

# Windblown Dust in the Coachella Valley

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# Presentation Overview

- What is Windblown Dust?
- Mechanics of Windblown Dust
- Human Impacts and Mitigation Strategies
- Particulate Measurement
- Windblown Dust in Coachella Valley
- Salton Sea Challenges
- Regional Data Plots



# What is Windblown Dust?

- Small soil particles entrained by high winds.
- Particles are small enough to remain suspended in the air for long periods.
- Particles are small enough to pass through the body's natural filters and deposit in lungs.



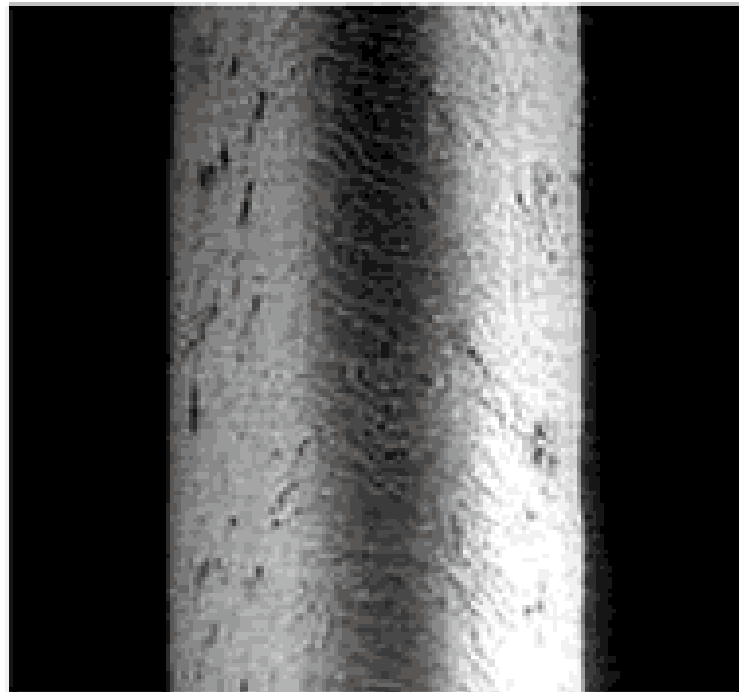


# Particle Sizes and Sources

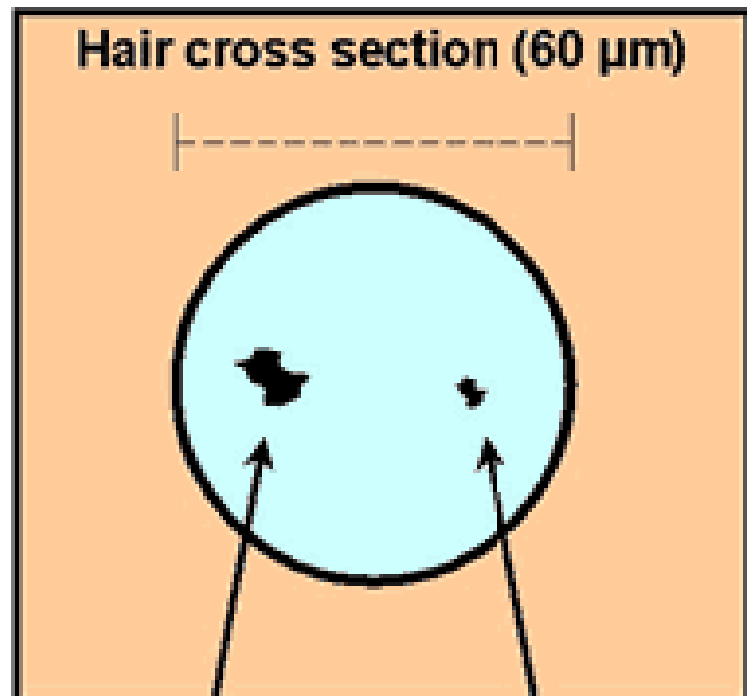
- PM10: Particles less than 10 micron in diameter
  - 10 to 2.5 micron called “coarse fraction”
  - Most of coarse fraction is from earth crust sources
- PM2.5: Particles less than 2.5 micron in diameter
  - <2.5 micron called “fine fraction”
  - Most of fine fraction from combustion sources, but 5-20% of windblown dust is in fine fraction.
  - Fine fraction considered greater health threat



