

SOUNDSCAPE STUDY REPORT

for



By

SIEBEIN **ASSOCIATES**

Consultants in Architectural Acoustics
625 NW 60th Street, Suite C, Gainesville, Florida 32607
(T) 352.331.5111
(F) 352.331.0009
office@siebeinacoustic.com



School of Architecture
1480 Inner Road, Gainesville, FL 32611

95% Complete Draft Report
August 23, 2023

Introduction

The City of Fort Lauderdale has evolved into a robust urban community with 24-hours each day of commercial activity, dense mixed-use activity centers, growing amounts of infill downtown housing, burgeoning destination retail, an active urbane nightlife, historic buildings, commuter rail transit, a street grid that is automobile and pedestrian friendly, and is home to the notable Riverwalk with an exceptional marine and pedestrian culture. This dynamic mix of uses, urban density, and high levels of activity with a benevolent climate that supports outdoor living leads to a complex soundscape with many desirable qualities. The City is looking to enhance compatibility among the different uses and stakeholders with different time schedules as the city continues to grow and become more complex.

Siebein Associates, Inc., in collaboration with the University of Florida School of Architecture, was engaged to conduct a study of the soundscape at multiple locations in the downtown area, designated activity centers, and locations that have been identified in collaboration with the City of Ft. Lauderdale Noise Control Advisory Committee. The study included 'sound walks' with Committee members and citizens in the designated areas, acoustical measurements of the soundscape, photographs, and maps of the areas under investigation. Short-term and long-term measurements of the soundscapes were conducted to assist in understanding the complexities of the soundscapes and how sounds change from early morning, throughout the day into the afternoon, and into the late evening. The acoustical data, field observations, and discussions with City staff, Committee members, and the general public, have been considered, and organized toward a comprehensive assessment of the areas of study in the City of Fort Lauderdale. This information is intended to support the work of the Noise Control Advisory Committee in making well-informed decisions on the priorities and balance for managing an active urban center with regard to shaping the soundscape. This report also provides recommendations for consideration to help improve compatibility among the various sound sources, entertainment venues, public spaces, residents and other stakeholders in the City of Fort Lauderdale. Fort Lauderdale's downtown, is unique in that there is both the 'main street' of Los Olas Boulevard and the second 'main street' of the New River and Riverwalk. Both are linked to transportation networks and host highly desirable pedestrian activities including dining, shopping, recreation, and nightlife. According to the Fort Lauderdale Downtown Development Authority (DDA), more than 50 developments are in the pipeline, some already underway, bringing more than 8,500 new residential units and 725,800 square feet of new restaurant and retail space (New York Post, February 2023). Fort Lauderdale is emerging as a unique model for growing a dense, demographically diverse, coastal urban lifestyle. As new residents come to Fort Lauderdale for the attractive mix of people, recreation, and entertainment they contribute to an active soundscape that includes all of the sounds found in complex urban environments including active socialization, gathering, special events of many types, cars, trains, boats, mechanical equipment, construction and amplified music. These sounds are balanced with the desire of residents to have normal repose inside their homes in the presence of activities in the urban core.

The current noise ordinance, Chapter 17 – Noise Control, of the City of Fort Lauderdale Code of Ordinances, designates A-weighted (dBA) sound level limits for daytime and nighttime hours with both A-weighted and C-weighted (dBC) maximum sound levels for use when measuring amplified sound. There is sometimes confusion about which sound levels and times of day are to be applied to different areas of the City. The measurement locations are also defined in the ordinance. The sound level limits and measurement procedures for foreseeable boundary situations are also defined in the ordinance. However, there are some indications of reported situations where sounds may be measured within the current sound level limits at points of enforcement, but are found as potentially disturbing at receiving locations in some

instances. A major focus of this work, as overseen by the Noise Control Advisory Committee, is to offer alternatives for consideration that can potentially be prioritized and implemented by the Committee toward enhancing sonic compatibility among the different uses as the city continues to grow.

The Soundscape Team including Siebein Associates, Inc., staff, and University of Florida faculty and students surveyed multiple locations, selected in consultation with the Noise Control Advisory Committee. Each site was visited multiple times during 2 weekends in the daytime, evening, late evening, and early morning hours. Each site was visited multiple times in February and again in April of 2023. Sound walks were conducted at each location. A soundwalk is a unique way of experiencing and measuring the acoustical aspects of urban environments. Consultants with sound measuring equipment walk through an environment documenting the sound levels, frequency content, sources of sound and other technical aspects of the soundscape while also discussing acoustical issues of concern with project stakeholders and observing the sonic and urban context. The sound walks in Fort Lauderdale included walks through the selected study areas with stakeholders to discuss issues of concern, their impression of possible strategies that could be implemented to enhance sonic compatibility among different uses, and to document the sonic context with sound level measurements, video recordings, and photographs at a variety of moments within the designated neighborhood locations. Two sets of unattended long-term acoustical measurements were also made. The first set was made at locations near entertainment venues where there had been acoustical concerns expressed in the past. The second set was made at locations near residential receivers where issue had been raised in the past.

METHOD

1. Sound walks were conducted with the soundscape team and residents, entertainment venue operators, City staff, and members of the Noise Control Advisory Committee through the neighborhoods in the designated study areas to document the range of conditions that are experienced daily. These soundwalks were made at different times of the day to qualify the different sonic conditions that occur throughout the day, evening, late night, and early morning on a typical weekend. Stakeholder concerns were noted and videos and photographs of the neighborhood conditions along with various spot sound level measurements were taken to qualify the types and levels of ambient and transient sounds in the neighborhoods.
2. Short-term sound level measurements were made of individual specific acoustic events to the extent that the sounds could be isolated and identified from the other sounds present at the time. This was done in the day, evening, late evening, and early morning hours at multiple sites within the designated study areas.
3. Long-term acoustical measurements were taken near identified sound sources and receiver locations. These measurements are taken continuously for 5 to 7 days at each of 12 locations. The data were used to calculate long-term average sound levels, document ambient sound levels, and identify sonic events that occurred during the measurement periods.
4. The data were analyzed, grouped, and presented to document existing conditions and to understand the quantitative sound levels of different sound sources, receivers and locations in the City.

5. Three dimensional computer models were built of selected sound transmission paths to understand the relative sound levels experienced at grade and above grade at selected locations for different sound sources and receivers.
6. The current Noise Ordinance was reviewed relative to the measured data and documented concerns expressed by stakeholders.
7. Building infrastructure was observed at selected locations to understand how the building elements may contribute to sound propagation and to determine the potential for planning, zoning, and code adjustments to contribute to future enhanced sonic compatibility in new and renovated construction.
8. The data were synthesized and recommendations provided to address each issue for consideration by the Committee and City.

Sound Levels and Decibels

Sound is defined as a pressure disturbance in the air caused by a vibrating body that is capable of being heard or detected by the human ear. The average sound pressure level or equivalent continuous sound level (LAeq) of a time-varying sound is defined as the level of an equivalent steady sound at a specific location for the same measurement duration that has the same A-weighted sound energy as the time-varying sound. The maximum A-weighted sound level or L_{Amax} is the greatest sound level measured on a sound level meter using fast time averaging during a designated time duration and an A-weighted filter.

An A-weighted sound level (dBA) is one to which an A-weighting filter has been applied. The A-weighting filter approximates the sensitivity of the human ear being less responsive to low frequency sounds. A-weighting deducts significant amounts of sound energy from the low frequencies preferencing the high-mid frequencies that the ear is most sensitive to. The mid-high frequencies are actually increased by (1.3 dB at the 2,500Hz frequency band) in the A-weighting process. Conversely, lower frequency or bass sounds are decreased by substantial amounts (-26 dB in the 63Hz Frequency band, -16 dB in the 125 Hz octave band, - 7 dB in the 250 Hz octave band among others). C-weighted sound levels filter out much less low frequency sound (-1 dB in the 63Hz frequency octave band) than A-weighted sound levels while both A and C weightings are more similar in the high frequencies. A 'flat' or unweighted measurement is referred to as Z-weighted. In this Z-weighted case, no weighting is applied to the measured sound levels in different frequency bands. There are no deductions or additions of any level in different frequency bands with the Z-or flat-weighting.

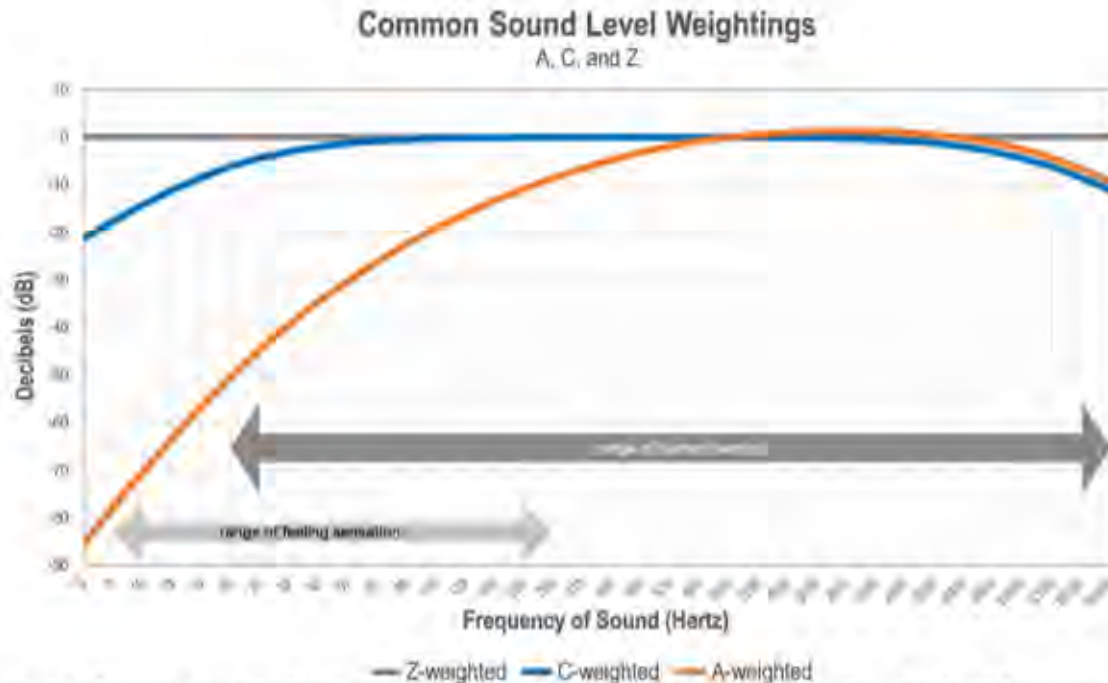


Figure 1. Common sound level weightings showing corresponding reductions in the 1/3 octave frequency bands for each weighting factor. Note that A-weighting adds approximately 0.5 to 1.3 dB to each 1/3 octave band sound level in the 1,250 Hz to 5,000 Hz 1/3 octave bands and deducts substantial amounts of lower frequency or bass energy from the overall sound level.

Sounds are typically measured in decibels. A decibel is 10 times the logarithm to the base 10 of the pressure disturbance in the air compared to the pressure at the threshold of human hearing. Decibels cannot be simply added by summation because they are logarithmic ratios. For example, 2 sounds of 50 decibels each added together result in a sound of 53 dB, not 100 dB as simple addition would achieve. A summary of the way that sounds with different sound levels are added together is shown in Table 1.

Table 1. Examples of the addition of sound levels (dBA).

Sound level 1	Sound level 2	Combined sound level	Explanation
50 dBA	50 dBA	53 dBA	When two sounds of equal level are combined, the result is a 3 dB increase in sound level
50 dBA	52 dBA	54 dBA	When one sound is combined with another sound that is 2-3 dB louder than first sound, the combined sound level is 2 dB louder than the louder sound
50 dBA	55 dBA	56 dBA	When one sound is combined with another sound that is 4-7 dB louder than the first sound, the combined sound level is 1 dB louder than the louder sound
50 dBA	60 dBA	60 dBA	When one sound is 10 dB louder than another, the combined sound level is approximately equal to the louder sound level

The differences in sound levels are not perceived by people linearly either. One sound must be 10 dB louder than another sound for it to be heard as approximately twice as loud as the first sound. A sound that is 0 to 1 dB louder than another sound is heard as approximately the same loudness as the first sound. A sound that is 2 to 3 dB louder than another sound is heard as barely louder than the first sound. A sound that is 5 to 6 dB louder than another sound is heard as noticeably louder, but not twice as loud as the first sound. A summary of the perception of the relative loudness of two sounds is shown in Table 2. An acoustic thermometer showing the sound levels associated with different sounds is shown in figure 1. The sound levels are measured in A-weighted decibels or dBA. An A-weighted decibel is one that has been adjusted so it corresponds to the relative loudness of middle level sounds as they are heard by human listeners. The low frequency or bass sounds are reduced by the A-weighting process and the higher pitch sounds that human ears are more sensitive to are increased slightly by the A-weighting process.

Table 2. Perception of the relative loudness of 2 sounds.

Difference in sound level between two sounds	The louder sound is perceived as ____ the quieter sound
0 to 1 dB	Not noticeably louder than
2-3 dB	Barely noticeably louder than
5-6 dB	Noticeably louder than, but not twice as loud as
10-12 dB	Approximately twice as loud as
15 dB	Approximately three times as loud as
20 dB	Approximately four times as loud as

In general terms, sound levels of 30 to 40 dBA are usually perceived by people as being relatively quiet. Normal conversation measured at approximately 3 feet from the person speaking is 60 to 65 dBA. Cars passing on a street or a residential air-conditioning unit are approximately 65 to 75 dBA. Loud night clubs and amplified music at concerts are often played at levels of 100 to 110 dBA.

Sounds can also be feelable. In particular, sounds below 250Hz can be felt through the mechanoreceptors that sense vibration and pressure as part of our sense of touch. High levels of low frequency sound, extending to frequencies as low as 5Hz, can be felt in the chest, legs, arms, and head – even though the sounds cannot be heard. Low frequency sounds from mechanical equipment or amplified music both within a building and outside a building can impart vibrations within building structural and enclosure systems that can be re-radiated as airborne sound, typically in the low frequencies, to the occupants inside the spaces. This reradiated sound can result in people feeling and hearing sound inside a space that may not be measurable, audible or feelable outside the space.

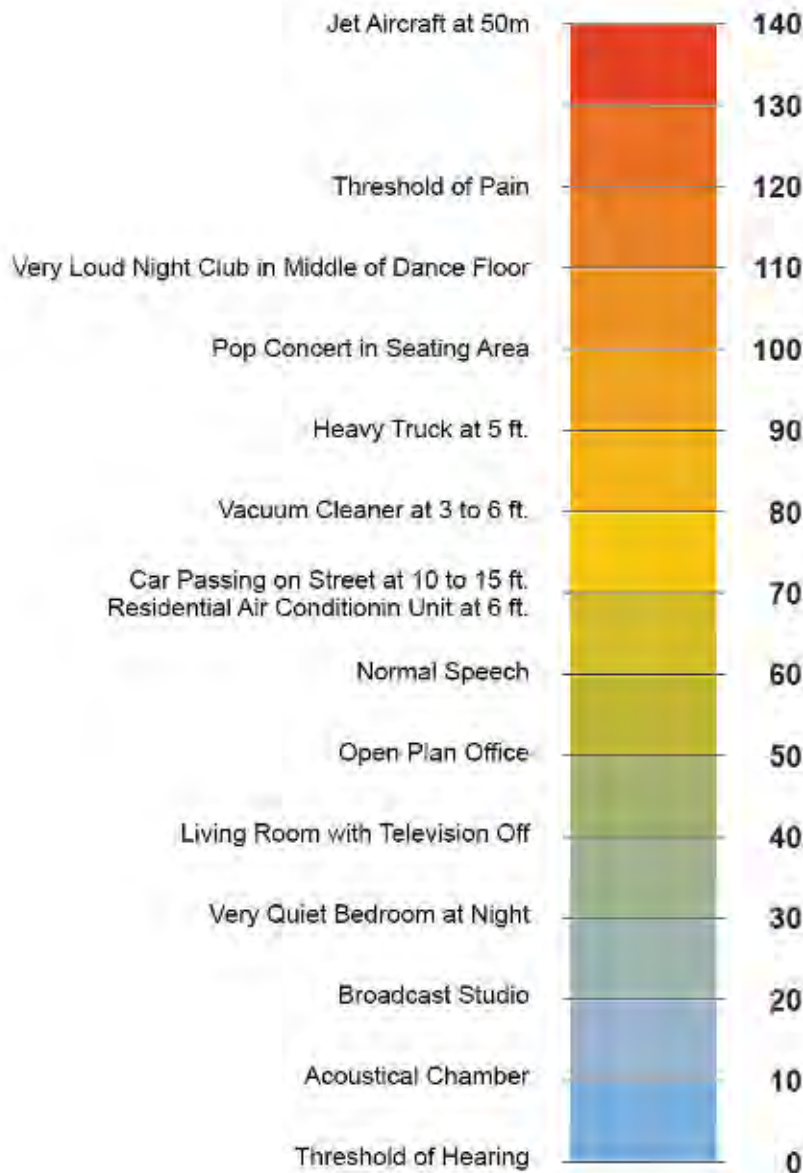


Figure 2. Acoustical thermometer showing the relative loudness in dBA of various sounds.

MEASUREMENT TIMES

Acoustical measurements were made by the Consultants during two trips to Fort Lauderdale. The first trip was from Thursday, February 16, 2023, until Sunday, February 20, 2023. The long-term meters were picked up on February 26, 2023 after recording data continuously for 9 to 10 days. The second trip began on Friday, April 21, 2023, and lasted until Sunday, April 23, 2023. The long-term meters were picked up on April 25, 2023 after recording data continuously for 5 days.

INSTRUMENTATION

Three types of acoustical measurements were made: long-term measurements of existing ambient sound levels; continuous measurements made during soundwalks at different times of the day and night; and short-term sound levels of specific acoustical events.

Long-term Instrumentation.

The long-term measurements were made with 3 Svantek SV 307A meters and 2 Rion NL-52 sound level meters on Trip 1 in February and with 6 Svantek and 2 Rion NL-52 and 1 Rion NL 32 sound level meters in April. The Rion NL-52 and NL-32 meters meet ANSI requirements for type I sound level meters. The Rion equipment was calibrated with a Larson Davis CAL200 pistonphone prior to and after testing. The calibration levels were 114 dBA and varied by $< \pm 0.1$ dB from the beginning of the measurement periods to the end. The microphones on the Rion meters were attached to an extension rod and the environmental cases strapped to trees or mounted on a tripod on a residential balcony approximately 6 ft. to 8 ft. above ground level.

The Svantek SV307A meters meet the IEC 61672-1:2013 for Class I sound level meters. The meters were set to the fast, A-weighted mode to acquire data. The Svantek SV 307A meters are internally calibrated before and after each use. The Svantek meters record files continuously during the measurement period and the files are uploaded to a cloud server for later use and analysis. The microphones were covered with wind screens and positioned approximately 6 ft. to 8 ft. (above reach height) above grade chained to trees or mounted on tripods or chained to balcony railings in residential units.

The meters were placed in secure weatherproof boxes and set to record sound levels every second for approximately 5 to 10 days. Graphs illustrating the A-weighted the maximum A-weighted and C-weighted sound levels (LA max and LC max), plotted vs. time for each time period are shown in Appendix A. Data were downloaded from the meter's memory card to a laptop computer and analyzed in our office.

Short-term Instrumentation.

The soundwalks and short-term measurements were made with Larson Davis 831 sound level meters as the basic instrumentation. These meters can record overall, octave and one-third octave band sound pressure levels over user programmed time periods. The meters meet ANSI standards for Type 1 sound level meters. Calibration of the meters with a Larson Davis Cal 200 calibrator occurred before and after each measurement period. The calibration levels were within ± 0.1 dB from the beginning of the measurement period to the end. The meters were hand held or tripod mounted with the microphones on the meters at a height of approximately 5 ft. 6 in. above grade. Windscreens were attached to the microphones for all measurements. Overall A-weighted, C-weighted, and octave band spectra of significant acoustic events were recorded at all locations. The data were downloaded to desktop computers in our laboratory where the data were analyzed.

Soundwalk Instrumentation

The Larson Davis type 831 sound level meters described in the section above were also used to take the measurements during the soundwalks. The meters were handheld at approximately 5 ft. 6 inches above grade during the sound walks. A windscreen was attached to the microphone for all of the measurements. The same calibration procedures described in the section above were used for the meters during the soundwalks.

LONG-TERM ACOUSTIC MEASUREMENT LOCATIONS

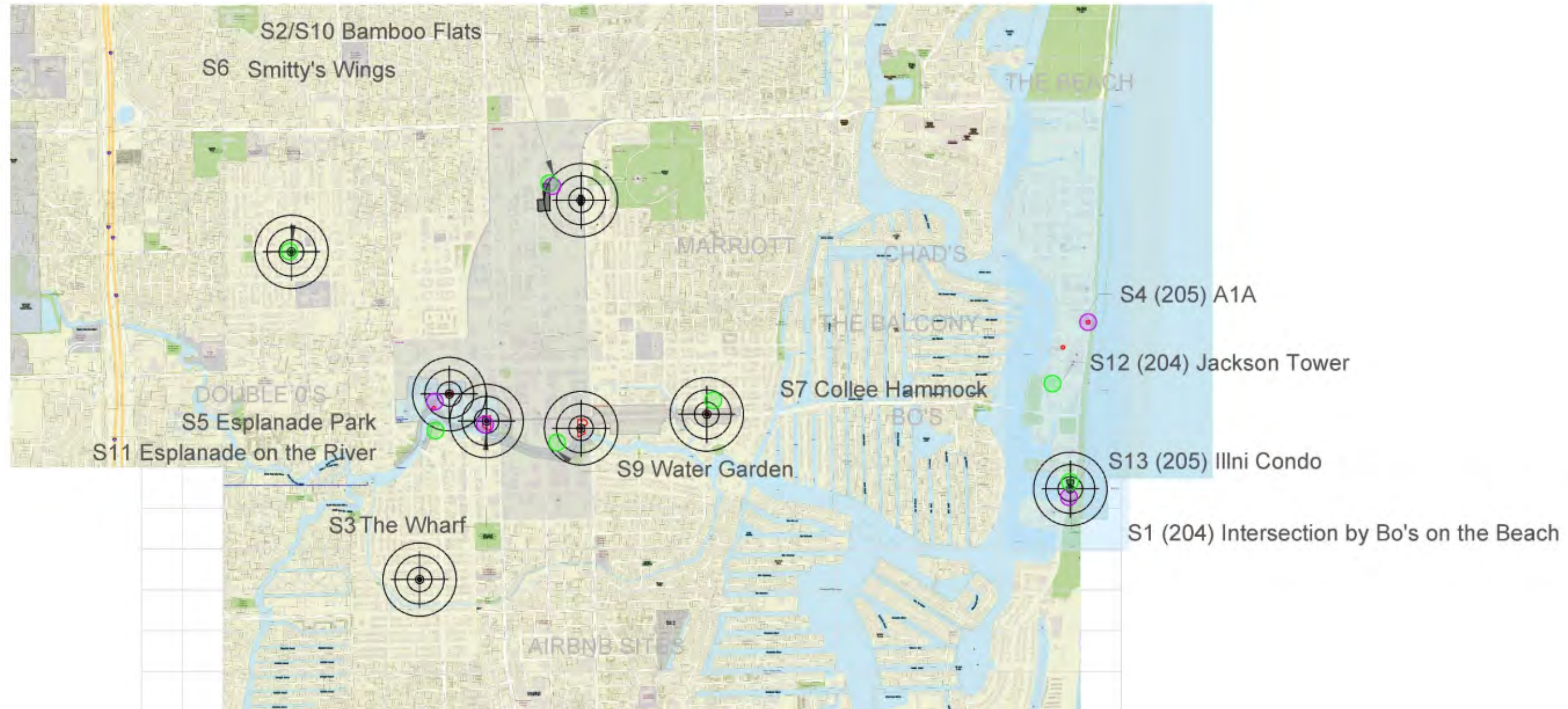


Figure X. Map of Ft. Lauderdale showing the long-term measurement locations. Purple circles indicate long-term meter locations from Trip 1. Green circles indicate long-term meter locations from Trip 2.

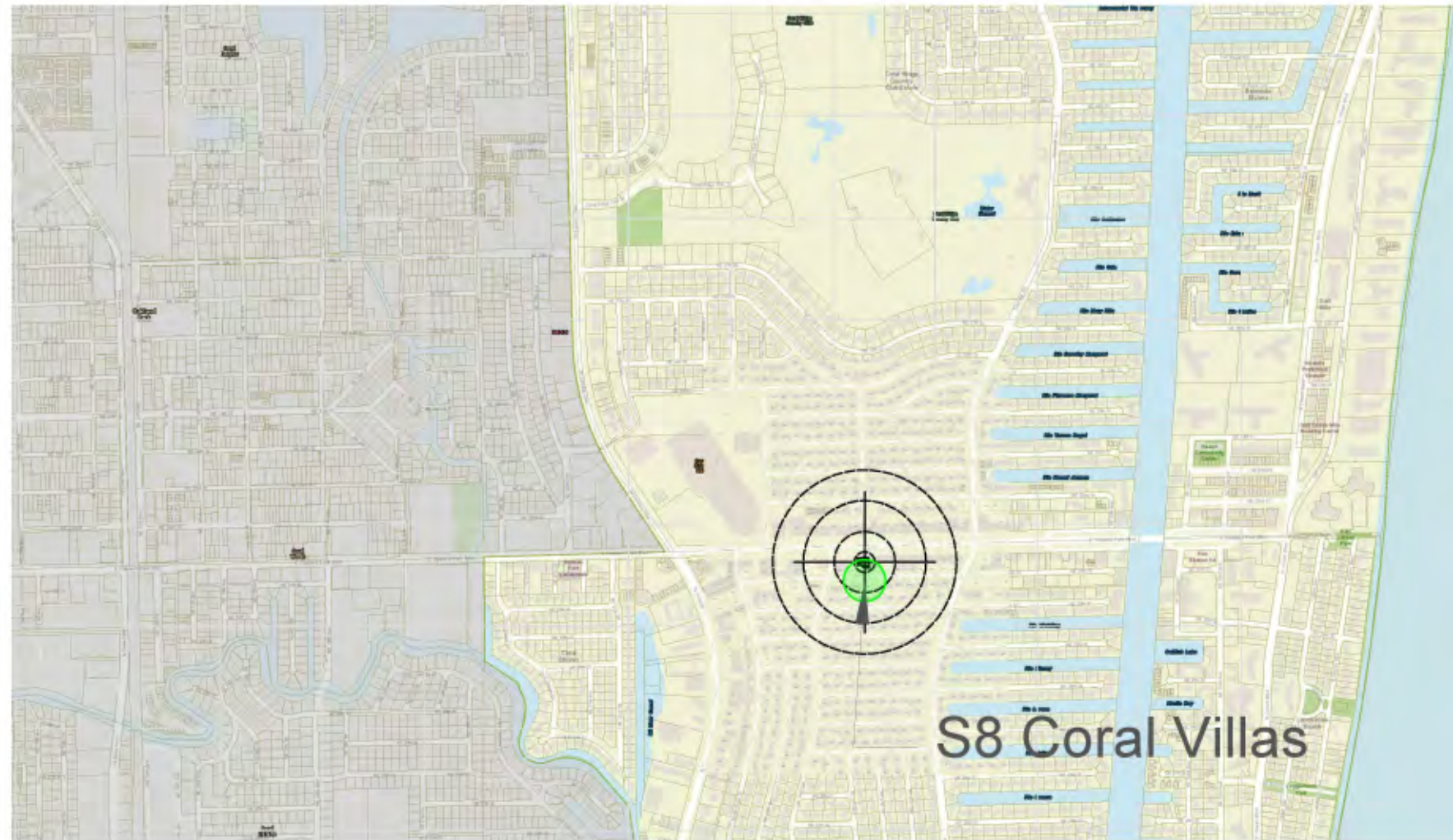


Figure X. Map of Ft. Lauderdale showing the long-term measurement location in the residential area outside of Truth Lounge. The green circle indicates this is a long-term meter location from Trip 2.

Long-term measurements were made during 2 trips to Fort Lauderdale. Measurement locations during the first trip were at locations near entertainment venues where noise issues had been identified in the past. Measurement locations during the second trip were at locations near residential receivers who had expressed concerns about entertainment noise in the past. Sound level meters were placed in each of the zones identified by City staff and the Noise Control Advisory Committee (NCAC) as being representative of the different sections of the City described above. Appendix A contains graphs of the data from the long-term measurements plotted as dBA and dBC vs. time for each day (24-hour period of time). Appendix B summarizes the long-term data in tables where the measured sound levels are broken out by the times of day and night when they occurred.

Trip 1 Measurement Locations

1. The Riverwalk near The Wharf

Rion 7 was mounted in a tree in a small garden in the Riverwalk adjacent to the New River across a public open space from the Wharf. The Wharf is an entertainment district that is adjoined on 2 sides by residential/mixed use towers. There are openings between the towers across the New River to the south and into the city center via SW 1st Avenue to the north. The meter recorded sounds of activities in the public open space, boats and people moving along the New River and activities in and around The Wharf. This is a very active area with pedestrians moving along the Riverwalk all day long, the active Wharf and the water craft moving along New River.

2. Esplanade Park between the Stage and the Restroom Building

Rion 8 was located in a tree between the stage and the Restroom Building in Esplanade Park. This is a relatively quiet location when there are no events in the park because it is reasonably far away from SW 2nd Street. There was a special event in the park on Saturday during the measurement week. There was also Jazz in the Park on the Sunday of the measurement week. The Himmarshee Entertainment District is located to the east of the park.

3. Median of A1A on the north

Svantek 205 was located in a tree in the median on the northern side of A1A where it separates into separate northbound and southbound lanes. Data were only recorded for 4 days with this meter due to a malfunction of the external battery for the unit. Sounds at this location are primarily vehicles traveling on A1A.

4. Median of A1A on the south

Svantek 204 was located in a tree in the median on the southern side of A1A where it separates into separate northbound and southbound lanes. Sounds at this location are primarily vehicles traveling on A1A and secondarily sounds from Bo's on the Beach and events in the beachfront park.

5. Flagler Village

Svantek 203 was located in a tree on the side of NW 4th Avenue street at the northern end of Flagler Village just south of NW 6th Street. The north side of Flagler Village adjoins an area that has several entertainment venues located in it, some of which play amplified music. Flagler Village is a relatively quiet residential development with a commercial area located on NE Flagler Drive. There is a train line on the west side of Flagler Village and there are several entertainment venues

located across the railroad tracks that have amplified entertainment in them. These venues are buffered from residential occupancies at the present time by distance and the commercial activities along NE Flagler Drive. Future development on open parcels in this area may need special planning to provide acoustical compatibility with the existing venues.

6. Smitty's Wings

A sixth sound level meter (Rion 7) was placed in a tree in a parking lot just west of Smitty's Wings. There was a technical error in the writing of the measured data to the meter hard drive so data were not available from this meter. The meter was successfully deployed during Trip 2 at the same location.

Trip 2 Measurement Locations

1. Illni Condominium upper floor unit balcony/Bo's on the Beach

Bo's on the Beach was identified as a source of noise complaints for residents living in the Illni Condominium in the past along with loud cars and motorcycles traveling on AIA. Bo's has an operable louvered roof and operable windows that are opened frequently while amplified music is played in the dining establishment. The music is usually played on weekends. The Illni tower is across an alley from Bo's on the Beach and residential units overlook the roof of Bo's. Svantek Green 205 was located on the balcony of a residential unit on the 10th floor of the building.



According to the resident, the music had been loud enough in the past to shake glasses in the cabinets, however it has not been that loud anymore. The resident stated that they have called the establishment when the music gets too loud and asks them to turn it down. According to the current noise ordinance, because this building is located within 200 ft of a commercial establishment, the residential sound limit would be 65 dBA during the day.

2. Jackson Tower 6th floor mezzanine/Rock Bar backyard patio

The Rock Bar was identified as a source of complaints for residents living in Jackson Tower in the past. The Rock Bar has an outdoor dining area to the east on AIA and a patio with a pool area to the rear. Residents have identified sounds coming from the pool area as being the source of amplified music that is heard. The east side of the residential tower has a direct line of sight both visually and acoustically to the rear pool area. There is a solid fence along the west side of the outdoor activity area that would possibly reduce sounds measured at 5 ft. from the property boundary to be within the sound level limits of the noise ordinance, while sounds can move over the top of the wall and propagate to the multi-story condominium across Seabreeze. Svantek Red 204 was located on the mezzanine walkway on the sixth floor of the building facing the Rock Bar and Sea Breeze.



Music from the Rock bar was plainly audible on grade and on 6th floor facing Rock bar. Bass music was plainly audible during afternoon hours when the long-term meter was placed at this location.

3. Bamboo Flats/Rose and other entertainment venues

Svantek 291 Pink was placed in a tree at the top of the fence separating one of the residential units on the north side of Bamboo Flats from the adjacent properties on the north. The location is diagonally across NE NE 8th Street from the measurement location. The Bamboo Flats neighborhood was described in the section on Trip 1 measurement locations.

4. Water Garden upper floor unit balcony/Yolo

Yolo has been identified as a source of noise complaints in the past for the residents in the Water Garden. Yolo has an outdoor area covered with a canopy that has amplified music. Measurements were taken on the balcony of a residential unit on the 26th floor of the Water Garden facing Yolo with Svantek 284 orange. Data were only available for 4 days with this meter due to a malfunction of the cord connecting the meter to the external battery. There is a direct line of sight from the balcony to Yolo. The lower floors of the Water Garden are partially blocked from a direct sound path to the entertainment sounds by the parking garage that is located between the 2 buildings. Furthermore, the ambient sound levels at grade are elevated compared to those above due to the presence of mechanical equipment and traffic on the streets at the street level.



The resident stated that on Friday and Saturday nights she typically has to wear ear plugs when she goes outside on the balcony and wears ear buds when she is inside the unit.

5. Esplanade on the New River upper floor unit/Himmarshee Entertainment District and The Wharf

The Esplanade on the New River is a multi-story condominium building that is located on the south side of the New River across from the Esplanade Park. The Himmarshee Entertainment District is located approximately 630 to 750 ft. to the north-northeast of the building. The Wharf Entertainment District is located approximately 1,100 ft. to the east-northeast. Svantek 282 Purple was located on the balcony of an upper floor unit in the building. There are clear direct sound paths from the balconies on the northwest, north and northeast sides of the building both entertainment districts and also to the Riverwalk and Esplanade Band Shell where special events are held in addition to Sunday Jazz Brunch in the park. Boats in New River with loud engines and/or playing amplified music also have direct acoustical lines-of-sight to the units. Interestingly, the configuration of balconies on multi-story residential buildings captures the direct sound from the sound sources. In addition, sounds propagating upwards strike the underside and side walls of the balconies are reflected back to the balcony increasing the perceived loudness of the sounds.

Sounds at this location were especially difficult when a night club that has since closed was operational. The amplified sounds, especially the bass sounds, could be clearly heard inside the units even when the large, hurricane patio doors were closed. Residents also spoke of how the sounds from the entertainment districts now last until 4:00 am when previously the limit was at midnight.

6. Colee Hammock/The Balcony and the service alley

Colee Hammock is a traditional residential neighborhood about ½ block off Las Olas Boulevard. The first row of residences are separated from the Las Olas commercial strip by a service alley. There are many activities in the service alley such as trucks coming to service the restaurants along Las Olas during night time hours that residents expressed concerns about as well as building equipment and amplified music. Rion7 was placed on an exterior balcony at a residence whose rear yard was along the alley. The residence was diagonally across the alley from The Balcony. There is a large opening on the rear of The Balcony covered with a screen mesh through which sounds propagate across the alley to the near by residences.

7. Coral Villas/Truth lounge

Svantek 203 was located in a tree at the edge of the driveway of a residence on NE 30th Place across the street and to the south of the rear of the Truth Lounge. Truth Lounge is located on East Oakland Park Boulevard which is a east-west roadway. Coral Villas is a relatively quiet residential area. Residents have complained about sounds from the Truth Lounge propagating to their homes in the past. Truth Lounge is an enclosed building with solid walls on the sides and rear of the building that face Coral Villas with several doors located in the walls. The front or north side of Truth Lounge is glass. Amplified sounds occur inside the closed building.

8. Smitty's Wings

Smitty's Wings is located on NW 6th Street which is a busy road on the edge of a low density residential district. Complaints from residents in the past were related to sounds from people parking a lot across the street from Smitty's and playing loud music in their cars while they gathered and talked. The sound level meter was originally located at this location during trip 1, but the data did not record and store properly, so the Rion 4 sound level meter was placed again at the location in a tree in the parking lot across the street from Smitty's where people congregate. Smitty's does have amplified music played sometimes, but this has not historically been a source of noise concerns from residents. Sunday afternoon/evening was identified as a time when noise-related activities occurred in the past near Smitty's.



SHORT-TERM ACOUSTIC MEASUREMENT LOCATIONS

A number of short-term spot measurements were taken throughout the city of specific acoustic events to isolate the events of interest from other background or intruding sounds to the extent that this was possible at each location.

A table that contains these measurement summaries as well as graphs of the sound level plotted vs. time for each event are contained in [Appendix C](#). The specific locations are identified in each graph.

SOUNDWALK MEASUREMENTS

A soundwalk is an acoustic measurement process where the consultants are outfitted with sound level meters and a method of taking notes on paper or digitally. The consultants walk through the City as a citizen does, and records the sounds as they move through the streets or areas. Soundwalks are performed to capture the experience of citizens as they inhabit the areas of interest, recording the sound levels, frequencies and .wav files of the soundscape in real time. The soundwalks were taken at different times of day during the measurement times.

Soundwalks were taken throughout the 2 weekends at different times and locations. Appendix D contains several selected soundwalk maps showing the locations of the measurements. It also contains graphs of the sound levels recorded on those sound walks. Soundwalks were taken around Bamboo Flats and the surrounding area, AIA and Seabreeze on the Beach, the Riverwalk and surroundings, Himmarshee Entertainment District, and Las Olas Boulevard along its entire length.

LONG-TERM MEASUREMENT RESULTS

Long-term measurements were made with sound level meters that continuously record sound levels from February 16-26, 2023 and April 21-25, 2023. The meters were placed at 13 locations selected by the Noise Control Advisory Committee as representative of key sound complaints in Fort Lauderdale. A summary of the measurements is included in [Table 5](#). Graphs of the average sound levels plotted vs. time for each day are included in Appendix A. The data recorded were average sound levels or LAeq's, LAFmax and LCFmax when available and Day-Night Average Sound levels or LDN's in dBA that were calculated from the measured average sound levels.

S1 (204) was located in the median by Bo's of the Beach off AIA. The LDNs ranged from 70-76 dBA. The range of average day time sound levels at this location varied between 68 and 85 dBA over the measurement period. This location is on grade at a main thoroughfare on the Beaches. It is adjacent to a restaurant. Sound levels tended to remain fairly consistent, picking up sounds from the traffic, wind, amplified music from venues and the motorcycles and loud cars on the road. Sound levels between 2am and 5am dropped off to approximately 47 dBA at the lowest to 70 dBA. Day time sound levels between 70-85 dBA were typical. At this location, it was difficult to see any major increase in sound level from amplified music during the evening hours. This is likely because the busy AIA tended to mask some of the sound levels. There were over 30 to up to 90 events above 90 dBC each day at this location, likely due to motorcycles and loud cars.

S2 (203) was located in a tree in the Bamboo Flats residential area located near the restaurants and nightlife. The LDNs at this location ranged from 62-65 dBA at this location with one day having a 72 dBA LDN from Feb 16-25, 2023. The range of average sound levels at this location varied between 53 and 75 dBA over the measurement period. This is a residential location adjacent to a neighborhood street so individual car pass bys would increase the sound level to the 70's. Sound levels during the weekend tended to increase around 10:00 pm and decrease around 2:00 am. Sound levels during the late evening and early morning hours were measured between 60-80 dBA. The sound levels began to decrease to 45-65dBA during the early morning hours between 3:00 am-7:00 am. Sound levels would then increase in the morning and remain fairly consistent until approximately 10:00 pm on the weekend. The increased sound levels are seen more clearly in the LCFmax (dBC) metric, with those levels increasing to 78-95 dBC and then decreasing to 60-75 dBC in the early morning. The A-weighted sound levels do not appear to increase dramatically during the late nights and early mornings, however, the increase in C-weighted sound level is clearly seen.

This indicates that bass sounds from amplified music are impacting the area, even though the middle and higher frequencies remain relatively the same as those measured at other times of day.

S3 (Rion 7) was located at rear of the Wharf. The LDN at this location ranged from 71- 79 dBA from Feb 16-25, 2023. Short-term sound levels increased in the day and night hours on Friday and Saturday to approximately 70-75 dBA, and tended to decrease around 2:00 am during the weekend to approximately 55-60 dBA. Tuesday had sound levels that rose in the evening around 10:00 pm and varied until approximately 4:00 am. This day had a sound signature that was unlike the other weekend days. Sound levels during the evenings without amplified music were approximately 55-60 dBA.

S4 (205) was located in the median at the intersection of A1A and Seabreeze at the northern point where A1A divides into separate northbound and southbound lanes. The LDN at this location ranged from 73-74 dBA. This location was another area in the Beach that is heavily travelled by automobiles. Day time sound levels ranged from 70-85 dBA. On Feb 19, 2023, a resident noted that a large number of motorcycles and ATV's had just passed by. Sound levels at that time were 102 dBA and 104 dBC. Many spikes in the vicinity of these levels are seen in the graphs, with 32 events above 100 dBC on that same day alone.

S5 (Rion 8) was located in a tree in Esplanade Park located between the stage and the Restroom building. The LDN at this location ranged from 61-66 dBA dBA from Feb 16-25, 2023. Day time sound levels tended to vary between 50-60 dBA and remained relatively constant during the evening and nighttime hours on the weekend with several spikes over 80 and 90 dBA. Night time sound levels drop to approximately 45-55 dBA during the late night and early mornings. Saturday between 11:00 am to 4:00 pm sound levels increased to 60-78 dBA during the chili cookoff.

S6 (Rion 4) was located in a tree in the parking lot adjacent to Smitty's Wings. The LDN at this location ranged from 69-71dBA dBA from April 21-25, 2023. This location is adjacent to a fairly busy road Sistrunk, in a residential area with Smitty's serving the local community. On Sunday April 23, 2023, sound levels increased to 63-87 dBA with a number of spikes over 90 and 100 dBA during this 3 ½ hour period. Night time and early morning sound levels tended to decrease to 45-65 dBA, with day time sound levels increasing to 58-65 dBA LAeq and 75-85 dBA LAFmax largely attributed to traffic on Sistrunk except for Sunday afternoon/evening.

S7 (Rion 7) was located on the 2nd story balcony in a residence at the rear of The Balcony and other establishments in the Collee Hammock residential area. The LDN's ranged from 64 to 65 dBA. The LAeq sound levels tended to remain fairly constant from day to night, however the LAFmax values show that louder specific acoustic events were taking place. The fairly constant LAeq is typical of a location near HVAC units that are on almost constantly. Saturday - Sunday shows a decrease in sound level around 1:00 to 2:00 am from 60-70 dBA, with quieter sound levels between 2:00 am to 7:00 am ranging from 50-60 dBA. There are a number of spikes over 70 and 80 dBA during the late night and early morning hours. The resident at this location observed that the music from the venues was not necessarily an issue at this location. The music was heard by residents who lived closer to the Balcony. Their street was apparently being disturbed by delivery trucks, cleaning trucks, etc. using the alley at times during the early morning hours.

S8(203) was located in a tree at the rear of the Truth Lounge in the Coral Villas residential neighborhood. The LDN's varied from 63-65 dBA. Sound levels tended to increase during the day and decreased during the evening. Day time sound levels ranged from 65-80 dBA LAFmax. On Saturday evening, the sound levels increased to approximately 75-80 dBA LCFmax around 11:00 pm, while the A-weighted sound levels were 55-70 dBA LAFmax. Sound levels from Friday early morning were also raised to 76-80 dBC from 12:00 am-2:00 am, and began to decrease and level off around 3:00 am through 5:00 am. The amplified

music is seen using the C-weighted metric at this location more so than the A-weighted sound levels. On Monday, there were a number of events over 90 and at 100 dBC throughout the early morning and day time hours at this location.

S9 (284) was located on the balcony of the Water Garden on the 26th floor. The LDN's varied between 68-70 dBA. Day time sound levels ranged from 65-75 dBA and 75-90 dBC. Sound levels tended to reduce in the early morning by approximately 2:00 to 2:30am and stayed low until approximately 6:00 am with levels in the high 50's and low 60's dBA as the quietest sound levels. The resident explained that Friday and Saturdays were typically the noisiest and that she needed to wear ear plugs outside and ear buds inside to maintain acoustical comfort. The graphs for Friday and Saturday do not show an increase in sound level in the late night hours that was seen in many of the other locations. On Monday at this location, there was an increase in sound levels in the morning and early afternoon.

S10 (291) was located in a tree in a residential courtyard that adjoins the lively entertainment area in Bamboo Flats. The LDN's ranged from 61-63 dBA. On Saturday, sound levels increased around 10:00 pm and stayed elevated until past 2:00 am (80-90 dBC and 60-70 dBA), then lowering to (48-60 dBA and 58-70 dBC) until about 6:00 am. Day time sound levels tended to range from 55-70 dBA and 65-80 dBC. There were a number of events that went over 90 dBC during the late night and early morning hours.

S11 (282) was located on the balcony of an upper level unit at the Esplanade on the New River Condominium. The LDN's ranged from 68-70 dBA. This location sits across the water from Esplanade Park. The Himmarshee Entertainment District is further across the river to the north. The Wharf is to the east approximately 1,100 ft. up the river and across from the River Walk. It is also located along the waterway and as such, boats with amplified music come along the waterway. According to the resident, the amplified music from the entertainment districts, boats traveling on the river and Jazz in the Park is heard through the windows at this location. It was mentioned that at this location previously, the amplified music was finished at 12 midnight. Now with the revision of the entertainment district requirements, amplified music is played until 4:00 am. The resident stated that it is difficult to find respite at night. Data from this location appears to generally agree with the resident's observations. There is an increase in sound level starting around 10:00 pm on Saturday that stays consistent through approximately 4:00 am (65-70 dBA and 73-78 dBC), then gradually decreases. Sound levels are lower from approximately 5:00 am to 7:00 am with levels of 55-68 dBA and 68-75 dBC. Because the sound levels fall off around 4:00 am, it is assumed that the Himmarshee district is a major contributor to the sound level at this location, as some of the other nearby entertainment establishments close earlier than 4:00 am.

S12 (204) was located on the mezzanine balcony on the 6th floor of Jackson Tower. This location was chosen to take representative sound levels measurements of sounds that residents in living units above experience that are in close proximity to the entertainment district. The LDN's at this location ranged between 72 dBA all 3 days. Elevated sound levels were recorded on Saturday between 2:00 to 7:00 pm, (85-95 dBC) and 70-80 dBA. This was also recorded on Sunday from 4:00 -7:00 pm as well. There appears to be an increase in sound level around 11:00 pm on Saturday to 85-95 dBC and 70-80 dBA. The level decreases around 1:00 am.

S13 (205) was located on an upper floor balcony at the Illni Condominium overlooking the roof of Bo's on the Beach. The LDN's ranged from 69-70 dBA. Sound levels tended to increase in the late afternoon from 5:00 pm through 9:00 pm on Saturday and Sunday. Several residents stated that during the times when the measurements were taken, the louvered roof of the restaurant was left closed. This condition was studied in a 3D computer model to simulate sound levels if the louvered roof were open compared to being closed. Results from that analysis are presented in section X. Sound levels during this time (5:00 -9:00 pm) ranged

from 70-80 dBA and 83-95 dBC. Sound levels then decrease to 65-75 dBA and 70-80 dBC. A large number of events are recorded in this location with sound levels above 90 dBC, some of which are attributable to loud vehicles on A1A and Seabreeze.

Table 5. Summary of Day-Night Average Sound Levels (LDN) (dBA) at the long-term measurement locations for Trips 1 and 2.

Meter	Date	LDN, dBA
Riverwalk Near The Wharf		
Rion 7	1Feb2023	73-79
Esplanade Park Between Rest Room and Stage		
Rion 8	16-Feb-23	61-66
Bamboo Flats on Street		
Svantek 203	16-Feb-23	62-72
Median in A1A South on the Beach		
Svantek 204	17-Feb-23	70-76

Meter	Date	LDN, dBA
Median in A1A North on the Beach		
Svantek 205	17-Feb-23 thru 20-Feb-23	73-74

Meter	Date	LDN, dBA
Parking Lot Across from Smitty's Wings		
Rion 4	21-Apr-23	69-71
Colee Hammock near The Balcony and Service Alley		
Rion 7	21-Apr-23	64-65
Coral Villas near Truth Lounge		
Svantek 203	21-Apr-23	63-65-

Water Garden Upper from Living Unit		
		68-70
Svantek 284	21-Apr-23	

Meter	Date	LDN, dBA
Bamboo Flats in Yard Closest to NE 8 th Street		
Svantek 291	22- Apr-23	61-63
Esplanade on New River Upper Floor Living Unit		
Svantek 282	21- Apr-23	68-70
Jackson Tower 6th Floor Mezzanine		
Svantek 204	22- Apr-23	72
ILLNI Upper Floor Living Unit		
Svantek 205	21- Apr-23	69-70

THE FORT LAUDERDALE SOUNDSCAPE

Neighborhood and District Discussion

The soundscape team worked closely with the Noise Control Advisory Committee to identify areas within the greater Fort Lauderdale area that were representative of locations where acoustical issues have been historically identified. There is a desire to explore the soundscape in these areas to identify potential strategies and regulations that could help to balance sounds from entertainment establishments and other sources and the residents who live near those establishments that sometimes find the sounds disturbing. Some of the locations are within or adjacent to designated entertainment districts and others are at or near establishments in commercial districts that are adjacent to residential occupancies and neighborhoods. The study locations represent a range of occupancies including single-family residential neighborhoods, low-rise residential neighborhoods, high-rise residential and high-rise mixed-use buildings. The locations also

represent the range of conditions in Fort Lauderdale including the urban core, beach areas, arterial roads, and low-density residential fabric.

Entertainment Districts

The City of Fort Lauderdale has implemented, through the Code of Ordinances, Special Entertainment Overlay Districts (Chapter 5: Alcoholic Beverages, Article III Special Entertainment Overlay District). These special areas are located in urban areas with mixed uses noted as Regional Activity Centers (RAC) and are intended to:

... create the opportunity to and encourage the development of areas which promote the cultural, economic educational and general welfare of the people of Fort Lauderdale in conjunction with the development of areas catering to and promoting tourism and providing entertainment centers for the utilization and enjoyment of the public.

Sec 5-51. Code of Ordinances, City of Fort Lauderdale



Figure 3. Maps showing Downtown (left) and Beach Entertainment Districts.

As illustrated in the maps in Figure 3, the special overlay districts are generally limited to individual properties or a collection of properties within a single urban block. Amplified music generated in the overlay districts is given specific limits crafted to specific hours, days of the week, and any holidays allowing activities to occur until 2:00 am on weeknights and 3:00 am on weekends and holidays. Sound level measurements taken to evaluate compliance with the ordinance are designated to be taken at five feet (5') from the property line of the sound source. The measurement duration is a 30 second period and there are to be no less than three (3) 30 second measurement durations. Measurement of the Lmax (maximum level) during the 30 second period is used to determine if the sound is in compliance with the code. A-weighted or C-weighted Lmax levels may be used to evaluate the sound based on the limits and times of day/week graphed in Figure 4 below.

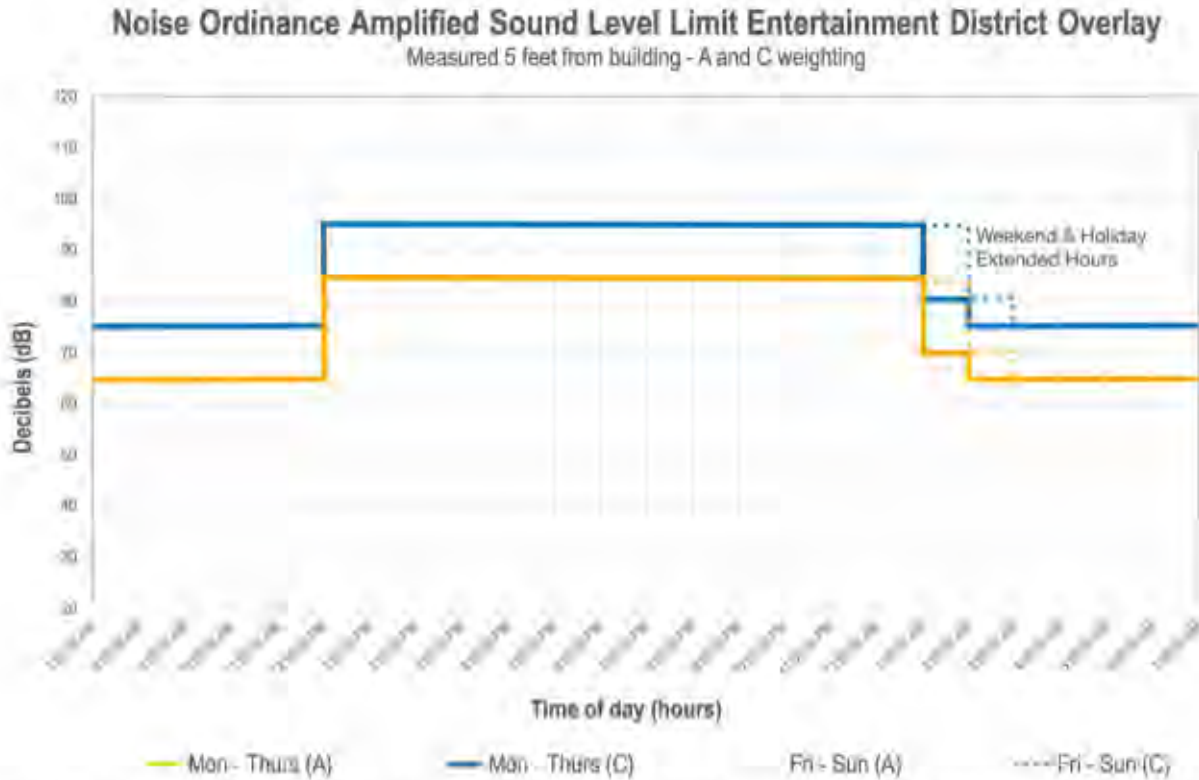


Figure 4. Allowable amplified sound levels within Entertainment District Overlays. The blue lines are for C-weighted sound levels (dBC). The orange lines show the limits for A-weighted sound levels (dBA).

The Soundscape Team traveled with code enforcement officials on sound walks, observed various acoustic event spaces, talked with stakeholders, and measured sound levels at multiple times during the day and night, using the criteria in the Ordinance in addition to other sound level metrics which were stored for presentation later in this report. The equipment being utilized by the noise enforcement staff is not capable of recording or storing data so the person measuring must visually observe the sound levels over the designated 30 second period while the level is rapidly changing constantly over that time. When code enforcement officers observe what they believe to be the maximum level, they write that down on a piece of paper and then take two or more additional 30 second measurements to determine the maximum sound level. The meters they are using only measure A-weighted levels and are not capable of measuring C-weighted levels. As noted previously, the C-weighted sound level is a better measurement to use in cases where low frequencies are prominent in the amplified sound because it does not deduct substantial amounts of sound in the lower or bass frequencies the way that the A-weighted sound levels do.

The Soundscape team conducted multiple sound walks in these entertainment districts and adjacent areas on weeknights and weekends in February and April of 2023. The sound walks occurred during the mornings, afternoons, early evenings, late nights, and early morning hours allowing a full contextual evaluation of the soundscape as daily activities change. The team cataloged many notable acoustic events and identified sound levels that are representative of the ambient sounds at multiple locations in the entertainment districts. Summarized sound levels are included for specific locations in the entertainment overlay districts in this section in addition to the full data sets that are included in the appendices to this report.

Ambient Sounds around the Riverwalk and Entertainment Overlay Districts

The urban center of Fort Lauderdale is a bustling urban hub. Ambient sounds are dominated by people talking as they walk through the city, breezes in in trees, automobiles moving through the city, bridge crossings, fountains, mechanical equipment in the many large buildings, and various amplified music sources from commercial establishments. Even in quieter evening hours ambient sounds, exceed the residential nighttime sound level limit of 50dBA. This was generally true for many of the measurements taken around the Special Overlay and Commercial districts surveyed,

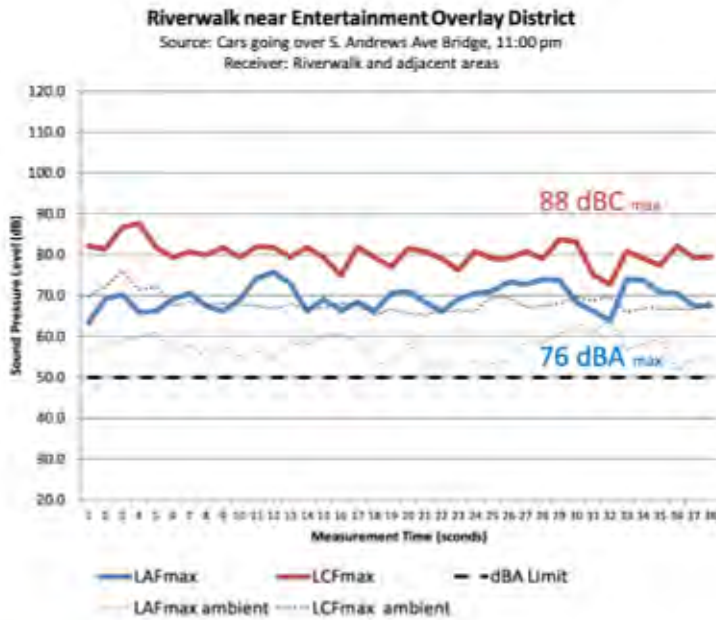


Figure XX. Cars transit the South Andrews Avenue bridge along with ambient sounds around the Riverwalk and Downtown. Please note that the cars driving on the bridge exceed the residential nighttime sound level limits of 50 dBA by 15 to 20 dB or 65 dBA by 5 dB or more.



Figure XX. Andrews Street bridge showing proximity to residential high-rise buildings.

Measurement data shows that cars transiting the bridge can be quite loud and clearly audible against the ambient sound levels measured. The measurements were taken at a distance of approximately 100' from the bridge. The cars themselves were not loud or playing loud music but rather the primary sound is from the tires rolling over the steel grating of the drawbridge.

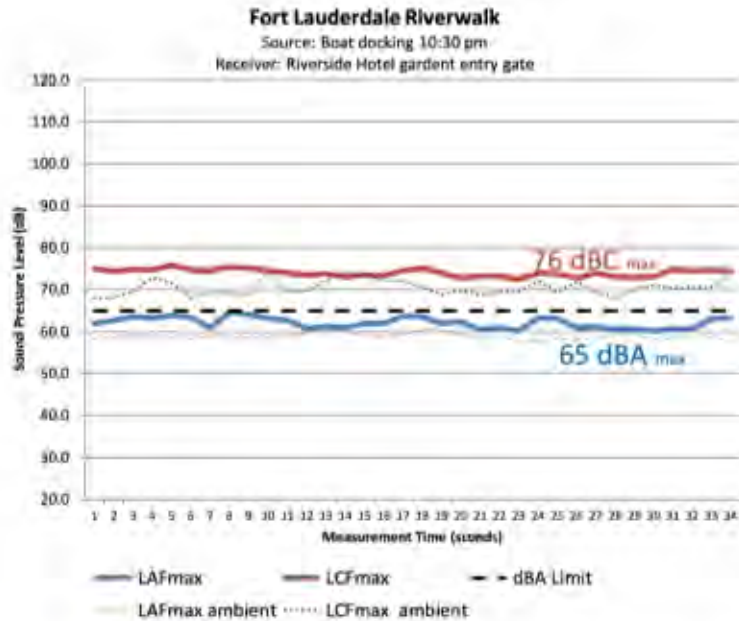


Figure XX. Measurement of large commercial boat docking near the Riverside Hotel. The sound levels are very close to the ambient levels with the lower frequencies somewhat above the ambient. Docking is louder than general operation and the duration is typically less than 10 minutes.;

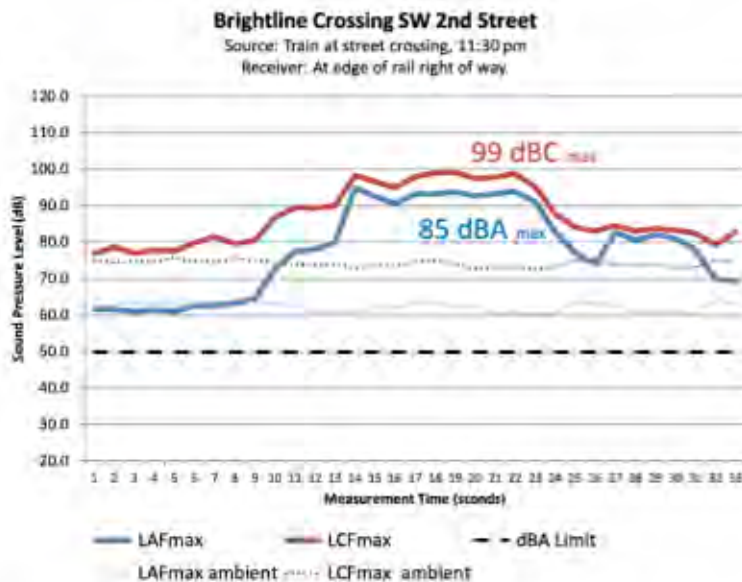


Figure XX. Measurement of the Brightline commuter rail transiting SW 2nd Street.

The train event consists of the warning bells and low frequency sound prior to the train arriving which are indicated in the measurement from 1 to 8 seconds – approximately 60 dBA. When the train passes, it is quite a short time (from 8 seconds to 33 seconds) with a substantial increase in both A and C weighted levels. It is important to note the large difference between A and C weighted levels as the train approaches – approximately 16 dB. This is an indicator of the low frequency sound radiated from the ground and rail surfaces as the train vibrates those surfaces.

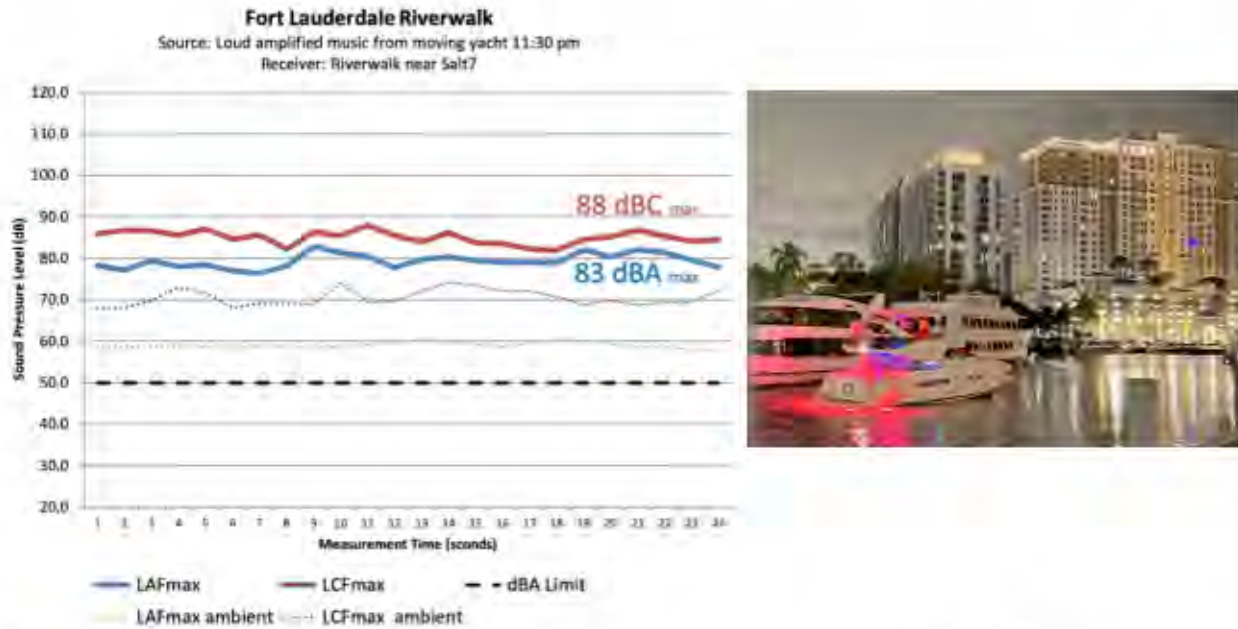


Figure XX Sound levels and image of loud music from yacht traveling down the New River at approximately 11:30 pm.

With the requirement for slow-speed no wake navigation, it took some time for the yacht to clear the downtown area, perhaps 20 to 30 minutes. During the time of the measurement the boat was clearly audible as the primary and dominant sound source in the Riverwalk District.

Riverwalk at the Wharf

The Wharf is an open-air restaurant and entertainment establishment located at 20 West Las Olas Boulevard and spans a city block between Los Olas Boulevard and the New River. The site is bounded by multiple tall and mid-rise buildings with mixed-use commercial/residential, commercial, and parking garage uses. The site is located within the Downtown Reginal Activity Center (RAC) and the site is designated as a *Special Entertainment Overlay District*

City of Fort Lauderdale Soundscape Study
Location : Riverwalk near the Wharf
Friday February 17, 2023

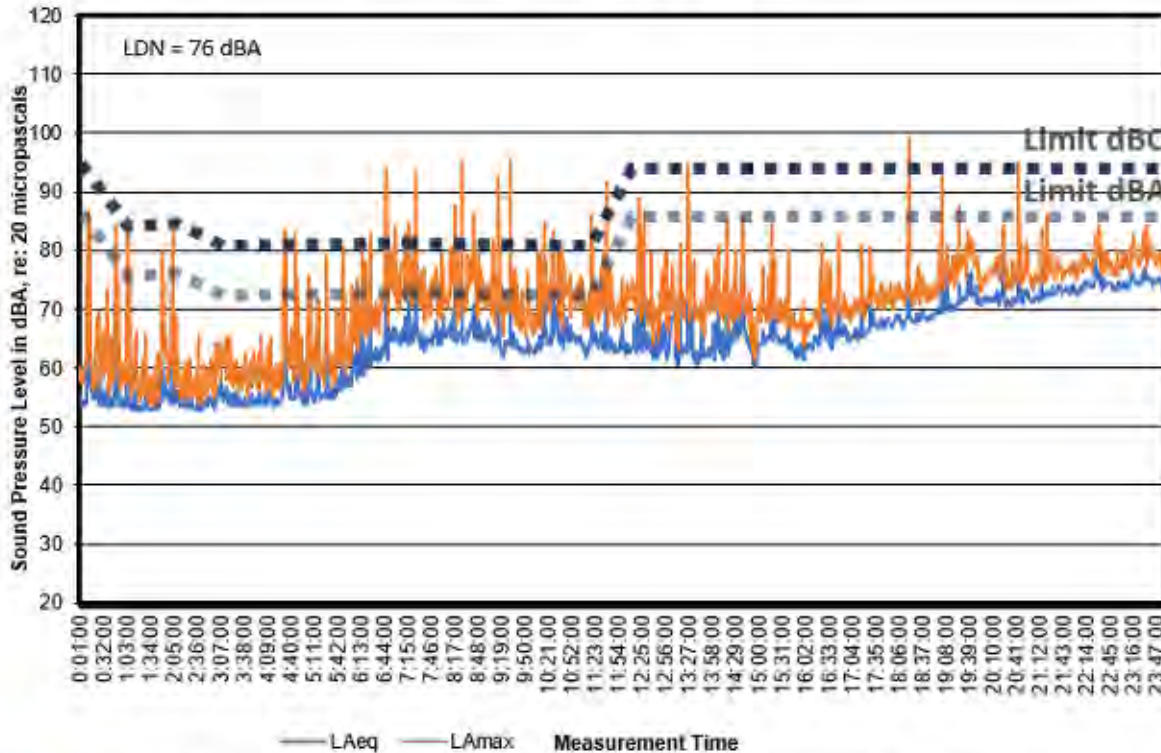


Figure X. Graph of overall A-weighted sound levels measured on the Riverwalk near the Wharf. The short-term transient sounds shown as “spikes” in the graph are from boats passing on the waterway, pedestrians or others playing music as they walk along the Riverwalk, sounds from boats passing playing music and other short-term sources of sound. There is a general increase in sound levels shown by the blue line during times when the Wharf is open that remains below 80 dBA at this location indicating that The Wharf is operating within the requirements of the ordinance.

It has been expressed by some residents living near the Wharf, that they clearly hear the music, that it is typically low frequency sound they hear, and that it can be disturbing even when measurements at the sound source indicate the Ordinance levels are being met.

Measurements conducted at the Wharf at various locations around the open-air structure at five (5) feet from the building (in this case a wooden fence) were generally in compliance with the sound level limits of the noise ordinance. Measurements were conducted at various times throughout the 24-hour day including late night and early morning on weekdays and weekends. Continuous noise monitoring was conducted at the site for a period of one week. Measurement results are summarized in Figure **XX** above.



Figure XX. Aerial view of the Wharf looking south.

The context of high and mid-rise structures around the open-air venue has a substantial impact on how sound radiates from the source into the city. There are four dominant phenomenon that effect the loudness and frequency content of sound in dense urban environments that might be heard at a given residence or receiver location in the vicinity of the sound source.

1. **Acoustical line of sight** is the primary path from the sound source to the receiver and in this high-rise context, multiple residences have a direct line of sight from their balcony or window to the Wharf, which is also a direct, unobstructed sound path from the source to the receiver.
2. **Reflective Amplification** is the increase in loudness of sounds reflecting off building surfaces that can subsequently reinforce and increase the loudness of the sounds at specific receiver locations.
3. **Acoustic Shadows** can reduce the sound levels near the source, if there is a physical barrier or obstacle between the sound source and the receiver.
4. **Environmental Filtering** occurs as sound is reflected by buildings, travels through the air, encounters vegetation, and then is transmitted through building materials. In the context of downtown Fort Lauderdale, higher frequencies are typically filtered out when being reflected, traveling through the air, encountering trees or vegetation, and transmitting through building materials such as walls and windows. The remaining sound energy is often in the lower frequencies or bass sounds. As amplified music also typically has repetitive low-frequency sounds, the remaining bump, bump, bump, without the musical context, can be annoying to people of normal hearing sensitivities and also difficult to measure using typical overall A-weighted sound levels.



Figure XX. Conceptual sketch showing reflected sound from the Wharf building up as it reflects off the buildings that surround it and then propagates off site.

When measuring the amplified sound at locations with fences or other barriers in Entertainment Districts such as the Wharf or the Rock Bar, the wooden fences could potentially reduce sound levels in the vicinity of the fence outside the establishment at 5 feet from the fence depending upon the exact height and distance relationships between the loudspeakers making the sounds, the top of the fence and the location of the sound level meter. The fence could have an attenuating effect reducing the sound level measured at the five-foot distance designated in the Ordinance. Consideration could be given to measuring the sound levels above the fence line at a specified distance, finding a location along the source property boundary that is open with no obstructions in the sound path, measuring at a vertical height that represents the acoustical line-of-sight to the potential receivers, or measuring at affected receiving properties. One of these strategies would help to measure the sound that is propagating to potentially affected properties nearby so that the measured sound levels are more representative of the sounds heard by people in their homes or on their balconies.

Measuring amplified music on the A-weighted scale greatly reduces the impact of low frequency or bass sounds on the overall measurement. Using a C-weighting measurement or octave band measurement could improve the correlation between the measured levels and concerns of receivers in and near the Entertainment Overlay Districts.

Alternately, measurements at the receiver locations could account for the factors of sight line, reflective amplification, and environmental filtering. Identifying locations of historic, present and potential future concerns and outfitting them with sound monitoring equipment, could provide the necessary information in real time to control the sound level at the source to reduce disturbances.

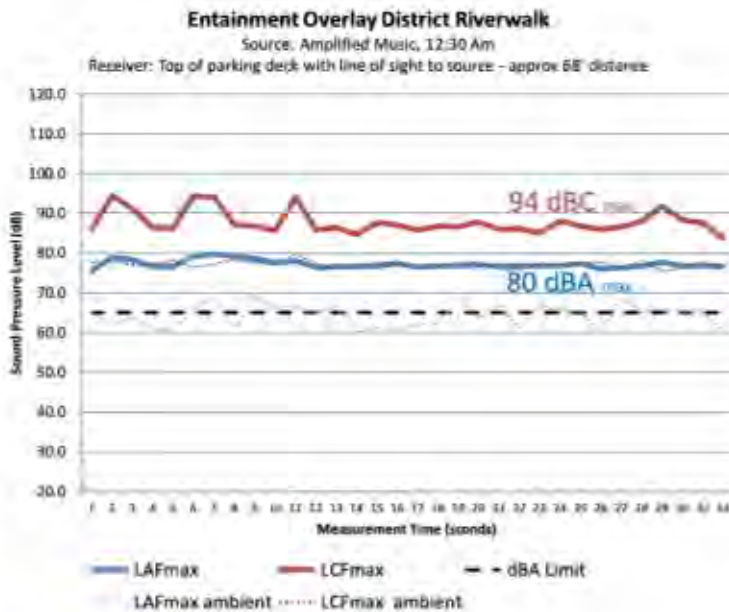


Figure xx. Sound levels measured from parking garage overlooking entertainment district establishment from an adjacent parking deck (approximately 68' distance above source).

Measurements taken in the overlay district at a distance of 5 feet from the property line (as prescribed by the code) were largely in compliance with the 85 dBA limit. In the case shown in **Figure XX** above, measurements were taken at distances equivalent to nearby residences (68 feet above grade), the levels were substantially higher than the residential property line limit of 65 dBA within 200 feet of commercial establishments. Additionally, the A-weighted measurement of 80 dBA is well below the 85 dBA limit prescribed at the sound source property line. However, the 94 dBC level at this distance is only 1 decibel below the prescribed limit at the 68-foot distance. Accounting for distance, the amplified music from the sound source, would be exceeding the dBC limit (95 dBC) even though it was likely meeting the dBA limit (85 dBA) if measured 5' from the source property line. In this case, measuring dBC rather than dBA, would be a better characterization of the sound and would also be in compliant with the current Ordinance.

Himmarshee District



Figure XX: Himmarshee district from rooftop of municipal parking garage.

Acoustical measurements were taken in the Himmarshee district during the day as well as late at night. The Himmarshee district is an area where many bars and clubs are located. It is in an entertainment district. When walking down the street passing by a number of clubs, sound levels were measured at 98-111 dBC and 85 to over 90 dBA. These levels do exceed the noise ordinance values for source locations and begin to approach levels that could potentially cause health effects for pedestrians walking on the street. NIOSH and OSHA have sound level limits of 85 and 90 dBA respectively as sound levels where hearing protection is advised for those working in environments with these sound levels. These levels are shown to be dangerous over an 8-hour duration. NIOSH recommends that people should be exposed to sound levels of 91 dBA for less than 2 hours per day. If the sound levels inside the venues are calculated, it could be estimated that sound levels inside the buildings were 90-95 dBA or higher depending on where the loudspeakers are located and 101-117 dBC or higher depending on the locations of the loudspeakers. This is estimated based on 1 doubling of distance from the sound source. With these levels, staff who work at these establishments and patrons who spend a significant amount of time in these establishments are at risk for potential temporary or permanent threshold shifts and also hearing damage.

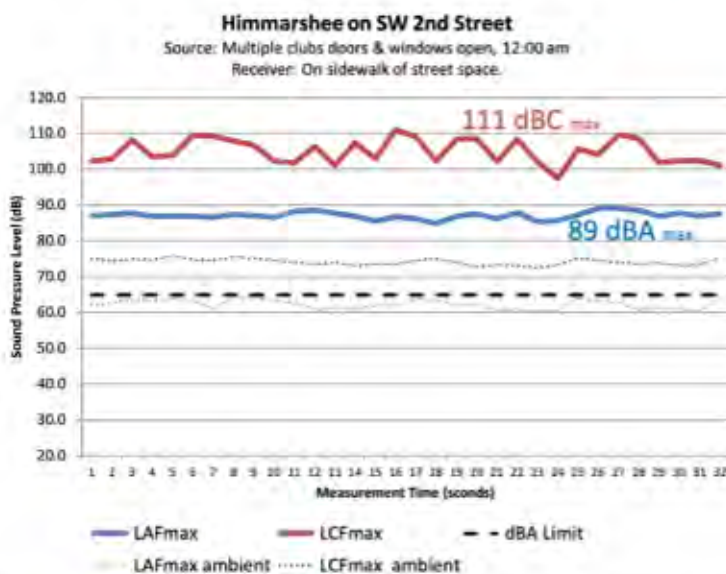


Figure XX. Sound levels measured during a soundwalk on the street in the Himmarshee Entertainment District. Both the A-weighted and |C-weighted sound levels exceed the sound level limits in the noise ordinance. Sound levels measured during other sound walks show equal and higher sound levels in this area.

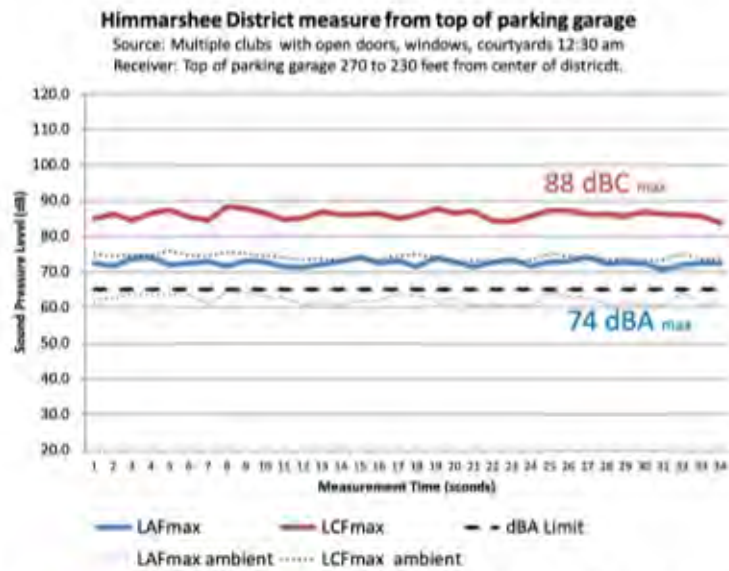


Figure XX. Sound levels measured from the parking garage located at the Brightline and SW 2nd Street crossing with a clear line of sight to multiple sources of amplified music.

The data in **Figure XX** above illustrates the propensity of sound to travel and maintain strength in the low frequencies. At this measurement location nominally 250 ft from the center of the district, sound levels are well above the limits for residences within 200 feet of the commercial area and twice as loud (another 10dB higher) for residential districts farther than 200 feet from commerce.

Rooftop @1WLO

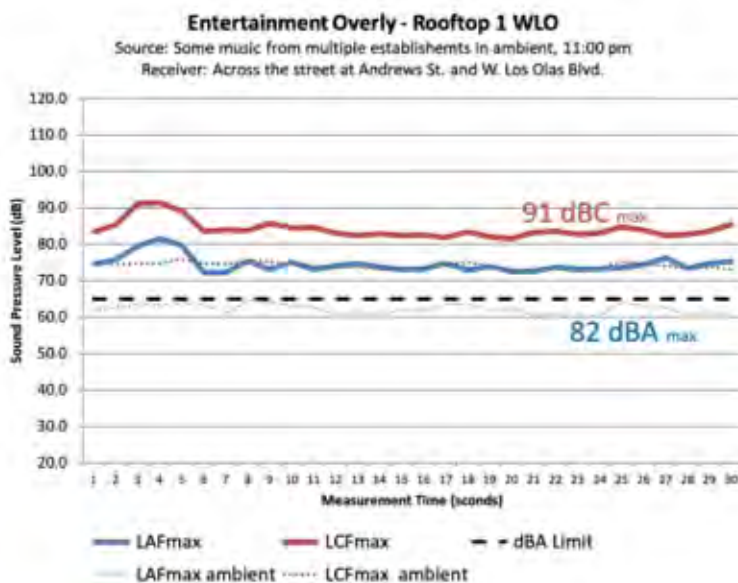


Figure XX. Shows sound levels measured at the street level near the location of the Rooftop 1 WLO and the site as seen from the street.

During the late evening/early morning, music was audible from the Rooftop @IWLO at the street below and across the street in Huizenga Plaza. Standing close to the fountain, the music from the Rooftop was masked but audible again, farther away, from the fountain. In the localized area of the fountain, it was the dominant sound source.

As an Entertainment Overlay District Establishment, amplified music noise monitoring and enforcement requires measurements to be taken at five (5) feet from the property line of the entertainment establishment. In the case of the Rooftop, located on the 7th floor roof terrace, one can only effectively measure the sound at ground level. This measurement would not be consistent with measuring equivalent establishments that are located at the ground level. Alternate sound level measurement protocols that could be considered for use at this establishment could include a permanent noise monitoring device structurally mounted to the facility 5 ft. off the edge of the roof deck; having enforcement staff use a tripod with a 5 ft extension arm that could be projected out from the edge of the facility to a distance of 5 ft from the roof, selecting an alternate, practical measurement location for these types of venues, and other means that could also effective notification to staff and potential enforcement if needed.

Party Bus – Veza Sur Tourbus



The 'Veza Sur Tour' bus was traveling down Los Olas Boulevard at approximately 8:00 pm February 17th (Friday) playing loud music with substantial bass sound energy. This amplified music, occurring in the right of way (city street) could be regulated under the current regulation that the sound cannot be "plainly audible a distance of twenty-five (25) feet or more from the source. This restriction would also apply to boats on the New River playing loud music. However, the mobility of these sources makes it difficult to enforce as the source has typically moved on before enforcement officers could measure it. One strategy, could be to conduct proactive stops with warnings and then citations toward building a consensus on acceptability. A second would be to have sound level meters at some intervals in areas where these activities occur that could record their pass-by sound levels.

The Rock Bar (Beach Entertainment Overlay District)



Figure XX Rock Bar front on SR A1A (left) and the Rock Bar outdoor pool area (right).

The Rock Bar is one of a number of establishments in the Beach Entertainment Overlay District just north of Los Olas Boulevard and facing the Atlantic Ocean along Florida State Road A1A. During sound walks along SR A1A, Las Olas Boulevard and the adjacent street grid to the north and west of A1A, amplified music was generally mixed with people talking, laughing, and generally enjoying dining and drinking in the open air and patios along the streets. Automobile traffic was a prominent element in the soundscape with an ebb and flow of autos, music, and people being the dominant ambient sources of sound in the area. Loud mufflers from cars, motorcycles, and motor scooters and amplified music playing from these vehicles dominated the soundscape in the area when present.

Much of the area to the north and west of the establishments along Los Olas Boulevard and SR A1A is dedicated to municipal parking lots and on-street parking. During visits in the day, evening, late night and early morning, the sound levels in this area included automobile traffic, some mechanical equipment noise, and breezes in the trees comprising the ambient sounds. Long-term sound level meters were placed at several locations along the beach areas. There were a number of occasions where loud sound levels from motorcycles and other vehicles were documented.

Some of the entertainment venues in this area have outdoor areas that face Almond Avenue and Seabreeze to the west. There are residential condominiums across Seabreeze from the entertainment venues. There is a tall fence that surrounds the outdoor areas of the entertainment venue. If one were to measure sound levels for compliance at a distance of 5 ft. from the property line of the entertainment venue the fence would significantly reduce the level of the sounds propagating in this direction likely showing compliance with the ordinance. However, concerns are expressed by residents of the near-by multi-story buildings that suggest that sound levels at their units which are elevated above street level may be worthwhile to look at.

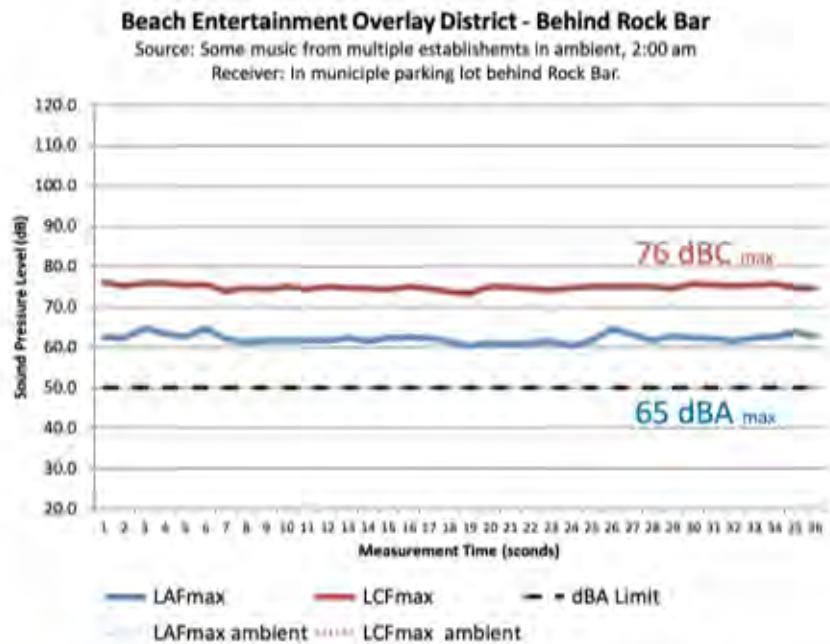


Figure XX Sound level measurements taken at the rear of the Rock Bar in accordance with the Overlay District Guidelines.

The sound levels measured in early morning hours at the Rock Bar were the same as the ambient measurements. In other words, there was no sound emanating from the Rock Bar during the measurement period at 2:00am. The ambient sounds in the area were the only sounds heard on multiple occasions on weekend early mornings and early evenings at this location.

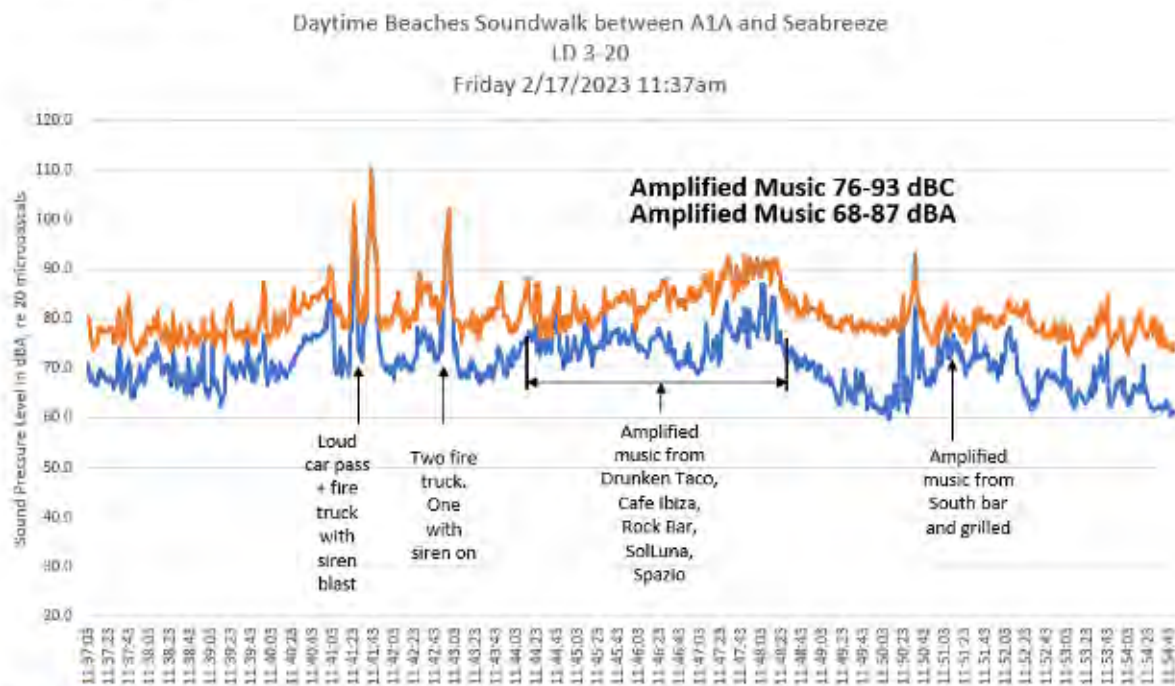


Figure X. Day time sound walk walking from A1A and Seabreeze.

Commercial, Mixed Use, Industrial and Adjacent Residential Districts

Commercial, Mixed-Use, and Industrial areas are regulated differently than the Entertainment Overlay Districts noted earlier in this report. Both within these areas and when they are adjacent to residential properties, sounds emanating from given sources, are measured at the property line of the resident or commercial property owner's property line who complains about the noise. Allowable sound level limits for the complainant's property designation, such as Residential Use, apply during the measurement. **Table XX** lists the allowable levels of noise sources.

In addition to the sound level limitations noted in **Table XX**, for general noise, the Fort Lauderdale municipal code also prescribes Specific Restrictions (Section 17-7 of the Code of Ordinances) on amplified sound of any type. Amplified sound shall not be plainly audible for a period of one (1) minute or longer at a distance of twenty-five (25) feet or more when measured from the source property line between the hours of 10:00 p.m. and 7:00 a.m. daily. Amplified sound shall not be plainly audible for a period of one (1) minute or longer at a distance of fifty (50) feet or more when measured from the source property line between the hours of 7:00 a.m. and 10:00 p.m. daily.

Amplified sound covers all forms of content including music, bass sound, speech, and any other type of amplified sound. In 2017, Florida Statute, F.S. §316.3045 was ruled unconstitutional based on an exception to amplified sound for businesses (ice cream truck) and political content. In 2022, the Florida Legislature revised F.S. §316.3045 to remove the exception for business and political content. Courts in the US have generally agreed that 'clearly audible', 'plainly audible', or 'loud and raucous' are sufficiently clear and can be used as a basis to regulate sound.

The Fort Lauderdale Code of Ordinances also identifies specific limitations for impulsive sounds, animal sounds, HVAC equipment, emergency generators, boats, construction, and commercial sanitation. The latter two are limited to operations between 7:00 a.m. and 10:00 p.m. and all equipment used during those hours must have the muffling equipment provided by the original manufacturer installed.

Table XX: Allowable noise levels at the complainant's property for sounds other than amplified music.

	Times	Outdoor	Indoor
Residential	7 am - 10 pm	60 dBA * 65 dBA if residential is within Commercial, Industrial or Mixed or within 200 ft of such 80 dBA (Impulsive sounds that occur less than 4 times in 1 hour)	45 dBA
	10 pm - 7am	50 dBA 70 dBA (Impulsive sounds that occur less than 4 times in 1 hour)	35 dBA
Commercial	24 hours	65 dBA	55 dBA
Industrial	24 hours	75 dBA	65 dBA

In the late evening, the ambient sounds at the Riverwalk near Salt7 are mostly wind blowing through the trees, people talking as they walk along the Riverwalk, and nominal noise from occasional cars and boats passing by or boats docking. The amplified music from Salt7 is just barely audible within the mix of ambient sounds. Other sound sources outside the terrace at Salt7 included water fall sounds from the fountain at Figure X and breezes in trees. During the daytime breezes in the trees, cars, and boats comprised the ambient sound levels. There was a repetitive banging noise emanating from an apparent mechanical space with a louvered exterior façade on the fourth floor of the building over Salt7 (Figure xx right). Additionally, the sound of a mechanical fan, perhaps with a bad bearing, seemed to dominate the ambient sounds with some other construction noise.

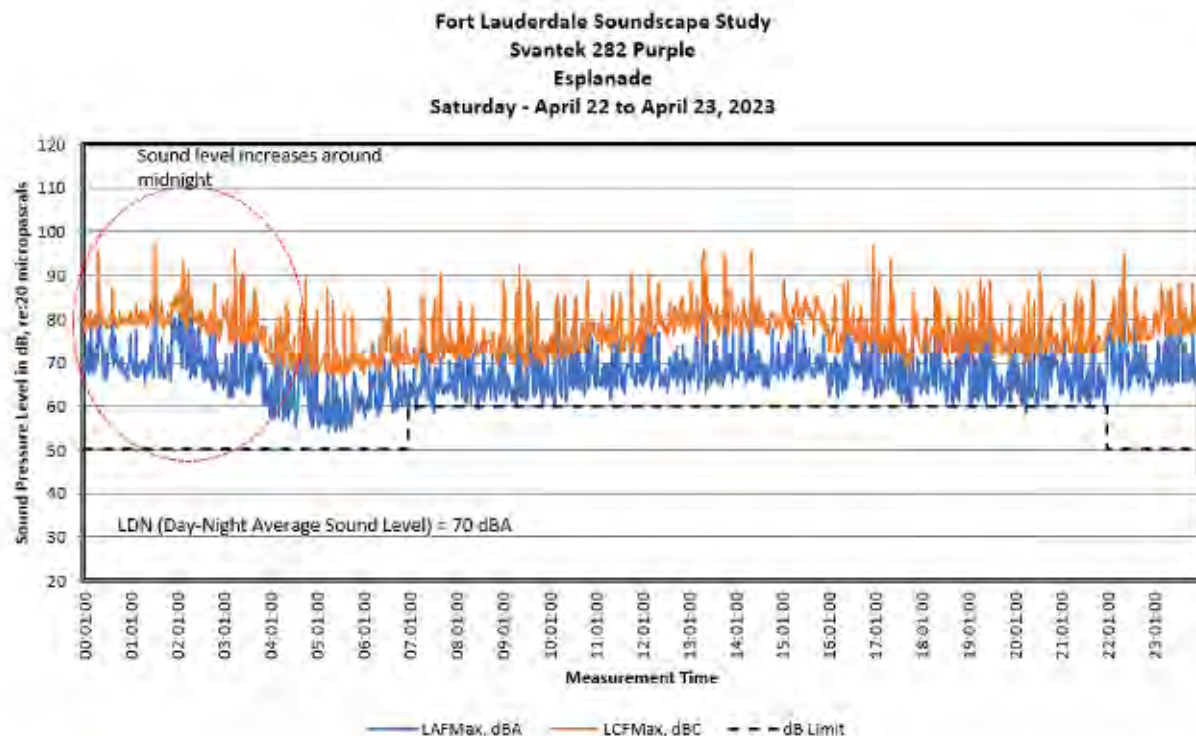


Figure X. Overall sound levels (dBA and dBC) measured on the balcony of an upper floor unit in the Esplanade in the New River residential tower across the river from the Esplanade Park. Notice the increase in sound level that begins around 10:00 pm on the right side of the graph and continues after midnight until 3:00 to 4:00 am on the left side of the graph.

Across from the Esplanade (Esplanade on the River Condominium)

Sound levels across from the Esplanade tended to be higher on the upper floors of the residential tower than in the Esplanade Park below. This is likely because the Esplanade park area is somewhat shielded on grade from the amplified music sound sources at Himmarshee and The Wharf. As one moves up higher, the ambient sound levels are higher, and there are high sound levels in the evening until approximately 4:00 am. At 4:00 am, sound levels decrease for approximately 2 hours, and then begin to increase after 6:00 am as day time activity in the city begins. The sound levels tend to rise until approximately 4:00 pm, when they drop slightly until approximately 10:00 pm. At 10:00 pm, the sound levels tend to rise, likely from amplified nightlife and do not decrease until 3:00 am to 4:00 am.

Los Olas Boulevard at YOLO (You Only Live Once) and the O lounge



Figure XX: YOLO patio dining in the foreground (green awning) and O Lounge beyond (maroon awning).

The YOLO and O Lounge are adjacent dining, drinking, and dancing establishments. The YOLO bar and restaurant has an outdoor patio and plays amplified music during the early evening hours. The O lounge, is an indoor bar/club that plays amplified music until 2:00 a.m. on Saturday night (Feb 18/19). Music emanating in the early morning hours from the O Lounge was barely audible above the ambient sounds of wind in trees and distant automobiles. At approximately 1:45 a.m., the double doors at the entry were held open while the loud music was still playing inside. At that time, the music was clearly audible in the areas outside the O Lounge.

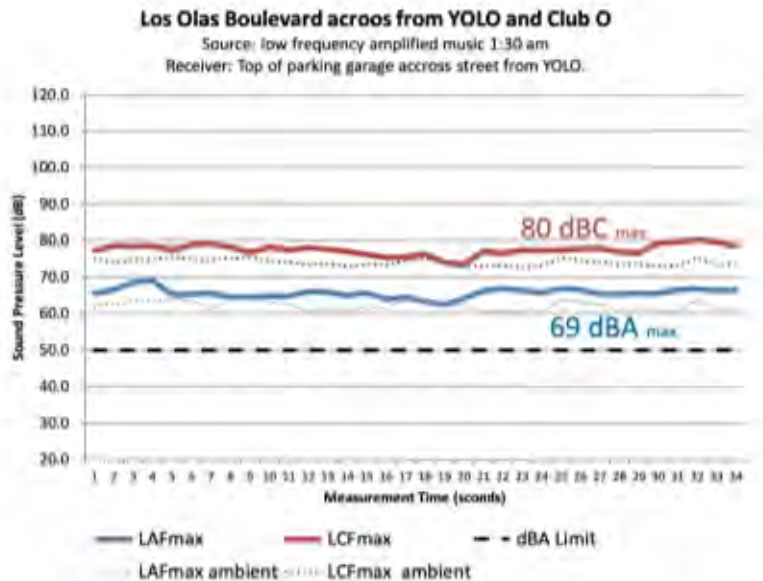


Figure X. Measurements taken from the parking deck across the street from Yolo and O club with line of sight to the establishments.

Colee Hammock

Sound levels were measured at Collee Hammock, as it is fairly close to a number of eating establishments. Discussion with the homeowner revealed that one source of noise complaints in this area was actually not from the amplified music at the eating establishments, but rather from sounds in the service alley directly behind the residential street. The alley adjoins the back yards of the homes and faces the eating establishments. It was used as access by delivery trucks, service trucks and other vendors during late night hours to the commercial properties. The back up beepers, sounds of trucks unloading, vacuuming, etc., associated with these vehicles were a primary source of noise issues according to the homeowners at this location. The long-term measurement graph shows a relatively uniform LAeq sound level over 24 hours, which means this location likely has HVAC units on at the neighboring properties and road traffic that keep the ambient sound level fairly consistent.

Potential strategies for improving this difficult adjacency could include:

- Planning: Residential adjacency to service area for restaurants. Orient the buildings away from service areas. Require solid walls or other buffers between service areas and adjacent properties.
- Operational: Require service trucks to come between hours of 8:00 am to 7:00 pm so residents aren't disturbed by their activities.
- Require acoustic controls on HVAC operation, kitchen exhausts and other building equipment for commercial occupancies.

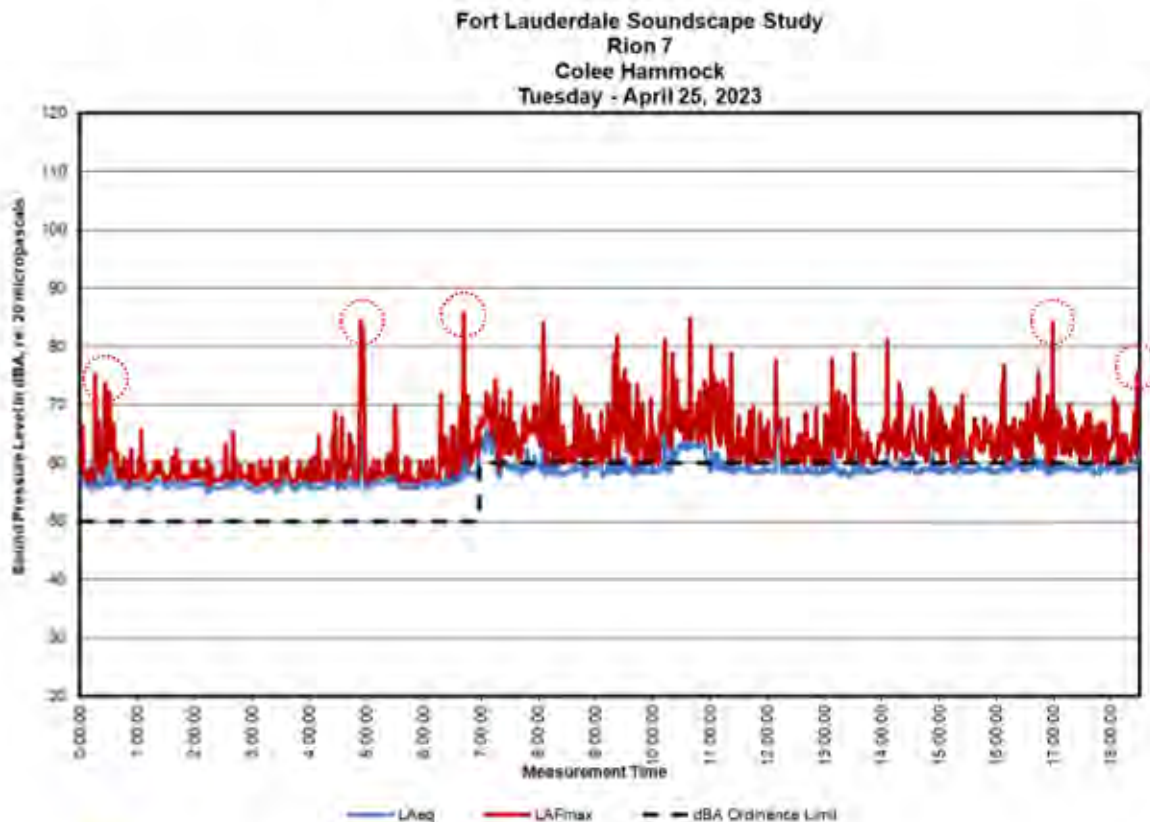


Figure X. Sound levels in Collee Hammock. Red circles show loud sound levels during late night and early morning hours right outside the bedroom window of a residence. Short-term intermittent sounds that are 10 to 20 dB above the ambient sound levels are loud enough to cause disturbed sleep or to wake older people or young children who are light sleepers.

Colee Hammock at The Balcony



Figure XX: The Balcony and Bo's Pub across a municipal parking lot in the Colee Hammock neighborhood at 2:15 am.

The Balcony is located at 1309 E. Los Olas Boulevard with a restaurant at ground level (Bo's Pub) and a bar and nightclub on the second level (The Balcony). The commercial establishment is located across an alley and within a city block of the established Colee Hammock neighborhood.

Although there is an opaque wall at the rear of The Balcony, significant amplified music dominated by low frequency bass energy was heard emanating from the establishment and recorded at a neighboring property approximately 180 feet from the rear of The Balcony/Bo's Pub. Figure XX illustrates the levels of the low frequency sounds measured with a C-weighting (dBC) at 18 decibels above the A-weighted (dBA) sound levels. This C-weighted measurement is indicative of the impact of low frequency sound as an annoyance that is not well measured using A-weighted sound levels.

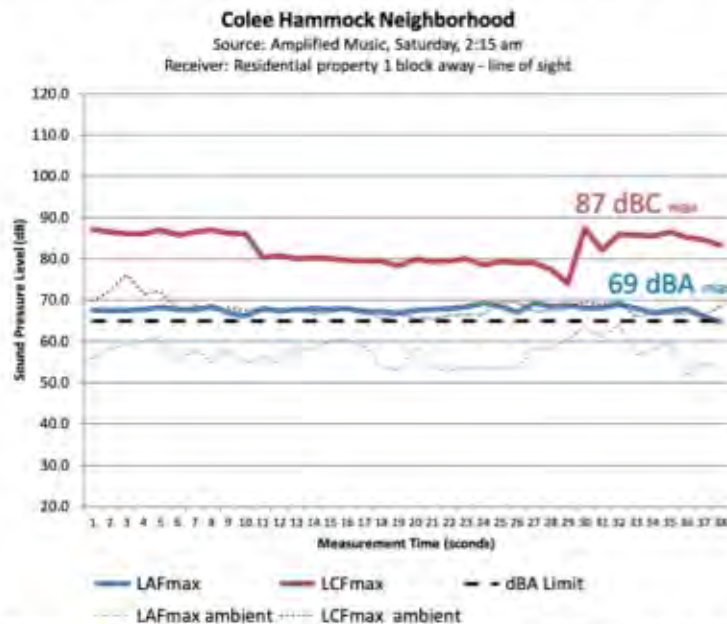


Figure XX: Sound levels measured approximately 180 feet from The Balcony, at a residential property at 2:15 a.m. February 18, 2023.

Bamboo Flats

The residential areas of Bamboo Flats are adjacent to a lively restaurant and entertainment area, where amplified sounds from the nearby establishments are a source of complaints to some of the residents. It was found the sound levels at the residential location tended to increase in the evening beginning at approximately 10:00 pm, and stayed relatively high until approximately 3:30 am, as shown in Figure X. There is a direct line of sight from a number of the residential areas to the bars and establishments with amplified music. Sound levels at this location tended to be above the 50 dBA residential sound level limit in the evening.

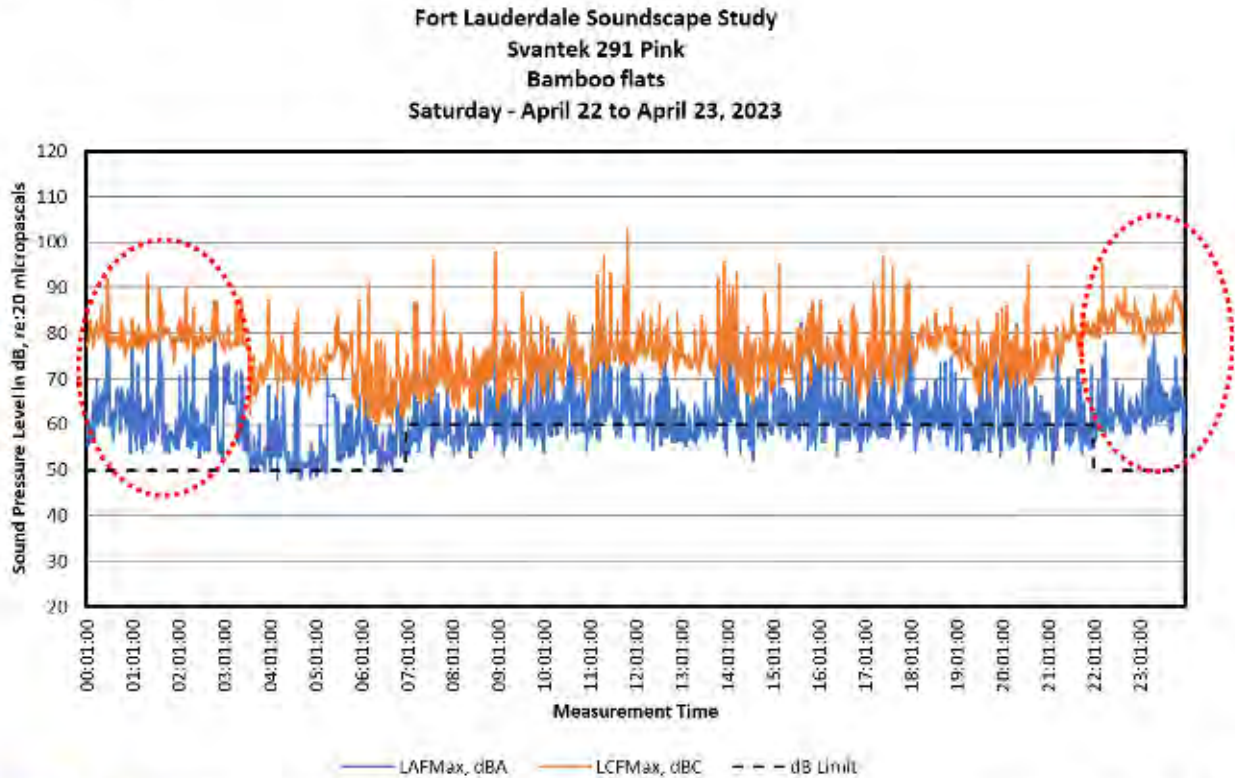


Figure X. Sound levels measured in the Bamboo Flats residential area that show an increase in sound level in the evening hours from approximately 10:00 pm to 3:30 am.

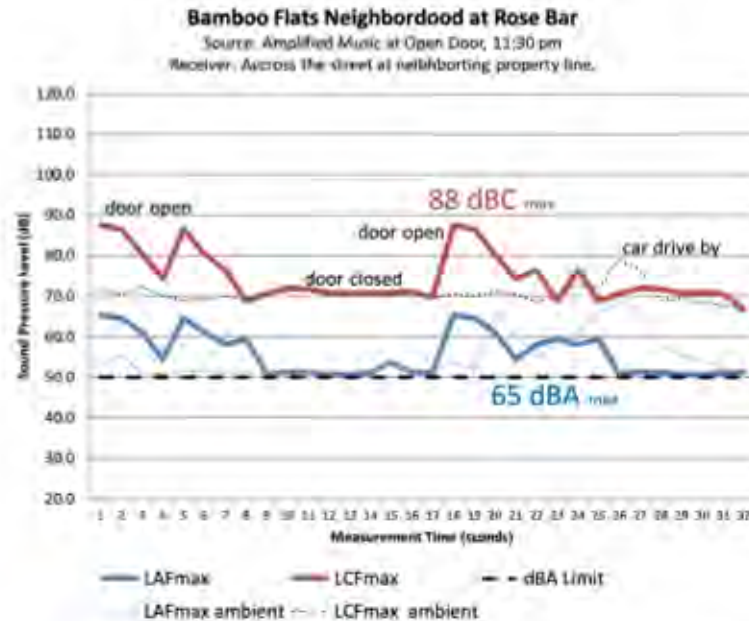


Figure X. Measurements across the street (south side of the road) from the Rose Bar showing door open and door closed levels.

