

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 16-39

***ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER
RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING
AND SOLIDS PROCESSING FACILITIES DURING 2015***

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ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING
FACILITIES DURING 2015

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LIST OF ACRONYMS

| | |
|------------------|--|
| District | Metropolitan Water Reclamation District of Greater Chicago |
| H ₂ S | hydrogen sulfide |
| HASMA | Harlem Avenue Solids Management Area |
| LASMA | Lawndale Avenue Solids Management Area |
| M&O | Maintenance and Operations |
| M&R | Monitoring and Research |
| ppbv | parts per billion by volume |
| RASMA | Ridgeland Avenue Solids Management Area |
| SDA | solids drying area |
| SDS | solids drying site |
| SPS | solids processing site |
| WRP | water reclamation plant |

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DISCLAIMER

Mention of proprietary equipment in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY

The Metropolitan Water Reclamation District of Greater Chicago (District) has maintained a program of monitoring odors at one solids drying site (SDS), one solids processing site (SPS), and five solids drying areas (SDAs) since 1990. Both Monitoring and Research (M&R) Department and Maintenance and Operations (M&O) Department personnel made subjective observations regarding the type and intensity of any odor perceived during odor monitors. The M&R Department staff recorded instantaneous hydrogen sulfide (H₂S) measurements using a handheld monitor at each monitoring site. The number of locations at each facility varied from 4 to 17. The frequency of monitoring varied from one to two days per week at the SDS, SDAs, and SPS. Each odor observation was characterized as very strong, strong, easily noticeable, faint, very faint, or no odor.

During 2015, two very strong odors were observed at the Vulcan Construction Site (CS) and Marathon West. At all the areas that were monitored, the observations were characterized as faint to no odor from 74 to 97 percent of the time.

At each of the SDS, SDAs, and SPS, there are specific locations which have noticeable odors. A summary of locations which had occasional strong or very strong odors is presented in Table 1.

The H₂S levels generally followed a pattern similar to the odor observations with occasional high values. The average level of H₂S ranged from 2.8 to 15.2 parts per billion by volume (ppbv) at the SDS, SDAs, and SPS.

TABLE 1: STRONG AND VERY STRONG ODOR OBSERVATIONS – 2015

| Facility (Station Number) | Number of Strong Odor Observations | Number of Very Strong Odor Observations | Total Number of Observations |
|--|------------------------------------|---|------------------------------|
| Calumet WRP SDS | | | |
| Drying Cell #1 SW (14) | 1 | | |
| Drying Cell #8 NW (16) | 1 | | |
| Drying Cell #1 SE (19) | 2 | | |
| Drying Cell #1 at Gate (20) | 1 | | |
| West Drying Cell #4 (21) | <u>1</u> | <u>0</u> | |
| | Total 6 | 0 | 679 |
| HASMA, Marathon, and Vulcan SDAs, and LASMA SPS | | | |
| HASMA (1) | 1 | | |
| HASMA Center (1.5) | 2 | | |
| Vulcan CS (4) | 2 | 1 | |
| LASMA Lagoon #16 (7) | 1 | | |
| LASMA Lagoon #24 (8) | 2 | | |
| Marathon (15) | 1 | | |
| Marathon West (16) | <u>1</u> | <u>1</u> | |
| | Total 10 | 2 | 519 |
| RASMA SDA¹ | | | |
| | <u>0</u> | <u>0</u> | |
| | Total 0 | 0 | 112 |
| Stony Island SDA | | | |
| | <u>0</u> | <u>0</u> | |
| | Total 0 | 0 | 108 |

¹RASMA was not used as a biosolids drying site during 2015.

DS = Drop shaft.

HASMA = Harlem Avenue Solids Management Area.

LASMA = Lawndale Avenue Solids Management Area.

RASMA = Ridgeland Avenue Solids Management Area.

CS = Construction Site.

SDA = Solids Drying Area.

SDS = Solids Drying Site.

SPS = Solids Processing Site.

INTRODUCTION

The M&R Department, in conjunction with the M&O Department, has been conducting an odor monitoring program at various District solids drying and processing facilities for the past 26 years. The program was initiated by the M&R Department to monitor the solids processing and drying sites at the Lawndale Avenue Solids Management Area (LASMA), Harlem Avenue Solids Management Area (HASMA), Marathon, and Vulcan CS in 1990, and was expanded to the Calumet Water Reclamation Plant (WRP) SDS in 1992 and to the Ridgeland Avenue Solids Management Area (RASMA) and Stony Island SDA in 2001 as part of the District's Solids Drying Area operating permits.

At each location, a similar procedure is followed to monitor odors. M&R Department personnel, and at some facilities M&O Department personnel, visit various locations at each facility on a regular basis. The odor monitoring personnel make subjective observations regarding the character and intensity of odors at each of the stations. The odor intensities are ranked on a scale of no odor, very faint, faint, easily noticeable, strong, and very strong. In addition to the subjective odor measurements, the ambient air is sampled and analyzed for H₂S concentration using a Jerome Model 631-X H₂S analyzer.

The objective of this program is to collect and maintain a database of odor levels within and around each solids drying and processing facility. This data can be used to study the trends in odor levels associated with solids drying and processing operations and to correlate odor levels to conditions related to solids drying and processing operations or changing conditions within the facility.

A summary of the odor monitoring program for the solids drying and processing facilities is presented in Table 2. This table includes a brief description of the program with regard to when the monitoring commenced at each facility, the number of monitoring locations, the frequency of the monitoring, who conducts the monitoring, if H₂S is measured by the department personnel, and the number of odor complaints.

Maps showing the odor monitoring locations are presented in Appendix AI.

The number of monitoring locations at each facility varies (4 to 17) depending upon the size of the facility and the history of odor episodes at those facilities. The solids drying and processing facilities are monitored one or two days per week.

In 2015, odor complaints were received only at the Calumet WRP SDS. The two complaints received were both verified.

This report presents the odor monitoring data for the year 2015. The odor monitoring data in terms of frequency of occurrence, locations of possible odor sources, and H₂S levels have been reviewed and summarized.

