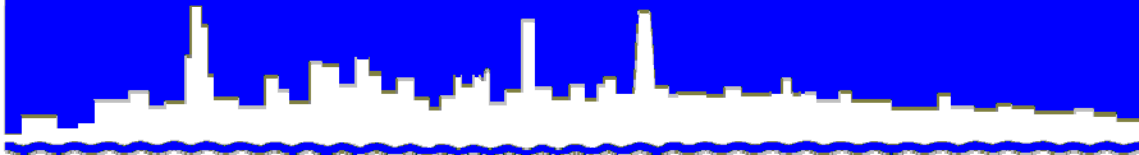


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 08-40

*ODOR MONITORING PROGRAM AT METROPOLITAN WATER
RECLAMATION DISTRICT FACILITIES DURING 2007*

August 2008

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ODOR MONITORING PROGRAM AT METROPOLITAN WATER RECLAMATION
DISTRICT FACILITIES DURING 2007

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ACKNOWLEDGMENTS

The authors wish to acknowledge the assistance of the Maintenance and Operations Department personnel in carrying out odor monitoring activities at various facilities.

The efforts of the laboratory technicians, Messrs. Robert Bodnar, Marc Byrnes, Shawn Kowalski, and Christopher Swies in the Wastewater Treatment Process Research Section who carried out the odor monitoring surveys and maintained the database are greatly appreciated.

Thanks are also due Ms. Laura Franklin, Principal Office Support Specialist, for her diligence in typing this report.

DISCLAIMER

Mention of proprietary equipment and chemicals 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) maintains a program of monitoring odors at five water reclamation plants (WRPs), one solids drying site, one solids processing site (SPS), and four solids drying areas (SDAs). This program started in 1990. Both Research and Development (R&D) Department and Maintenance and Operations (M&O) Department personnel make subjective observations regarding the type and intensity of any odor perceived. In 2007 the program included five of the District WRPs and all of the SDAs. The R&D Department staff records instantaneous hydrogen sulfide (H₂S) measurements using a hand-held monitor at each monitoring site. The number of locations at each facility varies from 4 to 19. The frequency of monitoring varies from one day per week at the Ridgeland SDA to seven days per week during the summer months at the Kirie WRP. Each odor observation is characterized as very strong, strong, easily noticeable, faint, very faint, or no odor.

During 2007 six very strong odors, out of 5,026 observations, were observed at the Stickney WRP, one very strong odor out of 9,501 was observed at the Kirie WRP, one very strong odor was observed at the Harlem Avenue Solids Management Area (HASMA), Marathon, and Vulcan SDA and the Lawndale Avenue Solids Management Area (LASMA). There were no very strong odors observed at the North Side, Egan, or Calumet WRPs or the other SDAs and SPSs. The majority of the observations at the five WRPs were characterized as faint to no odor from 55 to 99 percent of the time. At the six SDAs and sites, observations were characterized as faint to no odor from 57 to 99 percent of the time.

At each of the WRPs there are specific locations which have noticeable odors. A summary of the locations which had occasional strong odors is presented in [Table 1](#). For example, at the Calumet WRP the area where most strong odors were observed is in the vicinity of the Sludge Concentration Building. At the Stickney WRP the areas where most strong odors were observed are the preliminary tanks, Imhoff tanks, post centrifuge building, and sludge concentration tanks. While strong odors are generally infrequent, it shows there is the potential for odors from these areas. Strong odors occurring along Laramie Avenue were identified as typical odors coming from the Koppers Industries, Inc. plant, which is just east of the Stickney WRP.

The H₂S levels generally followed a pattern similar to the odor observations with occasional high values. It appears that the average level of H₂S is between 4 and 138 ppbv (parts per billion by volume) at the WRPs. At the Stickney WRP the average H₂S levels along the periphery of the plant were 7 to 25 ppbv and 8 to 86 ppbv at the majority of locations within the WRP.

TABLE 1: STRONG ODOR OBSERVATIONS - 2007

Facility	Number of Strong Odor Observations	Total Number of Observations
Calumet WRP		
Plant Entrance	6	
Lagoon #16 SW Corner	4	
Sludge Concentration Building	59	
Lagoon #16 NE Corner	10	
Sludge Digester Tanks	4	
Preliminary Tanks	16	
Gate Near Lagoon #9	3	
Lagoons #7 and #8	2	
Ellis Ave. & 130th St.	<u>1</u>	
	Total 105	3,010
Calumet SDS		
Drying Cell #1 SW	1	
Drying Cell #8 NW	2	
Truck Scale/Centrifuge	3	
Drying Cell #1 at Gate	1	
Drying Cell #1 SE	4	
West Drying Cell #4	<u>1</u>	
	Total 12	1,970
Egan WRP		
Waste Gas Burner	<u>1</u>	
	Total 1	341
Kirie WRP		
Airlift A1	2	
Airlift A2	<u>1</u>	
	Total 3	9,511

TABLE 1 (Continued): STRONG ODOR OBSERVATIONS - 2007

Facility	Number of Strong Odor Observations	Total Number of Observations
North Side WRP		
Channel Tide Gate	2	
Final Tank Battery D3	2	
Gallery Bldg. Battery D Mix Channel	1	
Main St. & Avenue E	1	
Weir Preliminary Tank #10	2	
Weir Rect. Preliminary Tanks	3	
Main St. Sludge Conc. Tanks	<u>4</u>	
	Total 15	625
Stickney WRP		
Imhoff Tanks*	36	
Digesters 6th Ave. & B St.	2	
Centrifuges (Pre)	11	
Centrifuges (Post)	21	
Sludge Concentration Tanks*	19	
Preliminary Tanks**	85	
39th St. & Central Ave.	3	
39th St. Digesters @ 57th Ave.	1	
Laramie Ave. & 40th St.*	17	
Laramie Ave. & 39th St.	<u>9</u>	
	Total 204	5,026
HASMA, Marathon, Vulcan SDAs, and LASMA SPS***		
HASMA	2	
Vulcan South	1	
Vulcan North	5	
Vulcan CS	9	
Lagoon #1	1	
Lagoon #24	1	
Lagoon #30	4	
LASMA Drying Cells***	16	
Marathon	2	
Marathon West	<u>6</u>	
	Total 47	2,174

TABLE 1 (Continued): STRONG ODOR OBSERVATIONS - 2007

Facility	Number of Strong Odor Observations	Total Number of Observations
RASMA SDA		
South of Cell 5W	$\begin{array}{r} 1 \\ \hline \text{Total } 1 \end{array}$	183
Stony Island SDA		
Entrance @ 22nd St.	1	
NE Corner Cell #5	6	
South End Cells #4 and #7	3	
	$\begin{array}{r} 10 \\ \hline \text{Total } 10 \end{array}$	333

*There was one observation of a very strong odor at these locations at the Stickney WRP.

**There were three observations of very strong odors at the Preliminary Tanks at the Stickney WRP.

***There was one observation of a very strong odor at the LASMA drying cells.

SDS = Solids Drying Site.

SDA = Solids Drying Area.

SPS = Solids Processing Site.

WRP = Water Reclamation Plant.

INTRODUCTION

The R&D Department in conjunction with the M&O Department has been carrying out an odor monitoring program at various District facilities for the past 17 years. The initial program started with the solids processing and drying sites at LASMA, HASMA, Marathon, and Vulcan in 1990, and was expanded to the WRPs and other drying sites. The latest additions were the Ridgeland and Stony Island solids drying sites in 2001.

At each location a similar procedure is followed to monitor odors. R&D Department personnel, and at some facilities M&O Department personnel, visit various stations 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 0, no odor, 1, very faint, 2, faint, 3, easily noticeable, 4, strong, and 5, very strong odor. In addition to the subjective odor measurements, an analysis of the ambient air for H₂S using a Jerome Model 631-X H₂S meter is also conducted.

The objective of this program is to collect and maintain a database of odor levels within and around each WRP, and associated solids processing areas. The data are used to study the trends in odor levels associated with WRP operations, and to correlate odor levels to conditions related to WRP operations or changing conditions within the WRP, such as installation of odor control equipment, or sometimes to conditions unrelated to the WRP. Since several residential areas surround the WRPs in the program, the odor monitoring activities are also designed to provide early warning of odorous conditions that develop within the WRPs, and to allow control of them before they come to the notice of the residents. If a very strong odor is observed, the incident is reported at the time of observation to the respective plant operating personnel.

This report presents the odor monitoring data for the year 2007. The odor monitoring data in terms of frequency of occurrence, locations of possible odor sources, and H₂S levels has been reviewed and summarized.

A summary of the odor monitoring program 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, and who conducts the monitoring.

Maps showing the odor monitoring sites at each WRP and SDA are presented in Appendix AI.

The number of monitoring locations at each facility varies from 4 to 19, depending upon the facility and the history of odor episodes in those facilities. The Calumet and Stickney WRPs and SDAs are monitored from three to five days per week. At the Kirie WRP, the M&O Department monitors the facility every day, once per shift, from the spring through fall months.

Odor complaints in 2007 at the various facilities were very infrequent, ranging from none at the Calumet WRP, Calumet SDS, RASMA SDA, and Stony Island SDA, to 21 at the John E. Egan WRP.

TABLE 2: ODOR MONITORING PROGRAM FOR 2007

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	15	1992	12	3 2	R&D M&O	Yes	0	—
Calumet SDS	9	1992	12	3 2	R&D M&O	Yes	0	—
Egan WRP	7	1993	12	1 **	R&D M&O**	Yes	21	11
Kirie WRP	17	1996	12	1 7*	R&D M&O	Yes	12	8
North Side WRP	13	1992	12	1 **	R&D M&O**	Yes	1	0
Stickney WRP	19	1991	12	3 2	R&D M&O	Yes	1	0
HASMA, Vulcan, Marathon SDA, and LASMA SPS	17	1990	12	3	R&D	Yes	2	2
RASMA SDA	4	2001	12	1 to 2	R&D	Yes	0	—

TABLE 2 (Continued): ODOR MONITORING PROGRAM FOR 2007

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
Stony Island SDA	4	2001	12	1	R&D	Yes	0	—

Note: SDA = Solids Drying Area

SDS = Solids Drying Site

SPS = Solids Processing Site

WRP = Water Reclamation Plant

*At Kirie, M&O Department personnel conduct odor monitoring surveys 7 days a week 3 times a day from May through November.

**The M&O Department conducts periodic odor monitoring surveys at these facilities depending upon conditions, but the data are not included in this report.

RESULTS OF ODOR MONITORING AT DISTRICT FACILITIES IN 2007

The results of the various odor monitoring programs at each of the District facilities for 2007 are summarized in Table 3. The results have been divided into two major groups: detected odors, which includes the very strong, strong, and easily noticeable odor categories, and non-detected odors, which are either faint, very faint, or no odor.

A general observation drawn from the table is that at those facilities where both R&D Department and M&O Department personnel conducted odor monitoring, the M&O Department personnel show a lower frequency in 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 R&D Department personnel which can result in olfactory desensitization. Thus, they may not differentiate especially well between faint and easily noticeable odors.

Calumet WRP

In general, the majority of the odor monitoring observations ranged from faint to no odor; 66 percent of the time by R&D Department personnel and 95 percent of the time by M&O Department personnel, respectively. The strong odors mainly occurred around the sludge concentration building and preliminary tanks, with 56 percent and 15 percent of the observations at these locations, respectively. Areas which had easily noticeable odors were in the vicinity of the preliminary tanks, sludge concentration tanks and northeast corner of Lagoon #16, sludge digester tanks, southwest corner of Lagoon #16, Aeration Battery A, and the plant entrance.

The H₂S measurements made at the time of the odor monitoring by the R&D Department personnel are summarized in Table 4. The highest instantaneous readings were at the sludge concentration building and the preliminary tanks.

Figure 1 summarizes the monthly observations of easily noticeable, strong, and very strong odors made during 2007 in terms of frequency of occurrence. The frequency of easily noticeable observations ranged between 14 and 34 percent each month with the highest percentage occurring in June. Very strong odors were observed less than one percent of the time during 2007.

No odor calls pertaining to the Calumet WRP were received in 2007.

