Sunrise Powerlink Transmission Line Project
Application No. 06-08-010
MGRA Phase 2 Direct Testimony, Appendix 2G

APPENDIX 2G – SPL AND WINDS

2G-1. Data Sources

2G-1.1. *Mesowest Weather Data*

Distribution: Open

Location: http://www.met.utah.edu/mesowest/

Description: Data for RAWS and other weather stations in a database searchable by web interface. Hourly data can be obtained for any date extending back to the time that collection started for a particular station. This data is displayed in graphical (and optionally tabular) form for windows extending from 12 hours up to 30 days.

Fields: Temperature, relative humidity, wind speed (sustained & gust), wind direction, precipitation

Restrictions & Limitations: Data for SD County RAWS stations goes back to 1999, with many coming on-line between 1999 and 2001. Non-RAWS stations sometimes lack wind gust data. Data quality is considered marginal for older data. Anomalous functioning can often be identified by “wild swings” in measurements for one parameter or another, or by missing blocks of data.

Processing: RAWS data was downloaded for a window surrounding key wind events with a width of at least 12 hours.

2G-1.2. ***Raws Weather Data***

Distribution: Western Regional Climate Institute

Location: http://www.raws.dri.edu/wraws/scaF.html

Description: DRI offers downloads of the most recent 30 days of weather station data from any specified weather station free of charge. It also offers historical data for a fee.

Fields: Temperature, relative humidity, wind speed (sustained & gust), wind direction, precipitation

Restrictions & Limitations: Data for SD County RAWS stations goes back to 1999, with many coming on-line between 1999 and 2001. Non-RAWS stations sometimes lack wind gust data. Data quality is considered marginal for older data. Anomalous functioning can often be identified by "wild swings" in measurements for one parameter or another, or by missing blocks of data.

Processing: Data for specified weather stations was downloaded in the aftermath of the 2007 fires in Excel spreadsheet format.

2G-1.3. ***SDG&E Wind Analysis***

Distribution: Provided by SDG&E in response to MGRA data request numbers MGRA-47 to MGRA-50, found in the March 3, 2008 response to MGRA Data Request #6.[1]

Location: http://www.sdge.com/sunrisepowerlink/info/

The following tabular information was extracted from the SDG&E response. It contains maximum wind speed data for a number of weather stations in San Diego and other representative stations.

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[1] Sunrise Powerlink Project; SDG&E's 3/3/08 Responses to MGRA Data Request No. 6

WindHistory.xls

File 2G-1 – This file, extracted from tabular data in SDG&E's response to MGRA-47, contains the maximum annual wind speed at a number of weather stations in San Diego County and elsewhere.

The data request also contains the map attached below:

SDGE_MGRA49_map
.pdf

File 2G-2 – SDG&E map indicating the wind gust speeds that are determining the design criteria along the proposed SPL route.

Description: The attached map and the analysis contained in the March 3, 2008 response to MGRA's Data Request #6 describe SDG&E's method for determining wind design parameters necessary to meet CPUC General Order 95 requirements.

Fields: Weather Station, maximum wind speed.

Limitations: Several weather stations used tend to be coastal and will not adequately represent inland conditions.

2G-1.4. *National Digital Forecast Database Archives*

Distribution: Open

Location: Archived at the National Climate Data Center: http://has.ncdc.noaa.gov

Description: Archived forecast data for the National Digital Forecast Database(NDFD) consist of all forecast information from the National Weather Service in a grid format. These are the raw data used by weather offices to make their forecasts, and only over the last few months (from mid 2006) have these become available for Southern California. The grid forecast made at a given time projects outward for a certain period into the future, and each future projection constitutes its own grid. The data product is described in this reference2.

Fields: Data for temperature, humidity, precipitation, wind speed and direction, and several other quantities are available separately. All available fields are described here: http://www.weather.gov/ndfd/technical.htm .

Restrictions and Limitations: Datasets are large, and take some time to download.

For this reason, only wind data have been analyzed for the economic impact analysis. Data have only become available since mid-2006, meaning that only recent Santa Ana events can be analyzed. Grids are also coarse (5 km), meaning that local weather conditions may not be well-represented.

Processing: Datasets must be selected in order to be downloaded from NCDC. Once downloaded, they need to be processed with the tkdegrib program to create shapefiles that can be used by GIS systems. This is available here: http://www.weather.gov/mdl/NDFD_GRIB2Decoder/index.php

2G-2. Analyses

2G-2.1. *Santa Ana Weather Patterns and SPL Wind Loading*

2G-2.1.1. Goal

To analyze the approach taken by SDG&E with regard to its calculation of wind loading for the SPL and to compare this with other weather data.

2G-2.1.2. Description

The very detailed response by SDG&E to MGRA Data Request #6 allows us to perform an analysis of their approach and compare it to alternative data sets and interpretations. Specifically, we will show that the wind loading calculations utilized by SDG&E appear to be optimized for prevailing winds rather than Santa Ana conditions, using information in the response, topological data, and academic sources. We also use National Digital Forecast Database archive data and wind data for several Santa Ana events to demonstrate that the SDG&E application of weather station data to the SPL route is not appropriate for Santa Ana conditions. Finally, we examine the SDG&E data and analysis used for determining wind gust loading for internal consistency.

2G-2.1.3. Methods

We start with a review of Santa Ana wind conditions and compare these to the methods applied during the determination of SPL wind loading. We examine the proposed maximum gust speeds for the route, and examine the topography of the route compared with the expected wind direction during Santa Ana events. We then discuss the choice of weather station that is applied as the “standard” for various segments of the route.

Mesowest data are analyzed for six Santa Ana events between 2006 and 2007, and the maximum wind gust speeds are presented for a number of these stations. Ten-day windows were examined for each station, and the maximum wind gust speed and the number of hours that gusts exceeded 40 mph are recorded.

