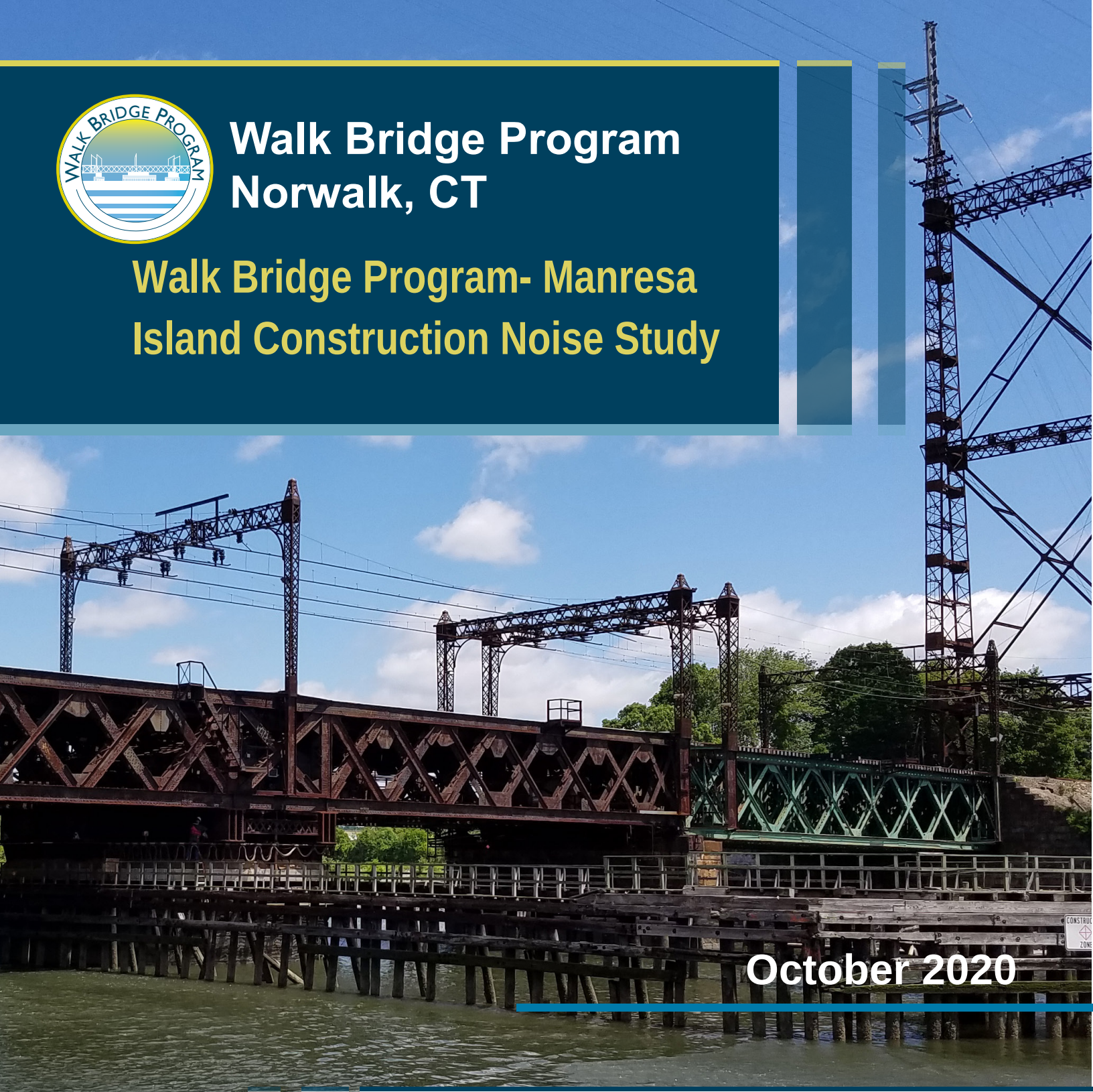
Walk Bridge Program
Norwalk, CT

Walk Bridge Program- Manresa Island Construction Noise Study



October 2020

Prepared for:

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Introduction

WSP was requested by the Connecticut Department of Transportation (CTDOT) to implement a noise study to model conditions anticipated to result from work at the proposed bridge assembly site on Manresa Island south of Norwalk Harbor. This work is part of the Walk Bridge Replacement Project (SPN 0301-0176) in Norwalk, CT. As part of the study, data collected in early September 2020 documented background ambient noise levels at five (5) locations adjacent to Manresa Island. This information was then compared to a model of future construction noise levels based on Manresa Island work activities. Additionally, a site in downtown Norwalk near 70 Water Street had previously been considered for bridge assembly work and additional comparisons were made between the Manresa Island locations and sites in downtown Norwalk.

WSP retained the services of Cross Spectrum Acoustics (CSA) of Longmeadow, MA to prepare the Manresa Noise Study; including background noise monitoring, analysis of monitoring results and modeling of construction phase noise levels for both Manresa Island and downtown Norwalk. CSA deployed noise monitoring systems at representative locations in neighborhoods adjacent to Manresa Island. Monitoring devices were placed on private property as coordinated with and agreed to by the property owners and/or representatives. Downtown Norwalk background noise levels were obtained from a previous study for the Walk Bridge Test Pile Program, conducted between summer of 2018 and winter of 2019.

The study (Attachment A) is supplemented by appendices that provide noise measurement site photographs (Appendix A), noise measurement results graphs (Appendix B) and additional graphics representing the expected noise levels for both the Manresa Island areas and downtown Norwalk (Appendix C).

Attachment A - Manresa Island Construction Noise Study

Cross-Spectrum Acoustics

Cross-Spectrum Acoustics Inc.

Massachusetts
Utah
California

TECHNICAL MEMORANDUM

From:	David Towers & Herbert Singleton, Cross-Spectrum Acoustics Inc.
Date:	October 9, 2020
Project Reference:	J2018-1050 – Walk Bridge Project - Manresa Island Construction Noise Study (SPN 301-176)

1. INTRODUCTION

This technical memorandum provides a summary of a noise study for proposed Walk Bridge Project construction activities at Manresa Island in Norwalk, CT. The study included pre-construction background ambient noise measurements at nearby noise-sensitive locations as well as predictions of future construction noise levels at these locations. The projected noise levels in nearby neighborhoods from the proposed construction activities at Manresa Island are compared to noise levels in downtown Norwalk from the same activities if conducted at the Marine Staging Yard on Water Street, south of the Stroffolino Bridge.