Calumet SDS

The Calumet Solids Drying Site consists of the East SDA, located east of the Calumet WRP, and the West SDA, located west of the Calumet WRP. As with the Calumet WRP, the occurrence of strong odors at the drying areas, which also includes the centrifuge building located at the East SDA, was infrequent. The majority of the observations were described as faint to no

TABLE 3: ODOR MONITORING RESULTS FOR 2007

Facility	Departments Participating	Total Number of Observations	Number of Observations Odors Were Detected			Number Non-Detects*	Percent Non-Detects
			Very Strong	Strong	Easily Noticeable		
Calumet WRP	R&D	1,746	0	90	515	1,150	66
	M&O	1,264	0	15	45	1,204	95
Calumet SDS	R&D	1,215	0	11	265	949	78
	M&O	755	0	1	9	745	99
Egan WRP	R&D M&O**	341	0	1	86	254	74
Kirie WRP	R&D	828	1	3	198	626	76
	M&O	8,683	0	0	82	8,601	99
North Side WRP	R&D M&O**	625	0	15	256	354	57
Stickney WRP	R&D	2,653	6	164	1,033	1,450	55
	M&O	2,373	0	40	215	2,118	89
HASMA Vulcan and Marathon SDA and LASMA SPS	R&D	2,174	1	47	760	1,360	63
RASMA SDA	R&D	183	0	1	7	175	96

TABLE 3 (Continued): ODOR MONITORING RESULTS FOR 2007

Facility	Departments Participating	Total Number of Observations	Number of Observations Odors Were Detected			Number Non- Detects*	Percent Non- Detects
			Very Strong	Strong	Easily Noticeable		
Stony Island SDA	R&D	333	0	10	134	189	57

Note: SDS = Solids Drying Site

SDA = Solids Drying Area

SPS = Solids Processing Site

WRP = Water Reclamation Plant

*Non-detects are all observations of faint, very faint, or no odor.

**The M&O Department conducts periodic odor monitoring surveys at these facilities but the data are not included in this Table.

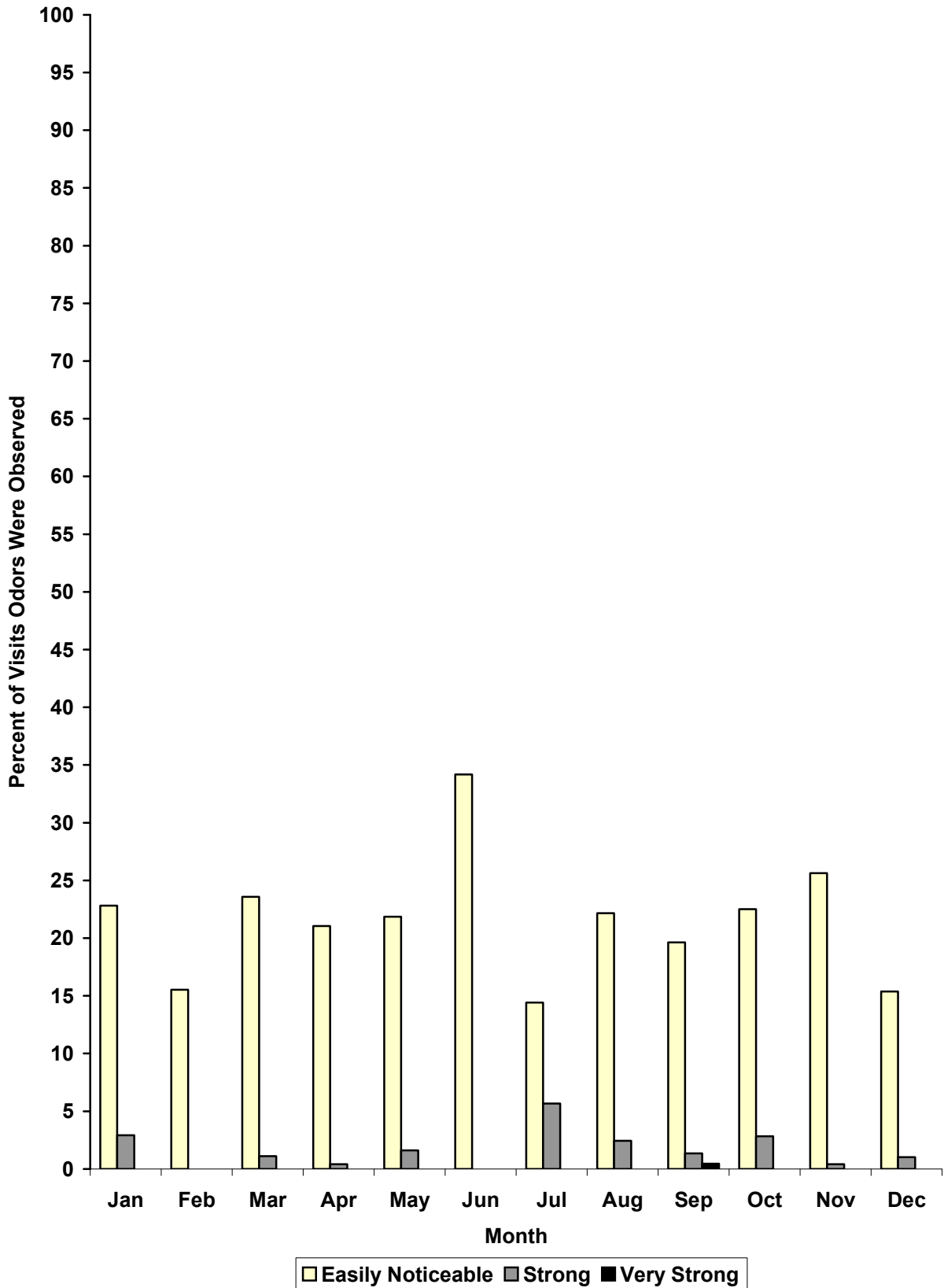
TABLE 4: HYDROGEN SULFIDE READINGS AT CALUMET WRP - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Plant Entrance (1) ²	11.0	0	175
Lagoon #16 SW Corner (2)	17.0	0	270
Sludge Conc. Bldg. (3)	138.0	0	3,400
Lagoon #16 NE Corner (4)	9.2	0	210
Sludge Digester Tanks (5)	15.3	0	280
Aeration Battery A—West (6)	8.8	0	51
TARP Pump Station (7)	9.6	0	13
Preliminary Tanks (8)	34.0	0	2,900
Gate Near Lagoon #9 (9)	7.4	0	44
Between Lagoon #7 & #8 (10)	7.2	0	26
Lagoon #1 & #2 (11)	10.2	0	45
Lagoon #3 & #4 (12)	7.0	0	22
Ellis Ave. & 130th St. (13)	14.4	0	220
H ₂ S Monitor—130th St. (23)	7.0	0	16
North H ₂ S Monitor (24)	7.6	0	14

¹ ppbv = Parts per billion by volume.

² Numbers in parentheses correspond to Station numbers in Figure AI-1.

FIGURE 1: ODOR OBSERVANCES AT CALUMET WRP—2007



odor. A few strong odors were observed at the drying areas during February, April, May, August, and October 2007. Strong odors occurred less than one percent of the time at the SDAs. Easily noticeable odors occurred between 7 and 37 percent of the time around the various drying area locations.

The average H₂S levels were between 6.9 and 10.8 ppbv, as shown in [Table 5](#). The highest value observed (250 ppbv) was at the Truck Scale/Centrifuge Building.

[Figure 2](#) presents the monthly frequency of occurrence of the easily noticeable, strong, and very strong odor observations. The easily noticeable odors peaked during the summer months of 2007.

No odor calls were received with regard to the Calumet Solids Drying Site.

John E. Egan WRP

There was one strong odor observation at the John E. Egan WRP in 2007. Faint or no odors were reported 74 percent of the time for the overall WRP. The easily noticeable odor observations occurred 25 percent of the time. The easily noticeable odors were greatest in the vicinity of the primary and final tanks.

The percentage of observations at which easily noticeable, strong, and very strong odors were observed during 2007 are plotted by month in [Figure 3](#).

The average H₂S measurements ranged from 4.6 to 11.2 ppbv, as shown in [Table 6](#). The highest average level was observed at the East Entrance gates.

Twenty-one odor calls pertaining to the John E. Egan WRP were received in 2007, of which 11 were verified.

James C. Kirie WRP

There were three strong and one very strong odor observations at the James C. Kirie WRP during 2007. Faint or no odors were reported 76 percent (R&D Department) and 99 percent (M&O Department) of the time for the overall WRP. The easily noticeable odors which occurred were generally in the vicinity of air lift station A1 (21 percent), the return aeration channel (16 percent), and air lift station A2 (13 percent).

[Figure 4](#) summarizes the observations of easily noticeable or stronger odors by odor monitoring personnel during 2007. There were three strong odors observed in January and one very strong odor observed in November.

The measured H₂S levels are summarized in [Table 7](#). The highest maximum and average levels of H₂S were measured in the vicinity of East Gallery–North. All the other locations had averages ranging from 3.7 to 14.2 ppbv.

TABLE 5: HYDROGEN SULFIDE READINGS AT CALUMET SOLIDS DRYING SITES - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
East Drying Cell #1 SW (14) ²	6.9	0	27
Hopper Building (15)	7.6	0	55
East Drying Cell #8 NW (16)	8.7	0	140
East Drying Cell #8 NE (17)	8.9	0	190
Truck Scale/Centrifuge (18)	9.1	0	250
East Drying Cell #1 SE (19)	7.2	0	26
West Drying Cell #1 @ Gate (20)	10.8	0	180
West Drying Cell #4 (21)	10.3	0	180
Bituminous Road @ Gate (22)	7.8	0	22

¹ ppbv = Parts per billion by volume.