Measurements at this location show the clear difference in amplified music sounds emanating from the establishment when the doors were open and closed. When the doors are closed, the sounds emitted were commensurate with the ambient levels in the neighborhood. When cars drove by, they were the dominant sounds source near the Rose Bar location.

Truth Lounge

Sound levels in a residential area behind the Truth Lounge were measured. Short-term sound level measurement made behind Truth Lounge included levels from 51-64 dBA and 68-76 dBC. The music sounds from the club tended to be within the ambient sound levels when the doors were closed at the front and rear of the building. When the doors opened, sound was more audible and sound levels increased. Providing a sound lock vestibule at the entrance could be a possible design intervention that could be considered to help reduce sound from escaping when the doors open as guests enter and exit the building. Some low frequency sounds may also be radiating out through the roof of the building. Roof assemblies of typical commercial buildings that have a metal roof deck on bar joists with insulation and an acoustical tile ceiling below have a relatively low sound transmission loss in the lower or bass frequencies. This means that sounds from subwoofers inside a typical commercial building could radiate out of the roof and propagate to adjacent properties. Sounds also propagated across the street when the doors in the rear of the building were opened.

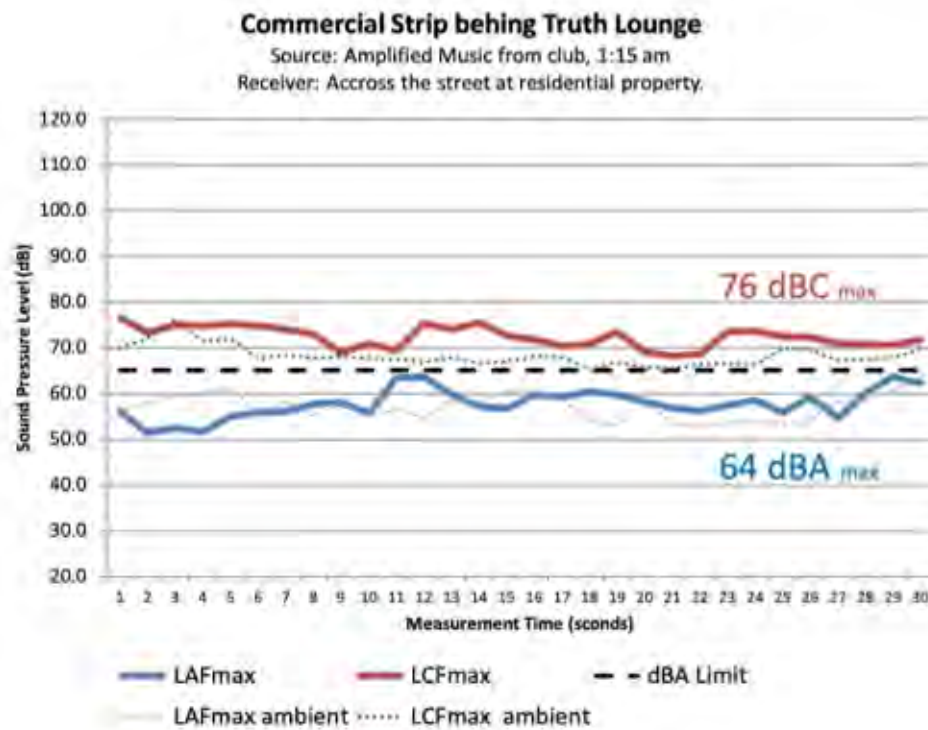


Figure X. Sound levels measured in the residential area behind Truth Lounge.

Smitty's

Sound levels were measured in the parking area of Smitty's Wings several times. Historically, sound complaints from this location were not associated with the operations of Smitty's, but rather with people who would congregate in the parking lots surrounding the establishment, playing amplified music in their cars. This was historically noticed on Sunday afternoons and evenings. Sound level measurements were made for 4 days in this location. Typical sound levels ranged from 75-85 dBA LAFmax during the day time hours, due to the large amount of traffic on the NW 6th Street or Sistrunk Boulevard. However, amplified music in the parking lot was measured at levels of 80-105 dBA LAFmax from approximately 6:00 pm-8:30 pm on Sunday April 23, 2023. Figure X shows the data from this day with the red dotted ellipse showing the sound levels from the amplified music in the parking lots.

City of Fort Lauderdale Soundscape Study
Location : Smitty's Wings
Sunday April 23, 2023

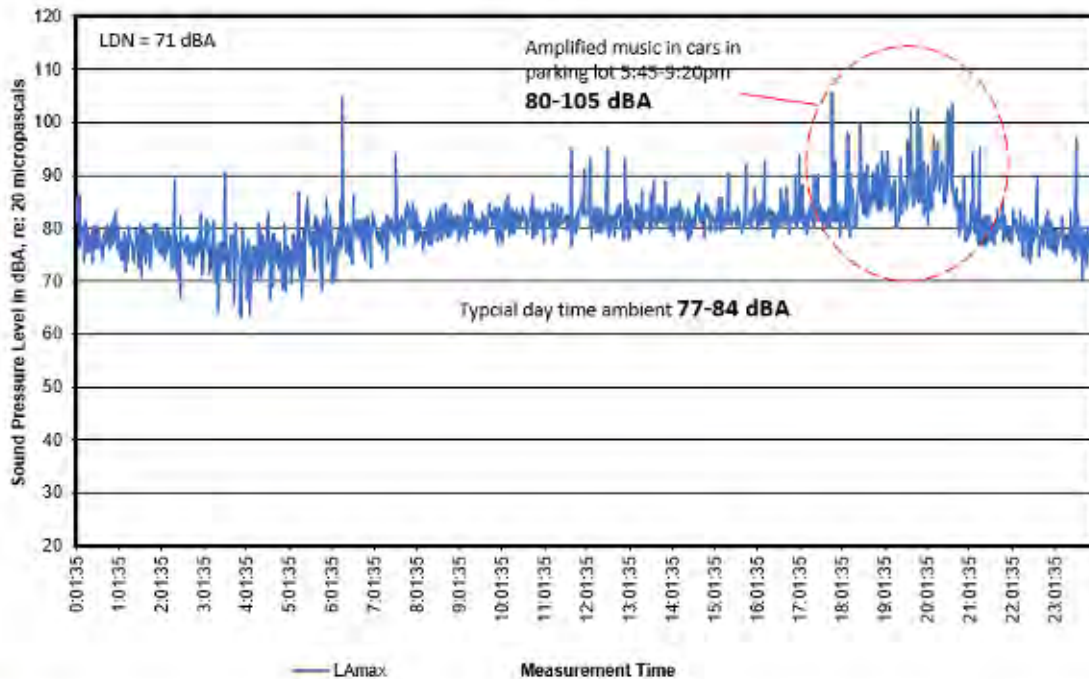


Figure X. Data from Sunday April 23, 2023 showing the sound levels from cars playing amplified music in the parking lots. Notice the increase in sound levels between approximately 6:30 to 8:30 pm on this Sunday evening.

MOTORCYCLE AND LOUD VEHICLE SOUNDS

There are a number of locations in Ft. Lauderdale that are regularly impacted by loud vehicular traffic. These locations include primarily along A1A at the Beach locations, however, loud vehicles are present throughout the city.

Sound levels from loud motorcycles were measured at levels over 100 dBA and 100 dBC. The sounds from loud vehicles were measured at the long term locations in the Beach area. These sounds are particularly challenging, as they are extremely loud, short duration events that can take place frequently, especially if large groups of riders are circling the Beach area. During the first measurement trip, sounds from the loud vehicles took place over 30-90 or more times in a 24 hour period. Loud, short duration sounds like those from motorcycles and loud vehicles can cause sleep disruption and other effects.

It has been discussed that recent police enforcement has resulted in less loud vehicles.

There are new devices that are able to detect loud vehicles in traffic. They may be integrated with an automatic ticketing system that would generate a ticket if a vehicle with excessive noise is detected. These devices are currently being tested and several cities around the world have implemented them. It may be worthwhile to test this kind of device on a trial basis in locations on the Beach or other areas that experience excessive loud vehicle traffic to see if the technology would be beneficial to the City.

SOURCE-PATH-RECEIVER INVESTIGATION: 3D Models

Measurements were taken on the 2nd trip to help identify the specific sound paths that the sounds from entertainment sources must travel to reach the potentially affected receivers. Sound level measurements were taken on grade, as well as on floors where residents have been affected by noise.

It is our understanding that the City of Ft. Lauderdale previously took sound measurements in the residences or on the balconies of residences where noise complaints originated. This many times included measurements on the balcony of the affected residences. Recently, the protocol has changed, and sound measurements are only permitted on grade level, not in the affected residence.

This study was performed to investigate the differences in sounds perceived and sound level at various heights above grade to understand the acoustical issues involved with selecting a measurement location..

The entertainment sounds measured on grade were often mixed in with ambient sounds so that a clear measurement of only the entertainment sounds could not be taken. Furthermore, the ambient sounds on or near grade were often louder than those above grade due to traffic on the street, pedestrian activity and building equipment sounds such as garage fans contributing to the ambient. At upper levels direct acoustical lines-of-sight between the entertainment sound source and the residential occupancy resulted in clear and plainly audible sounds being heard at these locations. The grade level ambient sounds were also reduced in level due to increased distance from these sources resulting in possibly cleaner sound level measurements of the entertainment sounds. City staff has commented that there are practical difficulties encountered in accessing residential living units that may preclude this as an option for enforcement measurements.

Open vs. Closed Building Infrastructure Investigation

Using the building infrastructure as a way of providing noise mitigation was explored in a 3-dimensional computer model. The model shows the approximate effects of having an operable roof structure open versus closed on the sounds propagating from inside the venue to the surrounding environment.

The model assumes sound levels of 95 dBA played inside the entertainment venue. With the roof open, the sound spread covers the near side of the adjacent building and wraps around the sides of the building. The figure on the left shows the open condition. The sound levels of 75 to 85 dBA are shown by the darker colors.

With the roof closed, the sound levels would likely be reduced by 15-20 dBA. The figure on the right shows this condition. The spread of sound is much more contained and sound levels of 50-55 dBA are projected across the facade of the building.

This is a noticeable sound reduction, and would be heard as 3-4 times quieter with the roof open versus closed.

This concept can be applied to many of the existing entertainment venues, especially those who might be located in or around residential areas, who may have operable roofs, windows, doors, roll up doors or other features.

Operational controls could be considered at different times of day or for different activities inside the building such as special performances that may play louder music than typical activities as a feasible sound

control strategy to contain sound spread to the extent possible. Keeping the roof, windows and doors closed will help contain the spread of sound to neighboring areas.

The use of sound lock vestibules at entry and exit points to entertainment occupancies might also be considered in establishments. This would essentially create a small entry vestibule with a second door whereby people could enter the establishment, the first door would open while the second door remained closed. After the guests entered the vestibule, the first door would close and then the second door would open into the main area. This strategy would result in blocking the direct sound path from inside the facility to the exterior through the single open door reducing sound propagation to near by properties. Similar strategies are often used in theaters and performance spaces to contain the spread of sound and light into a performance space.



Figure X. 3D model showing conceptually an entertainment establishment with the roof open (top) versus with the roof closed (bottom). There is a 20 dB difference between the 2 conditions. Sounds propagating out of the building through the roof in the roof open condition is heard as 4 times louder to a person of normal hearing sensitivities than sounds propagating through the roof closed condition. This is based on typical insertion loss values of a closed building as having at least 20 dB reduction.

3. Concept: Source Building- Open vs Closed



Figure X. 3D model showing conceptually an entertainment establishment with the roof open (top) versus with the roof closed (bottom). The elevated sound levels cover the front façade of the adjacent residential building that faces the entertainment venue and wrap part of the side walls as well.

Low frequency sound propagation

Low frequency bass energy is a major component of amplified music. It includes frequencies from 20-150 to 250 Hz typically and results in the feelable perception of music in one's chest and body. Low frequency sounds have extremely long wavelengths and are reduced less than middle and higher frequency sounds as they travel through the air and as they pass through building walls, windows, doors and roofs. They carry farther and with less reduction due to distance than the middle and higher frequency sounds. The low frequency sound waves can also cause building vibrations and window shaking.

A 3D model was built to study the spread of low frequency sound versus overall A-weighted sound level. The overall A-weighted sound level because it reduces the low frequency sound level, does not include the effect of low frequency sound.

The model on the left shows the A-weighted sound level on the facades of buildings with an entertainment establishment playing music. The A-weighted sound level across the facade of the building is xx dBA.

The model on the right shows the sound levels in the 63 Hz octave band. The 63 Hz octave band is one of the lower or bass frequencies. The spread of this frequency is much farther than the overall.

This means that even if sounds are measured with an A-weighting, that the measured sound level in dBA may not tell the whole story about what the low frequency sounds may be doing in that area.

This brings up two items for consideration:

1. Using an A-weighting to measure sound level, especially at the residences, may not show the low frequency sound from the establishments. Consider using a C-weighted sound level limit in addition to the A-weighted sound level. Alternately, sound level limits could also be required in individual octave bands similar to Rule 4 of the Duval County Environmental Protection Board which is used in the City of Jacksonville.

2. Because low frequency sounds travel much farther, propagate with less reduction into adjacent buildings, and sometimes result in vibrations of building infrastructure that are perceived by people, consider limiting low frequency sound levels after specified times.

6. Concept: Bass sounds travel farther and remain stronger

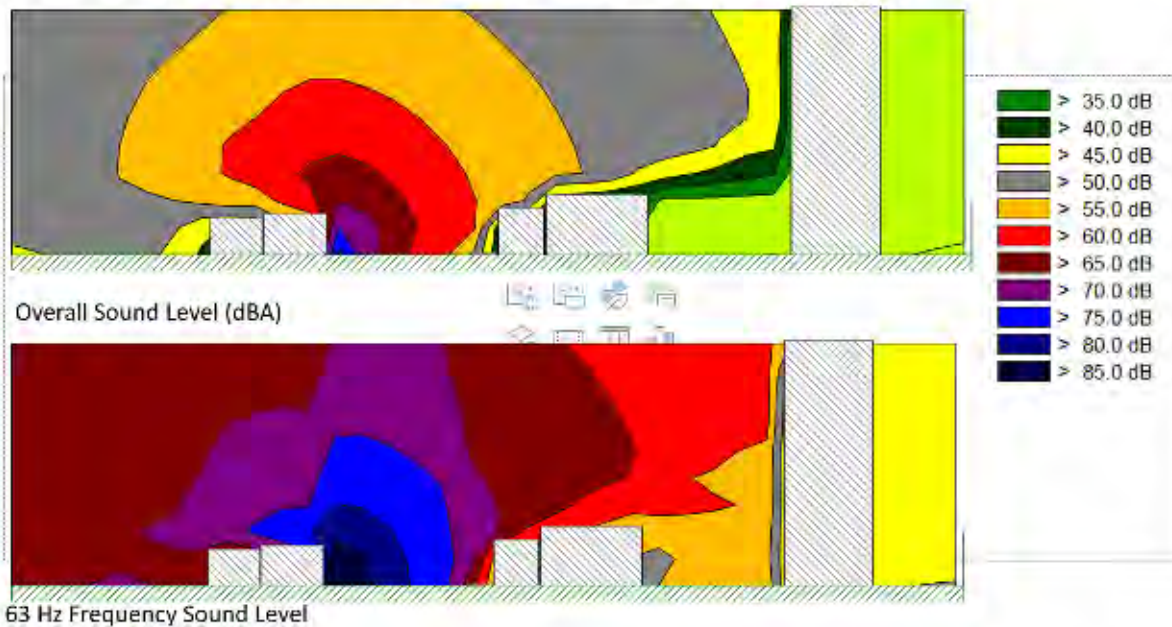


Figure X. Overall A-weighted sound level spread from entertainment establishment (top). And low frequency 63 Hz octave band sound level (bottom). Low frequency sounds travel farther with more energy than middle and higher frequency sounds and the overall A-weighted sound levels do not show the intensity of these low frequency sounds.

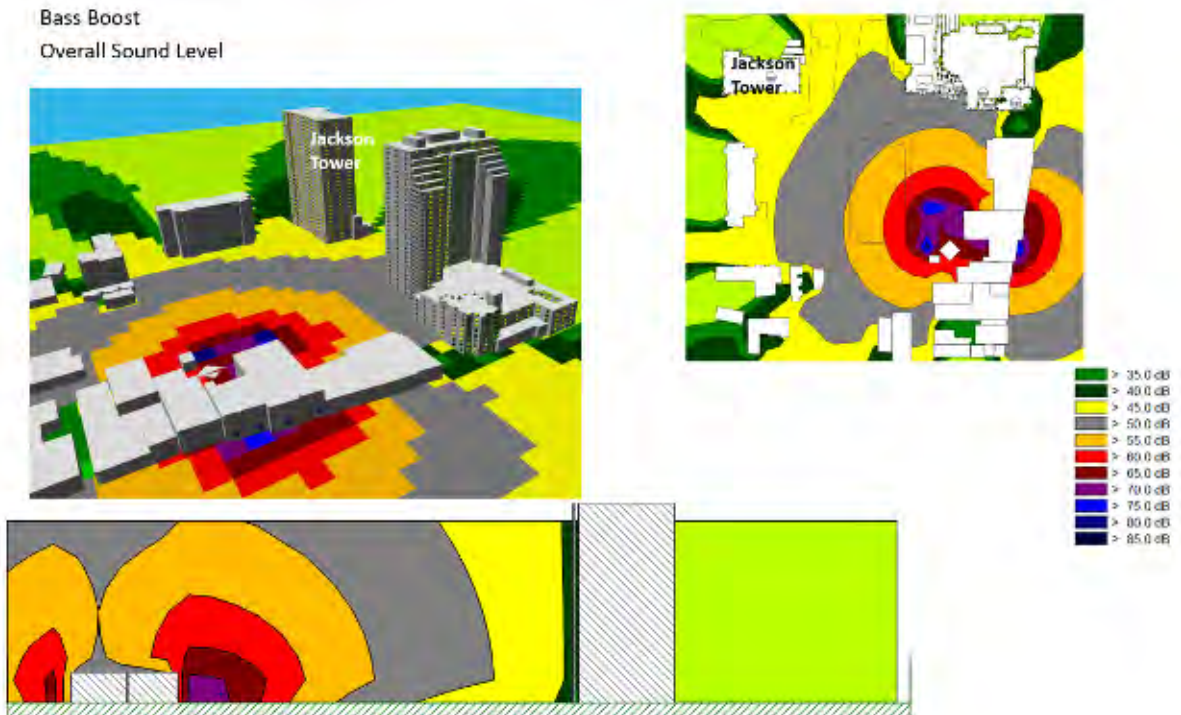


Figure X. Overall A-weighted sound level from entertainment establishment. Notice the overall sound level at Jackson Tower in the 45 dBA contour.

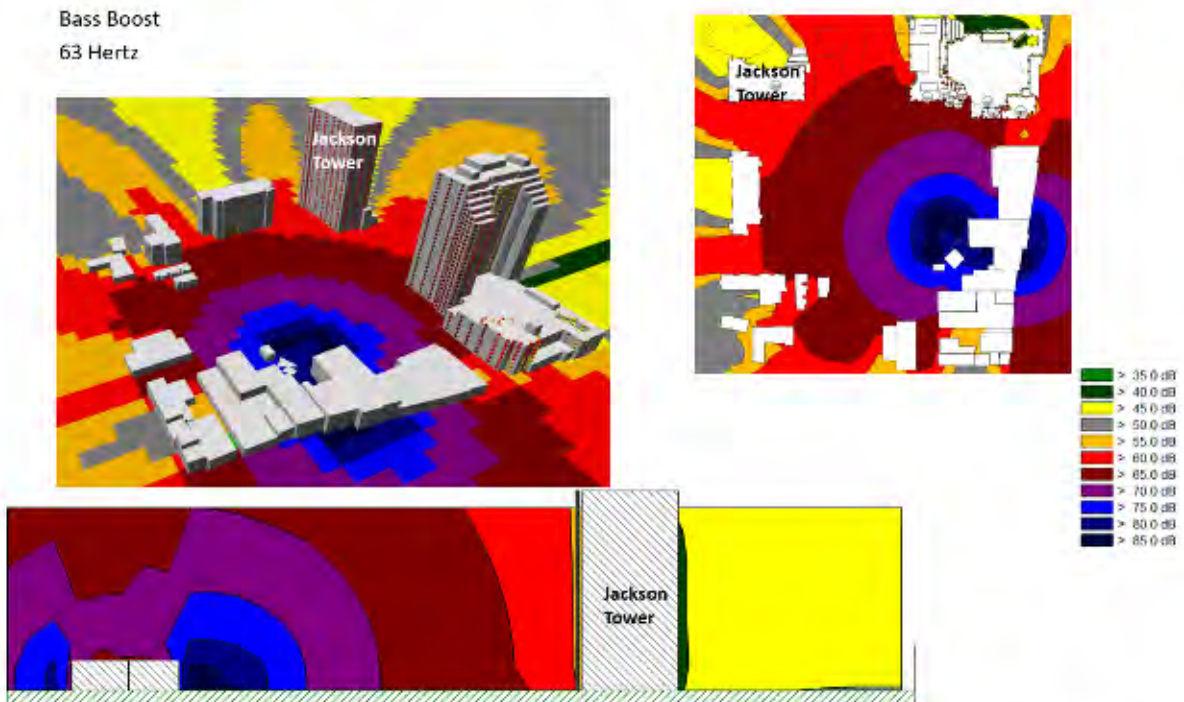


Figure X. 63 Hz sound level from entertainment establishment. Notice the sound level at Jackson Tower in the 60 dBA contour.

Time of respite

There are a number of residential locations that have raised sound levels starting in the late evening and continue until 2:00-4:00 am. The sound levels may stay somewhat low until approximately 6:00 am when they begin to increase again as day time activities in the city start. This means that in many areas, there are only 2-4 hours of relative quiet between the time when amplified music stops and the time when the city begins to wake up. These elevated sound levels likely make it difficult to sleep, which can have negative health impacts. Would it be desirable to address this concept of time or repose as it relates to the daily cycle of activities and sounds in the city? What are possible methods that could be used to address this concept?

Consider the following

1. To reach a sound level of 20-25dBA inside a residential building, the sound level outside would need to be 60-65 dBA. The level of 20-25 dBA would promote rest and a time of respite.
2. Limiting the exterior sound levels after 12am to 65dBC at the source if amplified music is played outside or not in an enclosed building.
3. Consider limiting the use of subwoofers after 12am.
4. Consider allowing the venues to remain open, but limiting the outside sound level to 65 dBA/dBC.

HEALTH EFFECTS OF NOISE

INTRODUCTION

Hearing loss is well documented in the literature as one of the primary health effects experienced by people exposed to high levels of noise, especially in the workplace and in leisure activities. There is also a substantial body of research that deals with identifying annoyance, speech interference and other potentially damaging effects of noise related to hearing. The World Health Organization (WHO) (Schwela, 2001) has identified 5 primary categories into which the effects of noise on people can be grouped.

1. Temporary or permanent hearing impairment.
2. Interference with communication
3. Sleep disturbance
4. Temporary and permanent impact on physiological and psychological functions in people
5. Social, behavioral and annoyance effects.

This section summarizes documented physiological effects of noise on people. It will also briefly address other aspects of noise effects as they may be pertinent to develop an understanding of the reactions of people exposed to high levels of noise on a regular basis.

A discussion of the physiological effects of noise should consider the goal of maintaining a healthful environment for high quality living and comfort. The presence of disease or illness is identified by an irregularity of physiological functions which are found to require treatment. This is determined by comparing measured values of physiological indicators to the mean and standard deviations of a "normal"

population. If a continuum is drawn from a diseased state requiring treatment to a low quality of life standard and extending to a high quality of life standard, the average for the "normal" population with its standard deviation will overlap the beginning of the standard deviation for the part of the population in jeopardy. High quality acoustical environments where people do not experience physiological or psychological symptoms and a relatively high degree of acoustic comfort are noted to have an A-weighted equivalent continuous sound level (LA_{eq}) of 30-35 dBA and maximum A-weighted sound level (LA_{max}) of 45 dBA. Annoyance, sleep interference and other psychological and physiological symptoms begin in the 55 - 65 dBA range. People living and working in environments with an average sound level or $LA_{eq} <$ approximately 70 to 75 dBA are considered to be in a reasonably healthful environment. Jeopardy for symptoms related to noise begins at approximately 70 to 75 dBA. Hearing loss occurs in environments with $LA_{eq} >$ 78 to 85 dBA. Extra aural overstrain occurs at $L_{max} >$ 99 dBA.

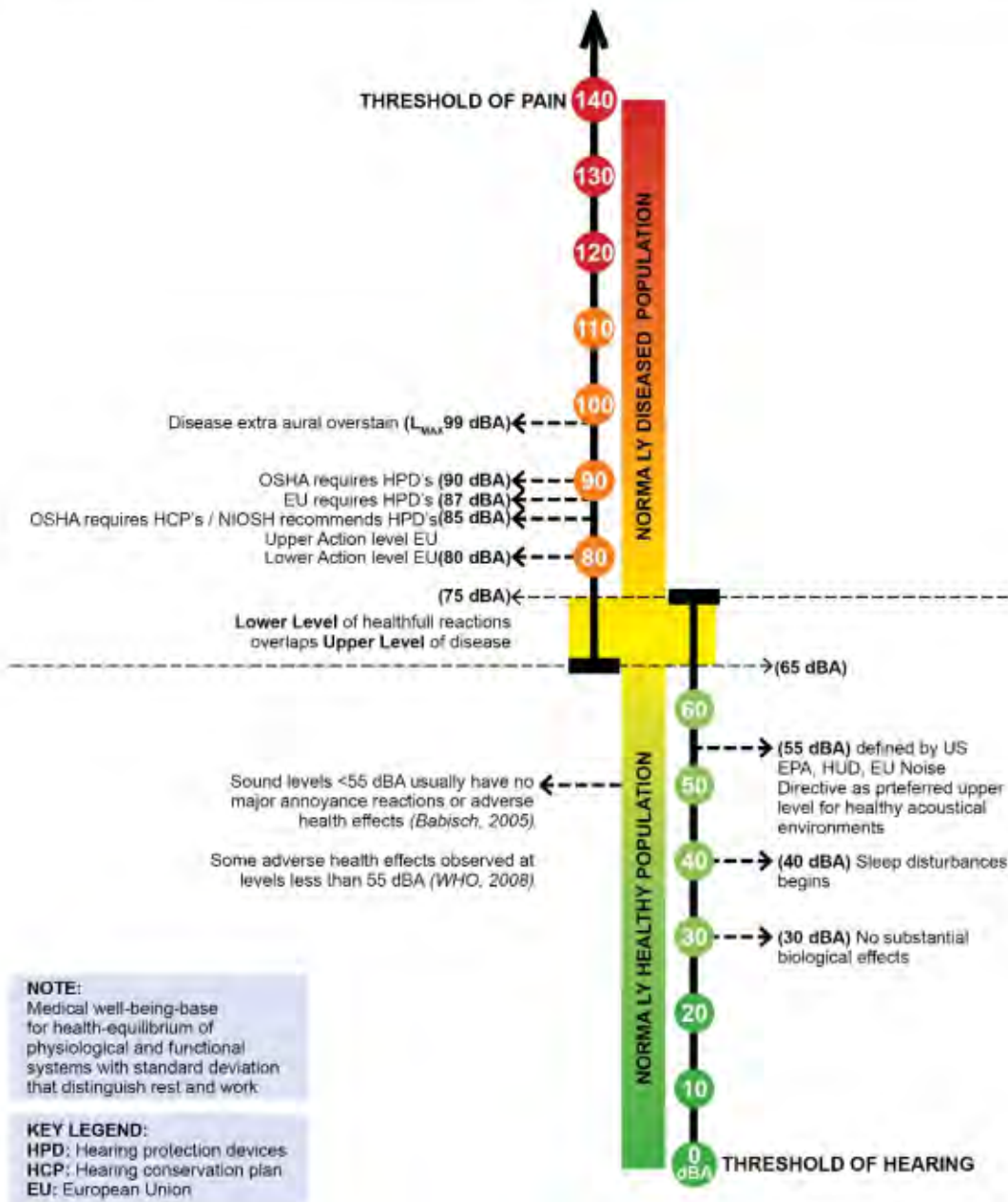


Figure 1. Diagram illustrating healthful and harmful acoustical environments.

TEMPORARY OR PERMANENT HEARING LOSS

Working, playing, or living in high levels of noise gives rise to the possibility that people may suffer noise induced hearing loss. There is a considerable variability in the human sensitivity to noise and resulting hearing impairment. Damage risk criteria have been developed to assess the probability that a noise induced population will suffer hearing losses. It is generally agreed that damage risk is negligible in environments with 8 hour sound levels < 70 to 75 dBA. Thresholds published by the World Health Organization are 70 dBA average sound levels over a 24 hour time period with maximum sound levels < 110 dB for industrial and commercial activities for continuous noise and a peak sound level of 140 dB 100mm from a person's

ear for impulsive sounds. In the work place in the United States OSHA, the Occupational and Safety Hazards Administration, has requirements that a hearing conservation program be administered in environments where the 8 hour sound level is > 85 dBA and hearing protection devices be worn in environments > 90 dBA. OSHA also recommends that people not be exposed to impulsive sounds > 140 dB.

OSHA REQUIREMENTS

The Occupational Safety and Health Administration (OSHA) states in Title 29 of the Code of Federal Regulation (CFR) Part 1910 Subpart G Occupational Noise Exposure Standard 1910.95 that feasible administrative or engineering controls must be utilized for covered employees subjected to sound levels exceeding those listed in Table X. If the controls fail to reduce sound levels within the levels of Table X, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. The acoustical measurements conducted in this study identified areas of the City where sound levels exceeded the levels in Table X. Areas of the City were also found to have sound levels above the 85 dBA required by OSHA for inclusion in a Hearing Conservation Program in covered industries. Sounds at these levels on the public rights-of way including sidewalks in the City could contribute to the noise dose that citizens experience at work thus adding to their overall noise exposure and potentially moving them into categories where the implementation of either administrative controls, engineering controls or the use of hearing protection devices reduce to noise exposure becomes required.

Administrative controls may include reducing the allowable sound level limit in the noise ordinance for sounds on sidewalks and public rights-of-way. This could also involve the posting of noise level warning signs as people enter areas with higher noise levels and possibly also buildings with higher noise levels so the public is aware of the potential risks involved. Engineering controls could include requiring clubs, entertainment establishments, industries, and other occupancies to contain noise within the physical boundaries of their facilities and to use noise mitigation systems to control the emission of sounds to accepted safe levels. Other options could include requiring residential and other potentially noise sensitive occupancies that are either built or renovated in areas of higher sound levels use noise mitigating construction assemblies for doors, windows, walls and roofs to reduce exterior sound levels to appropriate interior sound levels.

Many state and city staff and people working in establishments with 10 people or less are not covered by OSHA. However, the OSHA requirements may suggest a standard of comparison to evaluate the noise impact to which people may be exposed that could possibly result in temporary or permanent hearing damage.

Table X. Permissible Noise Exposures (OSHA 29 CFR Subpart G Part 1910.95 b Table G-16).

Permissible Noise Exposures	
Duration per day, hours	Sound level, dBA, slow response
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
1/2	110
1/4 or less	115

According to OSHA a Hearing Conservation Program (HCP) must be administered by the employer when the Time Weighted Average (TWA) sound level exceeds 85 dBA. The Hearing Conservation Program must have the following primary elements.

1. **Monitoring.** The sound levels that employees are exposed to should be monitored on an ongoing basis.
2. **Employee Notification.** The employer must notify employees of potential noise exposure to sound levels of 85 dBA or greater based in the results of the monitoring.
3. **Observation of Monitoring.** The employee or their representative can observe any noise measurements made during the monitoring.
4. **Audiometric Testing Program.** Audiometric testing paid for by the employer must be made available to all employees exposed to sound levels of 85 dBA or higher.
5. **Audiometric Test Requirements.** Audiometric tests shall consist of pure tone, air conduction, hearing threshold examinations, with test frequencies including 500, 1000, 2000, 3000, 4000 and 6000 Hertz performed separately for each ear.
6. **Hearing Protectors.** Hearing protectors selected by the employees and paid for by the employer shall be available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater.
7. **Hearing Protector Attenuation.** The employer shall evaluate hearing protector attenuation for the specific noise environments in which the protector will be used. Hearing protectors must attenuate employee exposure at least to an 8-hour time-weighted average of 90 decibels for normal hearing

employees and 85 decibels for employees who have experienced a standard threshold shift.

8. **Training Program.** The employer shall institute an annual training program covering a) the effects of noise on hearing, b) the purpose, use and types of hearing protectors and c) the purpose and explanation of audiometric testing for all employees who are exposed to noise at or above an 8-hour time-weighted average of 85 decibels.
9. **Access to Information and Training Materials.** The employer shall make available to affected employees or their representatives copies of the Department of Labor Occupational Noise Exposure Standard [Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart G, 36 FR 10466 May 29, 1971; Amended 48 FR 9776-9785, March 8, 1983] and shall also post a copy in the workplace.
10. **Record keeping.** The employer shall maintain an accurate record of all employee exposure measurements and audiometric tests.

NIOSH RECOMMENDATIONS

The National Institute of Occupational Safety and Health (NIOSH) has published guidelines for noise exposure in the work place that are intended to serve as “best” practices and as recommendations for revisions to OSHA. These include an 85 dBA threshold for implementation of the controls noted above with a 3 dB exchange rate in place of the 90 dBA threshold and 5 dB exchange rate used by OSHA. The NIOSH document also presents more detailed requirements regarding the Hearing Conservation Program and continued noise monitoring that should occur for exposed workers. Among these practices are the posting of large signs indicating potential noise hazards in areas with sound levels that exceed 85 dBA.

Similar legislation in other countries around the world including the European Union (EU) has standards of a low end of action of 80 dBA and a high end of action at 85 dBA with a maximum level of 87 dBA with a 3 dB exchange rate as the thresholds for initiating noise monitoring, hearing conservation programs and administrative, engineering, or personal protection device controls of the noise environment. These requirements are contained in the EU Noise Directive 2003/10/EC with subsequent updates.

INTERFERENCE WITH COMMUNICATION

There is a substantial body of literature that has explored the ways in which verbal communication is hindered in noisy environments (Basner et al, 2014). Metrics such as Speech Privacy Class (SPC), Articulation Index (AI), Privacy Index (PI), speech intelligibility (SI) and speech interference levels (SIL) are among the many indices that have been developed to relate how well people can hear and understand words in the presence of noise. Normal communication with people speaking at “normal” levels occurs among people at distances of 3 ft or greater. Analysis of the data recorded on Himmarshee shows that normal communication cannot occur among people at distances of 3 ft or greater. The high ambient noise levels in the Himmarshee Entertainment District and other similar areas of the city interfere with speech communication among residents, law enforcement officers and City staff. Maximum distances for “just-reliable” communication with different voice levels can be estimated from metrics in the literature (*Handbook of Acoustical Measurements and Noise Control, 3rd Edition* by Cyril M. Harris and *Noise and Vibration Control, Revised Edition* by Leo L. Beranek). “Just reliable communication” is the ability for

people to just barely communicate with each other in noisy situations. The maximum distances for “just-reliable” communication are presented in Table 1.

The values in the table for A-weighted sound levels of 85-90 dBA and higher show that for effective communication between people to occur, even when shouting, they must be 3’ or less from each other. This means that one person could not speak to another while walking along a sidewalk in the city and have a conversation. Communication could not occur across a street or a room until levels of < 55 dBA are reached assuming “normal” vocal effort and “normal” hearing abilities of the occupants. This means, for example, that if an officer is trying to talk to someone causing a disturbance and a fellow officer sees him about to be attacked from the rear, shouts of warning could not be heard unless the second officer is within 3 feet of the first officer. This puts the officer in a potentially dangerous situation.

Table 1. Maximum distances for “just-reliable” communications at different noise levels. (Harris, 1991, p.16.10).

A-weighted sound level, dBA	Maximum distance for “just-reliable” communication			
	with Shouting	with Very Loud voice	with Raised voice	with Normal voice
110	<2'	NRC*	NRC*	NRC*
105	<6'	NRC*	NRC*	NRC*
100	6'	NRC*	NRC*	NRC*
95	1'-6"	NRC*	NRC*	NRC*
90	2'	6"	NRC*	NRC*
85	3'	1'-6"	<6"	NRC*
80	5'	3'	1'	NRC*
75	10'	5'	2'	1'
70	16'	8'	4'	2'
65	28'	14'	7'	4'
60	55'	25'	12'	7'
55	100'	48'	22'	12'

NRC* = No Reliable Communication

Other effects of noise on communication include fatigue as one attempts to listen for periods of time in the presence of noise; concentration problems, decreased work capacity and misunderstandings. Psychologically these effects are sometimes manifest in lack of self confidence, irritation and uncertainty about what to do.

SLEEP DISTURBANCE

Noise from vehicular traffic, entertainment venues, building equipment, and other urban activities may impact residents who are trying to sleep or take naps during different times of day as part of their normal daily routine. The World Health Organization recommends average interior sound levels (LA_{eq}) of 30 dBA during night time (sleeping) hours. An LA_{eq} is the level of a steady sound that would have the same A-weighted sound energy as a time varying sound over the same time period. The Organization for Economic Cooperation provisionally recommends LA_{eq} levels of 35 dBA for light sleep and 50 dBA for deep sleep. The European Communities Commission recommends interior night time noise levels of 30-35 dBA with maximum peak levels of 45 dBA to minimize sleep disturbance. Griefahn found that the threshold for people awakening during the night was a peak noise level of 60 dBA. Electroencephalogram or brain wave (EEG) readings begin to show effects of peak noise levels as low as 37 dBA. It takes people 2-3 times longer to fall asleep with peak noise levels > 60 dBA than in a continuous background noise of 40 dBA. People will wake up at peak sound levels of 60 dBA and will stay awake longer once they awake as the noise level increases above 60 dBA. Heart rate increases and vasoconstrictions occur at peak noise levels between 60-85 dBA. Thresholds for physiological reaction to night time noise begin to occur at peak noise levels of 50 dBA for children, 55 dBA for middle aged and older people and 60 dBA for young adults.

TEMPORARY AND PERMANENT IMPACT ON PHYSIOLOGICAL FUNCTIONS

There are 3 general types of physiological responses to noise.

1. Adaptation. This usually occurs at low doses where one may elect to close a window for example when they hear unwanted noise.
2. Reversible damage which disappears when the noise stops.
3. Non-reversible damage which usually results from severe exposure and usually results in hearing loss.

The adaptive responses include muscle activities such as startle responses and increased muscle tension in response to the onset of sudden, high intensity sounds. These effects diminish with repeated exposure to the noise stimulus.

The evidence of epidemiological effects including change of blood pressure, increase in cholesterol levels, the appearance of mental anxiety and depression at sound levels between 50-75 dBA is not clear and is somewhat ambiguous. The evidence becomes much more clear at higher sound levels.

According to Jansen (1998) cardiovascular effects in adults are the most visible of the physiological effects of noise. These include changes in heart rate, reduction in the diameter of blood vessels (vasoconstriction) in peripheral regions (mostly the skin) and increases in blood pressure. Respiration is accelerated and oxygen consumption is increased in the presence of noise. There is a reduction in salivation and intestinal action. Modifications of the amount of secreted gastric juices and their composition can lead to intestinal irritation and possibly stomach or intestinal ulcers. Endocrine system effects are less visible than cardiac, respiratory and digestive effects, but they are the first responses to noise and cause other effects. (Basner et al, 2014)

Cardiovascular effects. Short term effects such as increases in heart rate when exposed to noise are eventually habituated after repeated stimuli and are usually considered as a startle response similar to the muscle activity discussed above.

Abnormal blood pressure levels have been found in both animal and human subjects exposed to noise in laboratory studies. The effects in the animals appear to be long lasting. Carter and Beh (1989) found increases in diastolic blood pressure in subjects exposed to 55 minutes of 92 dBA noise with no habituation. Van Dijk, Verbeek and de Fries (1987) found that people exposed to noise for 20 years in the work place had higher blood pressure and incidence of hypertension than those exposed for < 10 years. Wo, Ko and Chang (1987) found that workers in a ship yard who experienced noise levels of > 85 dBA at work had a higher incidence of hypertension and higher blood pressure than workers in jobs exposed to < 80 dBA sound levels. Talbot, et al found a strong relationship between severe high frequency hearing loss and hypertension in people > 56 years old. Rosenman (1990) found a relationship between noise exposure and increased incidence of hypertension. Andren, Hansson and Bjorkman (1981) found a 12% increase in blood pressure in healthy men exposed to 95 dBA noise for 20 minutes.

Vasoconstrictions in blood vessels in the finger have been documented for a variety of noise exposures in the 70-95 dBA range. Ray, Brady and Emurian (1984) found increases in mean arterial pressure and digital pulse amplitude in subjects performing a work task exposed to 93 dBA of pink noise.

Several studies of reactions to impulsive noise at levels of 90 and 105 dBA showed significant increases in diastolic blood pressure and large changes in finger pulse.

Increases in serum cholesterol and lipoproteins have been observed in human subjects are exposed to noise levels of 80-90 dBA.

Endocrine system effects. A general model on how noise stimulates endocrine system responses was proposed by Van Dijk, Ettema and Zielhuis (1986). Their hypothesis states that noise activates the higher cortical centers and hypothalamus by autonomic pathways. This causes the hypothalamus to trigger an increase of secretions of ACTH (adrenocorticotrophic hormone) by the pituitary gland. This causes the adrenal cortex and adrenal medulla to increase cortisol and catecholamine concentrations in the peripheral blood. This physiology basically describes a stress reaction. The hormones are found in urine samples.

Arguelles (1962 and 1970) found increases in epinephrine (E) and norepinephrine (NE) when people were exposed to noise in both normal patients and those who had heart attacks. Increases in blood pressure as well as E and NE increased at $p < 0.05$ values in the noise exposed group. Cantrell (1974) found that chronic intermittent noise produced more sustained effects of blood cortisol and cholesterol which did not return to the basal levels 15 days after the noise exposure was ended. Klotzbucher (1976), Klotzbucher and Fichter (1979), Ising (1980), Cesana (1982) and Cavatorth (1987) all found increases in E and blood pressure among other indicators in noise exposed populations at $p < 0.01$.

Selye found that white blood cells undergo modifications in the presence of noise. Lymphocytes disintegrate in the thymus and blood. Eosinocytes which regulate immunizing serological reactions and allergic responses disappear in the blood. As an organism is subjected to increasing noise it becomes weakened; more fragile; magnesium in cells is reduced; and there is an increase in blood leucocyte concentration.

Respiratory system effects. Larger, slower breathing movements occurred in response to a noise stimulus in a laboratory study. The magnitude of the effect increased with increasing noise levels. Subjects exposed to high levels of impulsive sounds showed increased resistance to respiration indicating a constriction of the bronchia followed by a slow decrease of the resistance. Subjects who were smokers or who were exposed to occupational noise had reduced reactions.

Gastrointestinal system effects. Healthy subjects exposed to noise at 105 dBA for 50 minutes after a “standard” meal showed increased, but delayed postprandial sigmoid colon motility. Increased motility was also observed in subjects exposed to an 80 dBA tone at 800 Hz.

SOCIAL, BEHAVIORAL AND ANNOYANCE EFFECTS

Annoyance has been defined as a feeling of displeasure with any agent or condition known or believed by an individual or group to be adversely affecting them. Exposure to noise has been shown to bring about changes in mood, everyday behavior and other social indicators. Among the negative emotions identified by people exposed to noise are anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation, and exhaustion (Basner, et al, 2014).

Glass and Singer (1975) found that exposure to unpredictable and uncontrollable high intensity noise leads to degradation of the quality of tasks being performed, impaired ability to resolve cognitive conflicts and lowered tolerance for frustration. Geen and O’Neal (1969) found that aggression increased in people exposed to high level noise.

Cherek (1985) found that smoking increased as noise levels increased in a laboratory study of noise exposure.

CONCLUSIONS OF HEALTH EFFECTS OF NOISE

Studies point to significant cardiovascular effects including higher blood pressure and increased incidence of hypertension in people exposed to high noise levels. Stress reactions indicated by increased production of hormones have also been clearly associated with noise exposure. A variety of psychological effects of noise including increased smoking, anger, depression, anxiety and agitation have been observed. Speech communication is severely reduced in the presence of noise especially for people with reduced hearing abilities. Living and/or working in high noise environments brings with it decreased work capacity, fatigue and misunderstandings as part of the normal consequences of the difficult environment.

EXISTING FT LAUDERDALE NOISE ORDINANCE SUMMARY

The current noise ordinance of the City of Fort Lauderdale has a number of strategies to limit noise from disturbing its inhabitants.

It includes the following:

1. **Special entertainment Overlay District.** Dedicated areas where entertainment venues are classified as special entertainment overlay districts. Large cities often have areas where night time entertainment establishments exist. These are often categorized as entertainment districts and include a fairly dense geographical area, typically in the downtown, that allows higher sounds levels from amplified music in these areas. Where these districts are located, in terms of acoustic land use compatibility, these districts would be better located in a commercial district where only commercial adjacencies are located.

Table X. Sound level limits contained in the Ft. Lauderdale Noise Ordinance compiled from Table and text

MAXIMUM PERMISSIBLE SOUND LEVEL LIMITS			
	Times	Outdoor	Indoor
Residential	7 am – 10 pm	60 dBA *65 dBA if residential is within Commercial, Industrial or Mixed or within 200 ft of such	45 dBA
	10 pm – 7am	80 dBA (Impulsive sounds that occur less than 4 times in 1 hour) 50 dBA 70 dBA (Impulsive sounds that occur less than 4 times in 1 hour)	35 dBA
	24 hours	65 dBA	55 dBA
Commercial	24 hours	65 dBA	55 dBA
Industrial	24 hours	75 dBA	65 dBA
SPECIAL ENTERTAINMENT DISTRICT			
Measured 5 ft from building, structure or establishment	Mon-Thur 12pm to 12am	85 dBA, 95 dBC	
	Mon – Thur 12am-2am	70 dBA, 80 dBC	

Mon-Thur 2am-12pm	65 dBA, 75 dBA
Fri-Sun 12pm to 1am and Legal holidays	85 dBA, 95 dBC
Fri-Sun 1am-3am and Legal holidays	70 dBA, 80 dBC
Fri-Sun 3am-12pm and Legal holidays	65 dBA, 75 dBC

- 2. Sound level change for days/times.** Different sound level limits at different days and times for source measurements enforcement.
- 3. Sound Level Limit Weighting.** Provides A and C weighted sound level limits at the source. The difference between the A and C weighted sound level limits is 10 dB.
- 4. Measurement Metric.** An Lmax is defined as the maximum sound level measured during the sound measurement period and is the measurement metric for source sound levels.
- 5. Receiver sound level limits.** Provides receiver sound level limits measured at grade during the day and night for residential, commercial and industrial uses.
- 6. Indoor and Outdoor limits.** Provides residential, commercial and industrial sound level limits both outdoors and indoors.
- 7. C-weighted sound level limit within “premises” from “amplified sound device”.** There is a provision to limit sound level limits “within premises” for commercial, mixed use or industrial uses. This may be an attempt to limit amplified music entertainment sound levels inside mixed use spaces, however “premises” is not defined in the noise ordinance. It may mean inside the physical building or it may mean the entire property including the building, site and outdoor spaces on the property.

Table X. Sound level limits contained in the Ft. Lauderdale noise ordinance that relate to Commercial, Mixed Use or Industrial occupancies.

COMMERCIAL, MIXED USE OR INDUSTRIAL			
Measured within the premises of a complainant	12pm-10 pm	Use limits in Table 1	60 dBC
Sound level limits from Table 1 apply when measurements are taken outdoors or within the property line of the complainant	10pm – 12 pm	Use limits in Table 1	55 dBC

9. **Continuous sound.** Continuous sound is defined as any sound with a duration of more than 1 seconds, as measured with a sound level meter set to the “slow” response.
10. **Plainly audible limit in residential area.** In residential areas, Section 17-7 states that amplified “sound shall not be plainly audible for a period of one (1) minute or longer at a distance of twenty-five feet or more when measured from the source property line between 10pm-7am, or at a distance of fifty feet or more when measured at the source property line between 7am and 10pm.
11. **Noise Management Plan for Construction of large public works transportation projects.** If large scale transportation projects exist, the noise ordinance calls for a fairly robust noise management plan, which includes among others, a “description of the anticipated noise impact of the construction on adjacent properties, how the plan might mitigate negative impacts, continuous noise monitoring during the construction period, the results of a baseline ambient A-weighted sound level noise study, etc.

NOISE ORDINANCE STRATEGIES.

The primary sources of excessive noise initially identified by the City and the Noise Control Advisory Committee as the basis for the study were amplified music from entertainment facilities, amplified music from residential rental units, cars playing amplified music in parking lots, and motorcycles, cars, trucks, and other vehicles with loud mufflers specifically in the Beaches area. The recent enforcement actions by police have reduced the numbers of loud vehicles on the streets in the Beaches. Sounds from businesses

and entertainment venues where measurements were taken during the study are generally within the current regulations. A three-tiered approach is usually required to address sonic issues in the built environment. Administrative controls, engineering controls and controls for specific sources of sound of interest such as amplified sounds and motor vehicles in the case of Fort Lauderdale.

Administrative controls may include adjustments to the noise ordinance such as adding a C-weighted or low frequency sound level limit, including references to measurement methods where the measurements would be made in accordance with appropriate national standards; using type 1 sound level meters that store data so that records of the measured levels are included as part of the measurement process; reviewing the permissible hours for outdoor amplified music; adding controls during the building permitting process requiring noise studies and designed mitigation systems in buildings that are either potential producers of sound that will propagate off-site to possibly impact other buildings or may be potential receivers of sounds produced by new and existing projects. Consideration could also be given to linking the planning and zoning process with the noise ordinance so that future projects must be shown to comply with the noise ordinance requirements at the time of permitting with the possibility of enacting a commissioning study to verify performance after completion of the project.

Engineering controls could include requiring future entertainment venues and dining facilities to reduce noise propagated onto the street and other public spaces or to contain noise within the physical boundaries of their facilities; and requiring residential and hotel occupancies built and renovated to construct the exterior walls, windows and roofs of the buildings to reduce interior sound levels to criteria levels based on current and projected future sound levels for the specific location of the facility.

Specific Sound Controls could include recommendations for the reduction of amplified sounds and motor vehicle sounds. It may involve the installation and operation of sound monitoring system in entertainment venues to record on a continuous basis sound levels at specific locations produced by the sound systems in venues and possibly requiring motor vehicles driven on city streets to have the original equipment mufflers and exhaust systems installed on their vehicles.

In an effort to maintain acoustic compatibility of the diverse uses of the city, the following are suggested recommendations.

CITY OF FT LAUDERDALE NOISE ORDINANCE STRATEGIES

The strategies contained in this section contain a mix of Administrative, Engineering and Specific Sound Controls that could work together toward achieving a more compatible sonic environment in the City. This approach of compatibility is necessary to find a balance between highly active and diverse urban living with the need for respite and a healthy environment that supports the long-term well-being of citizens of the City of Fort Lauderdale.

DISCUSSION POINTS

1. **Sound Level Limits - Source** The limit of 85 dBA or 95 dBC at a 5 ft. distance outside the source (from 12pm to 1am Friday through Sunday) allows entertainment establishments in Entertainment Districts to play amplified sounds outside at fairly high levels. These sounds can travel long distances and travel up the sides of buildings. In areas where regional activity zones exist and sounds may be played until 4:00 am, the amplified sounds have been measured at upper level balconies of residences. These sounds add to the other environmental sounds and increase the

sounds level by 5 to 10-20 dBA on the balconies of residences. Permitting sounds levels to be this loud outside may mean that the establishments play sounds at potentially damaging sound levels inside the boundaries of the establishment.

2. **To reach sound levels of 20-25 dBA inside a residential unit (typical luxury sound levels), the sound level outside would need to be approximately 60-65 dBA assuming that modern construction systems are used in the building with hurricane or impact glass or upgraded acoustical window assemblies.** A potential way of setting the dBC sound level limit might be to determine the location of the nearest residential occupancy, and determine the operating sound level limit based on this distance.
3. **Sound Level Limits – Entertainment Source – Self Limit.** The use of a system to limit sound levels inside or 5ft outside an entertainment venue could be considered to help self regulate sound levels and show compliance especially in Entertainment Districts where multiple venues are present in close proximity to each other where isolating the contribution of individual venues to the measured sound level is difficult to achieve. A product such as 10EaZy may be used inside the establishment at the door to measure sound levels inside or just outside the establishment at 5 ft. The data can be streamed to an online website where the levels are logged.
 - a. <https://www.10eazy.com/products>
4. Other strategies that could be considered include the following which are used in other cities.

The City of Hollywood, Florida requires the use of noise level detection devices for any nonresidential establishment from which amplified musical entertainment, whether live or recorded emanates to have a noise level detection device alerting the occupants of the property to the noise.

Sound Level Limit – Outdoor Speakers. Several noise ordinances that have been reviewed include specific requirements for outdoor loudspeakers.

The City of Tampa does not allow the use of loudspeakers on or above any public right of way.

The City of St. Petersburg has a section dedicated to “sidewalk cafés” in which loudspeakers are included. It requires that any loudspeakers that are located outside a building in or over the right of way shall be mounted overhead (preferably under an awning or other overhang feature) and oriented downward at an angle of 45 degrees or less toward the sidewalk cafe. No speaker is allowed in a sidewalk café unless the speaker is specifically identified on the approved plan for the sidewalk café permit. It includes a requirement that sound from the approved sidewalk café speakers may not be plainly audible at a distance of greater than 200 feet between 8am and 11pm and greater than 50 ft between 11pm and 8am.

2. **Sound Level Limits – Residential Receivers** The 50 dBA sound level limit for residential areas was exceeded in most residential areas in the downtown and built up areas of the City. This means that the 50 dBA from the establishments will likely not be measurable due to the existing ambient sound levels. The 50 dBA sound level limit at residential properties in areas with single family detached homes on streets that are not near major roadways is likely appropriate during night time hours. There are areas of the City where this limit could possibly be reconsidered.

3. Sound Level Limits – Weighting Discussion Including sound level limits specifically for low frequency sound such as an overall C-weighted sound level (dBA) or octave band sound level limits should be considered.

Cities such as Tampa, Sarasota, and Port St. Lucie use both A and C weighted metrics in their noise ordinances.

The city of Tampa limits sounds within the Ybor City Historic District or the Arena district to 85 dBA or 87 dBC between the hours of 6pm and 3am, and 65 dBA and 75 dBC between the hours of 3am and 6pm. This includes a measurement taken at the property line of the source for 30 seconds and the Leq must not exceed those limits.

The City of Sarasota limits amplified sounds **not in a completely enclosed building** to 65 dBA, 70 dBC or having a 5 dB difference between the dBA and dBC sound levels between the hours of 10pm to 7am. The measurement is to be made at the source or receiver property line, approximately 5 ft above ground.

The City of Port St. Lucie contains sound level limits of 60 dBA and 65 dBC during the hours or 7am to 11 pm, and 55 dBA and 60 dBC for residential receiving properties.

The City of Hollywood limits sounds in residential areas to 65 dBA or 65 dBC from 7am to 10 pm and 55 dBA or 55 dBC from 10pm to 7am.

4. Sound Level Limits - Metric Maximum sound levels are defined as Lmax. This is interpreted as LAFmax, which is the maximum sounds level measured with a 125ms. time constant.

Consider applying plainly audible to sound from the entertainment districts - this may not be viable from the club owners standpoint.

5. Sound Level Limits – Time of Day Consider reducing the times that amplified music can be played outdoors in Special Entertainment Districts to reduce the acoustic footprint of the establishments on their residential neighbors.

6. Enforcement Protocol. Measurements taken on grade versus at complainants' property. Consider allowing the measuring of amplified sound from Entertainment Overlay Districts at the receiver location when a complaint is made (possibly at the option of the complainant), **as opposed to 5 feet from the source property line on grade.** Possibly measure amplified sound at the window or balcony at receiver locations when a complaint is made (possibly at the option of the complainant) - acceptable levels need to be set for this. Consider restricting the low frequency content of amplified sound when measuring 5' from the property line in Entertainment Overlay districts (if this will be kept as an option). Possibly allow for options for the measurement procedure - at sources (metric set) or at receiver (metric set) and the enforcement personal can choose which is more representative of the situation or both and neither can be exceeded - this might be too cumbersome and would have to be developed as a concept.

Sound level meter for code enforcement. The sound level meters used by the city should be evaluated to determine if they are sufficient to take sound level measurements, log sound levels over time and record wav files as well, store the data and be in conformance with ANSI and ASTM standards.

8. Indoor Sound Level Limit. Define “premises” that means inside the building.

9. Sound Level Limits - Globally. Multiple sound level limits that reflect the differences within areas of the City such as different zoning classifications, days of week and times of day are currently used. These

differing sound level limits or procedures are not all contained in one accessible table. Rather indices are tabulated while others are in narrative paragraphs. Consider consolidating and simplifying the sound level limits for ease of understanding by enforcement personnel, residents, entertainment venue operators and other stakeholders.

10. Plainly audible clarification. There is currently “plainly audible” language in the noise ordinance in Section 17-7. The use of this by Code enforcement is typically for residential sound sources propagating to residential receivers. The issue of this provision and its application in enforcement should be clarified in the noise ordinance.

Consider adding verbiage such as “The plainly audible standard should be used for residential sources (such as a resident playing amplified music outside their home) in residential areas.

Consider adding the following table or similar to help clarify the intent of the sound level limits and plainly audible limits.

Amplified Music Source	Receiver	Ordinance Standard
Automobile	Distance away	Plainly audible (25 ft)
Residential	Residential	Plainly audible (25ft and 50 ft)
Special Entertainment Overlay District	Residential, Mixed Use	Sound level limit (dBA and dBC) at source and/or plainly audible
Commercial, mixed-use, or industrial uses		Sound level limit (dBA and dBC) at receiver and/or plainly audible

10. Consider developing strategies for **enhanced compatibility** of existing and future entertainment venues in Special Entertainment Districts and Regional Activity Centers with existing and future residential and mixed-use buildings.

11. Enforcement Protocol – Meters Used for Enforcement. Are the meters the code enforcement officials use able to take LAFmax, LCFmax data simultaneously? Can the measurements be stored and saved? Do they also record WAV files? Consider purchasing sound level meters that can take this data simultaneously.

12. Enforcement Protocol – Noise Measurement Training Consider a noise measurement training program for code enforcement and other staff to include proper measurement protocol. Consider annual refresher courses to allow officials to become more comfortable with the program.

13. Vehicular Noise Monitoring. Using a device that automatically detects loud vehicles, such as Sorama Loud Vehicle Detection System or similar system may be desired to be tested in the City to determine if the product is suitable to detect loud vehicles and ultimately deter loud vehicles from entering the City. It is recommended that any product that is considered for this application be tested for a limited duration to determine if it’s accuracy and performance meet the expectations of the City. This is a relatively new type of system that is still being developed and refined, and demoing the product first is strongly recommended.

<https://sorama.eu/solutions/loud-vehicle-detection>

OTHER CONSIDERATIONS

1. The current nuisance language and/or plainly audible language should be maintained in the residential areas. This should be clarified with Code Officials so that the plainly audible standard is used for sounds generated within residential areas by private residences.
2. The measurement method should be revised to address the particular needs of the unique parts of the City. The measurement time period should be relatively short to capture the transient sounds that comprise amplified music sounds from passing cars loud mufflers from cars.
3. **Definitions and standards**
 - a. Definitions from sources such as the American National Standards Institute (ANSI) and the American Society for Testing and Materials (ASTM) standards are preferred for technical acoustical issues.
 - b. ANSI and ASTM standards should be referenced for meter type, filters, use of windscreens, measurement techniques, measurement and other technical requirements.
 - c. Corrections for background noise levels should be made in accordance with ANSI and ASTM standards for all measurement data used for citation purposes.
 - d. Consider specifying a measurement duration and sampling period as appropriate to capture the nature of the disturbing sound.
 - e. A table listing many of the specific standards that can be cited for specific issues is included in Appendix F in our report.
 - f. Consider developing standard operating procedures for City staff and enforcement personnel if the ordinance is modified.
4. **Other provisions**
 - a. **Time of day limits.** Consider limiting the times of that playing of amplified music and speech are permitted.
 - b. **Muffler restrictions.** Consider including verbiage to limit any mufflers besides factory installed mufflers and exhaust systems. See Appendix E for example verbiage in the Florida State Statute 315.593.5a. – d.
 - c. **Increase Fines.** Consider increasing fines for repeat offenses.
 - d. **Planning and Zoning Approvals.** Consider implementing acoustical and noise-related requirements in planning and zoning applications for new construction and renovations of buildings in and near entertainment venues and other sources of sound. The requirements of the noise ordinance should be linked with planning and zoning submissions, building plans approval and Certificates of Occupancy for new and remodeled buildings.

Trial Period. The proposed ordinance should be enacted for a trial period of time for perhaps 6-12 months to allow residents, entertainment establishment owners and operators and city officials to gain first hand experience with the requirements with the possibility of adjusting requirements before a formal ordinance is passed. No citations would be given during the trial period unless extremely excessive noise is propagated and not turned down when requested by enforcement personnel.

ITEMS TO CONSIDER FOR THE FUTURE

Items presented below are suggestions that could be implemented as part of Planning and Zoning efforts in Fort Lauderdale that are not necessarily included in the Noise Ordinance but could be included in other planning or zoning documents.

1. **Noise Study for Differing Zoned Uses.** Planning efforts for new developments, especially those projects near Special Entertainment Districts, Regional Activity Centers, railroads, roadways, airports or in downtown areas could include a noise study to protect the soundscape of the existing city fabric and the new development.
2. **Noise Study Stipulation for Residential Developments Located Near Transportation and Industrial Sources of Sound.** Consider requiring any residential development that is within 1,000 feet of a major roadway or 3,000 ft from a rail line to provide adequate noise mitigation to the site, exterior areas and interior spaces to meet HUD, FTA, FAA and FHWA requirements at a minimum with options for Grade A, B and C housing to have stricter requirements. Any site that has an average Day Night Sound Level of 65 or higher would need to provide noise mitigation to the building façade to meet interior sound levels of 45 dBA or lower. See Manatee County Requirements in Appendix E for example verbiage of this concept. Lower criterion levels should be set for “market” and “luxury” residential properties.
3. **Noise Study for Establishments with Indoor and Outdoor Amplified Music.** New indoor, outdoor or partially open to the outside air establishments proposing amplified music should have to demonstrate that they can meet the requirements of the City ordinance before a permit is issued. A *Site Noise Study or Environmental Acoustic Assessment* and *Noise Mitigation Plan* (if needed) should be prepared by an acoustical consultant who is a member of the Institute of Noise Control Engineers (INCE) and the National Council of Acoustical Consultants as a part of the permit process. Consideration should be given to a specific clause in the ordinance regarding outdoor amplified music because of the inherent difficulties presented by these establishments. Similar consideration should be given to Balcony and Rooftop venues.
4. **Noise Enforcement Training Program.** Consider formal training of police and/or code enforcement officers to take measurements for noise ordinance enforcement. This should include the correct use of sound level meters, proper documentation, measurements in compliance with noise ordinance requirements and national standards, background sound correction, etc.
5. **Planning strategies** already used in the City could be formalized to address sonic compatibility issues in new developments
6. **Building façade requirements.** Considerations could include zoning or plans approval requirement for STC/OITC ratings for the building facades of hotels and residences that limit the propagation of sounds from Special Entertainment Districts, Regional Activity Centers or planned indoor and outdoor entertainment activities into sleeping and living areas and buffering of outdoor activity areas from adjacent existing or future projects.
 - a. Similarly, off-site sounds such as from rail lines, road traffic, aircraft flyovers, commercial, industrial and entertainment sounds could be considered during planning phases of projects so that requirements for STC/OITC ratings of the exterior skin of new buildings can reduce

existing sounds to reasonable interior sound levels for the specific occupancy being planned.

7. **Sound Isolation for Mixed Use Guidelines.** In mixed-use buildings consideration could be given to requirements for sound separations between mixed-use activities within a single building as well as within a complex of buildings. For example, having requirements for sound isolation systems for residential occupancies and hotel sleeping rooms in buildings with restaurants and nighttime amplified sounds on lower floors, rooftops or mid-level amenity spaces could be enacted.
8. Requirements to limit sounds produced inside or outside venues to the confines of the venue or to meet noise ordinance sound level limits if implemented at the property boundaries per the appropriate zoning district would help control potential off-site noise impacts.
9. **MEP Noise Control Requirements.** Building mechanical equipment or central plant equipment; loading activities at commercial buildings, indoor and outdoor dining; entertainment; animal facilities and any other potentially noisy building types of activities could all be considered for control.

PLANNING STRATEGIES FOR CITIES

1. **Self Contained Activated Mixed Use Areas.** Create activated areas that are self-contained. IE Mixed use areas with restaurants and outdoor seating on lower levels, intermediate levels, upper levels or rooftops. Interior courtyards with surrounding properties, rooftop venues with direct sound paths to adjacent or nearby buildings. If residences, potentially face residences away from the activated areas and put offices on the activates side.
 - a. Require STC/OITC ratings of windows for residences within **xxxx** feet.
 - b. Require isolated construction of restaurants/nightclubs and or buffer spaces between restaurant, club and residential.
 - c. Low frequency sound level limits for mixed use
 - d. Limit sound levels played at the outdoor restaurant or activated areas outside
 - e. Require all lessees and/or purchasers to acknowledge they are in an activated area and noise levels may be higher than in a residential area.

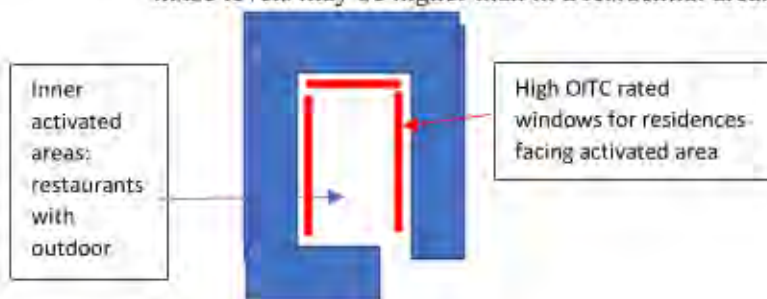


Figure X. Conceptual sketch of a self contained mixed use area with an inner activated core, high OITC rated windows, and possible sound diffusing elements on the inner exterior of the building.

2. **Vertical Zoning.** Requirements for mixed use buildings to provide buffer spaces and sound isolation systems between high sound level occupancies and sensitive occupancies.
 - a. Require sound isolation ceilings and walls for Noise Producing Spaces

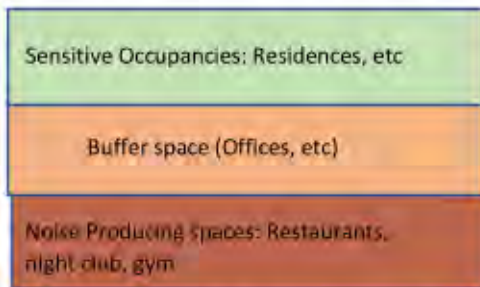


Figure X. Conceptual sketch of a vertical zoning strategy that could be applied in Mixed Use buildings that requires a buffer space to help shield residential or other sensitive occupancies from loud noise producing spaces on grade.

ACOUSTICAL PLANNING FOR FUTURE DEVELOPMENT

One of the first steps in a process that could involve acoustical planning for future development in areas with either known existing or possible future predicted sound levels would be to understand the necessary sound reduction properties of the exterior building envelope for new and renovated buildings would to meet desired interior sound levels. This is often evaluated by an outside to inside Noise Level Reduction (NLR) which is the difference between the existing or possible future exterior sound level and the desired interior sound level. Table XX presents NLR's required for different exterior sound levels to reach different interior sound levels based on analysis conducted using the HUD STraCAT analysis tool.

Background Sound Levels

The desired interior ambient sound levels are provided in 5 dB increments for simplicity with a citation of the source of the background sound level. U.S. Federal Department of Housing and Urban Development and 24 CFR 51.B require interior sound levels to be 45 dBA or less inside federally funded housing as a Day-Night Average Sound Level or LDN. Individual events such as aircraft flyovers can be 20 dB or more higher than the 45 dBA using this metric. Forty five dBA is a relatively high ambient sound level for a residence.

The interior sound level noted as HUD + is meant to be an improvement or reduction in interior sound level that represents improved performance. The 5 dB reduction in interior sound level from HUD would be heard as noticeably quieter by people of normal sensitivities.

The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) uses a criterion of 35 dBA as the maximum sound level from building equipment sounds in residences. Exterior sounds would have to be less than this for the combined level to reach 35 dBA. The 35 dBA would be heard as ½ as loud as the 45 dBA of HUD by people of normal sensitivities.

The International Standards Organization (ISO) standard 19488 provides a ranking of buildings by class based on acoustical criteria for exterior and interior noise sources. ISO classes A, B and C are shown in the table with their corresponding interior sound levels. Additionally, many luxury residences in south Florida have interior sound levels of 25 dBA or less. Some are at 20 dBA and less. These interior sound levels are found in many buildings and can be realistic to achieve in new and renovated residences in south Florida.

OITC's and other Sound Reduction Criteria

The sound reduction metric would be the OITC which is the Outside to Inside Transmission Class of the exterior assembly if other criteria such as the Facility Guidelines Institute (FGI) which provides acoustical regulations for health care occupancies or the United Facilities Code (UFC) which provides criteria for military facilities are used. The Outside to Inside Transmission Class is a weighted single number rating of the sound reduction of the assembly measured in accordance with ASTM E 966 and ASTM E 1332 using a transportation noise source that has low frequency content. The OITC ratings in the FGI and UFC are based on either maximum hour exterior sound levels or Day-Night Average Sound Levels or LDN's and could be 0 to -3 dB less than the NLR values in **Table XX**.

Sometimes the sound reduction of exterior building assemblies is given as Sound Transmission Class or STC ratings. The STC is a weighted average of the sound reduction, usually of interior partitions, measured in accordance with ASTM E90 and ASTM E413. It was originally developed as a rating applied to the reduction of primarily speech sounds, which are primarily mid and higher frequency sounds, attenuated by gypsum board partitions. The STC rating of an assembly is usually lower than the OITC of the same assembly because of the lower frequency sounds included in the source used in the OITC measurement.

Measurement Time

Since the focus of the current study has been on amplified music and loud vehicle sounds in Fort Lauderdale, the Noise Level Reductions are presented as reductions required to reduce short term sounds to the noted interior sound levels. They could also be applied to longer term average sound levels. The rationale for this is that if one is engaged in thoughtful work in an office or residence, reading or relaxing or sleeping in their home or other activities that usually involve relative quiet, the intermittent increases in sound levels associated with the beats of amplified music or pass-bys of louder vehicles could be disturbing. Therefore, intermittent, potentially disturbing sounds could be reduced to a specified maximum interior sound level using the NLR's in the table. Averaging sounds that occur for several minutes or hours over a longer period of time does not reflect the potential sleep disturbance, interference with communication or break in the train of thought nor does it mitigate other potential health effects of the sounds affecting people in their homes, offices or other occupancies.

Table XX. Noise Reduction Levels (NLR) required to meet different interior sound levels in dBA for given exterior sound levels in dBA.

Exterior Sound Level (dBA)	Interior Sound Level (dBA)					
	HUD	HUD+	ASHRAE	ISO C	ISO B +Typ. Luxury	ISO A
	45	40	35	30	25	20
	Noise Level Reduction (NLR) in dB to Reach Interior Sound Level					
90	48	53	58	63	68	73
85	43	48	53	58	63	68
80	38	43	48	53	58	63
75	33	38	43	48	53	58
70	28	33	38	43	48	53
65	23	28	33	38	43	48
60	18	23	28	33	38	43
55	13	18	23	28	33	38
50	8	13	18	23	28	33

Notes:

- Readily achievable NLR with typical "hurricane glass"
- NLR attained with upgraded glass
- Special acoustical construction; difficult to achieve

NLR numbers (dB), based on HUD's online STrCAT Tool analysis, could be 0 to -3 dB if other criteria are applied: such as FGI, UFC and other standards.

In addition to the NLR of the exterior assembly, the assembly's sound reduction in the lower frequencies is important to consider where the sources of sound are large trucks on a highway, railroads with diesel engines, amplified music or other sound sources with low frequency content. This is an especially important criterion in buildings with large areas of windows, sliding glass doors or other glazed openings because glass has relatively low sound reductions in the low frequencies even with laminated glass with multiple panes.

The area shaded in grey in Table XX are NLR's that can be practically achieved using typical impact or hurricane glass for windows and sliding doors and typical exterior wall, door and roof assemblies used in south Florida residences. To achieve the NLR's shaded in yellow in the high 30's to lower 40's acoustical upgrades to the glazing and other exterior assemblies are required. To achieve the NLR's shaded in blue in the mid to upper 40's and higher, special acoustical construction with significant cost increases are required compared to more typical building construction and these NLR's can still be very difficult to achieve.

Possible Applications of the NLR's

The table can be used in several ways. The first would be for the City to consider what exterior sound levels could be permitted in areas where present and future mixed use development was anticipated or

desired. If one knows the existing exterior sound level, one can find the appropriate NLR of the exterior assemblies of the building required to reach the desired interior sound level for a given project. For example, sounds of an entertainment venue located on the ground floor of a new mixed use building would have to be limited for specific background sound levels to be reached inside residences or offices on upper floors.

The second would be for consideration in the revision of exterior sound level limits in the noise ordinance. Exterior sound levels would have to be limited to levels that could be reduced to the desired interior level given a known or established NLR construction standard for a district in the City. If new and renovated occupancies in areas where there are current or future plans for mixed use development, the exterior sound levels could be limited to NLR's that are practical to achieve in the building types envisioned for the area.

The third application of the data would be to inform potential developers and residents that if they move to new, renovated or existing buildings in areas of the City with known sound levels, what they could expect to experience inside their homes by subtracting the known exterior sound level from the NLR of the exterior assemblies of the building they are thinking of moving in to.

The fourth application would be to inform present and future entertainment venue owners or operators what plausible sound levels may be to operate at given the construction assemblies of buildings in the vicinity of a prospective club site before they may receive complaints from those in near-by buildings.

CONCLUSIONS

Ft. Lauderdale is a highly livable, mixed use urban soundscape with a diversity of uses and vitality. The City, its residents, business owners, and visitors are very respectful of each other and the current regulations. As a result, the soundscape of Ft. Lauderdale is well managed by many citizens at this time and only relatively minor "tweaking" of sound-related regulations are recommended.

With the many vertical residential towers that populate the city skyline come some challenges in effectively managing the soundscape at these upper levels, where the sounds from grade level reflect up the vertical landscape off the reflective buildings and direct sounds to the many residences. This presents a challenging ecosystem to attempt to control and collaboration between the varying user groups is necessary to effectively deal with this unique sonic flow that only densely populated urban areas experience. By illuminating some of the acoustic phenomenon that take place in this area, by showing how these phenomena can be measured and modeled, it is our hope that the city will be able to use these tools to help guide the design of any new construction or renovation of buildings. By understanding how the sound level limits, time of day limits, weighting limits and other limits put in place work together in creating the soundscape that is Ft. Lauderdale, it is possible to creatively and collaboratively address these issues, to allow for a thriving and lively economy that is also sensitive to the surrounding agencies.

A common sense approach to incremental changes in sound and noise policies can be enacted as the City grows to preserve the desirable qualities of the City while optimizing opportunities for growth. Preserving and enhancing the "personality" of Fort Lauderdale is essential to the high quality, urban life style that residents enjoy and that has allowed the City to thrive.

Some of the recommendations described in this report could possibly help Ft. Lauderdale in maintaining the balance between vibrant urban life and high quality living environments for residents and visitors as the City grows and enjoys its prosperous and vibrant life.

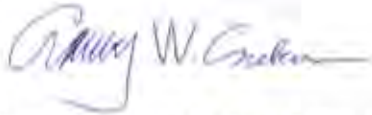
Please do not hesitate to call us if you have any questions in this regard.

Sincerely,

SIEBEIN ASSOCIATES, INC.



Keely M. Siebein, ASA, INCE, LEED AP BD+C
Associate Principal Consultant



Gary W. Siebein, FAIA, FASA, INCE,
Senior Principal Consultant



Martin Gold, FAIA
Associate Professor | Architect

REFERENCES

Basner, M., et al. *Auditory and Non Auditory Effects of Noise on Health*. *Lancet*, April 12: 383 (9925): 2014, pp. 1325-1332.

Bronzaft, Arline L. *The Effects of Noise on Learning, Cognitive Development, and Social Behavior* in Fay, Thomas H., ed. *Noise and Health*. New York Academy of Medicine, New York: 1991.

Jansen, Gerd. *Physiological Effects of Noise* in Harris, Cyril M., ed. *Handbook of Acoustical Measurements and Noise Control Fourth Edition*, Institute of Noise Control Engineers, Poughkeepsie, New York: 2001.

Raymond, Lawrence W. *Neuroendocrine, Immunologic and Gastrointestinal Effects of Noise* in Fay, Thomas H., ed. *Noise and Health*. New York Academy of Medicine, New York: 1991.

Schwela, Dietrich H. *World Health Organization Guidelines for Community Noise*. *Noise Control Engineering Journal*, Vol. 49, No. 4, July-August 2001, pp. 193-198.

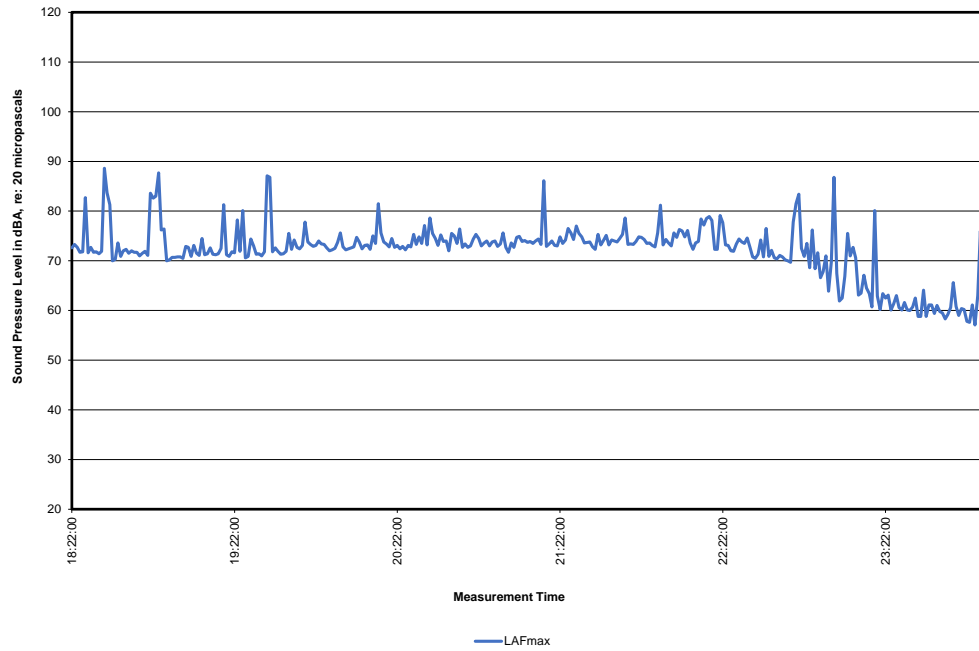
Sloan, Richard P. *Cardiovascular Effects of Noise* in Fay, Thomas H., ed. *Noise and Health*. New York Academy of Medicine, New York: 1991.

Vallet, M. *Effects of Noise on Health* in Garcia, A., ed. *Environmental Urban Noise*. WIT Press, Southampton: 2001.

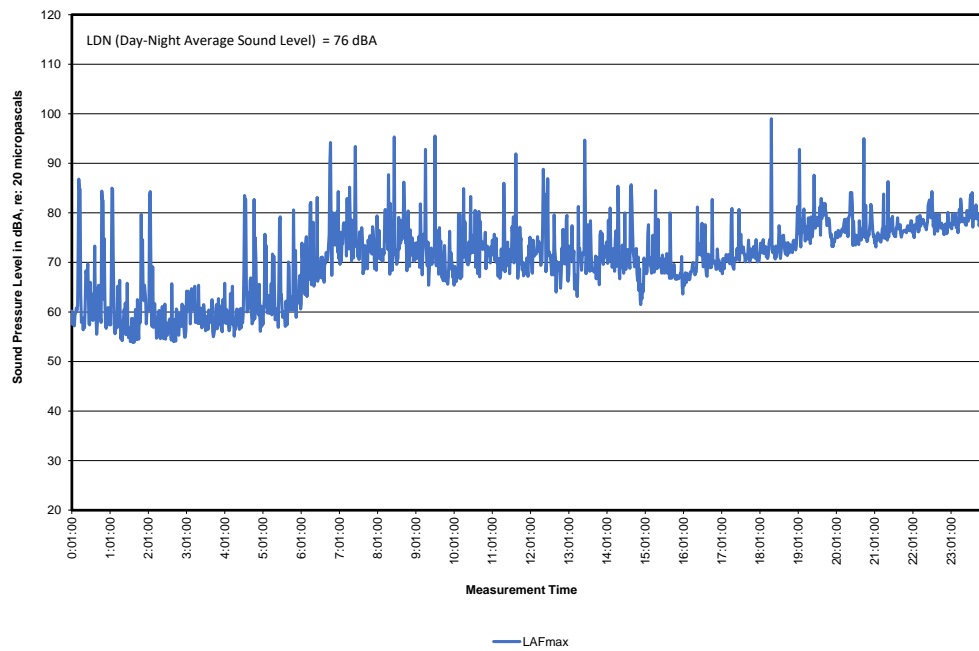
World Health Organization (WHO). *Environmental Noise Guidelines for the European Region*. WHO Regional Office for Europe, Copenhagen, Denmark: 2018.

**APPENDIX A-1:
SUMMARY GRAPHS OF LONG-TERM ACOUSTICAL DATA
TRIP 1**

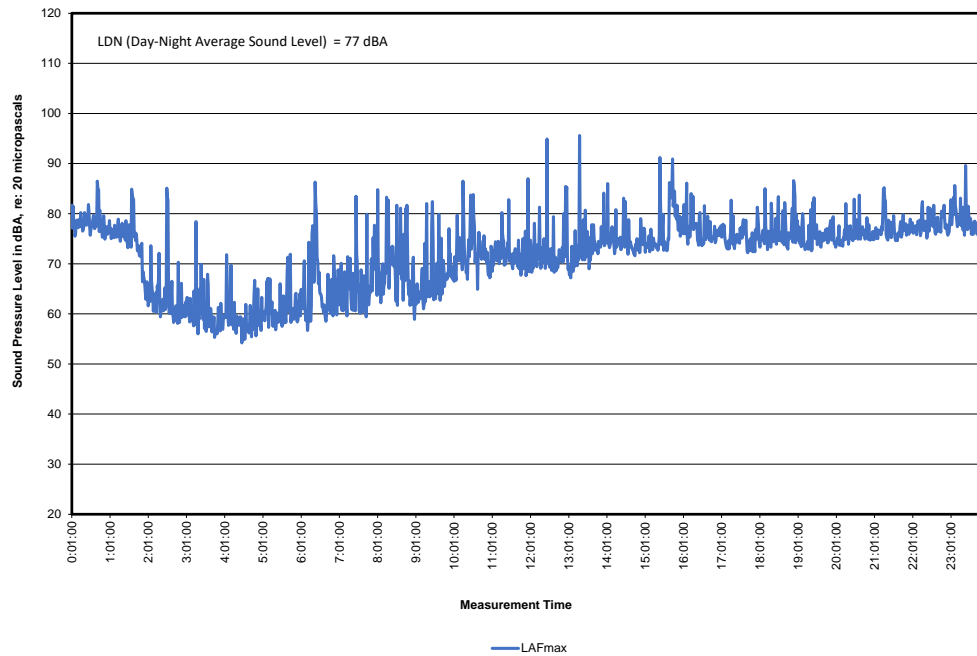
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Thursday - February 16 to February 17, 2023



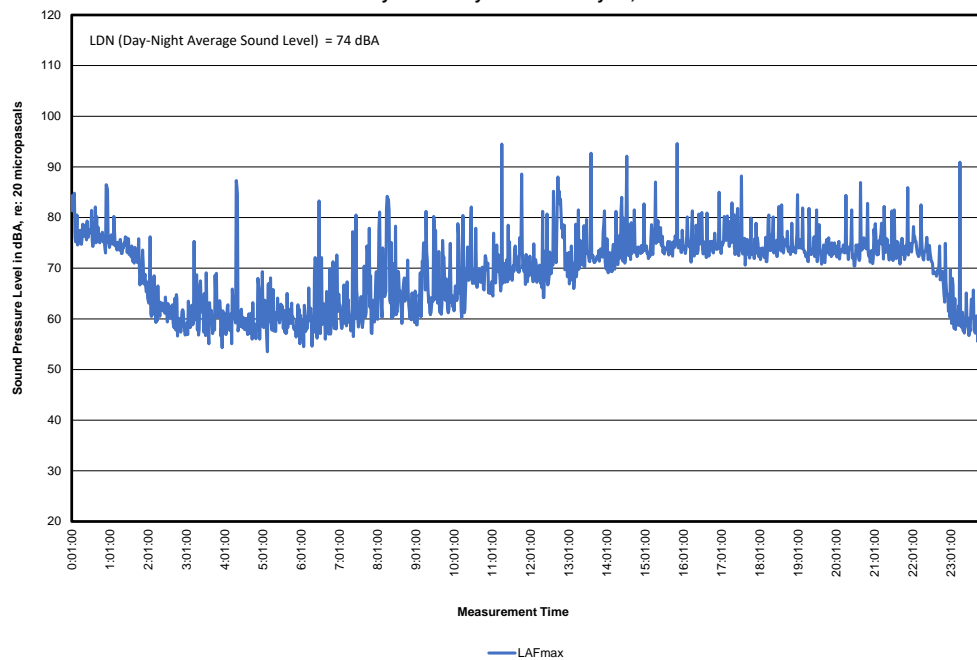
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Friday - February 17 to February 18, 2023



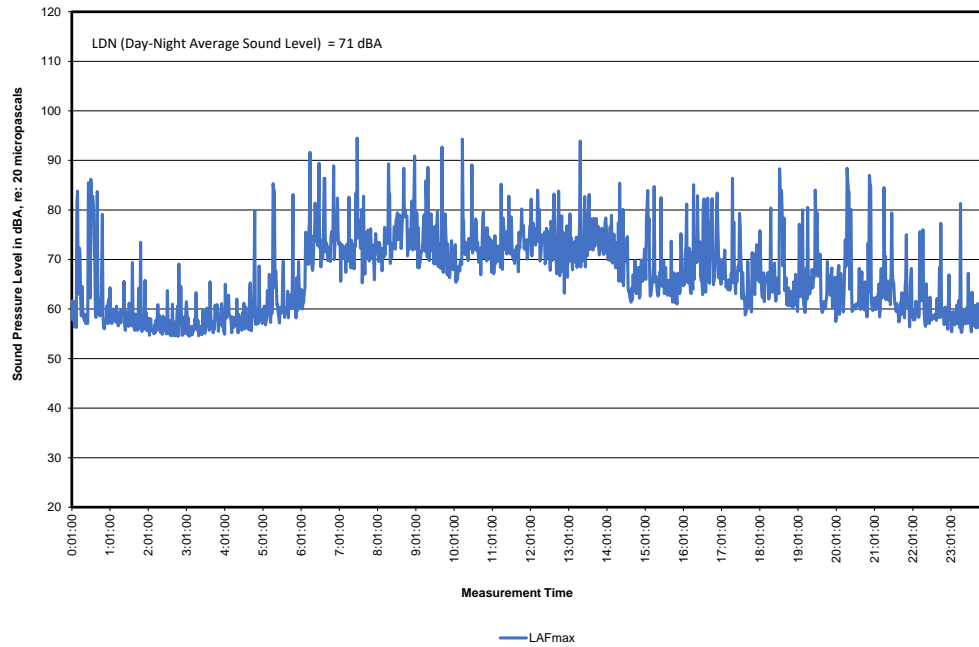
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Saturday- February 18 to February 19, 2023



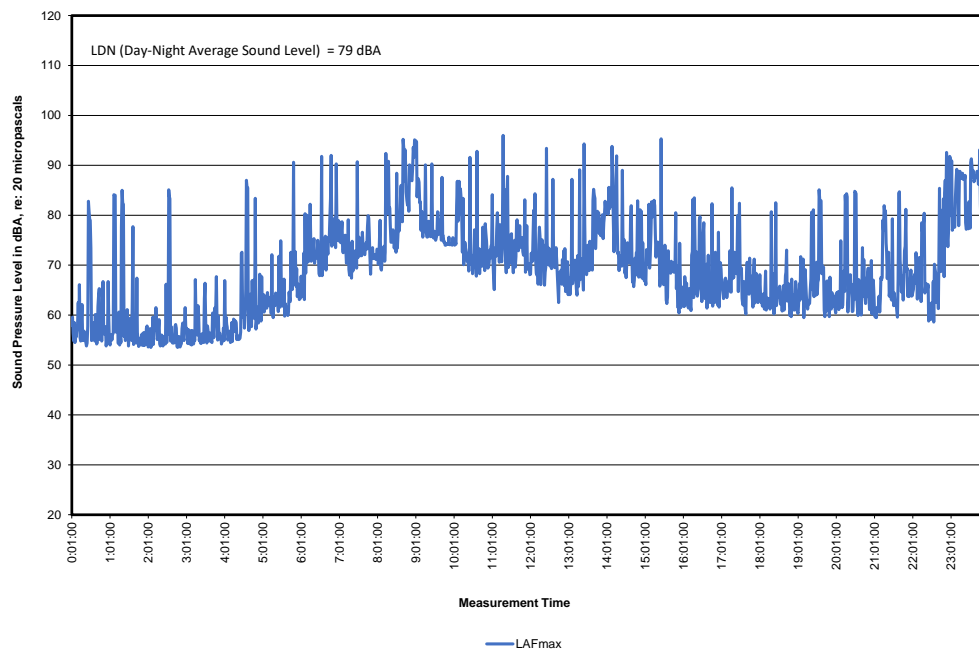
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Sunday - February 19 to February 20, 2023



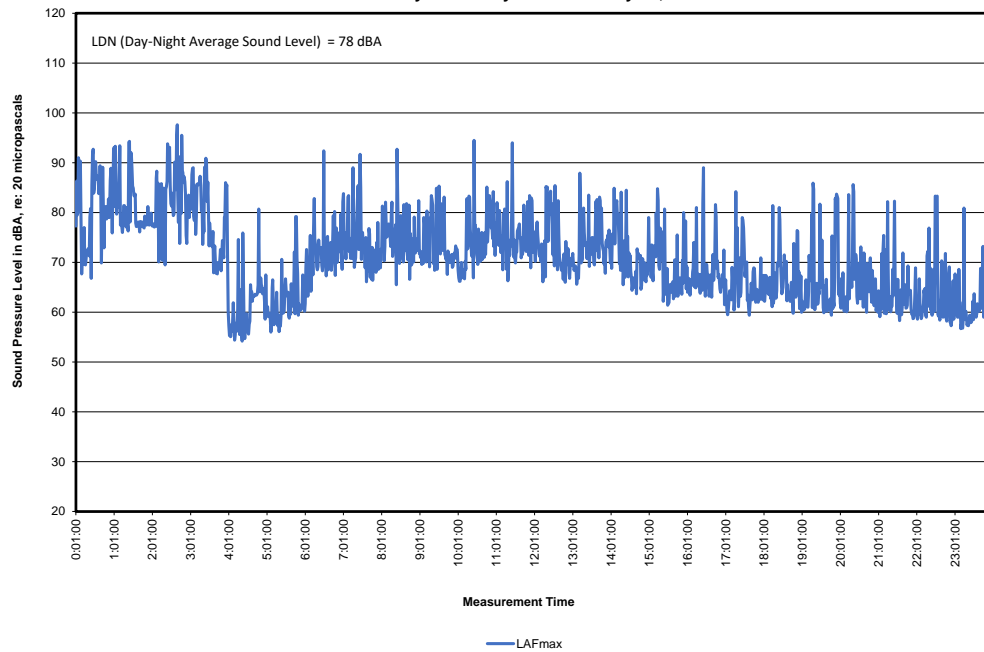
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Monday - February 20 to February 21, 2023



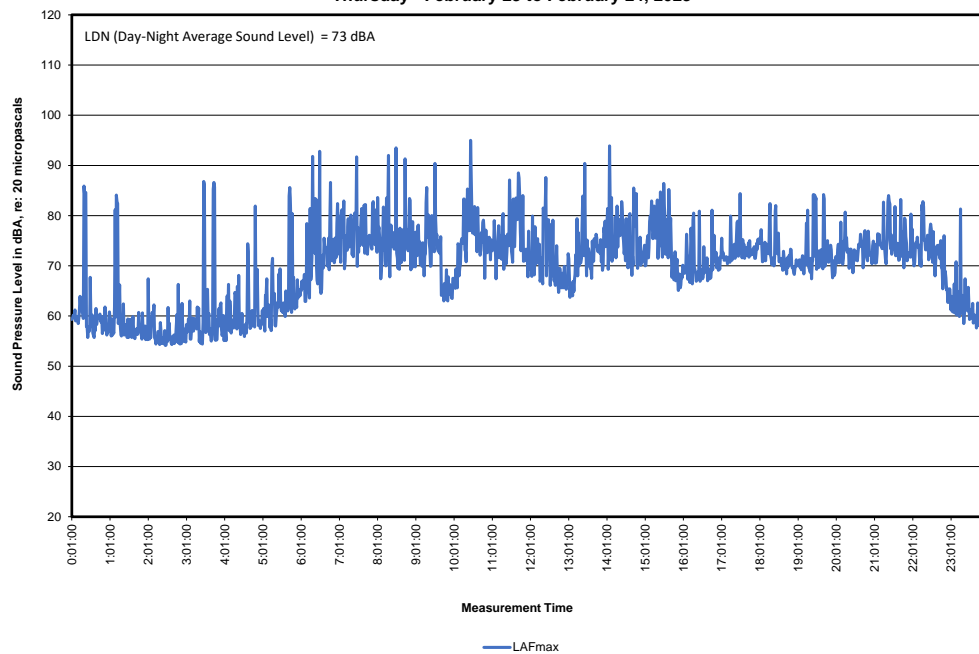
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Tuesday - February 21 to February 22, 2023



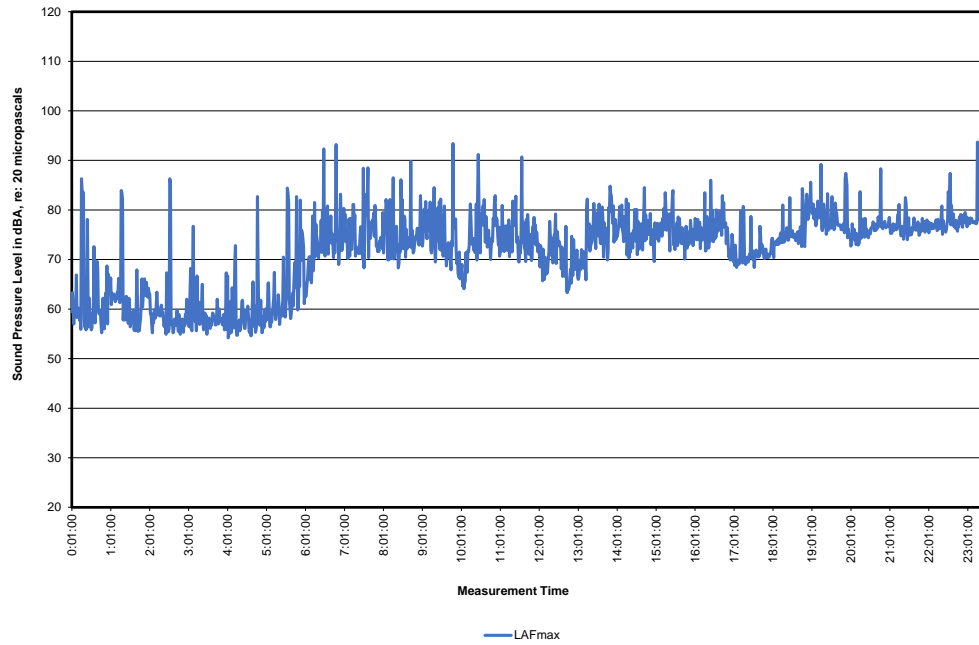
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Wednesday - February 22 to February 23, 2023



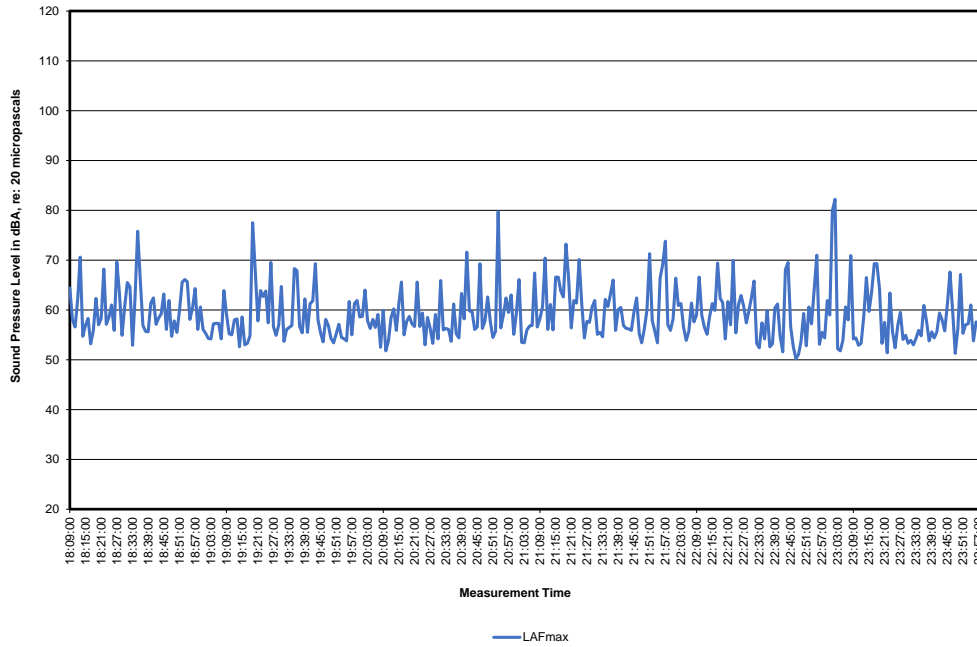
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Thursday - February 23 to February 24, 2023



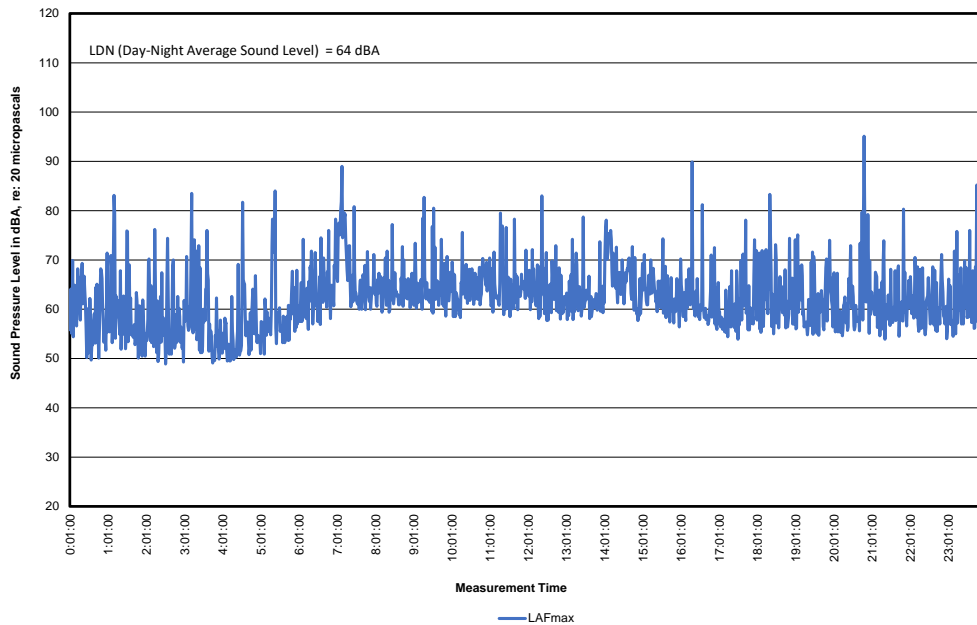
Fort Lauderdale Soundscape Study
The Wharf
Rion 7
Friday - February 24 to February 25, 2023



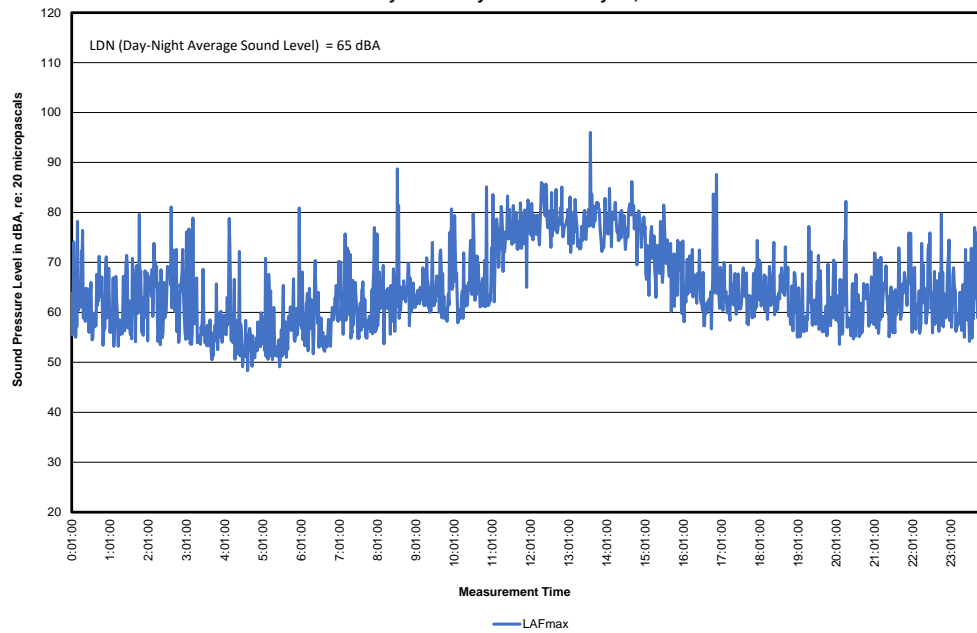
**Fort Lauderdale Soundscape Study
 Esplanade Park
 Rion 8
 Thursday - February 16 to February 17, 2023**



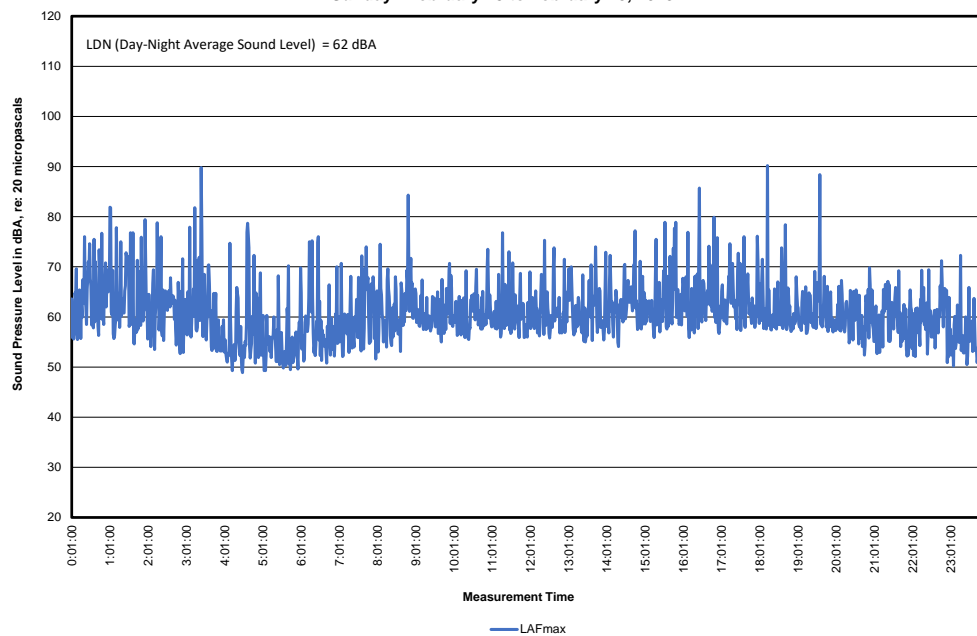
**Fort Lauderdale Soundscape Study
 Esplanade Park
 Rion 8
 Friday - February 17 to February 18, 2023**



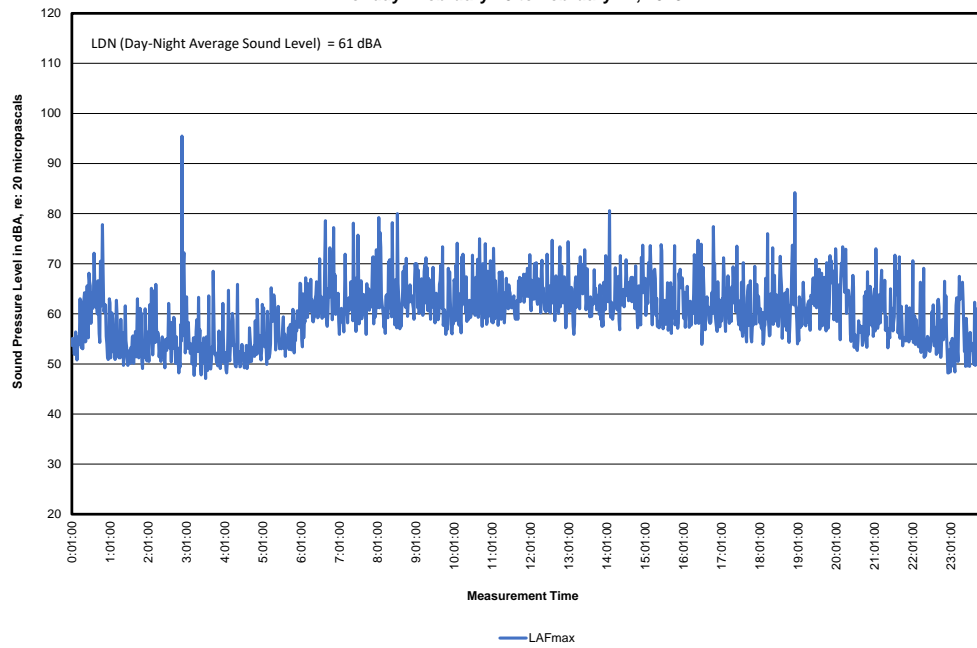
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Saturday - February 18 to February 19, 2023**



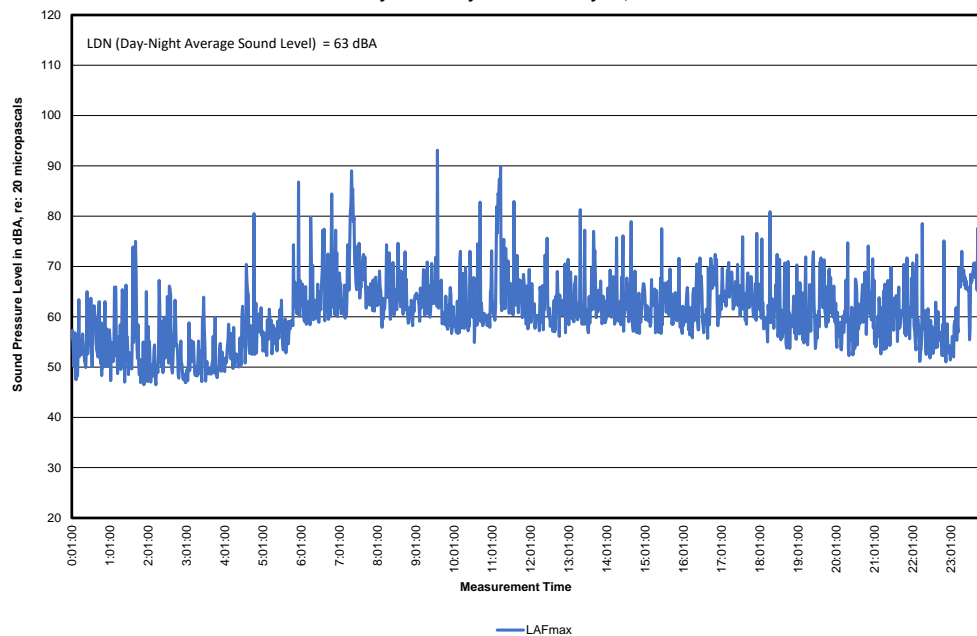
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Sunday - February 19 to February 20, 2023**



