INYO COUNTY WATER DEPARTMENT

2013-2014 ANNUAL REPORT

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SECTION 1: EXECUTIVE SUMMARY

To protect the County's environment, citizens, and economy from adverse effects caused by activities relating to the extraction and use of water resources and to seek mitigation of any existing or future adverse effects resulting from such activities.

The Water Department's efforts during 2013-2014 were directed toward our core mission of assisting in the implementation of the County's water resources policies through the Inyo/Los Angeles Long-Term Water Agreement. Our work consists of four main activities: management of LADWP water-related activities through the Inyo/Los Angeles Technical Group and Standing Committee; environmental monitoring to assess impacts of LADWP activities and compliance with Water Agreement goals; planning, monitoring, implementation, and enhancement of mitigation measures associated with the Water Agreement; and disseminating information and fostering public involvement in County water policy.

The 1997 MOU between LADWP, Inyo County, California Department of Wildlife, California State Lands Commission, the Sierra Club, and the Owens Valley Committee requires that "*DWP and the County will prepare an annual report describing environmental conditions in the Owens Valley and studies, projects, and activities conducted under the Los Angeles Agreement and this MOU.*" This requirement has customarily been fulfilled by two reports, one issued by LADWP and one issued by the Water Department. The Water Department's Annual Report is a vehicle for disseminating information about conditions and activities related to the Inyo/Los Angeles Long-Term Water Agreement. The Water Agreement contains a number of provisions for collecting and sharing data, analyzing data, managing groundwater pumping, and mitigating negative effects of LADWP water management. We strive to make this report informative broadly for those wishing an overview of conditions and trends, and also to provide detailed data and analysis for those desiring to look closely at conditions in Owens Valley. In general, this report covers the 2013-14 runoff year (April 1, 2013 through March 31, 2014), but also contains material pertaining to LADWP's planned pumping for the 2014-15 runoff year. Our Water Agreement-related data collection and analysis falls into three categories: (1) management of LADWP water-related activities through the Inyo/Los Angeles Technical Group and Standing Committee; (2) environmental monitoring to assess impacts of LADWP activities and compliance with Water Agreement goals; and (3) planning, monitoring, implementation, and enhancement of mitigation measures associated with the Water Agreement. This annual report gives the results of these activities.

One area of complete agreement between LADWP and the County is that we need more snow in the Sierra Nevada and rain on the Owens Valley floor; 2012-2013 was dry, 2013-2014 was drier, and 2014-2015 promises to be drier yet. Runoff was 57% of normal runoff in 2012-2013, 54% of normal for 2013-2014, and is forecast to be 50% of normal for 2014-2015. If the forecast is correct, 2014-2015 will have the lowest runoff on record, and the three-year period ending in 2014-2015 will be the driest of any three consecutive years on record. The prevailing dry conditions reduce the amount of water available for export to Los Angeles and for use in Owens Valley. During 2013-2014, LADWP reported in-valley uses of 164,835 acre-feet (AF), including 44,000 AF of irrigation, 11,000 AF of stock water, 8,170 AF supplied to enhancement/mitigation projects, 8,370 AF for recreation and wildlife projects, 3,300 AF provided to Indian lands, 18,200 AF for the Lower Owens River Project, 1,625 AF for MOU Additional Mitigation Projects, and 67,900 AF for dust control at Owens Lake. We anticipate that in-valley uses during 2014-15 will be similar. During the period October 2011 through September 2012 (the most recent 12-month period that LADWP has reported to the Water Department) LADWP exported 89,616 AF from the eastern Sierra Nevada. LADWP projects that the Los Angeles Aqueduct will deliver 37,546 AF to Los Angeles during 2014-15, the lowest amount in the period 1935 to present.

Total pumping within the Owens Valley for 2013-14 was 78,880 AF, which was slightly less than the 79,070 AF planned. The Water Agreement and Green Book include procedures to calculate a pumping limit to prevent groundwater mining to ensure no long term decline in aquifer storage. The mining calculation is a comparison of pumping and recharge for each wellfield on a water year basis (October 1st through September 31st) for a 20 water year period. The 19.5 year total of actual pumping is subtracted from 20 years of estimated recharge to arrive at an estimated April-September pumping limit for each wellfield and Owens Valley as a whole. The estimate of groundwater recharge in the Owens Valley from the mining calculations was approximately 124,771 AF compared to 88,146 AF of pumping for the 2013 water year, and no wellfield was in violation of the groundwater mining provision. For the 2014 water year recharge is preliminarily estimated to be 98,850 AF and planned pumping in wellfields is not expected to violate the groundwater mining provision.

For 2014-15, because of successive dry years, the annual operations plan developed this April is for the six-month period from April through September 2014, and a second plan will be developed for the period October 2014 through March 2015. For the period April through September 2014, LADWP plans to pump 37,310 – 48,200 AF. The Water Department analyzed the proposed plan by reviewing existing water levels, projecting how those water levels would change based on various levels of pumping, looking at vegetation conditions. It is expected the planned levels of pumping will result in pumping for the entire 2013-14 runoff year of around 65,000 AF, which will result in water table changes ranging from increases of around two feet to decreases of around two feet.

The Water Agreement's ON/OFF method of managing LADWP pumping wells is based on monitoring sites where vegetation cover, soil water, and depth to the water table are measured, and the vegetation's water needs are compared to the available soil water. Pumping wells are linked to a monitoring site, and if sufficient soil water is present for vegetation at a site, then wells linked to that site may be pumped. As part of the monitoring effort, each month the Water Department measures depth to water and soil water at 25 monitoring sites in wellfields and 8 sites in control areas (areas unaffected by pumping). As of May 2014, six sites were in ON status, which when combined with wells exempt from ON/OFF and Bishop Cone wells would provide an annual pumping capacity of approximately 134,600 AF.

The Water Department's Saltcedar Control Program focus in 2013 was eradicating saltcedar in the water-spreading basins that lie just to the west of the Lower Owens River and river-riparian area. These spreading basins are a concern because they harbor mature saltcedar thickets that function as seed sources for the re-establishment of saltcedar within the LORP riparian corridor. Program staff cut and treated 176 acres in these spreading basins. Saltcedar treatment efforts over the past fifteen years have resulted in large amounts of woody slash accumulation in the LORP. Inyo County and Los Angeles reached agreement in 2012 on a slash treatment plan prepared by the Water Department. The preferred treatment method was stacking and burning slash. Following acquisition of required burn permits, in April 2012 the Water Department conducted test burns on several piles in spreading basins. The necessary equipment to provide the required water supply at burn sites was purchased during the intervening summer, and a more aggressive burn program began in the fall after burn restrictions were lifted. Approximately 120 piles of slash were burned during the 2013-14 field season by the Saltcedar Program crews and CalFire .

One on the roles of the Water Department is to monitor and report on the status of environmental mitigation projects in the Owens Valley. More than 62 projects, spread throughout the Valley, mitigate for a range of environmental impacts due to abandonment of irrigated agriculture and groundwater pumping in the Owens Valley. These improvements range in size from single-acre spring projects to the 78,000-acre Lower Owens River Project (LORP). The majority of these projects are described in the Water Agreement and associated 1991 EIR (*Water from the Owens Valley to Supply the Second Los Angeles Aqueduct*), and in the 1997 MOU (*Resolving conflicts and concern over the 1991 EIR*), which can be found on the Water Department website (www.inyowater.org). Highlights of 2013 include construction of the Independence Eastside Regreening Project, construction of the Big Pine Northeast Regreening Project, and modifications to the Van Norman Field Project to provide a source of water for the Lone Pine High School Farm. The majority of projects are being implemented successfully; however, a number of projects requiring revegetation are not meeting goals.

The Water Department monitors populations of Sidalcea covillei (Owens Valley checkerbloom) and Calochortus excavatus (Inyo County star tulip) each year in accordance with the provisions of the Long Term Water Agreement. Between 1993 and 2013, estimates for 24 S. covillei populations ranged from an average of 2 to 101,879 individuals; and estimates for 28 C. excavatus populations ranged from an average of 0 to 568 individuals. Population size estimates are based on counts or sampling and extrapolation of above-ground detections. Both species are perennial and exhibit dormancy in unfavorable years. Annual population size estimates are for the non-dormant portion of the population and are thus likely underestimates of the true population size, especially in dry years such as 2013.

Each year the Water Department monitors selected vegetation parcels within the valley to ensure that the Water Agreement's vegetation goals are met. The primary goal of this monitoring, according to the Green Book are to detect any *"significant decreases and changes in Owens Valley vegetation from conditions documented in 1984 to 1987"*. Vegetation live cover and species composition documented during the 1984-87 mapping effort were adopted as the baseline for comparison with each annual reinventory according to the Water Agreement. From September 1984 to Nov 1987, LADWP inventoried and mapped vegetation on 2126 vegetation parcels (223,168 acres). In the summer of 2013, the Water Department resampled 111 parcels using the line-point protocol described in the Green Book. At the valley-wide scale we evaluated plant community cover and composition in parcels affected by groundwater pumping and for parcels that were generally further east of the wellfields. At the individual parcel scale, we quantified the change in perennial vegetation cover since baseline, assessed whether the relative proportion of shrubs, grass, and herbaceous vegetation has changed compared to baseline, and quantified the temporal trends of grass and shrub proportion for each parcel. The monitoring results can be summarized by four main findings. First, during the time period 1992-2013, change in wellfield parcels was different from control parcels, with the decrease in wellfield parcel cover below that of the control group. Second, overall perennial cover and grass cover in wellfield parcels (as a group) in 2013 was significantly below baseline while perennial grass cover in control parcels was not significantly different from baseline. Third, within the wellfield parcels, the relative proportion of shrub cover has significantly increased. Finally at the individual parcel level of analysis, 20 wellfield parcels were significantly below their baseline cover values and 24 wellfield parcels underwent significant increases in shrub cover.

This Annual Report is a requirement of the 1997 MOU, which is one of the governing documents of the Inyo/Los Angeles Long-Term Water Agreement, so the focus of the Annual Report is on Water Department activities related to the LADWP and the Water Agreement. The Water Department is involved in a number of activities unrelated or indirectly related to the Water Agreement, including participation in the Inyo-Mono Integrated Regional Water Management Group, assistance to other County departments needing hydrologic analysis on projects they are working on (e.g., environmental analysis for permitting of solar, industrial, or residential developments), monitoring and management of projects permitted under Inyo County's groundwater ordinance, and development of a County-wide groundwater elevation monitoring network to meet State mandates. These activities are not covered in this Annual Report, but information on their status may be found on our web site http://www.inyowater.org.

Bob Harrington
Inyo County Water Department Director
June 1, 2013

SECTION 2: DIRECTOR'S REPORT 2013-2014

INYO COUNTY
WATER DEPARTMENT

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One of our principal activities during 2013-14 was to move toward concluding a multi-year effort to seek mitigation for impacts to vegetation in parcel Blackrock 94, located southwest of the Black Rock Fish Hatchery. This effort has been controversial, contentious, and involved extended hard work by the Water Department staff. To resolve this matter, Inyo County and Los Angeles exercised the Water Agreement's dispute resolution procedures. This Director's Report recounts the history of this dispute.

Vegetation parcel Blackrock 94 is a 333 acre groundwater-dependent alkali meadow parcel located southwest of the Black Rock Fish Hatchery, between Big Pine and Independence. The Inyo/Los Angeles Long Term Water Agreement requires that groundwater pumping be managed to avoid negative impacts to alkali meadows and other groundwater-dependent vegetation communities.

In July 2007, the Technical Group received a letter from the California Native Plant Society (CNPS) stating that vegetation degradation was proceeding rapidly in vegetation parcel Blackrock 94 in the Thibaut-Sawmill wellfield. The CNPS consequently recommended that pumping management in the area be altered to avoid an impact by reducing groundwater pumping at the Blackrock Fish Hatchery from its present level of about 12,000 acre-feet per year to 8,000 acre-feet per year. In response to this letter, the Technical Group agreed to examine the issue based on the Water Agreement's provisions for determination of a significant effect on the environment.

On February 3, 2011, the County presented a report to the Technical Group which alleged that "available factual and scientific data indicate that a measurable vegetation change since baseline has occurred in Blackrock 94, both in terms of vegetation cover and species composition." The County's report stated that the vegetation degradation was primarily attributable to changes in water availability resulting from groundwater pumping and reduced surface water diversions into the vicinity of Blackrock 94. LADWP's Technical Group members disagreed with the County's conclusions. For the Technical Group to find that an impact is significant, the Water Agreement requires that the Technical Group make three determinations: (1) that an alleged change in vegetation cover or composition is measurable, (2) if so, that the change is attributable to groundwater pumping or changes in surface water practices, and (3) if so, that the measurable change is significant.

During the following year, the Technical Group was unable to resolve the issue. On May 1, 2012, the County invoked the Water Agreement's dispute resolution process by requesting the Technical Group to resolve issues involving vegetation parcel Blackrock 94. The Technical Group was unable to resolve the issues and written reports were submitted to the Standing Committee explaining the issues raised by the County and LADWP. At its September 26, 2012 meeting, the Standing Committee was unable to resolve the issues regarding Blackrock 94.

