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Air Pollution Control Officer

Owens Valley Planning Area Reasonable Further Progress

April 2018

Section 1.

Executive Summary

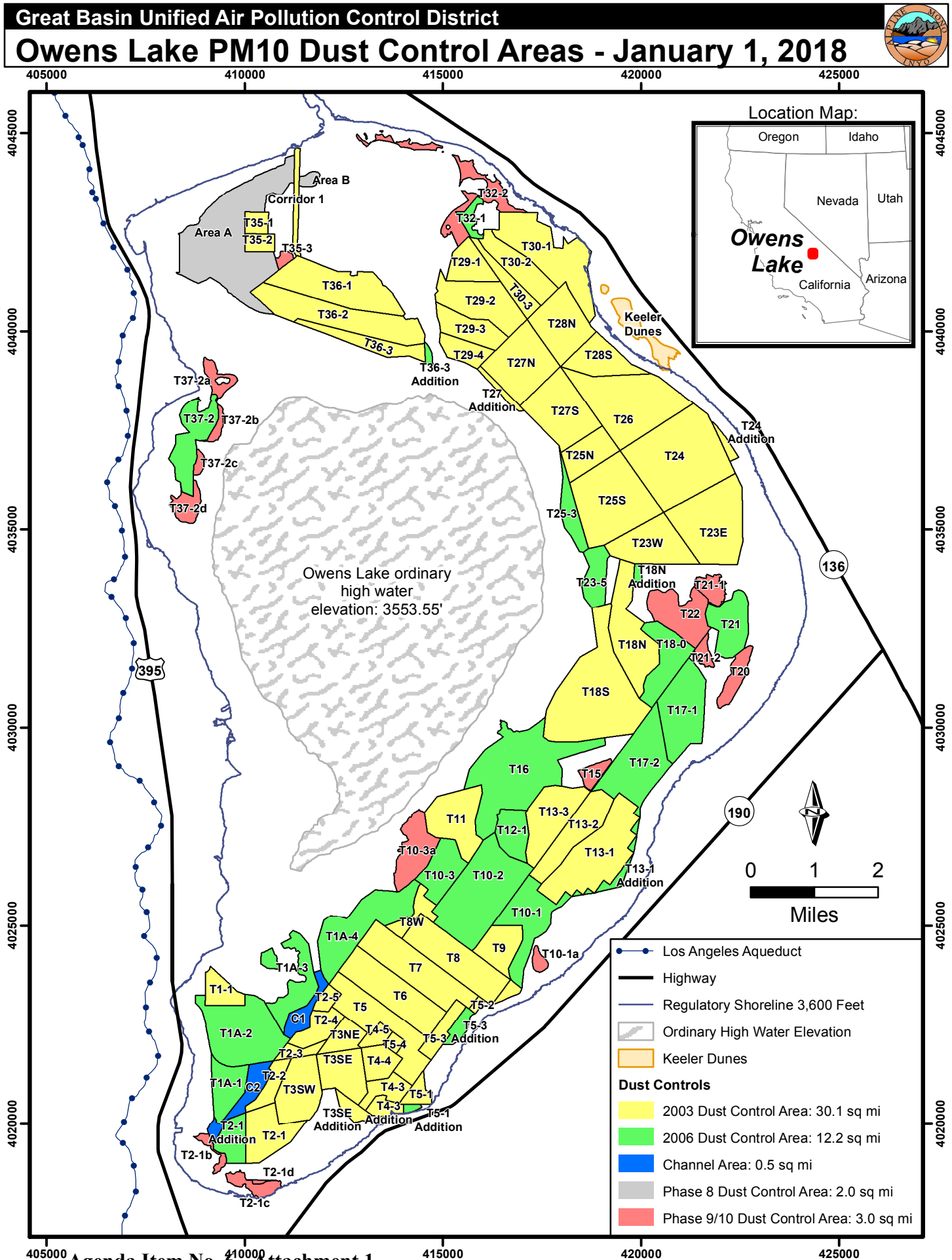
On April 13, 2016, the Great Basin Unified Air Pollution Control District (District) Governing Board adopted and approved;

1) District Governing Board Order #160413-01, authorized by California Health & Safety Code Section 42316, requiring the City of Los Angeles Department of Water and Power (City) to install, operate, and maintain additional dust control measures on the dried bed of Owens Lake
2) District Rule 433 - Control of Particulate Emissions at Owens Lake
3) 2016 Owens Valley PM10 Planning Area Demonstration of Attainment State Implementation Plan (2016 SIP)

Both the California Air Resources Board (CARB) and United States Environmental Protection Agency (USEPA) subsequently approved District Rule 433 and the 2016 SIP. Section 189(c)(2) of the Clean Air Act requires a demonstration to be submitted to the USEPA that each milestone has been met. The only milestone associated with the 2016 SIP was the completion of Phase 9/10 dust controls by December 31, 2017. Submission of this Reasonable Further Progress (RFP) Report to the USEPA details the fulfillment of that requirement.

Best Available Control Measures (BACM) have been applied to 47.8 of the 48.6 square miles (98.4%) of the required PM10 Control Areas (Rule 433, A.1.a. i-iv., Exhibit 1; Board Order #160413-01, section 1 and 3), for the control of particulate emissions at Owens Lake (Figure 1 – Owens Lake PM10 Dust Control Areas – January 1, 2018).

Of the required 3.62 square-mile Phase 9/10 Dust Control Area (DCA), 0.65 square miles were determined to meet Eligible Cultural Resource Area criteria (Rule 433, A.3.; Board Order #160413-01, paragraphs 2.A. and 3.A.) and will be mitigated on a deferred schedule due the presence of significant cultural resource areas if reordered for dust control in the future by the District Governing Board. This is in addition to 0.55 square miles of the 12.7 square miles within the 2006 Dust Control Area Phase 7 Project, determined to meet the same Eligible Cultural Resource Area criteria. Details and specifics of meeting the Phase 9/10 milestone are further addressed in the Phase 9/10 Milestone section of this document.



Agenda Item No. 6 - Attachment 1
Figure 1.

Although the primary focus of the RFP Report is the achievement of the Phase 9/10 Milestone, additional RFP content includes several Owens Lake project updates, including: the current status of the Phase 7a and Phase 7a Transition Areas, an update on the 2017 temporary emergency measures installed by the City to redirect the snowmelt runoff and protect at risk existing dust control infrastructure, the status of additional BACM Contingency Measures, Shallow Flood Wetness Cover Refinement Field Testing (SFWCRFT), and other BACM testing at Owens Lake. Each of these updates provides valuable information regarding the success of the 2016 SIP, District Board Order #160413-01, and District Rule 433, including information on the implementation, operation, maintenance, monitoring, and enforcement applied through or resulting from those actions. A comprehensive summary of BACM Shallow Flooding implementation, monitoring, and enforcement since January 1, 2015 through March 31, 2018 provides a thorough explanation of key provisional changes in the 2016 SIP and the ongoing work for successful compliance analyses and evaluations.

The District and the City have acknowledged the need to balance the requirements to control dust emissions and conserve water with the requirements to minimize impacts to cultural and biological resources. With dust controls at Owens Lake currently equal to 35.58 square miles of BACM Shallow Flooding (Table 1), (comprised of 29.5 square miles of Shallow Flooding, 3.55 square miles of Brine with BACM Shallow Flooding Backup, and 2.53 square miles of Tillage with BACM Shallow Flooding Backup) the balance of water conservation and dust control is critical to achieving the requirements contained in District Rule 433 and District Board Order #160413-01. Current BACM operational designations are shown in Figure 2 (Owens Lake Best Available Control Measures – January 1, 2018)

Table 1. Owens Lake Best Available Control Measures

Best Available Control Measure (BACM)		Acres	Square Miles
Gravel BACM		3,450	5.39
Managed Vegetation BACM		3,785	5.91
Minimum Dust Control Efficiency		572	0.89
Shallow Flooding BACM	Shallow Flooding BACM	18,879	29.5
	Brine with BACM Shallow Flooding Backup	2,272	3.55
	Tillage with BACM Shallow Flooding Backup	1,622	2.53
Undetermined (not controlled)		773	1.21
	Total Controlled	30,580	47.78
	Total Area	31,353	48.99

Owens Lake is the single largest dust control project in the United States of America, controlling fugitive PM10 (particulate matter less than 10 micron in aerodynamic diameter) dust emissions from the Nation's largest source area. Due to the enormity and complexity of control strategies across an immense unforgiving landscape, future challenges will inevitably materialize. Foreseeing and working diligently to understand these challenges as they present themselves will be instrumental in the sustainability of the Owens Lake Dust Mitigation Project (OLDMP).

