

## EMERYVILLE PUBLIC MARKET

EMERYVILLE, CA

PEDESTRIAN WIND STUDY

RWDI # 2102642

July 29, 2022

### SUBMITTED TO

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## EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed Emeryville Public Market in Emeryville, CA (Image 1). RWDI has conducted several rounds of wind-tunnel testing for the project dating back to July 2019. This report provides the results for the latest massing option (Proposed configuration, as shown in Image 2B) and includes the results for the Existing and Alternate G (2020 FDP) configurations for reference purposes (Images 2A and 2C, respectively). Using local wind records (Image 3), the predicted wind hazard and comfort conditions are graphically depicted on site plans in Figures 1A through 2C, with the associated wind speeds listed in Table 1 for the Existing and Proposed configurations and in Table 2 for the Alternate G (2020 FDP) configuration. These results are summarized as follows:

### Wind Hazard Conditions:

- For the Existing configuration, wind speeds at the majority of locations are anticipated to comply with the wind hazard criterion. An exception is one location on the east side of the railroad tracks.
- With the addition of the proposed project (i.e., Proposed configuration), wind speeds at all locations are expected to comply with the wind hazard criterion with the exception of the existing location on the east side of the railroad tracks which is anticipated to continue to exceed the wind hazard criterion 2 hours per year. Positively, all above-grade areas assessed are predicted to meet the hazard criterion.
- For all locations tested, the average wind speed exceeded for 1 hour per year is 24mph, which is 1 mph lower than the Existing configuration (Table 1).
- For the Alternate G (2020 FDP) configuration, wind speeds at all locations are expected to comply with the wind hazard criterion.

### Wind Comfort Conditions:

- On an annual basis, wind speeds at 12 out of 57 test locations in the Existing configuration are expected to exceed the comfort criterion of 11 mph. Most of these locations are on the east side of the railroad tracks.
- For the Proposed configuration, wind speeds at 28 out of 72 test locations are expected to exceed the comfort criterion.
- For the Alternate G (2020 FDP) configuration, wind speeds at 25 out of 55 test locations are expected to exceed the comfort criterion.
- Wind conditions on the pedestrian bridge over the railroad tracks and in all pedestrian areas east of the site, including the podium of the existing Emory Station West, will not be negatively impacted by the proposed project.
- A comparison to previously tested configurations is provided in Section 3.4.



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# INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a pedestrian wind assessment for the proposed Emeryville Public Market in Emeryville, CA. This report presents the project objectives, background and approach, and discusses of the results from RWDI's assessment.

## 1.1 Project Description

The project (site shown in Image 1) is located on the east side of Shellmound Street between 63<sup>rd</sup> Street to the north and Powell Street to the south. The project involves the construction of two buildings, Parcel A, which is proposed to be a naturally ventilated garage, and Parcel B, which will be a 162 ft tall mixed-use building. An outdoor public space with a bike pavilion and dispersed landscaping is proposed between the two Parcels. The general surroundings are characterized by low to mid-rise buildings to the east and San Francisco Bay to the west.

## 1.2 Objectives

The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, the outdoor public space, select balconies, and nearby sidewalks and walkways.



Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)



## 2 BACKGROUND AND APPROACH

### 2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

- |                             |   |
|-----------------------------|---|
| A – Existing:               | Existing site with existing surroundings, including the approved Wareham Research and Development building (Image 2A), and, |
| B – Proposed:               | Proposed project with existing surroundings, including the approved Wareham Research and Development building (Image 2B).   |
| C – Alternate G (2020 FDP): | Previously approved massing from 2019 with existing surroundings (Image 2C).  |

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 1200 ft radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel models were instrumented with 56 and 72 specially designed wind speed sensors for the 2019 and current tests, respectively, to measure mean and gust speeds at a full-scale height of approximately 5 ft above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increment. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site and reviewed by the project team.

### 2.2 Previous Wind Tunnel Tests

Testing was previously conducted for development proposals on the project site in 2019. The November 1, 2019 pedestrian wind study assessed numerous design options against the existing configuration. The results of this November 1, 2019 report addressed the existing conditions, two PDP alternatives and the currently approved Alternate G (2020 FDP). These results have been included for informational purposes. After the design options had been narrowed to Alternate G (2020 FDP), RWDI prepared a supplemental report for Alternate G (2020 FDP) and the existing EmeryStation building. To the extent permitted by the design, the sensors used for the study in these two previous reports were consolidated for assessment of this project, along with additional sensors in the proposed plaza and pedestrian bridge in order to assess wind impacts. As a result of design changes, there are differences between the sensor locations and numbering compared to the Existing and Proposed configurations in 2022. It may also be noted that the recently approved Wareham EmeryStation Overland Research and Development building was not included in the 2019 wind tunnel testing for the Alternate G (2020 FDP) configuration. However, since the building is located to the northeast of the project site and as the majority of prevailing winds originate from westerly directions, the impact of this building is expected to be local, and it is not expected to significantly alter the predicted wind conditions on the project site.



