2 Adequacy of the Wind Study and Evaluation of Turbulence

2.1 Baseline Wind Data

The Master Response describes the use of baseline wind data from the San Francisco Airport sensor as sufficient for establishing "free-stream" wind condition. A similar method of establishing baseline wind data is used in the DEIR. The Master Response continues by saying that a particular local sensor cannot be used for wind tunnel analysis purposes because it does not meet requirements for measuring "free-stream" wind conditions.

These Comments make extensive use of the CPSRA Sensor data as the single most accurate and reliable representative of realistic sailing conditions over millions of square feet of water area at the CPSRA. It is not the intent of these Comments to suggest that the wind tunnel analysis conducted for the DEIR should have used the CPSRA Sensor as the "free-stream" representative sensor.

This CPSRA Sensor is used herein separately from the wind tunnel analysis to consider how direct impacts to changes in wind speeds and turbulence would impact Sailable Days based on actual historic data. The use of this CPSRA Sensor is intended to point out that while the wind tunnel analysis is one method of considering impacts to the Resource, it is not the only way, and because of the numerous simplifying assumptions and complexity of the modeled system that far exceeds that of the 300 Airport Boulevard project, the wind tunnel analysis does not even seem to be an appropriate method for the Analysis.

According to the Master Response, the wind tunnel analysis was conducted for a much smaller project at 300 Airport Boulevard. The current Project is hundreds of acres in scope and the Analysis attempts to model an incredibly varied, dynamic, and complex terrain and wind system. To consider the wind tunnel analysis for the Project as the only source for determining that the Project would have no significant impact is short-sighted and overly aggressive in light of the very simple and very clear demonstration of the sensitivity of this Resource to even small changes in wind speed or turbulence over substantial portions of the Resource through the use of the CPSRA Sensor data.

Lastly, as pointed out elsewhere in these Comments, good engineering practice requires that such a model be validated against the very real-world conditions it is attempting to model. To our knowledge based on discussion with ESA, there was explicitly no attempt to take on-the-ground measurements to validate their wind tunnel model.

2.2 Applicability of Wind Study Results to Range of Wind Speeds

The Master Response reiterates the appropriateness of use of relative wind speed analysis as sufficient for considering the impact on windsurfing sailing. A similar claim is made in the DEIR. Realistically, windsurfing is highly dependent on actual wind speeds such that sailability is not linearly affected by relative changes in the wind speed.

Much like aircraft have specific critical takeoff, stall, and landing speeds, windsurfing has critical planing board speeds required very specific minimums of wind speed. Below these minimum planing speeds, performance is not linearly diminished, but relegated to a completely separate behavior known as non-planing sailing. The Required Conditions specified herein describe the minimum set of conditions required to maintain planing conditions.

Another way to view this is to consider that although the America's Cup boats would operate in some fashion below the minimum race wind speed and tidal conditions, their operation would be severely impacted and no longer indicative of the true capabilities for which the boats are primarily designed.

By failing to specify absolute wind speeds in the Analysis, there is no way to determine if the changes would result in board speed decreases that would fall below this minimum planing speed requirement. However, when applying the same relative wind speed reductions to the CPSRA Sensor historic data set, it is shown

that such decreases would in absolute terms yield very substantial decreases in ability to sail in this planing state.

Furthermore, the wind tunnel analysis conducted for the DEIR does not employ wind speeds in the range actually experienced on the ground at CPSRA. This is yet one more simplifying assumption in a dynamic system that is already incredibly complex and difficult to model accurately.

2.3 Measurements of Wind Direction and Turbulence

The Master Response dismisses the increase in wind turbulence intensity projected to occur much in the same fashion as the DEIR. However just a few paragraphs above, the Master Response states that there is a "lack of an established standard for ascribing changes in turbulence to an effect on wind-related recreational activities make it a less appropriate and effective method for determining the significance of wind impacts." If there is no standard for measuring the impact on the increase in turbulence, then the increase they admit occurs should not be dismissed out of hand.

These Comments show through the use of a simple and empirically validated model that has been peer-reviewed in the meteorological scientific community that turbulence intensity is connected to extreme wind values in a fashion than can be readily considered (cf. [9], [18], [24], [26], [34], [19], and [30]). These changes in extreme values (both gusts as well as lulls) can be evaluated against threshold required conditions for sailability as is done herein. Even a "relatively" small increase in turbulence (say from 0.10 to 0.11) would likely increase the range of lull-to-mean wind speeds by a comparable relative amount (0.10 to 0.11 is 0.01 absolute increase or a 10% relative increase).

2.4 Gusts or Gustiness

Gust used in these comments refers to the specific meteorological term defined as the maximum mean wind speed over a specified short-term duration within a longer-term observation. Lull is the minimum mean wind speed over a specified short-term duration within a longer-term observation. Gust or lull is not being used within these Comments interchangeably with turbulence. Turbulence (or turbulence intensity) used herein refers to a statistic of a series of mean wind speeds over a specified longer-term period. While gust and lull refer to extreme values within an observation period, turbulence refers to the distribution of values over a series of observations.

The Master Response states that "Gusts and longer-term changes in wind speed are not generated by wind passing by objects on the ground, and thus are independent of the 300 Airport Boulevard Project and need not be discussed in the Draft EIR." Much scientific study has revealed a strong connection between wind turbulence intensity and gusts and lull. The Master Response and the DEIR both admit that the respective projects will increase turbulence intensity. This in term will increase the range of gusts and lulls based on all scientific models reviewed ([9], [18], [24], [26], [34], [19], and [30]). In the model used in these Comments and described in Appendix H of these Comments, turbulence intensity is shown to be linearly proportional with the range between mean wind speed and gust wind speed and mean wind speed and lull wind speed.

Importantly, critical parameters of the Required Conditions are minimum gust and lull. It is insufficient to describe sailable conditions simply by the mean wind speed. If the lull wind speed is too low or too frequent, sail force and board speed will be insufficient to maintain critical planing speed on a regular basis. Much additional energy is required to propel the board to the planing state. Once planing, the mean wind speed may be sufficient to maintain sufficient sail force to keep the board in planing conditions. This is why the minimum gust is essential to provide enough impulse to begin planing or maintain sufficient momentum.

Increasing turbulence increases the range of extreme values (lulls and gusts relative to the mean wind speed). The importance of lull and gust wind speed to windsurfing is just as important as mean wind speed. To dismiss either or both of these facts demonstrates a fundamental misunderstanding of the Resource being analyzed.