The internal consistency of the SDG&E data is then analyzed by comparing the map provided by SDG&E which describes the design wind gust loads to the result that is obtained by applying the analysis method described by SDG&E to the data provided by SDG&E.

Additionally, we show wind model from the National Digital Forecast Database that displays the October 2007 Santa Ana event, and show how it supports our assertion that the gust speeds being used as design criteria are not conservative enough along the western portion of the proposed SPL route.

Finally, we analyze probability of exceeding the design limits for the 50, 100, 200 and 300 year return times analyzed by SDG&E.

2G-2.1.4. Analysis

SDG&E has performed an analysis of wind conditions along the proposed SPL route that allows them to set design constraints for the anticipated wind load. Their expectation as to where extreme winds was as follows[2]:
"Our expectation was that high wind climatology across the project area will vary with the following factors.

> (a) High wind climatology will vary with climate zone (coastal, inland, mountain, and desert zones) and the local weather phenomena (for example, thunderstorms, airflow acceleration around and over large-scale mountain barriers) that occur within each of those zones.
>
> (b) High wind climatology will vary with airflow patterns caused by small-scale local topographic features. Local topographic features can shelter a site from, or expose a site to, high winds associated with a large scale weather disturbance. Local topography in the form of a narrow valley at a mountain ridge or pass can also create local extreme winds via funneling of large scale airflow.
>
> (c) High wind climatology will vary somewhat with elevation above mean sea level."

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[2] Sunrise Powerlink Project; SDG&E's 3/3/08 Responses to MGRA Data Request No. 6; MGRA-49.

Note that Santa Ana wind conditions are not explicitly called out.

On p. 156 of its Phase 1 Reply Brief[3], SDG&E states that “Wind speeds being enhanced by funneling of airflow through mountain passes and along deep valleys were also considered.” When questioned about the details of this in question MGRA-50 of MGRA Data Request #6, it responded[4]:

“The behavior of airflow through mountain ranges was reviewed via descriptions in the technical literature. Relevant characteristics of mountain phenomena include the following.
Winds can be strong and gusty near the mouths of canyons oriented parallel to the direction of airflow.
Funneling of airflow through mountain passes and along deeper valleys can cause unusually high wind speeds.
Topographic features indicative of high wind energy include: *long, sloping valleys parallel to prevailing winds*, high elevation plateaus in areas of strong geostrophic winds, *valleys with persistent down slope winds associated with strong pressure gradients*, and exposed ridge crests and mountain summits in areas of strong geostrophic winds….” (Emphasis added).

Santa Ana wind events occur when there is a high pressure system over the Great Basin and a trough of low pressure over the Gulf of California or off of its coast. Anti-cyclonic winds flowing from the former to the latter pass over Southern California from a northeasterly direction[5,6,7]. As the winds pass over the coastal ranges of Southern California, they become “foehn” winds, a process that occurs as winds passing over to the lee side of mountains are accelerated as they move downslope. As the winds descend and expand they are heated adiabatically, and their relative humidity drops. These winds interact in complex ways with the topography, generally being diverted by obstructions such as mountains, and being channeled and accelerated through valleys[8]. As they

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[3] San Diego Gas and Electric Company; PHASE 1 REPLY BRIEF OF SAN DIEGO GAS & ELECTRIC COMPANY; November 30, 2007.

[4] Sunrise Powerlink Project; SDG&E’s 3/3/08 Responses to MGRA Data Request No. 6; MGRA-50.

[5] Fosberg, Michael A., O'Dell, Clyde A., and Schroeder, Mark J. 1966. Some characteristics of the three-dimensional structure of Santa Ana winds. Berkeley, Calif., Pacific SW. Forest & Range Exp. Sta. 35 pp., illus. (U. S. Forest Serv. Res. Paper PSW-30)

[6] Raphael, M. N.; The Santa Ana Winds of California; Earth Interactions; Volume 7 (2003) p. 1-13.

[7] Sommers, William T.; LFM Forecast Variables Related to Santa Ana Wind Occurrences; Monthly Weather Review; September, 1978; v. 106, pp. 1307-1316.

[8] Fosberg, O’Dell and Schroeder.

approach the sea, they encounter the on-shore sea breezes. How far the influence of the Santa Ana event extends depends on the relative strength of the Santa Ana wind flow and the on-shore marine flow, which itself varies with time of day[9]. Hence, the pattern of Santa Ana winds is complex, and varies greatly with both geographic location and time, as was observed in the development of the Santa Ana event that led to the Cedar Fire[10]. The general weather trend, however, consists of hot, dry winds from the northeast quadrant, on the downslope (western, in San Diego) side of the mountains, often weakening as they approach the coast.

SDG&E's analysis chose various weather stations to be representative of specific line segments based upon its analysis of the topological and meteorological data[11]:

(A)	From the Penasquitos substation to an elevation of about 2,200 ft MSL just south of the Santa Maria Valley (about 22 miles inland).	San Diego Lindbergh
(B)	The Santa Maria Valley area southeast and east of Ramona (about 22-28 miles inland)	Ramona
(C)	From the east edge of the Santa Maria Valley to a few km southeast of Ranchita (about 28-34 miles inland).	Campo
(D)	The short stretch of corridor (about 6 miles long) through the Grapevine Canyon mountain pass, north of Grapevine Mountain and the Volcan Mountains, and about 6 miles southeast of Ranchita, California. ***Wind direction should be parallel to the pass orientation, from either the west-northwest or the east-southeast (about 34-40 miles inland).***	Beaumont
(E)	From the east end of Grapevine Valley, to the edge of the Borrego Valley (about 40-47 miles inland along the corridor)	Campo

(emphasis added).