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

FIGURE 2: ODOR OBSERVANCES AT CALUMET SOLIDS DRYING SITES—2007

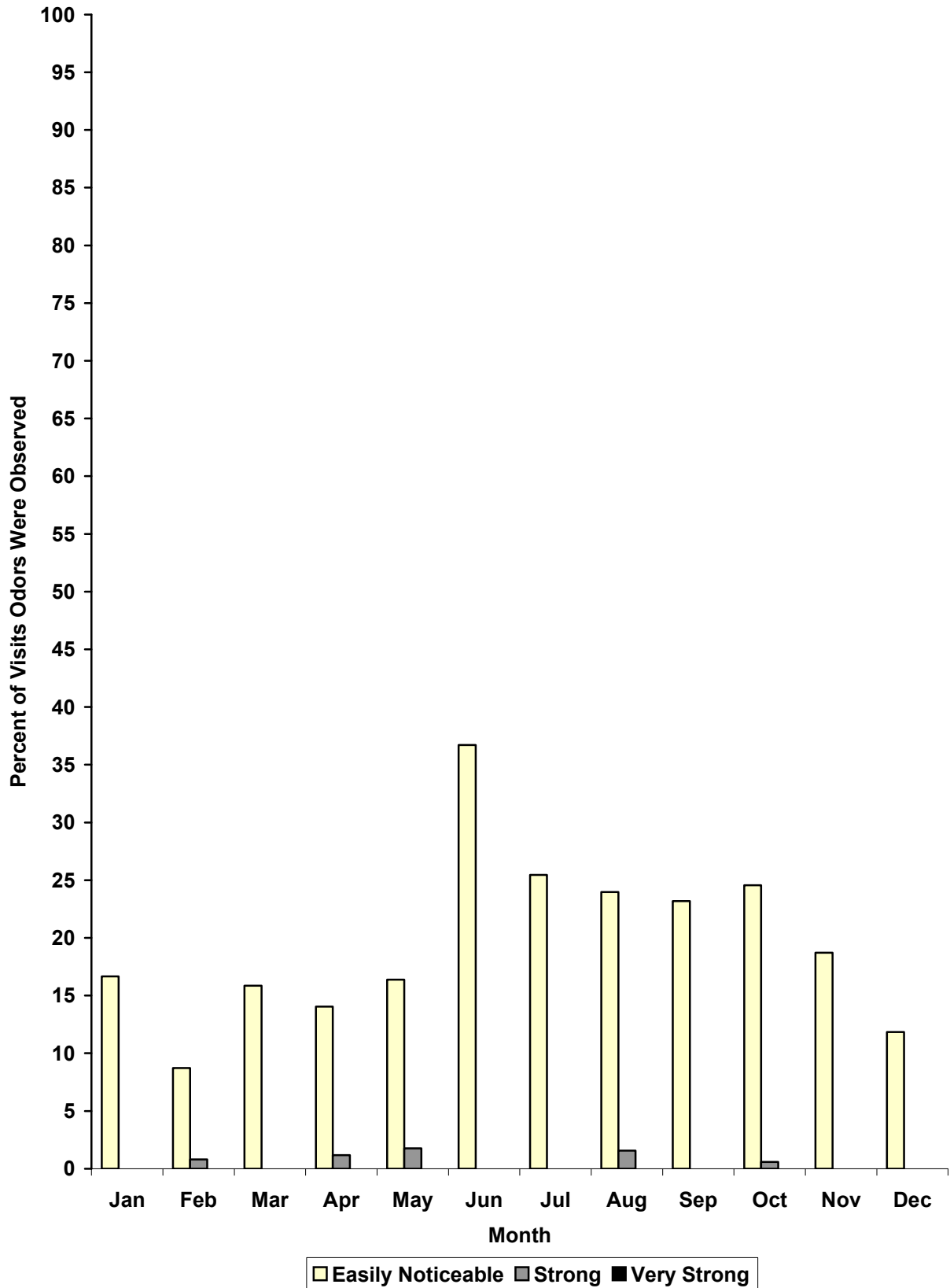


FIGURE 3: ODOR OBSERVANCES AT JOHN E. EGAN WRP—2007

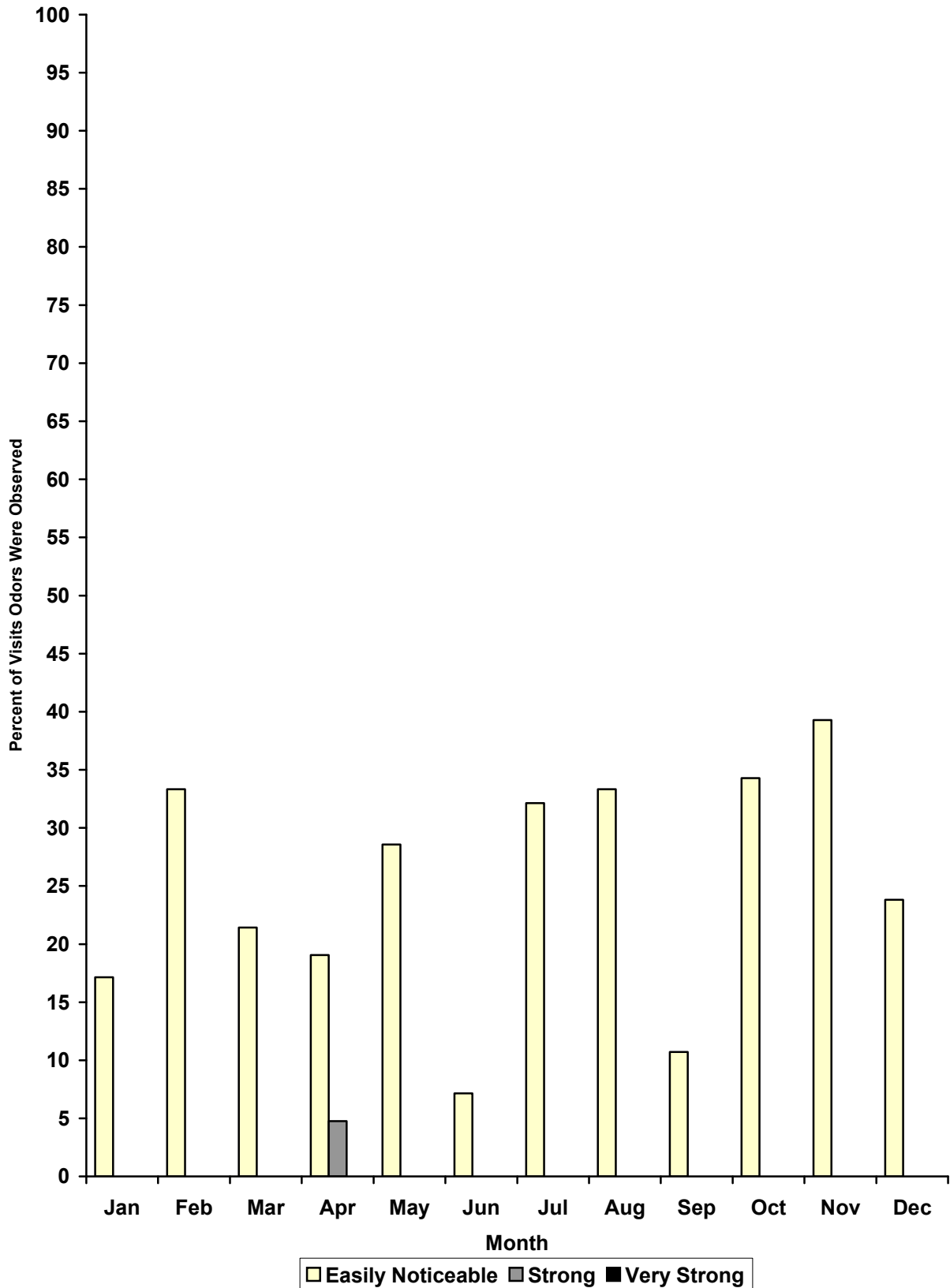


TABLE 6: HYDROGEN SULFIDE READINGS AT JOHN E. EGAN WRP - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
West Entrance Gate (1) ²	5.0	0	20
Near Waste Gas Burner (2)	7.6	0	140
Primary Tanks (3)	5.1	0	30
South End "A" Drive (4)	5.2	0	14
Final Tanks (5)	4.6	0	10
East Entrance Gates (6)	11.2	0	150
West of Storage Building (7)	6.6	0	38

¹ppbv = Parts per billion by volume.

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

FIGURE 4: ODOR OBSERVANCES AT JAMES C. KIRIE WRP—2007

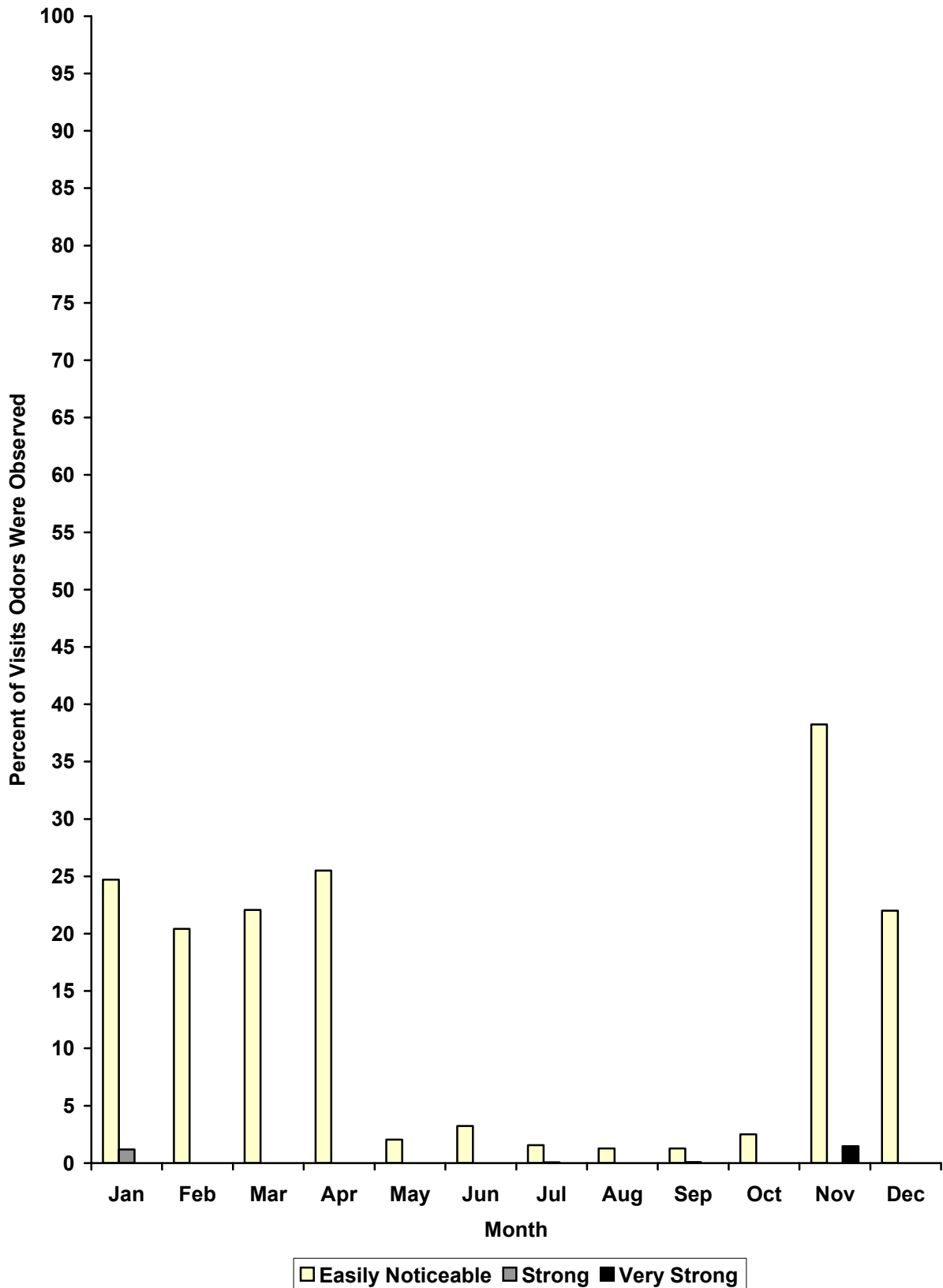


TABLE 7: HYDROGEN SULFIDE READINGS AT JAMES C. KIRIE WRP - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Plant Entrance (1) ²	11.7	0	111
Pump Station (2)	14.1	0	150
Air Lift B1 (3)	4.9	0	12
Road C-1 (4)	5.1	0	21
Return Channel (5)	5.0	0	9
East Gallery—North (6)	35.5	0	1,200
Road C-2 (7)	14.2	0	390
Road C-3 (8)	5.1	0	23
Road C-4 (9)	7.2	0	160
Air Lift A-1 (10)	5.0	0	19
Air Lift A-2 (11)	4.7	0	12
Road C-5 (12)	3.7	0	7
Road C-6 (13)	5.6	0	31
Road C-7 (14)	4.9	0	24
Air Lift B2 (15)	6.0	0	25
Ridge Lane—Point #1 (16)	6.6	0	34
Marshall and Pleasant (17) Lane—Point #2	6.7	0	22

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-3](#).

Twelve odor calls were received regarding the Kirie WRP, of which 8 were verified as resulting from Kirie WRP operations.

North Side WRP

The majority of the observations at the North Side WRP were faint to no odor. There were no very strong odor observations and 15 strong odor observations at this WRP during 2007. The easily noticeable odors accounted for 41 percent of the total observations, with the greatest frequency around Preliminary Tank 3, 20 percent of the time.

The monthly percentage of observations at which easily noticeable, strong, and very strong odors were observed are shown in [Figure 5](#). There was a downward trend for easily noticeable odors from January through July, and an upward trend in August through November.

The measured H₂S levels are summarized in [Table 8](#). The highest mean and maximum readings were at the McCormick Road location.

One odor call regarding the North Side WRP was received in 2007, but the call was not verified as being associated with odors originating in the WRP.

Stickney WRP

Overall, the majority of the observations in 2007 were faint to no odor, with 55 percent of R&D Department and 89 percent of M&O Department observations meeting this classification, respectively. Overall, there were six very strong odor observations and 204 strong odor observations, which accounts for 4 percent of the total number of observations. Most of these strong odors occurred in the vicinity of the preliminary tanks and Imhoff tanks. The strong odors observed at Laramie and 39th Street along with some of the strong odors in the vicinity of the Imhoff tanks were identified as a tar-like odor which was attributed to the adjacent chemical plant operated by Koppers Industries. These same locations had the majority of easily noticeable odors.

The frequency of occurrence of easily noticeable odors ranged from 16 percent to 27 percent of the time. The highest frequencies were observed at the predigestion centrifuges, Imhoff tanks, and concentration tanks.

[Figure 6](#) is a plot of the percentage of easily noticeable, strong, and very strong odors observed each month at the Stickney WRP. The easily noticeable odors range from 17 percent to 28 percent with no seasonal pattern. The strong odor occurrences were also spread out over the year, with the lowest occurrence in February.

The highest average H₂S level was adjacent to the preliminary tanks at Twelfth Avenue, with a concentration of 86 ppbv ([Table 9](#)). Four extreme concentrations of H₂S, 2,000, 2,400, 2,500, and 3,500 ppbv, were measured at the predigestion centrifuges, concentration tanks south, preliminary tanks at Tenth and Twelfth Avenues, respectively. Plant management was notified of this extreme H₂S reading as required by the standard operating procedure for odor runs.