In the months following the Standing Committee meeting, further attempts to resolve the issues in dispute were unsuccessful. The Water Agreement provides that if the Standing Committee is unable to resolve a dispute, a party may submit the dispute to a panel for mediation/temporary arbitration. By stipulation between the County and LADWP dated June 12, 2013, the County and LADWP informed the Standing Committee that the issues were being submitted to mediation/temporary arbitration under Section XXVI.C of the Water Agreement. On April 26, 2013, the County notified the LADWP of its intent to seek mediation/temporary arbitration. The Water Agreement provides for a three member mediation/temporary arbitration panel ("Arbitration Panel" or "Panel") with one member appointed by the County, one by LADWP, and a third member appointed by the two members appointed by the parties.

Pursuant to the stipulation by the parties, the requests for resolution submitted to mediation/temporary arbitration were:

The County's Request:

> The County requests a determination by the mediators/temporary arbitrators that LADWP's groundwater pumping and reductions in surface water diversions in the Blackrock 94 area have caused a measurable and significant change in the vegetation conditions in violation of the provisions of the LTWA. The County further requests the Panel to order that, as required by Section IV.A of the Water Agreement, reasonable and feasible mitigation of this significant impact be commenced within twelve (12) months of the determination by the mediators/temporary arbitrators that a significant effect on the environment has occurred at Blackrock 94.

The Requests by LADWP:

> With regard to the County's determination that there has been a measurable change in the environment at Blackrock 94, LADWP requests that the mediators/temporary arbitrators find that the County did not follow and conform to all the required rules, procedures and protocols in the Water Agreement, Green Book and 1991 EIR when it performed the vegetation monitoring, vegetation data collection, vegetation analysis (including the selection of analytical methods, assumptions made, and inputs used when conducting an analysis) and, therefore, the mediators/temporary arbitrators are unable to find that there has been a measurable change in the environment at Blackrock 94.
>
> and/or
>
> b. With regard to the County's determinations that a measurable, attributable, and significant effect has occurred at Blackrock 94, LADWP requests that the mediators/temporary arbitrators find that County did not follow and conform to required rules, procedures and protocols of the Water Agreement, Green Book, and 1991 EIR and, therefore, the

mediators/temporary arbitrators are unable to find that a measurable, attributable and significant effect has occurred at Blackrock 94.

In support of their positions, the parties submitted opening, response, and reply briefs to the Arbitration Panel. The Panel conducted a hearing on the dispute on October 9 and 10, 2013. On October 26, 2013, the Panel issued an “Interim Order and Award” which found that the parties had previously found that a measureable change in vegetation has occurred in Blackrock 94, but that the Technical Group had not adequately addressed the issues of attributability and significance.

The Interim Order and Award resolved several procedural matters that were in dispute. These matters included:

- Los Angeles contended that the EIR prohibits the Technical Group, the Standing Committee, and this Arbitration Panel from considering the impacts to vegetation in Blackrock 94 which the County identified in its February 2, 2011 report. The Panel found that the changes in vegetation identified in the County's report are not identified, or are not clearly identified, in the 1991 EIR as significant impacts or as future significant impacts of the project so as to give the decision makers sufficient knowledge of their existence or future existence. Because the impacts at Blackrock 94 that were identified in the County’s report were not clearly identified in the 1991 EIR or in the statement of overriding considerations adopted by Los Angeles at the time that it adopted the 1991 EIR, the Technical Group, the Standing Committee and the Arbitration Panel are not precluded from considering such impacts.

- Los Angeles contended the LTWA and Green Book prohibit the County from submitting any data, analysis or conclusion to the Technical Group, which is not the work product of the Technical Group. The Panel found that under the LTWA, each party to the LTWA may, independently of the other party, gather its own data, make its own analysis of such data, and arrive at its own conclusions regarding such data without such activities having to be approved by or done jointly as the Technical Group. Such independently gathered data, analysis and conclusions may be presented to and considered by the Technical Group.

- Section I.C. of the Green Book prescribes the three step process (measurability, attributability and significance) which must be used by the Technical Group to determine whether a significant effect has occurred. In the first step, the Technical Group is required to consider "all relevant factors. In the second step to determine attributability, the Technical Group is required to evaluate and consider "relevant' factors", which may include eight specified factors. Finally, in the third step the Technical Group is to consider eight identified factors in determining the degree of significance. The language of the LTWA and the Green Book does not prohibit the Technical Group from considering any factor which may be relevant when making a determination at each step of the three-step process. Of importance, it does not exclude from Technical Group consideration any data, analysis, or conclusions gathered and produced by either party independently and not as a Technical Group activity or as authorized by the Technical Group on its behalf.

- The LTWA and the Green Book provide a method through the Technical Group, Standing Committee, Arbitration Panel, and judicial decision making, whereby impacts on the environment caused by implementation of LADWP's groundwater pumping or changes in surface water management practices would be identified and analyzed, and if determined to be significant, would be mitigated. If the LTWA and Green Book cannot be interpreted and harmonized to serve this purpose, there will be a material failure of mitigation for LADWP's project. Interpreting Section III.D of the LTWA as creating the prohibition on independent monitoring and data analysis which LADWP argued for would give either party to the LTWA a de facto veto in the Technical Group and Standing Committee, which would prevent the LTWA from operating as the mitigation measure it was designed to be and would make the Dispute Resolution Process set forth in the LTWA superfluous. Interpretations of provisions of agreements which eviscerate the agreement's ability to operate as intended or which make major provisions of such agreement unnecessary, are to be avoided.

- Despite Los Angeles' contentions to the contrary, the 1984-87 vegetation inventory is the baseline for determining whether there have been changes or decreases in baseline vegetation conditions. To modify or adjust the 1984-87 inventory as baseline would require modification as provided for in Section XXV of the LTWA. Neither party has submitted evidence that the baseline has been so modified. Therefore, the Panel will not consider any changes to the baseline to take into consideration how it was made, or for the climatic conditions under which it was made.

- LADWP contends in its briefs that the vegetation monitoring and data collection activities performed by the County beginning in 1991, were not performed on behalf of, or authorized by the Technical Group, and were not performed in accordance with the procedures, and protocols established by the Technical Group for vegetation monitoring and data collection. The vegetation monitoring and data collection done by the County since 1991 was done on behalf of, and authorized by, the Technical Group; and that vegetation monitoring and data collection was done in substantial compliance with all of the requirements of the LTWA, Green Book, and procedures and protocols approved by the Technical Group. The County and LADWP as members of the Technical Group, at Technical Group meetings in 1992, implicitly authorized the County to monitor vegetation in the Owens Valley on behalf of the Technical Group, agreed that the vegetation data gathered by the County would be used to compare vegetation conditions to the baseline data, and that the staffs of both members of the Technical Group had agreed upon the procedures and protocols for such activities. For a period of over ten years, each year after the County had performed the vegetation monitoring and gathered the data, LADWP used this data without comment or objection, in its LADWP Annual Report on Conditions in the Owens Valley. The Technical Group was never asked to consider whether the vegetation monitoring and data collection done on its behalf by the County, was defective, flawed, incorrect, or not in accordance with the requirements of the LTWA, Green Book, or any Technical Group approved procedure or protocol.

- Los Angeles contended that the analysis should have been based on conditions in the Blackrock Vegetation and Wellfield Management Area. There are numerous references in the LTWA and The Green Book relating to parcels as areas of similar vegetation, soil types, and other characteristics which make them suitable for determining vegetation conditions, hydrologic conditions and changes in vegetation type. There is nothing in either of these two documents which restricts the application of the three step process to only Vegetation and Wellfield Management Areas.

The Interim Order and Award remanded the matter to the Technical Group so that it may "carry out its dispute resolution functions" and required both the City and the County to provide reports to the Technical Group addressing if the measurable change was attributable to LADWP's pumping operations and/or changes in LADWP’s past surface water management practices or if the measurable change was attributable to another factor or factors. The Interim Order and Award also required the Technical Group to consider the significance of the measurable change upon the vegetation of Blackrock 94 pursuant to the provisions of Water Agreement Section IV.B and Green Book Section I.C. The required reports were submitted to the Technical Group and Arbitration Panel. LADWP concluded that vegetation change in Blackrock 94 was attributable to periods of drought and fluctuations in wet/dry cycles, that LADWP’s surface water management practices had not changed, and that the vegetation change in the parcel was not significant. Despite the additional analysis and reports by both parties, the County still concluded that the observed vegetation change was principally due to groundwater pumping.

At its meeting on April 11, 2014, the Technical Group was unable to resolve the “attributability” and “significance” issues. In accordance with the Water Agreement and the Panel’s order, the issues were submitted to the Standing Committee for resolution. At its meeting on April 29, 2014, the Standing Committee agreed to recommend to their respective governing boards that each governing board adopt a resolution of the Blackrock 94 dispute that was tentatively agreed to by the Standing Committee.

By agreeing to the proposed resolution of the dispute, LADWP stressed that they do not admit or agree that any significant adverse decreases or changes to vegetation or the environment have occurred within vegetation parcel Blackrock 94 that are attributable to its groundwater pumping activities or attributable to any changes in surface water management practices by LADWP. LADWP further stated that they do not agree and do not believe that Inyo County provided any evidence that any changes in surface water management practices have occurred in the area of Blackrock 94. Further, LADWP does not endorse the findings contained in Inyo County’s February 2, 2011 report titled “Analysis of Conditions in Vegetation Parcel Blackrock 94.”

The following are the terms of the agreement reached by the Standing Committee:

I. Off-Site Enhancement to Preserve Alkali Meadows

A. To enhance certain alkali meadows by reversing the encroachment of woody shrubs into such meadows, LADWP will perform prescribed burns on approximately 665 acres of shrub encroached alkali meadows in the Owens Valley.

B. The Technical Group will identify areas of alkali meadows where the woody shrub proportion has increased to the point that the area will carry a burn and where sufficient grasses exist on the site that would make a burn beneficial. From the areas identified by the Technical Group, the Technical Group will select the 665 acres that will be burned.

C. Recognizing CALFIRE and GBAPCD will require that regulatory permits be issued prior to burning, burning the entire 665 acres may take several years; however, if permits and conditions allow, LADWP will conduct the burning of the 665 acres within 5 years of the date of this Settlement Agreement.

D. The burning of the 665 acres will be conducted as described in LADWP's land management plans.

II. Groundwater Pumping From Wells W351 and W356

LADWP will immediately reduce the level of pumping from wells W351 and W356, which supply the Blackrock Fish Hatchery, to a total amount not to exceed approximately 8,000 acre-feet per year.

III. Vegetation Monitoring - Measurability

The Parties will enter into a facilitated process with the Ecological Society of America (ESA) to develop and implement vegetation monitoring procedures and detailed analytical procedures for determining if a measurable change in vegetation has occurred, is occurring, or will occur. The monitoring methods and procedures shall be able to compare vegetation cover and composition to the vegetation cover and composition obtained during LADWP's initial vegetation inventory between 1984 and 1987. The monitoring methods and analytical procedures shall also be able to distinguish and recognize trends in vegetation cover and composition. The Parties shall use the vegetation monitoring and analytical procedures in determining if any change in vegetation cover or composition is measurable pursuant to Water Agreement IV.B and Green Book Section I.C.

IV. Blackrock 94 — Time Out on New Disputes

Both Parties agree not to initiate a dispute involving a decrease or change in vegetation type at Blackrock 94 for a period of at least four (4) years.

V. Arbitrators Decision

The October 21, 2014 Interim Order and Award of the Arbitration Panel shall be deemed a final decision by the Parties, the Parties waive their right to submit the decision to the Superior Court Judge as provided in Section XXVI.D of the Water Agreement and, as provided in Section XXVI.C of the Water Agreement, the Parties shall implement and follow the decision of the Arbitration Panel.

VI. CEQA

LADWP will prepare and certify all appropriate documents in compliance with California Environmental Quality Act (CEQA). LADWP shall act as the CEQA lead agency and the County of Inyo shall be the CEQA responsible agency. At least ten (10) days prior to consideration by the LADWP Board of Water and Power Commissioners, LADWP will provide a draft of its CEQA document to the County for review and comment.

VII. Effective Date

Approval of this Resolution of Dispute by the Standing Committee shall be deemed provisional and will become final following its approval by the Inyo County Board of Supervisors and the LADWP Board of Water and Power Commissioners. In the event that this Resolution of Dispute is not approved by June 30, 2014 by both the Inyo County Board of Supervisors and by the LADWP Board of Water and Power Commissioners, the Parties shall notify the Arbitration Panel. Upon notification, the Arbitration

Panel shall immediately schedule a final hearing on the Blackrock 94 Dispute to be held at its earliest convenience.