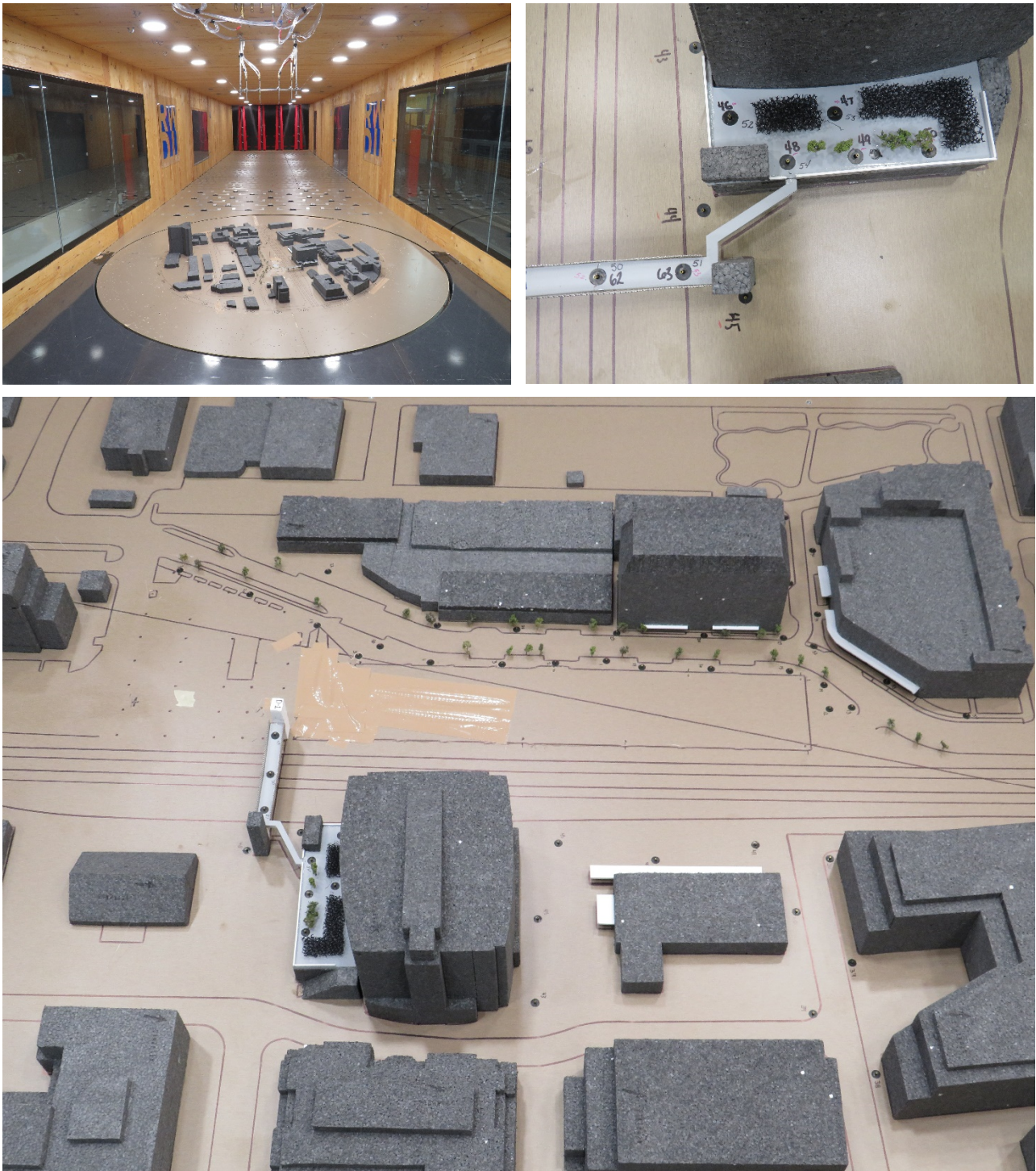


Image 2A: Wind Tunnel Study Model – Existing Configuration





Image 2B: Wind Tunnel Study Model – Proposed Configuration



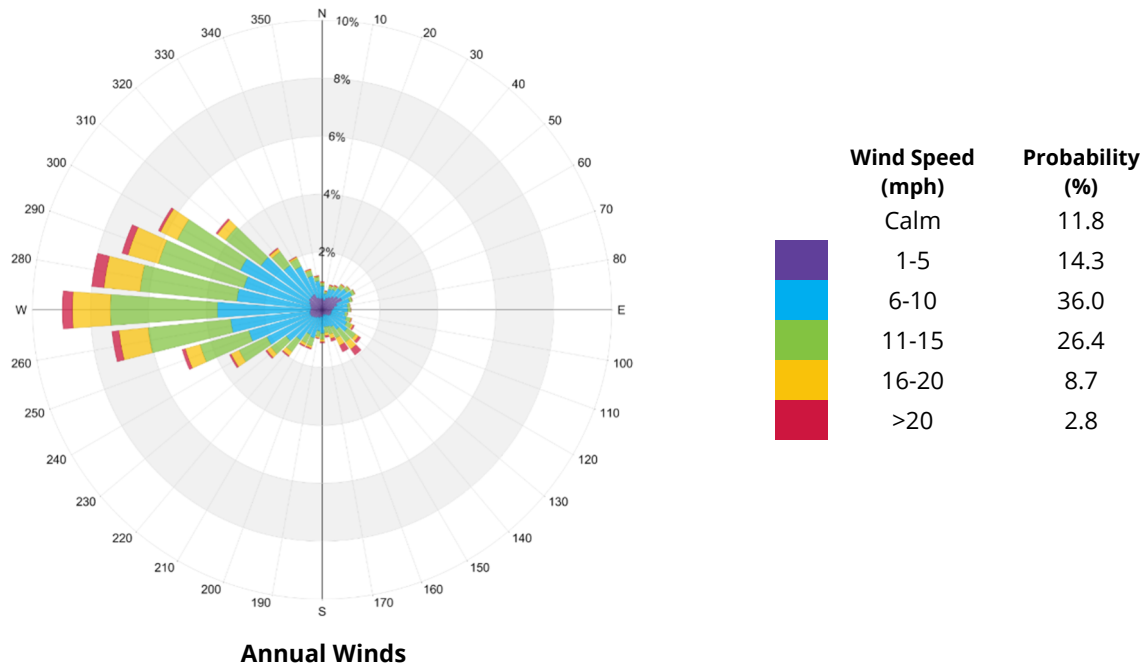


Image 2C: Wind Tunnel Study Model – Alternate G (2020 FDP) Configuration

## 2.3 Meteorological Data

Wind statistics recorded at Metropolitan Oakland International Airport between 1989 and 2019 were analyzed for annual wind conditions. Image 3 graphically depicts the directional distributions of annual wind frequencies and speeds. Winds are frequent from the northwest through west-southwest directions throughout the year, as indicated by the wind rose. Strong winds of a mean speed greater than 15 mph measured at the airport (at an anemometer height of 33 feet) occur 11.5% of the time annually.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the appropriate criteria for pedestrian safety and comfort.



**Image 3: Directional Distribution of Winds Approaching Metropolitan Oakland International Airport from 1989 to 2019**

## 2.4 Planning Code Requirements

Since the City of Emeryville does not have a wind significance threshold, due to the proximity of the Emeryville and Oakland, the City of Oakland's requirements were used for the wind tunnel study. The City of Oakland considers a significant wind impact to occur if a project were to "create winds exceeding 36 mph for more than one hour during daylight hours of the year," these are referred to as Wind Hazard exceedances. It is noted that the Marketplace EIR included the following significance threshold: if the exposure, orientation, and massing of a proposed structure can be expected to substantially increase ground-level winds in pedestrian corridors or public spaces near the project site. Since the ambient wind (undisturbed by buildings) in Emeryville seldom exceeds 36 mph, a project must substantially increase winds for this threshold to be exceeded.

In Oakland, a wind analysis needs to be done if the height of the project is 100 ft or greater (measured to the roof) and one of the following conditions exists:

- The project is located adjacent to a substantial water body (i.e., Oakland Estuary, Lake Merritt or San Francisco Bay).
- The project is in the downtown area.

Since the proposed project exceeds the 100 ft height and is adjacent to San Francisco Bay, it would be subject to the thresholds of significance if it were in subject to Oakland regulations.

The Planning Code defines these wind speeds in terms of equivalent wind speeds, and average wind speed (mean velocity), adjusted to include the level of gustiness and turbulence. Equivalent wind speeds were calculated according to the specifications in the City of Oakland Significant Wind Impact Criterion, whereby the mean hourly wind speed is increased when the turbulence intensity is greater than 15% according to the following formula:

$$EWS = V_m \times (2 \times TI + 0.7)$$

where **EWS** = equivalent wind speed

**$V_m$**  = mean pedestrian-level wind speed

**TI** = turbulence intensity

### Wind Comfort

Although not applicable towards Significant Wind Impacts as defined by the City of Oakland, wind comfort speeds have been calculated for informational purposes. The comfort criteria are that wind speeds do not exceed 11 mph for more than 10% of the time during the year, when calculated for daylight hours, in substantial pedestrian use areas. A lower wind speed threshold of 7 mph may be considered for public seating areas where calmer wind conditions are ideal.

## 3 RESULTS AND DISCUSSION

This section presents the results of the wind tunnel measurements analyzed in terms of equivalent wind speeds as defined by the equation in Section 2.3.

The wind hazard conditions for the Existing and Proposed configurations are graphically depicted on site plans in Figures 1A and 1B located in the “Figures” section of this report. Table 1, located in the “Tables” section, numerically presents these results and lists the predicted wind speed to be exceeded one hour per year at each location. The predicted number of hours per year that the wind hazard criterion (one-minute wind speed of 36 mph) is exceeded is also provided. A letter “e” in the last column of each configuration indicates the wind hazard exceedance.

The wind comfort results for the Existing and Proposed configurations are graphically depicted on site plans in Figures 2A and 2B, where locations have been color-coded according to the criteria of the 7 mph and 11 mph comfort categories explained in the Planning Code Requirements. This data is also numerically presented in Table 1. For all the measurement points, the equivalent wind speeds exceeded 10% of time are listed (please note that wind speeds will be below these values for 90% of the time). Each location is marked as a comfort exceedance if the 11-mph threshold is exceeded. A letter “e” in the last column of each configuration indicates a wind comfort exceedance.

For reference purposes, the wind hazard and comfort results for the Alternate G (2020 FDP) configuration is shown in Figures 1C and 2C with the associated wind speeds listed in Table 2.

The following is a detailed discussion of the suitability of the predicted wind conditions for each area of interest.

### 3.1 Existing Configuration

For the Existing configuration, the 1-hour per year wind hazard criterion is expected to be met for the majority of the locations assessed. An exception is Location 44, located on the east side of the railroad tracks (Figure 1A). For all locations tested, the average wind speed which is exceeded for 1 hour per year is approximately 25 mph (Table 1).