FIGURE 5: ODOR OBSERVANCES AT NORTH SIDE WRP—2007

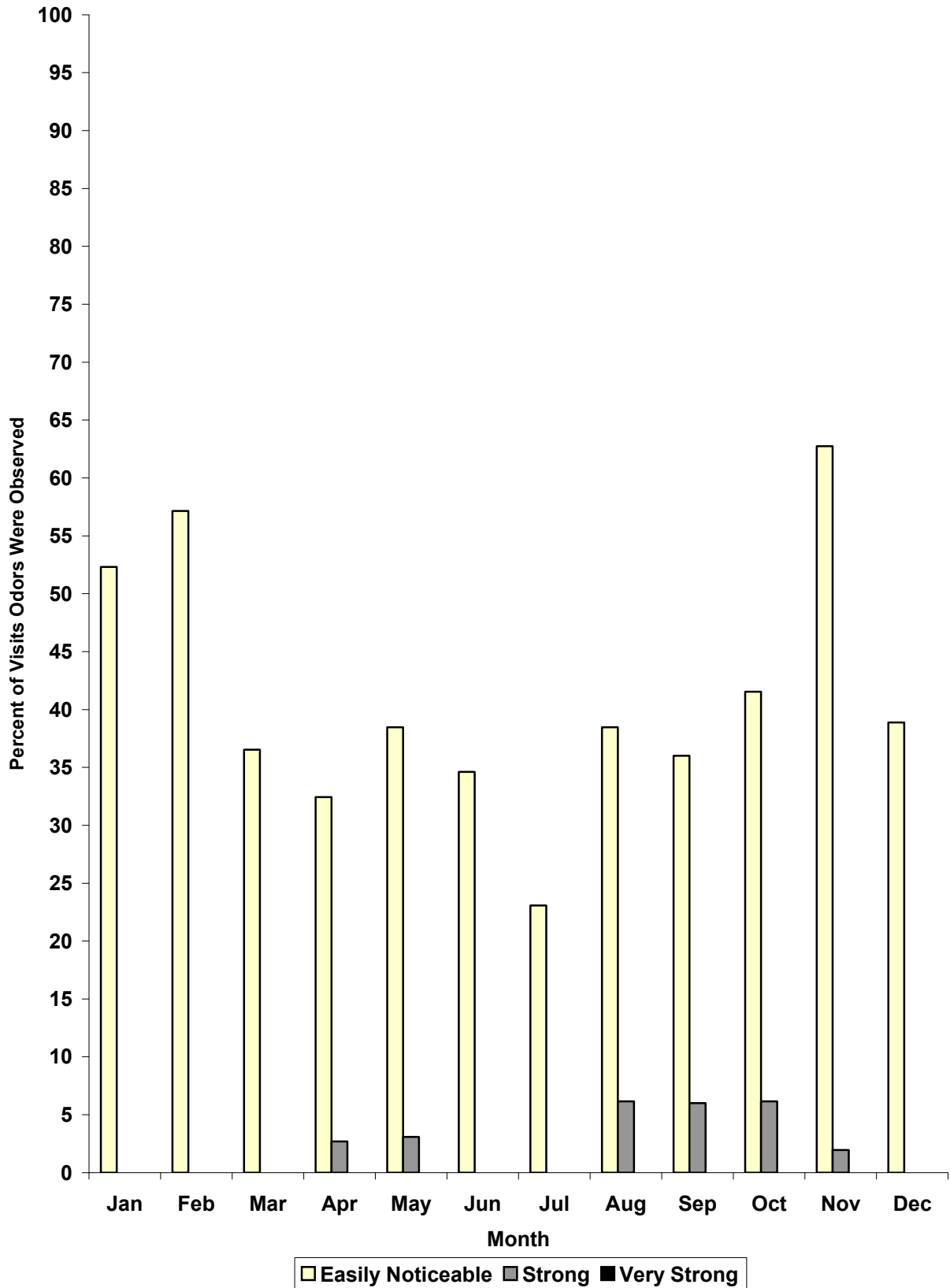


TABLE 8: HYDROGEN SULFIDE READINGS AT NORTH SIDE WRP - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Howard Street West End (1) ²	8.5	0	18
Howard Street East (2) of McCormick Road	13.1	0	110
McCormick Road (3)	37.6	0	560
P&B Building (4)	8.5	0	21
North Ave. Rect. Tank A6 (5)	7.1	0	12
North Ave. Rect. Tank B6 (6)	9.6	0	110
North Ave. Rect. Tank C6 (7)	7.4	0	27
Final Tank Batt. D3 (8)	14.7	0	300
Gallery Bldg. of Batt. D (9) Mix Channel	7.2	0	15
Main Street and Avenue E (10)	5.9	0	10
Covered Weir Prel. Tank 10 (11)	10.0	1	60
Weir Rect. Prel. Tank 3 (12)	30.1	0	300
Main St. Covered Sludge (13) Conc. Tanks	18.6	0	250

¹ppbv = Parts per billion by volume.

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

FIGURE 6: ODOR OBSERVANCES AT STICKNEY WRP—2007

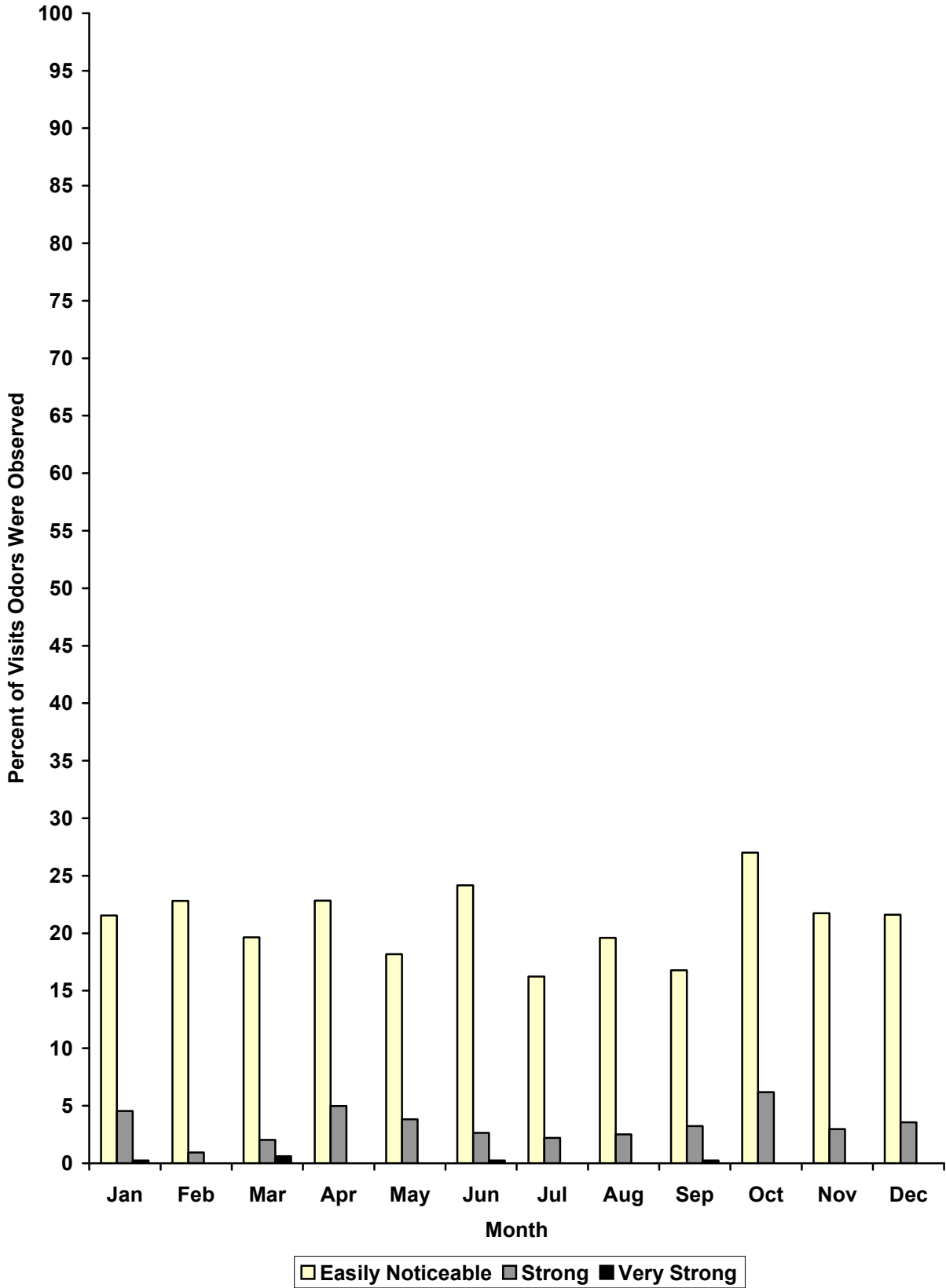


TABLE 9: HYDROGEN SULFIDE READINGS AT STICKNEY WRP - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Imhoff B St./3rd Ave. (1) ²	24.6	0	650
Imhoff B St./4th Ave. (2)	36.9	4	490
Imhoff B St./5th Ave. (3)	11.4	0	170
Digester 6th Ave. @ B St. (4)	10.8	0	120
West Digester Cont. Bldg. (5)	7.9	0	39
Centrifuges 6th Ave. @ Pre. (6)	65.0	2	2,000
Centrifuges 6th Ave. @ Post (7)	12.6	0	180
Concentration G St. North (8)	31.3	0	380
Concentration D St. South (9)	23.0	1	2,400
Preliminary 12th Ave. (10)	86.0	0	3,500
Preliminary 10th Ave. (11)	80.0	0	2,500
39th St./Central Ave. (12)	8.3	0	180
39th St./Morton College Ent. (13)	10.0	0	130
39th St./Dig. @ 57th Ave. (14)	6.6	0	24
39th St./Between Austin and Lombard (15)	9.4	0	320
Battery D, B St/13th Ave. (16)	8.4	0	120
Lombard Ave. @ Gate/39th St. (18)	8.0	0	200
Laramie and 40th St. (19)	25.1	0	450
Laramie and 39th St. (20)	14.1	0	270

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-5](#).

One odor call was received regarding the Stickney WRP, but the call was not verified as resulting from Stickney WRP operations.

HASMA, Vulcan, and Marathon SDAs, and LASMA SPS

The HASMA, Vulcan, Marathon, and LASMA sites had 63 percent of the observations characterized as faint to no odor. There was one very strong odor and 47 strong odor observations out of 2,168 observations. The strong odor observations were divided among the various areas (HASMA, HASMA Center, Vulcan, LASMA Cells 3 and 4, and Marathon) depending upon the activity at the time.

The percentage of observations at which easily noticeable, strong, and very strong odors were observed was plotted by month and are presented in [Figure 7](#). The frequency of observed odors is generally highest during the late spring through the fall months when solids processing and drying is being carried out.

The average H₂S levels at the various locations around these SDAs and SPS ranged from 5.5 and 22 ppbv as shown in [Table 10](#).

Two odor calls were received in 2007 with regard to the HASMA, Vulcan, and Marathon SDAs and the LASMA SPS, and both calls were verified as originating at the site mentioned in the call.

RASMA and Stony Island SDAs

The RASMA SDA had 96 percent of the observations characterized as faint to no odor. The easily noticeable odors were four percent of the total observations. A monthly summary of easily noticeable and stronger odors at the RASMA SDA during 2007 is presented in [Figure 8](#) expressed as percent frequency of occurrence. There was one strong odor observation during 2007. Easily noticeable odors occurred mainly during April, June, and November, with the highest frequency in November.

The average H₂S levels at the various locations around the RASMA SDA ranged from 5.3 to 19 ppbv, as shown in [Table 11](#).

The Stony Island SDA had 57 percent of the observations characterized as faint to no odor, with ten strong odor observations or three percent in 2007. The easily noticeable odors accounted for approximately 40 percent of the total observations.

A monthly summary of the observations at the Stony Island SDA of easily noticeable, strong, and very strong odors during 2007 is presented in [Figure 9](#) expressed as frequency of occurrence. The strong odors occurred during the months of January, February, August, September, October, and December.