# HOW SMALL IS PM?



Human Hair  
(60  $\mu\text{m}$  diameter)



PM10  
(10  $\mu\text{m}$ )

PM2.5  
(2.5  $\mu\text{m}$ )



# Health Effects of PM

- Studies show both short term and long term exposure can result in health impacts.
- Many studies have show higher PM associated with more hospitalizations, emergency room visits, doctor's visits for respiratory illnesses or heart disease, and deaths.
- Elderly, children, people with existing heart and/or lung disease most at risk.



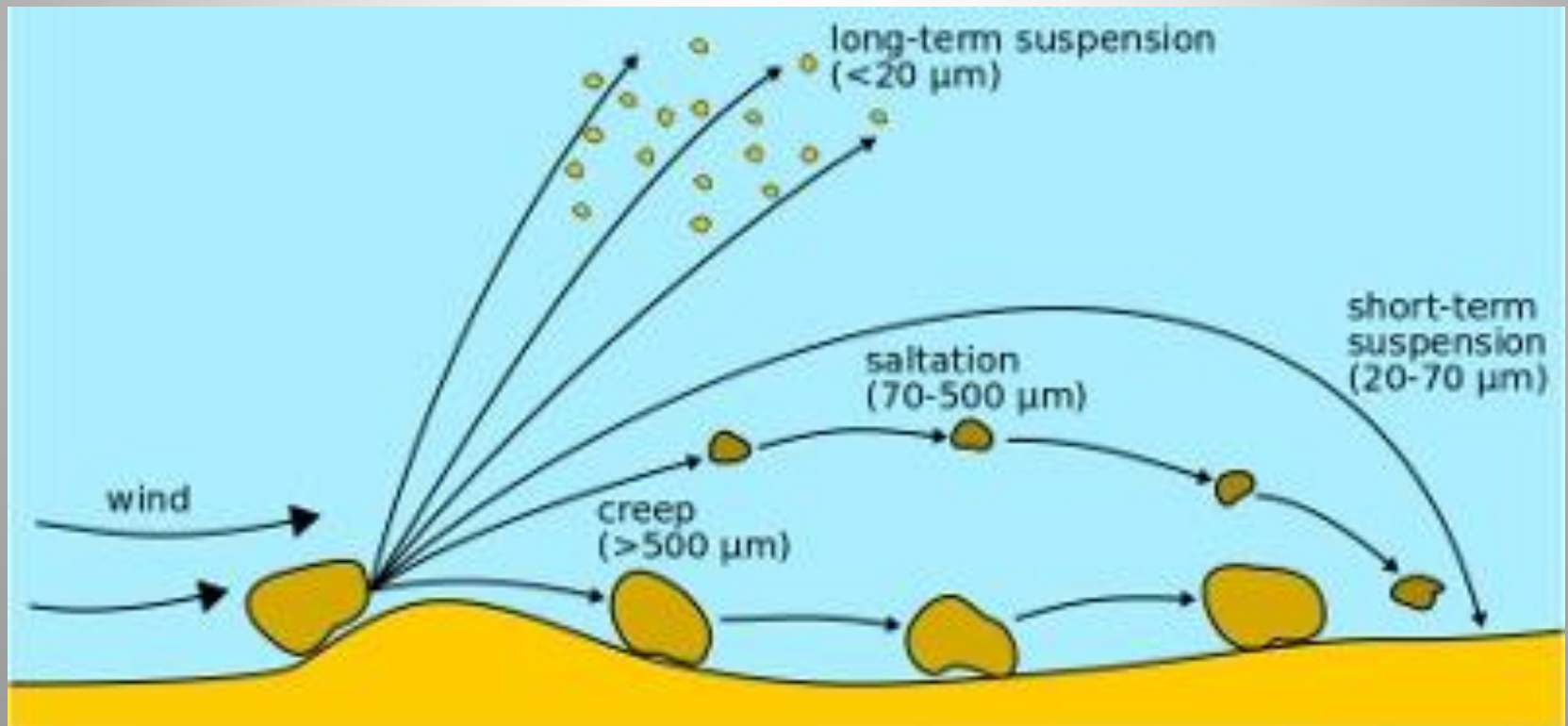
# Health Standards

- PM<sub>10</sub>:
  - NAAQS 150 ug/m<sup>3</sup> for 24 hour average
  - California State Standard 50 ug/m<sup>3</sup> for 24 hour average and 20 ug/m<sup>3</sup> for annual average.
- PM<sub>2.5</sub>:
  - NAAQS 35 ug/m<sup>3</sup> for 24 hour average and 12 ug/m<sup>3</sup> for annual average
  - California State Standard 12 ug/m<sup>3</sup> for annual average
- Health Standards only consider mass of PM, not composition of particles.



# Basics of Windblown Dust

- Wind force on soil surface is the driving force
- Prior to saltation, small particles on surface entrained by wind, result in short term spike in concentration.
- When wind force is strong enough to initiate saltation, particles small enough to stay suspended are generated by saltation mechanism.





# Factors Influencing Dust Emissions

- Anything that changes wind force on soil surface.