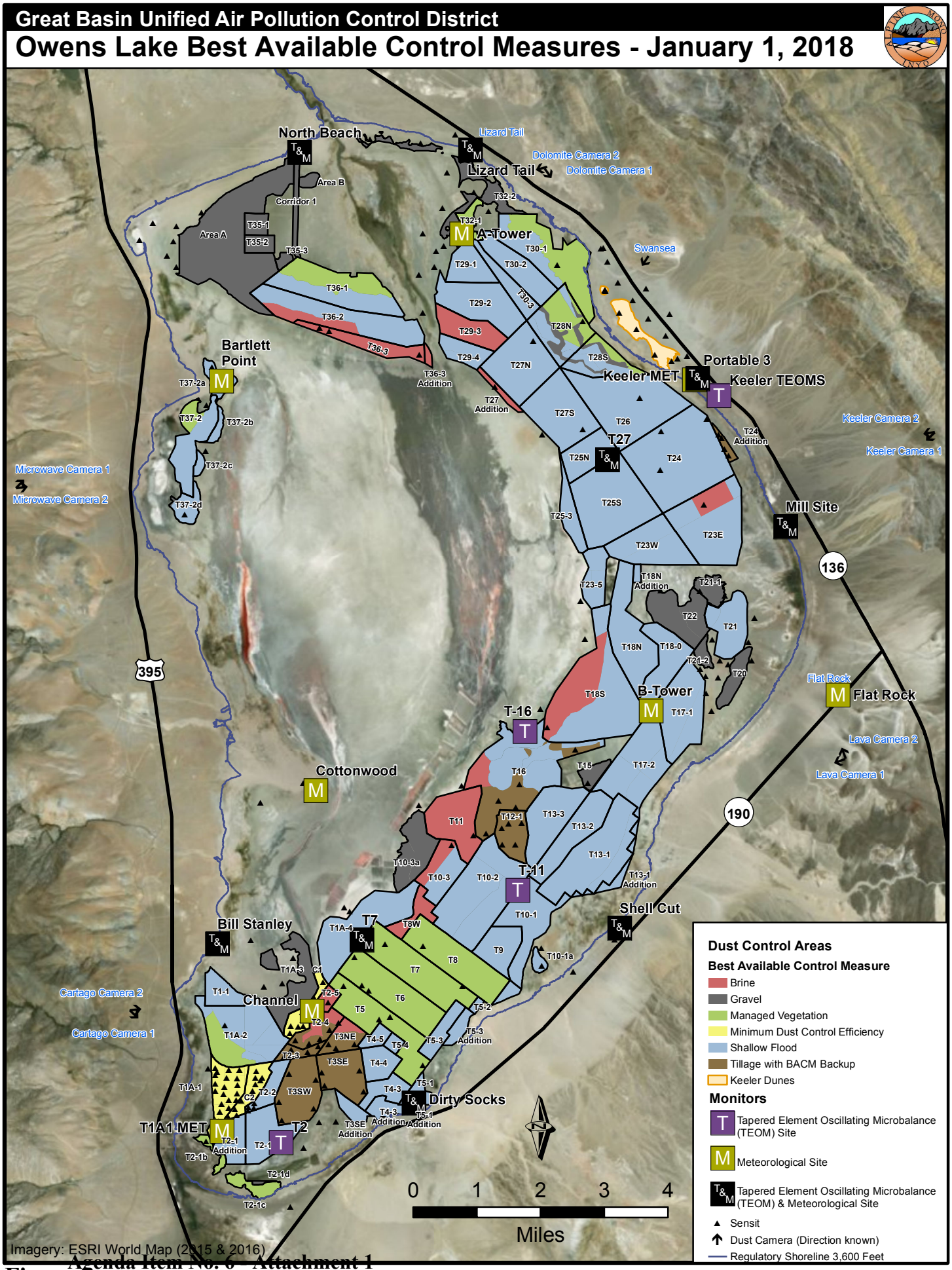

Great Basin Unified Air Pollution Control District
Owens Lake Best Available Control Measures - January 1, 2018
North Beach
Lizard Tail
Dolomite Camera 2
Dolomite Camera 1
Area B
Corridor 1
Area A
A-Tower
Swansea
Bartlett Point
Portable 3
Keeler MET
Keeler TEOMS
Keeler Camera 2
Keeler Camera 1
Microwave Camera 1
Microwave Camera 2
Mill Site
136
395
Flat Rock
B-Tower
T-16
Lava Camera 2
Lava Camera 1
Cottonwood
190
T-11
Shell Cut
Bill Stanley
T7
Cartago Camera 2
Cartago Camera 1
Channel
Dirty Socks
T1A1 MET
T2
Imagery: ESRI World Map (2015 & 2016)
0 1 2 3 4
Miles
Dust Control Areas
Best Available Control Measure
Brine
Gravel
Managed Vegetation
Minimum Dust Control Efficiency
Shallow Flood
Tillage with BACM Backup
Keeler Dunes
Monitors
Tapered Element Oscillating Microbalance (TEOM) Site
Meteorological Site
Tapered Element Oscillating Microbalance (TEOM) & Meteorological Site
Sensit
Dust Camera (Direction known)
Regulatory Shoreline 3,600 Feet

Figure 2.

Section 2.

Phase 9/10 Milestone

On December 30, 2014, a Stipulated Judgment (2014 SJ) was entered in favor of the District to provide for the City to continue operation of 45.0 square miles of existing Best Available Control Measure (BACM) PM10 control measures on Owens Lake and to implement 3.62 square miles of additional BACM control measures by December 31, 2017 in order to attain and maintain compliance with state and federal air quality standards (City of Los Angeles, et al. v California Air Resources Board, Sacramento County Superior Court, Case No. 34-2013-80001451-CU-WM-GDS). The additional 3.62 square miles of control measures were lakebed areas identified by the District in the 2011 and 2012 Supplemental Control Requirements Determinations and are collectively referred to as the Phase 9/10 DCAs (see Figure 1. Owens Lake PM10 Dust Control Areas – January 1, 2018).

The 2014 SJ also required the District to prepare a revision to the 2008 Owens Valley Planning Area State Implementation Plan (2008 SIP). This 2016 SIP revision incorporated all requirements of the 2008 SIP, every modification of the 2013 Amendment to the SIP (BO #130916-01), and all provisions contained in the 2014 SJ. The resulting 2016 SIP was approved and adopted along with District Board Order #160413-01, requiring the City to undertake measures to control PM10 emissions from the dried bed of Owens Lake, and District Rule 433 - Control of Particulate Emissions at Owens Lake, by the District Governing Board on April 13, 2016. District Rule 433 and the 2016 SIP were subsequently approved by the State of California Air Resources Board (CARB) on May 19, 2016 and approved by the US EPA with an effective date of April 12, 2017 (82 FR 13390). Section 189(c)(2) of the Clean Air Act requires a demonstration to be submitted to the USEPA that each milestone has been met. The only milestone associated with the 2016 SIP was the completion of Phase 9/10 DCAs by December 31, 2017.

Construction of the Phase 9/10 DCAs by the City officially began on February 17, 2016. Implementation of the control measures required construction of infrastructure for District-approved BACM including Managed Vegetation BACM, Shallow Flooding BACM, and Gravel Blanket BACM. Areas designated as Managed Vegetation BACM were required to have all infrastructure in place by December 31, 2017 but are allowed an additional two years, until December 31, 2019, to achieve full vegetation cover performance criteria compliance requirements.

Within the Phase 9/10 ordered control areas, 418 acres (0.65 square miles) were determined, either prior to or during construction, to contain eligible cultural resources and were avoided per the 2014 SJ and District Board Order #160413-01, extending procedures established in 2013 to the Phase 9/10 areas for the deferral of dust control implementation in areas containing eligible cultural resources as defined by the California Register of Historic Resources. Two separate areas containing sensitive resources, totaling 4.8 acres, which were not determined eligible under the established procedures, were avoided by the City during construction. The City submitted an application to the District in December 2017 for two minor boundary adjustments that per District Board Order #160413-01 included a demonstration by District approved modeling that such adjustments would not have an impact on the ability of the Phase 9/10 area to meet the PM10 control performance criteria. As a result, the District approved both minor boundary adjustments.

During construction, the City was unable to secure the necessary approvals from landowners to implement BACM on all of the ordered Phase 9/10 areas. In the northern portion of the lake, a private landowner did not allow access to a 0.48 acre parcel for dust controls. The City and the District agreed upon a like-kind dust mitigation area exchange as a solution. Gravel Blanket BACM was implemented in a 0.5 acre parcel in lieu of the original 0.48 acre parcel. In the southern portion of the lake, another private landowner initially did not allow access to a 12.4 acre parcel. However, with persistent and continued effort, the City was successfully able to secure a non-exclusive easement for implementation of dust control measures.