2. BACKGROUND AMBIENT NOISE MEASUREMENTS

Sound is defined as small changes in air pressure above and below the standard atmospheric pressure. Noise is usually considered to be unwanted sound. The level of sound is the magnitude of air pressure change above and below atmospheric pressure and is expressed in A-weighted decibels (dBA) to correspond with the characteristics of human hearing. Typical sounds fall within a range between 0 dBA (the approximate lower limit of human hearing) and 120 dBA (the highest sound level generally experienced in the environment). A 3-dB change in sound level is perceived as a barely noticeable change outdoors and a 10-dB change in sound level is perceived as a doubling (or halving) of loudness. Because environmental noise is constantly changing, it is common to use various metrics to describe the overall noise exposure. Some of these metrics are described below:

> **L_{eq}** is the "equivalent" sound level over a time period, typically 1 hour or 24-hours. It is the level of steady sound that has the same energy as a fluctuating sound measured over the same time period. L_{eq} is indicative of the average sound level during the measurement period.
>
> **L_{xx}:** represents "percentile" levels, i.e. the sound level that is exceeded over "xx" percent of the time during the measurement period. For example, the L_{90} is the sound level that is exceeded 90% of the time during the measurement period and is the metric commonly associated with the background noise. L_{10} and L_{50} are sound levels that are exceeded 10% of the time and 50% of the time, respectively. L_{10} and L_{50} are used by the Connecticut Department of Energy and Environmental Protection to assess noise levels.
>
> **L_{max}** is the maximum sound level and is used to describe the highest level over a measurement period .
>
> **L_{dn}** is the day-night sound level which is used by federal agencies to describe daily community noise exposure. L_{dn} is a cumulative equivalent noise level over a 24-hour period that is similar to L_{eq}. However, L_{dn} adds a night-time penalty of 10 decibels to events measured between 10:00 PM and 7:00 AM to account for increased nighttime sensitivity to noise.

2.1. AMBIENT NOISE MEASUREMENT LOCATIONS

Long-term noise measurements were conducted over a 48-hour weekday period between September 1 and September 3, 2020 at the five locations around Manresa Island shown in Figure 1, denoted as Sites MAN-1 through MAN-5. The measurements were performed using NTi Audio model XL2 sound level meters that conform to American National Standard Institute (ANSI) standards for Class 1 (Precision) sound measurement equipment. Calibrations, traceable to the National Institute of Standards and Technology (NIST), were conducted before and after each measurement. The monitors were set to continuously monitor noise levels and report the hourly equivalent noise level (L_{eq}), maximum noise level (L_{max}), and 10^{th}, 50^{th} and 90^{th} percentile sound level (L_{10}, L_{50} and L_{90}) metrics over the measurement periods.

The weather during the measurement period was mostly dry, except for some periods of rain on September 2, and temperatures in the area ranged from 60 to 80 degrees Fahrenheit. Wind speeds were generally below 10 mph. Windscreens were used to minimize wind noise in the measurements. CSA staff performed short-term on-site observations during the measurement periods to note sound sources and typical activities.

In addition to the September 2020 measurements, the existing noise data from measurement sites N-6 (at 50 Water Street) and N-7 (100 Water Street) collected in July 2018[1] are also presented in Figure 2. These results are intended to represent the existing noise conditions near newly constructed apartment buildings located west of Water Street between Hanford Place and Raymond Street. Because construction is still occurring at one building, it was not feasible to conduct additional long-term measurements in this area.

A summary of each location is provided below, and photographs of the measurement sites are included in Appendix A.

MAN-1: 10 Woodland Road. This measurement location was intended to represent the existing noise environment for homes in the southeast portion of the Wilson Point Community located west of the Manresa Island site. The noise monitor was located in the backyard of the home at 10 Woodland Road, facing toward the location of the proposed construction site. The major existing noise sources at this location were neighborhood activity, activity on the water, wind in the trees and birdsong.

MAN-2: 8 Valley Road. This measurement location was intended to represent the existing noise environment for homes in the northeast portion of the Wilson Point Community located west of the Manresa Island site. The noise monitor was located on the rear patio of the home at 8 Valley Road. Noise sources affecting this location included neighborhood activity, activity on the water, wind in the trees and birdsong.

MAN-3: 14 Outer Road. This measurement location was intended to represent the existing noise environment at the residences in the Village Creek community located to the northwest of Manresa Island. The noise monitor was located in the back yard of the 14 Outer Road residence, along the floodwall near the shore. Major noise sources at this location included wave motion, activity on the water, wind in the trees, birdsong, and neighborhood activity.

MAN-4: 4 Yost Street. This measurement location was intended to represent the existing noise environment along the proposed Woodward Avenue truck route, north of Manresa Island. The noise monitor was located at the edge of the side yard to the west of the 4 Yost Street residence, along Woodward Ave. The major noise sources affecting this location were traffic on Woodward Avenue and neighborhood activity.

MAN-5: 5 ½ Longshore Ave. This measurement location was intended to represent the existing noise environment at the Harborshore community, located to the north of Manresa Island. The noise monitor was located south of the property, along the fence separating the residence and the NRG property, near the water. The major noise sources affecting this location were wave action, activities on the water, local activity, wind in the trees and birdsong.

[1] "Walk Bridge Background Noise and Vibration Background Measurement Program – (SPN 301-176)," Technical Memorandum from David Towers and Herbert Singleton, Cross-Spectrum Acoustics Inc., September 5, 2018

N-6: 50 Water Street (2018). This measurement location was intended to represent the existing noise environment at the buildings in the vicinity of 50-68 Water Street, located south of Washington Street between Water Street and the Norwalk River. The noise monitor was located near the bottom of the stairway on the south side of the building. Noise at this location was continuously monitored for a 48-hour weekday period from July 9 to July 11, 2018, and for a 24-hour weekend period from July 14 to July 15, 2018. The major noise sources affecting this location were traffic on the Washington Street bridge and trains on the Walk Bridge, as well as local parking lot and boat dock activity.

N-7: 100 Water Street (2018). This measurement location was intended to represent the existing noise environment in the dock area in the vicinity of 100 Water Street, located south of Washington Street between Water Street and the Norwalk River. The noise monitor was located in the parking lot adjacent to the Sono Seaport Seafood building. Noise at this location was continuously monitored for a 48-hour weekday period from July 11 to July 13, 2018, and for a 24-hour weekend period from July 14 to July 15, 2018. The major noise sources affecting this location were traffic on the Washington Street bridge and Water Street, local parking lot and boat dock activity and a nearby air conditioning unit.