Note that the application of the Beaumont weather station (the "worst case" weather station) to Grapevine Canyon assumes that the wind will be from the west-northwest or east-southeast. This might well be appropriate for prevailing winds or winter storm conditions. However, it is nearly perpendicular to the prevailing direction of Santa Ana conditions. Furthermore, the trend of the valley is downslope to the east, towards the Salton Sea basin, which will tend to locally retard Santa Ana conditions. The weather

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[9] Fosberg, et. al., Sommers, and Raphael.

[10] Mitchell, Joseph W.; Wind-enabled ember dousing; Fire Safety Journal; Volume 41, Issue 6, September 2006, Pages 444-458.

[11] SDG&E; MGRA-49 response.

station at the Ramona Airport is located at the western side of the broad Santa Maria Valley, near the foot of Mount Woodson. Due to its location, one would expect it to experience less intense Santa Ana winds compared to other nearby locations, since the wind will tend to be slowed as it rises over the slopes to the west and then descends to the coast. Also, the terrain is quite unlike that of the proposed route, which traverses a steep landscape of valleys, canyons, ridges and mountains from the point where it rises out of the desert through Grapevine Canyon to the point where it descends out of the coastal range near the Sycamore Canyon substation. Finally, the choice of the coastal Lindbergh Field selects a location that is maximally shielded from Santa Ana conditions by on-shore breezes. One can conclude from this choice of stations that the choices that went into the wind loading analysis were based upon prevailing winds, and not on the Santa Ana wind storms that are of particular interest for analysis of power line fires and public safety.

We obtain support for this assertion by analyzing several data sources. We start by showing a map of the area that illustrates some of the effects that have been discussed:

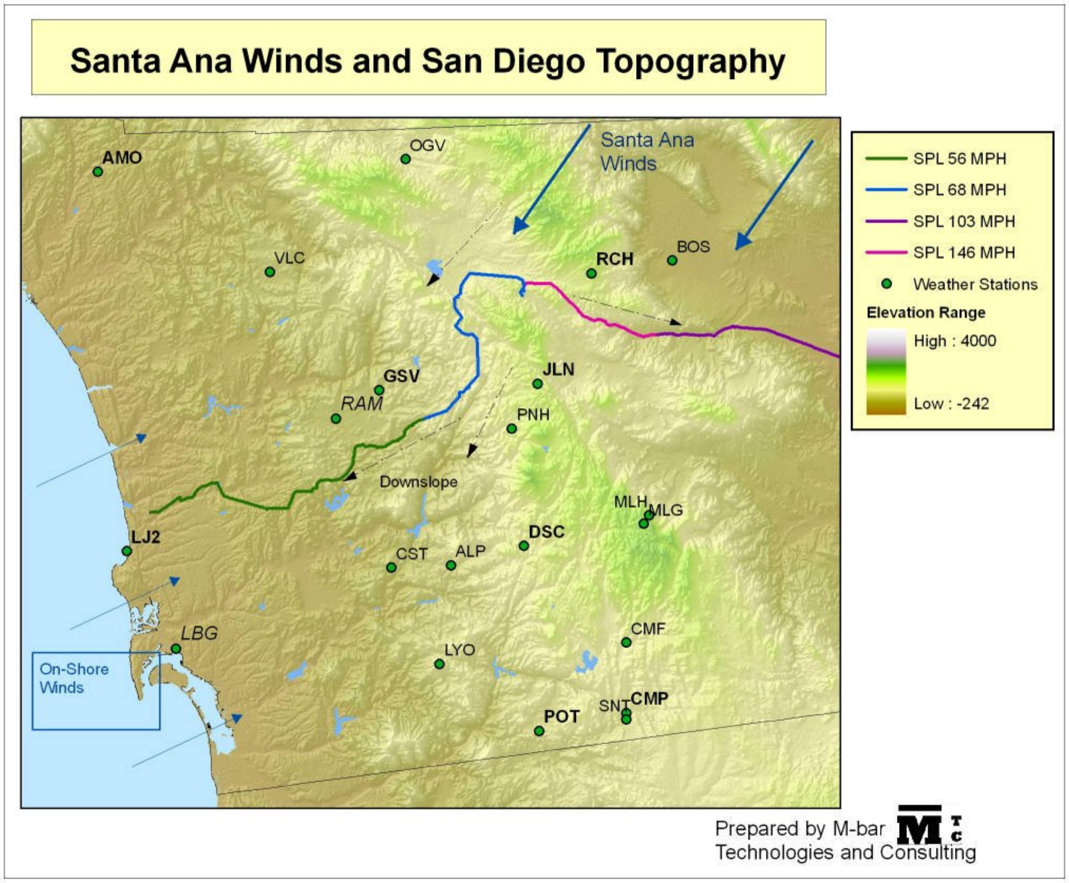

Figure 2G-1 – This figure illustrates the interaction of northeasterly Santa Ana winds (dark blue arrows) with San Diego County topography. The thin blue arrows indicate the marine flow that flows counter to the Santa Ana winds, reducing the intensity of Santa Ana conditions near the coast. Thin black arrows indicate downslope direction. The green circles are weather stations. Those in bold have been analyzed by MGRA while those in italics were used in the SDG&E analysis (with the exception of Campo, used in both). The proposed SPL route is divided into segments by the maximum design gust speed resulting from the SDG&E analysis.