The majority (3.3 square miles or 91%) of the 3.62 square-mile Phase 9/10 DCAs are located on California State Lands property. At the request of the California State Lands Commission, during construction, and upon discovery of significant and unique Owens Lake paleontological resources, an 11.88 acre area in the Phase 9/10 project was avoided to protect the site from construction disturbance. A request by the land owner of subsequent monitoring for dust emissions and allowing for the possible removal of the paleontological artifacts from the area was deemed acceptable to the District. At this time, dust controls have not been implemented in the 11.88 acre area.

At the southern end of Owens Lake, the U.S. Bureau of Land Management (BLM) did not approve a right-of-way grant for 19 acres located within the ordered Phase 9/10 DCAs. The City is currently seeking relief from the California Superior Court under the Force Majeure provisions of the 2014 SJ. The District opposes the City's motion and a court hearing is currently scheduled for May 11, 2018.

Following the December 31, 2017 deadline for Phase 9/10 areas, the District began evaluations to determine whether the areas meet the required compliance criteria for each BACM as described in the 2016 SIP, District Board Order #160413-01, and District Rule 433. Acreages of Phase 9/10 BACM DCAs are presented in Table 2. In early January 2018, BACM Gravel Blanket control measures were verified and determined to be in compliance through aerial assessment and field inspections. These inspections also verified the installation and compliance of the like-kind exchange. BACM Shallow Flooding Phase 9/10 areas were determined to meet wetness cover requirements in January 2018 through the use of satellite imagery analysis. Following the initial performance evaluation, regular compliance evaluations occur for all BACM Shallow Flooding areas every eight days (from October 16 to June 30). The Phase 9/10 areas for which BACM Managed Vegetation was installed have two additional years, until December 31, 2019 when evaluation of vegetative cover and distribution will be conducted for compliance with required performance criteria. Infrastructure for BACM Managed Vegetation areas were required to be installed by December 31, 2017. All BACM Managed Vegetation areas, with the exception of the 19 acres for which the City is seeking relief under the Force Majeure clause, have the necessary infrastructure in place to be in compliance with the interim deadline.

Table 2. Acreage of Phase 9/10 BACM Dust Controls

Best Available Control Measure (BACM)	Phase 9/10 Area*
Shallow Flooding BACM	319.0 acres
Managed Vegetation BACM	147.5 acres
Gravel Blanket BACM	1,423.2 acres

** Acreage does not include approved avoidance areas*

Section 3.

Owens Lake Updates

Phase 7a and Phase 7a Transition Areas

In addition to December 31, 2017 marking the deadline for Phase 9/10 areas, the date also marked the final deadline for the 2.2 square miles of area encompassing Phase 7a and 7a Transition Areas where Managed Vegetation BACM was implemented.

The Phase 7a areas are 3.1 square miles of area identified in 2006 and ordered in 2008, 2011, and 2013. The Phase 7a Transition Areas consist of approximately 3.4 square miles of existing BACM Shallow Flooding DCAs that were selected by the City in 2013 to be transitioned to a hybrid BACM which includes Managed Vegetation BACM, BACM Gravel Blanket, and Brine BACM. Brine BACM is a subset of BACM Shallow Flooding that allows for the use of protective brine crusts with BACM shallow flooding backup. The deadline for both Phase 7a and Phase 7a transition areas, as set in the 2013 Stipulated Order of Abatement, was to install and fully operate all BACM by December 31, 2015, except for Managed Vegetation BACM, for which the City was required to achieve fully-compliant Managed Vegetation BACM by December 31, 2017.

Of the total 6.5 square miles encompassing Phase 7a and Phase 7a transition areas, 0.23 square miles (148 acres) of Phase 7a and 1.92 square miles (1,231 acres) of Phase 7a transition were implemented as Managed Vegetation BACM. The vegetation planted was heterogeneous, consisting of mixed locally-adapted plant varieties from a California State Lands Commission-approved list of 48 native species. All previous existing Managed Vegetation BACM areas had been homogenous, consisting of one saltgrass species, *Distichlis spicata*.

The District and the City conducted the necessary field sampling and associated remote sensing to conduct an evaluation of vegetative cover for the Phase 7a and 7a transition areas in the fall of 2017. Based on results of that evaluation, not all the Phase 7a and 7a transition areas designated as Managed Vegetation BACM meet the required vegetative cover and distribution criteria. The District is attempting to work with the City toward a resolution for areas not meeting the required performance criteria.

2017 Emergency Snowmelt Runoff

On March 20, 2017 the Mayor of the City of Los Angeles (City) issued an emergency declaration for areas adjacent to the City of Los Angeles' Aqueduct, its water gathering facilities, its water delivery facilities and its air quality control facilities located within Mono, Inyo, Kern, Los Angeles Counties and the City of Los Angeles in anticipation of threats posed by the predicted runoff from the above average snowpack for the 2016-2017 winter. The Inyo County Board of Supervisors followed suit on March 28, 2017 adopting a resolution proclaiming the existence of a local emergency for Inyo County resulting from the 2017 precipitation and projected spring runoff conditions. The Owens Valley Planning Area (OVPA) and Owens Lake Dust Mitigation Project (OLDMP) are geographically located entirely in Inyo County.

In previous exceptional runoff years (1969 and 1983), excess water beyond that which can be handled in the Los Angeles Aqueduct (LAA) was largely sent down the lower Owens River into

Owens Lake before dust controls were in place. Serious concerns of dust control infrastructure damage by large uncontrollable flows in the lower Owens River jeopardized the OLDMP.

The City prepared for potential impacts on Owens Lake by improving the water flow path of the Owens River through the Owens Lake delta, armoring the berms along the delta-facing edges of the T29 and T36 dust control areas (DCAs), protecting the western submains that deliver water to the T37-2 DCA, and lining approximately 12 miles of the mainline to protect it from damage associated with floodwater-induced wave action. Installation of all temporary emergency measures and all construction activities were completed in June 2017 at which time the City had already successfully spread a total of 120,872 acre-feet from Pleasant Valley to the LAA Filtration Plant in Sylmar.

Throughout the emergency snowmelt runoff period, the City utilized BACM Shallow Flooding areas as water spreading basins by applying greater amounts of water in DCAs than required to meet wetness cover compliance in order to provide more on-lake water storage capacity. By fall 2017, peak runoff had passed, higher flows through the Owens Lake delta were subsiding, no dust control areas had been negatively impacted, and all OLDMP infrastructure remained intact and undamaged. On September 21, 2017, the District recognized the efforts of the City in successfully accomplishing their stated mission by presenting the City of Los Angeles Department of Water and Power staff with an Acknowledgement of Achievement at the Owens Lake Dust Control Workshop.

Additional BACM Contingency Measures

The Clean Air Act Amendment of 1990 requires State Implementation Plans to provide contingency measures if the area fails to make reasonable further progress, to reach milestones, or to attain the national primary ambient air quality standards by the attainment date (CAA Section 172(c)(9) and 182(c)(9)). The 2016 SIP contingency measures are additional PM10 BACM control measures that will be implemented in case the 2016 SIP control strategy fails to bring the planning area into attainment or if milestones cannot be met.

Per the 2014 SJ, District Board Order #160413-01, and Rule 433, the District will continue to make Additional BACM Contingency Measure determinations at least once per year. These determinations include review as to whether there have been any monitored or modeled exceedances of the PM10 National Ambient Air Quality Standard (NAAQS) from areas on the Owens Lake bed that have not been included in the 2016 SIP control strategy or if implemented controls are not controlling emissions sufficiently to attain the NAAQS. On the basis of this determination, the District may order the City to implement BACM PM10 control measures on additional areas of Owens Lake as a contingency measure such that the total area where the City shall implement BACM PM10 controls is up to 53.4 square miles. These additional control areas need not be contiguous.

Review and analysis of monitored and modeled exceedances by the District was completed in 2016, for the period of July 1, 2014 to June 30, 2016, and in 2017, for the period from July 1, 2016 to June 30, 2017. These determinations have resulted in no additional areas ordered for BACM contingency measure controls to date.

Shallow Flooding Wetness Cover Refinement Field Testing

The 2016 SIP allows the City, with approval of the District's Air Pollution Control Officer (APCO), to transition from one approved BACM to another provided that, with the exceptions discussed below, the performance standard of one or the other BACM is met at all times during the transition. There are three specific exceptions provided for in Appendix D of the District Board Order #160413-01 that provide a procedure for the City to modify a BACM implemented on Owens Lake without meeting the BACM performance requirements. The three specific exceptions are: 1) Adjustments to existing BACM to research different performance standards to achieve the NAAQS at the regulatory shoreline, 2) Research on new BACM, and 3) Transition from one BACM to another that requires a time period where neither BACM's performance standards can be met.

