Solid Waste Authority of Palm Beach County

7501 North Jog Road • West Palm Beach, FL 33401

New Renewable Energy Facility - Baseline Sound Survey

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1. Introduction and Scope

This technical memo documents the baseline sound survey conducted as part of the planning and permitting of the proposed Solid Waste Authority of Palm Beach County (Authority) Palm Beach Renewable Energy Facility No.2 (Proposed Facility). The project scope was to document baseline sound levels in the vicinity of the Palm Beach Renewable Energy Facility No. 1 (Existing Facility) and the Proposed Facility location.

The baseline sound data were collected to satisfy two needs:

1) Aid in the development of operational sound level design criteria and acceptance criteria for the procurement of a design, build, and operate vendor of the Proposed Facility and,

2) Provide a reference dataset for future use in the event that noise complaints are filed by nearby residents or on behalf of the threatened or endangered bird species located in the rookery immediately southwest of the existing facility.

This project scope was based on four assumptions:

1) Current sound levels do not negatively impact threatened or endangered bird species located in the rookery located southwest of the existing processing facility.

2) Current sound levels are acceptable to nearby residents with the exception of nighttime sounds reported by residence in the Ironhorse Community.

3) The City of West Palm Beach noise regulation prohibiting any unreasonably loud, excessive, unnecessary or unusual noise applies to the control of all sound originating within the jurisdictional limits of the city; however the Proposed and Existing Facilities are exempt from the regulation as the Authority is a publicly owned property and the activities have been authorized by the public authority owning the property and the regulatory agency governing the operation of such facilities, the FDEP. See Appendix A City of West Palm beach CODE OF ORDINANCES Chapter 34 Article II.

4) The Palm Beach County noise regulation does not apply to the Existing and Proposed Facilities because the Authority is not located within the unincorporated County.

2. Methods

2.1. Field Data Collection

The field data collection was conducted February 16th – 18th 2010 at the Authority facility on North Jog Road. Sound levels were measured using Larson Davis Model 831 Class 1 Integrating Sound Level Meters/Analyzers. The instrumentation meets the "Type 1-Precision" requirements set forth in American National Standards Institute (ANSI) S1.4 for acoustical measuring devices. The meters were tripod mounted approximately 5 feet above ground level with a Larson Davis windscreen covering each microphone. Prior to the field investigation, the sound level meters were calibrated under the stated conditions with the Measurement and Test Equipment Standards traceable to the U.S. National Institute of Standards and Technology. This calibration complies with the requirements of ANSI. The measurement equipment was also calibrated in the field before the surveys with an acoustical calibrator. The calibration had an accuracy of +/- 0.5 dB at the calibration level of 114.0 dB. All calibration level changes were 0.4 dB or less thus validating the data precision. Figure 2-1 shows one of the sound level meters as deployed at the Existing Facility.

Figure 2-2 depicts the Day 1 and Day 2 sound level data collection locations. Location A and B were initially selected to aid in the development of operational sound level design criteria and acceptance criteria for the Proposed Facility. Locations 1 and 2 were selected to document existing sound levels in the direction of the rookery southwest of the Existing Facility. Locations 3, 4, 5, and 6 were selected to document existing sound levels in the direction of the Ironhorse Community north of the Existing Facility. Location 7 was selected in the field to document sound levels from the odor control device located on the property boundary between the Authority facility and the Ironhorse Community. Figure 2-3 and 2-4 depict monitoring locations for Day 1 and Day 2 respectively. Data was collected at Location 7, near the odor control device, on February 18 for one hour.

The Authority provided additional data to aid in the interpretation of the sound level data. The additional data included operational logs for the existing power plant, operational logs for the refuse derived fuel facility (RDF), weather station logs, and logs of trucks passing over the weight scales as they entered the Existing Facility. The operational logs are provided in Appendix B.

2.2. Sound Descriptors

Sound is technically described in terms of amplitude (loudness) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (dB). The decibel scale is a logarithmic scale that describes the intensity of the pressure vibrations that make up the sound. The pitch of the sound is related to the frequency of the pressure vibrations. Since the human ear is not equally sensitive to all frequencies, a special frequency-dependent rating scale has been devised to relate noise to the human ear, called the A-weighted scale. Sound measurements taken related to human activities are measured in units called decibels on the A-weighted scale abbreviated dBA. In order to be perceptible to the human ear, noise level changes must be on the order of 3 dBA or greater. A 5 dBA change in sound level is readily perceptible and a 10 dBA increase would be perceived as a doubling of the sound level.

The A-weighted decibel incorporates the first two sound variables, amplitude and frequency, but does not incorporate the temporal sound variable. The duration of a sound is critical to quantifying sound because the receiver impact from a one second horn blast is easily less than the receiver impact from a 30 second horn blast. Continuous noise sources, such as those produced at the Existing Facility and expected to be produced at the Proposed Facility, are comparatively easy to measure and have been well documented in investigations at other locations for occupational health and safety and community disturbance. The A-weighted equivalent sound level (Leq) is broadly used as a metric in other investigations. The A-weighted Leq is the defined as the equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period (Florida Department of Transportation PD&E Manual Part 2 Chapter 17). A period of five minutes was used to calculate the Leq for data collected in the field investigation and is abbreviated as Leq (5min) dBA. This is a very conservative approach given that most sound criteria average sound over 1 hour, which generally results in lower averages.