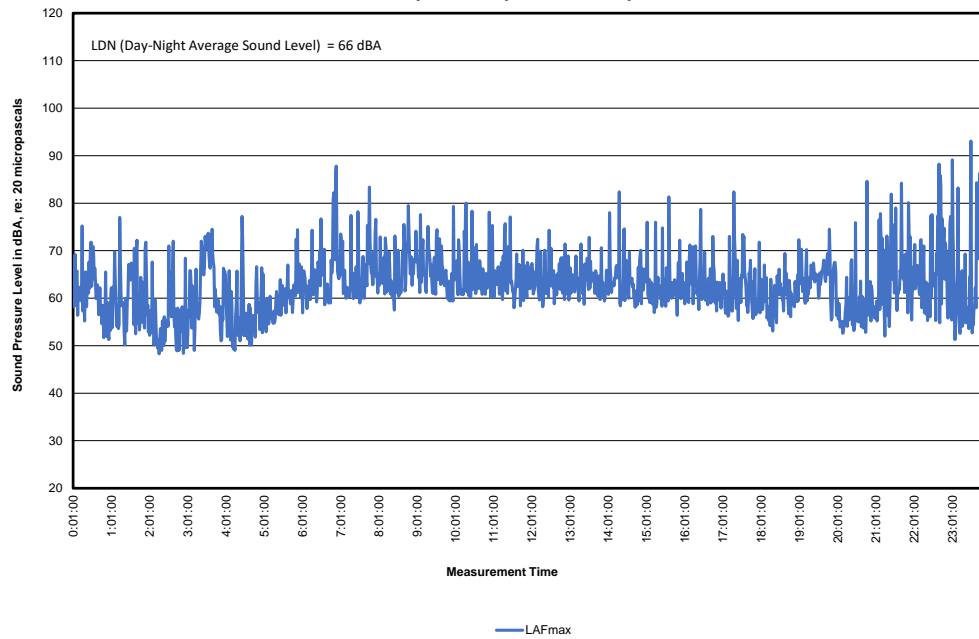
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Monday - February 20 to February 21, 2023**



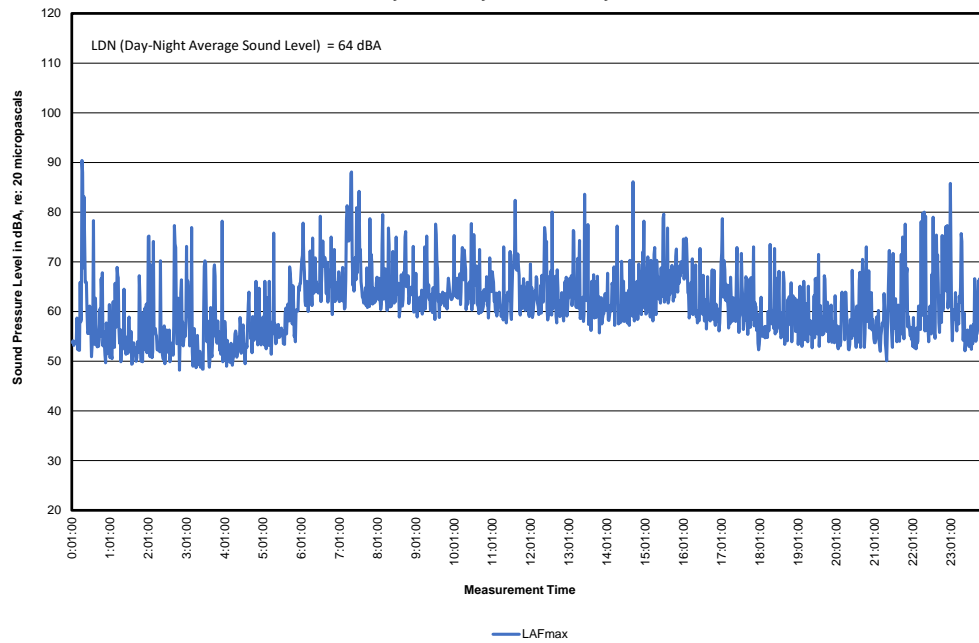
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Tuesday - February 21 to February 22, 2023**



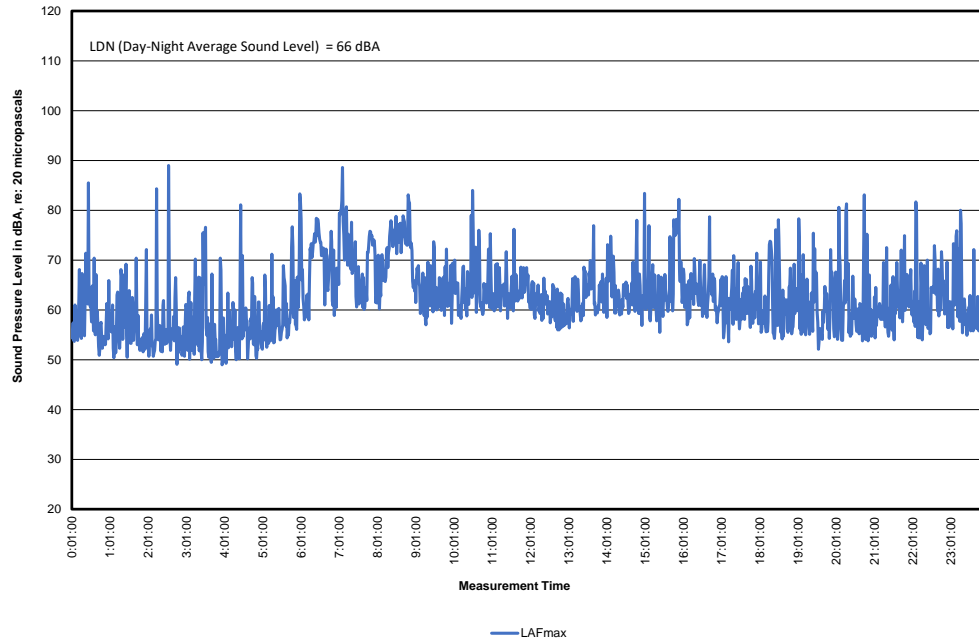
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Wednesday - February 22 to February 23, 2023**



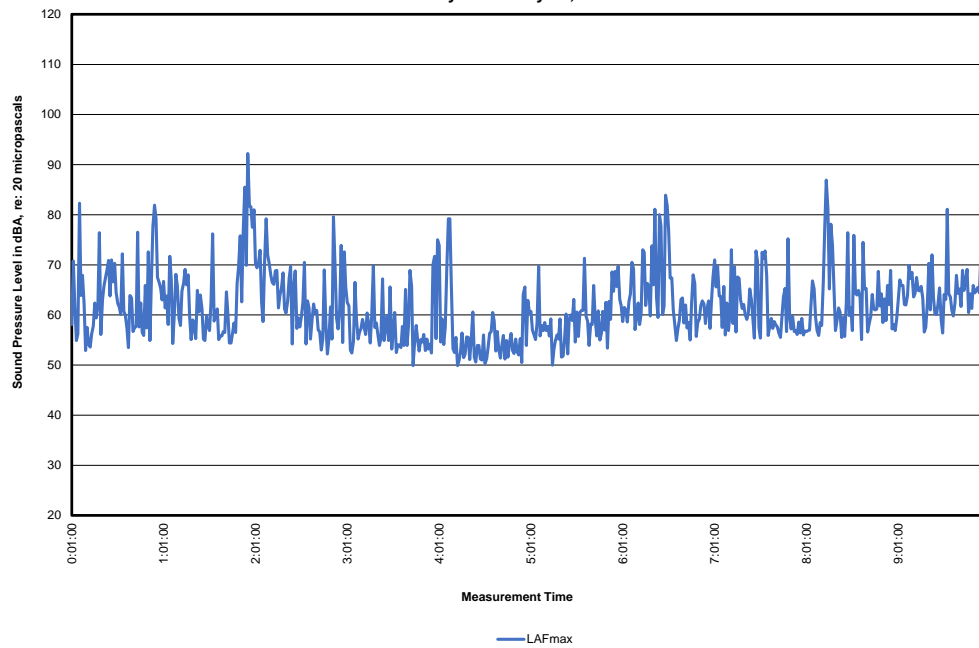
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Thursday - February 23 to February 24, 2023**



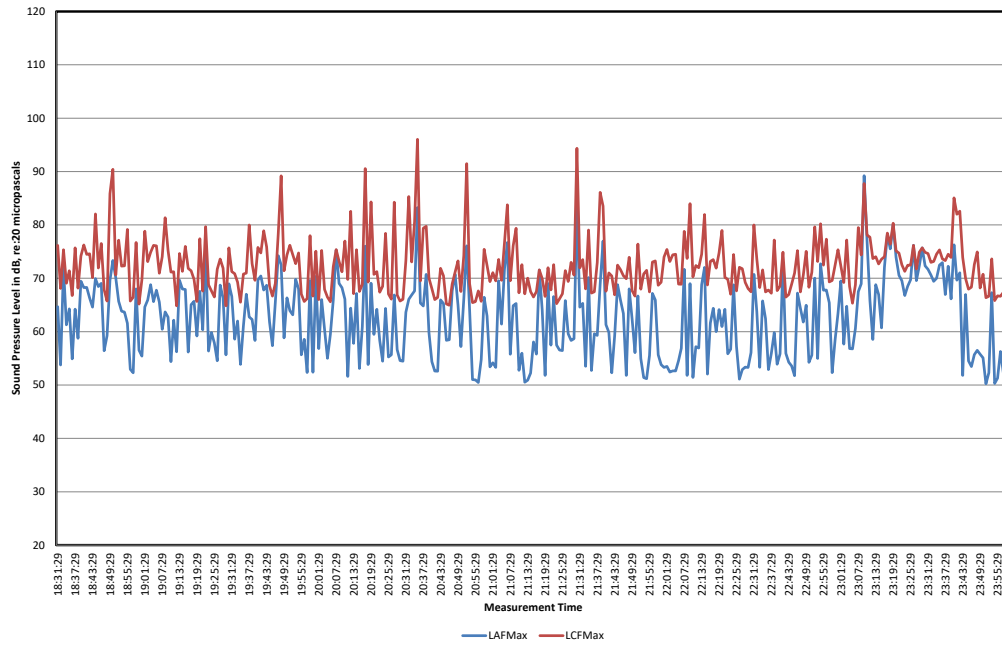
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Friday - February 24 to February 25, 2023**



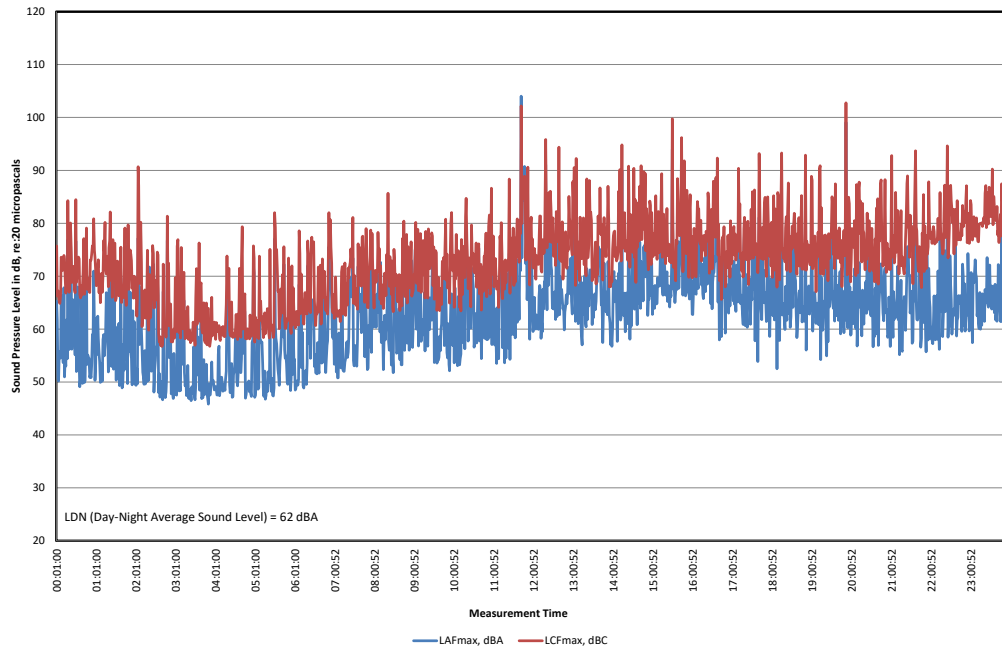
**Fort Lauderdale Soundscape Study
Esplanade Park
Rion 8
Saturday - February 25, 2023**



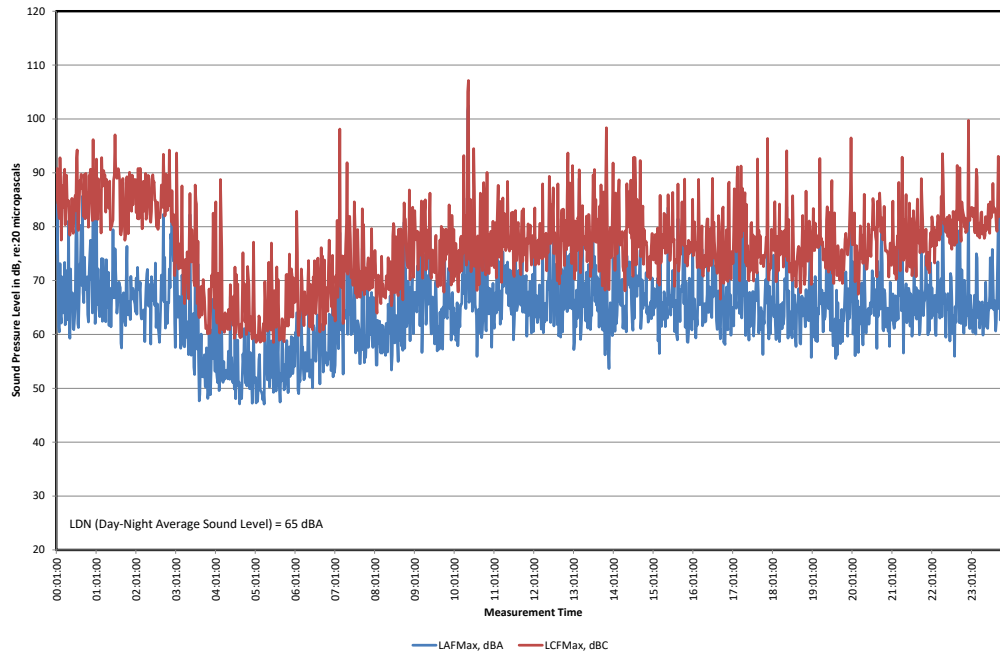
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Thursday - February 16 to February 17, 2023



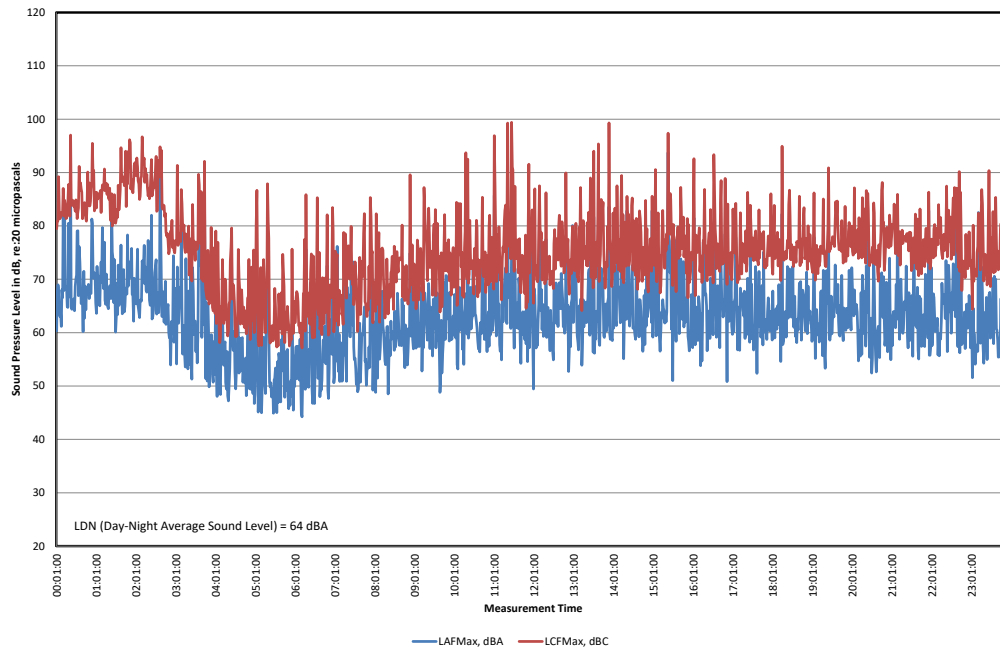
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Friday - February 17 to February 18, 2023



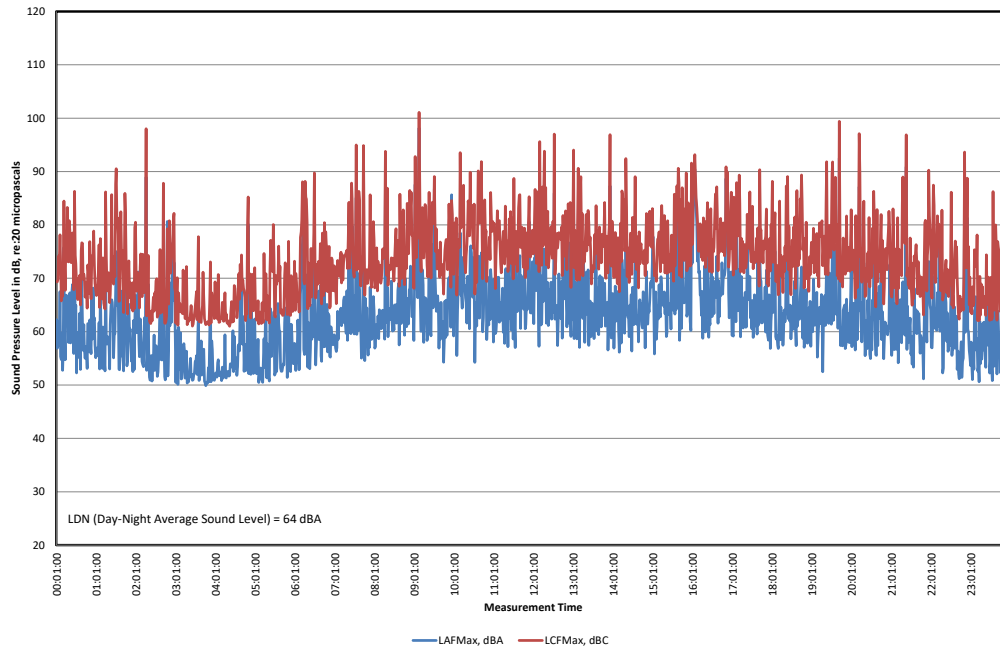
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Saturday - February 18 to February 19, 2023



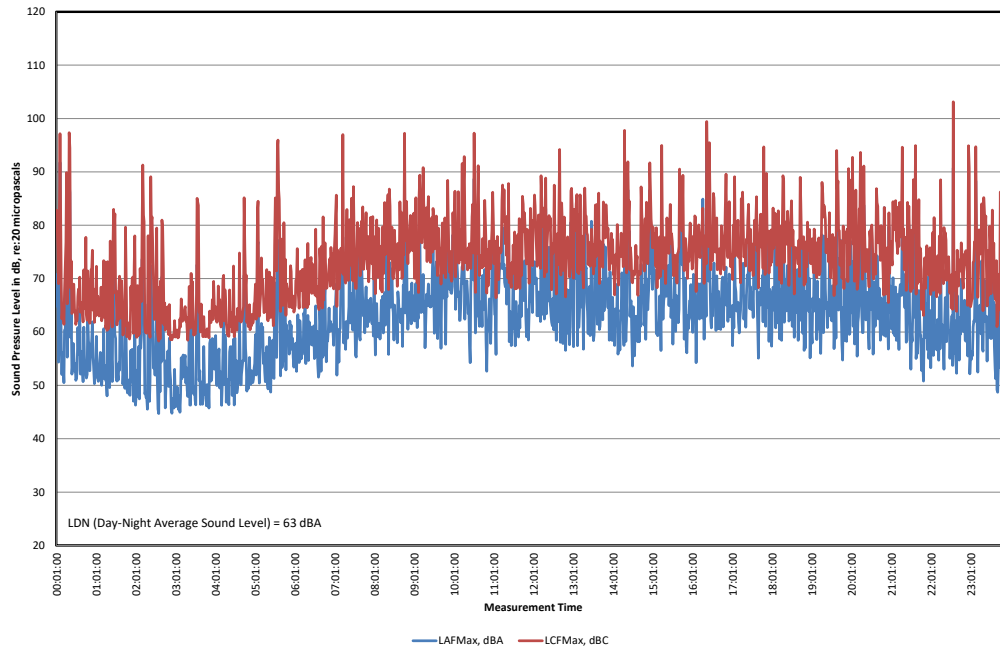
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Sunday - February 19 to February 20, 2023

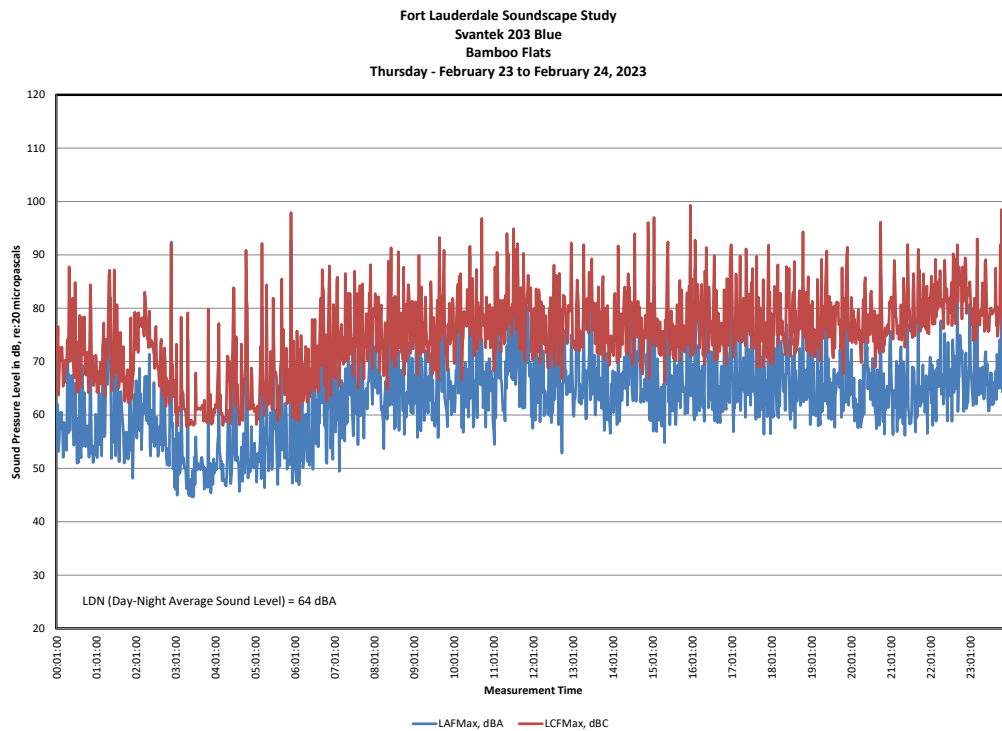
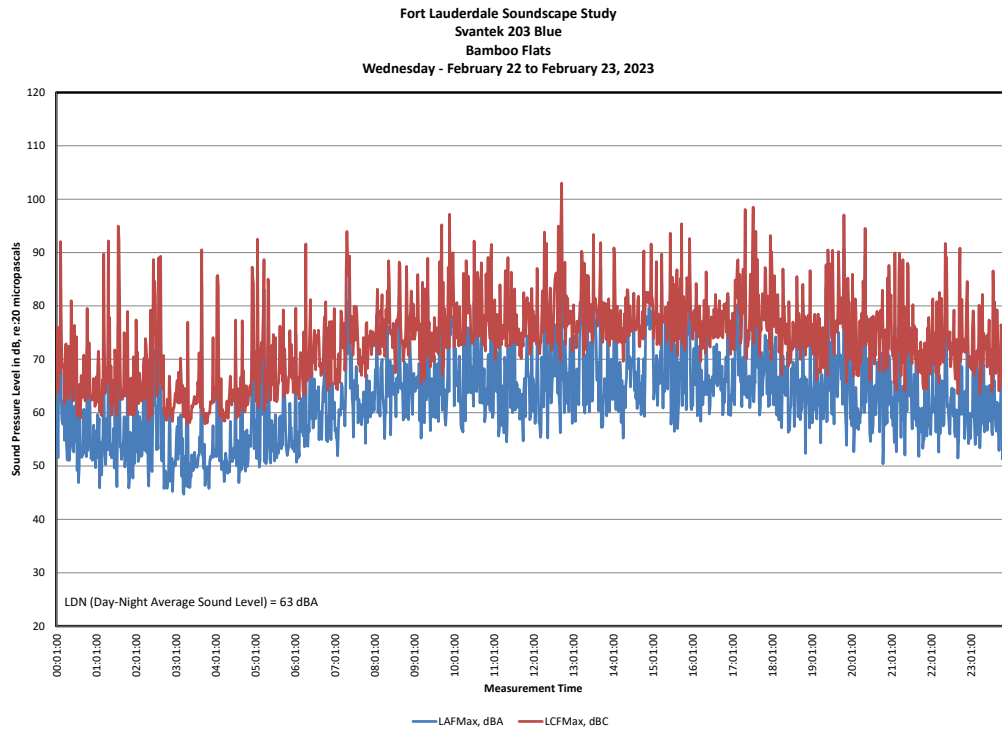


Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Monday - February 20 to February 21, 2023

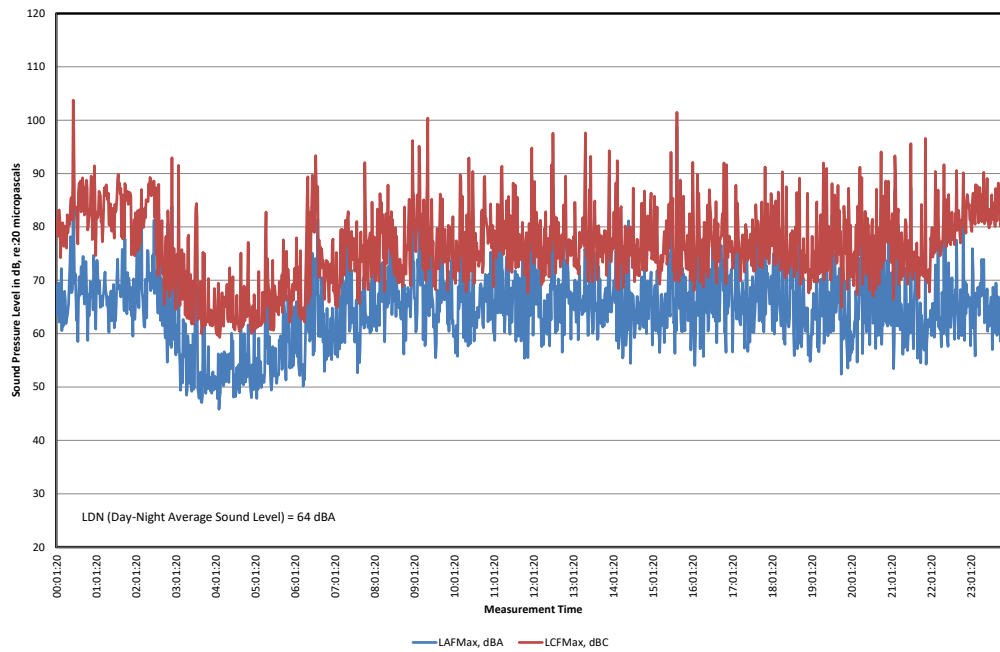


Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Tuesday - February 21 to February 22, 2023

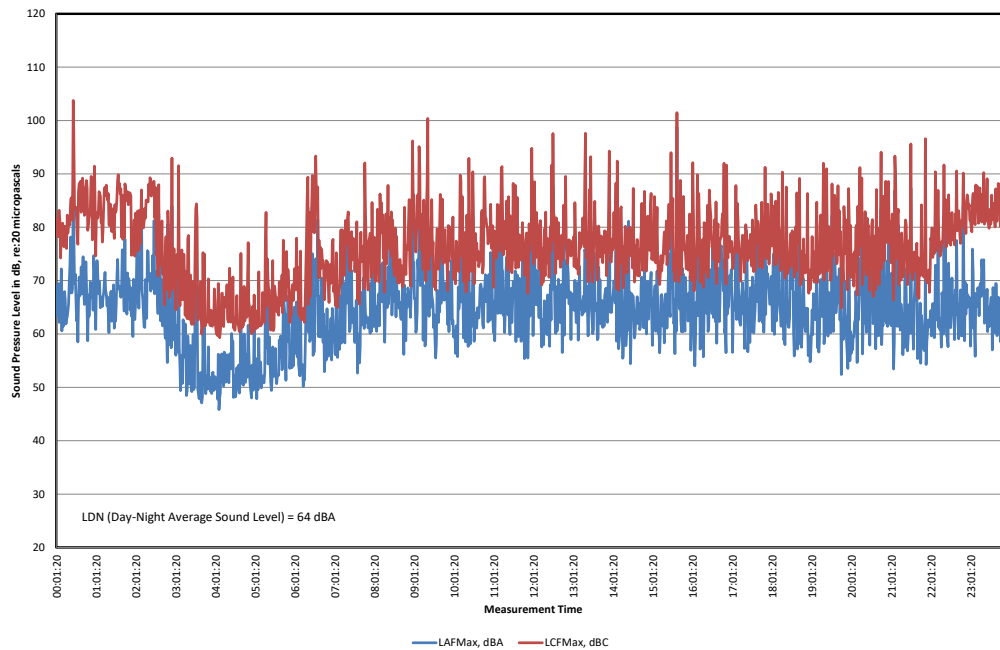




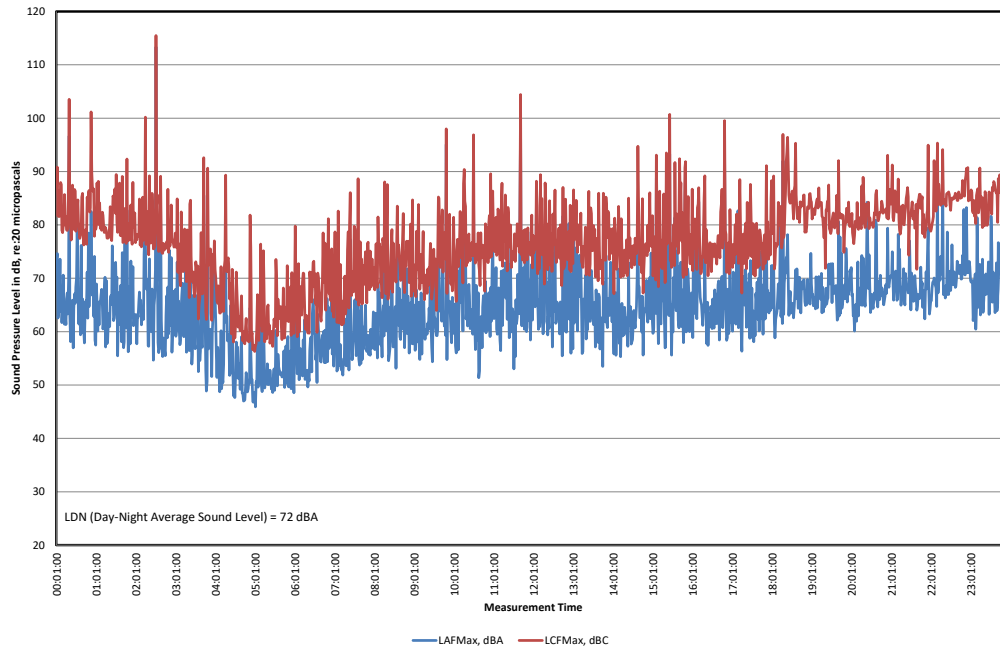
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Friday - February 24 to February 25, 2023



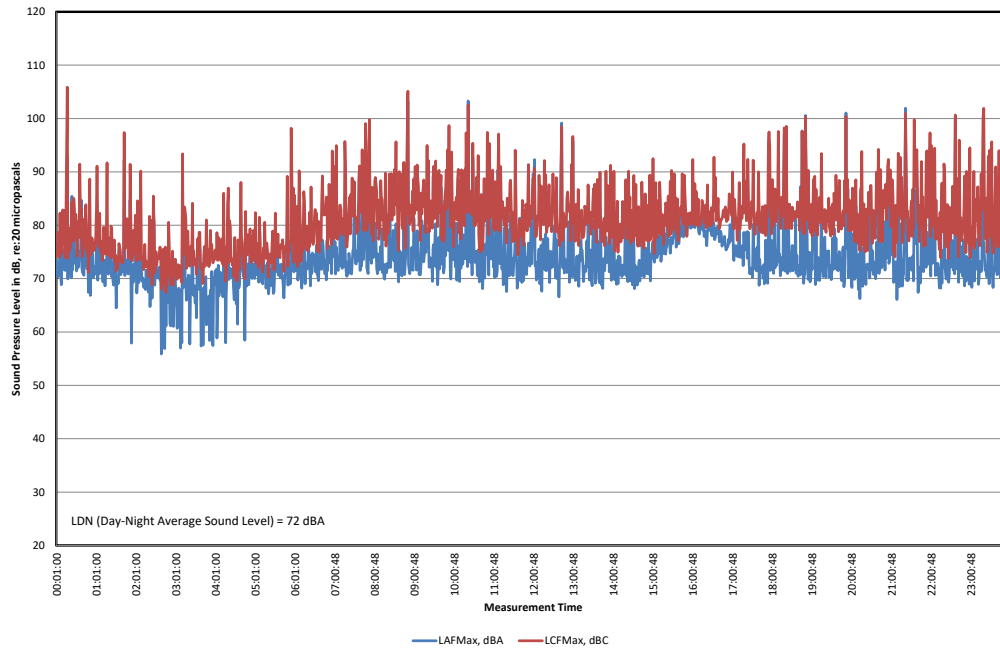
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Friday - February 24 to February 25, 2023



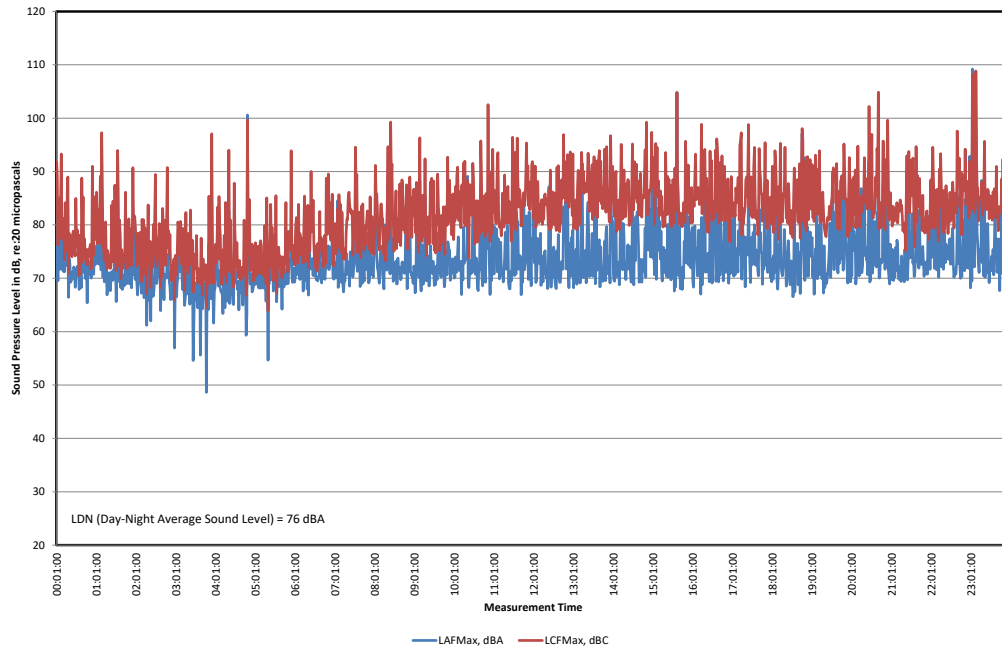
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Bamboo Flats
Saturday - February 25 to February 26, 2023



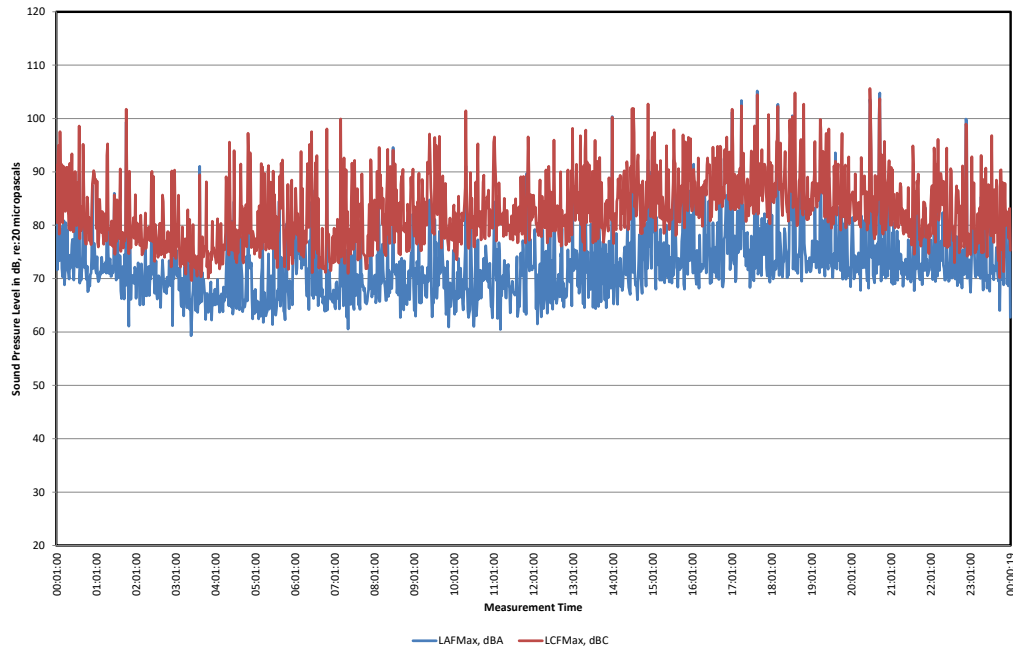
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo's on the beach
Friday - February 17 to February 18, 2023



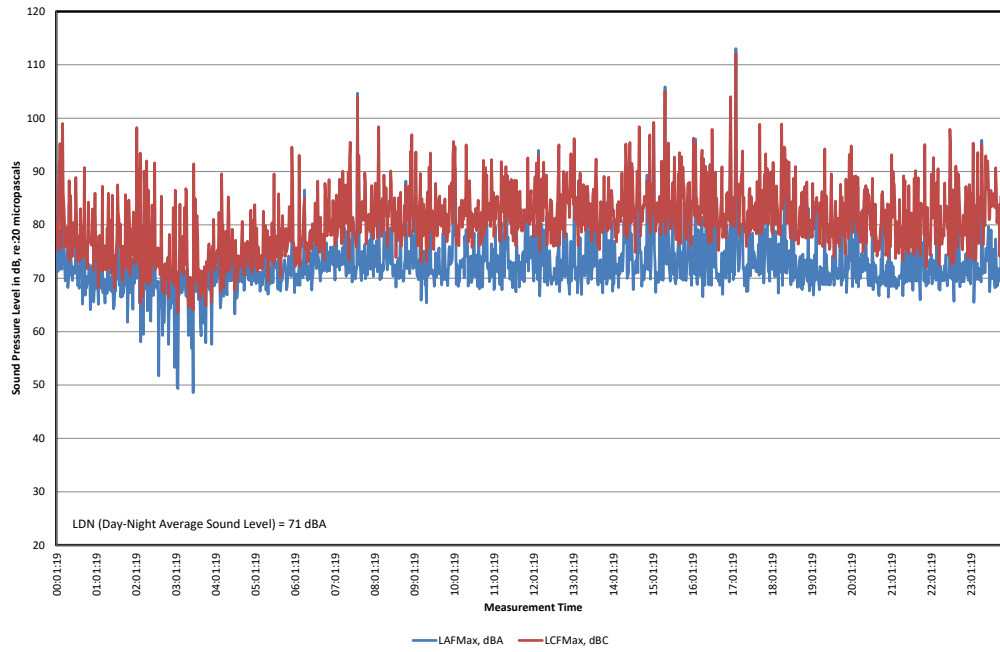
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo restaurant on the beach
Saturday - February 18 to February 19, 2023



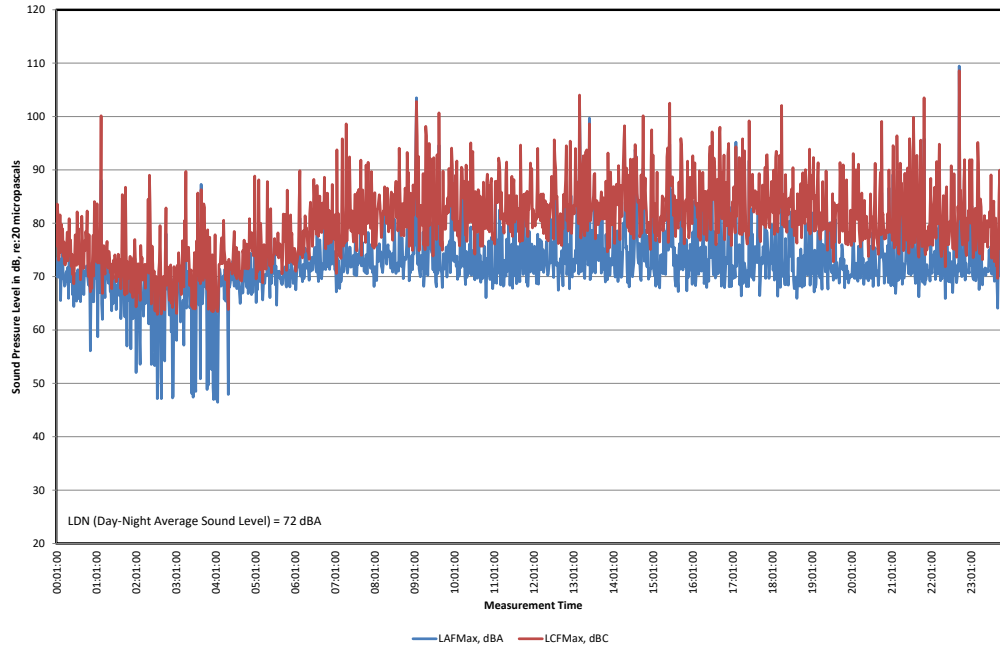
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo restaurant on the beach
Sunday - February 19 to February 20, 2023



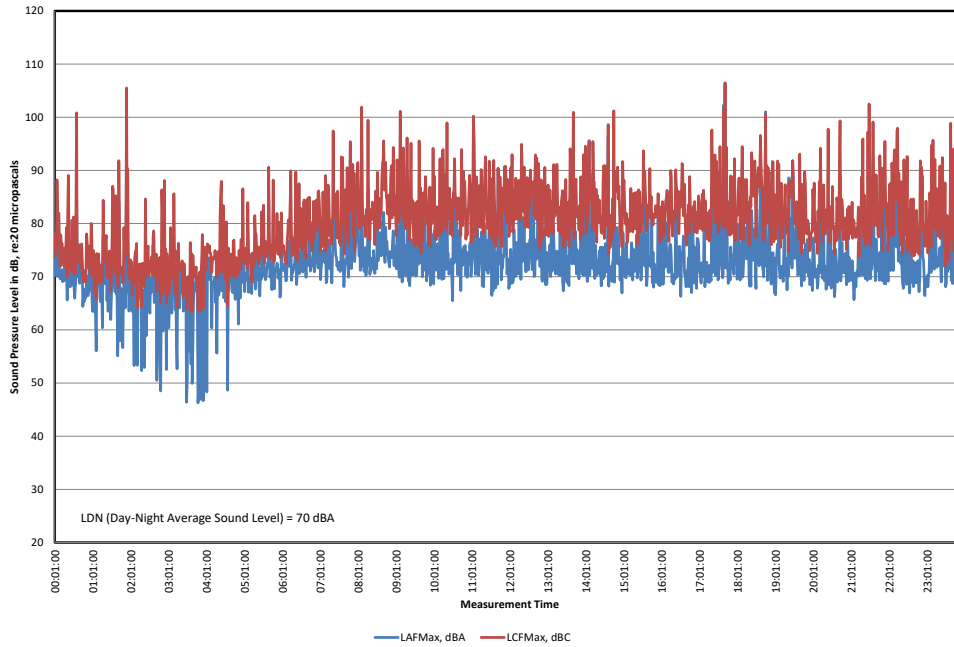
Fort Lauderdale Soundscape Study
SvanteK 204 Red
In median by Bo restaurant on the beach
Monday - February 20 to February 21, 2023



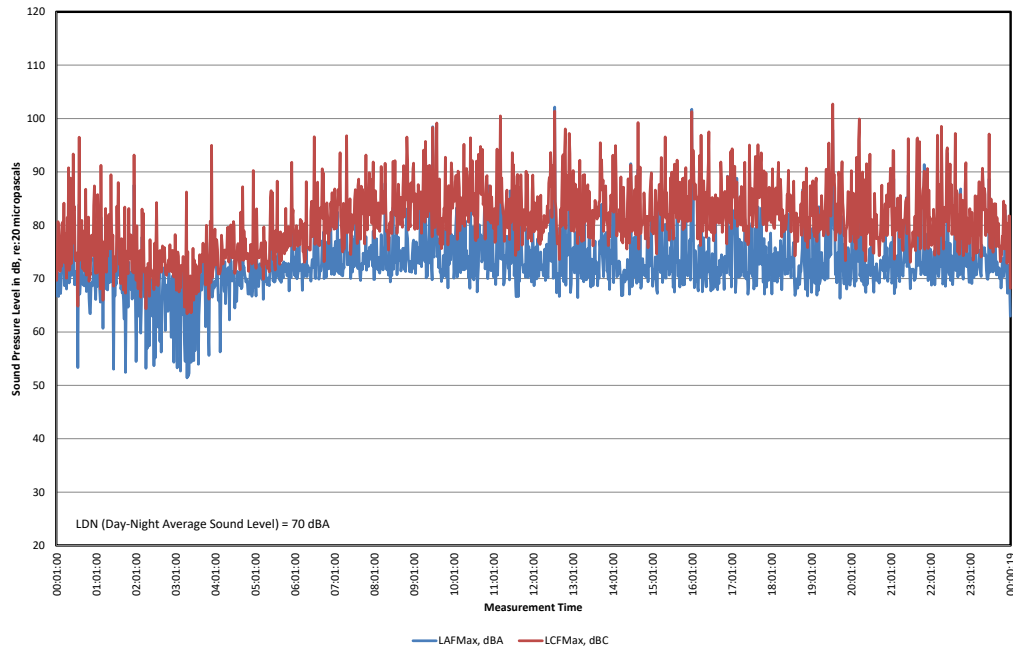
Fort Lauderdale Soundscape Study
SvanteK 204 Red
In median by Bo restaurant on the beach
Tuesday - February 21 to February 22, 2023



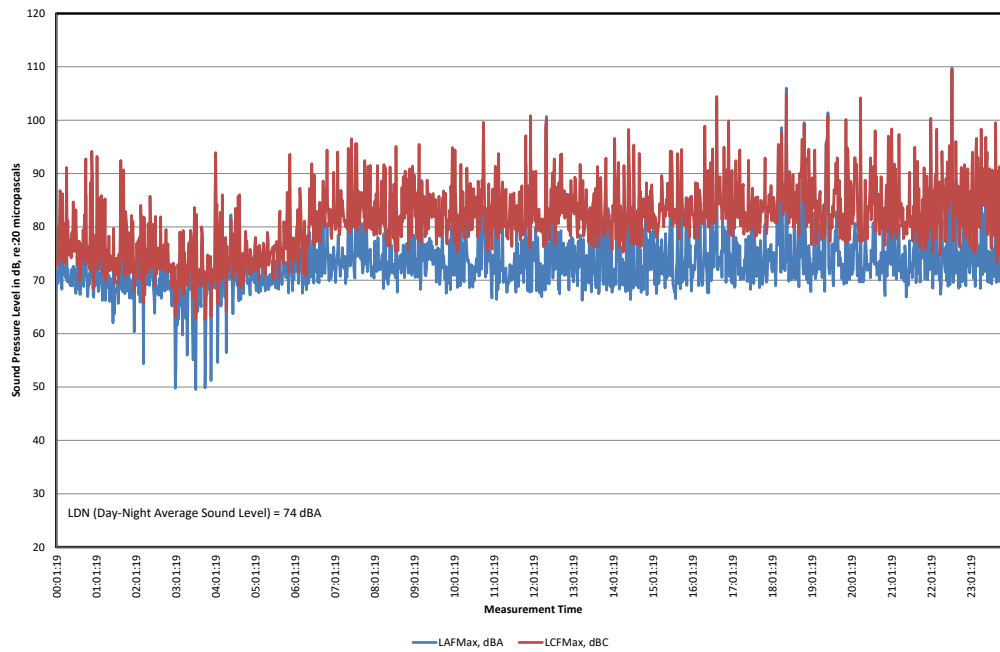
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo restaurant on the beach
Wednesday - February 22 to February 23, 2023



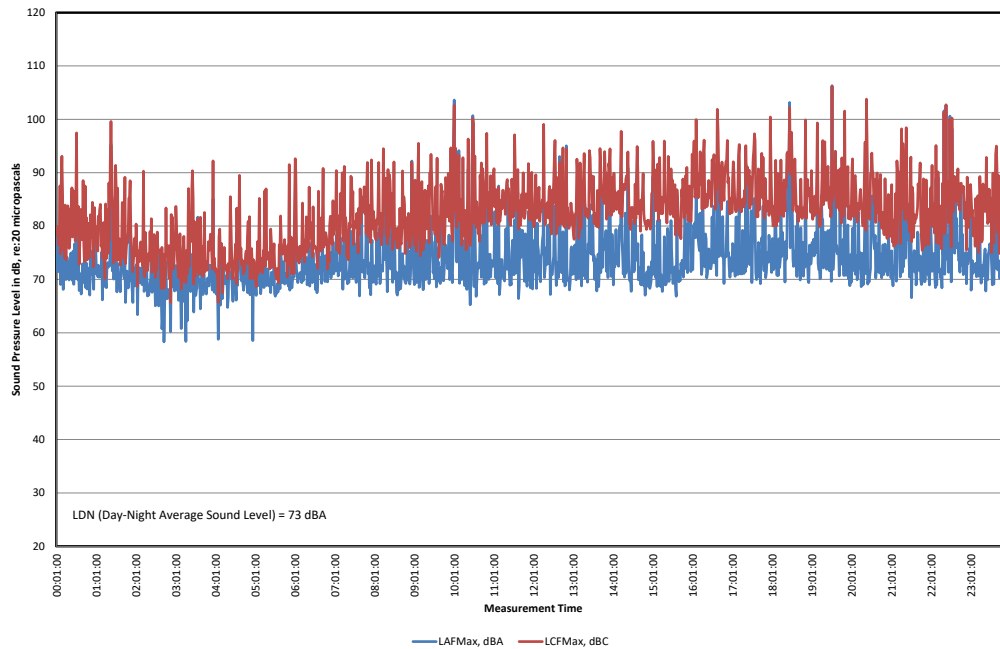
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo restaurant on the beach
Thursday - February 23 to February 24, 2023



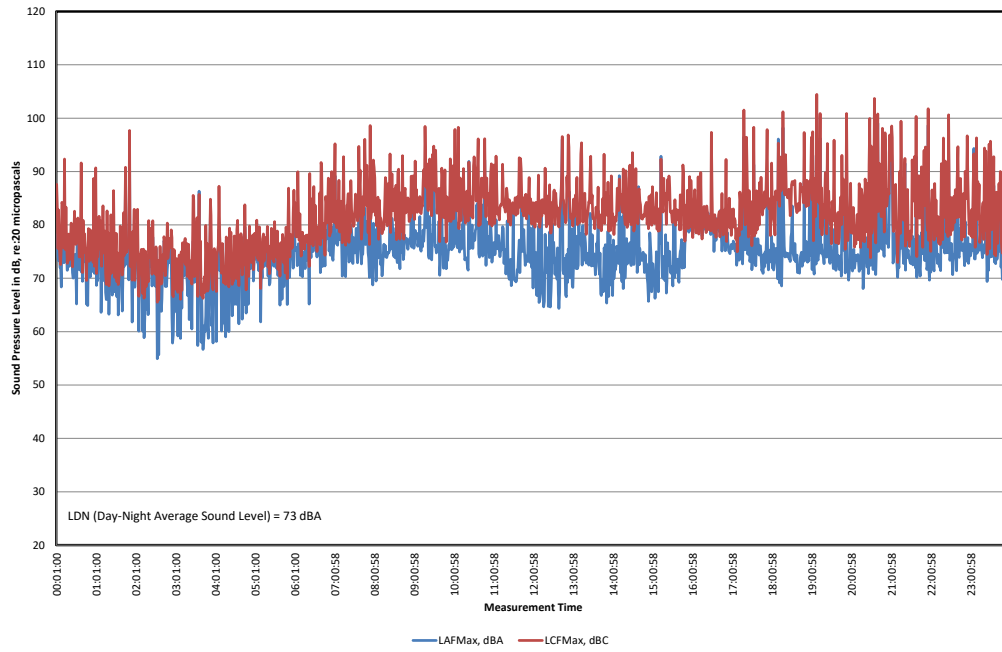
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo restaurant on the beach
Friday - February 24 to February 25, 2023



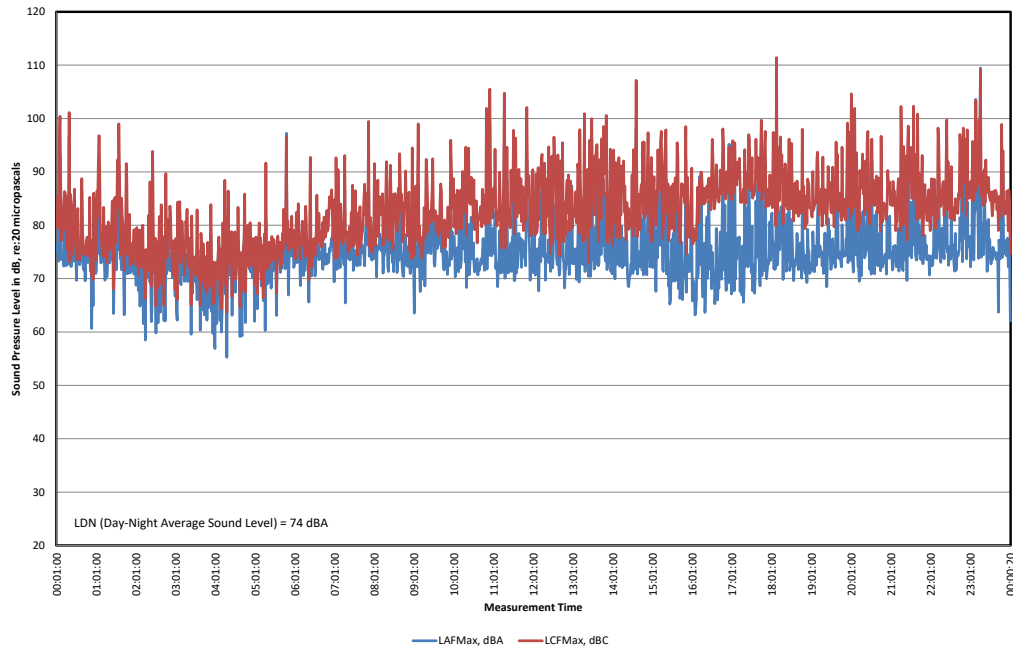
Fort Lauderdale Soundscape Study
Svantek 204 Red
In median by Bo restaurant on the beach
Saturday - February 25 to February 26, 2023



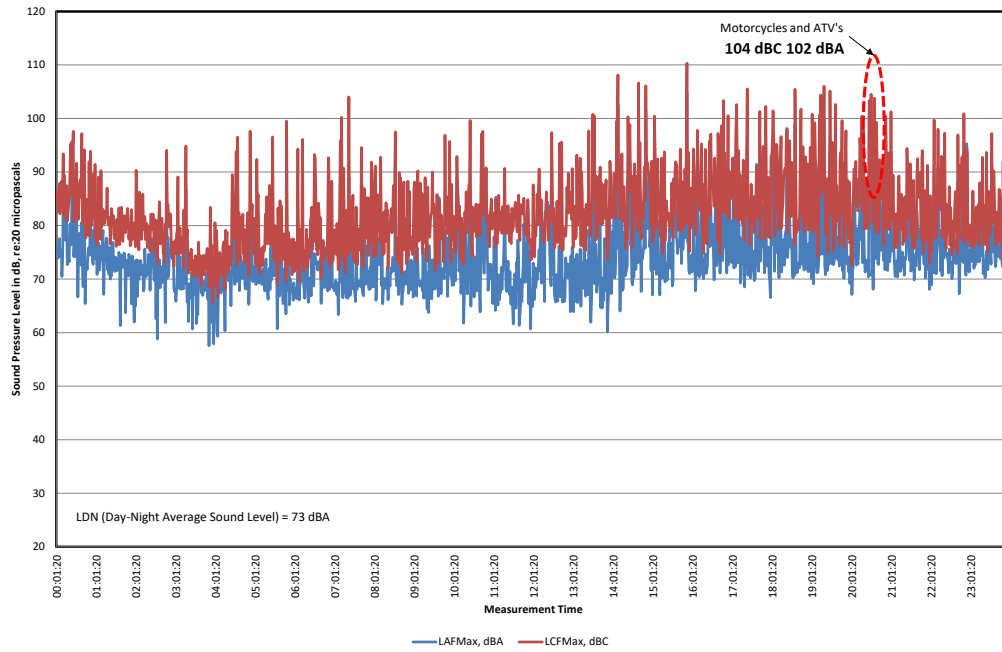
Fort Lauderdale Soundscape Study
Svantek 205 Green
In median of A1A at north
Friday - February 17 to February 18, 2023



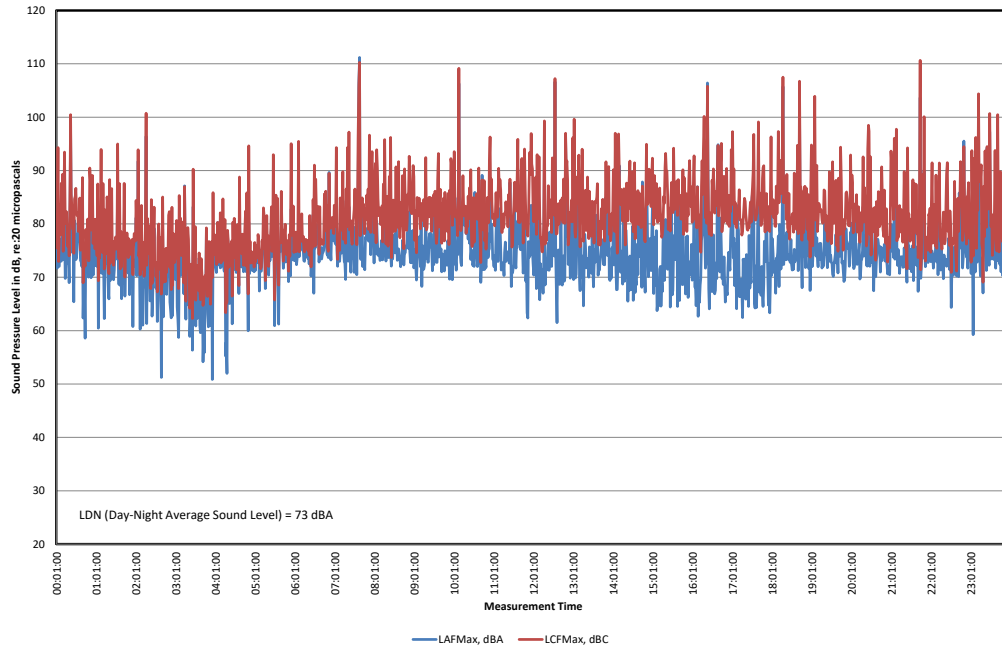
Fort Lauderdale Soundscape Study
Svantek 205 Green
In median of A1A at north
Saturday - February 18 to February 19, 2023



Fort Lauderdale Soundscape Study
Svantek 205 Green
In median of A1A at north
Saturday - February 19 to February 20, 2023

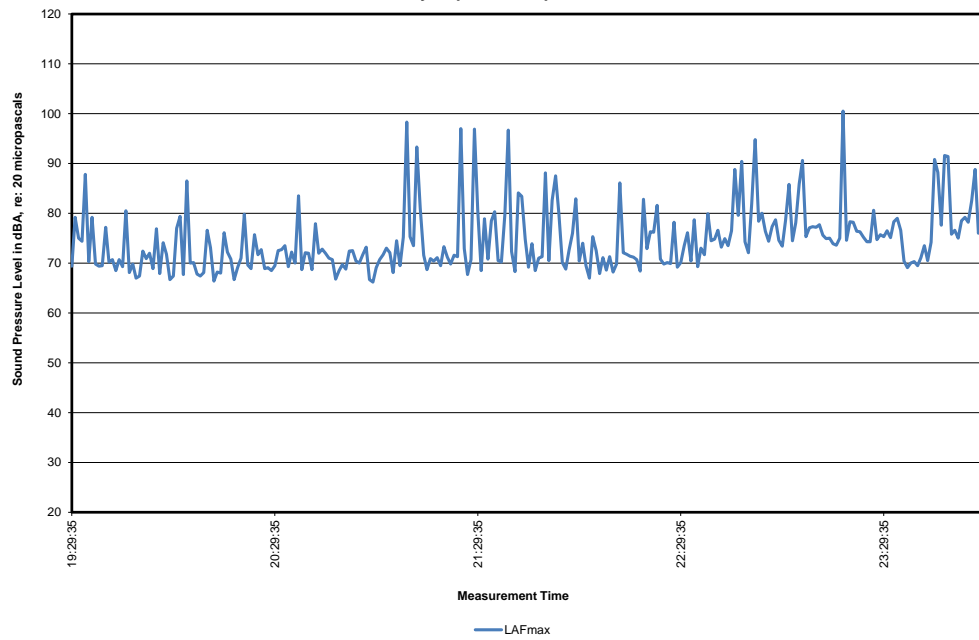


Fort Lauderdale Soundscape Study
Svantek 205 Green
In median of A1A at north
Sunday - February 20 to February 21, 2023

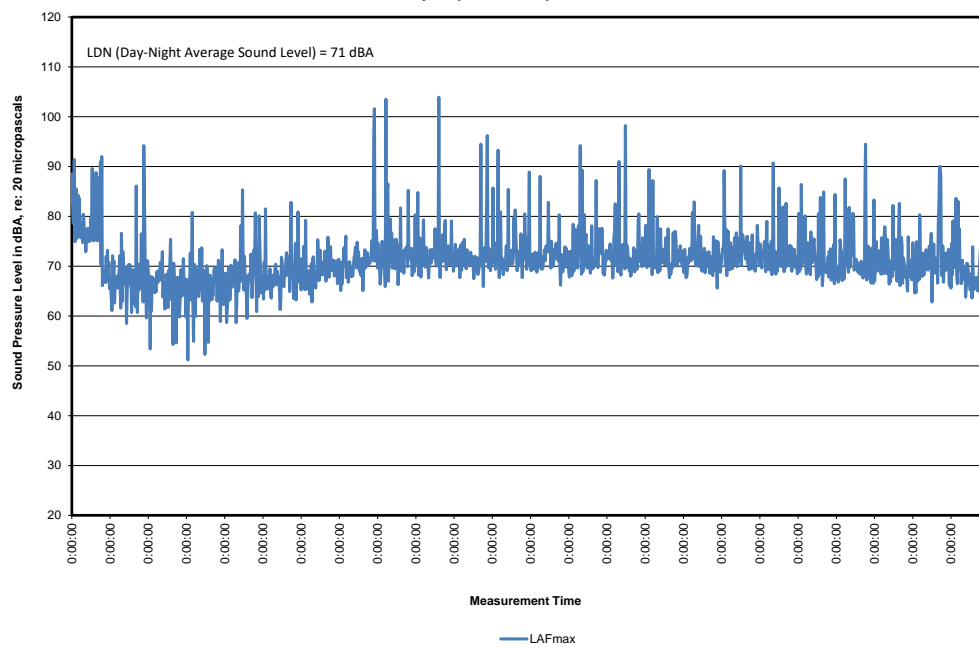


**APPENDIX A-2:
SUMMARY GRAPHS OF LONG-TERM ACOUSTICAL DATA
TRIP 2**

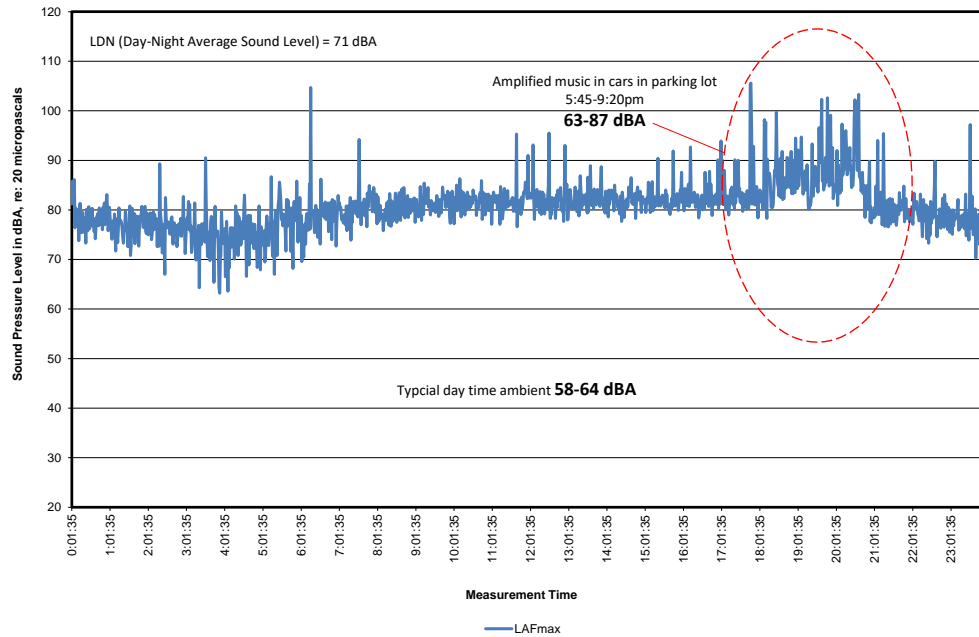
**Fort Lauderdale Soundscape Study
Smitty's Wings
Rion 7
Friday - April 21 to April 22, 2023**



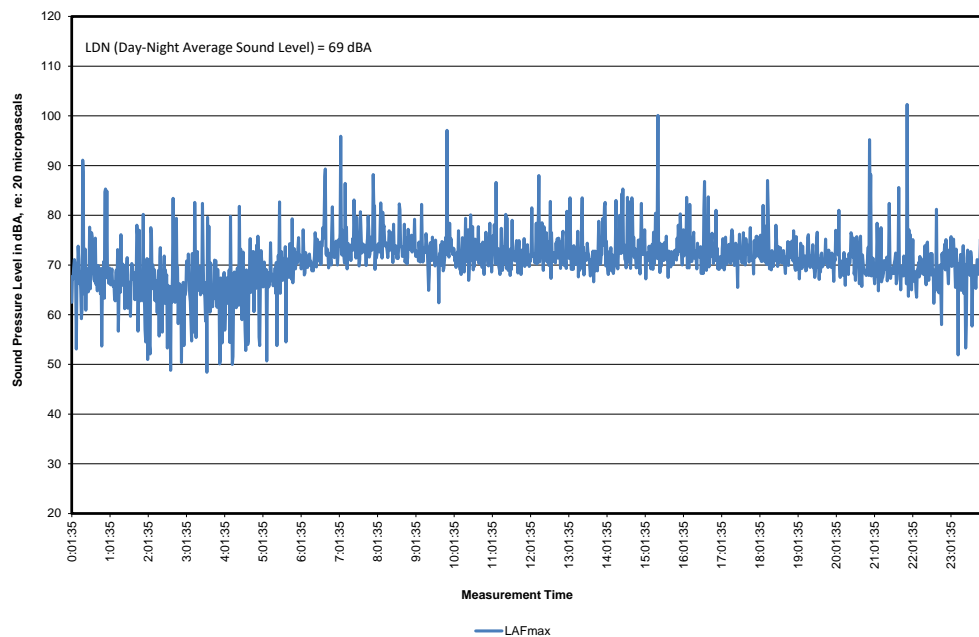
**Fort Lauderdale Soundscape Study
Smitty's Wings
Rion 7
Saturday - April 22 to April 23, 2023**



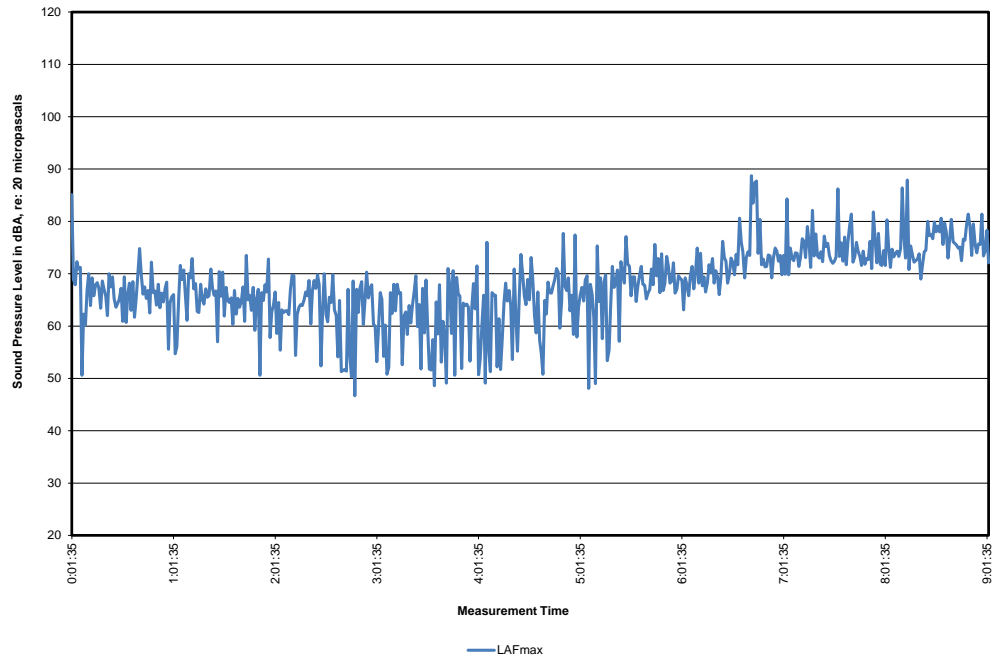
**Fort Lauderdale Soundscape Study
 Smitty's Wings
 Rion 7
 Sunday - April 23 to April 24, 2023**



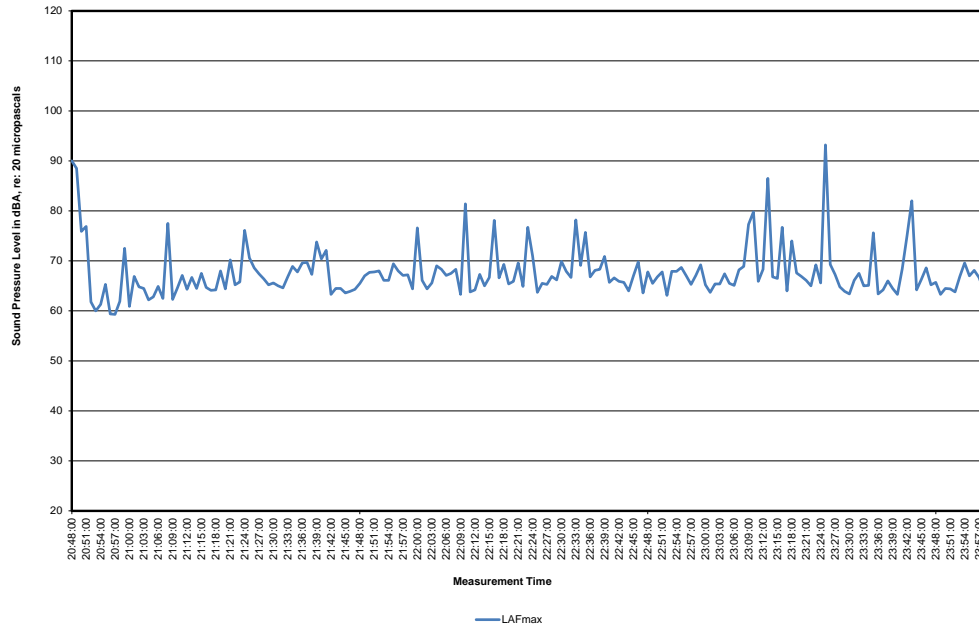
**Fort Lauderdale Soundscape Study
 Smitty's Wings
 Rion 4
 Monday - April 24 to April 25, 2023**



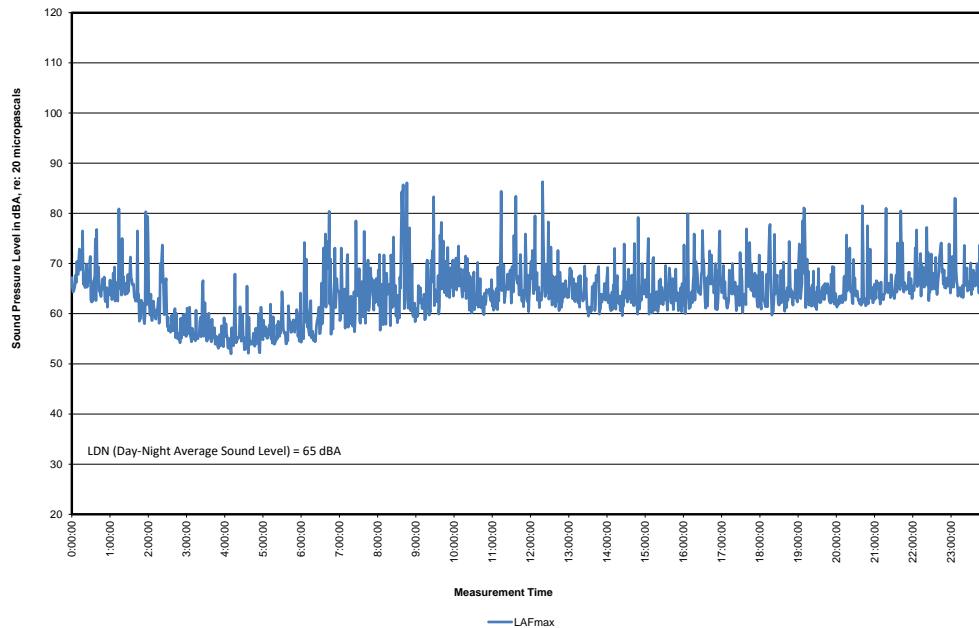
**Fort Lauderdale Soundscape Study
Smitty's Wings
Rion 4
Tuesday - April 25, 2023**



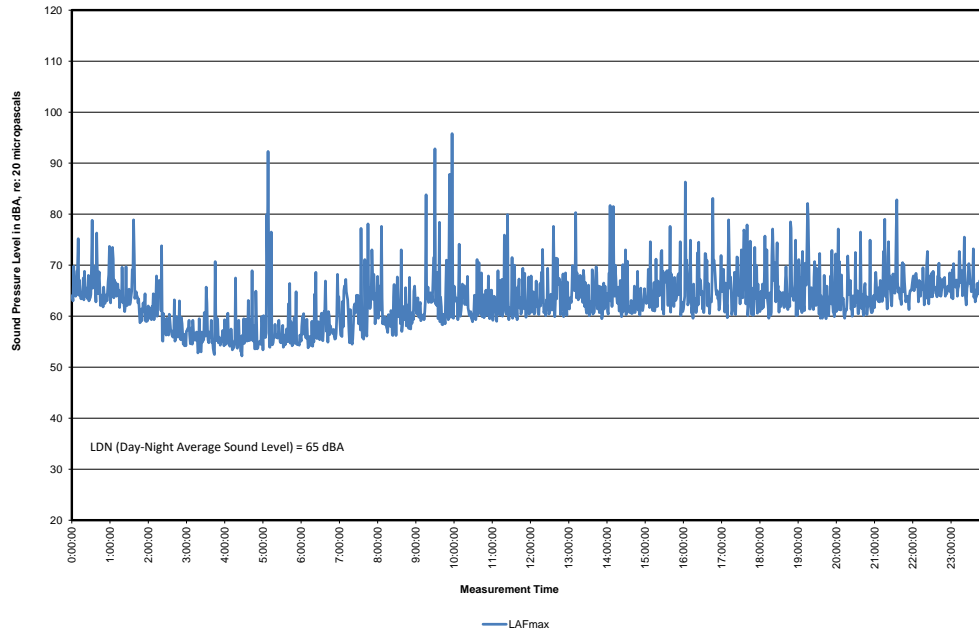
City of Fort Lauderdale Soundscape Study
 Rion 7
 Colee Hammock
 Friday - April 21 to April 22, 2023



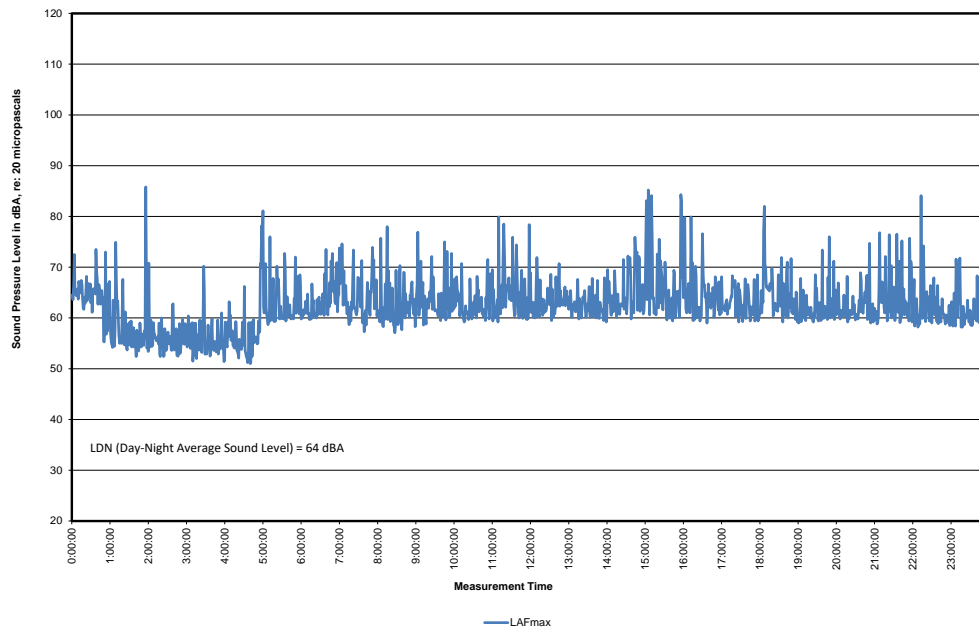
City of Fort Lauderdale Soundscape Study
 Rion 7
 Colee Hammock
 Saturday - April 22 to April 23, 2023



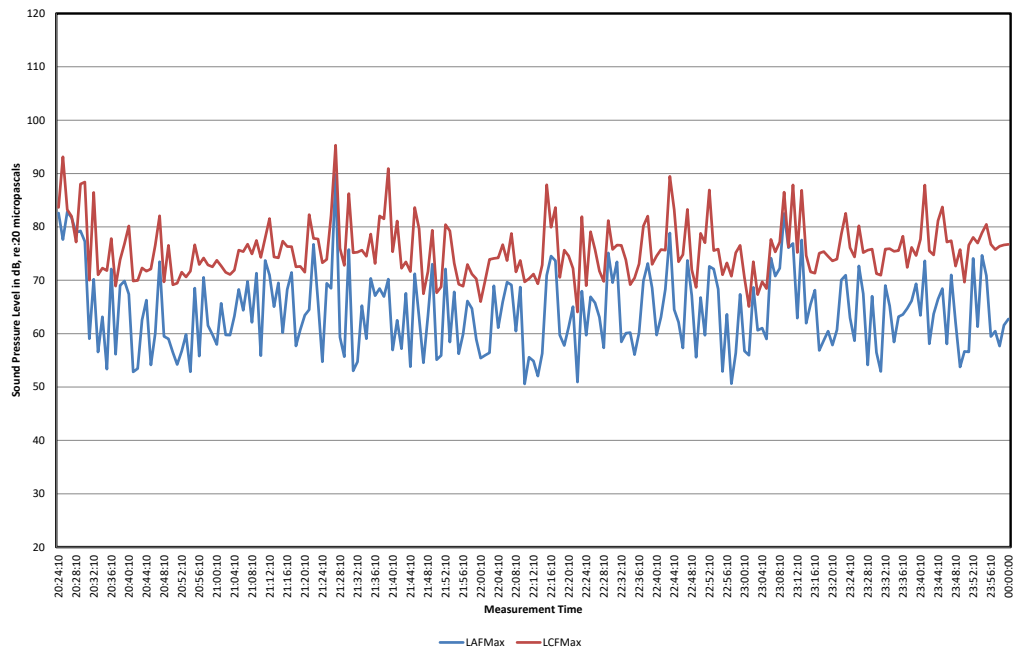
City of Fort Lauderdale Soundscape Study
Rion 7
Colee Hammock
Sunday - April 23 to April 24, 2023



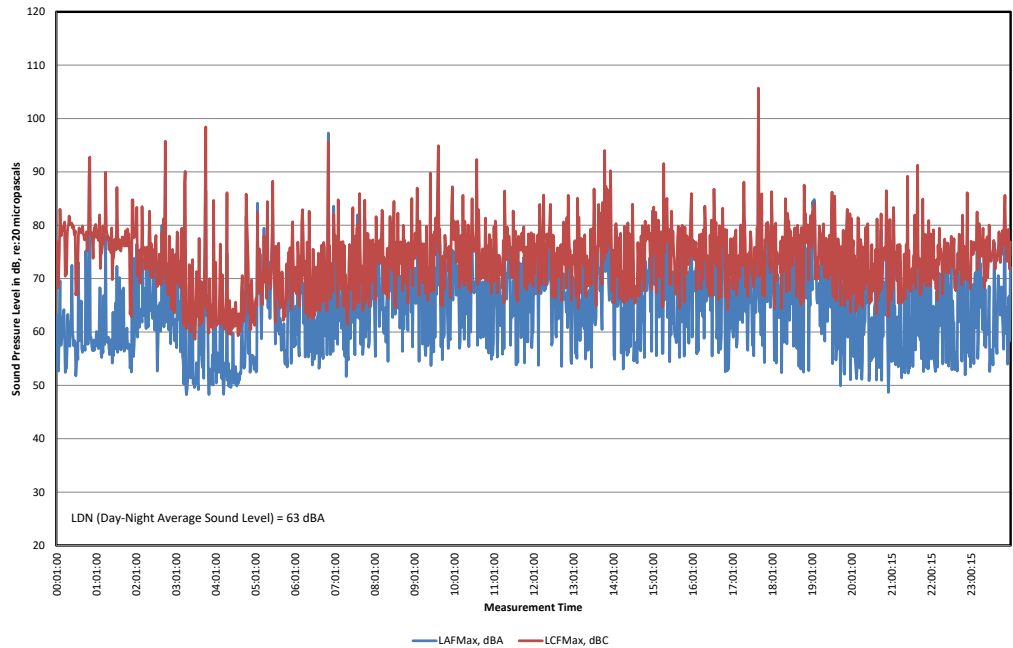
City of Fort Lauderdale Soundscape Study
Rion 7
Colee Hammock
Monday - April 24 to April 25, 2023



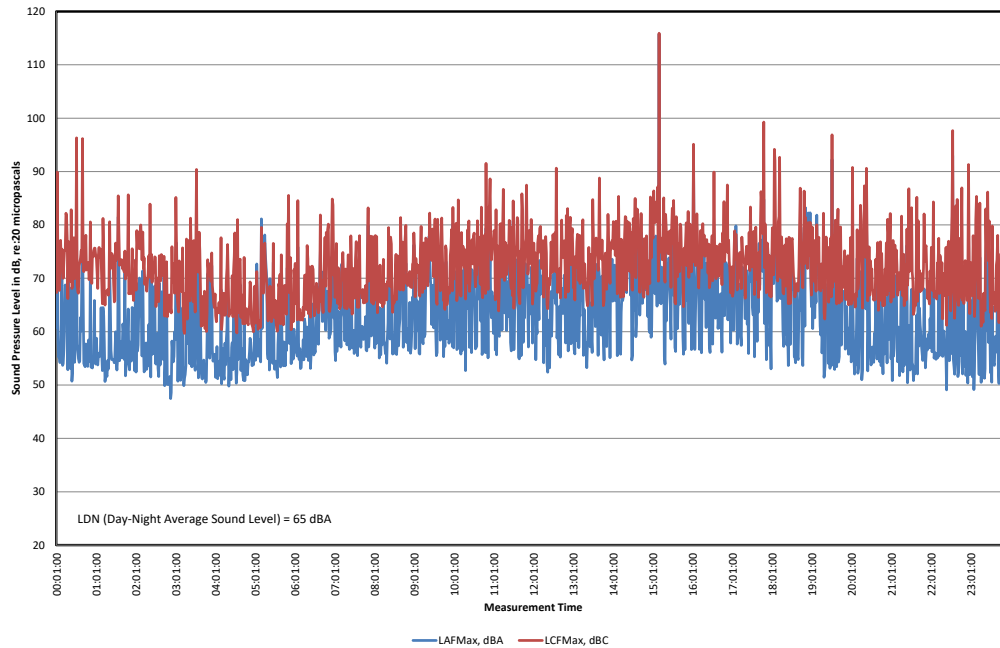
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Coral Villas - Truth Lounge
Friday - April 21, 2023



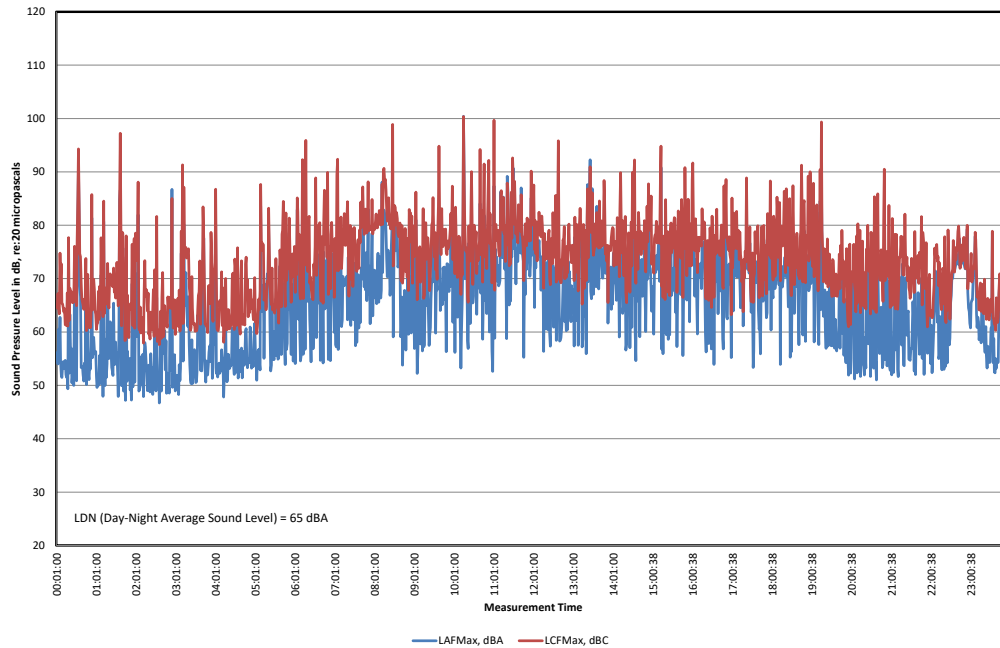
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Coral Villas - Truth Lounge
Saturday - April 22 to April 23, 2023



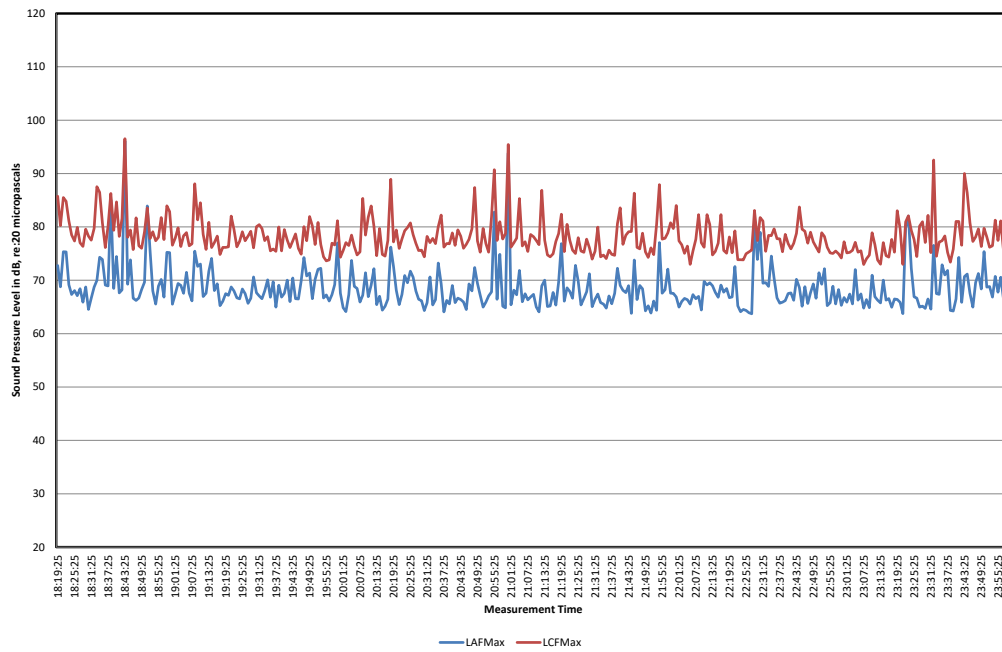
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Coral Villas - Truth Lounge
Sunday - April 23 to April 24, 2023



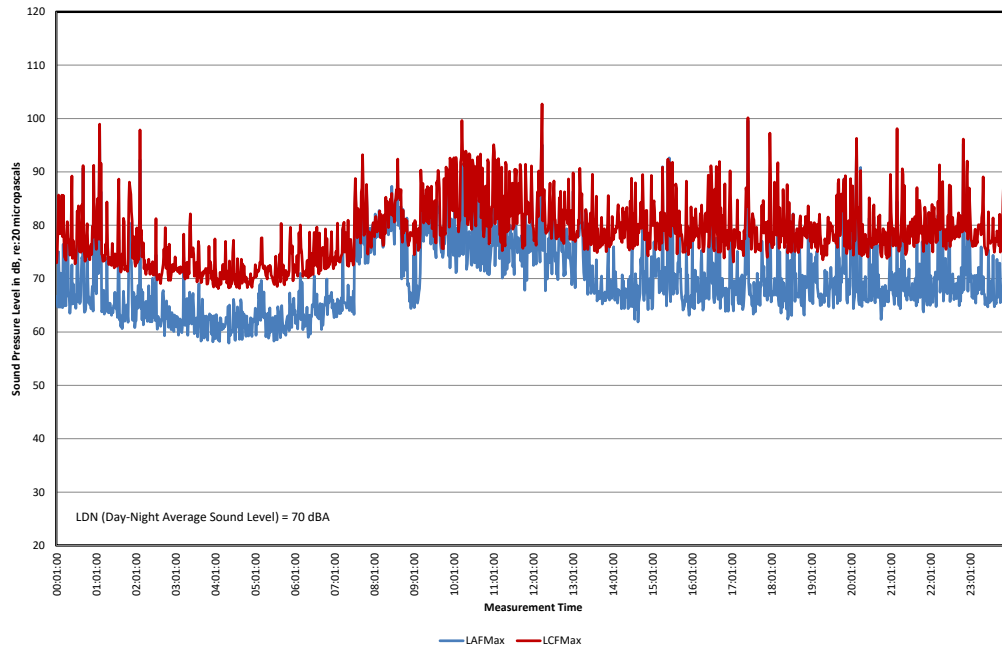
Fort Lauderdale Soundscape Study
Svantek 203 Blue
Coral Villas - Truth Lounge
Monday - April 24 to April 25, 2023



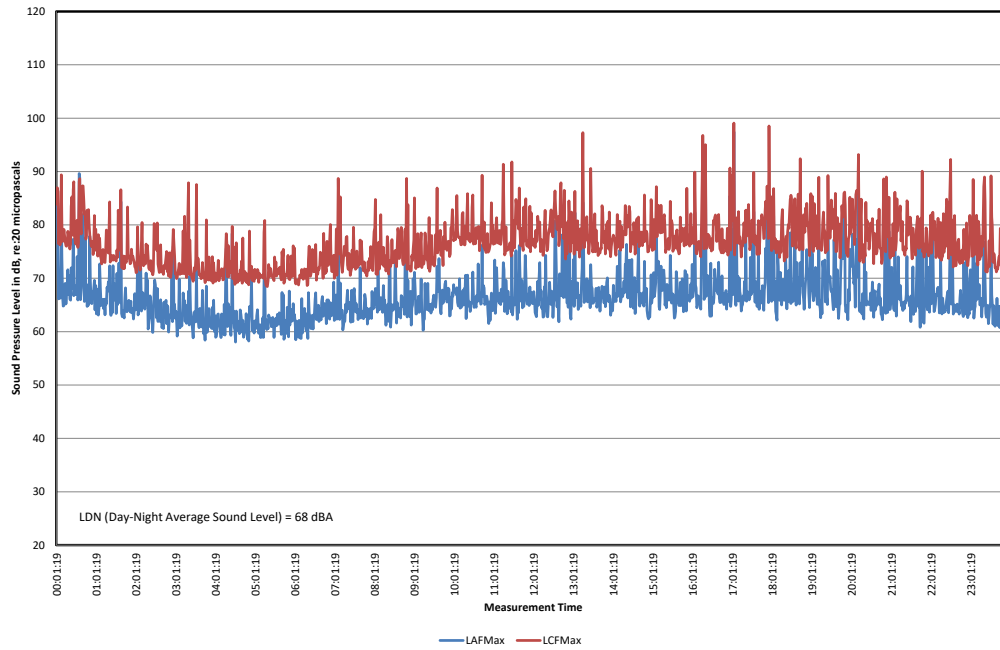
**Fort Lauderdale Soundscape Study
 Svantek 284 Orange
 Water Garden Unit on 26 th Floor
 Friday - April 21, 2023**



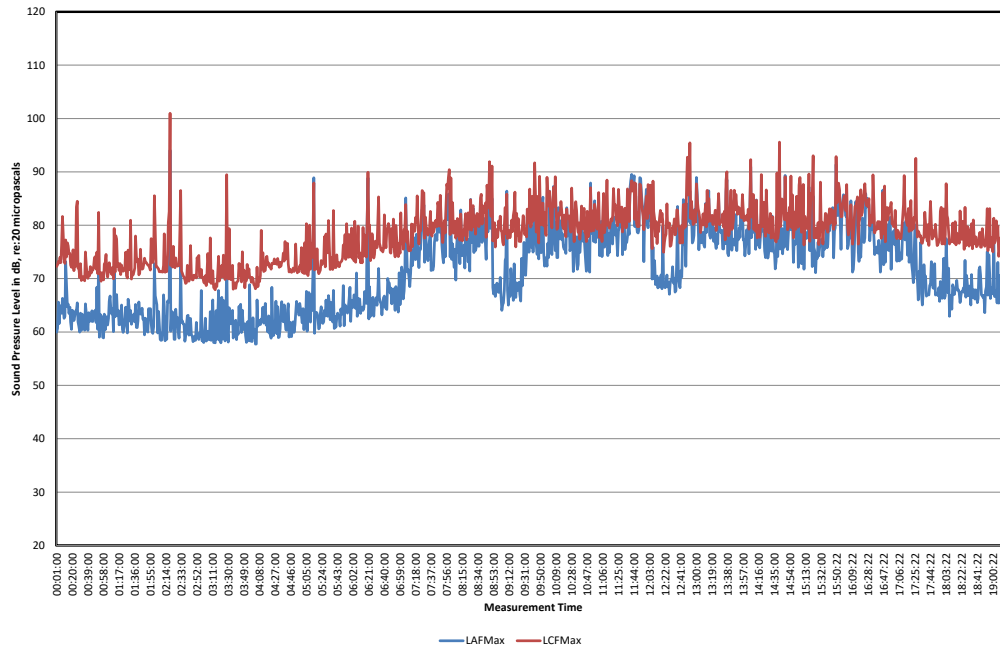
**Fort Lauderdale Soundscape Study
 Svantek 284 Orange
 Water Garden Unit on 26 th Floor
 Saturday - April 22 to April 23, 2023**



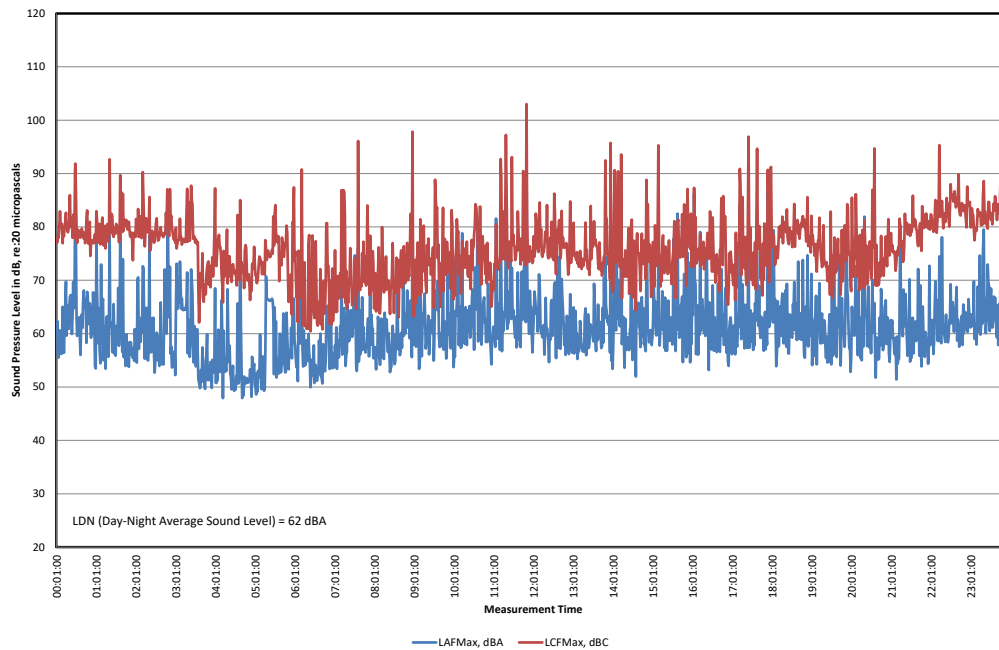
**Fort Lauderdale Soundscape Study
 Svantek 284 Orange
 Water Garden Unit on 26 th Floor
 Sunday - April 23 to April 24, 2023**



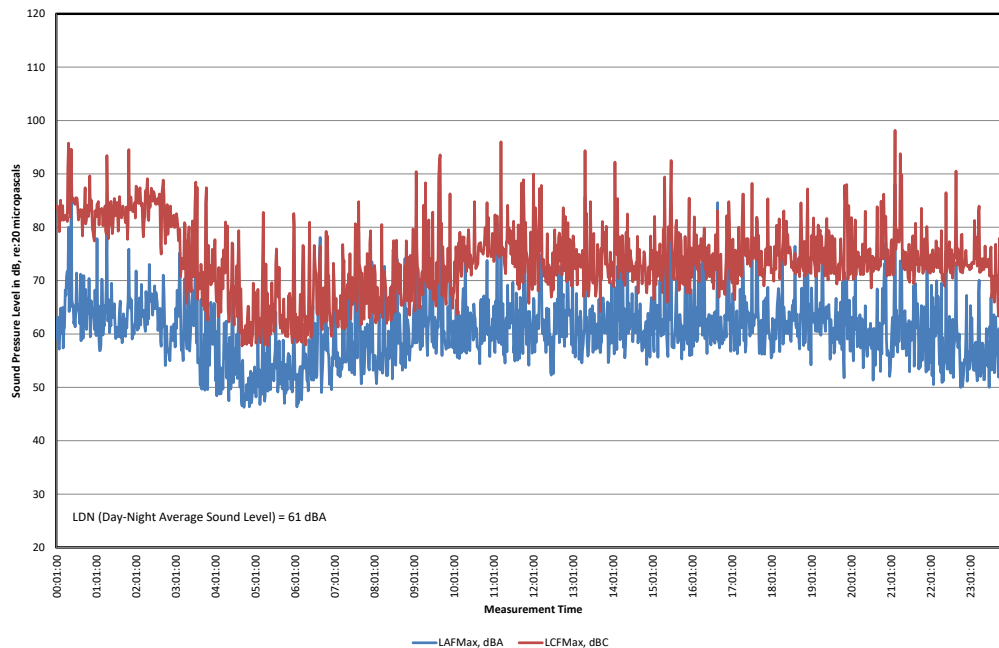
**Fort Lauderdale Soundscape Study
 Svantek 284 Orange
 Water Garden Unit on 26 th Floor
 Monday - April 24, 2023**



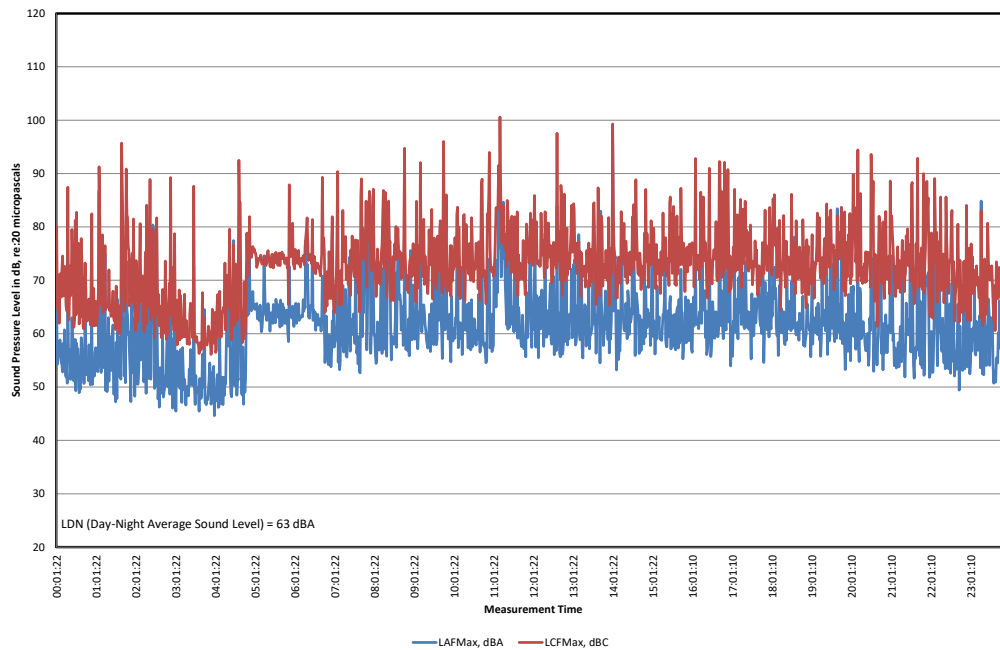
Fort Lauderdale Soundscape Study
SvanteK 291 Pink
Bamboo flats
Saturday - April 22 to April 23, 2023



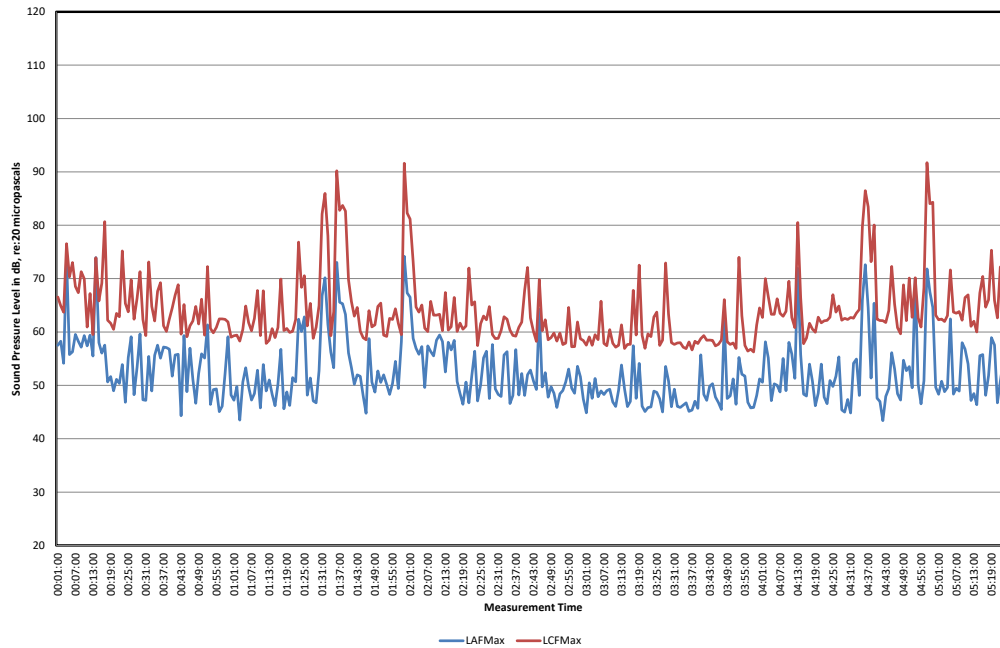
Fort Lauderdale Soundscape Study
SvanteK 291 Pink
Bamboo flats
Sunday - April 23 to April 24, 2023



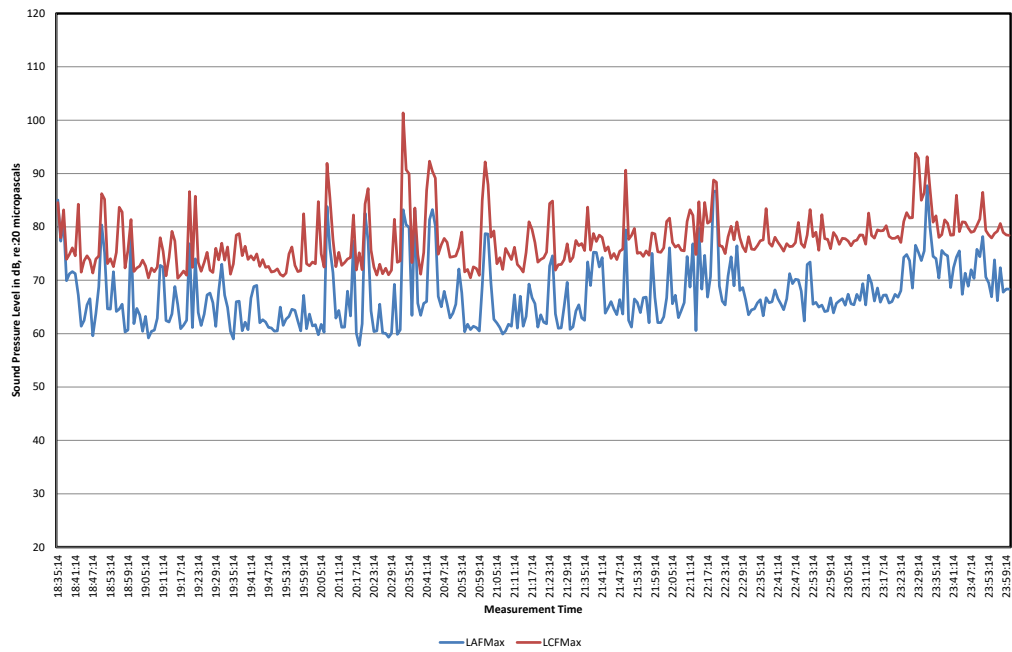
Fort Lauderdale Soundscape Study
SvanteK 291 Pink
Bamboo flats
Monday - April 24 to April 25, 2023