VIII. Successful CEQA Challenge

In the event that the CEQA document addressing this Resolution of Dispute is found to be legally inadequate by a court, or this Resolution of Dispute is successfully challenged by a third party in court under any other legal basis, this Resolution of Dispute shall be deemed unenforceable and its terms deemed null and void, unless otherwise agreed upon by the Parties. In such an event, the Parties shall request that the Arbitration Panel schedule the Blackrock 94 Dispute for a final hearing. The decision of the Arbitration Panel shall be fully appealable as provided in the Dispute Resolution procedures contained in the Water Agreement, including the appeal of any interim orders issued by the Arbitration Panel.

IX. Defense of CEQA Challenge

In the event that the legal adequacy of the CEQA document addressing this Resolution is challenged in Court, the Parties shall cooperatively work together in the defense of the document, each Party shall bear its own legal costs, and in the event that a court finds the document to be legally inadequate and awards attorney's fees and other costs, each Party shall pay one-half of the award.

X. Termination of Blackrock 94 Dispute

Upon approval of this Resolution by the Board of Water and Power Commissioners and by the Inyo County Board of Supervisors, subject to Section VIII, the Parties will inform the Arbitration Panel that the issues in dispute concerning Blackrock 94 have been resolved.

The proposed resolution has a number of elements that are favorable to the County. Burning of mixed shrub/grass communities where the water table is high has been a successful method of enhancing grass cover in Owens Valley. Improvement of groundwater-dependent meadows by burning has been used as a mitigation measure to compensate a lessee for loss of grazing. Reducing pumping at the Black Rock Hatchery will reduce the pumping stress on the water table at Blackrock 94. The proposed reduction is similar to that proposed by the California Native Plant Society in 2007. Agreeing to set aside any disputes over vegetation conditions at Blackrock 94 for four years will allow time to observe the effect of decreased pumping on water availability in the plant root zone, and the effect of water availability on vegetation. By agreeing to not challenge the Arbitration Panel's October 21, 2014 Interim Order and Award, the determinations of the Panel are preserved and become permanently applicable to future Technical Group work. Several of the findings of the Interim Order and Award are in the County's favor, as outlined above.

A concern with the proposed resolution is whether it will have a negative effect on the fishery by reducing fish production at Black Rock Fish Hatchery. The Department of Fish and Wildlife believes that reducing pumping at the Black Rock Hatchery will likely reduce fish production at that facility, at least in the short term; however, by shifting production to other facilities, reducing pumping at the hatchery will not reduce overall fish production in the eastern Sierra. The Department of Fish and Wildlife, in a letter to LADWP has represented that if pumping at the Black Rock Hatchery were reduced to 8,000 acre-feet per year, "In the near term historic fish production for eastern Sierra waters will be maintained by maximizing full production capabilities at Fish Springs Hatchery. At the Department's discretion this may require utilization of infrastructure improvement such as oxygen supplementation.

In the long term and dependent on sufficient funding, facility improvement at Black Rock Hatchery may allow higher fish production while not exceeding the 8,000 acre-foot pumping limitation."

Another concern with the proposed settlement is that LADWP does not admit to any responsibility for vegetation decline in Blackrock 94. In order to pursue the dispute at the Arbitration Panel to the point where LADWP was found to be responsible for mitigating the effects alleged by the County, we would need to persuade the Panel that the effects on vegetation were caused by LADWP water management and that the effects were significant. In the event the Panel made such a finding, the Panel's findings (including the Interim Order and Award) would be subject to appeal at the Superior Court. While staff believes that the evidence presented to the Arbitration Panel shows that pumping is the primary cause of vegetation change in the parcel, LADWP has presented lengthy arguments that the changes are due to varying water availability due to wet/dry climatological cycles. It is uncertain how the Panel would weigh the arguments put forth by both parties, and the Panel encouraged the parties to resolve the dispute on their own.

In developing this proposed resolution, the County was criticized at Technical Group meetings for not allowing adequate public review of the proposal. The Water Department will hold a workshop before the Board of Supervisors on May 13, 2014 that will provide information on the proposed resolution and provide a forum for any interested parties to address the Board with their concerns. There will be further opportunity for public input when the Board pf Supervisors considers approval of the resolution. The steps toward final approval are for LADWP to complete a CEQA analysis of the proposed resolution, they will provide the County ten days to review the CEQA analysis, the LADWP Board of Water and Power Commissioners will consider adoption of the CEQA document and resolution, and if they make those approvals, then the Board of Supervisors will consider adoption of the CEQA document and resolution. The proposed resolution requires that the approval process be complete by June 30, 2014. If not approved by then, the matter returns to the Arbitration Panel.

SECTION 3: PUMPING MANAGEMENT AND GROUNDWATER CONDITIONS

LADWP prepares an operations plan each April in accordance with the Water Agreement. The plan describes runoff conditions, wellfield pumping, water uses in the Valley, and export to Los Angeles.

ICWD and LADWP monitor groundwater levels throughout the Valley.

Annual Pumping Plans

LADWP prepares an operations plan each April for the twelve month runoff year beginning April 1st in accordance with the Water Agreement. In the event of two consecutive dry years when actual and forecasted Owens Valley runoff for the April to September period are below normal and average less than 75 percent of normal, LADWP prepares two six-month plans. The 2014-15 runoff year qualifies under the consecutive drought year provisions of the Agreement. The first plan describes operations from April 1st to September 30th, and the second plan covers the October 1st to March 31st period. The plans are submitted to Inyo County by April 20th and October 20th. Each plan includes projected amounts for runoff, pumping, reservoir storage, water used in the Owens Valley, and water exported to Los Angeles. Also, the plans must comply with the pumping well On/Off provisions of the Agreement based on soil water and vegetation measurements. Inyo County reviews the proposed operations plans which usually includes performing an analysis of the effects of LADWP operations on groundwater levels in the Valley. Following a Technical Group meeting to resolve concerns raised by the County, LADWP finalizes the plans.

In accordance with the Water Agreement, LADWP provided a pumping plan for the period October, 2013-March, 2014 on October 18. The proposed annual pumping amounts and the estimated amounts analyzed by the ICWD in April to evaluate LADWP's proposed pumping were similar, and the ICWD concluded that it was not necessary to revise its evaluation prepared in April.

2013-14 Pumping Plan

Total pumping within the Owens Valley for 2012-13 was 78,880 acre-feet (ac-ft), which was slightly less than the planned pumping of 79,069 ac-ft (Table 3.1). In most wellfields, actual pumping was within the planned range, In the Symmes-Shepherd Wellfield actual pumping was 234 ac-ft above the range planned. In the Big Pine Wellfield actual pumping was 466 ac-ft above the range planned. In the Taboose-Aberdeen Wellfield actual pumping was 743 ac-ft above the range planned. In Taboose-Aberdeen, the Technical Group granted a temporary exemption to one well to provide water to prevent a fish kill in Blackrock ditch and at the Blackrock Hatchery.

Runoff from the Owens River watershed during the 2013-14 runoff year was forecast to be 220,900 ac-ft or 54% of normal. The actual runoff value will be available later in 2014 when the all the surface water measurements that constitute the sum have been tabulated. The effect of pumping and runoff in 2013-14 on water levels in several test wells is shown in Table 3.2 and discussed below.

Table 3.1. Planned and LADWP actual pumping by wellfield for the 2013-14 runoff-year. Estimated planned pumping minimum and maximum for the entire 2013-14 runoff-year as well as absolute minimum pumping prepared by Inyo County to analyze the annual effect on water levels are also included.

Wellfield	Estimated Minimum Pumping (ac-ft)	Planned Pumping for Apr-Sept. 2013-2014 (ac-ft)	Planned 2013-14 Pumping (ac-ft)	Actual Pumping (ac-ft)	Inyo Estimate for 2013-14 (ac-ft)
Laws	6,460	5,760-7,200	6,126	6,199	7,900
Bishop	10,600	9,000	11,887	11,433	11,103
Big Pine	20,400	11,500-12,900	23,516	23,866	25,697
Taboose-Aberdeen	300	4,200-7380	9,186	9,593	7,720
Thibaut-Sawmill	12,200	6,600	12,693	12,717	13,200
Ind.-Oak	5,900	5,280-6,600	9,886	9,519	7,030
Symmes-Shepherd	1,200	3,100	3,331	3,334	3,175
Bairs-Georges	500	1,320	1,610	1,510	1,420
Lone Pine	775	560	834	709	755
Total	58,335	47,370-54,660	79,069	78,880	78,000

The Water Agreement and Green Book include procedures to calculate a pumping limit to prevent groundwater mining to ensure no long term decline in aquifer storage. The mining calculation is a comparison of pumping and recharge for each wellfield on a water year basis (October 1st through September 31st) for a 20 water year period. The 19.5 year total of actual pumping is subtracted from 20 years of estimated recharge to arrive at an estimated April-September pumping limit for each wellfield and Owens Valley as a whole. The estimate of groundwater recharge in the Owens Valley from the mining calculations was approximately 124,771 ac-ft compared to 88,146 ac-ft of pumping for the 2013 water year, and no wellfield was in violation of the groundwater mining provision. For the 2014 water year recharge is preliminarily estimated to be 98,850 ac-ft and planned pumping in wellfields is not expected to violate the groundwater mining provision.

Evaluation of 2013 DTW predictions

The Water Department routinely uses linear regression models to predict the effects of pumping on depth to water table (DTW) as part of its analysis of LADWP's annual operations plans. Periodically, we examine the accuracy of our models by comparing the predictions with DTW measurements collected the following year on April 1. The regression models were constructed from historical data for wellfield pumping, Owens Valley runoff, and current water levels. The models in Laws rely on an estimate of the diversions into the McNally canals instead of Owens Valley runoff as the variable related to groundwater recharge. For twelve permanent monitoring sites, a second model is used that relies on predicted DTW in a nearby indicator well that responds similarly to pumping and runoff. The models were originally developed by Harrington (1998) and Steinwand and Harrington (2003). These reports are available on the Water Department website. At one site, SS2, the monitoring well was dry in 2013

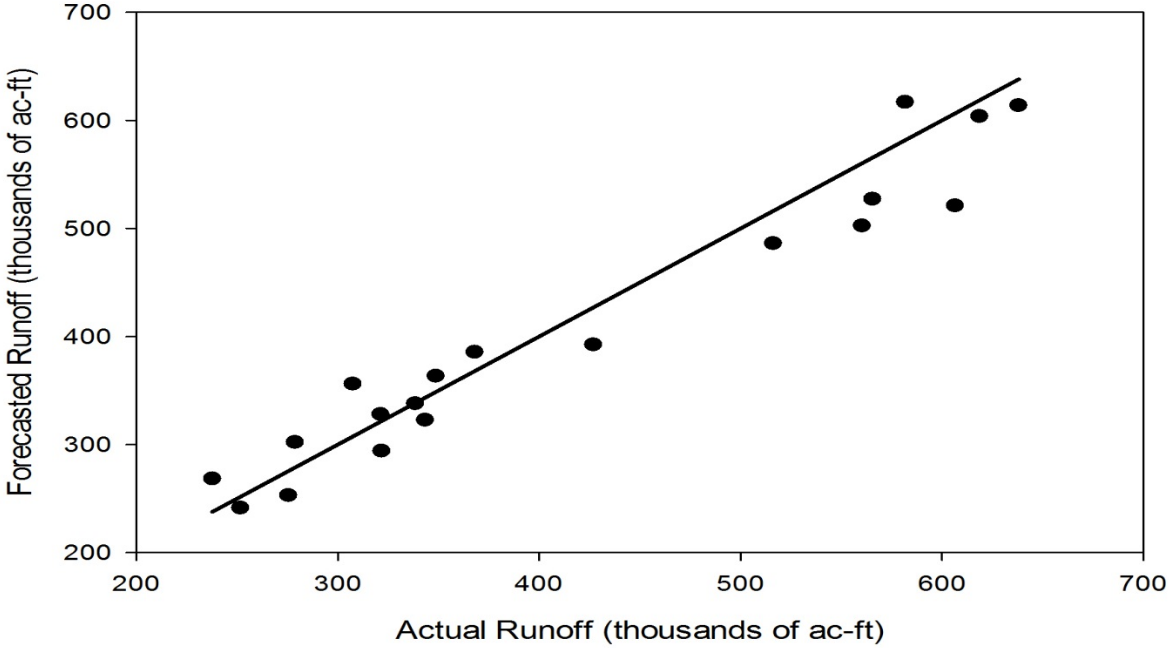


Figure 3.1. Comparison of actual and forecasted runoff since 1994 . During this period, LADWP has revised the method to forecast runoff, but there was no discernible trend (better or worse) in the accuracy of the forecasts over time.

preventing the comparison of predicted and measured change in water levels. Predictions for the other 44 wells made in 2013 were examined for this report.

