkalinity are presented in Figure 2-17. Alkalinity ranged from 210-mg/L as $CaCO_3$ in Cell 4 to 960-mg/L as $CaCO_3$ in Cell 1 for all samples. Figure 2-18 displays the COD results. Except for the spike in Cell 4, the COD concentrations of each cell show a slightly downward trend over time. Most of the time, the COD concentrations were all below 500 mg/L. Figure 2-19 presents the results of non-purgeable organic carbon (NPOC). The NPOC results range from 1.1 mg/L in Cell 2 to 80.5 mg /L in Cell 2. The NPOC concentrations in the cells were similar and followed the same decreasing trend, however, initially the NPOC concentrations were highly variable.

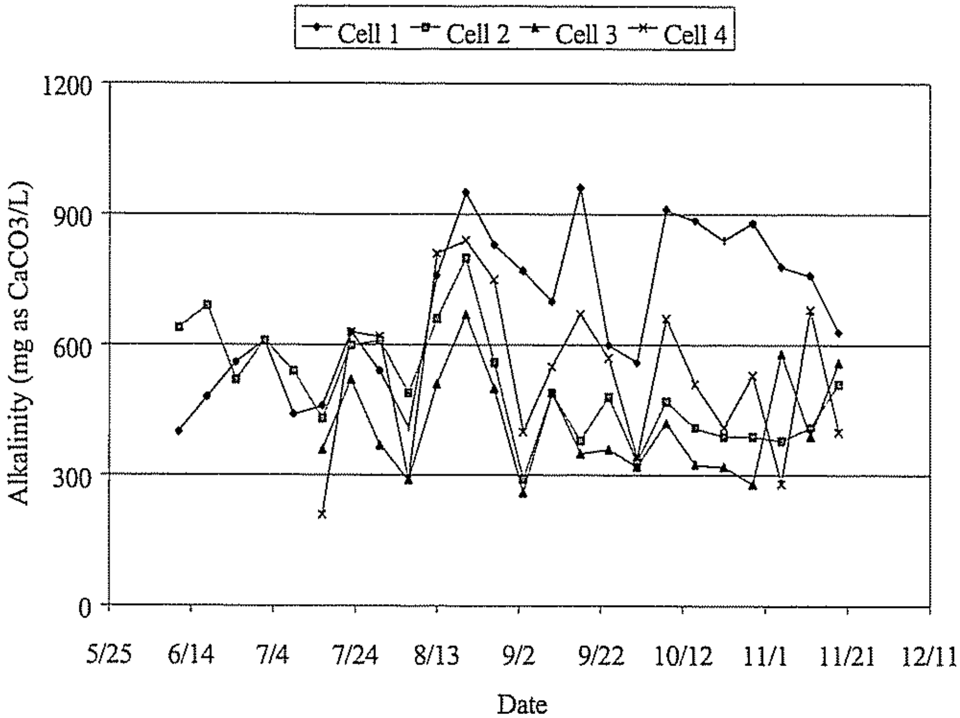


Figure 2-17 Alkalinity Results in Field Test Cells

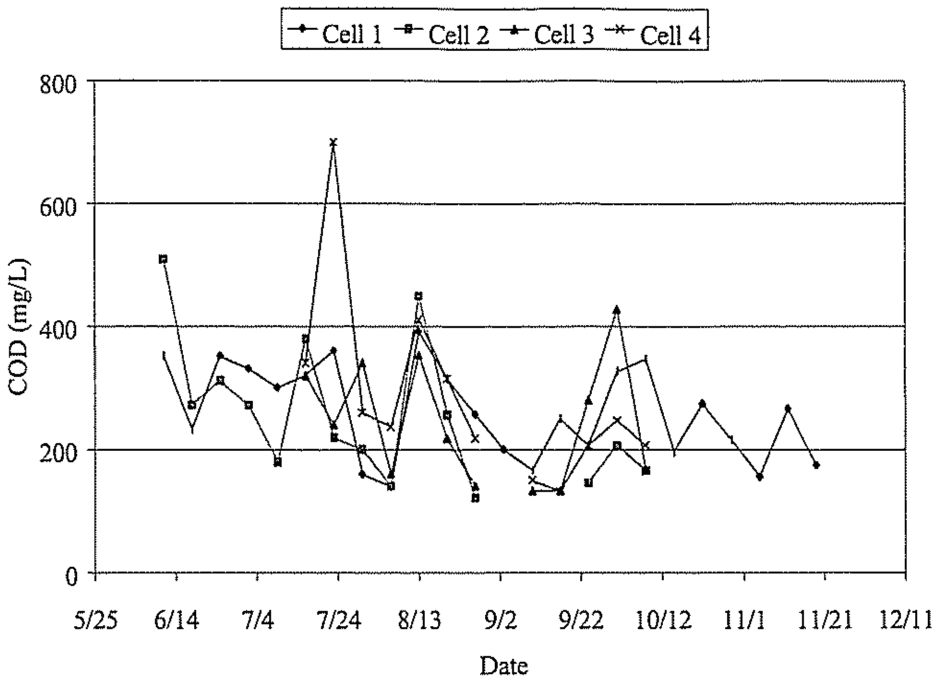


Figure 2-18 Chemical Oxygen Demand Results in Field Test Cells

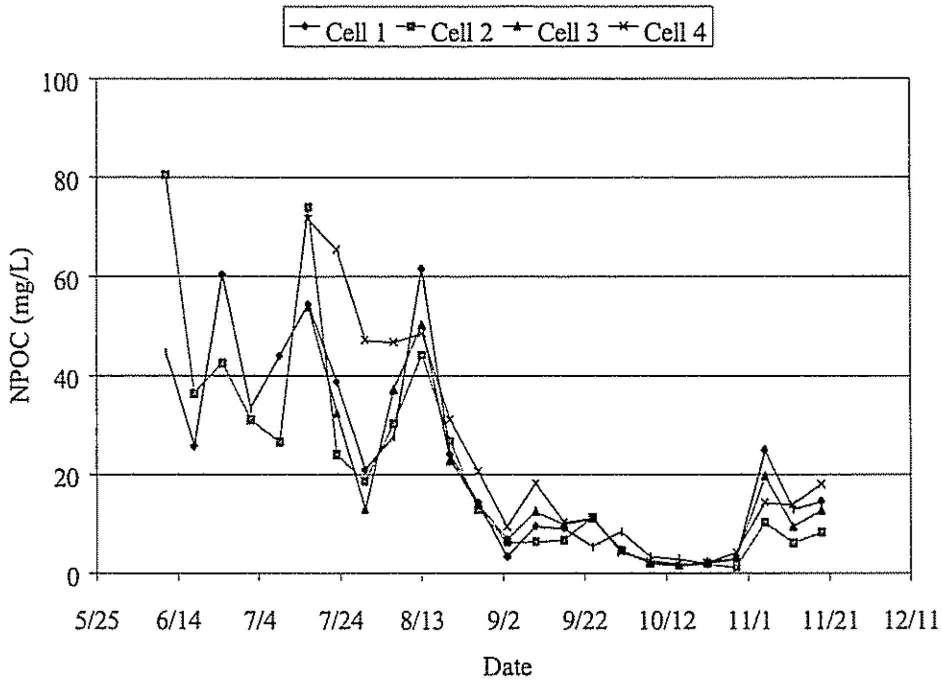


Figure 2-19 Non-Purgeable Organic Carbon Results in Field Test Cells

2.3.4 Metals Results

The leachate samples were analyzed for 13 metals. Many of the metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) are used as primary drinking water standards protecting human health. The remaining five metals (aluminum, copper, iron, manganese, and zinc) are used as secondary drinking water standards, which were established for aesthetic reasons. The following subsections presents the data collected for the metals that were detected in the leachate.

Aluminum results ranged from 52.4 μg/L in Cell 1 to 2380 μg/L in Cell 3 (Figure 2-20). There was a 1610- μg/L and a 2380- μg/L spike in the Cell 3 aluminum results and the concentrations were considerably higher than the other cells. Arsenic concentrations are presented in Figure 2-21 and ranged from below the detection limit of 10 μg/L in Cell 2 to 148 μg/L in Cell 1. Cell 1 contained significantly higher arsenic than the other cells (p-value < 0.01). The arsenic concentrations in the other cells remained relatively constant over time. Chromium results are presented in Figure 2-22. Chromium concentrations ranged from below the detection limit of 10 μg/L to 74.9 μg/L in Cell 1. Cell 1 also contained significantly higher chromium than the other cells (p-value < 0.01). The concentration of chromium increased in Cell 1 and peaked in the fourth sample (7/23/98), then began a steady decrease. All the other cells contained comparable concentrations of chromium, and remained steady throughout the experiment. Most copper samples were below 20 μg/L with an exception of one sample from Cell 4, which contained considerably high concentration of copper (1740 μg/L) (Figure not shown).

Iron concentrations ranged from 290 μg/L in Cell 1 to 4640 μg/L in Cell 4 (Figure 2-23). The iron concentrations from all the cells varied over time with a spike on 10/15/98 (Cell 2, Cell 3, Cell 4). Lead concentrations ranged from below the detection limit of 1.0 μg/L to 14 μg/L in Cell 3 (Figure not shown). Most sample concentrations were between 2 μg/L and 5 μg/L. Manganese results are presented in Figure 2-24. The sample concentrations ranged from 160 μg/L in Cell 3 to 2267 μg/L in Cell 1. Most manganese samples were between 250 μg/L and 500 μg/L. Cell 1 initially had a high concentration of manganese, then decreased and remained relatively constant throughout the remainder of the time. Selenium was detected in only five samples and ranged from below the detection limit of 5 μg/L to 24.2 μg/L in Cell 4 (data not shown). Only Cell 3 and Cell 4 leachate contained selenium. Most of the sample zinc concentrations were below the detection limit of 100 μg/L. The zinc concentrations ranged from below the detection limit of 100 μg/L to 1730 μg/L in Cell 4 (Figure not shown).

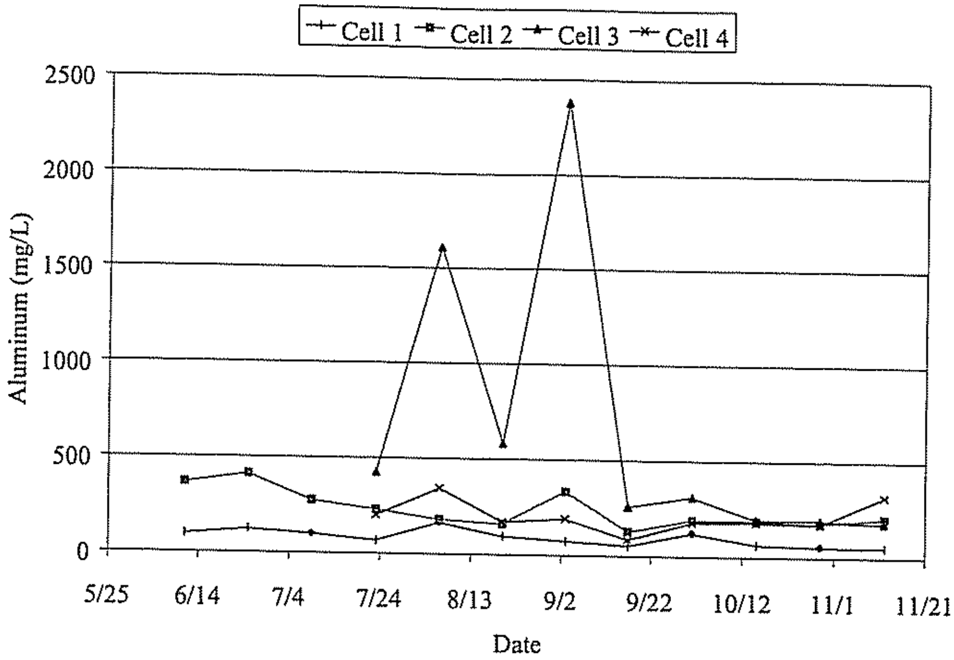


Figure 2-20 Aluminum Results in Field Test Cells

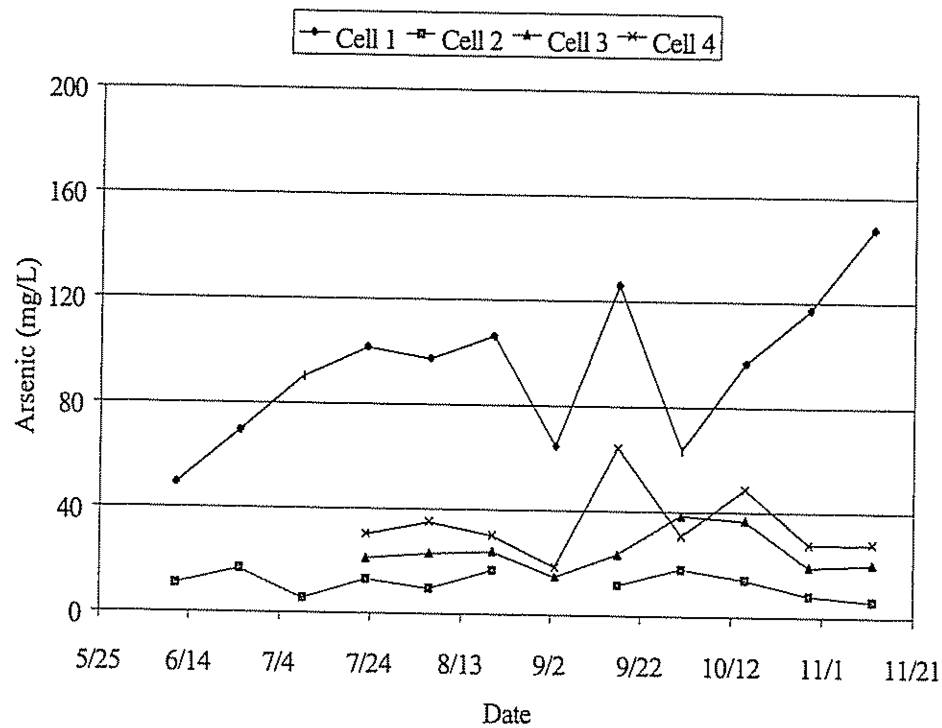


Figure 2-21 Arsenic Results in Field Test Cells

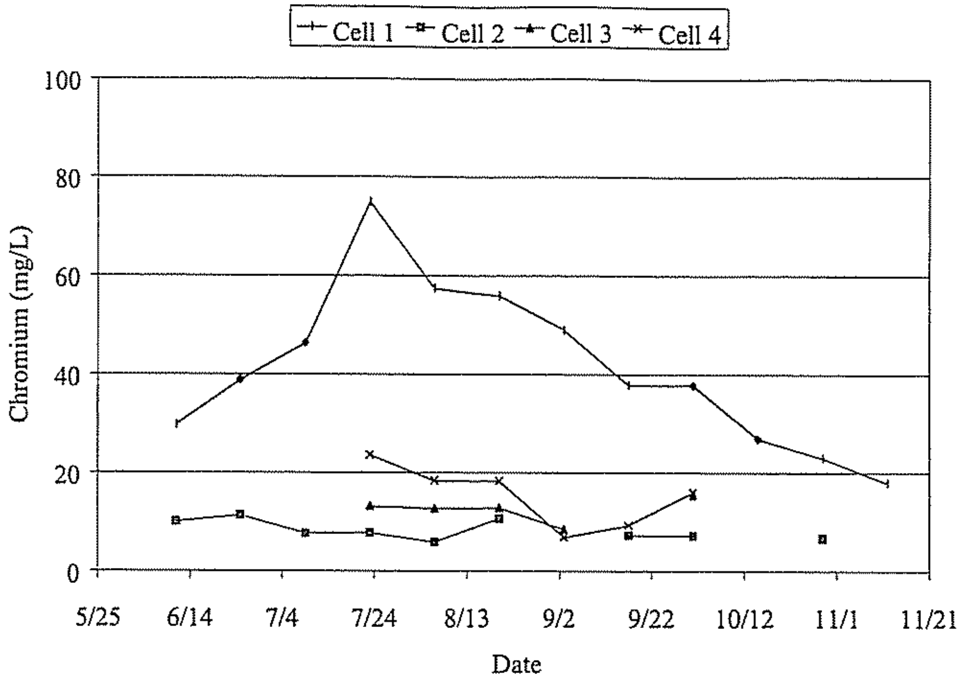


Figure 2-22 Chromium Results in Field Test Cells

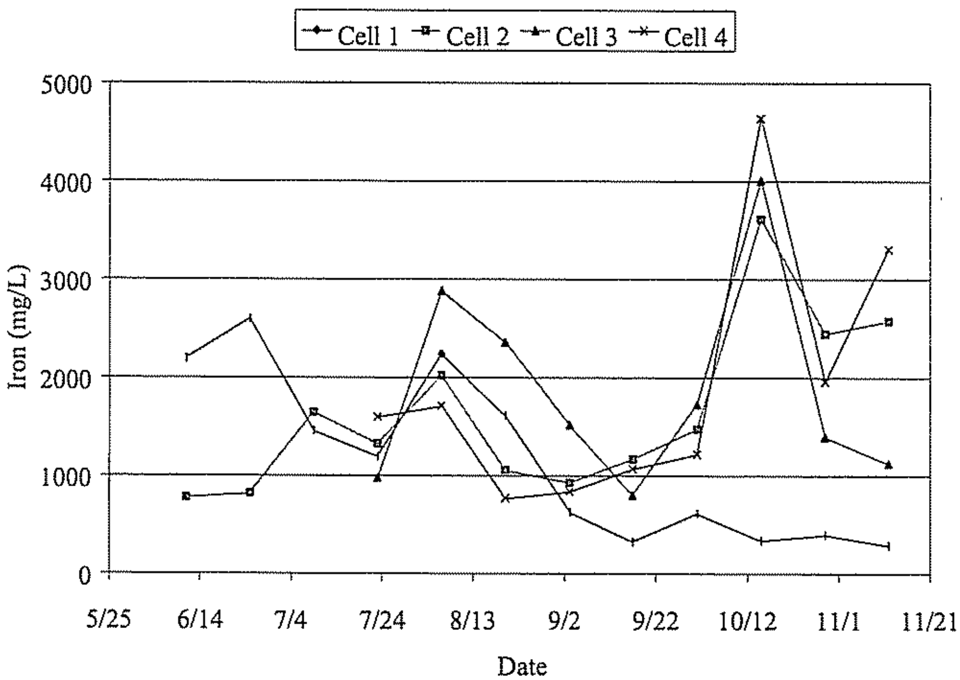


Figure 2-23 Iron Results in Field Test Cells

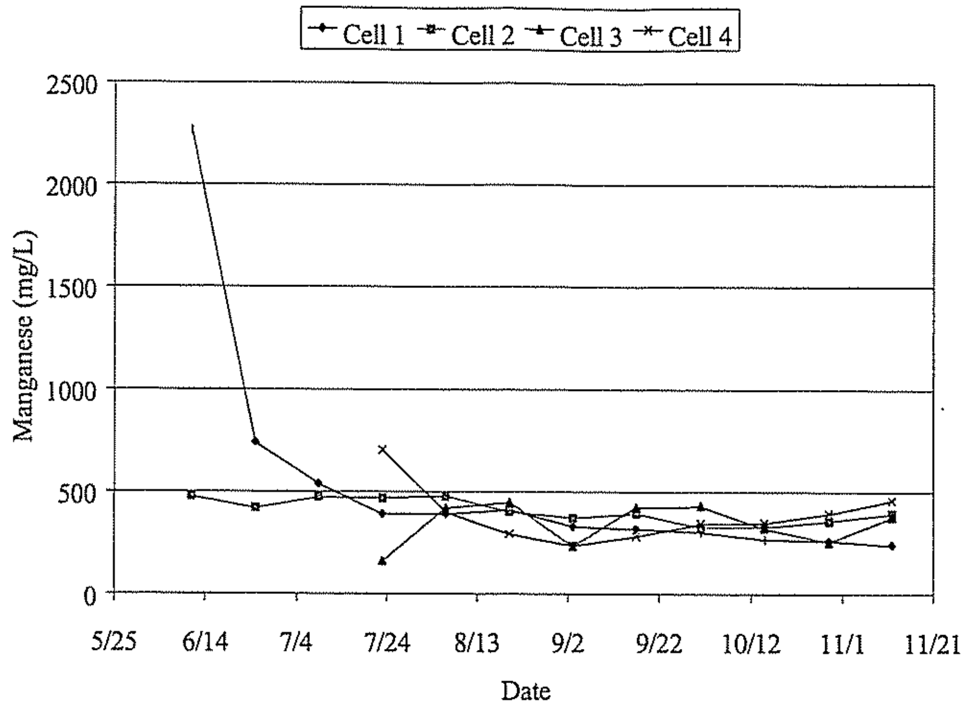


Figure 2-24 Manganese Results in Field Test Cells

All the metals analyzed are summarized in Table 2-5. Aluminum, iron, and manganese were detected from all of the samples (a total of 42 samples) above detection limits. Other routinely detected metals were arsenic, chromium, copper, and lead. Barium, cadmium, mercury, and nickel were not detected, while selenium and zinc were detected only in a small number of samples. The aluminum, iron, and manganese concentrations often exceeded the secondary standards for drinking water.

2.3.5. Volatile Organic Compounds and Semi-Organic Compounds

The VOC analytical results are presented in Table 2.6. Only 12 out of 52 volatile organic compounds were detected and many of these were detected only once. The detected VOC compounds were near the detection limit (1 µg/L). Ethylbenzene, 4-isopropyltoluene, methylene chloride, and toluene were commonly detected in the samples. One semi-VOC, di-n-butyl phthalate, from one sample in Cell 4 was detected with a concentration of 10.5 µg/L. No base/neutral compounds, pesticides, polycyclic aromatic hydrocarbons (PAHs), or polychlorinated biphenyls (PCBs) were detected during the entire leachate samples.

Table 2-5 Summary of Metal Results

Metal	Number of Samples Analyzed	Number of Sample Detected	Min. (µg/L)	Max. (µg/L)	Average[a] (µg/L)	Total Average[b] (µg/L)	Detection Limit (µg/L)
Aluminum	42	42	52.4	2380	284	284	20
Arsenic	42	41	BDL	148	43.8	42.8	5
Barium	42	0	BDL	--	--	--	500
Cadmium	42	0	BDL	--	--	--	0.5
Chromium	42	32	6.0	74.9	22.7	17.9	5
Copper	42	22	5.6	1740	92.0	50.6	5
Iron	42	42	290	4640	1613	1613	100
Manganese	42	42	160	2267	425	425	20
Mercury	30	0	BDL	--	--	--	1.25
Nickel	42	0	BDL	--	--	--	50
Lead	42	26	BDL	14.1	4.1	2.7	1
Selenium	42	5	BDL	24.2	14.8	4.0	5
Zinc	42	17	BDL	1731	433	205	100

BDL = Below Detection Limit

[a] Does not include BDL samples

[b] BDL samples are included at a value of one-half the detection limit.

Table 2-6 VOC Analysis Results

Parameters	Number of Analyzed Samples	Number of Detected Samples	Range (µg/L)
Ethylbenzene	26	15	1.1 - 10.8
1,1-dichloropropene	26	1	2.1
1,2,4-trimethylbenzene	26	1	9.7
1,3,5-trimethylbenzene	26	1	3
4-isopropyltoluene	26	5	1.1 - 1.7
m/p-xylene	26	1	2.7
Methylene chloride	26	4	1.6 - 2.8
Naphthalene	26	1	1.2
O-xylene	26	2	1.3 - 5.2
Tert-butylbenzene	26	1	3
Tetracholoroethane	26	1	3.2
Toluene	26	6	1.2 - 6.7

2.4 DISCUSSION OF FIELD STUDY

2.4.1 Field Leachate Characteristics and Pollutant Sources

Noticeable physical characteristics of leachate from the residential construction waste were odor and color. The leachate contained a very strong odor as a result of hydrogen sulfide production. The leachate color changed from clear yellow to turbid black. The black leachate likely resulted from insoluble black sulfide precipitates. The pH results were approximately neutral during the experiment. The dissolved oxygen concentrations remained below 1 mg/L throughout the experiment, indicating that anaerobic conditions predominated in the cells. Conductivity of the leachate ranged from 1.1 mS/cm to 3.1 mS/cm and correlated well with total dissolved solids (TDS).

Calcium, sulfate, and alkalinity were the predominant ions observed in leachate from the C&D field test cells. These ions were the greatest contributors to the high TDS concentrations and resulted from the dissolution of gypsum drywall as well as the microbial activity (specifically sulfate-reducing bacteria) in the cells. Another possible source of calcium and alkalinity was concrete, which often leaches calcium carbonate and calcium hydroxide.

Most of the COD samples fluctuated between 100 mg/L and 400 mg/L. Organic carbon also fluctuated around 50 mg/L and then dropped below 20 mg/L after three months. These ranges are fairly low relative to the typical organic constituent range of municipal solid waste landfill leachate. C&D waste contains a lower fraction of biodegradable organic material when compared to MSW.

Open paint cans, solvent cans, and sealant tubes may leach trace organic compounds into the leachate. The materials were removed from the waste piles prior to placement. Following normal requirements for C&D debris landfills in Florida (FAC, 1997), such materials were inspected and removed from the waste piles. However, there was still an opportunity for trace organic compounds to leach after the placement of the residual materials. No volatile and semi-volatile organic compounds were detected at elevated levels in the leachate. Twelve compounds out of 52 volatile organic compounds were detected. During the semi-volatile organic analysis, di-n-butyl phthalate from Cell 4 was detected with a concentration of 10.5 μg/L. No base/neutral compounds, pesticides, PAHs, or PCBs were detected in any leachate sample.

Of the thirteen metals analyzed, aluminum, iron, and manganese were detected from all of the samples above the detection limit. Arsenic, chromium, copper, and lead were also routinely detected. No barium, cadmium, mercury, or nickel was found in the leachate, while selenium and zinc were detected only in a small number of samples. The most likely source of arsenic and chromium was chromated copper arsenate (CCA)-treated wood. The possible sources of iron include metal packing-strips, nails, metal pipe, and metal containers in the waste. The wood waste in the cells is a likely source for the high levels of manganese in the leachate.

2.4.2 Comparison to Full-Scale C&D Landfill Leachate

Table 2- 7 presents a comparison of the leachate results from the field test cell with the leachate data from a few full-scale C&D waste landfills available in the literature. In some cases, the range of measurement from the test cells was within the range of data reported in the literature. For example, the pH from the test cells and from the literature was near neutral conditions. The TDS and sulfate concentrations in the test cell were also close to the ranges of the field studies. However, chloride, sodium, and magnesium concentrations in the test cell leachate were lower than those in the field leachate. Barium, cadmium, and nickel were evident in the literature but were not found in the test cells.

Table 2-7 Comparison of C&D Laboratory Leachate Constituents Levels with Full-Scale C&D Waste Leachate

Parameters	SKB [a]	WMI [b]	Class III Landfill in Florida	C&D Landfill Leachate[c]	Test Cell Leachate
pH	6.8 - 7.1	6.6 - 7.6	5.9 – 7.8	7.0	6.1 - 7.9
TDS (mg/L)	1,700 - 5,740	15 - 770	752 – 6,000	2,263	1,360 - 3,310
Chloride (mg/L)	100 – 460	44.4 - 493	10 – 5,720	158	12.5 – 62.7
Sulfate (mg/L)	690 – 1,700	33 - 2,100	<1.0 – 1,300	254	313- 1,138
Calcium (mg/L)	280 - 600	NA	140 – 740	274	299 – 691
NPOC (mg/L)	--	33 – 1,900[d]	359[d]	307[d]	1.1 – 80.5
Arsenic (μg/L)	2.0 - 200	7.0 - 41.3	--	12.3	<5.0 – 147.8
Barium (μg/L)	100 - 160	33 - 643	--	2,000	<500
Cadmium (μg/L)	1.0 – 2.0	7.0 - 41.3	--	31.9	<0.5
Chromium (μg/L)	--	36.6 - 45	--	--	6.0 – 74.9
Copper (μg/L)	10.0	155	--	20.3	5.6 – 1,740
Iron (mg/L)	20 – 14,000	1.4 - 48.6	--	36.8	0.3 – 4.6
Manganese (mg/L)	80 – 9,800	--	--	8.7	0.2 – 2.3
Nickel (μg/L)	--	23 – 46.9	--	20.0	<500
Zinc (μg/L)	10 - 30	13 – 2,320	--	657	107 – 1,731

a. Source: NADC (1994)
b. WMI (1993)
c. Mean values in Melendez (1996)
d. Total organic content concentration.

2.4.3 Leachate Quality and Regulatory Limits

Leachate quality data obtained from the field test cell study were compared to primary and secondary drinking water standards since the standards are very frequently adopted as groundwater standards or compliance guidelines (e.g. Florida). The comparison helps to identify pollutants of possible concern. However, it should be noted that the chemical constituents in most cases will be diluted and attenuated as leachate enters the groundwater underneath a landfill. The degree of dilution and attenuation depends on hydrologic conditions, the rate of discharge, and the pollutant species of concern.

Seven constituents were measured at concentrations above a drinking water standard: aluminum, arsenic, copper, iron, manganese, sulfate, and total dissolved solids. The regulatory limit for each parameter and the number of samples that exceeded this limit are presented in Table 2-8. Pollutants in the leachate that exceeded the drinking water standards by the greatest magnitude were manganese, followed by iron. Arsenic was the only primary drinking water standard (health-based) that was exceeded. The other six constituents exceeded secondary standards. The results will be discussed in more detail in Chapter 4.

Table 2-8 Comparison of Test Cell Leachate with Regulatory Standards

Parameters	Drinking Water Standard	Number of Samples	Number Exceeded	Total Average Concentration [a]
Aluminum (μg/L)	200	42	16	284
Arsenic (μg/L)	50	42	12	42.8
Copper (μg/L)	1000	42	1	50.6
Iron (μg/L)	300	42	41	1613
Manganese (μg/L)	50	42	42	425
Sulfate (mg/L)	250	86	86	860
TDS (mg/L)	500	86	86	2,100

a. BDL samples included at a value of one-half the detection limit.

3. SIMULATED LANDFILL DEPTH AS A FACTOR IN LEACHING OF CONTAMINANT FROM C&D WASTE

3.1 INTRODUCTION

The type, concentrations and production rates of contaminants in the leachate at a C&D waste landfill site are influenced by factors including waste type and composition, moisture flux into the waste, landfill depth, landfill operations, temperature, and time. The mechanisms and extents to which they influence contaminant leaching have not been well documented.

In previous studies, two leaching column (or lysimeter) experiments were conducted at the University of Florida to characterize C&D leachate and investigate the effects of the factors on the leachate. The first leaching column study (referred to as leaching column study 1) examined leachate composition produced from a typical C&D waste stream under two different conditions (saturated and unsaturated). The saturated (or flooded) conditions simulated the disposal of C&D waste in sand quarries that have been excavated to below the groundwater table. The unsaturated conditions simulated the general disposal practice of C&D debris, where waste is disposed in landfills above the groundwater table. The main objective of the second leaching column study (referred to as leaching column study 2) was to characterize leachates from the major C&D waste components (i.e. wood, concrete, drywall, and cardboard). The study investigated and measured the concentration of chemical constituents that leached from both individual C&D waste components and mixed C&D waste.

The purpose of this research was to examine the effect of waste depth on contaminant leaching. The simulated leaching columns were subjected to a low application rate of leaching solution. Batch leaching experiments on C&D waste components were also investigated using the synthetic precipitation leaching procedure (SPLP). In this study, heavy metals and sulfide, which were not included in the previous studies, were added to the leachate constituents measured.

3.2 MATERIALS AND METHODS

Experimental methods included leaching column set-up, waste preparation and loading, and leaching analysis. The column experiment was performed over a one-year period.

3.2.1 Leaching Experiment Set-up

A total of six leaching columns were used for this study (the same columns in the previous leaching studies). A column schematic was shown in the previous report (Townsend et al., 1998). To simulate 20-ft of waste in a landfill, a total of five columns were set up in series (Figure 3-1). Leachate produced from the first column was pumped into the top of the next column. This was repeated until the leachate flowed through the last column. A single column was utilized to represent a 4-ft deep waste layer.

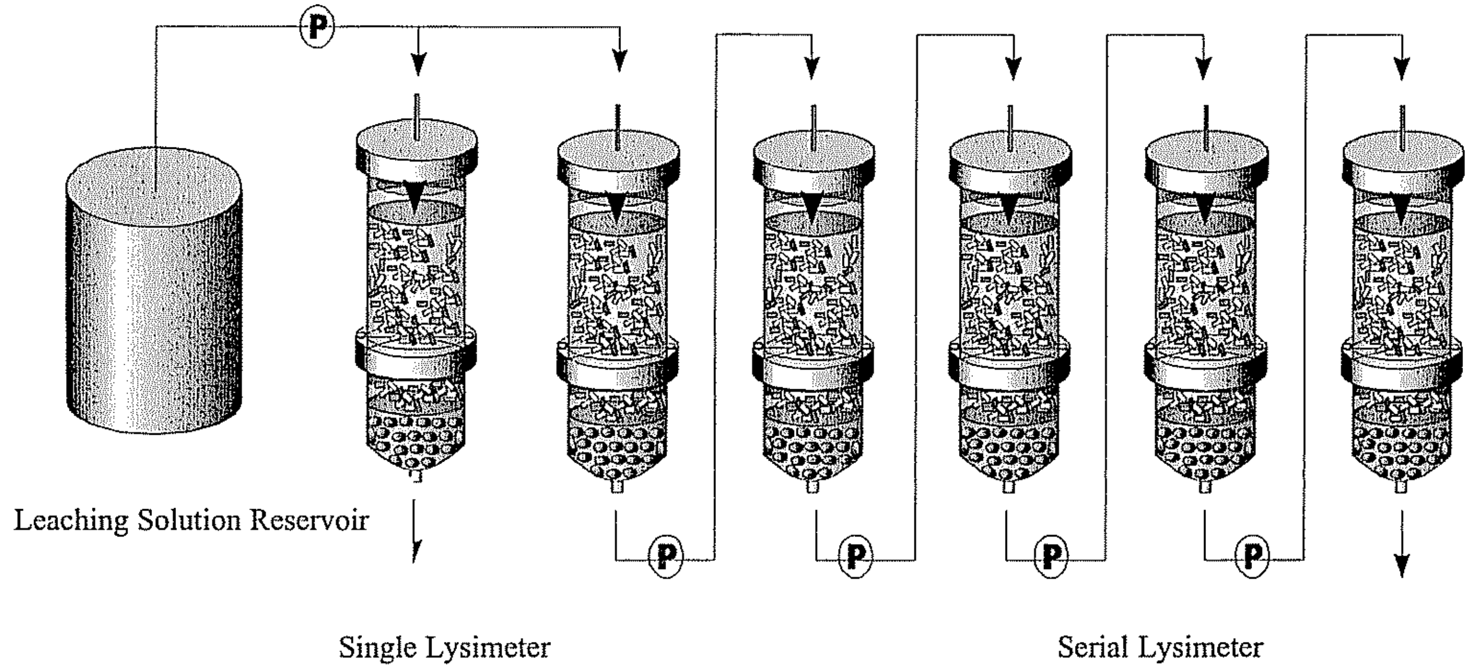


Figure 3-1 C&D Waste Leaching Lysimeter Set-up

Leaching solution was added to the columns using a low flow rate pump system (MASTERFLEX ® L/S™ Model 7419-10 and MASTERFLEX ® L/S™ Model 7419-05). Synthetic precipitate leaching procedure (SPLP) solution was used as a leaching solution. Table 3-1 presents the application rates of leaching solution, pumping frequency and duration, and simulation periods for the single and serial columns.

Table 3-1 Application Rates of Leaching Solution in Column Leaching Experiment

	Pump 1 (Single Column)	Pump 2 (Serial Column)
Flow Rate	46.3 ml/min	30.0 ml/min
Frequency	Every 6 hour	Every 1 hour
Duration	10 minutes	5 minutes
Simulation Period	10 years.	10 years.

3.2.2 Waste preparation

The materials placed in the columns consisted of clean, new construction materials or recycled materials with little chance of contamination from trace chemicals. The sources of these components included local home improvement stores, a concrete recycling facility, and local construction sites. Any bulky material was size-reduced to a uniform size, nominally to 2 inch by 2 inch pieces. It was necessary to select a component size that would fit into the lysimeter and allow for ease of mixing. Table 3-2 presents the source and amount of C&D waste components placed into the lysimeter.