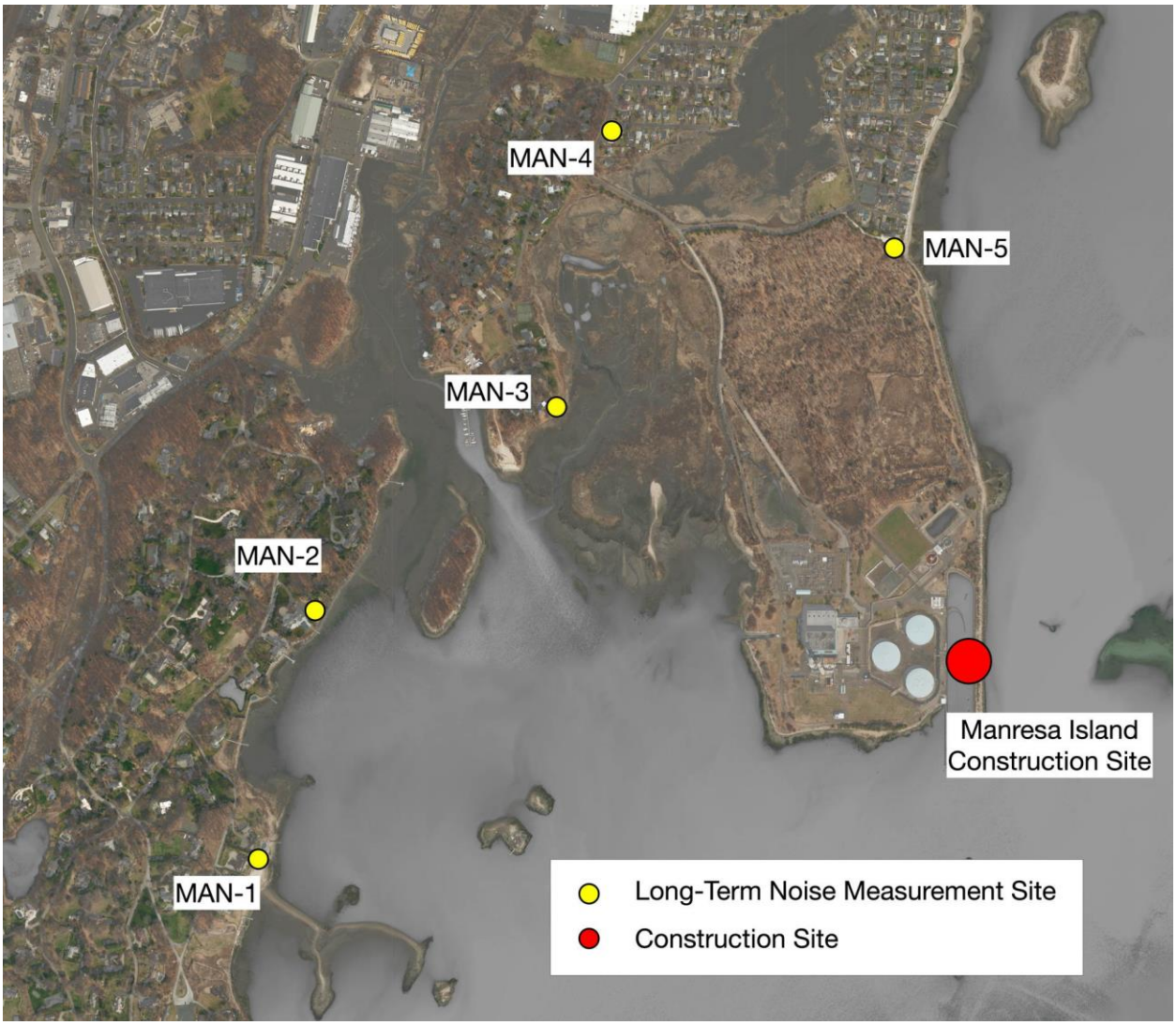


Figure 1. Noise Monitoring Locations Near Manresa Island

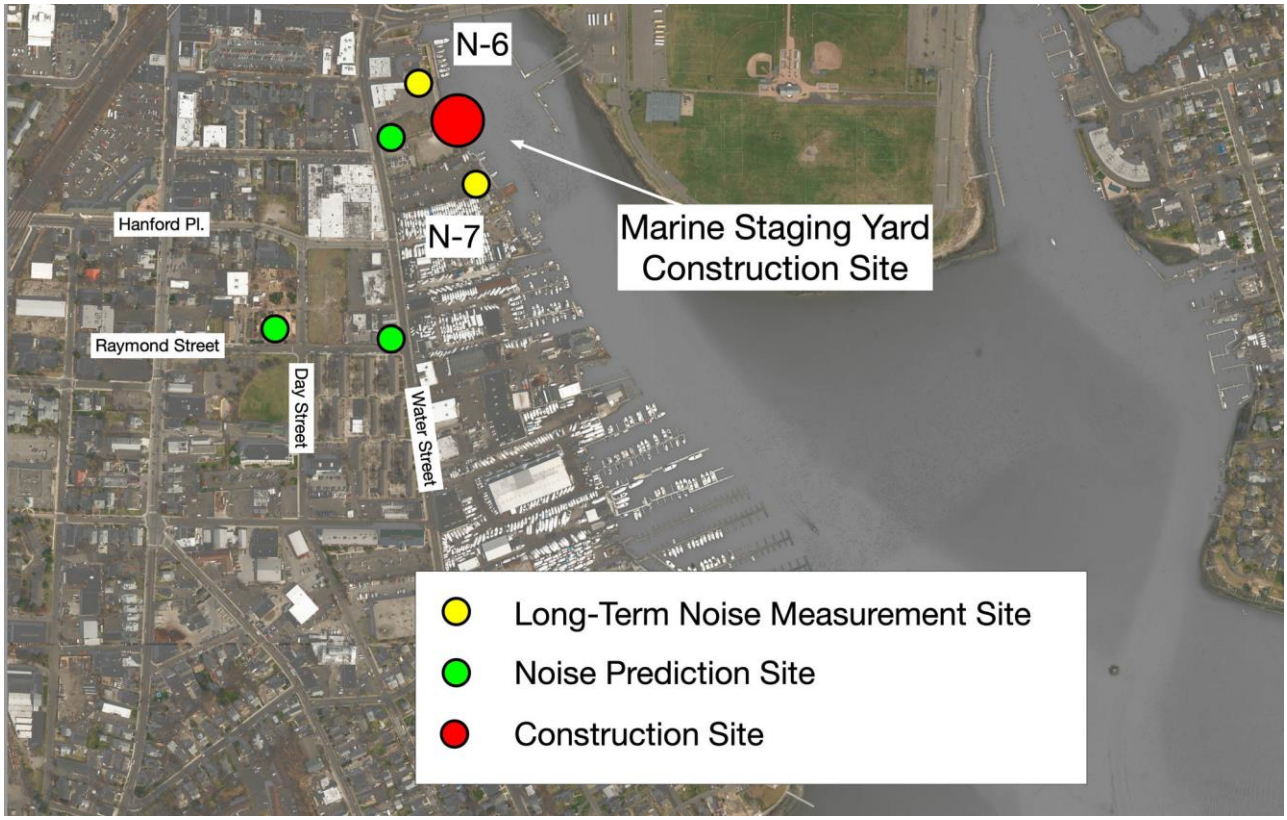


Figure 2. Noise Prediction Locations Near the Marine Staging Yard

2.2. AMBIENT NOISE MEASUREMENT RESULTS

The ambient long-term noise measurement results are presented in Table 1 for the 48-hour weekday measurements. The results are summarized in terms of the various noise metrics that were collected over the monitoring periods. The noise metrics presented here are consistent with those collected for previous Walk Bridge construction noise studies. Most of the noise near the project site was due to local neighborhood activities, beach sounds, motor-vehicle traffic on nearby streets, and biogenic sources such as bird song and insect noises. The hourly noise metrics for each position over the monitoring periods are presented in Appendix B.