Note first the extremely rugged terrain that the SPL route traverses between the point where it ascends from the desert, through mountain passes north of Julian (JLN), and then down again through the canyon-lands east and south of Ramona (RAM). Note that many of the downslope areas are oriented in a roughly parallel direction to the Santa Ana winds. This conforms to SDG&E's expectation for high-wind areas: "*Winds can be strong and gusty near the mouths of canyons oriented parallel to the direction of airflow. Funneling of airflow through mountain passes and along deeper valleys can cause unusually high wind speeds… valleys with persistent down slope winds associated with strong pressure gradients.*" These would seem to describe the conditions along the western flank of the mountains where the SPL would pass through Santa Ysabel and Ramona. However, the only place where highly conservative assumptions were made was in Grapevine Canyon, which may sometimes meet the above conditions when strong prevailing winds are coming from the northwest. Design criteria for this segment call for the SPL infrastructure to endure wind gusts up to 146 mph. This is appropriate, but it ignores the much greater risk arising out of Santa Ana conditions, which will cause winds to be much stronger elsewhere and carry with them the greater risk of power-line induced fire.

This effect is easily seen in weather data, and is most obvious for weak and medium strength Santa Ana events: When comparing the data from the Ranchita weather station (RCH), not far from Grapevine Canyon, to the nearby Julian (JLN) weather station which is on a western slope of the mountains, an interesting effect is seen. The winds at the Ranchita station may actually *lessen* during a Santa Ana event. This is illustrated in the two figures below. The first shows the data from the Julian weather station during a medium strength Santa Ana event the first week of January, 2007.

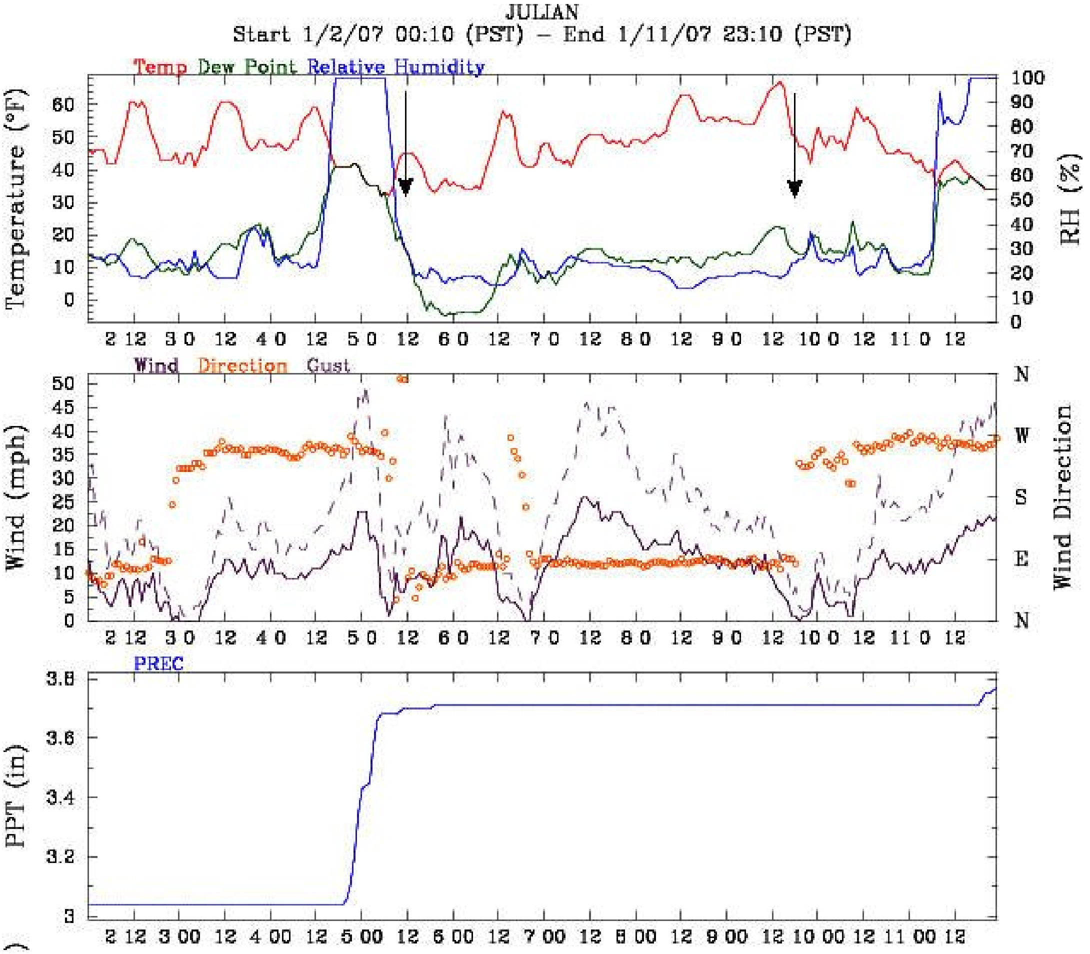

Figure 2G-2 – This figure shows ten days of data from the Julian weather station. The blue line in the TOP graph shows relative humidity, which can be seen to drop during the Santa Ana event (indicated by arrows). Continuous and gust wind speeds are indicated by solid and dashed purple lines, respectively. Wind direction is indicated by orange circles, and can be seen to be easterly during the Santa Ana event. The bottom figure is a rain gauge, which indicates that the Santa Ana event was bracketed by two "wet" storms. Graph is generated by Mesowest: **http://www.met.utah.edu**.

The data show all of the classic "Santa Ana" signatures: there is a sudden drop in relative humidity to less than 20% (blue line, top graph), the winds shift to easterly (orange circles, middle graph), and the winds are strong and gusty (purple solid and dashed lines in the middle graph). Since this event was bracketed by two "wet" storms, one can see that the Julian station endures strong wind conditions during both Santa Ana events and winter storms.