The predicted DTW values were based on the high pumping amount planned by LADWP in the 2013-14 pumping plan. As described above, the pumping amounts analyzed in 2013 included an estimated pumping distribution among wellfields during the October-April period to permit analysis using the ICWD models. Actual and modeled pumping in 2012-13 differed by as much as 2,489 ac-ft in Independence-Oak, and also differed from predicted amounts by several hundred ac-ft in Laws, Big-Pine, and Taboose-Aberdeen. In our analysis completed April of 2013, the ICWD estimated that about 3000 ac-ft of discretionary pumping would occur mostly in the Big Pine wellfield; instead, LADWP chose to pump most of that water from Independence-Oak. Pumping totals in the remaining wellfields were within a few hundred acre-ft of the ICWD estimates. The model predictions also rely on forecasted Owens Valley runoff and unavoidably include the uncertainty in that prediction. The LADWP runoff forecast has tracked actual runoff well since 1994 (Figure 3.1), and therefore the contribution to model uncertainty is small. The average absolute deviation is approximately 28,000 ac-ft (mean runoff is 412,284 ac-ft), and on average the forecasted and actual runoff values differ by 7% of the actual value.

This analysis of the predictions includes uncertainty in the input variables (runoff forecast and planned pumping) as well as uncertainty in the models. Model uncertainty includes all management actions and environmental conditions not captured in the regression model e.g. atypical recharge or pumping operations near one of the test wells. No attempt was made to revise the 2013 predictions based on actual runoff and wellfield pumping amounts to account for those sources of uncertainty.

Table 3.2. Depth to Water (DTW) at indicator wells, April 2014. All data are in feet. A negative change from April 2013 indicates a water table decline; negative deviation from baseline indicates the water table is below baseline. Depths are from reference point on the test well. Baseline elevation at monitoring sites was predicted from monitoring site/indicator wells regression models unless the test well was present 1985-87.

Well ID	DTW, April 2014	Change from April 2013	Deviation from Baseline in 2014††
Laws			
107T	35.27	-1.34	-11.00
436T	12.97	-0.64	-4.87
438T	15.74	-0.53	-6.14
490T	16.67	-1.93	-3.60
492T	36.20	-1.27	-3.40
795T, LW1	27.56	-1.41	-12.99
V001G, LW2	26.64	-1.13	-7.00
574T, LW3†	16.67	-0.70	-3.45
Big Pine			
425T	21.29	-1.07	-6.39
426T	16.29	-1.19	-4.72
469T	25.37	-1.05	-3.70
572T	17.02	-1.67	-5.12
798T, BP1	20.68	-2.40	-4.50
799T, BP2	21.94	-1.07	-3.56
567T, BP3	20.06	-0.11	-6.08
800T, BP4	19.53	-0.78	-5.99
Taboose Aberdeen			
417T	34.56	-1.72	-7.59
418T	9.80	-0.14	-1.57
419T	8.77	-0.20	-2.14
421T	37.78	0.36	-3.43
502T	11.55	0.05	-4.06
504T	12.51	0.28	-1.74
505T	26.24	-1.70	-7.64
586T, TA4	10.03	0.06	-1.74
801T, TA5	16.20	-0.01	-0.52
803T, TA6	15.88	-1.71	-7.49
Thibaut Sawmill			
415T	25.08	-2.28	-6.58
507T	5.27	-0.17	-0.60
806T, TS2	14.43	-1.33	-1.98
Independence Oak			
406T	4.48	-1.60	-2.91
407T	15.53	-0.96	-8.23
408T	7.33	-1.80	-4.20
409T	14.02	-1.16	-12.42

Well ID	DTW, April 2014	Change from April 2013	Deviation from Baseline in 2014††
546T	9.90	-1.45	-6.47
809T, IO1	15.01	-2.45	-9.08
Symmes Shepherd			
402T	11.66	-0.48	-3.63
403T	8.56	-0.24	-3.23
404T	6.92	-0.48	-3.35
447T	45.45	-0.92	-23.60
510T	7.64	-0.01	-2.64
511T	9.09	-0.36	-4.46
V009G, SS1	26.06	-1.35	-20.09
646T, SS2	Dry	NA	NA
Bairs George			
398T	6.62	0.65	-0.27
400T	6.88	0.05	-0.58

†: The new test well at LW3, 840T, tracks 574T except during active spreading on the site, and depth to water is on average 1.23ft deeper.

††: Values in this column are only significant to 0.1 ft. Extra digits are presented for transparency before rounding.

Model performance in 2013-14 was satisfactory and comparable to previous years. Measured and predicted change in DTW are shown in Table 3.2 and plotted in Figure 3.2. Water levels in most wells declined a small amount as was expected. In Figure 3.2, if the models were perfect predictors, the points would fall on the 1:1 line between the lower left and upper right quadrants. Most points were in the correct quadrant. The average of the actual deviation for all wells was slightly negative (-0.38 ft) suggesting a slight tendency in 2013 to predict smaller watertable declines than were observed. The average absolute deviation was 0.87 ft. Of the 44 wells, actual and predicted DTW in 30 wells differed by less than 1 ft, and 35 differed by less than 1.5 ft. Predictions were substantially in error (>2 ft) for three wells: 795T (Laws), 803T (Taboose-Aberdeen), and 409T (Independence-Oak). For these wells, small water table increases were predicted, but the watertable declined.

As mentioned previously, for eleven wells, two regression models were used sequentially to predict DTW which introduced an additional source of uncertainty in predictions for those wells. The average absolute deviation for the predictions based on one model and two models were 0.85 ft and 0.91 ft, respectively. Given the similar accuracy of the two sets of wells, relying on the paired regressions was not a large source of additional uncertainty.

2014-15 Pumping Plan

LADWP issued a first half of the year operations plan for the 2014-15 runoff year in late April, 2014. Forecasted runoff for the Owens River watershed was much below normal at 205,900 ac-ft (54% of normal). LADWP's plan provided a range of planned pumping for the first six months; the range between the lower and upper limit was up to several thousand acre-feet in some cases (Table 3.3). Projected total pumping for the entire runoff year of 2014-2015 is estimated to be approximately 65,000 ac-ft. The annual planned pumping will not be known with certainty until the second pumping plan is released in October 2014.

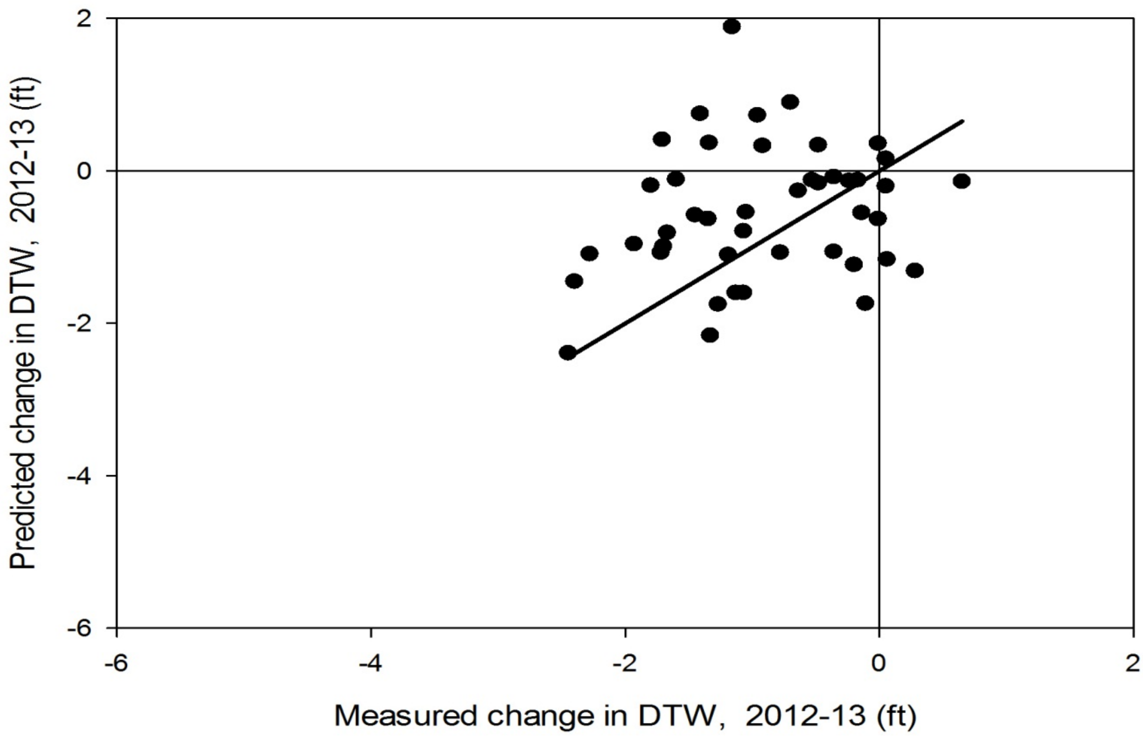


Figure 3.2. Measured and predicted change in DTW from April 2013 to April 2014 for 44 indicator wells and monitoring site wells. The solid line is the 1:1 line. Negative values denote a decline in water level.

The Water Department analyzed the effect of the operations plan on groundwater levels in the valley using regression models for several monitoring wells (Table 3.3). Most models rely on measured depth to water in April 2014, planned wellfield pumping for the total runoff year (which this year was only an estimate, see Table 3.1), and Owens Valley runoff to predict water levels next April. For several wells, Owens Valley runoff was not a statistically significant variable in the regression model. Water levels in those wells are correlated with pumping, and the models are still useful for evaluating the pumping plan. Models in Laws use the amount of water diverted from the Owens River into the McNally canals as the variable associated with recharge. The quantity of water diverted into the McNally canals was estimated from LADWP's annual estimated spreading in Laws provided in Chapter 3 of their 2013 annual report. No spreading is planned for 2014-15 which is not unusual given the low runoff forecast.

The models used by the Water Department to analyze the annual operations plan predict water levels one year in the future (e.g. April 2013 to 2014) based on annual pumping for each wellfield. The models cannot be used to analyze changes over a shorter period. However, the information provided in the pumping plan and LADWP correspondence allowed the Water Department to estimate annual pumping with sufficient accuracy to apply the models. LADWP's proposed pumping for April-September ranges between 36,920 and 47,930 ac-ft. LADWP also suggested that the maximum pumping for 2013-14 will be approximately 65,000 ac-ft. Minimum pumping for necessary uses during the fall and winter

Table 3.3. Planned LADWP pumping by wellfield for the 2014-15 runoff-year. Estimated minimum and maximum pumping for the entire 2014-15 runoff-year as well as absolute minimum pumping prepared by Inyo County to analyze the annual effect on water levels are also included.

Wellfield	Estimated Minimum Pumping (ac-ft)	Planned Pumping for Apr-Sept. 2014-2015 (ac-ft)	Inyo Estimate for 2014-15: 54,005 (ac-ft))	Inyo Estimate for 2014-15: 65,015 (ac-ft)
Laws	6,460	5,760-7,200	5,910	7,350
Bishop	10,600	7,200-8,700	9,240	10,740
Big Pine	20,400	10,200-11,550	20,400	21,750
Taboose-Aberdeen	300	1,500-4,500	1,650	4,650
Thibaut-Sawmill	8,400†	4,600	8,800	8,800
Ind.-Oak	5,900	5,280-6,600	5,430	6,750
Symmes-Shepherd	1,200	760-2,880	720	2,760
Bairs-Georges	500	1,080-1,440	1080	1,440
Lone Pine	775	730	775	775
Total	54,535	34,310-48,200	54,005	65,015

†: includes the proposed reduction in pumping for the Blackrock Hatchery.

months is approximately 17,415 ac-ft. That estimate for winter pumping consists of town and hatchery supply and stockwater and environmental project supply on the Bishop Cone. It includes the anticipated reduction in pumping at the Blackrock fish hatchery and no potential extension of irrigation reliant on pumped water into October. The sum of the high range of proposed summer pumping and the minimum pumping during the winter is approximately 66,015 ac-ft, approximately the annual total anticipated by LADWP. The sum of the low range proposed summer pumping and minimum pumping during the water was 54,005 ac-ft, almost the same as the minimum annual pumping estimated by the County in past years (54,535 ac-ft). Actual pumping distributions among wellfields may differ from the modeled values, but the assumptions to derive the values in Table 3.3 are reasonable enough to utilize the models to evaluate LADWP's proposal. After, the County's analysis of the draft plan, LADWP corrected the estimated pumping to supply E/M projects in Symmes-Shepherd and Lone Pine wellfields. The annual planned pumping increased by approximately 270 ac-ft. Because the proposed changes to pumping plan were small, the Water Department did not revise the model predictions of water table depths.

Given the relatively low runoff, relatively low proposed pumping, and that predicted water levels are expected to rise slightly, be maintained, or to decline less than 1.5 feet (Table 3.4), the Water Department did not object to LADWP's operations plan. In most cases, a well with a predicted decline would also decline if pumping were reducted to minimum. LADWP's model predictions suggest similar magnitudes of water table changes can be expected. The draft and final operations plans and recommendations provided by Inyo County are available from the Water Department.

Table 3.4. Predicted water level changes at indicator wells and monitoring sites for estimated amounts of LADWP's annual pumping for 2014 and estimated minimum pumping required for sole source uses. Negative DTW values denote a decline. Baseline is the average of April water levels in 1985-87.