Table 1. Long-Term (48-hour) Weekday Noise Measurement Results

Measurement Location		Start of Measurement		Measured Sound Level (dBA)													
				L_{dn}	$L_{eq(24)}$	Day (7 AM – 6 PM)				Evening (6 PM – 10 PM)				Night (10 PM - 7 AM)			
Site No.	Address	Date	Time			L_{eq}	L_{10}	L_{90}	L_{max}	L_{eq}	L_{10}	L_{90}	L_{max}	L_{eq}	L_{10}	L_{90}	L_{max}
MAN-1	10 Woodland Rd	9/1/20	10:00 am	56.7	49.9	49.2	50.4	44.1	69.2	48.9	52.6	47.8	66.3	50.4	54.5	45.2	59.8
MAN-2	8 Valley Rd	9/1/20	11:00 am	62.1	58.7	61.7	56.3	44.1	97.0	53.4	56.6	50.2	66.0	54.1	58.0	43.3	64.9
MAN-3	14 Outer Rd	9/1/20	11:00 am	63.9	61.0	63.8	53.1	42.0	104.4	51.9	55.1	50.5	67.6	55.0	58.6	48.5	64.3
MAN-4	4 Yost St	9/1/20	12:00 pm	60.0	53.5	53.4	55.7	45.3	81.8	53.4	56.5	47.9	68.6	53.5	55.6	46.3	65.3
MAN-5	5 ½ Longshore Ave	9/1/20	1:00 pm	63.1	54.8	49.9	56.4	43.9	68.2	55.8	58.7	54.6	65.4	57.2	58.8	49.7	66.9
N-6*	50 Water St	7/9/18	9:30 am	63.6	61.6	61.2	63.9	50.9	82.7	51.1	54.8	46.1	90.2	51.1	54.5	41.3	81.6
N-7*	100 Water St	7/11/18	10:50 am	62.1	59.5	57.2	58.3	50.2	86.5	59.6	62.5	52.1	87.9	50.5	50.9	43.2	83.9
* 2018 measurement																	

3. NOISE PREDICTIONS

3.1. CONSTRUCTION ACTIVITIES

The construction noise predictions were carried out using the methodology contained in the U.S. Federal Transit Administration (FTA) "Transit Noise and Vibration Impact Assessment Manual" (FTA Report No. 0123, September 2018). Specifically, the predictions were based on the FTA methodology for a General Assessment, which assumes simultaneous full-power operation of the two noisiest pieces of equipment for each construction activity. The reference noise levels used for the computations are based on the FTA methodology and the Federal Highway Administration (FHWA) Roadway Construction Noise model (RCNM) data.

In accordance with FTA methodology, sound propagation from construction equipment assumes a point source model based on spherical spreading, with a reduction of 6 decibels per doubling of distance from the source. To be conservative, no excess sound attenuation due to ground or atmospheric effects is assumed. However, an even more conservative approach has been adopted in cases where the sound from the construction site propagates over large bodies of water. Based on guidance provided by a working group of the Institute of Acoustics,[2] cylindrical sound spreading (with a reduction of only 3 decibels per doubling of distance from the source) is assumed for noise propagation over large bodies of water at least 700 meters (2,300 feet) in extent.

Predictions of construction noise levels generated by Lift Span Assembly activities at Manresa Island are shown in Table 2. The results indicate projected worst-case construction noise levels in the range of 50-64 dBA at the representative ambient noise measurement locations, depending on construction activity and location. These noise levels are well below the CT DOT noise limit of 90 dBA and the construction will be limited to daytime hours. However, given that the daytime background noise levels (L_{90}) were in the range of 42-45 dBA at the ambient measurement sites, the construction activities at Manresa Island are likely to be audible at some outdoor locations during quiet periods of time.

For purposes of comparison, predictions of construction noise levels generated by Lift Span Assembly activities at the Marine Staging Yard in downtown Norwalk were made at the five locations shown in Figure 2, and the results are presented in Table 3. The results indicate projected worst-case construction noise levels in the range of 67-87 dBA at the representative noise-sensitive locations, depending on construction activity and location. Although these noise levels do not exceed the CT DOT noise limit of 90 dBA, they are significantly (on the order of 20 decibels) greater than those projected in the nearest neighborhoods for the same construction activities at Manresa Island.

3.2. CONSTRUCTION TRAFFIC

Construction-related traffic along the proposed Woodward Avenue route will include both delivery trucks and personal employee vehicles, and will be limited to the daytime hours. It expected that there will be about five truck trips (in and out) per week and about 20 automobile trips (in and out) per day. The posted speed limit on Woodward Avenue is 25 mph.

Noise from construction traffic was predicted in terms of one-hour L_{eq} using FHWA procedures and was assessed by comparing the predictions with the ambient noise measurement results at Site MAN-4 (4 Yost Street). The measurement microphone at this site was directly behind a solid wood stockade fence, approximately 25 feet from the center of Woodward Avenue. Given the limited number of delivery truck trips, it was assumed that there would be one heavy truck traveling along the route during 10 different one-hour periods each week. For employee traffic, it was assumed that there would be 20 automobiles traveling along the route during two different one-hour periods each day. To be conservative, a speed of 30 mph was assumed for all vehicles traveling along Woodward Avenue (5 mph above the posted speed limit).

[2] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, Supplementary Guidance Note 6: Noise Propagation Over Water for On-Shore Wind Turbines (December 2013)

The results of the noise predictions at Site MAN-4 indicate one-hour L_{eq} values of 45 dBA for construction truck traffic and 44 dBA for employee vehicle traffic, assuming a -5 dB adjustment to account for shielding of road traffic noise by the fence adjacent to the measurement location. These predicted future construction-related traffic noise levels are lower than the measured existing daytime hourly Leq, which were in the range of 49-60 dBA and averaged 53 dBA. Combining the highest future traffic noise level (45 dBA) with the lowest existing noise level (49 dBA) results in a total future noise level of 50 dBA based on decibel addition (which is logarithmic rather than arithmetic). Therefore, it is concluded that construction-related traffic will result in an increase of no more than one decibel at locations along the proposed route, which is an insignificant change. Furthermore, the exposure to construction-related traffic will occur during a limited number of hours during the day.

4. SUMMARY OF RESULTS AND CONCLUSIONS

The results of the study indicate that, although noise from the proposed Lift Span Assembly construction activities at Manresa Island will be audible at times, the construction noise levels will be below the Connecticut Department of Transportation (CT DOT) noise limits for the Walk Bridge Project at all modeled community locations, and well below noise limits at the Manresa Island locations. In addition, noise increases from construction-related traffic along the proposed Woodward Avenue truck route are not expected to be significant.