The next figure shows data from the Ranchita weather station, the closest station to Grapevine Canyon and also on the eastern slope of the central range:

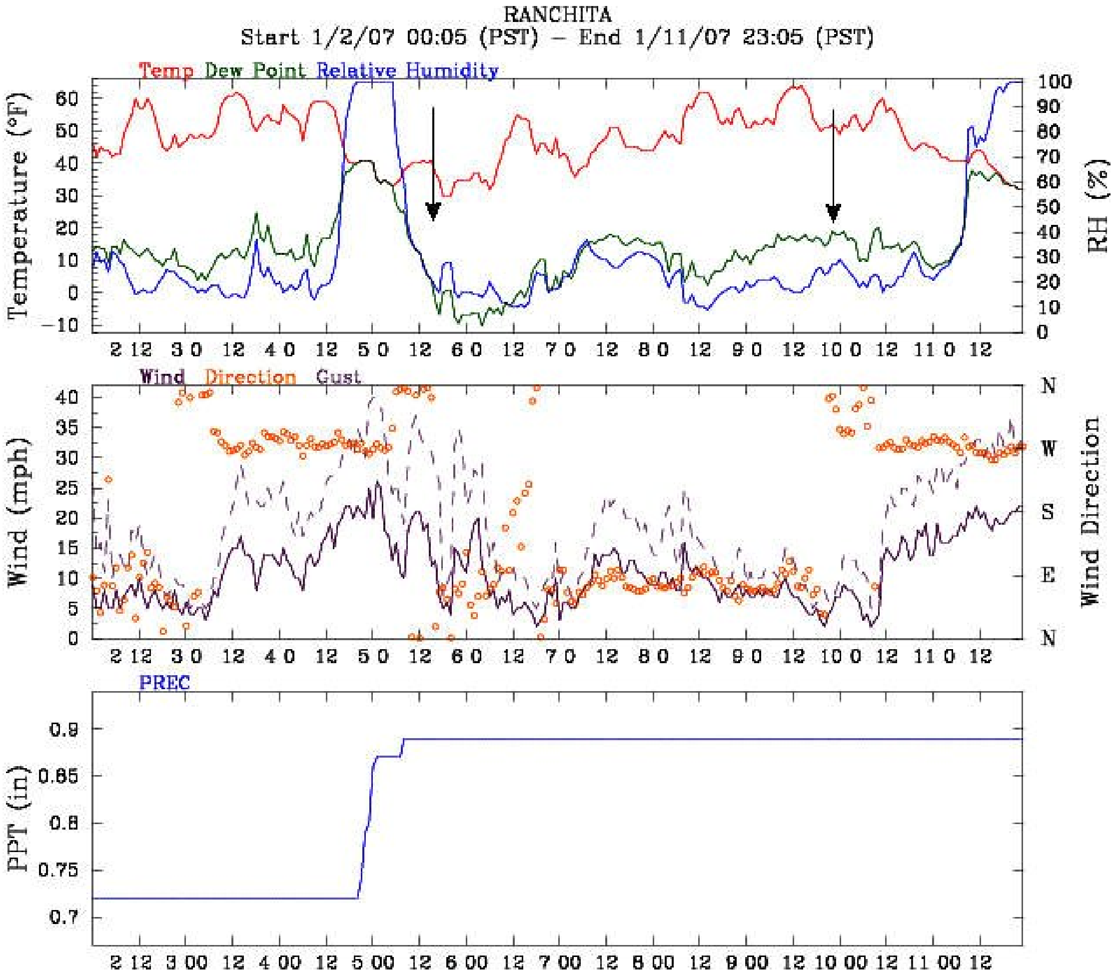

Figure 2G-3 - This figure shows ten days of data from the Ranchita weather station. The blue line in the TOP graph shows relative humidity, which can be seen to drop during the Santa Ana event (indicated by arrows). Continuous and gust wind speeds are indicated by solid and dashed purple lines, respectively. Wind direction is indicated by orange circles, and can be seen to be easterly during the Santa Ana event. The bottom figure is a rain gauge. Graph is generated by Mesowest: **http://www.met.utah.edu**.

The data from the Ranchita weather station is similar to that from the nearby Julian weather station in many respects. Both stations observe a drop in humidity at roughly the same time, and observe a wind shift to the east. However, the Ranchita station sees much weaker Santa Ana winds than those seen at the Julian weather station. This contrasts strongly with the “wet storm” winds that occur before and after the Santa Ana event, which show wind speeds nearly equal to those seen at the Julian weather station.

Hence, if the Ranchita weather station is indeed representative of the eastern slope of the coastal ranges, this data would support the assertion that the wind load experienced under Santa Ana conditions would be less than that experienced at other locations along the line – locations that are only designed for gust speeds of 56 mph or 68 mph. It follows that if the SPL segment on the eastern slopes is designed for “canyon effects” using data from a worst-case weather station, then the SPL route on the western slopes should be similarly designed, since these areas will not be prone only to high winds, but also to explosive fire growth should a failure in any line component occur.

The next question to be addressed is how far to the coast to extend more conservative design criteria. Below we have gathered wind gust data for six Santa Ana events from a number of weather stations[12]. We were unable to obtain wind gust data from the Ramona Airport (RAM) or Lindbergh Field (LBG) weather stations. The La Jolla (LJ2) station was chosen as an equivalent coastal station, and the Goose Valley (GOS) station northeast of Ramona was chosen as being more representative of the topography along the SPL route than the Ramona Airport would have been.

Abrev.	Station	10/26/06	11/29/06	12/24/06	1/6/07	1/12/07	10/21/07
POT	Potrero	32	46	20	47	35	70
GOS	Goose Valley	28	36	19	41	18	54
CMP	Campo	39	47	37	45	45	60
RCH	Ranchita	25	21	14	23	19	35
JLN	Julian	35	47	30	45	40	58
DSC	Descanso	35	35	17	40	34	60
AMO	Ammo Dump	35	15	25	40	25	47
LJ2	La Jolla	17	17	15	32	15	23
BMT	Beaumont	47	55	27	50	42	65

Table 2G-1 – This table shows the wind speed in miles per hour for six Santa Ana events. All stations are in San Diego County except for the Beaumont station.