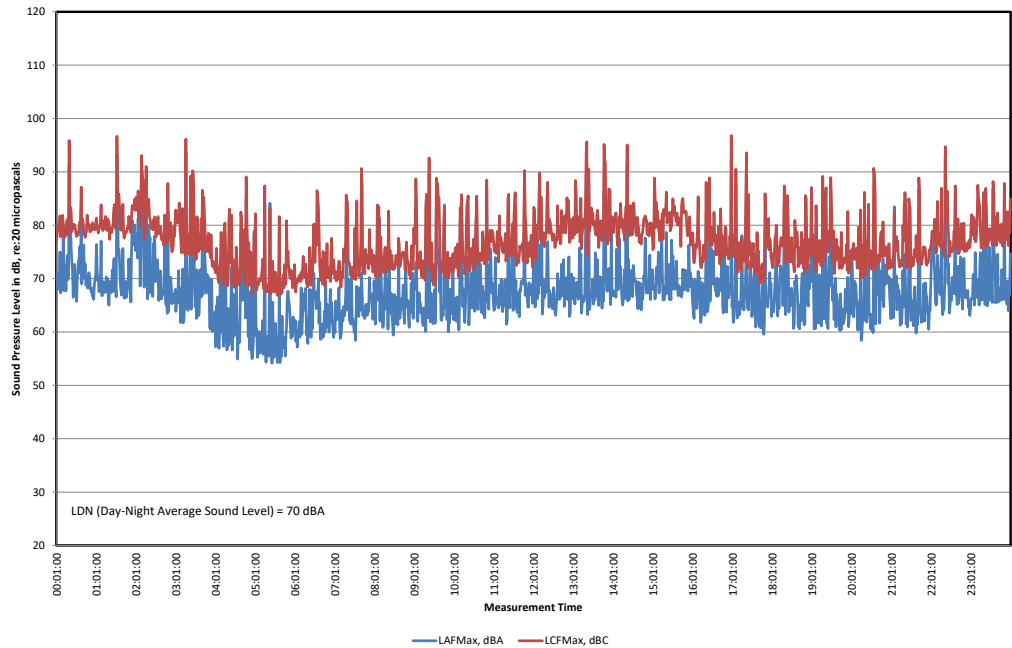
Fort Lauderdale Soundscape Study
SvanteK 291 Pink
Bamboo flats
Tuesday - April 25, 2023



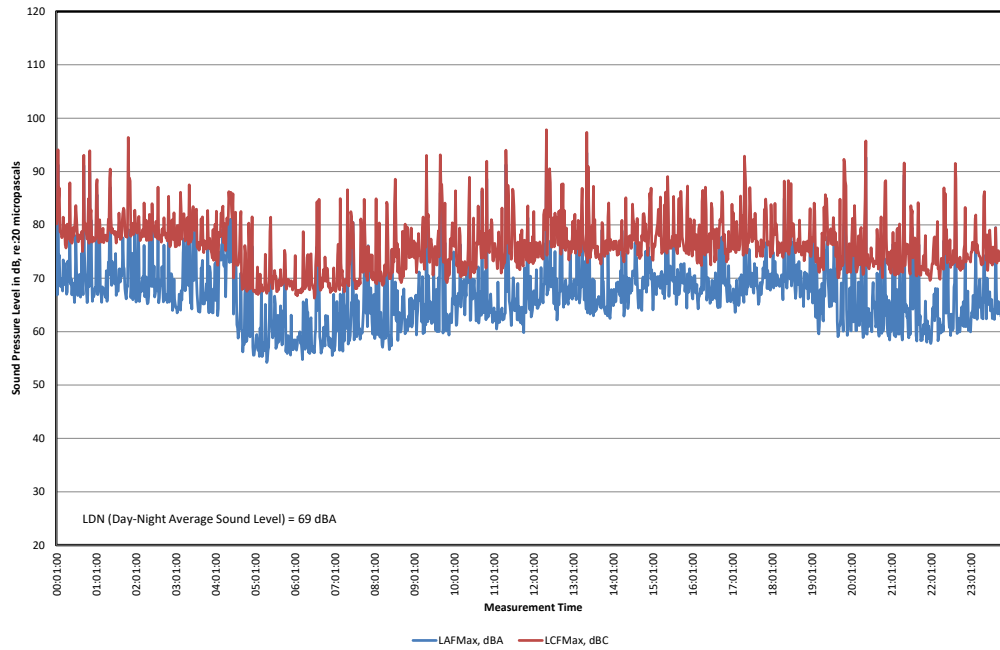
Fort Lauderdale Soundscape Study
SvanteK 282 Purple
Esplanade on New River - Upper Floor Unit
Friday - April 21, 2023



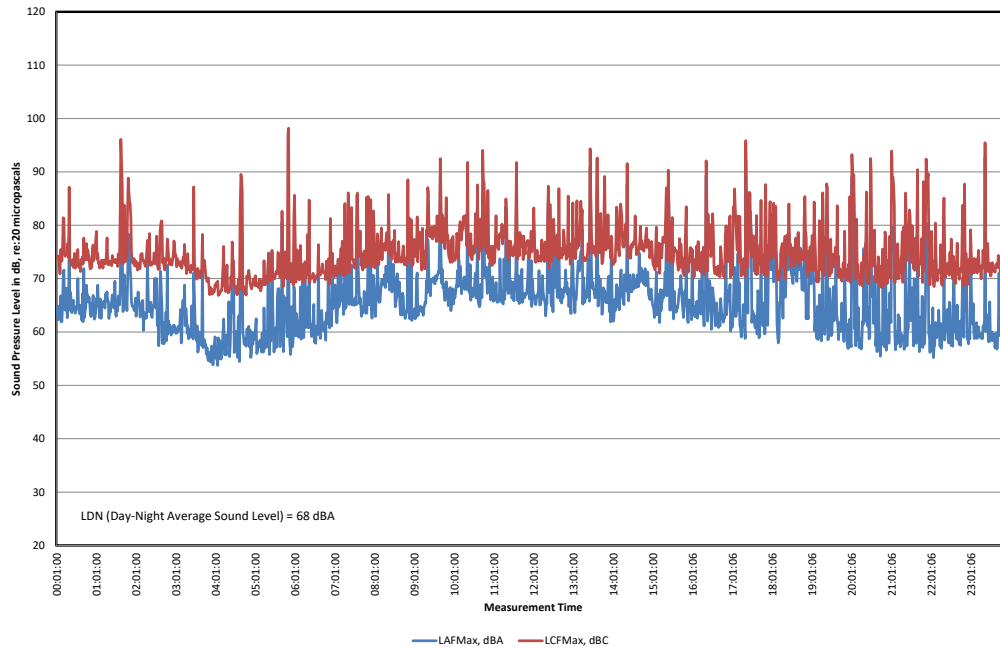
Fort Lauderdale Soundscape Study
SvanteK 282 Purple
Esplanade on New River - Upper Floor Unit
Saturday - April 22 to April 23, 2023



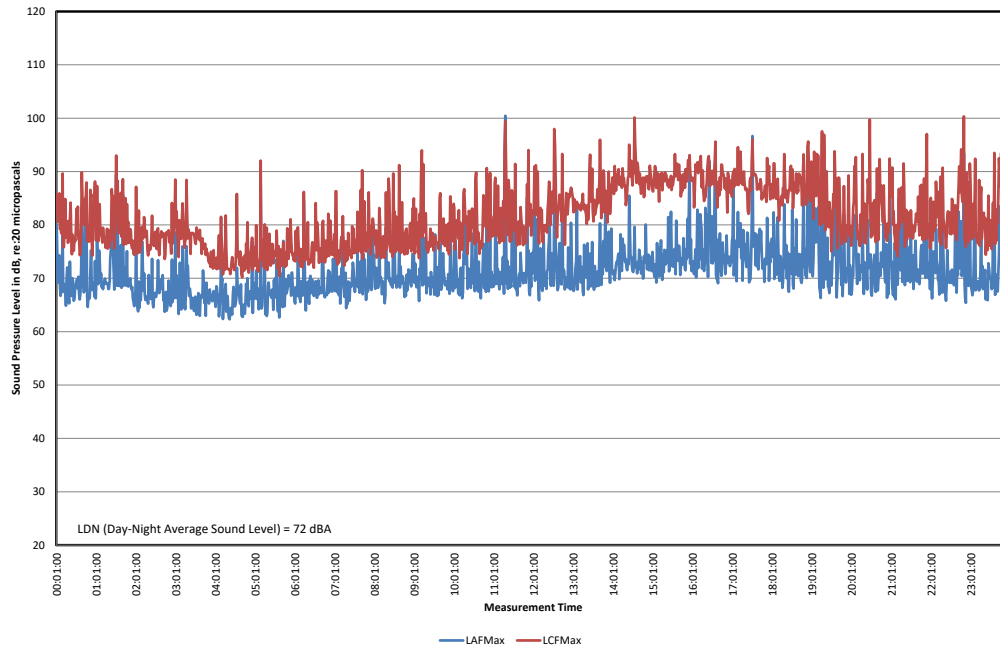
Fort Lauderdale Soundscape Study
Svantek 282 Purple
Esplanade on New River - Upper Floor Unit
Sunday - April 23 to April 24, 2023



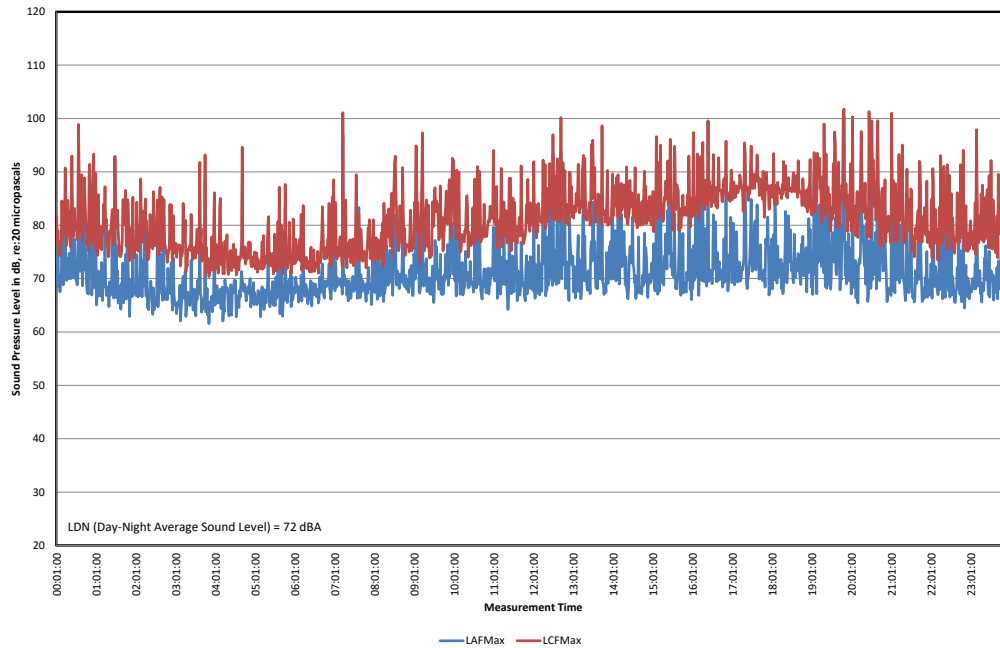
Fort Lauderdale Soundscape Study
Svantek 282 Purple
Esplanade on New River - Upper Floor Unit
Monday - April 24 to April 25, 2023



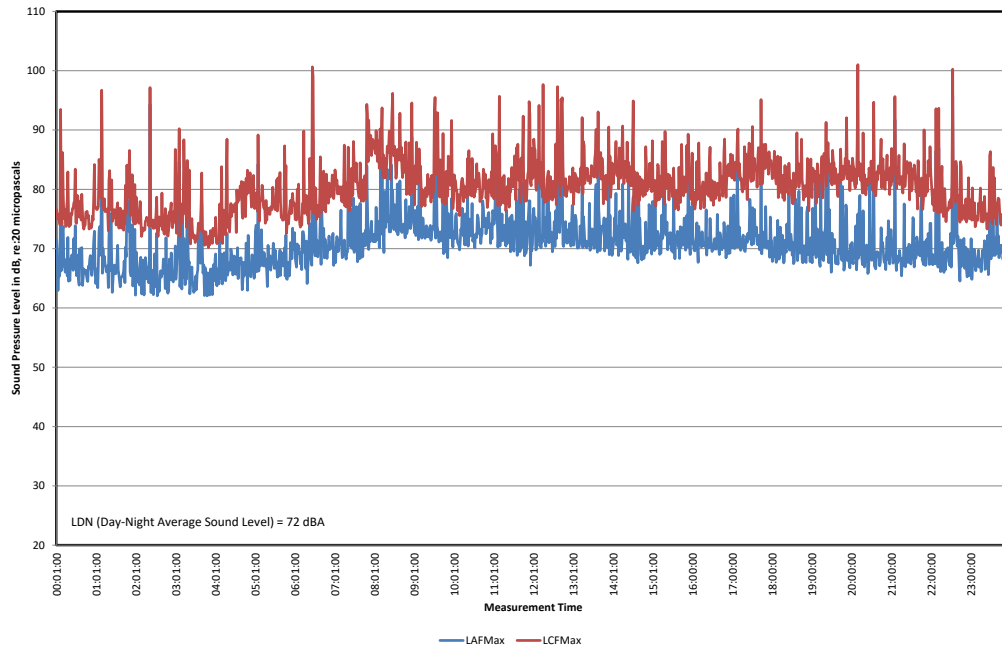
Fort Lauderdale Soundscape Study
Svantek 204 Red
Jackson Tower
Saturday - April 22 to April 23, 2023



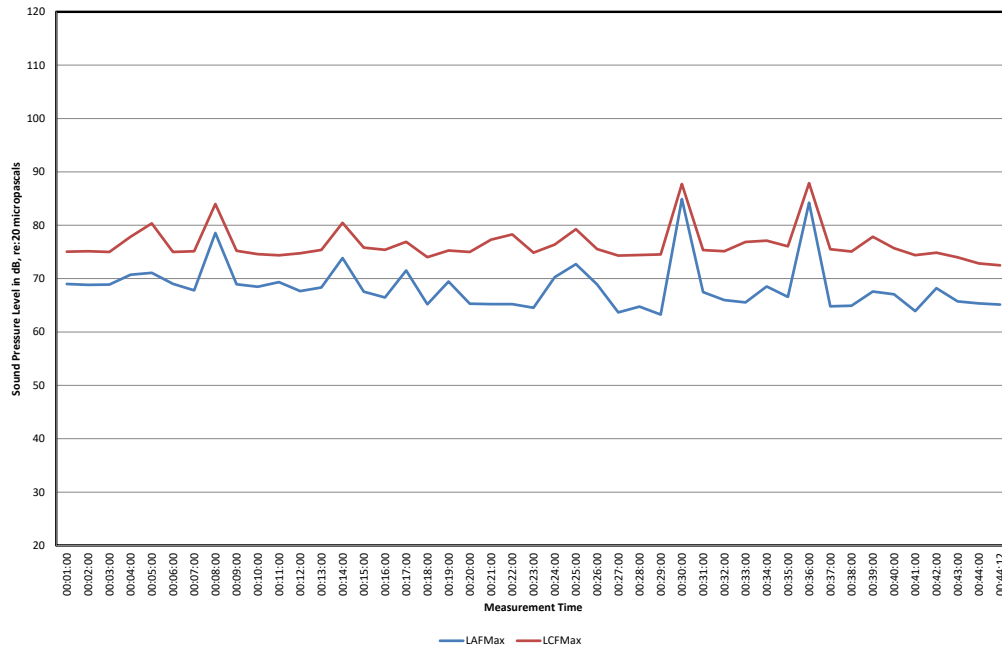
Fort Lauderdale Soundscape Study
Svantek 204 Red
Jackson Tower
Sunday - April 23 to April 24, 2023



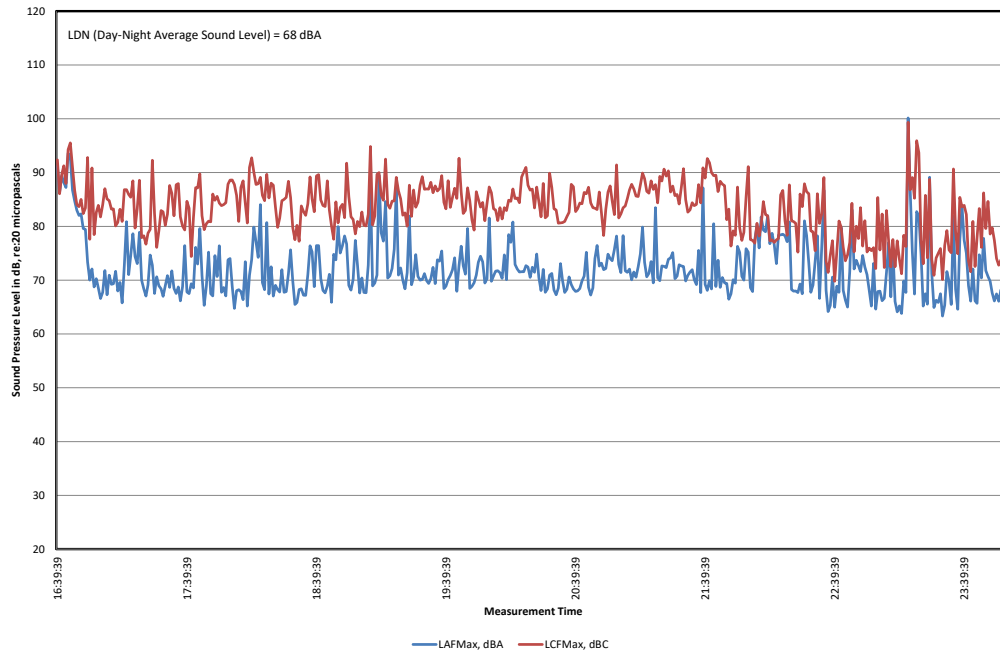
Fort Lauderdale Soudscape Study
 Svantek 204 Red
 Jackson Tower
 Monday - April 24 to April 25, 2023



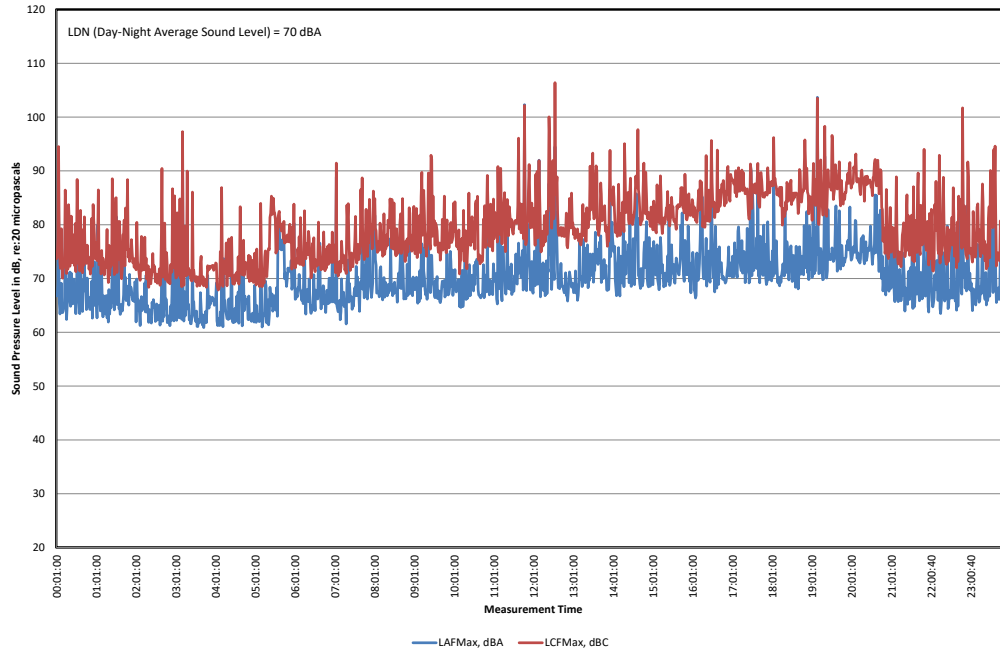
Fort Lauderdale Soudscape Study
 Svantek 204 Red
 Jackson Tower
 Tuesday - April 25, 2023



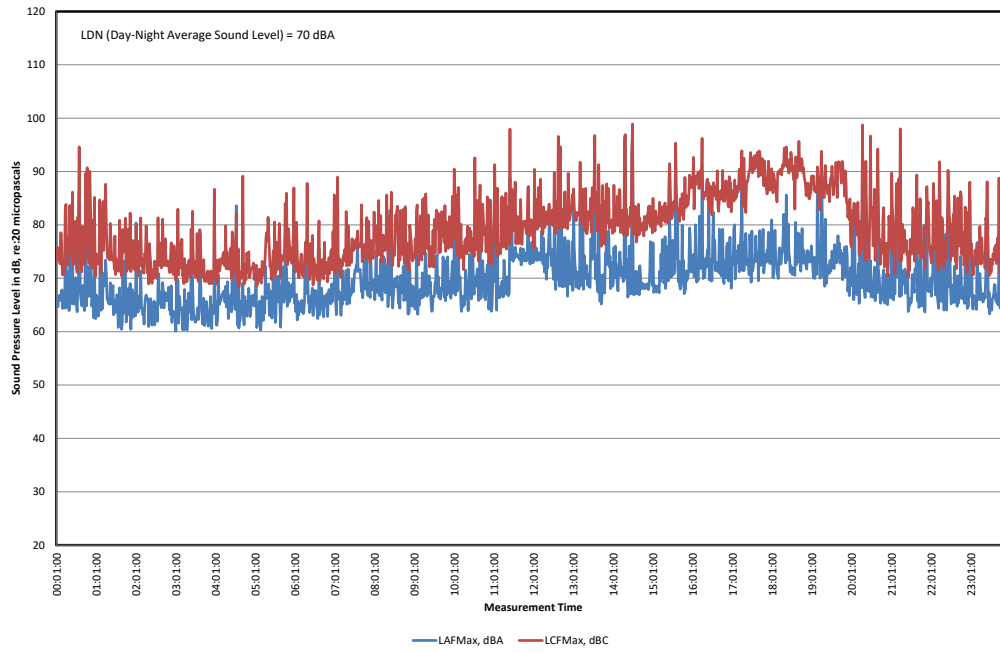
Fort Lauderdale Soundscape Study
Svantek 205 Green L182
Illni Building
Friday - April 21 to April 22, 2023



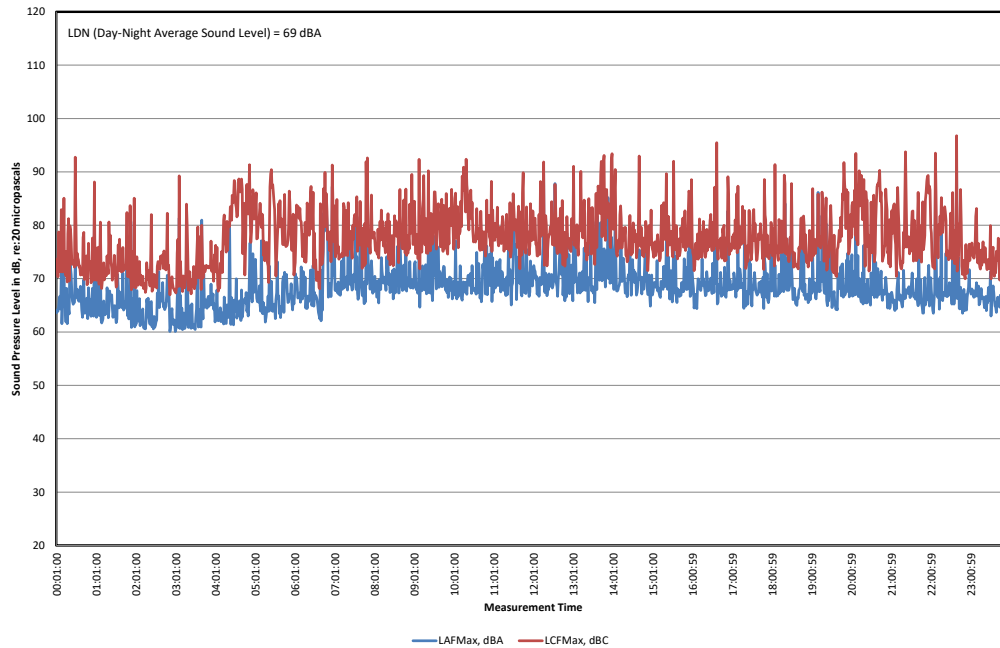
Fort Lauderdale Soundscape Study
Svantek 205 Green L184
Illni Building
Saturday - April 22 to April 23, 2023



Fort Lauderdale Soundscape Study
Svantek 205 Green
Illini Building
Sunday - April 23 to April 24, 2023



Fort Lauderdale Soundscape Study
Svantek 205 Green
Illini Building
Monday - April 24 to April 25, 2023



**APPENDIX B-1:
SUMMARY TABLE
DAY AND NIGHT SOUND LEVEL RANGES
TRIP 1**

TRIP 1: FEBRUARY 16 - 21, 2023

Meter	Date	LDN, dBA	Night Time Sound Level Range Early Morning	Day Time Sound Level Range 1	Day Time Sound Level Range 2	Night Time Sound Level Range Late Nights
Riverwalk Near The Wharf						
Rion 7	16-Feb-23	-	-	6 pm - 10:22 pm	-	-
			-	66 - 83 dBA	-	-
Rion 7	17-Feb-23	76	12 am - 6 am	7 am - 4 pm	-	7 pm - 12 am
			53 - 81 dBA	60 - 81 dBA	-	69 - 80 dBA
Rion 7	18-Feb-23	77	12 am - 1:30 am	3 am - 11 am	2 pm - 7 pm	7 pm - 12 am
			70 - 80 dBA	53 - 78 dBA	68 - 81 dBA	69 - 81 dBA
Rion 7	19-Feb-23	74	12 am - 1:30 am	2 am - 8 am	1 pm - 10 pm	-
			69 - 82 dBA	52 - 81 dBA	62.9 - 76 dBA	-
Rion 7	20-Feb-23	71	12 am - 5:30 am	6:30 am - 10 pm	-	10 pm - 12 am
			54 - 82 dBA	53 - 80 dBA	-	53 - 73 dBA
Rion 7	21-Feb-23	79	12 am - 4:30 am	7:30 am - 7 pm	-	10:30 pm - 12 am
			52 - 81 dBA	53 - 82 dBA	-	55 - 87 dBA
Rion 7	22-Feb-23	78	12 am - 4 am	7:30 am - 10 pm	-	10 pm - 12 am
			54 - 87 dBA	56 - 82 dBA	-	55 - 79 dBA
Rion 7	23-Feb-23	73	12 am - 5 am	7 am - 10 pm	-	11:30 pm - 12 am
			53 - 83 dBA	60 - 80 dBA	-	56 - 81 dBA
Rion 7	24-Feb-23	-	12 am - 5 am	7 am - 6 pm	-	6 pm - 12 am
			53 - 81 dBA	60 - 80 dBA	-	68 - 84 dBA
Esplanade Park Between Rest Room and Stage						
Rion 8	16-Feb-23	-	-	-	-	6:09 pm - 12 am
			-	-	-	48 - 66 dBA
Rion 8	17-Feb-23	64	12 am - 5:30 am	7 am - 3 pm	-	5:30 pm - 12 am
			47 - 69 dBA	54 - 82 dBA	-	51 - 76 dBA
Rion 8	18-Feb-23	65	12 am - 8 am	11 am - 3 pm	-	4:30 pm - 12 am
			47 - 71 dBA	58 - 78 dBA	-	52 - 72 dBA
Rion 8	19-Feb-23	62	12 am - 4 am	8:30 am - 7:30 pm	-	9 pm - 12 am
			49 - 74 dBA	51 - 72 dBA	-	48 - 68 dBA
Rion 8	20-Feb-23	61	12 am - 5 am	6 am - 10 pm	-	10 pm - 12 am
			45 - 77 dBA	49 - 65 dBA	-	47 - 73 dBA
Rion 8	21-Feb-23	63	12 am - 4 am	5:30 am - 11 pm	-	11 pm - 12 am
			44.6 - 64 dBA	48 - 82 dBA	-	49 - 67 dBA
Rion 8	22-Feb-23	66	12 am - 4 am	6 am - 10 pm	-	10 pm - 12 am
			46.5 - 67.3 dBA	50.1 - 80.8 dBA	-	48 - 76 dBA
Rion 8	23-Feb-23	64	12 am - 4 am	6 am - 3 pm	-	6 pm - 12 am
			46 - 74 dBA	53 - 80 dBA	-	49 - 69 dBA
Rion 8	24-Feb-23	66	12 am - 2 am	6 am - 12 am	-	-
			48 - 68 dBA	50 - 82 dBA	-	-
Rion 8	25-Feb-23	-	12 am - 9 am	-	-	-

Meter	Date	LDN, dBA	Night Time Sound Level Range Early Morning	Day Time Sound Level Range 1	Day Time Sound Level Range 2	Night Time Sound Level Range Late Nights
			47 - 75 dBA	-	-	-

Bamboo Flats on Street						
Svantek 203	16-Feb-23	-	-	-	-	6:30 pm - 12 am
			-	-	-	50 - 89 dBA
Svantek 203	17-Feb-23	62	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			47 dBA - 77 dBA	51 - 104 dBA	-	56 - 83 dBA
Svantek 203	18-Feb-23	65	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			57 - 89 dBA	53 - 102 dBA	-	56 - 86 dBA
Svantek 203	19-Feb-23	64	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			54 - 90 dBA	49 - 94 dBA	-	52 - 83 dBA
Svantek 203	20-Feb-23	64	12 am - 3 am	7 am - 12 am	-	10 pm - 12 am
			51 - 89 dBA	51 - 98 dBA	-	51 - 86 dBA
Svantek 203	21-Feb-23	63	12 am - 3 am	7 am - 9 pm	-	10 pm - 12 am
			45 - 92 dBA	52 - 96 dBA	-	49 - 91 dBA
Svantek 203	22-Feb-23	63	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			45 - 80 dBA	50 - 99 dBA	-	51 - 81 dBA
Svantek 203	23-Feb-23	64	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			46 - 92 dBA	49 - 95 dBA	-	56 - 95 dBA
Svantek 203	24-Feb-23	64	12 am - 3 am	6:30 am - 9 pm	-	10 pm - 12 am
			55 - 87 dBA	52 - 99 dBA	-	56 - 84 dBA
Svantek 203	25-Feb-23	72	12 am - 3 am	8 am - 6 pm	-	6 pm - 12 am
			55 - 113 dBA	51 - 100 dBA	-	59 - 92 dBA
Median in A1A South on the Beach						
Svantek 204	17-Feb-23	72	12 am - 5 am	7 am - 2 pm	2 pm - 6 pm	6 pm - 12 am
			56 - 93 dBA	67 - 103 dBA	68 - 88 dBA	66 - 102 dBA
Svantek 204	18-Feb-23	76	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			57 - 85 dBA	67 - 105 dBA	-	68 - 105 dBA
Svantek 204	19-Feb-23	73	12 am - 3 am	3 am - 3 pm	3 pm - 9 pm	10 pm - 12 am
			61 - 99 dBA	59 - 100 dBA	68 - 75 dBA	63 - 100 dBA
Svantek 204	20-Feb-23	71	12 am - 2 am	7 am - 10 pm	-	10 pm - 12 am
			62 - 89 dBA	67 - 105 dBA	-	68 - 105 dBA
Svantek 204	21-Feb-23	72	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			47 - 88 dBA	66 - 104 dBA	-	64 - 110 dBA
Svantek 204	22-Feb-23	70	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			49 - 93 dBA	66 - 106 dBA	-	64 - 92 dBA
Svantek 204	23-Feb-23	70	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			52 - 88 dBA	66 - 102 dBA	-	67 - 94 dBA
Svantek 204	24-Feb-23	74	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			50 - 90 dBA	66 - 106 dBA	-	67 - 110 dBA
Svantek 204	25-Feb-23	73	12 am - 3 am	7 am - 10 pm	-	10 pm - 12 am
			58 - 95 dBA	65 - 106 dBA	-	67 - 103 dBA

Meter	Date	LDN, dBA	Night Time Sound Level Range Early Morning	Day Time Sound Level Range 1	Day Time Sound Level Range 2	Night Time Sound Level Range Late Nights
-------	------	----------	--	------------------------------	------------------------------	--

Median in A1A North on the Beach						
Svantek 205	17-Feb-23	73	12 am - 3 am	6:30 am - 4 pm	-	6 pm - 12 am
			55 - 94 dBA	64 - 71 dBA	-	66 - 101 dBA
Svantek 205	18-Feb-23	74	12 am - 3 am	7 am - 4 am	-	6 pm - 12 am
			55 - 64 dBA	64 - 99 dBA	-	62 - 109 dBA
Svantek 205	19-Feb-23	73	12 am - 3 am	4 am - 1 pm	-	2 pm - 12 am
			59 - 89 dBA	59 - 90 dBA	-	64 - 105 dBA
Svantek 205	20-Feb-23	73	12 am - 3 am	7 am - 12 pm	12 pm - 6 pm	6 pm - 12 am
			51 - 98 dBA	62 - 111 dBA	62 - 107 dBA	59 - 106 dBA

**APPENDIX B-2:
SUMMARY TABLE DAY AND NIGHT SOUND LEVEL RANGES
ACOUSTICAL DATA
TRIP 2**

TRIP 2: April 21 - 25, 2023

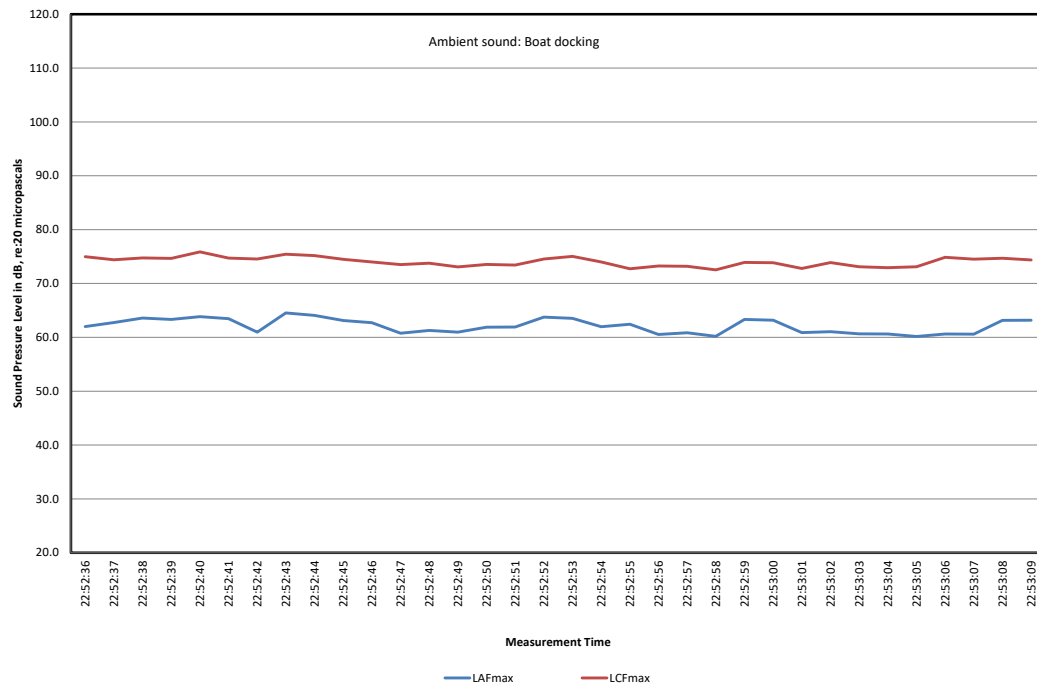
Meter	Date	LDN, dBA	Night Time Sound Level Range Early Morning 12 am - 4 am	Day Time Sound Level Range 1	Day Time Sound Level Range 2	Night Time Sound Level Range Late Nights
Parking Lot Across from Smitty's Wings						
Rion 4	21-Apr-23	-	7:30 pm - 12 am	-	-	-
			61 - 82 dBA	-	-	-
Rion 4	22-Apr-23	71	12 am - 1 am	7 am - 9 pm	-	9 pm - 12 am
			57 - 77 dBA	56 - 88 dBA	-	57 - 74 dBA
Rion 4	23-Apr-23	71	12 am - 4 am	8 am - 5 pm	5 pm - 9 pm	9 pm - 12 am
			45 - 73 dBA	58 - 78 dBA	60 - 88 dBA	53 - 79 dBA
Rion 4	24-Apr-23	69	12 am - 3 am	7 am - 8 pm	-	10 pm - 12 am
			43 - 76 dBA	54 - 86 dBA	-	47 - 88 dBA
Rion 4	25-Apr-23	-	12 am - 5 am	7 am - 9 am	-	-
			42 - 65 dBA	60 - 77 dBA	-	-
Colee Hammock near The Balcony and Service Alley						
Rion 7	21-Apr-23		-	-	-	8:48 pm - 12 am
			-	-	-	58 - 72 dBA
Rion 7	22-Apr-23	65	12 am - 3 am	9 am - 10 pm	-	10 pm - 12 am
			53 - 77 dBA	57 - 73 dBA	-	59 - 68 dBA
Rion 7	23-Apr-23	65	12 am - 3 am	9 am - 10 pm	-	10 pm - 12 am
			52 - 73 dBA	57 - 74 dBA	-	58 - 68 dBA
Rion 7	24-Apr-23	64	12 am - 5 am	7 am - 8 pm	-	8 pm - 12 am
			47 - 91 dBA	52 - 100 dBA	-	51 - 79 dBA
Coral Villas near Truth Lounge						
Svantek 203	21-Apr-23	-	-	-	-	8 pm - 12 am
			-	-	-	56 - 90 dBA
Svantek 203	22-Apr-23	63	12 am - 2 am	6 am - 7:30 am	-	7:30 pm - 12 am
			52 - 81 dBA	52 - 81 dBA	-	51 - 80 dBA
Svantek 203	23-Apr-23	65	12 am - 7 am	7 am - 10 pm	-	10 pm - 12 am
			47 - 85 dBA	50 - 116 dBA	-	49 - 93 dBA
Svantek 203	24-Apr-23	65	12 am - 5 am	7 am - 10 pm	-	10 pm - 12 am
			47 - 91 dBA	52 - 100 dBA	-	51 - 79 dBA

Meter	Date	LDN, dBA	Night Time Sound Level Range Early Morning 12 am - 4 am	Day Time Sound Level Range 1	Day Time Sound Level Range 2	Night Time Sound Level Range Late Nights
Water Garden Upper from Living Unit						
Svantek 284	21-Apr-23	-	-	-	-	6:20 pm - 12 am
			-	-	-	64 - 96 dBA
Svantek 284	22-Apr-23	70	12 am - 3 am	3 am - 7 am	7 am - 10 pm	10 pm - 12 am
			59 - 98 dBA	58 - 74 dBA	62 - 100 dBA	65 - 95 dBA
Svantek 284	23-Apr-23	68	12 am - 2:30 am	2:30 am - 7 am	7 am - 10 pm	10 pm - 12 am
			60 - 90 dBA	58 - 78 dBA	60 - 97 dBA	60 - 79 dBA
Svantek 284	24-Apr-23	-	12 am - 7 am	7 am - 7:20 pm	-	-
			58 - 94 am	63 - 91 dBA	-	-
Bamboo Flats in Yard Closest to NE 8 th Street						
Svantek 291	22-Apr-23	62	12 am - 5 am	5 am - 10 pm	-	10 pm - 12 am
			48 - 91 dBA	49 - 91 dBA	-	56 - 80 dBA
Svantek 291	23-Apr-23	61	12 am - 3:30 am	3:30 am - 7 am	7 am - 10 pm	10 pm - 12 am
			54 - 89 dBA	46 - 78 dBA	51 - 88 dBA	50 - 88 dBA
Svantek 291	24-Apr-23	63	12 am - 5 am	5 am - 9 pm	-	10 pm - 9 am
			45 - 87 dBA	53 - 98 dBA	-	49 - 85 dBA
Svantek 291	25-Apr-23	-	12 am - 5:24 am	-	-	-
			43 - 74 dBA	-	-	-
Esplanade on New River Upper Floor Living Unit						
Svantek 282	21-Apr-23	-	-	-	-	6:35 pm - 12 am
			-	-	-	58 - 88 dBA
Svantek 282	22-Apr-23	70	12 am - 3 am	3 am - 7 am	7 am - 10 pm	10 pm - 12 am
			63 - 93 dBA	54 - 94 dBA	58 - 92 dBA	63 - 93 dBA
Svantek 282	23-Apr-23	69	12 am - 4 am	4 am - 7 am	7 am - 10 pm	10 pm - 12 am
			64 - 91 dBA	54 - 82 dBA	56 - 96 dBA	58 - 81 dBA
Svantek 282	24-Apr-23	68	12 am - 2 am	7 am - 10 pm	-	10 pm - 12 am
			62 - 80 dBA	55 - 92 dBA	-	55 - 93 dBA
Jackson Tower 6th Floor Mezzanine						
Svantek 204	22-Apr-23	72	12 am - 3 am	7 am - 2 pm	2 pm - 7 pm	7 pm - 12 am
			64 - 90 dBA	64 - 100 dBA	67 - 97 dBA	65 - 93 dBA
Svantek 204	23-Apr-23	72	12 am - 3 am	3 am - 7 am	7 am - 10 pm	10 pm - 12 am
			63 - 94 dBA	62 - 88 dBA	64 - 100 dBA	65 - 94 dBA
Svantek 204	24-Apr-23	72	12 am - 3 am	8 am - 10 pm	-	10 pm - 12 am
			62 - 96 dBA	65 - 94 dBA	-	65 - 96 dBA
Svantek 204	25-Apr-23	-	12 am - 12:44 am	-	-	-
			63 - 85 dBA	-	-	-

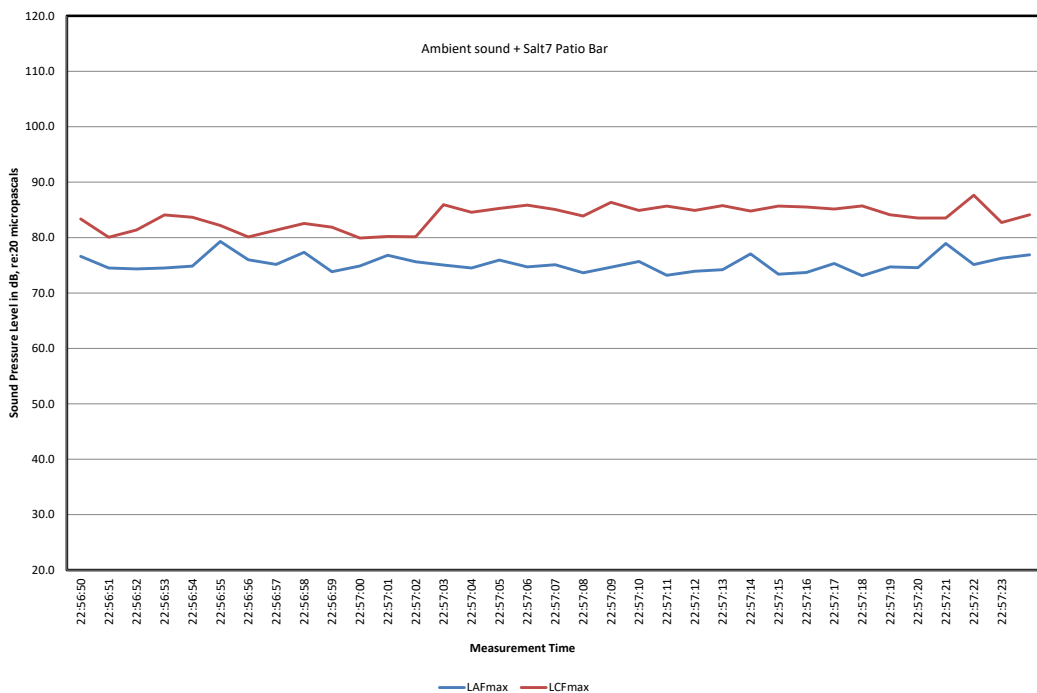
Meter	Date	LDN, dBA	Night Time Sound Level Range Early Morning 12 am - 4 am	Day Time Sound Level Range 1	Day Time Sound Level Range 2	Night Time Sound Level Range Late Nights
ILLNI Upper Floor Living Unit						
Svantek 205	21-Apr-23	-	-	-	-	4:40 pm 12 am
			-	-	-	63 - 100 dBA
Svantek 282	22-Apr-23	70	12 am - 5:30 am	5:30 am - 8 pm	-	8 pm - 12 am
			61 - 95 dBA	62 - 104 dBA	-	63 - 90 dBA
Svantek 282	23-Apr-23	70	12 am - 7 am	7 am - 8 pm	-	8 pm - 12 am
			60 - 86 dBA	63 - 97 dBA	-	63 - 98 dBA
Svantek 282	24-Apr-23	69	12 am - 7 am	7 am - 12 am	-	-
			60 - 87 dBA	63 - 92 dBA	-	-

APPENDIX C-1: GRAPHS OF SHORT TERM ACOUSTICAL MEASUREMENTS

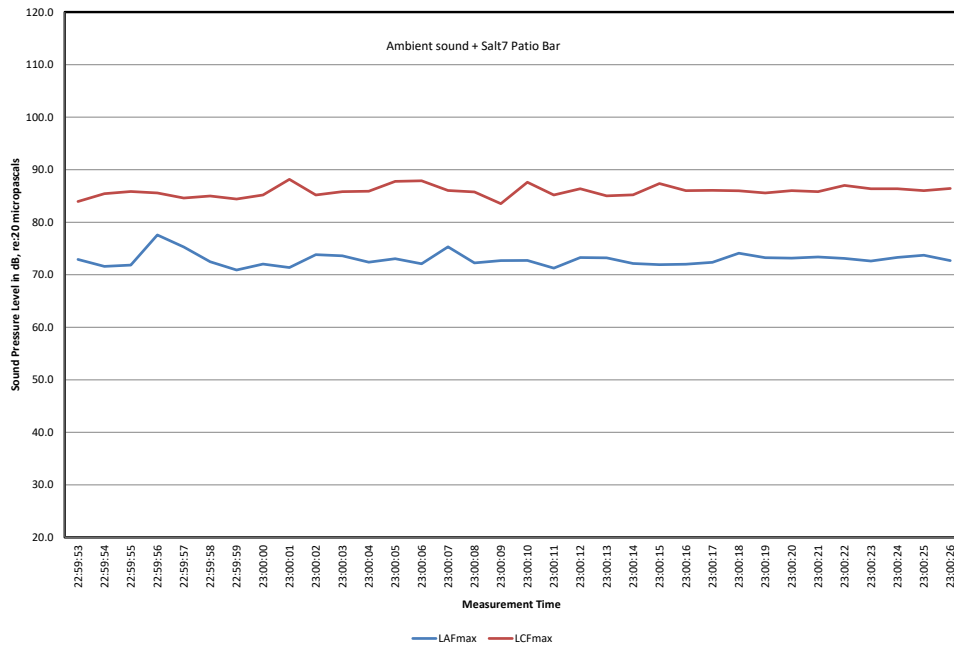
Fort Lauderdale Soundscape Study
Entry of the Riverside hotel
LD2.03
Thursday - February 16, 2023



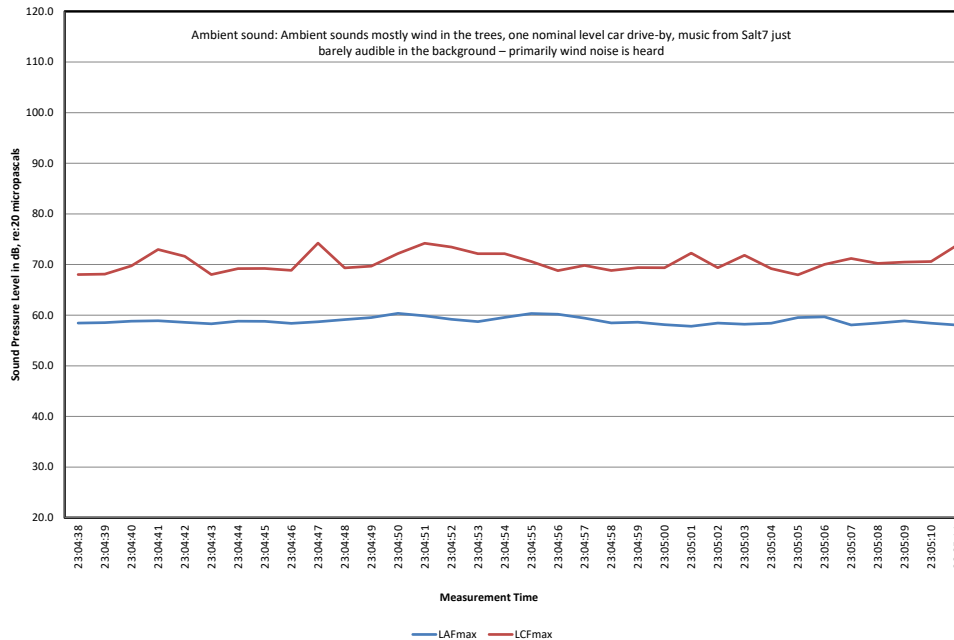
Fort Lauderdale Soundscape Study
Outside the Salt7 patio bar – east side
LD2.04
Thursday - February 16, 2023



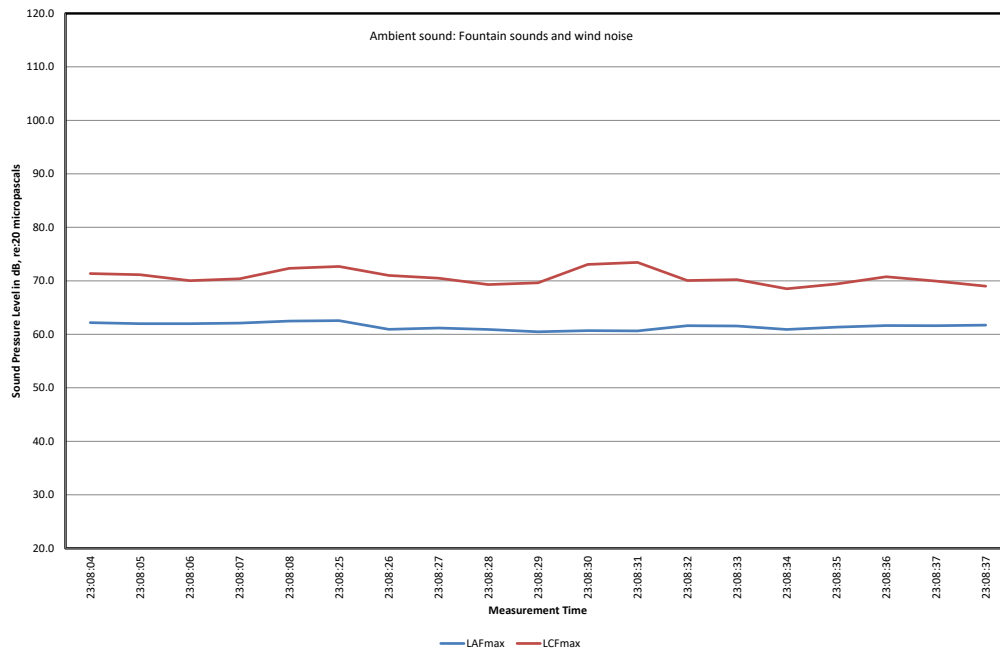
Fort Lauderdale Soundscape Study
Outside Salt7 near the street and the condominiums - west side of Salt7
LD2.05
Thursday - February 16, 2023



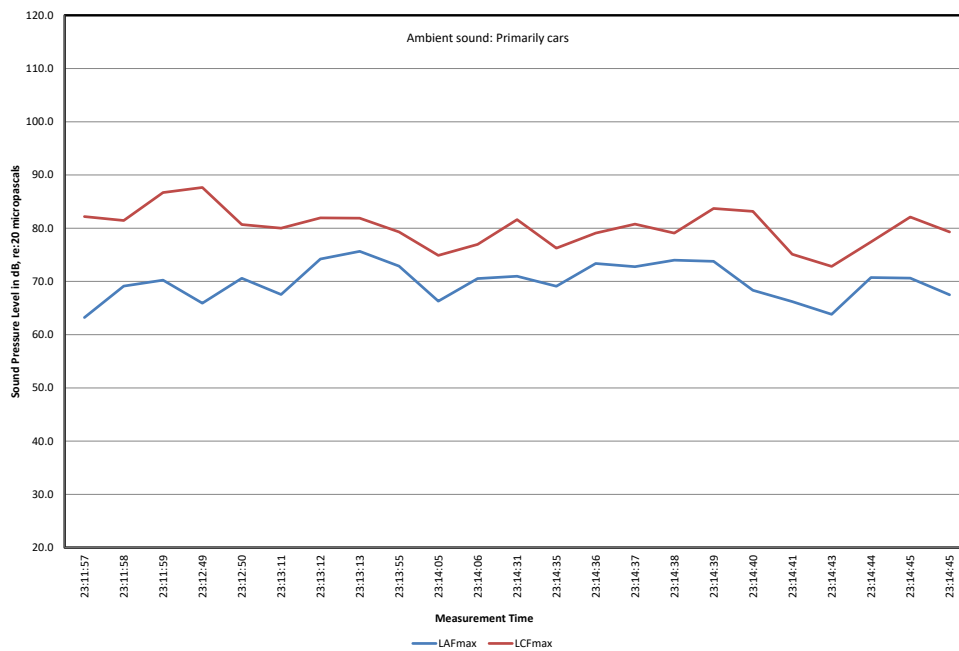
Fort Lauderdale Soundscape Study
Outside Salt 7
LD2.06
Thursday - February 16, 2023



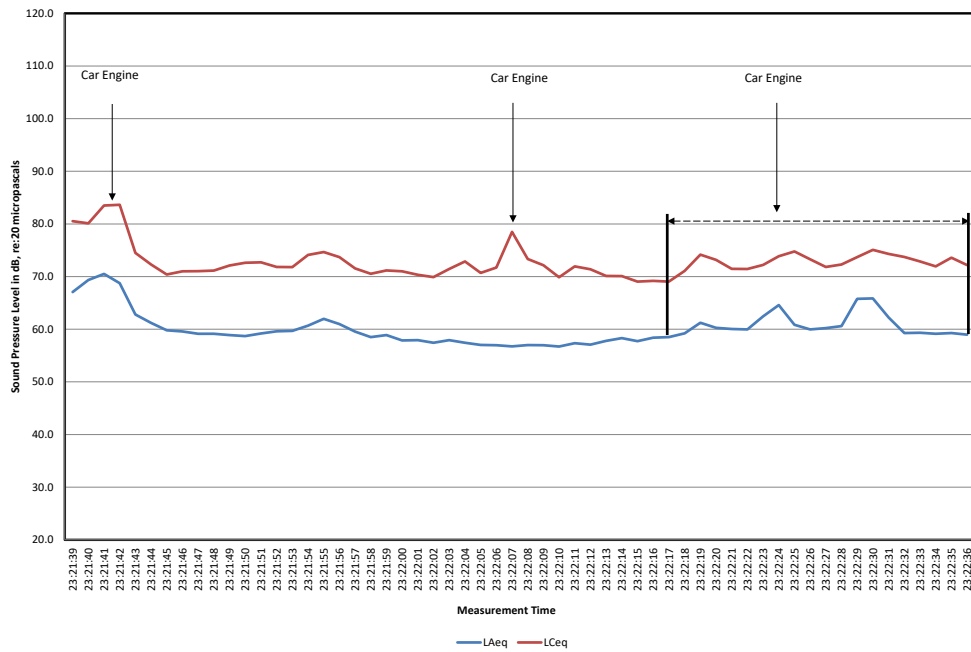
Fort Lauderdale Soundscape Study
Across the street from Water Garden
LD2.07
Thursday - February 16, 2023



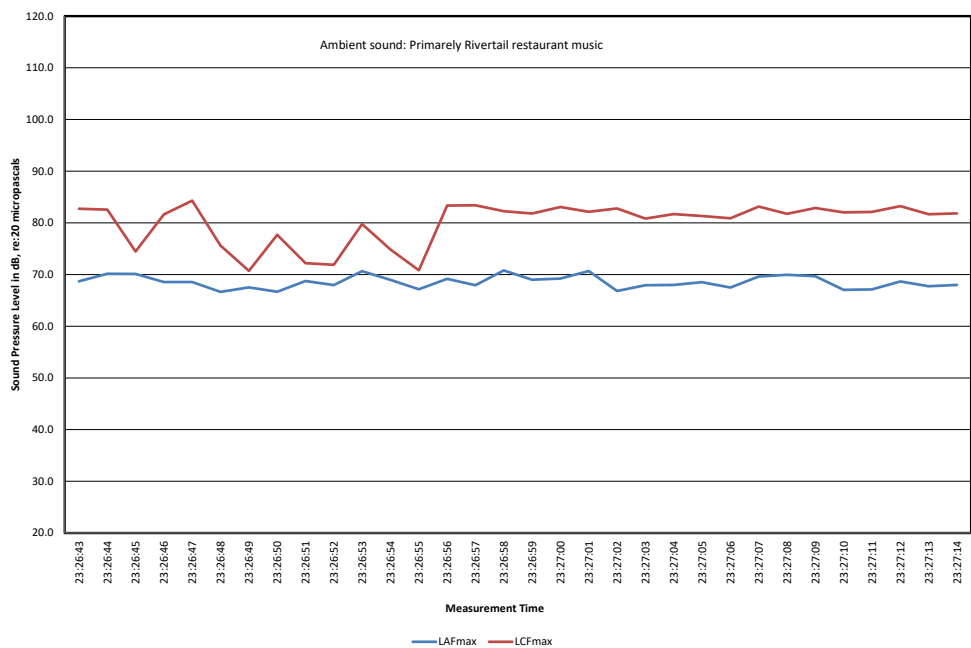
Fort Lauderdale Soundscape Study
New River, which is crossed by a grand overpass
LD2.08
Thursday - February 16, 2023



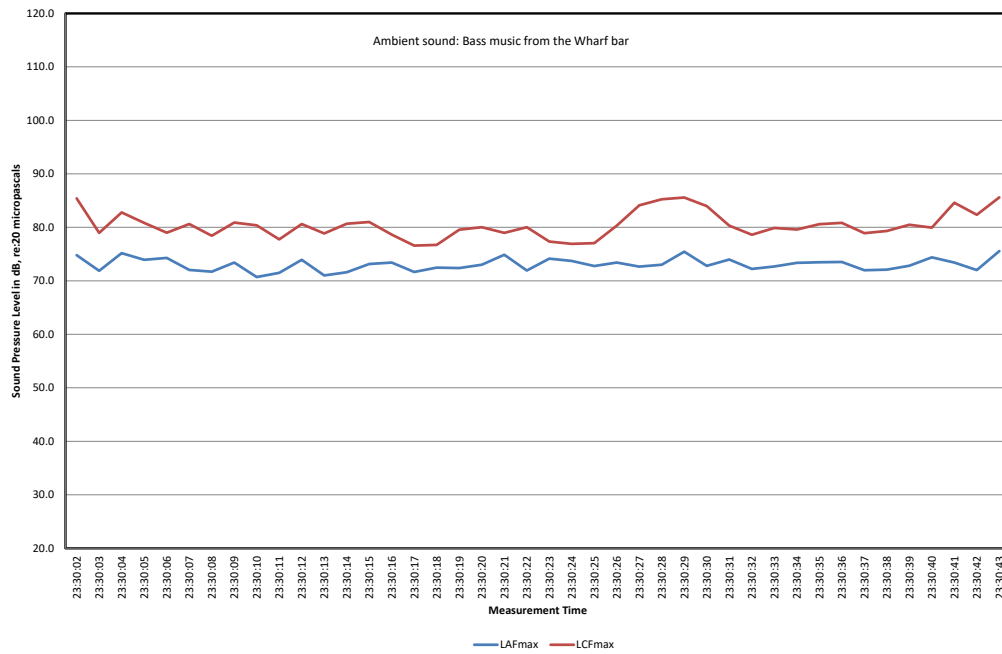
Fort Lauderdale Soundscape Study
Huizenga Plaza
LD2.09
Thursday - February 16, 2023



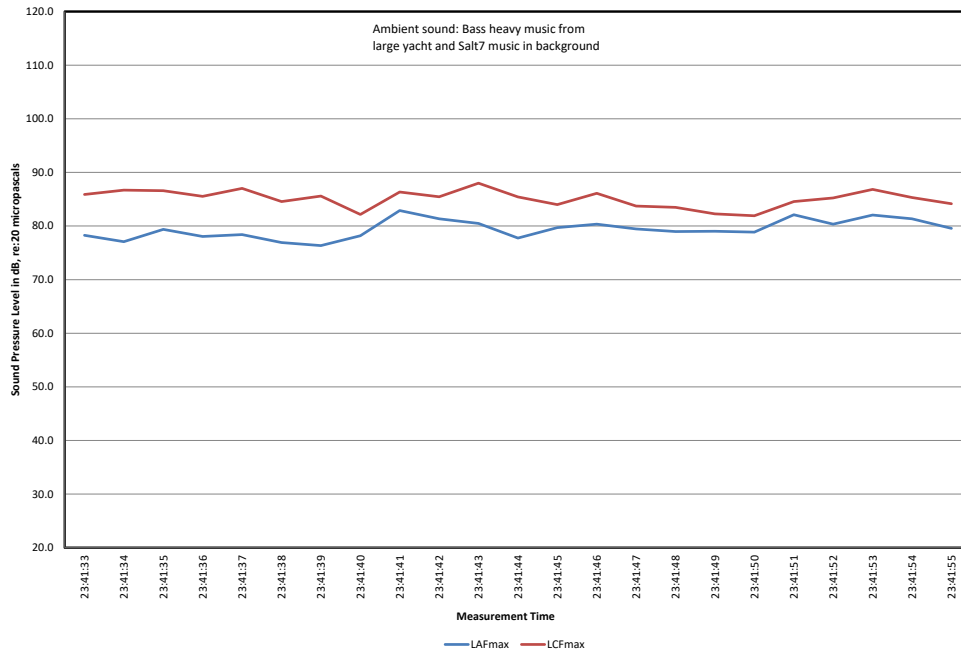
Fort Lauderdale Soundscape Study
Outside Rivertail restaurant
LD2.10
Thursday - February 16, 2023



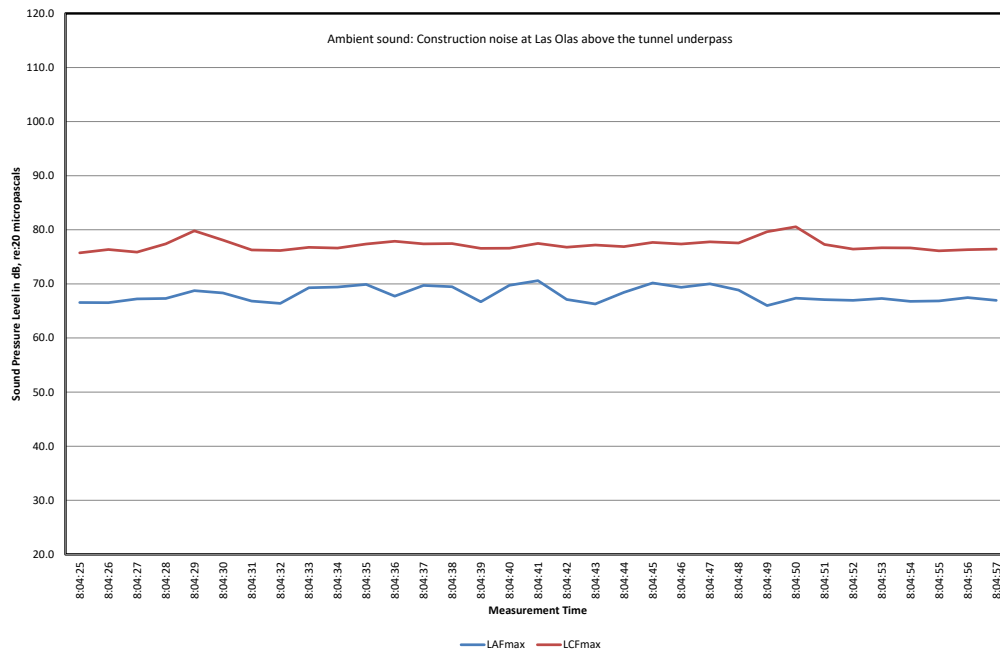
Fort Lauderdale Soundscape Study
Outside the Wharf between the Wharf and River
LD2.11
Thursday - February 16, 2023



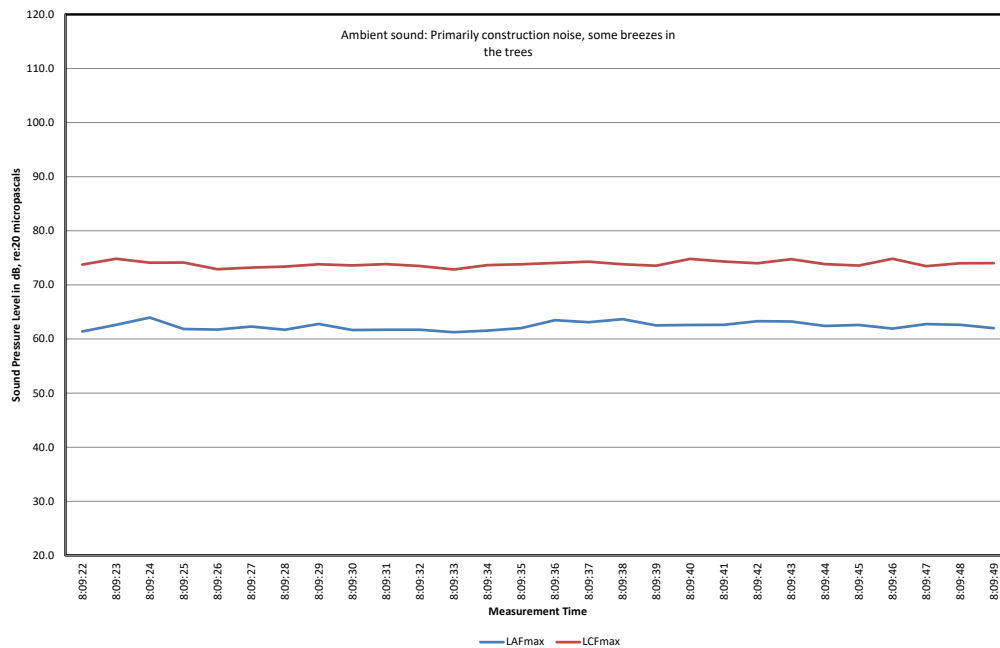
Fort Lauderdale Soundscape Study
In front of Salt7
LD2.12
Thursday - February 16, 2023



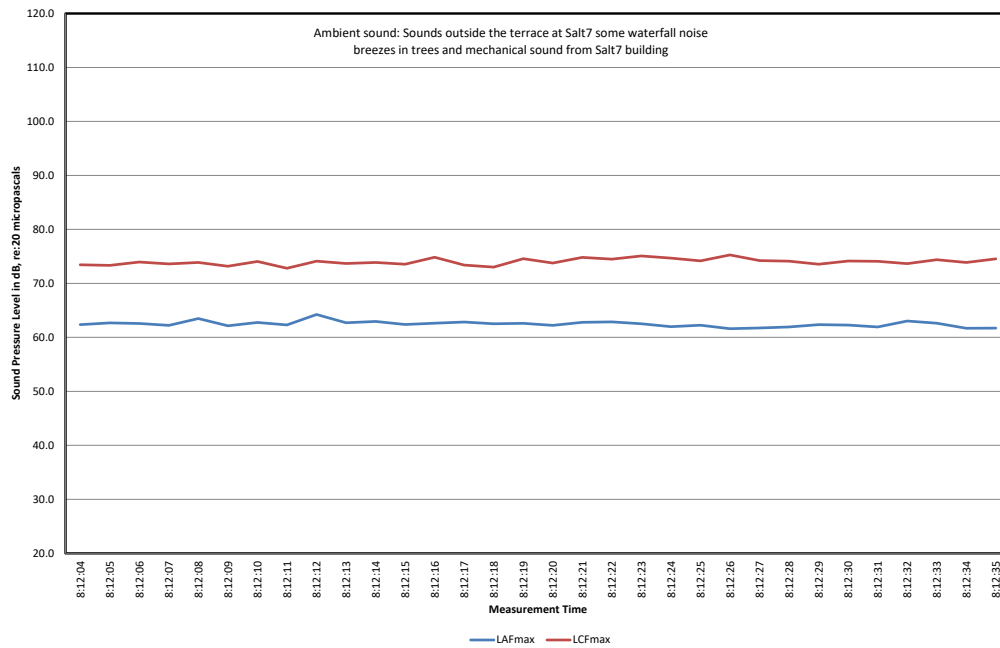
Fort Lauderdale Soundscape Study
Las Olas above the tunnel underpass
LD2.13
Friday - February 17, 2023



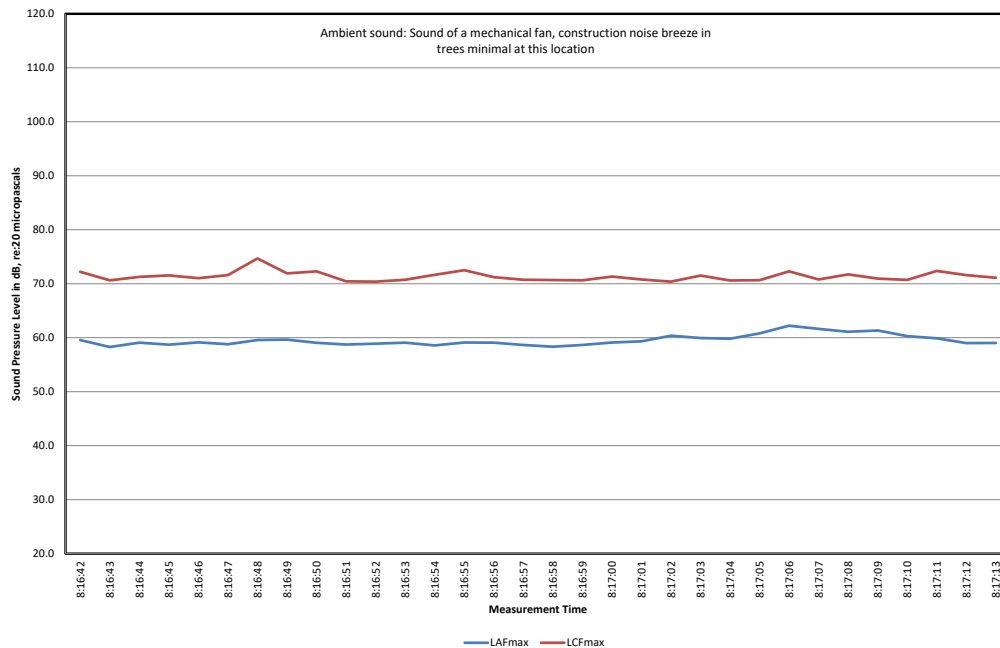
Fort Lauderdale Soundscape Study
Riverside Hotel entrance
LD2.14
Friday - February 17, 2023



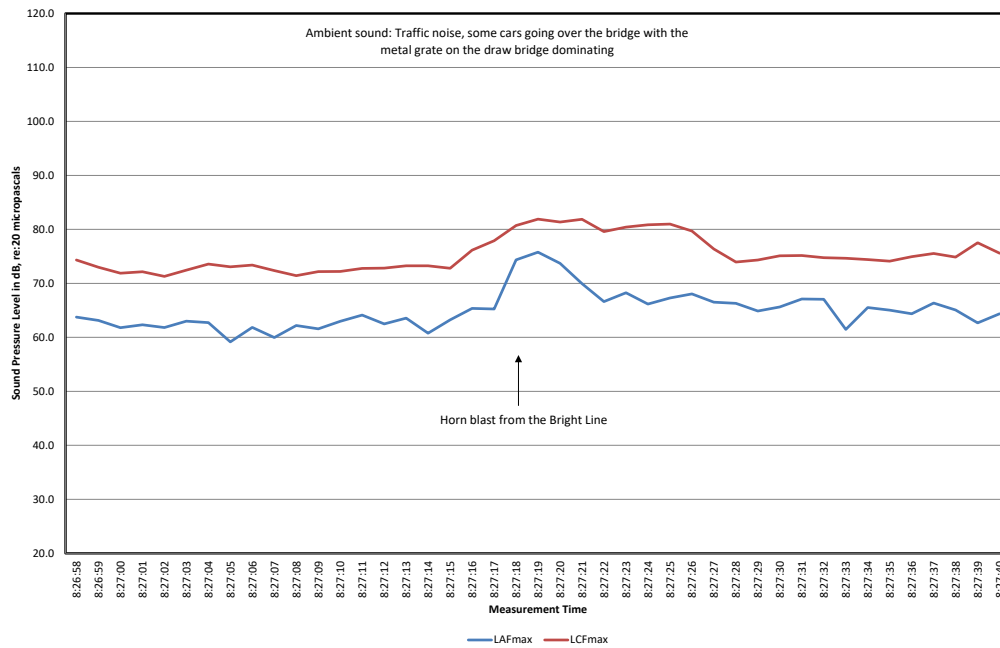
Fort Lauderdale Soundscape Study
Sounds outside the terrace at Salt7 some waterfall noise breezes in trees and some repetitive banging noise
LD2.15
Friday- February 17, 2023



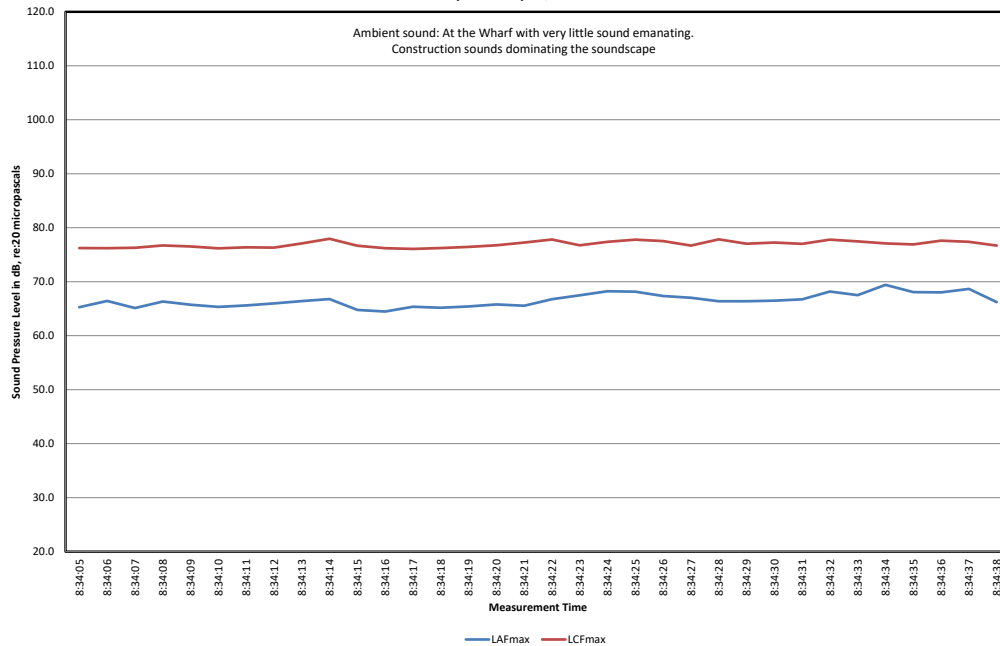
Fort Lauderdale Soundscape Study
Outside Salt7 on the west side
LD2.16
Friday- February 17, 2023



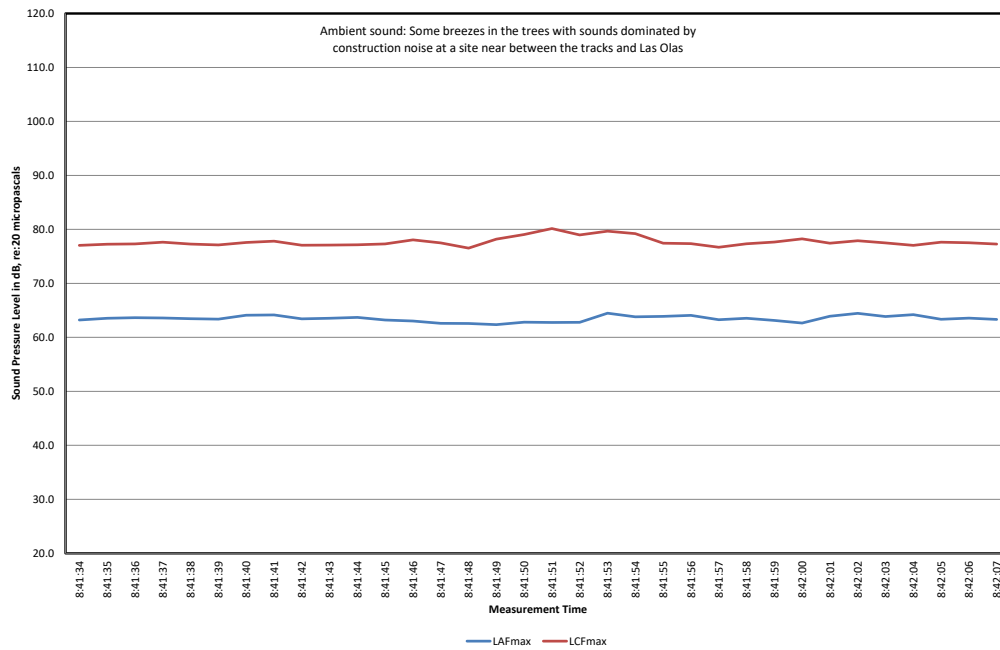
Fort Lauderdale Soundscape Study
Huizenga plaza
LD2.17
Friday- February 17, 2023



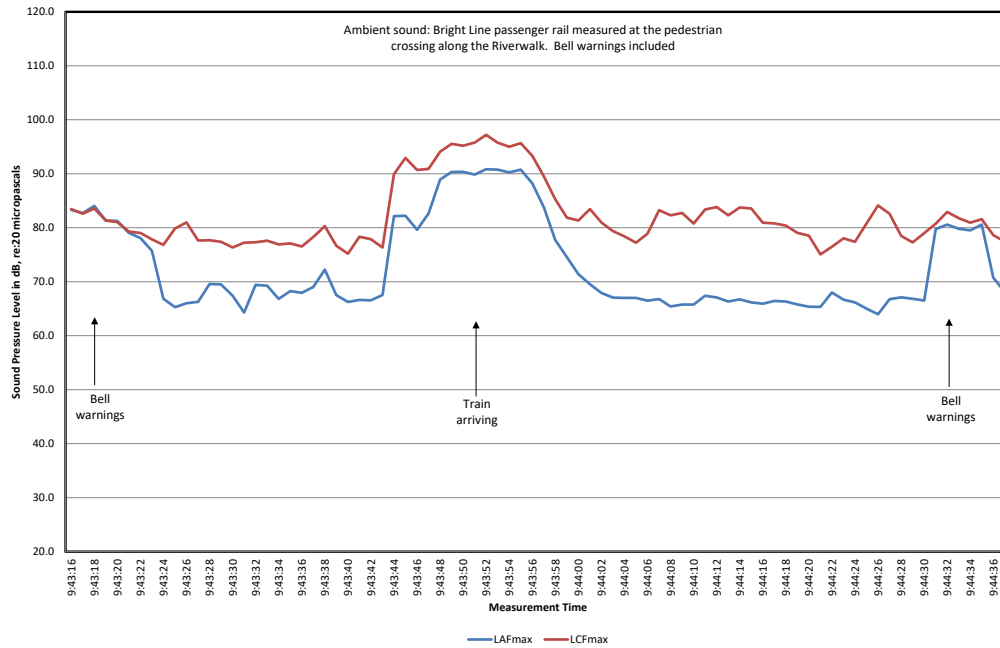
Fort Lauderdale Soundscape Study
At the Wharf
LD2.18
Friday- February 17, 2023



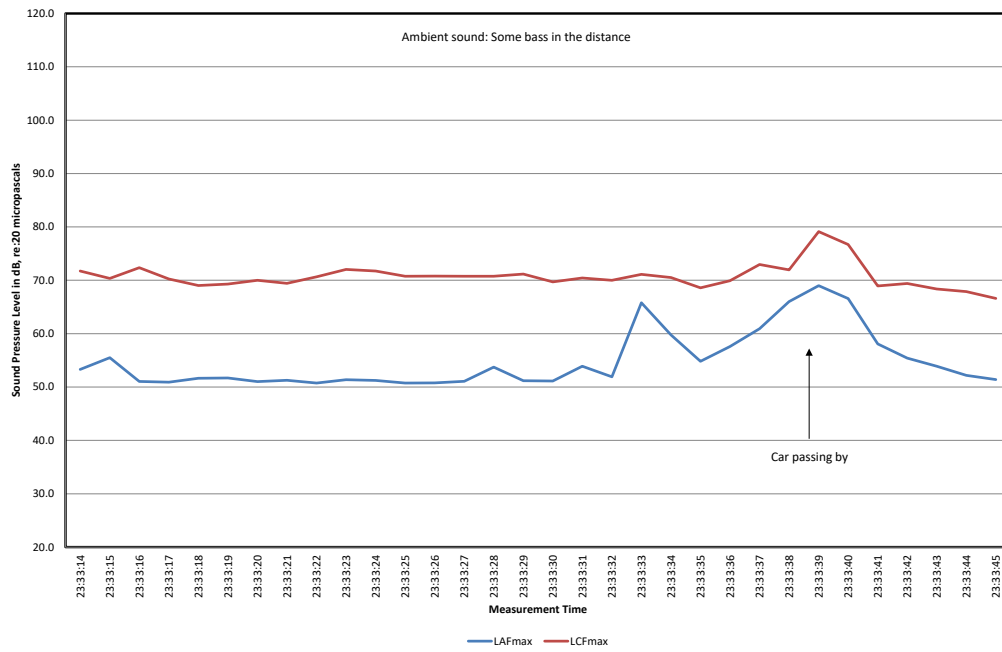
Fort Lauderdale Soundscape Study
In front of King Cromartie House
LD2.19
Friday - February 17, 2023



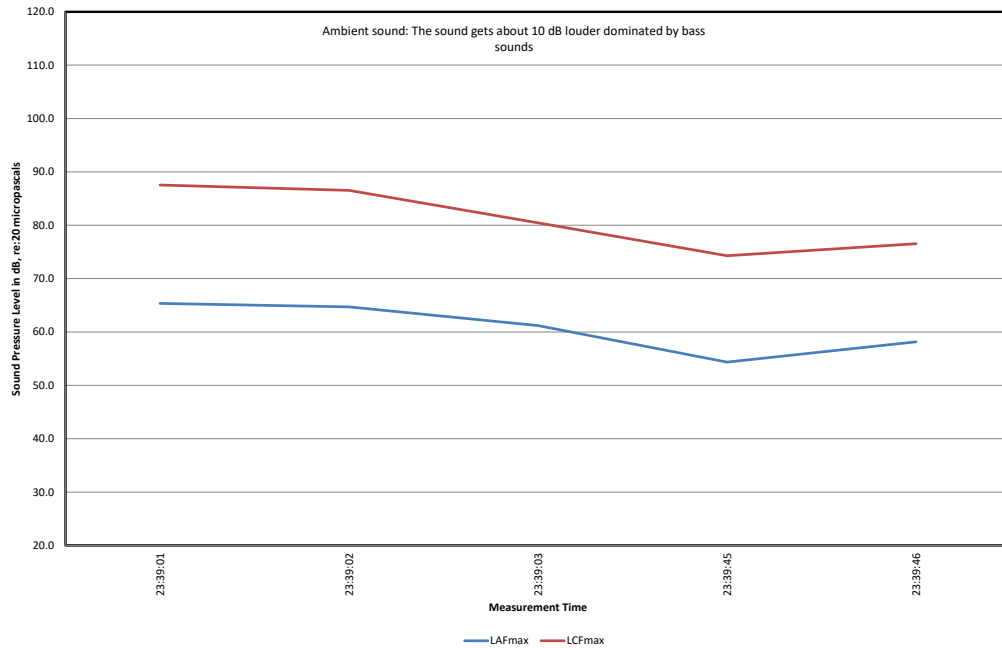
Fort Lauderdale Soundscape Study
At the pedestrian crossing along the Riverwalk
LD2.20
Friday - February 17, 2023



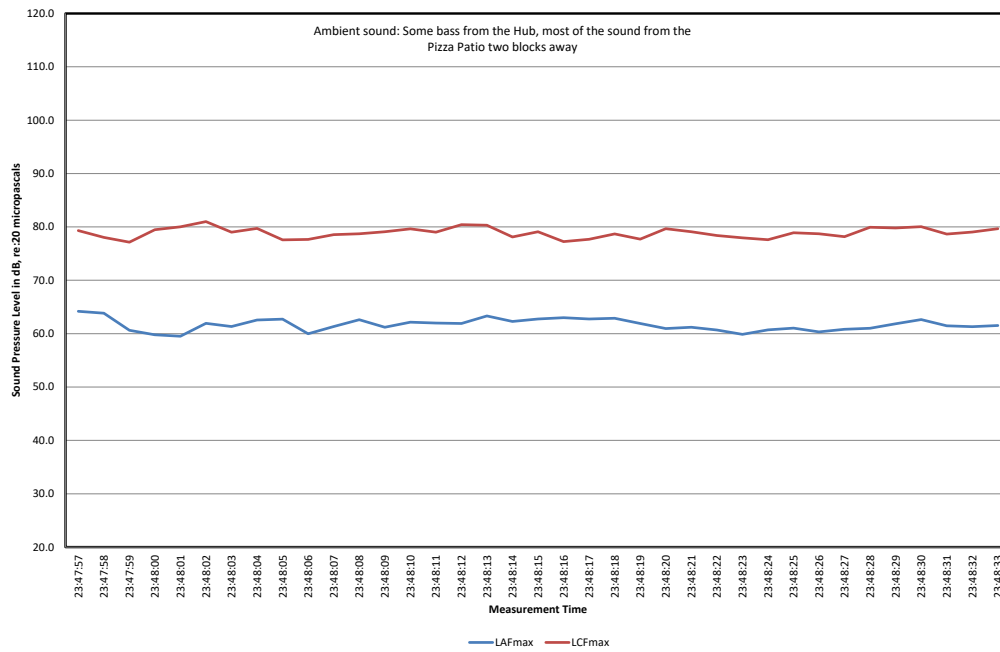
**Fort Lauderdale Soundscape Study
 Bamboo Flats
 LD2.21
 Friday - February 17, 2023**



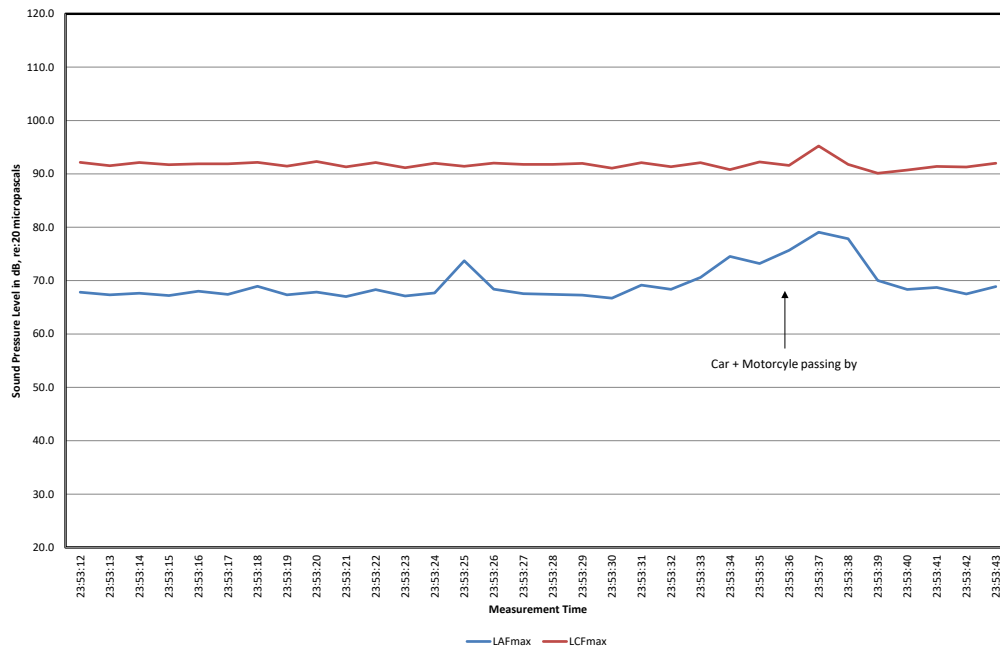
**Fort Lauderdale Soundscape Study
 In front of Rose Bar – when the door opens
 LD2.22
 Friday - February 17, 2023**



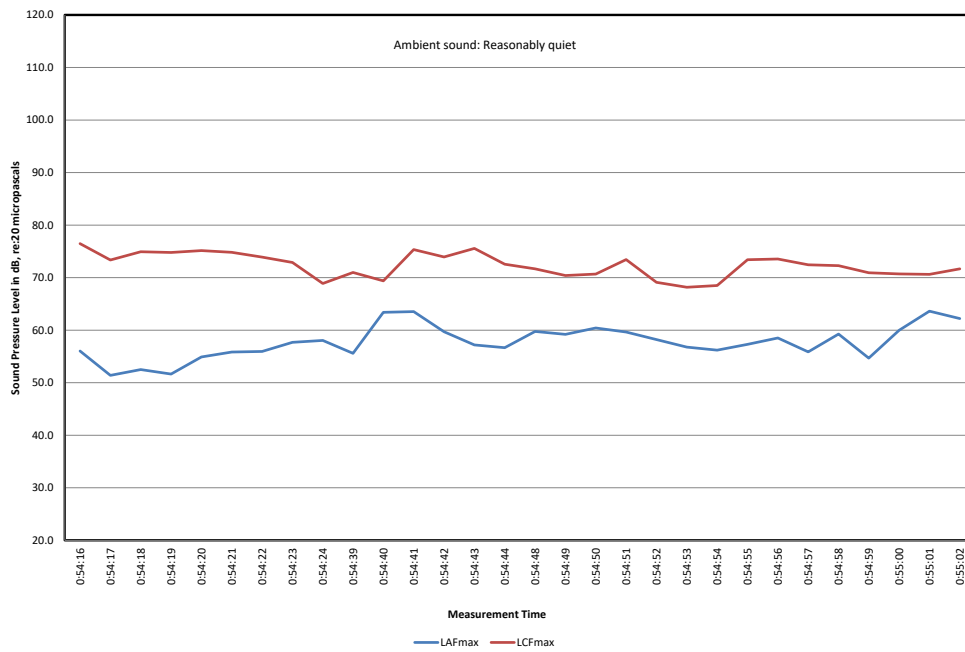
Fort Lauderdale Soundscape Study
North of the Hub
LD2.23
Friday - February 17, 2023



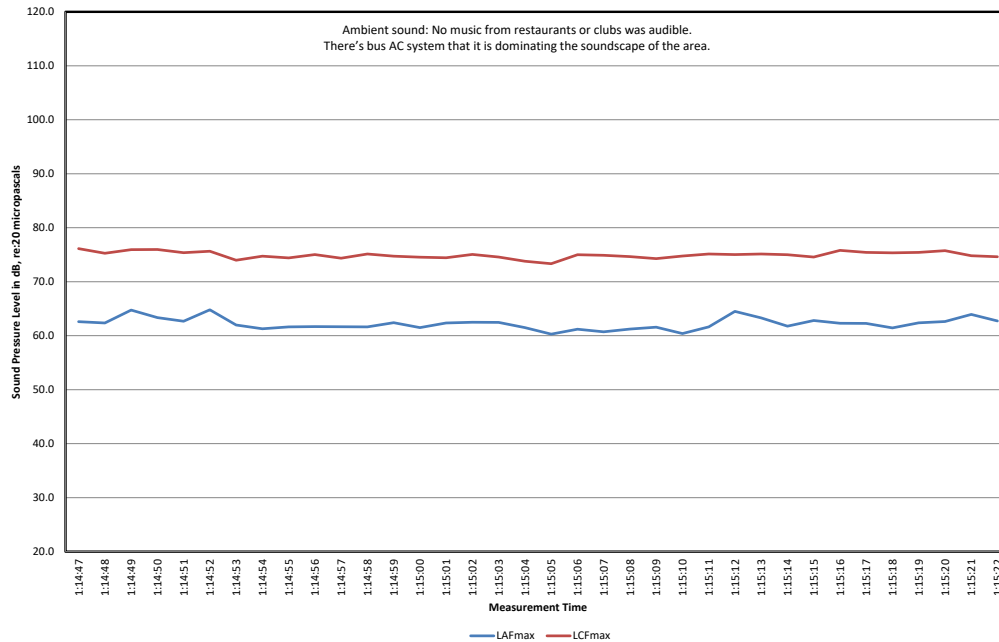
Fort Lauderdale Soundscape Study
Closer to the Pizza Patio, about 600 to 700 feet across the street and railroad tracks
LD2.24
Friday - February 17, 2023



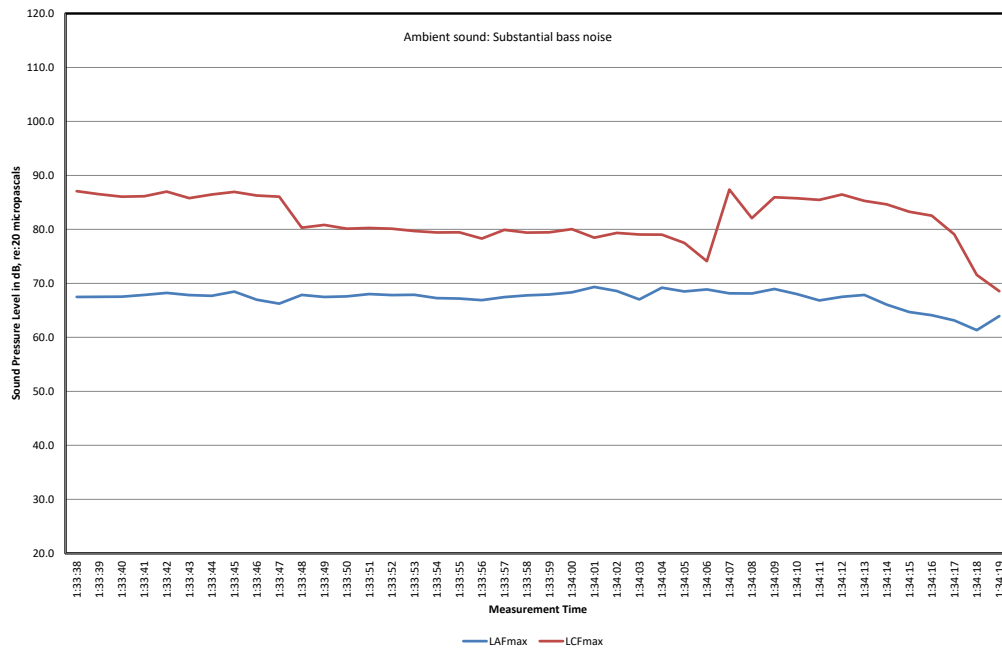
Fort Lauderdale Soundscape Study
Behind the Truth Lounge
LD2.25
Saturday - February 18, 2023



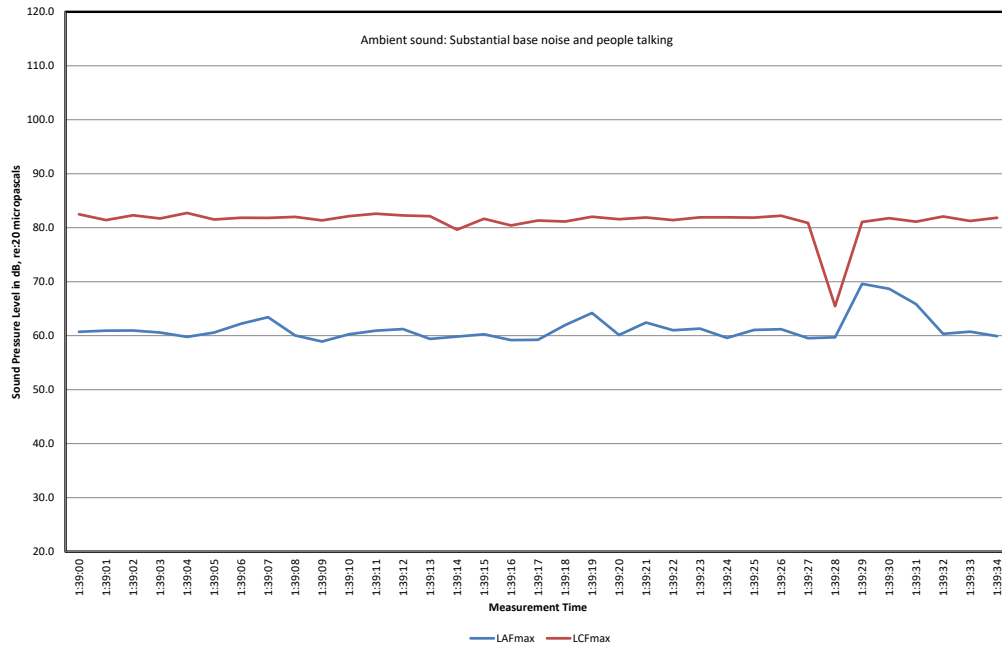
Fort Lauderdale Soundscape Study
Beach entertainment district. Behind Drunken Taco in the clubs along the beach near Las Olas
LD2.26
Saturday - February 18, 2023



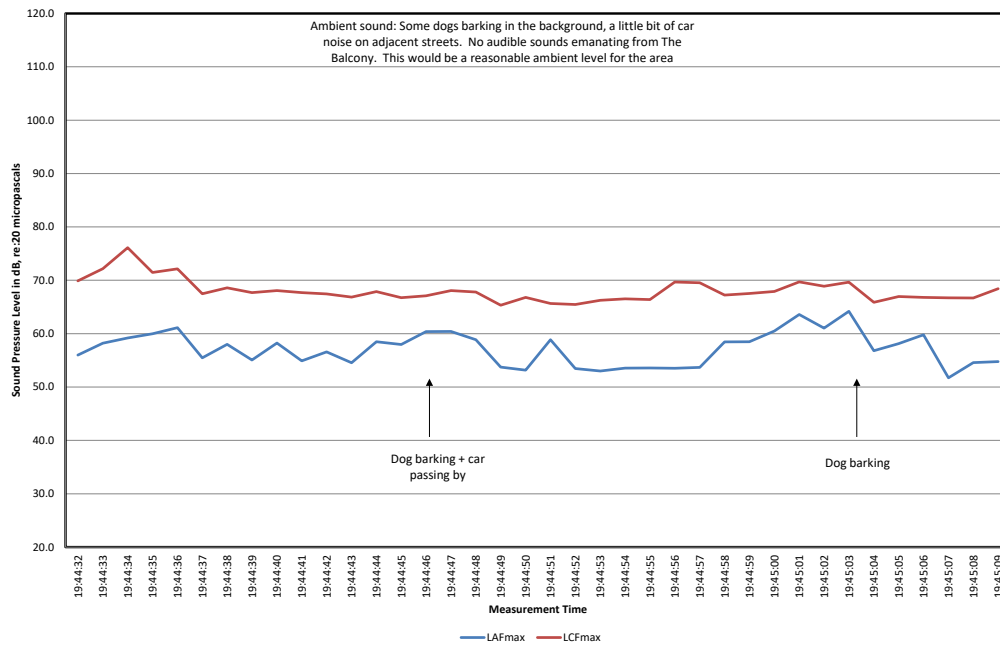
Fort Lauderdale Soundscape Study
At the property line behind The Balcony
LD2.27
Saturday - February 18, 2023



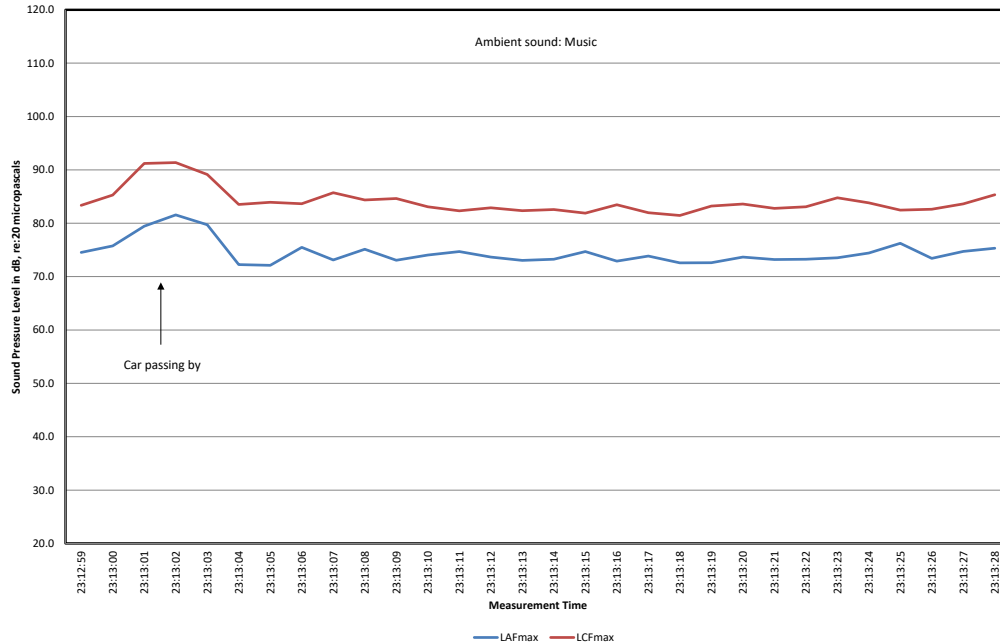
Fort Lauderdale Soundscape Study
Measuring behind The Balcony, a block away
LD2.28
Saturday - February 18, 2023



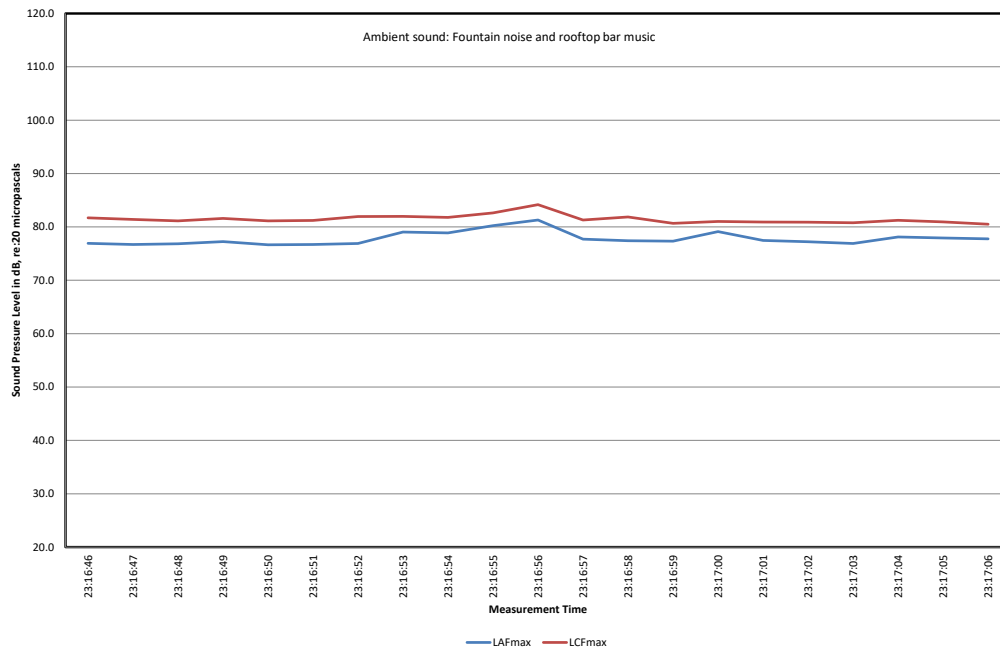
Fort Lauderdale Soundscape Study
Across the parking lot a block away from the Balcony
LD2.29
Saturday - February 18, 2023



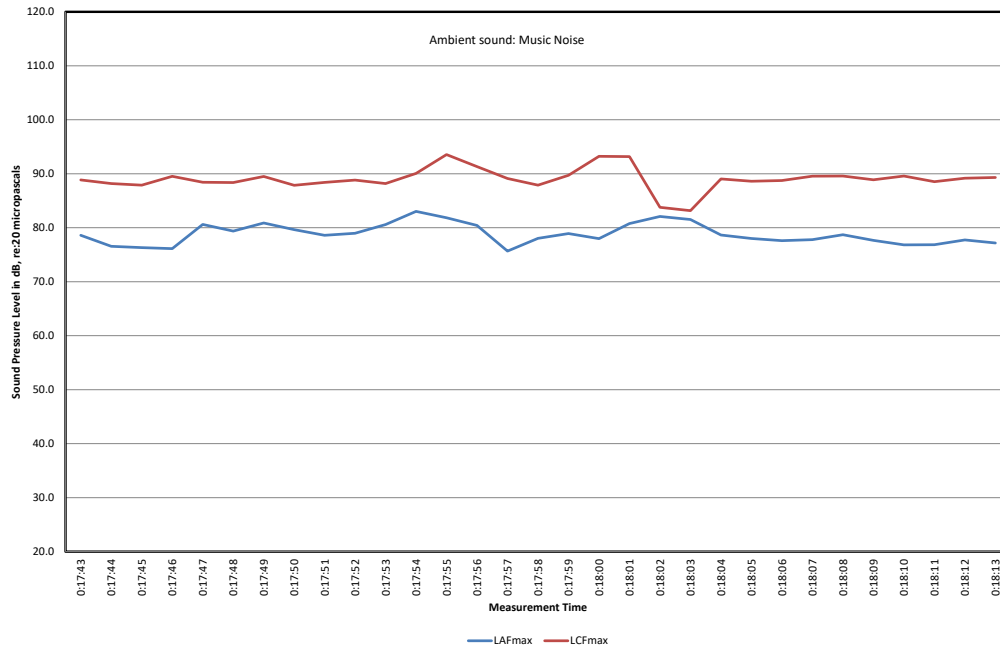
Fort Lauderdale Soundscape Study
Across the street from roof of Rooftop Bar On Andrews and Las Olas
LD2.30
Saturday - February 18, 2023



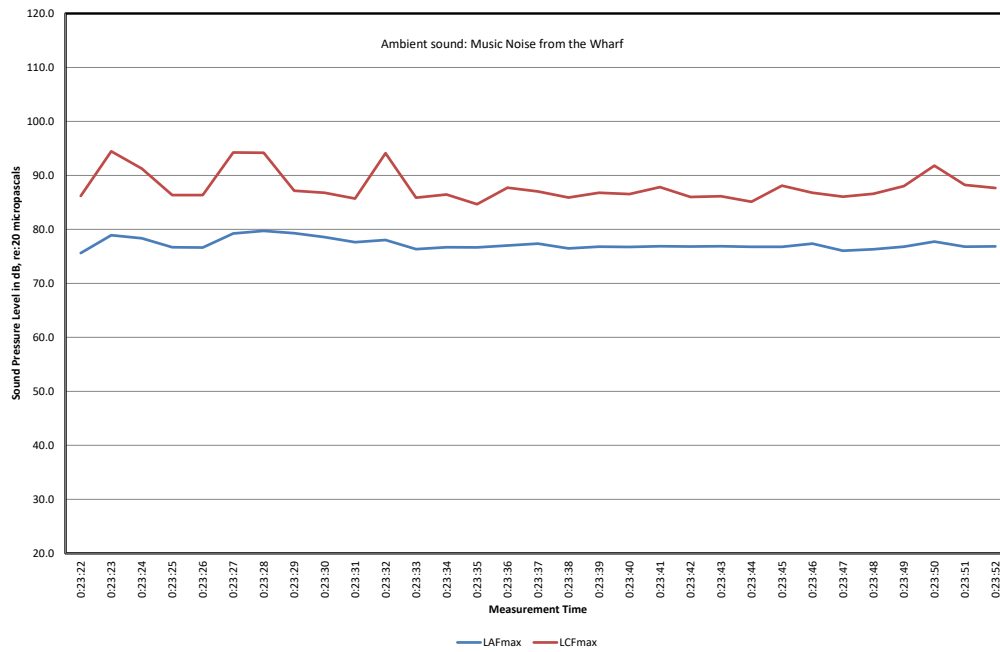
Fort Lauderdale Soundscape Study
The fountain outside Huizenga Park near Las Olas
LD2.31
Saturday - February 18, 2023