  - Surface roughness
    - Vegetation
    - Wind barriers-buildings, walls, etc.
- Soil type
  - Availability of small particles
  - Soil moisture
  - Natural soil “crust”
  - Disturbed soil surface





# Impacts of Human Activities

- Some windblown dust is entirely “natural”
- Human Activities can dramatically increase emissions
  - Loss of vegetation
  - Disturbed Vs. Non Disturbed soil
    - Agriculture- positive as well as negative effects
    - Dirt Roads
    - Off-Road Activities
- “Nature knows best”





# Mitigation Techniques

- Agricultural practices
  - Cover Crop
  - Limit tilling
- Wind barriers
  - Fences or berms
  - Increase surface roughness
- Soil stabilizing techniques
  - Chemical binding agents
  - Mechanical stabilization





# Mitigation Techniques

- Re-vegetation
  - Blowing sand adds difficulty
  - Need to protect new vegetation
- Emissions are rarely homogenous
  - Determine “hot spots”
  - Focus mitigation on “hot spots”





# Ambient PM Measurement





# PM Measurement Methods

- Manual Methods typically only provide 24 hour averages.
- Dust episodes typically one-6 hours long
- 24 hour average can obscure short episode
- Continuous methods provide hourly averages or continuous data.
- Won't miss dust episode
- Allow better comparison to wind and other conditions
- Chemical analysis of particulates possible only with manual methods
- Provides important information on source of PM