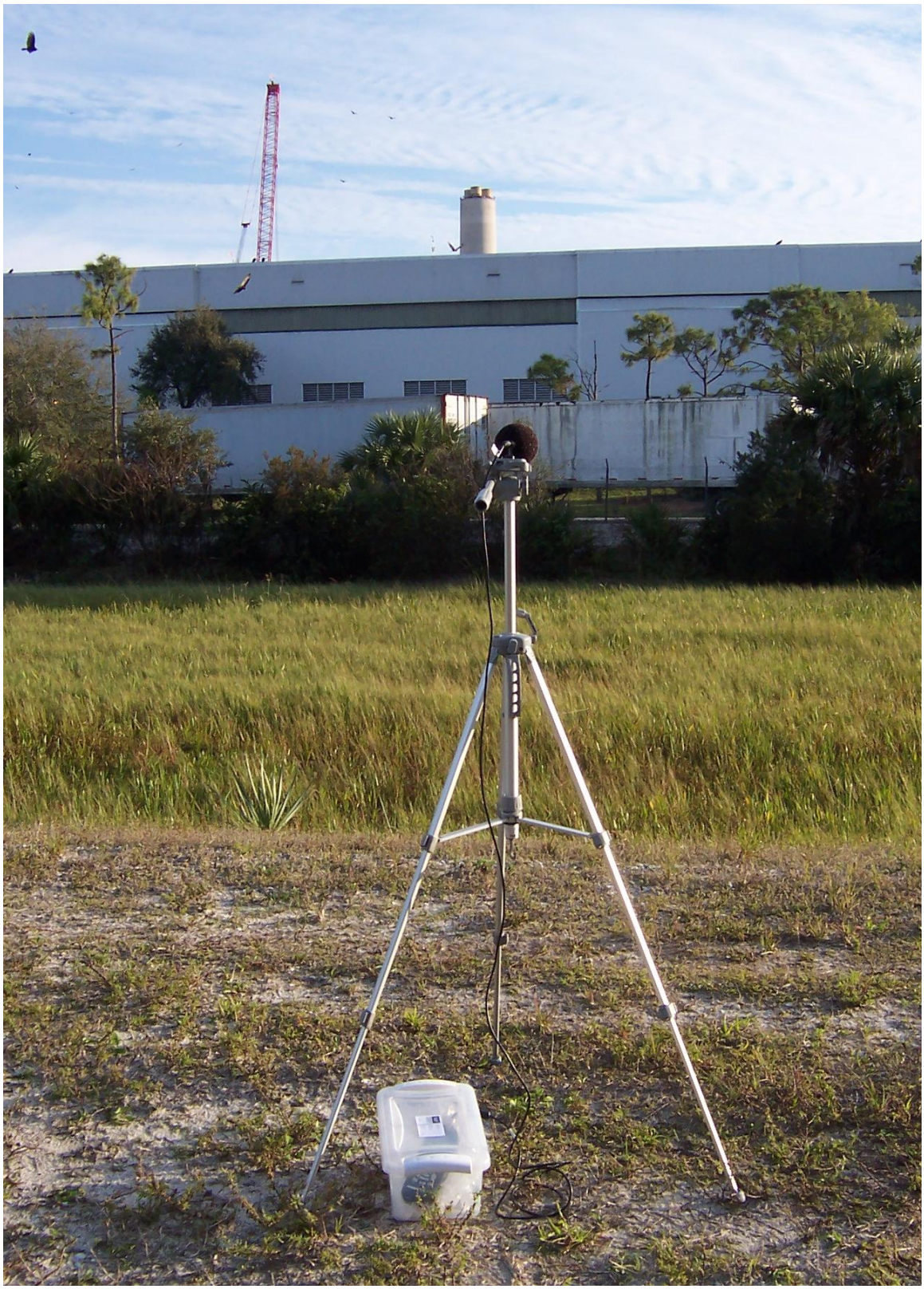

Figure 2-1: Sound Level Meter

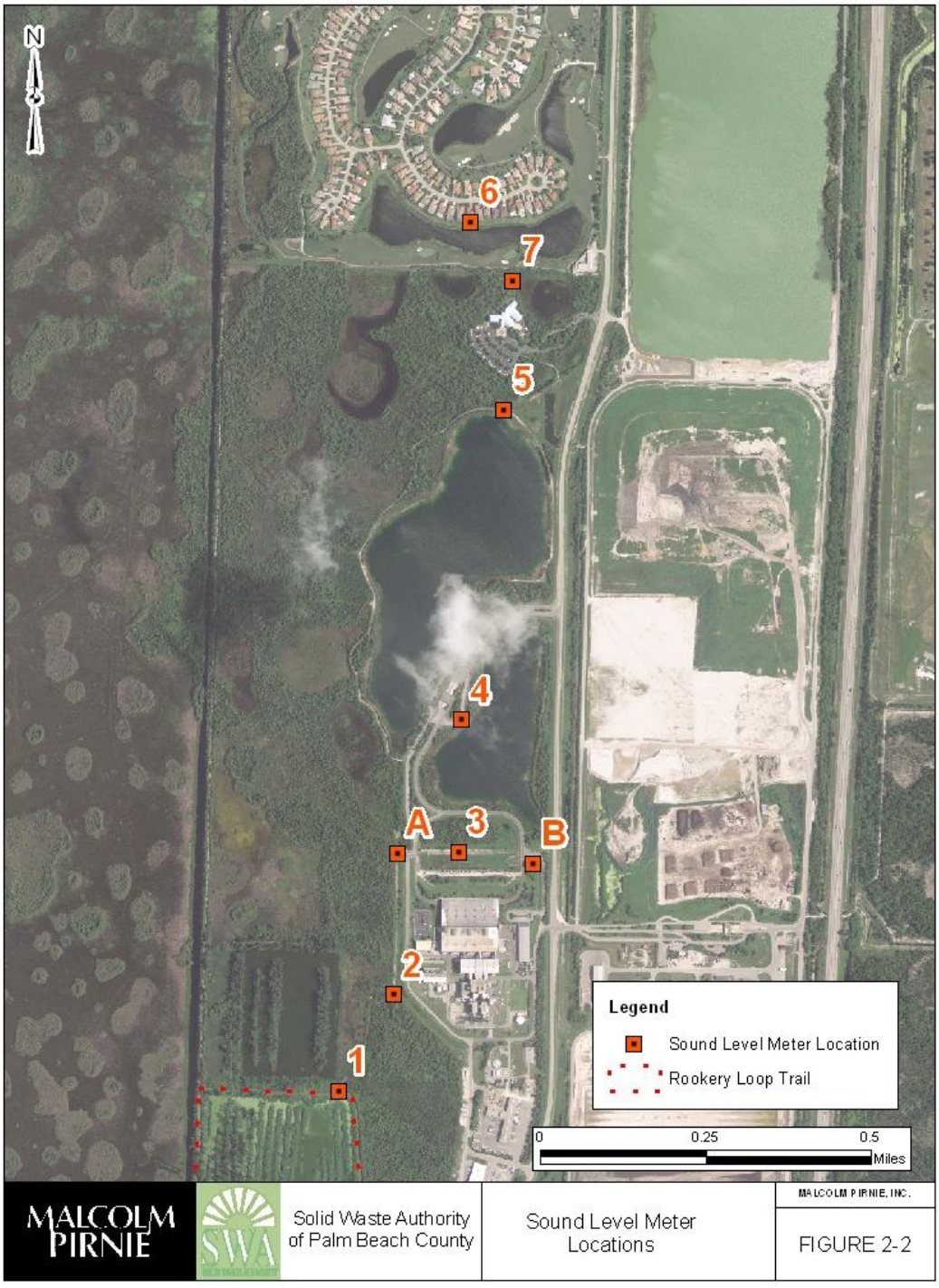

Figure 2-2: Sound Level Meter Locations

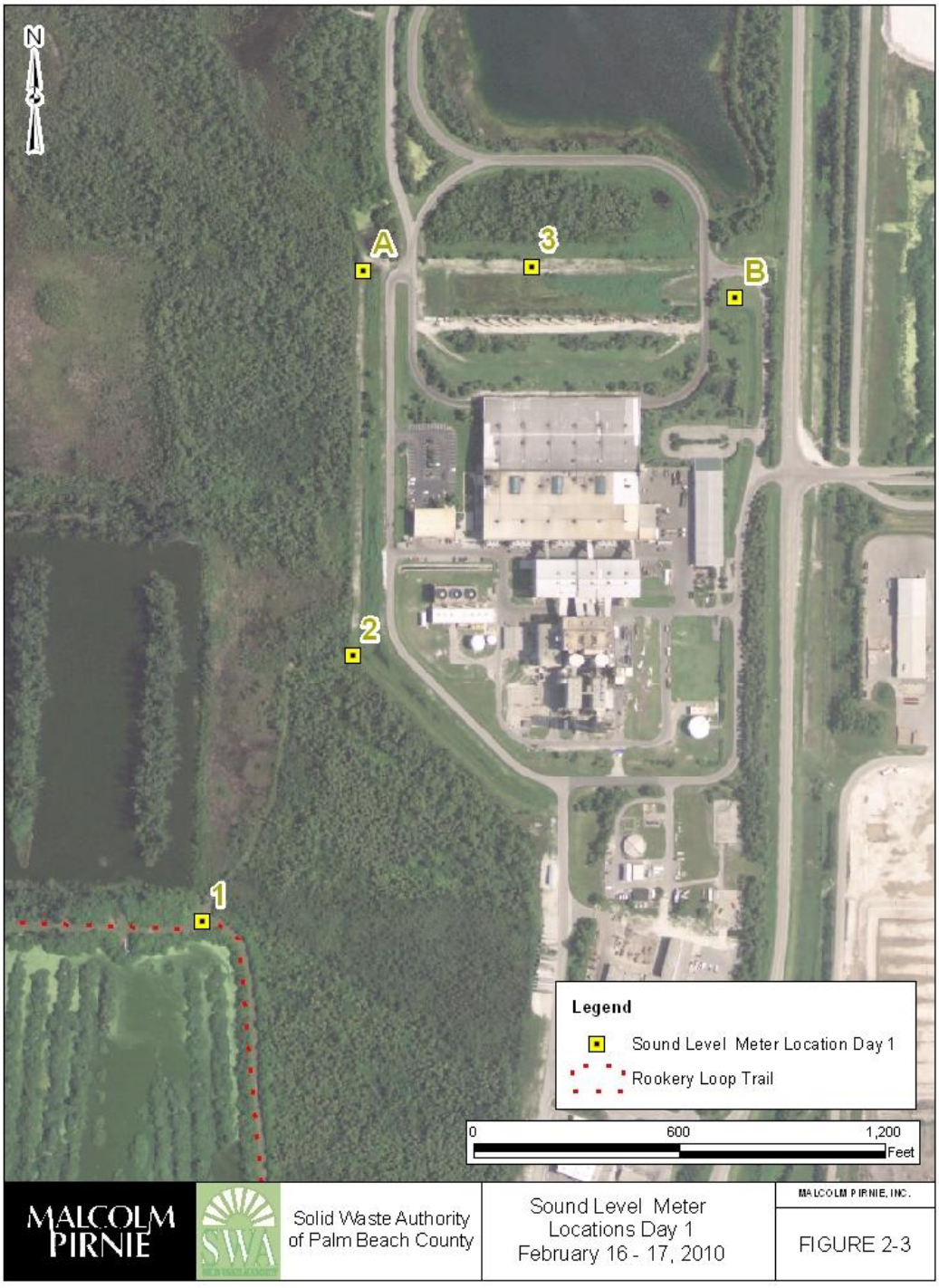

Figure 2-3: Day 1 Sound Level Meter Locations

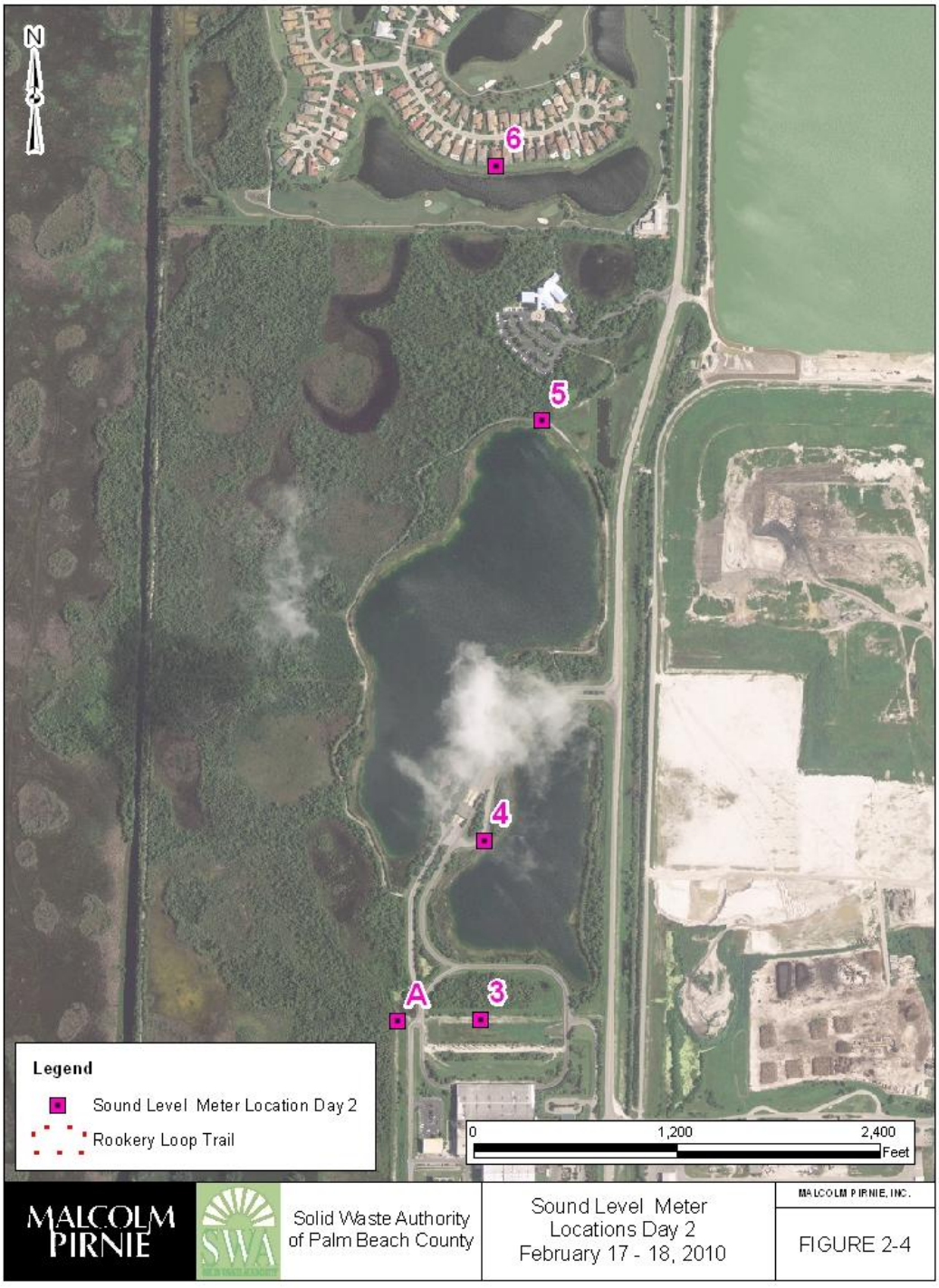

Figure 2-4: Day 2 Sound Level Meter Locations

3. Findings

The sound level data are presented here to address sound levels in the direction of the rookery southwest of the Existing Facility, sound levels in the direction of the Ironhorse Community north of the Existing Facility, and the development of operational sound level design criteria and acceptance criteria for the Proposed Facility.

3.1. Sound Levels in the Direction of the Rookery

Figure 3-1 depicts the sound level data collected at Location 1 and Location 2. At the beginning of the data collection on February 16th, the Existing Facility was venting steam during unplanned maintenance. The steam was being released to the atmosphere from a condenser unit located on the southwest side of the Existing Facility. At approximately 1:45 PM, the steam vent was closed and the Existing Facility returned to normal service. Closing the steam vent resulted in sound level reduction of approximately 10 dBA which amounts to a 50% reduction in perceived sound level. Once the Existing Facility was operating under normal service, sound levels held steady at approximately 69 dBA at Location 2 and 53 dBA at Location 1.