3.2.3 Waste loading

In order to ensure the proper mixing of C&D components, after the materials were weighed they were pre-mixed in a 5-gallon bucket and then loaded into the columns in 1 foot lifts. A tamping device was used for waste compaction after each lift was added to the columns. A thermocouple was placed in each column after the second lift to monitor the temperature inside the waste column. The average waste bulk density of the C&D waste in the columns was 520 lb/yd^3. This value falls within the range of mixed construction waste density (305 – 605 lb/yd^3) reported in the literature (Tchobanoglous et al., 1993).

Table 3-2 Sources and Mass Composition of C&D Debris Components

C&D component	Source	Mass Composition (%)
Wood	Home Improvement Store, Southern Pine	33.2
CCA-Wood	Home Improvement Store, Type C, retention value: 0.25 lb/ft^3	0.5
Drywall	Home Improvement Store, Gypsum Wallboard Sheet	12.4
Concrete	Concrete Recycling Facility, 1 in. Screened Concrete	29.2
Copper	Home Improvement Store, Copper Wire (1/8 in. dia.)	0.6
Steel	Home Improvement Store, Galvanized Steel Sheet	0.6
Aluminum	Home Improvement Store, Aluminum Sheet	0.6
Steel Bar	Demolition Site, 1 in. dia. Steel Bar	0.6
Roofing	Home Improvement Store, Roofing Shingles	13.7
Insulation	Home Improvement Store, Fiber Glass	0.6
Cardboard	Construction Site, Corrugated Cardboard	8.0
Total		100.0

3.2.4 Leachate Analysis

Leachate was drained from the single and serial columns every other day. The volume of leachate collected was measured and recorded. The pH, oxidation-reduction potential (ORP) [Accumet Co. Model 20], dissolved oxygen (DO) (YSI Inc. Model 55/12 FT), and conductivity (HANNA Instruments, Model H19033) of the leachate were immediately measured after draining. After measuring the parameters, a portion of the leachate was preserved and filtered as necessary, placed in appropriate containers (conventional water quality parameters, organics, and metals), and stored at 4°C until analyzed. Table 3-3 summarizes the analytical parameters and the methods used in the laboratory analysis. Blanks, replicates, and calibration check samples were performed as appropriate to assure proper quality assurance and quality control (QA/QC).

Table3-3 Analytical Methods for Lysimeter Study 3

Parameter	Method
Temperature	Standard Method 2550[a]
pH	Standard Method 4500-H^+
Total dissolved solids	Standard Method 2540C
ORP	Standard Method 2580
Conductivity	Standard Method 2510
COD	Standard Method 5220C
NPOC[b]	Standard Method 5310B
Anions	SW-846 Method 9056[c]
Cations	Ion Chromatography[d]
Alkalinity	Standard Method 2320B
Ammonia	Standard Method 4500-D
Sulfide	Standard Method 4500-D
Arsenic	EPA SW846-7060A
Chromium	EPA SW846-7191
Copper	EPA SW846-7211
Iron	EPA SW846-7280
Manganese	EPA SW846-7461
Zinc	EPA SW846-7950

a. Source: APHA, 1995
b. Only non-purgeable organic carbon (NPOC) was measured.
c. Source: US EPA, 1994
d. Source: Dionex, 1995

3.2.5 Methodology for Synthetic Leaching Procedure Test of C&D materials

To examine contaminant leachability of each C&D component, a synthetic precipitation leaching procedure (SPLP) batch test was performed (US EPA SW 846-1312). The SPLP test simulates contaminant leaching using mildly acidic rainwater. A 100-gram sample was placed in a 2-liter polyethylene container. Two liters of SPLP leaching solution were then added to the container. The container was placed in a rotary extractor and rotated for 18 hours ± 2 hours at 30 rpm. After tumbling, the mixture was filtered using a pressurized filtration apparatus with a 0.7-μm glass fiber filter. The test method is the same as other standardized batch leaching tests such as the Toxicity Characteristic Leaching Procedure (TCLP; EPA SW-846 Method 1311, USEPA 1994) with the exception of the leaching fluid. The filtrate was analyzed for a number of the same parameters (e.g. conventional water quality parameters and metals) as measured for the column leachates.

3.3 RESULTS

The leachate analytical results from the leaching columns and the batch tests are presented in this section. The columns contained a typical composition of mixed C&D waste in the United States, while the batch tests involved individual C&D waste components to identify sources of contaminants as well as individual contaminant leachability. Further detailed analytical results can be found elsewhere (Jang, 2000).

3.3.1 Leachate Generation

The total volume of leachate produced from the single lysimeter was approximately 165 gallons over the experimental period of one year, while the leachate volume drained from the serial lysimeter was 141 gallons. The single lysimeter reached field capacity (leachate volume collected from the single lysimeter was constant) after day 15. The leachate volume from the serial lysimeter became constant after day 100 because it took much more time to bring 20 feet of waste to field capacity than the 4 feet of waste in the single lysimeter.

3.3.2 Conventional Water Quality Parameters

The conventional water quality parameters measured here include pH, dissolved oxygen (DO), oxidation reduction potential (ORP), total dissolved solids (TDS), alkalinity, total sulfides and ions. The following subsection presents some of the results of the parameters.

The pH results are presented in Figure 3-2. The pH of both columns remained relatively constant at neutral conditions (pH 6.5 to 7) throughout the experiment with an exception of the slight decrease of pH (approximately pH 6) from the single lysimeter for the first month. The average pH of the serial lysimeter was 6.7, which was slightly higher than that of the single lysimeter (approximately pH 6.5).

Figure 3-3 presents the DO results from both the single lysimeter and the serial lysimeter. The DO concentrations from both lysimeters dropped dramatically for the first month, after which the concentrations stayed relatively low (below 2 mg/L). The measurements of ORP in the leachate, both from the single lysimeter and the serial lysimeter, followed a trend similar to dissolved oxygen (Figure 3-4). The ORP values decreased rapidly over time (day 50) and remained below –300 mV for the remainder of the experimental period. The low DO concentrations and ORP values were likely a result of biological activity (specifically by sulfate-reducing bacteria) that occurred within the lysimeters. In landfill leachate, highly reduced conditions and low DO concentrations are typically found as a result of anaerobic microbial activity.

Results of conductivity measurements are presented in Figure 3-5. Conductivity from the single lysimeter and the serial lysimeter remained relatively constant throughout the experiment. However, the values of conductivity from the serial lysimeter were much higher that that of the single lysimeter. The serial lysimeter leachate contained more dissolved solids than the single lysimeter leachate indicating that the concentration of dissolved solids in the leachate was dependent on the depth of waste.

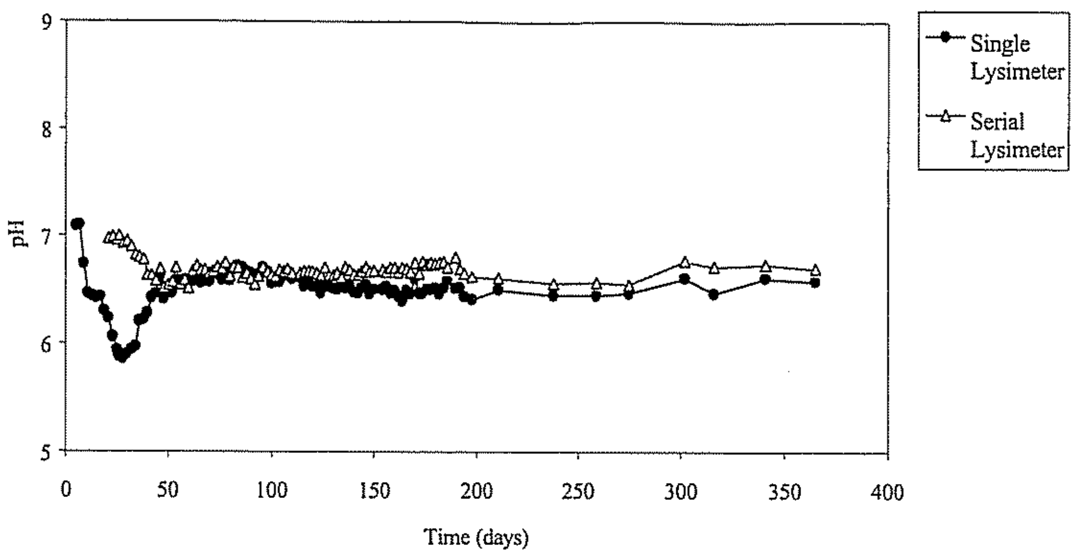


Figure 3-2 pH Results from Leaching Lysimeter Study

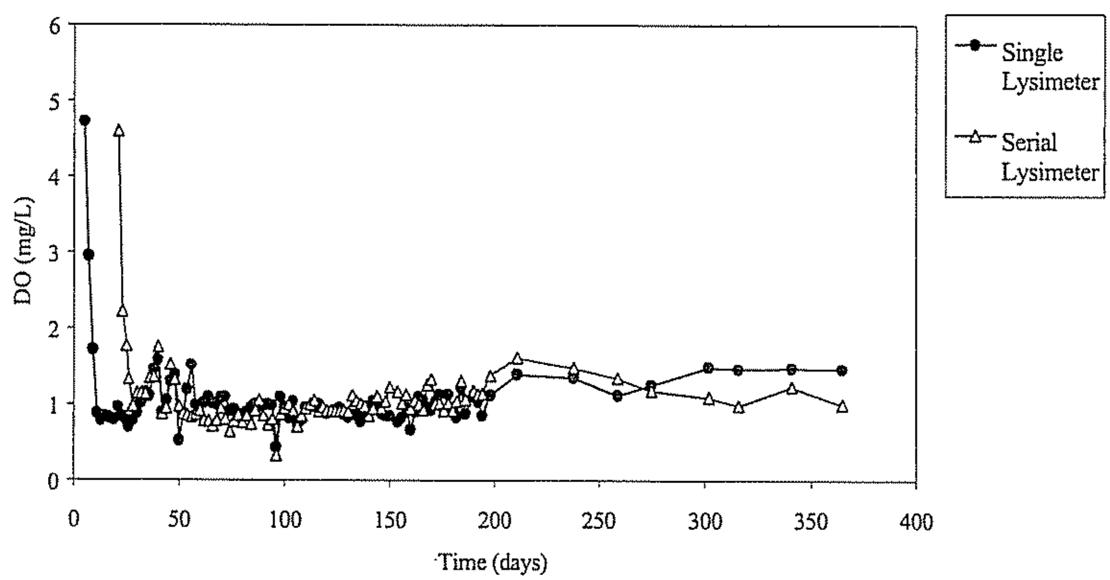


Figure 3-3 DO Results from Leaching Lysimeter Study

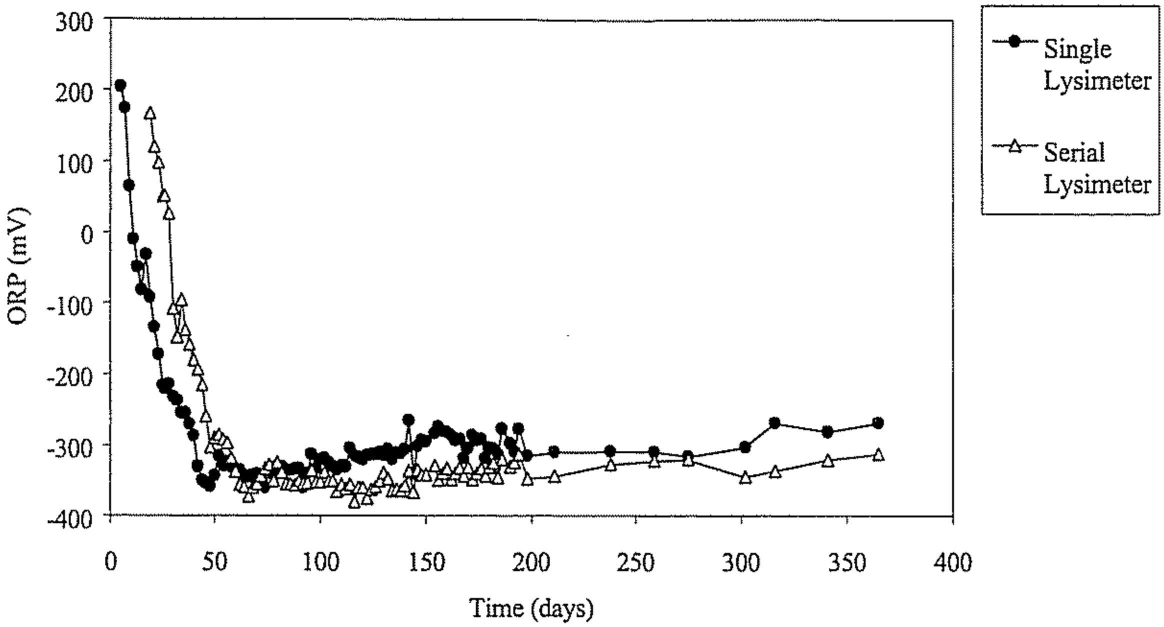


Figure 3-4 ORP Results from Leaching Lysimeter Study

Figure 3-5 Conductivity Results from Leaching Lysimeter Study

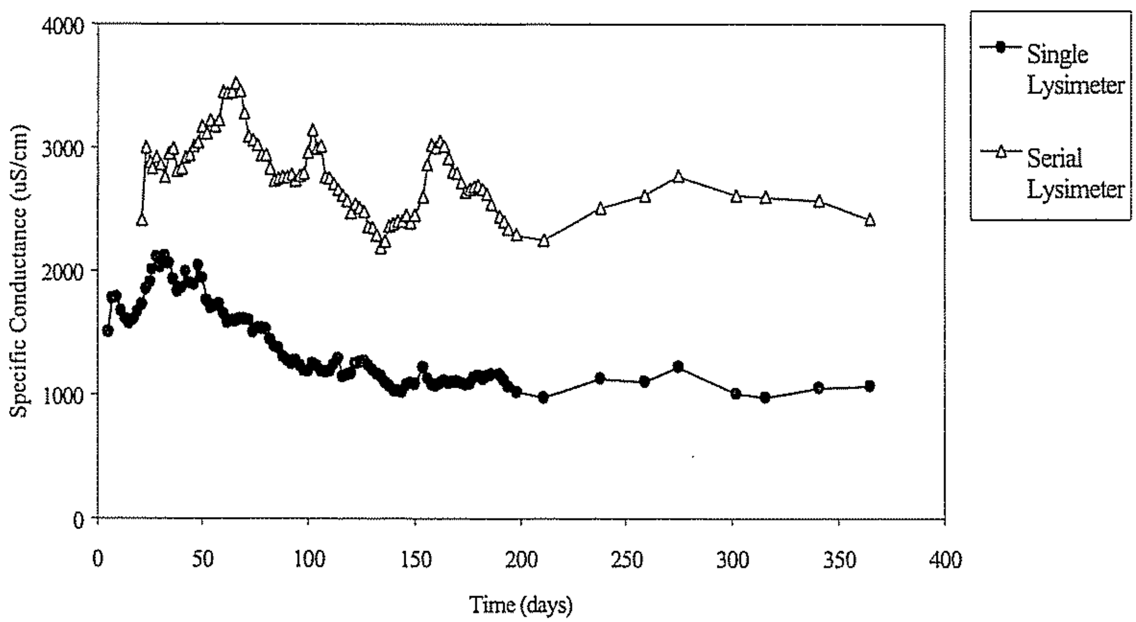


Figure 3-6 presents the TDS results and shows a very similar leaching trend as conductivity. The TDS concentrations from the serial lysimeter were higher than the single lysimeter. The increased depths resulted in more dissolved solids in the leachate because the contact time between the solid and liquid phases increased. Total dissolved solids in leachate correlated well with conductivity ($r^2 = 0.91$). The relationship between TDS and conductivity was as follows: TDS (mg/L) = 0.88 * conductivity (μS/cm) – 128. The average TDS concentrations from the serial lysimeter and the single lysimeter were 2,300 mg/L and 1,200 mg/L, respectively. These concentrations exceeded the secondary drinking water standard of 500 mg/L for TDS.

The results of alkalinity in the leachate are presented in Figure 3-7. Alkalinity measures the leachate's buffering capacity based on its ability to neutralize acids. In landfill leachate, this pH buffering capacity is primarily a result of carbonate-bicarbonate species, hydroxides, and other anions. Alkalinity from both the serial lysimeter and the single lysimeter dramatically increased over time, up to 80 days and 60 days, respectively, then slightly decreased. The alkalinity concentration of the serial lysimeter was approximately double that of the single lysimeter.

Sulfides were present in the laboratory C&D waste leachate and contributed to a very strong hydrogen sulfide odor. Sulfides are formed by the microbial decomposition of sulfur-containing organic matter or by the reduction of sulfate (Hayes, 1999). The results of total sulfide (mg/L as S^{2-}) in the leachate are presented in Figure 3-8. Since sulfate from the dissolution of gypsum drywall was present in the leachate, sulfides were believed to be produced by the activity of sulfate-reducing bacteria (SRB) under anaerobic conditions. Sulfide measurements in both lysimeter leachates were not detected during the initial leaching periods during which the anaerobic and sulfate reducing conditions were not yet established. In this period, dissolved oxygen concentrations and the values of oxidation reduction potential decreased rapidly over time. These conditions can be seen in the results of DO and ORP (Figure 3-2 and Figure 3-3). As dissolved oxygen was depleted, sulfate serves as an electron acceptor for biological reduction by SRB. Also, the waste depth affected the sulfide concentrations in the leachate, especially for the later stage.

Anions measured in the leachate included chloride, sulfate, nitrate, nitrite, fluoride, and bromide. No nitrate, nitrite, fluoride, or bromide was detected in any of the leachate samples. Sulfate and chloride were detected in all of the samples. The sulfate results are presented in Figure 3-9. Sulfate concentrations in the single lysimeter began at high levels, and then rapidly decreased from 1,350 mg/L to approximately 100 mg/L (day 50). Then, the sulfate concentrations in the leachate increased slightly from less than 100 mg/L to approximately 200 mg/L at day 200, after which they remained relatively constant. The sulfate in the leachate produced from the serial lysimeter followed a leaching trend similar to the single lysimeter but exhibited much higher concentrations. Sulfate concentrations decreased from 1,570 mg/L to 350 mg/L by day 150, increased to 790 mg/L, and then remained between 890 mg/L to 720 mg/L. The average concentration of the serial lysimeter was 794 mg/L, while the average of the single lysimeter was 225 mg/L. There was a significant concentration difference between the single lysimeter and the serial lysimeter.

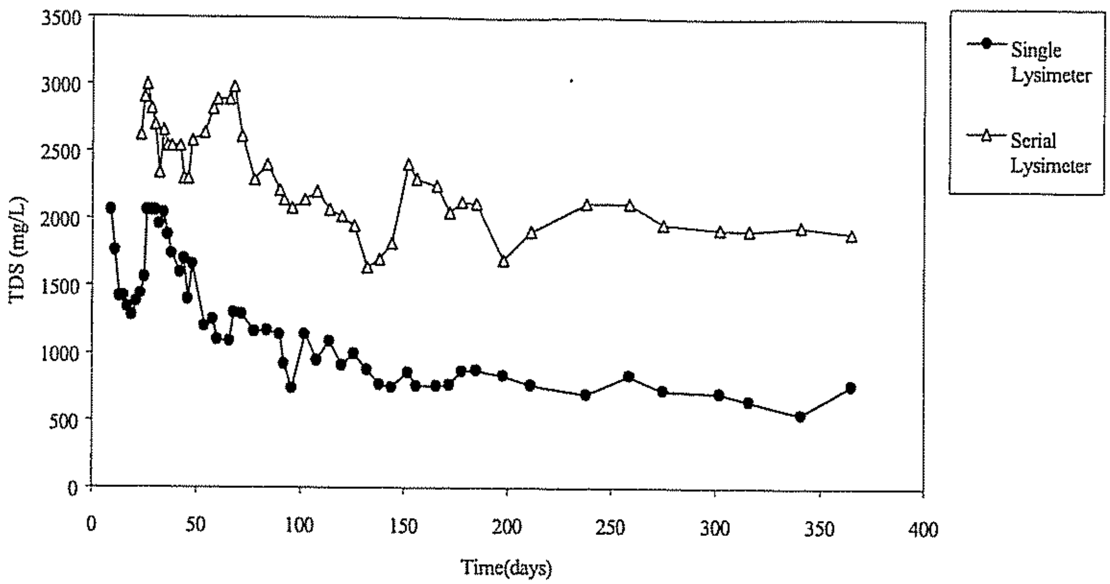
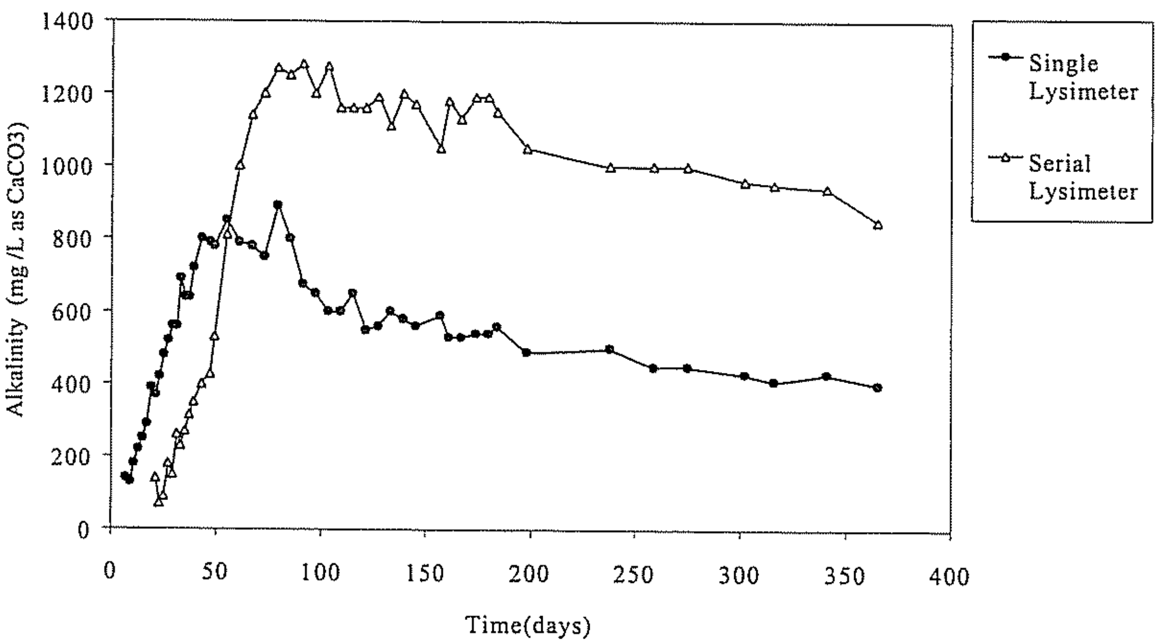


Figure 3-6 Total Dissolved Solids Results from Leaching Lysimeter Study

Figure 3-7 Alkalinity Results from Leaching Lysimeter Study



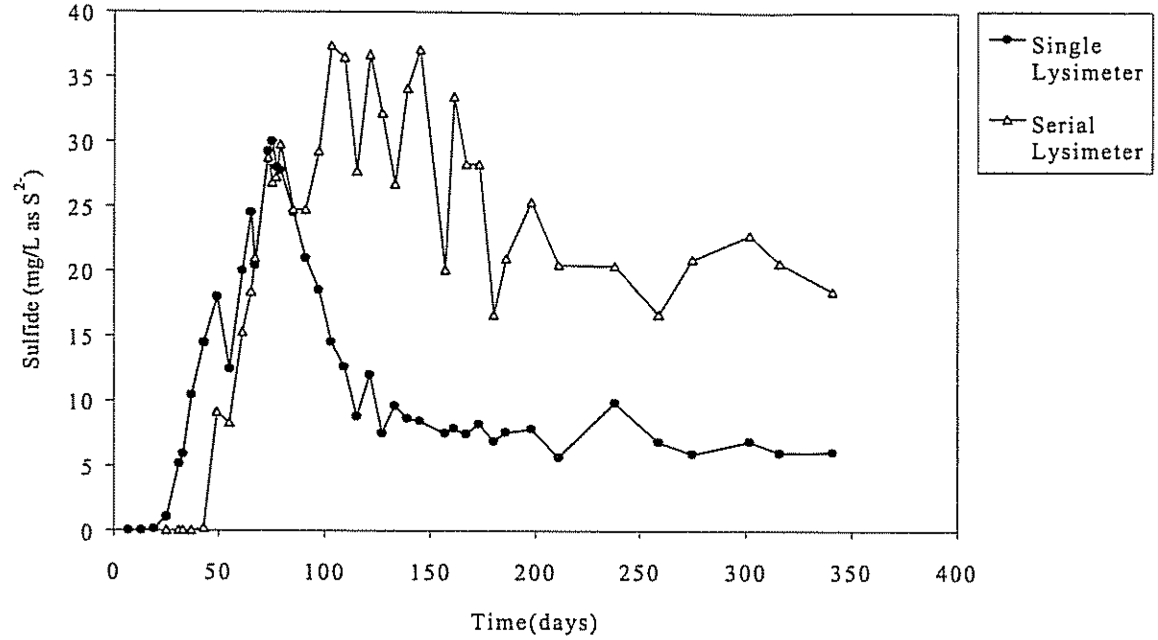


Figure 3-8 Total Sulfide Results from Leaching Lysimeter Study

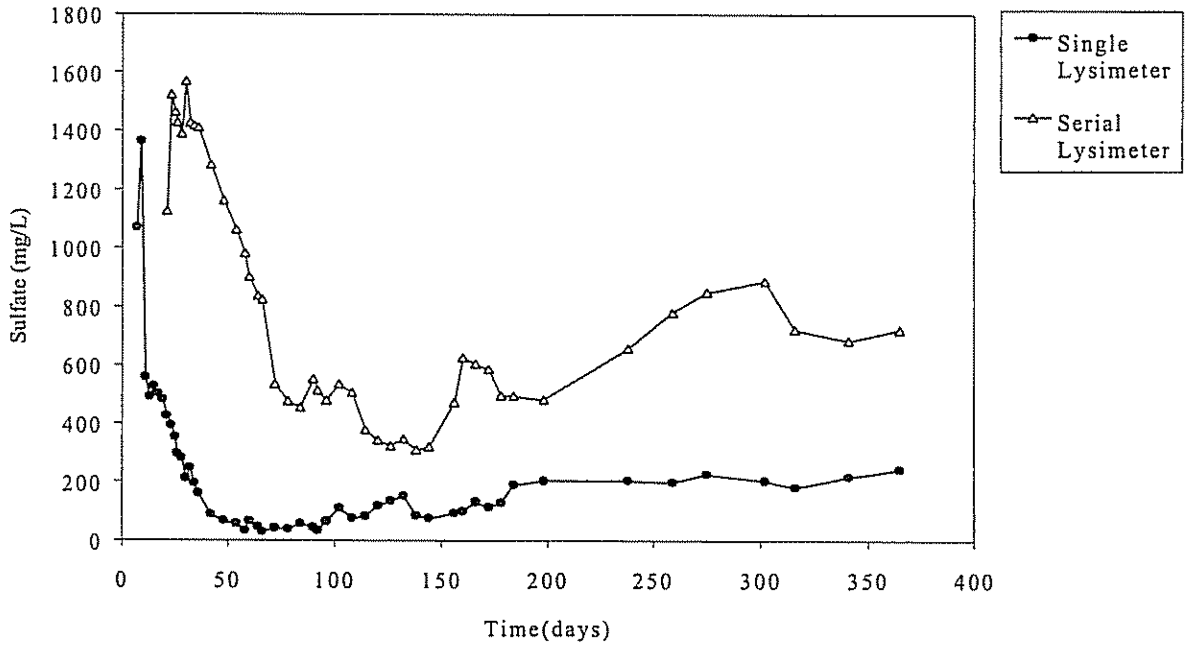


Figure 3-9 Sulfate Results from Leaching Lysimeter Study

Chloride, which is commonly found in municipal solid waste leachate at a high level, was present in only small amounts in the laboratory C&D waste leachate, as shown in Figure 3-10. The chloride in both lysimeter leachates followed a typical leaching trend, which begins with a high concentration of a pollutant and then decline over time as depletion of the pollutant occurs. Chloride concentrations in the single lysimeter decreased dramatically from 27.3 mg/L to 4.5 by day 100 and then remained relatively constant in the range of 1.7 mg/L to 4.6 mg/L. The leachate chloride concentrations in the serial lysimeter decreased continually from 28.7 mg/L to 5.1 mg/L over the 365-day experimental period. Except for one occasion, the single lysimeter contained less chloride than the serial lysimeter throughout the experiment. The average chloride concentrations of the single and serial lysimeters were 8.9 mg/L and 16.2 mg/L, respectively.

The cations analyses consisted of ammonium, calcium, magnesium, potassium, and sodium. No ammonium was detected in any of the leachate samples. Calcium was the predominant cation observed in the laboratory C&D waste leachate. All other cations were detected at low concentrations relative to the calcium concentrations. The leaching trend for calcium is presented in Figure 3-11. The concentrations in both lysimeter leachates were relatively constant throughout the experiment. It should be noted that this trend was also observed in the results of conductivity and TDS (Figure 3-5 and Figure 3-6). However, the serial lysimeter resulted in considerably higher calcium concentrations than the single lysimeter. The average of calcium concentrations in the serial lysimeter was 536 mg/L, while the single lysimeter had an average concentration of 290 mg/L.

Sodium is very commonly found at relatively high concentrations in municipal solid waste landfill leachate, typically ranging from 3,000 mg/L for young landfills to 100 mg/L for old landfills (Farquhar, 1989). In the laboratory C&D waste leachate, the results of sodium ranged from 6.4 mg/L to 181 mg/L (Figure 3-12). Sodium concentrations from both lysimeter leachates decreased continually over time. The single lysimeter sodium concentration was lower than that of the serial lysimeter throughout the experiment. The average concentrations of the single and the serial lysimeter were 37.8 mg/L and 114 mg/L, respectively. Potassium showed a leaching trend similar to sodium but with relatively low concentrations (Figure 3-13). The average potassium concentration of the single lysimeter was 8.3 mg/L, while the serial lysimeter leachate had an average concentration of 23.6 mg/L.

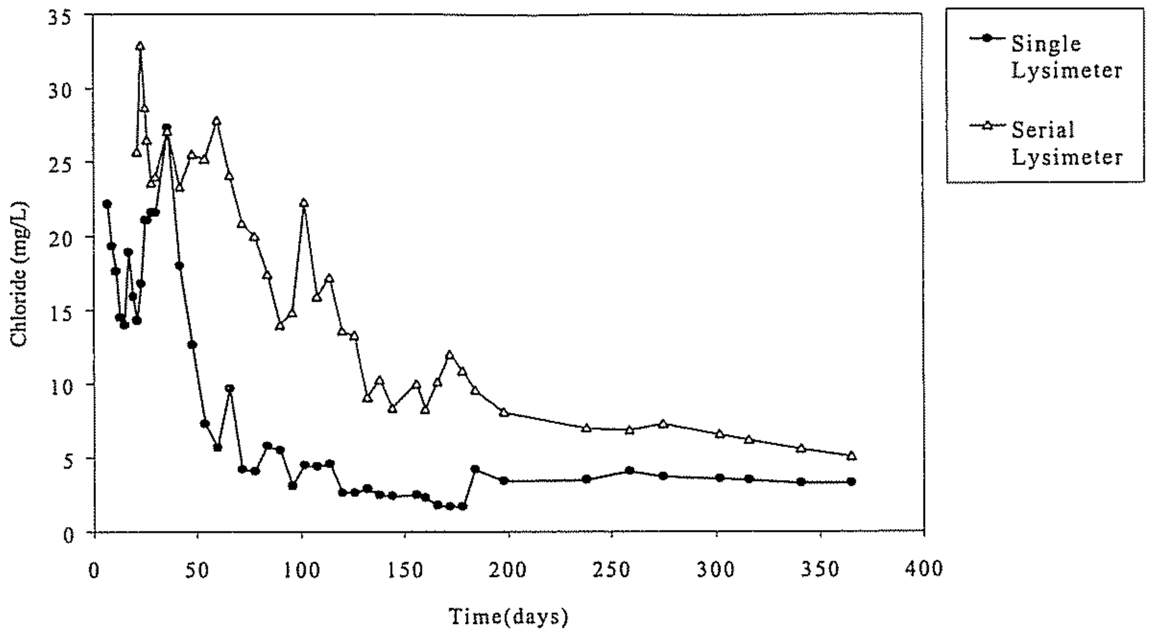


Figure 3-10 Chloride Results from Leaching Lysimeter Study

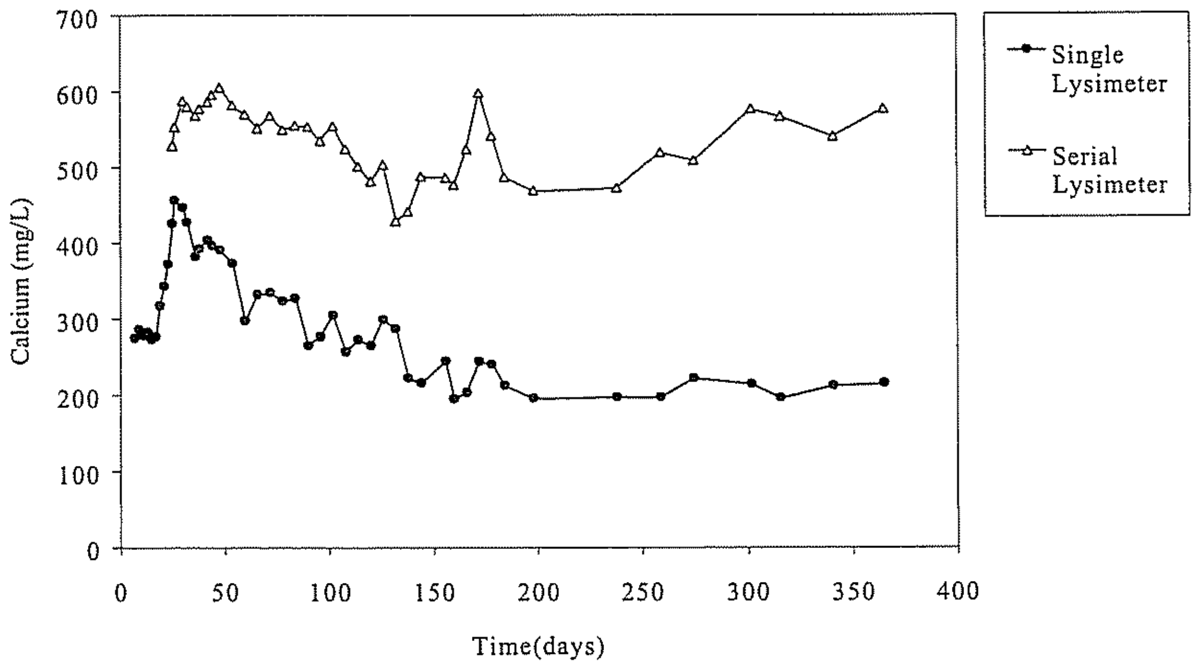


Figure 3-11 Calcium Results from Leaching Lysimeter Study

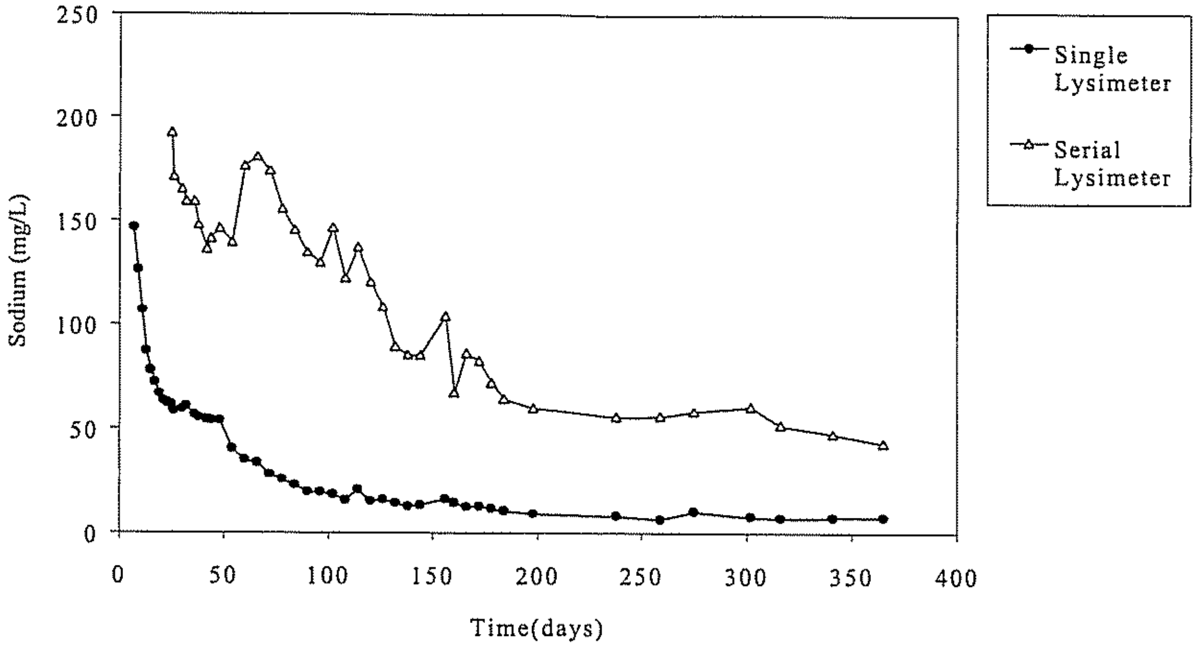


Figure 3-12 Sodium Results from Leaching Lysimeter Study

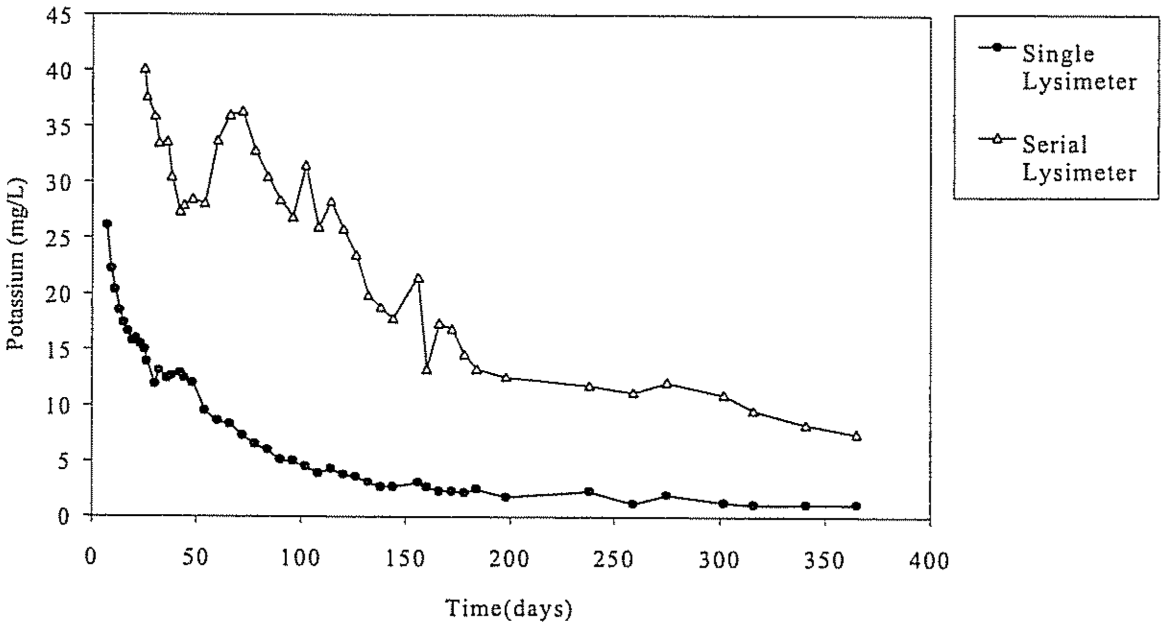


Figure 3-13 Potassium Results from Leaching Lysimeter Study

In this study, organic constituents in leachate were measured by chemical oxygen demand (COD) and organic carbon (as non-purgeable organic carbon). The non-purgeable organic carbon (NPOC) measurement was used since the purgeable organic carbon present in the C&D waste leachate was considered to be negligible, compared to the NPOC. C&D waste streams consist largely of inorganic components (e.g. concrete, wallboard, dirt and rock) and organic materials with a low degree of biodegradability (e.g. wood). The primary components contributing to the organic matter in the C&D waste leachate are wood and cardboard.