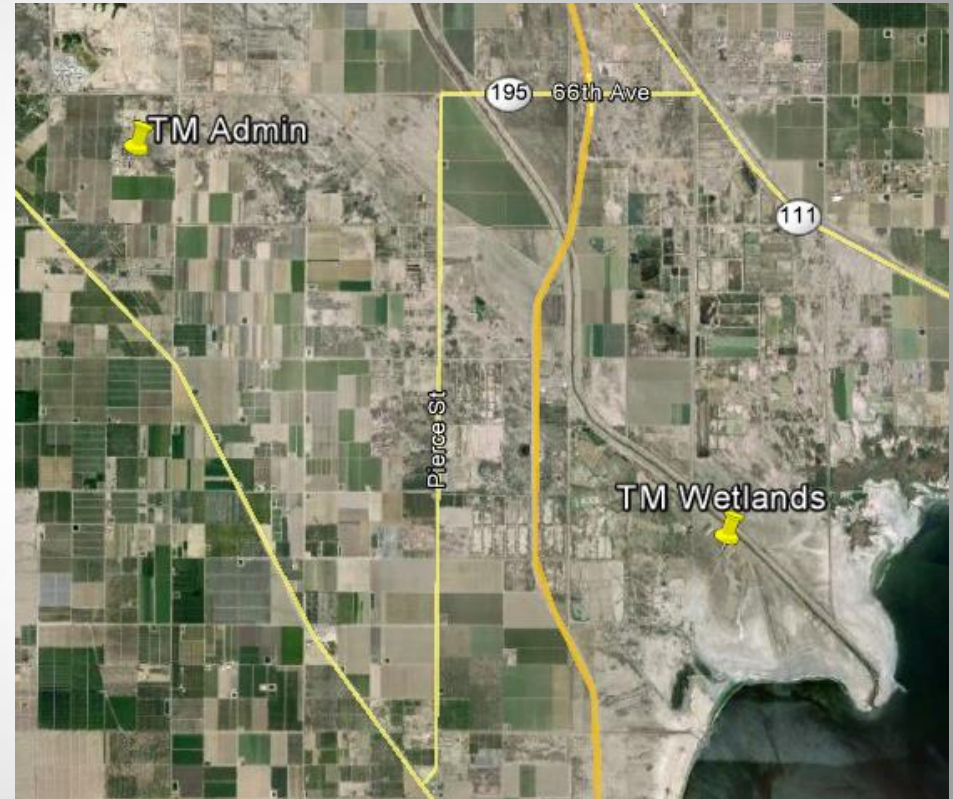
# Coachella Valley Windblown Dust

- Region is very susceptible to dust storms
  - Sandy Soil
  - Sparse vegetation
  - Periods of very high wind conditions
- Human activities effect on dust storms
  - Agriculture
  - Dirt Roads
  - OHV Activity



# Torres Martinez Air Program

- Operate two sites that measure PM and meteorological parameters.
- Administration site is located at Tribal offices, Wetlands site part of the Salton Sea air monitoring network.





# Torres Martinez Administration Site

- Admin Site has recorded numerous exceedances of the PM10 NAAQS.
- Many potential dust sources in vicinity.
- Dirt parking lot suspected source, paving project completed June 2014.
- Analysis will be performed to determine dirt parking lot contribution.





# Wetland Site

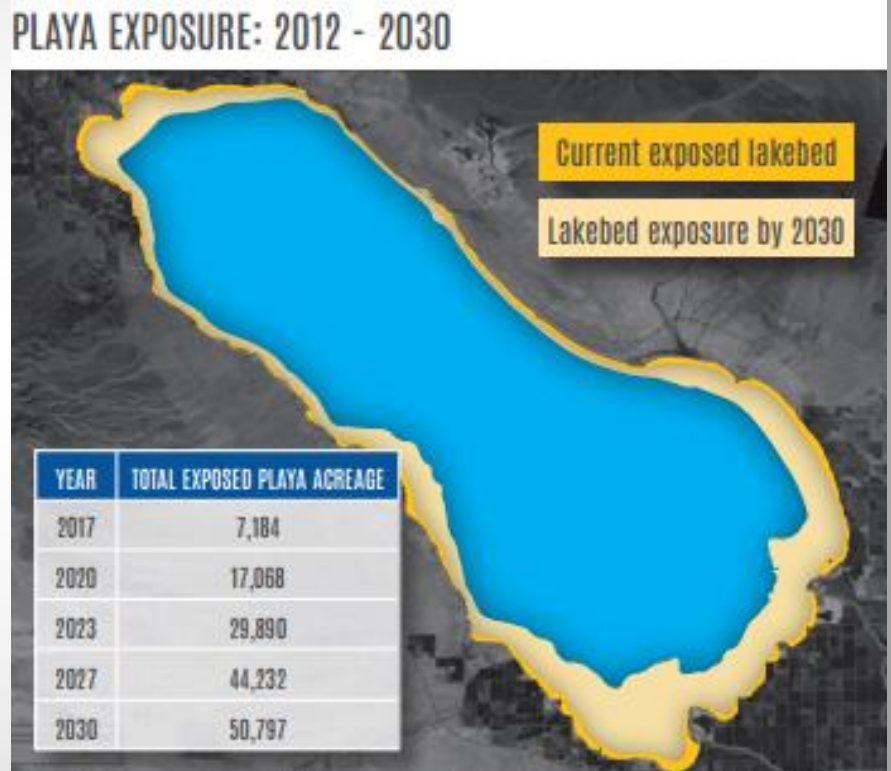
- Part of 6 station Salton Sea network.
- Owned by IID, operated by Torres Martinez.
- Network designed to assess effect of lowering sea level.
- Data not reported to AQS, only for study purposes.