Sound levels observed during the unplanned maintenance on February 16th identified a significant sound source in the rookery. On February 17th, the Existing Facility operator was asked to vent steam as they would during a normal boiler startup and shutdown to determine if a worst case scenario had been observed. The sky-valve steam vents were opened between 75% and 25%. Sound levels at Location 2 increased less than 3 dBA. Consequently, the steam venting from the condenser on February 16th was determined to be the worst-case scenario and Figure 3-1 represents normal conditions and worst-case conditions in the rookery. The worst case scenario is expected to occur very infrequently.

3.2. Sound Levels in the Direction of the Ironhorse Community

Figure 3-2 depicts the sound level data collected at locations north of the Existing and Proposed Facilities in the direction of the Ironhorse Community. The times of loaded trucks passing the scales near Location 4 in route to the RDF are depicted with a red marker.

In a free field (e.g. an environmental without obstructions or other sound sources), sound levels can be expected to attenuate 6 dBA for every doubling of distance from a source. The environment at the Authority is not a free field, but the sound level attenuation from location 3 to location 6 is well within the range of expectations. The evening sound level

in the Ironhorse Community are within the acceptable range in U.S. Department of Housing and Urban Development guidance for residential areas (i.e. a 65 dBA day-night average sound level calculated as the 24-hour average sound level, in decibels, obtained after the addition of 10 decibels to the sound levels occurring between 10:00 pm and 7:00 am), although the federal guidelines do not apply.

Location 7 was established to quantify the sound level from the odor control system location on the property boundary between the Authority facility and the Ironhorse Community. At 50 feet from the source, the sound level was a constant 67 dBA. This is a significant sound source; however the source may not be the cause of concern to the residents of Ironhorse as further discussed in Section 4.

3.3. Operational Sound Level Design Criteria and Acceptance Criteria

Figures 3-3 and 3-4 depict sound level data collected at Locations A and B. The operational schedule of the RDF during the field survey captured the typical operational modes of the RDF. These modes include trucks entering with the RDF lines running, no trucks entering with the RDF lines running, and truck entering with the RDF lines not running. The oversized bulk waste (OBW) shredder was also operating during the monitoring period.

Figure 3-3 shows data collected with the RDF lines running with truck entering and RDF lines running without truck entering. The data show that while truck traffic does cause a noticeable increase in sound levels, the operational sound levels of the RDF in the evening is only 5 dBA less than during the day.

Figure 3-4 shows data with the RDF lines not running during planned weekly maintenance with trucks are entering and the RDF lines running with truck entering. When the RDF lines went back in service on February 17th after planned maintenance, sound levels increased approximately 7 dBA.