The results of the study also indicate that although construction noise levels at nearby noise-sensitive locations are not projected to exceed the CT DOT noise limits, they would be significantly (on the order of 20 decibels) higher if the Lift Span Assembly activities were to occur at the Marine Staging Yard location. Therefore, it is concluded that relocating these construction activities to Manresa Island will result in significantly less community noise impact.

Finally, it should be noted that, although construction noise levels at noise-sensitive locations are not projected to exceed the CT DOT noise limits, the Department may consider mitigations to the extent that they are warranted and feasible as the program advances.

Additional graphics showing Manresa Island and the Marine Staging Yard noise predictions at specified distances from the work areas are presented in Appendix C.

Table 2. Construction Noise Projections for Lift Span Assembly at Manresa Island

Construction Activity	Major Equipment Items	Maximum Projected Noise Level (dBA) at Given Site/Distance						
		Reference Level at 50 feet	Calculated Level at 100 feet	MAN-1 (4,600 ft)†	MAN-2 (4,300 ft)‡	MAN-3 (3,000 ft)	MAN-4 (4,000 ft)	MAN-5 (2,600 ft)
Grading, fabric, and stone installation for yard	Tri-Axle Dump Truck Cat 950 Loader	90	84	58	58	54	52	56
Structural steel erection and boltup installation	Grove 60T Rough Terrain Yard Crane Impact Wrench	90	84	58	58	54	52	56
Sand blasting and touchup paint	Sand Blaster Air Compressor	96	90	64	64	60	58	62
Construction fencing installation	Cat 950 Loader Skid Steer with Auger attachment	88	82	56	56	52	50	54
Lift Span Construction	Tri Axel Dump Truck Grove 60T Rough Terrain Yard Crane	91	85	59	59	55	53	57
Temporary power, site lighting and water installation	Cat 950 Loader Tri Axel Dump Truck	90	84	58	58	54	52	56
Lift span barge demobilization	Manitowoc 4100 Ringer on Barge Tri-Axle Dump Truck	91	85	59	59	55	53	57

† Assumes propagation over land for 1,200 feet and propagation over water for 3,400 feet.

‡ Assumes propagation over land for 1,300 feet and propagation over water for 3,000 feet.

Table 3. Construction Noise Projections for Lift Span Assembly at the Marine Staging Yard

Construction Activity	Major Equipment Items	Maximum Projected Noise Level (dBA) at Given Site/Distance						
		Reference Level at 50 feet	Calculated Level at 100 feet	N-6 50 Water Street (200 ft)	70 Water Street (140 ft)	N-7 100 Water Street (250 ft)	123 Water Street (550 ft)	19 Day Street (550 ft)
Grading, fabric, and stone installation for yard	Tri-Axle Dump Truck Cat 950 Loader	90	84	78	81	76	69	69
Structural steel erection and boltup installation	Grove 60T Rough Terrain Yard Crane Impact Wrench	90	84	78	81	76	69	69
Sand blasting and touchup paint	Sand Blaster Air Compressor	96	90	84	87	82	75	75
Construction fencing installation	Cat 950 Loader Skid Steer with Auger attachment	88	82	76	79	74	67	67
Lift Span Construction	Tri Axel Dump Truck Grove 60T Rough Terrain Yard Crane	91	85	79	82	77	70	70
Temporary power, site lighting and water installation	Cat 950 Loader Tri Axel Dump Truck	90	84	78	81	76	69	69
Lift span barge demobilization	Manitowoc 4100 Ringer on Barge Tri-Axle Dump Truck	91	85	79	82	77	70	70

APPENDIX A: NOISE MEASUREMENT SITE PHOTOGRAPHS

MAN-1

MAN-2

MAN-3

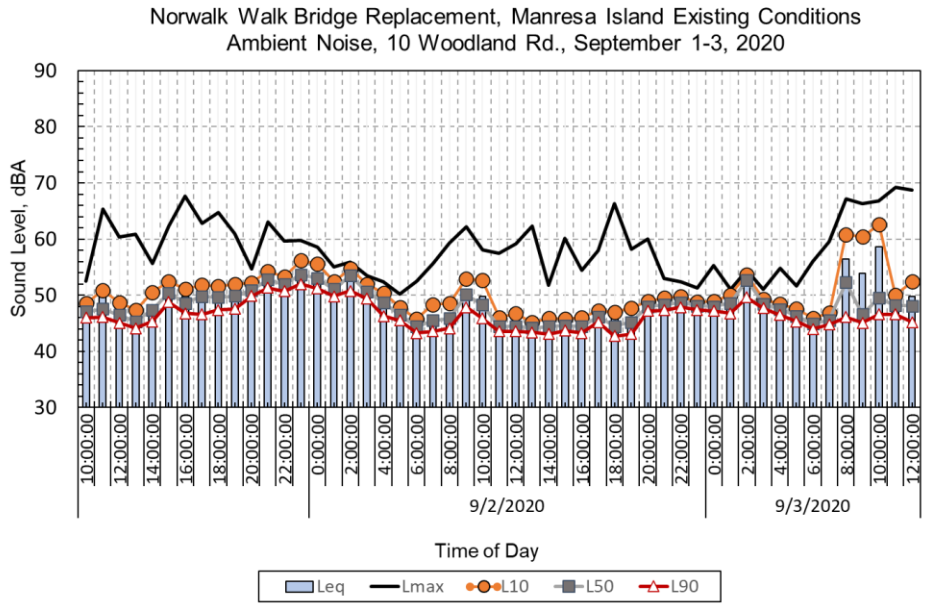
MAN-4

MAN-5

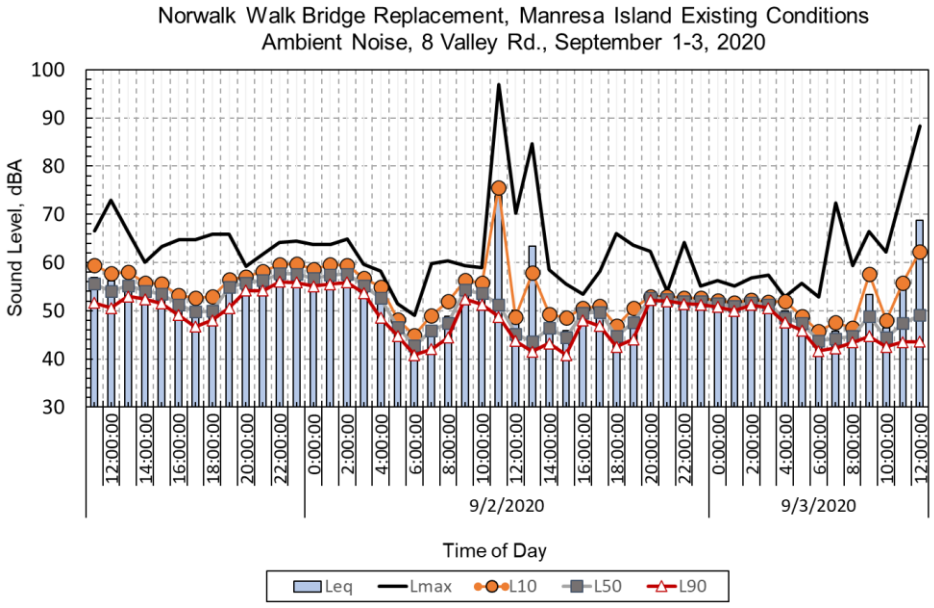
N-6 (2018)