TABLE 2: ODOR MONITORING PROGRAM FOR 2015

| Facility | Number of Locations Monitored | Year Began | Months of Year | Days per Week | Departments Participating | H ₂ S Measured | Number of Odor Complaints | Number of Complaints Verified |
|---|-------------------------------|------------|----------------|---------------|---------------------------|---------------------------|---------------------------|-------------------------------|
| Calumet WRP SDS | 9 | 1992 | 12 | 1 2 | M&R M&O | Yes No | 2 | 2 |
| HASMA, Marathon, Vulcan SDAs, and LASMA SPS | 17 | 1990 | 12 | 1 to 2 | M&R | Yes | 0 | 0 |
| RASMA SDA | 4 | 2001 | 12 | 1 to 2 | M&R | Yes | 0 | 0 |
| Stony Island SDA | 4 | 2001 | 12 | 1 | M&R | Yes | 0 | 0 |

Note: HASMA = Harlem Avenue Solids Management Area.
 LASMA = Lawndale Avenue Solids Management Area.
 RASMA = Ridgeland Avenue Solids Management Area.
 SDA = Solids Drying Area.
 SDS = Solids Drying Site.
 SPS = Solids Processing Site.
 M&R = Monitoring and Research Department.
 M&O = Maintenance and Operations Department.

RESULTS OF ODOR MONITORING AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES IN 2015

The results of the various odor monitoring programs at each of the monitored sites for 2015 are summarized in Table 3. The results have been divided into two major groups: significant odors, which include the very strong, strong, and easily noticeable odors, and insignificant odors, which are either faint, very faint, or no odors.

A general observation drawn from the table is that at the Calumet WRP SDS, where both M&R and M&O Department personnel conducted odor monitoring, the M&O Department personnel show a lower percentage of odors detected. This may be due to the fact that the M&O Department personnel are exposed to the specific area on a daily basis as compared to the M&R Department personnel, which can result in olfactory desensitization. Thus, they may not differentiate especially well between significant and insignificant odors.

Calumet Water Reclamation Plant Solids Drying Site

The Calumet WRP SDS consists of the East SDA, located east of the Calumet WRP, and the West SDA, located west of the Calumet WRP. The occurrence of strong odors at the drying areas, which also includes the non-operational centrifuge building located at the East SDA, was infrequent. The majority of the observations were described as faint to no odor. No very strong odors were detected in 2015. Strong odors were observed at the SDS in March, June, July, October, and November. Strong odors were observed mostly under three percent of the time on a monthly basis. Easily noticeable odors occurred between 0 and 23 percent of the time on a monthly basis throughout the various locations. Figure 1 presents the monthly frequency of occurrence of the easily noticeable, strong, and very strong odor observations. The easily noticeable odors were highest during June 2015.

The average H₂S levels were between 3.2 and 8.3 ppbv, as shown in Table 4. The highest value observed (57 ppbv) was at East Drying Cell #1 SE.

Two odor complaints were received with regard to the Calumet WRP SDS during 2015.

Harlem Avenue Solids Management Area, Vulcan Solids Drying Area, Marathon Solids Drying Area, and Lawndale Avenue Solids Management Area Solids Processing Site

The HASMA facility consists of HASMA, Vulcan SDA, LASMA, and Marathon, located near the intersection of South Harlem Avenue and the Chicago Sanitary and Ship Canal, north bank of the Canal. The HASMA, Vulcan SDA, and Marathon SDAs and the LASMA SPS had 76 percent of the total observations characterized as faint to no odor. There were two very strong and ten strong odor observations out of 519 total observations. The very strong and strong odor observations were spread among the various locations (HASMA, HASMA Center, Vulcan CS, LASMA Lagoon 16, LASMA Lagoon 24, Marathon, and Marathon West) depending upon the activity at the time.

TABLE 3: ODOR MONITORING RESULTS FOR 2015

| Facility | Departments Participating | Total Number of Observations | Number of Observations Significant Odors Detected | | | Number Insignificant Odors ¹ | Percent Insignificant Odors |
|---|---------------------------|------------------------------|---|--------|-------------------|---|-----------------------------|
| | | | Very Strong | Strong | Easily Noticeable | | |
| Calumet WRP SDS | M&R | 239 | 0 | 6 | 56 | 177 | 74% |
| | M&O | 440 | 0 | 0 | 14 | 426 | 97% |
| HASMA, Marathon, Vulcan SDAs, and LASMA SPS | M&R | 519 | 2 | 10 | 114 | 393 | 76% |
| RASMA SDA ² | M&R | 112 | 0 | 0 | 14 | 98 | 88% |
| Stony Island SDA | M&R | 108 | 0 | 0 | 5 | 103 | 95% |

Note: HASMA = Harlem Avenue Solids Management Area.
 LASMA = Lawndale Avenue Solids Management Area.
 RASMA = Ridgeland Avenue Solids Management Area.
 SDA = Solids Drying Area.
 SDS = Solids Drying Site.
 SPS = Solids Processing Site.
 M&R = Monitoring and Research Department.
 M&O = Maintenance and Operations Department.

¹Insignificant odors are all observations of faint, very faint, or no odor.

²RASMA SDA was not used as a biosolids drying site during 2015.

FIGURE 1: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE CALUMET SOLIDS DRYING SITE – 2015