Figure 3-14 presents the results of NPOC. The concentrations of organic carbon in the serial lysimeter started off at a high level and then decreased sharply from 630 mg/L to less than 50 mg/L for the first three months. Thereafter, the concentrations remained constant in the range of 20 to 32 mg/L. Unlike the dissolved ions, the leaching trend and concentration range of the serial lysimeter were not visibly different from those of the single lysimeter.

The COD results are presented in Figure 3-15. The single lysimeter COD leaching trend was very similar to the NPOC trend. The COD concentration ranged from 44 mg/L to 1700 mg/L. In the serial lysimeter leachate, the COD concentrations fluctuated during the first six months, after which they remained relatively constant at an average of approximately 120 mg/L.

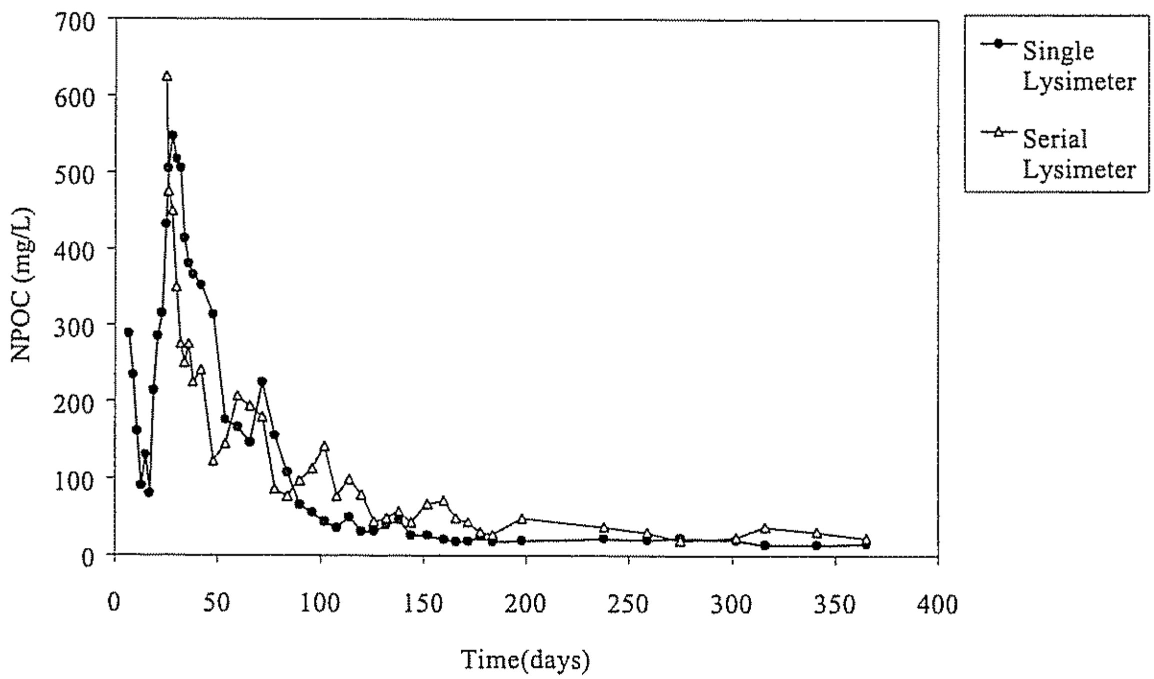


Figure 3-14 Non-Purgeable Organic Carbon Results from Leaching Lysimeter Study

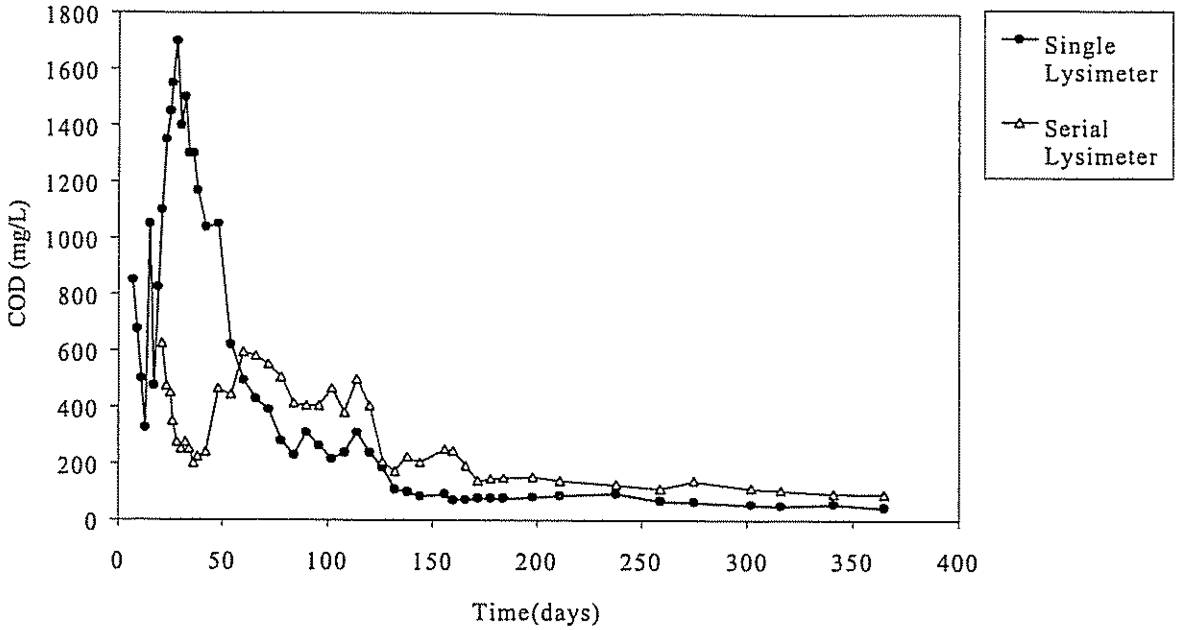


Figure 3-15 Chemical Oxygen Demand Results from Leaching Lysimeter Study

3.3.3 Metals

C&D wastes typically contain several metal components such as structural steel, metal pipe, wire and brass as well as non-metal components that contain metals (e.g. chromated copper arsenate (CCA)-treated wood). In this study, six metals were analyzed: arsenic, chromium, copper, iron, manganese, and zinc. These metals were chosen because they were contained in components of the synthesized waste. The laboratory C&D waste leachate contained arsenic, chromium, and manganese at appreciable levels. The remaining three metals leached for the first one or two months, and then decreased from a high to a low concentration. The metal removal was likely the results of metal precipitation with sulfide.

Arsenic results are presented in Figure 3-16. The concentration of arsenic found in the serial lysimeter leachate began at a much higher level than the single lysimeter and then decreased rapidly to low concentrations (day 180). Thereafter, the concentrations remained within the range of 10 μg/L to 35 μg/L. In the single lysimeter, arsenic concentrations followed a slightly downward trend over the entire experimental period. Arsenic is commonly found in pharmaceuticals, paints and pesticides. The source of arsenic was believed to be CCA-treated wood because other sources of arsenic were not included in the waste column. The primary drinking water standard for arsenic is 50 μg/L (CFR, 1997). For the first four months, the arsenic concentrations in the serial lysimeter exceeded the primary standard, after which it dropped below the standard. The arsenic concentrations in the single lysimeter exceeded the standard through day 100 and then decreased over time, never exceeding the limit.

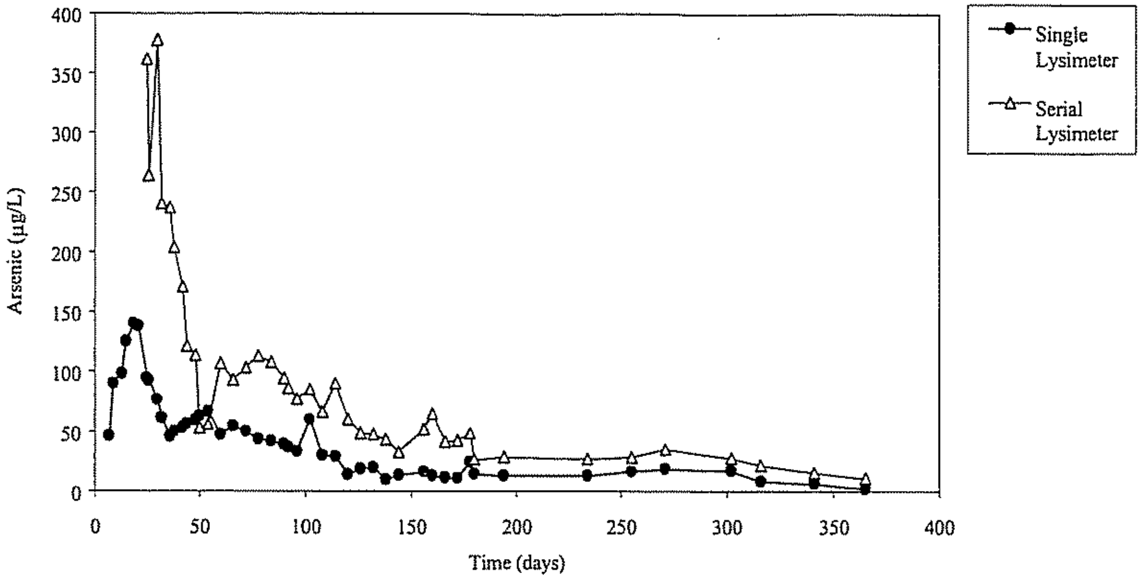


Figure 3-16 Arsenic Results from Leaching Lysimeter Study

Chromium results are presented in Figure 3-17. The concentration of chromium found in the single lysimeter leachate increased rapidly to 330 µg/L by day 50 and then decreased to below 50 µg/L. The serial lysimeter showed variations in chromium concentration between 71.9 µg/L to 165 µg/L. The average chromium concentrations from the single and the serial lysimeter were 127 µg/L and 125 µg/L, respectively. The most likely source of the chromium was CCA-treated wood. Chromium chemistry is complex because a variety of chromium forms can exist depending on several oxidation states. The most toxic form is hexavalent chromium. Under reduced conditions, it is likely that any hexavalent chromium will be reduced to the trivalent chromium, which decreases the mobility of chromium. The primary drinking water standard for chromium is 100 µg/L. The chromium concentration in the leachate from the single lysimeter was above the limit by day 120, and then decreased rapidly, not exceeding the standard again until the end of the experiment. However, the chromium concentration in the serial lysimeter often exceeded the standard throughout the experiment.

Copper concentrations found in the lysimeter leachate are shown in Figure 3-18. In both lysimeters, copper leached at appreciable levels only for the first two months and then was not detected thereafter. The likely cause of the disappearance of copper was precipitation of copper as a sulfide precipitate. Initially, the serial lysimeter leachate contained more copper than the single lysimeter leachate.

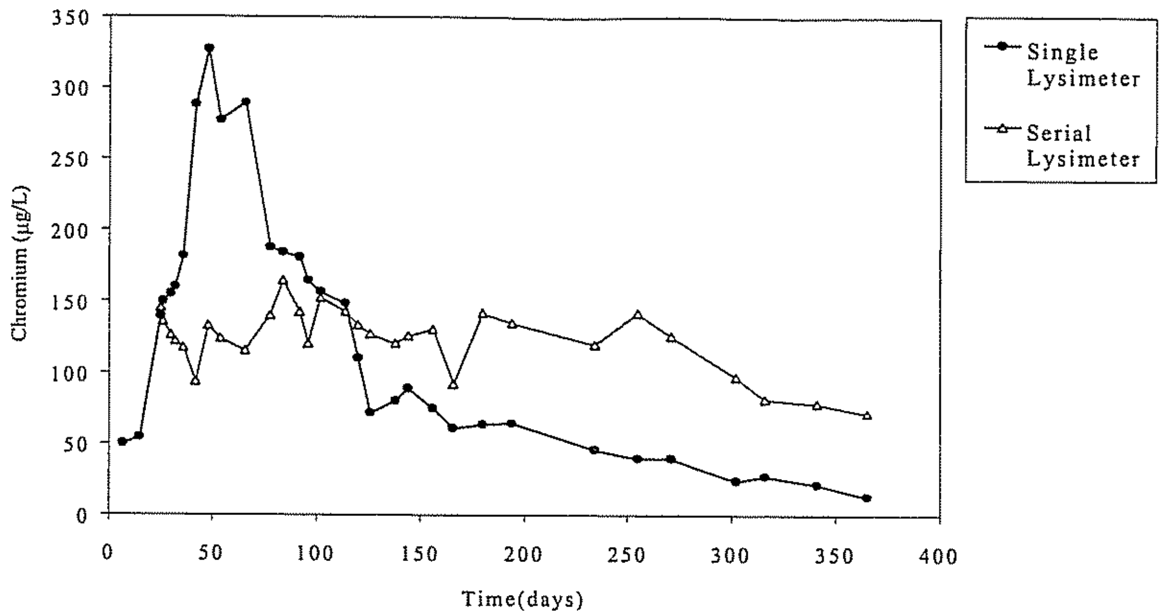


Figure 3-17 Chromium Results from Leaching Lysimeter Study

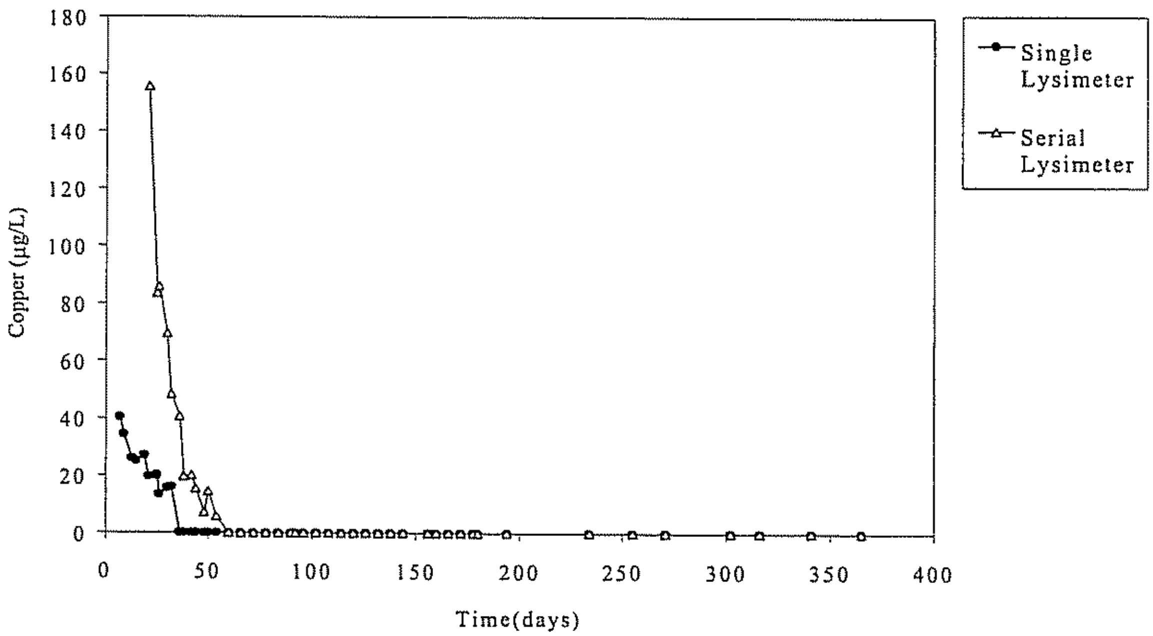


Figure 3-18 Copper Results from Leaching Lysimeter Study

Iron and zinc followed a trend similar to copper, dramatically decreasing in concentration with the onset of sulfate reducing conditions (Figure 3-19 and Figure 3-20, respectively). It is widely known that reduced sulfides react with metals to form insoluble sulfide precipitates under anaerobic conditions (Chen, 1974; Pomeroy and Bailey, 1981; Bhattacharyya and Ku, 1984; Lyn and Taylor, 1992). Iron is commonly found in solid wastes. Since sulfides were produced in high concentrations and anaerobic conditions prevailed in the lysimeter body throughout the experiment, it is likely that copper, iron, and zinc were mostly removed in leachate by precipitation during the active stage of sulfate-reducing bacteria (after day 50). The precipitates produce a colloidal suspension that is commonly described as "black water" (AWWA, 1990; Lyn and Taylor, 1992). This black precipitate was observed in the leachate from both lysimeters. A black coating was observed throughout the waste and the gravel layer when the columns were dismantled.

Iron concentrations in the single lysimeter increased rapidly, reached a peak (7.5 mg/L) and then declined dramatically to below 1 mg/L (Figure 3-19). The serial lysimeter followed a similar trend but at relatively lower iron concentrations. The secondary drinking water standard for iron is 300 μg/L. Throughout most of the study, the single lysimeter exceeded the standard limit. Iron in the serial lysimeter also exceeded the limit up to day 200, after which it dropped and remained below the standard limit. Zinc was detected in the serial lysimeter in the range of 104 μg/L to 572 μg/L (Figure 3-20). In the single lysimeter, three out of 40 samples had zinc concentrations above the detection limit of 1 mg/L. All of the samples had zinc concentrations below the secondary drinking water standard of 5 mg/L.

Manganese results are presented in Figure 3-21. Manganese concentrations in the single lysimeter followed a decreasing trend to approximately day 240 and then stayed relatively constant at 0.3 mg/L. Manganese concentrations in the serial lysimeter varied as a function of time, ranging from 0.3 mg/L to 1.4 mg/L. All of the leachate samples analyzed for manganese exceeded the secondary drinking water standard of 0.05 mg/L. The average manganese concentrations of the single and the serial lysimeters were 0.6 mg/L and 1.0 mg/L, respectively. Manganese is naturally found in plant tissue. Other sources include alloys, paints, and dry cells (Hammond, 1980). Wood is a likely source of its presence in leachate. In a study of demolition waste leachate, high concentrations of manganese (17 mg/L) were also found from wood-based laboratory landfill experiments (50% by volume of total demolition waste) (Ferguson and Male, 1980).

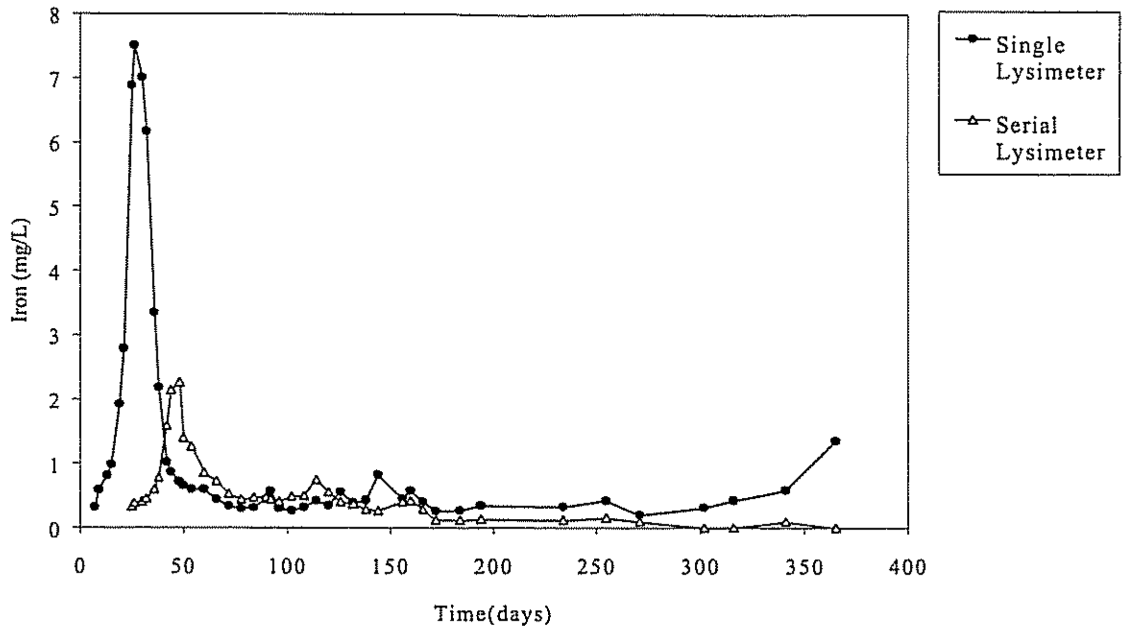


Figure 3-19 Iron Results from Leaching Lysimeter Study

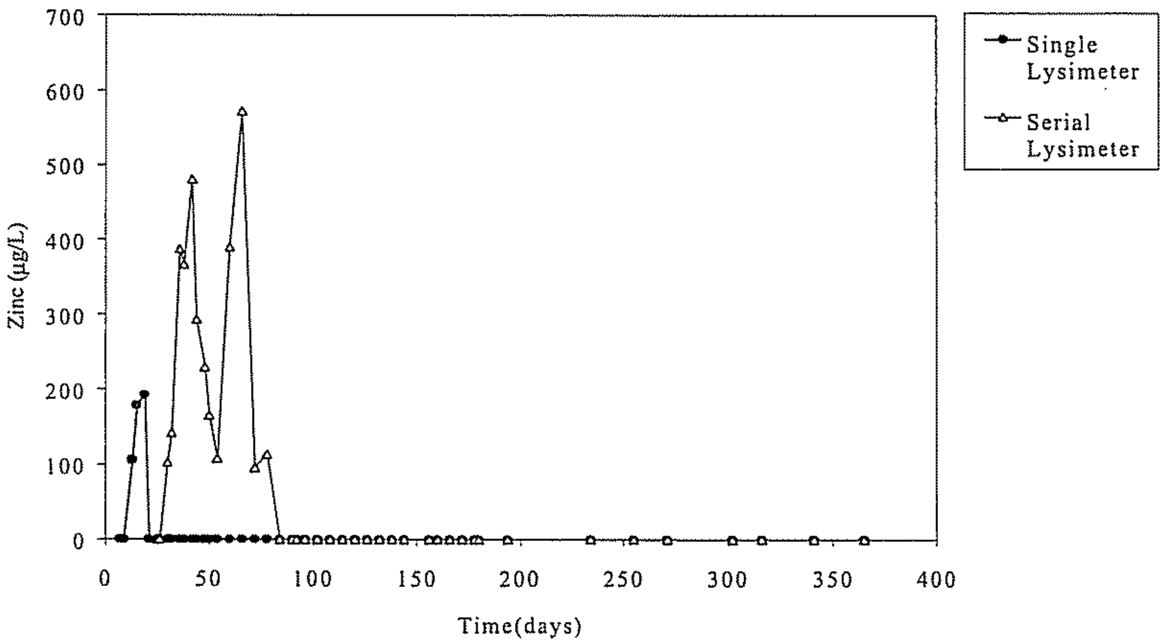


Figure 3-20 Zinc Results from Leaching Lysimeter Study

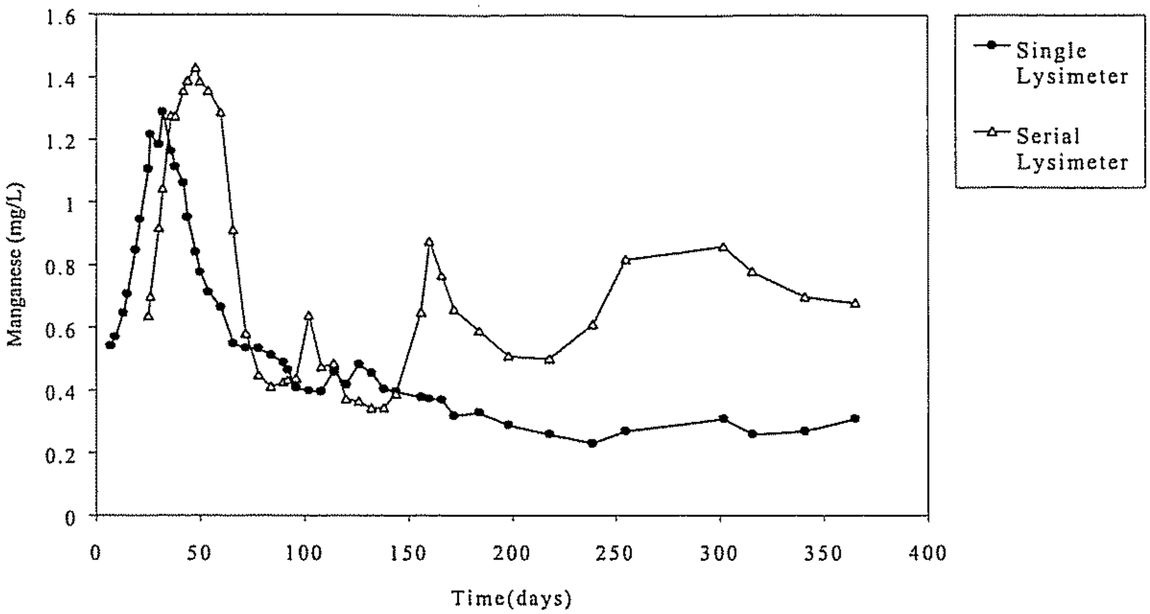


Figure 3-21 Manganese Results from Leaching Lysimeter Study

3.3.4 Batch Results

The synthetic precipitation leaching procedure (SPLP) batch tests were conducted to evaluate the contaminant leaching potential of individual C&D waste components as well as to determine the sources of contaminants of C&D waste. The 11 components used for the batch tests were the same materials as used in the lysimeter experiment (See Table 3-2). Leachate from the batch tests was analyzed for conventional water quality parameters and metals.

3.3.4.1 Conventional Water Quality Parameters

The conventional water quality parameters measured here included pH, conductivity, TDS, sulfide and COD. Results of these parameters are presented in Table 3-4. No sulfide was detected in any of the leachate samples.

The concrete batch resulted in pH above 11. The high pH was likely caused by the release of hydroxyl ions from the dissolution of the alkali hydroxides (KOH, NaOH) and calcium hydroxide [$Ca(OH)_2$]. Concrete is a mixture of aggregate (e.g., sand, gravel), cement, and water. Concrete aggregates in Florida are supplied primarily from crushed limestone ($CaCO_3$) and sand (Graves, 1991). Alkali oxides (Na_2O, K_2O) comprise less than 1% (by mass) of cement, while calcium oxide (CaO) content in cement is typically 20% (by mass) (Glasser et al., 1987). Once these oxides react with water, alkali and calcium hydroxides are produced. The final pH of the wood batch and CCA-treated wood batch did not change very much from the leaching solution and remained below pH 5. The leachate pH from insulation, metal rebar and roofing shingle batches was greater than 9, while the pH from aluminum, cardboard, drywall, and galvanized steel batch remained near neutral (pH 6-8).

The highest conductivity was observed from the drywall batch followed by the concrete batch. The TDS content was greatest from the drywall batch. Organic matter measured in leachate as COD were leached from cardboard, wood, insulation, and drywall. The highest COD was measured in the cardboard batch leachate.

Table 3-4 Results of Conventional Water Quality Parameters from Batch Tests

C&D Waste Component	pH	Specific Conductance (μS/cm)	TDS (mg/L)	COD (mg/L)
Aluminum	7.13	< 20	< 50	< 50
Cardboard	6.28	325	510	809
CCA Wood	4.52	30	< 50	130
Concrete	11.65	1,172	260	< 50
Copper	5.17	< 20	< 50	< 50
Drywall	7.93	2,360	2,290	58
Steel	7.08	< 20	< 50	< 50
Insulation	9.45	256	440	295
Metal Rebar	9.38	55	< 50	< 50
Roofing	9.69	70	< 50	< 50
Wood	4.82	31	< 50	120

3.3.4.2 Ions

The results of ions measured in the batch leachates are presented in Table 3-5. The predominant anion observed in the leachate was sulfate from the drywall batch, while calcium was a major species in cations found in the batch. This is from the soluble characteristics of gypsum ($CaSO_4 \cdot 2H_2O$). Another major source of calcium is believed to be concrete. Some of the components such as insulation, cardboard and concrete also produced sulfate in the leachate at low levels. Sodium was detected in the cardboard batch leachate at a appreciable level (60 mg/L). Nitrate and sulfate were detected in the leachate from all batch samples. The chemical composition of the SPLP leaching solution contains small amounts of sulfate (SO_4^{2-}) and nitrate (NO_3^-) from sulfuric and nitric acids. No ammonium, bromide, fluoride, magnesium, nitrite, or phosphate was detected in any of the batch samples.

3.3.4.3 Metals

Metal results are summarized in Table 3-6. Arsenic, chromium, and copper leached in significant quantities from the CCA treated-wood batch leachate. Another major source of copper in the C&D waste components evaluated was copper wire. Manganese resulted only from the wood-containing batches (treated and untreated). No iron was detected in any of the batch samples, while zinc leached in a small quantity from the galvanized steel batch.

Table 3-5 Results of Ions from Batch Tests **unit: mg/L**

C&D Waste Component	Calcium	Chloride	Nitrate	Potassium	Sodium	Sulfate
Aluminum	2.4	3.0	4.8	< 1.0	< 1.0	1.9
Cardboard	< 1.0	6.3	12.3	< 1.0	59.7	28.8
CCA Wood	2.5	3.6	4.0	4.1	< 1.0	3.6
Concrete	143	3.7	3.1	12.0	2.6	21.7
Copper	< 1.0	3.0	3.2	< 1.0	< 1.0	2.5
Drywall	550	7.6	5.1	< 1.0	10.7	1,430
Steel	< 1.0	3.0	3.6	< 1.0	< 1.0	2.5
Insulation	< 1.0	8.2	4.3	1.1	< 1.0	125
Metal Rebar	8.5	3.2	3.7	< 1.0	< 1.0	5.2
Roofing	5.1	7.3	7.0	< 1.0	5.4	4.2
Wood	1.2	3.7	2.3	2.1	< 1.0	2.3

Table 3-6 Results of Metals from Batch Tests

C&D Waste Component	As (μg/L)	Cr (μg/L)	Cu (μg/L)	Fe (mg/L)	Mn (mg/L)	Zn (mg/L)
Aluminum	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
Cardboard	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
CCA Wood	2,380	970	519	< 0.1	0.14	< 0.1
Concrete	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
Copper	< 10	< 10	1,620	< 0.1	< 0.1	< 0.1
Drywall	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
Steel	< 10	< 10	< 10	< 0.1	< 0.1	0.28
Insulation	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
Metal Rebar	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
Roofing	< 10	< 10	< 10	< 0.1	< 0.1	< 0.1
Wood	< 10	< 10	< 10	< 0.1	0.11	< 0.1

3.4 DISCUSSION OF LABORATORY STUDY

This section discusses the results of C&D waste leachate obtained from the third lysimeter study (or lysimeter study 3). The following topics are discussed and addressed: the characteristics of laboratory C&D waste leachate, the impact of waste depth on contaminant leaching, the comparison of the laboratory leachate results to leachate from the field test cell study, and the laboratory leachate quality compared to regulatory limits.

3.4.1 Characteristics of Laboratory C&D Waste Leachate

The serial lysimeter was used to characterize leachate from the laboratory landfill-simulators. As mentioned previously, leachate from the serial lysimeter simulated a 20-feet waste depth of a C&D landfill. Five lysimeters were set up in series and leachate produced from the first lysimeter was pumped into the top of the next lysimeter.

Table 3-7 presents a summary of leachate characteristics of the laboratory C&D waste landfill-simulators. Leachate pH from the landfill-simulators was approximately neutral, as observed in the field test cell study as well as in the literature. Dissolved oxygen concentrations consistently remained near 1 mg/L, indicating that the lysimeters were predominantly under anaerobic conditions. Highly reduced conditions were found in the laboratory landfill leachate as a result of microbial activity (typically less than -250 mV).

