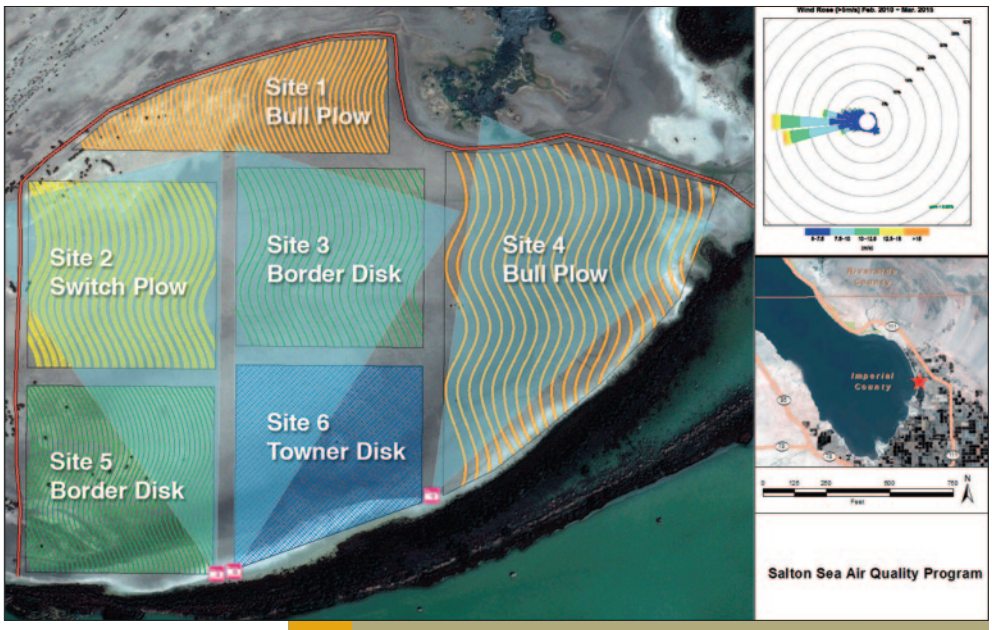
SURFACE ROUGHENING PILOT PROJECT

SURFACE ROUGHENING AS A DUST CONTROL MEASURE

Surface Roughening is recognized in the United States and around the world as an effective dust control measure on bare, unprotected surfaces in arid climates. Surface Roughening is also expected to provide quick, waterless, and effective control on soil types at the Salton Sea playa. Surface Roughening provides dust control in two ways: (a) by modifying the airflow and decreasing the wind velocity at the surface, and (b) by physically trapping soil particles that enter the roughened area from upwind sources.



1 Surface Roughening Study Area and Wind Rose Showing the Primary Wind Direction

Surface Roughening is typically created by a tractor-drawn tillage implement, such as a disk or plow. After installation, roughness levels are monitored and areas are periodically re-tilled to restore roughness that has eroded over time. When necessary, water may be applied to restore soil structure so that re-tilling is more effective.

PURPOSE OF PILOT STUDY

The purpose of this pilot study is to perform an operational field test to support approval of Surface Roughening as a Best Available Control Measure (BACM) by the Imperial County Air Pollution Control District (ICAPCD). BACM are measures designated by the EPA and the ICAPCD as the *best available* to control PM_{10} emissions.

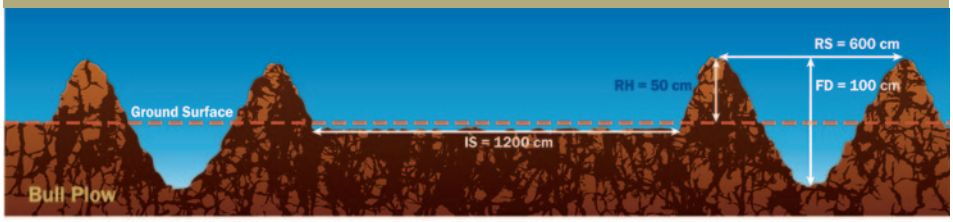
The pilot study will evaluate the durability and longevity of surface roughness on different soil types tilled with various types of implements. The study area is located near the Alamo River delta and includes six study sites **(Figure 1)**. Results will be used to:

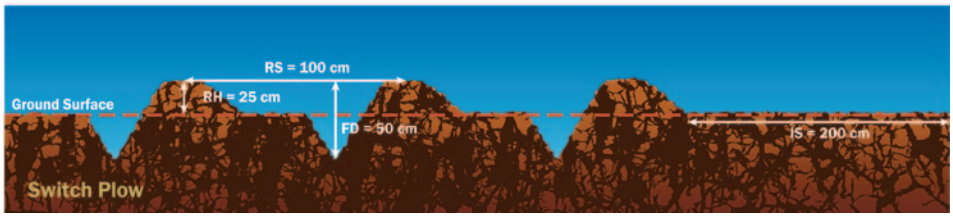
- Understand which soils and tillage equipment confer the greatest, most sustainable degree of roughness.
- Inform development of a Surface Roughening suitability map based on soil types, monitoring results, and the experience of operating various equipment and implements on the playa.
- Determine the cost and feasibility of Surface Roughening as a part of the overall dust control strategy for the Salton Sea.

DESIGN

Dust control effectiveness is dependent on the geometric characteristics created by the tillage implement. **Figure 2** displays a conceptual schematic of the geometric parameters for a bull plow and a switch plow. Furrow depth, ridge height, and ridge spacing are functions of the implement. Interrow spacing is the spacing required between implement passes to achieve effective dust control. Surface Roughening is expected to provide greater than 99 percent dust control effectiveness as long as the average ridge height within tilled areas is sufficient to arrest soil particle motion. Each study site was designed to achieve the geometric characteristics necessary for effective dust control.

2 Conceptual Schematic of the Ridge Height (RH), Ridge Spacing (RS), Furrow Depth (FD), and Interrow Spacing (IS) for a Bull Plow and a Switch Plow (Not to Scale).





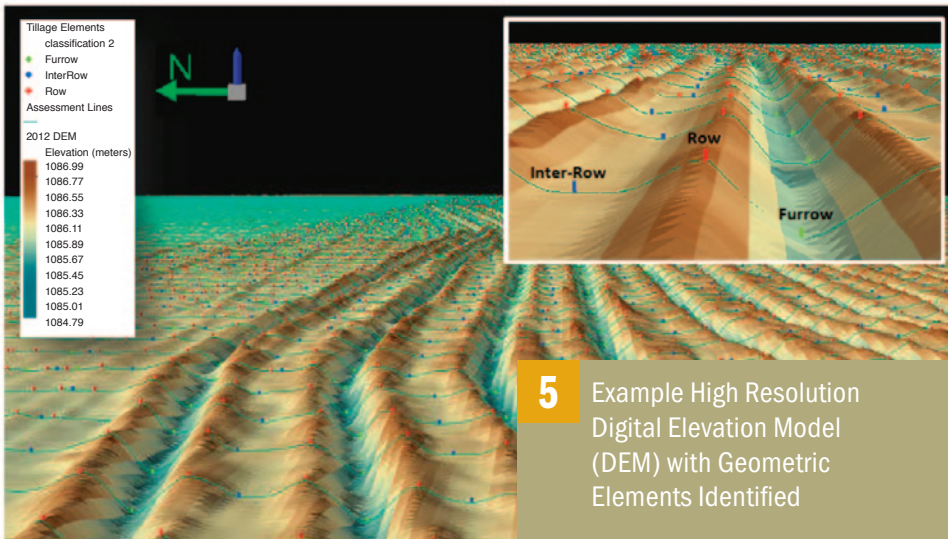
3 Surface Roughening at the Salton Sea Playa with a Switch Plow

4 Aerial view of Surface Roughening on the Salton Sea Playa

IMPLEMENTATION AND MONITORING

Implementation occurred in October 2015. It included obtaining and mobilizing equipment, and roughening the surface based on a GPS course **(Figures 3 and 4)**. The surface was tilled perpendicular to the predominant wind direction, and in a sinusoidal pattern to reduce saltation when the wind direction varies from perpendicular. In addition, a physical barrier was installed to prevent ATV access to the study area.

Monitoring the durability and longevity of roughness over time is essential to understanding which soils and equipment confer the greatest, most sustainable degree of roughness. Surface roughness will be monitored for one year (until October 2016) using remote sensing techniques **(Figure 5)**. Video monitoring also will be used to identify periods when other sources (e.g., unauthorized ATV traffic, nearby vehicle traffic, off-area windblown dust) impact the study area. A final report summarizing results of the pilot study will be completed by the end of 2016.



5 Example High Resolution Digital Elevation Model (DEM) with Geometric Elements Identified

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