Well ID, Monitoring site	Predicted change in DTW: 65,015 ac-ft	Predicted change in DTW: 54,005 ac-ft	2015 predicted dev. from baseline†: 65,0165 ac-ft
	(ft)	(ft)	(ft)
Laws			
107T	1.23	1.73	-9.77
436T	0.10	0.32	-4.77
438T	0.21	0.39	-5.93
490T	-0.50	-0.40	-4.10
492T	-0.90	-0.13	-4.30
795T, LW1	1.92	2.18	-11.07
V001G, LW2	-1.01	-0.60	-8.02
574T	0.56	0.63	-2.89
Big Pine			
425T	-0.88	-0.66	-7.27
426T	-0.64	-0.51	-5.36
469T	0.13	0.27	-3.57
572T	0.47	0.73	-4.65
798T, BP1	0.63	0.84	-3.87
799T, BP2	-0.12	0.02	-3.68
567T, BP3	-1.30	-1.11	-7.39
800T, BP4	-0.61	-0.41	-6.60
Taboose-Aberdeen			
417T	0.03	0.75	-7.57
418T	-0.24	0.08	-1.81
419T, TA1	-0.47	0.31	-2.61
421T	-0.49	0.31	-3.92
502T	-0.04	0.34	-4.09
504T	-0.52	0.45	-2.27
505T	0.10	0.84	-7.54
803T, TA6	-0.08	0.64	-7.56
586T, TA4	-0.02	0.64	-1.76
801T, TA5	0.68	0.87	-0.02
Thibaut Sawmill			
415T	2.13	2.13	-4.45
507T	0.65	0.65	0.05
806T, TS2	-0.34	-0.34	-2.32
Ind. Oak			
406T	0.19	0.34	-2.73

Well ID, Monitoring site	Predicted change in DTW: 65,015 ac-ft	Predicted change in DTW: 54,005 ac-ft	2015 predicted dev. from baseline†: 65,0165 ac-ft
407T	1.02	1.46	-7.21
408T	0.54	0.85	-3.65
409T	2.44	3.54	-9.98
546T	-0.04	0.17	-6.50
809T, IO1	-1.40	-1.07	-10.48
Symmes-Shepherd			
402T	-0.01	0.22	-3.64
403T	0.02	0.66	-3.21
404T	0.49	0.73	-2.86
510T	0.38	0.61	-2.26
511T	0.46	0.71	-4.00
447T	0.20	1.68	-23.39
646T, SS2	NA	NA	NA
V009G, SS1	0.16	1.46	-19.93
Bairs George			
398T	-0.59	-0.13	-0.86
400T	0.13	0.21	-0.45

†: Values in this table are only significant to 0.1 ft. Extra digits are presented for transparency before rounding.

Summary of Hydrologic Conditions

The history of Owens Valley pumping and runoff are presented in Figures 3.3 and 3.4. Given the much below normal runoff in 2013-14 (Predicted at 54%), and the slightly decreased pumping compared to the previous runoff year, the runoff and pumping experienced resulted in decreases in the measured DTW in all but six indicator wells and monitoring sites (Table 3.2) in the range of +0.65 to -2.45 feet. Water levels declined more than 2 ft in three wells, one in the Big Pine (798T), one in Thibuat-Sawmill (415T) and one in Independence-Oak (809T) wellfield. Water levels in the Bairs-Georges wellfield rose by as much as 0.65 feet. Water levels rose in four wells in the Taboose- Aberdeen wellfield. Water levels remain below the levels of the mid-1980's (average 1985-87). Hydrographs for the indicator wells are provided in following discussions of conditions in each wellfield; hydrographs for the permanent monitoring sites are included in the Soil Water section of the annual report. All data presented in the hydrographs are DTW below the ground surface in feet.

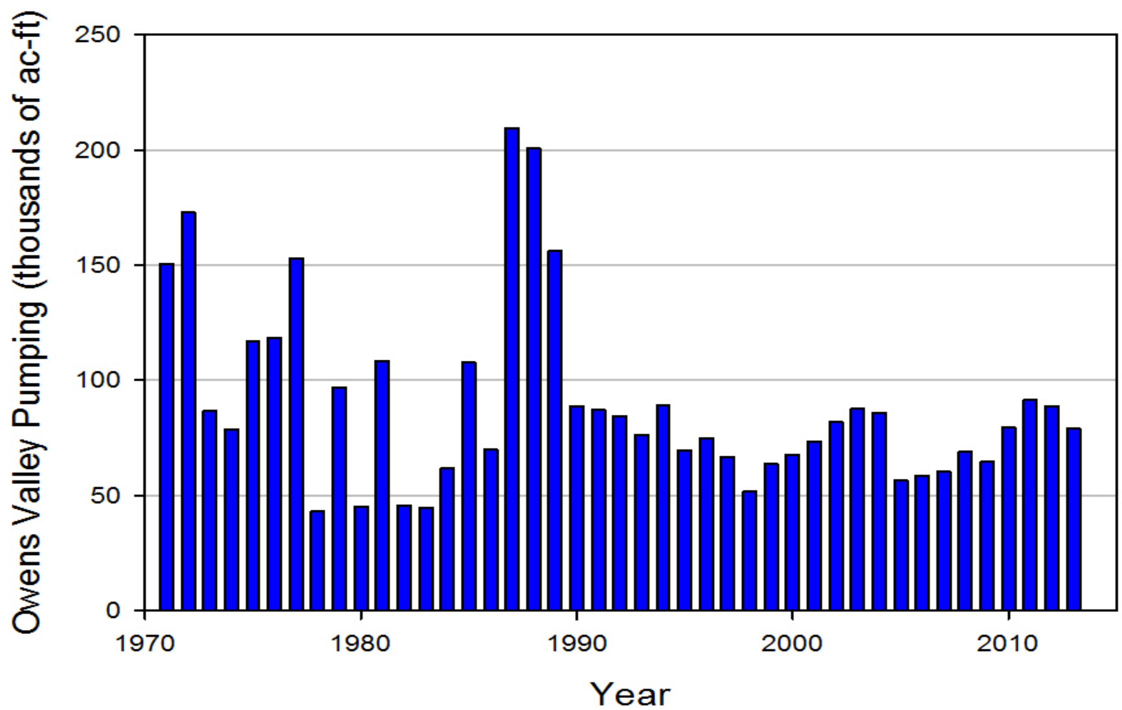


Figure 3.3. Total LADWP pumping in the Owens Valley since 1970. Values are for the runoff year (e.g. runoff year 2013 includes pumping from April 2013 through March 2014).

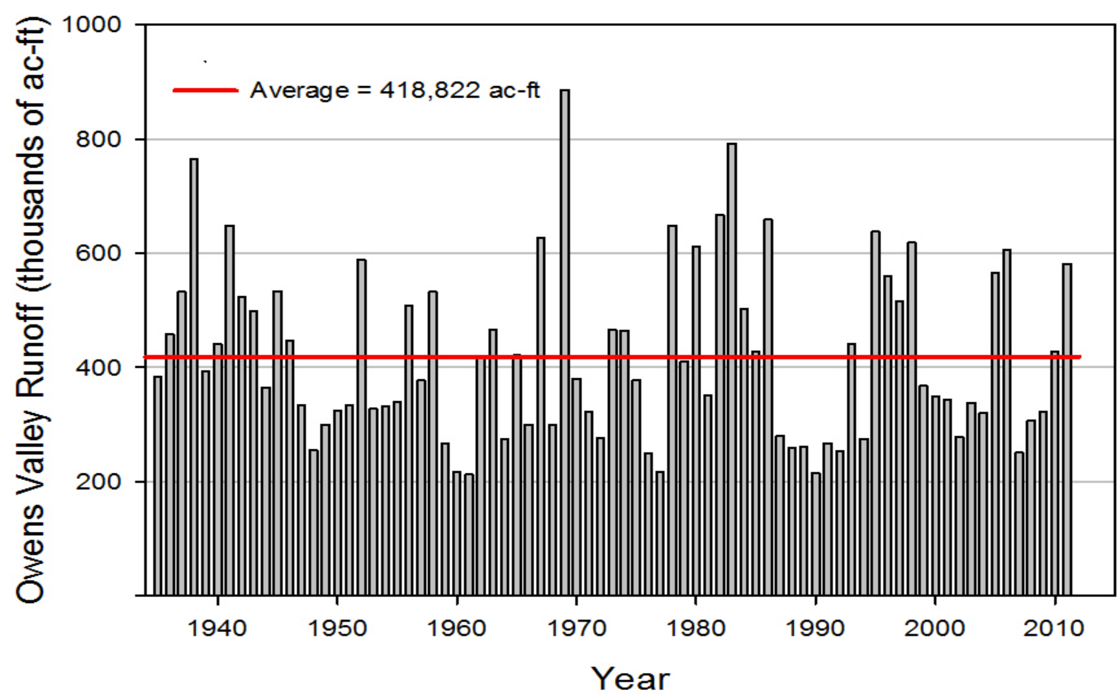


Figure 3.4. Measured Owens Valley runoff since 1935.Values are for the runoff year.

Laws Wellfield

In the 1970's and 80's, pumping and spreading in Laws varied greatly year to year causing large fluctuations in the water table (Figures 3.5 and 3.6). This was especially true for 107T and 492T because of their proximity to the McNally canals and LADWP pumping wells. Heavy pumping and low recharge in the late 1980's caused severe declines in the water table in Laws. Under the Water Agreement pumping has remained considerably below the maximum wellfield capacity. As a result, water levels rose, and beginning in 2000, water table fluctuations have been largely driven by pumping for uses in the wellfield and by water spreading in 2005 and 2006. In 2013-14 DTW declined in all test holes, and all test holes were below baseline water levels in April 2014 (Table 3.2).

Bishop Wellfield

Pumping in the Bishop Wellfield also called the Bishop Cone has been relatively constant for the past 25 years except in above normal runoff when pumping decreased, for example 2005 and 2006 (Figure 3.7). The Water Agreement requires Inyo and Los Angeles prepare an annual audit of pumping and uses on the Bishop Cone to demonstrate compliance with the Hillside Decree. The Hillside Decree is a 1940 Inyo County Superior Court stipulation and order under which LADWP pumping and water from uncapped flowing wells cannot exceed the annual total of water used on LADWP owned land on the Bishop Cone. The most recent Bishop Cone Audit examined conditions for the 2012-13 runoff year. Total water extraction on the Bishop Cone was 16,188 ac-ft compared with 25,243.5 ac-ft of recorded uses.

Because of the Hillside Decree and relatively constant pumping, we do not routinely use indicator wells to analyze the annual operations plan for this wellfield. The three wells in Figure 3.8 are located near the locus of pumping and irrigation adjacent to the city of Bishop (387T) and at intermediate (485T) and larger (479T) distances from the city. Constant pumping as well as recharge results in relatively stable water levels in the Bishop Cone Wellfield. (Figure 3.8).

In 2013-14, prolonged severe drought conditions (two runoff years of very low runoff) and changes in Bishop Creek management resulted in dry ditches in the west Bishop area in the second half of the summer. LADWP relies on ditches managed by the Bishop Creek Water Users Association to convey water to irrigated pastures elsewhere on the Bishop Cone. Water levels in west Bishop typically peak after the summer irrigation season. As a result of the reduced groundwater recharge locally, shallow groundwater levels dropped, in some cases to their lowest recorded levels. The Water Department participated in increased groundwater monitoring to document conditions and to investigate whether LADWP groundwater pumping caused the groundwater decline. That information is available at the Water Department.

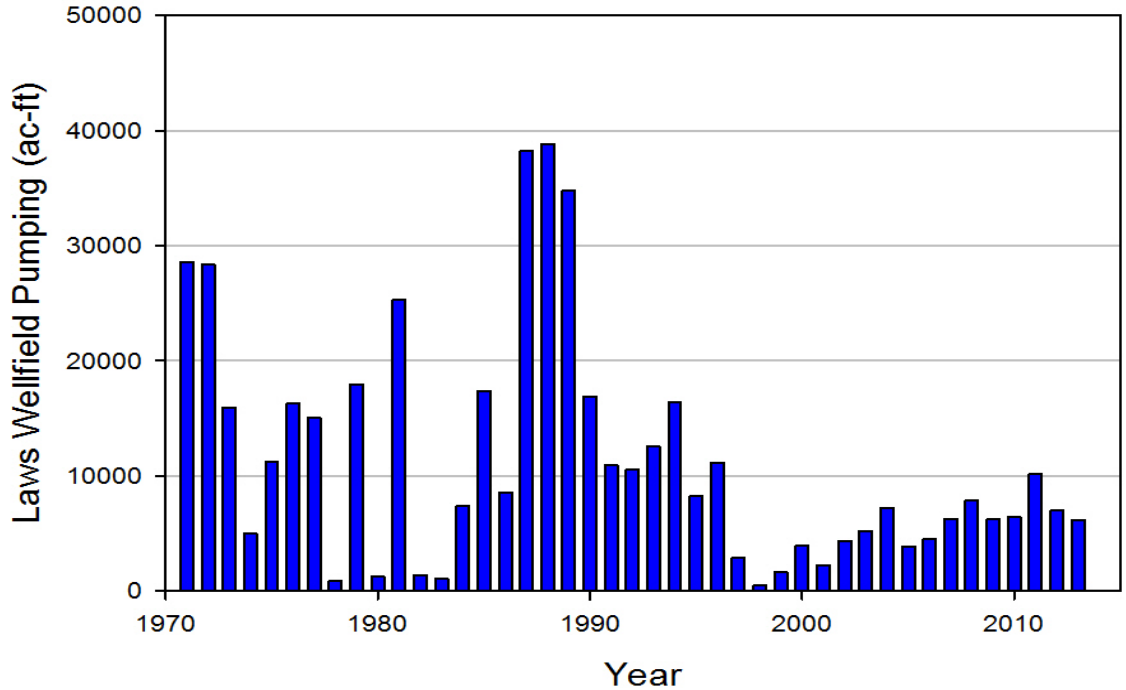


Figure 3.5. Pumping totals for the Laws Wellfield.