FIGURE 7: ODOR OBSERVANCES AT HASMA, VULCAN, MARATHON SOLIDS DRYING AREAS AND LASMA SOLIDS PROCESSING SITE—2007

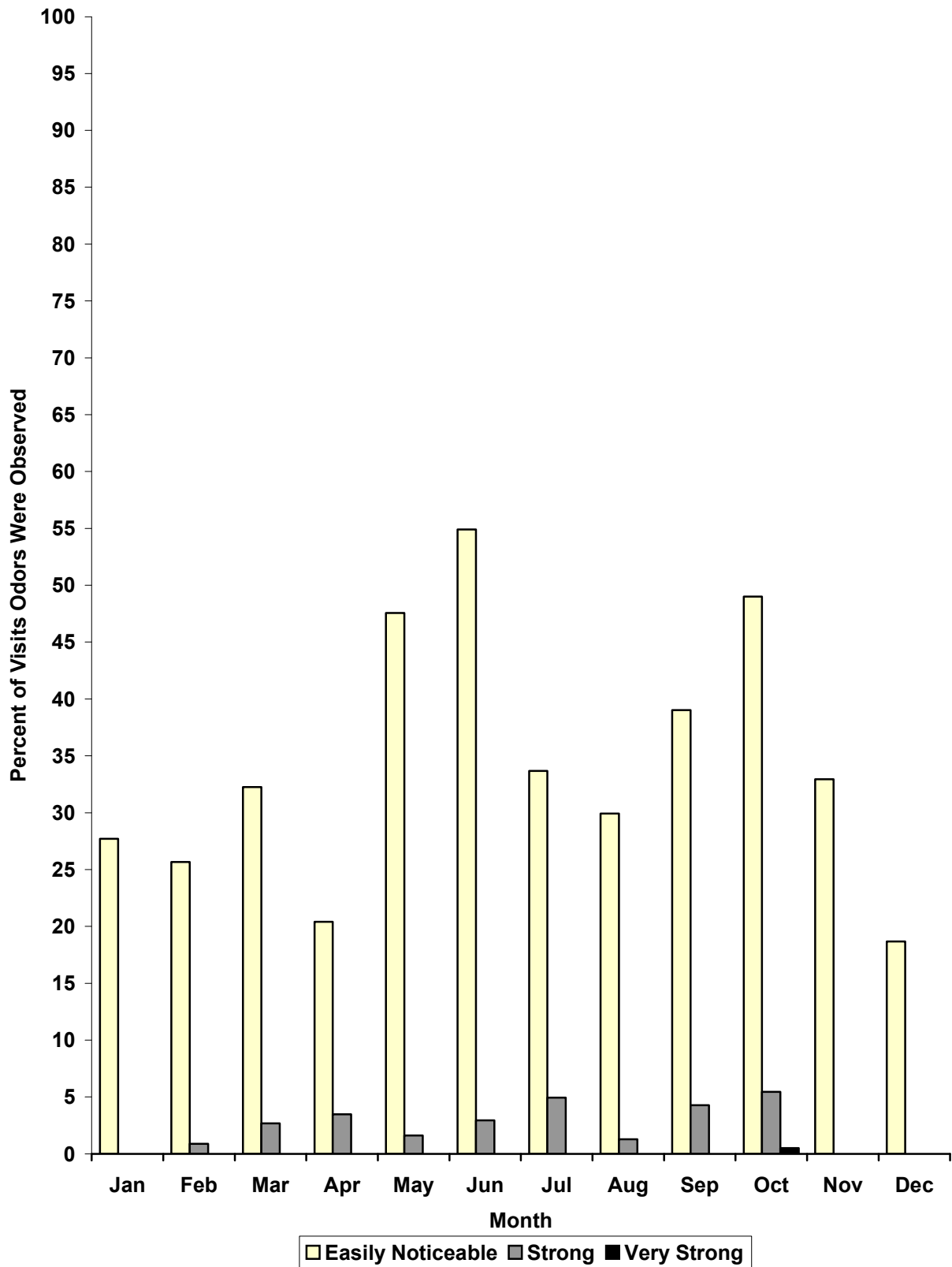


TABLE 10: HYDROGEN SULFIDE READINGS AT HASMA, VULCAN,
MARATHON SOLIDS DRYING AREAS AND LASMA SOLIDS PROCESSING
SITE - 2007

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
HASMA (1) ²	6.1	0	150
HASMA Center (1.5)	17.8	0	160
Vulcan South (2)	7.0	0	30
Vulcan North (3)	6.0	0	18
Vulcan TARP Drop Shaft (4)	9.0	0	120
Vulcan TARP Well (5)	7.6	0	110
LASMA Lagoon 1 (6)	7.7	0	180
LASMA Lagoon 16 (7)	10.9	0	250
LASMA Lagoon 24 (8)	10.6	0	260
LASMA Lagoon 30 (9)	5.5	0	18
LASMA Cell 1E-1W (10)	22.0	0	1,200
LASMA Cell 2E-2W (11)	10.3	0	160
LASMA Cell 3E-3W (12)	8.1	0	130
LASMA Cell 4E-4W (13)	9.8	0	220
LASMA Cell 5E-5W (14)	8.0	0	160
Marathon (15)	6.2	0	120
Marathon West (16)	7.8	0	240

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-6](#).

FIGURE 8: ODOR OBSERVANCES AT RASMA SOLIDS DRYING AREA—2007

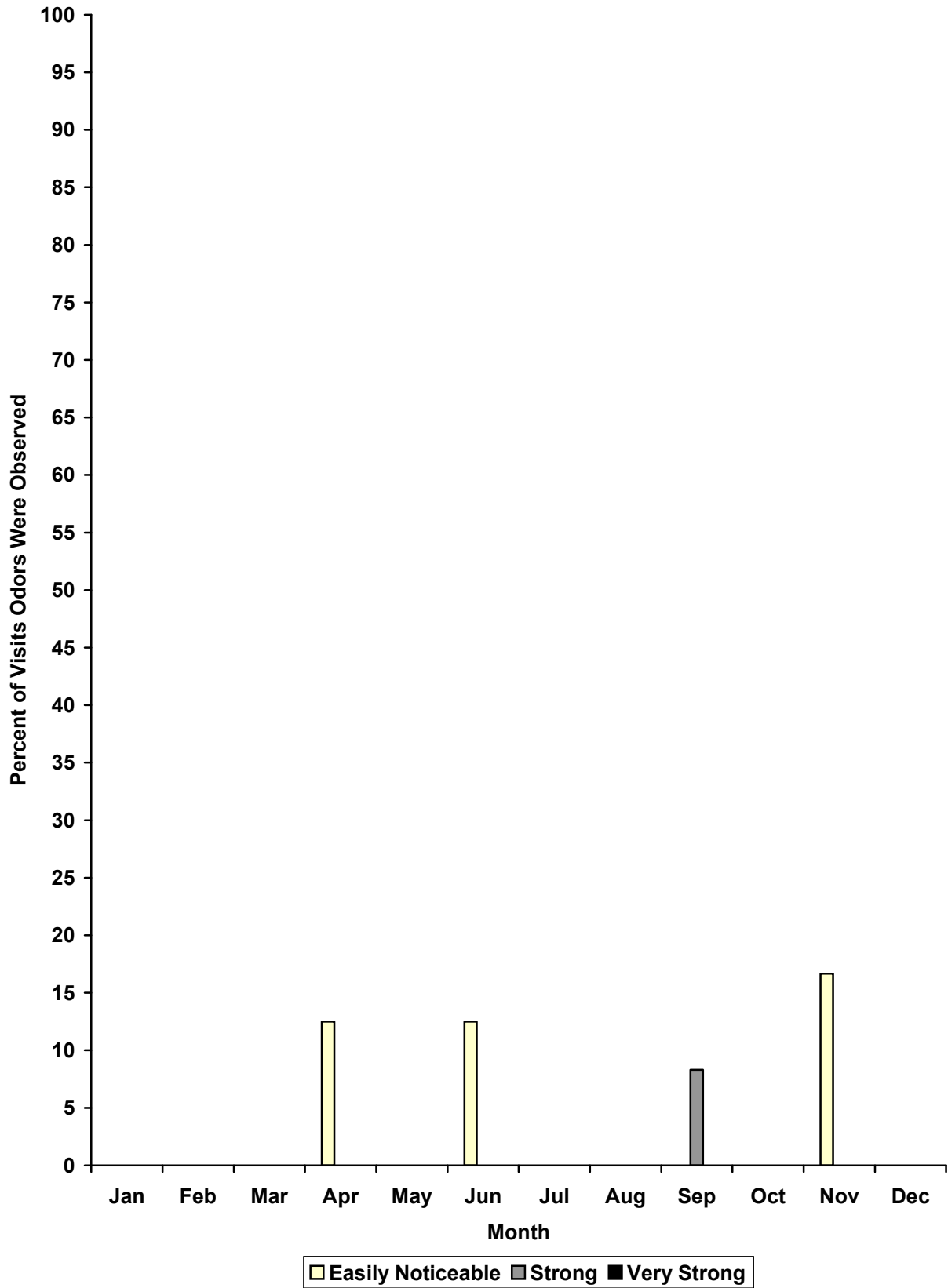


TABLE 11: HYDROGEN SULFIDE READINGS AT RASMA AND STONY ISLAND
SOLIDS DRYING AREAS - 2007

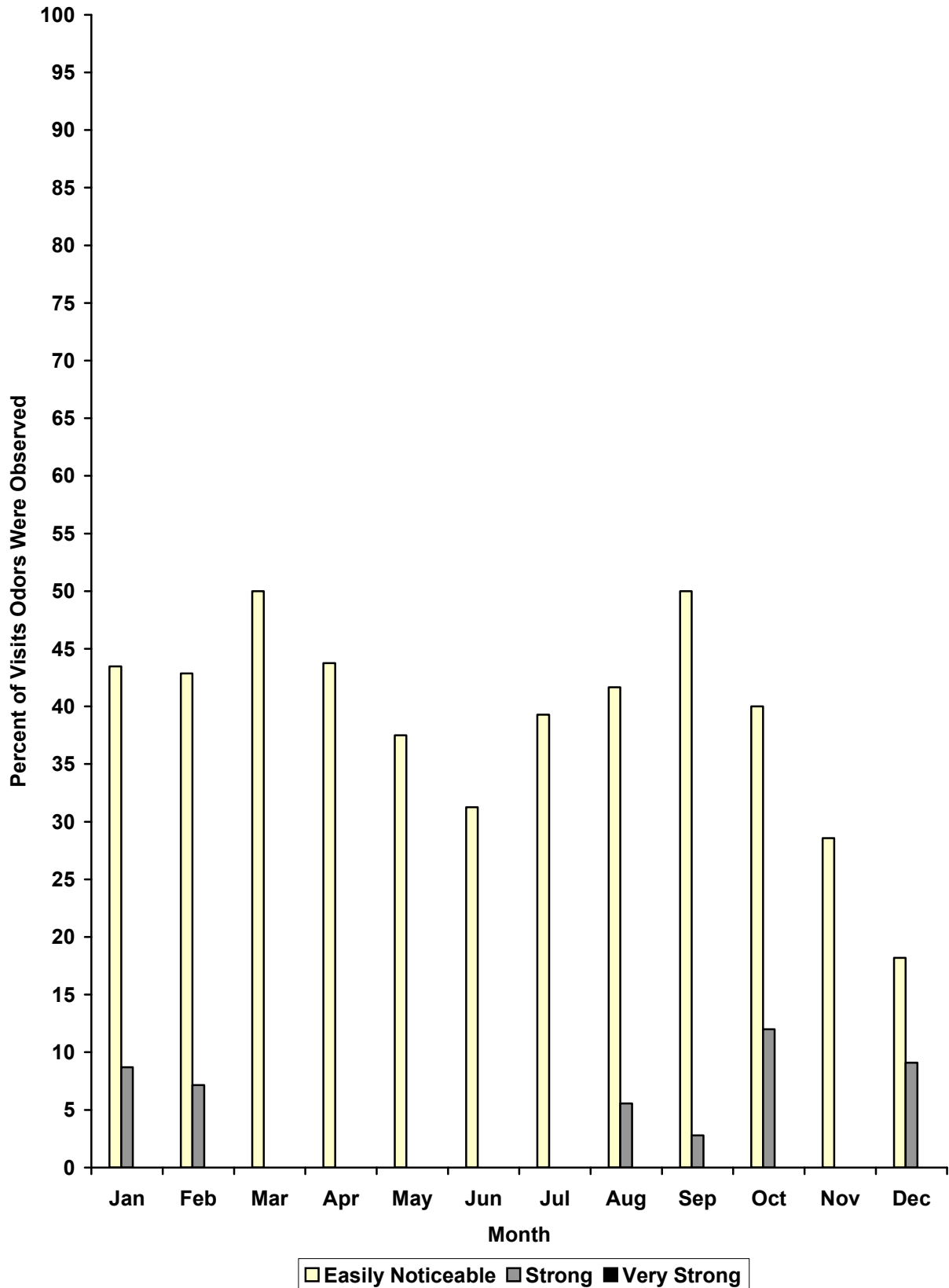
Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
-----RASMA-----			
SW Parking Area (1) ²	5.3	0	13
North of Cell 2W (2)	5.4	0	17
NE Corner Cell 5E (3)	6.3	0	50
South of Cell 5 (4)	19.0	0	520
-----Stony Island-----			
Entrance 122nd St (1) ³	8.0	0	111
NE Corner Cell 5 (2)	12.7	0	170
South End Cells 4 & 7 (3)	10.0	0	260
West Side of Cell 3 (4)	8.6	0	140

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-7](#).

³Numbers in parentheses correspond to Station numbers in [Figure AI-8](#).

FIGURE 9: ODOR OBSERVANCES AT STONY ISLAND SOLIDS DRYING AREA—2007



The average H₂S levels around the Stony Island SDA, as shown in Table 11, varied from 8 to 12.7 ppbv.

No odor calls were received in 2007 with regard to the RASMA and Stony Island SDAs.

CALUMET CONTINUOUS AMBIENT H₂S MONITORS

Two H₂S monitoring stations were set up in October 2002 for the continuous monitoring and recording of ambient air H₂S concentration. One station (North Monitor) is located at the northern boundary of the Calumet WRP, and the second station (South Monitor) is located outside of the plant fence line near 130th Street. Each station consists of a H₂S analyzer in a temperature-controlled shelter. The monitors are Single Point Monitors made by Honeywell Analytics. Lead acetate impregnated tape is used for the measurement of H₂S with a concentration range of 0 to 90 parts per billion. Measurements are recorded every two minutes.

A summary of the monthly H₂S concentrations measured during 2007 is presented in [Table 12](#). The monitors were in operation all year except for February. The North Monitor was in error for the last week of June and intermittently in July and August. The intermittent errors on the North Monitor were due to obstruction of air flow to the intake of the monitor. The data collected during the flow problems was omitted from the summaries. All minimum values were zero.