Table 3-7 Leachate Characteristics of C&D waste Landfill Simulators

Parameters	Serial Lysimeter		
	Min.	Max.	Average
pH	6.51	7.0	6.69
DO (mg/L)	0.33	4.59	1.07
ORP (mV)	-380	167	-298
Specific conductance (µS/cm)	2,190	3,520	2,770
TDS (mg/L)	1,640	3,000	2,300
Alkalinity (mg/L as $CaCO_3$)	70	1,280	852
NPOC (mg/L)	19.4	625	138
COD (mg/L)	90	625	296
Chloride (mg/L)	5.1	33	16.2
Sulfate (mg/L)	308	1,569	794
Sulfide (mg/L)	0.02	37.4	21.6
Calcium (mg/L)	429	605	536
Magnesium (mg/L)	18	33.3	24.6
Potassium (mg/L)	7.5	40.1	23.6
Sodium (mg/L)	43.3	193	114
Arsenic (µg/L)	10.9	378	96
Chromium (µg/L)	72	165	125
Copper (µg/L)	7.1	155	10
Iron (mg/L)	0.1	2.3	1
Manganese (mg/L)	0.3	1.4	1
Zinc (µg/L)	100	572	92

The concentration of TDS ranged from 1,640 mg/L to 3,000 mg/L with an average of 2,300 mg/L. Specific conductance measurements ranged from 2.2 mS/cm to 3.5 mS/cm. Sulfate and calcium, which contributed the most to the high concentration of TDS, were the major ions present in the leachate. High levels of the ions were attributed to the soluble nature of gypsum drywall, as seen in a previous study (Townsend et al., 1999). Sulfides were present in laboratory C&D waste leachate and were responsible for a strong odor (specifically "rotten egg" odor) in the leachate. Sulfides were formed by sulfate-reducing bacteria during the reduction of sulfate. Since C&D waste streams consist of mainly inorganic materials, or organic components with a low degree of biodegradability (e.g. concrete, drywall, wood, etc), the organic content in C&D leachate was low relative to MSW leachate. Wood and cardboard were the major components contributing to the relatively small amount of organic matter in the C&D waste leachate.

Arsenic, chromium and manganese were found in the lysimeter leachate at appreciable levels during the experiment. Copper, iron and zinc concentrations significantly decreased to lower levels because of metal precipitation. Reduced sulfides react with the metallic ions to form insoluble sulfide precipitates under anaerobic conditions (Chen, 1974; Pomeroy and Bailey, 1981; Bhattacharyya and Ku, 1984; Lyn and Taylor, 1992).

3.4.2 Impact of Waste Depth on Leachate Quality

The two lysimeter experiments were designed to demonstrate waste depth effect on the composition of leachate. As mentioned previously, the single lysimeter represented a 4-ft waste depth of a C&D landfill, while the serial lysimeter simulated a 20-ft waste depth of a C&D landfill.

Table 3-8 presents comparisons of chemical constituent concentrations in leachates between the single lysimeter and the serial lysimeter at the end of the experiment (i.e. at day 365). In most cases, chemical constituents in the leachate reached steady-state concentrations at the end of the experiment. Concentration ratios of the serial lysimeter to the single lysimeter were calculated to examine the effect of waste depth on leachate characteristics and strength.

The concentration ratios between the single lysimeter and the serial lysimeter ranged from 1.5 to 7.0 (Table 3-8), typically less than 5. Some parameters (mostly inorganic constituents) were strongly affected by the waste depth. The concentrations of inorganic constituents (dissolved solids and ions) were distinctively different depending on the waste depth. Other parameters, such as organic constituents, did not appear to be different depending on waste depth. Some of the organic compounds from wood and cardboard (biodegradable components) were probably utilized by microorganisms during the sulfate reduction processes. Some metals (e.g. arsenic, chromium, manganese) in the leachate from the serial lysimeter were higher than the single lysimeter, indicating that waste depth affected metal concentrations in the leachate. Other metal concentrations (copper, iron, zinc) in the lysimeter leachates could not be compared because of metal precipitation.

The results of this study demonstrated that, in general, the deeper the waste layer, the higher contaminant concentrations observed. This phenomenon was observed in other leaching studies in the literature (Reitzel et al., 1992; Karnchanawong et al, 1995; Öman et al., 1999).

Table 3-8 Comparisons of Leachate Concentrations Between Single Lysimeter (4 ft) and Serial Lysimeter (20 ft) at the End of the Experiment

Parameters	Waste Depth		Ratio (Serial/Single)
	Single (4 ft)	Serial (20 ft)	
Conductivity (µS/cm)	1,070	2,420	*2.3*
TDS (mg/L)	770	1,900	*2.5*
Alkalinity (mg/L as $CaCO_3$)	400	850	*2.1*
NPOC (mg/L)	15.5	22.7	*1.5*
COD (mg/L)	44	90	*2.0*
Chloride (mg/L)	3.3	5.1	*1.5*
Sulfate (mg/L)	240	720	*3.0*
Sulfide (mg/L)	5.4	19.3	*3.6*
Calcium (mg/L)	215	530	*2.5*
Magnesium (mg/L)	5.9	20.9	*3.5*
Potassium (mg/L)	1.1	7.5	*7.0*
Sodium (mg/L)	7.4	43.3	*5.9*
Arsenic (µg/L)	< 5.0	10.9	--
Chromium (µg /L)	13.3	71.9	*5.4*
Copper (µg/L)	< 5.0	< 5.0	--
Iron (mg/L)	1.4	< 0.1	--
Manganese (mg/L)	0.3	0.7	*2.3*
Zinc (mg/L)	< 0.1	< 0.1	--

3.4.3 Comparison of Laboratory C&D Leachate with Field Test Cell Leachate

In this section, the results of the laboratory leachate are compared to those of the field test cell leachate. Table 3-9 presents comparisons of the laboratory C&D waste leachate with the field test cell leachate. In most cases, the concentration ranges of constituents in the leachate from the laboratory study were near the ranges of concentrations observed in the test cell study. Organic carbon, arsenic, and chromium concentrations were much higher in the laboratory than in the field. This may be partly from different particle sizes of waste present during the leaching studies. It is generally recognized that the more waste surface area (i.e. smaller particle size) exposed to the percolating liquid, the greater the contaminant concentrations in the leachate (McCabe, 1975; Fungaroli and Steiner, 1979; van der Sloot; 1996). In the laboratory study, more surface area of the waste was produced within the column because it was necessary to select a standard, uniform size (two inches) in order for the C&D materials to fit into the lysimeter. It should be also noted that more variability could be expected of C&D waste leachate in the field-scale landfills. As a result, a wider range of leachate constituent concentrations were found in the field cell study when compared to the laboratory study.

Table 3-9 Comparison of C&D Laboratory Leachate Quality with Field Test Cell Leachate Quality

Parameters	Test Cell Leachate	Lab C&D Leachate (Serial)
pH	6.1 - 7.9	6.5 - 7.0
TDS (mg/L)	1,360 - 3,310	1,640 – 3,000
Chloride (mg/L)	12.5 – 62.7	5.1 – 33.0
Sulfate (mg/L)	313- 1,138	308 - 1,569
Calcium (mg/L)	299 – 691	429 – 605
NPOC (mg/L)	1.1 – 80.5	19.4 – 625
Arsenic (µg/L)	<5.0 – 147.8	10.9 – 378
Chromium (µg/L)	6.0 – 74.9	72.0 – 165
Copper (µg/L)	5.6 – 1,740	<5.0 – 155
Iron (mg/L)	0.3 – 4.6	0.1 – 2.3
Manganese (mg/L)	0.2 – 2.3	0.3 – 1.4

Overall, the results from the laboratory leachate quality confirm observations from previous field leachate studies. The pH in both leachates was near neutral. C&D waste leachate possesses inorganic constituents (e.g. TDS, calcium, sulfate) in high levels, primarily calcium and sulfate. In both studies, the organic strength of the C&D waste leachate were fairly low compared to MSW leachate. Arsenic and chromium resulting from CCA-treated wood were present in both leachates at appreciable levels.

3.4.4 Laboratory Leachate Quality and Regulatory Limits

Laboratory C&D leachate quality data obtained from the serial lysimeter were compared to primary and secondary drinking water standards, as the same manner presented in Chapter 2. Table 3-10 presents the comparisons of laboratory C&D waste leachate with the standards.

A total of six constituents that exceeded the standards at least once included arsenic, chromium, iron, manganese, sulfate, and total dissolved solids. The chemicals that exceeded the primary drinking water standards (health-based) were arsenic and chromium. Approximately two-thirds of the samples of arsenic exceeded the standard. All chromium samples exceeded the standard of 100 μg/L.

The other four constituents were secondary standards (causing aesthetic and cosmetic effects). Pollutants in the leachate that exceeded the drinking water standards by the greatest magnitude were manganese, followed by iron. All samples exceeded the secondary drinking water limits of 250 mg/L for sulfate and 500 mg/L for total dissolved solids.

As discussed in Chapter 2, some contaminants are adsorbed onto soil or diluted by the groundwater when leachate migrates through soil and into the groundwater. The contaminant concentrations observed in the leachate are not likely to be detected at a monitoring well. Depending on the dilution/attenuation process occurring within the subsurface system, the final concentrations of leachate are determined at the monitoring well. Some of the parameters that exceeded the drinking water limits may cause a contamination problem of groundwater if little dilution of leachate occurs.

In previous C&D leachate studies (USEPA, 1995; Melendez, 1996; Weber, 1999), some of the potentially problematic contaminants, which may pose a risk to human health and the environment, were manganese, iron, sulfate, and TDS. Such contaminants were also detected when the laboratory leachate quality was compared with the drinking water standards. It indicates that the results from the laboratory leachate study confirms observations from the previous studies.

Table 3-10 Comparison of C&D Laboratory Leachate with Regulatory Standards

Parameters	Number of Samples	Number of Detected	Number of Exceeded	Average	Regulatory Standard
Primary					
Arsenic (μg/L)	41	41	25	96	50
Chromium (μg/L)	41	41	36	125	100
Secondary					
Iron (mg/L)	41	37	28	1.0	0.3
Manganese (mg/L)	41	41	41	1.0	0.05
Sulfate (mg/L)	44	44	44	790	250
TDS (mg/L)	47	47	47	2,300	500

4. CONCLUSION

A large fraction of construction and demolition (C&D) waste is disposed of in unlined C&D debris landfills. It is generally considered that leachate produced from these landfills poses less of a threat to human health and the environment than leachate from other types of waste disposal facilities (e.g. municipal solid waste landfills). Unlike leachate from municipal solid waste landfills, however, C&D debris landfill leachate does migrate directly to the groundwater. While adverse environmental impacts resulting from C&D waste disposal facilities have been reported in recent years, more information regarding the true nature of C&D waste leachate and its impact on the environment is needed. Research investigating the characteristics of C&D waste leachate has been ongoing at the University of Florida since 1996.

This report presents the results of the third year of a research project to investigate C&D waste leachate. Both a field study and a laboratory study were conducted. In the field study, four test cells were constructed on top of an existing Class III landfill in Alachua County, Florida. Leachate samples were collected and analyzed for conventional water quality parameters, metals, and trace organic compounds. The test cell study was performed over a period of 161 days and leachate produced from residential construction waste was characterized.

The laboratory study involved a leaching column (or lysimeter) experiment and batch tests. The lysimeter experiment simulated and characterized leachate produced from C&D waste with different waste depths. The single lysimeter represented a 4-foot waste depth, while the serial lysimeter simulated a 20-foot waste depth at a C&D landfill. An examination of the data from the laboratory leaching columns (single vs. serial) demonstrated the effect of waste depth on the composition of the leachate produced. Batch tests for individual C&D waste components (a total of 12) were also conducted using the EPA synthetic precipitation leaching procedure (SPLP) to evaluate contaminant leachability of individual C&D waste components as well as to determine the sources of contaminants in C&D waste. Leachate samples were collected from the column and batch tests and analyzed for a number of chemical parameters.

Leachate from the residential construction waste in the test cells contained a strong hydrogen sulfide odor. The leachate was turbid and black in color. These characteristics were most likely a result of sulfate reduction by sulfate-reducing bacteria under anaerobic conditions. The source of sulfate was believed to be the dissolution of gypsum drywall ($CaSO_4$ $2H_2O$). Sulfate and calcium were the predominant ions observed in the leachate, and largely contributed to total dissolved solids. From a total of 13 metals analyzed, aluminum, iron, and manganese were detected in all of the leachate samples (42 samples). Arsenic, chromium, copper, and lead were routinely detected. The most likely source of arsenic, chromium, and copper was chromated copper arsenate (CCA)-treated wood. CCA-treated wood is a common construction component in Florida and was observed in the test cells. Trace organic compounds may be found in paint thinners, stains, motor oils, plastics and paints, which are not uncommon in the construction waste stream. However, no volatile or semi-volatile organic compounds were detected at appreciable levels in the leachate.

In the laboratory study, leachate results confirm many observations from the field test cell study. For example, the laboratory leachate also possessed a strong hydrogen sulfide odor. Sulfate, calcium, and bicarbonate were the predominant ions observed in the leachate. The high concentrations of these ions contributed to the dissolved solids content in the leachate. Arsenic, chromium, iron, and manganese leached at appreciable levels. Precipitation of copper, iron, zinc (as metal sulfides) occurred during the laboratory study.

Parameters such as inorganic ions and metals in the lysimeter leachate were strongly affected by the waste depth. In general, the deeper the waste layer, the higher contaminant concentrations observed in the leachate. As the leachate serially flowed through the lysimeters, the higher concentrations were caused by an increase in contact time between the waste and liquid phase.

The batch test results support the findings from the lysimeter experiment. The drywall batch leachate contained a large amount of dissolved solids, mainly sulfate and calcium. The cardboard and wood batches contained relatively high concentrations of organic constituents when compared to other C&D waste components. Arsenic, chromium, and copper leached in high concentrations from the CCA-treated wood batch.

In both field and laboratory leachate, contaminants such as arsenic, iron, manganese, sulfate, and TDS often exceeded the drinking water standards. Arsenic was the only primary standard limit exceeded (with an exception of chromium in the laboratory study). All of the other exceeded standards were based on secondary drinking water limits (used for aesthetic reasons). These chemical parameters are important in Florida because groundwater is the predominant source of drinking water. The parameters that exceeded the standards could potentially impact the groundwater and it may need additional treatment before it can be used for drinking water.

In a C&D leachate investigation reported by EPA, some of the potentially problematic contaminants determined were manganese, iron, sulfate, and TDS, which may pose a threat to the environment. The same was found true in the research reported here. Arsenic was not included as the problematic constituents in the EPA investigation. However, during the leachate studies in the field and the laboratory, arsenic leached at high levels. Arsenic may be of particular concern because the drinking water standard will likely be lowered in the near future, as well as, a forecasted increase of CCA treated wood in the C&D waste stream over time (Solo-Gabriele and Townsend, 1999). Potential impacts of CCA-treated wood from unlined C&D waste landfills should be further investigated.

While the drinking water standard comparison helps to identify contaminants of concern in the leachate, the leachate concentration, in most cases, will be greater than the actual concentration in the groundwater. When leachate enters the groundwater beneath a C&D landfill, the chemical constituents are expected to be diluted, and subsequent pollutant transport in the subsurface may cause attenuation. Figure 4-1 presents a schematic of leachate migration from an unlined C&D waste landfill and subsequent migration in an aquifer. Dilution and attenuation are often expressed by means of a dilution attenuation factor (DAF).

$$DAF = \frac{C_{Leachate}}{C_{Compliance}}$$

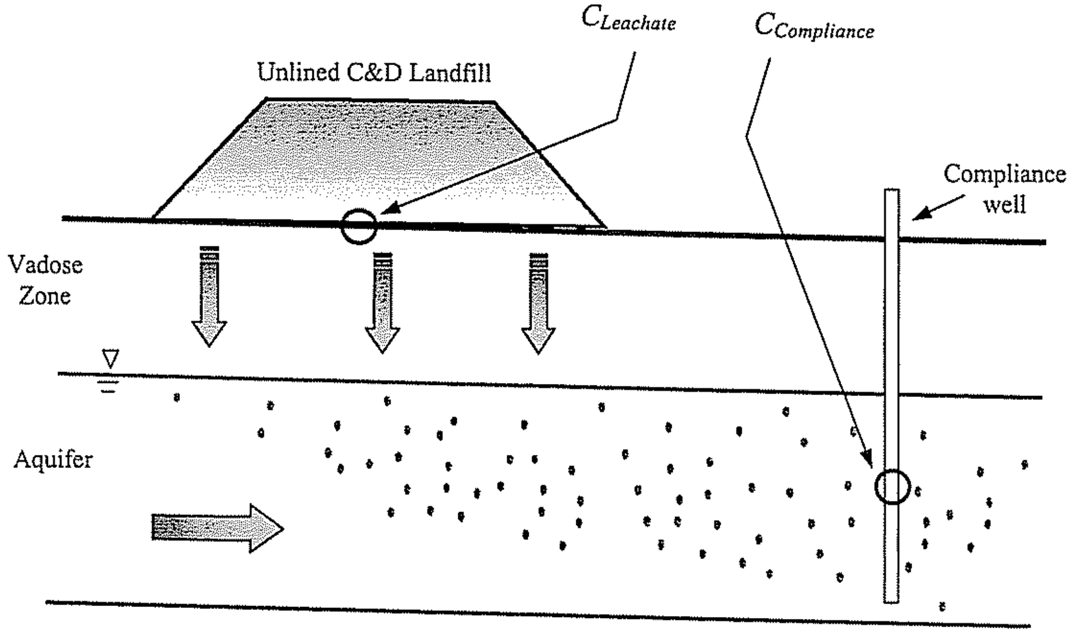


Figure 4-1 Schematic of Pollutant Migration from a C&D Landfill to a Compliance Well

The degree of dilution and attenuation is dictated by hydrologic conditions, the pollutant species of concern, and the rate of discharge. Table 4-1 presents the maximum concentrations of the chemicals of concern (measured in this study) and the corresponding DAFs needed to meet the Florida Groundwater Guidance Concentrations. The use of the maximum concentration is conservative, as the average concentration will be lower. The largest DAF needed to meet the standards was for manganese, which required the DAF in the range of 28 to 45. The DAF required to meet the arsenic standard was 3.0 for the field test cell leachate and 7.6 for the laboratory leachate. While these DAFs may be attainable by most landfill hydrogeologic settings, if the arsenic drinking water standard is lowered, the needed degree of DAF will be increased. The DAFs used in regulatory programs in the literature ranged from 10 to 100 (US EPA, 1995; US EPA, 1996). They may be lower under disposal conditions in which the landfill is large and the aquifer is small.

The DAF analysis presented here does not provide conclusive evidence that the groundwater contamination will or will not occur. There are still too many unknowns. The analysis suggests that leachate from C&D waste is likely to impact the groundwater at some sites. Now that groundwater monitoring results from Florida C&D debris landfills are available, these data should be carefully reviewed and compared to the information collected in more controlled experiments. Additional laboratory and field studies on the environmental impacts of hydrogen sulfide generation and CCA-treated wood from C&D waste would be valuable to the C&D leachate quality database.

Table 4-1 Maximum Concentration in Leachate from Both Field and Laboratory Studies and Dilution Attenuation Factor

Parameters	Field Test Cell Study		Laboratory Lysimeter Study	
	Maximum Concentration	DAF for Max Concentration	Maximum Concentration	DAF for Max Concentration
Arsenic (μg/L)	148	*3.0*	380	*7.6*
Chromium (μg/L)	--	--	164	*1.6*
Aluminum (μg/L)	2,380	*11.9*	--	--
Iron (mg/L)	4.6	*15.5*	2.3	*7.7*
Manganese (mg/L)	2.3	*45.3*	1.4	*28.0*
Sulfate (mg/L)	1,370	*5.5*	1,570	*6.3*
TDS (mg/L)	3,310	*6.6*	3,000	*6.0*

In summary, leachate from well-operated C&D debris landfills (with proper spotting) does appear to pose less risk to human health and the environment than leachate from MSW landfills and hazardous waste landfills. In Florida, C&D debris landfills do not require liners. The research suggest that even well-operated C&D debris landfills will impact the characteristics of the underlying groundwater from the minerals that leach from the primary C&D debris components (e.g. concrete, gypsum wallboard, wood). A question that must be addressed by policy makers is what level of concern does exceedance of secondary drinking water standards represent, and do these chemical parameters warrant additional controls for landfills. The presence of CCA-treated wood does appear to represent a possible problem in regard to arsenic leaching, especially if the drinking water standard is lowered. Continued long-term monitoring of Florida C&D debris landfill groundwater data will help answer some of these questions.

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The NADC Reports:

Demolition Contractors Manage and Dispose of Waste Responsibly

A report based on research conducted
by Gershman, Brickner & Bratton, Inc.

February, 1995

Presented by

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Executive Summary

Is demolition waste being managed in an environmentally safe manner; are additional regulatory controls needed? To help answer these questions, the National Association of Demolition Contractors (NADC) has been asked by the U.S. Environmental Protection Agency to provide information that will help the EPA and other agencies determine what type of regulations will be sufficient to ensure environmental protection for landfills serving the demolition industry.

NADC's Conclusions:

> **The majority of waste disposed at demolition landfills is relatively inert.** Demolition waste is primarily a mixture of wood, concrete, bricks, glass, metals, roofing materials, plastics, and dirt which cannot be economically recycled. These materials are not a source of significant environmental risk when managed appropriately.
>
> **State-of-the-art demolition landfills pose no significant environmental risk.** The NADC's studies show that demolition landfills, when monitored and operated consistent with industry guidelines, provide appropriate environmental safeguards. Leachate representative of such facilities meets National Primary Drinking Water Standards and can be managed so that it does not pose a significant environmental threat.

NADC Research: Those conclusions could be arrived at only after a number of other questions were asked and answered.

> How does the demolition industry manage project sites and segregate waste streams for proper handling?
>
> How are demolition landfills currently regulated?
>
> What are the operating practices and design characteristics of a state-of-the art landfill serving the demolition industry?
>
> What are the characteristics of leachate from demolition landfills?

The firm of Gershman, Brickner & Bratton, Inc. (GBB), consultants with particular expertise in the study of construction and demolition waste management, has completed a nation-wide research project for the

The firm of Gershman, Brickner & Bratton, Inc. (GBB), consultants with particular expertise in the study of construction and demolition waste management, has completed a nation-wide research project for the NADC which provides an up-to-date compilation of available information needed to address these questions.

This report summarized the results of GBB's research effort and presents the NADC"s position based on this current data.

Background

NADC-The National Association of Demolition Contractors

For more than two decades, the National Association of Demolition Contractors (NADC) has been a source of information about the demolition industry, offering its professional and experience-based insight to governmental regulators, and helping to ensure that environmentally responsible and safe practices are standard practice for the demolition industry.

As the recognized voice for the demolition industry, the NADC is often asked for information about topics of current focus, concern, and significance. This report has been prepared in response to requests from the U.S. Environmental Protection Agency for information about the character of demolition waste, methods by which it is managed, the quality of leachate from demolition landfills, associated environmental risks, and for the NADC's conclusions and recommendations regarding the type of regulation and control appropriate for demolition landfills.

Sierra Club vs. Browner

In settlement of a lawsuit brought by the Sierra Club, the U.S. EPA agreed to promulgate revised criteria for nonmunicipal solid waste facilities in the coming months. Demolition landfills which receive for disposal a very controlled and limited wastestream are one type of facility which could be subject to such regulations.

The EPA has requested the NADC to provide information that will help address the question of whether regulations similar to EPA's Sub-title D standards for municipal solid waste landfills are needed to ensure environmental protection for landfills serving the demolition industry – essentially to answer the question, are demolition wastes managed and disposed of responsibly?

NADC"s Databases

For decades, the NADC has supported the environmentally responsible management of

demolition wastes by the industry. NADC experience has led to it's firm belief that these efforts have resulted in safe management of demolition wastes. However, NADC's knowledge of the effectiveness of the industry's efforts is not the same as being able to demonstrate and document:

- •What **materials** are being landfilled?
- •What type of **regulations apply** to demolition landfills across the U.S.?
- •What are the **characteristics of leachate** from demolition landfills?

In order to provide the best available base of information to address these questions, NADC sought an independent third-party to perform the necessary research effort.

The firm of Gershman, Brickner & Bratton, Inc. (GBB), recognized experts in the study and management of demolition waste, was retained to complete a nation-wide research program that would compile and review databases on the characteristics of demolition waste, applicable state regulations, and leachate characteristics. These research efforts and their resulting resource documents are identified in the table below.

Table 1: NADC Databases and Reports

Topic	Research Approach	Resource Developed
Characteristics of construction and demolition wastes	Compilation of published reports and articles about of materials delivered to demolition landfills for disposal	C & D Waste Characterization Database, Volumes 1 & 2, prepared for the NADC by GBB, February, 1994
Regulations governing design, operation, monitoring, and closure of demolition landfills	Survey of 50 states	State Regulatory Database, Volumes 1 & 2, prepared for the NADC by GBB, August 1994
Characteristics of leachate from demolition landfills	Survey of 50 states, published reports and articles, records solicited from operating facilities	C & D Waste Landfills Leachate Quality Data, Volumes 1 & 2 prepared for the NADC by GBB, February, 1994
Analysis of collected leachate Data	GBB evaluation of collected information	Preliminary Report on Demofill Leachate Quality, prepared for the NADC by GBB, February 1995

The databases and technical reports developed through GBB's efforts are available through the NADC; more information about how to obtain these resource reports can be found on the last page of this document.

How does the Demolition Industry Manage Project Site and Segregate Waste Streams for Proper Handling?

What is demolition waste?

Before significant demolition activity begins, demolition contractors carefully inventory and isolate items which are know to be hazardous. Materials which are difficult to identify or which are suspected of potentially having hazardous characteristics are also isolated. Suspect materials are either identified or tested in order to select an appropriate disposal method. Marketable timbers, metals, fixtures, and other materials from demolition projects which have value for reuse or recycling are segregated and recovered. The demolition industry annually recycles millions of tons of concrete, steel, and brick.

As a result of these efforts to isolate hazardous items for separate disposal and to reclaim materials of value, the demolition wastes which are ultimately delivered to landfills comprise only a portion of all the material initially found at demolition project sites. This landfilled fraction is composed of materials which cannot be economically recovered and which do not require special disposal arrangements. Numerous composition studies show this landfilled fraction to be primarily a mixture of unrecyclable concrete, wood, glass, metals, roofing materials, plastics, and dirt, an inert material.

Pre-demolition Inspections

A first step for demolition projects includes a walk-through visual inspection that helps to identify any transformers, drums, liquids, tanks, or other items which will require special handling and/or testing. Site managers and crews are highly trained and drilled in the importance of identifying and isolating suspect materials. Many projects are begun only after a more formal site audit is performed by the site owner or a third party environmental consultant.

In addition, during the site inspection demolition contractors identify materials to be removed and sold for reuse or to be processed and recycled. This inspection process is also essential for the demolition contractor to identify and structural hazards, note any safety concerns and to determine the specific sequence that will be followed for the demolition activities.

Sequencing of Demolition Activities

Interior or partial demolition projects and an increasing number of total demolition projects are scheduled so that the removal of floor coverings, ceiling materials, interior walls, and other items occur in sequence before any structural demolition takes place. These steps maximize the efficiency and safety of the process and provide a further opportunity to inspect the waste materials as they are separately removed and readied for disposal.

Demolition contractors provide sophisticated safeguards for their businesses, employees, and projects by being experts in the applicable regulations for their projects: air quality, water quality, solid and hazardous waste, occupational safety, and noise, among others. The industry's standard practice entails careful assessment of project sites well in advance of demolition activities; specialized removal and disposal of potentially hazardous items; recycling of marketable equipment and extensive recycling of brick, concrete, and steel, along with growing efforts to recycle wood waste. The balance of materials from demolition project sites are landfilled.

Composition of Wastes Delivered to Demolition Landfills

The database compiled by GBB shows that the majority of wastes delivered to demolition landfills are made up of mixed concrete, wood, brick, rubble, metals (primarily ferrous), soil and fines, and smaller quantities of intermixed glass, plastics, textiles, and other materials.

The quantity and type of waste materials received by demolition landfills vary somewhat by the type of activity performed: site clearance, roadwork, excavation, building demolition, and construction/renovation. Some demolition landfills receive waste from all these types of activities; some accept only a more limited spectrum; for example, some accept wastes originating strictly from demolition operations. However, data from many sources shows a general materials profile for the wastes received at all studied demolition landfills, with wood waste dominating, followed by concrete and other rubble. Ferrous metals, glass, plastics, roofing materials, and other items comprise significantly smaller fractions of the mix.

The full waste composition database compiled by GBB is available from the NADC. This compilation of studies and investigations of demolition landfills across the U.S. shows a certain degree of uniformity in the categories of waste landfilled at these facilities, and the composition consists of a limited range of materials. In contrast, landfills for municipal solid waste (MSW-the aggregate wastestream from a community's commercial, residential, and industrial sources) and landfills for industrial waste disposal typically receive a very broad spectrum of waste types and quantities.

The waste characteristics of these facilities has a far higher organic fraction, and the generation of the incoming waste loads is from millions of untrained, often indifferent, casual generators. In contrast, demolition wastes originate from a highly specialized and trained industry, whose success in safeguarding the environment is evident both in the uniformity of composition found in the database search as well as in the historical absence of significant environmental problems associated with landfills that have accepted only demolition wastes.

How are demolition landfills currently regulated?

State Regulations

GBB's nationwide survey found that over 40 of the 50 states have differentiated regulations for demolition landfills. However, where the states have regulated demolition landfills, their regulatory approaches have generally reflected the comparatively inert character of the demolition wastestream, and demolition landfill requirements have been far less complex than the requirements the states have put in force for the management and disposal of municipal solid wastes and industrial wastes.

For the majority of states which do regulate demolition landfills, a significant portion of the regulations rely heavily on disclosure of the location of small volume disposal facilities and on the innocuous character of the wastestream to provide a sufficient safeguard for disposal sites. Commonly, small demolition disposal sites are required only to provide a registration or notification of operations and to maintain simple records of the quantity and/or origin of wastes disposed.

Most states which have adopted more formal permit or license requirements for demolition landfills have some form of groundwater monitoring requirement as well. GBB's analysis however, has found that these standards are often inadequate to document both background groundwater quality as well as a discernible identification of the effects of the monitored facilities.

What are the operating practices and design characteristics of a state-of-the-art landfill serving the demolition industry?

Based on the experience of the demolition industry, the NADC has identified an inventory of the operating practices and design characteristics that it considers to be representative of demolition landfill that reflects current industry standards. For many situations, these attributes would exceed the minimum existing regulatory requirements. However, they are viewed by the NADC as representing an industry guideline for prudent, environmentally responsible operations.

Table 2: Operating Practices and Design Characteristics for State-of-the-Art Demolition Landfills

Responsible, trained personnel	Appropriate supervision of facility operations; training requirements for all on-site employees
Routine Procedures and Protocols	Plan of Operations or Operations Manual; training in site safety/operational practices required of all staff
Defined Listing of Acceptable and unacceptable wastes	Wastes allowable for receipt well defined; personnelUnacceptable Wastes trained in identification
Inspection of All Incoming Waste Loads	Required disclosure of waste type and source; visual inspection of material when delivered also when placed on working face
Isolation and Analysis of Suspect Materials	Requirements for and routine practice of isolation of suspect materials; documented procedures for identification, isolation,testing, and disposal of unacceptable and suspect wastes
Siting	Suitable site surface and subsurface conditions; Compatible with adjacent land uses
Leachate Containment	Capacity to contain leachate either through native soil conditions, compaction of native soils, or other containment system
Groundwater Monitoring	Upgradient (background) and downgradient groundwater monitoring for appropriate parameters, tested at least annually
Record Keeping	Maintenance of records of waste receipts and waste placements
Financial Assurance	Long-term funding for post-closure cover maintenance
Closure Plan	Design for installation and maintenance of final cover

These standards and practices provide an assurance that demolition landfills are repositories of only those wastes appropriate for disposal at these sites and the corresponding assurance that unacceptable materials are diverted to proper management alternatives; long-term monitoring of the environment; and assurance of permanent facility care.

Just as demolition contractors apply stringent controls to ensure that hazardous materials are separately removed from project sites and properly disposed, similarly, state-of-the-art demolition landfills must apply clear, consistent standards to define wastes acceptable for disposal. This is among the best, most effective means of environmental control for demolition facilities. Training for site operators and personnel, training and informational materials for haulers and facility users; rigorous screening of incoming loads; records of gate receipts and disposal placement all are hallmarks of facilities which follow NADC guidance. Such steps can ensure that the long-standing characterization of demolition waste as environmentally innocuous is well-founded.

What are the characteristics of leachate from demolition landfills?

The third database developed for the NADC by GBB entailed compilation and review of demolition landfill leachate monitoring records and other background documentation about the quality of leachate generated from demolition landfills across the United States.

Data from MSW Sites is not Representative of Demolition Landfills

GBB's 1994 research and assessment found that many of the existing reports and leachate data supposedly about "demolition landfills" are seriously flawed. Municipal solid waste has very different characteristics from demolition debris, and obviously, sizable deposits of municipal solid waste at facilities would skew the groundwater minitoring data considerably. Several sites classified as construction /demolition landfills (sites supposedly accepting only demolition and construction waste) were found to have accepted municipal solid waste for some period of time. It is suspected that many facilities were converted to construction/ demolition landfills rather than attempt to comply with contemporary regulations for municipal solid waste sites. Regardless of such facilities' present suitability for demolition waste disposal, leachate data from such dual purpose facilities cannot be used to validly characterize the effects of construction/demolition wastes.

Leachate Data from a State-of-the-Art Demolition Landfill

The research effort found excellent long-term leachate test documentation (more than 5 years) froma state-of-the-art demolition landfill operated in a major midwestern metropolitan area. Reports provided by this facility to its state regulators document leachate characteristics on a quarterly basis. Because the facility is lined and leachate is collected, the information is comprehensive.

The facility operator has concluded that the facility's waste receipts are characteristic of the mix of materials regularly received by demolition landfills, and the NADC considers the data from this facility to be the best current information representative of leachate characteristics for demolition landfills meeting industry standards.

Representative Leachate Data for Demolition Landfills

Tables 3 and 4 are excerpted from GBB's technical analysis of the leachate database. On Table 3, the first column identifies the National Drinking Water Standard's Maximum (allowable) Contaminant Levels (MCL). The second column lists the published range of leachate concentrations found for demolition landfills, including those for which the data is flawed by a past history of MSW disposal. The third column, headed "Potential Surrogate Range C&D Landfills," provides a calculated range -a surrogate- for the range of contaminants in the demolition landfill leachate. This calculated range is based heavily on the record of analysis for the representative midwestern demolition landfill described above.

The table indicates that contaminant concentrations in leachate from a state-of-the-art demolition landfill, as represented by the "Potential Surrogate Range" values, would not exceed primary national drinking water standards.

Table 4 compares the representative values for demolition landfill leachate, the "Potential Surrogate Range" in column 3, with one source's published data and its estimates of leachate concentrations for MSW landfills. As is quickly evident in a scan of the table, for most listed parameters, the "Potential Surrogate Range" representative of demolition facilities shows values far below those found at MSW sites, often by a least an order of magnitude.

Of special note is the fact that the GBB database showed that lead is not a major component of demolition landfill leachate even with high lead paint content often found in older demolition projects. The U.S. EPA has recently taken these findings into account in development of a proposed disposal standard for lead-based paint contaminated debris.

On Table 4, sulfate, a substance that is essentially environmentally innocuous, is the one parameter for which there is an exception to the pattern of higher concentrations in MSW leachate. The higher sulfate concentrations estimated for demolition facilities are associated with the higher volumes of concrete and rubble disposed at demolition sites.