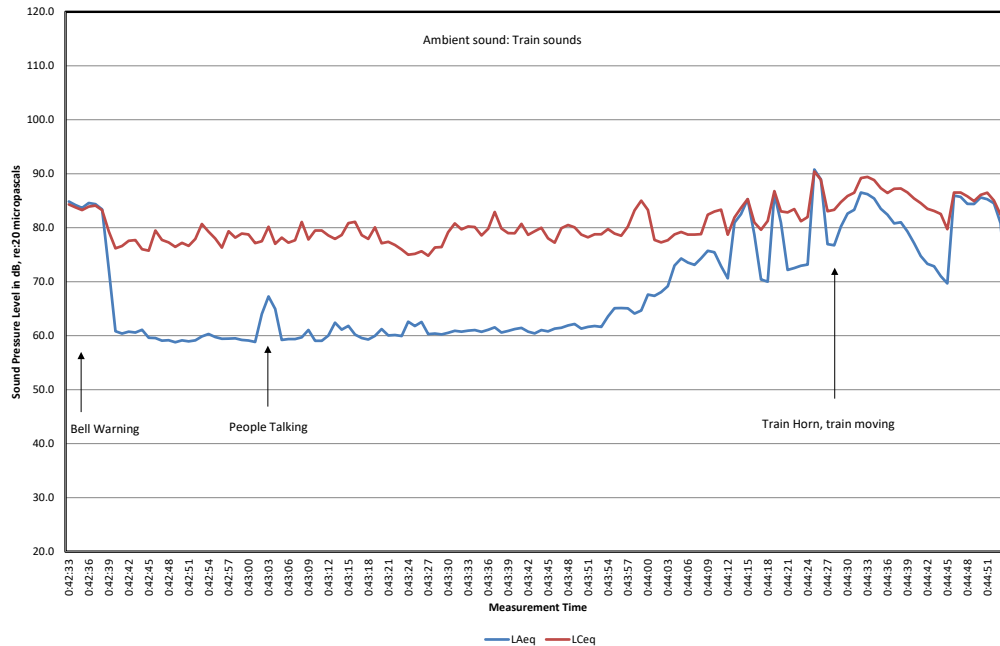
Fort Lauderdale Soundscape Study
Standing outside the Wharf
LD2.32
Saturday - February 18, 2023



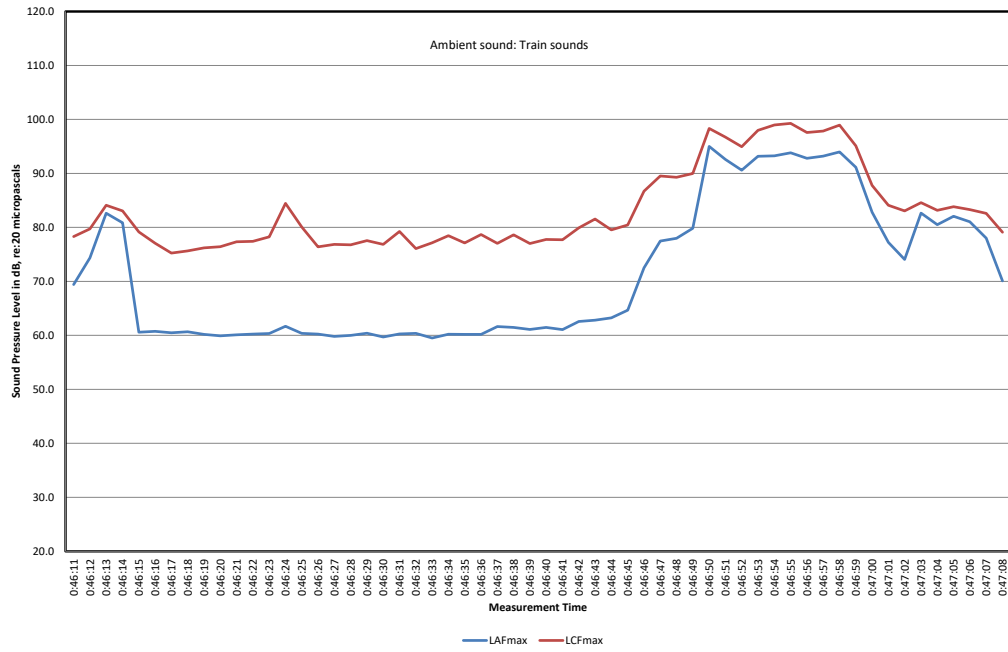
Fort Lauderdale Soundscape Study
On the top level (seventh floor) of the parking garage to the east of the Wharf on the second floor
LD2.33
Saturday - February 18, 2023



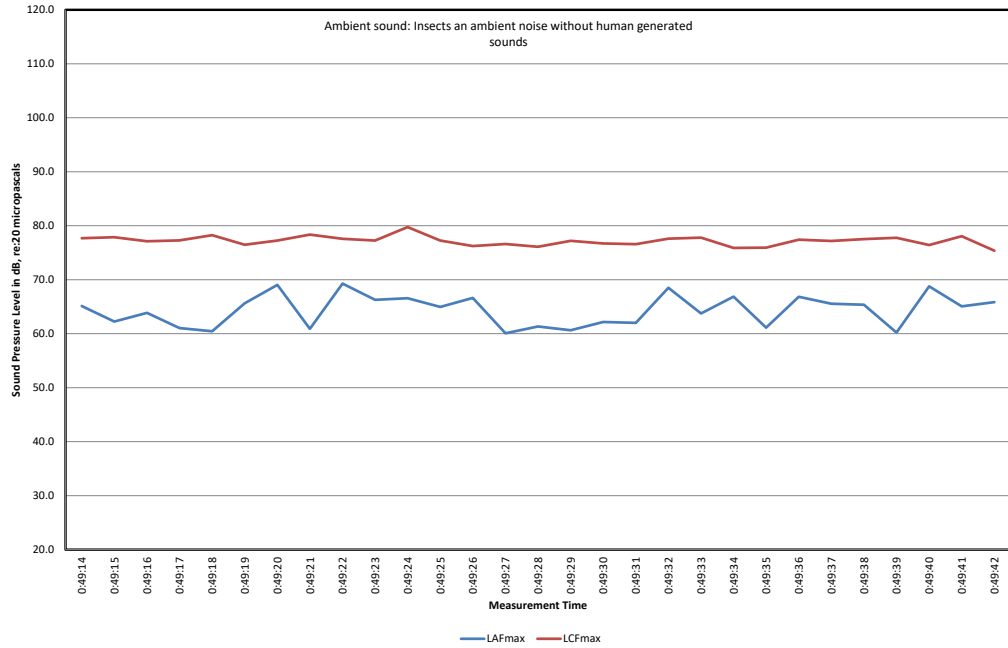
Fort Lauderdale Soundscape Study
Maintenance train moving down the track with horns and moving fairly slowly
LD2.34
Saturday - February 18, 2023



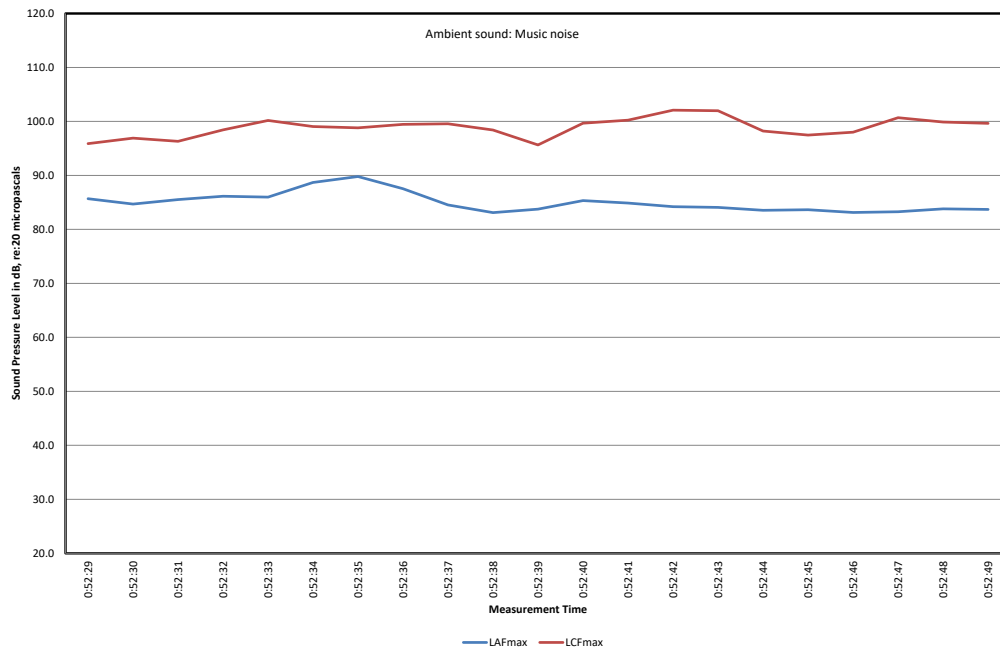
Fort Lauderdale Soundscape Study
Riverwalk area
LD2.35
Saturday - February 18, 2023



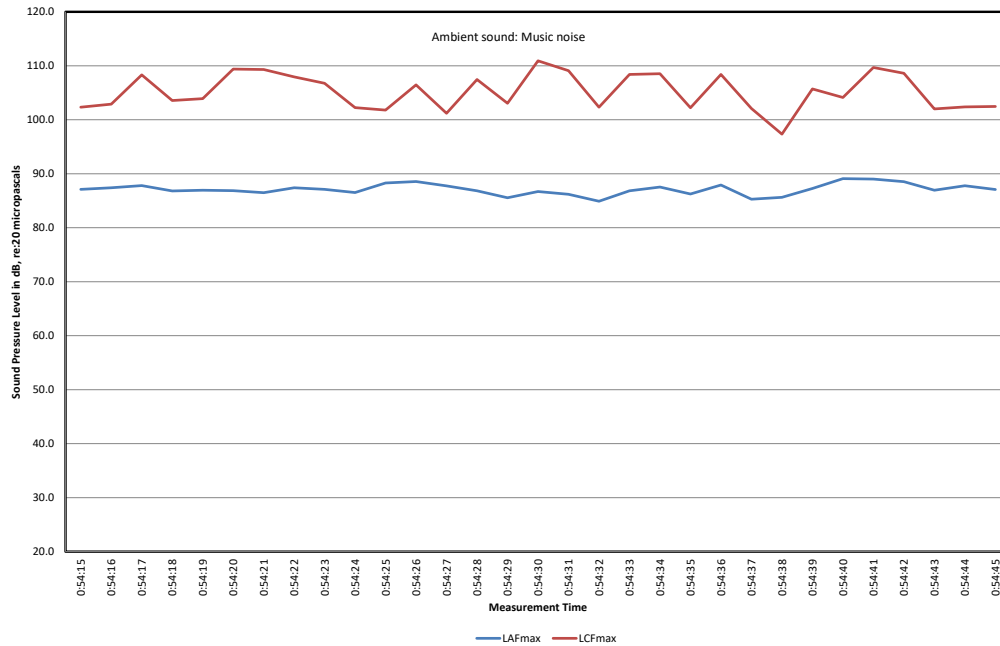
Fort Lauderdale Soundscape Study
In front of the King Cromartie House
LD2.36
Saturday - February 18, 2023



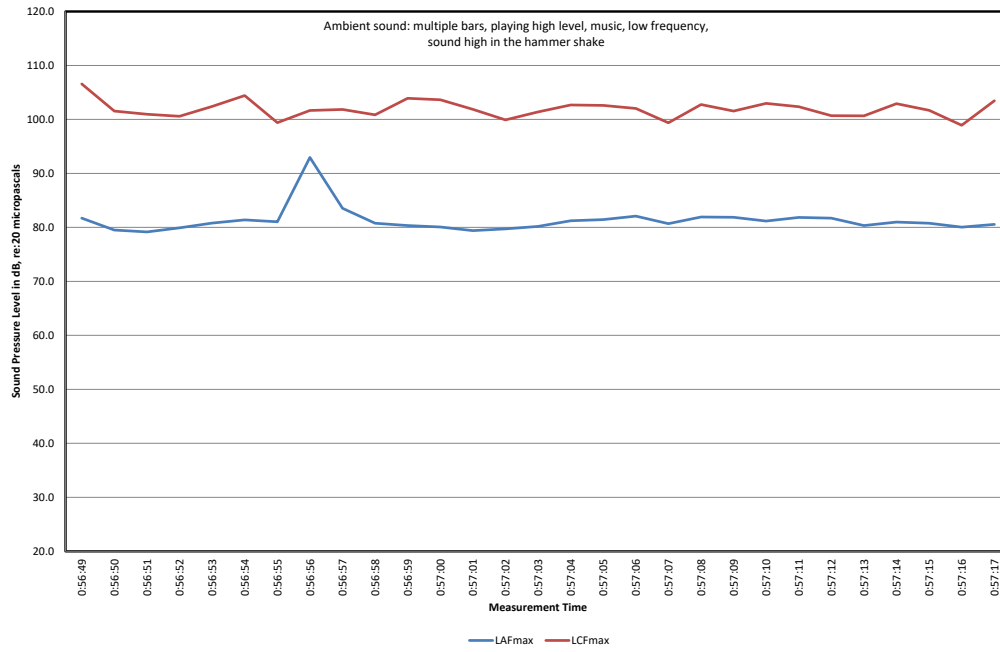
Fort Lauderdale Soundscape Study
In front of the clubs at the corner of Himmarshee district the first club on the corner
LD2.37
Sunday - February 19, 2023



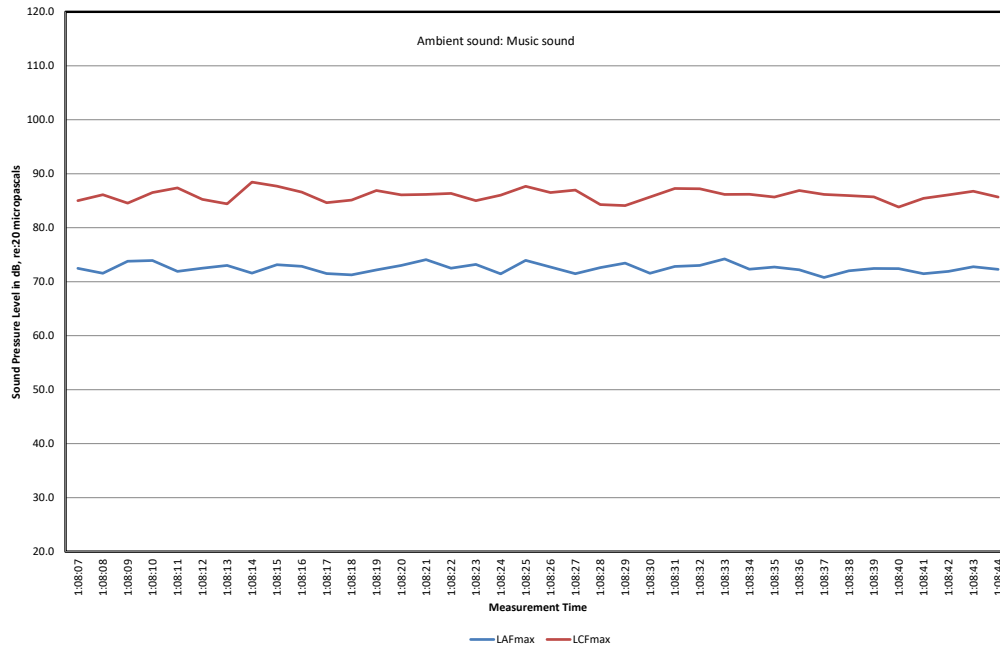
Fort Lauderdale Soundscape Study
In front of the Clovis in the Himmarshee district wide open outdoors
LD2.38
Sunday - February 19, 2023



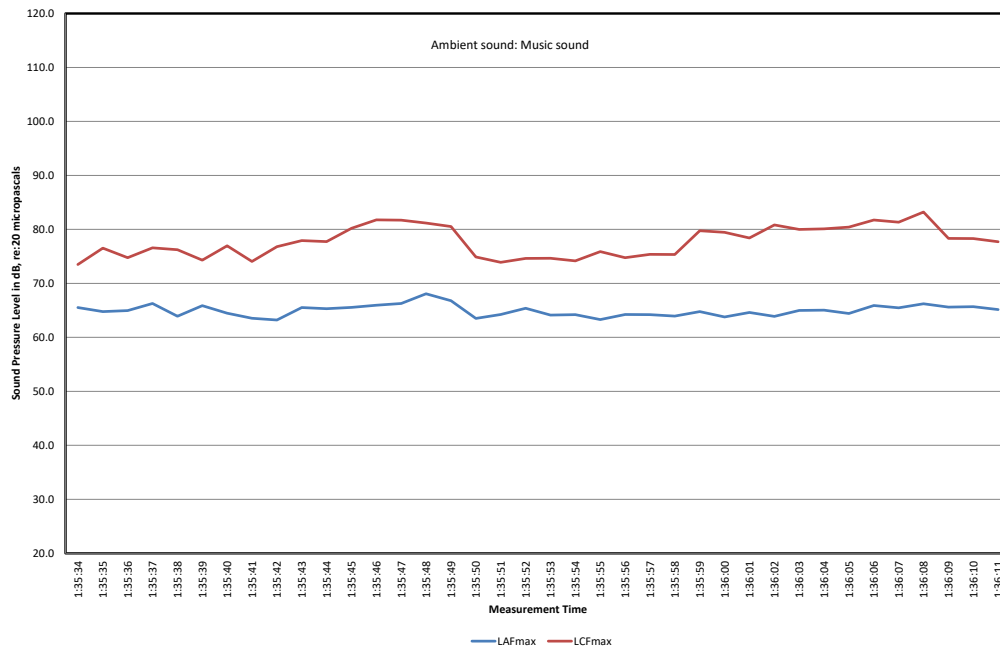
**Fort Lauderdale Soundscape Study
 Himmarshee District
 LD2.39
 Sunday - February 19, 2023**



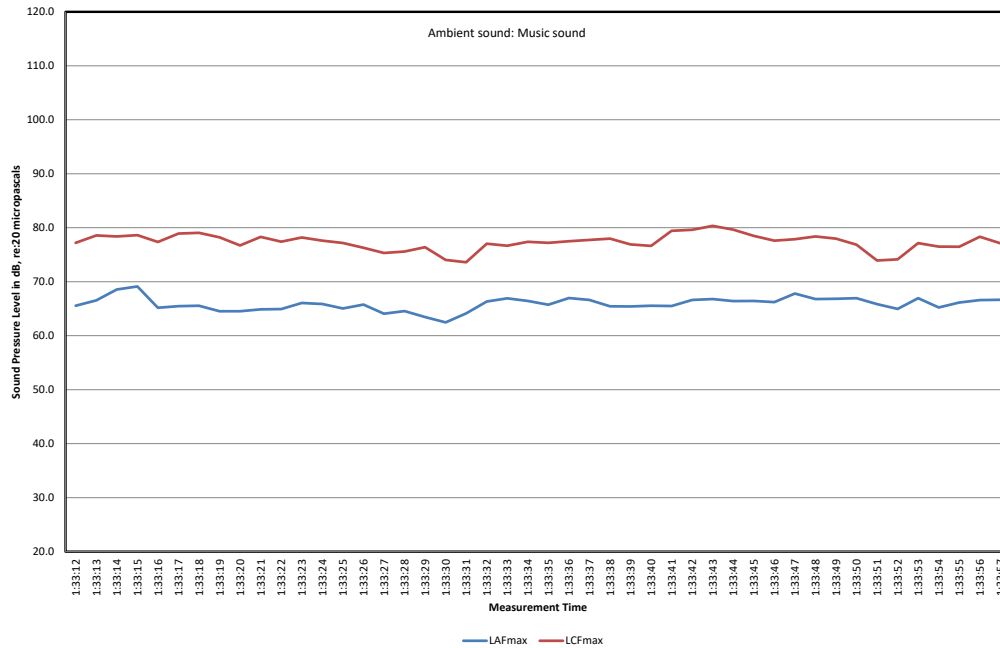
**Fort Lauderdale Soundscape Study
 On the roof of the garage looking out over the Himmarshee District
 LD2.40
 Sunday - February 19, 2023**



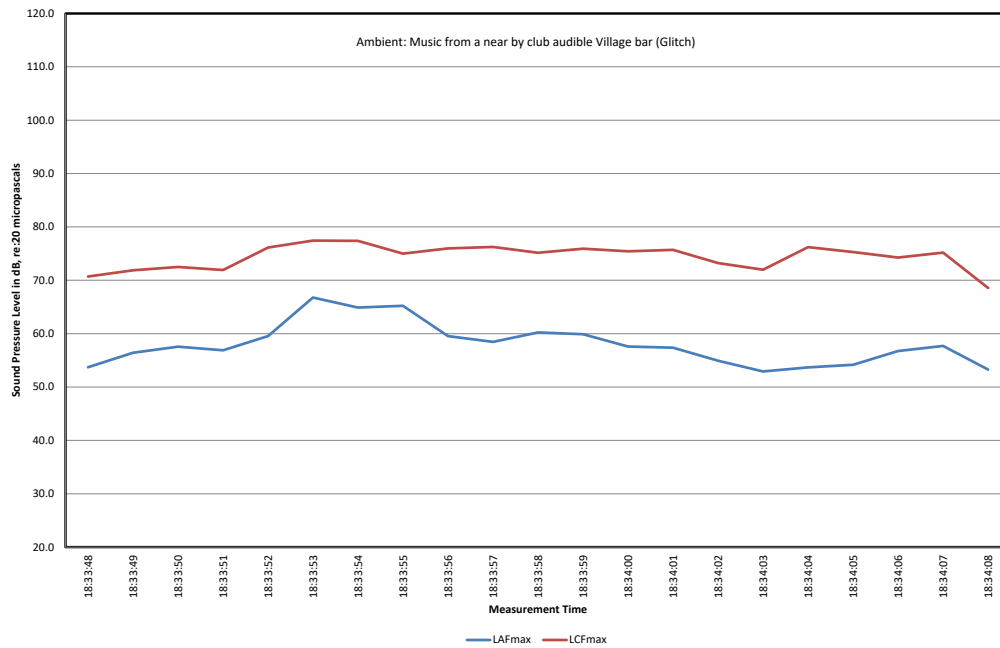
Fort Lauderdale Soundscape Study
On the parking deck at the gap between the parking garage across from Yolo at the bridge between two parking decks
LD2.42
Sunday - February 19, 2023



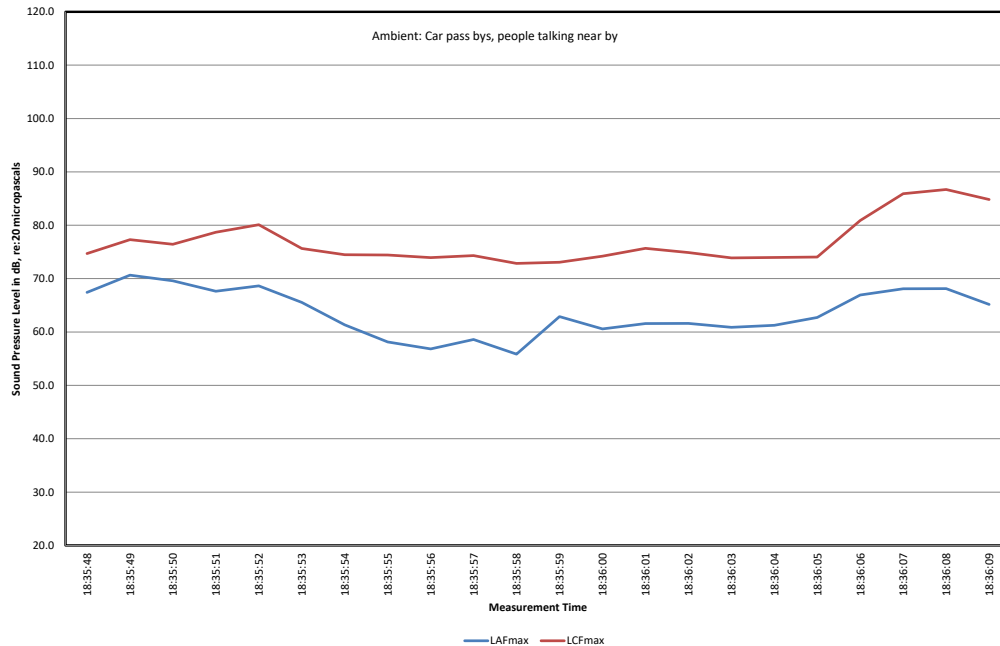
Fort Lauderdale Soundscape Study
Across the street from Yolo on top of the parking deck
LD2.41
Sunday - February 19, 2023



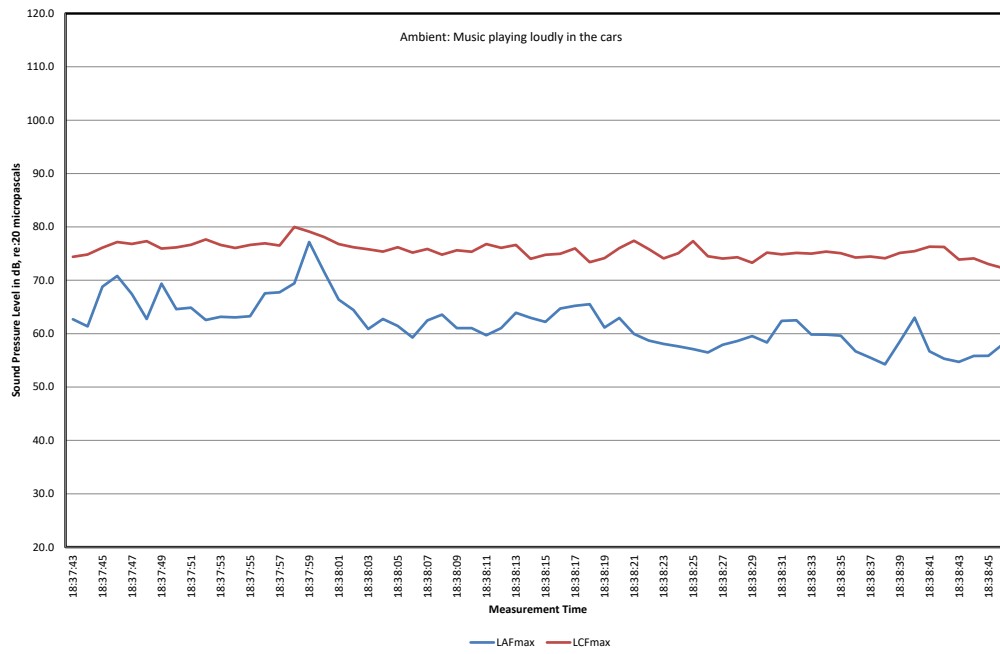
Fort Lauderdale Soundscape Study
Across the street from the Hub (828 NE Fourth Ave)
LD3.01
Thursday - February 16, 2023



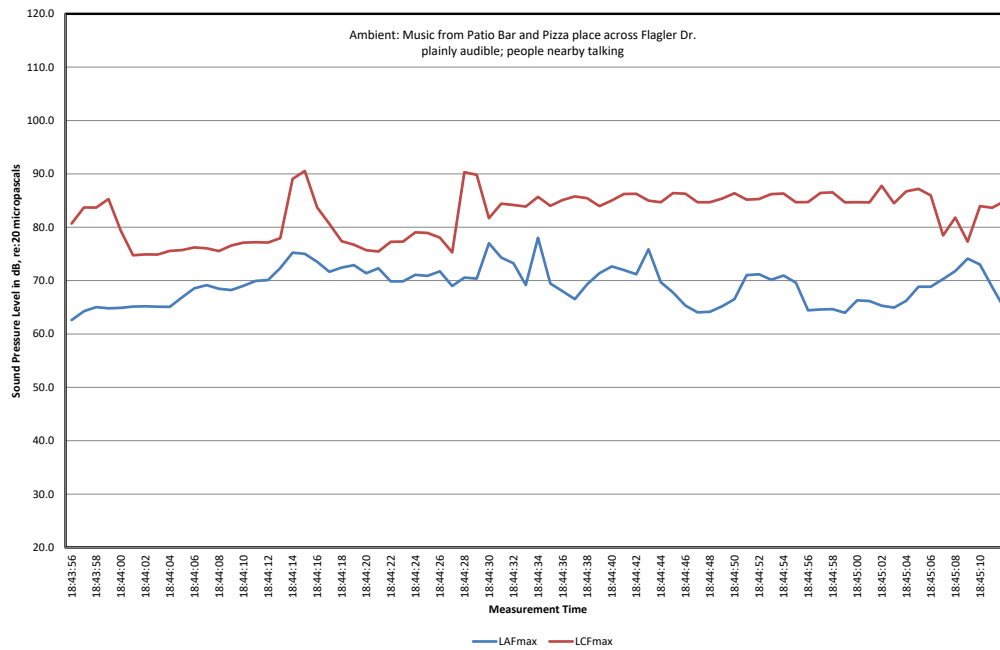
Fort Lauderdale Soundscape Study
Corner of parking lot in front of rail line with sight line to the Glitch
LD3.02
Thursday - February 16, 2023



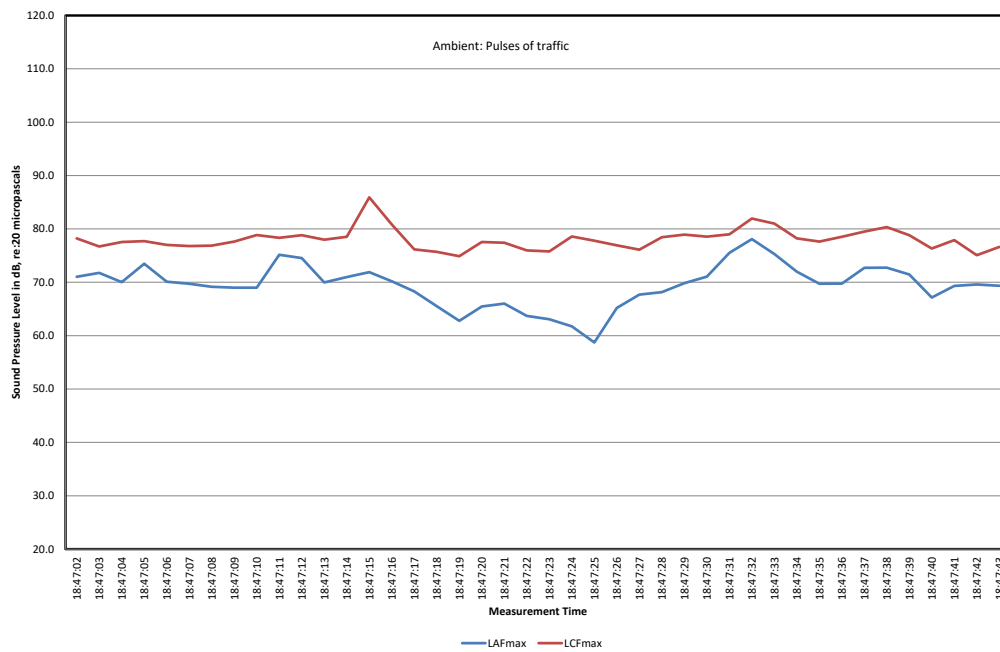
Fort Lauderdale Soundscape Study
Middle of parking lot of Glitch bar
LD3.03
Thursday - February 16, 2023



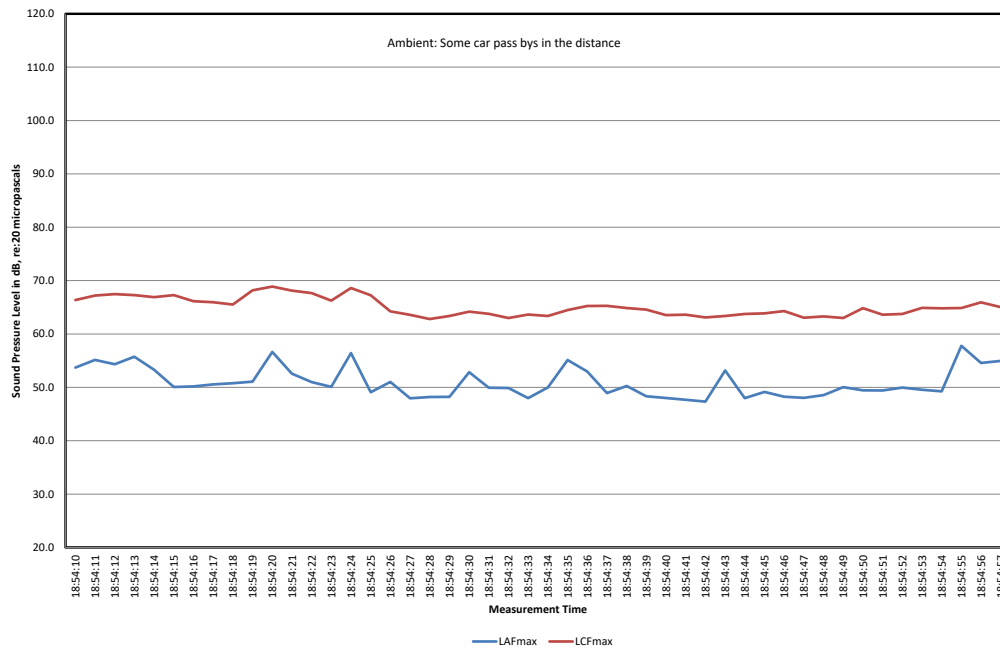
Fort Lauderdale Soundscape Study
NE 3rd Avenue and Flagler Dr
LD3.04
Thursday - February 16, 2023



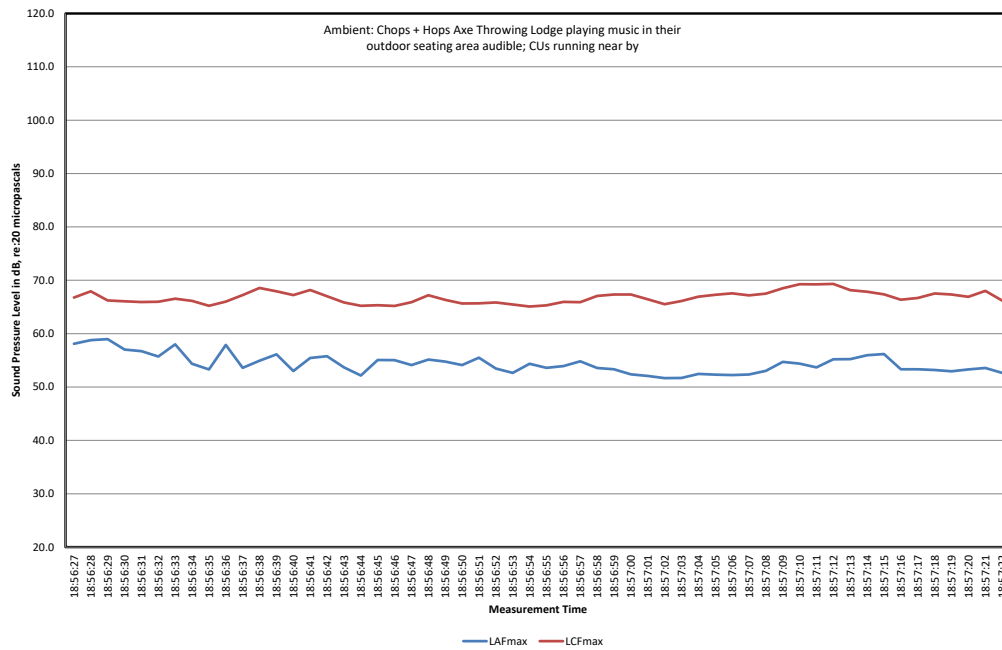
Fort Lauderdale Soundscape Study
NE 3rd Avenue and Flagler Dr (same as Ld04)
LD3.05
Thursday - February 16, 2023



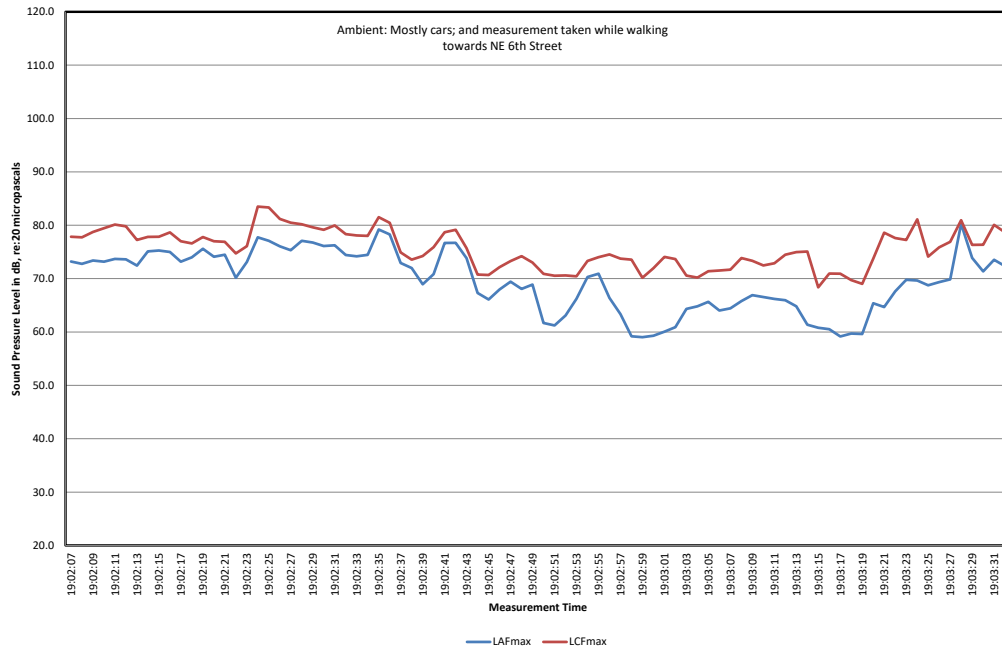
Fort Lauderdale Soundscape Study
By the Event Bliss on NE First Avenue
LD3.06
Thursday - February 16, 2023



Fort Lauderdale Soundscape Study
NE Seventh St
LD3.07
Thursday - February 16, 2023



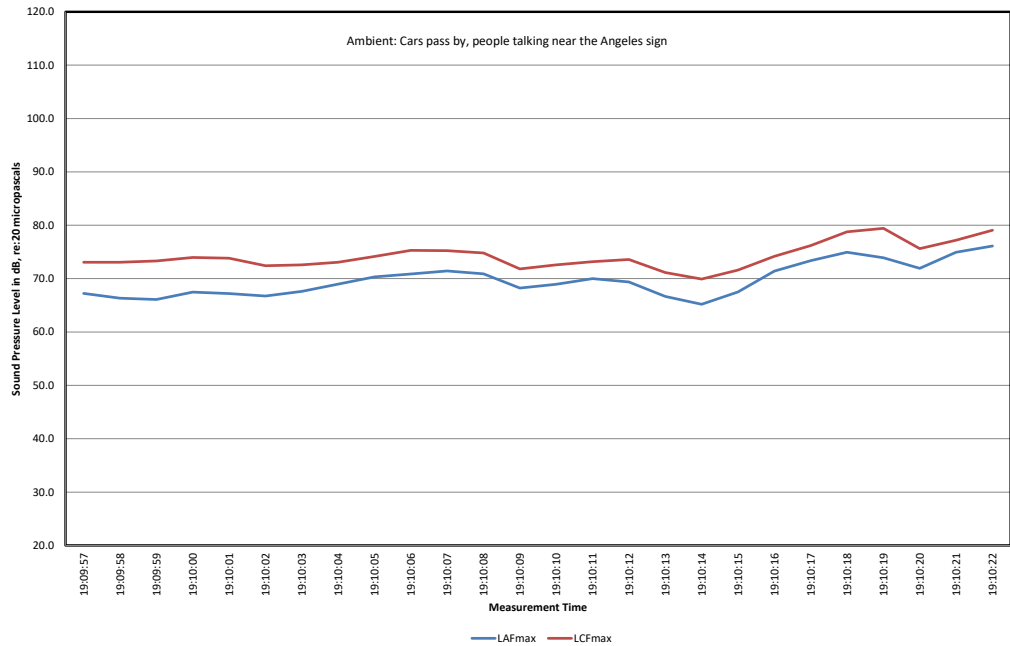
Fort Lauderdale Soundscape Study
Along NE 3rd Avenue from NW 7th Street to NE 6th Street
LD3.08
Thursday - February 16, 2023



Fort Lauderdale Soundscape Study
From Circle T food store which was across the street
LD3.09
Thursday - February 16, 2023



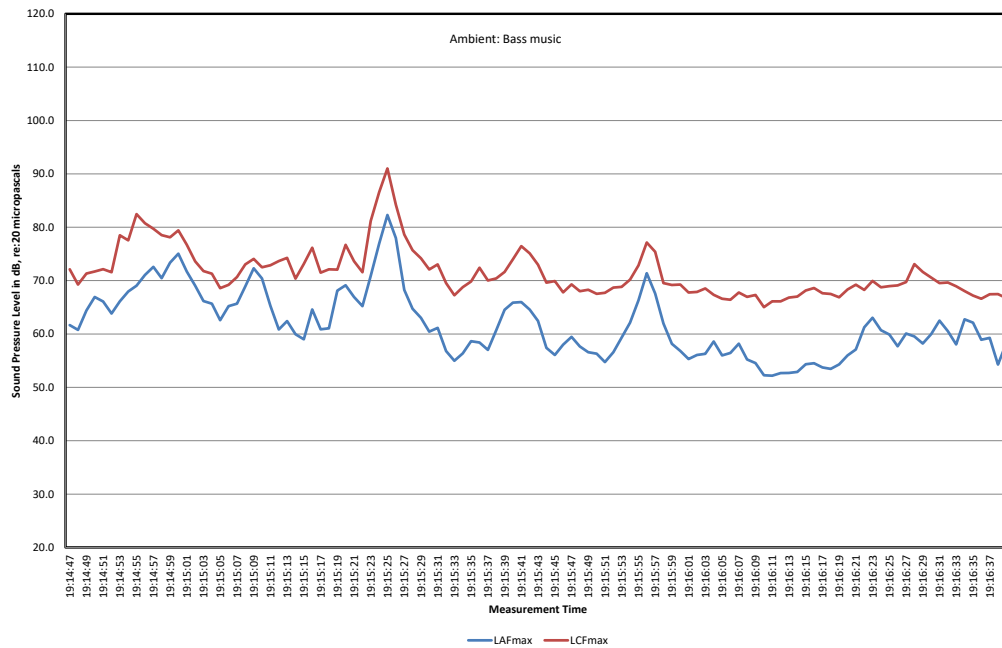
Fort Lauderdale Soundscape Study
Along NE 3rd Avenue from NE 5th Street to Holly Blue Restaurant
LD3.10
Thursday - February 16, 2023



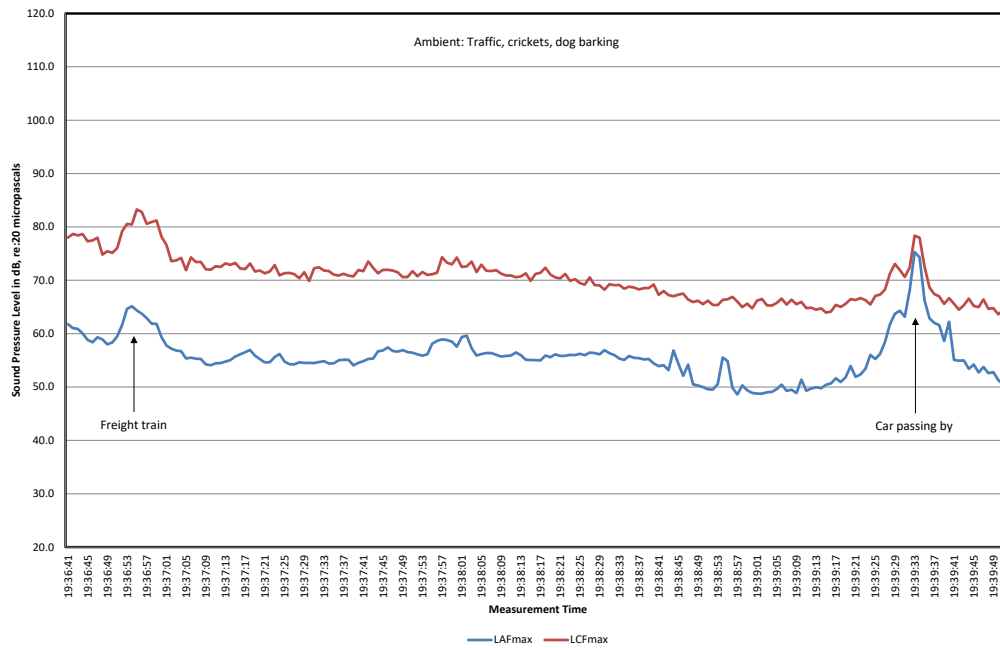
Fort Lauderdale Soundscape Study
By the dining area of the Angeles
LD3.11
Thursday - February 16, 2023



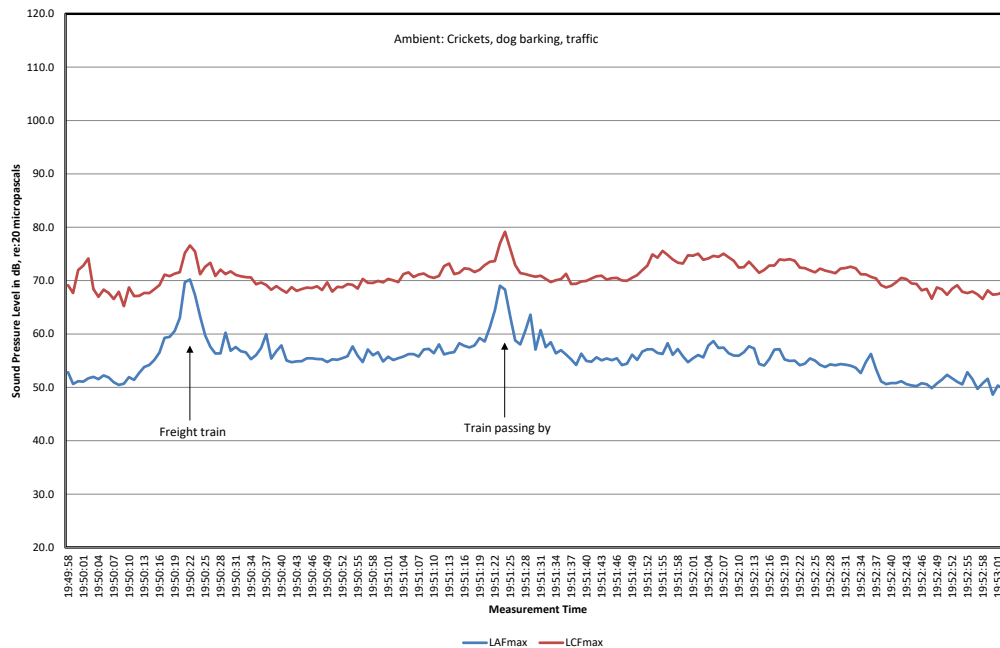
Fort Lauderdale Soundscape Study
The Hub
LD3.12
Thursday - February 16, 2023



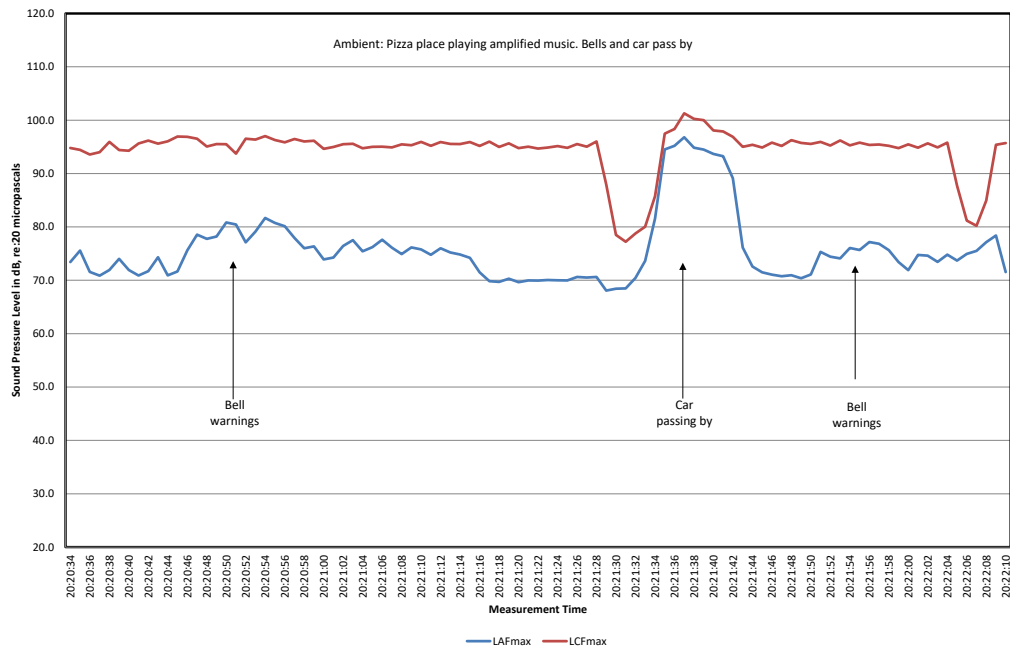
**Fort Lauderdale Soundscape Study
 Bamboo Flats
 LD3.13
 Thursday - February 16, 2023**



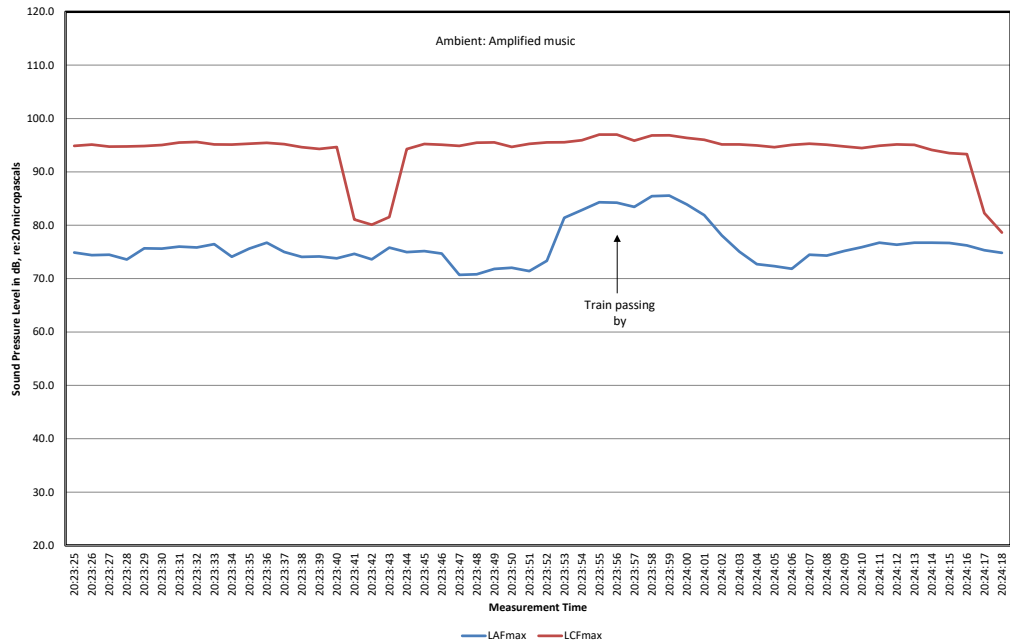
**Fort Lauderdale Soundscape Study
 Bamboo Flats
 LD3.14
 Thursday - February 16, 2023**



**Fort Lauderdale Soundscape Study
 By train tracks
 LD3.15
 Thursday - February 16, 2023**



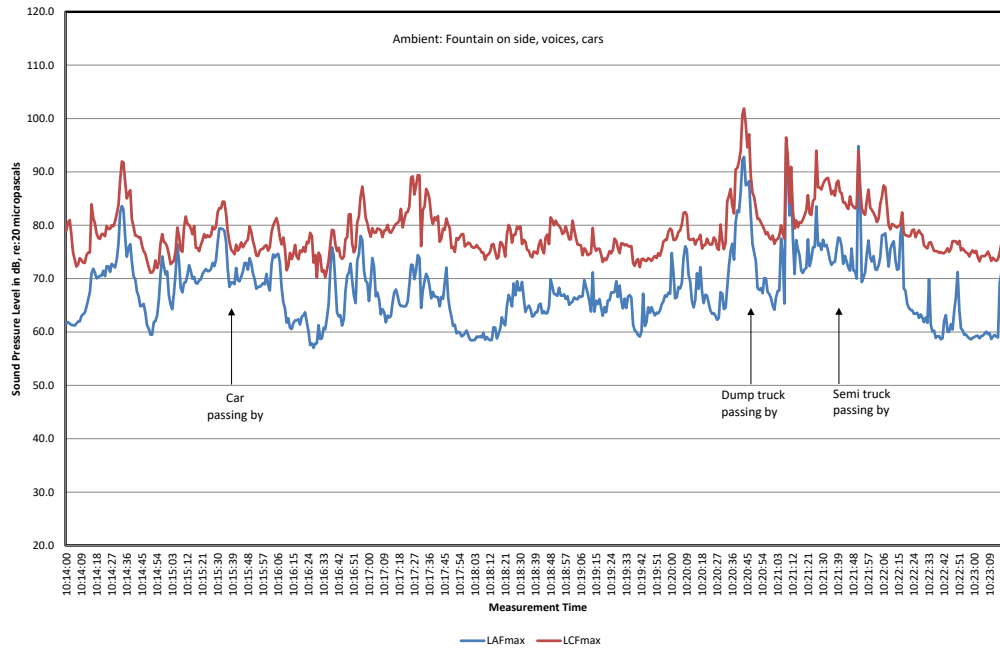
**Fort Lauderdale Soundscape Study
 Across the street, in front of train
 LD3.16
 Thursday - February 16, 2023**



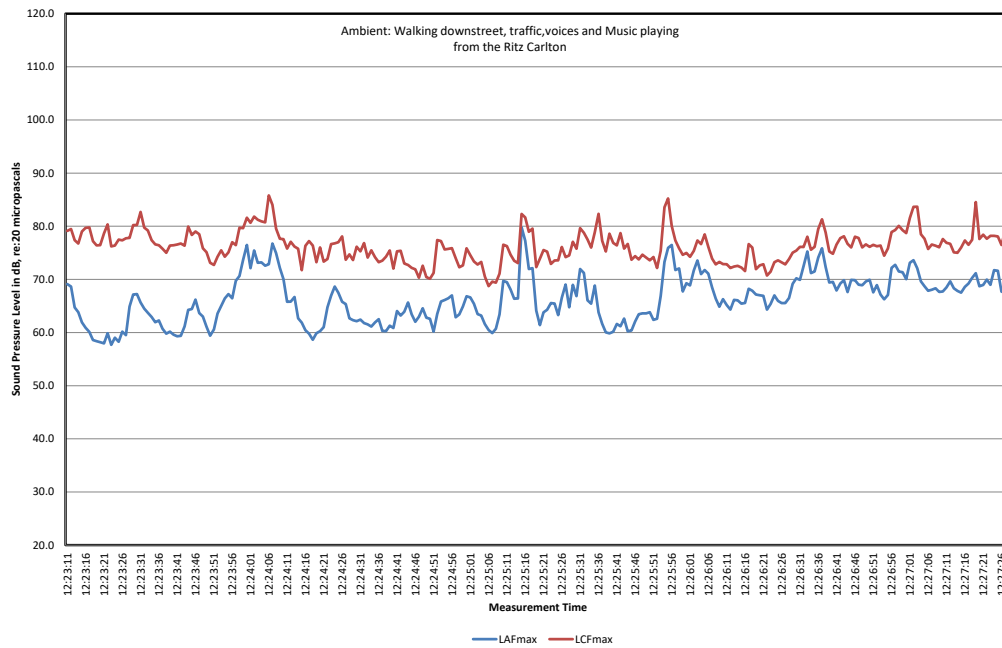
Fort Lauderdale Soundscape Study
Aida
LD3.17
Thursday - February 16, 2023



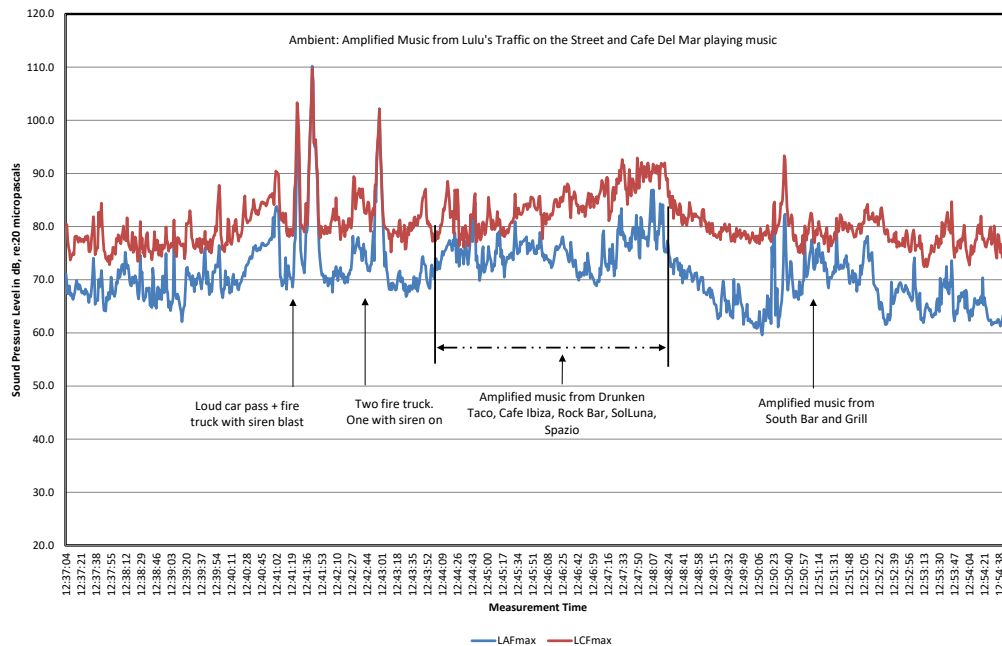
Fort Lauderdale Soundscape Study
Soundwalk along the beach
LD3.18
Friday - February 17, 2023



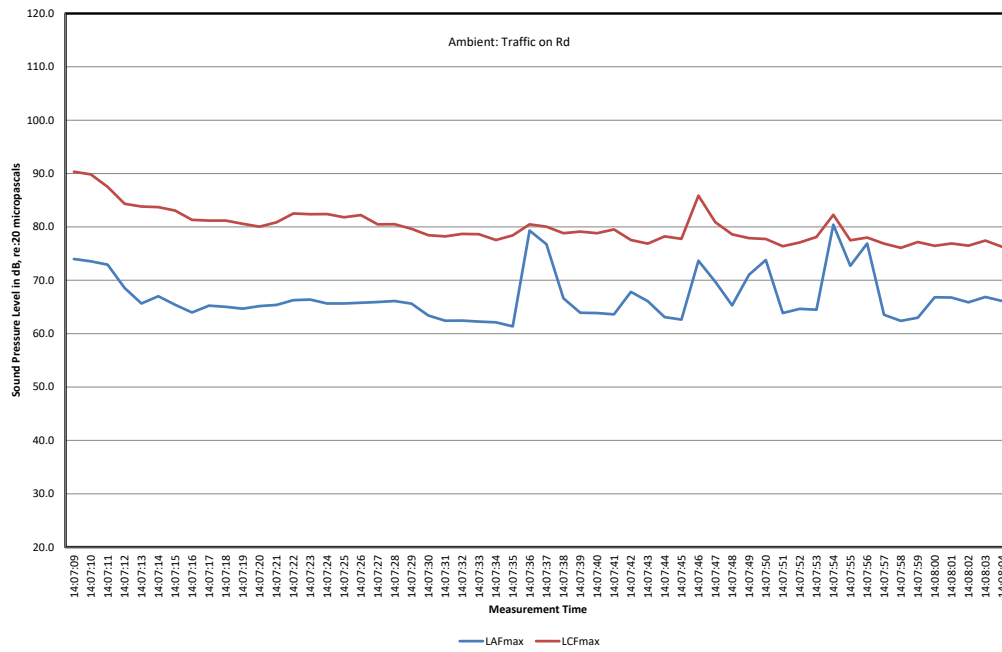
Fort Lauderdale Soundscape Study
Beach Soundwalk Start at Svantek 205 and end at CVS
 LD3.19
 Friday - February 17, 2023



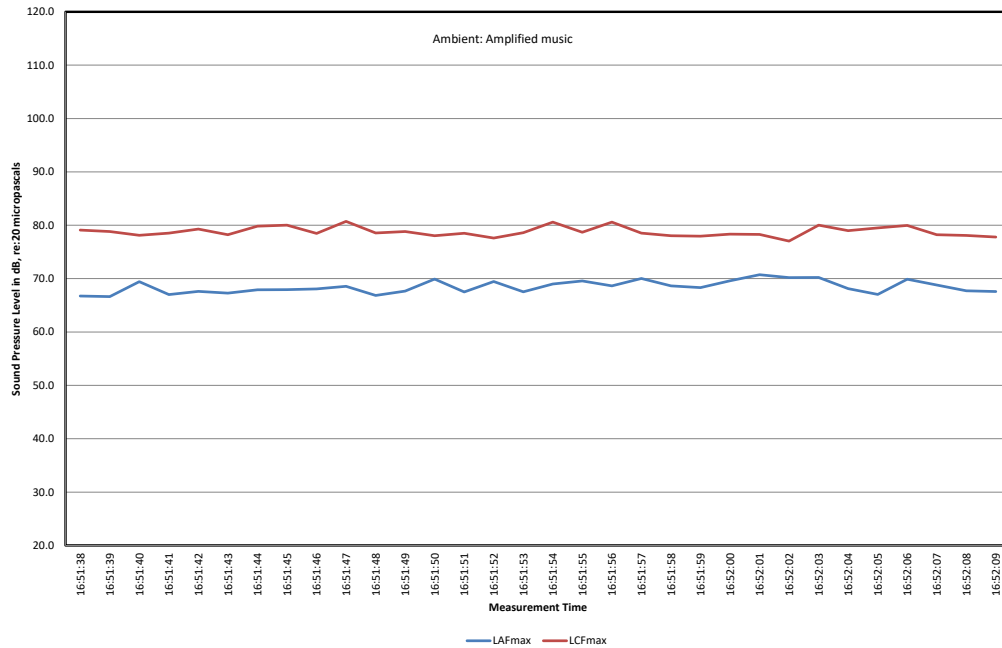
Fort Lauderdale Soundscape Study
Soundwalk: Beach Soundwalk Start at CVS to Cafe Del Mar
 LD3.20
 Friday - February 17, 2023



Fort Lauderdale Soundscape Study
Soundwalk: From hotel to Las Olas
LD3.21
Friday - February 17, 2023



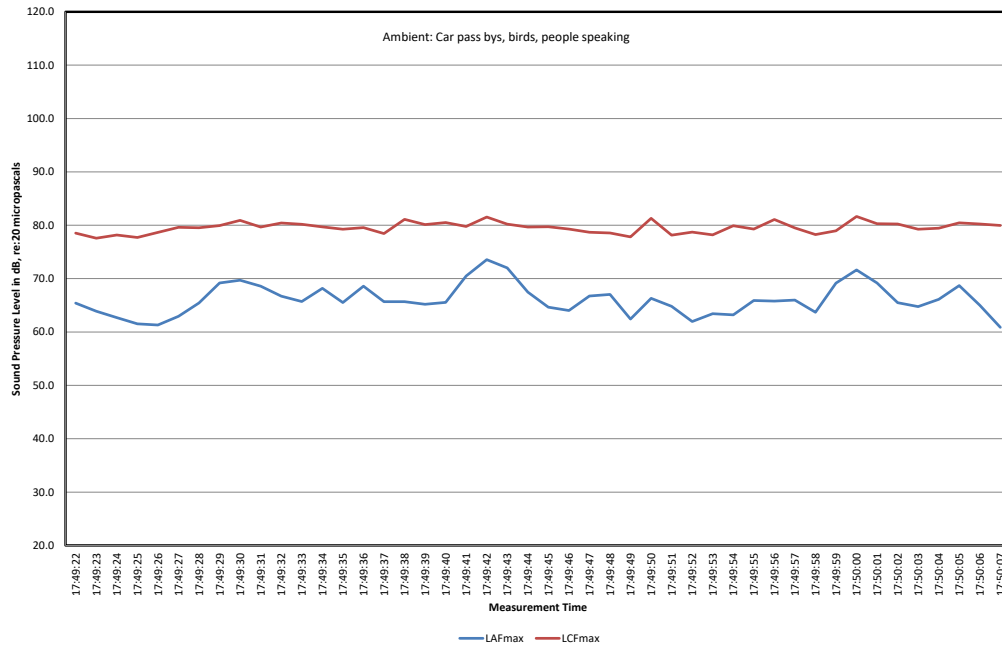
Fort Lauderdale Soundscape Study
5 ft from The Wharf
LD3.22
Friday - February 17, 2023



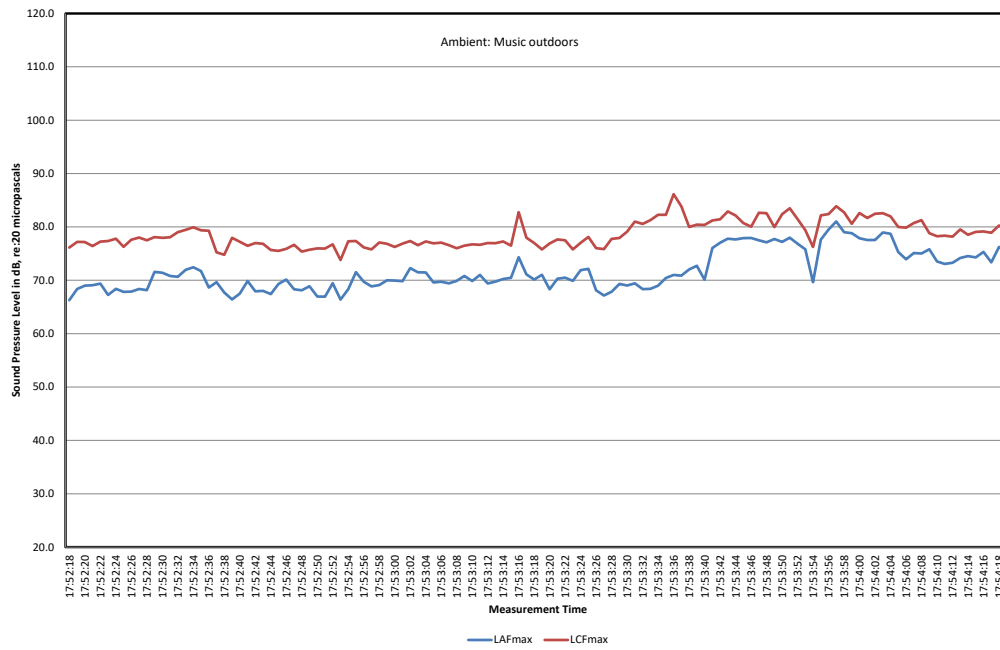
**Fort Lauderdale Soundscape Study
 Near the IMAX theater
 LD3.24
 Friday - February 17, 2023**



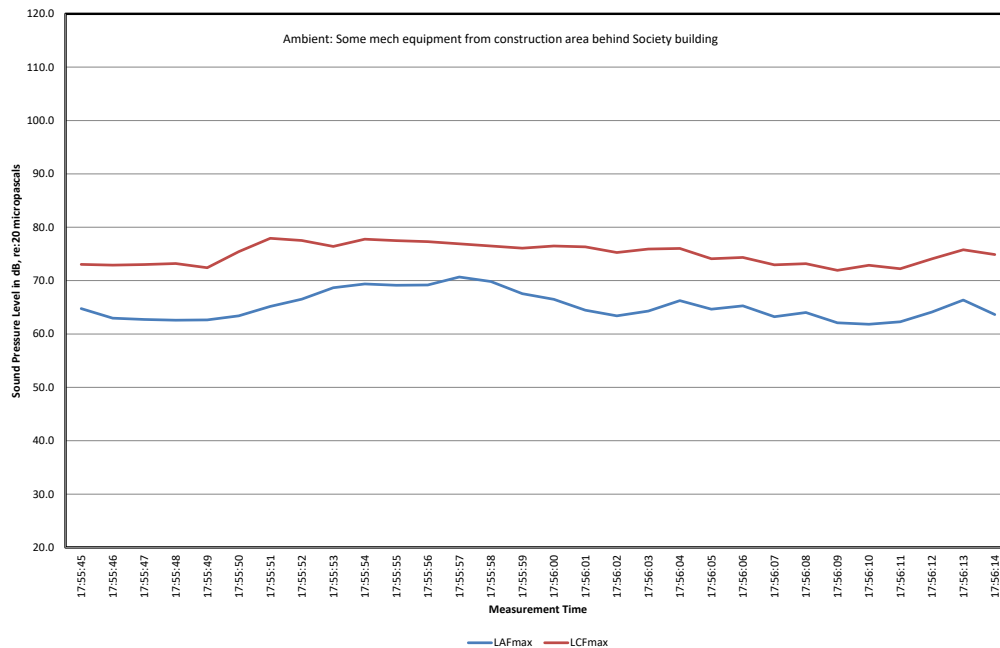
**Fort Lauderdale Soundscape Study
 By OO's
 LD3.25
 Friday - February 17, 2023**



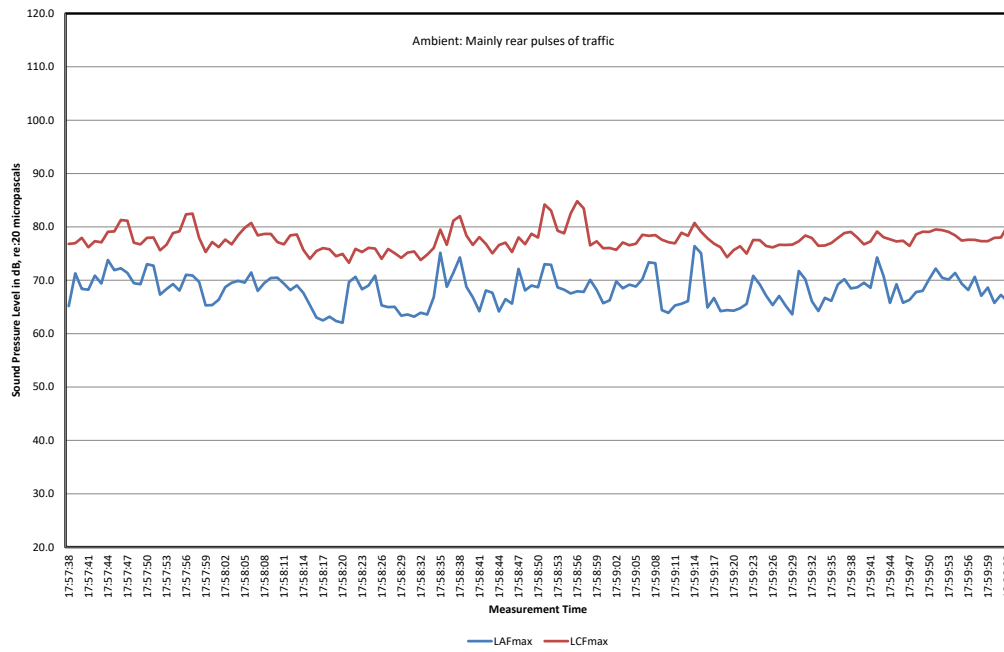
Fort Lauderdale Soundscape Study
By the Pizza and Drink Vibe
LD3.26
Friday - February 17, 2023



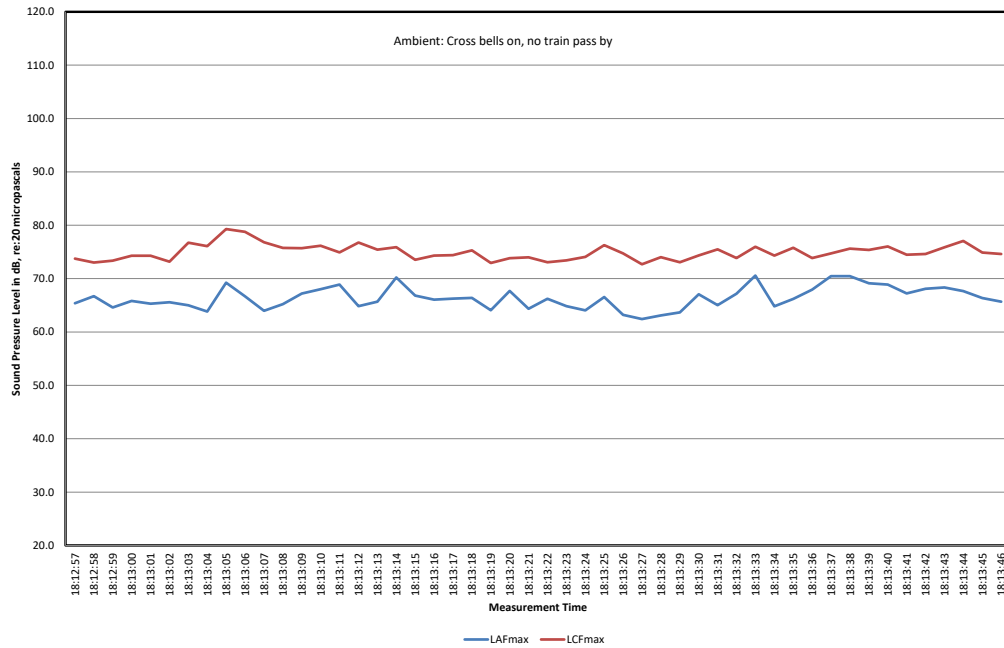
Fort Lauderdale Soundscape Study
Government center parking garage
LD3.27
Friday - February 17, 2023



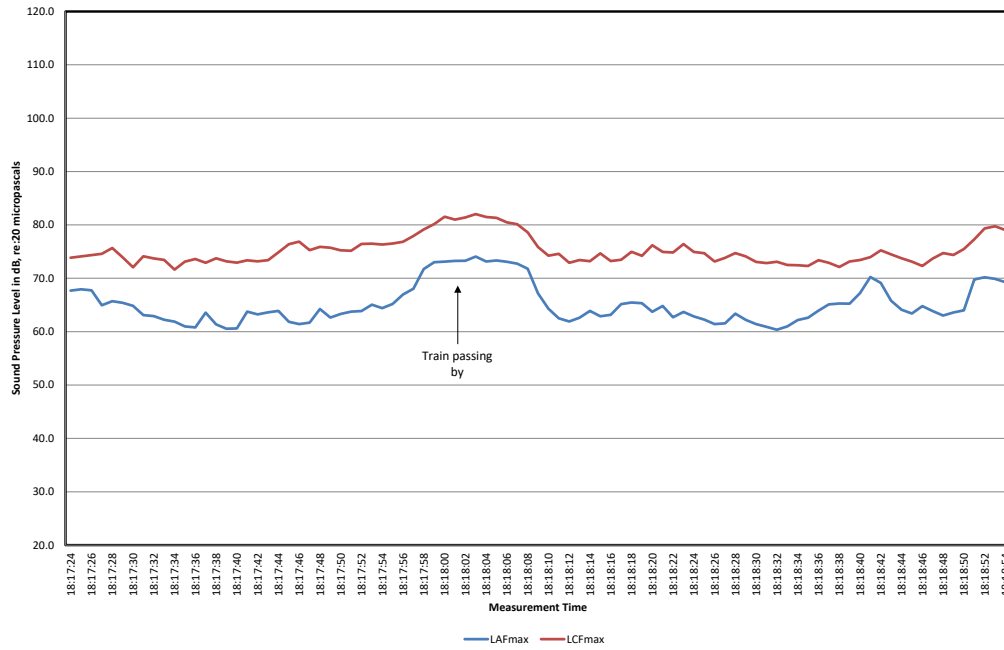
Fort Lauderdale Soundscape Study
Corner SW 1st Avenue and SW 2nd Street
LD3.28
Friday - February 17, 2023



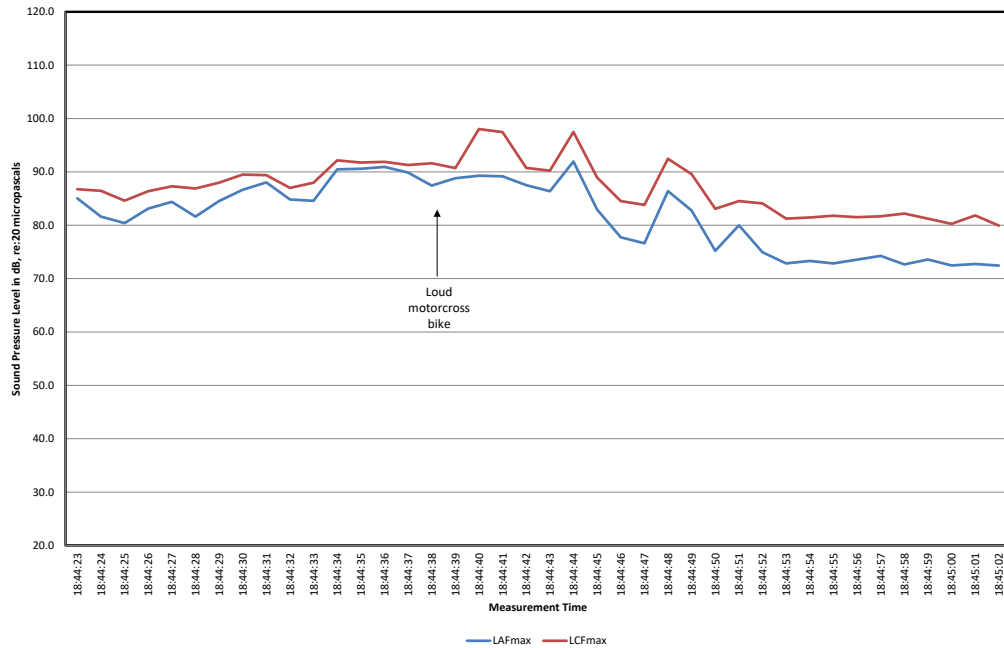
Fort Lauderdale Soundscape Study
SW 2nd Street next to Governmental Center Packing Garage
LD3.29
Friday - February 17, 2023



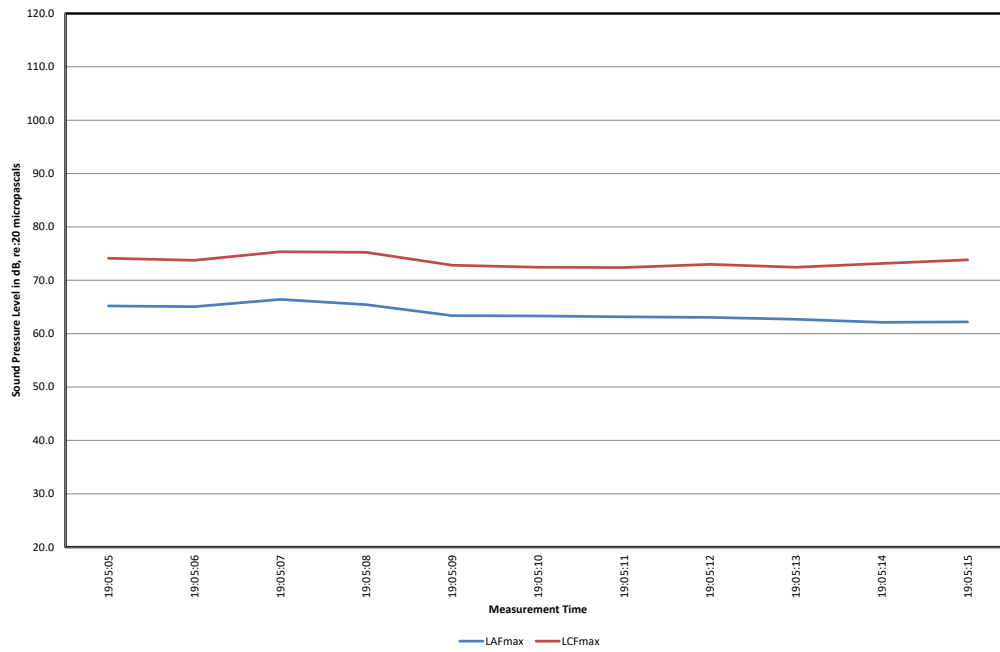
Fort Lauderdale Soundscape Study
SW 2nd Street next to Governmental Center Packing Garage
LD3.30
Friday - February 17, 2023



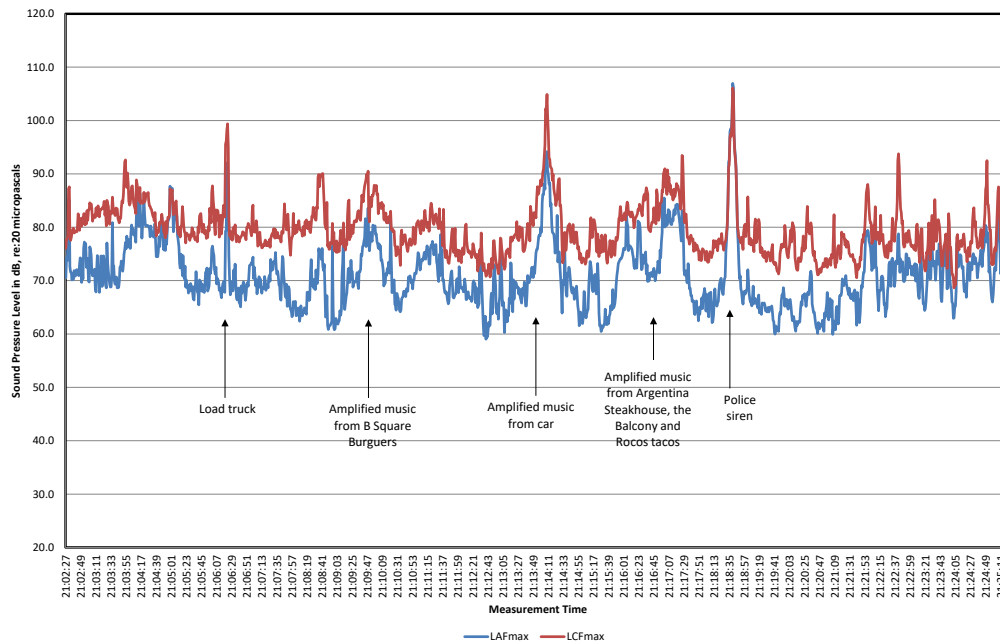
Fort Lauderdale Soundscape Study
The Wharf
LD3.31
Friday - February 17, 2023



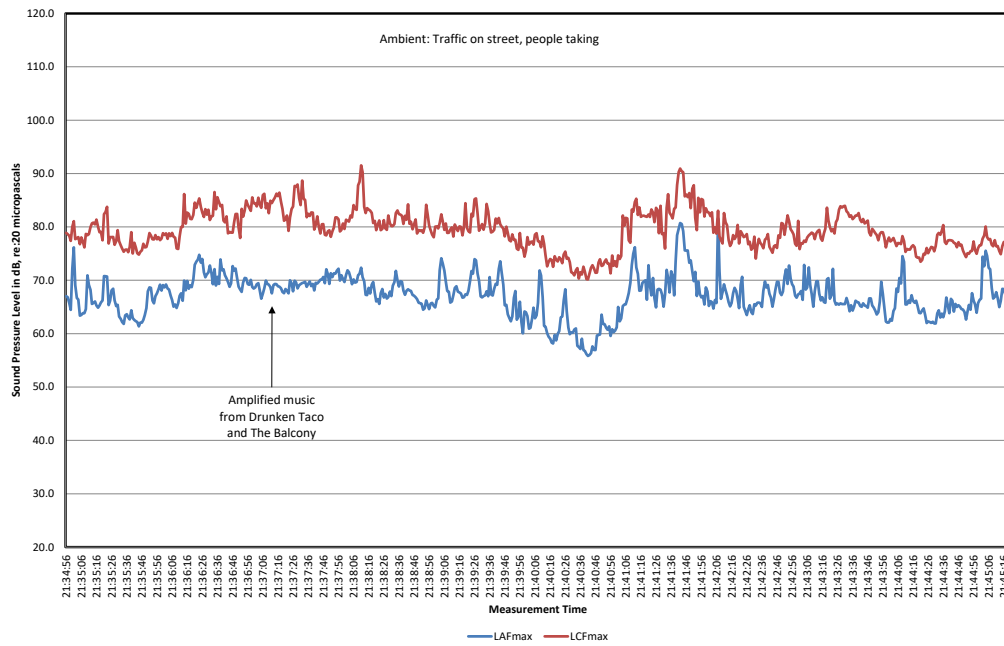
Fort Lauderdale Soundscape Study
Huizenga Plaza
LD3.32
Friday - February 17, 2023



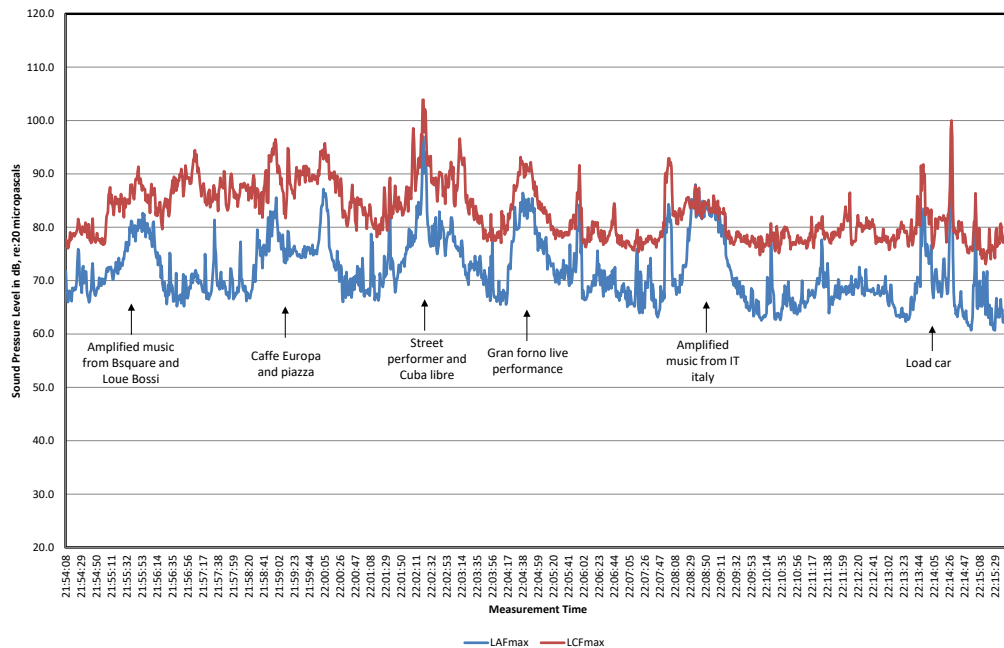
Fort Lauderdale Soundscape Study
Sound walk: Las Olas
LD3.33
Friday - February 17, 2023



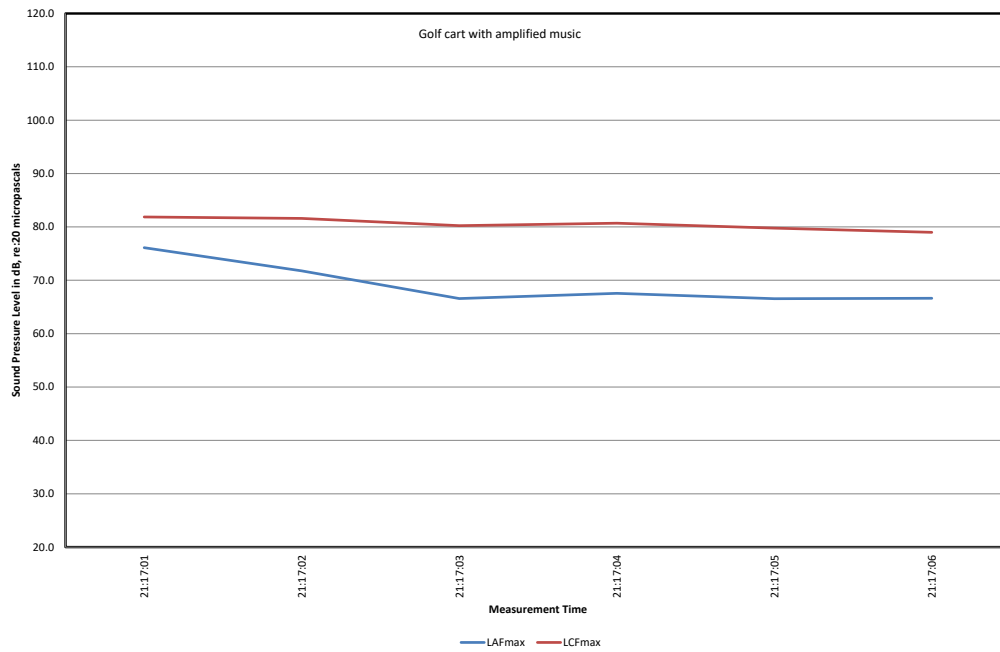
Fort Lauderdale Soundscape Study
Start at Las Olas and 15th to Luigi
LD3.34
Friday - February 17, 2023



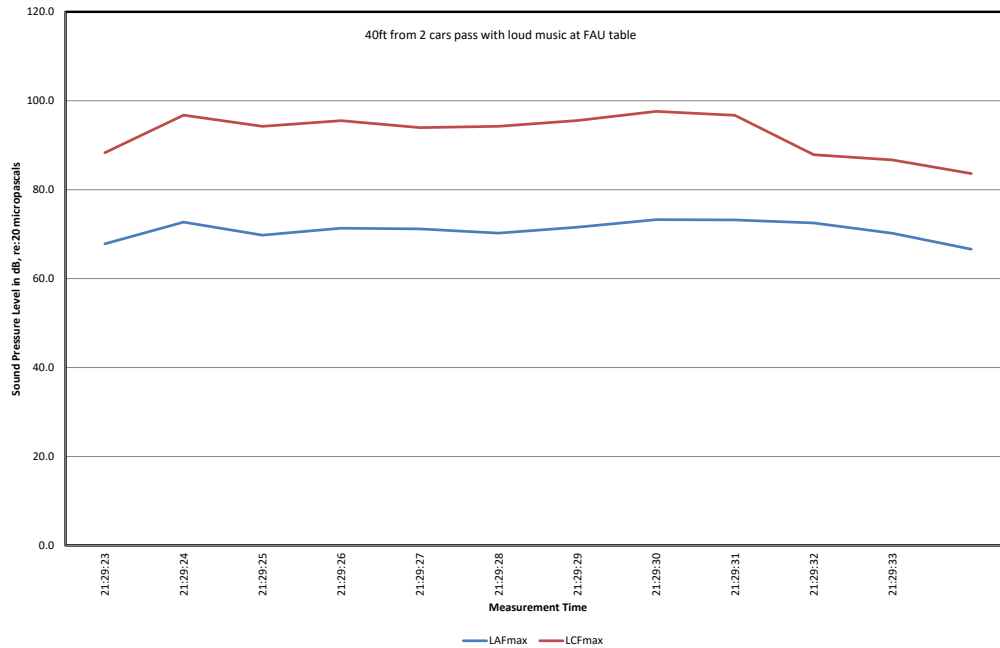
Fort Lauderdale Soundscape Study
Cross SE 11th Avenue at 36 to 200 East las Olas
LD3.35
Friday - February 17, 2023



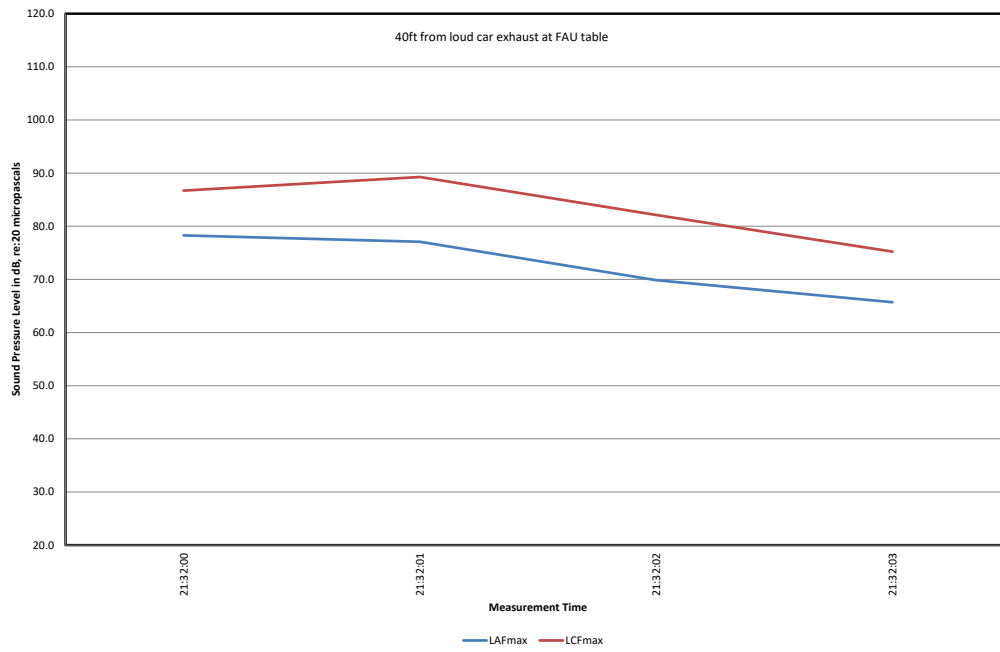
Fort Lauderdale Soundscape Study
FAU Las Olas
LD3.36
Friday - February 17, 2023



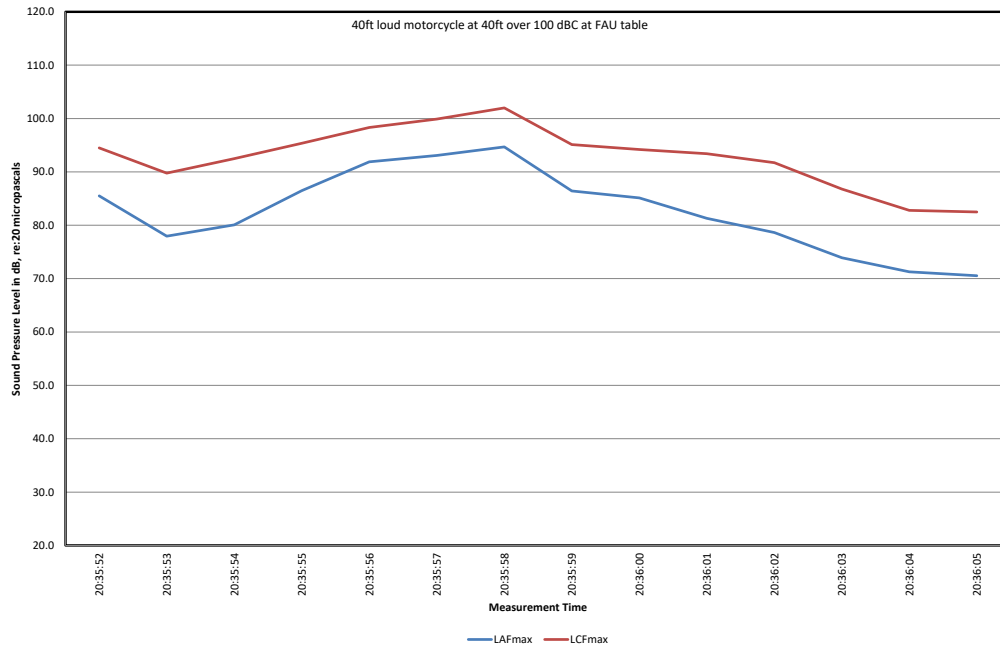
Fort Lauderdale Soundscape Study
FAU Las Olas
LD3.37
Friday - February 17, 2023



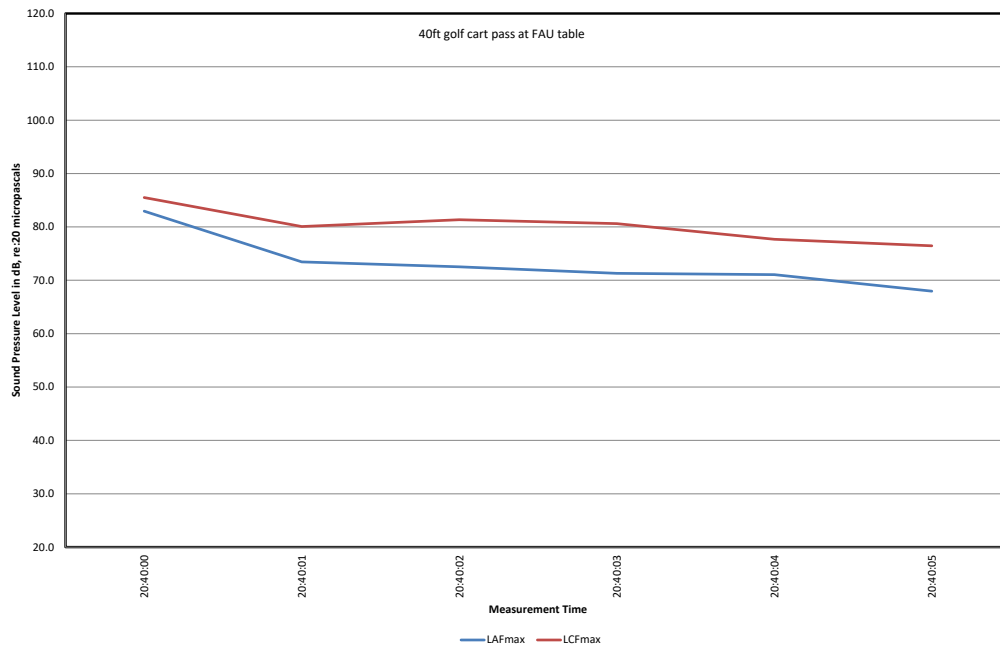
Fort Lauderdale Soundscape Study
FAU Las Olas
LD3.38
Friday - February 17, 2023



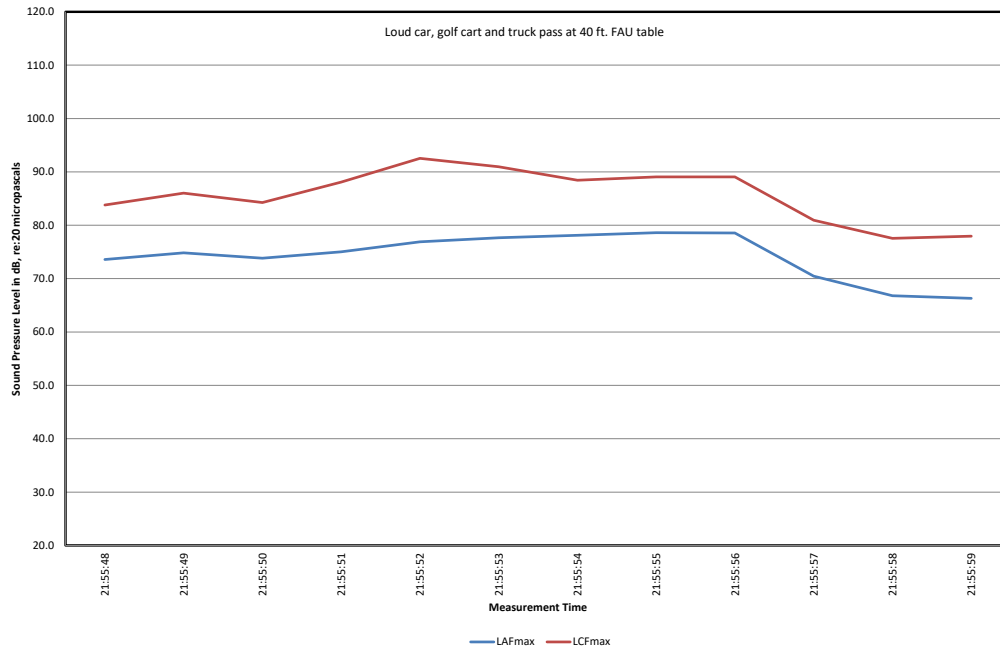
Fort Lauderdale Soundscape Study
FAU Las Olas
LD3.39
Friday - February 17, 2023



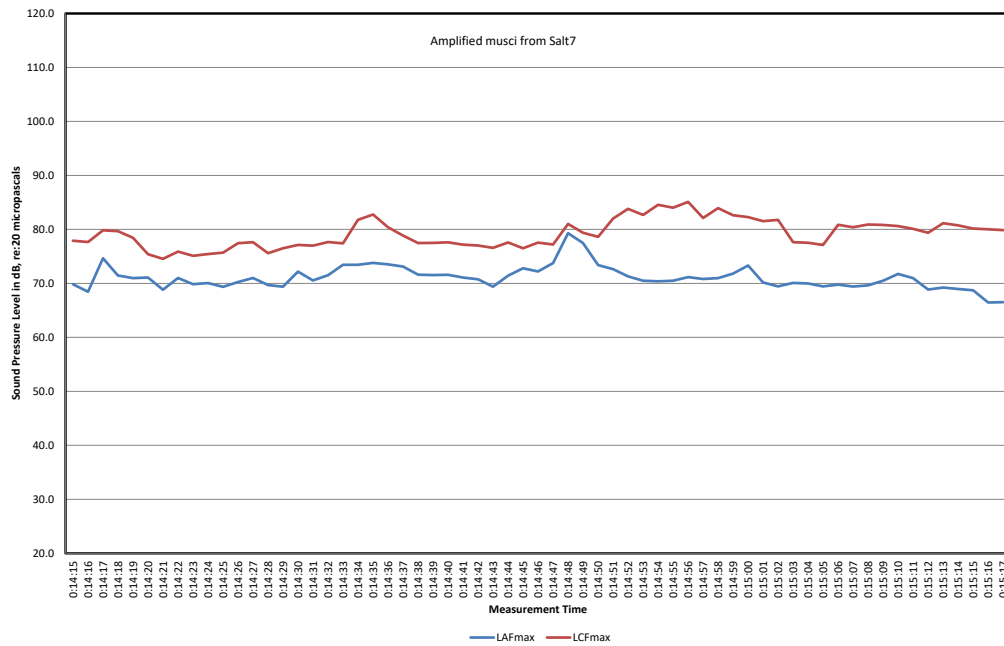
Fort Lauderdale Soundscape Study
FAU Las Olas
LD3.40
Friday - February 17, 2023



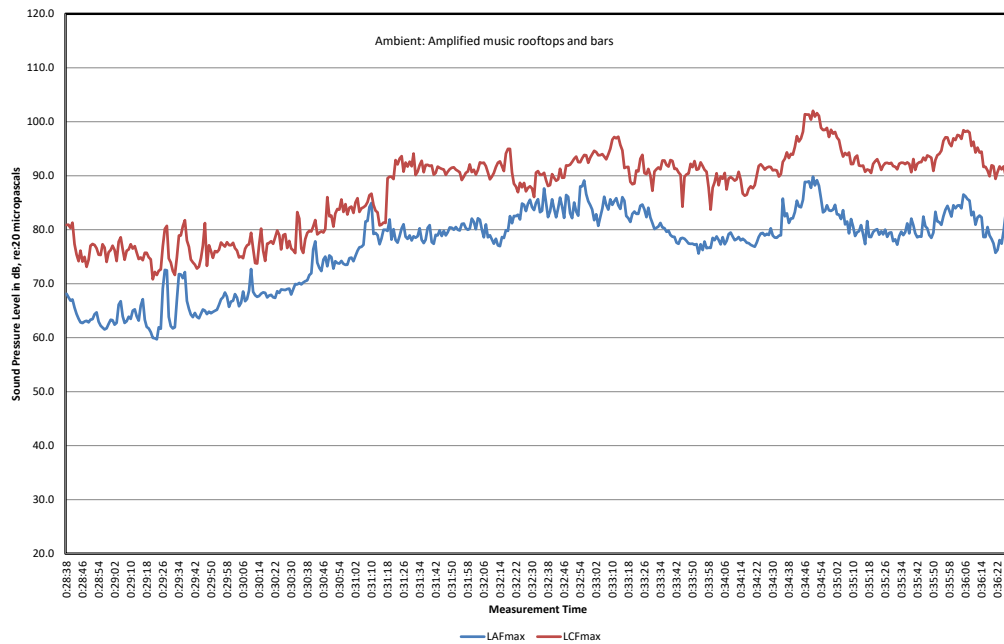
Fort Lauderdale Soundscape Study
FAU Las Olas
LD3.41
Friday - February 17, 2023



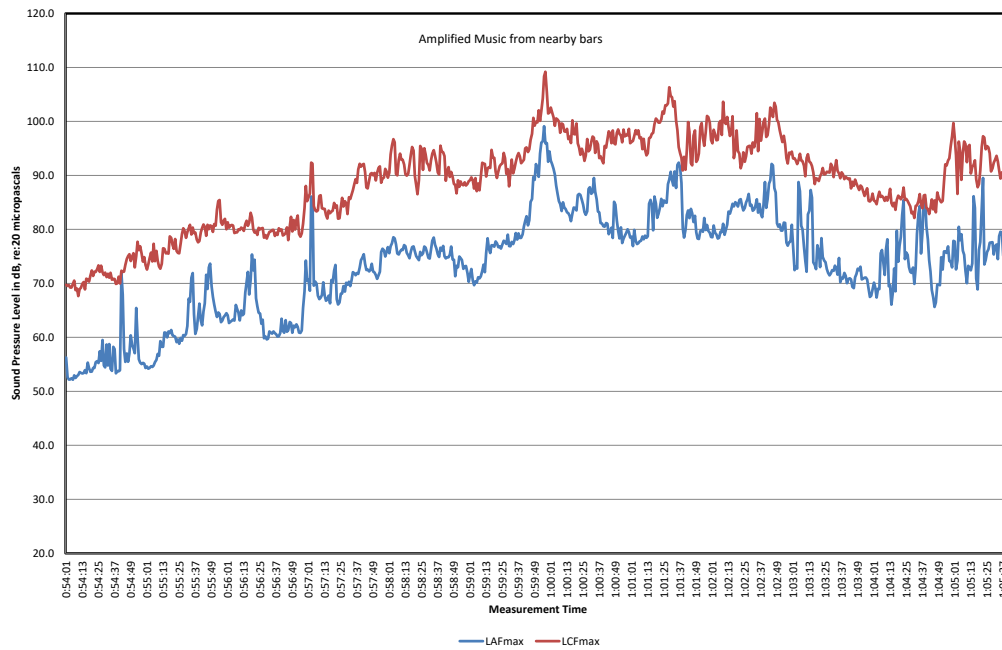
**Fort Lauderdale Soundscape Study
 Across the Street from Salt7
 LD3.42
 Friday - February 17, 2023**



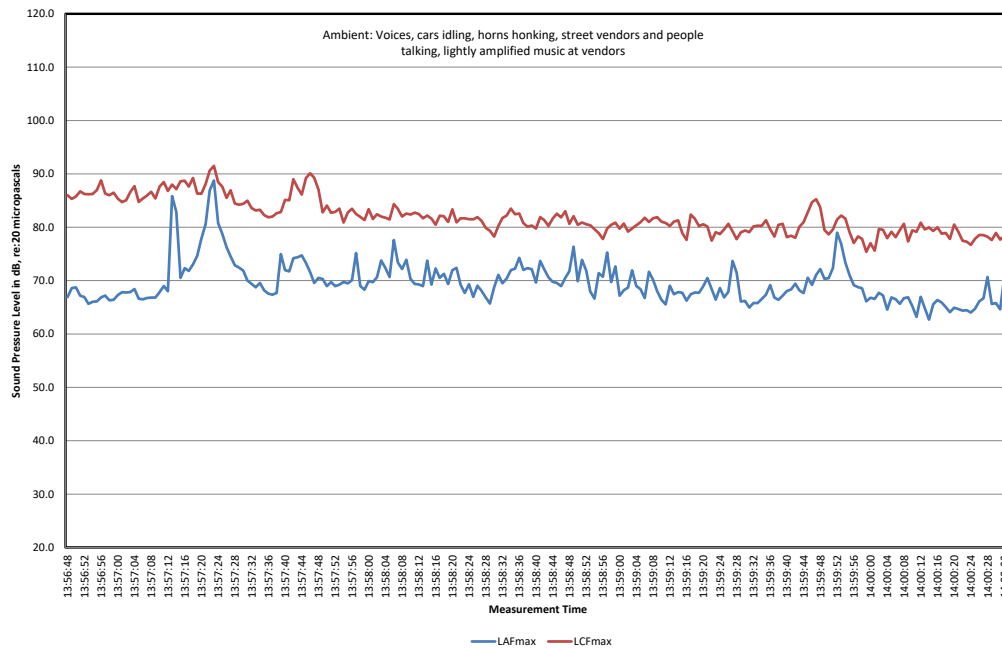
**Fort Lauderdale Soundscape Study
 Walking down by Riverwalk
 LD3.43
 Friday - February 17, 2023**