The majority of the concentration values were less than 10 ppb. [Table 13](#) shows the percent observations greater than 10 ppb for the months of June through August. The South Monitor percentage of values greater than 10 ppb varied from 0.7 to 4.2 percent. The North Monitor levels were lower than the South Monitor, likely due to the intermittent flow problems. The monthly maximum H₂S concentrations ranged from 0 ppb to 21.6 ppb for the North Monitor and from 0.1 ppb to 33.0 ppb for the South Monitor ([Table 12](#)). Both monitors recorded higher H₂S concentrations during the warmer months.

The highest H₂S concentration of 33.0 ppb was recorded on July 5, 2007, with the South Monitor as shown in [Table 14](#). The event began at 1:18 AM and peaked at 1:34 AM at 33 ppb. Subsequently, the H₂S concentration gradually decreased to 3.6 ppb at until about 3:02 AM. It was typical to see H₂S concentration peaks late at night or in the early morning hours.

The time series plots of the 2-minute recorded H₂S concentrations from the monitoring stations are shown as an example of the peak H₂S concentrations. The June 2007 South Monitor H₂S concentrations are shown in [Figure 10](#). Similarly, [Figure 11](#) shows the June 2007 H₂S concentrations for the North Monitor.

TABLE 12: CALUMET WRP HYDROGEN SULFIDE CONTINUOUS
 AMBIENT MONITORING - 2007*

Month	<u>H₂S at North Monitor, ppbv</u>		<u>H₂S at South Monitor, ppbv</u>	
	Mean	Maximum	Mean	Maximum
January	0.0	1.4	0.0	9.6
February	NR	NR	NR	NR
March	0.0	0.0	0.0	0.1
April	0.0	4.2	0.0	3.6
May	0.1	7.1	0.2	14.2
June	0.4	13.5	0.4	21.3
July	0.4	13.5	0.8	33.0
August	1.0	21.6	1.7	32.3
September	0.0	7.4	0.1	12.4
October	0.0	5.3	0.1	6.4
November	0.0	4.3	1.4	1.4
December	0.0	14.2	0.0	5.6

*Summary of hydrogen sulfide readings taken every 2 minutes, Minimum values are all zero.
 ppbv = Parts per billion by volume.
 NR = No readings.

TABLE 13: PERCENT OF HYDROGEN SULFIDE CONCENTRATIONS ABOVE STATED VALUES AT THE CALUMET CONTINUOUS MONITORING STATION - 2007

Month	Total Number of Observations	Percent Observations		
		> 0 ppbv ¹	> 3 ppbv	> 10 ppbv
.....South Monitor.....				
June	21,563	16.3	2.5	0.7
July	22,298	0.2	6.5	1.3
August	22,218	0.4	14.0	4.2
.....North Monitor.....				
June	15,801	14.0	2.4	0.2
July	687	9.3	5.2	1.0
August	10,398	33.4	9.7	1.3

¹ppbv = Parts per billion by volume.

TABLE 14: HYDROGEN SULFIDE SPIKE AT THE CALUMET SOUTH MONITOR,
JULY 5, 2007

Date	Time	Elapsed Minutes	Hydrogen Sulfide, ppbv ¹
7/5/2007	1:18–1:32	14	4.6
	1:34–1:50	16	33.0
	1:52–2:04	12	10.7
	2:06–2:34	28	5.0
	2:36–2:50	14	3.9
	2:52–3:02	10	3.6

¹ppbv = Parts per billion by volume.

FIGURE 10: CALUMET SOUTH MONITOR HYDROGEN SULFIDE TIME SERIES—JUNE 2007

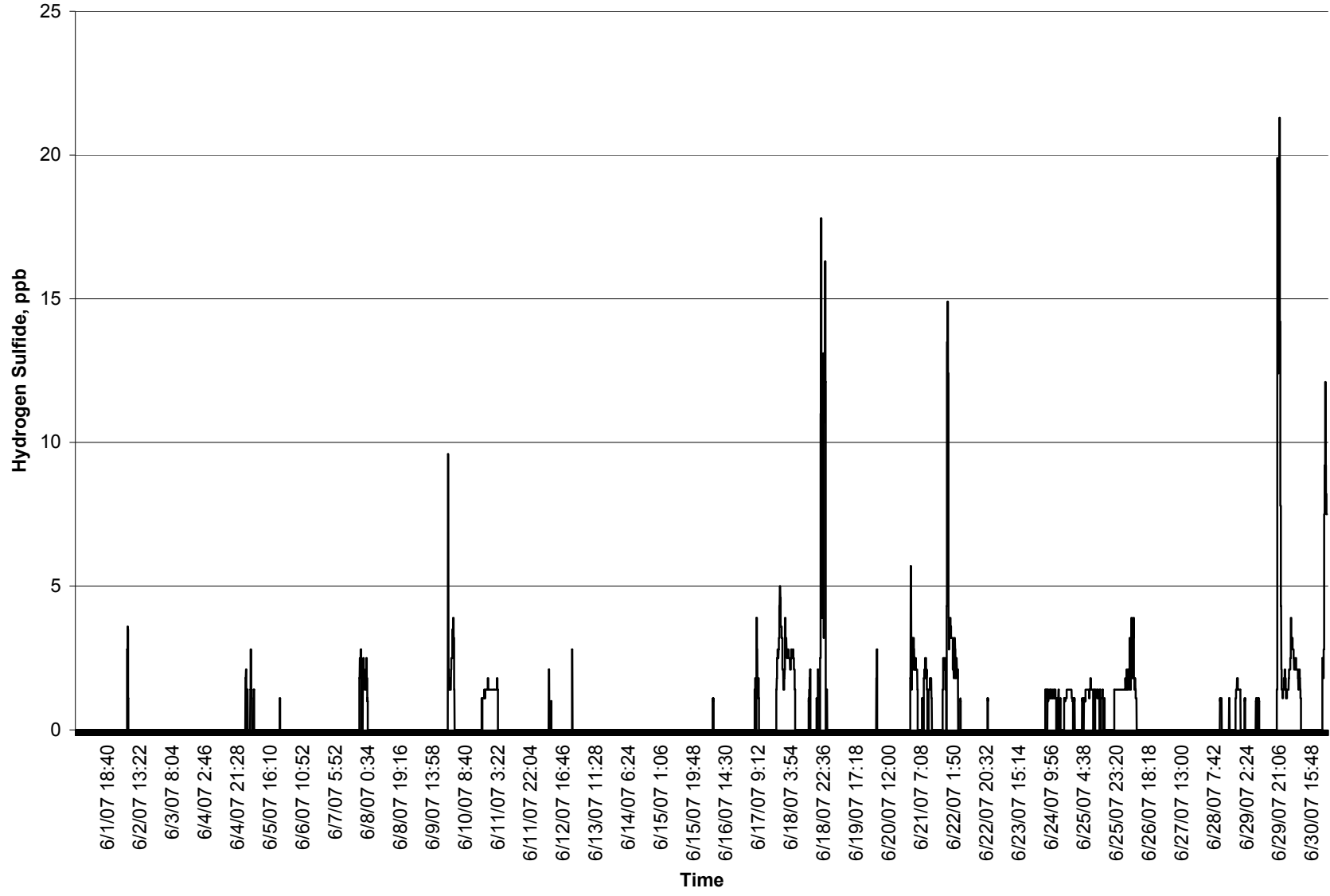
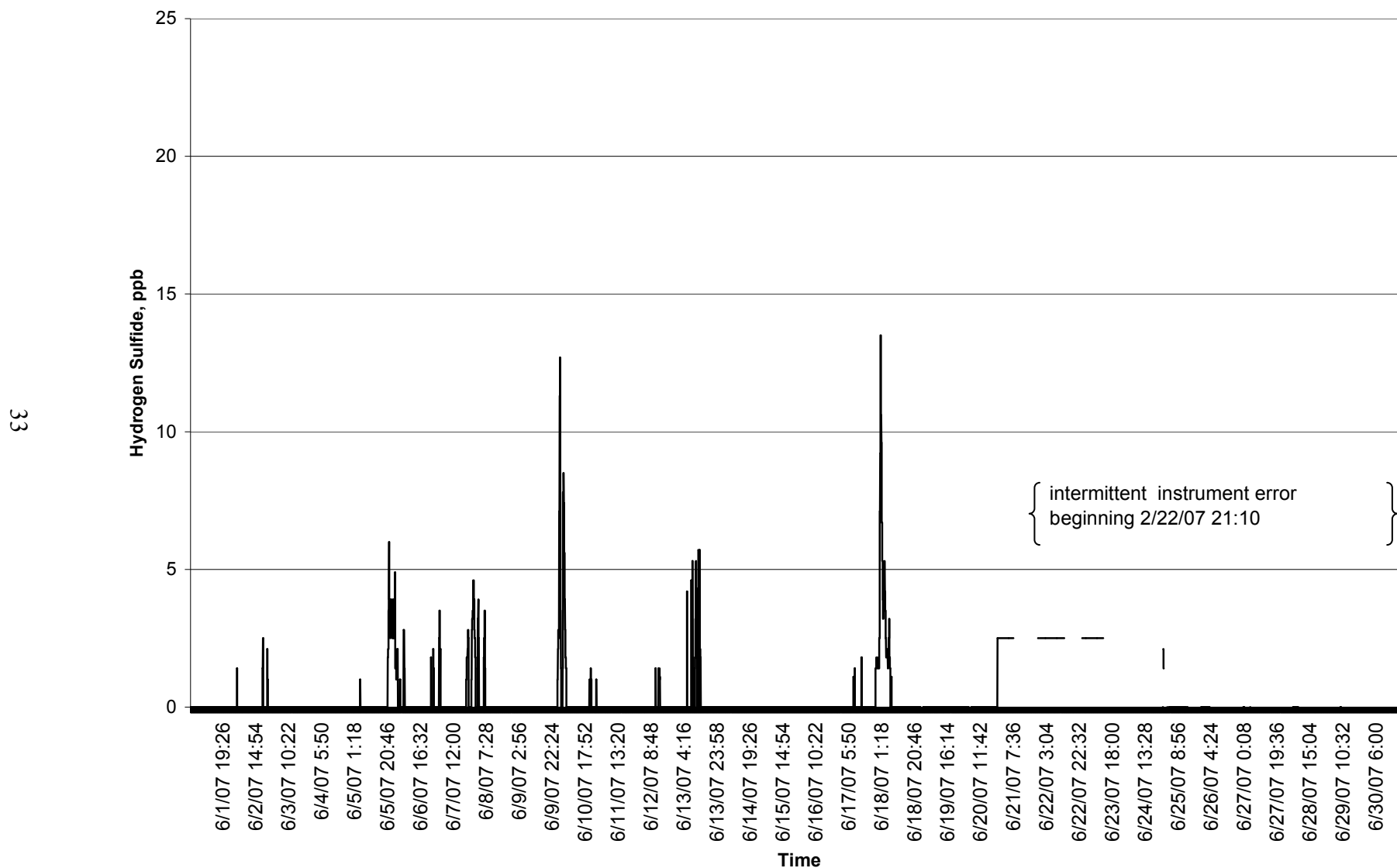


FIGURE 11: CALUMET NORTH MONITOR HYDROGEN SULFIDE TIME SERIES—JUNE 2007



APPENDIX AI

LOCATION OF ODOR MONITORING STATIONS AT DISTRICT WRPs,
SOLIDS DRYING AREAS, AND SOLIDS PROCESSING SITES

FIGURE AI-1: CALUMET WRP AND CALUMET WRP SOLIDS DRYING AREAS
 NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)