Table 3. Leachate Data Summary

	MCL[2]	Published Range C&D Landfills[4]	Potential Surrogate Range C&D Landfills
Metals (mg/L)			
Arsenic	0.05	ND-0.12	<0.002-0.02
Barium	1.0	0.05-0.8	0.1-0.16
Cadmium	0.005	ND-2.05	0.0001-<0.0004
Chromium	0.10	ND-0.45	<0.001-<0.01
Lead	0.05	0.0002-0.669	<0.0002-<0.003
Manganese	0.05[3]	0.019-258	<0.08-12
Selenium	0.01	ND-<0.02	<0.02
Zinc	5.0[3]	ND-0.81	<0.01-0.03
Volatile Organics (mg/L)			
Trichloroflouromethane	N/A	<0.02-13	<0.02-0.025
1,2 Dichloroethan	0.005	<0.0004-26	<0.0004-0.0008
Trichloroethane	—	<0.025	<0.025
1,1,1-Trichloroethane	0.2	0.0006-<0.025	<0.001-<0.025
Ethyl Benzene	0.7	0.0008-18	<0.0008-<0.025
Conventional Parameters			
Alkalinity	N/A	ND-1800	410-1450
Calcium	N/A	<0.03-600	280-600
Chloride	250[3]	8-2400	100-460
Chemical Oxygen Demand (COD)	—	ND-1100	110-230
Conductivity (mmhos/CM	—	220-2010	1000-2010
Cyanide	.02	ND-0.02[5]	0.01-0.02[5]
Hardness	N/A	150-2420	340-2420
Iron	0.3	0.02-93.4	0.02-14
Nitrogen, Organic	—	0.07-2.4	0.07-1.5
Nitrogen, Nitrate	10	ND-10	<0.25-3.5
Nitrogen, Ammonia	—	ND-170	<.05-1.2
pH (unit)	6.5-8.5[3]	6.2-7.24	6.8-7.1
Sulfate	250[3]	11.7-2700	730-1700
Total Dissolved Solids (TDS)	500[3]	270.8400	1700-5740
Total Suspended Solids (TSS)	—	<4-5000	<4-320

[1]C&D Waste Project Report, A Preliminary Report on Demofill Leachate Quality prepared for the National Association of Demolition Contractors (NADC), prepared by Gershman, Brickner & Bratton, Inc., February 14, 1995.
[2]MCL = Maximum Contaminent Level – National Primary Drinking Water Standards.
[3]National Secondary Drinking Water Standards.
[4]Includes data from facilities which accepted MSW for some period of time.
[5]Exclusive of complex; highest complex is 0.34
ND = Not-detected.
All Quantities mg/L unless otherwise noted.

Table 4. Comparison of Published MSW Landfill and C&D Landfill Leachate Data

	Published Range MSW Leachate Data	Surrogate MSW Leachate Data	Potential Surrogate Range C&D Landfills
Metals (mg/L)			
Arsenic	5.0-1600	0.0039-0.12	<0.002-0.02
Cadmium	0.5-Ñ140	ND-0.013	0.0001-<0.0004
Chromium	30-1600	ND-0.12	<0.001-<0.01
Lead	8-1020	ND-0.25	<0.0002-<0.003
Zinc	0.03-4	ND-53	<0.01-0.03
Conventional Parameters			
Alkalinity	300-11500	DNP	410-1450
Chloride	100-5000	99-3300	100-460
Chemical Oxygen Demand (COD)	500-4500	97-8100	110-230
Iron	3.0-280	3.3-320	0.02-14
Nitrogen, Nitrate	0.1-50	DNP	<0.25-3.5
Nitrogen, Ammonia	30-3000	DNP	<.05-1.2
pH (unit)	7.5-9	6.2-8.3	6.8-7.1
Sulfate	10-420	ND-330	730-170
Total Dissolved Solids (TDS)	—	480-24000	1700-5740
Total Suspended Solids (TSS)	—	26-7400	<4-320

[1]Excerpted data from referenced reports for comparison purposes only; mg/L unless otherwise noted.

[2]Norstrom, James M. et al Properties of Leachate from Construction/Demolition Waste Landfills (presented at the Fourteenth Annual Madison Waste Conference) September 25-26, 1991 and from Waste Age Landfill Course, July 1991.

[3]Wastewater Treatment Group (Waste Management of North America, Inc.) Construction & Demolition Lanfill Leachate Study, December 1991.

[4]Consolidated database from Table 3.

DNP = Data Not Provided in referenced report.

NADC Conclusions and Recommendations

NADC's development of nation-wide databases regarding demolition waste composition, state regulation of demolition landfills, and demolition landfill leachate characteristics was prompted by requests for the best available up-to-date information that could help guide development of federal and state regulations applying to demolition landfills. NADC has concluded that data representative of state-of-the-art demolition landfill leachate does exist and is the best information representative of industry impacts. The NADC's database and associated research effort should be considered by regulators as a comprehensive attempt to reconcile several different databases, documents and opinions on the use of published construction/demolition landfill leachate databases in the effort to help formulate regulatory policy.

NADC's waste characterization database documents that a vast majority of waste received by demolition landfills is relatively inert, Demolition wastes are predominantly a mixture of wood, concrete, brick, dirt, metals, roofing materials, glass, plastics and other non-recyclable wastes.

Some have suggested that demolition lanfills must meet EPA standards for Sub-title D municipal solid waste landfills, a view based in part on data regarding demolition landfill leachate quality from studies which pre-date NADC's 1994 review and database compilation. It cannot be overemphasized that the extensive NADC research effort found that landfills that used to be "old MSW dumps" or that have been the recipients of unchecked, unauthorized or illegal waste generate poor quality leachate. Unfortunately, the records for some of these sites are still being considered as part of the database being relied on to support the development of new, more stringent regulations for demolition facilities. However, as NADC's database shows, leachate from state-of-the-art demolition landfills and MSW landfills are not similar in concentration or composition, and thus should not demand similar regulatory regimes.

These findngs support NADC's conclusion that properly designed, well maintained and operated demolition waste landfills are the most economical and environmentally sound method to manage that portion of the demolition industry's waste which cannot economically be recycled. NADC recommends that the standards and practices outlined in Table 2 be the basis for defining the manner in which demolition landfills can remain a viable and economic alternative for disposal of demolition wastes. In all cases, the NADC believes that the development of effective regulations for demolition landfills must begin with a clear definition of the materials which constitute "Acceptable Waste" for demolition landfill disposal. In addition, every facility must have an Operations Plan which includes provisions to effectively exclude unacceptable wastes and provide for their proper management.

NADC believes that just as the disposal of significant quantities of hazardous waste, batteries, waste oils, and other special wastes have been successfully reduced and/or eliminated from MSW landfills, yard waste composting sites, and waste-to-energy facilities, it is possible to work through demolition contractors, home builders, general contractors and other construction/demolition waste generators to eliminate inappropriate materials from demolition landfills.

In response to the challenge of handling the large amount of demolition debris generated in the United States in an environmentally safe manner, NADC members recycle millions of tons of waste annually, creating products for use in manufacturing, road building and maintenance, landscaping, nursery production, and more. However, not all wastes can be recycled, therefore, landfilling remains an integral, necessary component of the industry's appropriate waste management options. The demolition landfill is considered by the NADC to be a viable means of disposal for construction/demolition waste. For years, these facilities have accepted construction/demolition wastes and, when managed properly, pose no significant threat to the environment.

Databases, Reports, and Other Information

The databases and technical reports described in this document are available from the NADC for the nominal cost of reproduction.

- C&D Waste Characterization Database, Volumes 1&2, prepared for the NADC by GBB, February, 1994
- State Regulatory Database, Volumes 1&2, prepared for the NADC by GBB, August, 1994
- C&D Waste Landfills Leachate Quality Data, Volumes 1&2, prepared for the NADC by GBB, February, 1994
- Preliminary Report on Demofill Leachate Quality, prepared for the NADC by GBB, February, 1995

About the NADC

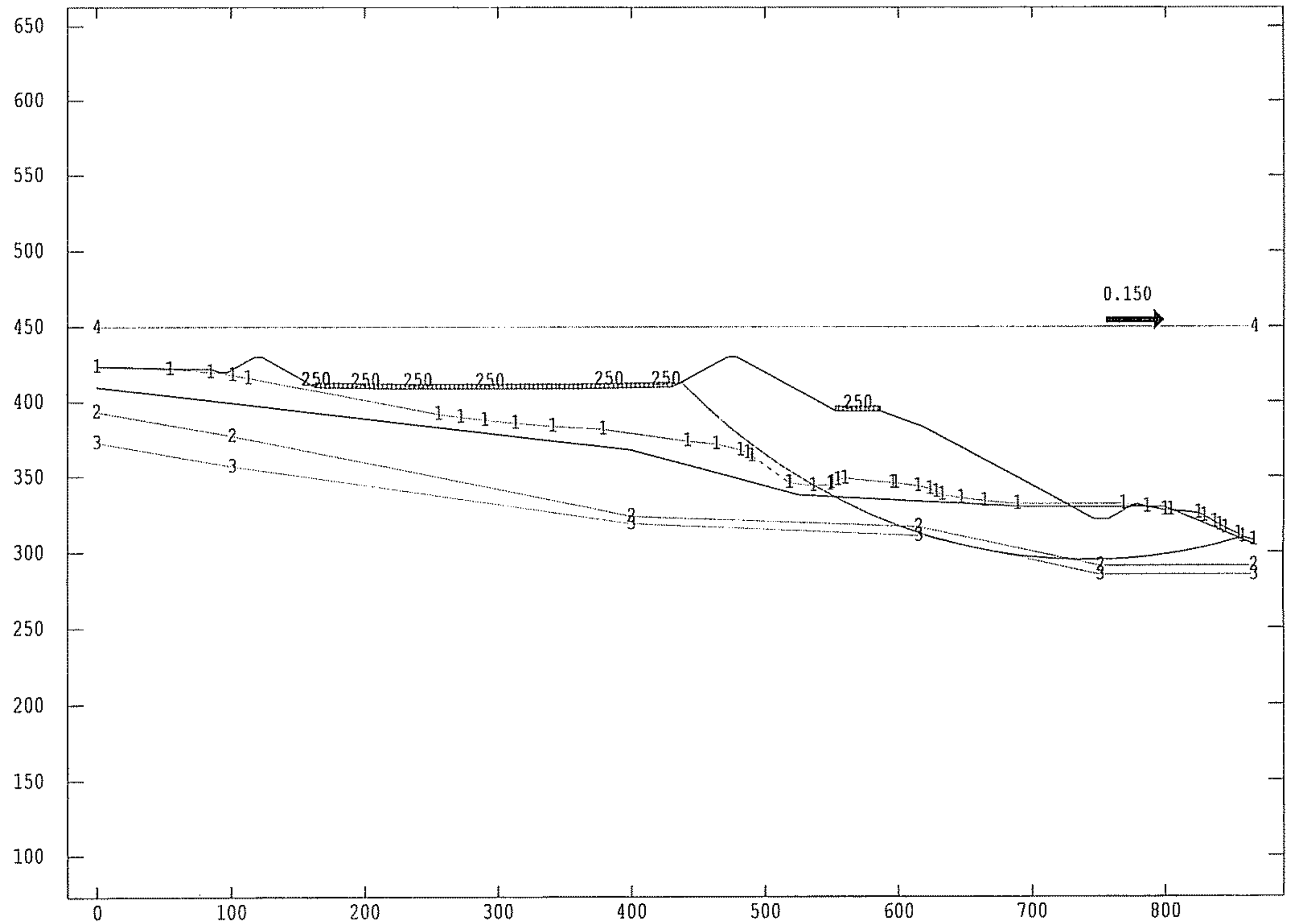
The size and experience of its membership have made the National Association of Demolition Contractors (NADC) a driving force and voice for the demolition and recycling industry for nearly a quarter century. The NADC was formed in 1972 as a non-profit organization to foster communication between the public, governmental regulators and contractors engaged in the demolition industry. NADC sponsors educational programs to increase public understanding of all aspects of the demolition industry, supports research efforts regarding issues of concern, and acts as an information clearinghouse for its members.

For copies of these documents or for additional information about the NADC or about the demolition industry, please call or write:

National Association of Demolition Contractors
16 North Franklin Street • Doylestown, Pennslyvania 18901
215-348-4949 • Toll Free 1-800-541-2412 • Fax 215-348-8422

K

Appendix K
Slope Stability Analysis



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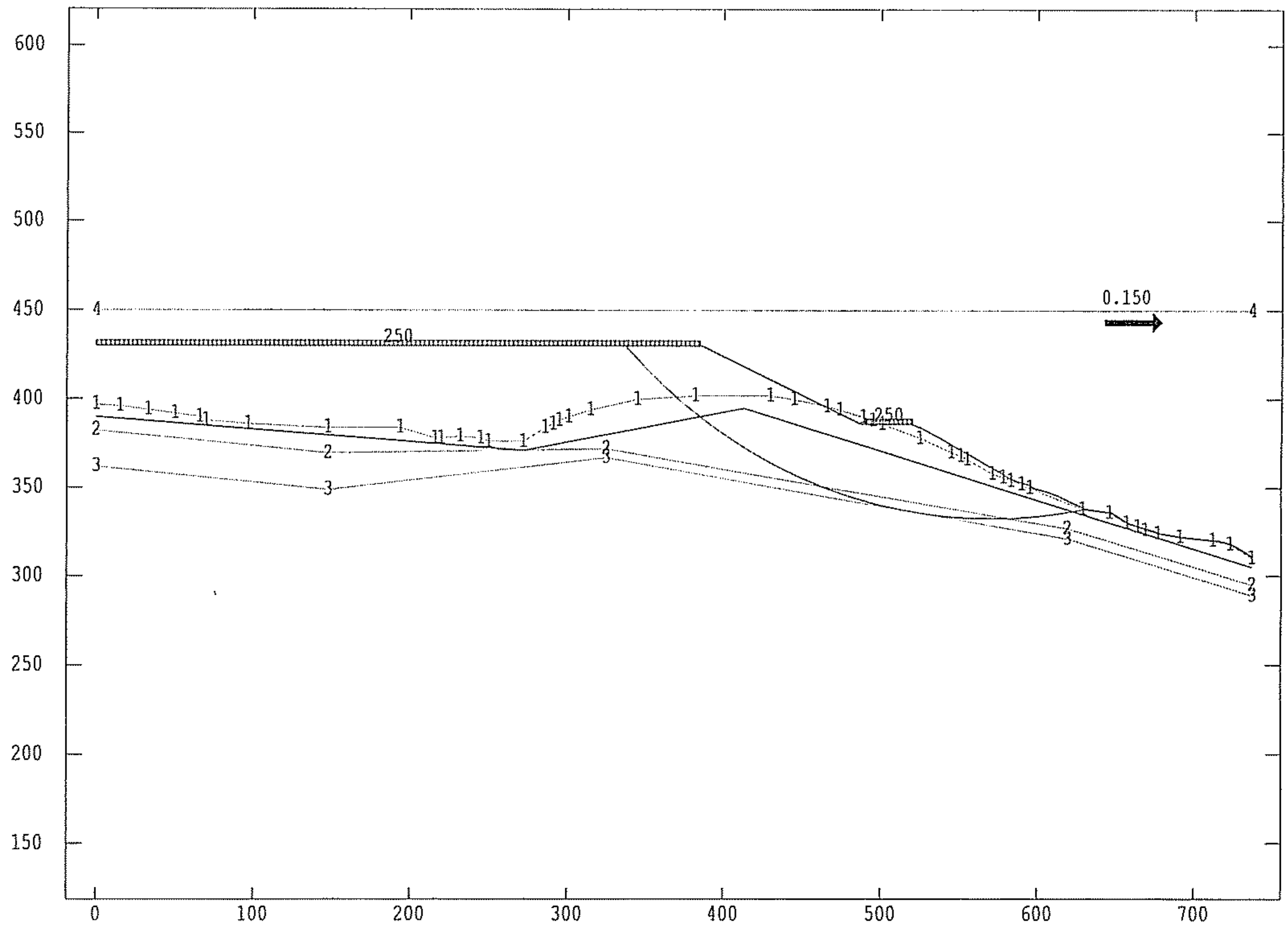

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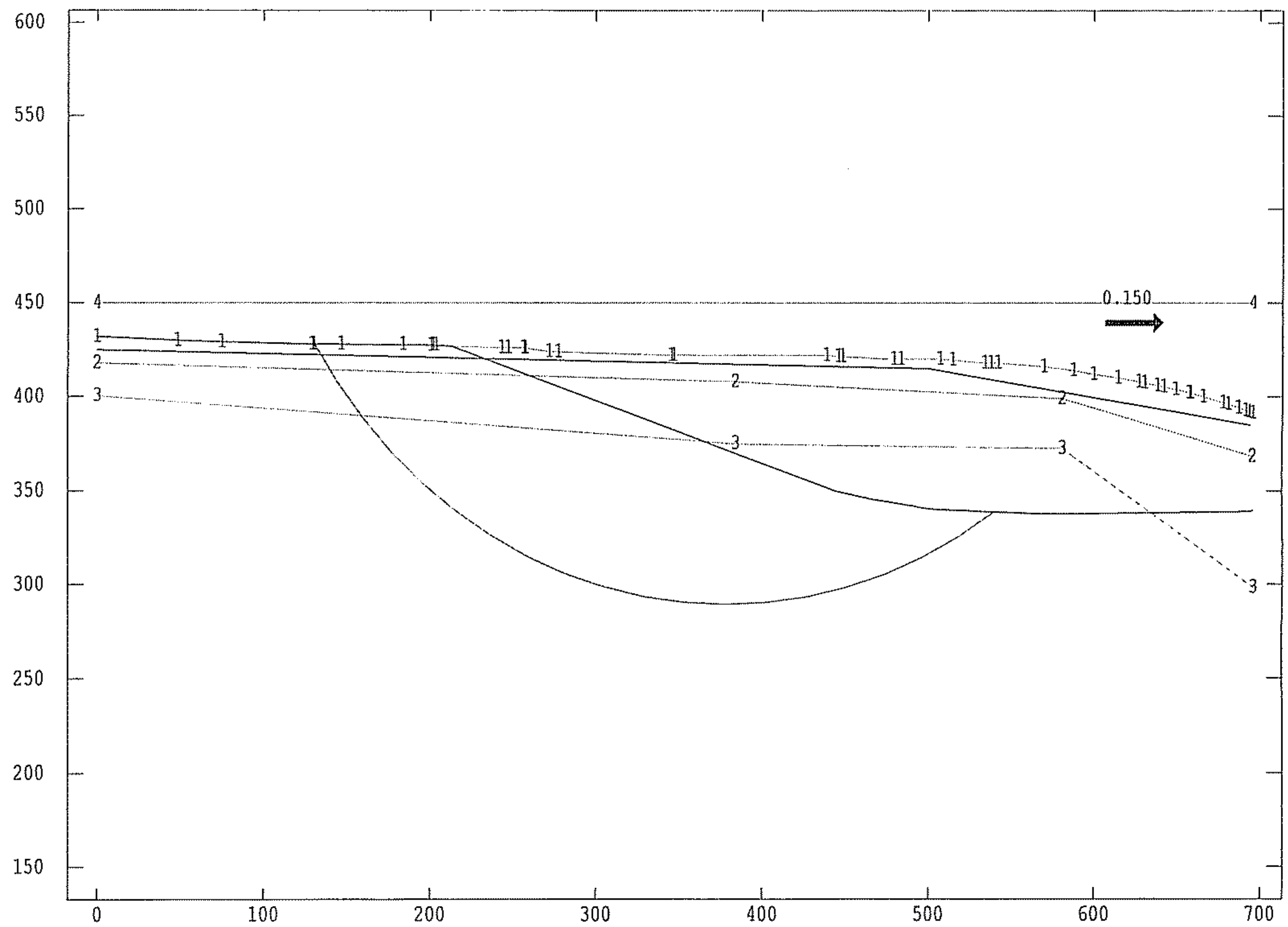

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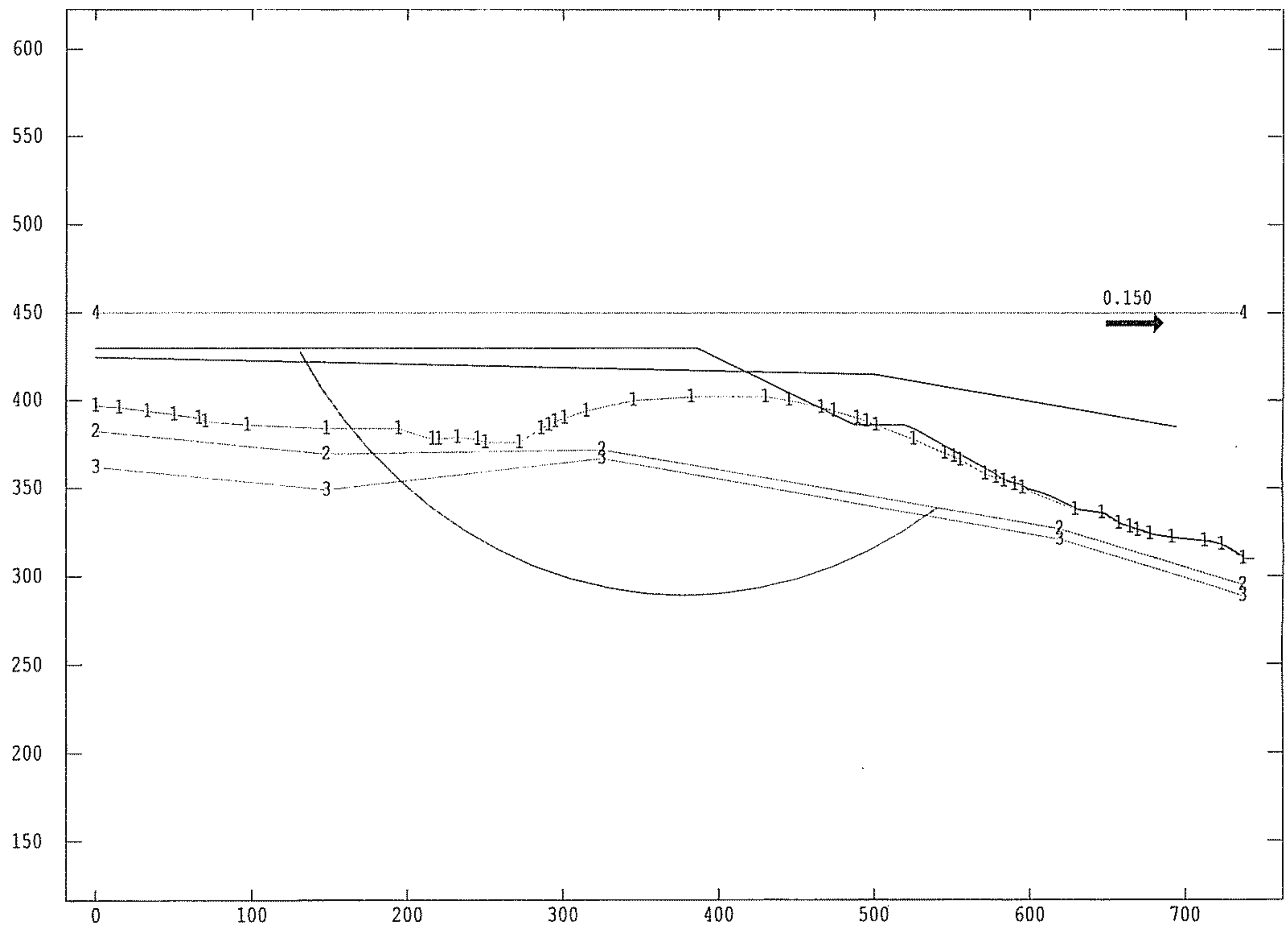

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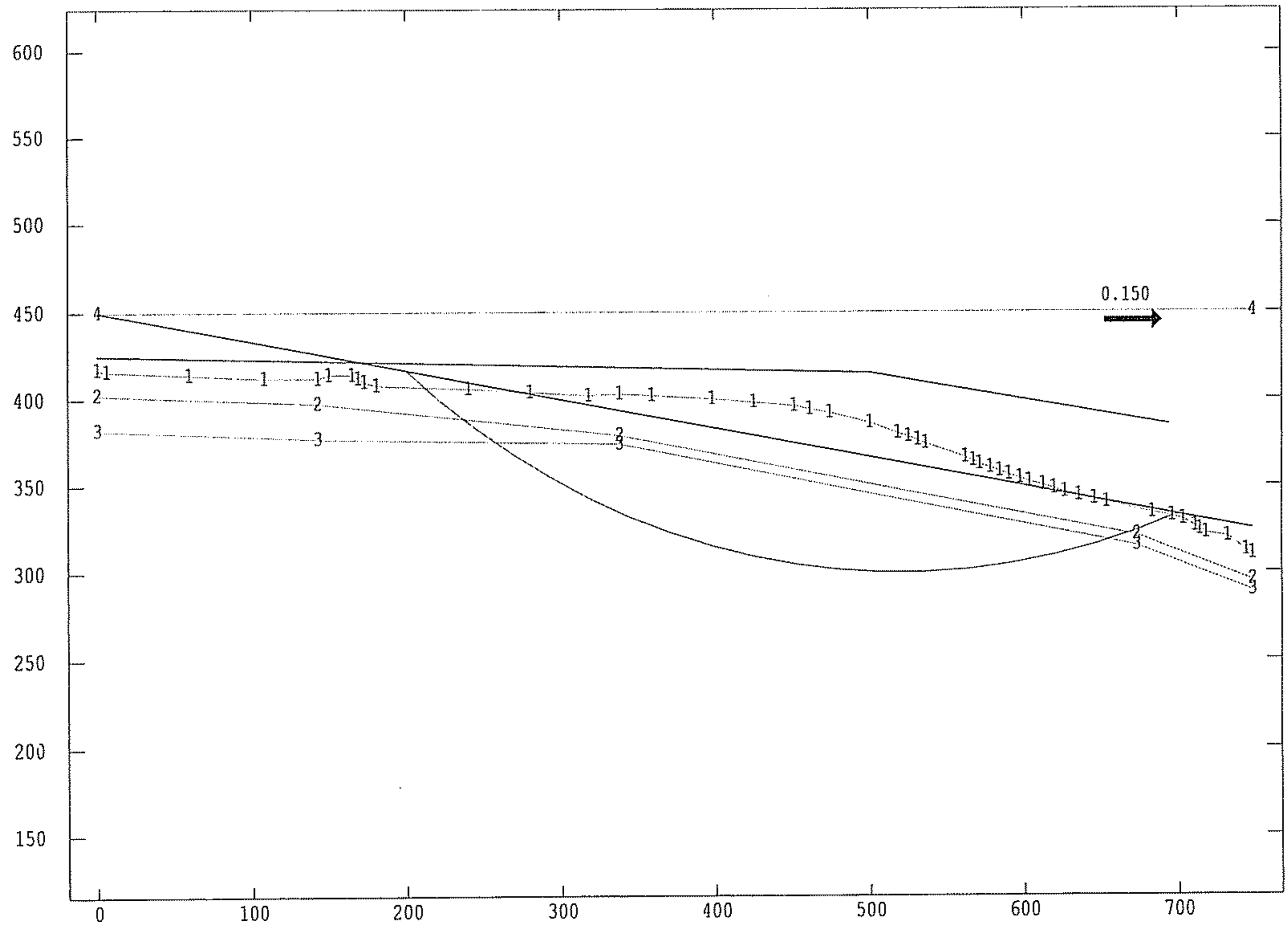

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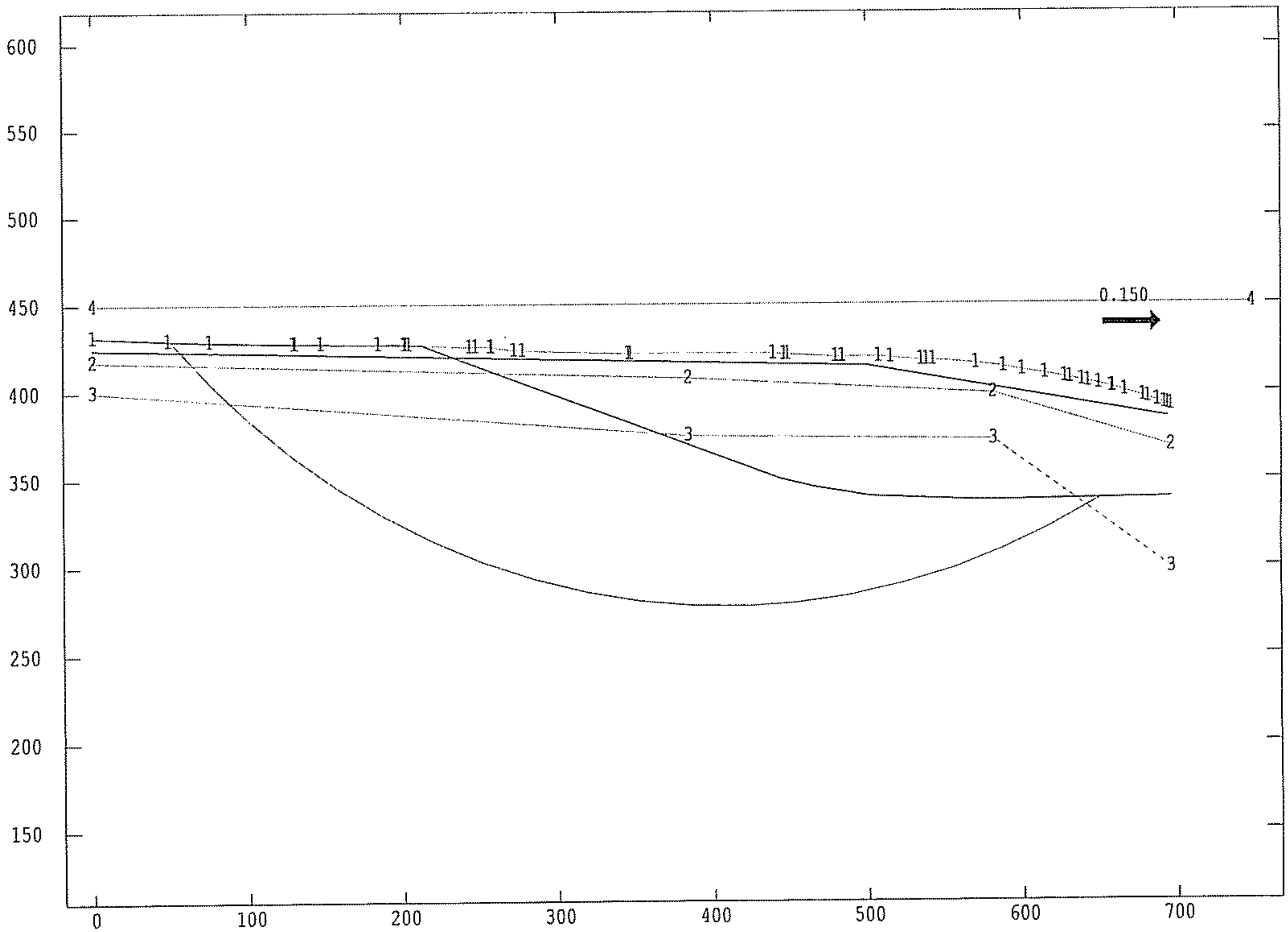
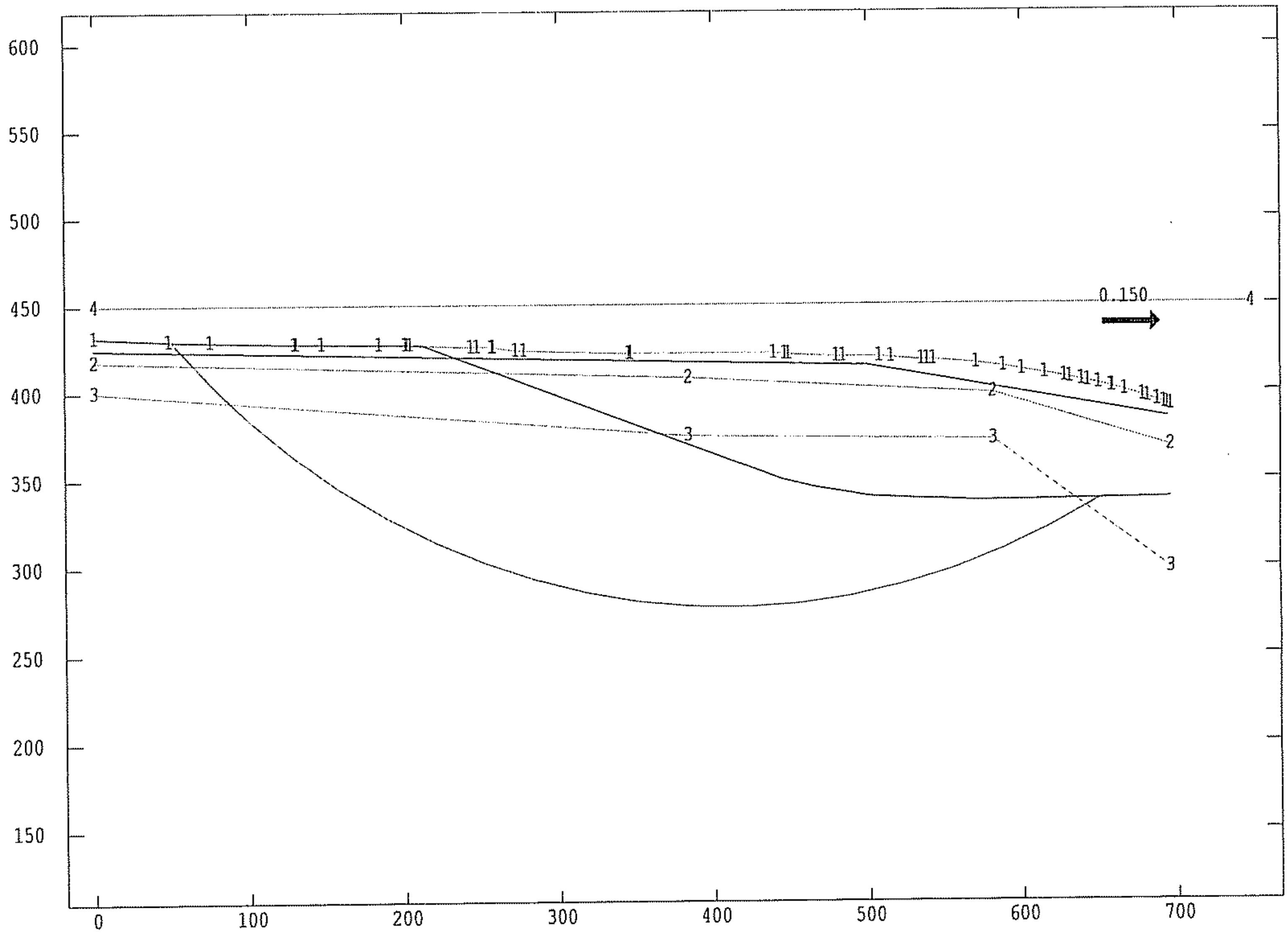


Project: Amsterdam Landfill Area: Cut #1 - 8/26/03 *File:* SlopeAnalysis.gmf	Analysis: 6	**GALENA** *EVALUATION Version 3.01*



Project: Amsterdam
Landfill Area: Cut #1 - 8/26/03
File: SlopeAnalysis.gmf

Analysis: 7

GALENA
EVALUATION Version 3.01

SlopeAnalysis

Galena for Windows Version 3.10

Clover Technology

Licensee: The Chazen Companies
Project: Amsterdam
File: S:\9\90300-90399\90303_00\Eng\Geotech\SlopeAnalysis.gmf
Processed: 16:02:20 08 Dec 2003

DATA: Analysis 1
Berm Area: Cut #1 - 8/21/03

Material and Water Properties

Number of defined material types: 7

Type	Cohesion	Phi	PI	Gamma	Ru	Description
1	1000.00	0.0	20	120.00	1.10	Brn fm SAND and SILT
2	1000.00	0.0	20	120.00	1.10	Brn fm SAND and CLAY
3	1000.00	0.0	20	120.00	1.10	Brn sandy SILT
4	2360.00	0.0	18	108.30	1.10	Brn sandy, silty, CLAY
5	2360.00	0.0	11	111.00	1.10	Dk gry till
6	9999.00	45.0	0	150.00	1.10	Bedrock
7	2360.00	0.0	16	112.00	1.10	Compacted On-Site Soils

Unit weight of water: 62.40 Unit weight of water/medium above ground:
62.40

Material Profiles

Number of material profiles: 4

Profile number 1 co-ordinates: (48 points) Material type: 4 - Brn sandy,
silty, CLAY
0.00 423.78 54.15 422.00 54.58 422.00
84.80 420.00 101.28 418.00
112.75 416.00 255.58 392.00 272.30 390.00
290.31 388.00 313.29 386.00
341.26 384.00 378.91 382.00 378.92 382.00
378.94 382.00 442.04 374.00
463.46 372.00 481.52 368.00 486.98 366.00
490.17 364.00 517.90 346.00
518.79 346.00 536.18 344.00 548.92 344.89
550.13 346.00 554.60 348.00
559.82 349.00 595.86 346.00 597.94 346.00
614.47 344.00 623.46 342.00
628.40 340.00 632.49 338.00 646.90 336.00
664.46 334.00 688.86 332.00
768.33 332.00 786.18 330.00 799.75 328.00
803.99 328.00 824.59 326.00
828.98 324.00 836.85 320.00 840.67 318.00
844.73 316.00 854.69 312.00
857.92 310.00 866.05 308.00 866.32 308.00