For all the 57 test locations, the average wind speed for 90% of the time is 10 mph (Table 1). Wind speeds at 12 test locations exceed the Planning Code's pedestrian comfort criterion of 11 mph (see Figure 2A). On average, winds exceed the comfort criterion 8% of the time when all test locations are considered.

### 3.2 Proposed Configuration

With the addition of the proposed project, the 1-hour per year wind hazard criterion is expected to be met at all test locations with the exception of the existing location (Location 44) on the east side of the railroad tracks (Figure 1B). For all locations tested, the average wind speed exceeded for 1 hour per year is 24 mph, which is 1 mph lower than the Existing configuration and 2 mph lower than the Alternate G (2020 FDP) configuration (Table 1).

For the 72 test locations, the average wind speed for 90% of the time is 11 mph (Table 1). Wind speeds at 28 test locations exceed the Planning Code's pedestrian comfort criterion of 11 mph (see Figure 2B). On average, winds exceed the comfort criterion 10% of the time when all applicable test locations are considered. There is no negative wind impact of the project on the adjacent pedestrian bridge and all pedestrian areas across the railway tracks, including on the podium of the existing Emory Station West.



Wind speeds on above-grade areas of the proposed project, including on the balconies, pavilion roof and the parking garage, were also measured and they are expected to meet the wind hazard criterion of 36 mph (Locations 58 through 72, in Figure 1B).

### 3.3 Alternate G (2020 FDP) Configuration

For the Alternate G (2020 FDP) configuration, the 1-hour per year wind hazard criterion is expected to be met at all test locations (Figure 1C). For all locations tested, the average wind speed exceeded for 1 hour per year is 26 mph (Table 2).

For the 55 test locations (Sensor 1 is covered by the Alternate G (2020 FDP) massing), the average wind speed for 90% of the time is approximately 11 mph (Table 2). Wind speeds at 25 test locations exceed the Planning Code's pedestrian comfort criterion of 11 mph (see Figure 2C). On average, winds exceed the comfort criterion approximately 12% of the time when all applicable test locations are considered.

### 3.4 Comparison to Previous Tests

As mentioned in the Executive Summary, RWDI has conducted several rounds of wind-tunnel testing for the project dating back to July 2019. Below is a table that summarizes the wind hazard and comfort conditions from select configurations of interest. Additional details and photographs of the configurations are provided in their respective reports previously issued by RWDI. It may be noted that differences between the sensor locations and numbering between the configurations exist and therefore this is not a direct comparison.

SUMMARY	Configurations	WIND HAZARD				WIND COMFORT			
		Average (mph)	Total Hours	Hours Change	Total	Average (mph)	Average (%)	Speed Change (mph)	Total
	Existing	25 mph	1 Hr	-	1 / 57	10 mph	8%	-	12 / 57
	Proposed	24 mph	2 Hrs	1	1 / 72	11 mph	10%	1	28 / 72
	Alternate G (2020 FDP)	26 mph	0 Hrs	-1	0 / 55	11 mph	12%	1	25 / 55
	PDP Stepped Down	29 mph	11 Hrs	10	5 / 43	13 mph	18%	3	26 / 43
	PDP 120' Height	30 mph	15 Hrs	14	8 / 43	13 mph	20%	3	27 / 43

**Notes:**

1) Wind Hazard = Wind speeds exceeding 36 mph for  $\geq 1$  hour/year

2) Wind Comfort = Wind speeds exceeding 11 mph for  $\geq 10\%$  of the time

### 3.5 Wind Control Measures

Wind speeds may be further mitigated by the use of landscaping, wind screens or other techniques at grade and above-grade. Depending on design and placement, these methods may reduce the wind speeds to below the hazard speed. RWDI recommends discussing these options further as the design progresses.

## 4 STATEMENT OF LIMITATIONS

### Limitations

This report entitled Emeryville Public Market (July 14, 2022) was prepared by Rowan Williams Davies & Irwin, Inc. ("RWDI") for HDR ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

### Design Assumptions

RWDI confirms that the pedestrian wind assessment (the "**Assessment**") discussed herein was performed by RWDI in accordance with generally accepted professional standards at the time when the Assessment was performed and in the location of the Project. No other representations, warranties, or guarantees are made with respect to the accuracy or completeness of the information, findings, recommendations, or conclusions contained in this Report. This report is not a legal opinion regarding compliance with applicable laws.

The findings and recommendations set out in this report are based on the following information disclosed to RWDI. Drawings and information listed below were received from HDR and used to construct the scale model of the proposed Emeryville Public Market in Emeryville, CA ("**Project Data**").

File Name	File Type	Date Received (dd/mm/yyyy)
13-013_Parcel B Massing for analysis	SketchUp	30/10/2019
10279661_EPMD_A_2021	Revit	13/06/2022
20220512_Public Market FDP update R6	PDF	14/06/2022

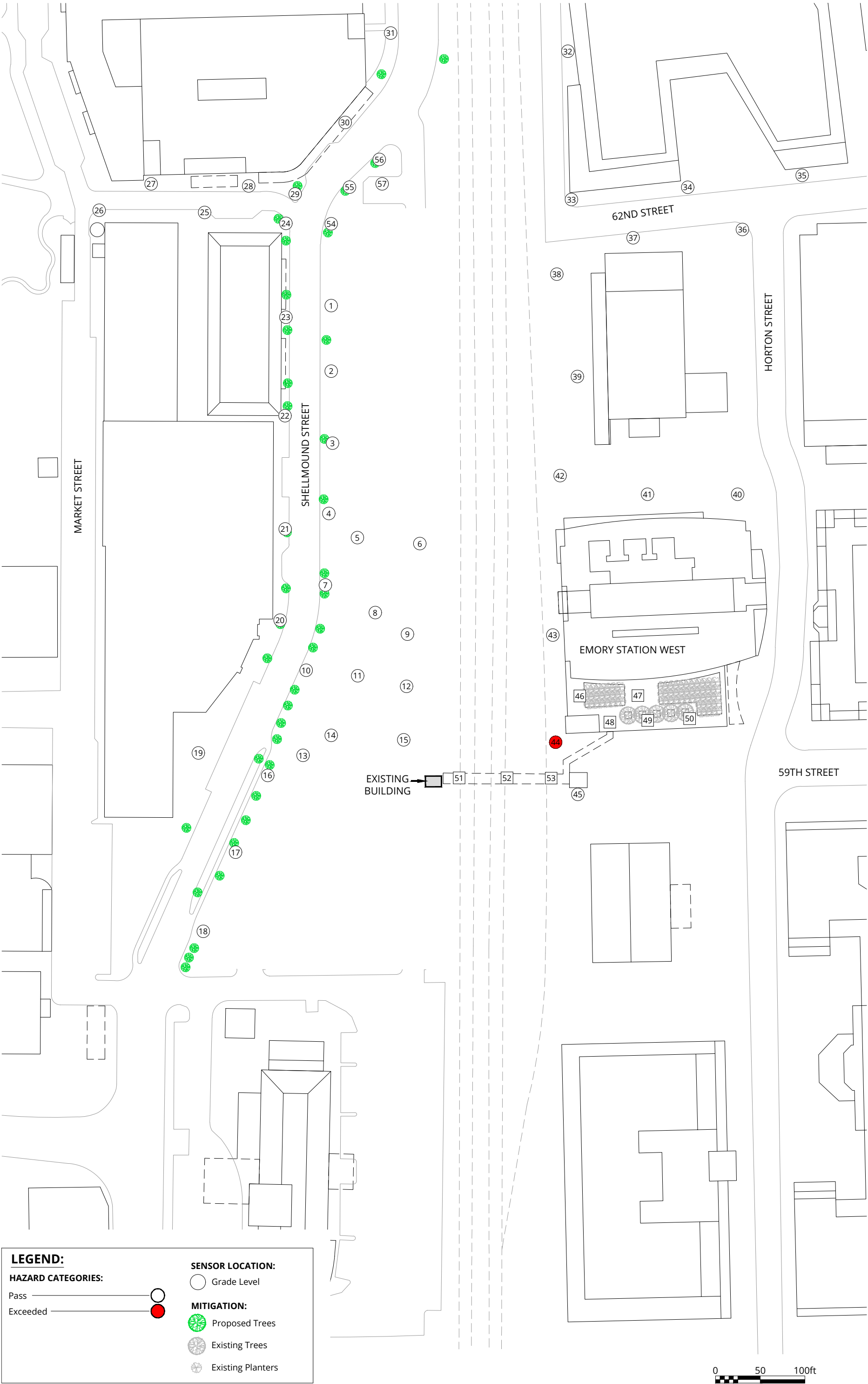
The recommendations and conclusions are based on the assumption that the Project Data and Climate Data are accurate and complete. RWDI assumes no responsibility for any inaccuracy or deficiency in information it has received from others. In addition, the recommendations and conclusions in this report are partially based on historical data and can be affected by a number of external factors, including but not limited to Project design,