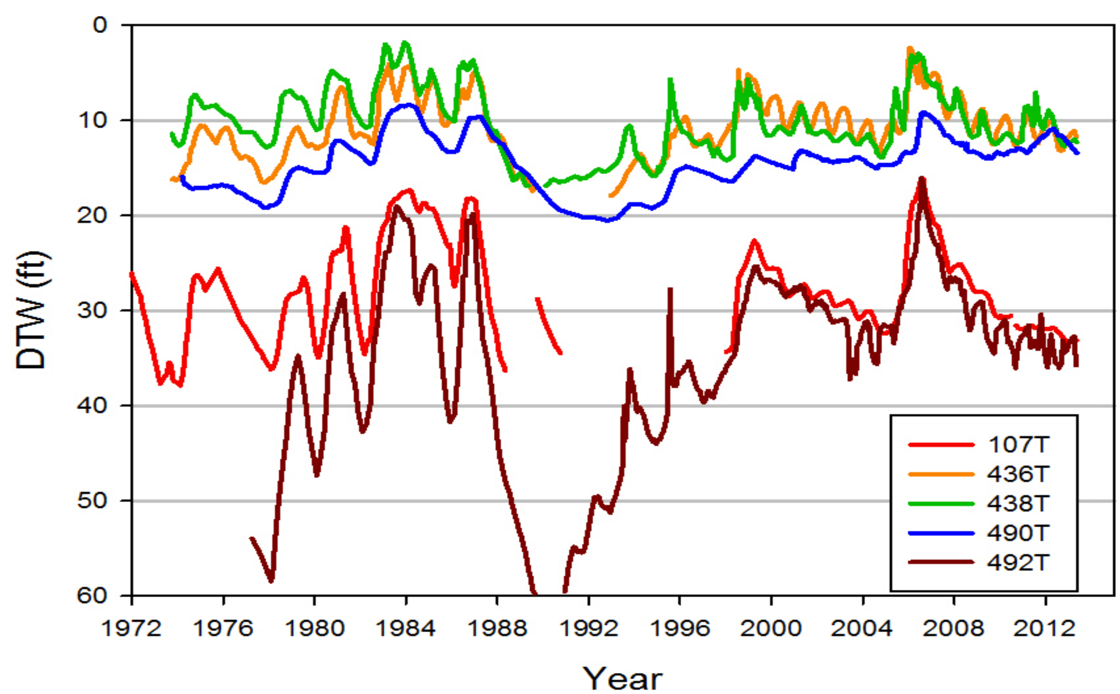


Figure 3.6. Hydrographs of indicator wells in the Laws Wellfield. Well 492T is dry if DTW is below 60 ft. Missing data for well 107T reflect when the wells was dry.

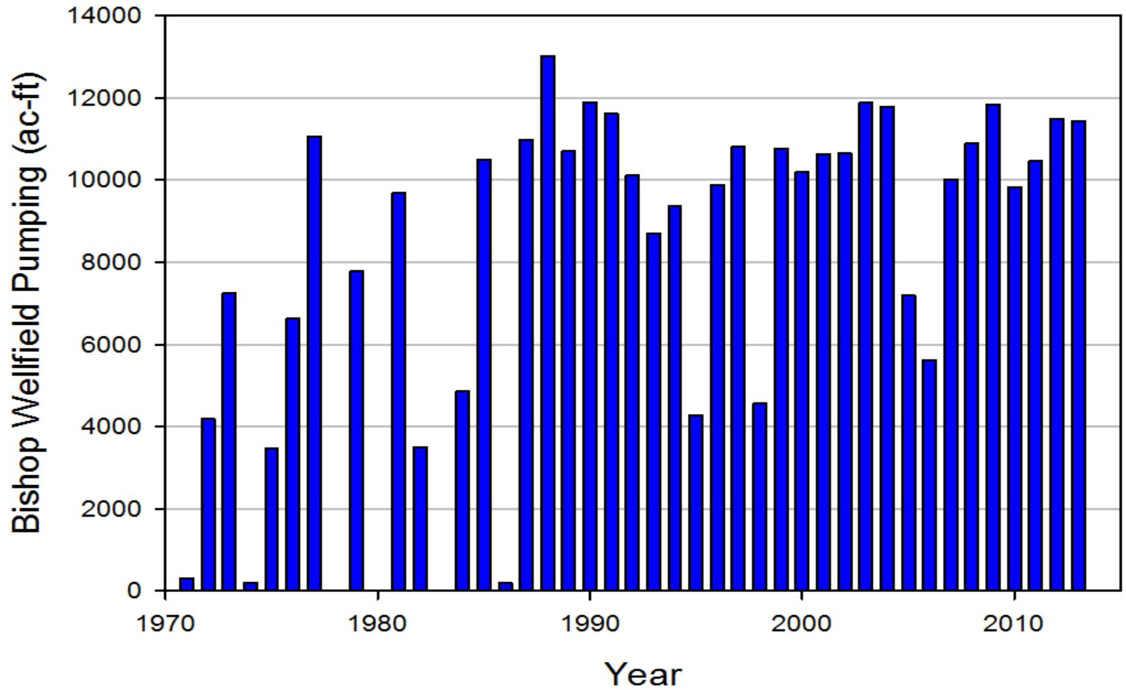


Figure 3.7. Pumping totals for the Bishop Wellfield.

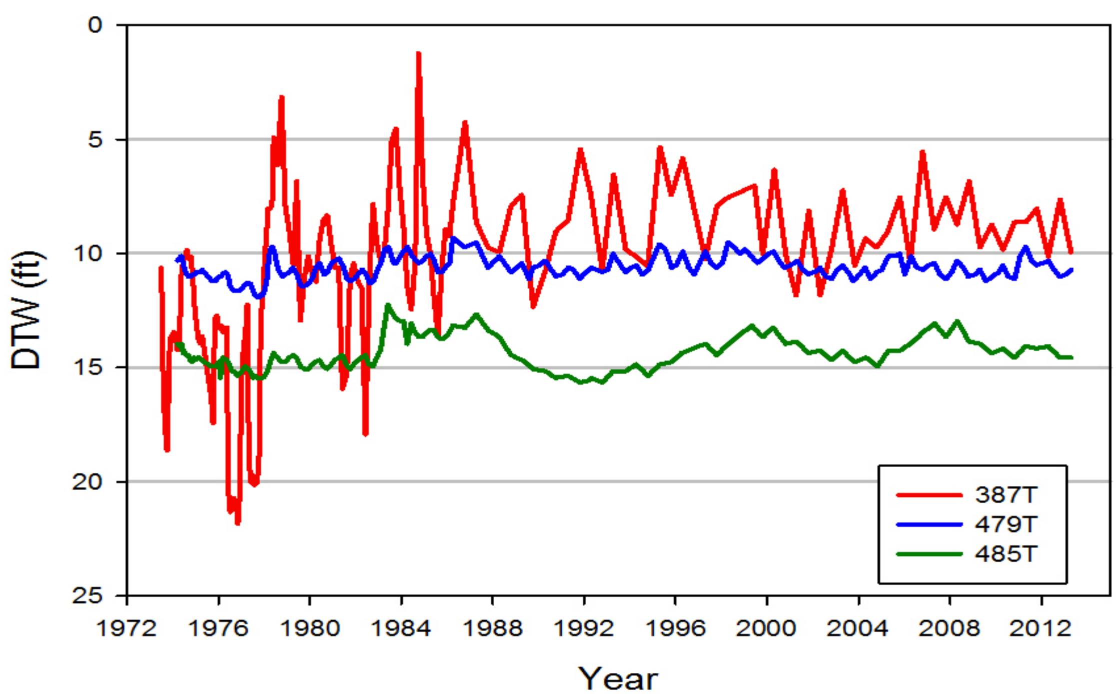


Figure 3.8. Hydrographs of selected test wells in the Bishop Wellfield.

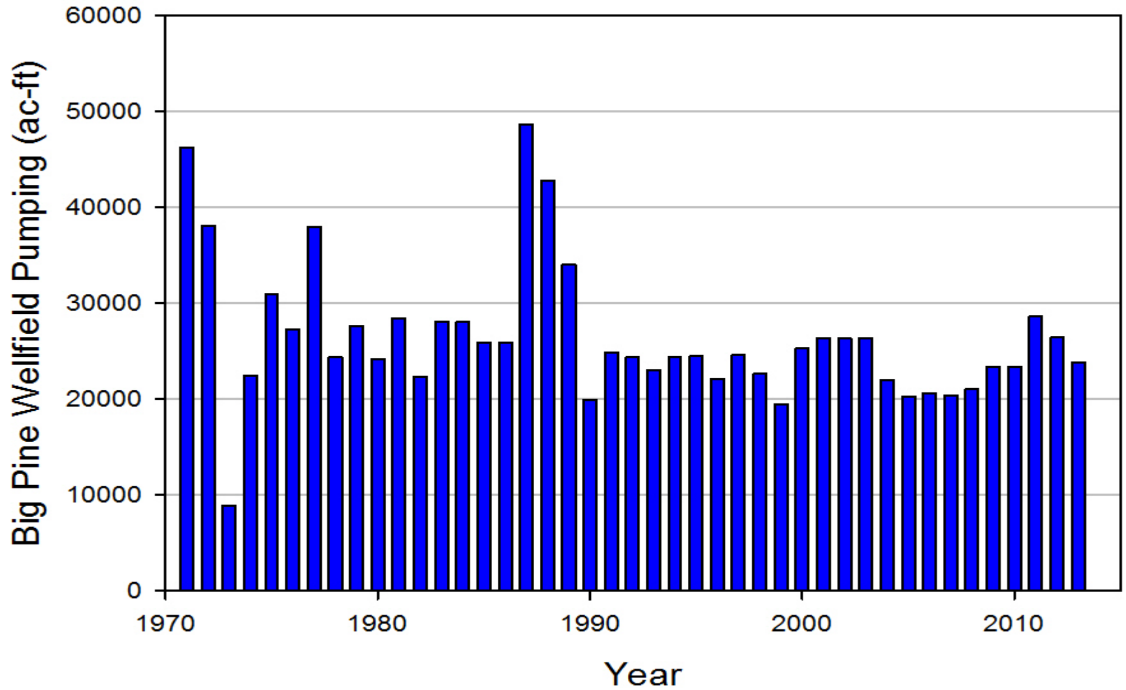


Figure 3.9. Pumping totals for the Big Pine Wellfield.

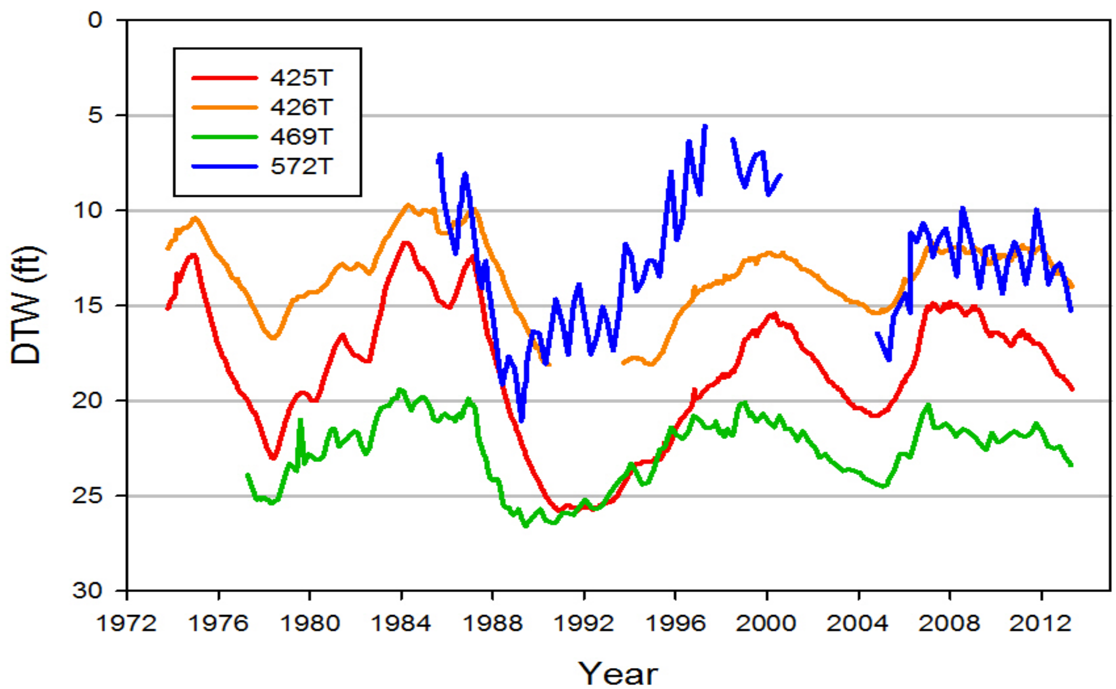


Figure 3.10. Hydrographs of indicator wells in the Big Pine Wellfield. Periods of missing data for 572T occurred when the well was plugged and in need of repair.