# Salton Sea

- Planned reductions in water inflow from the Colorado River will reduce the sea level and increase exposed playa by ~50K acres.
- Playa soil is composed of fine sediments, creating additional dust sources for the area.
- Playa soils contain high levels of selenium and farm chemicals, adding a toxic component to the dust sources.





# Salton Sea

- As water resources become scarce, sea level could be further reduced.
- Owens Dry Lakebed is the largest single source of PM<sub>10</sub> in the U.S. and provides insight into the potential for the Salton Sea.
- Tribal and other governments in the area need to be vigilant to ensure the Salton Sea does not become a new Owens lakebed.

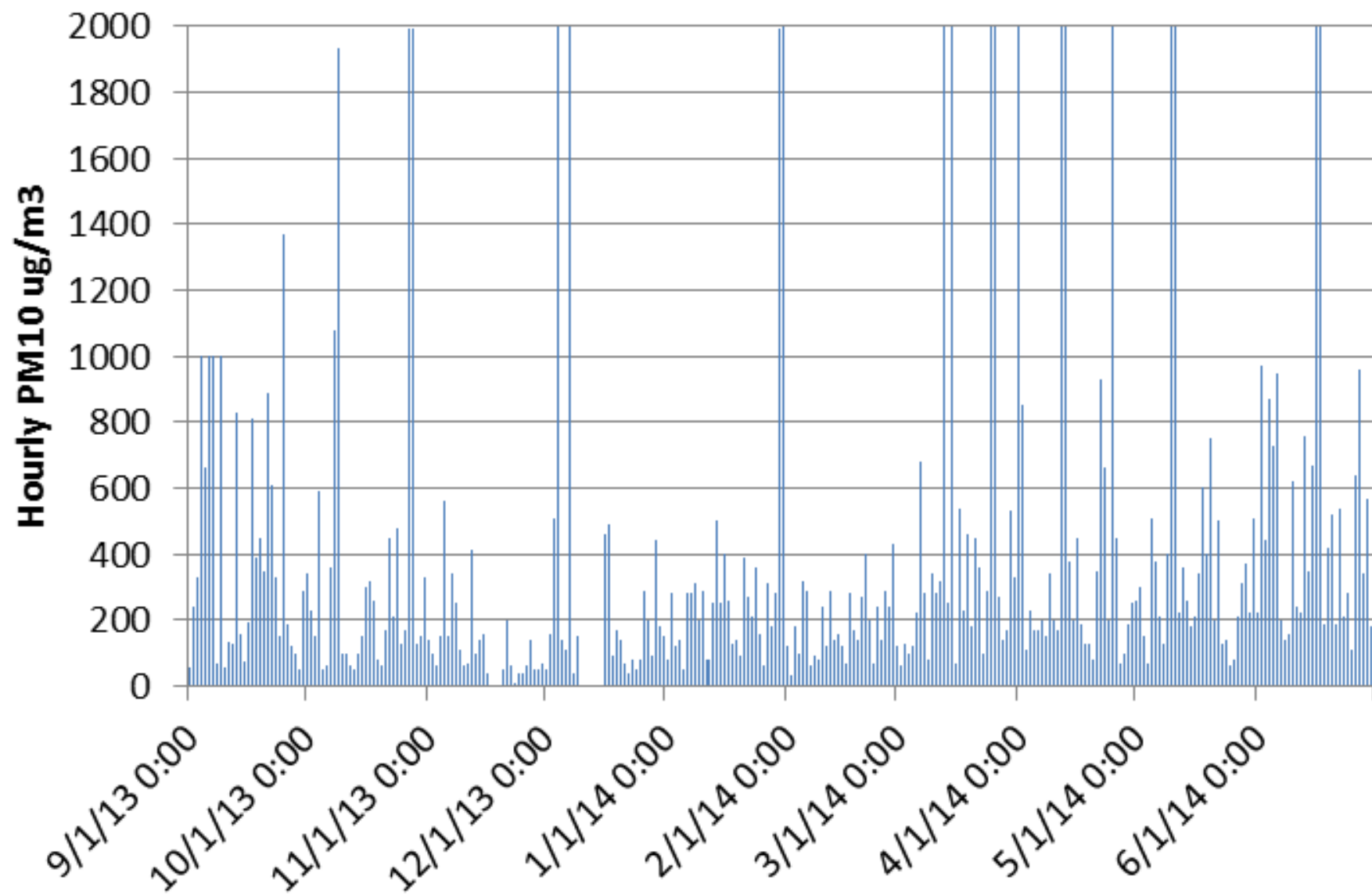




# Coachella Valley Data Examples



# Torres Martinez Admin. Hourly PM10

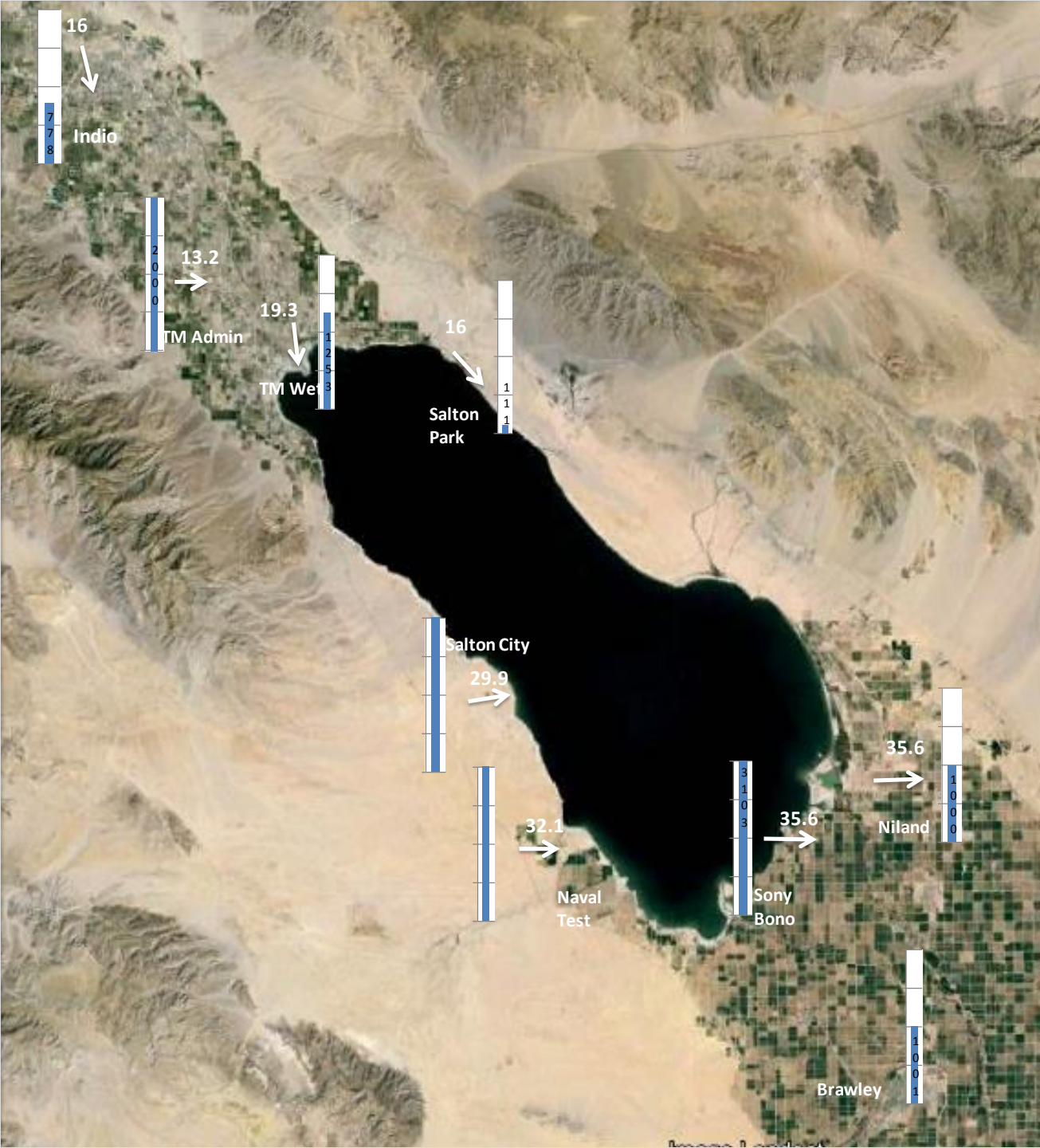




# Spatial Data Display

- Created using Excel to visualize PM10 and wind conditions from multiple sites across the region.
- Display can manually be stepped through hourly data or to automatically present each hour and pause for a specified time.
- Data displayed is preliminary.
- Data taken from local District, IID, and tribal sites in the region.