N-7 (2018)

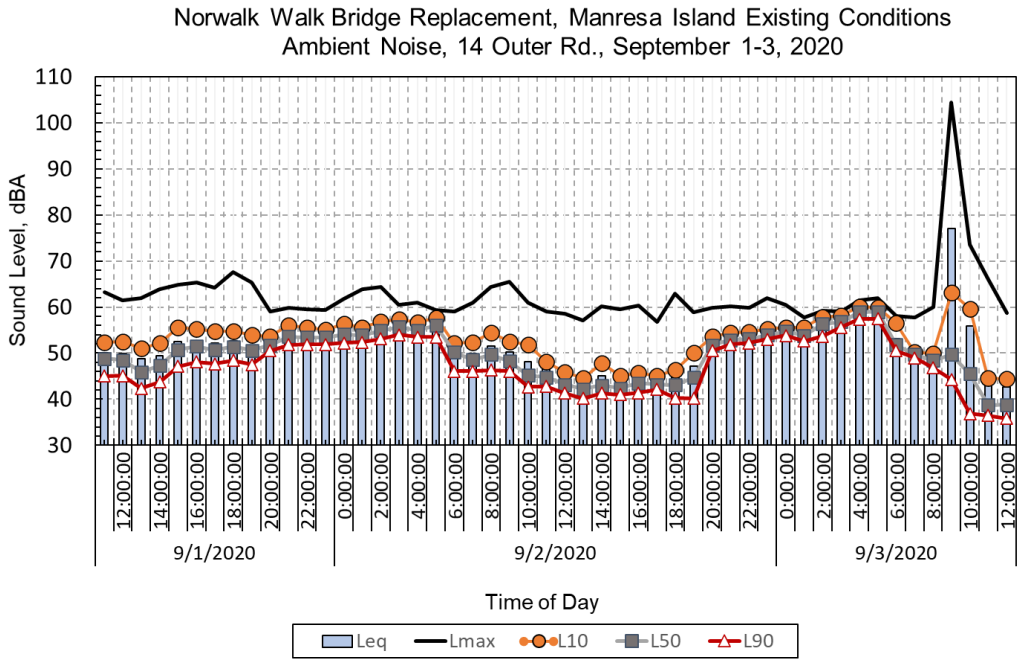
APPENDIX B. NOISE MEASUREMENT RESULTS



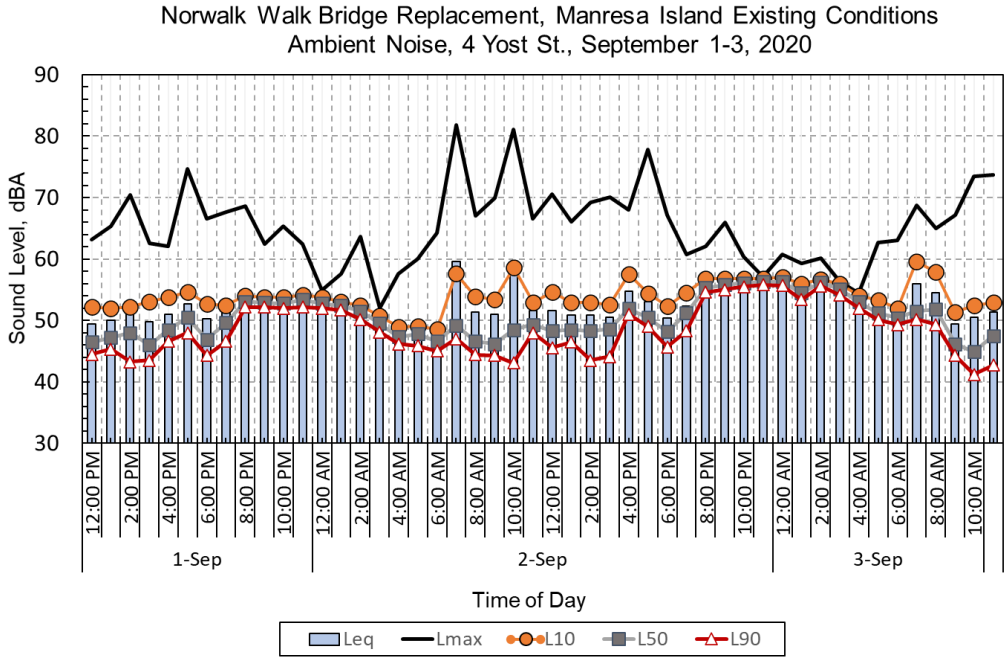
MAN-1 10 Woodland Rd.