Taking advantage of the provision that allows testing of BACM performance standards, the City worked from 2014-2017 to refine the surface wetness cover performance standard required for BACM Shallow Flooding. The performance standard for BACM Shallow Flooding is defined by a curve that relates the surface wetness cover across a control area to the control efficiency. This curve is referred to as the Shallow Flooding Control Efficiency Curve and determines the surface wetness cover required within a control area.

In the fall of 2014, the City applied to the APCO for a Shallow Flooding Wetness Cover Refinement Field Test (SFWCRFT) to refine the Shallow Flooding Control Efficiency Curve during the 2014-2015 dust year. The work plan and protocol were approved by the APCO and testing began in late spring 2015, after a delayed test setup by the City. Due to the late start of the test, an extension of the test period was approved until June 2016 to allow for testing through the 2015-2016 dust year. Review of the draft report on the results of the test, provided to the District in October 2016 and revised in November 2016, found that the testing was inconclusive, and that additional analysis and field testing would be needed to provide data for refining the Shallow Flooding Control Efficiency Curve to allow lower wetness cover conditions within Shallow Flooding BACM areas.

The City submitted a revised workplan for further testing of the Shallow Flooding Control Efficiency Curve in December 2016 for planned testing in the 2016-2017 dust year. However, in March 2017, the City notified the District that it was suspending the SFWCRFT due to the anticipated high runoff from record snowpack melt in the spring and summer of 2017. The City submitted a new workplan to resume the SFWCRFT in the 2017-2018 dust season which was approved by the APCO in April 2017 provided provision were met . The City was unwilling to modify the workplan as required by the District, resulting in authorization for 2017-2018 dust season being revoked by the APCO in September 2017. At this time, there is no current testing of BACM modifications being conducted on Owens Lake.

Best Available Control Measure (BACM) Testing

The 2016 SIP and District Board Order #160413-01 contain provisions for the City to test and develop new BACM for use on Owens Lake (Paragraph 13 and Attachment D of District Board Order #160413-01). During the period from April 13, 2016, when the District approved the 2016 SIP and District Board Order #160413-01, through the current time of March 2018, the City has not applied to the APCO for any testing of new BACM. However, in the spirit of the 2014 SJ, the District has conducted multiple tests of a potential new waterless BACM called Engineered Roughness Elements (ERE).

The ERE testing work has been conducted by researchers from the Desert Research Institute (DRI) in three phases of field testing and one wind tunnel test. The first two phases of field testing consisted of an array of approximately 1,600 solid elements placed in a regular staggered array in a 100-meter-by-100-meter area with a designed control efficiency of 90%. The first field phase (Phase 1) was conducted from March 2014 to June 2014 in the T1A-4 DCA. The Phase 1 ERE test had to be removed from the lake bed after only three months of operation due to its conflict with construction of the Phase 7a project. Due to the short length of the test, the results of the Phase 1 test were inconclusive. Phase 2 field testing was conducted from May 2015 to June 2016 in the T26 DCA. Results from the Phase 2 testing indicate that the overall target of 90% sand flux reduction was achieved in the interior of the array and recommended that further testing be conducted on a large scale to determine whether EREs can be used to achieve the 99% control efficiency needed for BACM on Owens Lake. Additionally, further work needs to be conducted to determine the most efficient element size and shape and to determine overall feasibility and cost of implementation.

In addition to the first two field tests, the District contracted with DRI to conduct laboratory wind tunnel testing of roughness elements with varying porosity and three-dimensional permeability finding that these elements provide more effective reduction in wind erosion than solid elements. Based on results of wind tunnel testing, the District is currently working with DRI to conduct the Phase 3 field test with a small array of Porous Roughness Elements (PRE). The Phase 3 testing began in April 2017 and will be concluded in June 2018. One of the constraints limiting the first two phases of field testing is that most of the suitable locations for the research on Owens Lake are part of the City's 48.6 square-mile dust control project and are required to meet specific performance standards. Thus, the Phase 3 testing is being conducted at Mono Lake where there is extensive uncontrolled lake bed exposed.

Section 4.
Summary of Implementation, Monitoring and Enforcement of BACM Shallow Flooding (January 1, 2015 - March 31, 2018)

Tillage with BACM Backup

The 2014 Stipulated Judgment allowed the City to implement Tillage with BACM Backup (TWB^2) as a dust control on Owens Lake. The control method is to till the lakebed soils deeply to create a rough surface in accordance with performance requirements established by the District. If an area no longer meets the required performance criteria BACM Shallow Flooding is to be used as the backup control method. The District may order reflooding based on failure to meet performance criteria. Additional performance thresholds are established to indicate when the City should perform maintenance activities.

The District has developed a variety of measurement methods for determining the dust control performance of the tilled areas. These methods include: sand motion monitoring, upwind-downwind PM_{10} monitoring, visual checks, light detection and ranging (LIDAR) measurements coupled with photogrammetry measurements and induced particulate emissions testing (IPET).

The City began installation of TWB^2 mitigation measures in March 2015 and continued installation through January 2016. The total area originally tilled was 2.93 square miles. Since the implementation of TWB^2, District staff has conducted over 100 field observations, IPET surveys, and unmanned aerial vehicle (UAV) mapping activities. Since implementation, two areas have been subject to reflood orders by the APCO. The ordered areas were T29 in December 2016 and T2-2 in February 2018. Due to the high levels of spring runoff in 2017, ten of the eleven TWB^2 areas required maintenance during the year. Three areas were leveled and reflooded and have remained flooded since. The total area currently being operated as TWB^2 is 2.51 square miles. A summary District enforcement and City operation and maintenance activities are provided in Table 3.

Table 3. Summary of Tillage with BACM Backup (TWB2) Enforcement and Maintenance

		Dust Control Season (October 15- June 1)		
		2015-2016	**2016-2017**	**2017-2018**
TWB2 Operation[1]	Number of Areas	11	11	9
	Total Area (acres)	2,220.5	1,963.2	1,621.6
Enforcement: District Ordered Refloods	Number of Areas Ordered	0	1	1
	Total Reflood Area (acres)	0	13.5	14.8
Maintenance[2]	Number of Areas	6	10	2
	Maintenance Area (acres)	243	1449	85

[1] Operational Designations provided by the City to the District

[2] Data on Maintenance activities based on information provided by the City

Brine with BACM Backup

The 2016 SIP and associated District Board Order #160413-01 and Rule 433 - Control of Particulate Emissions at Owens Lake, include a modification to the Shallow Flooding BACM where the wetness surface cover requirement can be replaced with thick stable surface salt crusts. The modified control measure is called Brine with BACM Backup or Brine BACM. The Brine BACM measure is modeled after the naturally occurring stable areas present on Owens Lake, such as the Brine Pond area, and thick salt deposits at the distal areas of spring and seep outflow.

Compliance of a Brine BACM area is evaluated based on extent and types of surface coverage as well whether the area is determined to be in a potentially emissive state. If a Brine BACM area fails to meet the required compliance criteria, then the APCO may issue either a maintenance order or a re-flood order to re-establish compliant conditions in the area. The performance requirements for Brine BACM areas are provided in Attachment E of District Board Order #160413-01.

The combined areal surface cover of the qualifying component stable surfaces within a Brine BACM area must be at least the percentage required for fully compliant Shallow Flooding BACM. Currently, Shallow Flooding areas requiring 99% emissions control efficiency must have 72% to 75% wetness cover, depending on their location. Similarly, Brine BACM areas requiring 99% control must have 72% to 75% total surface cover (depending on location) of a mix of three stable qualifying surfaces. For areas requiring less than 99% control, the surface coverage of component surfaces shall be determined by the current approved Shallow Flooding control efficiency curve. The three stable surfaces for Brine BACM compliance consist of: standing water, evaporite salt deposits greater or equal to 1.5 centimeters in thickness, and capillary brine salt crust greater or equal to 10 centimeters in thickness.

There are two potential enforcement options should a Brine BACM area, requiring 99% control efficiency, fail to meet the required surface cover requirements. The APCO may issue an order for maintenance activities in a Brine BACM area that does not meet the aggregate cover of qualifying surface provided the total compliant surface cover exceeds 60% or the proportion of capillary brine crust exceeds the allowed one-third of the total required cover, provided the area does not require re-flooding based on IPET results or sand flux conditions. If the total compliant surface cover for areas requiring 99% control falls below 60%, the APCO may issue a re-flood order.