Big Pine Wellfield

Pumping in the Big Pine Wellfield since 1974 has been relatively large compared with other wellfields (Figure 3.9). Minimum pumping to supply uses in this wellfield include the Fish Springs Hatchery (approximately 19,500 ac-ft) and Big Pine town supply (500 ac-ft). Pumping under the Water Agreement largely has been to supply these uses. In 2009 , 2010, 2011, 2012, and 2013 wellfield pumping increased above the minimum. The increase in pumping was primarily for aqueduct supply although it should be noted that most of the hatchery pumped water also reaches the aqueduct. With the increase in export pumping, DTW in all four indicator wells during the last year declined (Figure 3.10 and Table 3.2). Well 572T is located to the north of the town of Big Pine and the hatchery pumping and also declined. Groundwater levels in 2013-2014 declined 0.11-2.40 ft in all wells. All wells remain below baseline levels in April 2014, usually by more than 3 ft (Table 3.2).

Taboose-Aberdeen Wellfield

Pumping in the Taboose-Aberdeen Wellfield since 1990 under the Water Agreement has remained much below the wellfield capacity (Figure 3.11). Minimum pumping for this wellfield is approximately 300 ac-ft to supply one mitigation project at Big Seeley Spring, and nearly all of the pumping in 2012-13 (12,734 ac-ft) and 2013-14 (9,593 ac-ft) was for aqueduct supply.

Hydrographs for the indicator wells exhibit similar response to fluctuations in pumping and runoff (Figures 3.12 and 3.13). Despite the above normal runoff during 2010 and 2011, pumping also increased, and water levels were stable or declined slightly. Most of the recent pumping has been from well 349W. Groundwater levels in 2013-2014 declined in six out of ten test wells; most wells increased or declined by less that 0.5 ft. Three wells declined more that 1.5 ft, 505T, 417T, and 803T (Table 3.2). These wells are affected by well 370W which was granted a temporary exemption in 2013 to supply water for fish in the Blackrock Ditch and at the Blackrock Hatchery. That well operated approximately June-November. Water levels have not yet recovered in the short time since pumping ceased, but the planned reduction in the constant pumping to supply the hatchery should result in water table increases in the southern portion of this wellfield this year. Depth to water in all wells was below baseline in April 2014 (Table 3.2).

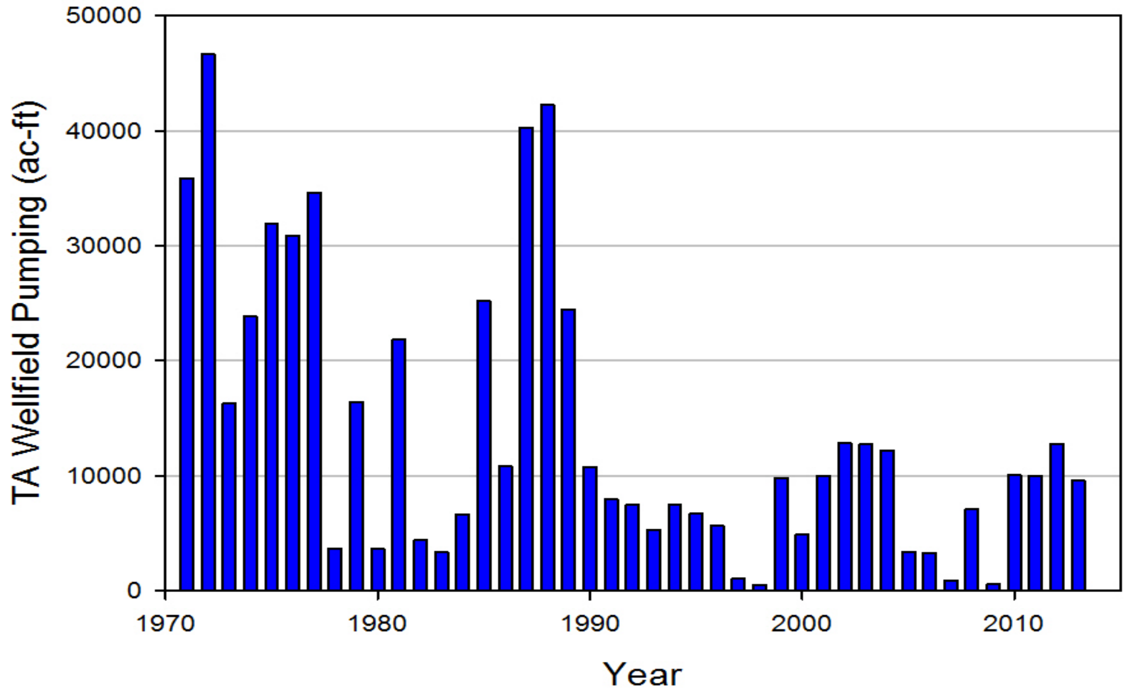


Figure 3.11 Pumping totals for the Taboose-Aberdeen Wellfield.

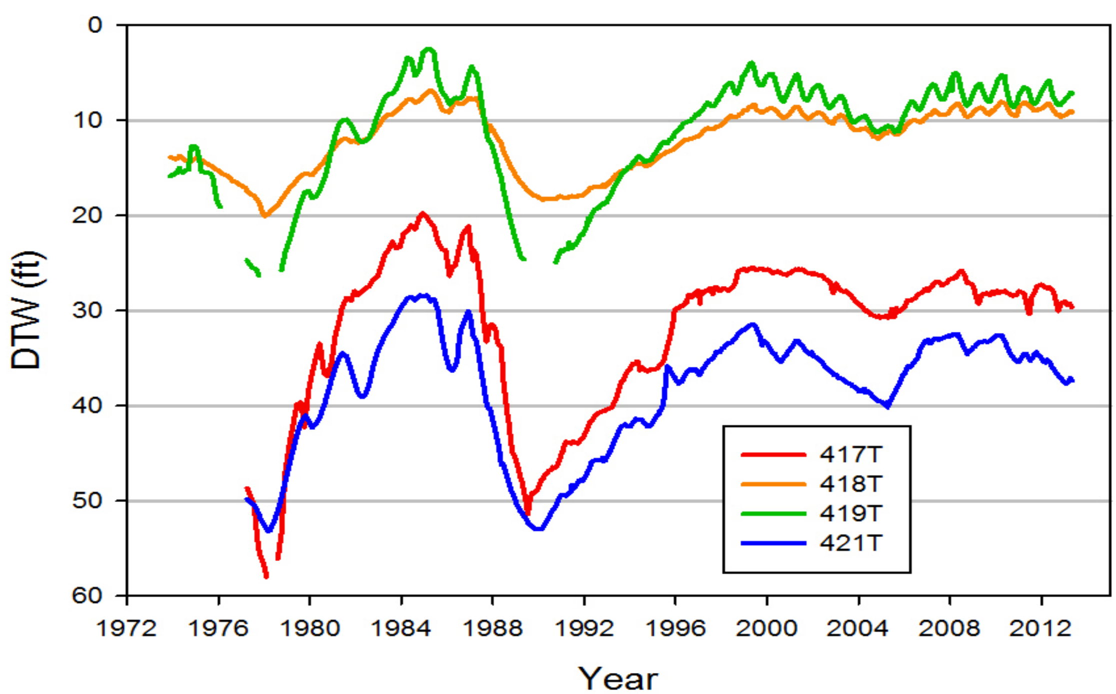


Figure 3.12. Hydrographs of indicator wells in the Taboose-Aberdeen Wellfield. Periods of missing data denote when the test well was dry.

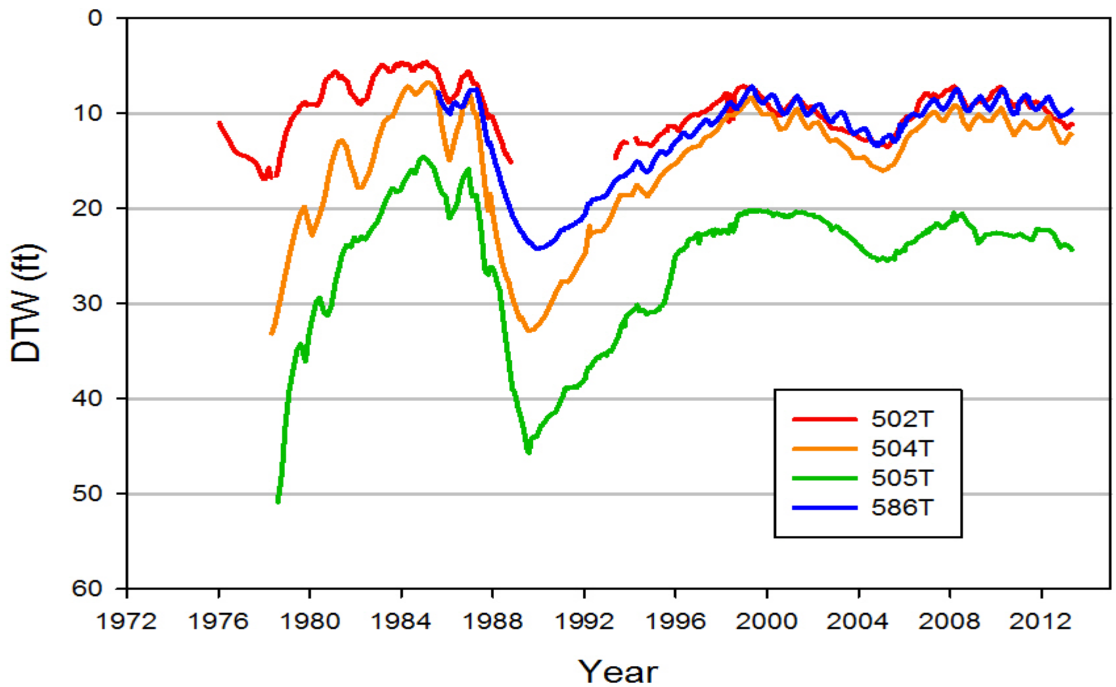


Figure 3.13. Hydrographs of indicator wells in the Taboose-Aberdeen Wellfield. Periods of missing data denote when the test well was dry.

Thibaut-Sawmill Wellfield

Historically, most pumping in the Thibaut-Sawmill Wellfield has been to supply approximately 12,200 ac-ft annually to the Blackrock Fish Hatchery (Figure 3.14). In 2011-12, approximately 1,800 ac-ft was pumped from this wellfield for aqueduct supply. In 2012-13 total wellfield pumping was 12,520 ac-ft and in 2013-2014 pumping was 12,717 ac-ft. The four test wells used to track water levels in Thibaut-Sawmill exhibit differing patterns due to local water management within the wellfield (Figure 3.15). Wells 413T and 414T are not used as indicator wells but they are included as examples from the southern portion of the wellfield. Both wells respond to spreading during high runoff years (e.g. 2006) and then decline gradually in response to pumping and reduced runoff. The overall trend in these wells has been stable or slightly increasing since the late 1990's. Recently in 2011-2012, the trend downward has increased due to low runoff. Following nearly ten years of stable water levels, 507T began to respond in 2009 to the establishment of wetlands in the Blackrock Waterfowl Management Area. Well 415T has declined slightly from the recent peak water level in 2008. Groundwater levels in all wells in 2013-2014 decreased. All wells were below baseline in April 2014 (Table 3.2).