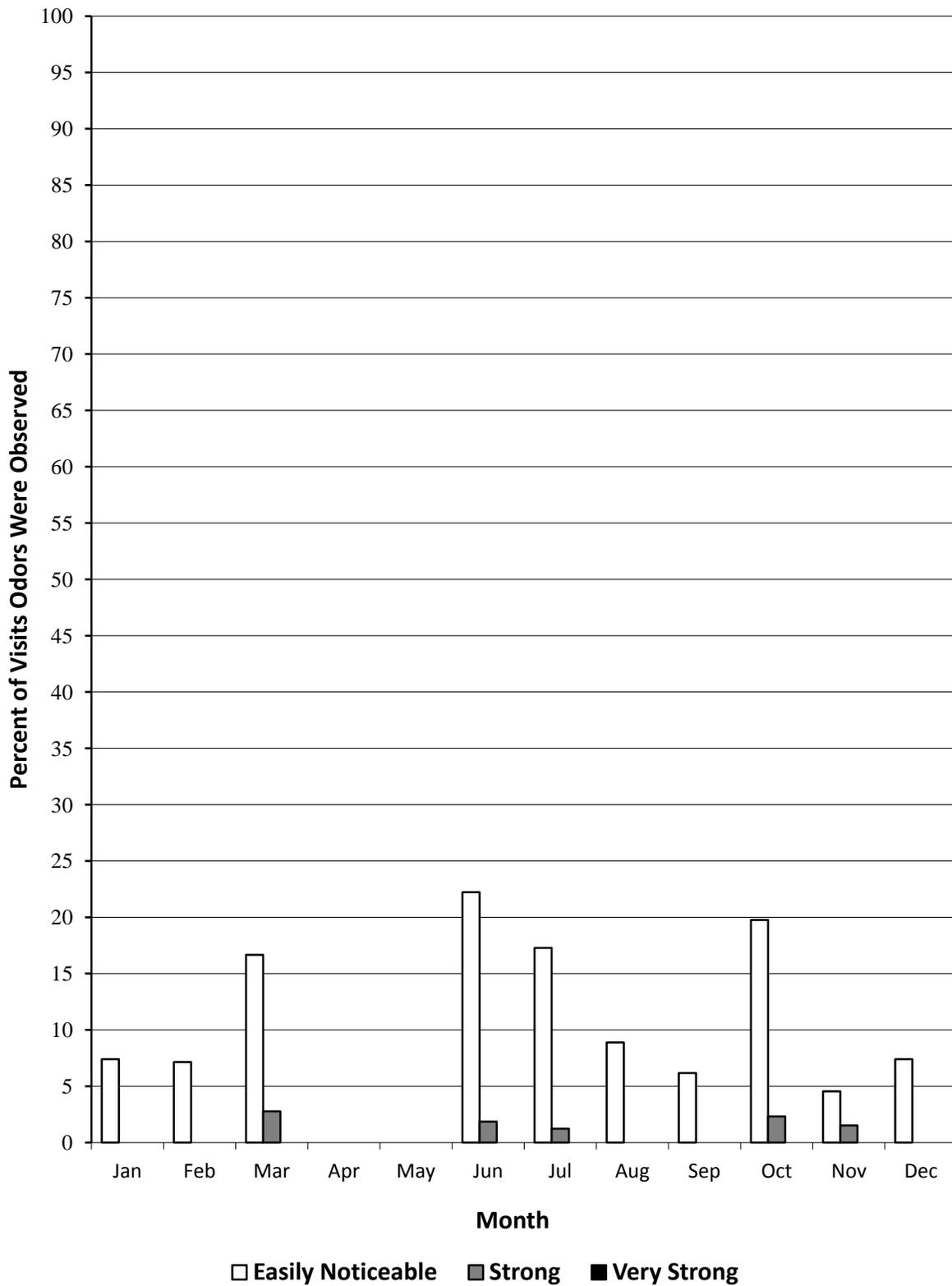


TABLE 4: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITE – 2015

| Location ² | Hydrogen Sulfide, ppbv ¹ | | |
|---------------------------------|-------------------------------------|----------------------|---------|
| | Mean ³ | Minimum ⁴ | Maximum |
| East Drying Cell #1 SW (14) | 7.0 | 0 | 31 |
| Hopper Building (15) | 4.6 | 0 | 8 |
| East Drying Cell #8 NW (16) | 4.5 | 0 | 14 |
| East Drying Cell #8 NE (17) | 4.4 | 0 | 12 |
| Truck Scale/Centrifuge (18) | 4.9 | 0 | 9 |
| East Drying Cell #1 SE (19) | 8.3 | 0 | 57 |
| West Drying Cell #1 @ Gate (20) | 4.9 | 0 | 19 |
| West Drying Cell #4 (21) | 4.5 | 0 | 9 |
| Bituminous Road @ Gate (22) | 3.2 | 0 | 9 |

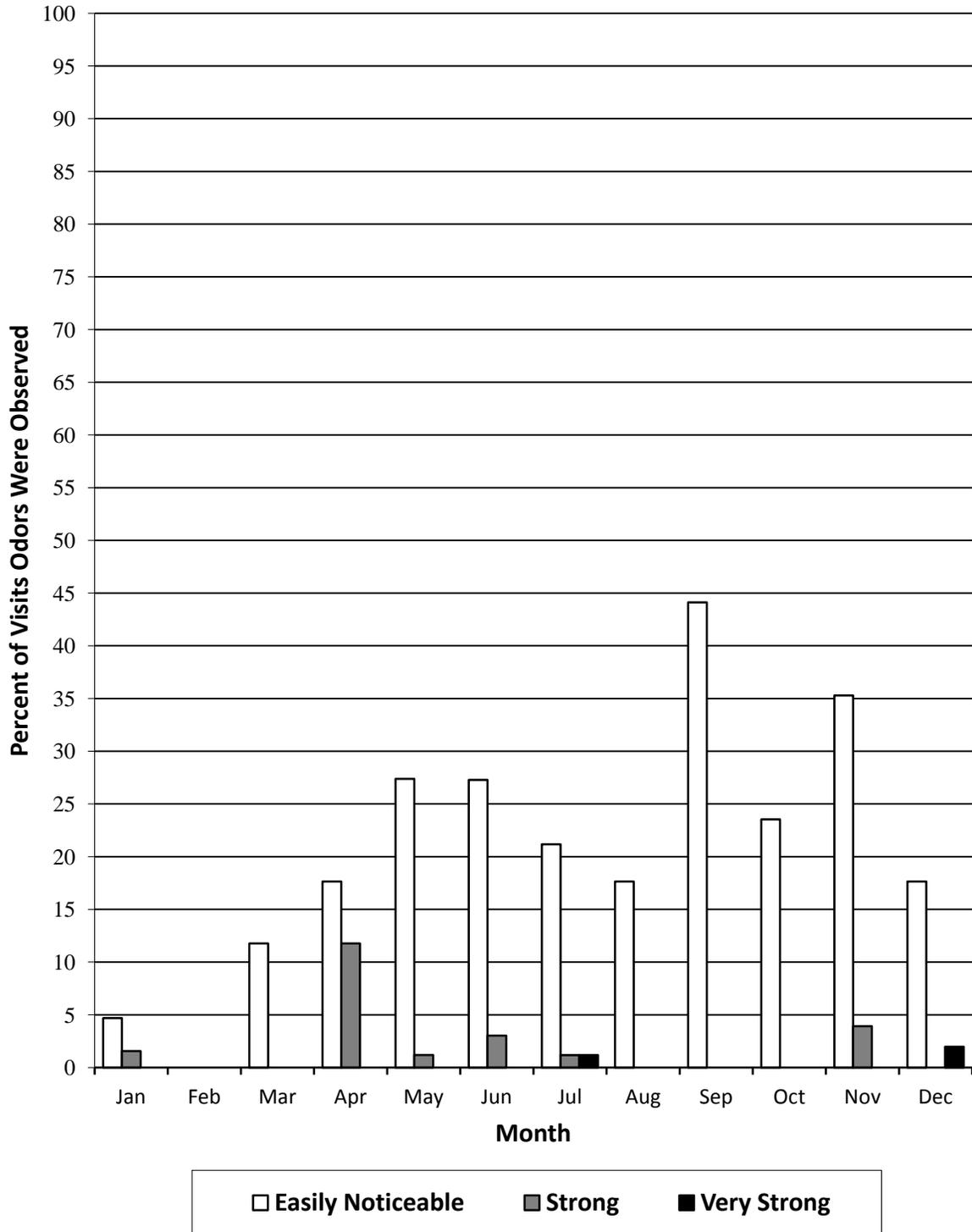
¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-1](#).

³Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the calculation.

⁴Minimum values are based on actual values displayed by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the minimum determination.

FIGURE 2: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE HARLEM AVENUE SOLID MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2015



The percentage of observations at which easily noticeable, strong, and very strong odors were observed was plotted by month and is presented in [Figure 2](#). The frequency of observed odors is generally highest during the spring through the fall months (April through November) when solids processing and drying are being carried out. The easily noticeable odor observations ranged from 5 to 44 percent during this time period.

The average H₂S levels at the various locations around these SDAs and SPS ranged from 4.0 to 15.2 ppbv as shown in [Table 5](#). The highest value observed (115 ppbv) was at LASMA Lagoon 16.

No odor complaints were received in 2015 with regard to these solids drying and processing facilities.

Ridgeland Avenue Solids Management Area

The RASMA facility is located near the intersection of South Ridgeland Avenue and the Little Calumet River, north bank of the river. Although the Ridgeland Avenue Solids Management Area was not used as a biosolids drying site during 2015, it was used as a landscape waste composting site, which led to odor observances in the area. A monthly summary of the observations at RASMA of easily noticeable, strong, and very strong odors during 2015 is presented in [Figure 3](#), expressed as frequency of occurrence. The highest frequency of odors was observed in February 2015. RASMA had 88 percent of the observations characterized as faint to no odor, with no strong odor observations in 2015.

The average H₂S levels around RASMA, as shown in [Table 6](#), varied from 2.8 to 3.3 ppbv. The highest value observed (11 ppbv) was at South of Cell 5W.

No odor complaints were received in 2015 with regard to RASMA.

Stony Island Solids Drying Area

The Stony Island SDA is located near the intersection of South Stony Island Avenue and the Calumet River, north bank of the river. The Stony Island SDA had 95 percent of the observations characterized as faint to no odor, with no strong odor observations in 2015.

A monthly summary of the observations at the Stony Island SDA of easily noticeable, strong, and very strong odors during 2015 is presented in [Figure 4](#) expressed as frequency of occurrence. The highest frequency of odors (2.0 percent) was observed in July 2015.

The average H₂S levels around the Stony Island SDA, as shown in [Table 6](#), varied from 3.9 to 4.2 ppbv. The highest value observed (11 ppbv) was at South End Cells 4 and 7.

No odor complaints were received in 2015 with regard to the Stony Island SDA.

TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2015

| Location | Hydrogen Sulfide, ppbv ¹ | | |
|-------------------------------|-------------------------------------|----------------------|---------|
| | Mean ² | Minimum ³ | Maximum |
| HASMA (1) ⁴ | 4.0 | 0 | 11 |
| HASMA Center (1.5) | 5.0 | 0 | 26 |
| Vulcan CS South (2) | 4.3 | 0 | 21 |
| Vulcan CS North (3) | 7.2 | 0 | 39 |
| Vulcan CS TARP Drop Shaft (4) | 4.7 | 0 | 12 |
| Vulcan CS TARP Well (5) | 6.6 | 0 | 57 |
| LASMA Lagoon 1 (6) | 5.0 | 0 | 15 |
| LASMA Lagoon 16 (7) | 6.7 | 0 | 115 |
| LASMA Lagoon 24 (8) | 15.2 | 0 | 93 |
| LASMA Lagoon 30 (9) | 7.9 | 0 | 41 |
| LASMA Cell 1E-1W (10) | 7.8 | 0 | 61 |
| LASMA Cell 2E-2W (11) | 6.1 | 0 | 20 |
| LASMA Cell 3E-3W (12) | 6.3 | 0 | 31 |
| LASMA Cell 4E-4W (13) | 6.1 | 0 | 23 |
| LASMA Cell 5E-5W (14) | 6.5 | 0 | 25 |

TABLE 5 (Continued): HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN CONSTRUCTION SITE, MARATHON SOLIDS DRYING AREAS, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2015

| Location | Hydrogen Sulfide, ppbv ¹ | | |
|--------------------|-------------------------------------|----------------------|---------|
| | Mean ² | Minimum ³ | Maximum |
| Marathon (15) | 7.0 | 0 | 35 |
| Marathon West (16) | 8.7 | 0 | 57 |

Note: HASMA = Harlem Avenue Solids Management Area.
 LASMA = Lawnsdale Avenue Solids Management Area.
 CS = Construction Site.
 TARP = Tunnel and Reservoir Plan

¹ppbv = Parts per billion by volume.

²Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the calculation.

³Minimum values are based on actual values displayed by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the minimum determination.

⁴Numbers in parentheses correspond to Station numbers in [Figure AI-2](#).