Three evaluations of the surface coverage extent within Brine BACM areas have been performed since the measure was approved for use on Owens Lake in April 2016 and are summarized in Table 4 below. The first evaluation was conducted in April 2016 and included ten Brine BACM DCAs. In this evaluation, three of the Brine BACM areas failed to meet the minimum amount of surface cover of qualifying surfaces. Two of these areas were re-flooded in May 2016 in order to meet the required wetness cover for BACM Shallow Flooding in June 2016. The third area was part of a TwB2 area and was able to come into compliance with Brine BACM requirements by tilling 35 acres and adding them into the adjacent TWB2 area.

The next two surface cover compliance evaluations of Brine BACM areas were conducted in the fall of 2016 and the fall of 2017, at the beginning of each of those respective dust seasons. In the fall 2016 surface cover evaluation, all of the twelve Brine BACM areas were compliant, and met

the minimum extent of qualifying surfaces. In the fall 2017, fourteen Brine BACM DCAs were evaluated for compliance with surface cover performance standards. Nine of the evaluated DCAs passed the compliance criteria tests for surface coverage extent and five evaluated areas failed. In December 2017, the APCO issued a re-flood order for one of the failed areas and a maintenance order for the remaining four failed areas. Re-flooding was completed in January 2018 and all maintenance work was completed in March 2018. The areas will be reassessed for surface cover extent and compliance in spring 2018, as conditions allow.

In addition to evaluating the surface cover extent of stable surfaces across Brine BACM areas, the District also reviews the sand flux data recorded at sites located within each Brine BACM DCA and conducts visual observations and IPET evaluations, to determine whether surface conditions appear to be deteriorating and the areas are becoming potentially emissive. In the two years of Brine BACM operation, one Brine area had sand flux that exceeded the minimum allowed (5 grams/square centimeter per day) in November 2016. Verification of the elevated sand flux and potentially emissive surface conditions was conducted and the APCO issued a re-flood order for the area to the City in December 2016. The area met Shallow Flooding wetness cover requirements in January 2017.

Overall, enforcement action has been taken three times for Brine BACM areas since April 2016. The first was in May 2016 and required re-flooding of two areas and tillage of a portion of another by the end of the dust season in June 2016. The second enforcement action was taken in December 2016 in response to elevated sand flux in one of the Brine areas that required re-flooding of the area by January 2017. The third enforcement action took place in December 2017 requiring re-flooding of one area and maintenance work in four other areas that failed to meet the minimum required surface cover mix of water and stable salt crusts.

Table 4.
Summary of Brine with BACM Backup (Brine BACM) Enforcement and Maintenance

		Dust Control Season		
		2015-2016*	2016-2017	2017-2018
Brine Operation	Number of Areas	10	12	14
	Total Area (Acres)	924	1,135	1,827
Enforcement Actions				
Reflood Orders	Number of Areas Ordered	2	1	1
	Total Reflood Area (Acres)	168	31.9	49.5
Maintance Orders	Number of Areas	0	0	4
	Total Maintenance Area (Acres)	0	0	934

** Note: One DCA failed to meet surface cover requirements in the spring of 2016 but was not re-flooded. Instead a portion of the Brine area was tilled and included in the adjacent TWB2 DCA.*

Dynamic Water Management

The 2016 SIP for the OVPA and associated District Board Order #160413-01 and Rule 433 - Control of Particulate Emissions at Owens Lake, include a modification to the Shallow Flooding BACM where the annual shallow flood season is modified for select DCAs to allow a shorter duration of required wetness. This modified BACM control measure is called Dynamic Water Management (DWM), which is a joint effort between the City and the District to reduce water use on the lake, while maintaining sufficient emissions reductions to prevent exceedances of the federal PM10 Standard. The regulatory BACM Shallow Flood season is October 16 through June 30. The DWM Modified seasons for Shallow Flood BACM are:

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Standard Shallow Flood Season October 16 – June 30								
Modified Dust Season #1 October 16 – April 30								
		Modified Dust Season #2 December 1 – April 30						
				Mod. Dust Season #3 Jan 16 – Apr 30				

For eligible areas that are shallow flooded with sprinkler irrigation, the modified DWM seasons are adjusted to provide water two weeks earlier in the beginning of the dust season and one month later at the end of the dust season. The adjustments to the DWM seasons for sprinkler irrigated shallow flooding areas are:

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Standard Shallow Flood Season October 16 – June 30								
Sprinkler Modified Dust Season #1 October 16 – May 31								
		Sprinkler Modified Dust Season #2 November 16 – May 31						
			Sprinkler Mod. Dust Season #3, Jan 1 – May 31					

The DCAs eligible for DWM and their modified dust seasons are mapped on Board Order #160413-01, Exhibit 4. Prior to DWM implementation, the City is required to obtain appropriate approvals, leases and permits. To ensure DWM DCAs are sufficiently non-emissive before and after the Modified Dust Seasons, the City is required to operate sand motion monitoring sites in each DWM DCA. The number of sand motion monitoring sites (from which sand flux can be calculated) required varies with the extent of the areas of dried exposed lakebed. In accordance with Rule 433, Section E, the City shall re-flood a DWM area or sub-area when the sand flux exceeds 5.0 grams per square centimeter per day.

DWM implementation

Table 5a provides the number of eligible DWM acres available to LADWP by date in 2017-2018. The total acres of DWM in 2017-2018 was 6,622.5 acres. The actual number of acres implemented by LADWP can vary from the eligible area.

Table 5a. Eligible acres of DWM in 2017-2018

Dynamic Water Management (DWM) Modified Season	Eligible acres
DWM approved for late start on 12/1/2017	722.0 acres
DWM approved for late start on 1/16/2018	3,751.9 acres
DWM approved for early finish on 4/30/2018	6,622.5 acres

In The 2016-2017 and 2017-2018 Dust Years, the City operated 28 sand motion monitoring sites in DWM DCAs. The City provided sand flux data and reports monthly, as well as occasional intra-month data transmissions when an additional sand motion monitoring site sand collection was conducted. During the 2016-2017 and 2017-2018 Dust Years there were two days where the DWM sand flux exceeded 5.0 g/cm²/day, as shown in Table 5b.

Table 5b: 2016-2017 and 2017-2018 DWM Sand Flux > 5.0 g/cm²/day

Flux Date	Sand Flux Site	Daily Sand Flux (g/cm²/day)	Dust Control Area
16-Oct-2016	1902	6.75	T5-3
27-Nov-2017	1907	72.48	T10-2_a

As a result of the 16-Oct-2016 sand flux trigger exceedance at T5-3, the District issued an order to reflood. The City complied and the DCA was reflooded.

As a result of the 27-Nov-2017 sand flux trigger exceedance at T10-2a, District staff conducted a site inspection and found that a small subset, consisting of 15.8 acres of the DCA was emissive. The District ordered the City to implement BACM Shallow Flood on the 15.8 acres. The City complied and re-flooded the entire T10-2a DCA.