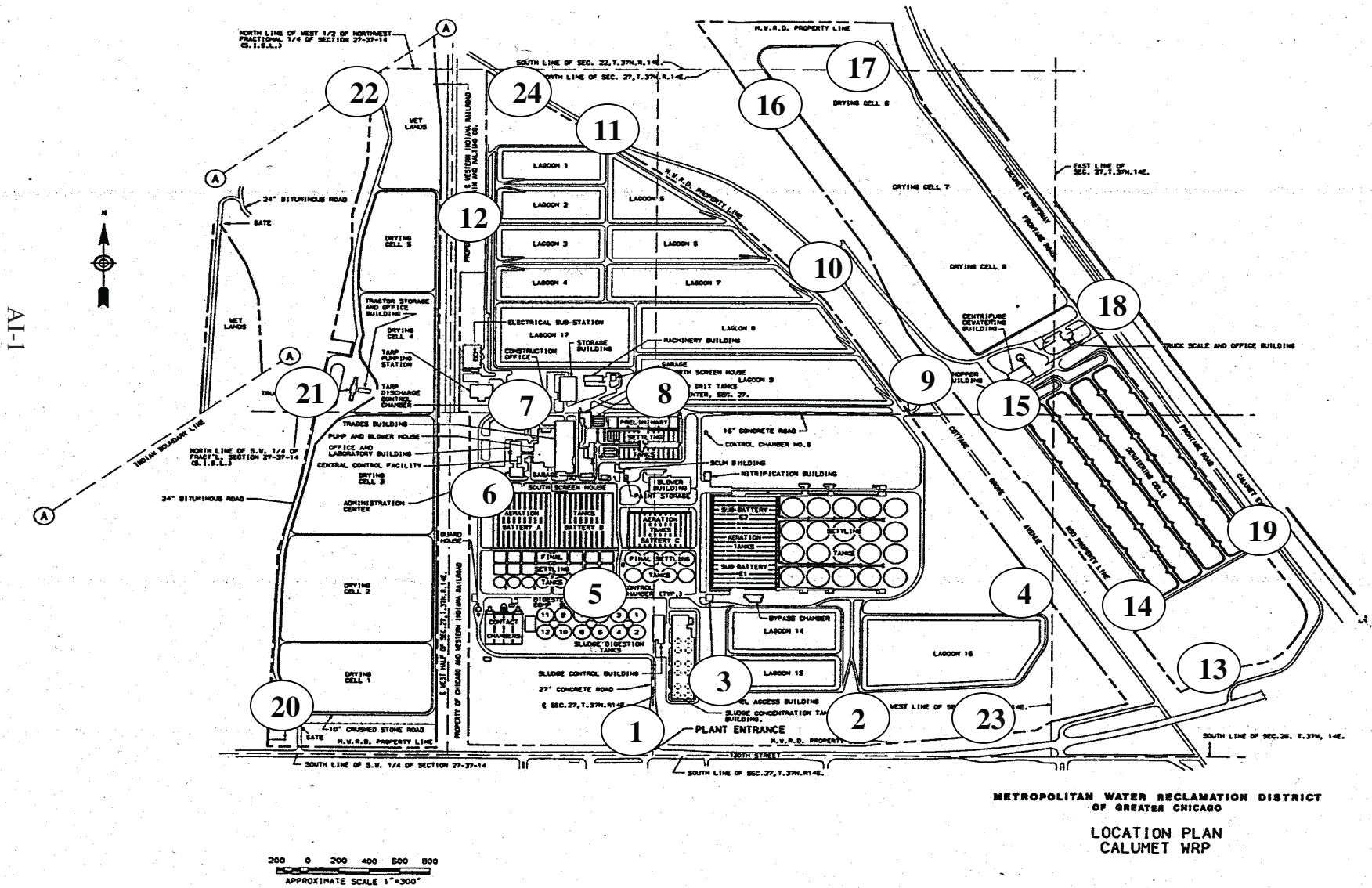


FIGURE AI-2: JOHN E. EGAN WRP AND SOLIDS DRYING AREA
NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)

AI-2

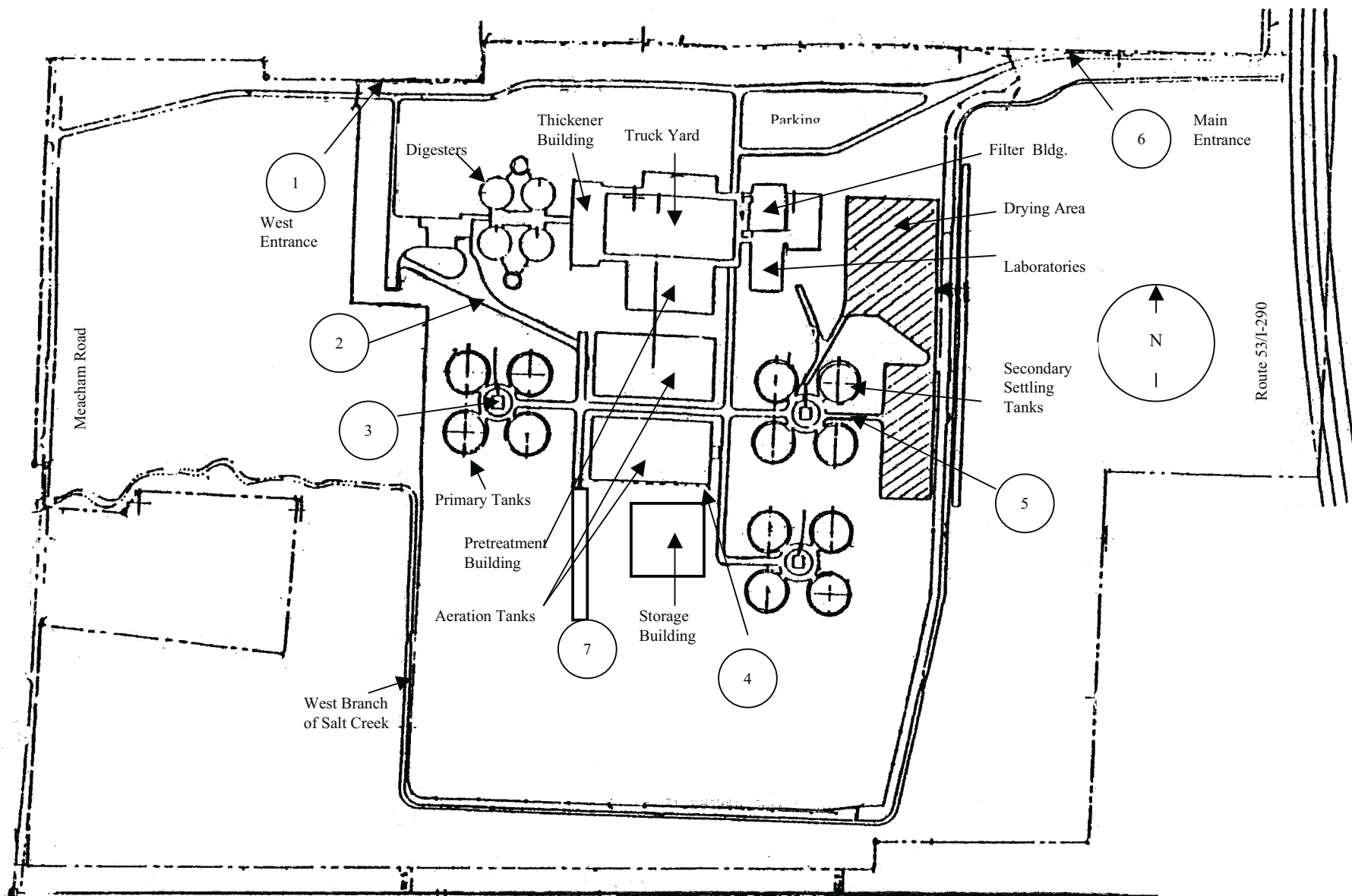
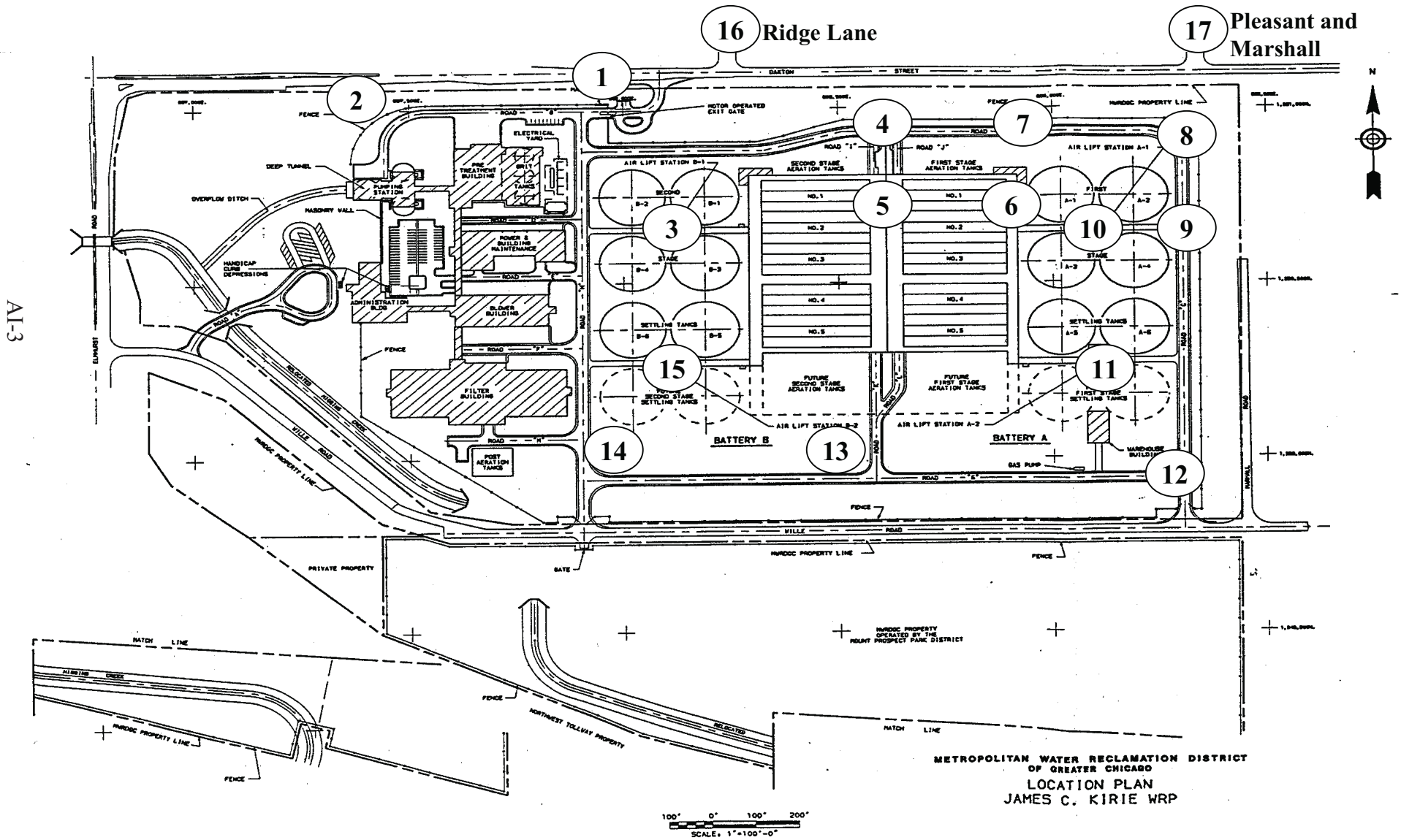
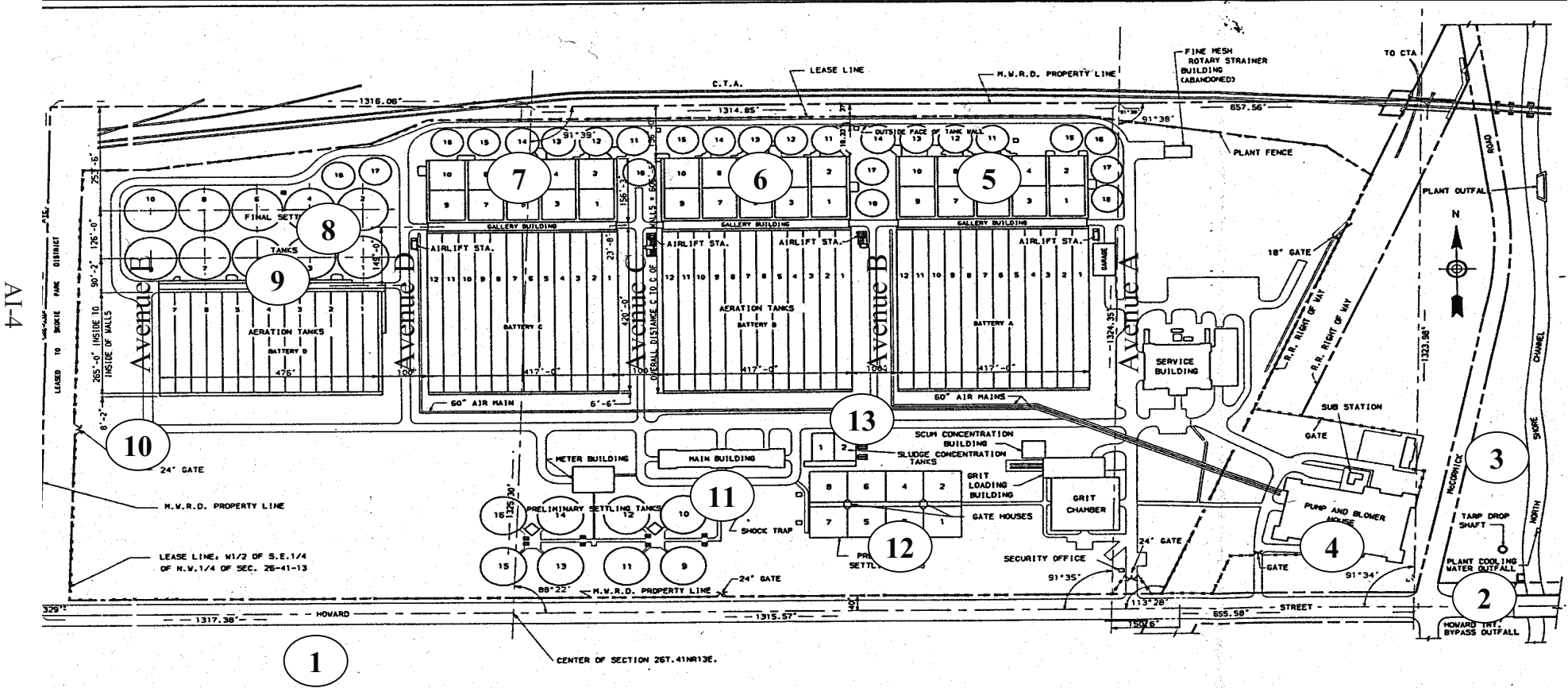