quality of materials and construction, site conditions, meteorological events, and climate change. As such, the conclusions and recommendations contained in this report do not list every possible outcome.

The opinions in this report can only be relied up on to the extent that the Project Data and Project Specific Conditions have not changed. Any change in the Project Data or Project Specific Conditions not reflected in this report can impact and/or alter the recommendations and conclusions in this report. Therefore, it is incumbent upon the Client and/or any other third party reviewing the recommendations and conclusions in this report to contact RWDI in the event of any change in the Project Data and Project Specific Conditions in order to determine whether any such change(s) may impact the assumptions upon which the recommendations and conclusions were made.

# FIGURES



**Pedestrian Wind Hazard Conditions**  
Existing Configuration  
Annual (January to December, 0:00 to 23:00)

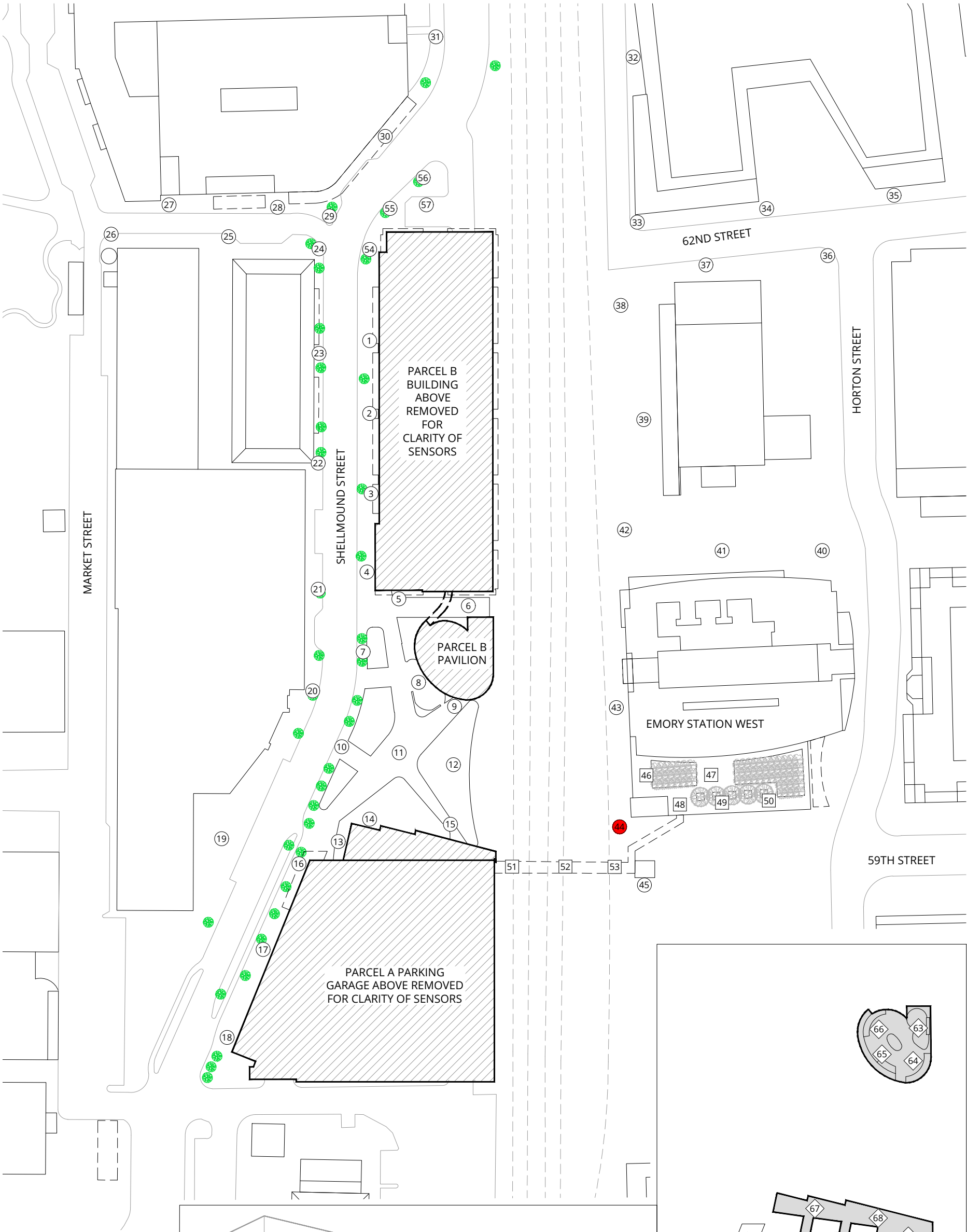
Emeryville Public Market - Emeryville, CA