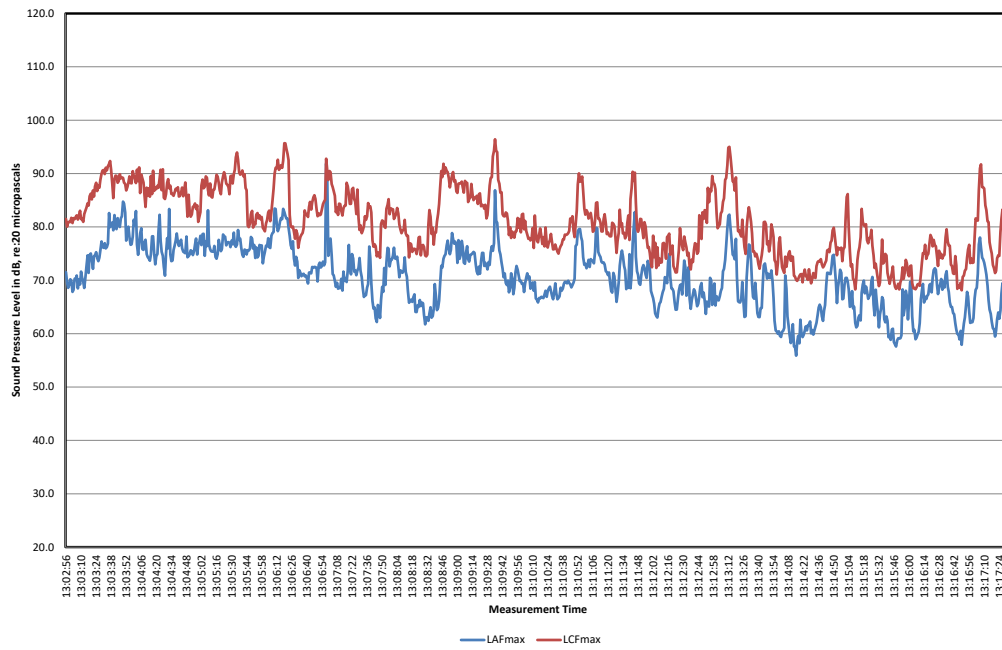
Fort Lauderdale Soundscape Study
Soundwalk Himmarshee
LD3.45
Thursday - February 17, 2023



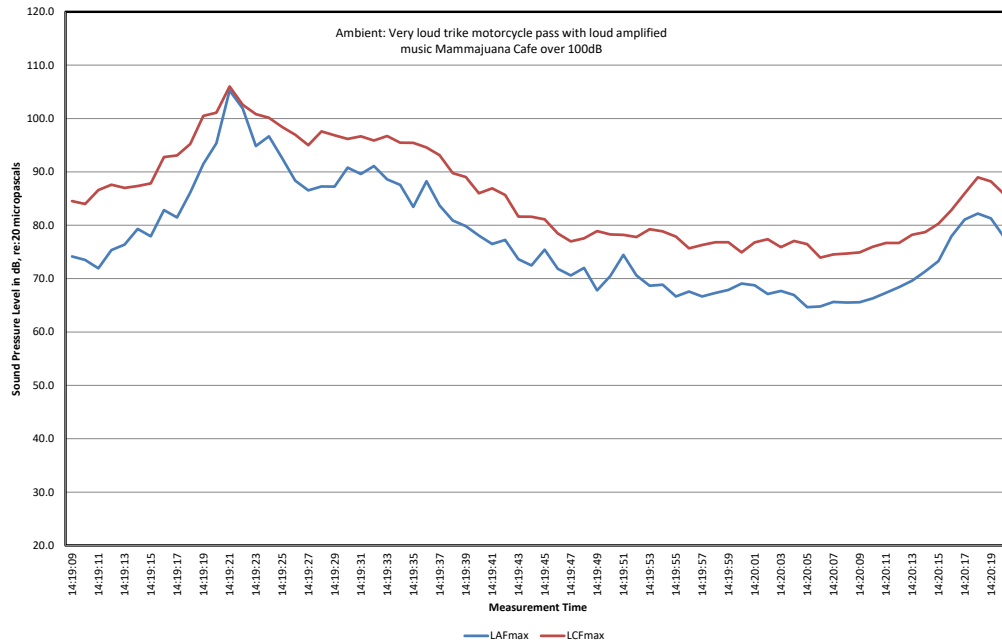
Fort Lauderdale Soundscape Study
Soundwalk to corner of Las Ola's to Farmer's Market area
LD3.46
Friday - February 18, 2023



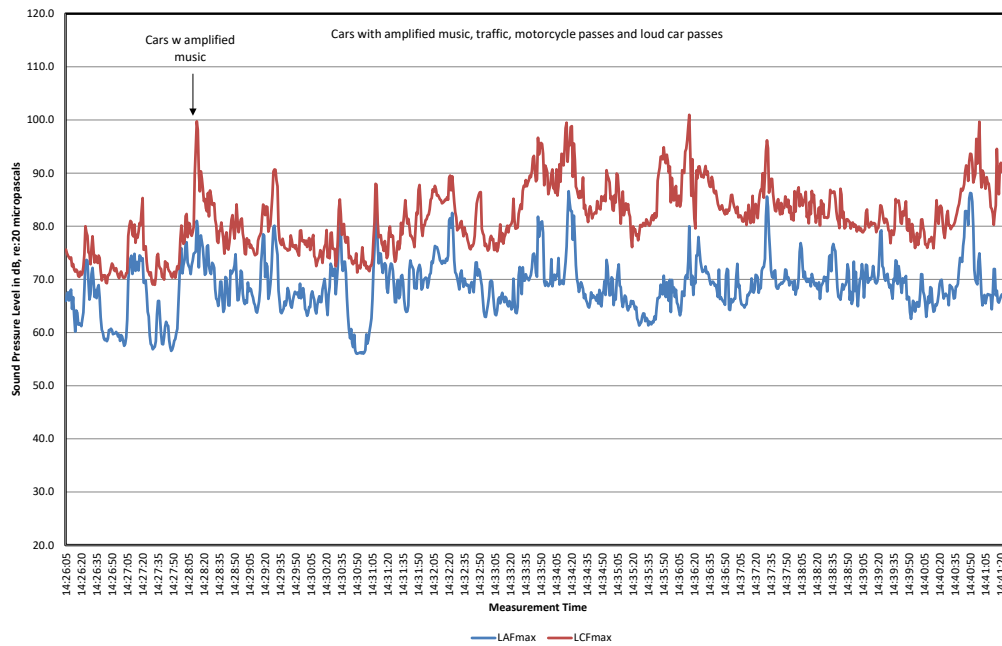
Fort Lauderdale Riverwalk
Soundwalk: Ft. Lauderdale Beach from Las Olas to Merriweather Resort
LD3.47
Friday - February 18, 2023



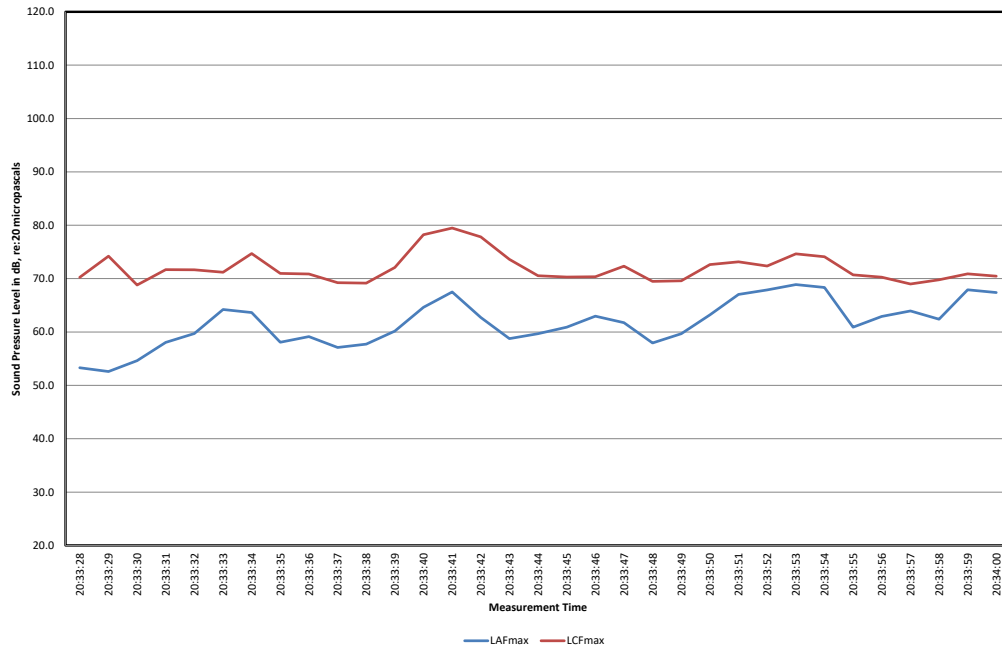
Fort Lauderdale Soundscape Study
In front of Merriweather Resort
LD3.48
Friday - February 18, 2023



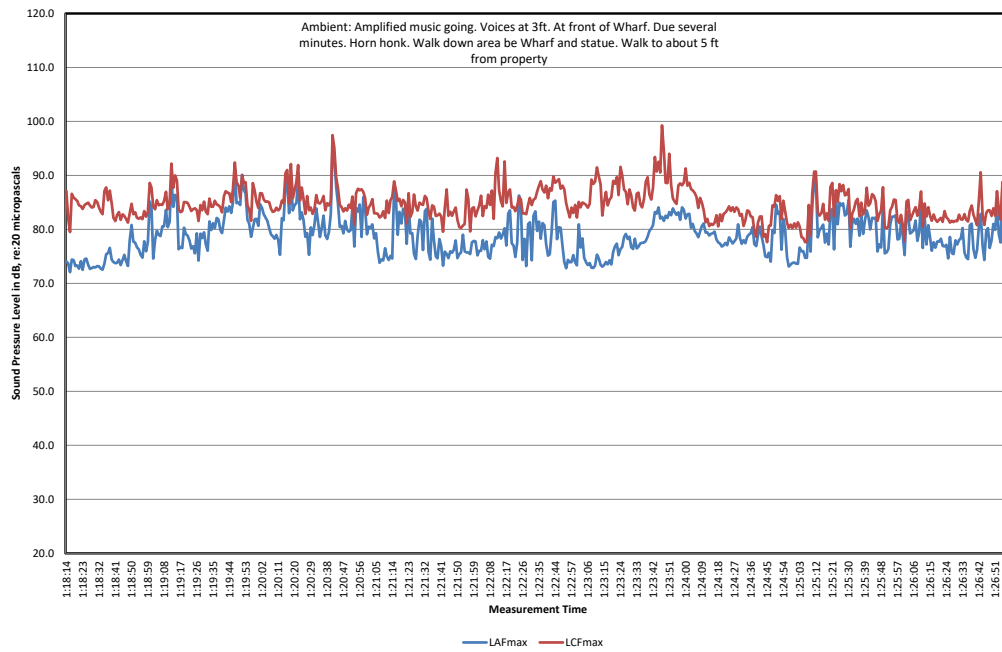
Fort Lauderdale Soundscape Study
Beach Soundwalk 1:26 up other side of A1A
LD3.49
Friday - February 18, 2023



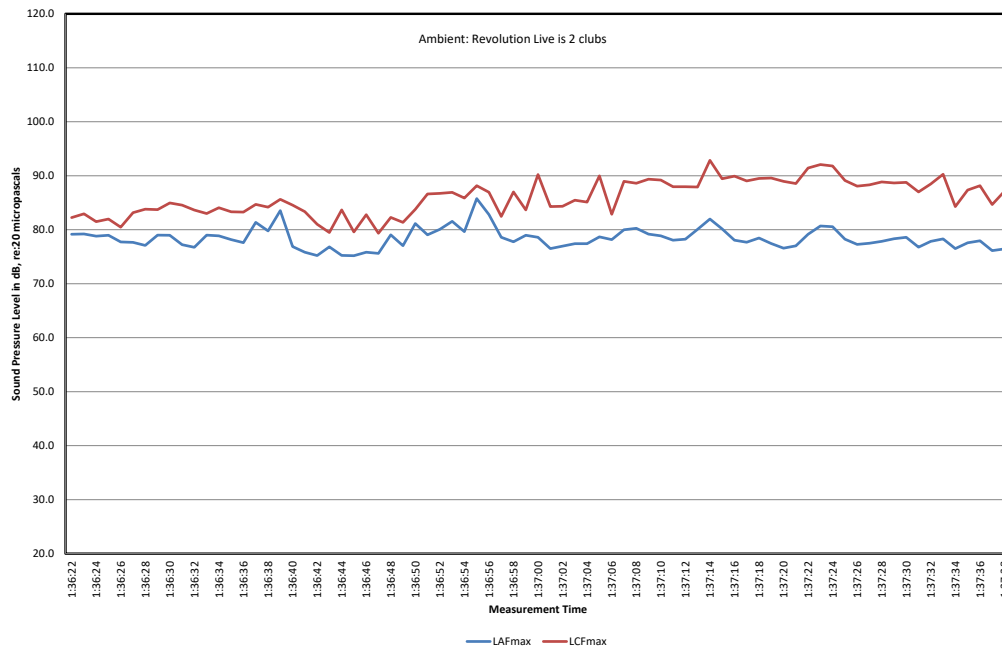
Fort Lauderdale Soundscape Study
Smittys
LD3.50
Friday - February 18, 2023



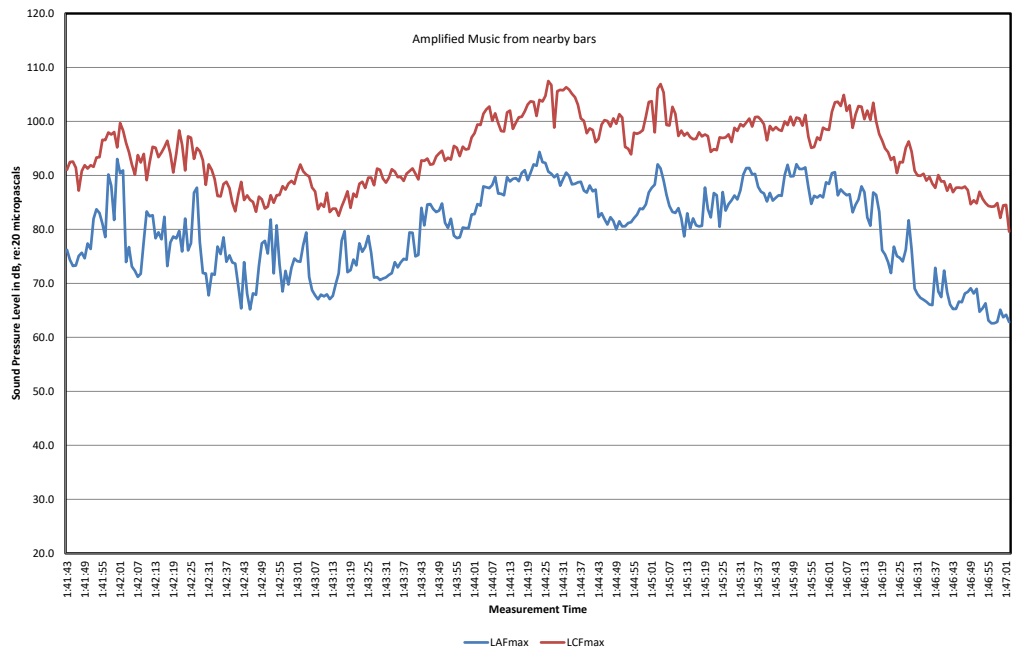
Fort Lauderdale Soundscape Study
Sounds walk from back of Wharf
 LD3.51
 Saturday - February 19, 2023



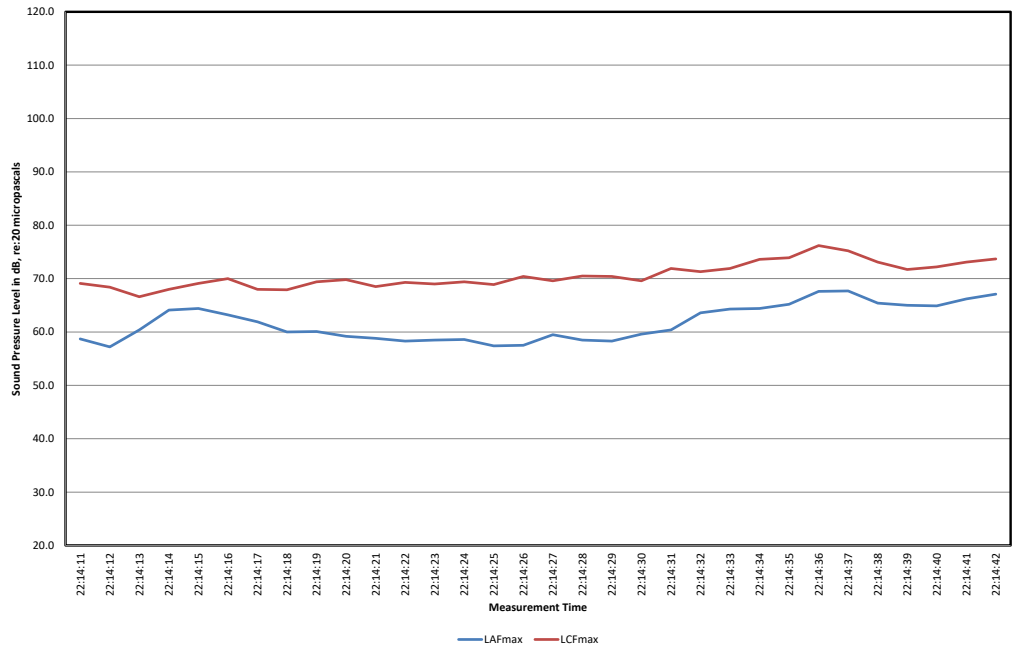
Fort Lauderdale Soundscape Study
Soundwalk Himmarshee
 LD3.52
 Saturday - February 19, 2023



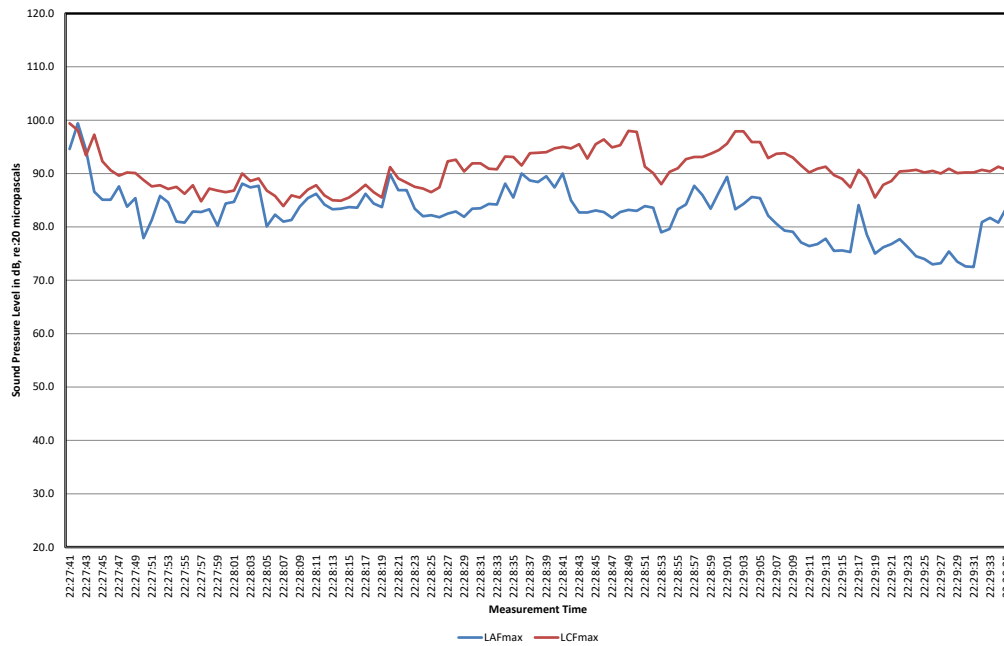
Fort Lauderdale Soundscape Study
Soundwalk Himmarshee
LD3.53
Saturday - February 19, 2023



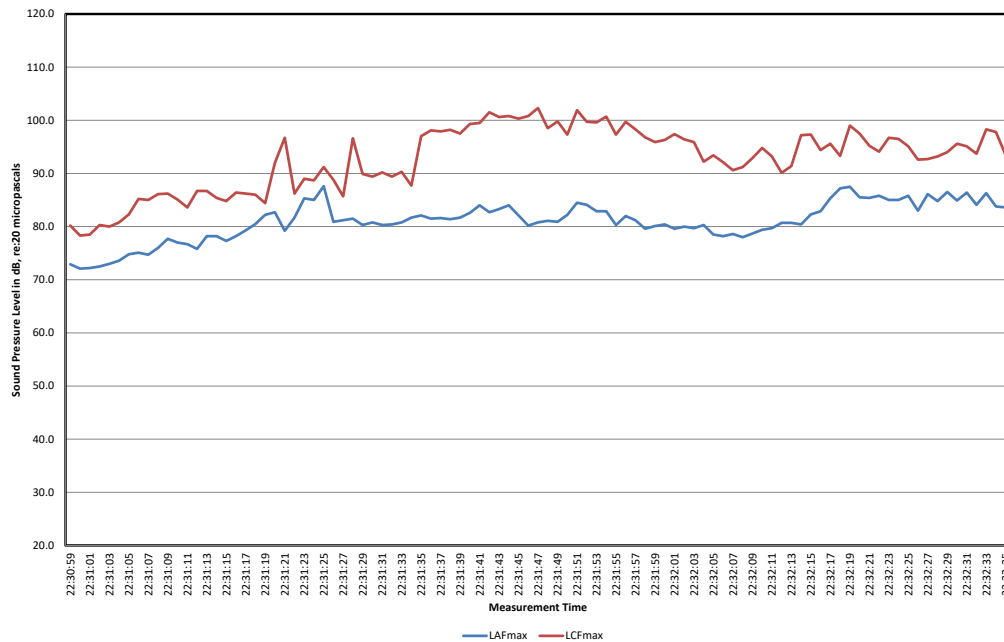
Fort Lauderdale Soundscape Study
Bo's
LD2.01
Saturday - April 22, 2023



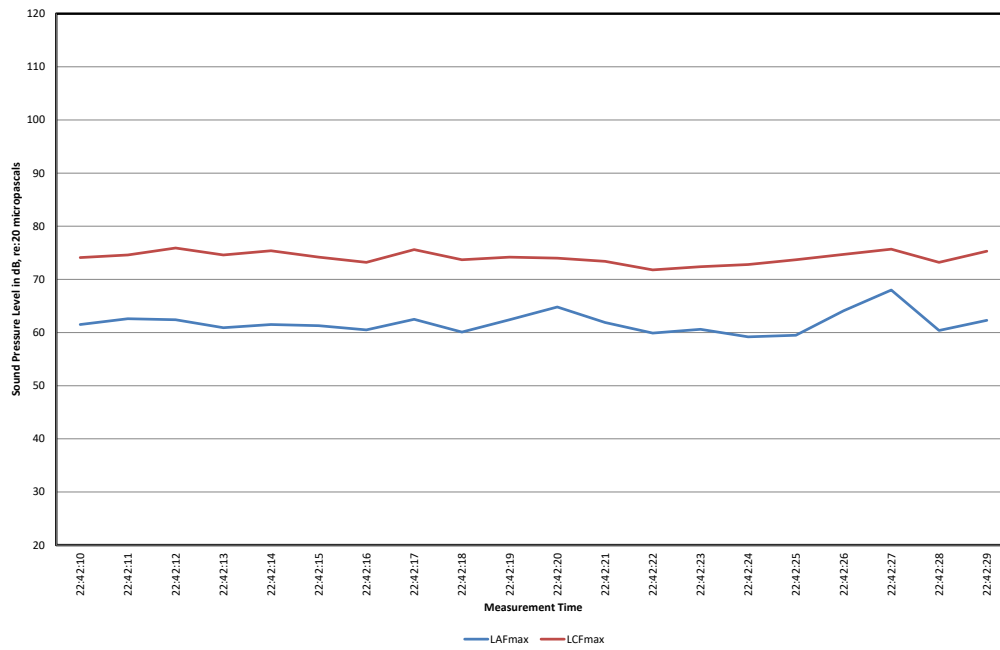
Fort Lauderdale Soundscape Study
 Rock Bar
 LD2.02
 Saturday - April 22, 2023



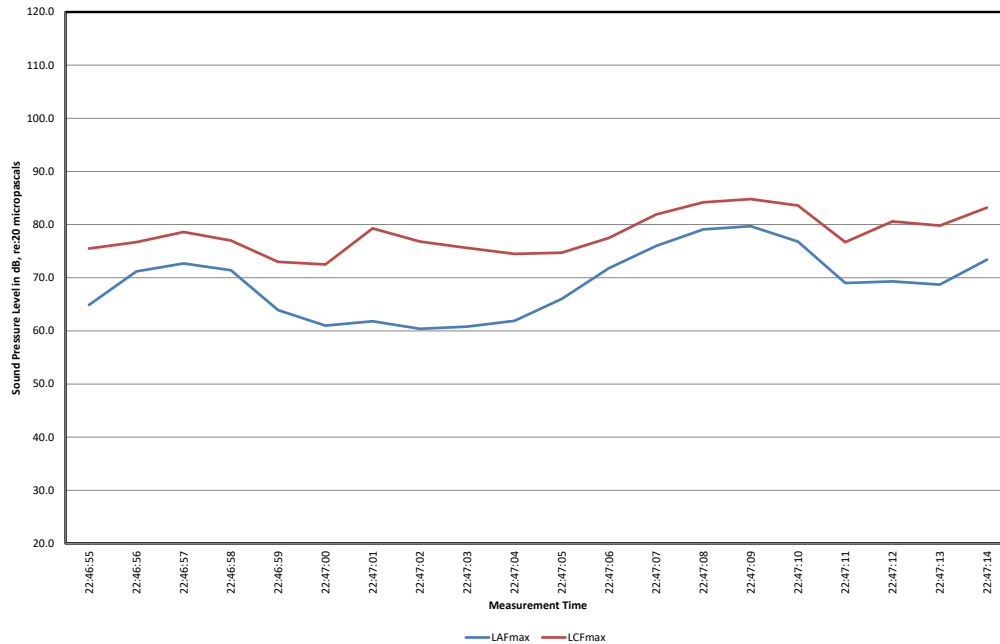
Fort Lauderdale Soundscape Study
 Rock Bar
 LD2.03
 Saturday - April 22, 2023



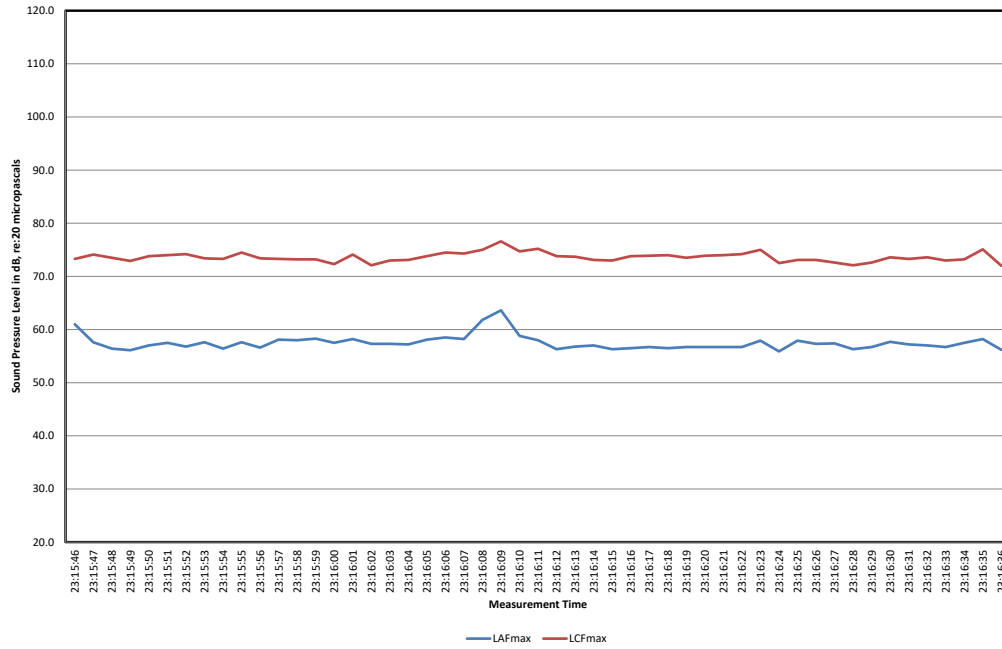
Fort Lauderdale Soundscape Study
 Rock Bar
 LD2.04
 Saturday - April 22, 2023



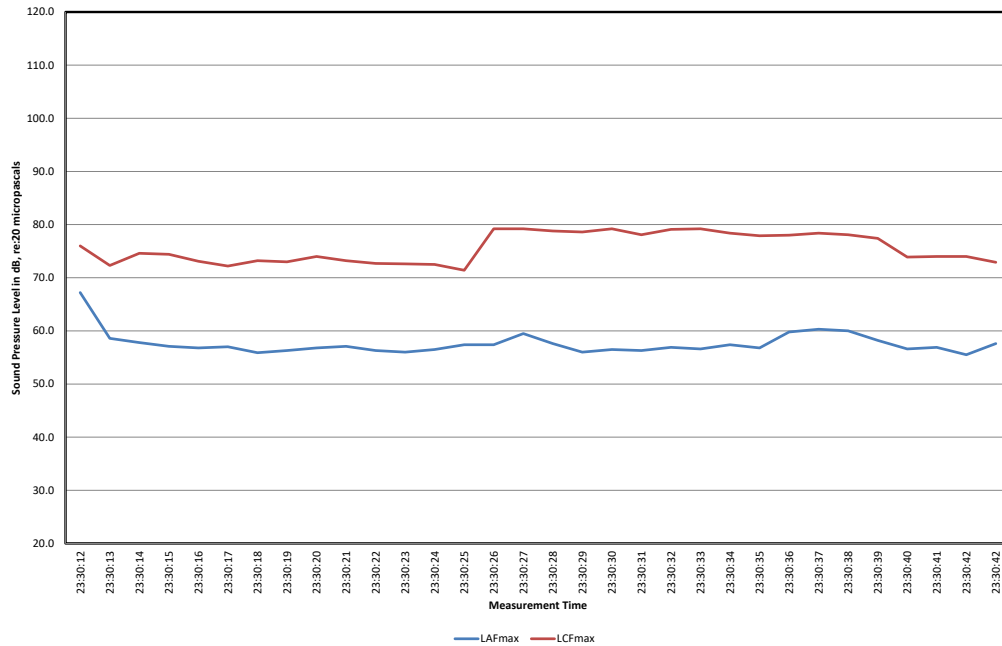
Fort Lauderdale Soundscape Study
 Rock Bar
 LD2.05
 Saturday - April 22, 2023



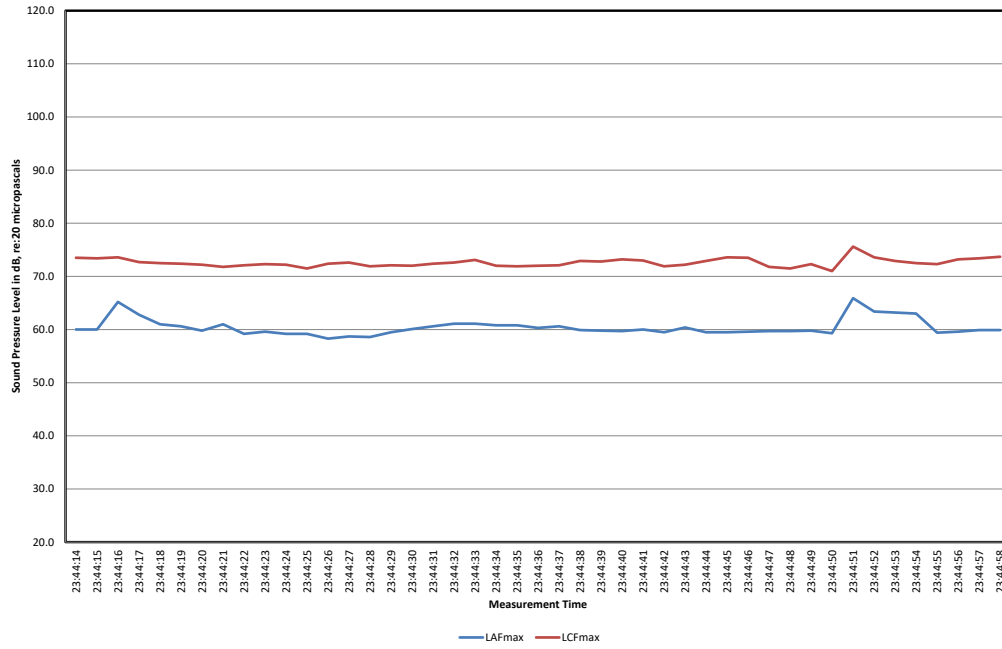
Fort Lauderdale Soundscape Study
 The Balcony
 LD2.07
 Saturday - April 22, 2023



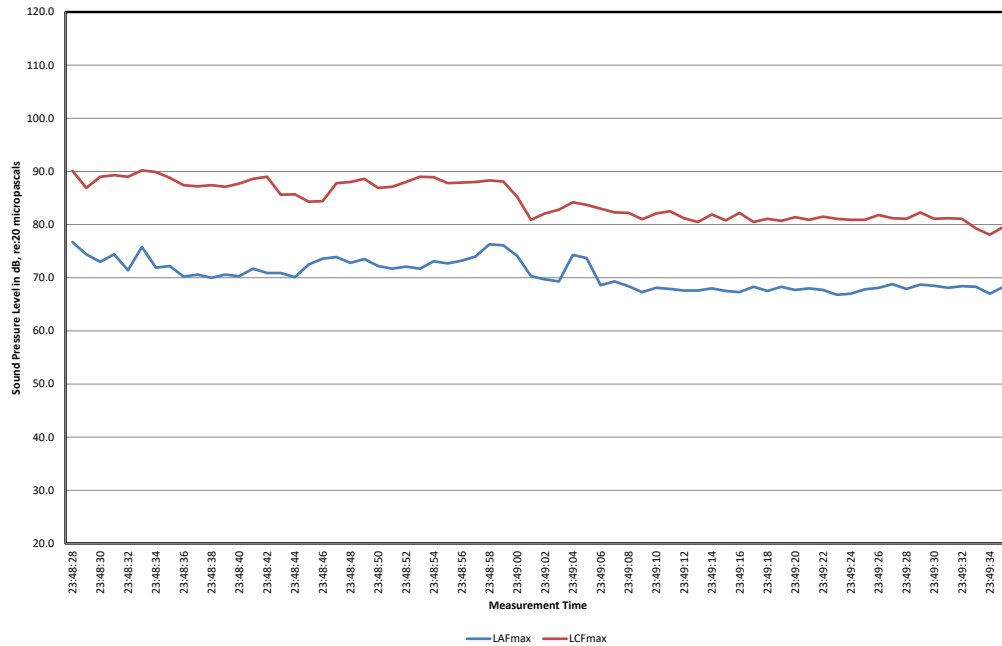
Fort Lauderdale Soundscape Study
 The Balcony
 LD2.08
 Saturday - April 22, 2023



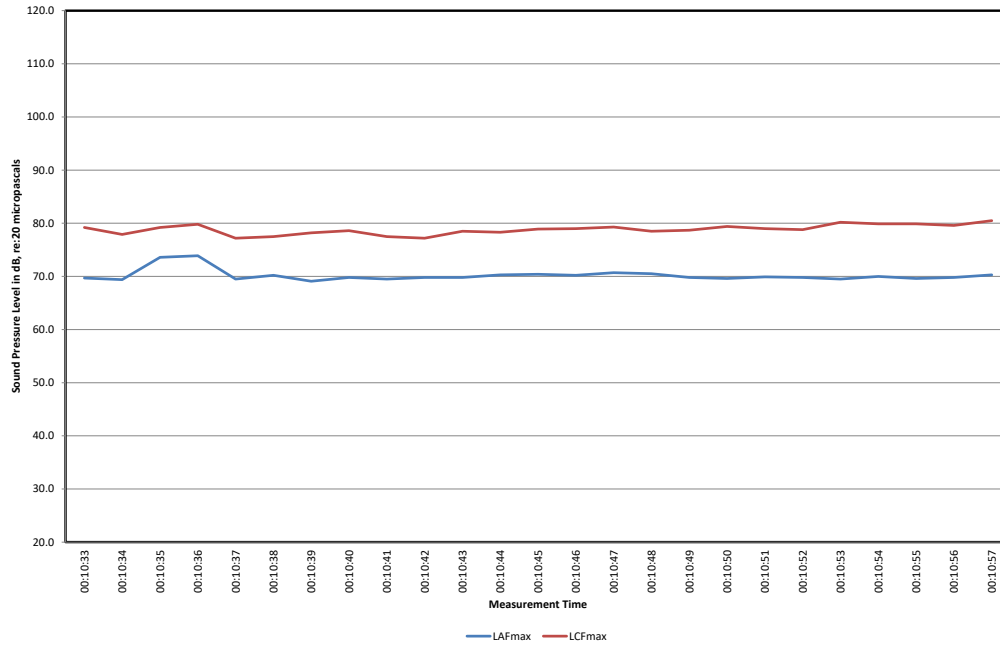
Fort Lauderdale Soundscape Study
 Yolo
 LD2.09
 Saturday - April 22, 2023



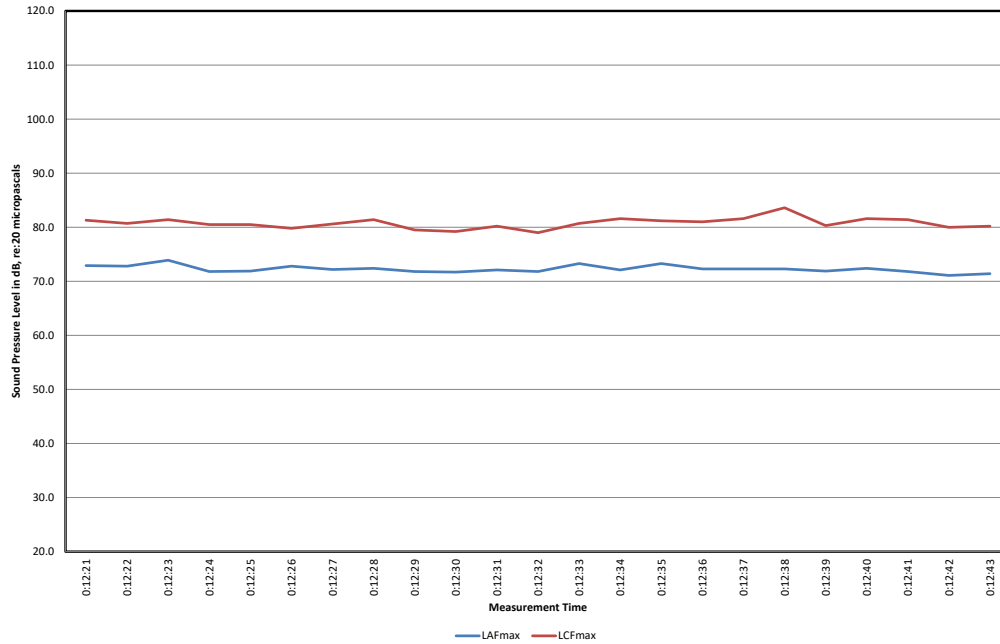
Fort Lauderdale Soundscape Study
 Yolo
 LD2.10
 Saturday - April 22, 2023



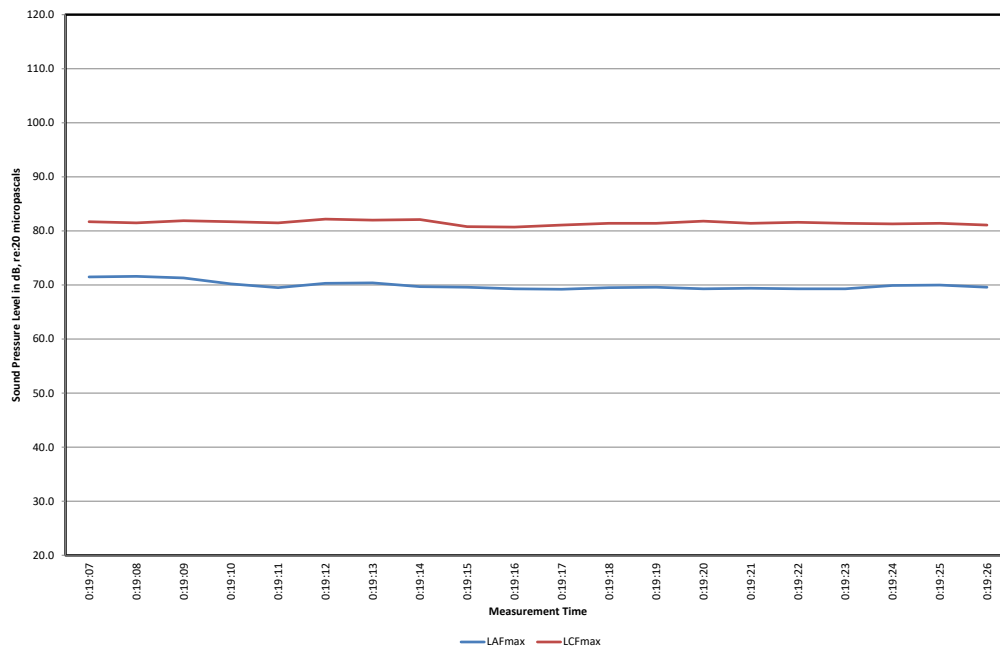
Fort Lauderdale Soundscape Study
 The Wharf
 LD2.11
 Sunday - April 23, 2023



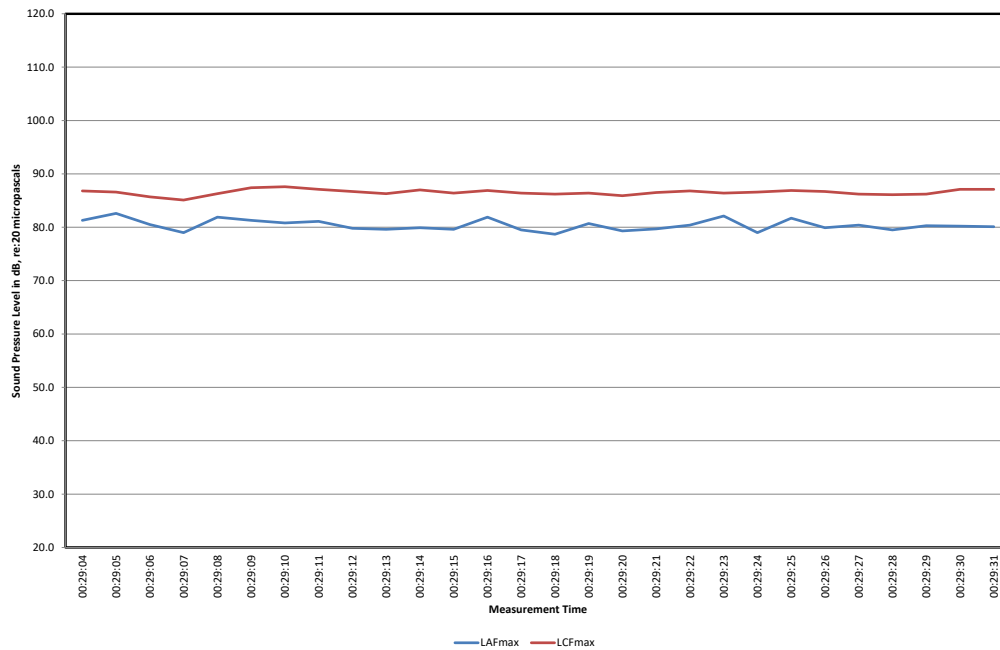
Fort Lauderdale Soundscape Study
 The Wharf
 LD2.12
 Sunday - April 23, 2023



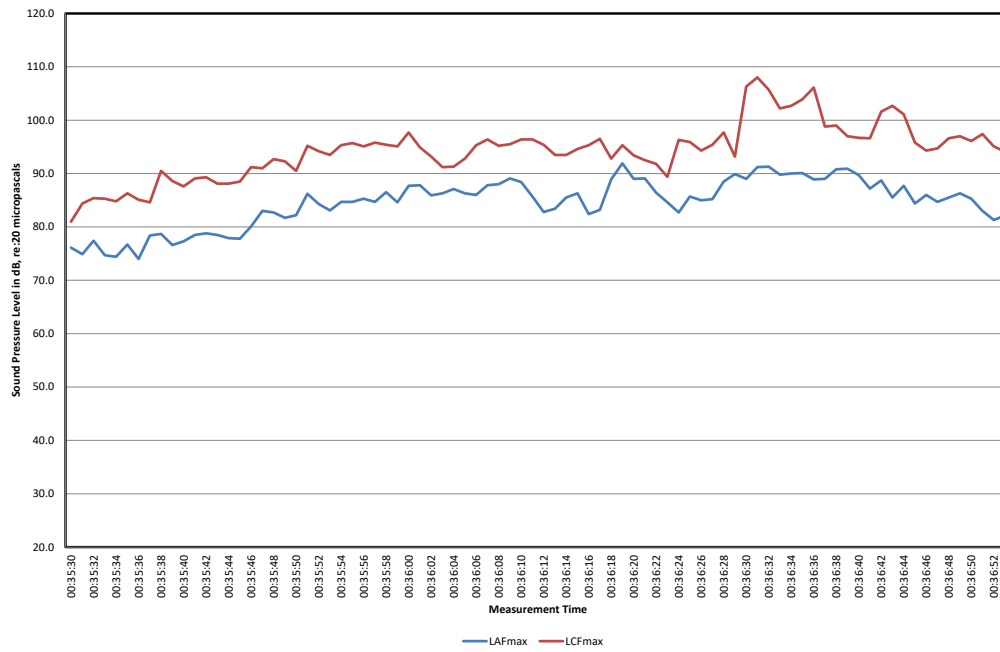
Fort Lauderdale Soundscape Study
 The Wharf
 LD2.13
 Sunday - April 23, 2023



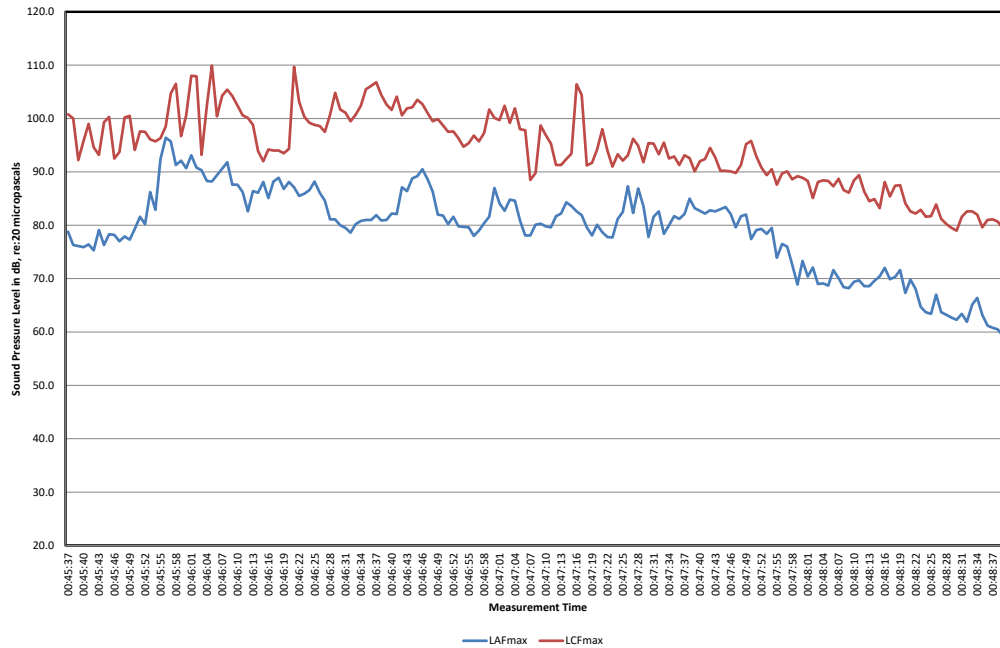
Fort Lauderdale Soundscape Study
 The Wharf
 LD2.14
 Sunday - April 23, 2023



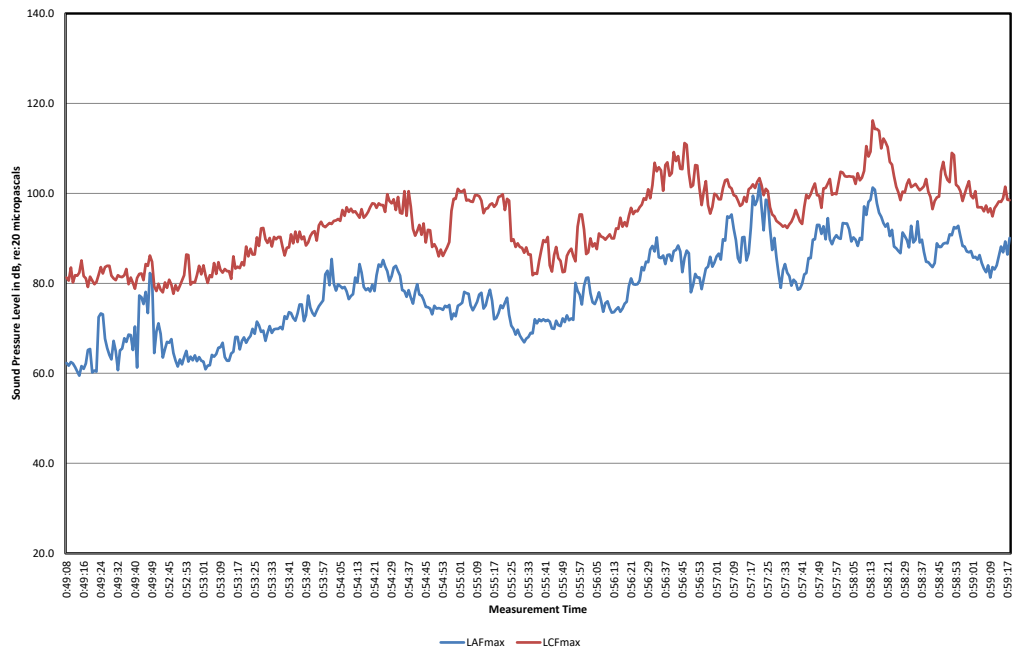
Fort Lauderdale Soundscape Study
 The Wharf
 LD2.15
 Sunday - April 23, 2023



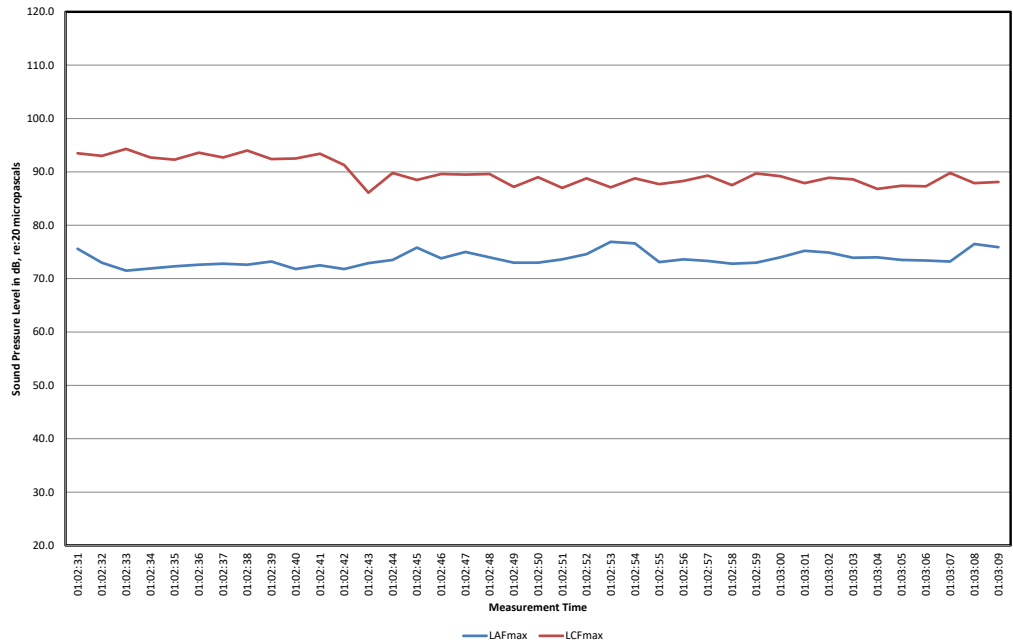
Fort Lauderdale Soundscape Study
 Himershee
 LD2.16
 Sunday - April 23, 2023



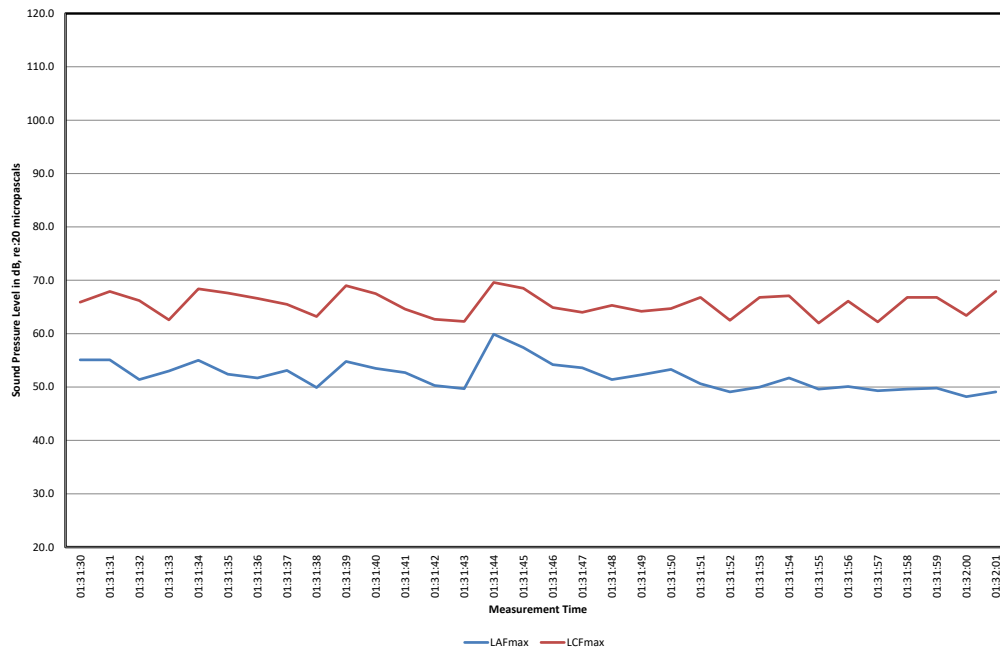
Fort Lauderdale Soundscape Study
 Himershee
 LD2.17
 Sunday - April 23, 2023



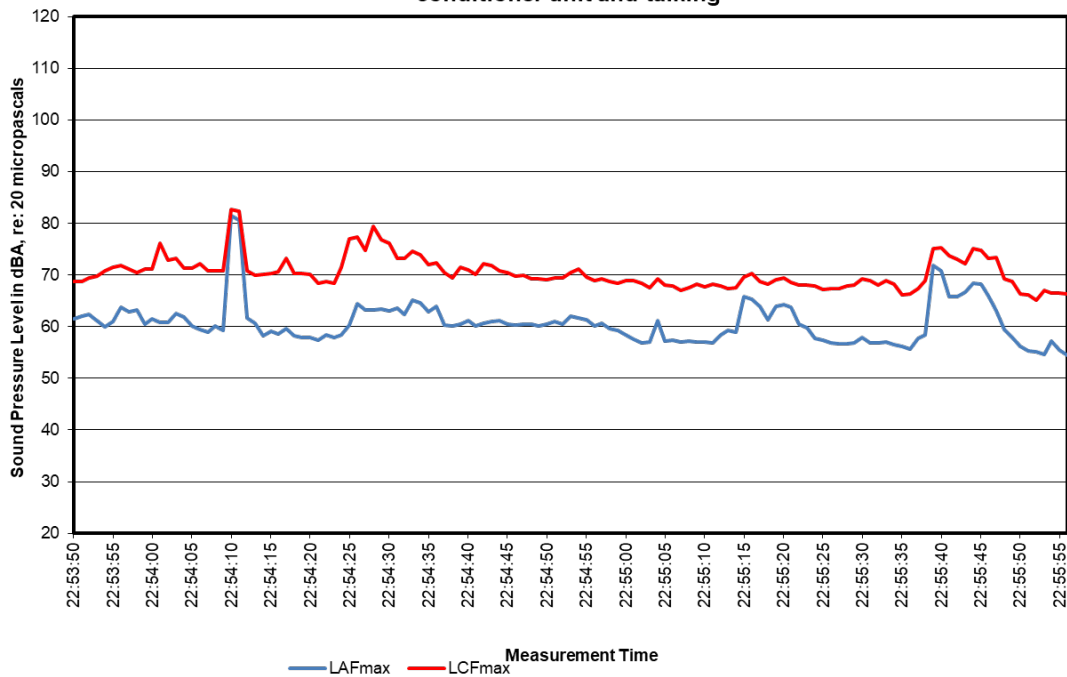
Fort Lauderdale Soundscape Study
 Himeshee
 LD2.18
 Sunday - April 23, 2023



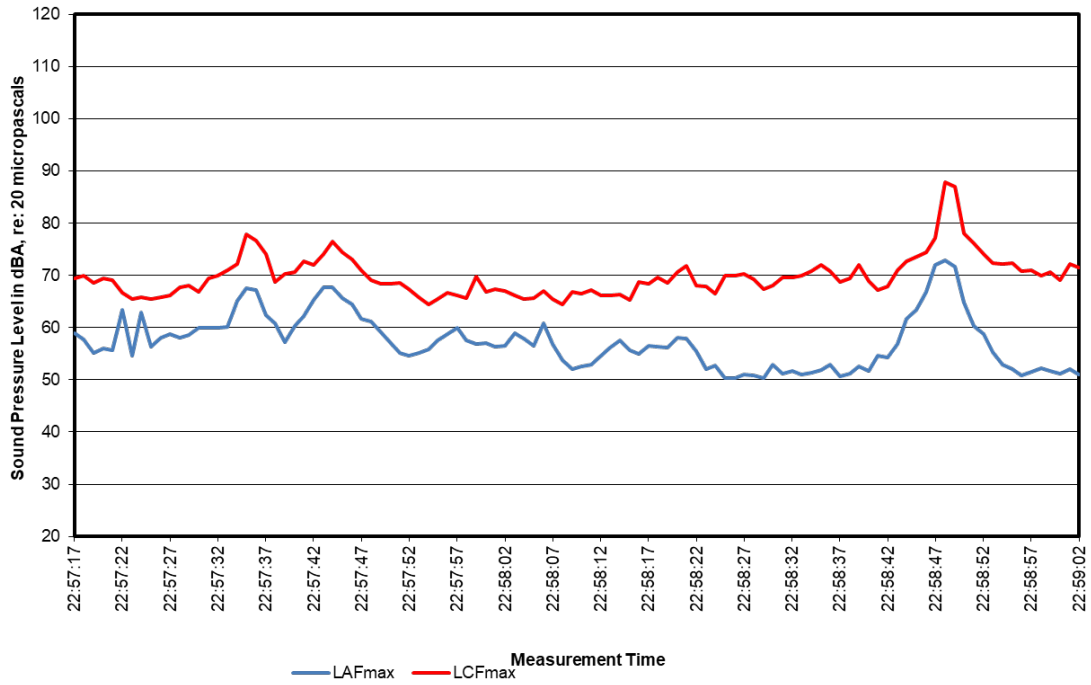
Fort Lauderdale Soundscape Study
Himershee
LD2.19
Sunday - April 23, 2023



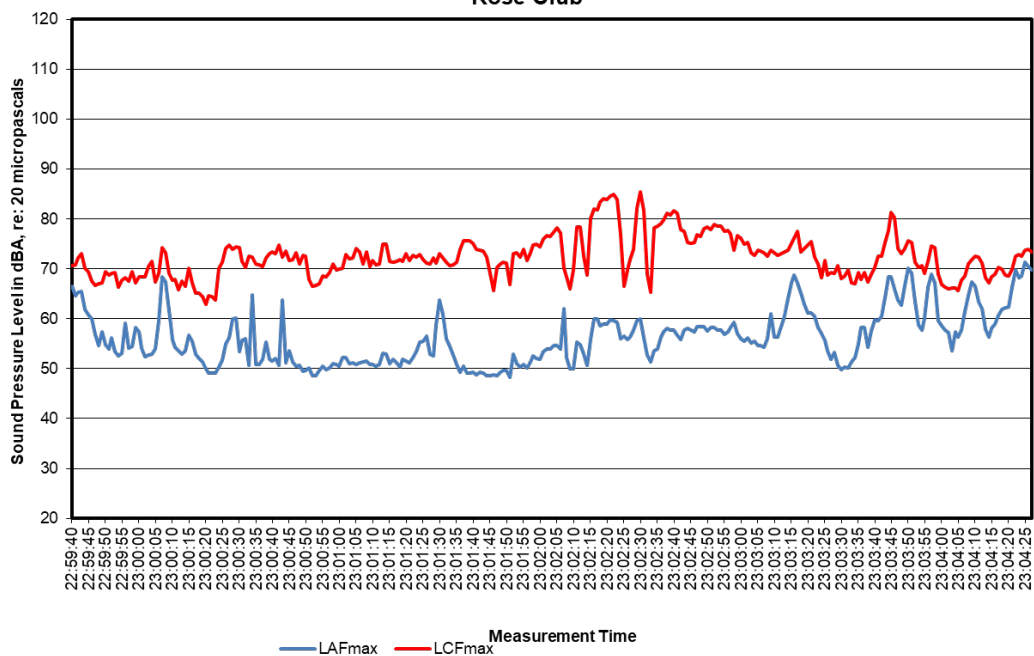
Fort Lauderdale Soundscape Study
Location : Soundwalk Start at Courtyard Marriott to NE 8th Street
Saturday February 16, 2023 LD 04-01
Traffic, voices, ambient music from bar, distant motorcycle, laughing, wind, air conditioner unit and talking



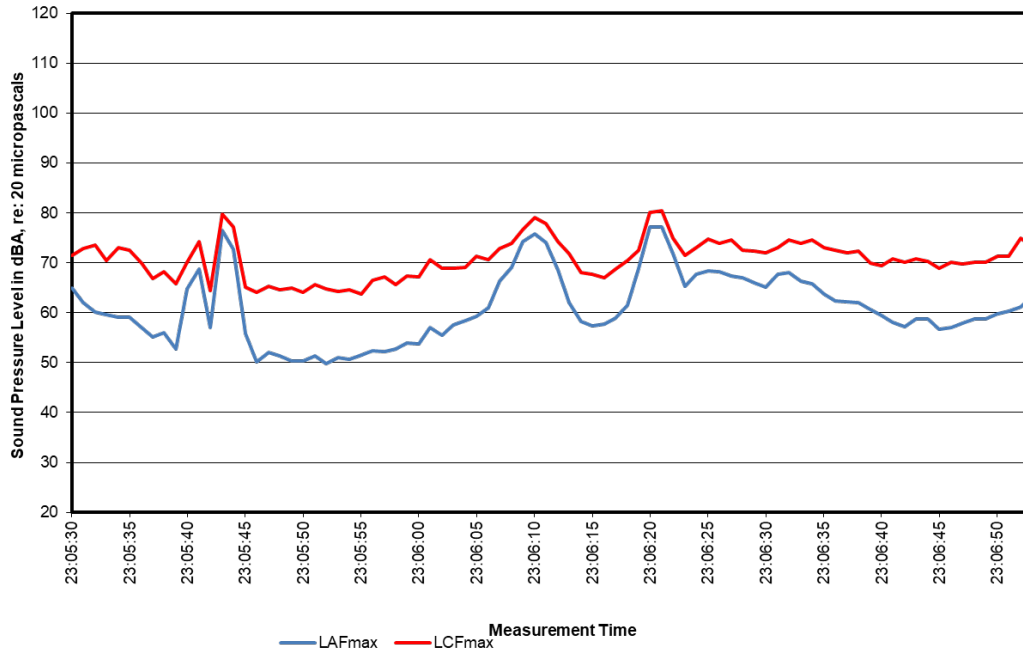
Fort Lauderdale Soundscape Study
Location : Soundwalk Start at NE 8th Street Flager Village
Saturday February 16, 2023 LD 04-02
Water going down drain, distant voices, cars on 8th, birds and music from party



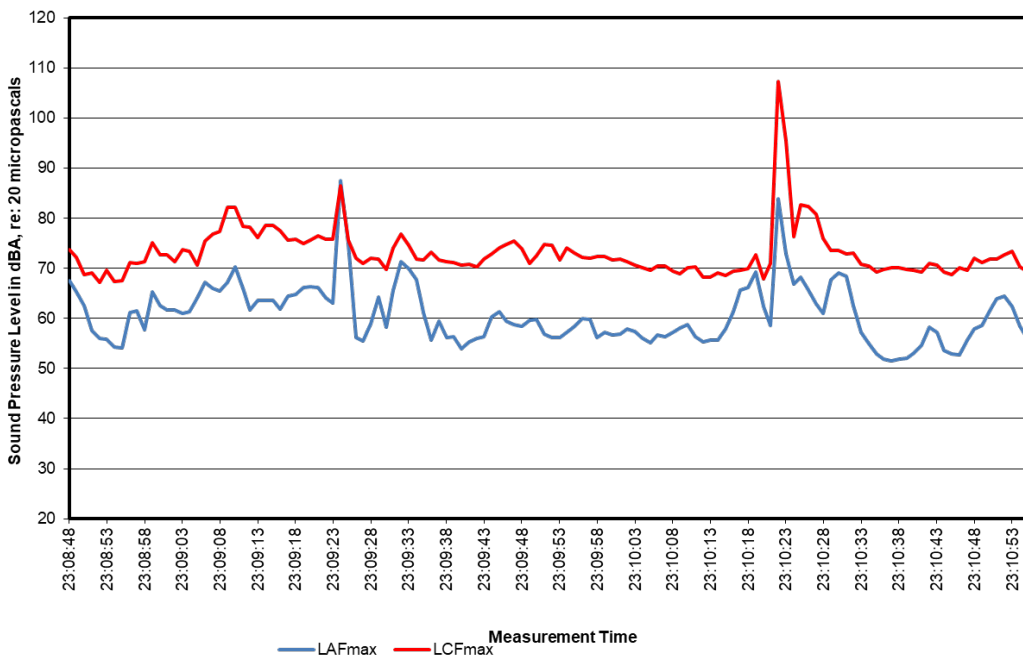
Fort Lauderdale Soundscape Study
Location : NE 8th Street Flager Village
February 16, 2023 LD 04-03
Car revving, yelling, music from party, motorcycle and cars passing, music at Rose Club



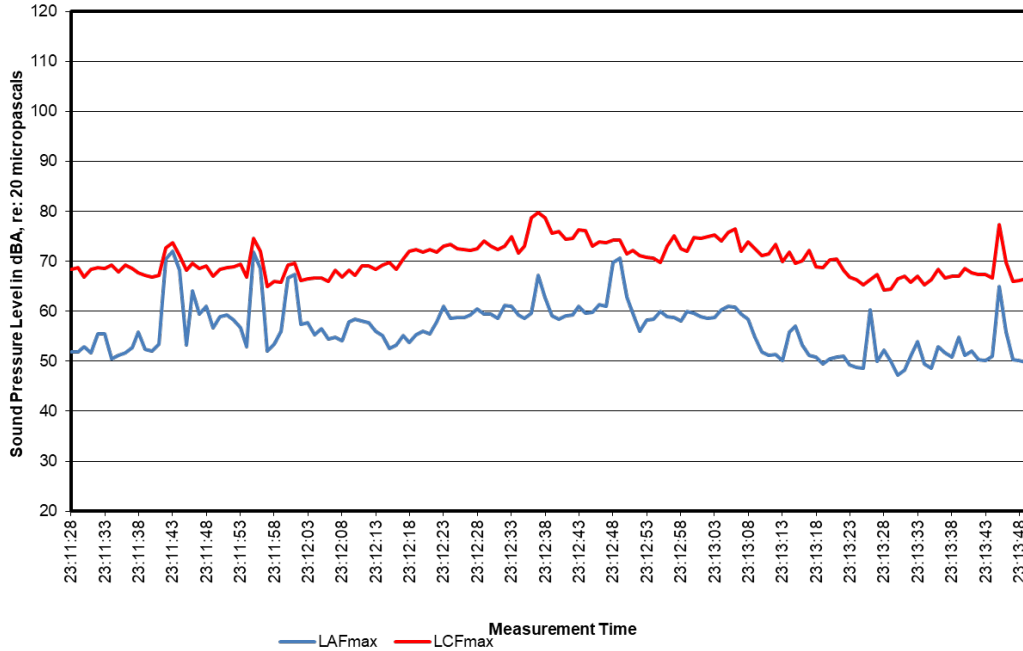
Fort Lauderdale Soundscape Study
Location : NE 8th Street Flager Village and 3rd
February 17, 2023 LD 04-04
Music from house, traffic and coughing



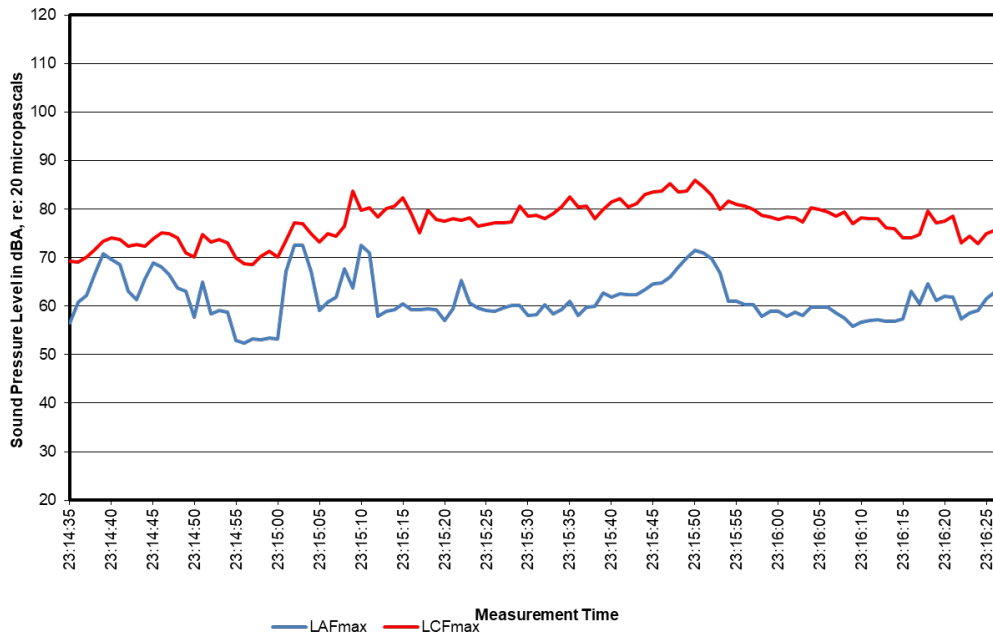
Fort Lauderdale Soundscape Study
Location : Flager Drive at NE 3rd going down Flagler Drive to NE 4th
February 17, 2023 LD 04-05
Music across train tracks, Traffic, Car Revving, airplane, voices, crickets and Music



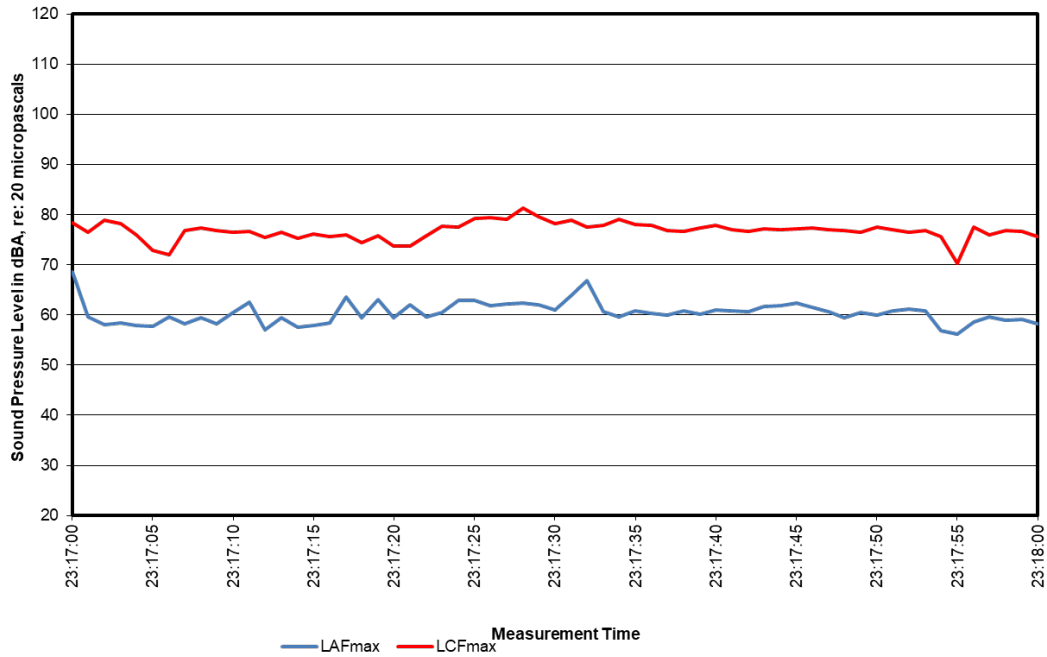
Fort Lauderdale Soundscape Study
Location : NE 4th and North Flagler
February 17, 2023 LD 04-06
Distant music, voices, Loud distant music, Glitch bar 75 ft behind and crickets



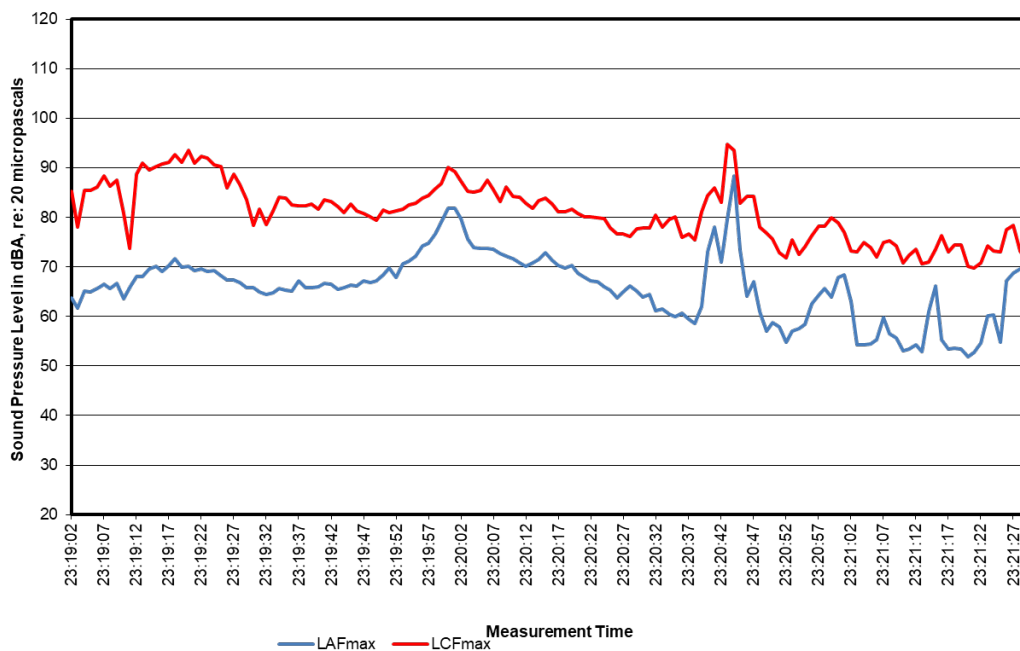
Fort Lauderdale Soundscape Study
Location : NE 4th and North Flagler
February 17, 2023 LD 04-07
Distant music, voices, Loud distant music, Glitch bar 75 ft behind and crickets



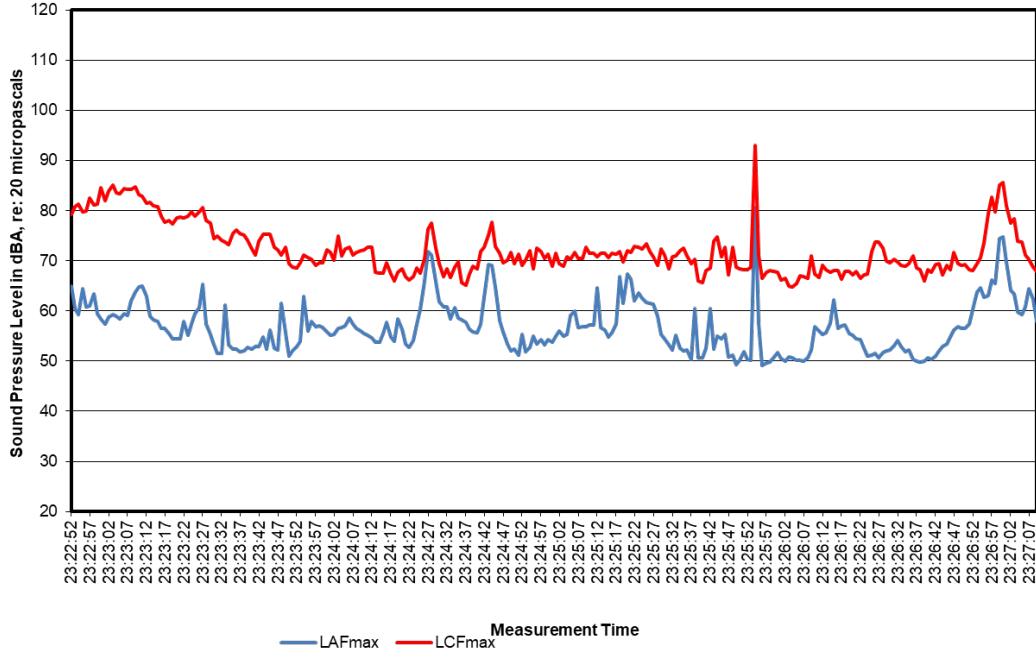
Fort Lauderdale Soundscape Study
Location : Juice Bar
February 17, 2023 LD 04-08
Voices, traffic, car revving, cough, Glitch Bar and wind



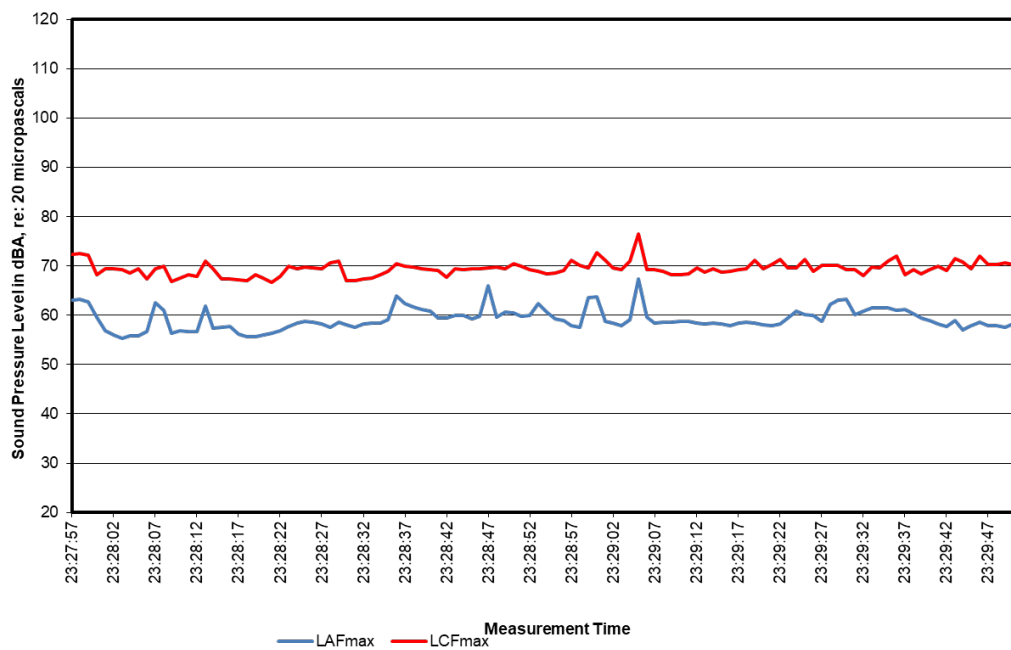
Fort Lauderdale Soundscape Study
Location : NE 5th Flager Village beyond glitch bar
February 17, 2023 LD 04-09
Voices, music from bar and traffic



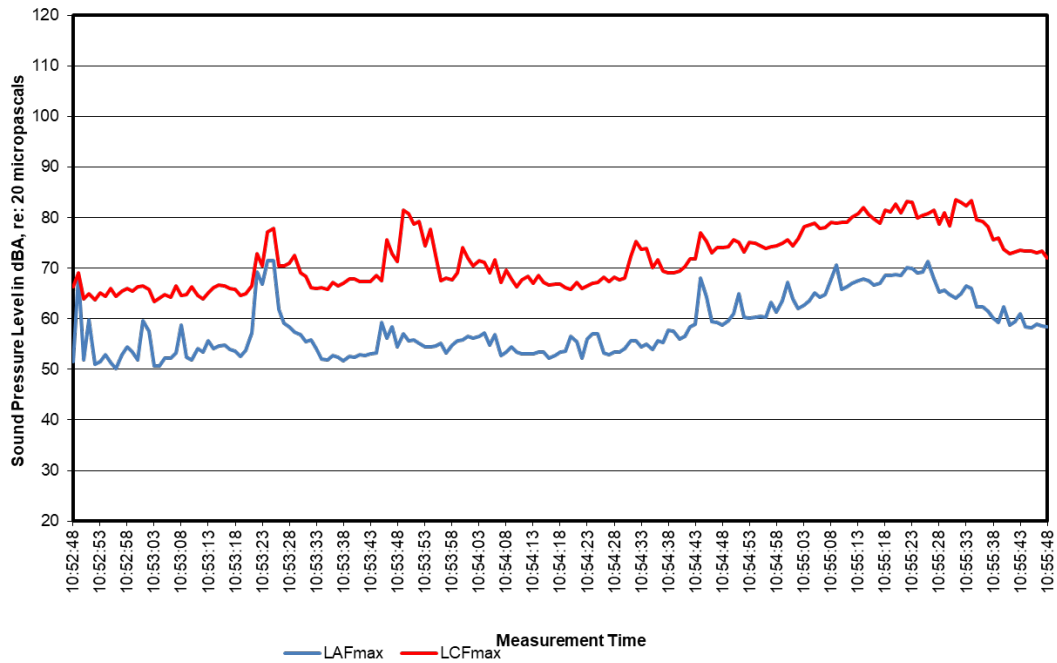
Fort Lauderdale Soundscape Study
Location : NE 8th going to courtyard
February 17, 2023 LD 04-10
Voices, Rose music get louder when door is opened, AC unit, Distant train and traffic



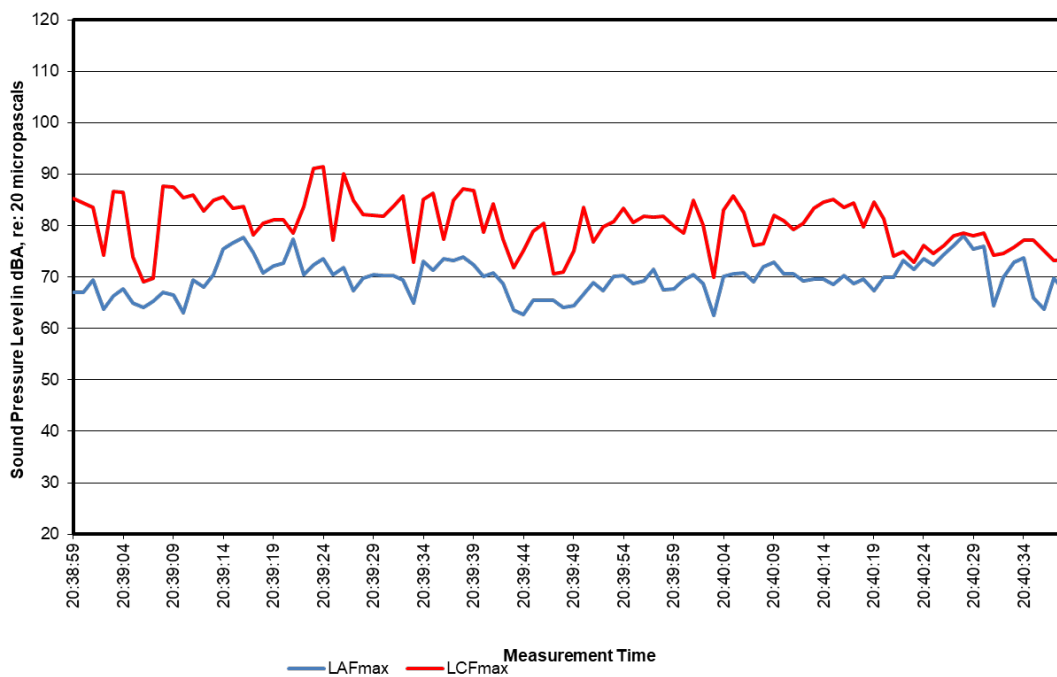
Fort Lauderdale Soundscape Study
Location : NE 5th terrace going to courtyard
February 17, 2023 LD 04-11
Motorcycle, bus stop noise, AC unit, sprinklers, voices, insects and music



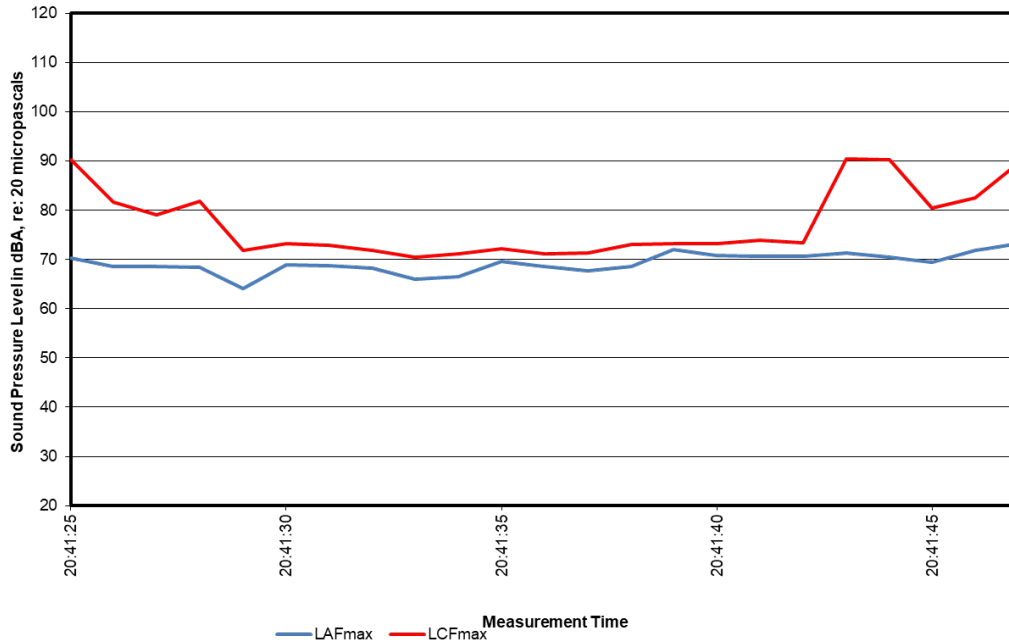
Fort Lauderdale Soundscape Study
Location : Bamboo Flats to Coner near Rose
February 17, 2023 LD 04-12
Ambient traffic on nearby roads and engine revving



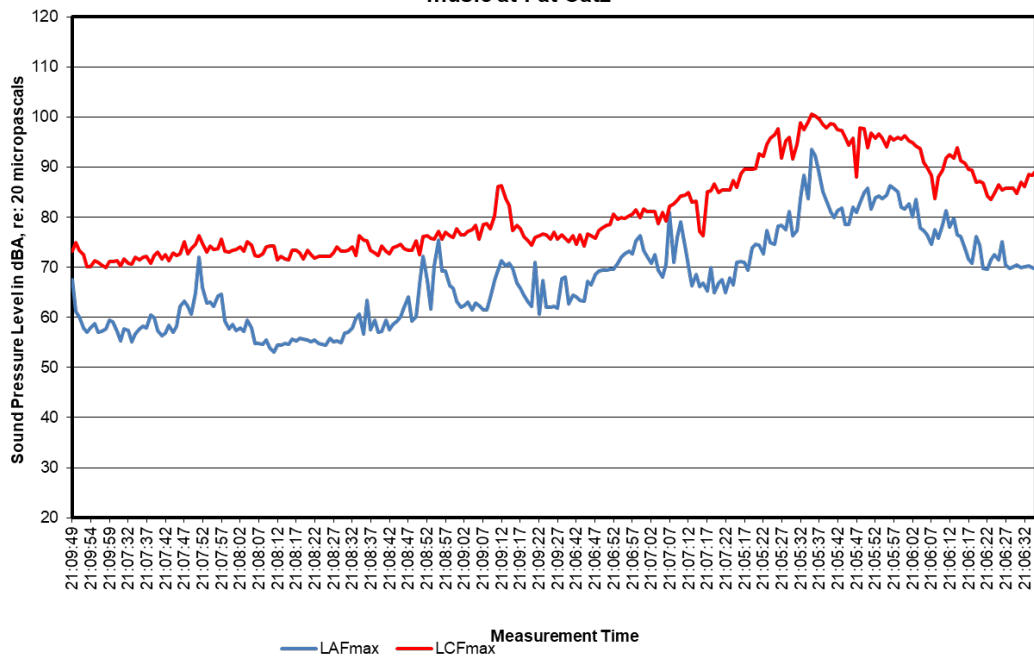
Fort Lauderdale Soundscape Study
Location : Courtyard by Marriott Downtown Rooftop Bar
February 17, 2023 LD 04-13
Music and Voices



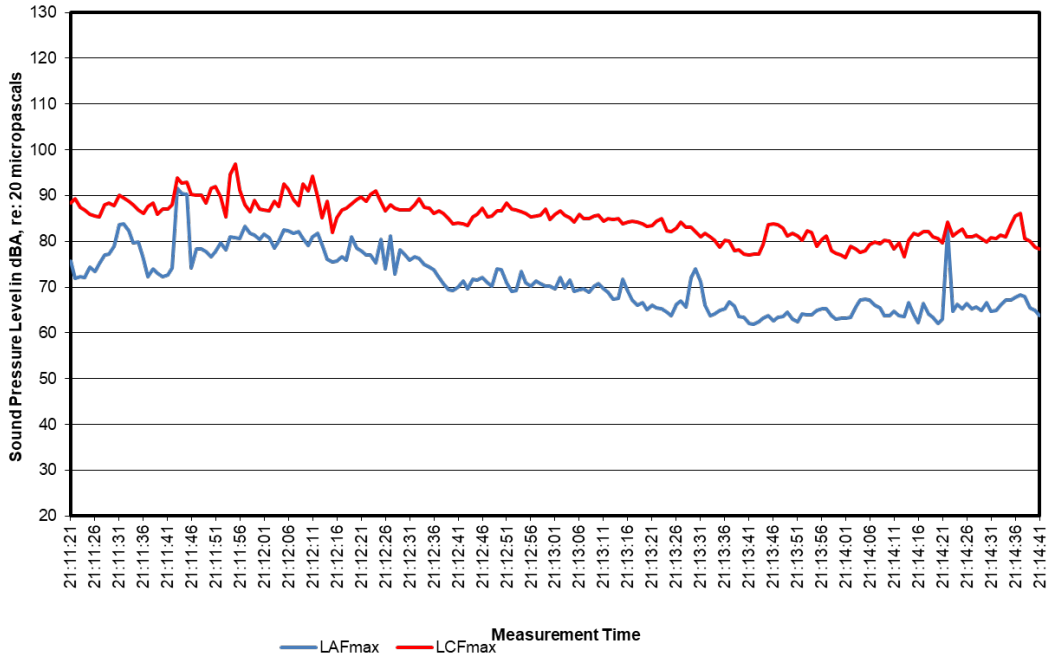
Fort Lauderdale Soundscape Study
Location : Courtyard by Marriott Downtown Rooftop Bar
February 17, 2023 LD 04-14
Music and Voices



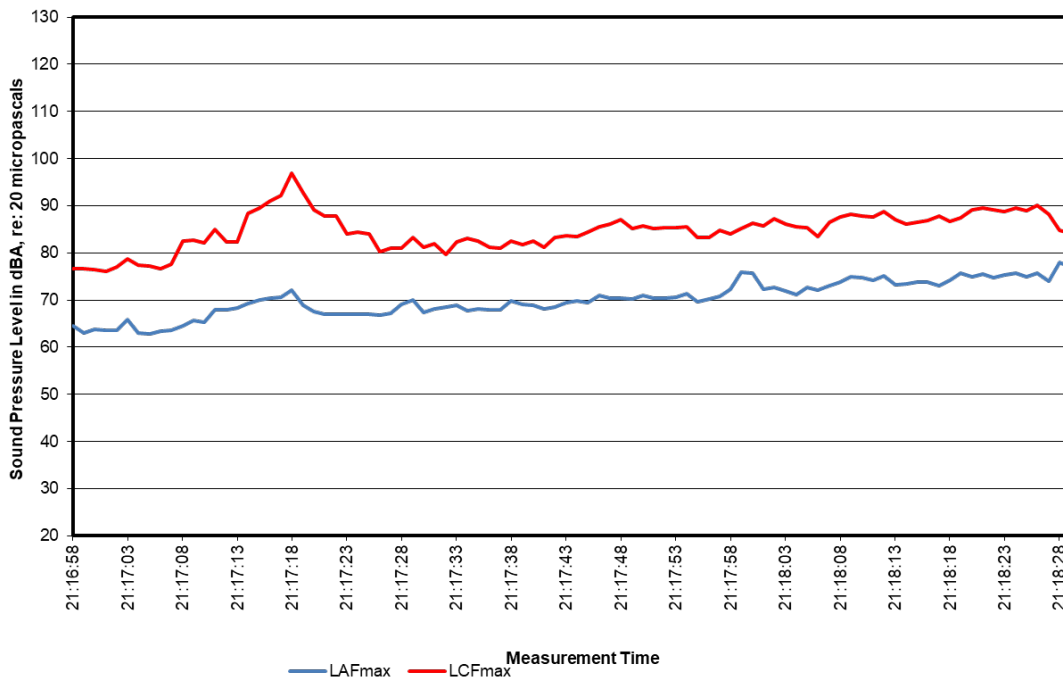
Fort Lauderdale Soundscape Study
Location : Esplande Park Starting at Commodore Brook Ave,
February 17, 2023 LD 04-15
Soundwalk, footsteps, nearby and distant traffic, distant music, Voices and
music at Fat Catz



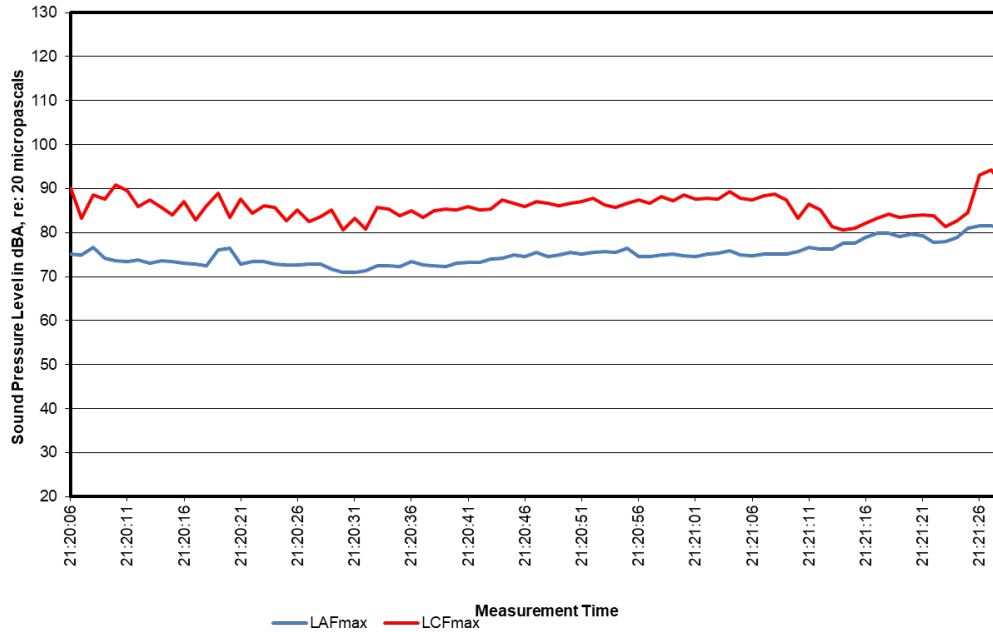
City of Fort Lauderdale Soundscape Study
Location : Crossing the street
LD 04-16
Music from Lucky's Tavern, voices, music from Wee Tacos, traffic and engine rev



City of Fort Lauderdale Soundscape Study
Location : The Wharf
LD 04-17
Distant music, distant voices, voices and music from the Wharf Bodega

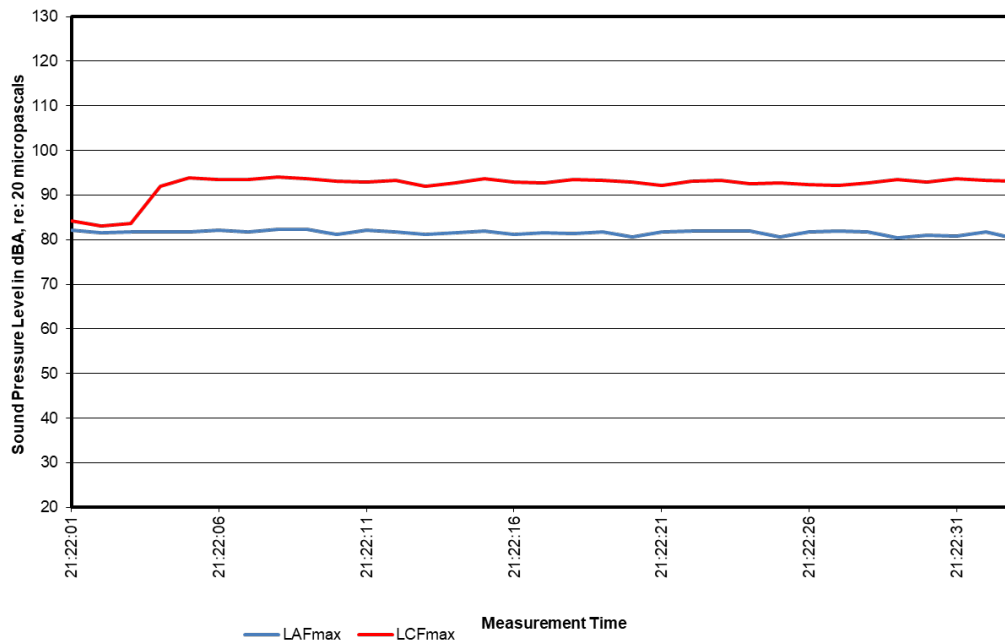


City of Fort Lauderdale Soundscape Study
Location : Brickell to the Wharf
LD 04-19
Distant music and cars, voices and Music from the Wharf Bodega



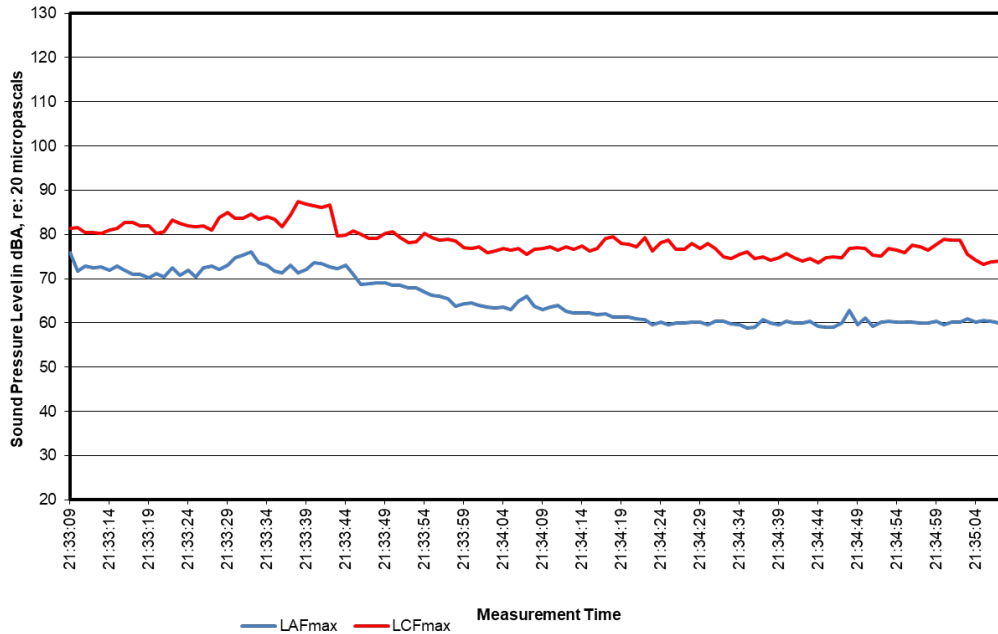
— LAFmax — LCFmax Measurement Time

City of Fort Lauderdale Soundscape Study
Location : 6' from Wharf
LD 04-20
Loud voices and Music from the Wharf Bodega

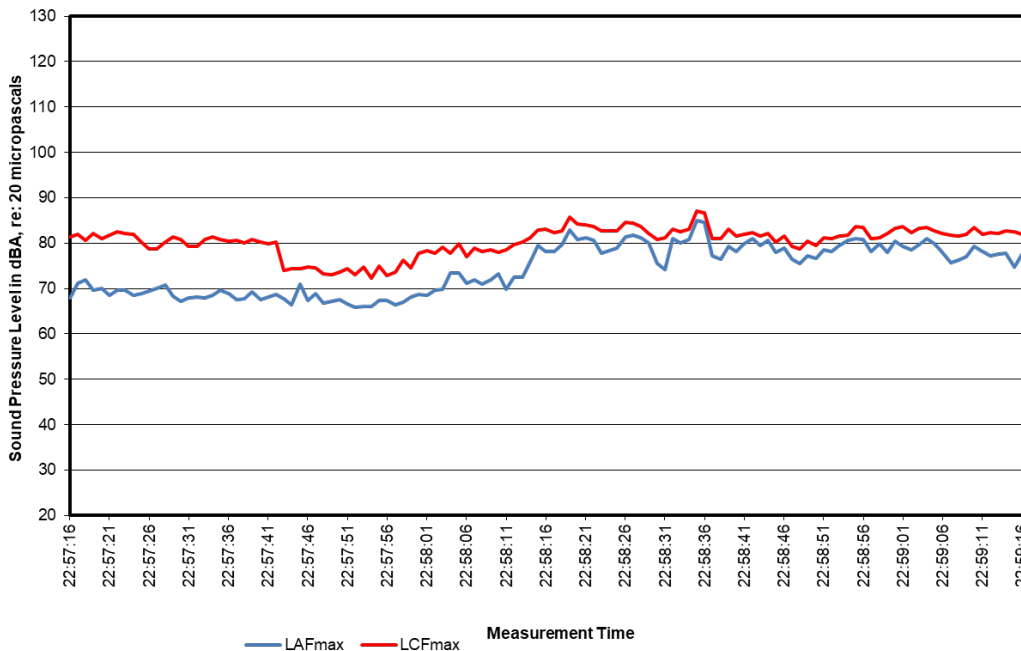


— LAFmax — LCFmax Measurement Time

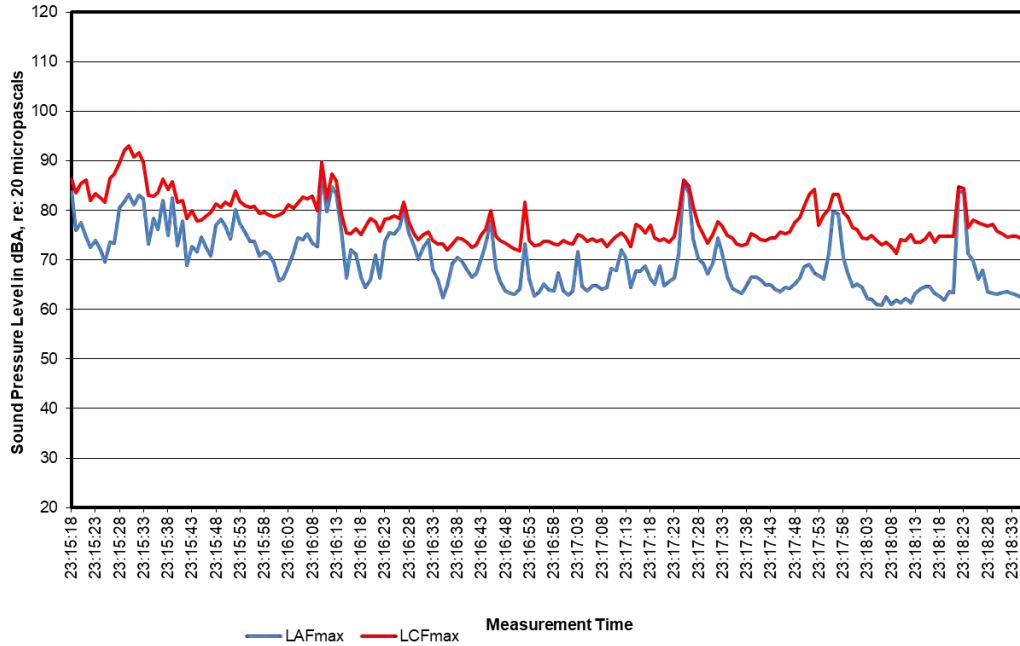
City of Fort Lauderdale Soundscape Study
Location : Riverwalk to Automation Stage
LD 04-21
Boats, distant music, quiet waves, distant bass and distant talking



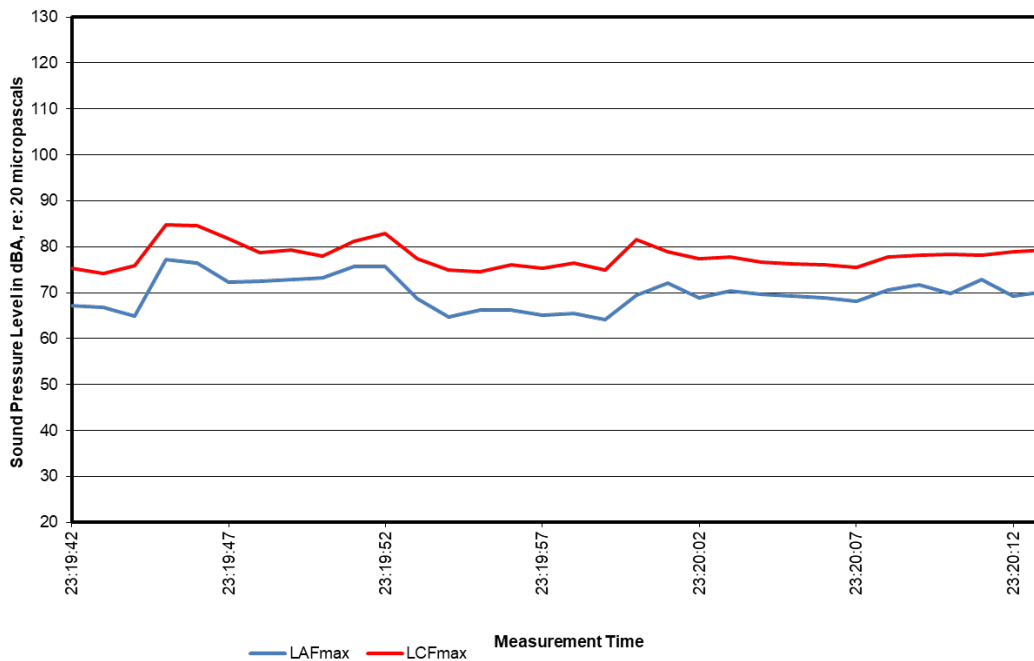
City of Fort Lauderdale Soundscape Study
Location : Soundwalk New River Drive to Salt Seven
LD 04-23
Music, voices and crickets