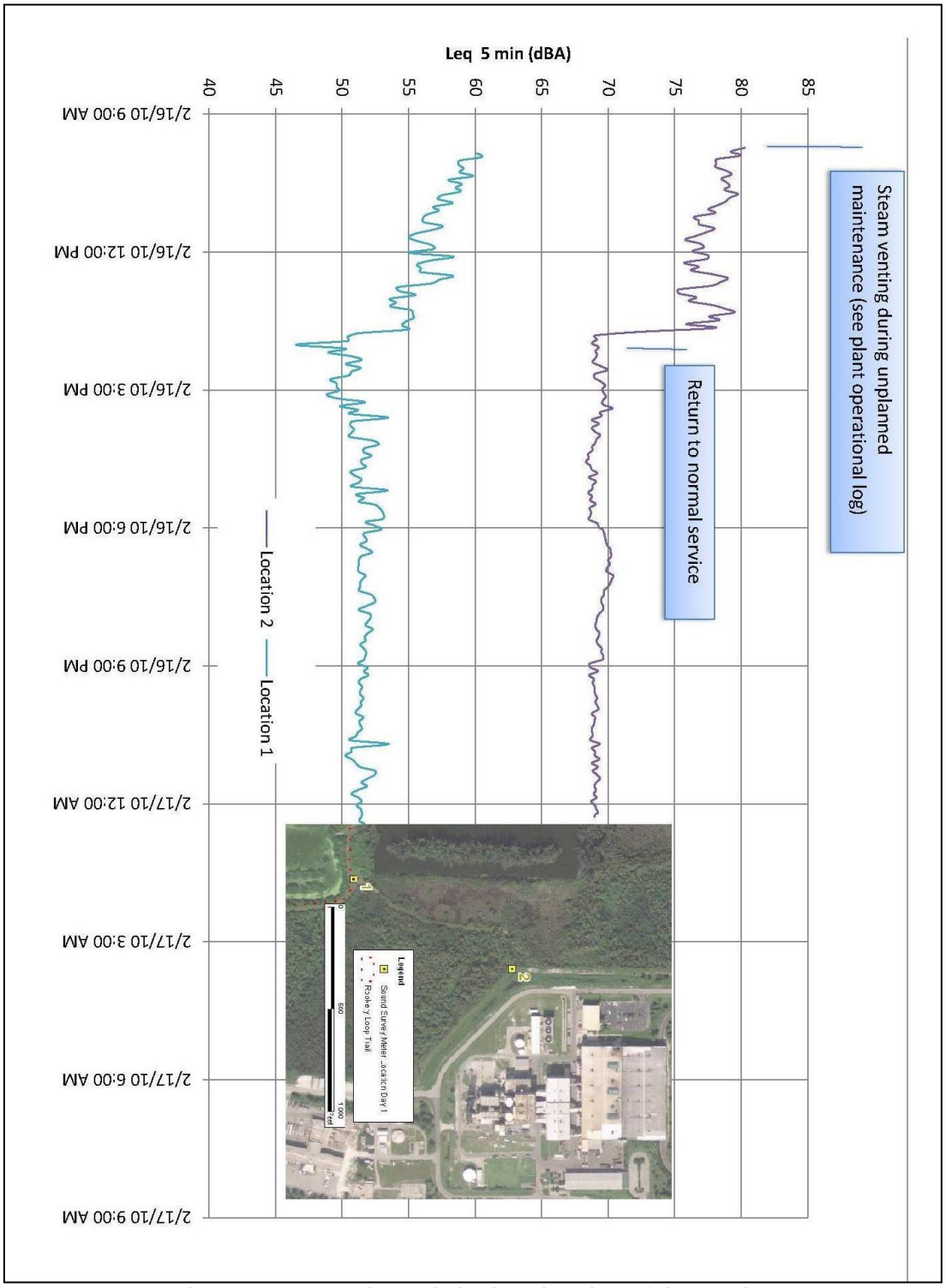

Figure 3-1: Sound Levels in the Direction of the Rookery

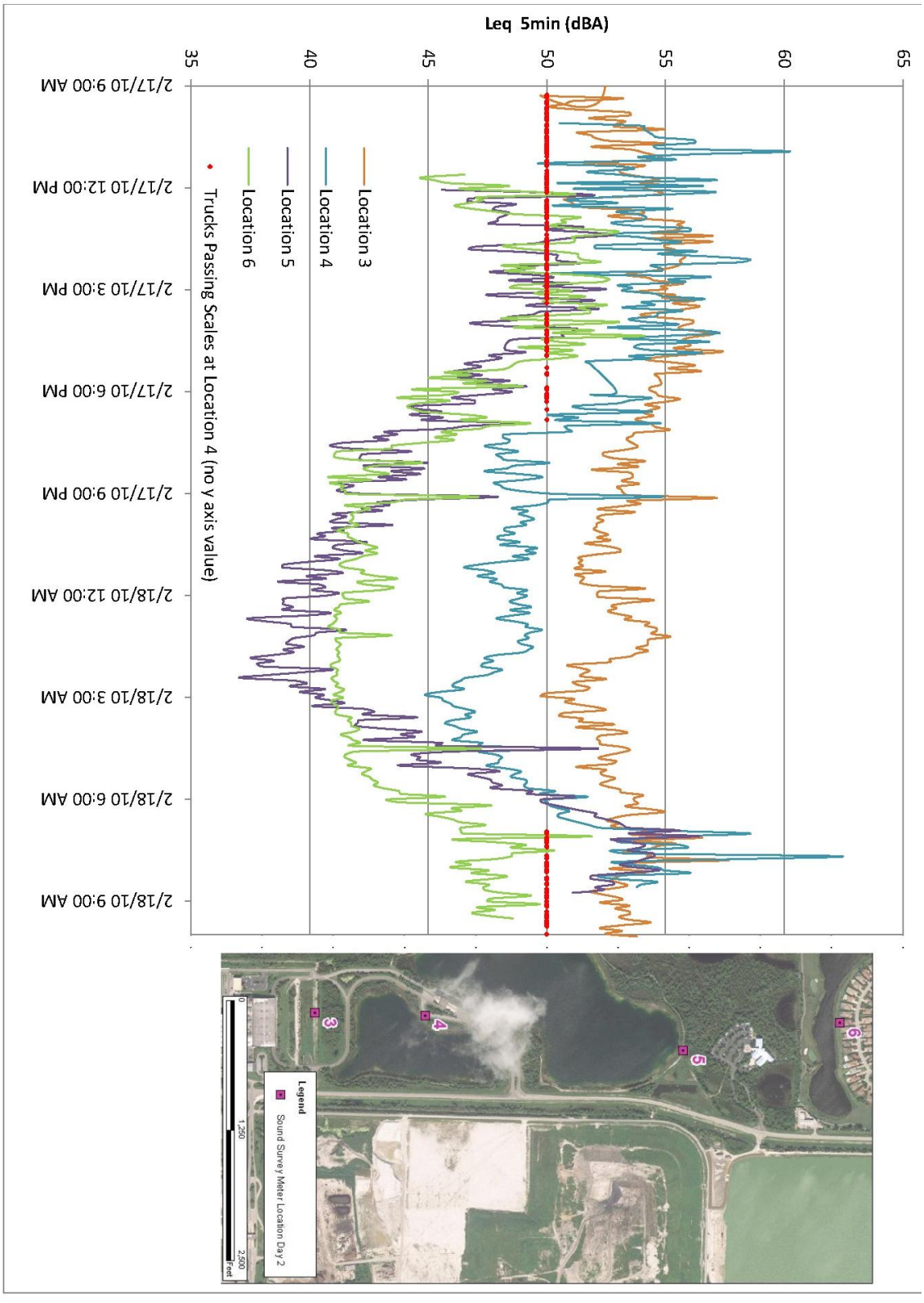

Figure 3-2: Sound Levels in the Direction of Ironhorse

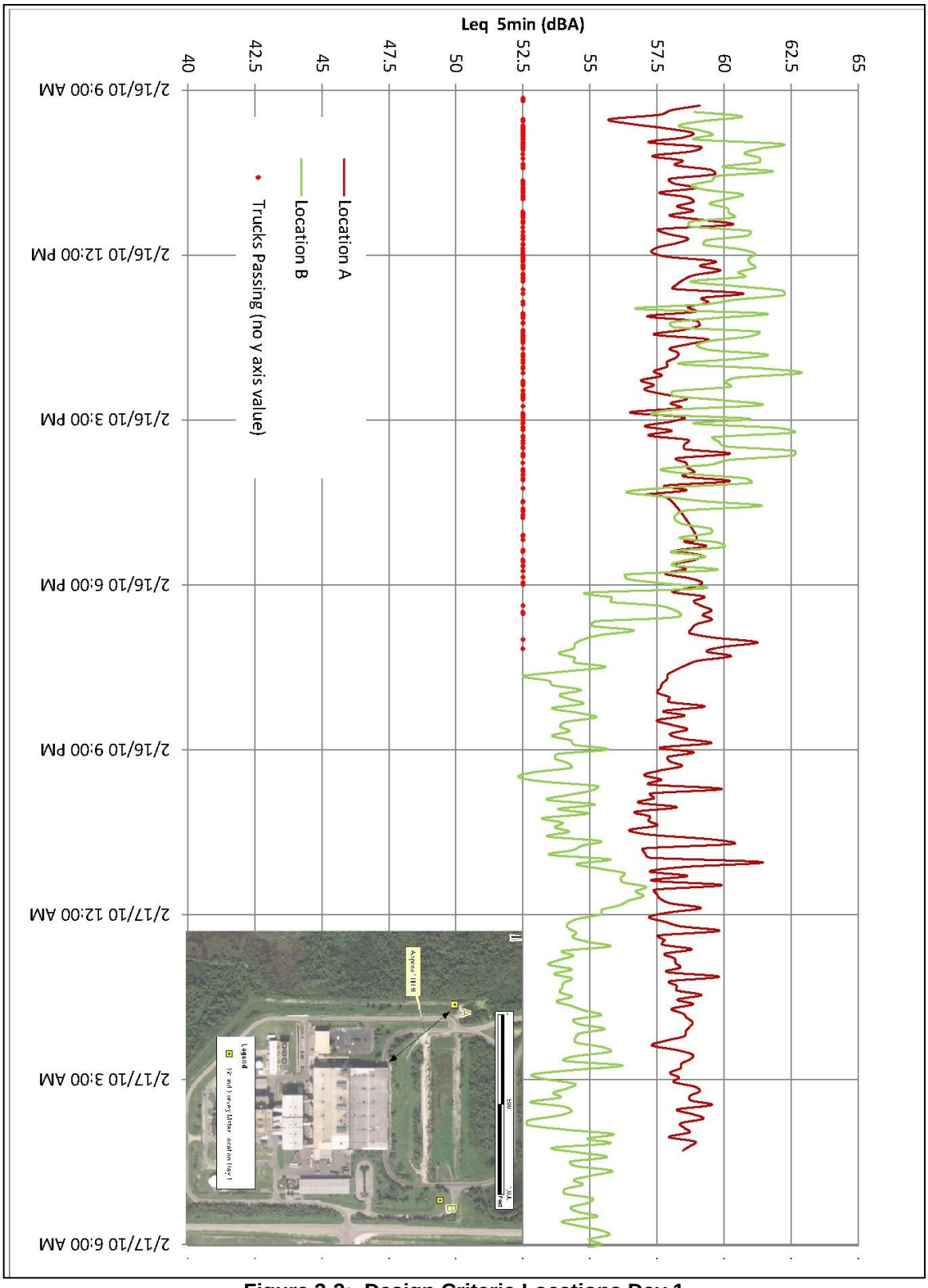

Figure 3-3: Design Criteria Locations Day 1

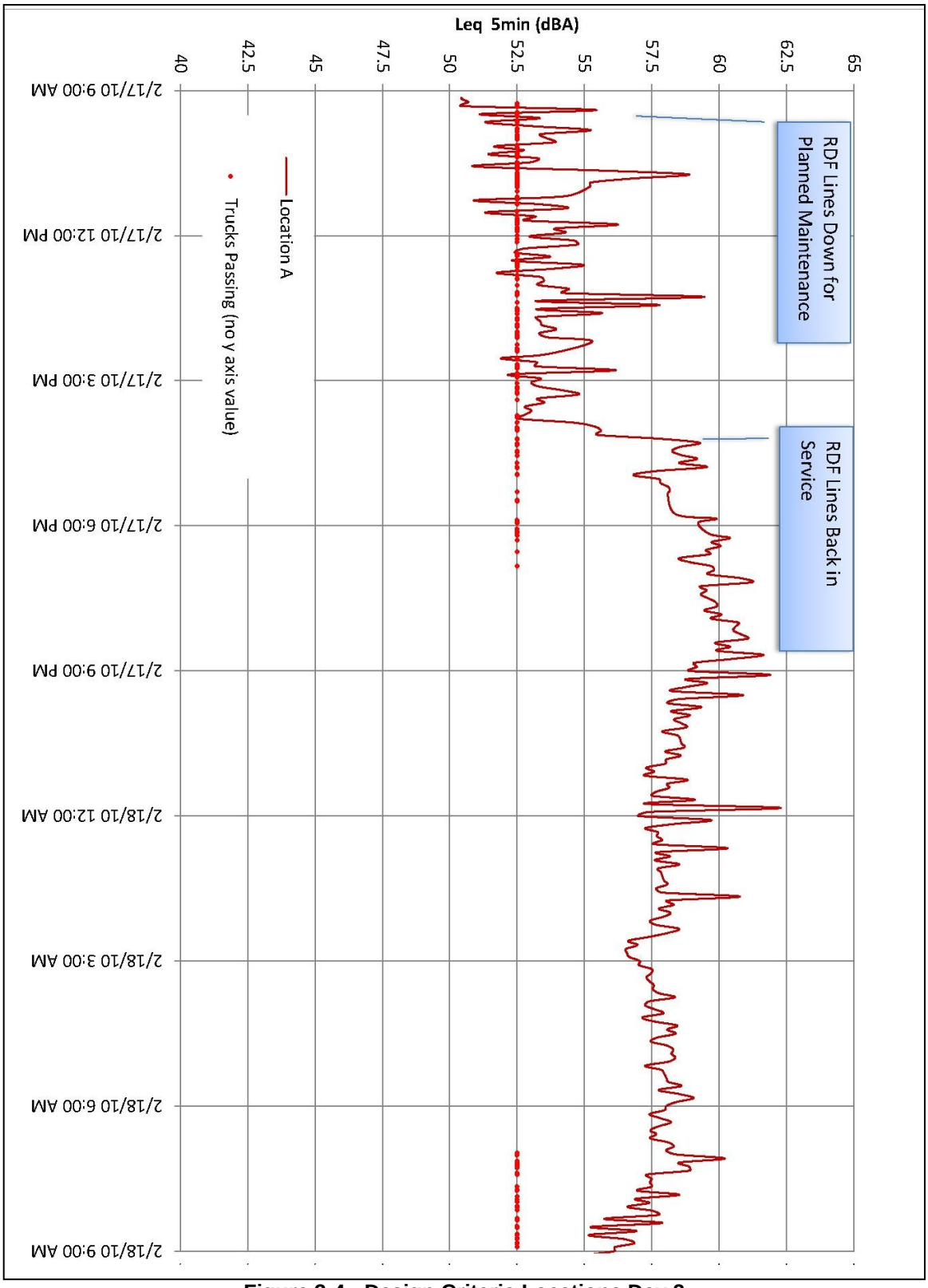

Figure 3-4: Design Criteria Locations Day 2

4. Recommendations

4.1. Rookery Receptors

Sound levels in the area of the rookery appear to be most influenced by sound sources at the southern portion of the Existing Facility (e.g. the power plant) and less influenced by sound sources at the northern portion of the Existing Facility (e.g. the RDF). This is due in part to the location of the rookery and the manner in which multiple sounds combine to create a total sound level. Specifically, the sum of two sounds is not calculated by simple addition. In other words 25 dBA + 27 dBA does not equal 52 dBA; nor are four passing trucks twice as loud as two passing trucks. The sum of two sounds is actually the addition of logarithmic quantities as illustrated in Figure 4-1. As shown in the figure, the addition of two equal sounds results in 3 dBA increase. Similarly, the addition of a 25 dBA sound and a 27 dBA sound yields a 29 dBA sound. The sound level measurements and field observations indicate that sound sources in the southern