Drawn by:	JD	Figure: 1A
Approx. Scale:	1"=100'	
Date Revised:	Jul. 12, 2022	



Project #2102642








**LEGEND:**




**COMFORT CATEGORIES:**

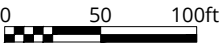
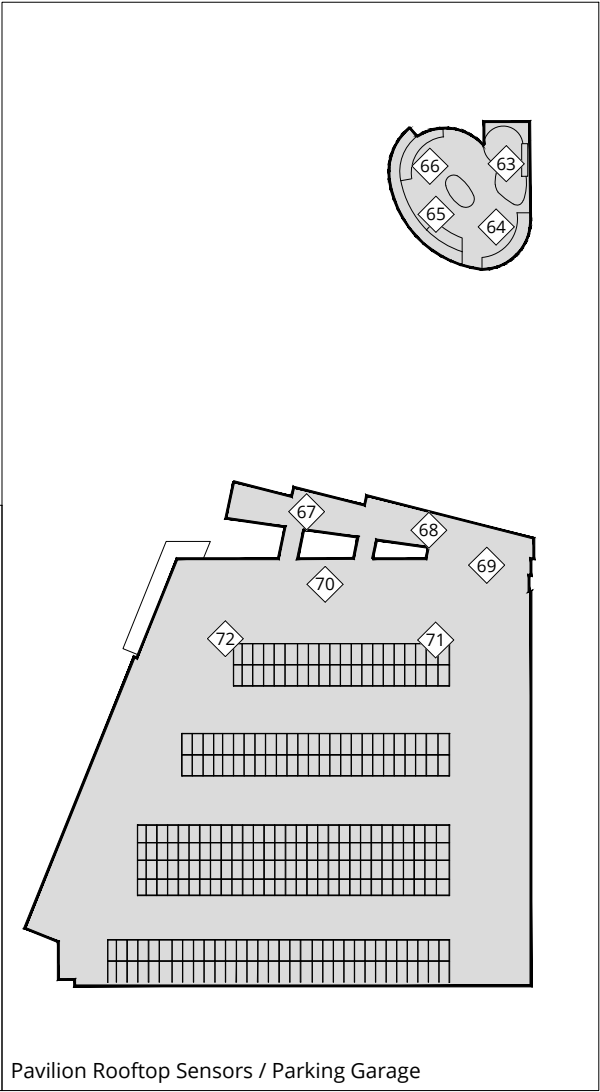
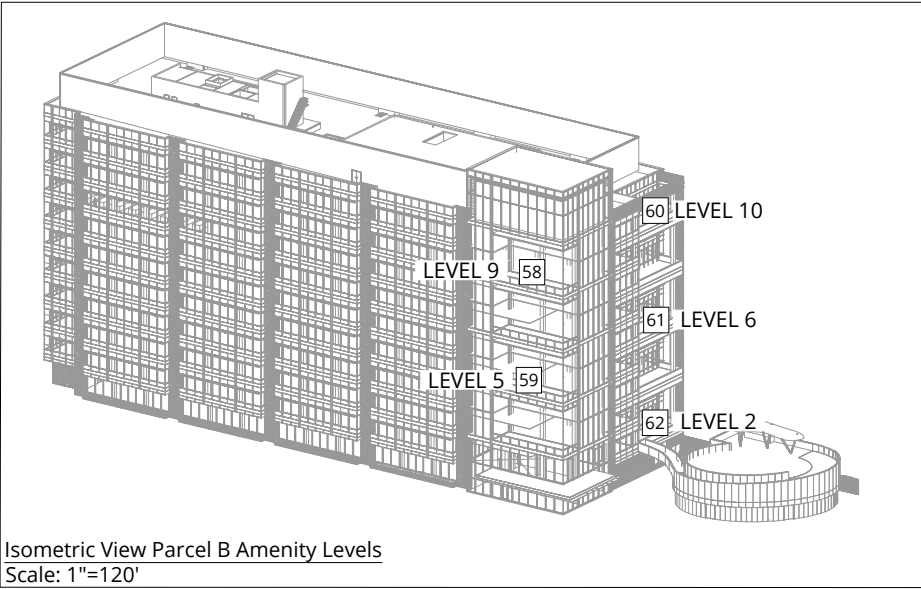
Pass   
Existing 

**SENSOR LOCATION:**

 Grade Level  
 Parking Garage / Public Right of Way / Emory Station West  
 Rooftop Level