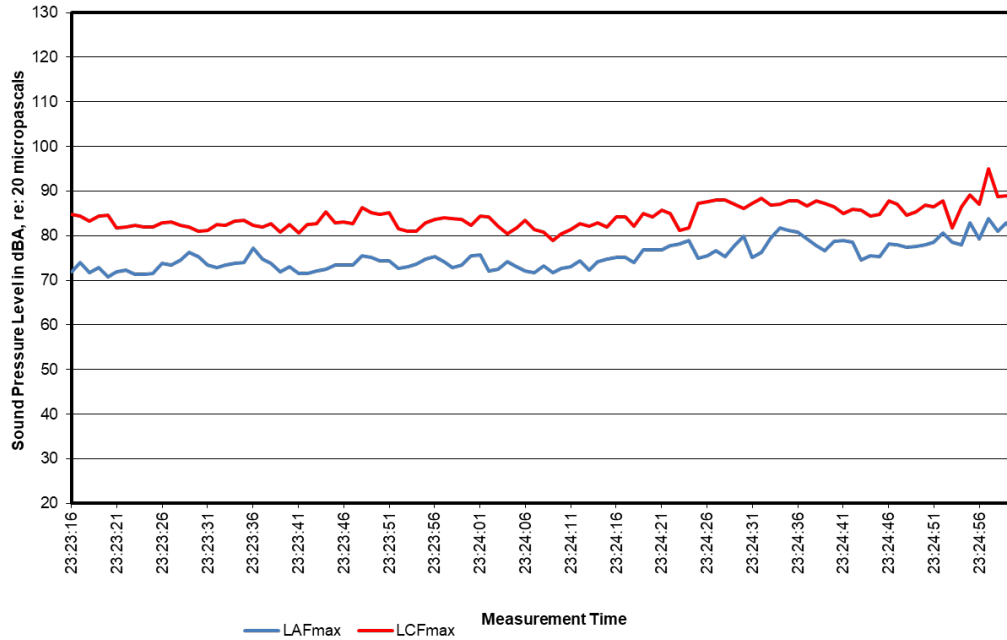
Fort Lauderdale Soundscape Study
Location : Soundwalk New River Drive to Salt Seven
February 17, 2023 LD 04-26
Car Rev, Voices at Fogo De Chao, distant music from Eddie V's, yelling and distant music



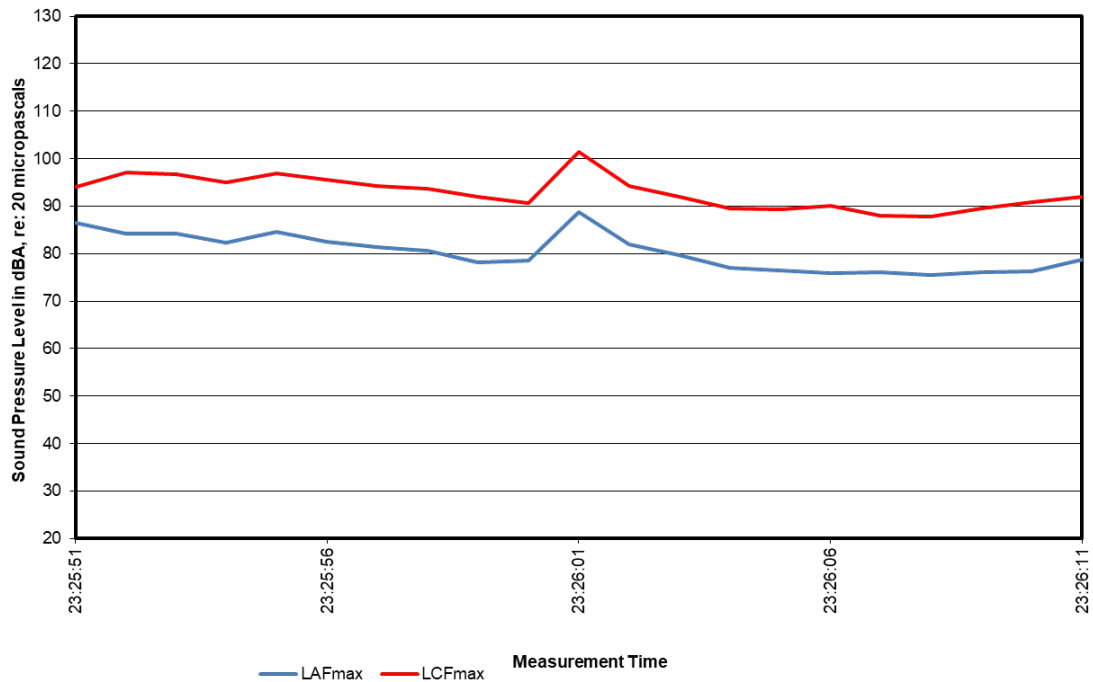
Fort Lauderdale Soundscape Study
Location : Outside Hyatt Centric
February 17, 2023 LD 04-27
Music, voices and traffic



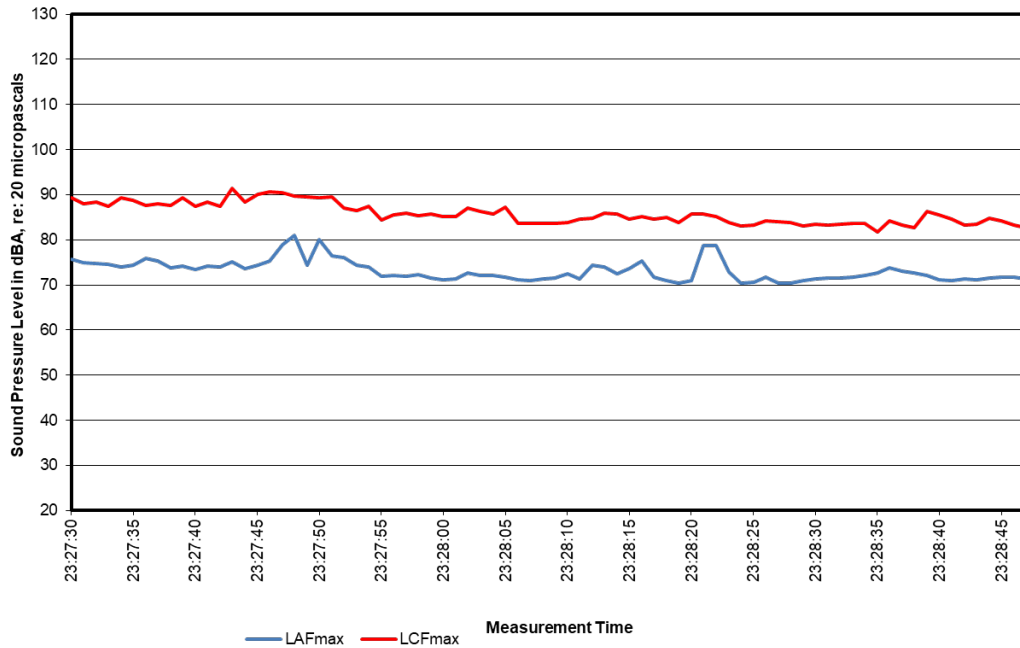
Fort Lauderdale Soundscape Study
Location : Andres Ave to The Wharf
February 17, 2023 LD 04-28
Music, voices and traffic



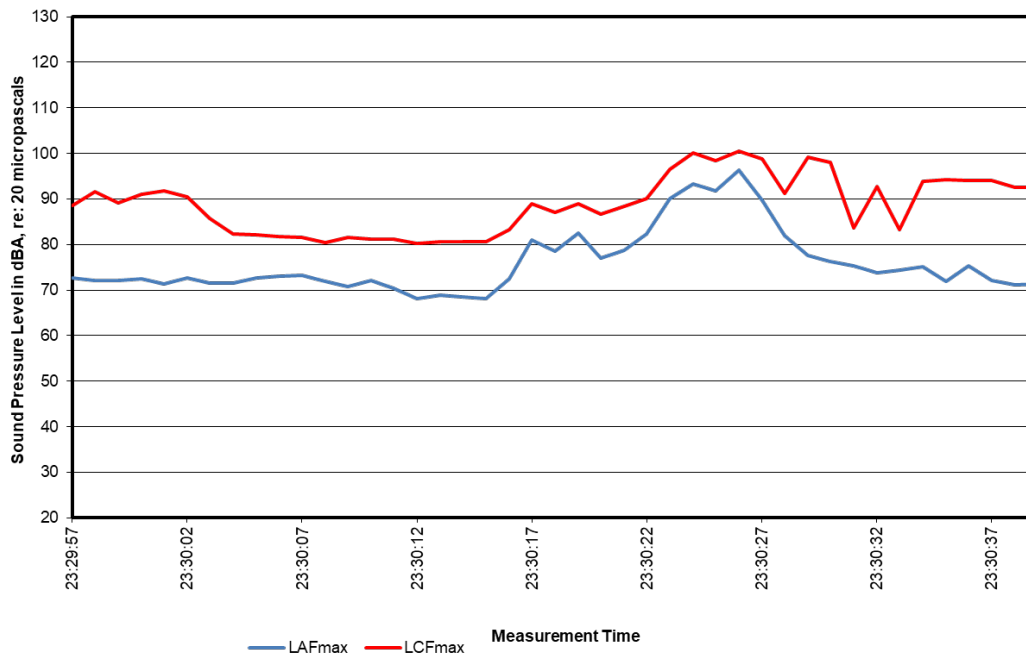
Fort Lauderdale Soundscape Study
Location : The Wharf
February 17, 2023 LD 04-29
Music, voices, Lamborgini and Bentley Revving



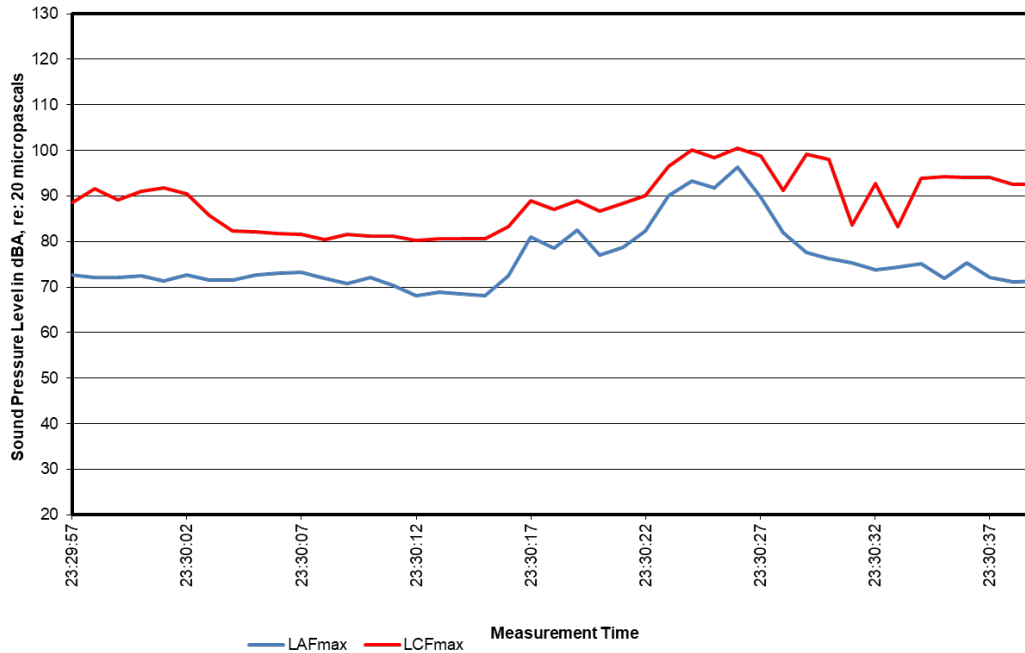
Fort Lauderdale Soundscape Study
Location : Corner of The Wharf and Bodega
February 17, 2023 LD 04-30
Music, voices, slow traffic and Car Revving



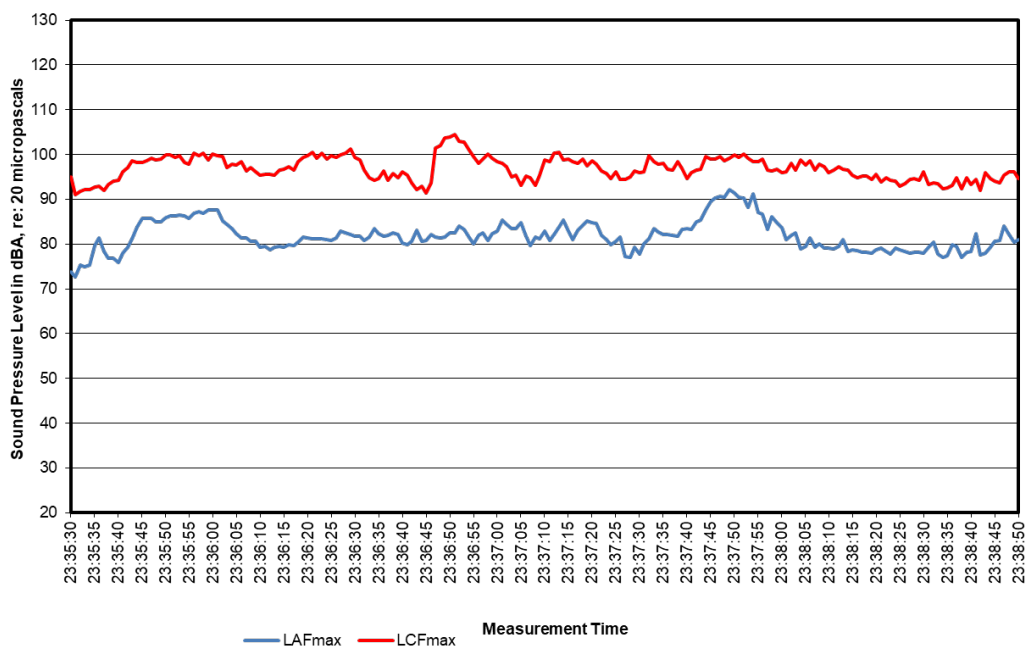
Fort Lauderdale Soundscape Study
Location : Brickell and 2nd Ave
February 17, 2023 LD 04-31
Music, voices and Motorcycle Passing



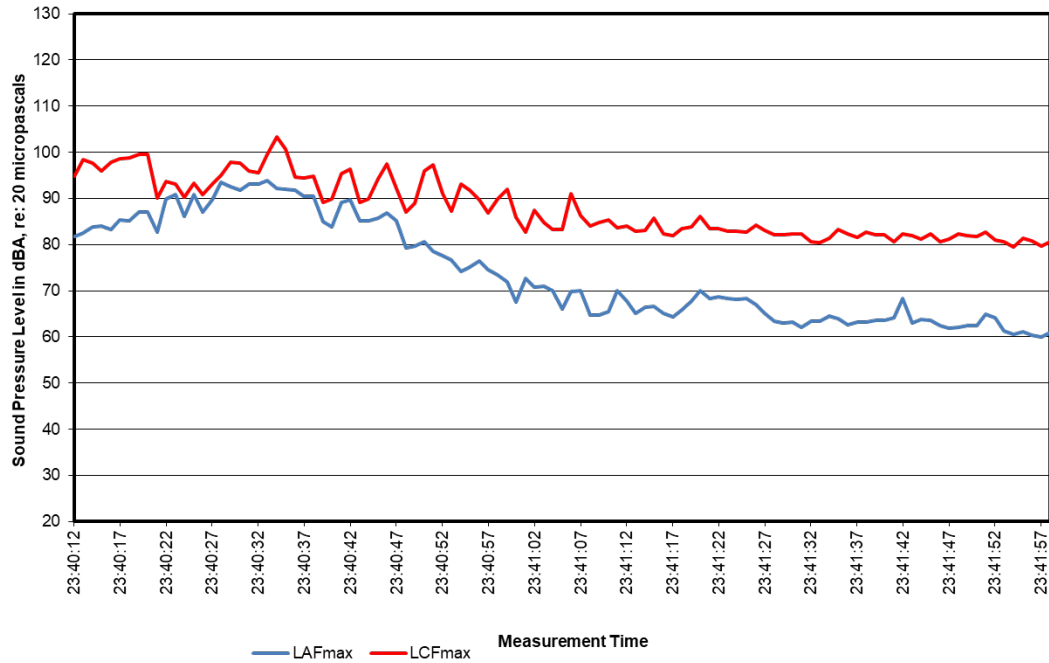
Fort Lauderdale Soundscape Study
Location : Brickell and 2nd Ave
February 17, 2023 LD 04-31
Music, voices and Motorcycle Passing



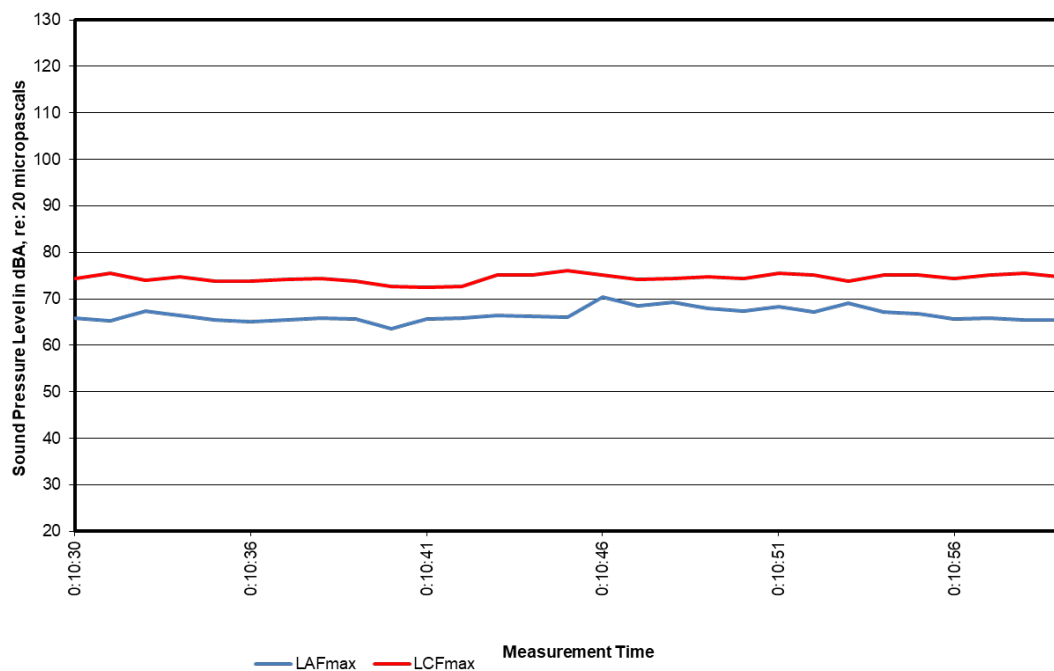
Fort Lauderdale Soundscape Study
Location : Moffat Ave walking down Himmarshee
February 17, 2023 LD 04-33
Music, bass, and voices



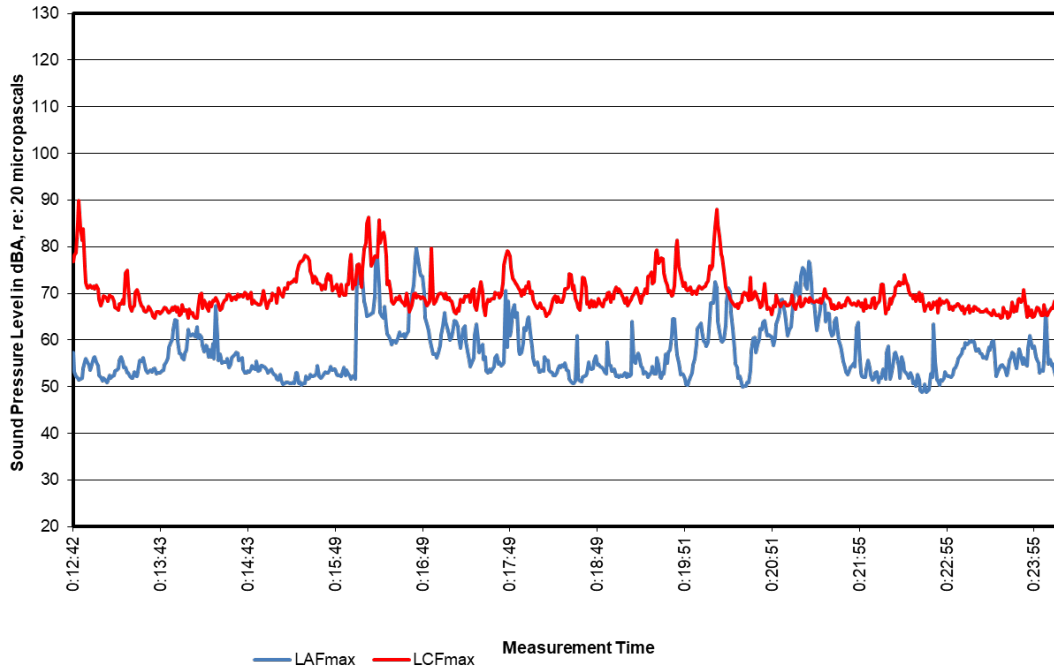
Fort Lauderdale Soundscape Study
Location : Capones to Southwest 4th
February 17, 2023 LD 04-34
Music, bass, and voices



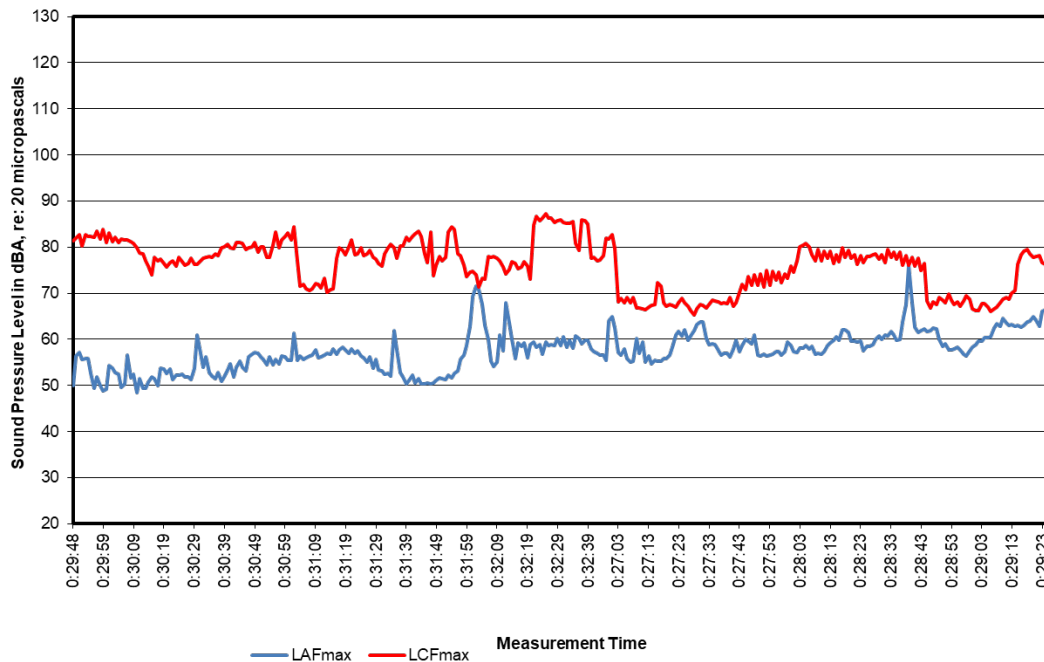
Fort Lauderdale Soundscape Study
Location : Port Cochere at Marriott
February 17, 2023 LD 04-35
Background music, traffic, and voices



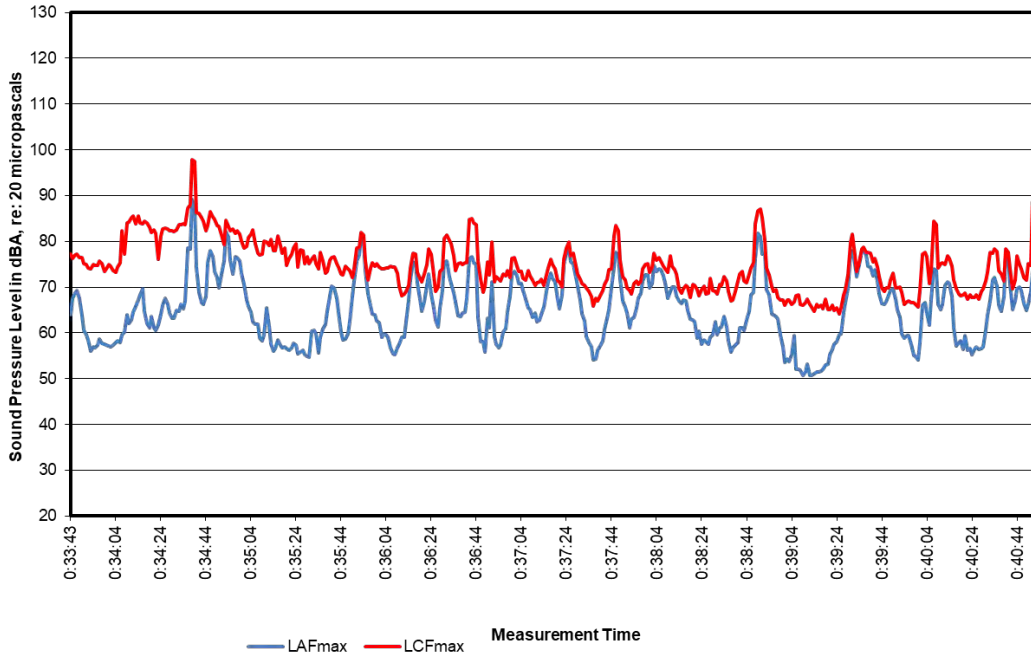
Fort Lauderdale Soundscape Study
Location : NE 7th street
February 17, 2023 LD 04-36
Siren, insects, distant plane, music, train horn, traffic, and voices



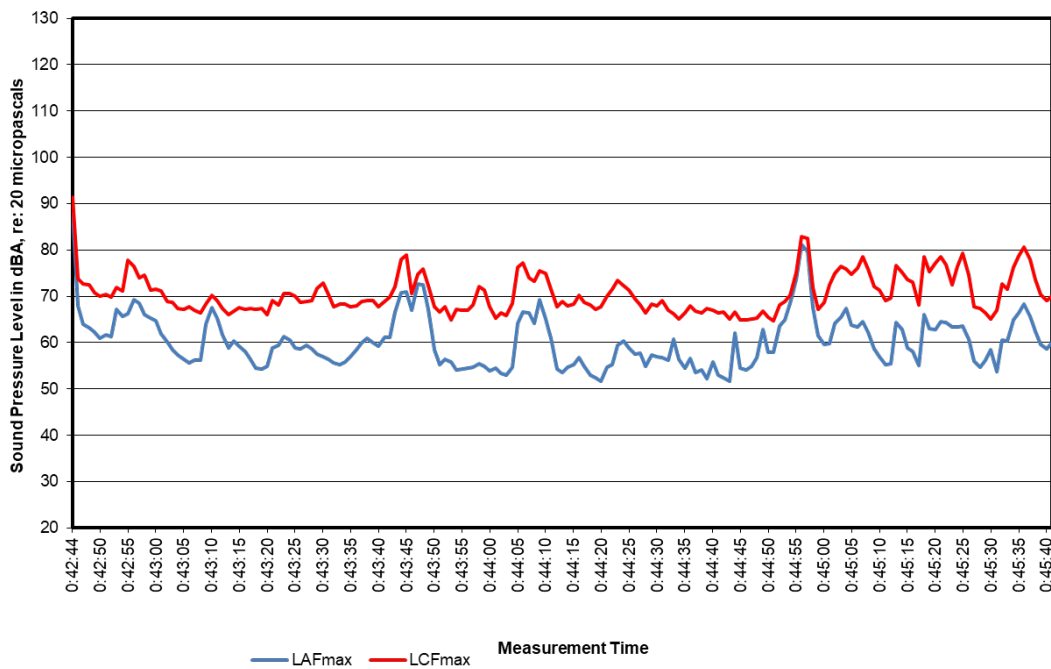
Fort Lauderdale Soundscape Study
Location : NE 1st and NE 7th Street
February 17, 2023 LD 04-37
Distant plane, music, traffic and voices



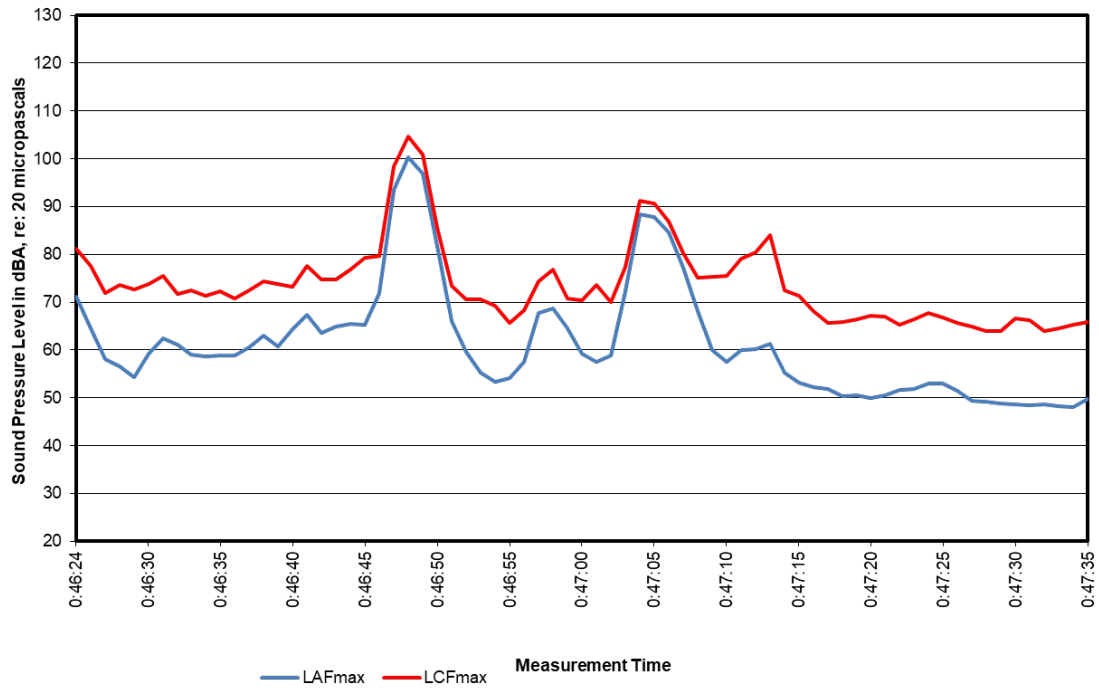
Fort Lauderdale Soundscape Study
Location : NE 7th by Ora to NE 30th Ave
February 17, 2023 LD 04-38
Music, loud traffic and voices



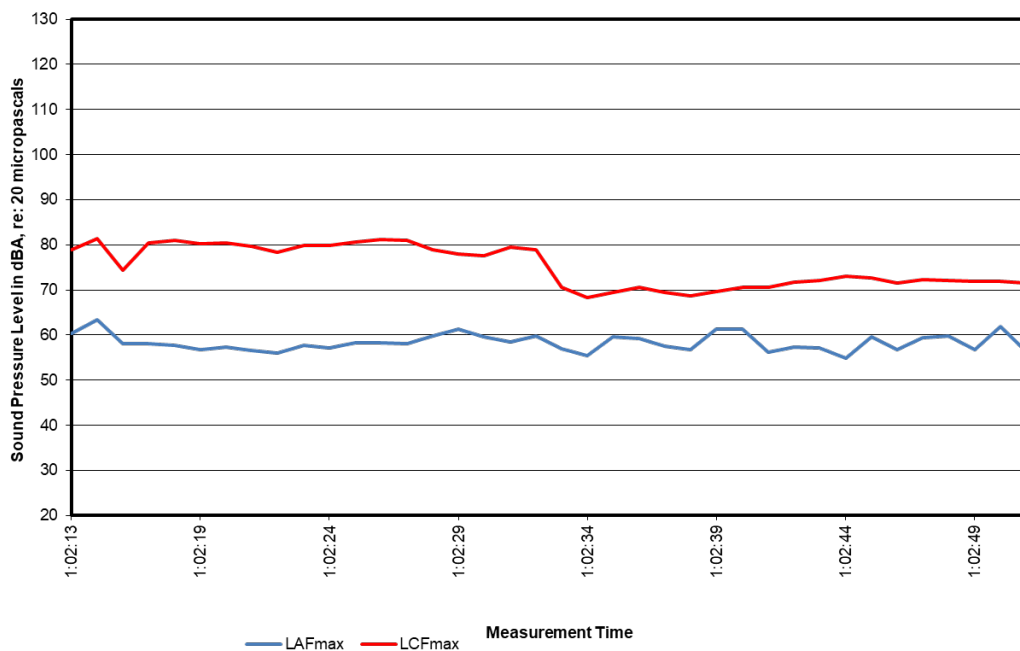
Fort Lauderdale Soundscape Study
Location : NE 6th street to NE 1st and NE 6th
February 17, 2023 LD 04-39
Music, insects, traffic and voices



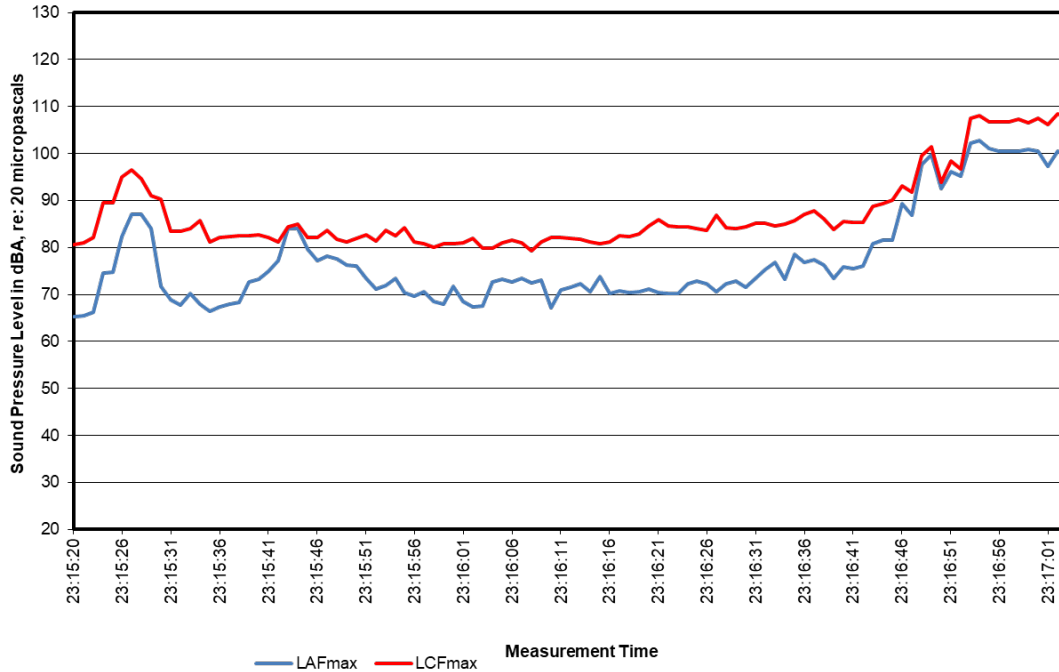
Fort Lauderdale Soundscape Study
Location : NE 6th street to NE 1st and NE 6th
February 17, 2023 LD 04-40
Engine Rev in Parking Garage



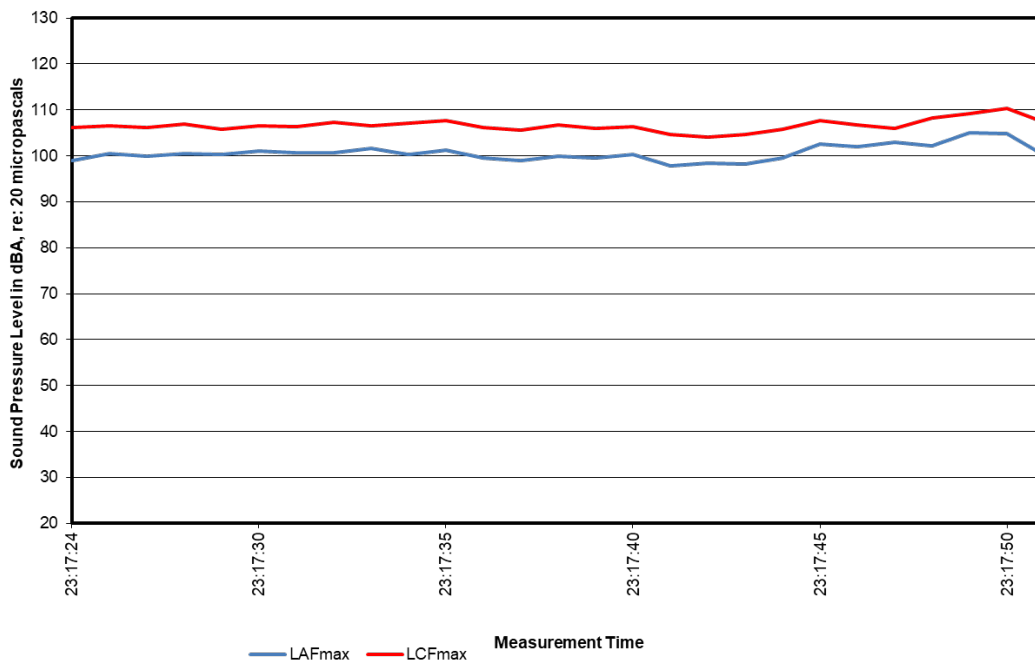
Fort Lauderdale Soundscape Study
Location : NE 6th Street to NE 1st and NE 6th
February 17, 2023 LD 04-41
Voices and Loud Cars



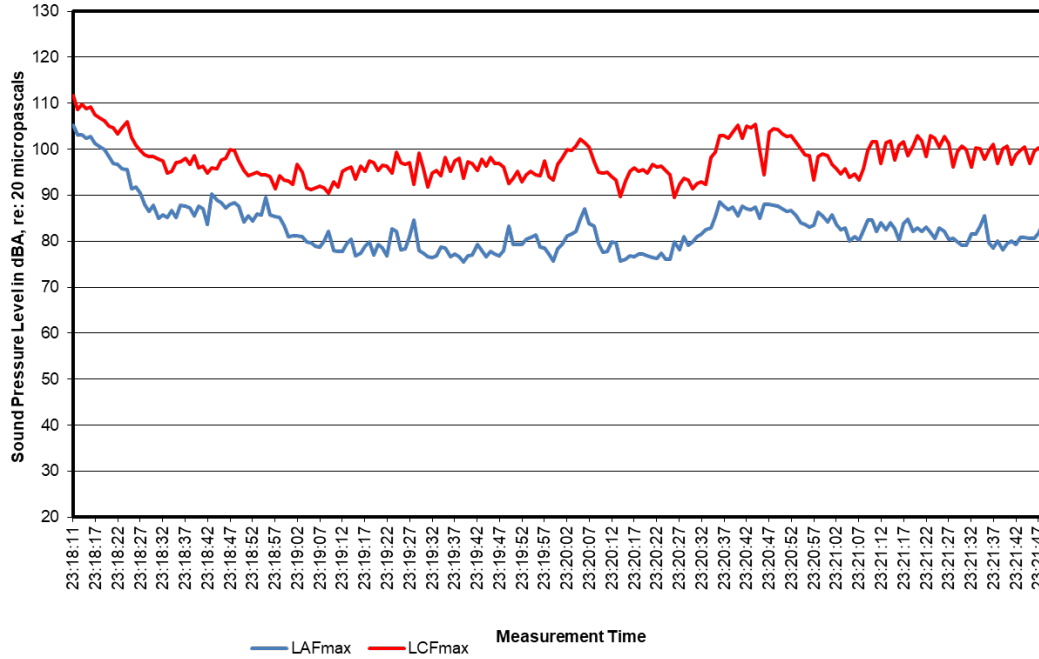
Fort Lauderdale Soundscape Study
Location : Fatcats
February 17, 2023 LD 04-52
Music, Voices and Loud Cars



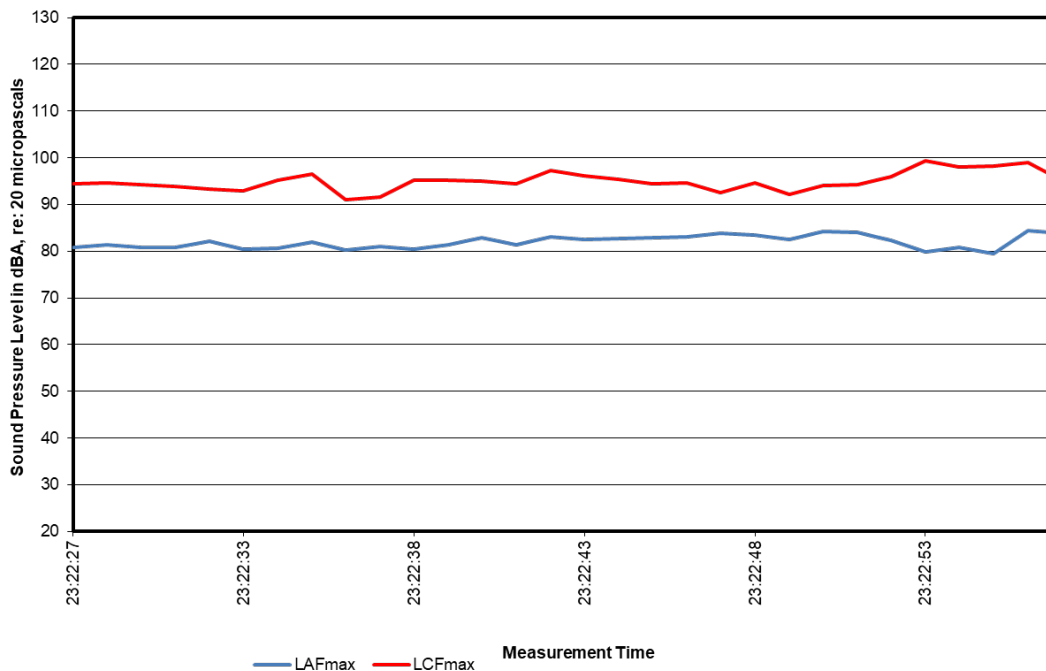
Fort Lauderdale Soundscape Study
Location : Fatcats
February 17, 2023 LD 04-53
Music, Voices and Traffic



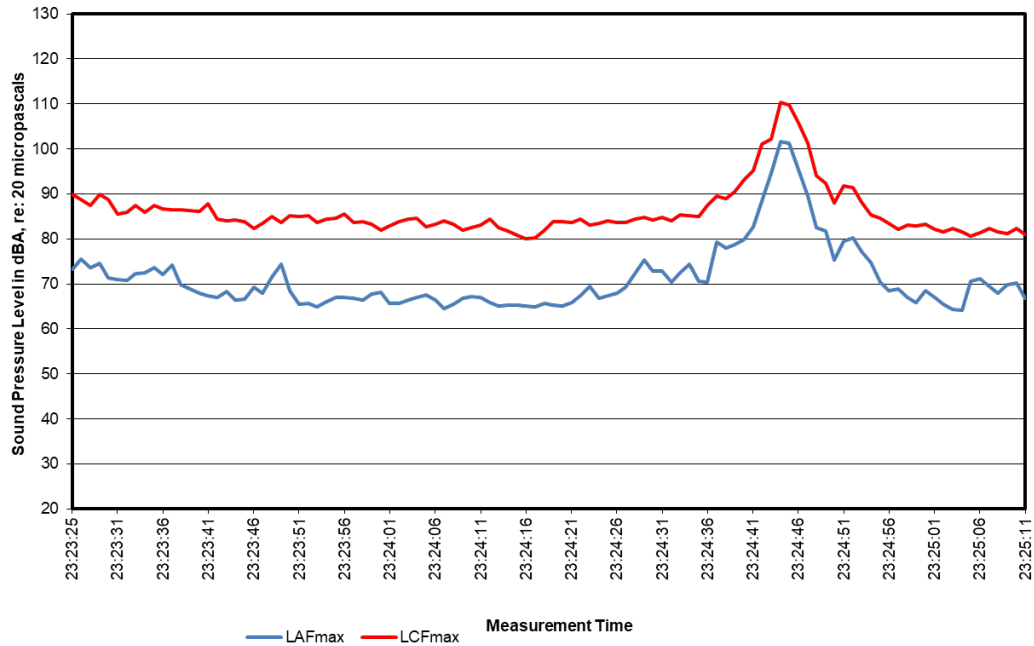
Fort Lauderdale Soundscape Study
Location : Fatcats to Rileys Irish Pub
February 17, 2023 LD 04-54
Music, Voices and Traffic



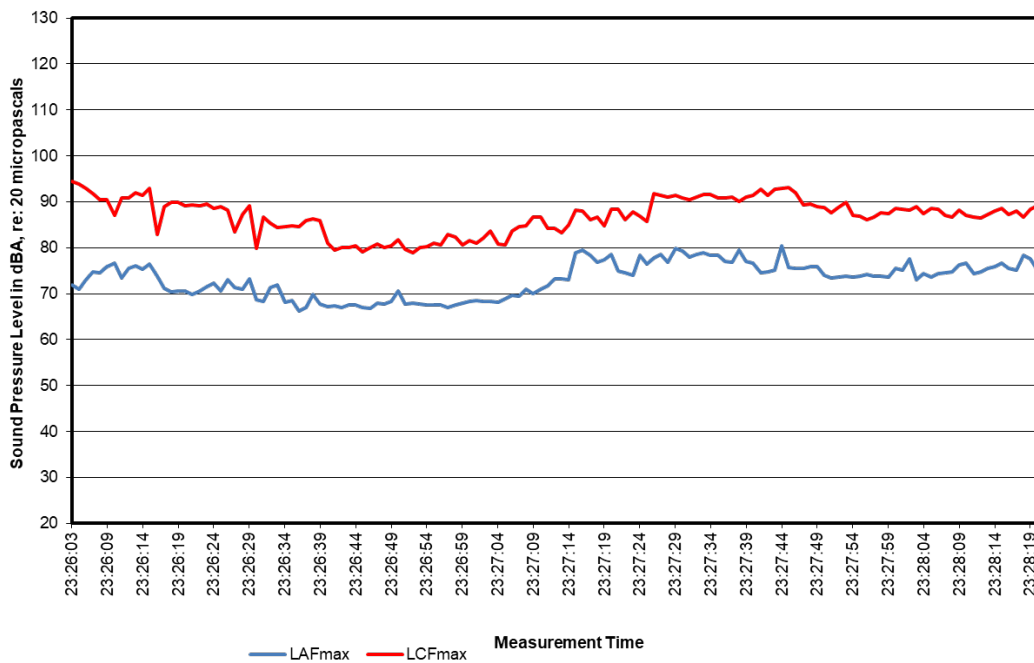
Fort Lauderdale Soundscape Study
Location : SW 2nd Ave by the Road
February 17, 2023 LD 04-55
Music, Voices and Traffic



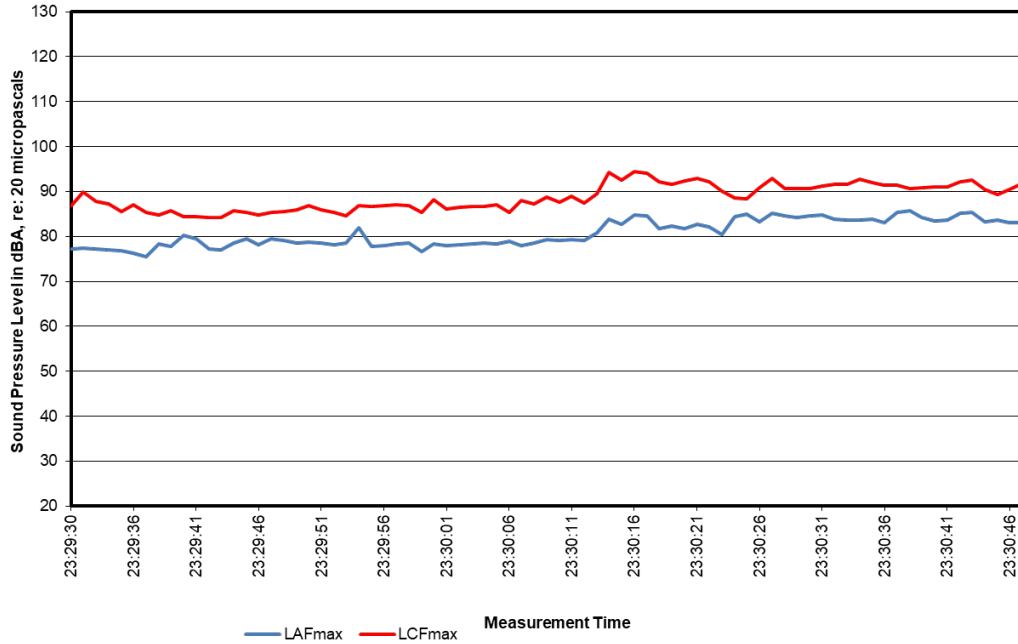
Fort Lauderdale Soundscape Study
Location : Moffat to Brickell
February 17, 2023 LD 04-56
Music, Insects, Voices, Loud Rev, Train and Traffic



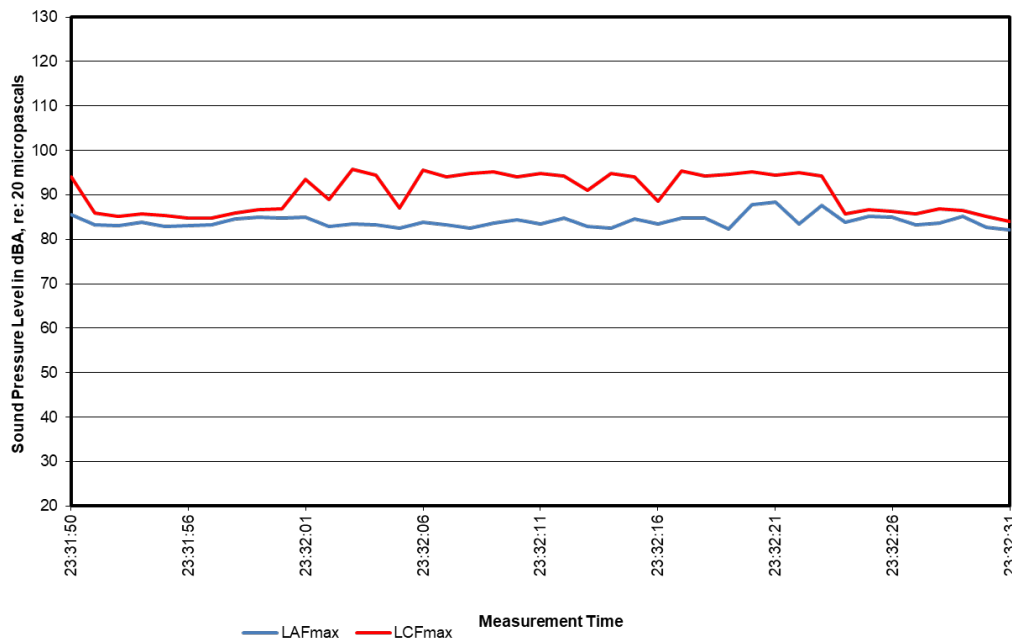
Fort Lauderdale Soundscape Study
Location : Brickell to the Wharf
February 17, 2023 LD 04-57
Music, Insects, Voices, car horn and Traffic



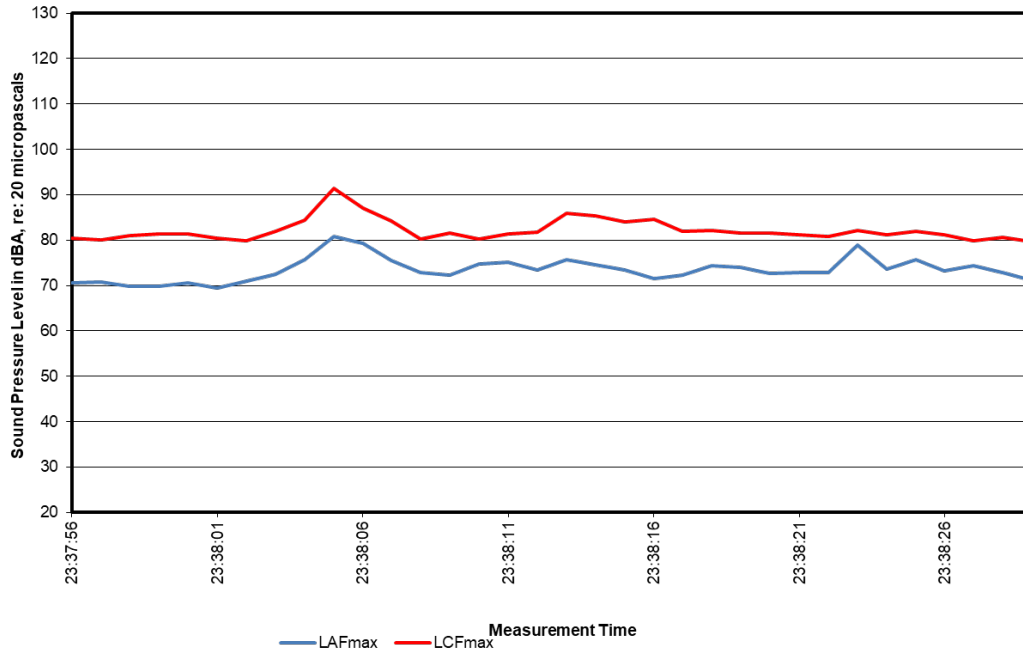
Fort Lauderdale Soundscape Study
Location : The Wharf 6' outside fence
February 17, 2023 LD 04-58
Music, Voices, motorcycle and Traffic



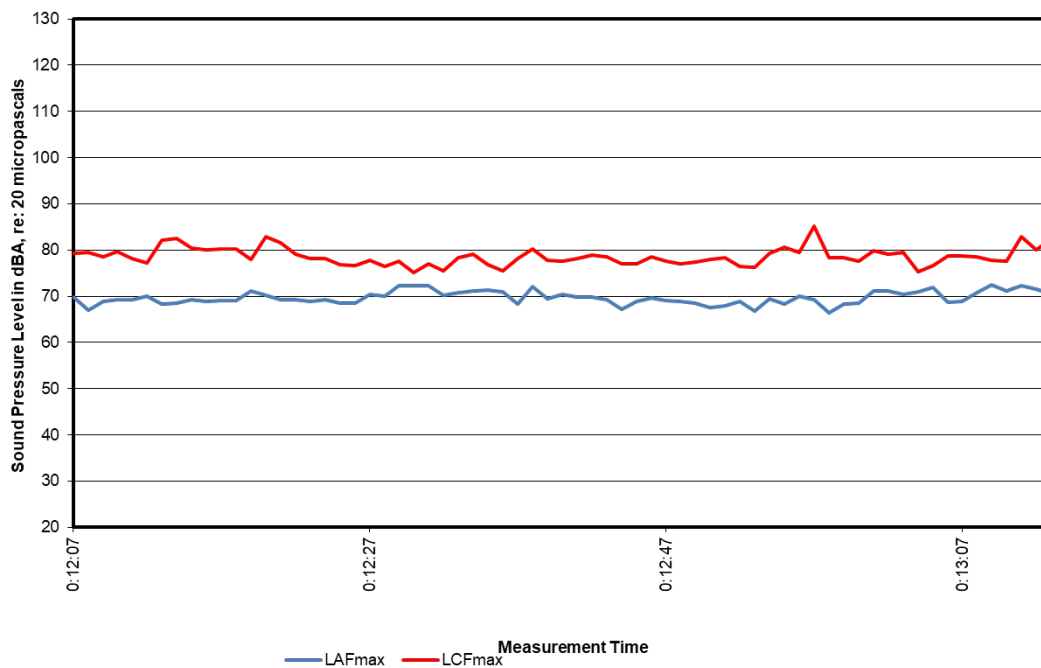
Fort Lauderdale Soundscape Study
Location : The Wharf 6' outside fence
February 17, 2023 LD 04-59
Music, Voices and Traffic



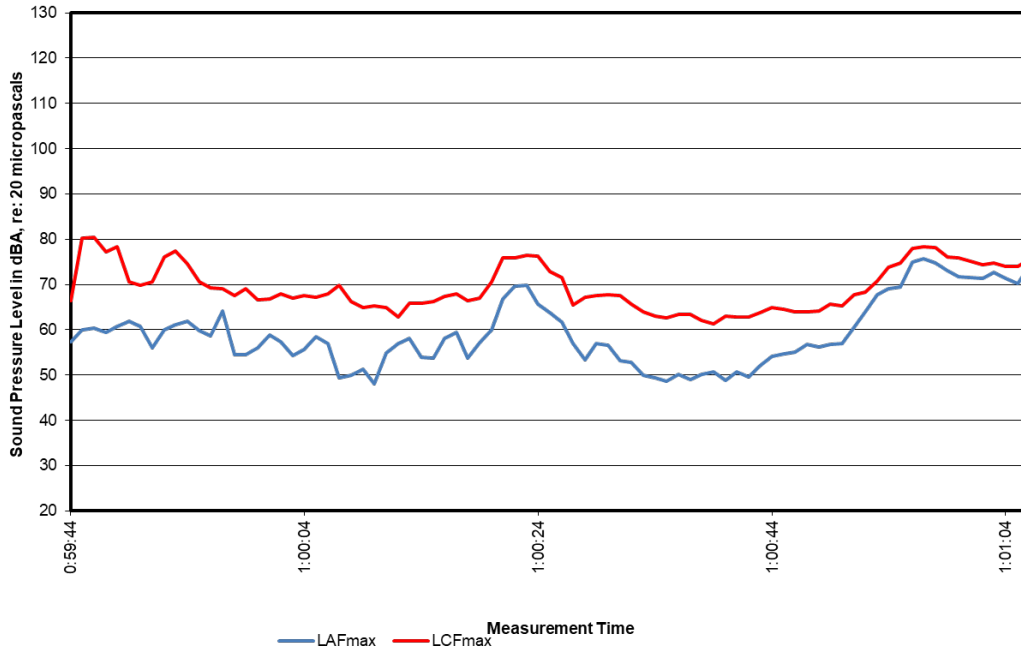
**Fort Lauderdale Soundscape Study
Location : Las Olas and St. Andrews
Saturday February 19, 2023 LD 03-60
Traffic, music from bar and talking**

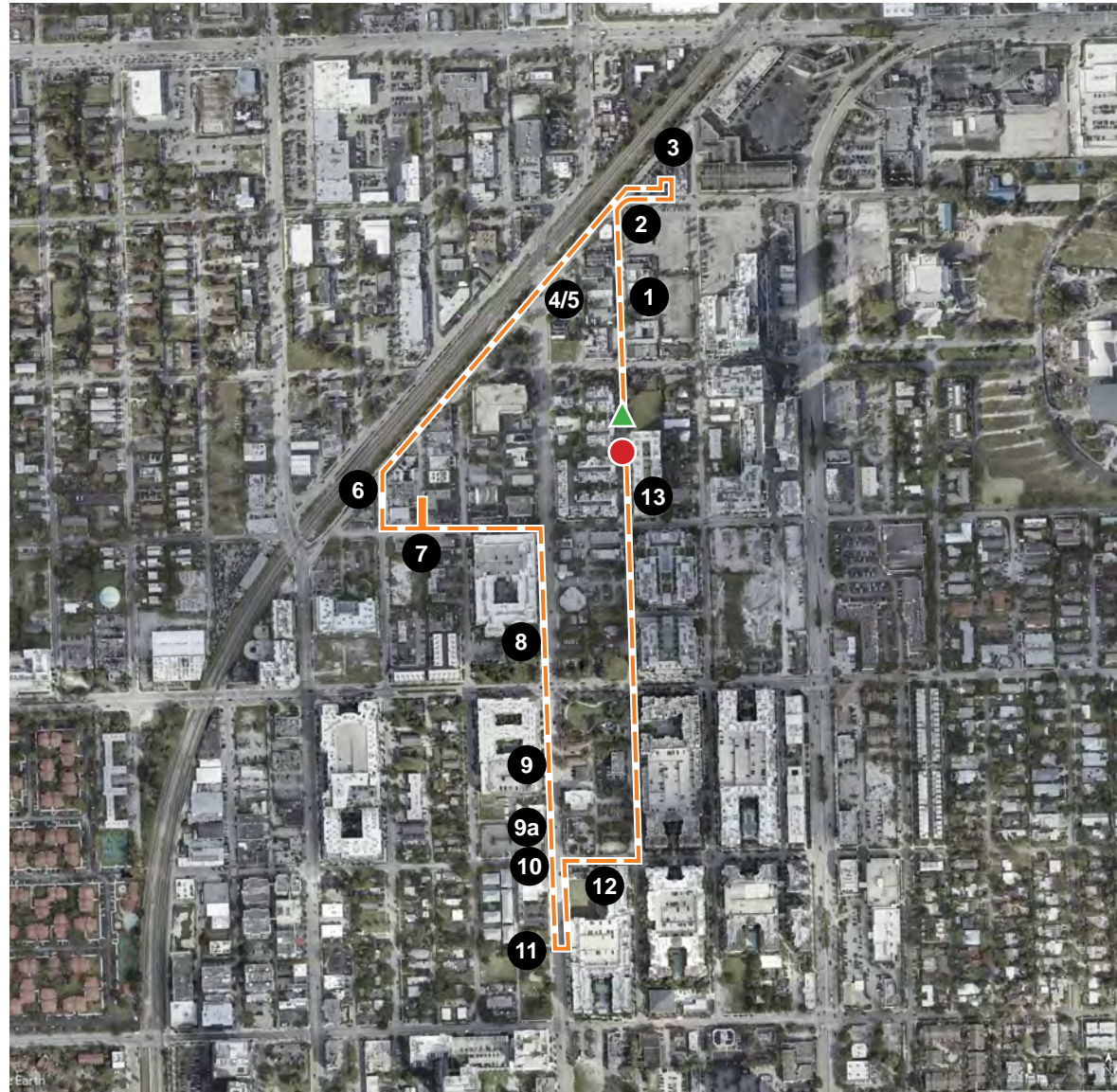


**Fort Lauderdale Soundscape Study
Location : Salt 7
Saturday February 19, 2023 LD 03-64
Distant traffic, music voices and distant motorcycle**



Fort Lauderdale Soundscape Study
Location : Soundwalk NE 7th to Ora at Bamboo Flats.
Saturday February 19, 2023 LD 03-66
Distant motorcycle, train signal, traffic and light music



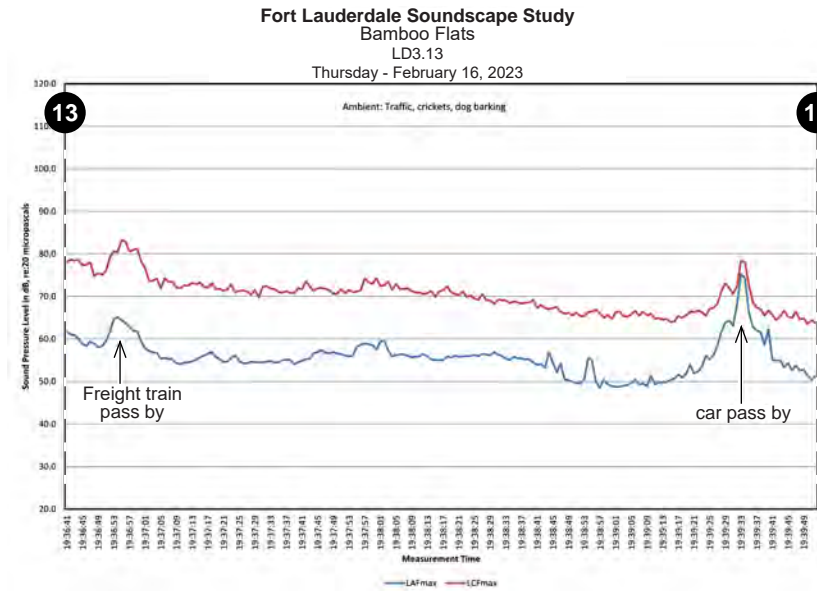


LEGEND

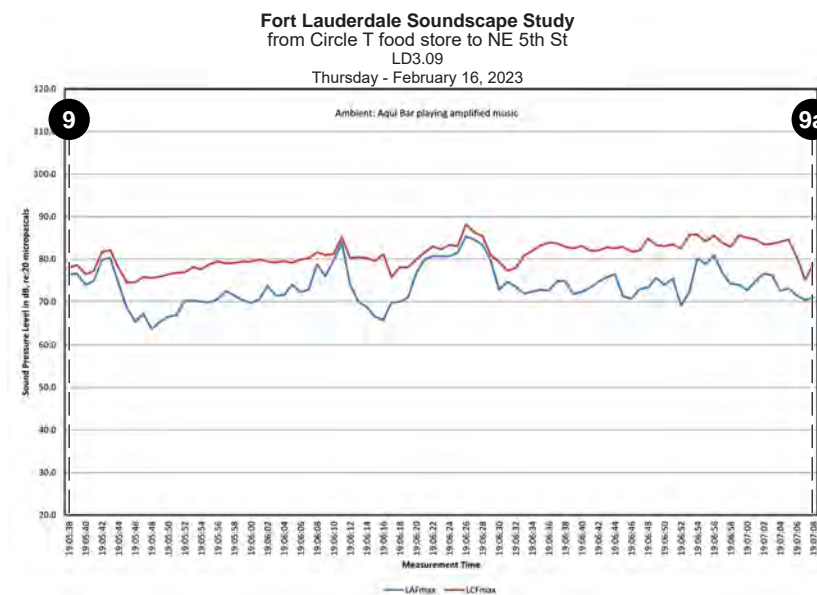
- ▲ START OF SOUNDWALK PATH
- END OF SOUNDWALK PATH
- SOUNDWALK PATH: 2/16/2023 6PM TO 7PM

SPOT SHORT TERM MEASUREMENT LOCATIONS

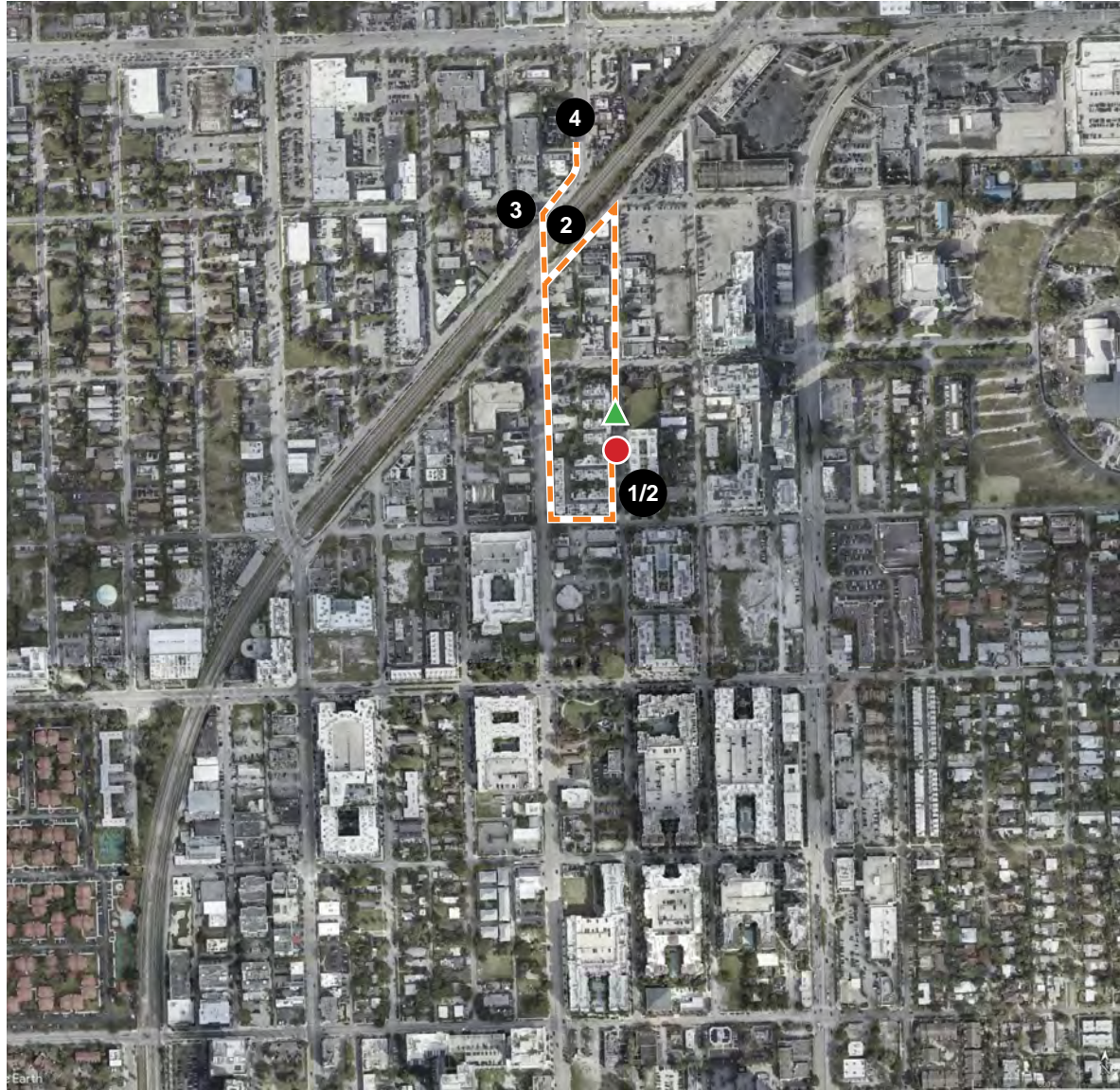
- | | | | |
|---|------------------------------------|--|-----------------------------|
| 1 In front of the Hub, on NE 4th Ave | 5 NE 3rd Ave and NE Flagler Dr | 9 522 NE 3rd Ave; across Food T Stores | 13 In front of Bamboo Flats |
| 2 NE 9th St and NE 4th Ave; with sight line to the Glitch | 6 by the Event Bliss in NE 1st Ave | 10 The Angeles - Night club | |
| 3 On parking lot Glitch | 7 in alley near NE7th St | 11 by the dining area of the Angeles | |
| 4 NE 3rd Ave and NE Flagler Dr | 8 near 615 NE 3rd Ave | 12 NE 5th St | |



Standing at location 13:
On NE 4th Ave, train pass by audible in the distance



Standing at location 9a:
Amplified music playing inside Aquí Bar audible while standing on the sidewalk

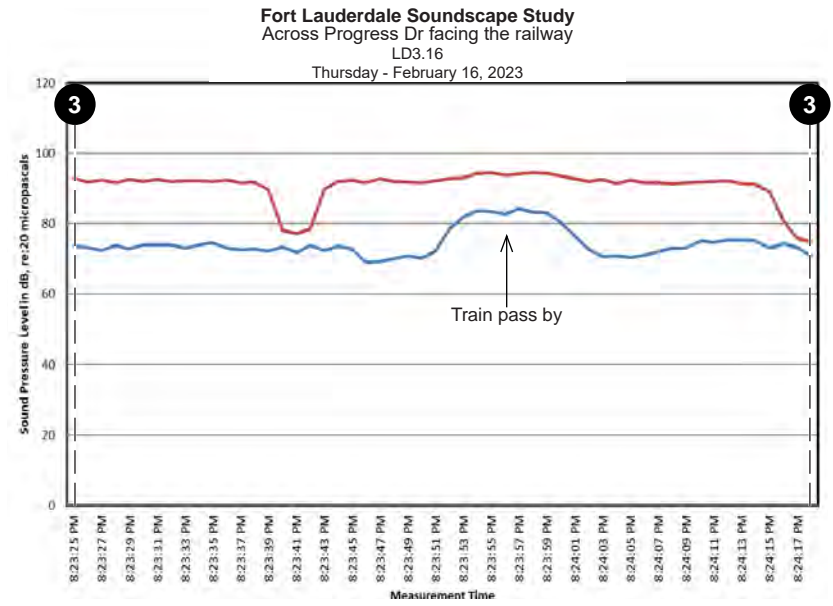


LEGEND

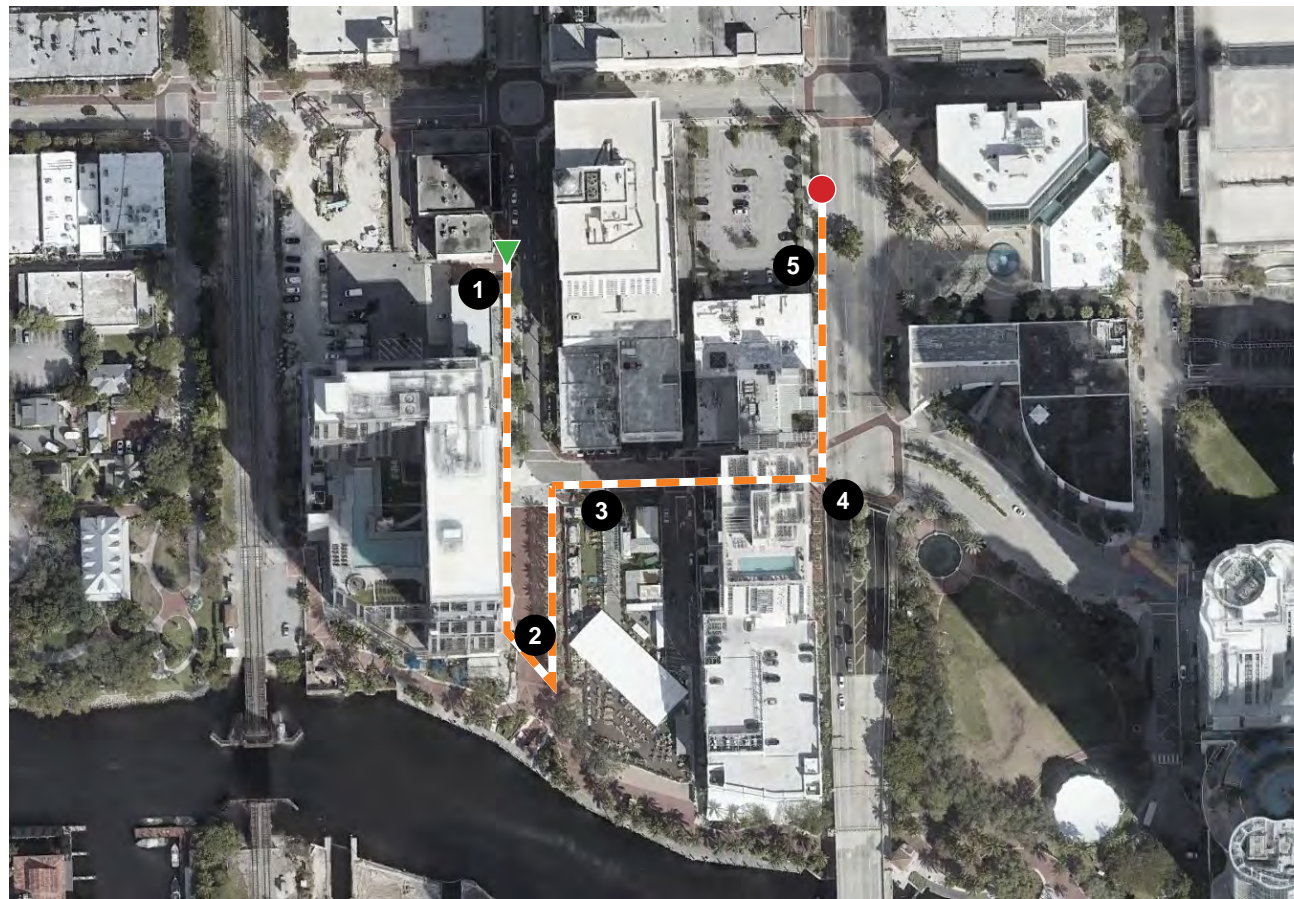
- ▲ START OF SOUNDWALK PATH
- END OF SOUNDWALK PATH
- SOUNDWALK PATH: 2/16/2023 6PM TO 7PM

SPOT SHORT TERM MEASUREMENT LOCATIONS

- 1 In front of Bamboo Flats
- 2 In front of Bamboo Flats
- 3 Near the railway
- 4 Patio Bar & Bar; Progress Dr. NE 3rd Ave
- 5 Seating area inside Aida Mexican Restaurant



Standing at location 3:
Standing on the sidewalk by Patio Bar & Pizza



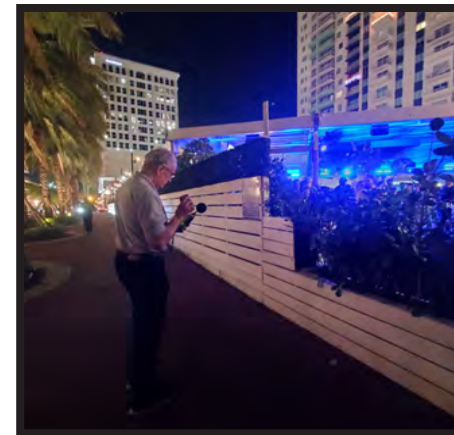
LEGEND

▲ START OF SOUNDWALK PATH

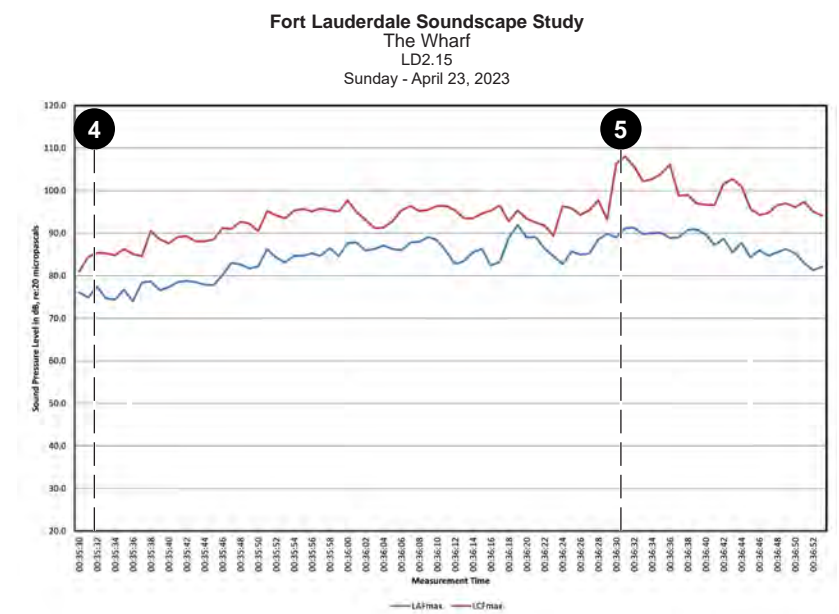
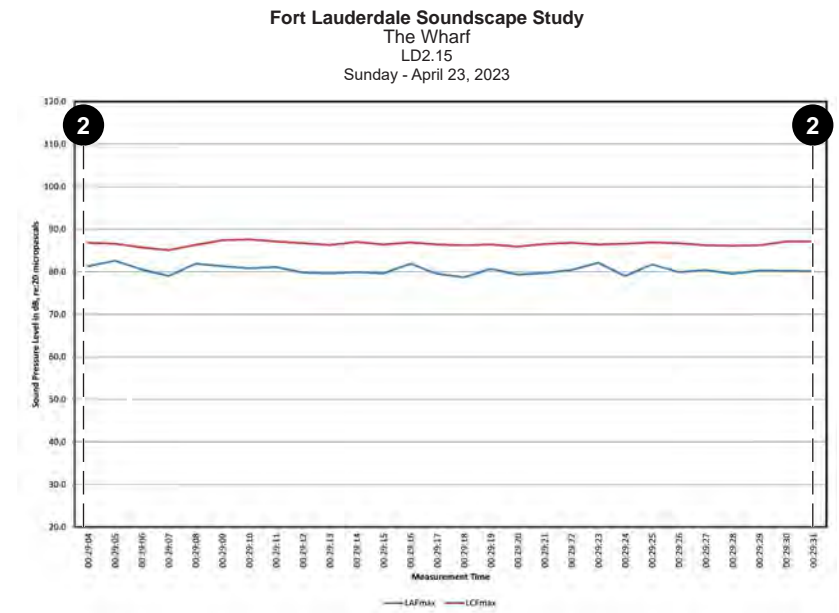
● END OF SOUNDWALK PATH

--- SOUNDWALK PATH: 4/23/2023 1:25AM TO 1:37AM

Standing at location 2:
Standing to the west of The Wharf

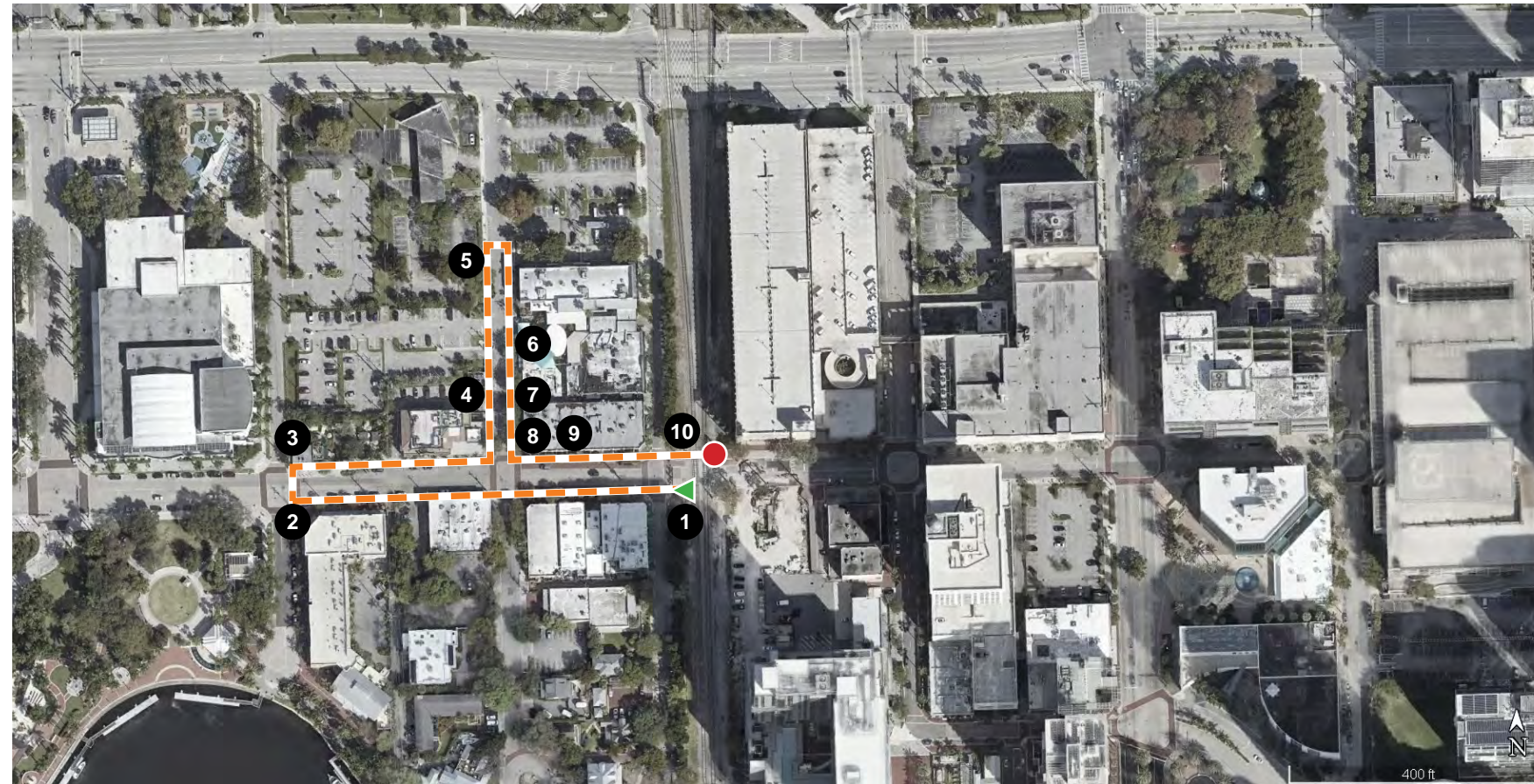


Standing at location 5:
Near the outdoor seating area at Tin Roof



SPOT SHORT TERM MEASUREMENT LOCATIONS

- 1 Walking south on SW 1st Ave
- 2 On walkway west of The Wharf
- 3 In front of the entry to the Wharf
- 4 S Andrew Ave and SW 2nd St
- 5 Tin Roof outdoor seating area



LEGEND

▲ START OF SOUNDWALK PATH

● END OF SOUNDWALK PATH

--- SOUNDWALK PATH: 4/23/2023 1:40AM TO 1:50AM

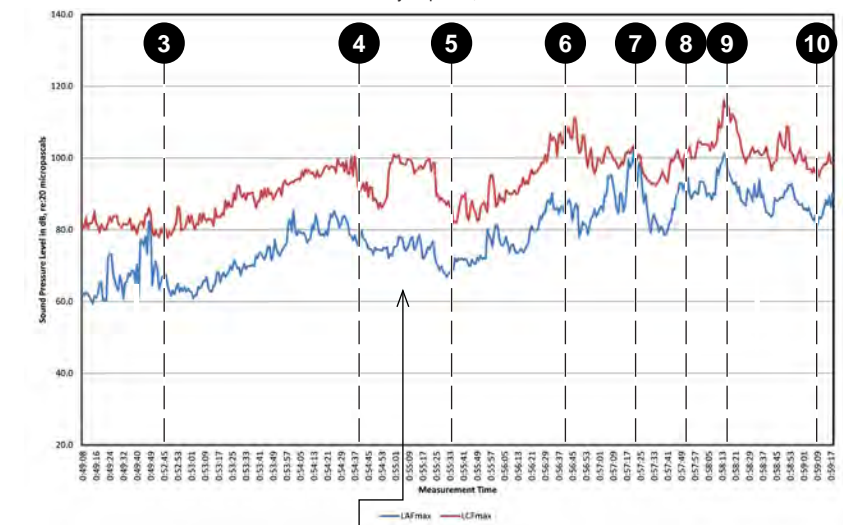
SPOT SHORT TERM MEASUREMENT LOCATIONS

- | | | |
|---|-----------------------------------|------------------------|
| 1 Walking west on SW 2nd St; starting on Moffat Ave | 5 Parking lot, west of Nugent Ave | 9 Ebar Club 13 |
| 2 Vegan Fine Foods; SW 4th Ave and SW 2nd St | 6 The Backyard | 10 west of the railway |
| 3 Breakfast House O-B House | 7 Club Euro | |
| 4 Parking lot, north of #00 Shato | 8 Dicey Riley's Irish Pub | |



Standing at location 1:
Walking west on SW 2nd St

Fort Lauderdale Soundscape Study
Himmarshee Street
LD2.17
Sunday - April 23, 2023



Amplified music playing in The Backyard audible on sidewalk across club

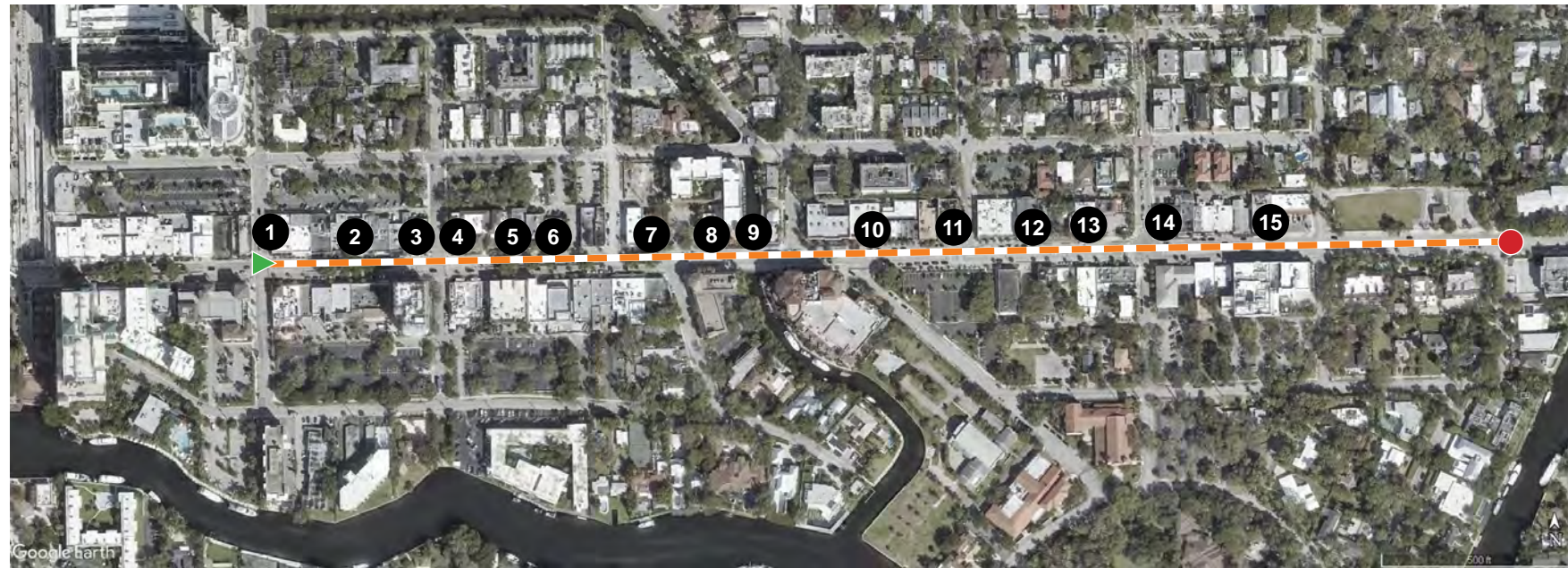
Standing at location 1:
Amplified music and from Cuba Libre plainly audible



Standing near location 7:
Amplified music and voices from Loui Bossi's Ristorante audible



Standing near location 9:
Amplified music from outdoor seating area facing the river audible from the bridge



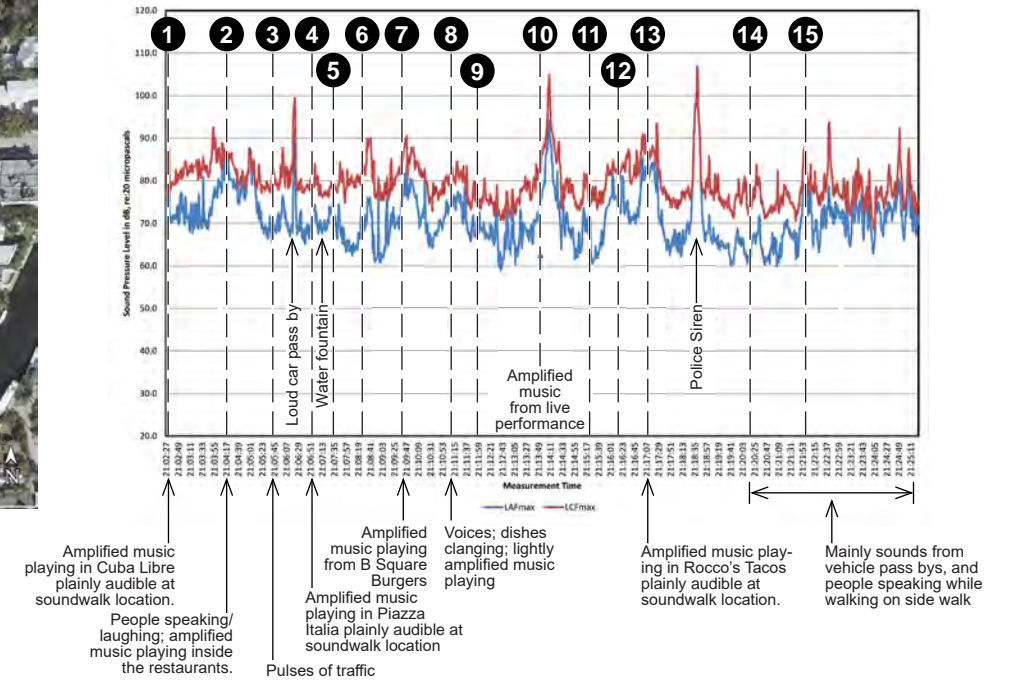
LEGEND

▲ START OF SOUNDWALK PATH

● END OF SOUNDWALK PATH

--- SOUNDWALK PATH: 2/17/2023 9:00PM TO 9:25PM

Fort Lauderdale Soundscape Study
Las Olas Soundwalk
LD3.33
Friday - February 17, 2023



SPOT SHORT TERM MEASUREMENT LOCATIONS

- | | | | |
|---|--------------------------------------|---|---|
| 1 Capital One Cafe | 5 Vinos Wine Bar and Cocktail Lounge | 9 Eve on the Water | 13 Rocco's Tacos and Tequila Bar |
| 2 El Camino/Noodles Panini | 6 Ann's Florist and Coffee Bar | 10 Macabi Havana Lounge | 14 Street corner: SE 15th Ave and Las Olas Blvd |
| 3 Street corner: SE 9th Ave and Las Olas Blvd | 7 B Square Burgers | 11 Street corner: SE 13th Ave and Las Olas Blvd | 15 Bombay Darbar Indian Restaurant |
| 4 El Edificio de Las Olas | 8 Ya Mas! Taverna | 12 The Balcony | 16 Baires Grill Argentine Steakhouse |

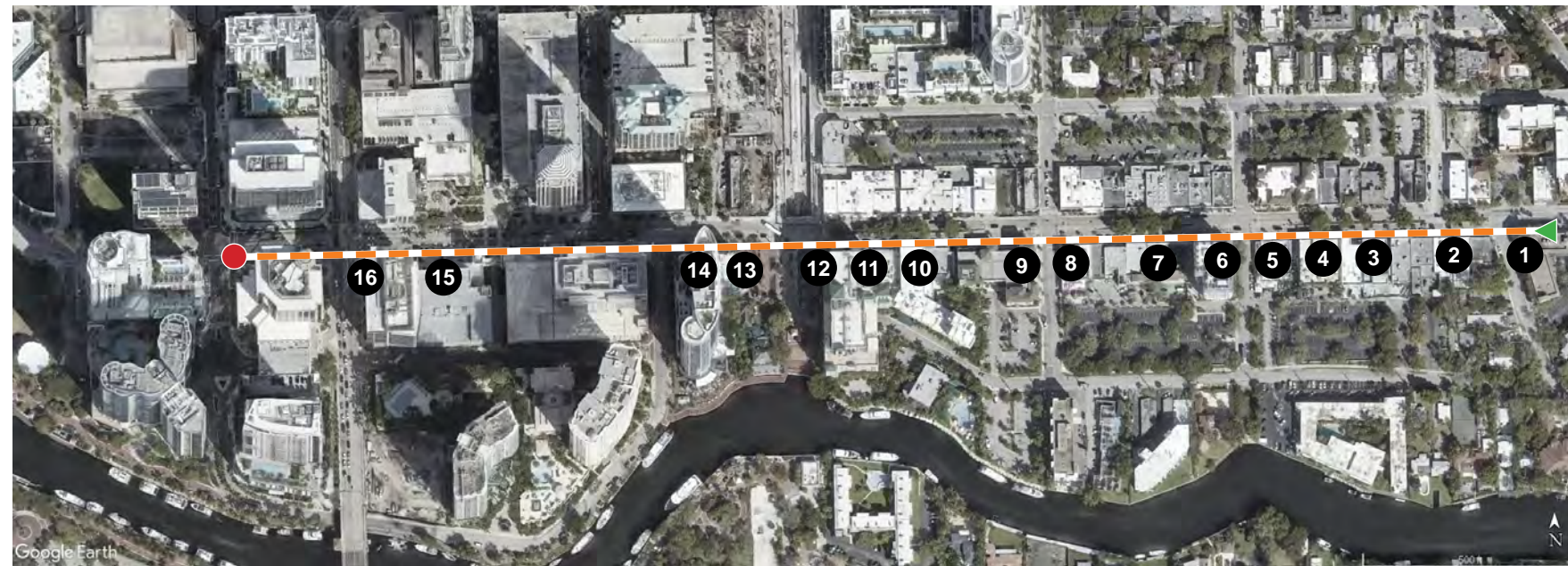
Standing at location 4:
Amplified music playing in Piazza Italia



Standing near location 14:
Amplified music propagating through open doors leading into Sushi Garage



Standing near location 15:
Amplified music from YOLO's audible; water fountain sounds in the ambient

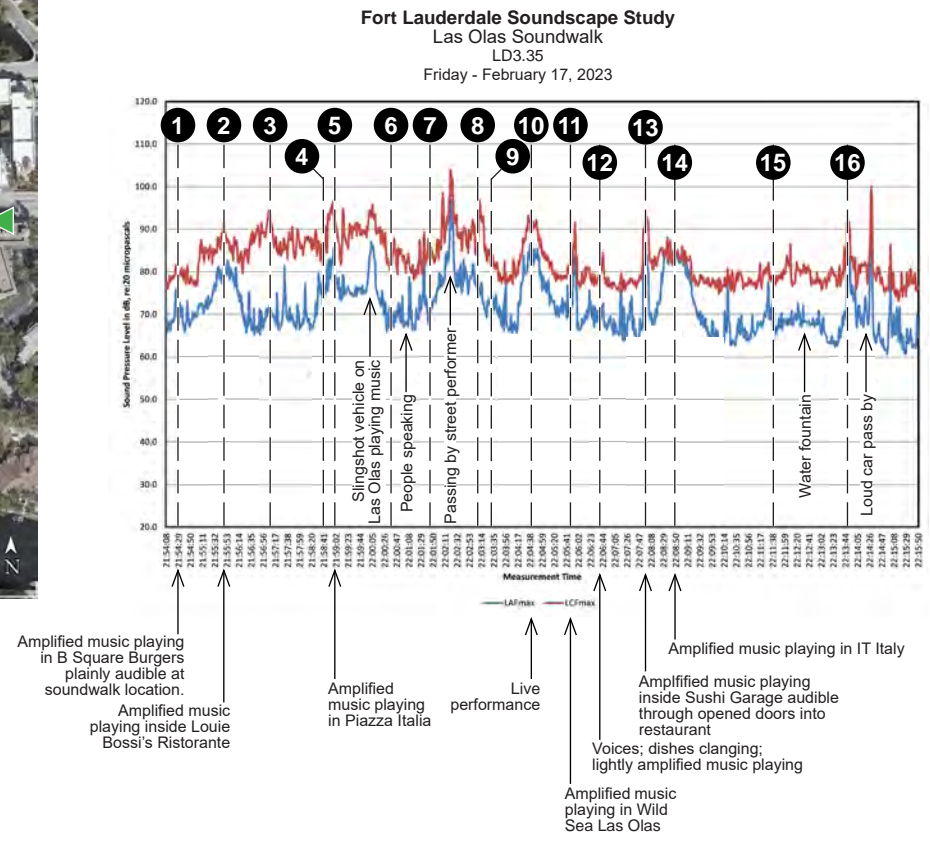


LEGEND

▲ START OF SOUNDWALK PATH

● END OF SOUNDWALK PATH

--- SOUNDWALK PATH: 2/17/2023 9:50PM TO 10:15PM



SPOT SHORT TERM MEASUREMENT LOCATIONS

- | | | | |
|--|--|---|--|
| 1 Street corner: SE 11th Ave and Las Olas Blvd | 5 Piazza Italia | 9 Street corner: SE 8th Ave and Las Olas Blvd | 13 Sushi Garage |
| 2 El Camino/Noodles Panini | 6 Street corner: SE 9th Ave and Las Olas Blvd | 10 Gran Forno Pronto (live performance playing) | 14 IT! Italy Ristorante |
| 3 Across Las Olas Blvd., by Ann's Florist and Coffee | 7 Across Las Olas Blvd., in front of El Camino | 11 Wild Sea Las Olas | 15 Across Las Olas Blvd., in front of YOLO |
| 4 Caffe Europa | 8 Cuba Libre | 12 Cheesecake Factory | 16 Street corner: SE 3rd Ave and Las Olas Blvd |

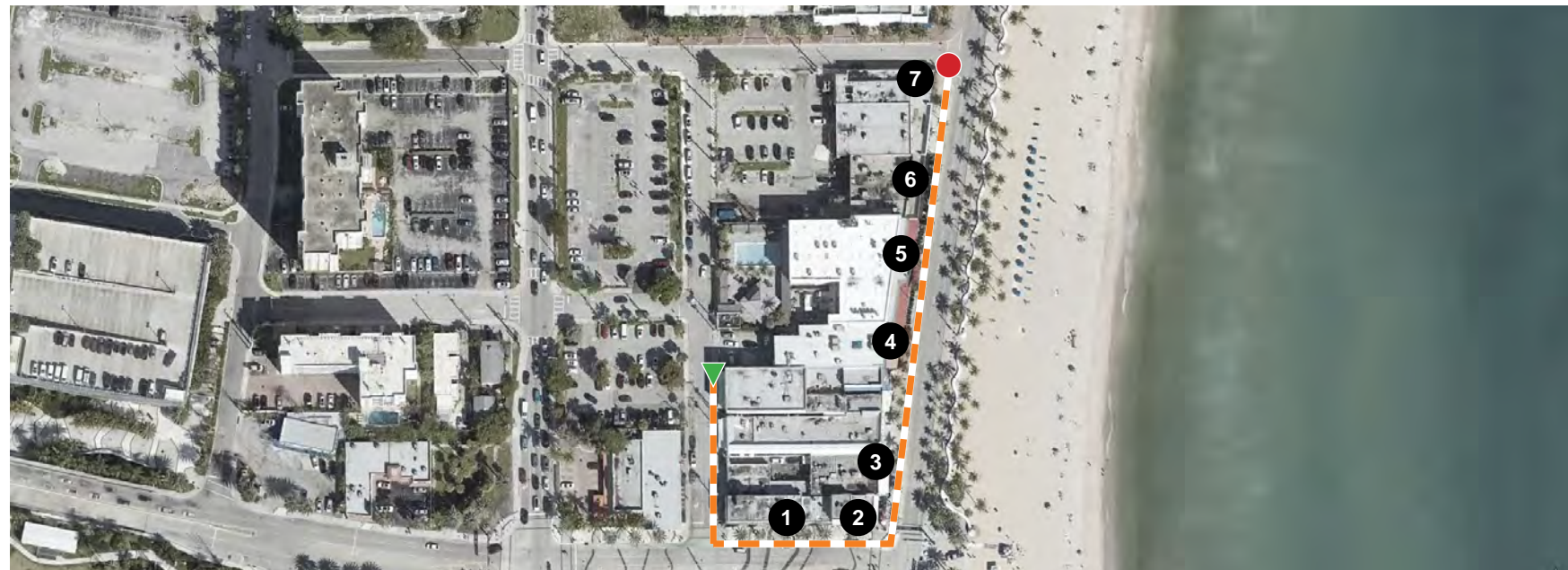
Standing at location 1:
Amplified music for multiple establishments audible



Standing near location 4:
Pulse of vehicle pass bys near location 4



Standing near location 5:
Amplified music playing inside Rock Bar; sounds from people speaking/laughing audible



LEGEND

▲ START OF SOUNDWALK PATH

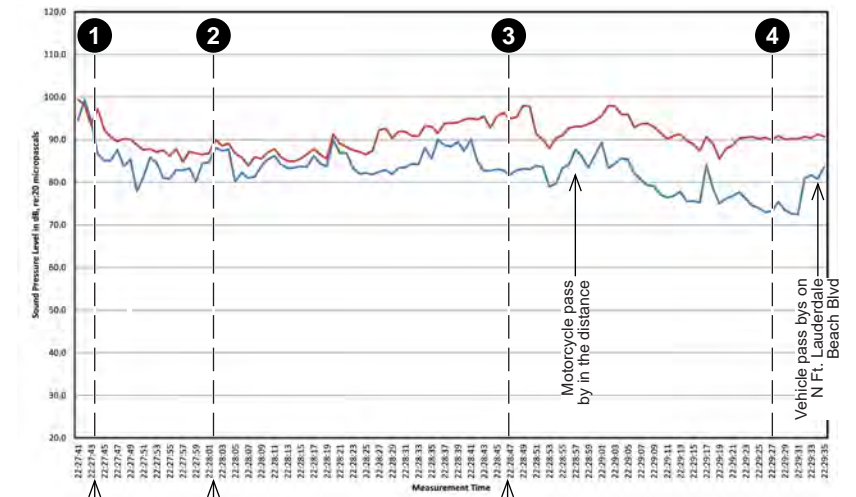
● END OF SOUNDWALK PATH

--- SOUNDWALK PATH: 4/22/2023 10:15PM TO 10:40PM

SPOT SHORT TERM MEASUREMENT LOCATIONS

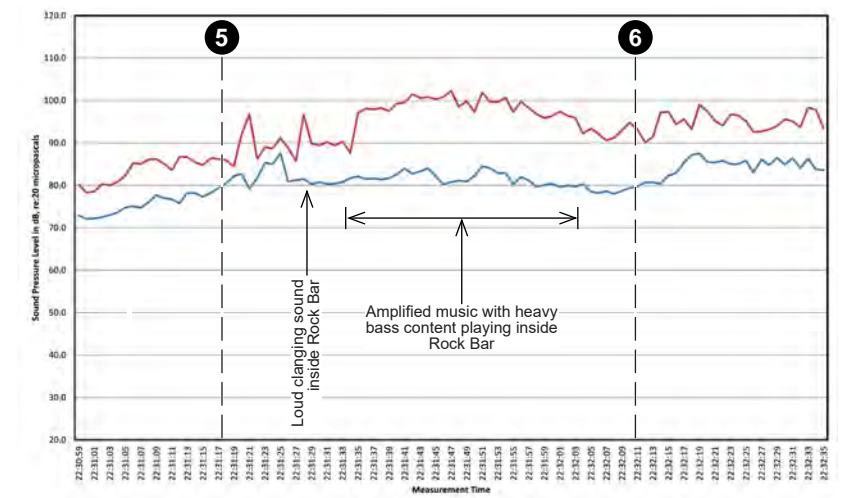
- 1 Beach Party Pizza & Karaoke; 3009 E Las Olas Blvd
- 2 Elbo Room
- 3 Spazio Italian Restaurant
- 4 Solluna
- 5 Rock Bar
- 6 Cafe Ibiza
- 7 The Drunken Taco

Fort Lauderdale Soundscape Study
Beach Soundwalk
LD2.02
Saturday - April 22, 2023



Amplified music playing; people laughing and speaking.
Amplified music playing in Elbo Room, people speaking loudly
Live performance in Spazio; sounds from people speaking loudly in Elbo Room audible
Motorcycle pass by in the distance
Vehicle pass bys on N Ft. Lauderdale Beach Blvd

Fort Lauderdale Soundscape Study
Beach Soundwalk
LD2.03
Saturday - April 22, 2023



Loud clanging sound inside Rock Bar
Amplified music with heavy bass content playing inside Rock Bar

Soundscape Intervention:

academic studies and schematic proposals for locations in Fort Lauderdale, FL

Students from the University of Florida School of architecture participated in developing architectural and planning strategies that respond to the soundscape at locations of interest that were identified as part of the larger soundscape study with Sieben Acoustic and the UF School of Architecture.

The work below represents student visits to the selected locations, participation in sound walks, personal observations, photo documentation, precedent studies, and then, coalescing that information and generating schematic design proposals seek to provide strategies to improve urban density, mixed-use, and an improved soundscape.

The work includes 11 student projects spanning two academic semesters including Fall 2022 and Spring 2023 in two different courses: Advanced Graduate Design Studio 3 (Fall 2022), and the graduate seminar Energy, Ecology, and Architecture (Spring 2022). Included below is an overview of each of the courses and selected work from each student illustrating how future architectural design, while considering sustainability and urbanity, can improve sonic livability in urban contexts with very specific implementation proposals for specific sites in Ft. Lauderdale.

Summary of findings

1. Vertical distance can be an effective sound abatement strategy general street noise including traffic, sidewalk cafes, and unamplified events in the streets. This strategy could be implemented through requiring residential high-rise construction to limit residences in the lower floors – vertical zoning.
2. In addition to Item 1, sound level limits at the windows or balconies of these units could be established as a more nuanced implementation of property line standards.
3. Building envelope systems (walls, doors, windows) could be required that, as a system, would limit the amount of sound that is transmitted through them. This could be achieved by material layers, heavier construction or buffer spaces between the outside and inside spaces.
4. Buildings themselves could absorb and diffuse the sounds striking them rather than reflecting and subsequently amplifying the sounds or focusing the sounds in particular areas. Absorption and diffusion can be achieved through material selections and articulation on the building skin or a combination of both.
5. Strategic zoning could incentivize designs, along arterial corridors that fill the sites and provide acoustic barriers to the residential neighborhoods behind them. This strategy would also benefit from Item 4 above. Care should be taken to keep noisy program elements on the arterial corridor side of the building.
6. Sound locks or buffer spaces between noisy interior programs such as loud clubs or manufacturing could be implemented to control intermittent loud sounds from emanating from a building.
7. Rooftop and elevated terraces, that allow residents to find peaceful spaces within their larger buildings could offer times respite and relief from urban bustle while enjoying the outdoors.

Soundscape Studio: Advanced Graduate Design 3 | Fall 2022

ARC 6356 | School of Architecture | College of Design Construction and Planning |
University of Florida

We may speak of a musical composition as a soundscape, or a radio program as a soundscape or an acoustic environment as a soundscape... .. the auditory equivalent of a landscape.