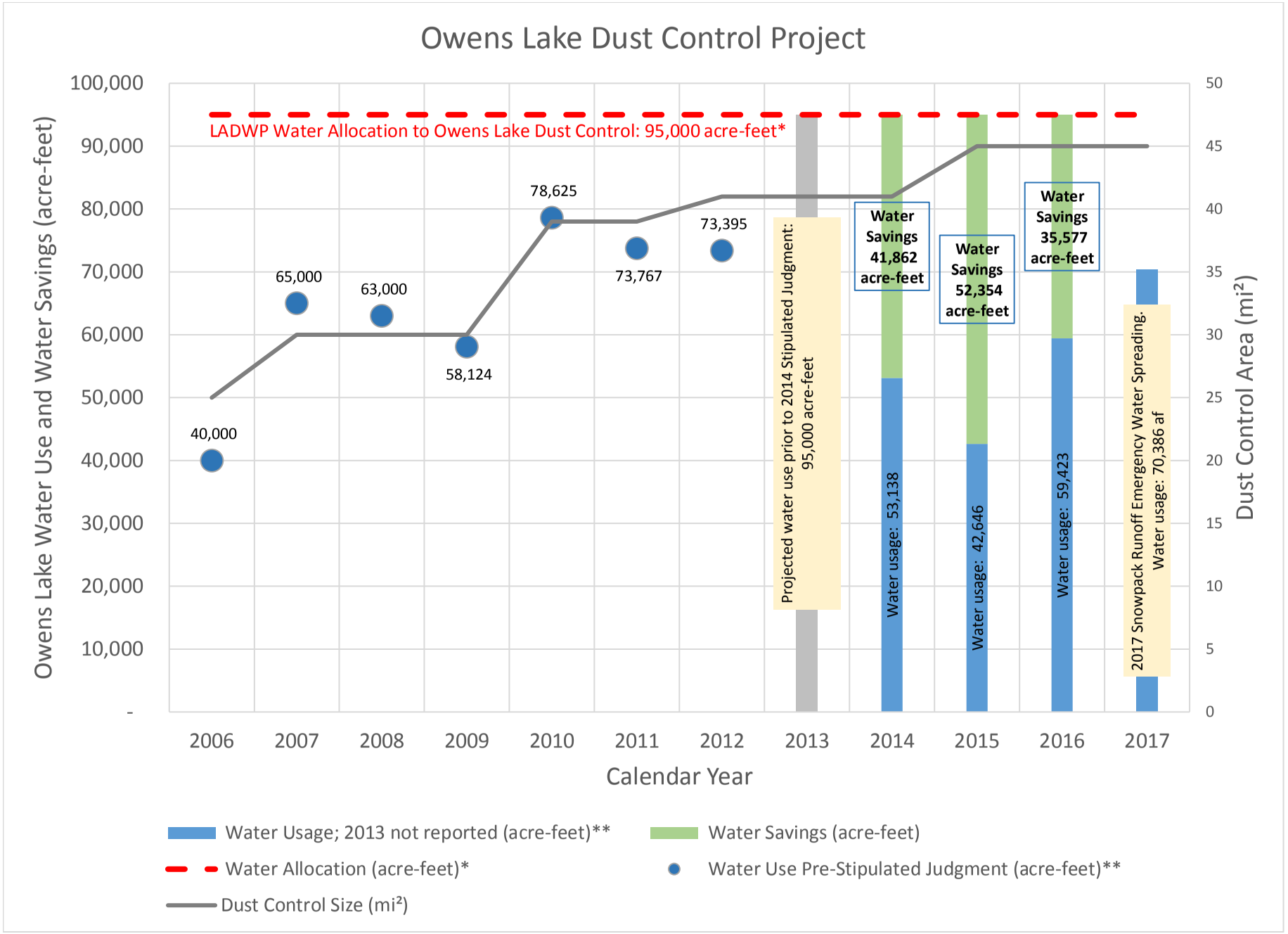
Section 5.

Water Conservation

When the Owens River was diverted from Owens Lake into the Los Angeles Aqueduct by the City of Los Angeles, the exposed bed of the lake dried and became the single largest source of PM10 air pollution in the history of the United States. This source of emissions of fine dust particles creates an enormous danger to public health. When implementation of BACM to control these emissions began, water was utilized for its immediate control effectiveness, environmental benefits, and availability. This project has significantly reduced the amount of harmful air pollution, with estimated emissions reductions totaling over 150,000,000 pounds annually, transforming some of the nation's dirtiest air into some of its cleanest. BACM performance evaluations are measured and confirmed on the surface of Owens Lake with ongoing monitoring as part of the District's Dust Identification program that has been in operation for almost 20 years. Regular BACM performance criteria compliance evaluations and analyses of lake-wide DCAs have proven performance success. To add to the complexity of the solution, water conservation measures have been integrated into BACM Shallow Flooding.

Variations to BACM Shallow Flooding presented in Section 4, Summary of BACM Shallow Flooding Implementation, Monitoring, and Enforcement, include Tillage with BACM Backup, Brine with BACM Backup, and Dynamic Water Management. These water conservation methodologies have been legally defined in the 2014 SJ, 2016 SIP, District Board Order #160413-01, and District Rule 433. The City, facing a water-use demand of 95,000 acre-feet of potable water for dust control at Owens Lake, through modification of District BACM requirements, has saved an average of 43,264 acre-feet of water over the three-year period spanning 2014 – 2017 (Figure 3, Water Conservation). This volume is enough water to serve 86,528 households for one year. In realized average cost savings for the City, the total dollar value is approximately $21 million per year, since 2014. On March 2, 2018, the District submitted a letter of support for the City of Los Angeles Department of Water and Power's application to the US Water Alliance for the US Water Prize in recognition of this significant achievement.

To date, compliance measurements of BACM Shallow Flooding DCAs consistently show an overall wetness cover well above the performance criteria requirements. Over time, with further infrastructure refinement and more efficient operations at Owens Lake, refining water use to the minimum legally required for dust control purposes has the potential to provide additional water conservation. Overcoming pressing water challenges while maintaining necessary and required dust controls to protect public health have been successful thus far, yet pose likely future challenges as well.



* Water allocation of 95,000 acre-feet from LADWP 2011 SCRD CARB appeal.
** Water usage from LADWP annual Performance Monitoring Plans

4/4/2018
PMP water use through 2017.xlsx

Section 6.

Future Challenges

The more obvious and looming challenge remains simple arithmetic. As of January 1, 2018, only 98.4% of DCAs requiring BACM installation, operation, and maintenance have been completed at Owens Lake by the City. For 2016 SIP attainment demonstration, dust control at 99%-100% efficiency on 48.6 square miles is necessary. The discrepancy between these two conditions have yet to be resolved.

The 1.2 square miles determined to meet the Eligible Cultural Resource Area requirements (Rule 433, A.3.; District Board Order #160413-01, paragraphs 2.A. and 3.A.) that are currently set aside in a state of avoidance and monitoring may be subject to future dust abatement orders. Progress on balancing the requirements to control dust emissions and conserve water with the requirement to minimize impacts to cultural and biological resources, has been minimal. On July 13, 2017, the District Governing Board passed a resolution (Resolution 2017-01) authorizing the APCO and staff to spearhead the nomination of Owens Lake as an archaeological district to the National Register of Historic Places and to collaborate with the Cultural Resources Task Force (CRTF) participants to develop any necessary agreements and plans in order to protect cultural resources while at the same time preventing delays in dust control implementation.

On August 31, 2017, the City announced that the September 11, 2017 CRTF meeting would be the last for the time being because there was no additional work that the City was in a position to undertake due to provisions in the legal agreement that created the CRTF. Disbanding the CRTF because the City had necessary legal release for dust mitigation requirements in Eligible Cultural Resource Areas for the time being, only delays remedies with no progress on solutions and postpones working towards acceptable resolutions prior to areas being re-ordered for control. The District is continuing to work with the Tribes, City, and the CRTF on a nomination of Owens Lake as an archaeological district and on development of a comprehensive management plan. This important shift to a more holistic approach to the issue is in alignment with the National Historic Preservation Act Section 106 as well as with recent California legislation including California Assembly Bill 52 recognizing Tribal Cultural Resources under the California Environmental Quality Act. The District is also working with the CRTF to begin development of dust controls that will be acceptable to the Tribes and other agencies for use in sensitive areas.

In February 2017, the City petitioned the District Hearing Board for a variance for 12.2 square miles of BACM Shallow Flooding DCAs at Owens Lake for removing those areas from service and repairing a water line. The variance was denied, but more importantly, the Hearing provided insight to important vulnerabilities of the tried-and-true Owens Lake dust control abatement program. The valuable lesson learned is that with no backup system and redundancy of infrastructure in place, minor breakdowns can result in extremely large areas of non-compliant BACM for periods of up to a month or more. Performing timely and costly routine maintenance and repairs of critical infrastructure at Owens Lake in the years to come will remain a difficult challenge, but achievable with commitment and vigilance on the part of all involved.

As experienced firsthand with the 2017 Emergency Snowmelt Runoff event, addressing dust control design insufficiencies in preparation for potential dynamic and extreme annual snowpack runoff scenarios will be a monumental challenge. The City is currently working toward developing an Owens Lake Master Plan, hopefully, with consideration of these types of events. Building a resilient and sustainable dust control program into any revision of the design of the OLDMP in preparation for these circumstances is a worthwhile endeavor.

Section 7.

Conclusion

Although this RFP Report primarily addresses events that have occurred during Phases 7, 7a, 9, and 10 of the Owens Lake Dust Mitigation Project, the span of the effort extends back to 1983 and the first Owens Valley SIP. Much work has been done on the part of the District and on the part of the City over these past 35 years. The parties have been at odds as often as they have been in cooperation over that period, nevertheless, the near-complete mitigation of the Owens Lake dust problem has been achieved. The accomplishment of constructing the largest public works project for dust mitigation in the world is no small success.

There will continue to be legal, cultural, and scientific challenges as the District, the City, the Tribes, and land owners move forward in completing the mitigation of those few small areas that remain. During construction of the Phase 9/10 OLDMP, dust emissions at Owens Lake continued to cause exceedance of the federal PM10 standard (Appendix A - 2016 and 2017 National Ambient Air Quality Exceedances with From-the lake and Off-Lake Wind Screens). With Phase 9/10 construction complete, the District will continue to vigilantly monitor and enforce BACM performance criteria in all DCAs to ensure operational success of the dust abatement mitigation measures. Off-Lake PM10 emissions continue to pose the largest challenge for PM10 attainment demonstration within the OVPA.