FIGURE 3: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE RIDGELAND AVENUE SOLIDS MANAGEMENT AREA – 2015

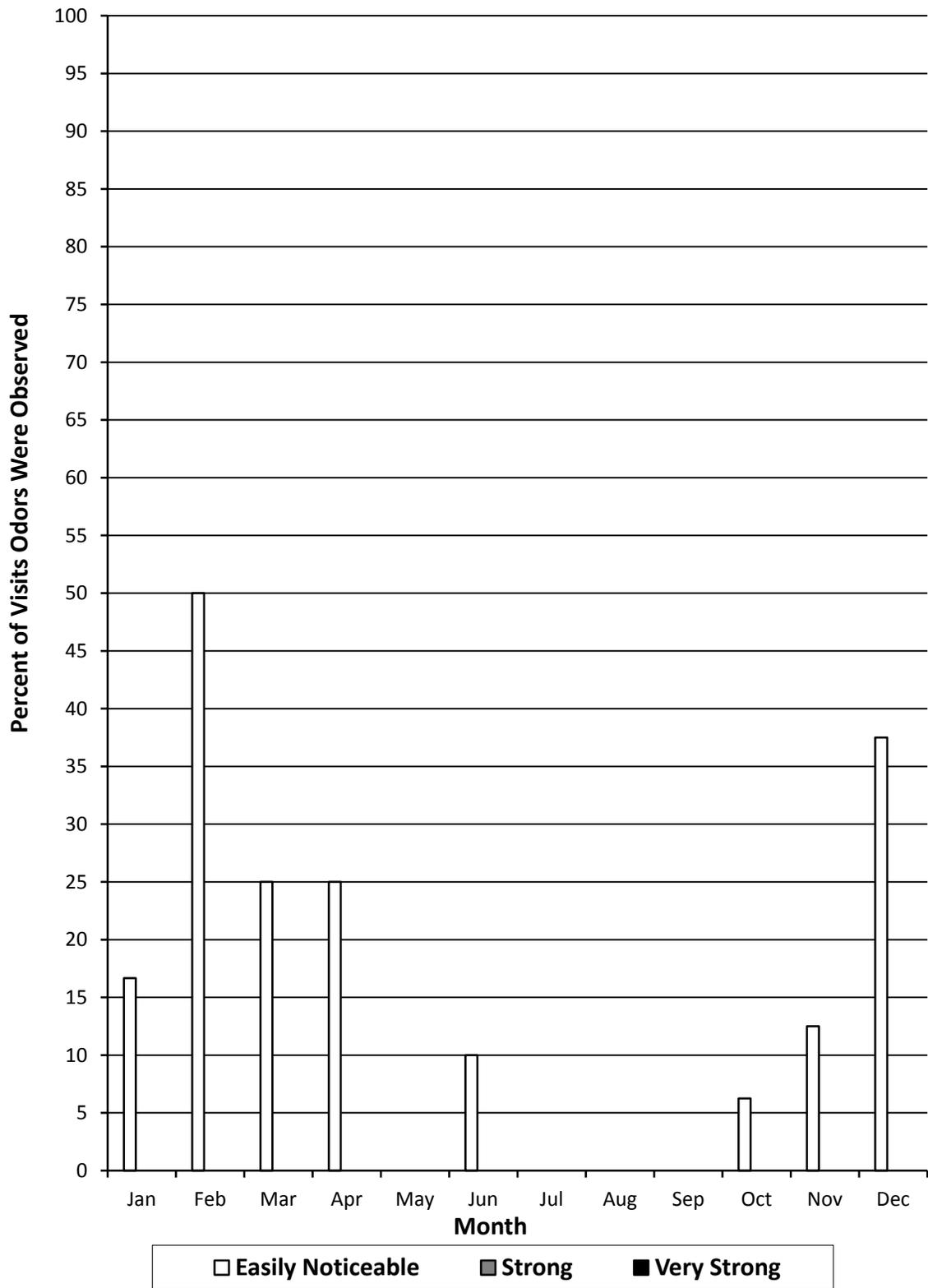


TABLE 6: HYDROGEN SULFIDE READINGS AT THE RIDGELAND AVENUE SOLIDS MANAGEMENT AREA AND STONY ISLAND SOLIDS DRYING AREA – 2015

| Location | Hydrogen Sulfide, ppbv ¹ | | |
|------------------------------------|-------------------------------------|----------------------|---------|
| | Mean ² | Minimum ³ | Maximum |
| RASMA | | | |
| SW Parking Area (1) ⁴ | 3.2 | 0 | 10 |
| North of Cell 2W (2) | 2.8 | 0 | 9 |
| NE Corner Cell 5E (3) | 3.3 | 0 | 9 |
| South of Cell 5 (4) | 3.0 | 0 | 11 |
| Stony Island SDA | | | |
| Entrance 122nd St (1) ⁵ | 4.2 | 0 | 9 |
| NE Corner Cell 5 (2) | 4.2 | 0 | 9 |
| South End Cells 4 & 7 (3) | 4.1 | 0 | 11 |
| West Side of Cell 3 (4) | 3.9 | 0 | 10 |

¹ppbv = Parts per billion by volume.