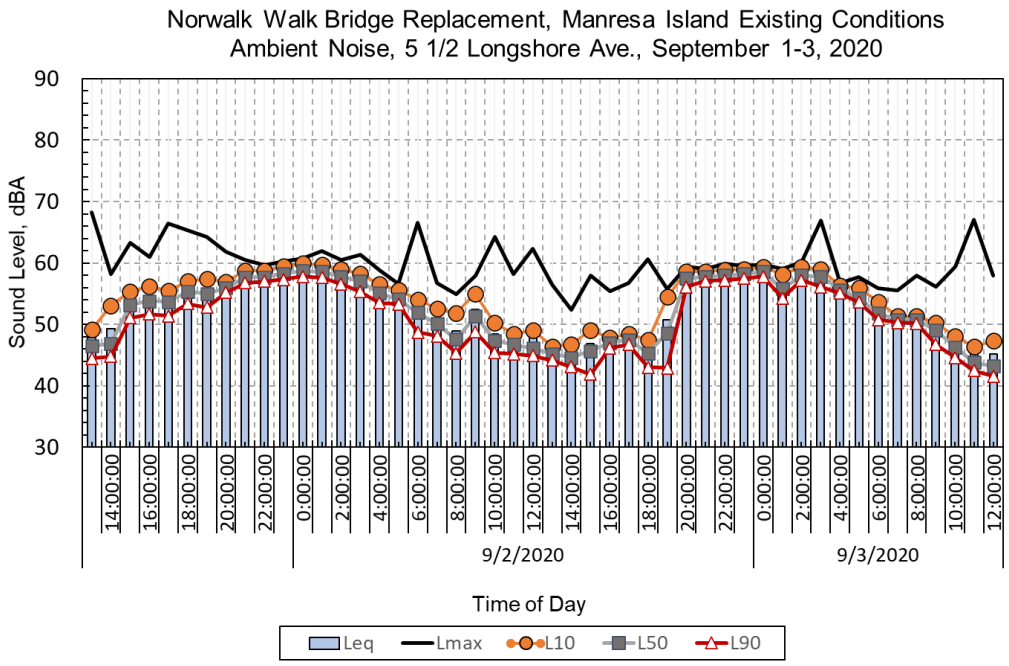
MAN-2 8 Valley Rd



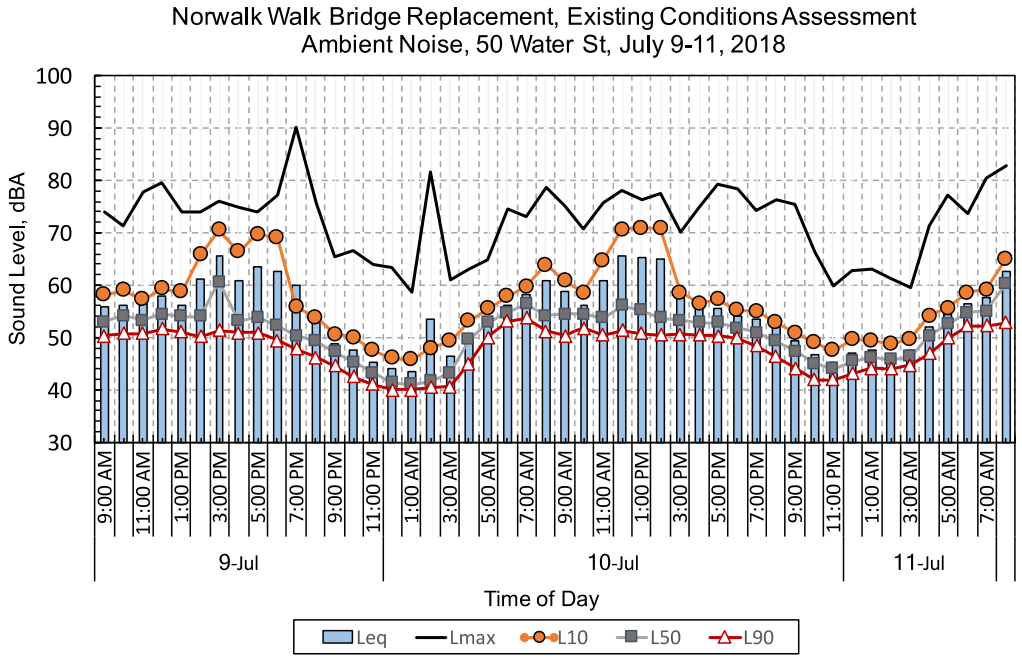
MAN-3 14 Outer Rd.



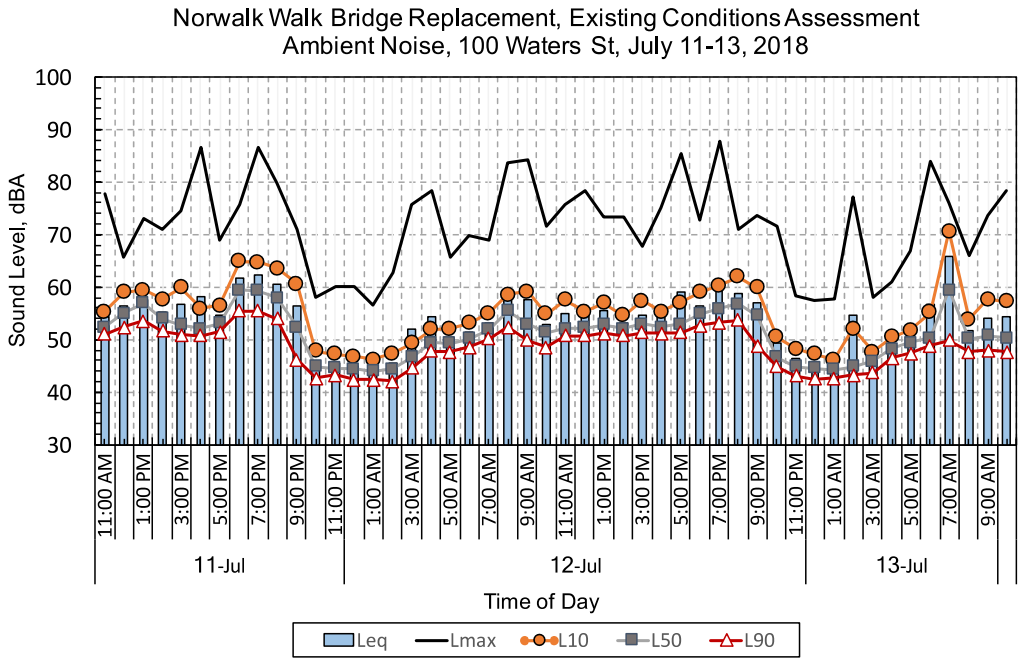
MAN-4 4 Yost Street



MAN-5 5 ½ Longshore Ave



N-6 50 Water Street (Weekday)