Profile number 2 co-ordinates: (6 points) Material type: 5 - Dk gry till
0.00 393.50 101.00 377.50 400.00 324.00
615.00 317.00 751.00 291.00
866.32 291.00

Profile number 3 co-ordinates: (6 points) Material type: 6 - Bedrock
0.00 373.00 101.00 357.00 400.00 319.00

615.00 311.00 751.00 285.00
866.32 285.00

Profile number 4 co-ordinates: (2 points) Material type: 7 - Compacted On-Site Soils
0.00 450.00 866.32 450.00

Slope Surface

Slope surface co-ordinates: (48 points)

0.00	423.78	60.87	422.35	72.55	422.00
85.41	422.00	90.91	420.30	91.90	420.00
97.26	420.00	97.91	420.33	117.37	430.00
123.26	430.00	125.31	428.98	163.26	410.00
163.86	409.97	164.00	409.97	237.52	408.94
242.85	408.96	345.75	408.83	420.94	410.00
430.69	410.00	432.82	411.02	472.21	430.00
474.69	430.00	478.44	430.00	479.78	429.36
553.05	394.00	559.23	394.00	586.27	394.00
587.31	393.67	617.43	384.00	619.86	382.83
746.21	322.00	753.09	322.00	757.43	322.00
759.49	323.03	775.67	331.08	778.64	332.00
786.18	330.00	799.75	328.00	803.99	328.00
824.59	326.00	828.98	324.00	836.85	320.00
840.67	318.00	844.73	316.00	854.69	312.00
857.92	310.00	866.05	308.00	866.32	308.00

Phreatic Surface

Phreatic surface co-ordinates: (6 points)

0.00	410.00	400.00	368.00	525.00	338.00
700.00	330.00	800.00	330.00	867.00	305.00

External Distributed Loads

Number of external distibuted loads: 8

Load number	X-Left	Load Left	X-Right	Load Right
1	163.26	250.0	163.86	250.0
2	163.86	250.0	164.00	250.0
3	164.00	250.0	237.52	250.0
4	237.52	250.0	242.85	250.0
5	242.85	250.0	345.75	250.0
6	345.75	250.0	420.94	250.0
7	420.94	250.0	430.69	250.0
8	553.05	250.0	586.27	250.0

Pseudo-Static Earthquake Effect

Specified earthquake (or seismic) coefficient: 0.150

Failure Surface

Initial failure circle for critical search with specified circle data: XL,XR,R
Circle centre: XC: 741.80 YC: 746.47 Circle radius: R: 451.66
Intersections: XL: 437.09 YL: 413.08 XR: 857.93 YR: 310.00

Generated failure surface co-ordinates: (20 points)
437.09 413.08 455.06 397.50 473.83 382.89

```
493.33    369.29          513.53    356.74
    534.36    345.26          555.77    334.90          577.69    325.68
600.06    317.63          622.83    310.76
    645.93    305.10          669.29    300.67          692.86    297.47
716.56    295.52          740.33    294.81
    764.10    295.36          787.82    297.16          811.40    300.21
834.80    304.49          857.93    310.00
```

Variable Restraints

	XL	XR	R
Parameter descriptor:	XL	XR	R
Range of variation:	50.00	50.00	100.00
Trial positions within range:	10	10	10

RESULTS: Analysis 1
Berm Area: Cut #1 - 8/21/03

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Circle Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure circle approximation: 1.24

There were: 701 successful analyses from a total of 1001 trial circles
300 analyses aborted due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.24

Final Angle of Interslice Forces: 8.5 degrees

Negative interslice forces exist on one or more slices
Examine slice data and consult the Galena Users' Guide

Effective stress line of thrust for one or more slices is not within middle third of slice
Examine slice data and consult the Galena Users' Guide

Circle Data and Results Summary

Lowest 40 calculated values of Factor of Safety

Circle	X-Centre	Y-Centre	X-Left	Y-Left	X-Right	Y-Right	Radius	FoS
1	744.06	785.79	428.76	410.00	860.71	309.31	490.55	1.237
2	728.78	755.01	428.76	410.00	849.60	314.05	457.22	1.242
3	711.96	735.33	423.20	410.00	838.49	319.14	434.99	1.244
4	741.80	746.47	437.09	413.08	857.93	310.00	451.66	1.244
5	719.69	767.86	417.65	409.95	844.04	316.34	468.33	1.245
6	736.29	787.64	423.20	410.00	855.15	311.71	490.55	1.245
7	713.35	724.14	428.76	410.00	838.49	319.14	423.88	1.246
8	726.88	800.46	412.09	409.86	849.60	314.05	501.66	1.248
9	721.21	756.75	423.20	410.00	844.04	316.34	457.22	

								1.249
10	722.63	722.46	434.31	411.74	844.04	316.34	423.88	1.250
11	737.78	776.56	428.76	410.00	855.15	311.71	479.44	1.251
12	737.88	753.63	434.31	411.74	855.15	311.71	457.22	1.252
13	728.52	789.42	417.65	409.95	849.60	314.05	490.55	1.253
14	722.65	745.61	428.76	410.00	844.04	316.34	446.10	1.254
15	722.99	699.32	439.87	414.42	844.04	316.34	401.66	1.255
16	702.41	748.57	412.09	409.86	832.93	321.99	446.10	1.256
17	746.88	797.89	428.76	410.00	860.71	309.31	501.66	1.258
18	703.96	737.43	417.65	409.95	832.93	321.99	434.99	1.258
19	730.09	778.35	423.20	410.00	849.60	314.05	479.44	1.259
20	711.55	769.94	412.09	409.86	838.49	319.14	468.33	1.260
21	705.45	726.25	423.20	410.00	832.93	321.99	423.88	1.261
22	720.74	791.14	412.09	409.86	844.04	316.34	490.55	1.261
23	747.09	775.10	434.31	411.74	860.71	309.31	479.44	1.261
24	738.44	730.76	439.87	414.42	855.15	311.71	434.99	1.262
25	706.85	715.04	428.76	410.00	832.93	321.99	412.77	1.263
26	713.14	758.84	417.65	409.95	838.49	319.14	457.22	1.264
27	731.67	744.28	434.31	411.74	849.60	314.05	446.10	1.264
28	731.57	767.26	428.76	410.00	849.60	314.05	468.33	1.265
29	739.04	799.75	423.20	410.00	855.15	311.71	501.66	1.266
30	716.11	713.36	434.31	411.74	838.49	319.14	412.77	1.266
31	722.38	780.08	417.65	409.95	844.04	316.34	479.44	1.266
32	714.67	747.72	423.20	410.00	838.49	319.14	446.10	1.268
33	716.11	736.57	428.76	410.00	838.49	319.14	434.99	1.271
34	723.94	769.00	423.20	410.00	844.04	316.34	468.33	1.272
35	738.58	707.68	445.42	417.09	855.15	311.71	412.77	1.272
36	740.57	788.69	428.76	410.00	855.15	311.71	490.55	1.273
37	732.22	721.35	439.87	414.42	849.60	314.05	423.88	1.273
38	731.21	801.54	417.65	409.95	849.60	314.05	501.66	1.274
39	747.81	752.37	439.87	414.42	860.71	309.31	457.22	1.275
40	740.79	765.86	434.31	411.74	855.15	311.71	468.33	1.276

Critical Failure Circle Data

Circle centre:	XC: 744.06	YC: 785.79		Circle radius:	R: 490.55		
Intersections:	XL: 428.76	YL: 410.00		XR: 860.71	YR: 309.31		

Generated failure surface co-ordinates: (20 points)

428.76	410.00	447.69	394.89	467.34	380.74
487.67	367.58	508.63	355.43	530.16	344.34
552.21	334.32	574.73	325.40	597.66	317.60
620.94	310.95	644.53	305.45	668.36	301.12
692.38	297.97	716.52	296.02	740.72	295.26
764.94	295.69	789.11	297.32	813.16	300.14
837.05	304.14	860.71	309.31		

Slice Geometry and Properties (58 slices)

Slice	X-Left	Width	Y-Top	Y-Base	Base Angle	Base Mat'l	Base Cohesion	Total Weight	PoreWater Force	Side Force (LHS)	l/h (LHS)	l'/h (LHS)
1	428.76	1.93	410.00	409.23	38.6	7	2360.00	167.01	0.00	0.00	0.00	0.00
2	430.69	2.13	410.51	407.61	38.6	7	2360.00	692.35	0.00	-4961.10	0.41	0.41
3	432.82	7.43	412.81	403.79	38.6	7	2360.00	7509.91	0.00	-10375.47	0.31	0.31
4	440.25	7.43	416.39	397.86	38.6	7	2360.00	15432.24	0.00	-24912.86	0.29	0.29
5	447.69	9.83	420.55	391.36	35.8	7	2360.00	32135.08	0.00	-32666.21	0.31	0.31
6	457.52	9.83	425.29	384.28	35.8	7	2360.00	45135.79	0.00	-33128.44	0.36	0.36
7	467.34	4.87	428.83	379.17	32.9	7	2360.00	27060.55	0.00	-23264.61	0.53	0.53
8	472.21	2.48	430.00	376.79	32.9	7	2360.00	14779.79	0.00	-15510.94	0.77	0.77
9	474.69	3.75	430.00	374.77	32.9	7	2360.00	23195.57	0.00	-10833.44	1.10	1.10
10	478.44	9.23	427.78	370.57	32.9	7	2360.00	59169.24	0.00	-3137.81	3.71	3.71
11	487.67	10.48	423.02	364.54	30.1	7	2360.00	68623.59	0.00	17320.26	-0.62	-0.62
12	498.15	10.48	417.97	358.47	30.1	7	2360.00	69816.02	0.00	39065.56	-0.22	-0.22
13	508.63	10.32	412.95	352.77	27.3	7	2360.00	69557.07	0.00	61620.44	-0.07	-0.07
14	518.95	10.32	407.97	347.45	27.3	7	2360.00	69948.26	0.00	81680.53	0.00	0.00
15	529.27	8.49	403.43	342.81	24.7	4	2360.00	57558.50	0.00	101985.01	0.06	0.06
16	537.76	8.49	399.33	338.96	24.4	4	2360.00	57207.02	0.00	116680.27	0.09	0.09
17	546.24	5.97	395.85	335.67	24.4	4	2360.00	40001.52	498.62	130929.54	0.12	-0.34
18	552.21	7.02	394.00	332.93	21.6	4	2360.00	47635.62	1729.09	140820.34	0.14	-0.33
19	559.23	7.75	394.00	330.00	21.6	4	2360.00	54997.92	3253.35	151444.86	0.15	-0.33
20	566.98	7.75	394.00	326.93	21.6	4	2360.00	57591.04	4664.99	164527.13	0.16	-0.33
21	574.73	11.54	394.00	323.44	18.8	4	2360.00	90220.01				

									9151.32	178961.34	0.17	-0.33
22	586.27	11.39	392.18	319.54	18.8	4	2360.00	91502.92	11557.90	198807.05	0.17	-0.33
23	597.66	9.89	388.76	316.19	16.0	5	2360.00	79325.20	11719.09	218637.78	0.19	-0.33
24	607.54	9.89	385.59	313.36	16.0	5	2360.00	78947.05	13242.29	232379.02	0.19	-0.33
25	617.43	2.43	383.41	311.60	16.0	5	2360.00	19292.28	3487.83	245960.41	0.20	-0.33
26	619.86	12.34	379.86	309.76	13.4	5	2360.00	95595.84	18688.67	249251.55	0.21	-0.33
27	632.20	12.34	373.92	306.89	13.1	5	2360.00	91421.60	20496.27	261168.94	0.22	-0.33
28	644.53	11.92	368.08	304.37	10.3	5	2360.00	83842.62	21080.96	271068.28	0.24	-0.33
29	656.45	11.92	362.35	302.20	10.3	5	2360.00	79035.66	22304.33	274928.28	0.25	-0.33
30	668.36	12.01	356.59	300.33	7.5	5	2360.00	74365.84	23302.92	276931.69	0.27	-0.33
31	680.37	12.01	350.81	298.76	7.5	5	2360.00	68657.66	24076.78	273868.22	0.29	-0.33
32	692.38	12.07	345.01	297.49	4.6	5	2360.00	62825.71	24624.90	269061.03	0.32	-0.33
33	704.45	12.07	339.20	296.51	4.6	5	2360.00	56205.16	25309.28	259808.64	0.35	-0.33
34	716.52	8.92	334.15	295.88	1.8	5	2360.00	37071.08	19006.87	248968.33	0.39	-0.33
35	725.44	4.15	331.00	295.67	1.8	4	2360.00	15894.38	8903.17	238393.03	0.42	-0.33
36	729.59	11.13	327.32	295.43	1.8	4	2360.00	38443.91	24023.64	233217.92	0.44	-0.33
37	740.72	5.49	323.32	295.30	-1.0	4	2360.00	16643.43	11877.80	218647.41	0.50	-0.33
38	746.21	6.88	322.00	295.42	-1.0	4	2360.00	19808.51	14850.08	210298.78	0.54	-0.33
39	753.09	4.34	322.00	295.52	-1.0	4	2360.00	12448.21	9340.38	199673.70	0.53	-0.33
40	757.43	2.06	322.51	295.57	-1.0	4	2360.00	6010.76	4426.12	192964.45	0.52	-0.33
41	759.49	5.45	324.39	295.64	-1.0	4	2360.00	16968.64	11688.26	189794.66	0.49	-0.33
42	764.94	8.56	327.87	295.98	-3.9	4	2360.00	29562.85	18211.69	181561.25	0.44	-0.33
43	773.50	2.17	330.54	296.34	-3.9	4	2360.00	8040.42	4569.90	167645.92	0.37	-0.33
44	775.67	2.97	331.54	296.51	-3.9	4	2360.00	11272.91	6220.50	164178.97	0.35	-0.33
45	778.64	7.54	331.00	296.87	-3.9	4	2360.00	27889.05	15624.58	159456.03	0.34	-0.33
46	786.18	2.93	329.78	297.22	-3.9	4	2360.00	10319.08	5998.54	147393.23	0.34	-0.33
47	789.11	10.64	328.78	297.94	-6.7	4	2360.00	35556.96	21440.21	142662.80	0.34	-0.33
48	799.75	4.24	328.00	298.81	-6.7	4	2360.00	13402.80	8122.13	123338.60	0.33	-0.33
49	803.99	1.85	327.91	299.17	-6.7	4	2360.00	5764.23	3373.68	115584.84	0.31	-0.33
50	805.84	7.32	327.46	299.71	-6.7	4	2360.00	22003.41	12300.06	112204.93	0.31	-0.33
51	813.16	11.43	326.55	301.09	-9.5	4	2360.00	31515.94	15810.22	98804.45	0.29	-0.33
52	824.59	4.39	325.00	302.42	-9.5	4	2360.00	10736.22	4885.00	75763.14	0.26	-0.33

53 828.98 7.87 322.00 303.45 -9.5 4 2360.00 15814.70
7107.09 66874.59 0.26 -0.33

54 836.85 3.82 319.00 304.51 -12.2 4 2360.00 5993.67
2688.72 50914.79 0.27 -0.33

55 840.67 4.06 317.00 305.37 -12.3 4 2360.00 5111.56
2254.28 42684.55 0.28 -0.33

56 844.73 9.96 314.00 306.91 -12.3 4 2360.00 7650.13
2890.72 33949.79 0.29 -0.33

57 854.69 2.70 311.17 308.29 -12.3 4 2360.00 838.92
137.43 12653.96 0.28 -0.34

58 857.39 3.32 309.72 308.95 -12.3 4 2360.00 277.74
0.00 6960.81 0.35 -0.35

860.71
-0.11 0.00 0.00

DATA: Analysis 2
Landfill Area: Cut #3 - 8/26/03

Material and Water Properties

Number of defined material types: 7

Type	Cohesion	Phi	PI	Gamma	Ru	Description
1	1000.00	0.0	20	120.00	1.10	Brn fm SAND and SILT
2	1000.00	0.0	20	120.00	1.10	Brn fm SAND and CLAY
3	1000.00	0.0	20	120.00	1.10	Brn sandy SILT
4	2360.00	0.0	18	108.30	1.10	Brn sandy, silty, CLAY
5	2360.00	0.0	11	111.00	1.10	Dk gry till
6	9999.00	45.0	0	150.00	1.10	Bedrock
7	2360.00	0.0	16	112.00	1.10	Compacted On-Site Soils

Unit weight of water: 62.40 Unit weight of water/medium above ground: 62.40

Material Profiles

Number of material profiles: 4

Profile number 1 co-ordinates: (48 points) Material type: 4 - Brn sandy, silty, CLAY

0.00	397.00	15.00	396.00	33.00	394.00
50.00	392.00	66.00	390.00	70.00	388.00
97.00	386.00	148.00	384.00	194.00	384.00
216.00	378.00	220.00	378.00	232.00	379.00
245.00	378.00	250.00	376.00	272.00	376.00
286.00	384.00	291.00	386.00	295.00	388.00
301.00	390.00	315.00	394.00	345.00	400.00
382.00	402.00	430.00	402.00	445.00	400.00
466.00	396.00	474.00	394.00	489.00	390.00
495.00	388.00	501.00	386.00	525.00	378.00
545.00	370.00	551.00	368.00	555.00	366.00
571.00	358.00	578.00	356.00	583.00	354.00
590.00	352.00	595.00	350.00	629.00	338.00
646.00	336.00	657.00	330.00	664.00	328.00
669.00	326.00	677.00	324.00	691.00	322.00
712.00	320.00	723.00	318.00	737.00	310.00

```
Profile number  2 co-ordinates: ( 5 points)     Material type:  5 - Dk gry till
      0.00    382.50           148.00    369.50           325.00    372.00
619.00    327.00          737.00    295.00

Profile number  3 co-ordinates: ( 5 points)     Material type:  6 - Bedrock
      0.00    362.00           148.00    349.00           325.00    367.00
619.00    321.00          737.00    289.00

Profile number  4 co-ordinates: ( 2 points)     Material type:  7 - Compacted
On-Site Soils
      0.00    450.00           737.00    450.00

Slope Surface
-------------
Slope surface co-ordinates: (45 points)
      0.00    430.00           386.36    430.00           487.55    386.00
519.57    386.00          523.78    384.60
    525.57    384.00           529.57    382.00           533.58    380.00
537.58    378.00          541.58    376.00
    545.59    374.00           549.59    372.00           553.59    370.00
557.60    368.00          561.60    366.00
    565.60    364.00           569.60    362.00           573.61    360.00
577.61    358.00          580.80    356.00
    586.26    354.00           594.44    352.00           597.84    350.00
605.75    348.00          611.99    346.00
    616.89    344.00           621.67    342.00           626.79    340.00
631.38    338.00          647.40    336.00
    650.99    334.00           654.48    332.00           658.51    330.00
665.05    328.00          672.68    326.00
    678.70    324.00           692.76    322.00           713.68    320.00
715.79    320.00          723.94    318.00
    727.98    316.00           731.73    314.00           735.34    312.00
736.76    310.81          737.00    310.00

Phreatic Surface
----------------
Phreatic surface co-ordinates: ( 4 points)
      0.00    390.00           272.00    371.00           413.00    395.00
737.00    305.00

External Distributed Loads
--------------------------
Number of external distibuted loads:  2

Load number     X-Left      Load Left          X-Right      Load Right
      1           0.00        250.0             385.00         250.0
      2         490.00        250.0             520.00         250.0

Pseudo-Static Earthquake Effect
-------------------------------
Specified earthquake (or seismic) coefficient: 0.150

Failure Surface
---------------
Initial failure circle for critical search with specified circle data: XL,XR,R
Circle centre:  XC:     570.27   YC:     660.44     Circle radius:  R:     327.84
Intersections:  XL:     337.08   YL:     430.00   XR:     630.83   YR:     338.24

Generated failure surface co-ordinates: (20 points)
    337.08    430.00           349.23    418.32           361.97    407.28
375.26    396.90          389.07    387.23
    403.35    378.27           418.08    370.07           433.20    362.63
448.69    355.97          464.51    350.13
```

480.60 345.10 496.93 340.91 513.45 337.56
530.12 335.07 546.90 333.43
563.74 332.66 580.60 332.76 597.43 333.72
614.19 335.55 630.83 338.24

Variable Restraints

	XL	XR	R
Parameter descriptor:	XL	XR	R
Range of variation:	50.00	50.00	50.00
Trial positions within range:	10	10	10

RESULTS: Analysis 2
Landfill Area: Cut #3 - 8/26/03

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Circle Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure circle approximation: 1.59

There were: 1001 successful analyses from a total of 1001 trial circles

Critical (minimum) Factor of Safety: 1.53

Negative normal stresses exist on the base of one or more slices
Examine slice data and consult the Galena Users' Guide

Circle Data and Results Summary

Lowest 40 calculated values of Factor of Safety

Circle FoS	X-Centre	Y-Centre	X-Left	Y-Left	X-Right	Y-Right	Radius
1 1.531	531.05	647.17	312.08	430.00	605.83	347.97	308.40
2 1.534	546.74	678.42	312.08	430.00	616.94	343.98	341.73
3 1.538	538.71	663.03	312.08	430.00	611.39	346.19	325.06
4 1.543	556.03	682.54	317.64	430.00	622.50	341.68	347.28
5 1.547	532.76	653.30	312.08	430.00	605.83	347.97	313.95
6 1.548	547.10	650.06	323.19	430.00	616.94	343.98	313.95
7 1.549	547.85	667.30	317.64	430.00	616.94	343.98	330.62
8 1.549	548.44	684.44	312.08	430.00	616.94	343.98	347.28
9 1.551	539.76	651.87	317.64	430.00	611.39	346.19	313.95
10 1.553	540.42	669.10	312.08	430.00	611.39	346.19	330.62
11 1.558	565.30	686.67	323.19	430.00	628.05	339.45	352.84
12 1.558	557.76	688.53	317.64	430.00	622.50	341.68	352.84
13 1.560	533.78	642.12	317.64	430.00	605.83	347.97	302.84

14	557.12	671.43	323.19	430.00	622.50	341.68	336.17	1.561
15	534.47	659.41	312.08	430.00	605.83	347.97	319.51	1.563
16	550.13	690.44	312.08	430.00	616.94	343.98	352.84	1.563
17	556.33	654.26	328.75	430.00	622.50	341.68	319.51	1.564
18	549.59	673.34	317.64	430.00	616.94	343.98	336.17	1.564
19	548.03	638.87	328.75	430.00	616.94	343.98	302.84	1.565
20	548.89	656.15	323.19	430.00	616.94	343.98	319.51	1.565
21	540.74	640.68	323.19	430.00	611.39	346.19	302.84	1.566
22	541.50	657.96	317.64	430.00	611.39	346.19	319.51	1.568
23	542.11	675.15	312.08	430.00	611.39	346.19	336.17	1.569
24	535.52	648.25	317.64	430.00	605.83	347.97	308.40	1.576
25	558.89	677.43	323.19	430.00	622.50	341.68	341.73	1.577
26	566.39	675.57	328.75	430.00	628.05	339.45	341.73	1.579
27	536.16	665.48	312.08	430.00	605.83	347.97	325.06	1.579
28	551.31	679.35	317.64	430.00	616.94	343.98	341.73	1.580
29	558.15	660.31	328.75	430.00	622.50	341.68	325.06	1.581
30	550.66	662.21	323.19	430.00	616.94	343.98	325.06	1.581
31	549.85	644.99	328.75	430.00	616.94	343.98	308.40	1.583
32	542.52	646.80	323.19	430.00	611.39	346.19	308.40	1.583
33	557.24	643.09	334.30	430.00	622.50	341.68	308.40	1.584
34	543.23	664.03	317.64	430.00	611.39	346.19	325.06	1.584
35	543.79	681.17	312.08	430.00	611.39	346.19	341.73	1.584
36	565.55	658.45	334.30	430.00	628.05	339.45	325.06	1.584
37	560.66	683.41	323.19	430.00	622.50	341.68	347.28	1.593
38	537.26	654.35	317.64	430.00	605.83	347.97	313.95	1.593
39	570.27	660.44	337.08	430.00	630.83	338.24	327.84	1.594
40	537.85	671.53	312.08	430.00	605.83	347.97	330.62	1.595

Critical Failure Circle Data

Circle centre: XC: 531.05 YC: 647.17 Circle radius: R: 308.40
Intersections: XL: 312.08 YL: 430.00 XR: 605.83 YR: 347.97

Generated failure surface co-ordinates: (20 points)
312.08 430.00 324.22 418.41 336.98 407.49
350.31 397.28 364.17 387.82

378.53	379.12	393.35	371.22	408.57	364.13	424.15	357.89
440.05	352.50	456.22	347.99	472.61	344.36	489.18	341.63
505.87	339.80	522.63	338.88	539.42	338.88	556.18	339.80
572.87	341.62	589.44	344.35	605.83	347.97		

Slice Geometry and Properties (57 slices)

Slice	X-Left	Width	Y-Top	Y-Base	Base Angle	Base Mat'l	Base Cohesion	Total Weight	PoreWater Force	Normal Stress	Test Factor
1	312.08	6.07	430.00	427.10	43.7	7	2360.00	1970.95	0.00	-897.07	1.38
2	318.15	6.07	430.00	421.30	43.7	7	2360.00	5912.78	0.00	-247.80	1.38
3	324.22	6.38	430.00	415.68	40.6	7	2360.00	10230.93	0.00	535.13	1.32
4	330.60	6.38	430.00	410.22	40.6	7	2360.00	14129.56	0.00	1146.44	1.32
5	336.98	9.67	430.00	403.79	37.4	7	2360.00	28377.23	0.00	2005.56	1.26
6	346.64	3.66	430.00	398.69	37.4	4	2360.00	12828.90	0.00	2571.54	1.26
7	350.31	6.93	430.00	394.92	34.3	4	2360.00	27098.79	0.00	3106.54	1.21
8	357.24	6.93	430.00	390.18	34.3	4	2360.00	30642.63	0.00	3617.70	1.21
9	364.17	1.46	430.00	387.38	31.2	4	2360.00	6875.81	0.00	4039.62	1.17
10	365.63	6.45	430.00	384.98	31.2	4	2360.00	32142.77	1178.15	4298.14	1.17
11	372.08	6.45	430.00	381.08	31.2	4	2360.00	34865.01	3534.40	4720.04	1.17
12	378.53	7.83	430.00	377.03	28.1	4	2360.00	45699.49	7064.98	5224.06	1.13
13	386.36	6.99	428.48	373.08	28.1	4	2360.00	42603.03	8883.23	5275.28	1.13
14	393.35	7.61	425.31	369.45	25.0	4	2360.00	46695.14	11971.12	5418.35	1.10
15	400.96	7.61	422.00	365.91	25.0	4	2360.00	46793.88	14505.04	5431.36	1.10
16	408.57	7.79	418.65	362.57	21.8	4	2360.00	47799.75	16937.29	5516.90	1.08
17	416.36	7.79	415.26	359.45	21.8	4	2360.00	47478.34	17565.30	5475.65	1.08
18	424.15	5.73	412.32	356.92	18.7	4	2360.00	34616.52	12913.26	5516.04	1.06
19	429.88	5.08	409.97	355.08	18.7	5	2360.00	30380.36	11562.12	5453.61	1.06
20	434.97	5.08	407.76	353.36	18.7	5	2360.00	30096.17	11666.26	5397.68	1.06
21	440.05	8.09	404.90	351.37	15.6	5	2360.00	47061.23	18328.45	5390.41	1.04
22	448.14	8.09	401.38	349.11	15.6	5	2360.00	45921.40	18334.63	5249.43	1.04
23	456.22	7.20	398.06	347.19	12.5	5	2360.00	39781.96	16020.91	5182.39	1.02
24	463.42	9.19	394.49	345.37	12.5	5	2360.00	49002.17	20170.16	4991.17	1.02
25	472.61	7.47	390.87	343.74	9.4	5	2360.00	38222.74	15899.41	4863.81	1.01

26	480.08	7.47	387.62	342.51	9.4	5	2360.00	36593.87	15501.15	4645.72	1.01
27	487.55	1.63	386.00	341.76	9.4	5	2360.00	7823.94	3326.52	4551.21	1.01
28	489.18	5.91	386.00	341.30	6.2	5	2360.00	28695.03	11768.03	4901.21	1.01
29	495.09	5.91	386.00	340.66	6.2	5	2360.00	29104.87	11398.75	5005.30	1.01
30	501.00	4.87	386.00	340.07	6.2	5	2360.00	24287.88	9108.75	5071.51	1.01
31	505.87	6.85	386.00	339.61	3.1	5	2360.00	34567.13	12262.29	5211.12	1.00
32	512.72	6.85	386.00	339.24	3.1	5	2360.00	34889.67	11607.41	5258.24	1.00
33	519.57	3.06	385.49	338.97	3.1	5	2360.00	15516.82	4974.01	5020.44	1.00
34	522.63	2.94	384.49	338.88	0.0	5	2360.00	14605.68	4631.64	4969.25	1.00
35	525.57	4.00	383.00	338.88	0.0	5	2360.00	19222.78	6062.88	4805.58	1.00
36	529.57	4.01	381.00	338.88	0.0	5	2360.00	18389.90	5799.75	4585.89	1.00
37	533.58	4.00	379.00	338.88	0.0	5	2360.00	17465.22	5507.66	4366.19	1.00
38	537.58	1.84	377.54	338.88	0.0	5	2360.00	7736.47	2439.65	4205.83	1.00
39	539.42	1.43	376.72	338.92	-3.1	5	2360.00	5884.60	1856.87	4195.67	1.00
40	540.85	4.74	375.18	339.09	-3.1	4	2360.00	18603.35	5845.70	4009.11	1.00
41	545.59	4.00	373.00	339.33	-3.1	4	2360.00	14643.68	4570.80	3744.81	1.00
42	549.59	4.00	371.00	339.55	-3.1	4	2360.00	13674.58	4238.64	3502.52	1.00
43	553.59	2.59	369.35	339.73	-3.1	4	2360.00	8352.39	2570.44	3304.77	1.00
44	556.18	1.42	368.35	339.87	-6.2	4	2360.00	4387.05	1347.89	3264.96	1.01
45	557.60	4.00	367.00	340.17	-6.2	4	2360.00	11671.85	3542.40	3086.34	1.01
46	561.60	4.00	365.00	340.61	-6.2	4	2360.00	10616.14	3153.70	2822.41	1.01
47	565.60	4.00	363.00	341.04	-6.2	4	2360.00	9560.44	2764.99	2558.50	1.01
48	569.60	3.27	361.18	341.44	-6.2	4	2360.00	7036.78	1973.06	2318.60	1.01
49	572.87	4.74	359.18	342.01	-9.4	4	2360.00	8853.74	2373.84	2122.79	1.01
50	577.61	3.19	357.00	342.66	-9.4	4	2360.00	4970.77	1244.61	1812.13	1.01
51	580.80	5.46	355.00	343.38	-9.4	4	2360.00	6897.35	1469.43	1517.14	1.01
52	586.26	3.18	353.61	344.09	-9.4	4	2360.00	3289.93	471.16	1289.15	1.01
53	589.44	3.29	352.82	344.71	-12.5	4	2360.00	2903.74	172.50	1223.79	1.02
54	592.73	1.71	352.21	345.27	-12.5	4	2360.00	1298.64	0.00	1099.09	1.02
55	594.44	3.40	351.00	345.83	-12.5	4	2360.00	1921.05	0.00	905.97	1.02
56	597.84	4.86	349.39	346.74	-12.5	4	2360.00	1412.62	0.00	631.58	1.02
57	602.70	3.05	348.39	347.62	-12.5	7	2360.00	261.64			

0.00 426.77 1.02

DATA: Analysis 3
Landfill Area: Cut #2 - 8/26/03

Material and Water Properties

Number of defined material types: 7

Type	Cohesion	Phi	PI	Gamma	Ru	Description
1	1000.00	0.0	20	120.00	1.10	Brn fm SAND and SILT
2	1000.00	0.0	20	120.00	1.10	Brn fm SAND and CLAY
3	1000.00	0.0	20	120.00	1.10	Brn sandy SILT
4	2360.00	0.0	18	108.30	1.10	Brn sandy, silty, CLAY
5	2360.00	0.0	11	111.00	1.10	Dk gry till
6	9999.00	45.0	0	150.00	1.10	Bedrock
7	2360.00	0.0	16	112.00	1.10	Compacted On-Site Soils

Unit weight of water: 62.40 Unit weight of water/medium above ground: 62.40

Material Profiles

Number of material profiles: 4

Profile number 1 co-ordinates: (48 points) Material type: 4 - Brn sandy, silty, CLAY

0.00	432.00	48.45	430.00	75.10	429.33
129.37	428.00	130.34	428.00		
146.79	428.00	183.90	427.68	200.86	427.47
202.03	427.42	203.85	427.41		
243.26	426.00	247.29	426.00	256.73	426.00
257.57	425.89	272.01	424.00		
277.45	423.87	345.51	422.00	346.77	422.00
438.95	422.00	445.92	421.58		
448.24	421.52	479.36	420.00	483.70	420.00
507.26	420.00	514.91	419.53		
534.41	418.00	537.95	418.00	542.20	418.00
569.95	416.00	587.69	414.00		
599.72	412.00	614.45	410.00	614.50	410.00
627.10	408.00	630.51	407.40		
638.24	406.00	641.96	405.29	649.05	404.00
657.27	402.19	658.11	402.00		
665.93	400.00	677.74	396.80	680.86	396.00
687.06	394.09	687.34	394.00		
691.62	392.61	693.48	392.00	695.75	391.32

Profile number 2 co-ordinates: (4 points) Material type: 5 - Dk gry till

0.00	418.00	384.00	408.00	581.00	399.00
695.75	368.32				

Profile number 3 co-ordinates: (4 points) Material type: 6 - Bedrock

0.00	400.50	384.00	375.00	581.00	372.50
695.75	298.32				

Profile number 4 co-ordinates: (2 points) Material type: 7 - Compacted On-Site Soils

0.00	450.00	695.75	450.00

Slope Surface

Slope surface co-ordinates: (38 points)

0.00	432.00	48.28	430.01	48.45	430.00
75.10	429.33	125.93	428.24		
129.37	428.00	130.34	428.00	146.79	428.00
183.90	427.68	184.60	427.67		
186.53	427.64	187.53	427.65	188.52	427.63
189.81	427.63	191.12	427.61		
192.47	427.60	193.81	427.58	195.41	427.55
196.43	427.54	198.26	427.49		
199.04	427.48	199.79	427.48	200.86	427.47
202.03	427.42	212.49	427.10		
242.71	417.04	444.17	350.00	465.61	345.51
490.41	341.85	495.92	340.87		
502.89	340.00	522.83	339.30	524.59	339.22
548.07	338.38	552.08	338.20		
572.70	337.44	693.40	338.98	695.75	339.49

Phreatic Surface

Phreatic surface co-ordinates: (3 points)

0.00	425.00	500.00	415.00	694.00	385.00

Pseudo-Static Earthquake Effect

Specified earthquake (or seismic) coefficient: 0.150

Failure Surface

Initial failure circle for critical search with specified circle data: XL,XR,R

Circle centre:	XC:	378.09	YC:	579.27	Circle radius:	R:	290.01
Intersections:	XL:	130.66	YL:	428.00	XR: 540.00	YR:	338.67

Generated failure surface co-ordinates: (20 points)

130.66	428.00	144.39	407.55	159.81	388.33
176.80	370.50	195.24	354.17		
215.01	339.46	235.95	326.49	257.91	315.34
280.74	306.09	304.28	298.81		
328.35	293.56	352.77	290.37	377.38	289.27
402.00	290.25	426.44	293.32		
450.53	298.46	474.10	305.62	496.98	314.75
519.00	325.80	540.00	338.67		

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	50.00	50.00	100.00
Trial positions within range:	10	10	10