Maximum wind speed was recorded for six Santa Ana events in 2006 and 2007, including the October 2007 event which led to the Witch, Rice, and Guejito power line fires. Some common characteristics can be seen. First, the "coastal effect" is very strong. Data from the La Jolla station indicate a strong suppression of Santa Ana conditions. We can deduce that the Lindbergh Field station would be experiencing similar conditions. Hence, it is inappropriate to use it as a design reference for any portion of the line when designing for Santa Ana wind events.

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[12] MGRA has used wind gust data (three-second gusts) from RAWS weather stations for all Phase 1 and Phase 2 analysis to date. SDG&E has used continuous wind data, and has preferred airport weather stations. Some of these do not offer gust data, but only continuous wind speed, and so they cannot be compared directly to the MGRA data. We have tried as far as possible to gather equivalent data.

Another thing to be noted is the strong consistency between the Potrero (POT), Descanso (DSC), Julian (JLN), and Campo (CMP) stations. While these vary from event to event as far as which encountered the strongest gust, the maximum gust speeds for these stations are usually quite close together, and this should be taken to mean that they are good representatives of the regions high on the western slopes of the coastal range, and also that Santa Ana winds effect the entire region and are not an entirely local phenomenon.

The weakening of the Santa Ana event as it approaches the coast can be seen first at Goose Valley (GOS), which has slightly lower values than the maximum stations, and then at Ammo Dump (AMO), which is in northeast San Diego County and still closer to the coast.

It should be noted, though, that the wind gust speed at Goose Valley in October 2007 was 54 mph, only two mph short of the maximum gust design criteria. The SPL route to the east would have been expected to encounter even stronger winds, and there is a good chance that the design criteria would have been exceeded. Likewise, the Potrero station recorded a maximum gust speed of 70 mph, and this would also have exceeded the 68 mph wind gust criterion put in place for Campo.

The Ranchita station, near the SPL segment designed for 146 mph gusts, encountered winds that were roughly the same as the coastal winds measured in La Jolla.

Finally, the Beaumont station is a plausible “worst-case” weather station, having recorded the maximum wind gust value measured in three of the six events. Notably, though, it did *not* exceed the wind speed measured at the Potrero station during the October 2007 Santa Ana event, and both Descanso and Campo stations clocked speeds of only 5 mph less.

One more question that arises is how the delineation of maximum design wind gusts in File 2G-2 (the SDG&E map attached as SDGE_MGRA49_map.pdf) is derived from the application of the weather station data. We show the correlation of the map and the calculations provided in the MGRA Data Request #6[13] below:

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[13] SDG&E Response; MGRA-48.

Segment West	Segment East	Max Gust mph	Station	50 y Wind mph	50 y Gust mph	100 y Wind mph	100 y Gust mph
Del Mar	Ramona	56	LBG	50.0	80.0	55.3	88.4
Ramona	E. Ramona	56	RAM	42.8	68.5	45.3	72.5
E. Ramona	Grapevine	68	CMP	54.3	86.9	57.7	92.3
Grapevine	Desert	146	BMT	75.6	121.0	91.4	146.2
Desert	Desert	103	El Centro	60.5	96.8	64.6	103.4

Table 2G-2 – This table shows the five SPL segments divided up into wind gust domain as per the SDG&E map file's description. Only four segments are shown on the SDG&E map. The maximum designed wind gust is taken from the map. The station data used for analysis of that segment is taken from the SDG&E Response to Data Request #6, as are the 50 year and 100 year wind speeds. The 50 and 100 year gust speeds are derived by multiplying by the factor of 1.6 used by SDG&E in its analysis. Green highlighting is used where this calculation is consistent with the result obtained by SDG&E, and in yellow or magenta where it is not.

One of the most notable problems in the analysis shown in the table above is that the method detailed by SDG&E indicates that five different segments of the line were independently treated between the desert and the western end of the line, whereas the map provided to illustrate this shows only four segments. It appears that the 56 mph segment represents a merger of the first two segments in the SDG&E analysis description.

In the data request, the design gust factor was defined as being obtained by taking the 100 year wind speed and multiplying it by a "gust factor" of 1.6. As can be seen in the table, this was applied correctly for the Desert and Grapevine Canyon segments of the line. However, it is not clear at all how the 56 mph and 68 mph gust values were obtained. It would appear that for the western segment it is possible that the 100 year wind speed and not 100 year gust speed was used. For the sections from Ramona to Grapevine canyon, there is no plausible explanation of how the value of 68 mph listed on the map was obtained.

If the map provided by SDG&E is simply inaccurate, it should be corrected and the correct values for wind gusts applied, and the map re-issued to the MGRA and the Commission. If, however, the map accurately represents the planned engineering design limits for the SPL, this would represent a major and potentially catastrophic under-engineering of the project. New construction costs would need to be developed by SDG&E and provided for inclusion in Phase 2 cost/benefit analysis.