R. Murray Schafer | Simon Fraser University

Project Challenge:

Conceptual Visioning – the big ideas

Before endeavoring to resolve the 1000's of detail questions that a piece of architecture will demand that we answer, we must develop a clarity of intention, that is: spatial, contextual, supports human activities, and that is inspiring for designers and for those who might dwell within our architecture. Clarity of intention comes from research into the context, precedents, visiting the context and sites, and considering linkages between conceptual ideas and the physicality of the place.

Schematic Design

Here we translate visioning concepts into architecturally specific proposals that integrate linkages to context; develop structural, spatial, and circulation systems; and resolve these systems through plan, section, and 3D models. How does the focus on 'soundscape' influence and prioritize these systems? How does soundscape design suggest possibilities for materials, enclosure systems, and refinement of program elements that advance the conceptual visioning phase?

The site

Students will work on one of two sites: Ft. Lauderdale Beach, Ft. Lauderdale Downtown. Each of the sites is approximately 1.2 to 1.5 acres. Requirements for setbacks and height limits should be governed by the local building code. In the case of expanding outside those limitations, please propose a rationale for the benefit to the community and why the code might be modified.

The Program

Program elements are the minimum required and other program elements, especially those that explore ideas of the soundscape should be added, but not substituted. Program areas should not vary by more than 10%.

- Night Club 10,000 sf with 5,000 sf of that area at least 24' tall (main dance area)
- Retail area 30,000 sf
- Municipal offices 35,000 sf
- Lease offices 35,000 sf • Parking for 300 automobiles.
- Residences (2,000 sf average size): 300
- Required vertical circulation – elevators and fire stairs

Each student will submit the following elements for the final presentation (mid-term can be in progress):

- Concept statement that expresses the prioritization of ideas, and how they relate to the soundscape strategies among other architectural considerations (100 – 250 words)

- Site plan with context 1/32"=1 foot scale (the site info can be an image from google earth)
- First level plan 3/32" (should show adjacent context)
- Parking level plan 3/32"=1 foot scale
- Residential level plan 3/32"=1 foot scale
- Two building sections 3/32"= 1 foot scale
- Two site elevations with context 1/32"=1 foot scale
- One exploded isometric showing program elements & soundscape strategies (labeled) – not to scale
- Five+ sketch perspectives illustrating the form, occupational moments, and how they relate to the conceptual ideas and soundscape strategies.

Student Responses:

In the following section selected student work illustrates how concepts generated from the soundscape studies could influence building design and perhaps guide codes and requirements toward a continued improvement in Fort Lauderdale's soundscape over the next few decades.

The project summaries are those of the students seeking to explain their proposals as simplified abstracts of the larger body of research and design over the course of the semester.

Cascade Park by Stephanie Roberts (Downtown Fort Lauderdale)

Cascade Park is a mixed-use project that is a vertical extension of the river, as well as a vertical extension of the Riverwalk's greenspaces in downtown Fort Lauderdale. Nearby the railroad tracks, the parcel opens its first floor to the east edge along Moffat Avenue with a viewing platform for the railroad; this is where the train proves itself as a temporal spectacle for guests to experience only a few times throughout their day, rather than a noisy nuisance.

The first floor also embodies a main plaza that holds an outdoor market space where guests can shop at kiosks and food trucks. While considerably noisy with the railroad on the east edge, and the traffic on the north edge from Southwest 2nd Street, the north segment of the site provides corridors beside enclosed retail space for pedestrians to enter into a courtyard threshold space. The courtyard acts as a visual and physical acoustic buffer with the building masses to moderate the undesirable city sounds.

As for the southeastern edge, a corner plaza incorporates water features of water walls and fountains to additionally mask the unwanted noise, and introduce desirable natural sounds. This includes the rustling of the foliage with birdsong along with the dropping water sounds from the installations. These features at the ground level ascend their way upward to elevated vegetated spaces in the residential tower adding to the green aspect of Cascade Park. The water features function practically to collect rainwater providing irrigation for the sky garden terraces.

COMMUNAL RELATIONSHIP WITHIN TOWER



RELATIONSHIP TO RIVER + SURROUNDING GREENSPACES



TRAIN AS SPECTACLE



COMMUNITY



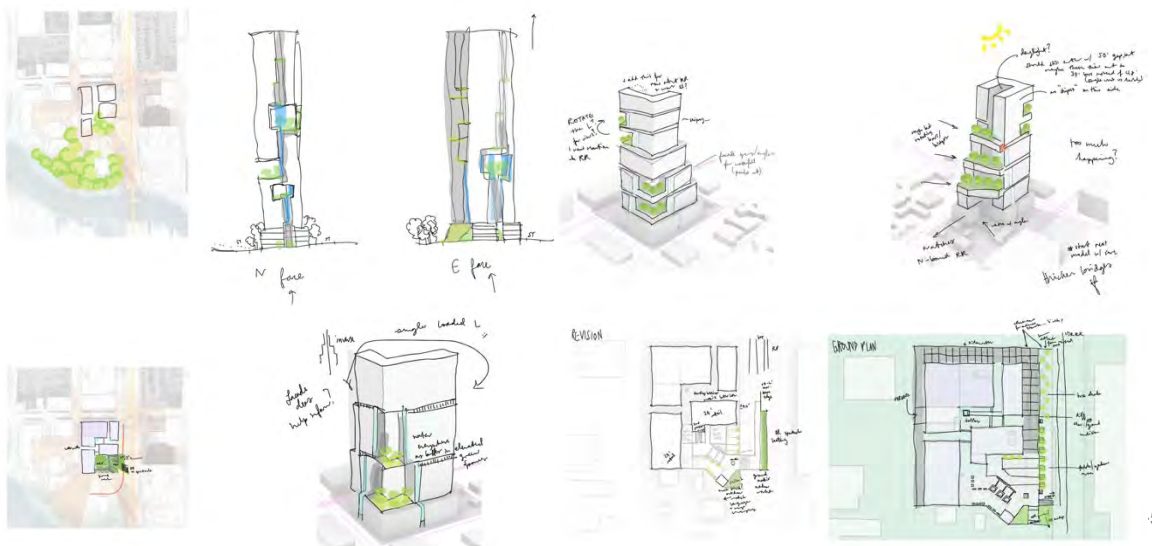
EXISTING CONTEXTUAL RELATIONSHIPS

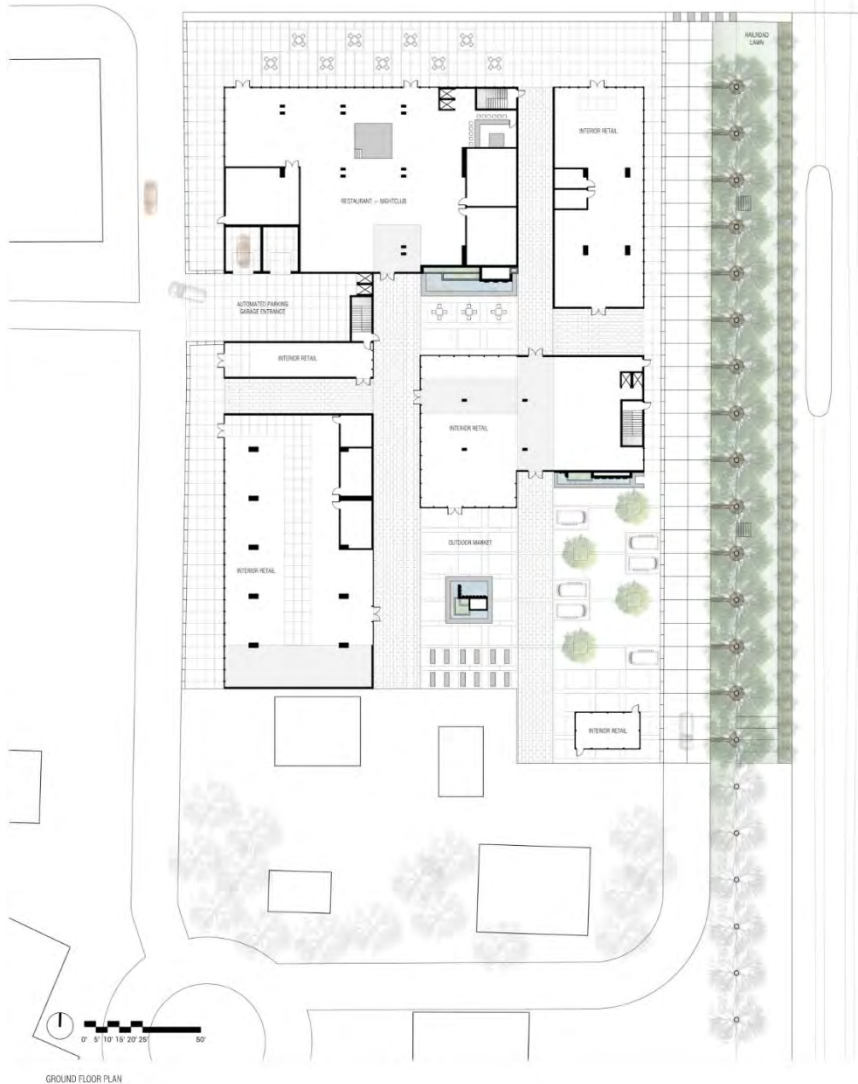


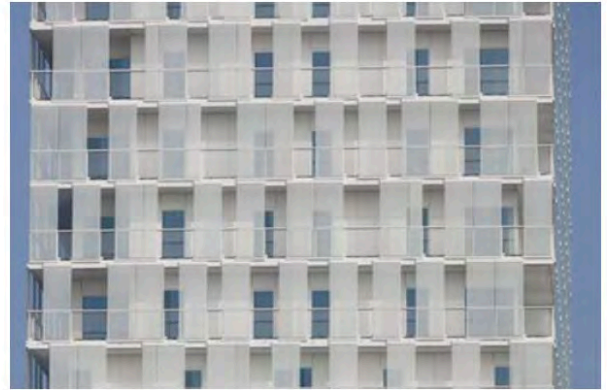
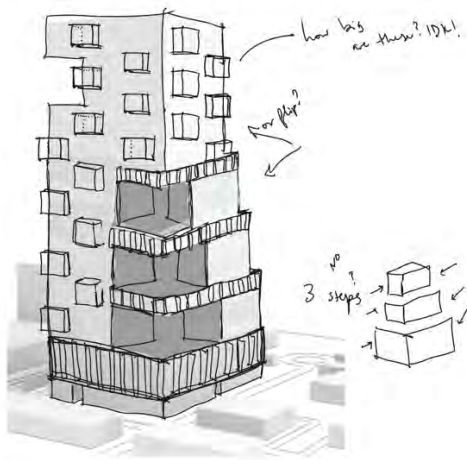
OUTDOOR MARKET/RETAIL



GROUND PLAZA







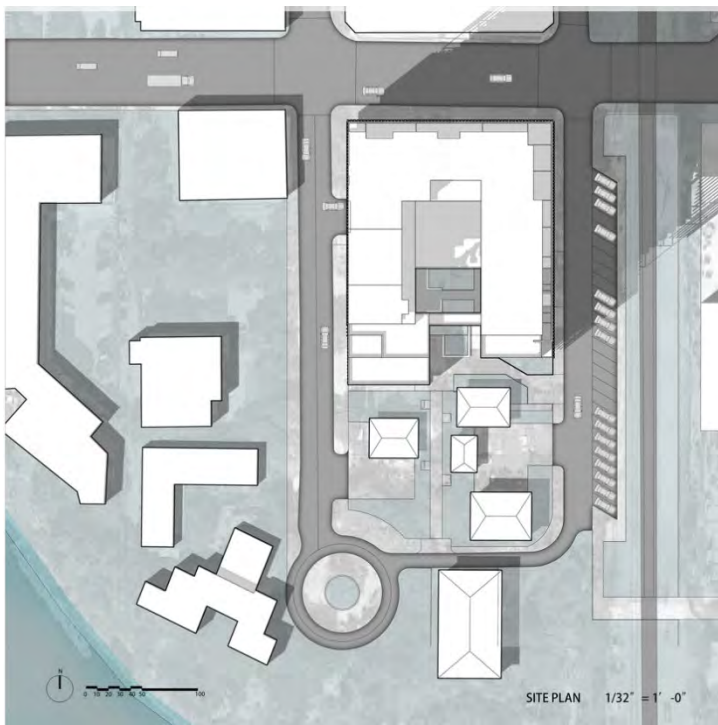
Park Tower
Studio Farris

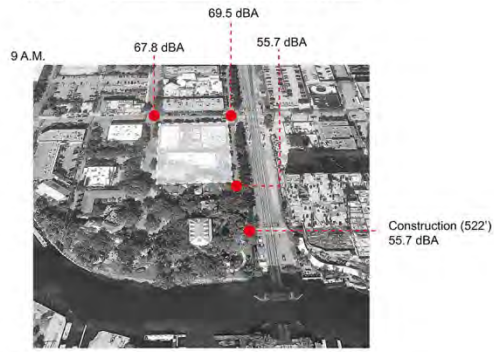
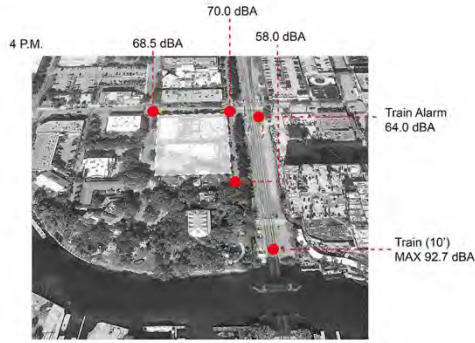
DeNoiser by Baichuan Liu (Downtown Fort Lauderdale)

Our daily life is surrounded by many different sounds from the environment, either noisy and annoying or pleasant and soothing. This design is designed as **a denoiser** to prevent urban noise from entering the interior space as much as possible, and to help people hear the sounds of nature to some extent. The design aims to make noise reduction more possible on the noisy side through the use of mask, buffer, and sound-absorbing material. In the quieter part of the building, part of the building is dissolved to make it possible to accept desired sounds. While considering the sounds of the environment, this design also responds positively to the surrounding urban context.

The shape of the part of the building facing the river, to the south is open, creating a visual connection of green space along the north-south axis of the site, both horizontally and vertically. The western part of the building has a strong sense of mass being dissipated, in response to the park to the west. The public space in the northeast corner of the building provides an opportunity to observe the bustling city. The green space in the building is not only to respond to the urban green environment, but also to increase the dynamics of the interior and provide a place for people to interact and enjoy in life.







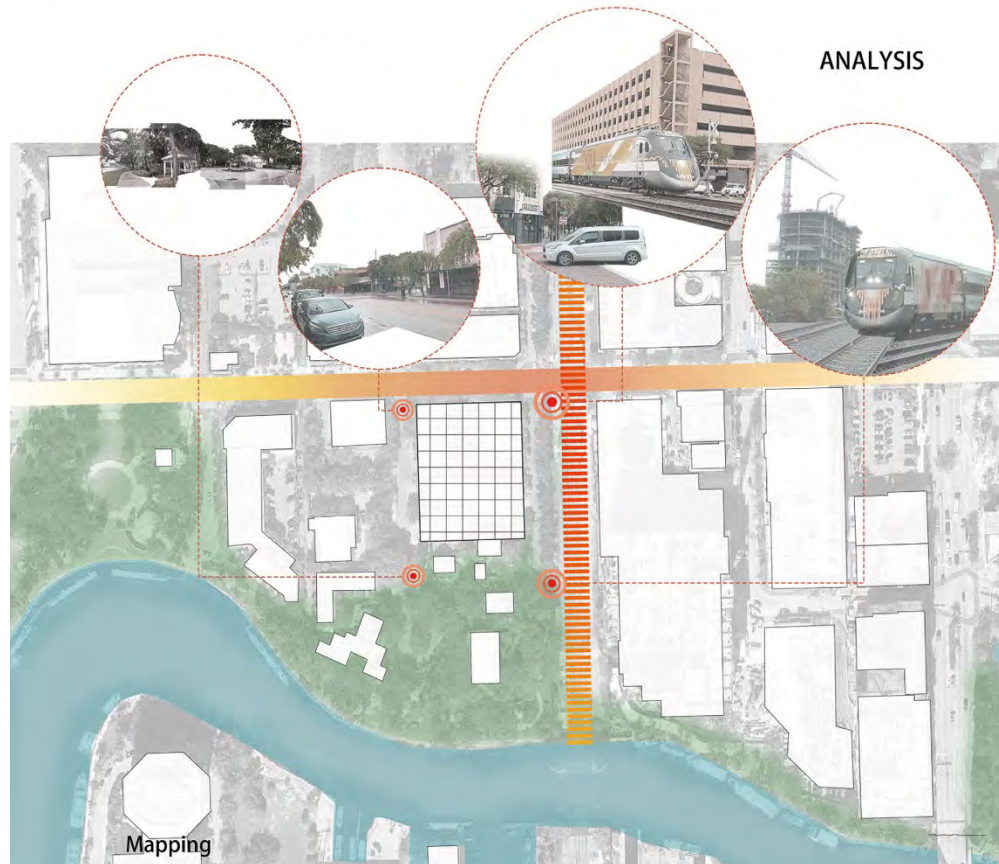
Sounds

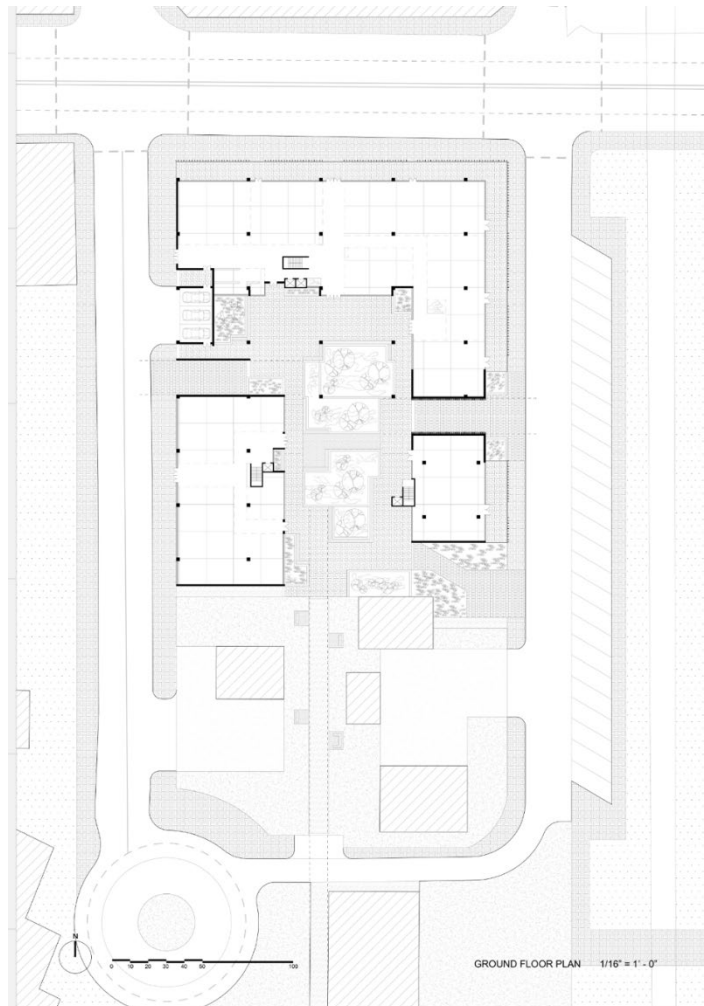


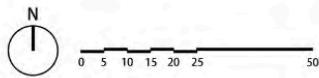
Building



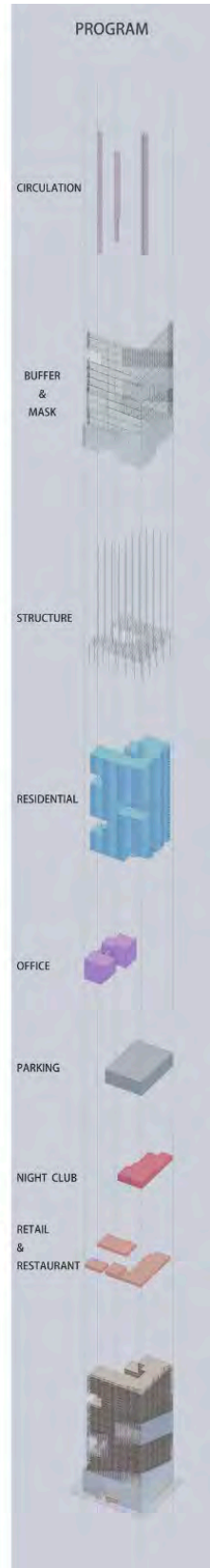
Traffic







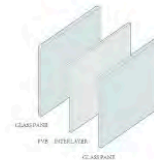
RESIDENTIAL PLAN 3/32" = 1' - 0"



GREEN SPACE



BUFFER



MASK

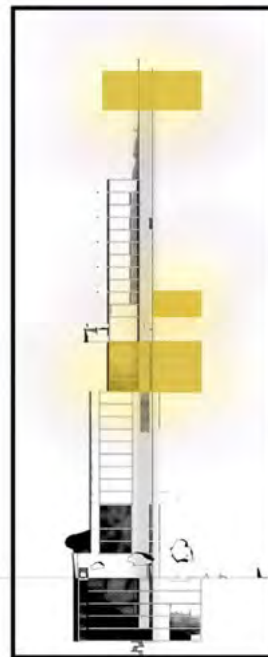


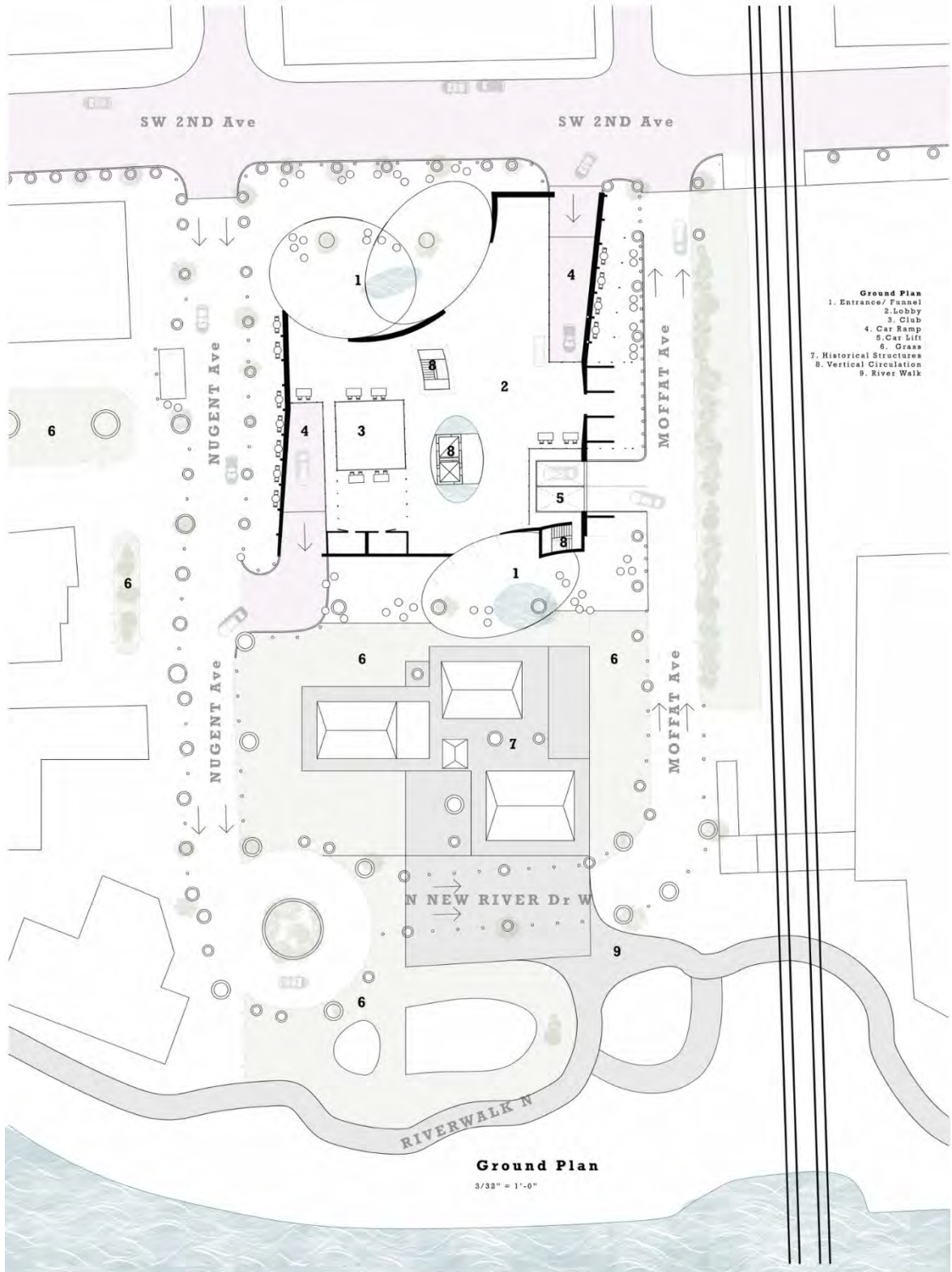


Seam and Beacon by Kuljon J. Pierre (Downtown Fort Lauderdale)

A vertical experience that is anchored by a 'seam' that stitches various elements of the project and an urban lantern emitting light that reaches above acting as a 'beacon' for downtown Fort Lauderdale. The seam travels through the project tethering vertical guardians, and light volumes providing a balance between voids and masses.

The project seeks to provide suburban amenities, yards and green spaces, mechanical parking, and noise abatement via spatial separation from the street below. Building articulation provides sound diffusion with green spaces as acoustic buffers within the structure.







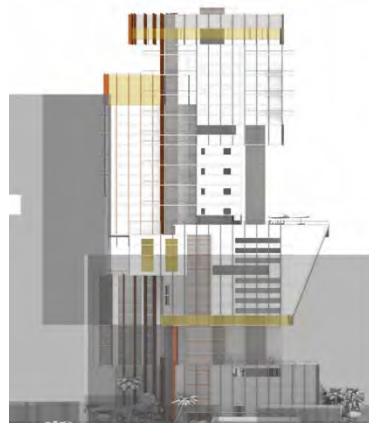




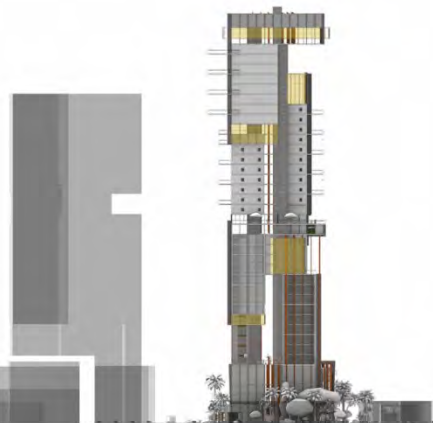
West Elevation
1/32" = 1'-0"



South Elevation
1/32" = 1'-0"



East Elevation
1/32" = 1'-0"

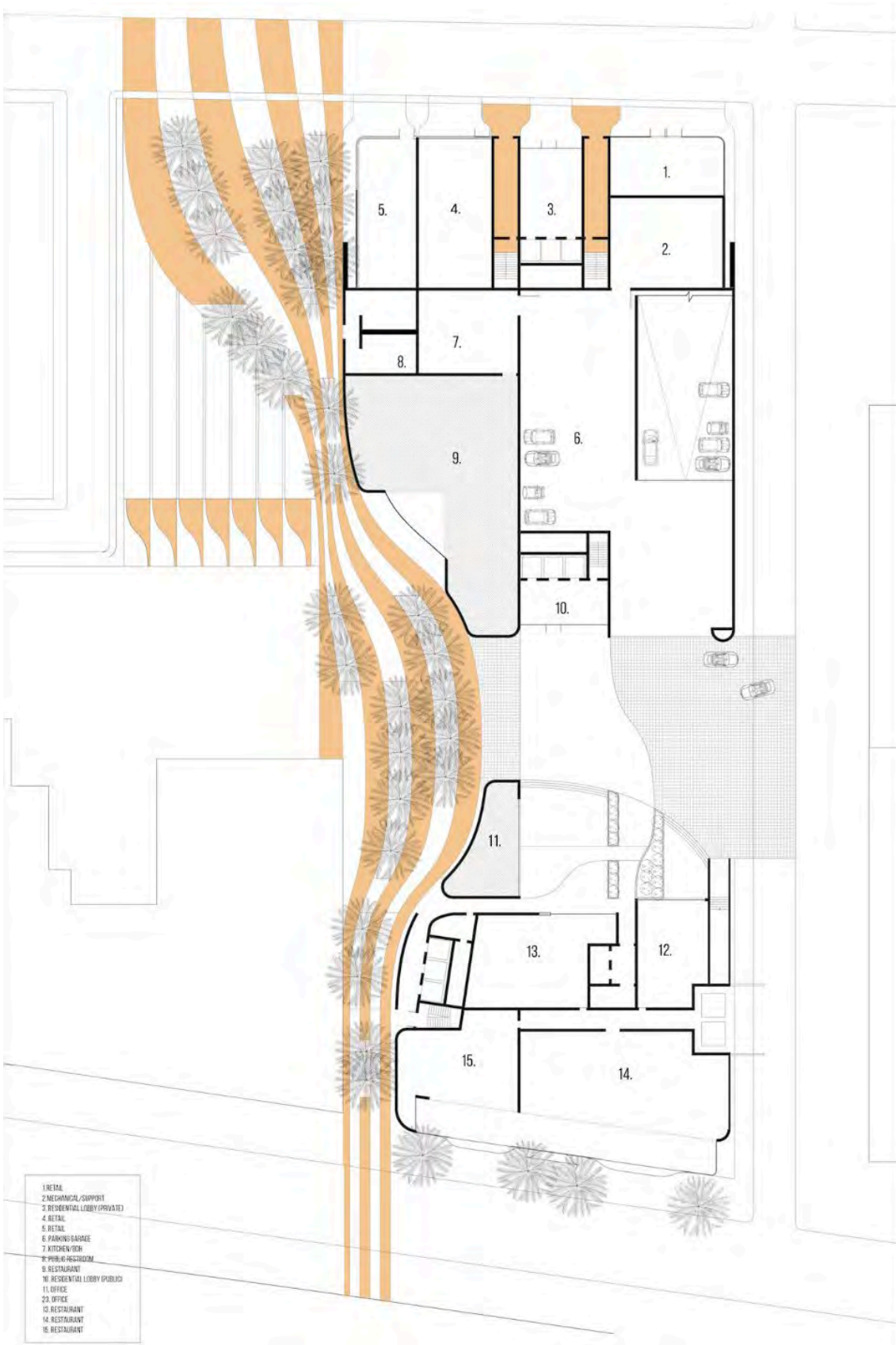


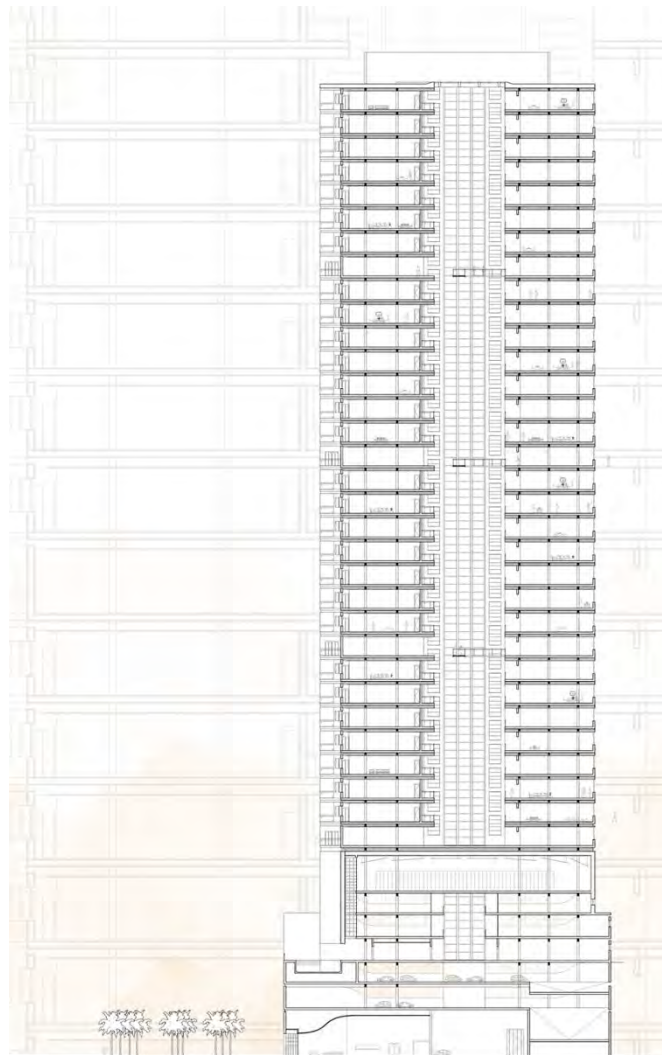
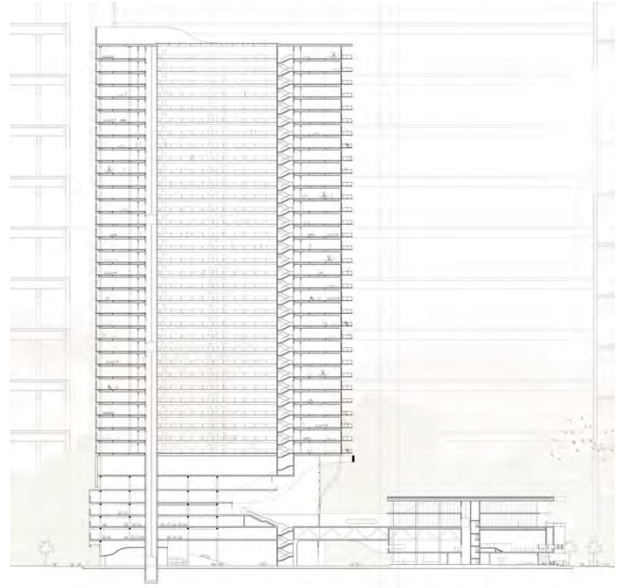
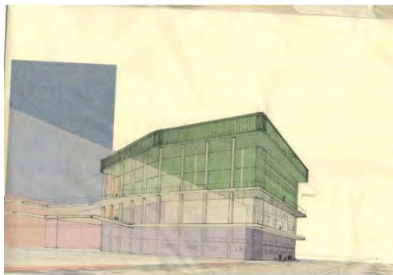
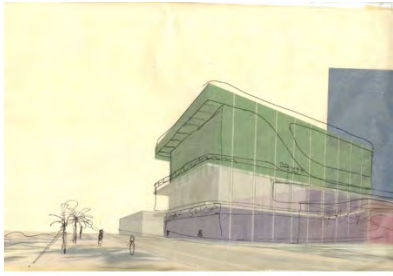
North Elevation
1/32" = 1'-0"

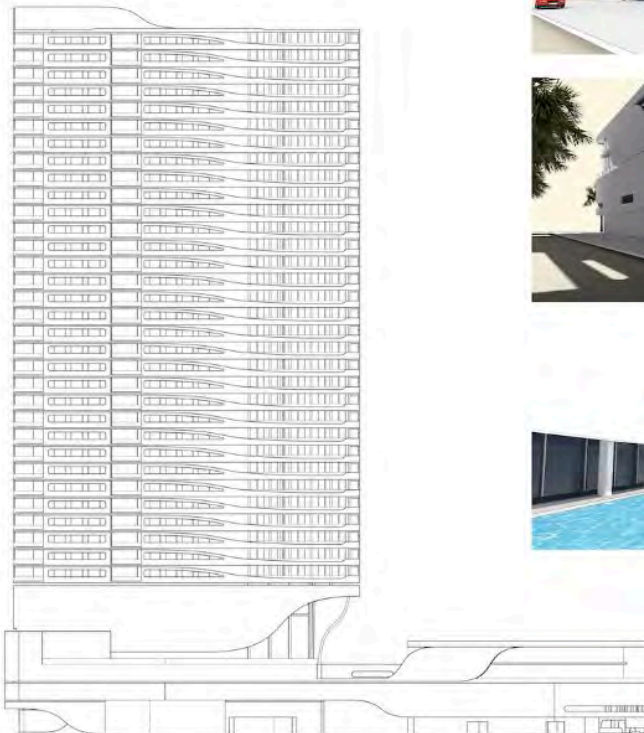
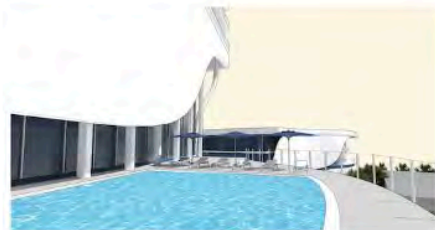
The Wave Condominiums by Alex Boucher (Fort Lauderdale Beach)

Designed with the sound of the ocean. The Wave Condominiums synergistically blends the acoustic and formal delight akin to the lapping, rolling or crashing of waves with their smooth, directional, and consistent form. The fibrous exterior facade, on the west is robust and absorbs the unwanted noise from cars and trucks before peeling back on the ocean façade to allow the sounds of the ocean roll in. The onsite nightclub and nearby bar scene could cause disturbances during the day and into the night. In this proposal, the nightclub and entertainment venues are surrounded by unoccupied evening/night program acting as a buffer between residential and noisy spaces. The complex features a public park surrounded by shopping and dining options. Office workers, customers and residents alike can enjoy panoramic views along the East facade, just above the nightclub. Varied scales of curvature are deployed for visual continuity in addition to providing an effective sound diffusing strategy.



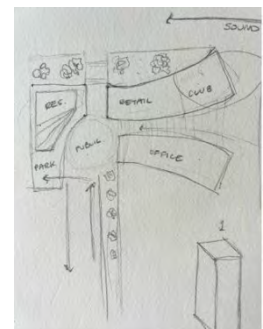
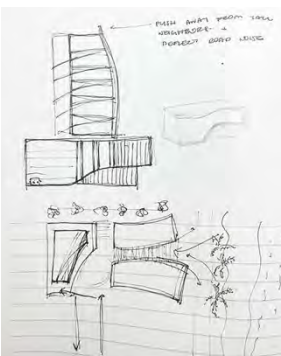
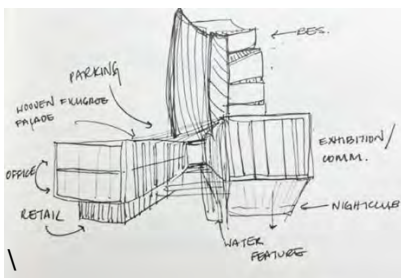
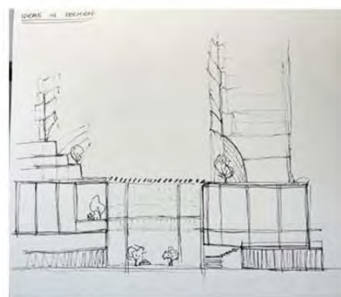
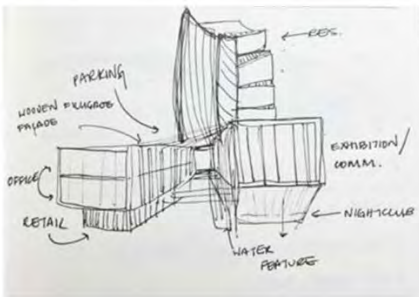


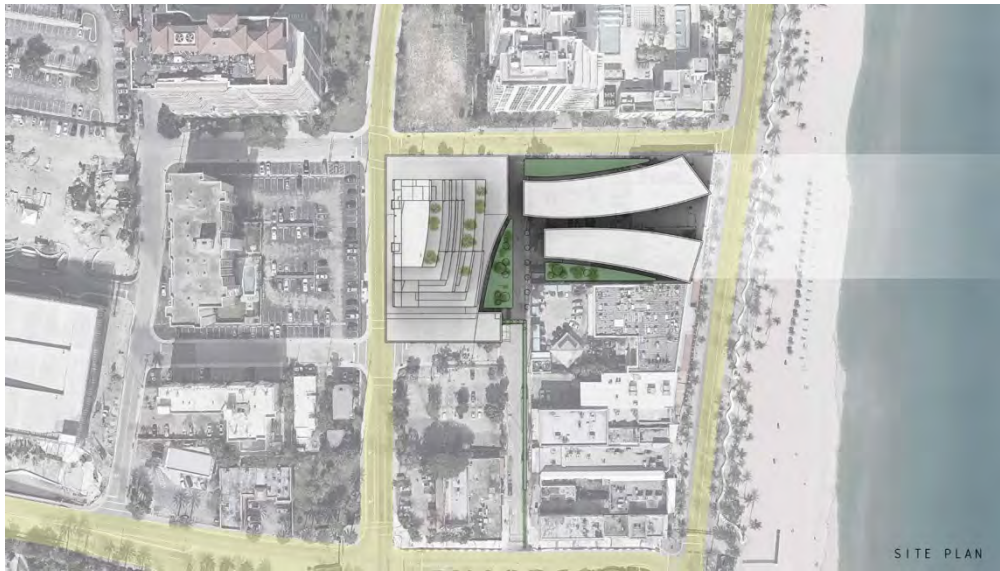




Reflection Tower by Maya Kwasniewski (Fort Lauderdale Beach)

Reflection Tower seeks to bring the sound of the ocean into the building through reflection and diffusion. The main residential block is pulled away from AIA allowing the commerce and entertainment venues to buffer residential space. Other acoustically non-sensitive spaces such as the parking garage are located to buffer traffic and loud vehicle noise. The project studied building form as a diffusing/reflecting system tuned to the desired (waves from the beach and seagulls) and undesirable noises such as traffic and amplified music. These ideas are integrated at the building scale, commercial terrace scale, and at the scale of the residential balconies.

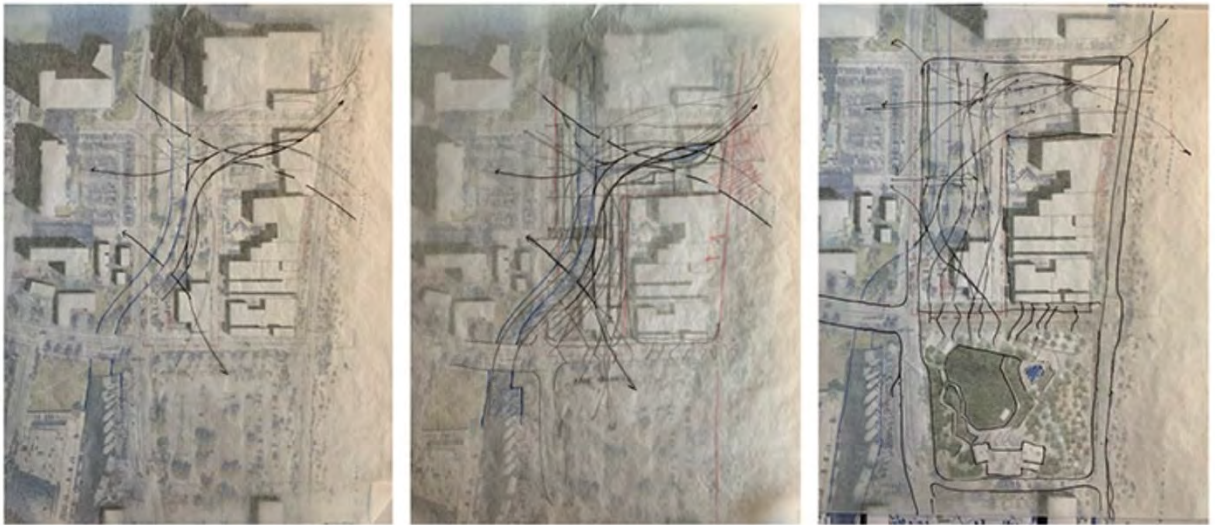




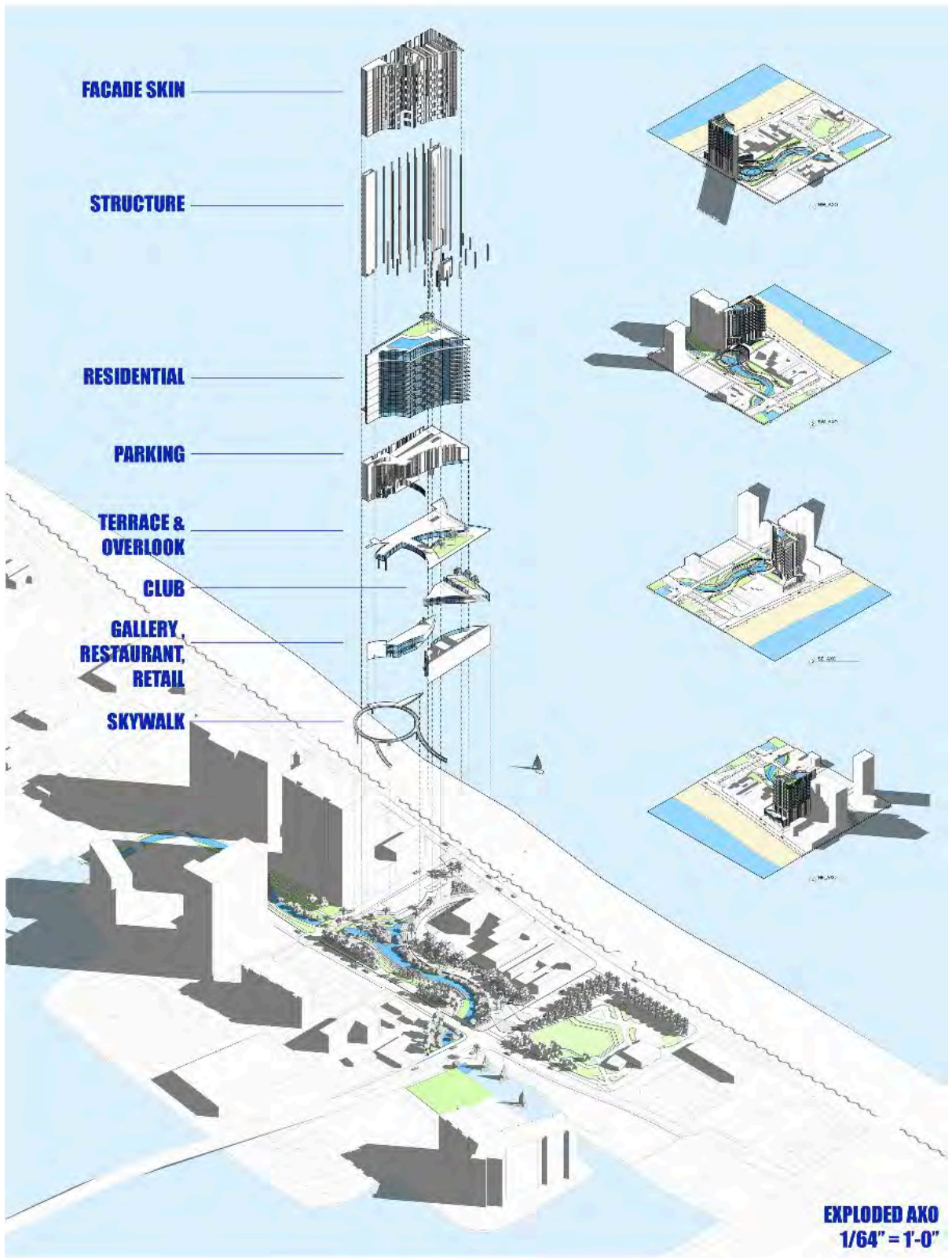
Filtered Connectivity: Adapting Coastal Soundscapes by Dana Shores (Fort Lauderdale Beach)

Building an ecology that allows sounds we want to attract to fold into walkable experience. Diffusing and reflecting traffic noise, providing natural buffer sounds, and focusing through are the main acoustic strategies implemented. The movement of users throughout the project allows program to be activated at multiple levels layering itself to protect residences above from unwanted noise. The site located between the Intracoastal Waterway and Ocean is at a unique junction to encourage pedestrian experiences yet the noise and disruption from vehicular traffic can ruin the beach essence. Re-Integrating the water's soundscape back into the site becomes a primary goal with nature's connection acting as a datum of responses and reactions.



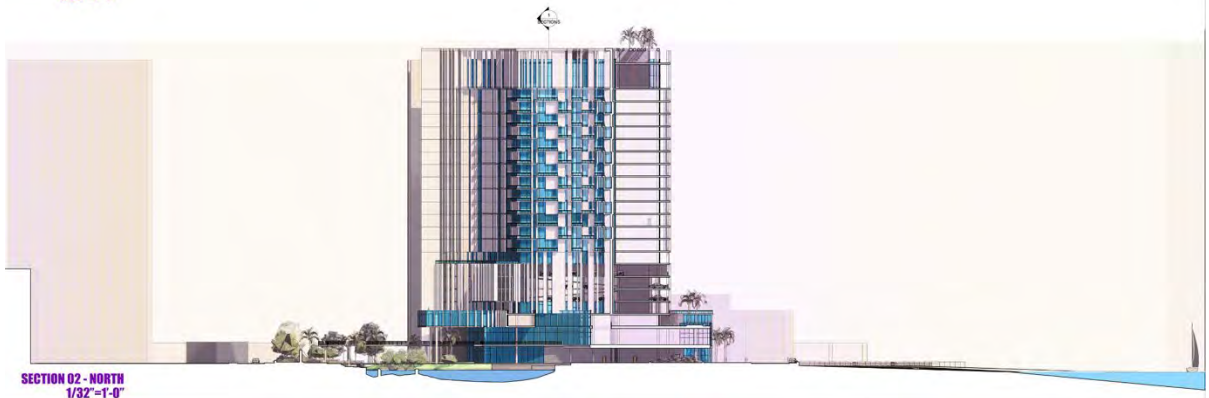








SECTION 01 - WEST
1/32"=1'-0"



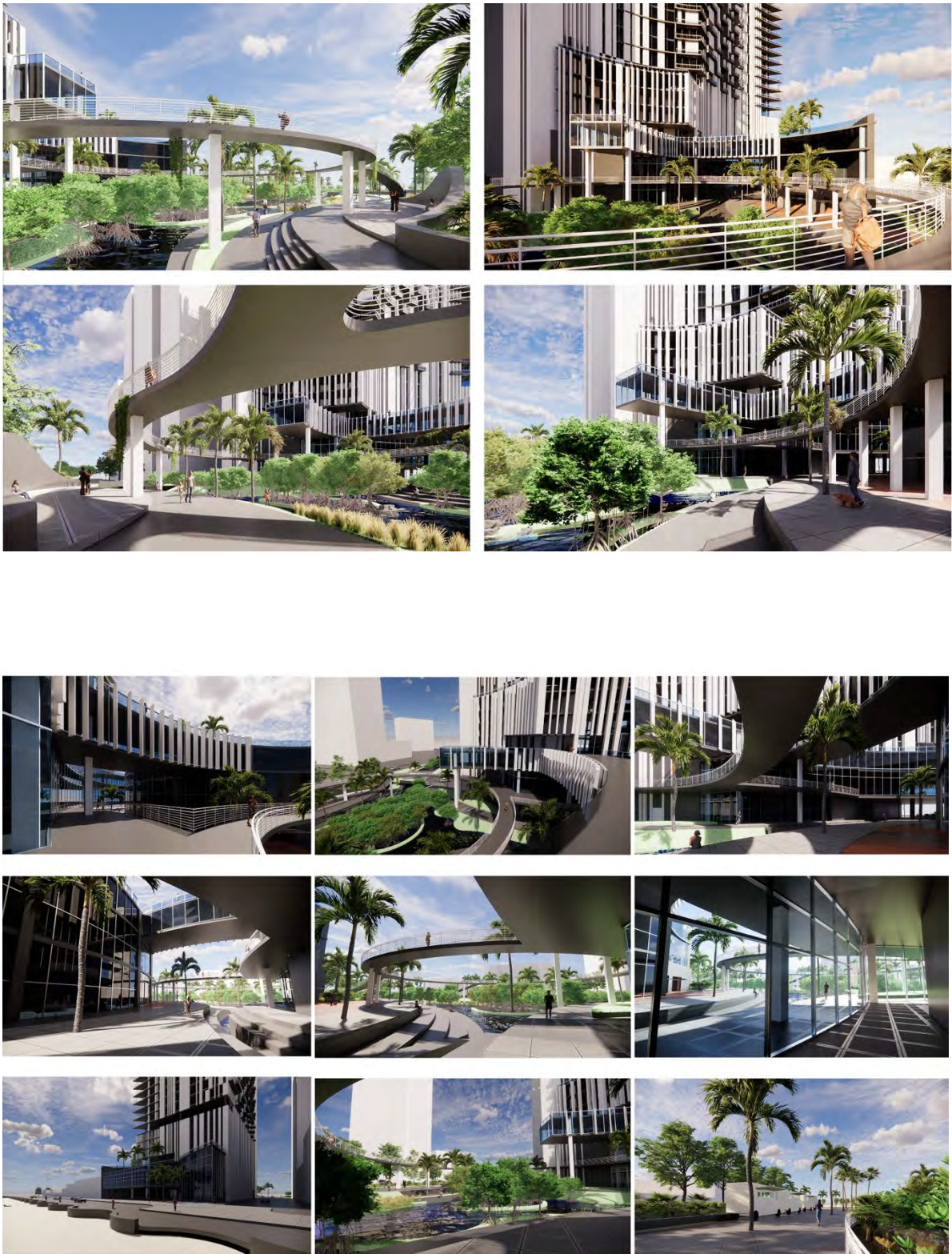
SECTION 02 - NORTH
1/32"=1'-0"



EAST ELEVATION
1/32"=1'-0"



WEST ELEVATION
1/32"=1'-0"



Soundscape Seminar

Environmental Technology Elective
ARC 6680 • 03 Credits

Spring 2023

Soundscape Tower

Project Challenge:

How do we, as architects translate our understanding context into architecture that is responsive and sensitive to the contextual ecology: urban, suburban, natural, social, commercial, sonic? Students are asked to explore this question through speculative design and analysis with regard to the incorporation of local resources, environmental impact, resource efficiency, integrated technology, soundscape ecology, and to propose architecture that promotes culturally rich lifestyles.

"In the case of all things which have several parts and in which the totality is not, as it were, a mere heap, but the whole is something besides the parts..."

Aristotle 980a Metaphysics, Translated by W. D. Ross

Schematic Design

Translate visioning concepts, as noted above, into architectural proposals that integrate linkages to the context contextual ecology; develop spatial, and circulation systems; develop enclosure systems, and resolve these systems these elements through plan, section, and 3D models. How does the focus on 'soundscape' influence and prioritize these systems? How does soundscape design suggest possibilities for materials, enclosure systems, and refinement of program elements that advance the conceptual visioning phase?

The site

Students will work on their site of selection in Ft. Lauderdale, Florida. Requirements for setbacks and height limits should be governed by the local land use code. In the case of expanding outside those limitations, please propose a rational for the benefit to the community and why the code might be modified.

The Program

Program elements are the minimum required and other program elements, especially those that explore ideas of the soundscape should be added, but not substituted. Program areas may vary to meet the opportunities and constraints of the site. The program seeks to develop a floor area ratio (FAR) of at least 10.

- Night Club 10,000 sf with 5,000 sf of that area at least 24' tall (main dance area)
- Retail area 10,000 to 30,000 sf
- Municipal offices 10,000 - 30,000 sf
- Lease offices 10,000 sf • Parking for 100 automobiles.
- Residences (1,600 sf average size): 80
- Required vertical circulation – elevators and fire stairs

Deliverables

24x36 PDF sheets in portrait format. Number of sheets as needed.

Each student will submit the following elements for the final submission:

- Concept statement that expresses the prioritization of ideas, and how they relate to the ecological strategies including soundscape considerations among other architectural considerations (100 – 250 words)

- Site plan with context
- First level plan
- Parking level plan
- Residential level plan
- Two building sections with context
- One exploded isometric showing program elements & soundscape strategies (labeled) – not to scale
- Five+ sketch perspectives illustrating the form, occupational moments, and how they relate to the conceptual ideas and soundscape strategies.

Note: drawings should be resolved at 1/16" scale level of resolution. Detail is not critical but rather the organization, relationship to context, material selections, and strategies for sustainability and the soundscape ecology expressed as architectural strategies.

Process

Students will follow the general outline below to develop their proposals. Much of this was done in the project 1 research phase of work and that information should be condensed and applied withing the Project 2 submission

Steps:

1. Students should become familiar with their site by visiting physically if possible and via Google Earth. Students Student should provide a context site plan and images with their proposals. [5 pts]
2. Review climate data: psychrometric chart, breezes, rainfall, and solar availability for contextual responses. Sources would include Climate Consultant or other. Include a climate summary [5 pts]
3. Based on the site selected, students are asked to develop a conceptual site analysis identifying: access to roads, opportunities for views, solar orientation, natural ecology, (vegetation, wetlands, topography), potential open civic space, agricultural opportunities and any inspiration for organizing the site. [15 pts]
4. Initial unit concepts. Develop a simple unit diagram for the program spaces making decisions regarding vertical zoning and circulation systems. Consider daylight, shading, and potential for photovoltaic with regard to unit for and orientation (N.S.E.W.). Consider view, privacy (visual and acoustic), and the relationship to the street as a community contributor. This should be expressed as a modular system for the residential portion of the project. [5 pts]
5. Once the base unit(s) are developed schematically, test configurations within the tower and how circulation works between and through the lower commercial elements in the tower. Opportunities for view, daylight, breezes, and quiet should be considered. It is suggested to make minor modifications to the unit prototypes to accommodate combining of the units. [15 pts]
6. Commercial and institutional programming. These are typically open area spaces to be developed by occupants in the future. Consider what is at the street and how that enhances the context at the pedestrian level in terms of organizing entry (auto/Ped), providing shade, contributing to an occupied street, and of course mitigating noise while perhaps enhancing the soundscape. [20 pts]
7. Integrate the elements studied above as cohesive soundscape tower proposal for your site in Ft. Lauderdale. [15 pts]

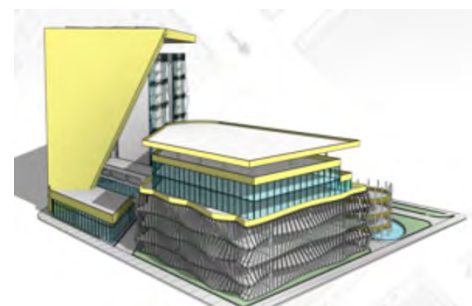
"In the case of all things which have several parts and in which the totality is not, as it were, a mere heap, but the whole is something besides the parts..."

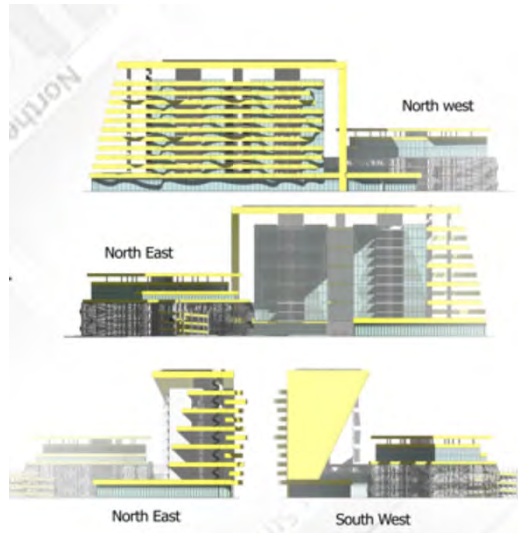
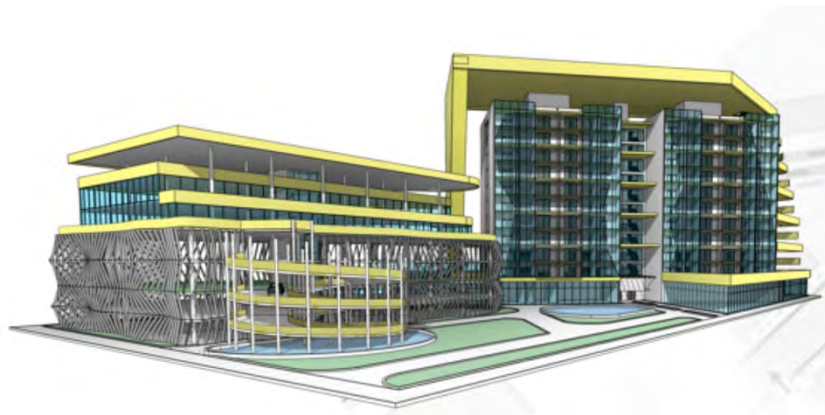
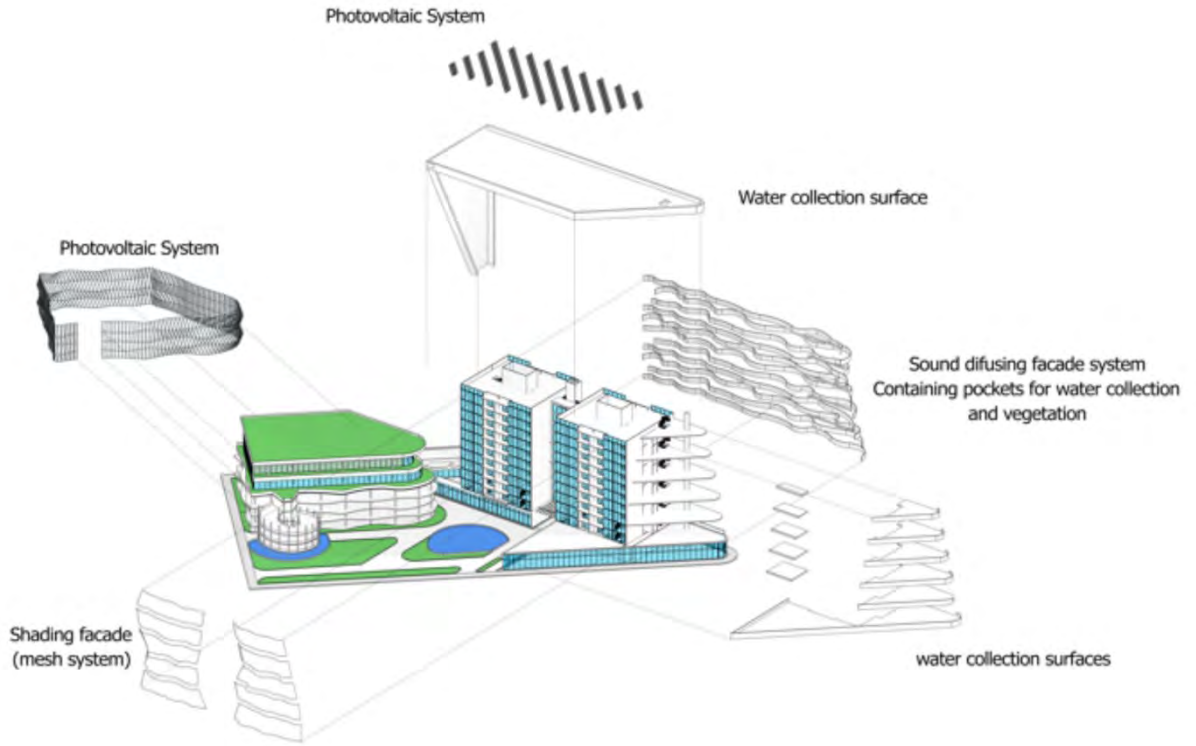
Aristotle 980a Metaphysics, Translated by W. D. Ross

Ribbon Tower by Maysain Tannos
(SE corner of NE 3rd Avenue and North Flagler Drive.)

Energy ecology efficiency in buildings has become an increasingly important topic in recent years. With the growing awareness of environmental issues and the need for sustainable living, more and more people are looking for ways to reduce their carbon footprint and live in an eco-friendly manner. One key aspect of energy ecology efficiency in buildings is the use of renewable energy sources such as solar power. Photovoltaic panels are a popular choice for many homeowners and businesses as they allow for the generation of electricity from the sun. Another important aspect of energy ecology efficiency in buildings is water collection. With water becoming an increasingly scarce resource in many parts of the world, it is important to find ways to conserve it. Collecting rainwater can be a simple yet effective way to do this, and many buildings are now incorporating rainwater collection systems into their design.

As a response to the soundscape, the building itself acts as an urban buffer from a noisy intersection and rail line in addition to loud music venues. As an acoustic barrier, the building deploys a 'ribbon' system of shading and acoustic diffusing material. This strategy dissipates sound rather than reflecting it to other buildings. The building mass forms a barrier between the generally commercial-transportation corridor and emergent residential neighborhoods.





The Ecological Revive by Maite Bruno (SW 4th Avenue at the New River)

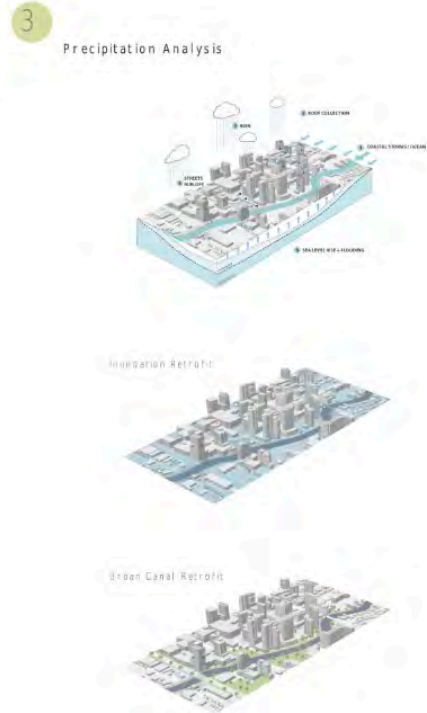
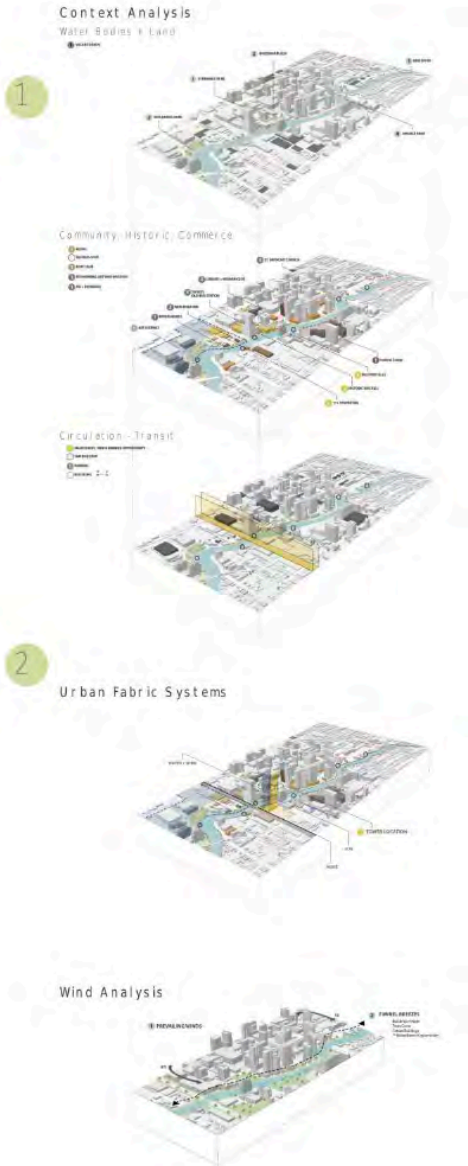
Downtown Ft. Lauderdale is a place that has nurtured life before the existence of the city, with the New River area becoming the heart where the natural ecology of the town emerged. The site acts as the origin of Ft. Lauderdale, serving as the crown that holds together the districts of art, history, entertainment, culture, education, and business, while linking them to its natural local resources, thus playing an important role in the city life for the emerging community. Historically, the Riverwalk reflects the past and present of the city, telling the story of the town. Commercially, it is a tourist destination that connects with the 3rd largest cruise port, while extending the livability of the place with the waterways as another layer of circulation, which makes it part of the main wealth source of economy of Ft. Lauderdale. Culturally, it links to the New River, being one the main 165 waterways that represent the identity of the town. However, it is currently in need of repair, with the New River affected by debris, pollutants, inappropriate land uses, the site being in danger of flooding in the next 5 years, and most importantly, losing the ecological link that defines the place. Therefore, the site offers an opportunity to form strong links between its districts, activate the area for the community, and create an environment that showcases the character of the place, restoring its local resources.

The project proposal receives the Riverwalk but also continues its path vertically, by creating a new ground plane and allowing for green pockets as the tower increases in height. The New Ground not only helps to enhance the character of the place, but it also acts as a noise barrier for the residents that are going to inhabit the building. Also, by creating a new elevated ground, the building captures the prevailing breezes for natural cooling effects, allows for community gather spaces to emerge, and reacts to the rising flooding levels, being able to function at least until the year 2130.

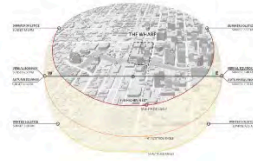
The project aims to not only enhance the existent natural resources but to give back to the environment. Therefore, the skin is designed to harvest energy with the use of algae and vegetation variations to capture the energy from the sun based on the sun angle and heating hours, while absorbing the noise coming from night clubs in the area with angled matrix variations that reacts to the sound waves. Thus, the proposal fosters an overall ecology of the place, creating an urban retrofit to provide benefits from natural ecology, to community ecology, economical ecology, and heritage+ art ecology.







Sun Analysis



Current Shade



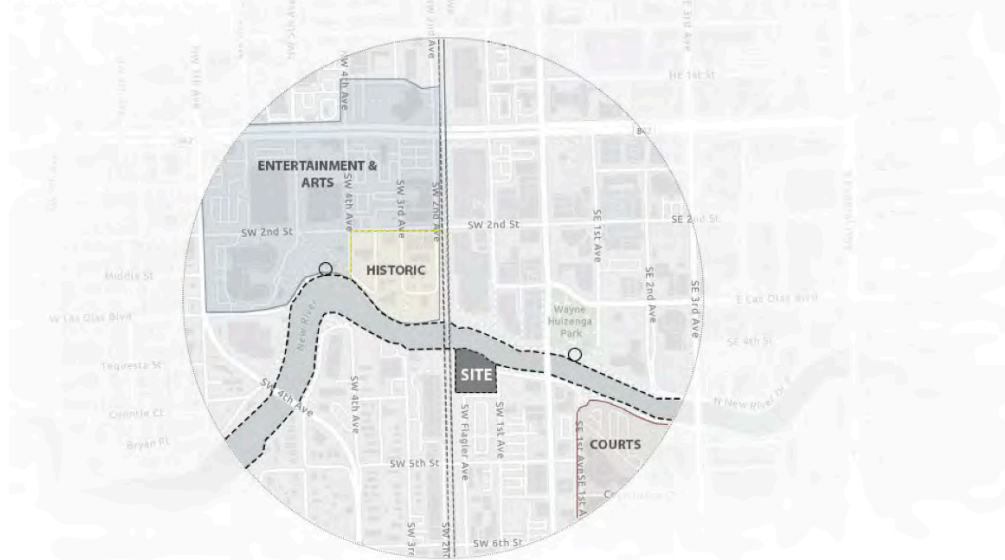
Future Shade - 60 Years



Precipitation Analysis



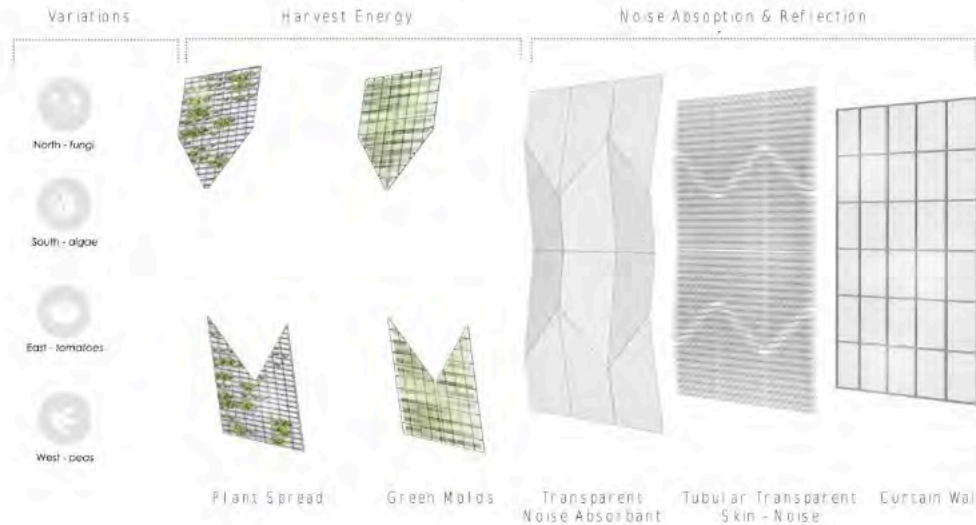
Districts Analysis - Site



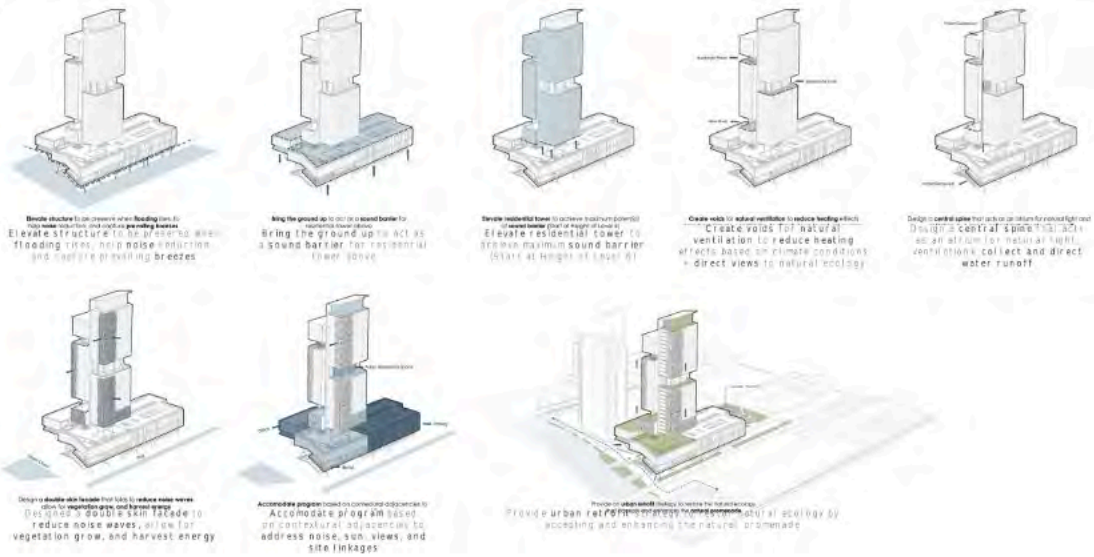
Site Plan



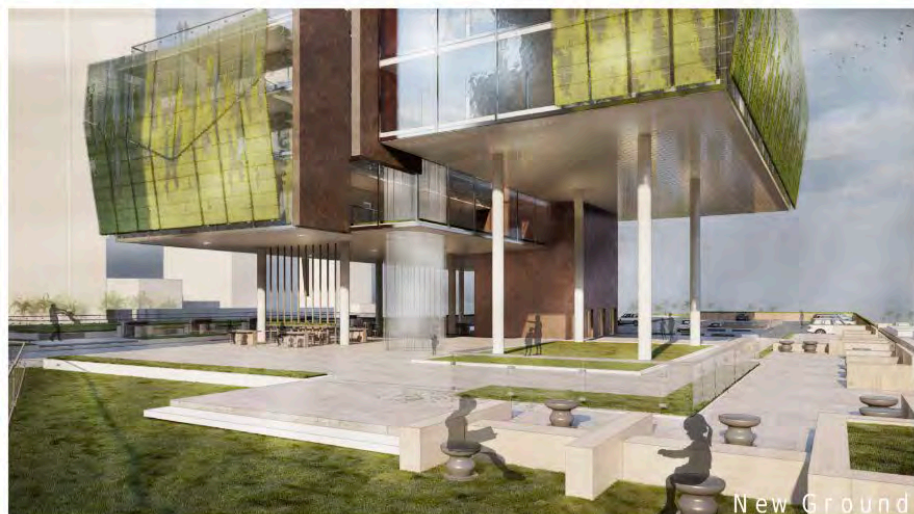
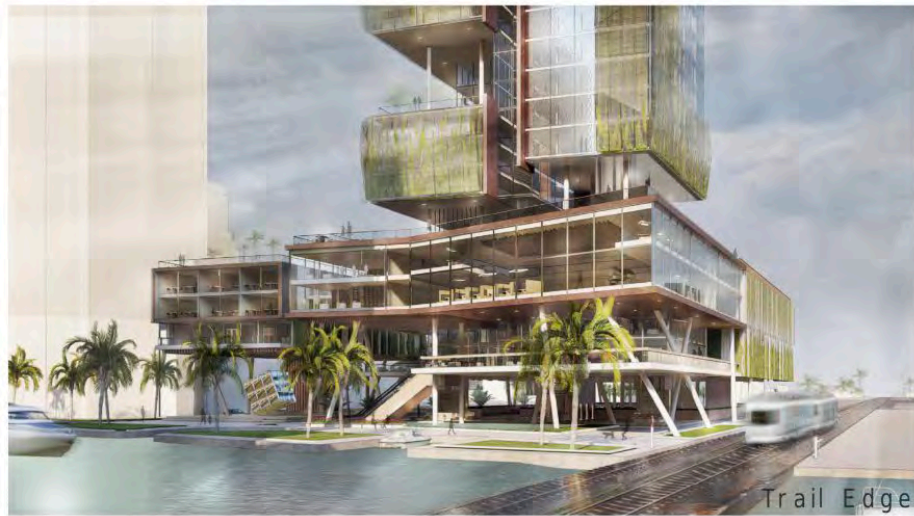
Skin Diagram



Massing Diagrams







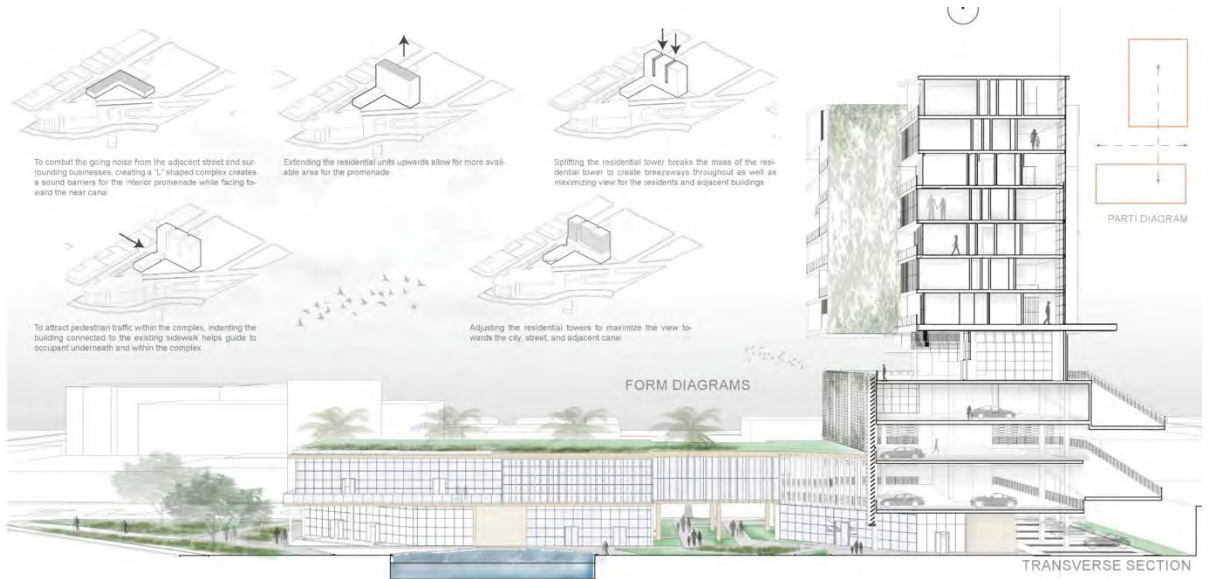
**Timber Heights by TQuion Smith
(SE corner of East Los Olas Boulevard and Tarpon Drive.)**

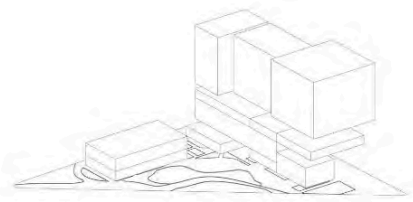
Sustainability has been a critical issue in architect in recent years due to the increasing concerns about climate change, resource depletions, and environmental degradation. As architects, we have the responsibility to consider the environmental impact our work has on the environment and need to push toward design that is energy-efficient, resource efficient and environmentally responsible. This project is a culmination of integration, adaptation and innovation within the city of Fort Lauderdale, located on one of the major corridors of East Las Olas Boulevard. Surrounded with robust pedestrian activity during the day and the evening, this boulevard has been a staple in Fort Lauderdale. Unfortunately, as these events continue to occur, the harsh reality of noise pollution is a growing concern for the residents of the city.

Located on a current parking lot adjacent to East Las Olas Boulevard, this site is the perfect location for this new mixed-use complex that gives back to the community with its program and architectural presence. The city of Fort Lauderdale has a future vision for the progression of its city life and from the image above, their plan is to create a linkage from downtown to Las Olas to create a corridor full of activity. Stemming from arts and entertainment to walking as well as clubbing, this lineage of activity is in alignment with the current path of the site chosen.

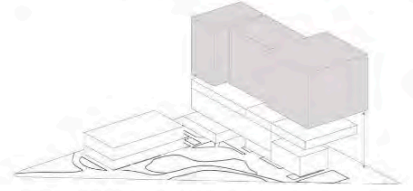
The program of the Timber Heights extends both residential and nightlife activities with architectural design strategies that buffer noisy activities, use the building mass as a barrier, and uses sustainable facades that also can effectively diffuse and reduce sound energy to improve quiet along East Los Olas Boulevard.



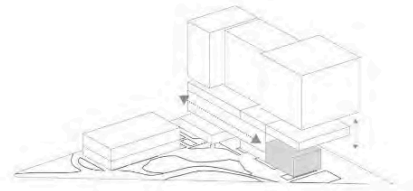




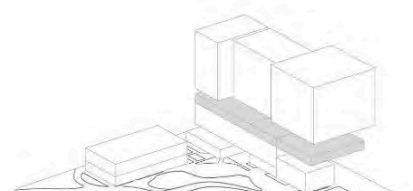
Transforming the current site which is an existing parking lot allowed for the transformation of the plaza which included a detention pond to mitigate rainwater. This can act as a water feature but as a sustainable option to water collection.



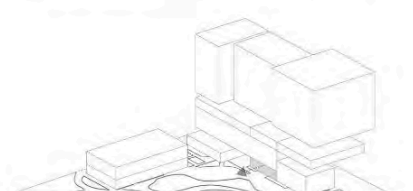
Positioning the residential units above the other program helps decrease the noise level.



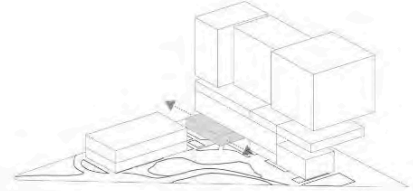
The placement of the nightclub sits on the ground floor of the complex for easy access and positioned as far away from the residents and main street.



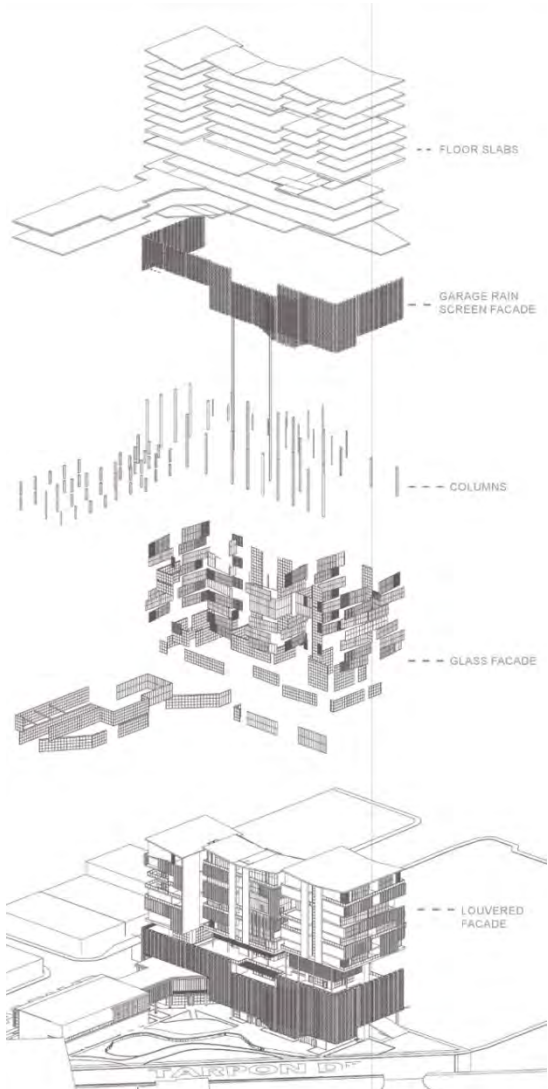
The office spaces between the parking garage and residential units allows for a semi-private location for the municipal programs.



The addition of a market serves as another program that relates to the existing building near the site, bringing the attraction into the site.



Adding the gallery serves as a link to the future vision of the city to bring forward local artists of the community, this location has the access to the main corridor as well as the interior plaza.





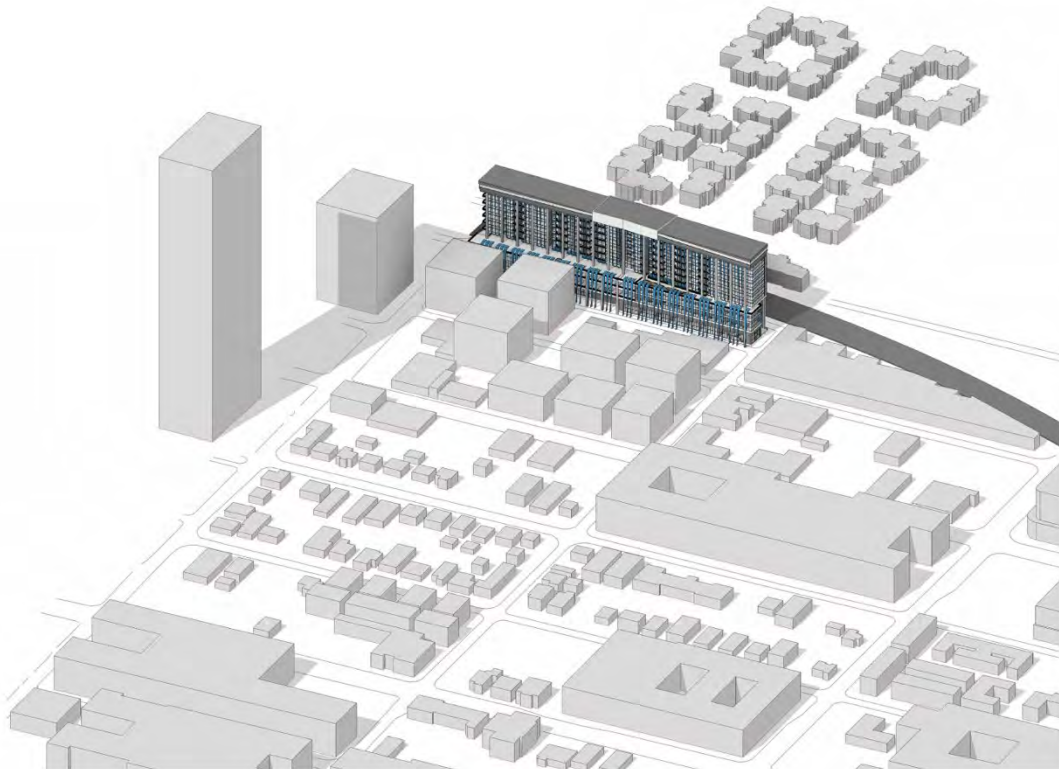
RESIDENTIAL SKY LOUNGE

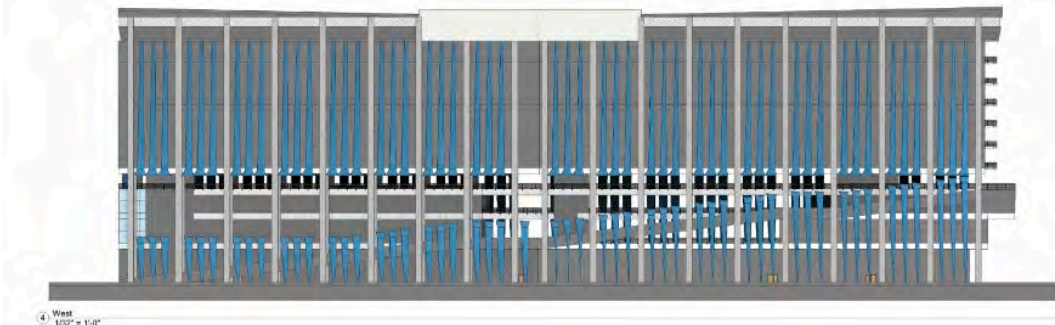
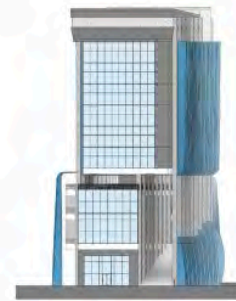
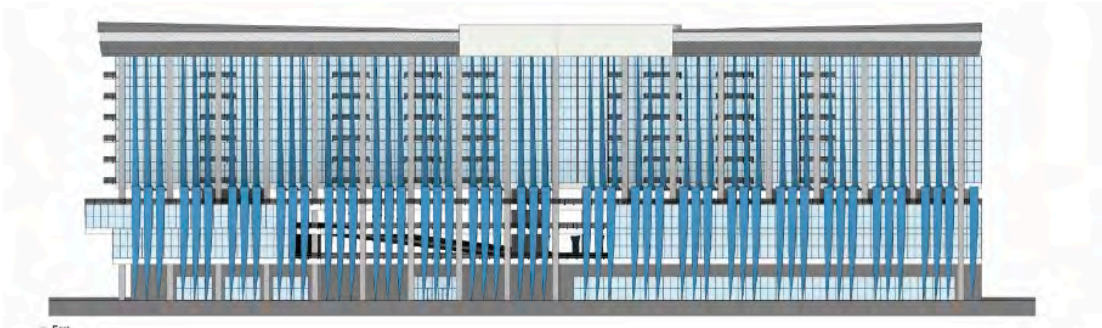


Soudscape Cocoon by Blake Albritton (NE corner of Northwest Flagler Avenue and Northwest 4th Street)

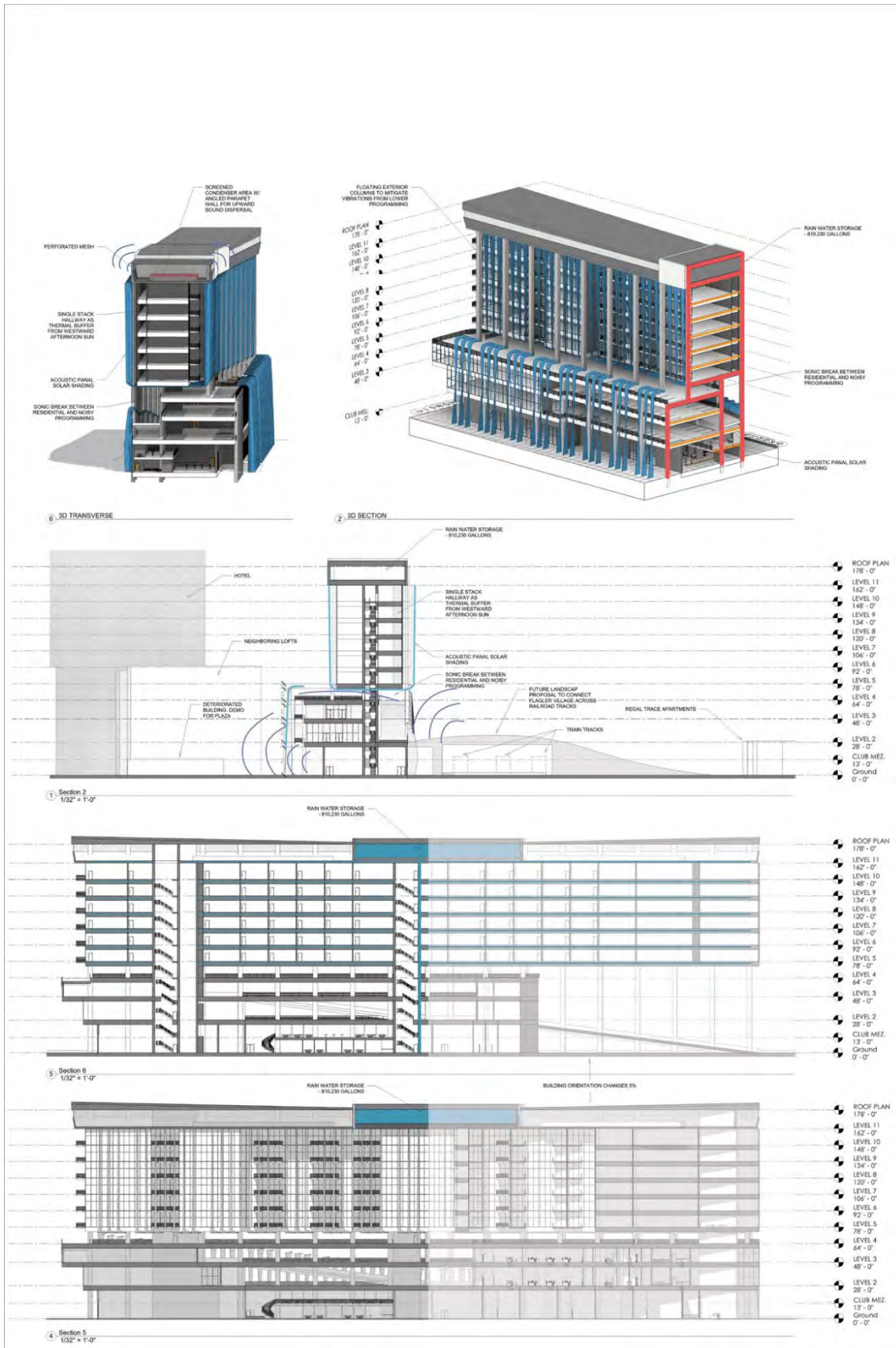
This project aims to create a multiuse residential tower containing retail space, leasing offices, municipal offices, a nightclub, and appropriate parking, while reacting to the elements of the site, taking advantage of and mitigating aspects of the location's environment and soundscape. This building utilizes a unique louvered facade which wraps it in sound baffling material to both absorb sound and heat, angling outward vertically to provide shade while maintaining views, and stretching horizontally when delineating sound separation between differing programmatic typologies of differing sound intensity. This is most noticeable in the transition between the lower programmatic elements and the residential tower, which is isolated and wrapped by the façade, like a protective cocoon, protecting against solar heat gain and unwanted sound

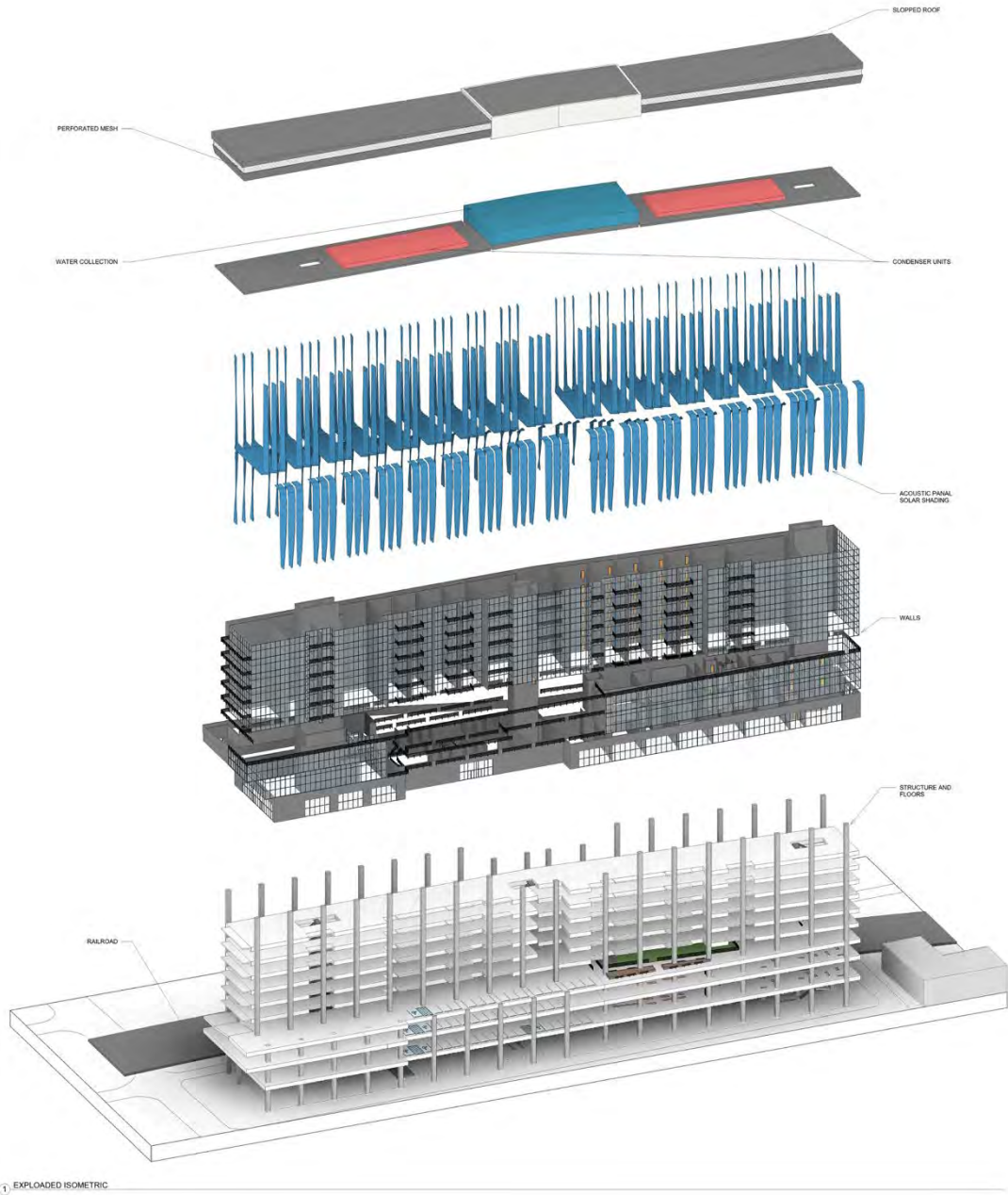
The southwestern site location in Flagler village is a north to south oriented site on the perimeter of the neighborhood along the railroad tracks which run through Fort Lauderdale. The buildings size, orientation, and sound dispersing facade help create a barrier between the noisy railroad tracks and the eastward neighborhood largely made up of residential and mixed-use buildings. Against the central business district to the south, the size and program of this building is appropriate for the site and within context of current and ongoing development in the area. Minimizing some of the negative effects of reconstruction in this dense urban area, the site is currently occupied by a self-storage facility, an empty lot, and a small abandon shop complex. Outside of the site itself, additional possible site interventions include demolishing a small single story abandoned building to the east to create a greenspace in front of the club, to allow the noise from the club to dissipate outward and creating a landscaped bridge over the railroad tracks. This would further contain the noise from the train while connecting pedestrians from the adjacent neighborhood to the city and retail within the building while creating more greenspace in otherwise undevelopable areas.





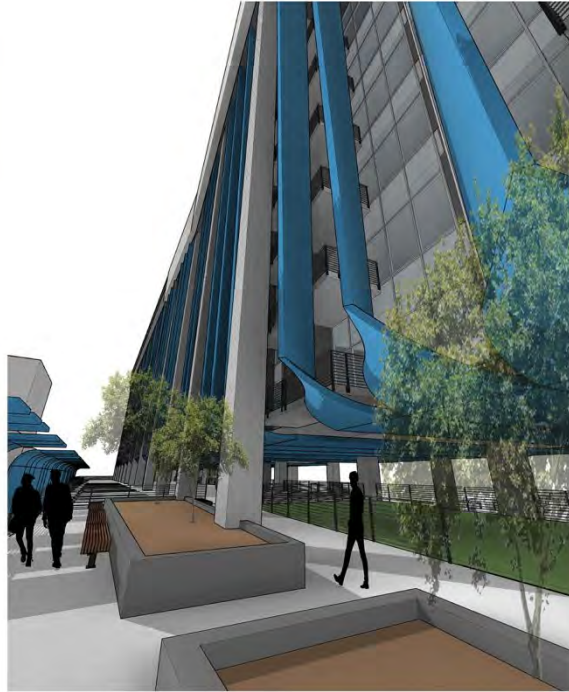








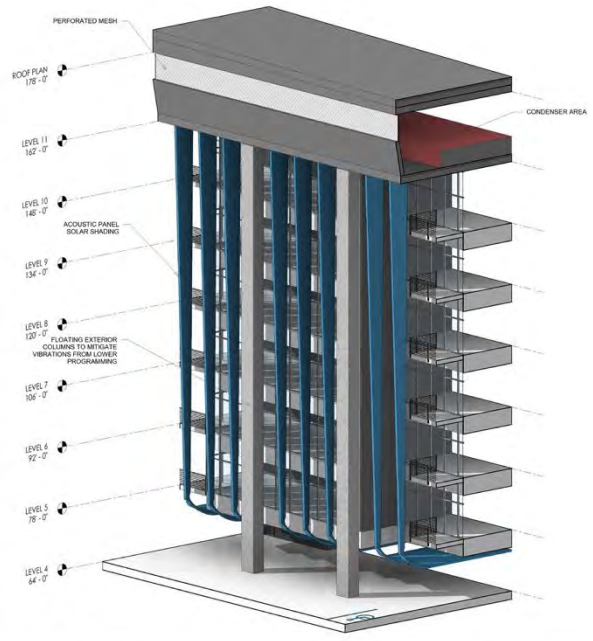
3 VIEW FROM RESIDENCE



2 4TH FLOOR OUTDOOR SPACE



5 NE PERSPECTIVE



1 RESIDENTIAL FACADE SHADING



4 SE PERSPECTIVE

Mixed-Use Strip Intervention by Kyle O'Quinn (East Oakland Park Boulevard between NW 26th and NW 27th Avenues)

The site is located at a major urban arterial corridor (East Oakland Park Boulevard) that connects downtown Fort Lauderdale to the Atlantic Ocean. The road is flanked on either side by urban strip commercial with residential neighborhoods behind them. Traffic along this corridor is somewhat high speed and the buildings are pulled back, placed along parallel secondary streets that allow vehicles to be siphoned from the highway.

This project proposes that these secondary streets be reoriented from a primary vehicle focus to a pedestrian focus. The reconstruction has the potential of transforming what is essentially a linear parking lot into an urban oasis and drawing commercial activity from the residences by offering shade and walkability. Improved integration between East Oakland Park Boulevard and the adjacent neighborhoods could enhance the sustainability of this retail corridor, rather than relying on seasonal traffic. However, because of this corridor's central highway, it is important to maintain a strong urban barrier that will block, diffuse and absorb as much of the road noise as possible. Sound reduction is achieved using low and wide buildings that span their sites, stepping back as it rises vertically, with a facade that is designed in a shape derived from an acoustical form.

Finally, due to conflict in programmatic requirements, the proposal includes two separate buildings, rather than a single building. These buildings are placed diagonally along the highway at the termination of perpendicular side streets, acting as a gateway or threshold for the cars passing by, denoting an increase in pedestrian activity and marking a major crossing area that links the neighborhoods symbolically and physically to stitch the residential neighborhoods on either side of this urban divide back together.





ZONING



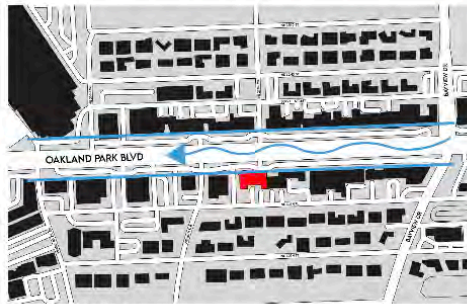
SOUND PENETRATION



TREE COVERAGE



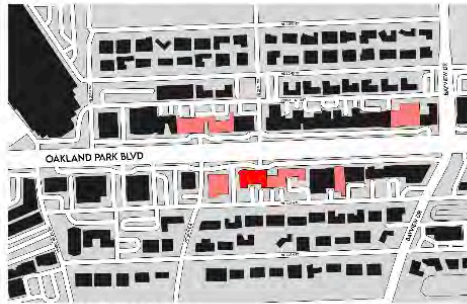
RETAIL BLOCKS



WIND CORRIDOR



MICROSHADING



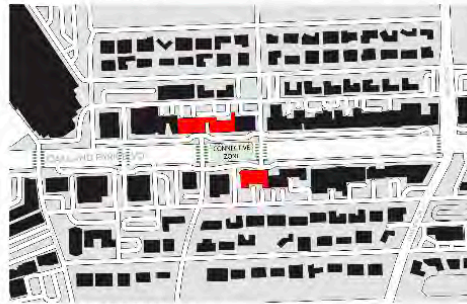
POTENTIAL SISTER SITES



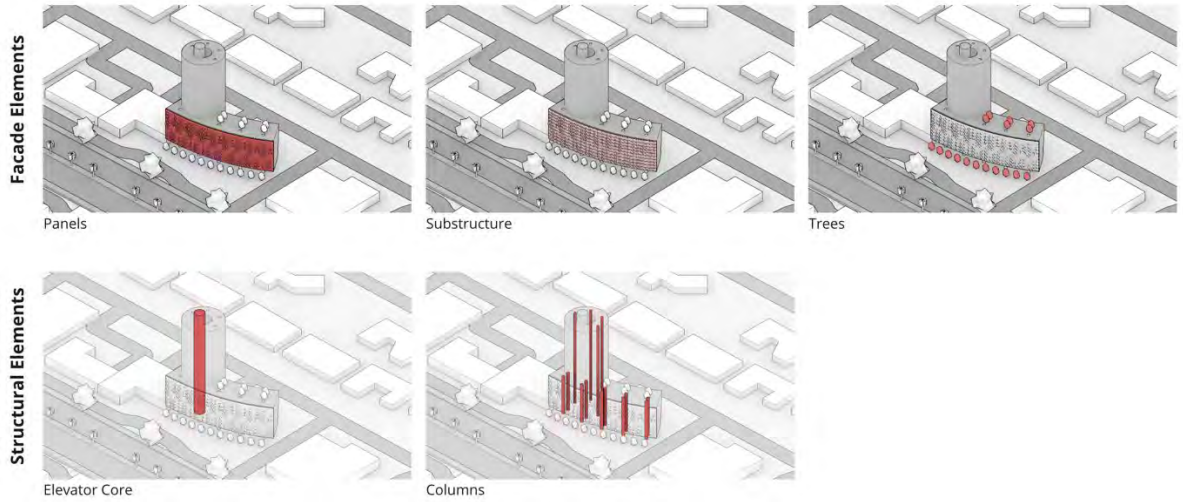
URBAN ALIGNMENTS

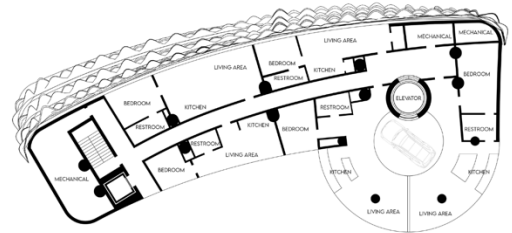
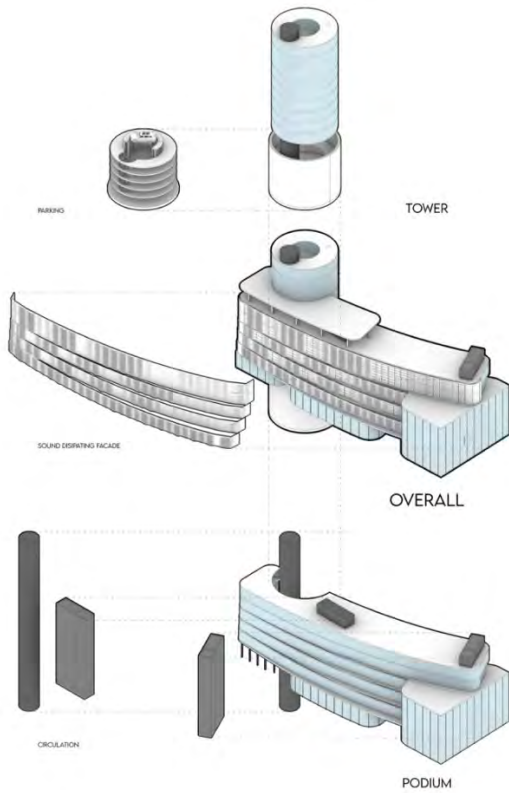


RETAIL/RESIDENTIAL DIVIDE



POTENTIAL CROSSWALKS





RESIDENTIAL FLOOR PLAN