FIGURE AI-3: JAMES C. KIRIE WRP
 NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)



AI-3

FIGURE AI-4: NORTH SIDE WRP
 (NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)



METROPOLITAN WATER RECLAMATION DISTRICT
 OF GREATER CHICAGO
 LOCATION PLAN
 NORTH SIDE WRP

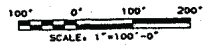


FIGURE AI-5: STICKNEY WRP
 NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS

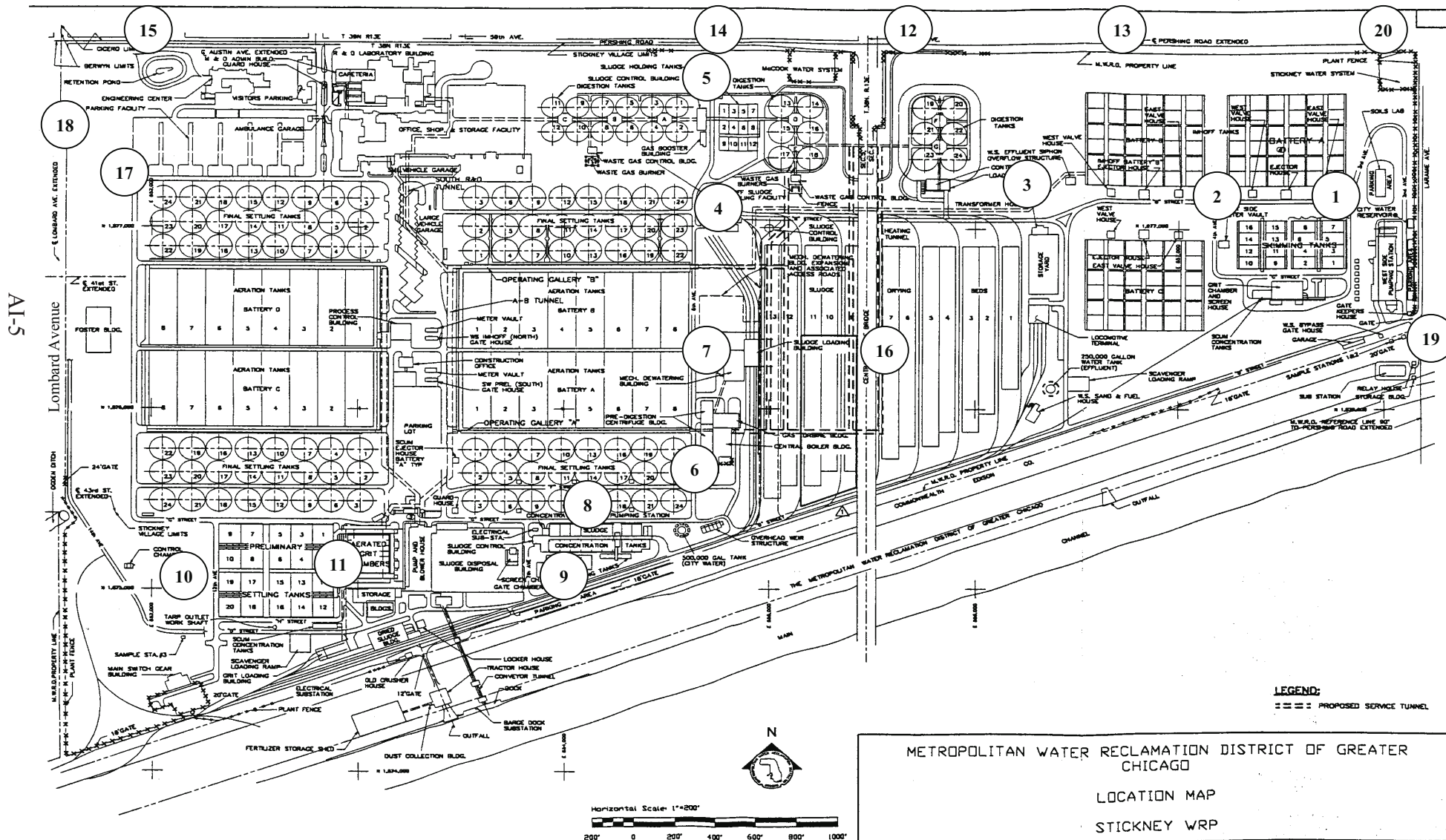


FIGURE AI-6: HASMA, VULCAN, AND MARATHON SOLIDS DRYING SITES AND LASMA SOLIDS PROCESSING SITE
(NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)

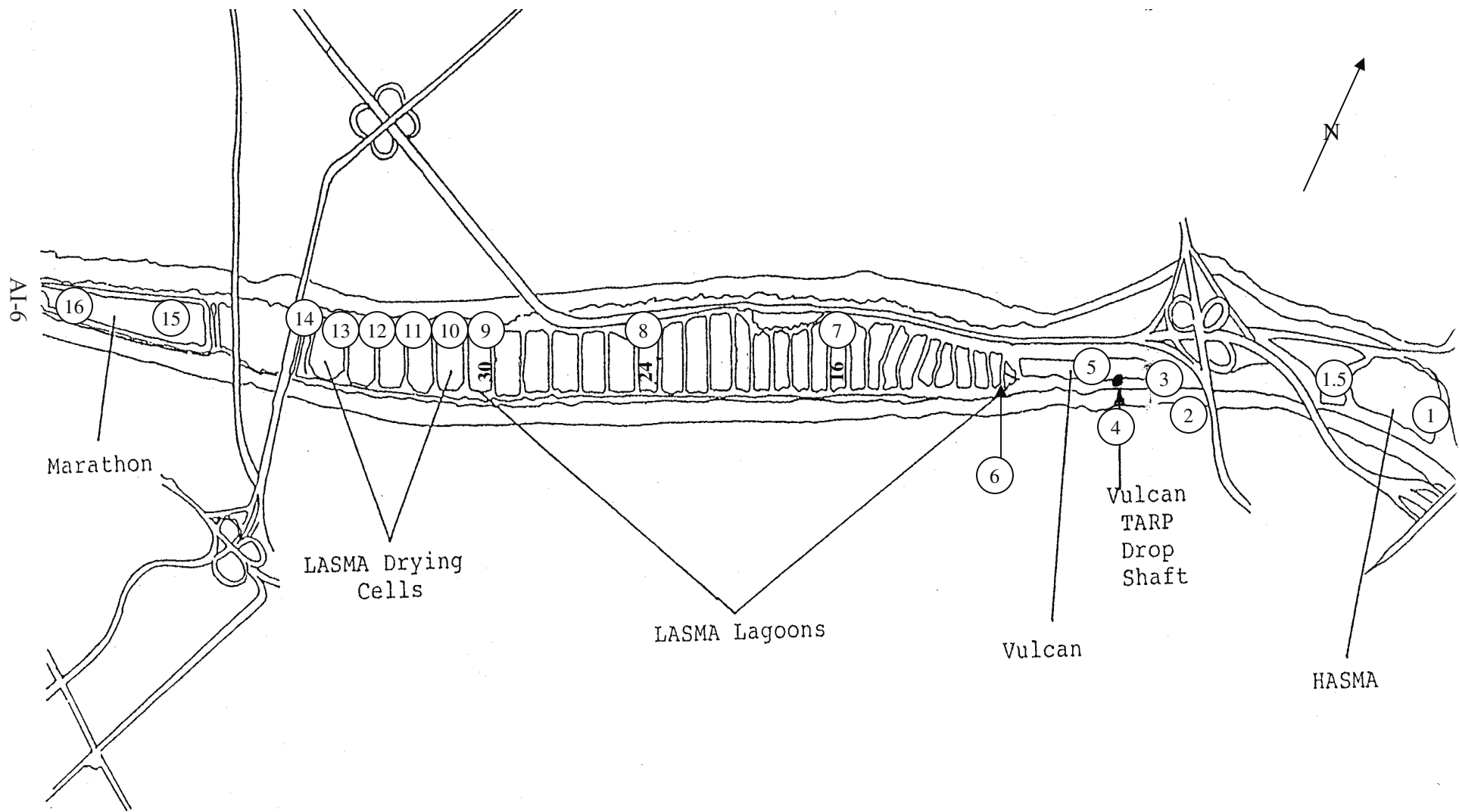


FIGURE AI-7: RASMA SOLIDS DRYING AREA
(NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)

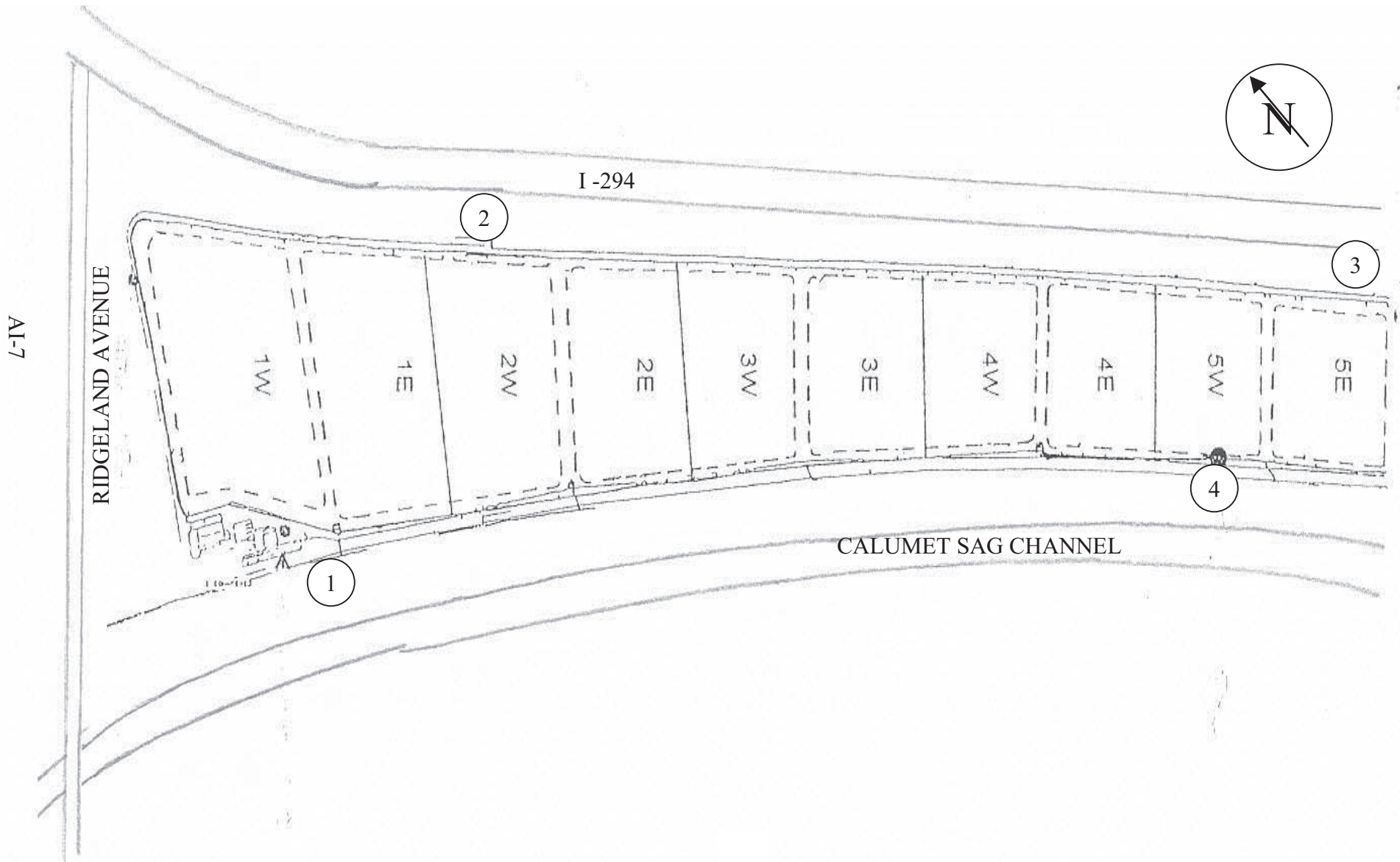


FIGURE AI-8: STONY ISLAND SOLIDS DRYING AREA
NUMBERED CIRCLES INDICATE ODOR MONITORING STATIONS)