**MITIGATION:**

 Proposed Trees  
 Existing Trees  
 Existing Planters



**Pedestrian Wind Comfort Conditions**  
Proposed Configuration  
Annual (January to December, 0:00 to 23:00)

Emeryville Public Market - Emeryville, CA



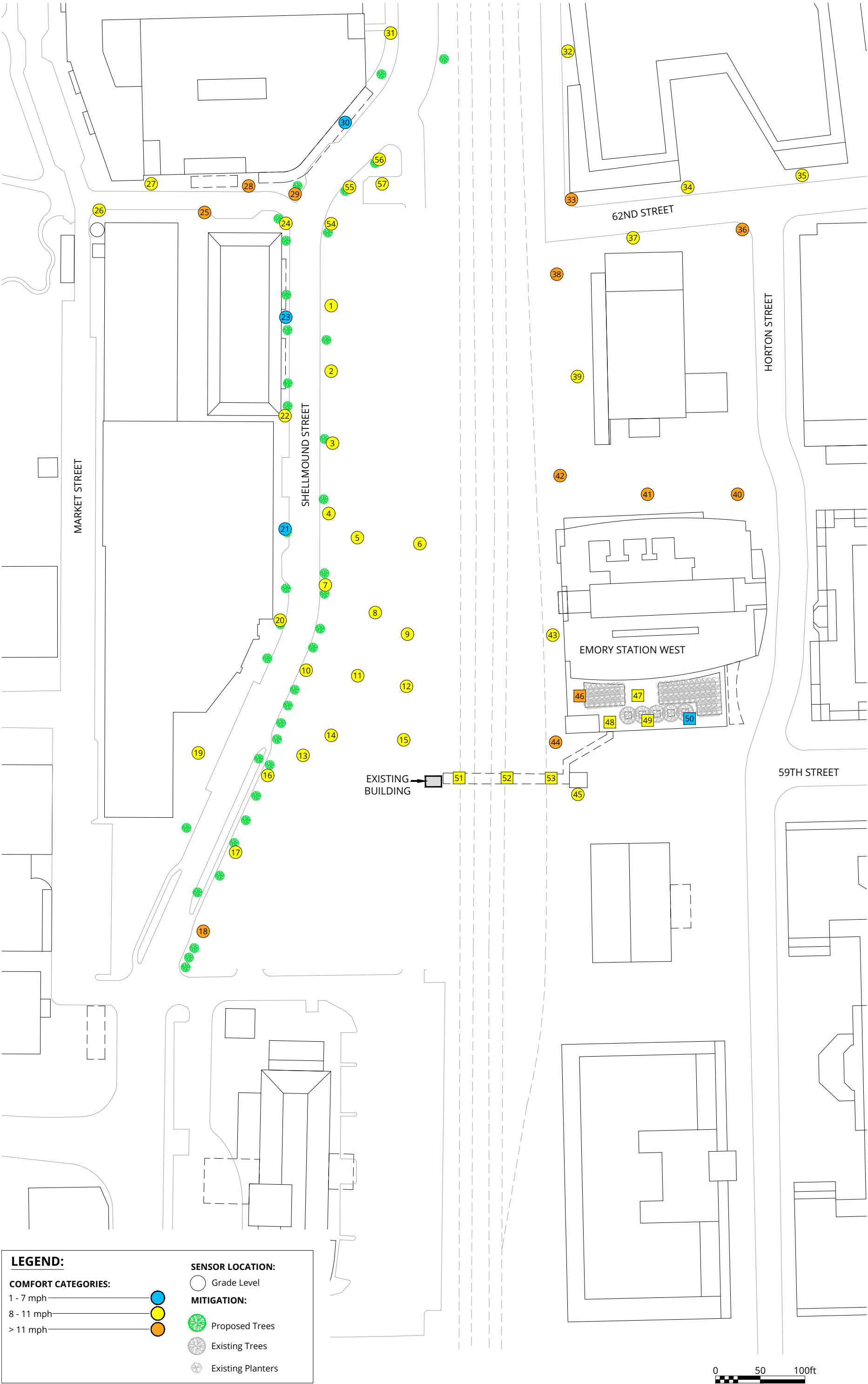
Project #2102642

Drawn by:	JD	Figure: 1B
Approx. Scale:	1"=100'	
Date Revised:	Jul. 12, 2022	









**Pedestrian Wind Comfort Conditions**  
Existing Configuration  
Annual (January to December, 0:00 to 23:00)

Emeryville Public Market - Emeryville, CA

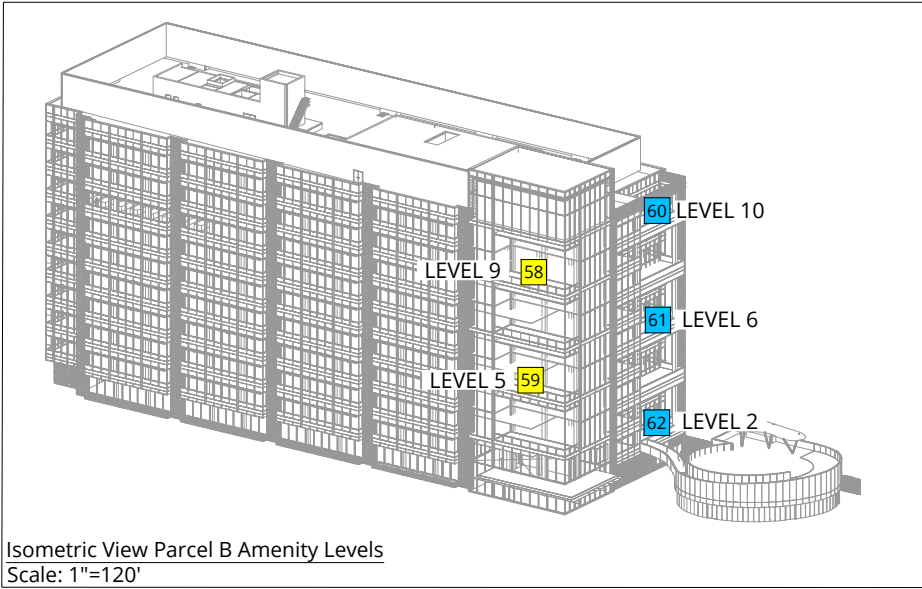
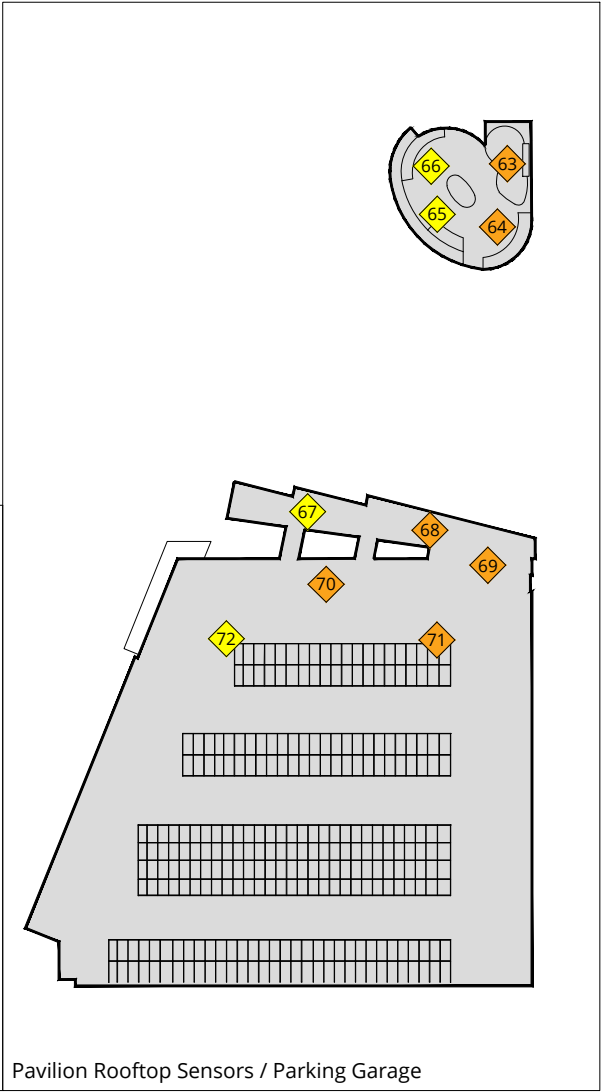
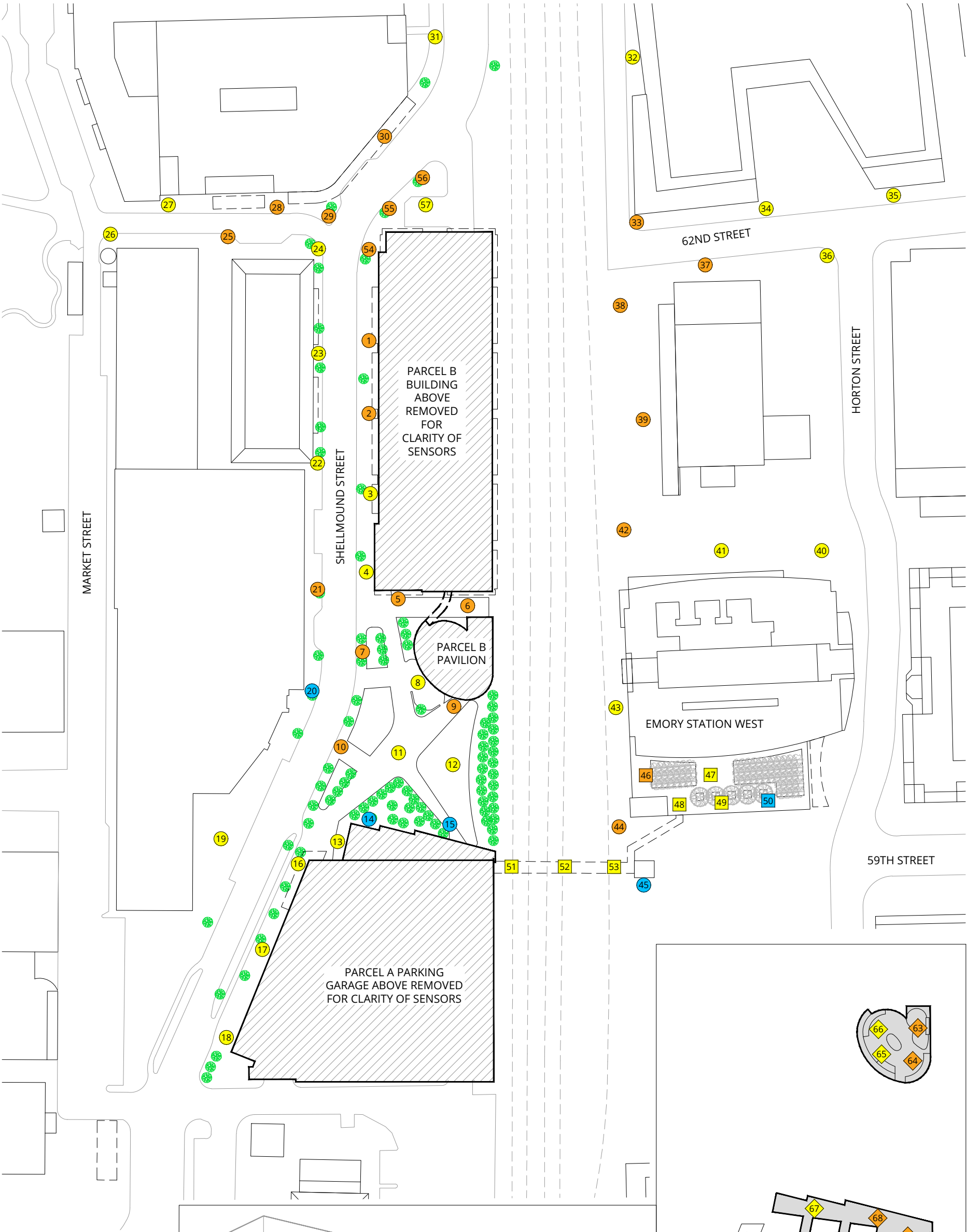