As resolved (Resolution No. 2016-03) by the Governing Board, the control strategy for the 2016 SIP includes an off-lake dust control in the Keeler Dunes (Appendix B – Keeler Dunes Dust Control Project). This project was funded by the City with a $10 million-dollar public benefit contribution and implemented by the District pursuant a 2013 settlement agreement between the District and the City on 194 acres to provide the necessary control efficiency to meet the NAAQS and California Ambient Air Quality Standard (CAAQS) for PM10 in the communities of Swansea and Keeler with scheduled completion in 2016. However, the original goal of the project has not been met and efforts to that end continue.

The constancy of the commitment of all parties to protect the public health of the people of the Owens Valley will drive us forward to fully accomplish the goal of clean air.

Appendix A

2016 and 2017 National Ambient Air Quality Exceedances (NAAQS) with From-the lake and Off-Lake Wind Screens

2016 NAAQS Owens Lake Shoreline PM10 Exceedances

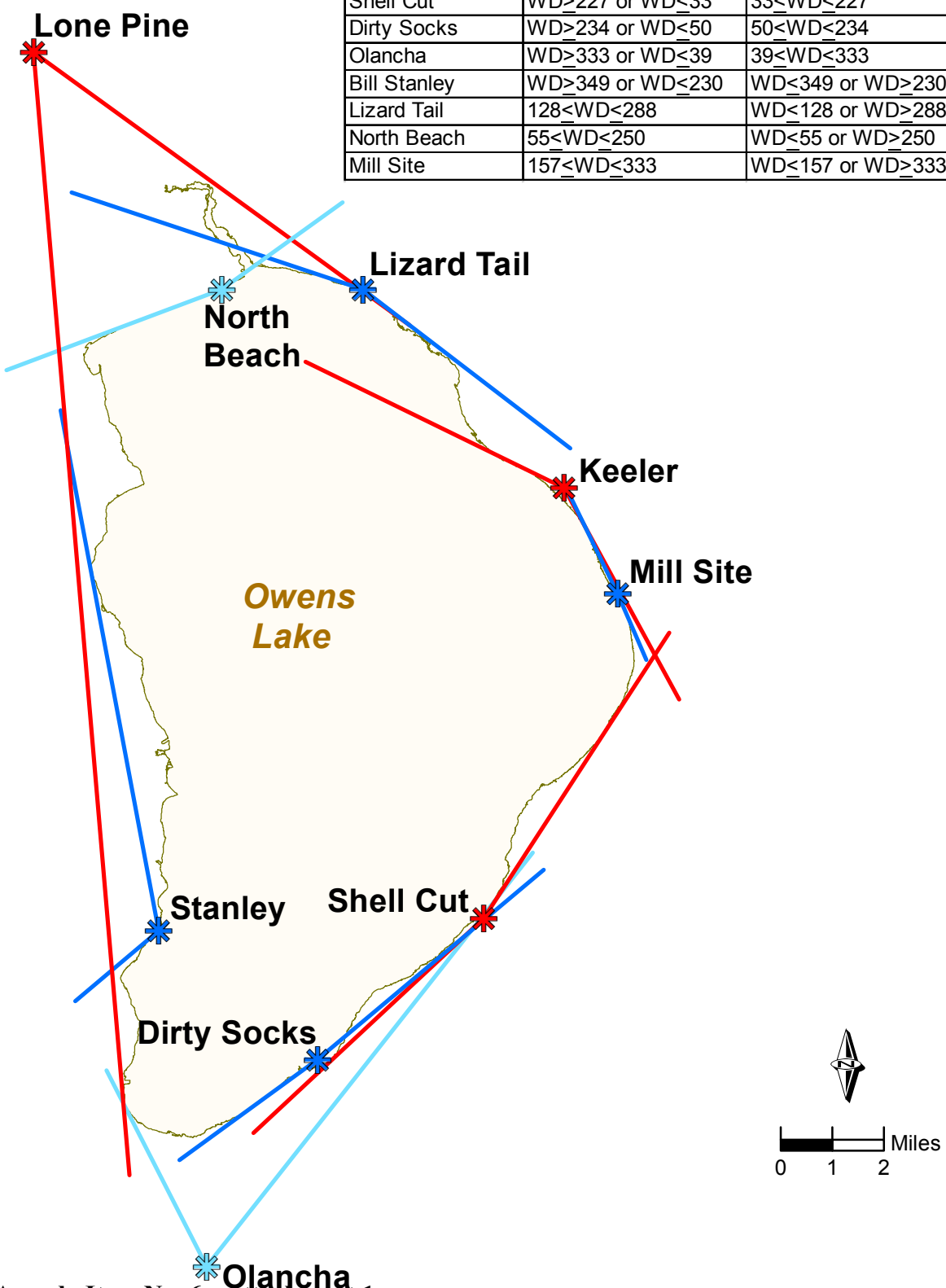
Exceedance Date	Monitor Site Name	Daily NAAQS PM10 Average	From-the-lake PM10 Concentration >150	Off-lake PM10 Concentration >150
1/30/2016	Olancha	279	No	Yes
	Stanley	166	No	Yes
2/1/2016	Keeler	236	No	Yes
3/5/2016	Lizard Tail	178	Yes	No
	Shell Cut	478	No	Yes
3/28/2016	Keeler	159	Yes	No
	North Beach	382	Yes	No
	Shell Cut	204	No	No
4/14/2016	Keeler	188	No	Yes
4/15/2016	Keeler	198	No	Yes
	North Beach	249	No	Yes
4/22/2016	Shell Cut	235	Yes	No
5/20/2016	Keeler	175	Yes	No
	Shell Cut	304	No	Yes
6/15/2016	Shell Cut	208	No	Yes
10/15/2016	Shell Cut	156	No	No
10/16/2016	Keeler	201	Yes	No
	Lizard Tail	198	No	No
	Lone Pine	227	No	Yes
	Olancha	530	No	Yes
	Shell Cut	202	No	Yes
10/17/2016	Shell Cut	326	No	Yes
10/30/2016	Dirty Socks	170	No	Yes
	Shell Cut	213	No	Yes
11/16/2016	Keeler	249	No	Yes
	Lizard Tail	446	No	Yes
	North Beach	284	No	Yes
	Olancha	246	No	Yes
12/2/2016	Olancha	161	Yes	No
12/15/2016	Shell Cut	227	No	Yes

2017 NAAQS Owens Lake Shoreline PM10 Exceedances

Exceedance Date	Monitor Site Name	Daily NAAQS PM10 Average	From-the-lake PM10 Concentration >150	Off-lake PM10 Concentration >150
3/4/2017	Lizard Tail	203	Yes	No
3/5/2017	Dirty Socks	768	No	No
	Keeler	171	Yes	No
	Lizard Tail	403	Yes	No
	Shell Cut	540	Yes	No
3/18/2017	Lizard Tail	178	Yes	No
3/24/2017	Lizard Tail	183	Yes	No
3/27/2017	Dirty Socks	235	Yes	No
	Olancha	218	Yes	No
3/30/2017	Dirty Socks	247	Yes	No
	Keeler	512	No	Yes
	Lizard Tail	1015	No	Yes
	Mill Site	397	Yes	No
	North Beach	555	No	Yes
	Olancha	334	Yes	No
	Shell Cut	279	Yes	No
3/31/2017	Dirty Socks	240	Yes	No
	Keeler	1170	No	Yes
	Lizard Tail	1222	No	Yes
	Mill Site	376	Yes	No
	North Beach	615	No	Yes
	Olancha	810	Yes	No
	Shell Cut	167	Yes	No
4/6/2017	Dirty Socks	182	No	No
	Lizard Tail	223	Yes	No
	North Beach	185	Yes	No
	Shell Cut	170	No	No
	Stanley	429	No	Yes
4/7/2017	Dirty Socks	2164	No	Yes
	Lizard Tail	297	Yes	No
	Lone Pine	261	Yes	No
	North Beach	218	Yes	No
	Shell Cut	784	No	Yes
4/12/2017	Dirty Socks	167	No	Yes
4/13/2017	Dirty Socks	213	No	Yes
	Shell Cut	483	No	Yes
6/11/2017	Keeler	205	No	No
9/21/2017	Shell Cut	229	No	Yes
10/8/2017	Keeler	269	No	Yes
	Olancha	282	Yes	No
11/27/2017	Dirty Socks	199	No	Yes
	Keeler	326	No	Yes
	Shell Cut	184	No	Yes
12/16/2017	Keeler	238	No	Yes
12/20/2017	Lizard Tail	192	No	No
	North Beach	172	No	No