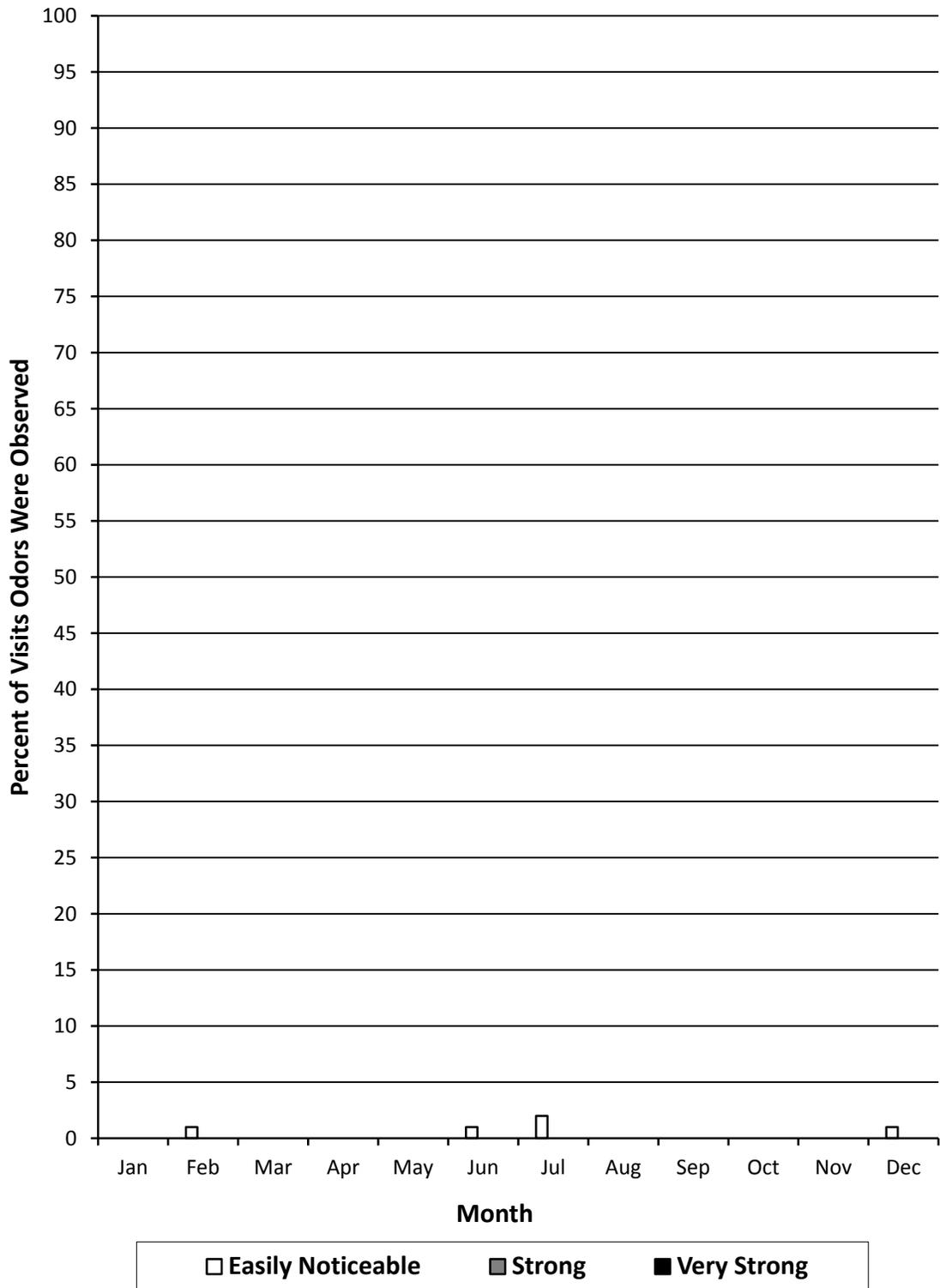
²Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the calculation.

³Minimum values are based on actual values displayed by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the minimum determination.

⁴Numbers in parentheses correspond to Station numbers in [Figure AI-3](#).

⁵Numbers in parentheses correspond to Station numbers in [Figure AI-4](#).

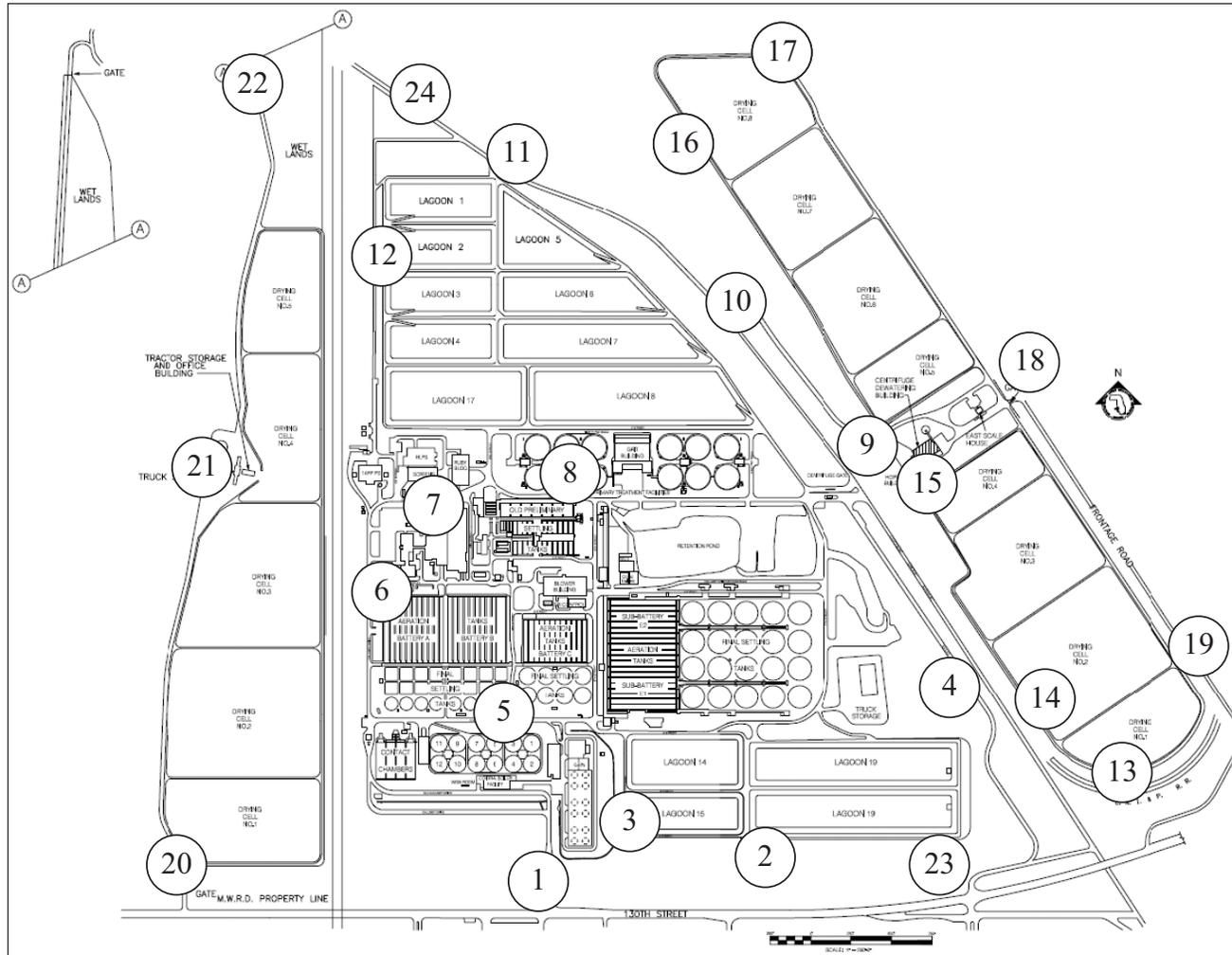
FIGURE 4: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE STONY ISLAND DRYING AREA – 2015



APPENDIX AI

LOCATION OF ODOR MONITORING STATIONS AT THE METROPOLITAN WATER
RECLAMATION DISTRICT OF GREATER CHICAGO SOLIDS DRYING AREAS AND
SOLIDS PROCESSING SITES