For further illustration of the effect of Santa Ana winds along the SPL route, we re-plot the NDFD predicted wind gust speeds for the October 2007 Santa Ana event below. This figure shows the predicted wind gust speeds at 11 a.m., roughly two hours before the ignition of the Witch Creek Fire:

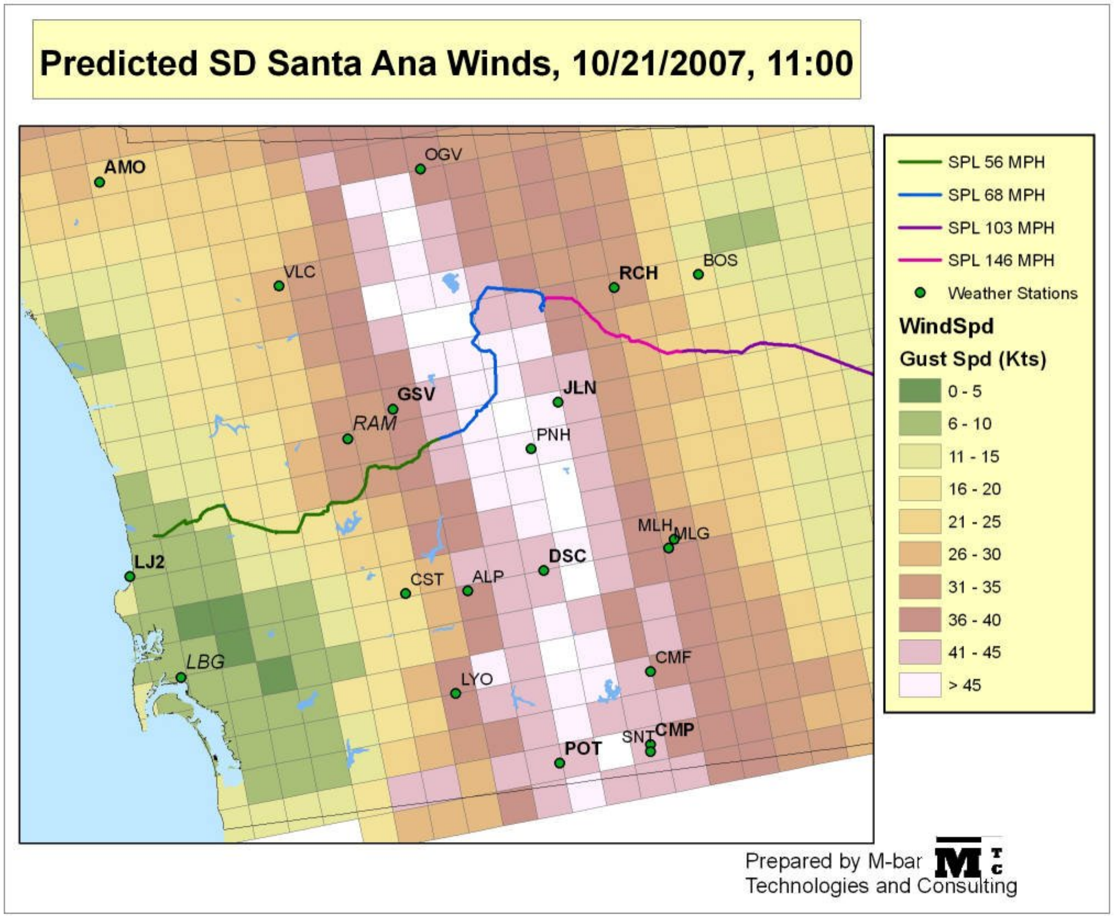

Figure 2G-4 – The NDFD predicted wind gust speeds for 11 a.m. on October 21, 2007, roughly two hours prior to the start of the Witch Creek Fire. Superimposed is the proposed SPL route divided into segments on the basis of wind gust load design criteria. Weather station locations are also shown, with those used in the MGRA analysis indicated in bold face, and those used only on the SDG&E analysis in italics.

While the NDFD predictions do not take into account fine-grained local topology, they do make use of the general geography of the region to generate wind models. The interaction of Santa Ana winds with on-shore breezes causes a rapid drop off of the event intensity from the high western slopes to the coast. What is most evident from the above figure is that the most intense winds are present where the proposed SPL is designed with the minimum "coastal" criteria or the slightly more rigorous "Campo" criteria. Likewise, the highly conservative "Beaumont" segment does not encounter nearly the same extreme wind conditions. General consistency with weather station data can be seen, though it needs to be kept in mind that the above figure is a snapshot in time whereas the weather station data in the table above captures the maxima seen throughout the entire event.

One further consideration of SPL safety arises from the decision to use conservative approach because of the similarity of Grapevine Canyon to other location where strong wind funneling occurs. This is a sound approach, and should be applied to the western slopes as well. Indications can be found in the figure below:

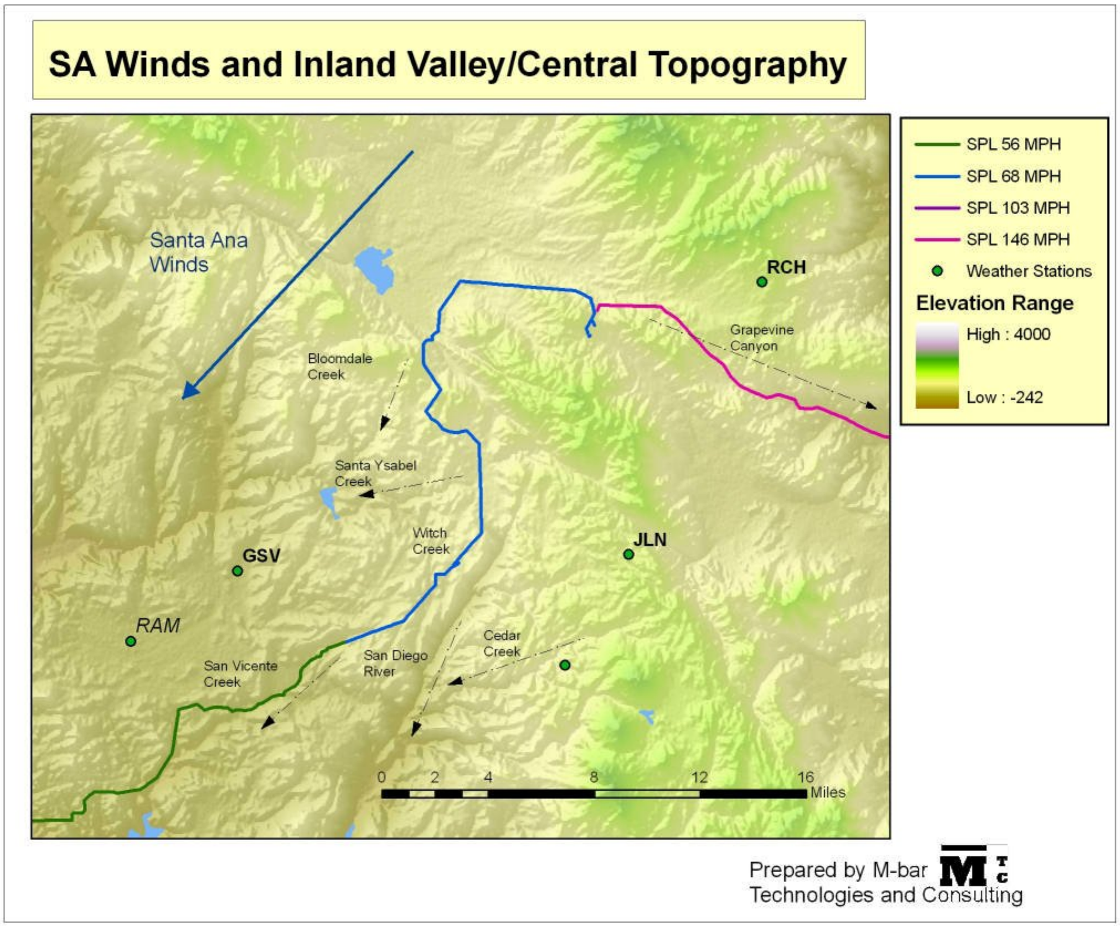

Figure 2G-5 –Among the potential “wind funnels along the proposed route are the San Diego River basin, Santa Ysabel Creek, San Vicente Creek, and Bloomdale Creek, shown with arrows along the downslope vector. Shown for reference are Witch Creek (ignition point of the Witch Fire) and Cedar Creek (ignition point of the Cedar Fire).

As can be seen in the figure above, there are many valleys and canyons trending downhill from northeast to southwest that are traversed by the proposed SPL route. Among these are the Bloomdale Creek, Santa Ysabel Creek, San Vicente Creek, Kimball Valley, and San Diego River drainages. Shown for reference are Witch Creek and Cedar

Creek drainages, which were the ignition points for the Cedar and Witch fires, the largest and fourth largest fires in recorded California history. That these ignition points are a approximately five miles apart is not mere coincidence – the Santa Ana wind conditions in this area are fierce, as all locals and firefighters know. We would argue that the "Beaumont" criteria should be used through this area.

Finally, we address the issue of return periods, since this affects how the wind data is used to generate maximum gust design criteria. In the table below, we calculate the probability that the design criteria will be exceeded one or more times during the lifetime of the line:

Return Period (years)	**Expected Occurences**	**Probability ≥ 1 event**
50	0.8	55%
100	0.4	33%
200	0.2	18%
300	0.13	12%

Table 2G-3 – This table shows the relationship between return period for an event (wind gust greater than design criteria), the number of times that this would be expected to occur during the 40 year lifetime of the proposed transmission project, and the probability of one or more events of this type occurring during the project lifetime. Probabilities were calculated with the Poisson.rb calculator.

2G-2.1.5. Limitations

Weather conditions are very strongly dependent on the interaction between weather systems and local topography. It is therefore risky to assume too much based on data from one or only a few weather stations, since these may only represent their local conditions and not necessarily represent weather conditions in a wider area.

Grid data forecasts such as the NDFD wind gust predictions do not take small-scale features into account, and these can be the dominant effect at the local level. Also, they are predictions, and as all weather predictions are subject to inaccuracies, particularly when there are strong local dynamics such as in the case of Santa Ana events.

One issue when addressing Santa Ana versus other data is that we do not know for sure which high-wind storms in historical records are due to "wet" storms blowing in from a westerly direction and which are due to Santa Ana events. Significant research would be necessary to extricate these two effects in order to come up with measurements of a “maximum expected Santa Ana wind speed” using station data. We would argue that this would fall properly under the auspice of the EIR/EIS process, and that it is lacking therein, and that this should be included in the final EIR/EIS.

2G-2.1.6. Conclusions

We find significant support in weather data and weather simulation data that the design criteria for wind load on the SPL line were derived for prevailing westerly winds and not for Santa Ana wind events. While ensuring SPL integrity during wind storms coming in from the west is certainly within the purview of SPL design, we have demonstrated that this is very likely to be inadequate for extreme Santa Ana wind events.

Furthermore, some of the wind gust speed values in the map provided by SDG&E in File 2G-2 are inconsistent with the method they claim to use to derive them. This issue needs to be investigated carefully by the CPUC. If this is not merely an error made in plotting the map, but instead indicates the wind gust design criteria used for estimating the cost of the line, then it would mean that the line is significantly under-engineered, and that the actual costs of line construction need to be fully recalculated under the correct wind gust criteria.

Use of coastal weather station data to model areas of steeply sloping canyon lands is not appropriate, and does not capture the complex interaction of winds and topography during Santa Ana events.

The remedy would be to apply much more stringent design criteria to the SPL segments on the western slopes of the coastal range. We would recommend applying the more stringent “Beaumont” design criteria to SPL route areas on the western slopes of the coastal ranges. A number of measures that can be taken to comply with GO 95 are listed in the response to MGRA Data Request #6[14]. We would urge that the extra cost of adding these engineering enhancements to the areas at-risk be included in Phase 2 testimony.

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[14] Sunrise Powerlink Project; SDG&E’s 3/3/08 Responses to MGRA Data Request No. 6; MGRA-51.