portion of the Existing Facility are at least equal to sound sources in the northern portion of the Existing Facility. Because the rookery is located southwest of the Existing Facility and sound attenuates with distance, sound sources in the southern portion of the Existing Facility essentially mask sound sources in the northern portion. The same effect can be assumed for the Proposed Facility location north of the Existing Facility. If sound sources at the Proposed Facility are similar to source sources at the Existing Facility, it can be expected that sound levels in the rookery will not noticeably increase and should not pose any potential negative impacts.

4.2. Ironhorse Community Receptors

The sound levels in the Ironhorse Community are within guidance for residential areas as outlined in Section 3. However, community residents have expressed concerns regarding some nighttime sounds. During this sound survey, a community resident and owner of the property at Location 6 described the sound of concern as a "grinding metal sound." Qualitative observations on the night of February 17th identified the Existing Facilities OBW shredder as a potential source of the grinding sound. The grinding sound was barely audible, but noticeable in the Ironhorse Community.

A possible explanation of the concern that residents have expressed over the night time sounds is the characteristics of the OBW shredder sound and not the magnitude of the OBW sound. Specifically, as materials are passed into the shredder, the sound level varies. The varying loads in the shredder produce sound that are not predicable can might be considered annoying or startling to residents sleeping with windows open. The fact that the sounds from the OBW emanate from the roof vent on top of the RDF exacerbates

the problem by limiting the amount of sound reduction that would come from vegetation if the sound source was close to the ground. Figure 4-2 depicts the OBW roof vent and sound source area. The Ferrous Processing Facility Relocation Noise Study prepared for the Authority in August 2009 documents the potential sound level benefits of relocating the OBW shredder to the proposed Ferrous Processing Facility location on 45th Street.

4.3. Design and Acceptance Criteria

4.3.1. Criteria

The goal of the design and acceptance criteria is to limit and potential negative impacts from sound sources at the Proposed Facility with achievable design requirements. The design and acceptance criteria is a maximum sound level and the design and acceptance criteria location is where sound level will be measured after construction. Achieving the acceptance criteria is a condition of the Authority accepting the project as complete.