Drawn by: JD Figure: 2A  
Approx. Scale: 1"=100'  
Date Revised: Jul. 12, 2022

Project #2102642







**LEGEND:**

**COMFORT CATEGORIES:**

1 - 7 mph

8 - 11 mph

> 11 mph

Grade Level

Parking Garage / Public Right of Way / Emory Station West

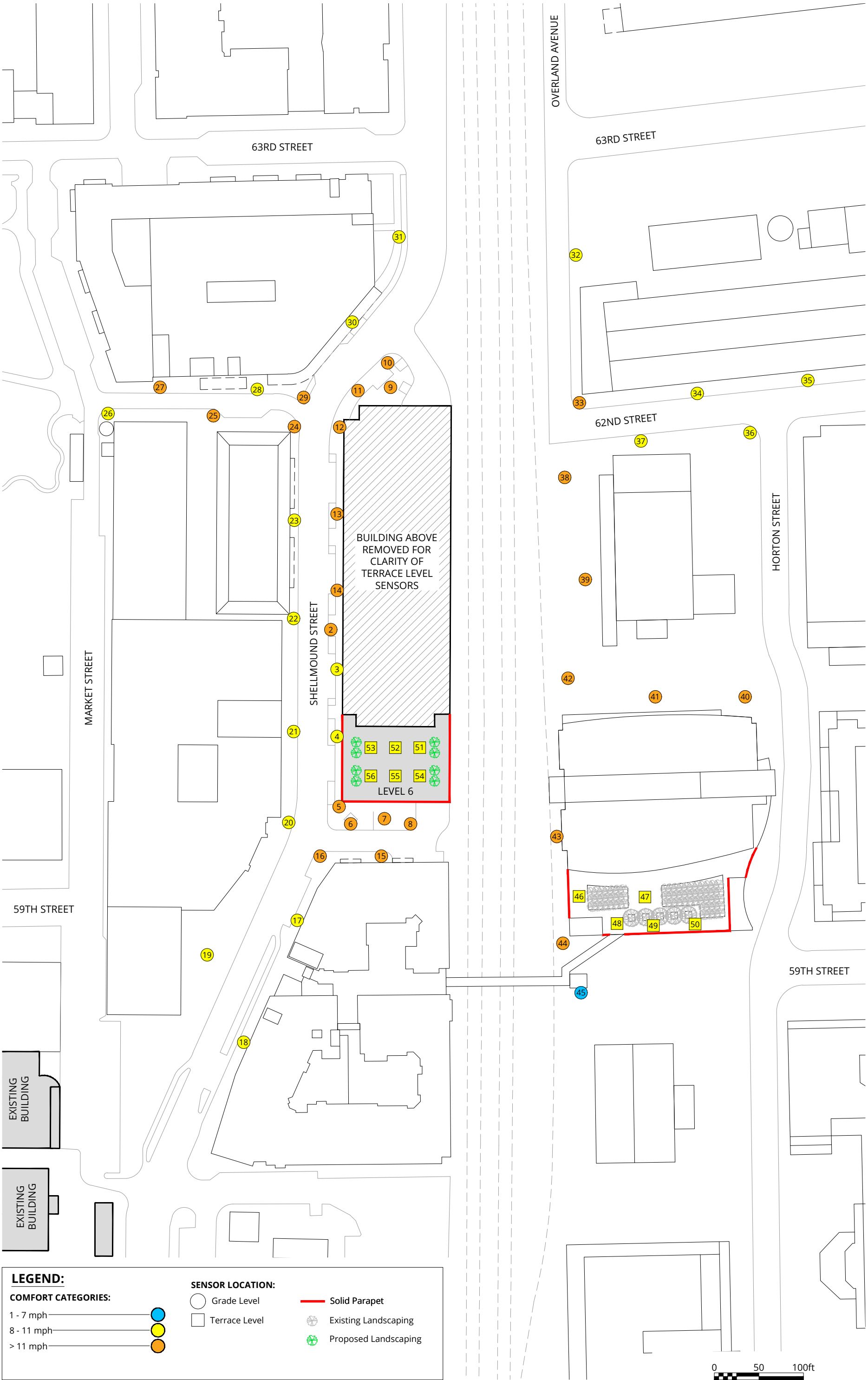
Rooftop Level

**MITIGATION:**

Proposed Trees

Existing Trees

Existing Planters



**Pedestrian Wind Comfort Conditions**  
Alternate G (2020 FDP)  
Annual

Emeryville Public Market - Parcel B - Emeryville, CA



Drawn by: GRE | Figure: 2C  
Approx. Scale: 1"=100'  
Date Revised: Dec. 3, 2019



Project #1902969

# TABLES

**Table 1: Pedestrian Wind Hazard and Comfort Conditions**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
1	Existing Proposed	24	0	-		10	5	-	
		25	0	0		12	13	2	e
2	Existing Proposed	25	0	-		8	3	-	
		25	0	0		12	13	4	e
3	Existing Proposed	27	0	-		9	4	-	
		24	0	0		11	10	2	
4	Existing Proposed	23	0	-		10	6	-	
		19	0	0		9	3	-1	
5	Existing Proposed	23	0	-		10	6	-	
		28	0	0		12	15	2	e
6	Existing Proposed	29	0	-		11	10	-	
		28	0	0		13	19	2	e
7	Existing Proposed	22	0	-		9	5	-	
		32	0	0		15	27	6	e
8	Existing Proposed	26	0	-		9	4	-	
		24	0	0		11	10	2	
9	Existing Proposed	27	0	-		10	5	-	
		27	0	0		12	15	2	e
10	Existing Proposed	24	0	-		9	4	-	
		26	0	0		12	15	3	e
11	Existing Proposed	25	0	-		9	4	-	
		21	0	0		10	4	1	
12	Existing Proposed	26	0	-		10	6	-	
		21	0	0		9	4	-1	
13	Existing Proposed	22	0	-		9	3	-	
		21	0	0		10	6	1	
14	Existing Proposed	24	0	-		9	3	-	
		16	0	0		7	0	-2	
15	Existing Proposed	23	0	-		10	5	-	
		17	0	0		6	1	-4	
16	Existing Proposed	22	0	-		9	4	-	
		20	0	0		10	5	1	
17	Existing Proposed	24	0	-		11	10	-	
		19	0	0		9	3	-2	

**Table 1: Pedestrian Wind Hazard and Comfort Conditions**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
18	Existing Proposed	27	0	-		13	17	-	e
		22	0	0		10	5	-3	
19	Existing Proposed	19	0	-		8	2	-	
		22	0	0		10	8	2	
20	Existing Proposed	18	0	-		8	1	-	
		15	0	0		6	0	-2	
21	Existing Proposed	22	0	-		7	1	-	
		24	0	0		12	13	5	e
22	Existing Proposed	25	0	-		9	3	-	
		24	0	0		11	10	2	
23	Existing Proposed	18	0	-		7	1	-	
		22	0	0		10	5	3	
24	Existing Proposed	23	0	-		9	5	-	
		25	0	0		11	10	2	
25	Existing Proposed	27	0	-		11	10	-	
		27	0	0		11	10	0	
26	Existing Proposed	23	0	-		9	4	-	
		22	0	0		9	4	0	
27	Existing Proposed	26	0	-		12	14	-	e
		25	0	0		12	15	0	e
28	Existing Proposed	30	0	-		12	15	-	e
		27	0	0		12	13	0	e
29	Existing Proposed	28	0	-		12	12	-	e
		29	0	0		12	16	0	e
30	Existing Proposed	22	0	-		6	2	-	
		29	0	0		13	18	7	e
31	Existing Proposed	25	0	-		8	3	-	
		25	0	0		11	10	3	
32	Existing Proposed	21	0	-		9	4	-	
		18	0	0		8	2	-1	
33	Existing Proposed	26	0	-		12	17	-	e
		32	0	0		15	25	3	e
34	Existing Proposed	32	0	-		10	5	-	
		21	0	0		8	2	-2	

**Table 1: Pedestrian Wind Hazard and Comfort Conditions**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
35	Existing Proposed	31	0	-		10	6	-	
		21	0	0		8	2	-2	
36	Existing Proposed	28	0	-		12	14	-	e
		25	0	0		10	7	-2	
37	Existing Proposed	24	0	-		10	8	-	
		32	0	0		14	19	4	e
38	Existing Proposed	27	0	-		12	14	-	e
		34	0	0		15	27	3	e
39	Existing Proposed	24	0	-		11	10	-	
		30	0	0		14	24	3	e
40	Existing Proposed	31	0	-		15	28	-	e
		27	0	0		10	7	-5	
41	Existing Proposed	33	0	-		15	22	-	e
		19	0	0		8	1	-7	
42	Existing Proposed	35	0	-		16	32	-	e
		34	0	0		16	32	0	e
43	Existing Proposed	25	0	-		10	5	-	
		20	0	0		8	2	-2	
44	Existing Proposed	37	1	-	e	17	36	-	e
		38	2	1	e	17	32	0	e
45	Existing Proposed	26	0	-		11	10	-	
		20	0	0		7	1	-4	
46	Existing Proposed	31	0	-		15	28	-	e
		31	0	0		14	23	-1	e
47	Existing Proposed	21	0	-		8	1	-	
		19	0	0		8	1	0	
48	Existing Proposed	21	0	-		10	5	-	
		19	0	0		9	2	-1	
49	Existing Proposed	23	0	-		10	5	-	
		21	0	0		9	4	-1	
50	Existing Proposed	18	0	-		7	1	-	
		18	0	0		7	1	0	
51	Existing Proposed	22	0	-		9	3	-	
		21	0	0		10	6	1	