RESULTS: Analysis 3
Landfill Area: Cut #2 - 8/26/03

Bishop Simplified Method of Analysis - Circular Failure Surface
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Critical Failure Circle Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure circle approximation: 7.11

There were: 1001 successful analyses from a total of 1001 trial circles

Critical (minimum) Factor of Safety: 6.78

Negative normal stresses exist on the base of one or more slices
Examine slice data and consult the Galena Users' Guide

Circle Data and Results Summary

Lowest 40 calculated values of Factor of Safety

Circle	FoS	X-Centre	Y-Centre	X-Left	Y-Left	X-Right	Y-Right	Radius
1	6.784	377.07	593.99	105.66	428.67	565.00	337.72	317.79
2	6.792	380.20	609.79	105.66	428.67	565.00	337.72	328.90
3	6.804	373.80	577.50	105.66	428.67	565.00	337.72	306.68
4	6.815	383.22	625.06	105.66	428.67	565.00	337.72	340.01
5	6.815	380.86	596.72	111.22	428.56	565.00	337.72	317.79
6	6.815	370.37	560.16	105.66	428.67	565.00	337.72	295.57
7	6.817	377.61	580.49	111.22	428.56	565.00	337.72	306.68
8	6.819	375.27	596.90	105.66	428.67	559.44	337.93	317.79
9	6.830	383.98	612.33	111.22	428.56	565.00	337.72	328.90
10	6.832	378.39	612.51	105.66	428.67	559.44	337.93	328.90
11	6.840	372.02	580.67	105.66	428.67	559.44	337.93	306.68
12	6.843	374.20	563.46	111.22	428.56	565.00	337.72	295.57
13	6.844	381.42	583.39	116.77	428.44	565.00	337.72	306.68
14	6.849	375.83	583.57	111.22	428.56	559.44	337.93	306.68
15	6.851	384.66	599.39	116.77	428.44	565.00	337.72	317.79
16	6.853	368.61	563.63	105.66	428.67	559.44	337.93	295.57
17	6.853	379.07	599.56	111.22	428.56	559.44	337.93	317.79
18	6.856	370.24	583.74	105.66	428.67	553.89	338.13	306.68
19	6.857	373.47	599.74	105.66	428.67	553.89	338.13	317.79
20	6.859	381.41	627.60	105.66	428.67	559.44	337.93	340.01
21	6.859	378.03	566.64	116.77	428.44	565.00	337.72	295.57
22	6.860	387.00	627.42	111.22	428.56	565.00	337.72	340.01
23	6.867	372.45	566.82	111.22	428.56	559.44	337.93	295.57
24	6.873	382.18	614.97	111.22	428.56	559.44	337.93	328.90
25	6.875	376.59	615.15	105.66	428.67	553.89	338.13	328.90
26		385.24	586.20	122.33	428.32	565.00	337.72	306.68

6.877							
27	366.86	567.00	105.66	428.67	553.89	338.13	295.57
6.877							
28	379.65	586.37	116.77	428.44	559.44	337.93	306.68
6.879							
29	387.78	614.79	116.77	428.44	565.00	337.72	328.90
6.879							
30	374.06	586.55	111.22	428.56	553.89	338.13	306.68
6.883							
31	381.87	569.72	122.33	428.32	565.00	337.72	295.57
6.884							
32	376.28	569.90	116.77	428.44	559.44	337.93	295.57
6.886							
33	368.46	586.75	105.66	428.67	548.33	338.37	306.68
6.891							
34	382.88	602.15	116.77	428.44	559.44	337.93	317.79
6.892							
35	388.47	601.97	122.33	428.32	565.00	337.72	317.79
6.892							
36	377.28	602.33	111.22	428.56	553.89	338.13	317.79
6.893							
37	370.70	570.08	111.22	428.56	553.89	338.13	295.57
6.895							
38	371.67	602.53	105.66	428.67	548.33	338.37	317.79
6.898							
39	370.58	545.37	111.22	428.56	565.00	337.72	284.45
6.903							
40	379.60	630.08	105.66	428.67	553.89	338.13	340.01
6.904							

Critical Failure Circle Data

Circle centre: XC: 377.07 YC: 593.99 Circle radius: R: 317.79
Intersections: XL: 105.66 YL: 428.67 XR: 565.00 YR: 337.72

Generated failure surface co-ordinates: (20 points)

105.66	428.67
121.09	405.67
138.45	384.10
157.64	364.12
178.49	345.88
200.84	329.53
224.54	315.19
249.39	302.97
275.22	292.96
301.82	285.24
328.99	279.86
356.52	276.86
384.21	276.28
411.85	278.11
439.22	282.34
466.12	288.93
492.34	297.84
517.69	309.01
541.97	322.33
565.00	337.72

Slice Geometry and Properties (54 slices)

Slice	X-Left	Width	Y-Top	Y-Base	Base Angle	Base Mat'l	Base Cohesion	Total Weight	PoreWater Force	Normal Stress	Test Factor
1	105.66	3.93	428.63	425.74	56.2	4	2360.00	1233.11	0.00	-205.33	1.80
2	109.59	5.23	428.53	418.91	56.2	4	2360.00	5452.94	2253.80	524.03	1.80
3	114.82	6.26	428.41	410.34	56.2	5	2360.00	12336.72	8631.24	1451.15	1.80
4	121.09	4.84	428.29	402.66	51.2	5	2360.00	13609.79	9578.25	2376.99	1.59
5	125.93	3.44	428.12	397.52	51.2	5	2360.00	11561.87	8533.50	2928.93	1.59
6	129.37	2.95	428.00	393.55	51.2	5	2360.00	11183.52	8470.92	3356.07	1.59

7	132.32	6.13	428.00	387.90	51.2	6	9999.00	27930.35	20982.51	2634.49	1.35
8	138.45	8.34	428.00	379.76	46.2	6	9999.00	47994.00	31837.71	4012.68	1.25
9	146.79	10.85	427.95	369.77	46.2	6	9999.00	78373.80	51004.20	5366.57	1.25
10	157.64	10.42	427.86	359.56	41.2	6	9999.00	90885.79	53736.86	7024.25	1.18
11	168.06	10.42	427.77	350.44	41.2	6	9999.00	104750.82	61434.91	8265.90	1.18
12	178.49	5.41	427.70	343.90	36.2	6	9999.00	59565.25	32427.64	9427.90	1.12
13	183.90	2.63	427.66	340.96	36.2	6	9999.00	30052.26	16332.49	9829.70	1.12
14	186.53	1.99	427.65	339.27	36.2	6	9999.00	23228.98	12610.84	10061.84	1.12
15	188.52	2.60	427.63	337.59	36.2	6	9999.00	30982.32	16804.42	10291.57	1.12
16	191.12	2.69	427.60	335.66	36.2	6	9999.00	32807.74	17777.40	10555.61	1.12
17	193.81	2.62	427.56	333.72	36.2	6	9999.00	32685.67	17697.16	10819.20	1.12
18	196.43	2.61	427.50	331.81	36.2	6	9999.00	33276.85	18004.96	11078.08	1.12
19	199.04	2.99	427.47	329.76	34.3	6	9999.00	39007.72	20595.16	11462.68	1.10
20	202.03	10.46	427.26	325.65	31.2	6	9999.00	142479.73	72632.70	12173.44	1.07
21	212.49	12.05	425.09	318.84	31.2	6	9999.00	173241.08	89451.06	12902.22	1.07
22	224.54	8.25	421.72	313.17	26.2	6	9999.00	122332.10	61497.01	13610.44	1.04
23	232.78	9.93	418.69	308.70	26.2	6	9999.00	150431.34	76991.99	14015.80	1.04
24	242.71	6.68	415.93	304.62	26.2	6	9999.00	103231.01	53659.27	14454.96	1.04
25	249.39	10.79	413.02	300.88	21.2	6	9999.00	169114.42	85976.78	15088.70	1.01
26	260.19	15.03	408.72	295.87	21.2	6	9999.00	239192.61	124507.98	15574.83	1.01
27	275.22	13.30	404.01	291.03	16.2	6	9999.00	213851.08	110899.66	16256.96	1.00
28	288.52	13.30	399.58	287.17	16.2	6	9999.00	214565.33	114007.54	16566.58	1.00
29	301.82	13.58	395.11	283.89	11.2	6	9999.00	218633.63	116605.73	17030.76	0.99
30	315.40	13.58	390.59	281.20	11.2	6	9999.00	216819.09	118695.09	17162.90	0.99
31	328.99	13.77	386.04	279.11	6.2	6	9999.00	216615.75	120268.47	17445.21	0.99
32	342.75	13.77	381.46	277.61	6.2	6	9999.00	212214.66	121323.90	17396.25	0.99
33	356.52	8.79	377.70	276.77	1.2	6	9999.00	132743.20	77398.30	17537.02	1.00
34	365.31	9.45	374.67	276.58	1.2	6	9999.00	139020.70	83162.01	17334.92	1.00
35	374.76	9.45	371.52	276.38	1.2	6	9999.00	134847.36	83168.18	17078.42	1.00
36	384.21	13.82	367.65	276.74	-3.8	6	9999.00	188451.38	121363.74	16904.98	1.01
37	398.03	13.82	363.06	277.65	-3.8	6	9999.00	177024.77	120334.73	16343.00	1.01
38	411.85	13.69	358.48	279.16	-8.8	6	9999.00	162827.86			

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 118787.91    15920.49     1.04
39      425.53     13.69     353.92       281.28       -8.8       6      9999.00    149137.84
 116724.42    15173.71     1.04
40      439.22      4.95     350.82       282.94      -13.8       6      9999.00     50398.52
  42366.13    14857.53     1.07
41      444.17     10.72     348.88       284.86      -13.8       6      9999.00    102935.47
  90326.05    14376.42     1.07
42      454.89     10.72     346.63       287.49      -13.8       6      9999.00     95098.80
  88367.82    13756.11     1.07
43      465.61     12.40     344.60       290.86      -18.6       6      9999.00     99939.16
 101787.80    13254.29     1.11
44      478.01     12.40     342.77       295.08      -18.8       6      9999.00     88696.21
  98261.19    12427.78     1.11
45      490.41      1.93     341.68       297.51      -18.8       6      9999.00     12815.69
  15001.49    11941.93     1.11
46      492.34      3.58     341.19       298.63      -23.8       6      9999.00     22823.85
  28397.11    11949.66     1.17
47      495.92      6.97     340.43       300.95      -23.8       6      9999.00     41278.66
  54204.38    11510.12     1.17
48      502.89     14.80     339.74       305.75      -23.8       6      9999.00     75479.93
 108662.41    10596.74     1.17
49      517.69      5.14     339.39       310.42      -28.8       6      9999.00     22326.71
  37097.86     9972.35     1.24
50      522.83      9.57     339.11       314.45      -28.8       6      9999.00     35403.34
  65594.69     9238.21     1.24
51      532.40      9.57     338.77       319.71      -28.8       6      9999.00     27368.96
  61006.87     8284.65     1.24
52      541.97      6.10     338.49       324.37      -33.8       6      9999.00     12912.23
  38287.74     7685.52     1.33
53      548.07      4.01     338.29       327.75      -33.8       6      9999.00      6340.75
  23929.46     7078.43     1.33
54      552.08     12.92     337.96       333.41      -33.8       6      9999.00      8828.93
  70344.29     6062.02     1.33
```

DATA: Analysis 4
Berm Area: Cut #2 - 8/25/03

Material and Water Properties

Number of defined material types: 7

Type	Cohesion	Phi	PI	Gamma	Ru	Description
1	1000.00	0.0	20	120.00	1.10	Brn fm SAND and SILT
2	1000.00	0.0	20	120.00	1.10	Brn fm SAND and CLAY
3	1000.00	0.0	20	120.00	1.10	Brn sandy SILT
4	1000.00	0.0	20	120.00	1.10	Brn sandy, silty, CLAY
5	1000.00	0.0	20	120.00	1.10	Dk gry till
6	9999.00	45.0	0	150.00	1.10	Bedrock
7	1000.00	0.0	25	110.00	1.10	Reworked fill

Unit weight of water: 62.40   Unit weight of water/medium above ground: 62.40

Material Profiles

Number of material profiles: 4

Profile number 1 co-ordinates: (48 points)   Material type: 4 - Brn sandy, silty, CLAY

```
     0.00    397.00          15.00    396.00          33.00    394.00
```

```
50.00    392.00             66.00    390.00
    70.00    388.00             97.00    386.00          148.00    384.00
194.00    384.00            216.00    378.00
   220.00    378.00            232.00    379.00          245.00    378.00
250.00    376.00            272.00    376.00
   286.00    384.00            291.00    386.00          295.00    388.00
301.00    390.00            315.00    394.00
   345.00    400.00            382.00    402.00          430.00    402.00
445.00    400.00            466.00    396.00
   474.00    394.00            489.00    390.00          495.00    388.00
501.00    386.00            525.00    378.00
   545.00    370.00            551.00    368.00          555.00    366.00
571.00    358.00            578.00    356.00
   583.00    354.00            590.00    352.00          595.00    350.00
629.00    338.00            646.00    336.00
   657.00    330.00            664.00    328.00          669.00    326.00
677.00    324.00            691.00    322.00
   712.00    320.00            723.00    318.00          737.00    310.00

Profile number  2 co-ordinates: ( 5 points)    Material type:  5 - Dk gry till
     0.00    382.50            148.00    369.50          325.00    372.00
619.00    327.00            737.00    295.00

Profile number  3 co-ordinates: ( 5 points)    Material type:  6 - Bedrock
     0.00    362.00            148.00    349.00          325.00    367.00
619.00    321.00            737.00    289.00

Profile number  4 co-ordinates: ( 2 points)    Material type:  7 - Reworked fill
     0.00    450.00            737.00    450.00
```

Slope Surface

```
Slope surface co-ordinates: (47 points)
     0.00    430.00            386.36    430.00          487.55    386.00
519.57    386.00            523.78    384.60
   525.57    384.00            529.57    382.00          533.58    380.00
537.58    378.00            541.58    376.00
   545.59    374.00            549.59    372.00          553.59    370.00
557.60    368.00            561.60    366.00
   565.60    364.00            569.60    362.00          573.61    360.00
577.61    358.00            580.80    356.00
   586.26    354.00            594.44    352.00          597.84    350.00
605.75    348.00            611.99    346.00
   616.89    344.00            621.67    342.00          626.79    340.00
631.38    338.00            647.40    336.00
   650.99    334.00            654.48    332.00          658.51    330.00
665.05    328.00            672.68    326.00
   678.70    324.00            692.76    322.00          713.68    320.00
715.79    320.00            723.94    318.00
   727.98    316.00            731.73    314.00          735.34    312.00
736.76    310.81            737.65    310.00
   738.70    309.95            743.86    309.76
```

Phreatic Surface

```
Phreatic surface co-ordinates: ( 3 points)
     0.00    425.00            500.00    415.00          694.00    385.00
```

Pseudo-Static Earthquake Effect

Specified earthquake (or seismic) coefficient: 0.150

Failure Surface

Failure surface is the critical surface from the previous analysis (critical seed)
Circular failure surface with specified circle data: XL,XR,R
Circle centre: XC: 366.08 YC: 612.13 Circle radius: R: 317.79
Intersections: XL: 105.66 YL: 430.00 XR: 565.00 YR: 364.30

Generated failure surface co-ordinates: (20 points)

X	Y	X	Y	X	Y
105.66	428.67	121.09	405.67	138.45	384.10
157.64	364.12	178.49	345.88		
200.84	329.53	224.54	315.19	249.39	302.97
275.22	292.96	301.82	285.24		
328.99	279.86	356.52	276.86	384.21	276.28
411.85	278.11	439.22	282.34		
466.12	288.93	492.34	297.84	517.69	309.01
541.97	322.33	565.00	337.72		

RESULTS: Analysis 4
Berm Area: Cut #2 - 8/25/03

Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 6.01

Slice Geometry and Properties (51 slices)

Slice	X-Left	Width	Y-Top	Y-Base	Base Angle	Base Mat'l	Base Cohesion	Total Weight	PoreWater Force	Normal Stress	Test Factor
1	105.66	3.93	430.00	425.74	56.2	7	1000.00	1842.72	0.00	220.41	1.80
2	109.59	11.49	430.00	414.24	56.2	7	1000.00	19922.48	10885.05	1485.65	1.80
3	121.09	8.57	430.00	400.35	51.2	7	1000.00	27949.75	18881.20	3055.09	1.59
4	129.65	8.57	430.00	389.71	51.2	7	1000.00	37982.31	27810.23	4225.86	1.59
5	138.22	14.19	430.00	376.95	46.3	4	1000.00	83792.27	57791.61	5733.32	1.45
6	152.41	5.23	430.00	366.84	46.2	5	1000.00	37220.34	25936.28	6946.03	1.44
7	157.64	14.48	430.00	357.78	41.2	5	1000.00	118826.48	76727.21	8060.38	1.33
8	172.12	6.37	430.00	348.67	41.2	6	9999.00	59816.28	38444.56	7507.67	1.16
9	178.49	11.18	430.00	341.80	36.2	6	9999.00	116824.47	68719.49	8771.31	1.10
10	189.66	11.18	430.00	333.62	36.2	6	9999.00	130874.25	75590.39	9945.64	1.10
11	200.84	11.85	430.00	325.95	31.2	6	9999.00	152388.47	82020.73	11313.09	1.06
12	212.69	11.85	430.00	318.78	31.2	6	9999.00	165260.81	88011.98	12339.76	1.06
13	224.54	12.43	430.00	312.14	26.2	6	9999.00	186292.89	93541.10	13611.96	1.03
14	236.97	12.43	430.00	306.03	26.2	6	9999.00	198061.28	98607.17	14515.02	1.03
15	249.39	12.91	430.00	300.47	21.2	6	9999.00	216777.56			

```
 2    7
     0.00    450.00       737.00    450.00

[Materials]
  7   0
 1     1000.00    0.00    20    120.00    1.10   Brn fm SAND and SILT
 2     1000.00    0.00    20    120.00    1.10   Brn fm SAND and CLAY
 3     1000.00    0.00    20    120.00    1.10   Brn sandy SILT
 4     2360.00    0.00    18    108.30    1.10   Brn sandy, silty, CLAY
 5     2360.00    0.00    11    111.00    1.10   Dk gry till
 6     9999.00   45.00     0    150.00    1.10   Bedrock
 7     2360.00    0.00    16    112.00    1.10   Compacted On-Site Soils
  62.400
  62.400

[Slope]
 45
      0.00    430.00       386.36    430.00       487.55    386.00       519.57    386.00
    523.78    384.60       525.57    384.00       529.57    382.00       533.58    380.00
    537.58    378.00       541.58    376.00       545.59    374.00       549.59    372.00
    553.59    370.00       557.60    368.00       561.60    366.00       565.60    364.00
    569.60    362.00       573.61    360.00       577.61    358.00       580.80    356.00
    586.26    354.00       594.44    352.00       597.84    350.00       605.75    348.00
    611.99    346.00       616.89    344.00       621.67    342.00       626.79    340.00
    631.38    338.00       647.40    336.00       650.99    334.00       654.48    332.00
    658.51    330.00       665.05    328.00       672.68    326.00       678.70    324.00
    692.76    322.00       713.68    320.00       715.79    320.00       723.94    318.00
    727.98    316.00       731.73    314.00       735.34    312.00       736.76    310.81
    737.00    310.00

[Phreatic]
  4
      0.00    390.00       272.00    371.00       413.00    395.00       737.00    305.00

[DLoads]
  2
      0.00       250.00
    385.00       250.00
    490.00       250.00
    520.00       250.00

[Failure]
circular   XL XR R
    337.08       630.83       327.84

[Restraints]
     50.00     50.00     50.00   10   10   10

[Run Bishop Multiple Analysis]

[ATitle]
Landfill Area: Cut #2 - 8/26/03

[Profiles]
  4
 48    4
      0.00    432.00        48.45    430.00        75.10    429.33       129.37    428.00
    130.34    428.00       146.79    428.00       183.90    427.68       200.86    427.47
    202.03    427.42       203.85    427.41       243.26    426.00       247.29    426.00
    256.73    426.00       257.57    425.89       272.01    424.00       277.45    423.87
```

```
   345.51   422.00    346.77   422.00    438.95   422.00    445.92   421.58
   448.24   421.52    479.36   420.00    483.70   420.00    507.26   420.00
   514.91   419.53    534.41   418.00    537.95   418.00    542.20   418.00
   569.95   416.00    587.69   414.00    599.72   412.00    614.45   410.00
   614.50   410.00    627.10   408.00    630.51   407.40    638.24   406.00
   641.96   405.29    649.05   404.00    657.27   402.19    658.11   402.00
   665.93   400.00    677.74   396.80    680.86   396.00    687.06   394.09
   687.34   394.00    691.62   392.61    693.48   392.00    695.75   391.32
  4    5
     0.00   418.00    384.00   408.00    581.00   399.00    695.75   368.32
  4    6
     0.00   400.50    384.00   375.00    581.00   372.50    695.75   298.32
  2    7
     0.00   450.00    695.75   450.00

[Materials]
  7   0
 1     1000.00    0.00   20    120.00    1.10   Brn fm SAND and SILT
 2     1000.00    0.00   20    120.00    1.10   Brn fm SAND and CLAY
 3     1000.00    0.00   20    120.00    1.10   Brn sandy SILT
 4     2360.00    0.00   18    108.30    1.10   Brn sandy, silty, CLAY
 5     2360.00    0.00   11    111.00    1.10   Dk gry till
 6     9999.00   45.00    0    150.00    1.10   Bedrock
 7     2360.00    0.00   16    112.00    1.10   Compacted On-Site Soils
  62.400
  62.400

[Slope]
 38
     0.00   432.00     48.28   430.01     48.45   430.00     75.10   429.33
   125.93   428.24    129.37   428.00    130.34   428.00    146.79   428.00
   183.90   427.68    184.60   427.67    186.53   427.64    187.53   427.65
   188.52   427.63    189.81   427.63    191.12   427.61    192.47   427.60
   193.81   427.58    195.41   427.55    196.43   427.54    198.26   427.49
   199.04   427.48    199.79   427.48    200.86   427.47    202.03   427.42
   212.49   427.10    242.71   417.04    444.17   350.00    465.61   345.51
   490.41   341.85    495.92   340.87    502.89   340.00    522.83   339.30
   524.59   339.22    548.07   338.38    552.08   338.20    572.70   337.44
   693.40   338.98    695.75   339.49

[Phreatic]
  3
     0.00   425.00    500.00   415.00    694.00   385.00

[DLoads]
  0

[Failure]
circular   XL XR R
   130.66      540.00      290.01

[Restraints]
    50.00    50.00   100.00   10   10   10

[Run Bishop Multiple Analysis]

[ATitle]
Berm Area: Cut #2 - 8/25/03

[Profiles]
```

```
 4
48    4
     0.00    397.00      15.00    396.00      33.00    394.00      50.00    392.00
    66.00    390.00      70.00    388.00      97.00    386.00     148.00    384.00
   194.00    384.00     216.00    378.00     220.00    378.00     232.00    379.00
   245.00    378.00     250.00    376.00     272.00    376.00     286.00    384.00
   291.00    386.00     295.00    388.00     301.00    390.00     315.00    394.00
   345.00    400.00     382.00    402.00     430.00    402.00     445.00    400.00
   466.00    396.00     474.00    394.00     489.00    390.00     495.00    388.00
   501.00    386.00     525.00    378.00     545.00    370.00     551.00    368.00
   555.00    366.00     571.00    358.00     578.00    356.00     583.00    354.00
   590.00    352.00     595.00    350.00     629.00    338.00     646.00    336.00
   657.00    330.00     664.00    328.00     669.00    326.00     677.00    324.00
   691.00    322.00     712.00    320.00     723.00    318.00     737.00    310.00
 5    5
     0.00    382.50     148.00    369.50     325.00    372.00     619.00    327.00
   737.00    295.00
 5    6
     0.00    362.00     148.00    349.00     325.00    367.00     619.00    321.00
   737.00    289.00
 2    7
     0.00    450.00     737.00    450.00

[Materials]
 7   0
1     1000.00    0.00    20    120.00    1.10   Brn fm SAND and SILT
2     1000.00    0.00    20    120.00    1.10   Brn fm SAND and CLAY
3     1000.00    0.00    20    120.00    1.10   Brn sandy SILT
4     1000.00    0.00    20    120.00    1.10   Brn sandy, silty, CLAY
5     1000.00    0.00    20    120.00    1.10   Dk gry till
6     9999.00   45.00     0    150.00    1.10   Bedrock
7     1000.00    0.00    25    110.00    1.10   Reworked fill
 62.400
 62.400

[Slope]
 47
     0.00    430.00     386.36    430.00     487.55    386.00     519.57    386.00
   523.78    384.60     525.57    384.00     529.57    382.00     533.58    380.00
   537.58    378.00     541.58    376.00     545.59    374.00     549.59    372.00
   553.59    370.00     557.60    368.00     561.60    366.00     565.60    364.00
   569.60    362.00     573.61    360.00     577.61    358.00     580.80    356.00
   586.26    354.00     594.44    352.00     597.84    350.00     605.75    348.00
   611.99    346.00     616.89    344.00     621.67    342.00     626.79    340.00
   631.38    338.00     647.40    336.00     650.99    334.00     654.48    332.00
   658.51    330.00     665.05    328.00     672.68    326.00     678.70    324.00
   692.76    322.00     713.68    320.00     715.79    320.00     723.94    318.00
   727.98    316.00     731.73    314.00     735.34    312.00     736.76    310.81
   737.65    310.00     738.70    309.95     743.86    309.76

[Failure]
critical

[Restraints]
    10.00     10.00     10.00   10   10   10

[Run Bishop Analysis]

[ATitle]
Berm Area: Cut #3 - 8/26/03
```

```
[Profiles]
  4
 48    4
      0.00    417.00        6.00    416.00       59.00    414.00      108.00    412.00
    143.00    412.00      150.00    414.00      165.00    414.00      169.00    412.00
    173.00    410.00      181.00    408.00      240.00    406.00      280.00    404.00
    318.00    402.00      338.00    403.00      359.00    402.00      398.00    400.00
    425.00    398.00      451.00    396.00      461.00    394.00      474.00    392.00
    500.00    386.00      518.00    380.00      525.00    378.00      531.00    376.00
    536.00    374.00      562.00    366.00      567.00    364.00      571.00    362.00
    578.00    360.00      584.00    358.00      590.00    356.00      597.00    354.00
    603.00    352.00      612.00    350.00      619.00    348.00      626.00    346.00
    635.00    344.00      645.00    342.00      653.00    340.00      683.00    334.00
    696.00    332.00      703.00    330.00      711.00    326.00      714.00    324.00
    718.00    322.00      732.00    320.00      744.00    312.00      748.00    310.00
  5    5
      0.00    402.50      143.00    397.50      338.00    379.00      673.00    321.00
    748.00    295.00
  5    6
      0.00    382.00      143.00    377.00      338.00    374.00      673.00    315.00
    748.00    289.00
  2    7
      0.00    450.00      748.00    450.00

[Materials]
  7   0
 1     1000.00    0.00    20    120.00    1.10   Brn fm SAND and SILT
 2     1000.00    0.00    20    120.00    1.10   Brn fm SAND and CLAY
 3     1000.00    0.00    20    120.00    1.10   Brn sandy SILT
 4     1000.00    0.00    20    120.00    1.10   Brn sandy, silty, CLAY
 5     1000.00    0.00    20    120.00    1.10   Dk gry till
 6     9999.00   45.00     0    150.00    1.10   Bedrock
 7     1000.00    0.00    25    110.00    1.10   Reworked Fill
  62.400
  62.400

[Slope]
  2
      0.00    450.00      748.00    325.00

[Failure]
circular   XL XR R
    200.00      700.00      500.00

[Restraints]
     10.00     10.00     10.00   10   10   10

[Run Bishop Analysis]

[ATitle]
Landfill Area: Cut #1 - 8/26/03

[Profiles]
  4
 48    4
      0.00    432.00       48.45    430.00       75.10    429.33      129.37    428.00
    130.34    428.00      146.79    428.00      183.90    427.68      200.86    427.47
    202.03    427.42      203.85    427.41      243.26    426.00      247.29    426.00
    256.73    426.00      257.57    425.89      272.01    424.00      277.45    423.87
```

```
     345.51    422.00       346.77    422.00        438.95    422.00        445.92    421.58
     448.24    421.52       479.36    420.00        483.70    420.00        507.26    420.00
     514.91    419.53       534.41    418.00        537.95    418.00        542.20    418.00
     569.95    416.00       587.69    414.00        599.72    412.00        614.45    410.00
     614.50    410.00       627.10    408.00        630.51    407.40        638.24    406.00
     641.96    405.29       649.05    404.00        657.27    402.19        658.11    402.00
     665.93    400.00       677.74    396.80        680.86    396.00        687.06    394.09
     687.34    394.00       691.62    392.61        693.48    392.00        695.75    391.32
  4    5
       0.00    418.00       384.00    408.00        581.00    399.00        695.75    368.32
  4    6
       0.00    400.50       384.00    375.00        581.00    372.50        695.75    298.32
  2    3
       0.00    450.00       748.00    450.00

[Materials]
  6    0
 1      1000.00     0.00     20     120.00     1.10    Brn fm SAND and SILT
 2      1000.00     0.00     20     120.00     1.10    Brn fm SAND and CLAY
 3      1000.00     0.00     20     120.00     1.10    Brn sandy SILT
 4      1000.00     0.00     20     120.00     1.10    Brn sandy, silty, CLAY
 5      1000.00     0.00     20     120.00     1.10    Dk gry till
 6      9999.00    45.00      0     150.00     1.10    Bedrock
  62.400
  62.400

[Slope]
 38
       0.00    432.00        48.28    430.01         48.45    430.00         75.10    429.33
     125.93    428.24       129.37    428.00        130.34    428.00        146.79    428.00
     183.90    427.68       184.60    427.67        186.53    427.64        187.53    427.65
     188.52    427.63       189.81    427.63        191.12    427.61        192.47    427.60
     193.81    427.58       195.41    427.55        196.43    427.54        198.26    427.49
     199.04    427.48       199.79    427.48        200.86    427.47        202.03    427.42
     212.49    427.10       242.71    417.04        444.17    350.00        465.61    345.51
     490.41    341.85       495.92    340.87        502.89    340.00        522.83    339.30
     524.59    339.22       548.07    338.38        552.08    338.20        572.70    337.44
     693.40    338.98       695.75    339.49

[Failure]
circular   XL XR R
    50.00       650.00       500.00

[Run Bishop Analysis]

[End]
```

```
[Title]
Amsterdam

[ATitle]
Berm Area: Cut #1 - 8/21/03

[Profiles]
  4
 48    4
      0.00    423.78        54.15    422.00        54.58    422.00        84.80    420.00
    101.28    418.00       112.75    416.00       255.58    392.00       272.30    390.00
    290.31    388.00       313.29    386.00       341.26    384.00       378.91    382.00
    378.92    382.00       378.94    382.00       442.04    374.00       463.46    372.00
    481.52    368.00       486.98    366.00       490.17    364.00       517.90    346.00
    518.79    346.00       536.18    344.00       548.92    344.89       550.13    346.00
    554.60    348.00       559.82    349.00       595.86    346.00       597.94    346.00
    614.47    344.00       623.46    342.00       628.40    340.00       632.49    338.00
    646.90    336.00       664.46    334.00       688.86    332.00       768.33    332.00
    786.18    330.00       799.75    328.00       803.99    328.00       824.59    326.00
    828.98    324.00       836.85    320.00       840.67    318.00       844.73    316.00
    854.69    312.00       857.92    310.00       866.05    308.00       866.32    308.00
  6    5
      0.00    393.50       101.00    377.50       400.00    324.00       615.00    317.00
    751.00    291.00       866.32    291.00
  6    6
      0.00    373.00       101.00    357.00       400.00    319.00       615.00    311.00
    751.00    285.00       866.32    285.00
  2    7
      0.00    450.00       866.32    450.00

[Materials]
  7    0
 1      1000.00     0.00    20     120.00     1.10   Brn fm SAND and SILT
 2      1000.00     0.00    20     120.00     1.10   Brn fm SAND and CLAY
 3      1000.00     0.00    20     120.00     1.10   Brn sandy SILT
 4      2360.00     0.00    18     108.30     1.10   Brn sandy, silty, CLAY
 5      2360.00     0.00    11     111.00     1.10   Dk gry till
 6      9999.00    45.00     0     150.00     1.10   Bedrock
 7      2360.00     0.00    16     112.00     1.10   Compacted On-Site Soils
  62.400
  62.400

[Slope]
 48
      0.00    423.78        60.87    422.35        72.55    422.00        85.41    422.00
     90.91    420.30        91.90    420.00        97.26    420.00        97.91    420.33
    117.37    430.00       123.26    430.00       125.31    428.98       163.26    410.00
    163.86    409.97       164.00    409.97       237.52    408.94       242.85    408.96
    345.75    408.83       420.94    410.00       430.69    410.00       432.82    411.02
    472.21    430.00       474.69    430.00       478.44    430.00       479.78    429.36
    553.05    394.00       559.23    394.00       586.27    394.00       587.31    393.67
    617.43    384.00       619.86    382.83       746.21    322.00       753.09    322.00
    757.43    322.00       759.49    323.03       775.67    331.08       778.64    332.00
    786.18    330.00       799.75    328.00       803.99    328.00       824.59    326.00
    828.98    324.00       836.85    320.00       840.67    318.00       844.73    316.00
    854.69    312.00       857.92    310.00       866.05    308.00       866.32    308.00

[Phreatic]
  6
      0.00    410.00       400.00    368.00       525.00    338.00       700.00    330.00
```

```
   800.00    330.00       867.00    305.00

[Piezometric]
  0

[DLoads]
  8
   163.26       250.00
   163.86       250.00
   163.86       250.00
   164.00       250.00
   164.00       250.00
   237.52       250.00
   237.52       250.00
   242.85       250.00
   242.85       250.00
   345.75       250.00
   345.75       250.00
   420.94       250.00
   420.94       250.00
   430.69       250.00
   553.05       250.00
   586.27       250.00

[Earthquake]
0.150

[Failure]
circular   XL XR R
   437.09       857.93       451.66

[Restraints]
    50.00     50.00    100.00   10   10   10

[Run Spencer Multiple Circle Analysis]

[ATitle]
Landfill Area: Cut #3 - 8/26/03

[Profiles]
  4
 48    4
     0.00    397.00       15.00    396.00       33.00    394.00       50.00    392.00
    66.00    390.00       70.00    388.00       97.00    386.00      148.00    384.00
   194.00    384.00      216.00    378.00      220.00    378.00      232.00    379.00
   245.00    378.00      250.00    376.00      272.00    376.00      286.00    384.00
   291.00    386.00      295.00    388.00      301.00    390.00      315.00    394.00
   345.00    400.00      382.00    402.00      430.00    402.00      445.00    400.00
   466.00    396.00      474.00    394.00      489.00    390.00      495.00    388.00
   501.00    386.00      525.00    378.00      545.00    370.00      551.00    368.00
   555.00    366.00      571.00    358.00      578.00    356.00      583.00    354.00
   590.00    352.00      595.00    350.00      629.00    338.00      646.00    336.00
   657.00    330.00      664.00    328.00      669.00    326.00      677.00    324.00
   691.00    322.00      712.00    320.00      723.00    318.00      737.00    310.00
  5    5
     0.00    382.50      148.00    369.50      325.00    372.00      619.00    327.00
   737.00    295.00
  5    6
     0.00    362.00      148.00    349.00      325.00    367.00      619.00    321.00
   737.00    289.00
```

```
  2    7
      0.00    450.00       737.00    450.00

[Materials]
  7   0
 1      1000.00    0.00    20    120.00    1.10   Brn fm SAND and SILT
 2      1000.00    0.00    20    120.00    1.10   Brn fm SAND and CLAY
 3      1000.00    0.00    20    120.00    1.10   Brn sandy SILT
 4      2360.00    0.00    18    108.30    1.10   Brn sandy, silty, CLAY
 5      2360.00    0.00    11    111.00    1.10   Dk gry till
 6      9999.00   45.00     0    150.00    1.10   Bedrock
 7      2360.00    0.00    16    112.00    1.10   Compacted On-Site Soils
  62.400
  62.400