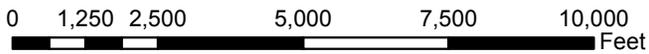
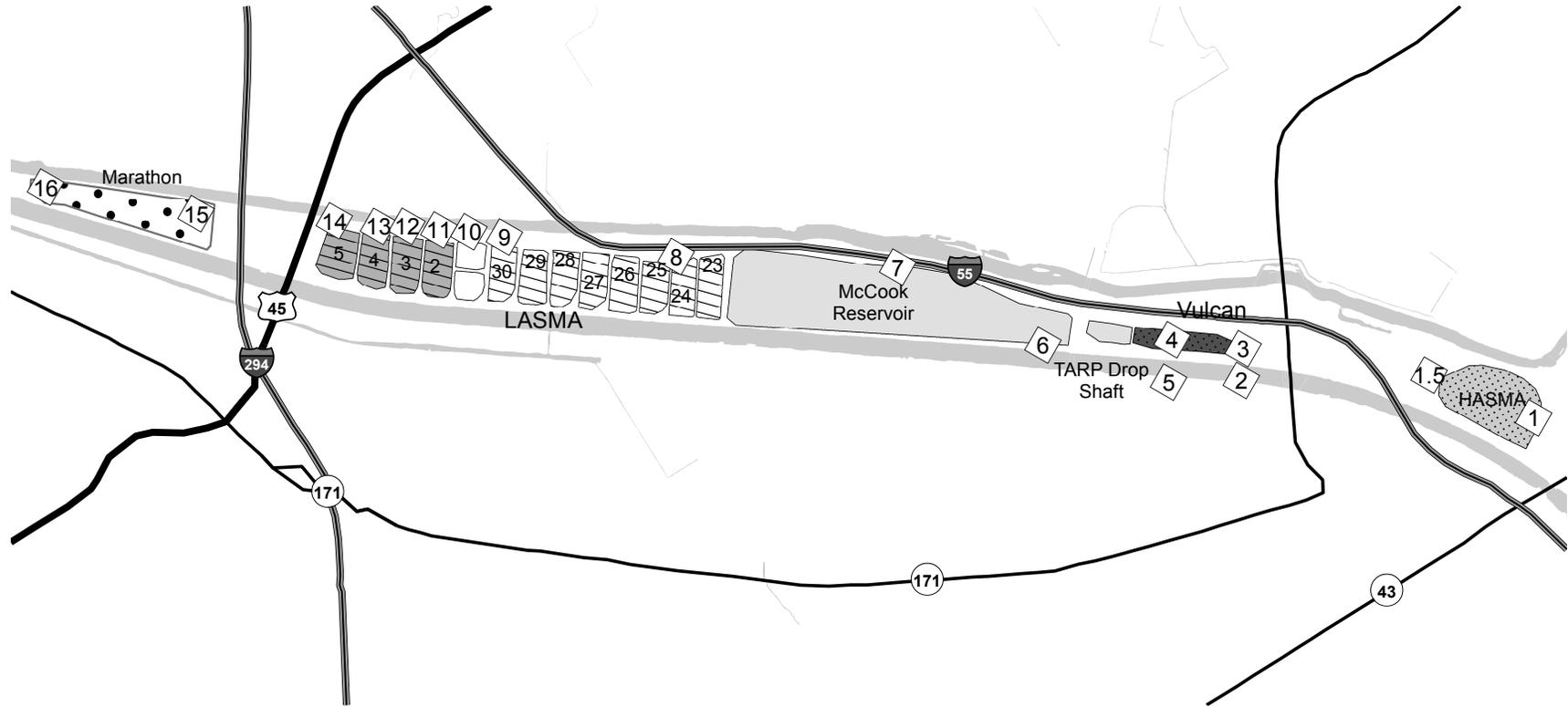
FIGURE AI-1: CALUMET WATER RECLAMATION PLANT AND CALUMET WATER RECLAMATION PLANT SOLIDS DRYING AREAS*



*Numbered circles (14–22) indicate odor monitoring locations for Solids Drying Areas.

FIGURE AI-2: HARLEM AVENUE SOLID MANAGEMENT AREA, VULCAN AND MARATHON SOLID DRYING AREAS, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLID PROCESSING SITE*