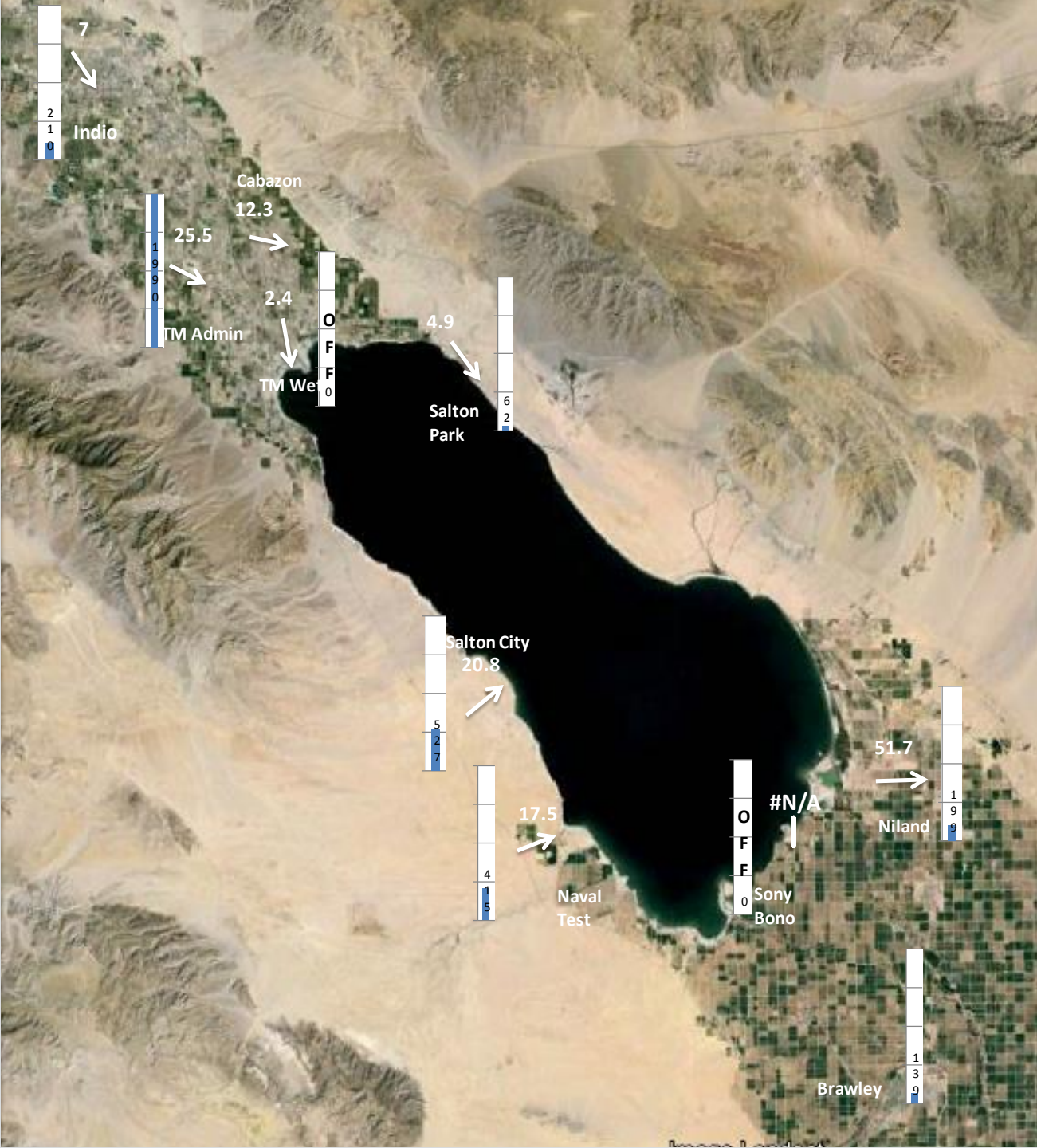




DATE	5/10/2014
HOUR	20
Time	1

Run Day
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DATE 10/28/2013  
HOUR 2  
Time 1

Run Day







# General Resources and Links

- Western Regional Air Partners Windblown Dust Handbook
  - [www.wrapair.org/forums/dejf/fdh/content/final-handbook.doc](http://www.wrapair.org/forums/dejf/fdh/content/final-handbook.doc)
- Dustbusters/Antelope Valley APCD Guide
  - <http://www.avaqmd.ca.gov/index.aspx?page=327>
- Great Basin Unified APCD – Owens Lakebed
  - <http://www.gbuapcd.org/owenslake.htm>
- Dust Storms and Health
  - <http://www.nmenv.state.nm.us/aqb/NEAP/DustStormsAndHealth.pdf>



# Measurement Resources and Links

- CARB PM Measurements Page
  - [www.arb.ca.gov/aaqm/partic.htm](http://www.arb.ca.gov/aaqm/partic.htm)
- EPA Analysis of PM Method Sampling Issues
  - [www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1048415.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1048415.pdf)
- Owens Lake Emission Estimation Method
  - [www.epa.gov/ttnchie1/conference/ei12/fugdust/ono.pdf](http://www.epa.gov/ttnchie1/conference/ei12/fugdust/ono.pdf)
- Vendors:
  - [www.metone.com/](http://www.metone.com/) Met One Instruments
  - [www.thermoscientific.com/content/tfs/en/products/particulate-monitoring.html](http://www.thermoscientific.com/content/tfs/en/products/particulate-monitoring.html) Thermo Scientific



# Mitigation-Resources and Links

- Wind Barrier Evaluation
  - <http://ucce.ucdavis.edu/files/repositoryfiles/ca5204p14-67747.pdf>
- Long Term Study in Antelope Valley
  - <http://www.avagmd.ca.gov/Modules/ShowDocument.aspx?documentid=2708>
- Imperial Co. APCD Agricultural Practices Guide
  - <http://www.co.imperial.ca.us/airpollution/Forms%20&%20Documents/AGRICULTURE/AG%20AIR%20QUALITY%20CMP%20FOR%20IC%202012.pdf>



# Further Information

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