Map of From-the-lake and Off-Lake Wind Screens

	From-the-Lake	Off-Lake	
PM_{10} Monitor Site	*Wind Dir.(Deg.)*	*Wind Dir.(Deg.)*	*Met Tower*
Lone Pine	126≤WD≤176	WD≤126 or WD≥176	Lone Pine
Keeler	151≤WD≤296	WD≤151 or WD≥296	Keeler
Shell Cut	WD≥227 or WD≤33	33≤WD≤227	Shell Cut
Dirty Socks	WD≥234 or WD≤50	50≤WD≤234	Dirty Socks
Olancha	WD≥333 or WD≤39	39≤WD≤333	Olancha
Bill Stanley	WD≥349 or WD≤230	WD≤349 or WD≥230	Bill Stanley
Lizard Tail	128≤WD≤288	WD≤128 or WD≥288	Lizard Tail
North Beach	55≤WD≤250	WD≤55 or WD≥250	North Beach
Mill Site	157≤WD≤333	WD≤157 or WD≥333	Mill Site



Appendix B

Keeler Dunes

Dust Control Project

Appendix B

Keeler Dunes Dust Control Project

The Keeler Dunes Dust Control Project is fundamentally a vegetation mitigation measure that encompasses an area of 194 acres above the Owens Lake shoreline (Figure B.1). The overall goal of the project is to reduce the PM10 impacts from the dunes through the establishment of a stable vegetated dune system. Similar systems can be found in many locations around Owens Lake and also existed at one time in the Keeler area. Additionally, the system must require minimal long-term operation and maintenance efforts. The initial project design was to establish control of the active dunes by strategic placement of an array of straw bales across the surface. Planting of native shrubs within the straw bale array ultimately provides the long-term control mechanism of the emissions from the dunes as the plants grow and mature and as the straw bales deteriorate.

The Keeler Dunes Dust Control Project began in 2014 and is now in its fourth year of work activities. The original design for the Keeler Dunes project included two phases of work: an initial build/plant/irrigate phase and a second and final plant/irrigate phase. The first phase lasted approximately 9-10 months starting in the fall of 2014 and consisted of the main construction activities, including building the irrigation system and initial bale placement, planting and irrigation). The second phase consisted of maintenance and operation activities ending in December 2017. It was thought that after three growing seasons the plants would be sufficiently established such that they would be able to survive with little to no long-term maintenance, that the irrigation system could be removed, and that the project would be self-sustaining. That thinking did not account for the ever-changing nature of the Owens Lake environs and the logistical issues associated with obtaining plants and straw for the project.

During the first year of the project, problems obtaining the straw (certified weed-free) and plant material delayed the original schedule. Straw procurement was completed in the fall of 2015 and the bale placement was finished in December of 2015. After several failed efforts by the original nursery to produce the required plants, a second nursery was contracted to grow the plant stock for the project for 2016 and 2017. The delays in obtaining the materials for the project combined with the unforeseen difficulties in plant establishment and greater difficulty in controlling the dunes in the southern portion of the project, than originally projected caused the entire project to fall behind schedule requiring additional work well beyond the original December 2017 project end date.

Several design changes have been made to improve overall project success. Some of the changes made include: using bale mounds (involving multiple bales) as roughness elements instead of single bales to better mimic the existing landscape and to more effectively mitigate the higher levels of sand motion found in the southern portion of the project; adding irrigation periods to provide the young plants with more water each year; and, adjusting planting schedules and cultivation methods. All of these changes have improved the level of dust control within the dunes and thus, the overall success of the project, but have further delayed the project end date.

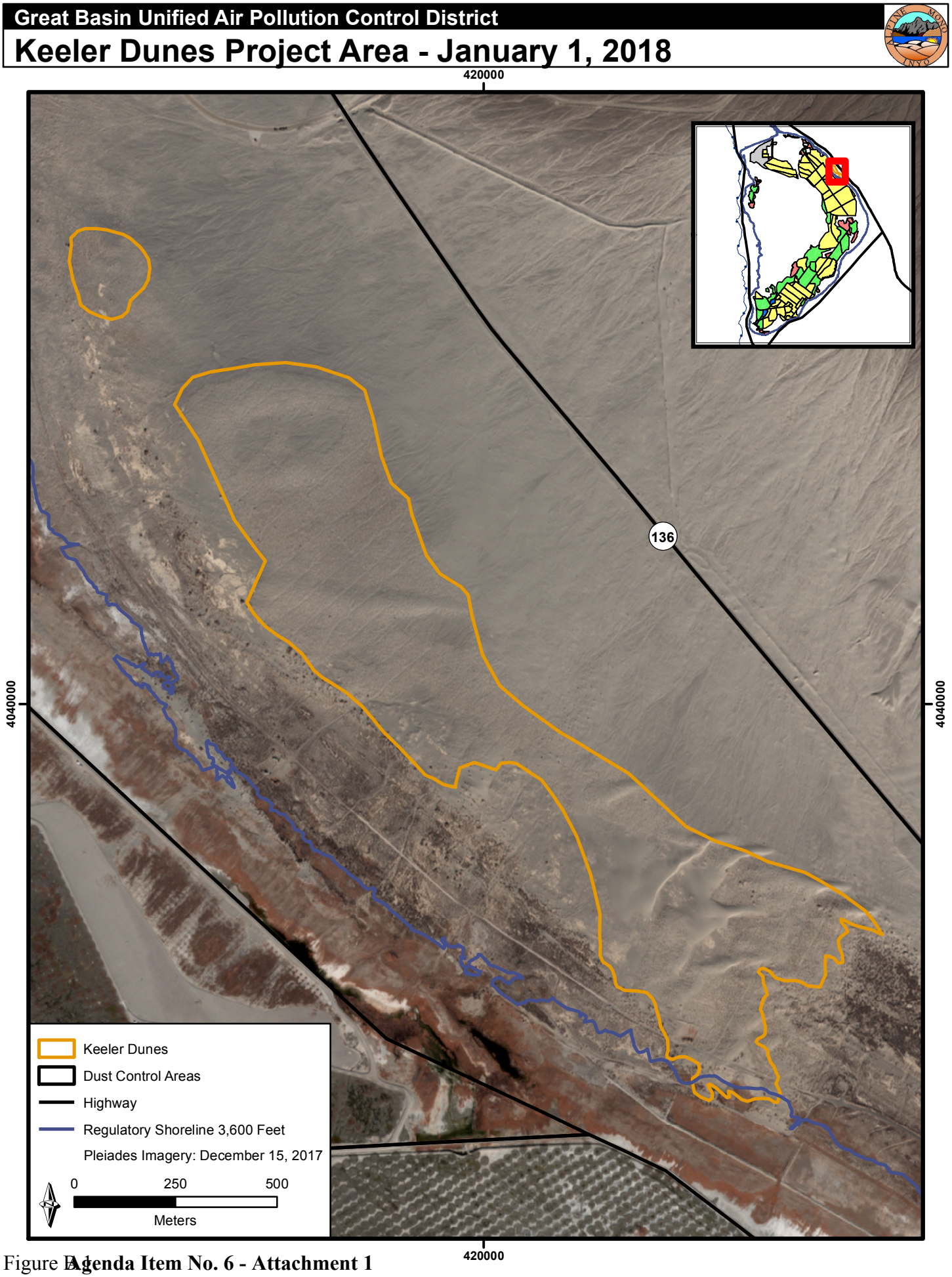

Great Basin Unified Air Pollution Control District
Keeler Dunes Project Area - January 1, 2018
420000
4040000
136
Keeler Dunes
Dust Control Areas
Highway
Regulatory Shoreline 3,600 Feet
Pleiades Imagery: December 15, 2017
0
250
500
Meters

Figure 1

Implementation of the Keeler Dunes Dust Control project has achieved an overall reduction in the number of exceedances of the PM10 Federal and California State standards and in the magnitude of PM10 concentrations monitored in the community of Keeler. However, the original goal of the project, reducing impacts from the Keeler Dunes until there are no exceedances of the Federal PM10 standard in the community of Keeler, has not been met and efforts to that end continue.

In 2016 the District committed an additional $1.2 million for the Keeler Dunes Dust Control Project in addition to the City of Los Angeles Department of Water and Power's 2013 Settlement Agreement Public Benefit Contribution of $10 million dollars. Ongoing project activities for the fourth year include: a fourth planting effort, bringing the total number of plants planted in the dunes to over 220,000; the addition of over 500 new bale mounds over 11 acres of the project; and continued and additional irrigation activities. The new projected end of the operation and irrigation work in the project is June 2019, an extension of 1.5 years beyond the original project design.