Review of the data and discussions among the design team have lead to a decision to establish the design and acceptance criteria location at Location 4 (Figure 2-1). The reasoning is that Location 4 is between the Proposed Facility and the community to the north, and is sufficient distance away from the Proposed Facility to capture total sound levels. It is recommended that the design criteria be established for operations with no trucks entering the facility (i.e. night time operations) and that the criteria be evaluated as a Leq dBA with a 15 minute averaging period.

The recommended design and acceptance criteria is a Leq (15 min) of 60 dBA measured at Location 4 as depicted on Figure 2-1.

4.3.2. Comparison of Baseline and Proposed Conditions

In order to evaluate the adequacy of the proposed design and acceptance criteria, comparisons were made between observed baseline conditions, estimated baseline conditions, and estimated future conditions. Estimates of baseline and future conditions were made using the basic sound attenuation rate outlined in Section 3.2 (i.e. a loss of 6 dBA for every doubling of distance from a source). The future sound source was estimated using a value of 65 dBA at 400 ft as provided by the condenser manufacturer. These estimates are not a fully developed source-pathway-receptor sound model, but they are useful for a qualitative evaluation. Table 4-1 contains the observed and estimated sound levels at Locations 4, 5, and 6. Locations 4, 5, and 6 are shown on Figure 2-1.

Table 4-1:
Comparison of Observed and Estimated Sound Levels

Location	Observed baseline Leq (15min) dBA 8:00pm – 5:00am	Estimated baseline Leq (15min) dBA 8:00pm – 5:00am	Estimated future Leq (15min) dBA 8:00pm – 5:00am
4	48.1	49.2	59.8
5	41.5	40.5	47.0
6	41.8	37.7	43.6

Note: Only sound sources at the Existing and Proposed Facilities are included in the estimates

The comparison of observed and estimated baseline sound levels shows that the method of estimation is reasonable. The estimated baseline sound levels at Locations 4 and 5 are within 1.1 dBA of observations; however, the method underestimates the sound level at Location 6. This is because the method of estimation only considers sound sources at the Existing Facility and excludes sound sources in the community at Location 6. To account for this, a community sound source value of 39.6 dBA was added to the estimates at Location 6. Table 4-2 contains the estimates for Location 6 adjusted for community sound levels.

Table 4-2:
Comparisons on Observed and Adjusted Sound Levels

Location	Observed baseline Leq (15min) dBA 8:00pm – 5:00am	Estimated baseline Leq (15min) dBA 8:00pm – 5:00am	Estimated future Leq (15min) dBA 8:00pm – 5:00am
4	48.1	49.2	59.8
5	41.5	40.5	47.0
6	41.8	37.7 + 39.6 = 41.8	43.6 + 39.6 = 45.1

Note: Decibel addition calculated using equation depicted in Figure 4-1.

The adjusted estimate of future mean Leq (15 min) between 8:00pm and 5:00am at Location 6 is 45.1 dBA. This is 3.3 dBA above the mean baseline observation of 41.8 dBA. This amounts to a perceptible increase in total sound level. This night time sound level is well within the acceptable range for residential areas. It should be noted that under baseline conditions community sound sources contribute more to the total sound level at Location 6 than sound sources on Authority property. In contrast, sound sources on Authority property will contribute more to the total sound level at Location 6 than community sound sources under proposed future conditions. This switch in the dominate contributor to total sound levels may be noticeable to residents of the Ironhorse Community even though the total sound level should only have a slightly perceptible increase.

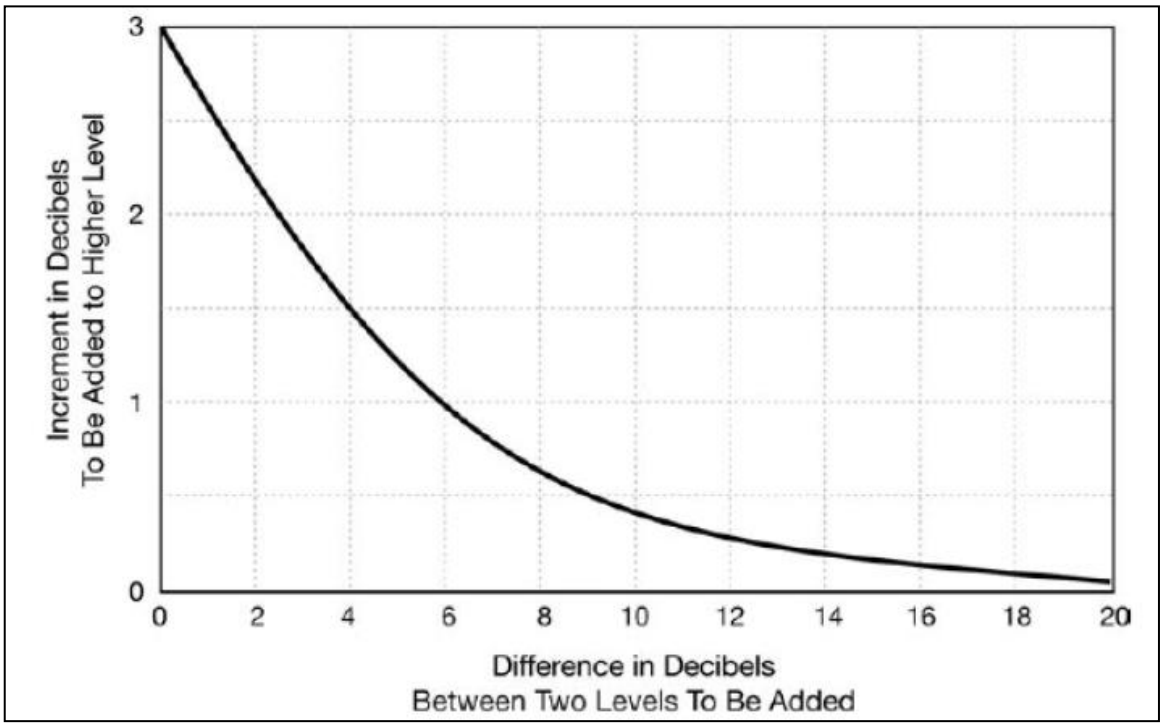

Figure 4-1: Decibel Addition

Federal Transit Administration, 2006. Transit Noise and Vibration Impact Assessment. Office of Planning and Environment.

Figure 4-2: OBW Shredder Vent