[Slope]
 45
      0.00    430.00       386.36    430.00       487.55    386.00       519.57    386.00
    523.78    384.60       525.57    384.00       529.57    382.00       533.58    380.00
    537.58    378.00       541.58    376.00       545.59    374.00       549.59    372.00
    553.59    370.00       557.60    368.00       561.60    366.00       565.60    364.00
    569.60    362.00       573.61    360.00       577.61    358.00       580.80    356.00
    586.26    354.00       594.44    352.00       597.84    350.00       605.75    348.00
    611.99    346.00       616.89    344.00       621.67    342.00       626.79    340.00
    631.38    338.00       647.40    336.00       650.99    334.00       654.48    332.00
    658.51    330.00       665.05    328.00       672.68    326.00       678.70    324.00
    692.76    322.00       713.68    320.00       715.79    320.00       723.94    318.00
    727.98    316.00       731.73    314.00       735.34    312.00       736.76    310.81
    737.00    310.00

[Phreatic]
  4
      0.00    390.00       272.00    371.00       413.00    395.00       737.00    305.00

[DLoads]
  2
      0.00       250.00
    385.00       250.00
    490.00       250.00
    520.00       250.00

[Failure]
circular   XL XR R
    337.08       630.83       327.84

[Restraints]
     50.00     50.00     50.00   10   10   10

[Run Bishop Multiple Analysis]

[ATitle]
Landfill Area: Cut #2 - 8/26/03

[Profiles]
  4
 48    4
      0.00    432.00        48.45    430.00        75.10    429.33        129.37    428.00
    130.34    428.00       146.79    428.00       183.90    427.68        200.86    427.47
    202.03    427.42       203.85    427.41       243.26    426.00        247.29    426.00
    256.73    426.00       257.57    425.89       272.01    424.00        277.45    423.87
```

```
     345.51    422.00       346.77    422.00       438.95    422.00       445.92    421.58
     448.24    421.52       479.36    420.00       483.70    420.00       507.26    420.00
     514.91    419.53       534.41    418.00       537.95    418.00       542.20    418.00
     569.95    416.00       587.69    414.00       599.72    412.00       614.45    410.00
     614.50    410.00       627.10    408.00       630.51    407.40       638.24    406.00
     641.96    405.29       649.05    404.00       657.27    402.19       658.11    402.00
     665.93    400.00       677.74    396.80       680.86    396.00       687.06    394.09
     687.34    394.00       691.62    392.61       693.48    392.00       695.75    391.32
  4    5
       0.00    418.00       384.00    408.00       581.00    399.00       695.75    368.32
  4    6
       0.00    400.50       384.00    375.00       581.00    372.50       695.75    298.32
  2    7
       0.00    450.00       695.75    450.00

[Materials]
  7   0
 1      1000.00     0.00    20    120.00     1.10   Brn fm SAND and SILT
 2      1000.00     0.00    20    120.00     1.10   Brn fm SAND and CLAY
 3      1000.00     0.00    20    120.00     1.10   Brn sandy SILT
 4      2360.00     0.00    18    108.30     1.10   Brn sandy, silty, CLAY
 5      2360.00     0.00    11    111.00     1.10   Dk gry till
 6      9999.00    45.00     0    150.00     1.10   Bedrock
 7      2360.00     0.00    16    112.00     1.10   Compacted On-Site Soils
  62.400
  62.400

[Slope]
 38
       0.00    432.00        48.28    430.01        48.45    430.00        75.10    429.33
     125.93    428.24       129.37    428.00       130.34    428.00       146.79    428.00
     183.90    427.68       184.60    427.67       186.53    427.64       187.53    427.65
     188.52    427.63       189.81    427.63       191.12    427.61       192.47    427.60
     193.81    427.58       195.41    427.55       196.43    427.54       198.26    427.49
     199.04    427.48       199.79    427.48       200.86    427.47       202.03    427.42
     212.49    427.10       242.71    417.04       444.17    350.00       465.61    345.51
     490.41    341.85       495.92    340.87       502.89    340.00       522.83    339.30
     524.59    339.22       548.07    338.38       552.08    338.20       572.70    337.44
     693.40    338.98       695.75    339.49

[Phreatic]
  3
       0.00    425.00       500.00    415.00       694.00    385.00

[DLoads]
  0

[Failure]
circular    XL  XR  R
    130.66       540.00       290.01

[Restraints]
     50.00     50.00    100.00   10   10   10

[Run Bishop Multiple Analysis]

[ATitle]
Berm Area: Cut #2 - 8/25/03

[Profiles]
```

```
 4
48    4
      0.00    397.00        15.00    396.00        33.00    394.00        50.00    392.00
     66.00    390.00        70.00    388.00        97.00    386.00       148.00    384.00
    194.00    384.00       216.00    378.00       220.00    378.00       232.00    379.00
    245.00    378.00       250.00    376.00       272.00    376.00       286.00    384.00
    291.00    386.00       295.00    388.00       301.00    390.00       315.00    394.00
    345.00    400.00       382.00    402.00       430.00    402.00       445.00    400.00
    466.00    396.00       474.00    394.00       489.00    390.00       495.00    388.00
    501.00    386.00       525.00    378.00       545.00    370.00       551.00    368.00
    555.00    366.00       571.00    358.00       578.00    356.00       583.00    354.00
    590.00    352.00       595.00    350.00       629.00    338.00       646.00    336.00
    657.00    330.00       664.00    328.00       669.00    326.00       677.00    324.00
    691.00    322.00       712.00    320.00       723.00    318.00       737.00    310.00
 5    5
      0.00    382.50       148.00    369.50       325.00    372.00       619.00    327.00
    737.00    295.00
 5    6
      0.00    362.00       148.00    349.00       325.00    367.00       619.00    321.00
    737.00    289.00
 2    7
      0.00    450.00       737.00    450.00

[Materials]
 7   0
 1     1000.00    0.00   20    120.00    1.10   Brn fm SAND and SILT
 2     1000.00    0.00   20    120.00    1.10   Brn fm SAND and CLAY
 3     1000.00    0.00   20    120.00    1.10   Brn sandy SILT
 4     1000.00    0.00   20    120.00    1.10   Brn sandy, silty, CLAY
 5     1000.00    0.00   20    120.00    1.10   Dk gry till
 6     9999.00   45.00    0    150.00    1.10   Bedrock
 7     1000.00    0.00   25    110.00    1.10   Reworked fill
  62.400
  62.400

[Slope]
 47
      0.00    430.00       386.36    430.00       487.55    386.00       519.57    386.00
    523.78    384.60       525.57    384.00       529.57    382.00       533.58    380.00
    537.58    378.00       541.58    376.00       545.59    374.00       549.59    372.00
    553.59    370.00       557.60    368.00       561.60    366.00       565.60    364.00
    569.60    362.00       573.61    360.00       577.61    358.00       580.80    356.00
    586.26    354.00       594.44    352.00       597.84    350.00       605.75    348.00
    611.99    346.00       616.89    344.00       621.67    342.00       626.79    340.00
    631.38    338.00       647.40    336.00       650.99    334.00       654.48    332.00
    658.51    330.00       665.05    328.00       672.68    326.00       678.70    324.00
    692.76    322.00       713.68    320.00       715.79    320.00       723.94    318.00
    727.98    316.00       731.73    314.00       735.34    312.00       736.76    310.81
    737.65    310.00       738.70    309.95       743.86    309.76

[Failure]
critical

[Restraints]
    10.00     10.00     10.00   10   10   10

[Run Bishop Analysis]

[ATitle]
Berm Area: Cut #3 - 8/26/03
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```
[Profiles]
  4
 48    4
      0.00    417.00         6.00    416.00        59.00    414.00       108.00    412.00
    143.00    412.00       150.00    414.00       165.00    414.00       169.00    412.00
    173.00    410.00       181.00    408.00       240.00    406.00       280.00    404.00
    318.00    402.00       338.00    403.00       359.00    402.00       398.00    400.00
    425.00    398.00       451.00    396.00       461.00    394.00       474.00    392.00
    500.00    386.00       518.00    380.00       525.00    378.00       531.00    376.00
    536.00    374.00       562.00    366.00       567.00    364.00       571.00    362.00
    578.00    360.00       584.00    358.00       590.00    356.00       597.00    354.00
    603.00    352.00       612.00    350.00       619.00    348.00       626.00    346.00
    635.00    344.00       645.00    342.00       653.00    340.00       683.00    334.00
    696.00    332.00       703.00    330.00       711.00    326.00       714.00    324.00
    718.00    322.00       732.00    320.00       744.00    312.00       748.00    310.00
  5    5
      0.00    402.50       143.00    397.50       338.00    379.00       673.00    321.00
    748.00    295.00
  5    6
      0.00    382.00       143.00    377.00       338.00    374.00       673.00    315.00
    748.00    289.00
  2    7
      0.00    450.00       748.00    450.00

[Materials]
  7   0
 1     1000.00    0.00    20    120.00    1.10   Brn fm SAND and SILT
 2     1000.00    0.00    20    120.00    1.10   Brn fm SAND and CLAY
 3     1000.00    0.00    20    120.00    1.10   Brn sandy SILT
 4     1000.00    0.00    20    120.00    1.10   Brn sandy, silty, CLAY
 5     1000.00    0.00    20    120.00    1.10   Dk gry till
 6     9999.00   45.00     0    150.00    1.10   Bedrock
 7     1000.00    0.00    25    110.00    1.10   Reworked Fill
  62.400
  62.400

[Slope]
  2
      0.00    450.00       748.00    325.00

[Failure]
circular   XL XR R
    200.00      700.00      500.00

[Restraints]
     10.00     10.00     10.00   10   10   10

[Run Bishop Analysis]

[ATitle]
Landfill Area: Cut #1 - 8/26/03

[Profiles]
  4
 48    4
      0.00    432.00        48.45    430.00        75.10    429.33       129.37    428.00
    130.34    428.00       146.79    428.00       183.90    427.68       200.86    427.47
    202.03    427.42       203.85    427.41       243.26    426.00       247.29    426.00
    256.73    426.00       257.57    425.89       272.01    424.00       277.45    423.87
```

```
   345.51    422.00       346.77    422.00       438.95    422.00       445.92    421.58
   448.24    421.52       479.36    420.00       483.70    420.00       507.26    420.00
   514.91    419.53       534.41    418.00       537.95    418.00       542.20    418.00
   569.95    416.00       587.69    414.00       599.72    412.00       614.45    410.00
   614.50    410.00       627.10    408.00       630.51    407.40       638.24    406.00
   641.96    405.29       649.05    404.00       657.27    402.19       658.11    402.00
   665.93    400.00       677.74    396.80       680.86    396.00       687.06    394.09
   687.34    394.00       691.62    392.61       693.48    392.00       695.75    391.32
  4    5
     0.00    418.00       384.00    408.00       581.00    399.00       695.75    368.32
  4    6
     0.00    400.50       384.00    375.00       581.00    372.50       695.75    298.32
  2    3
     0.00    450.00       748.00    450.00

[Materials]
  6   0
 1     1000.00    0.00    20     120.00    1.10   Brn fm SAND and SILT
 2     1000.00    0.00    20     120.00    1.10   Brn fm SAND and CLAY
 3     1000.00    0.00    20     120.00    1.10   Brn sandy SILT
 4     1000.00    0.00    20     120.00    1.10   Brn sandy, silty, CLAY
 5     1000.00    0.00    20     120.00    1.10   Dk gry till
 6     9999.00   45.00     0     150.00    1.10   Bedrock
  62.400
  62.400

[Slope]
 38
     0.00    432.00        48.28    430.01        48.45    430.00        75.10    429.33
   125.93    428.24       129.37    428.00       130.34    428.00       146.79    428.00
   183.90    427.68       184.60    427.67       186.53    427.64       187.53    427.65
   188.52    427.63       189.81    427.63       191.12    427.61       192.47    427.60
   193.81    427.58       195.41    427.55       196.43    427.54       198.26    427.49
   199.04    427.48       199.79    427.48       200.86    427.47       202.03    427.42
   212.49    427.10       242.71    417.04       444.17    350.00       465.61    345.51
   490.41    341.85       495.92    340.87       502.89    340.00       522.83    339.30
   524.59    339.22       548.07    338.38       552.08    338.20       572.70    337.44
   693.40    338.98       695.75    339.49

[Failure]
circular   XL XR R
    50.00      650.00      500.00

[Run Bishop Analysis]

[End]
```

									103191.22	15617.37	1.01
16	262.31	12.91	430.00	295.46	21.2	6	9999.00	226981.05	107293.52	16377.72	1.01
17	275.22	13.30	430.00	291.03	16.2	6	9999.00	243910.02	110899.66	17403.54	0.99
18	288.52	13.30	430.00	287.17	16.2	6	9999.00	253008.02	114007.54	18066.47	0.99
19	301.82	13.58	430.00	283.89	11.2	6	9999.00	266236.56	116605.73	18922.96	0.99
20	315.40	13.58	430.00	281.20	11.2	6	9999.00	272723.81	118695.09	19390.12	0.99
21	328.99	13.77	430.00	279.11	6.2	6	9999.00	280506.44	120268.47	19989.35	0.99
22	342.75	13.77	430.00	277.61	6.2	6	9999.00	282993.66	121323.90	20168.16	0.99
23	356.52	13.85	430.00	276.72	1.2	6	9999.00	285660.28	121857.74	20555.67	1.00
24	370.37	13.85	430.00	276.42	1.2	6	9999.00	285470.53	121870.73	20542.07	1.00
25	384.21	2.15	430.00	276.35	-3.8	6	9999.00	44254.54	18940.28	20837.23	1.01
26	386.36	12.74	427.23	276.84	-3.8	6	9999.00	257186.27	111816.59	20419.46	1.01
27	399.10	12.74	421.69	277.69	-3.8	6	9999.00	247044.28	110941.63	19615.50	1.01
28	411.85	5.19	417.79	278.51	-8.8	6	9999.00	97577.52	45313.85	19322.42	1.04
29	417.04	11.09	414.25	279.77	-8.8	6	9999.00	201550.11	95776.61	18839.54	1.04
30	428.13	11.09	409.43	281.48	-8.8	6	9999.00	192186.56	94421.85	18270.76	1.04
31	439.22	12.10	404.38	283.82	-13.8	6	9999.00	197914.89	102845.85	17885.63	1.07
32	451.32	12.10	399.12	286.79	-13.8	6	9999.00	184557.25	100350.43	17070.04	1.07
33	463.42	2.70	395.90	288.60	-13.8	6	9999.00	39303.96	22025.55	16567.93	1.07
34	466.12	10.71	392.99	290.75	-18.8	6	9999.00	148593.70	88141.12	16325.22	1.12
35	476.84	10.71	388.33	294.39	-18.8	6	9999.00	136211.58	85418.31	15408.74	1.12
36	487.55	4.79	386.00	297.03	-18.8	6	9999.00	57542.28	37341.50	14809.09	1.12
37	492.34	8.66	386.00	299.75	-23.8	6	9999.00	100071.88	68053.92	14654.13	1.18
38	501.00	8.35	386.00	303.49	-23.8	6	9999.00	91363.90	63001.14	13954.54	1.18
39	509.35	8.35	386.00	307.17	-23.8	6	9999.00	86203.16	60175.11	13224.96	1.18
40	517.69	1.88	386.00	309.52	-28.8	6	9999.00	18647.77	13708.98	13087.10	1.26
41	519.57	4.21	385.30	311.19	-28.8	6	9999.00	40341.02	30104.56	12728.86	1.26
42	523.78	5.79	383.45	313.94	-28.8	6	9999.00	51678.00	39952.52	12102.33	1.26
43	529.57	4.01	381.00	316.63	-28.8	6	9999.00	32922.91	26686.29	11452.89	1.26
44	533.58	4.00	379.00	318.82	-28.8	6	9999.00	30502.41	25817.40	10922.05	1.26
45	537.58	4.00	377.00	321.02	-28.8	6	9999.00	28165.96	25016.14	10391.76	1.26
46	541.58	4.01	375.00	323.41	-33.3	6	9999.00	25776.53	25399.78	10122.83	1.34

```
47      545.59     4.00     373.00     326.09     -33.8     6     9999.00     23093.69
 24483.66     9541.45     1.35
48      549.59     4.00     371.00     328.76     -33.8     6     9999.00     20477.21
 23495.42     8928.22     1.35
49      553.59     4.01     369.00     331.44     -33.8     5     1000.00     17942.47
 22561.77     6919.59     1.20
50      557.60     4.00     367.00     334.11     -33.8     5     1000.00     15652.97
 21516.30     6444.50     1.20
51      561.60     3.40     365.15     336.59     -33.8     4     1000.00     11541.92
 17512.78     6005.47     1.20
```

DATA: Analysis 5
Berm Area: Cut #3 - 8/26/03

Material and Water Properties

Number of defined material types: 7

Type	Cohesion	Phi	PI	Gamma	Ru	Description
1	1000.00	0.0	20	120.00	1.10	Brn fm SAND and SILT
2	1000.00	0.0	20	120.00	1.10	Brn fm SAND and CLAY
3	1000.00	0.0	20	120.00	1.10	Brn sandy SILT
4	1000.00	0.0	20	120.00	1.10	Brn sandy, silty, CLAY
5	1000.00	0.0	20	120.00	1.10	Dk gry till
6	9999.00	45.0	0	150.00	1.10	Bedrock
7	1000.00	0.0	25	110.00	1.10	Reworked Fill

Unit weight of water: 62.40   Unit weight of water/medium above ground:
62.40

Material Profiles

Number of material profiles: 4

Profile number 1 co-ordinates: (48 points)   Material type: 4 - Brn sandy,
silty, CLAY

```
     0.00    417.00          6.00    416.00          59.00    414.00
108.00    412.00          143.00    412.00
   150.00    414.00          165.00    414.00         169.00    412.00
173.00    410.00          181.00    408.00
   240.00    406.00          280.00    404.00         318.00    402.00
338.00    403.00          359.00    402.00
   398.00    400.00          425.00    398.00         451.00    396.00
461.00    394.00          474.00    392.00
   500.00    386.00          518.00    380.00         525.00    378.00
531.00    376.00          536.00    374.00
   562.00    366.00          567.00    364.00         571.00    362.00
578.00    360.00          584.00    358.00
   590.00    356.00          597.00    354.00         603.00    352.00
612.00    350.00          619.00    348.00
   626.00    346.00          635.00    344.00         645.00    342.00
653.00    340.00          683.00    334.00
   696.00    332.00          703.00    330.00         711.00    326.00
714.00    324.00          718.00    322.00
   732.00    320.00          744.00    312.00         748.00    310.00
```

Profile number 2 co-ordinates: (5 points)   Material type: 5 - Dk gry till

```
     0.00    402.50          143.00    397.50         338.00    379.00
673.00    321.00          748.00    295.00
```

Profile number 3 co-ordinates: (5 points) Material type: 6 - Bedrock
0.00 382.00 143.00 377.00 338.00 374.00
673.00 315.00 748.00 289.00

Profile number 4 co-ordinates: (2 points) Material type: 7 - Reworked Fill
0.00 450.00 748.00 450.00

Slope Surface

Slope surface co-ordinates: (2 points)
0.00 450.00 748.00 325.00

Phreatic Surface

Phreatic surface co-ordinates: (3 points)
0.00 425.00 500.00 415.00 694.00 385.00

Pseudo-Static Earthquake Effect

Specified earthquake (or seismic) coefficient: 0.150

Failure Surface

Circular failure surface with specified circle data: XL,XR,R
Circle centre: XC: 521.04 YC: 799.90 Circle radius: R: 500.00
Intersections: XL: 200.00 YL: 416.58 XR: 700.00 YR: 333.02

Generated failure surface co-ordinates: (20 points)
200.00 416.58 221.94 399.22 244.82 383.12
268.56 368.32 293.10 354.88
318.34 342.82 344.23 332.20 370.66 323.05
397.57 315.38 424.86 309.23
452.46 304.62 480.26 301.56 508.20 300.06
536.18 300.13 564.11 301.76
591.90 304.94 619.47 309.68 646.74 315.95
673.61 323.74 700.00 333.02

RESULTS: Analysis 5
Berm Area: Cut #3 - 8/26/03

Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 6.10

Slice Geometry and Properties (42 slices)

Slice	X-Left	Width	Y-Top	Y-Base	Base Angle	Base Mat'l	Base Cohesion	Total Weight	PoreWater Force	Normal Stress	Test Factor
1	200.00	12.18	415.56	411.76	38.3	7	1000.00	5090.70	8835.91	620.14	1.28
2	212.18	9.76	413.73	403.08	38.3	4	1000.00	11790.58	13651.12	1510.72	1.28
3	221.94	15.13	411.65	393.90	35.1	4	1000.00	31416.11	30600.09	2508.32	1.22
4	237.07	7.75	409.74	385.85	35.1	5	1000.00	21928.17	20308.95	3365.13	1.22

5	244.82	12.65	408.03	379.18	31.9	5	1000.00	43454.05	37932.81	4079.58	1.18
6	257.47	11.10	406.05	371.78	31.9	6	9999.00	46622.16	39132.04	3937.42	1.07
7	268.56	4.68	404.73	367.04	28.7	6	9999.00	22265.81	17489.93	4663.52	1.05
8	273.24	9.93	403.51	363.04	28.7	6	9999.00	51751.86	39840.82	5160.78	1.05
9	283.17	9.93	401.85	357.60	28.7	6	9999.00	57832.27	43544.15	5833.35	1.05
10	293.10	12.62	399.96	351.86	25.5	6	9999.00	81472.63	58610.79	6666.17	1.03
11	305.72	12.62	397.86	345.84	25.5	6	9999.00	89614.35	63650.46	7397.94	1.03
12	318.34	12.94	395.72	340.17	22.3	6	9999.00	99477.34	68375.72	8212.34	1.01
13	331.29	12.94	393.56	334.86	22.3	6	9999.00	106350.74	72785.48	8841.17	1.01
14	344.23	13.22	391.37	329.91	19.1	6	9999.00	114062.73	76872.37	9495.19	1.00
15	357.44	13.22	389.16	325.34	19.1	6	9999.00	118714.52	80638.27	9957.48	1.00
16	370.66	13.45	386.93	321.13	15.9	6	9999.00	124770.35	84076.91	10502.05	0.99
17	384.12	13.45	384.69	317.30	15.9	6	9999.00	127918.05	87187.02	10853.50	0.99
18	397.57	13.65	382.42	313.85	12.7	6	9999.00	132137.31	89963.59	11286.71	0.99
19	411.21	13.65	380.14	310.77	12.7	6	9999.00	133711.14	92408.49	11524.94	0.99
20	424.86	13.80	377.85	308.08	9.5	6	9999.00	135956.59	94517.20	11844.22	0.99
21	438.66	13.80	375.54	305.78	9.5	6	9999.00	135905.41	96289.07	11967.25	0.99
22	452.46	13.90	373.23	303.86	6.3	6	9999.00	136082.69	97720.61	12170.42	0.99
23	466.36	13.90	370.90	302.33	6.3	6	9999.00	134375.66	98813.41	12176.60	0.99
24	480.26	13.97	368.57	301.19	3.1	6	9999.00	132449.81	99565.56	12261.81	0.99
25	494.23	13.97	366.24	300.44	3.1	6	9999.00	129078.73	99833.97	12139.70	0.99
26	508.20	13.99	363.90	300.08	-0.1	6	9999.00	125064.51	98261.31	11988.01	1.00
27	522.19	13.99	361.57	300.11	-0.1	6	9999.00	120038.82	96344.88	11639.56	1.00
28	536.18	13.96	359.23	300.53	-3.3	6	9999.00	114002.89	94088.12	11367.27	1.01
29	550.14	13.96	356.90	301.35	-3.3	6	9999.00	107355.70	91492.26	10899.42	1.01
30	564.11	13.90	354.57	302.55	-6.5	6	9999.00	99422.53	88561.23	10505.95	1.03
31	578.00	13.90	352.25	304.15	-6.5	6	9999.00	91205.95	85294.15	9918.84	1.03
32	591.90	13.79	349.93	306.13	-9.8	6	9999.00	81544.04	81695.14	9403.82	1.04
33	605.69	13.79	347.63	308.50	-9.8	6	9999.00	71829.85	77766.77	8697.92	1.04
34	619.47	9.53	345.68	310.78	-13.0	6	9999.00	43587.85	51885.22	8185.13	1.07
35	629.00	9.53	344.09	312.97	-13.0	6	9999.00	38149.79	49646.98	7608.95	1.07
36	638.54	8.20	342.61	315.01	-13.0	6	9999.00	28456.20			

```
 40917.71     7071.66    1.07
37     646.74      7.88     341.26     317.10    -16.2     6    9999.00    23226.39
 38182.03     6666.20    1.09
38     654.61     12.84     339.53     320.10    -16.2     5    1000.00    29800.61
 58398.40     5523.43    1.04
39     667.46      6.15     337.95     322.85    -16.2     4    1000.00    11053.20
 26288.11     5006.98    1.04
40     673.61     11.50     336.47     325.76    -19.4     4    1000.00    14573.56
 46773.90     4494.59    1.06
41     685.11     11.50     334.55     329.81    -19.4     4    1000.00     6342.82
 42347.18     3787.72    1.06
42     696.60      3.40     333.31     332.42    -19.4     7    1000.00      329.01
     0.00      154.50    1.06
```

DATA: Analysis 6
Landfill Area: Cut #1 - 8/26/03

Material and Water Properties

Number of defined material types: 6

Type	Cohesion	Phi	PI	Gamma	Ru	Description
1	1000.00	0.0	20	120.00	1.10	Brn fm SAND and SILT
2	1000.00	0.0	20	120.00	1.10	Brn fm SAND and CLAY
3	1000.00	0.0	20	120.00	1.10	Brn sandy SILT
4	1000.00	0.0	20	120.00	1.10	Brn sandy, silty, CLAY
5	1000.00	0.0	20	120.00	1.10	Dk gry till
6	9999.00	45.0	0	150.00	1.10	Bedrock

Unit weight of water: 62.40   Unit weight of water/medium above ground:
62.40

Material Profiles

Number of material profiles: 4

Profile number 1 co-ordinates: (48 points)   Material type: 4 - Brn sandy,
silty, CLAY

```
     0.00    432.00            48.45    430.00            75.10    429.33
129.37    428.00          130.34    428.00
   146.79    428.00           183.90    427.68           200.86    427.47
202.03    427.42          203.85    427.41
   243.26    426.00           247.29    426.00           256.73    426.00
257.57    425.89          272.01    424.00
   277.45    423.87           345.51    422.00           346.77    422.00
438.95    422.00          445.92    421.58
   448.24    421.52           479.36    420.00           483.70    420.00
507.26    420.00          514.91    419.53
   534.41    418.00           537.95    418.00           542.20    418.00
569.95    416.00          587.69    414.00
   599.72    412.00           614.45    410.00           614.50    410.00
627.10    408.00          630.51    407.40
   638.24    406.00           641.96    405.29           649.05    404.00
657.27    402.19          658.11    402.00
   665.93    400.00           677.74    396.80           680.86    396.00
687.06    394.09          687.34    394.00
   691.62    392.61           693.48    392.00           695.75    391.32
```

Profile number 2 co-ordinates: (4 points)   Material type: 5 - Dk gry till

```
     0.00    418.00           384.00    408.00           581.00    399.00
```

```
695.75    368.32

Profile number  3 co-ordinates: ( 4 points)     Material type:  6 - Bedrock
      0.00     400.50           384.00    375.00             581.00    372.50
695.75    298.32

Profile number  4 co-ordinates: ( 2 points)     Material type:  3 - Brn sandy SILT
      0.00     450.00           748.00    450.00
```

Slope Surface

```
Slope surface co-ordinates: (38 points)
      0.00     432.00            48.28    430.01              48.45    430.00
75.10     429.33            125.93    428.24
    129.37     428.00           130.34    428.00             146.79    428.00
183.90    427.68             184.60    427.67
    186.53     427.64           187.53    427.65             188.52    427.63
189.81    427.63             191.12    427.61
    192.47     427.60           193.81    427.58             195.41    427.55
196.43    427.54             198.26    427.49
    199.04     427.48           199.79    427.48             200.86    427.47
202.03    427.42             212.49    427.10
    242.71     417.04           444.17    350.00             465.61    345.51
490.41    341.85             495.92    340.87
    502.89     340.00           522.83    339.30             524.59    339.22
548.07    338.38             552.08    338.20
    572.70     337.44           693.40    338.98             695.75    339.49
```

Phreatic Surface

```
Phreatic surface co-ordinates: ( 3 points)
      0.00     425.00           500.00    415.00             694.00    385.00
```

Pseudo-Static Earthquake Effect

Specified earthquake (or seismic) coefficient: 0.150

Failure Surface

```
Circular failure surface with specified circle data: XL,XR,R
Circle centre:  XC:      409.93   YC:      777.02      Circle radius:  R:      500.00
Intersections:  XL:       50.00   YL:      429.96    XR:      650.00   YR:      338.43

Generated failure surface co-ordinates: (20 points)
     50.00     429.96            74.66    406.09             100.89    383.96
128.58    363.69             157.60    345.36
    187.81     329.07           219.06    314.89             251.21    302.88
284.11    293.11             317.60    285.62
    351.53     280.44           385.73    277.61             420.05    277.12
454.32    279.00             488.38    283.21
    522.07     289.76           555.23    298.60             587.71    309.69
619.35    322.99             650.00    338.43
```

RESULTS: Analysis 6
Landfill Area: Cut #1 - 8/26/03

Bishop Simplified Method of Analysis - Circular Failure Surface
----

Factor of Safety: 6.15

Slice Geometry and Properties (56 slices)

Slice	X-Left	Width	Y-Top	Y-Base	Base Angle	Base Mat'l	Base Cohesion	Total Weight	PoreWater Force	Normal Stress	Test Factor
1	50.00	6.29	429.88	426.92	44.1	4	1000.00	2236.20	0.00	198.27	1.39
2	56.29	7.79	429.71	420.10	44.1	4	1000.00	8976.45	2499.20	994.81	1.39
3	64.08	10.58	429.47	411.21	44.1	5	1000.00	23188.09	11397.58	2034.31	1.39
4	74.66	13.57	429.19	400.36	40.1	5	1000.00	46955.83	25489.71	3322.42	1.31
5	88.23	12.66	428.91	389.30	40.1	6	9999.00	62060.16	34944.90	3358.35	1.15
6	100.89	12.52	428.64	379.38	36.2	6	9999.00	79268.32	42094.14	4882.98	1.11
7	113.41	12.52	428.37	370.21	36.2	6	9999.00	95764.16	50725.65	6119.63	1.11
8	125.93	2.65	428.15	364.66	36.2	6	9999.00	22397.62	11860.99	6862.17	1.11
9	128.58	18.21	428.00	357.94	32.3	6	9999.00	171320.03	86409.18	7975.91	1.07
10	146.79	10.81	427.95	348.78	32.3	6	9999.00	116214.71	58388.71	9242.63	1.07
11	157.60	13.15	427.85	341.82	28.3	6	9999.00	154608.75	74490.99	10405.23	1.04
12	170.75	13.15	427.74	334.72	28.3	6	9999.00	168075.23	80858.18	11381.12	1.04
13	183.90	2.63	427.66	330.47	28.3	6	9999.00	35229.59	16936.24	11965.76	1.04
14	186.53	3.28	427.64	328.90	26.0	6	9999.00	44676.76	21020.74	12310.13	1.03
15	189.81	2.66	427.61	327.56	24.4	6	9999.00	36745.16	17064.77	12578.89	1.02
16	192.47	2.94	427.58	326.29	24.4	6	9999.00	41145.60	19105.71	12752.81	1.02
17	195.41	2.85	427.53	324.97	24.4	6	9999.00	40414.45	18766.06	12930.90	1.02
18	198.26	2.60	427.48	323.74	24.4	6	9999.00	37296.19	17318.46	13098.12	1.02
19	200.86	11.63	427.28	320.51	24.4	6	9999.00	172157.69	79992.91	13526.61	1.02
20	212.49	6.57	426.01	316.38	24.4	6	9999.00	100182.19	46956.90	13961.46	1.02
21	219.06	13.72	422.63	312.32	20.5	6	9999.00	211788.84	98871.27	14362.28	1.01
22	232.78	9.93	418.69	307.91	20.5	6	9999.00	154828.19	74271.70	14625.41	1.01
23	242.71	8.50	415.63	304.47	20.5	6	9999.00	133706.88	65454.67	14928.84	1.01
24	251.21	8.98	412.72	301.55	16.5	6	9999.00	141803.64	69136.62	15377.70	1.00
25	260.19	11.96	409.23	298.44	16.5	6	9999.00	189324.91	94403.44	15607.15	1.00
26	272.15	11.96	405.25	294.89	16.5	6	9999.00	189699.67	96983.25	15869.31	1.00
27	284.11	16.75	400.48	291.24	12.6	6	9999.00	264655.06	136966.92	16302.70	0.99
28	300.86	16.75	394.90	287.49	12.6	6	9999.00	262306.03			

										140618.70	16490.22	0.99
29	317.60	16.96	389.30	284.33	8.7	6	9999.00	261782.33		143647.92	16795.91	0.99
30	334.57	16.96	383.65	281.74	8.7	6	9999.00	256302.20		146055.44	16807.16	0.99
31	351.53	13.78	378.53	279.87	4.7	6	9999.00	203227.83		119065.10	16949.08	0.99
32	365.31	10.21	374.54	278.88	4.7	6	9999.00	146504.28		88674.97	16791.44	0.99
33	375.52	10.21	371.14	278.03	4.7	6	9999.00	142597.89		89085.66	16611.05	0.99
34	385.73	17.16	366.59	277.49	0.8	6	9999.00	229330.88		149509.67	16477.60	1.00
35	402.89	17.16	360.88	277.24	0.8	6	9999.00	215257.50		149401.00	15993.35	1.00
36	420.05	12.06	356.02	277.45	-3.1	6	9999.00	142126.84		104778.58	15708.87	1.01
37	432.11	12.06	352.01	278.11	-3.1	6	9999.00	133675.19		104100.29	15239.77	1.01
38	444.17	10.15	348.94	278.72	-3.1	6	9999.00	106895.99		87078.13	14863.18	1.01
39	454.32	11.29	346.69	279.70	-7.1	6	9999.00	113470.41		96627.59	14688.09	1.03
40	465.61	11.38	344.67	281.10	-7.1	6	9999.00	108556.55		96258.48	14279.98	1.03
41	476.99	11.38	342.99	282.51	-7.1	6	9999.00	103279.80		95086.30	13901.54	1.03
42	488.38	7.54	341.54	283.95	-11.0	6	9999.00	65149.71		62898.73	13723.51	1.05
43	495.92	6.97	340.43	285.36	-11.0	6	9999.00	57584.67		57445.03	13398.98	1.05
44	502.89	19.18	339.66	287.90	-11.0	6	9999.00	148923.73		152602.59	12819.77	1.05
45	522.07	2.52	339.28	290.10	-14.9	6	9999.00	18600.40		19750.06	12525.66	1.08
46	524.59	11.74	339.01	292.00	-14.9	6	9999.00	82791.17		89685.43	12139.69	1.08
47	536.33	11.74	338.59	295.13	-14.9	6	9999.00	76540.02		85936.16	11506.05	1.08
48	548.07	4.01	338.29	297.23	-14.9	6	9999.00	24700.42		28494.06	11079.35	1.08
49	552.08	3.15	338.14	298.18	-14.9	6	9999.00	18885.52		22080.27	10884.28	1.08
50	555.23	17.47	337.76	301.58	-18.9	6	9999.00	94801.89		119254.67	10403.73	1.12
51	572.70	15.01	337.54	307.13	-18.9	6	9999.00	68446.47		94476.10	9365.37	1.12
52	587.71	15.82	337.73	313.02	-22.8	6	9999.00	58644.83		93366.47	8498.19	1.16
53	603.53	15.82	337.93	319.67	-22.8	6	9999.00	43348.17		83628.61	7324.57	1.16
54	619.35	14.68	338.13	326.69	-26.7	6	9999.00	25191.49		70469.55	6271.95	1.22
55	634.02	6.82	338.27	332.10	-26.7	6	9999.00	5848.13		29366.12	5253.81	1.22
56	640.84	9.16	338.37	336.12	-26.7	5	1000.00	2469.55		36080.16	3730.16	1.12