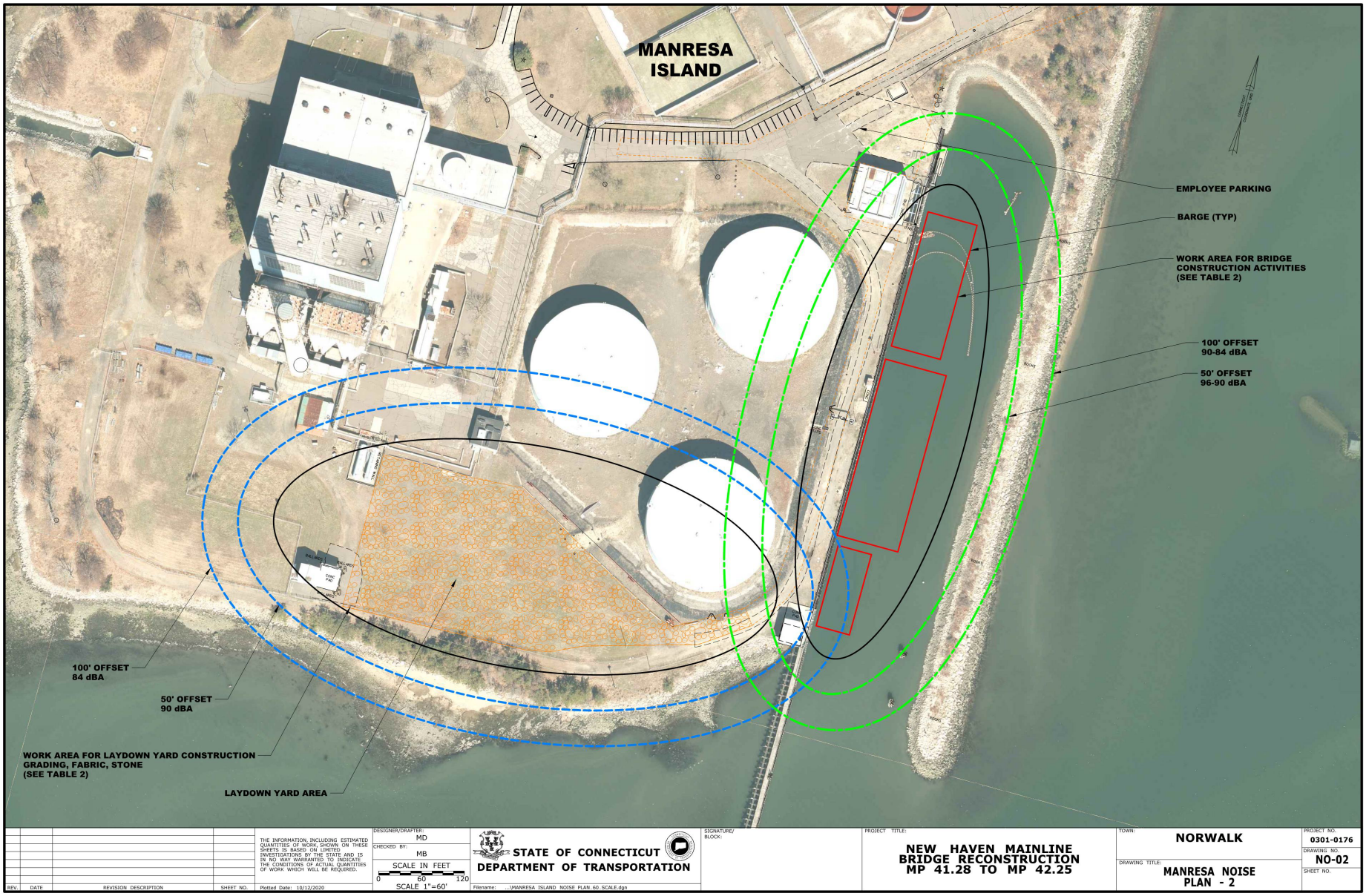


N-7 100 Water Street (Weekday)

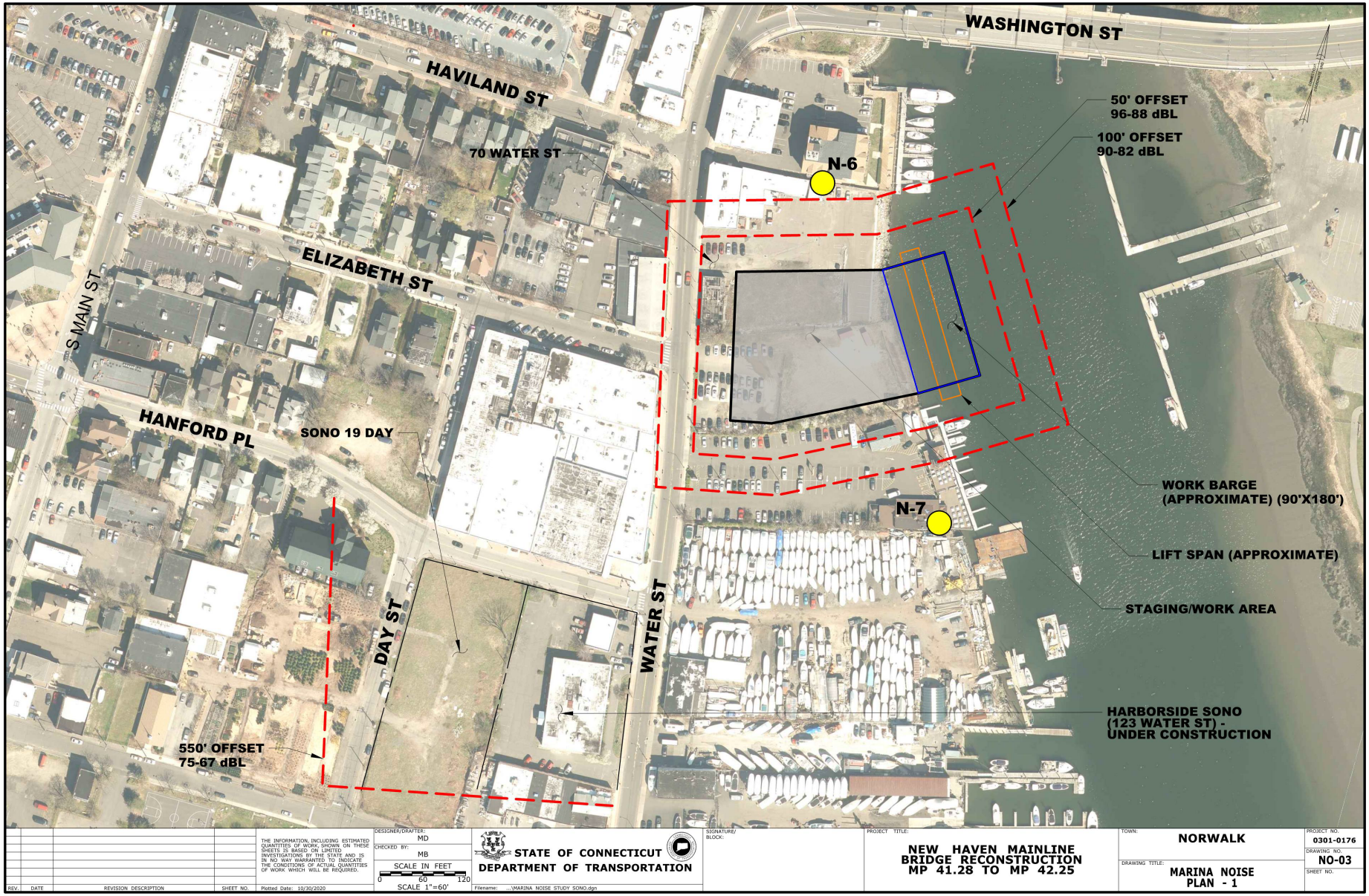
APPENDIX C: ADDITIONAL GRAPHICS

- **MANRESA NOISE PLAN 1 – MANRESA ISLAND 400 SCALE**
- **MANRESA NOISE PLAN 2 – MANRESA ISLAND 60 SCALE**
- **MARINA NOISE PLAN 1 – MARINE STAGING YARD 60 SCALE**

MANRESA NOISE PLAN 1 – MANRESA ISLAND 400 SCALE



MANRESA NOISE PLAN 2 – MANRESA ISLAND 60 SCALE



MARINA NOISE PLAN 1 – MARINE STAGING YARD 60 SCALE