AI-2

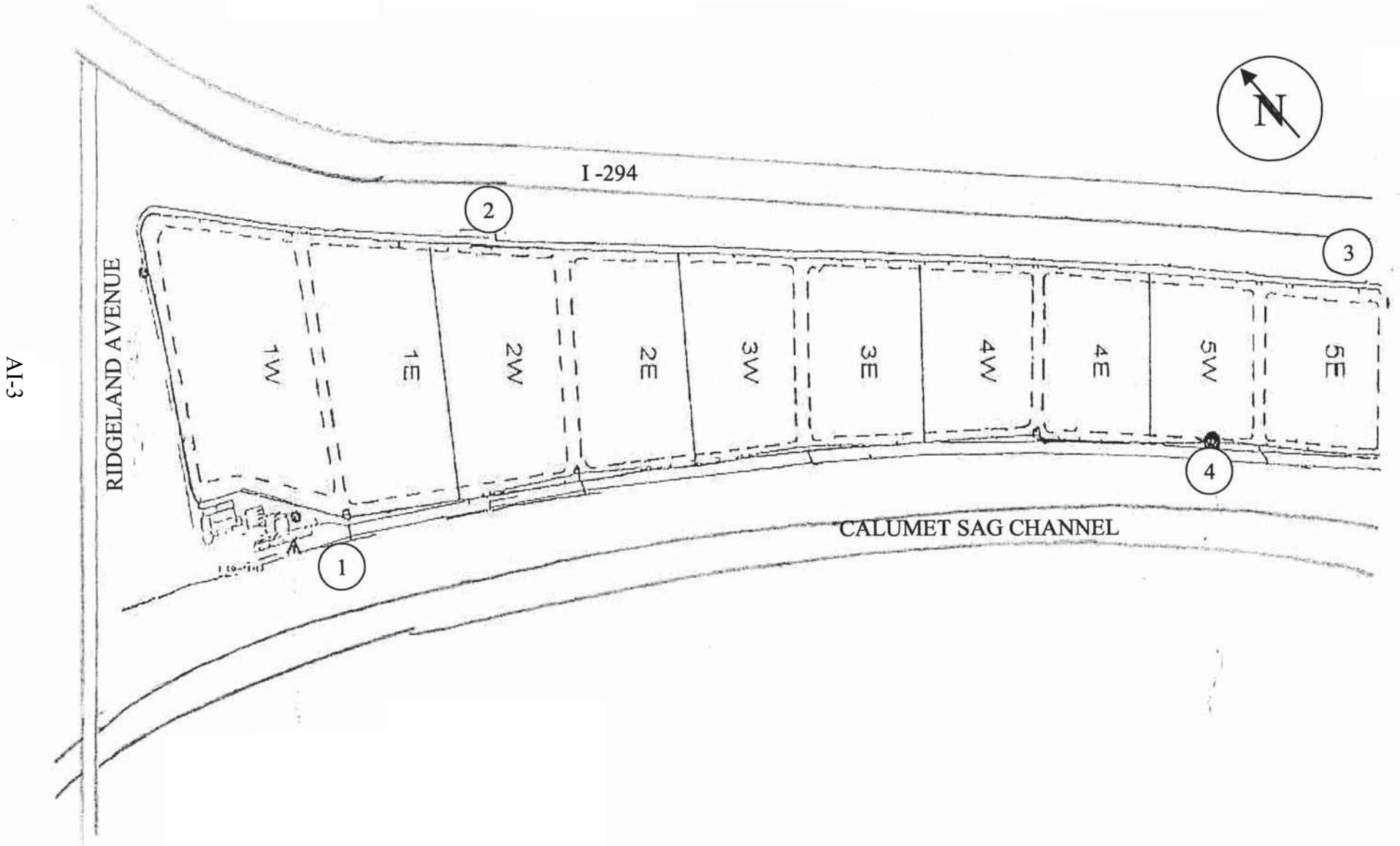


Legend

-  HASMA Drying Cells
-  LASMA Desilting
-  LASMA Drying Cells
-  LASMA Lagoon
-  Marathon Drying Cells
-  McCook Reservoir
-  TARP Drop Shaft
-  Vulcan Drying Cells
-  Monitoring Location

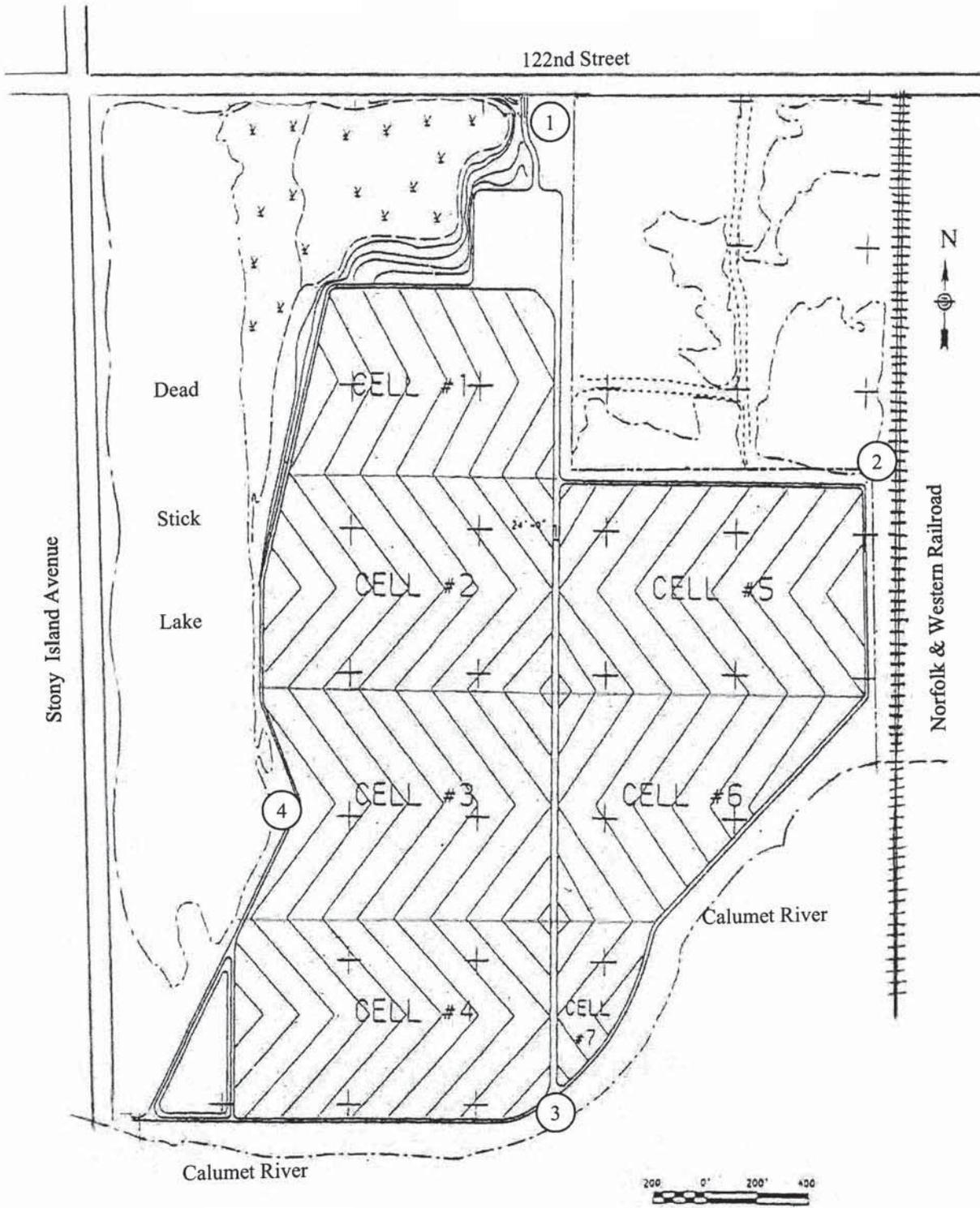
*Numbers indicate odor monitoring locations.

FIGURE AI-3: RIDGELAND AVENUE SOLIDS MANAGEMENT AREA SOLIDS DRYING AREA*



*Numbered circles indicate odor monitoring locations.

FIGURE AI-4: STONY ISLAND SOLIDS DRYING AREA*



*Numbered circles indicate odor monitoring locations.