**Table 1: Pedestrian Wind Hazard and Comfort Conditions**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
52	Existing Proposed	22	0	-		10	6	-	
		20	0	0		10	4	0	
53	Existing Proposed	21	0	-		10	5	-	
		17	0	0		8	1	-2	
54	Existing Proposed	25	0	-		11	10	-	
		28	0	0		13	16	2	e
55	Existing Proposed	23	0	-		9	4	-	
		30	0	0		14	23	5	e
56	Existing Proposed	24	0	-		8	3	-	
		30	0	0		14	23	6	e
57	Existing Proposed	23	0	-		8	2	-	
		24	0	0		10	5	2	
58	Existing Proposed	-	-	-		-	-	-	
		20	0	0		10	5	7	
59	Existing Proposed	-	-	-		-	-	-	
		22	0	0		10	4	7	
60	Existing Proposed	-	-	-		-	-	-	
		29	0	0		7	3	4	
61	Existing Proposed	-	-	-		-	-	-	
		19	0	0		5	0	2	
62	Existing Proposed	-	-	-		-	-	-	
		18	0	0		6	1	3	
63	Existing Proposed	-	-	-		-	-	-	
		28	0	0		13	18	10	e
64	Existing Proposed	-	-	-		-	-	-	
		26	0	0		12	15	9	e
65	Existing Proposed	-	-	-		-	-	-	
		19	0	0		8	2	5	
66	Existing Proposed	-	-	-		-	-	-	
		17	0	0		8	1	5	
67	Existing Proposed	-	-	-		-	-	-	
		21	0	0		9	4	6	
68	Existing Proposed	-	-	-		-	-	-	
		27	0	0		12	14	9	e

**Table 1: Pedestrian Wind Hazard and Comfort Conditions**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
69	Existing	-	-	-		-	-	-	
	Proposed	28	0	0		13	17	10	e
70	Existing	-	-	-		-	-	-	
	Proposed	30	0	0		13	17	10	e
71	Existing	-	-	-		-	-	-	
	Proposed	25	0	0		12	14	9	e
72	Existing	-	-	-		-	-	-	
	Proposed	22	0	0		10	7	7	

SUMMARY	Configurations	WIND HAZARD				WIND COMFORT			
		Average (mph)	Total Hours	Hours Change	Total	Average (mph)	Average (%)	Speed Change (mph)	Total
	Existing	25 mph	1 Hr	-	1 / 57	10 mph	8%	-	12 / 57
	Proposed	24 mph	2 Hrs	1	1 / 72	11 mph	10%	1	28 / 72

**Notes:**

- 1) Wind Hazard = Wind speeds exceeding 36 mph for  $\geq 1$  hour/year  
 2) Wind Comfort = Wind speeds exceeding 11 mph for  $\geq 10\%$  of the time





**Table 2: Pedestrian Wind Hazard and Comfort Conditions - Alternate G (2020 FDP)**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
1	Alternate G (2020 FDP)	-	-	-		-	-	-	
2	Alternate G (2020 FDP)	29	0	-		12	13	-	e
3	Alternate G (2020 FDP)	21	0	-		9	4	-	
4	Alternate G (2020 FDP)	22	0	-		10	7	-	
5	Alternate G (2020 FDP)	26	0	-		12	13	-	e
6	Alternate G (2020 FDP)	32	0	-		15	28	-	e
7	Alternate G (2020 FDP)	31	0	-		15	27	-	e
8	Alternate G (2020 FDP)	30	0	-		14	25	-	e
9	Alternate G (2020 FDP)	29	0	-		12	13	-	e
10	Alternate G (2020 FDP)	26	0	-		12	12	-	e
11	Alternate G (2020 FDP)	30	0	-		13	18	-	e
12	Alternate G (2020 FDP)	31	0	-		13	22	-	e
13	Alternate G (2020 FDP)	33	0	-		15	28	-	e
14	Alternate G (2020 FDP)	34	0	-		15	24	-	e
15	Alternate G (2020 FDP)	27	0	-		12	14	-	e
16	Alternate G (2020 FDP)	31	0	-		15	27	-	e
17	Alternate G (2020 FDP)	20	0	-		9	4	-	
18	Alternate G (2020 FDP)	22	0	-		10	7	-	
19	Alternate G (2020 FDP)	24	0	-		11	10	-	
20	Alternate G (2020 FDP)	26	0	-		11	10	-	
21	Alternate G (2020 FDP)	19	0	-		9	2	-	
22	Alternate G (2020 FDP)	30	0	-		11	10	-	
23	Alternate G (2020 FDP)	24	0	-		10	5	-	
24	Alternate G (2020 FDP)	30	0	-		12	11	-	e
25	Alternate G (2020 FDP)	33	0	-		14	22	-	e

**Table 2: Pedestrian Wind Hazard and Comfort Conditions - Alternate G (2020 FDP)**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
26	Alternate G (2020 FDP)	25	0	-		10	6	-	
27	Alternate G (2020 FDP)	30	0	-		13	15	-	e
28	Alternate G (2020 FDP)	24	0	-		10	7	-	
29	Alternate G (2020 FDP)	32	0	-		13	19	-	e
30	Alternate G (2020 FDP)	25	0	-		11	10	-	
31	Alternate G (2020 FDP)	24	0	-		10	7	-	
32	Alternate G (2020 FDP)	23	0	-		9	3	-	
33	Alternate G (2020 FDP)	26	0	-		12	13	-	e
34	Alternate G (2020 FDP)	20	0	-		8	1	-	
35	Alternate G (2020 FDP)	23	0	-		10	7	-	
36	Alternate G (2020 FDP)	27	0	-		11	10	-	
37	Alternate G (2020 FDP)	25	0	-		10	8	-	
38	Alternate G (2020 FDP)	29	0	-		13	14	-	e
39	Alternate G (2020 FDP)	27	0	-		12	14	-	e
40	Alternate G (2020 FDP)	29	0	-		13	19	-	e
41	Alternate G (2020 FDP)	27	0	-		13	15	-	e
42	Alternate G (2020 FDP)	34	0	-		15	32	-	e
43	Alternate G (2020 FDP)	29	0	-		13	18	-	e
44	Alternate G (2020 FDP)	35	0	-		16	32	-	e
45	Alternate G (2020 FDP)	19	0	-		7	1	-	
46	Alternate G (2020 FDP)	24	0	-		11	10	-	
47	Alternate G (2020 FDP)	23	0	-		9	5	-	
48	Alternate G (2020 FDP)	19	0	-		9	3	-	
49	Alternate G (2020 FDP)	22	0	-		9	3	-	
50	Alternate G (2020 FDP)	17	0	-		8	1	-	

**Table 2: Pedestrian Wind Hazard and Comfort Conditions - Alternate G (2020 FDP)**

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
51	Alternate G (2020 FDP)	27	0	-		9	5	-	
52	Alternate G (2020 FDP)	25	0	-		10	8	-	
53	Alternate G (2020 FDP)	23	0	-		10	8	-	
54	Alternate G (2020 FDP)	23	0	-		11	10	-	
55	Alternate G (2020 FDP)	22	0	-		11	10	-	
56	Alternate G (2020 FDP)	18	0	-		8	2	-	

SUMMARY	Configuration	WIND HAZARD				WIND COMFORT			
		Average (mph)	Total Hours	Hours Change	Total	Average (mph)	Average (%)	Speed Change (mph)	Total
	Alternate G (2020 FDP)	26 mph	0 Hrs	-	0 / 55	11 mph	12%	-	25 / 55

**Notes:**

- 1) Wind Hazard = Wind speeds exceeding 36 mph for  $\geq 1$  hour/year  
 2) Wind Comfort = Wind speeds exceeding 11 mph for  $\geq 10\%$  of the time