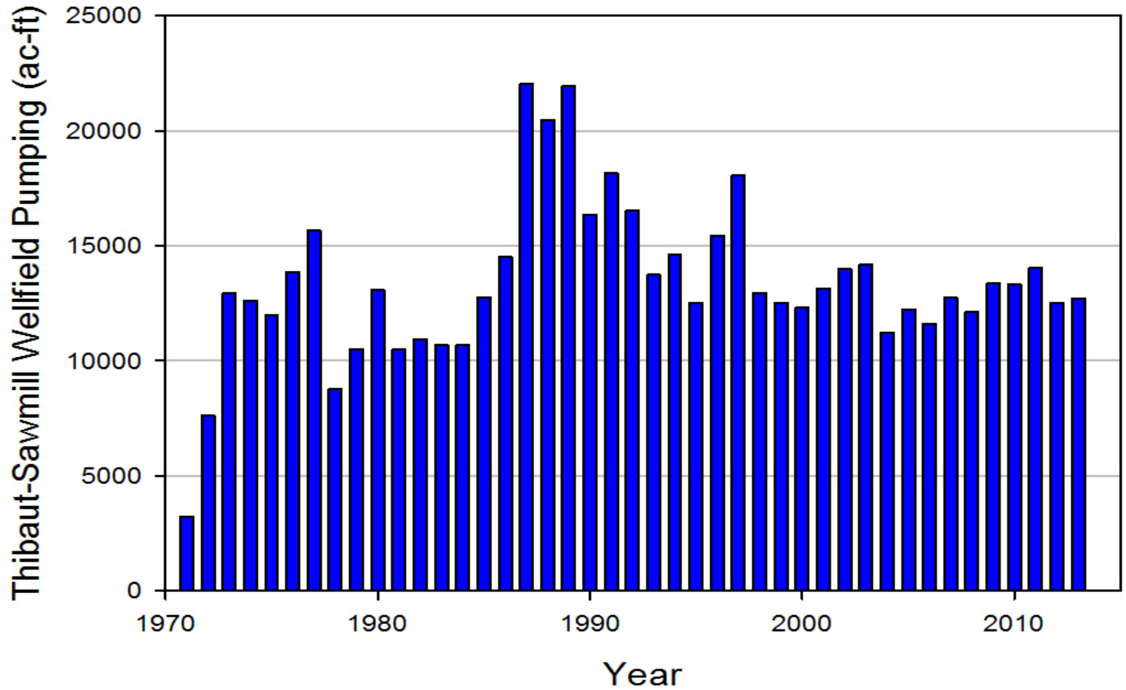


Figure 3.14. Pumping totals for the Thibaut-Sawmill Wellfield

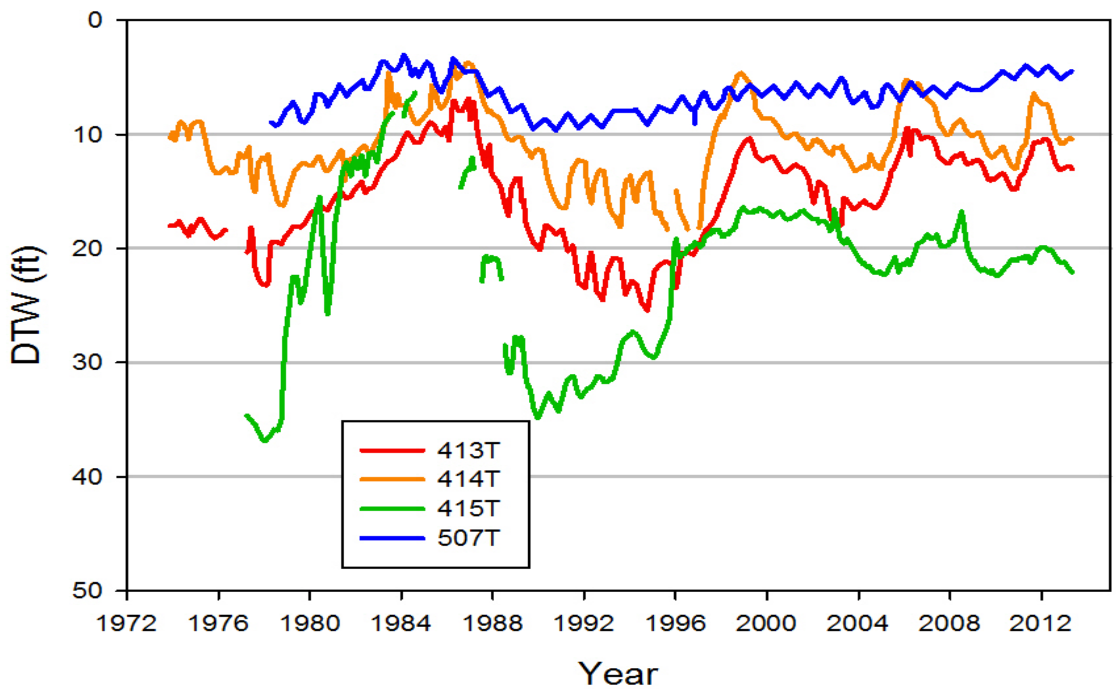


Figure 3.15. Hydrographs of selected test wells in the Thibaut-Sawmill Wellfield.

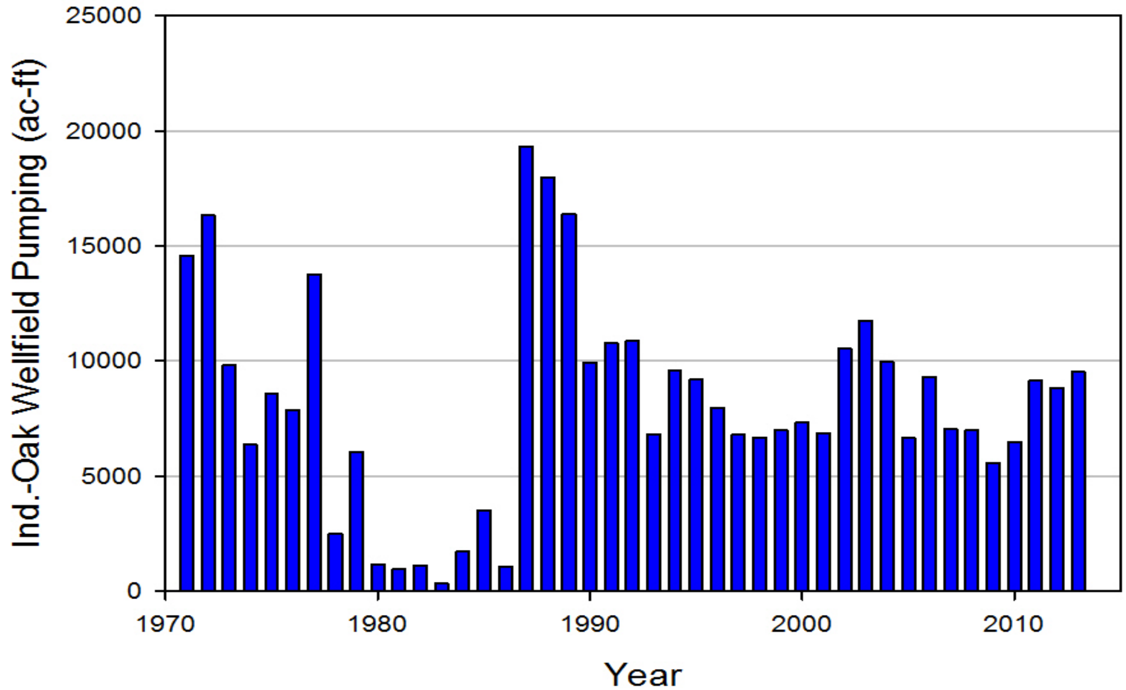
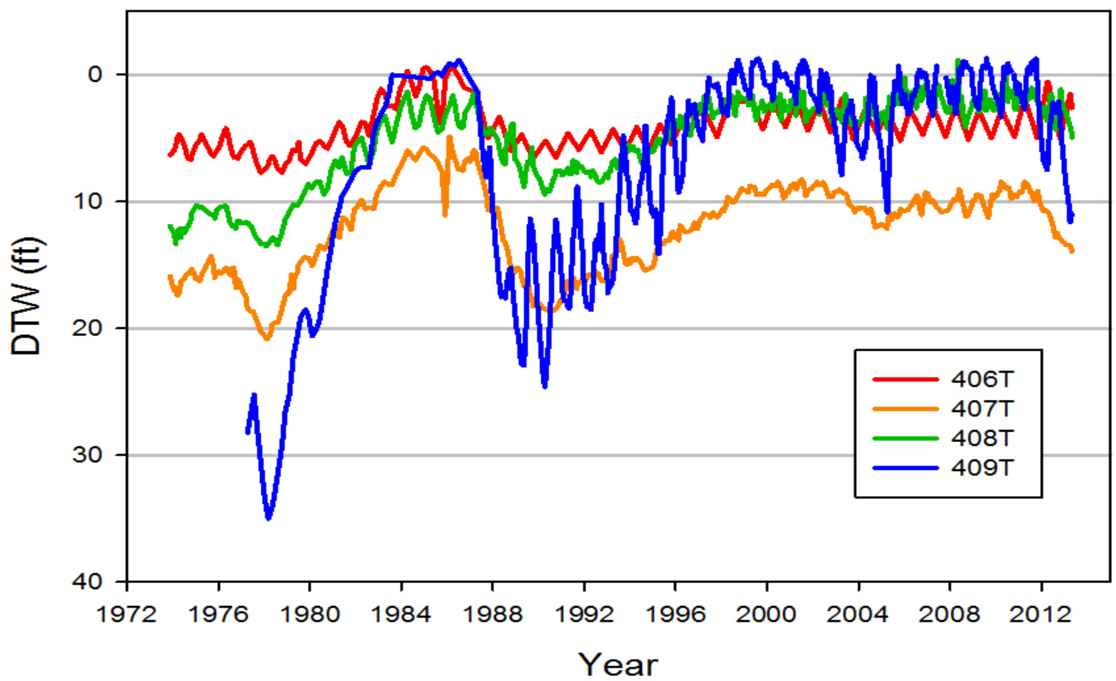


Figure 3.16. Pumping totals for the Independence-Oak Wellfield.

Independence-Oak Wellfield

This wellfield has experienced annual pumping of approximately 6,700 ac-ft for irrigation projects surrounding Independence and for town supply (Figure 3.16). Following four years of near minimum pumping, LADWP increased pumping for the 2011-12 runoff-year to 9,175 ac-ft, 8,816 ac-ft for the 2012-13 runoff year and 9,519 ac-ft for the 2013-2014 runoff-year. Water levels had been stable for several years in wells located in the center of the wellfield (407T, 408T, 409T), but they declined in response to the increased pumping of the last three years (Table 3.2 and Figure 3.17). The other indicator wells located east and north of Independence also exhibited declining water levels last year. Wells 412T and 453T are not used as indicator wells, but they are included as examples of water levels in the northern portion of the wellfield. All of the indicator wells in the Independence-Oak Wellfield were below the baseline in April 2014 (Table 3.2).



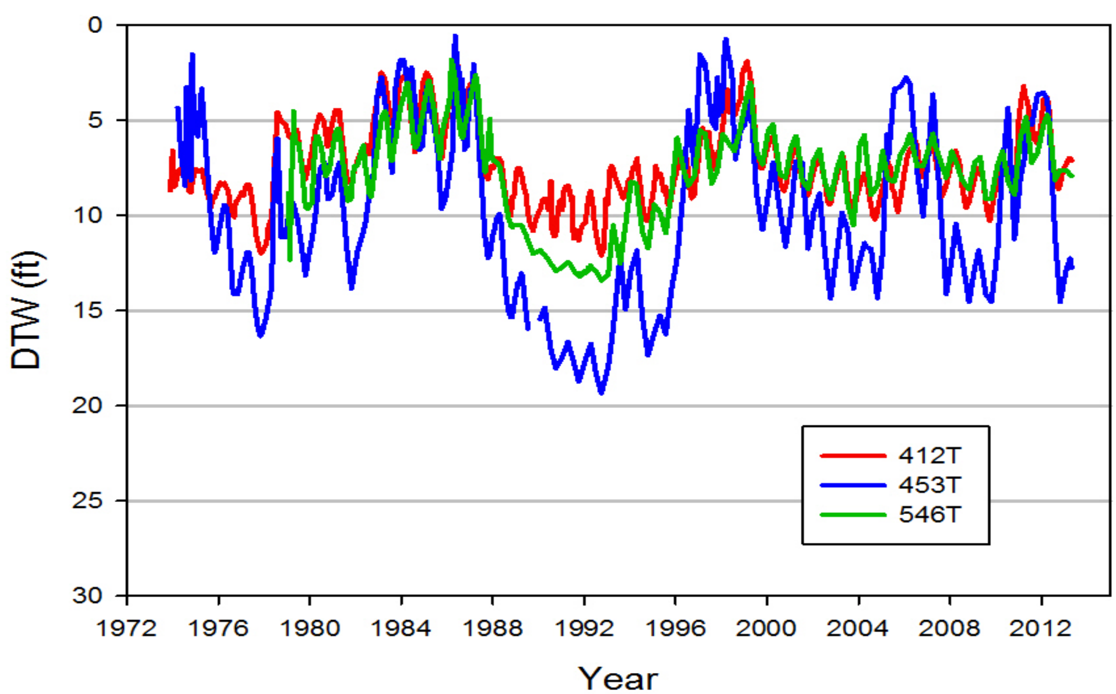


Figure 3.17. Hydrographs of selected test wells in the Independence-Oak Wellfield

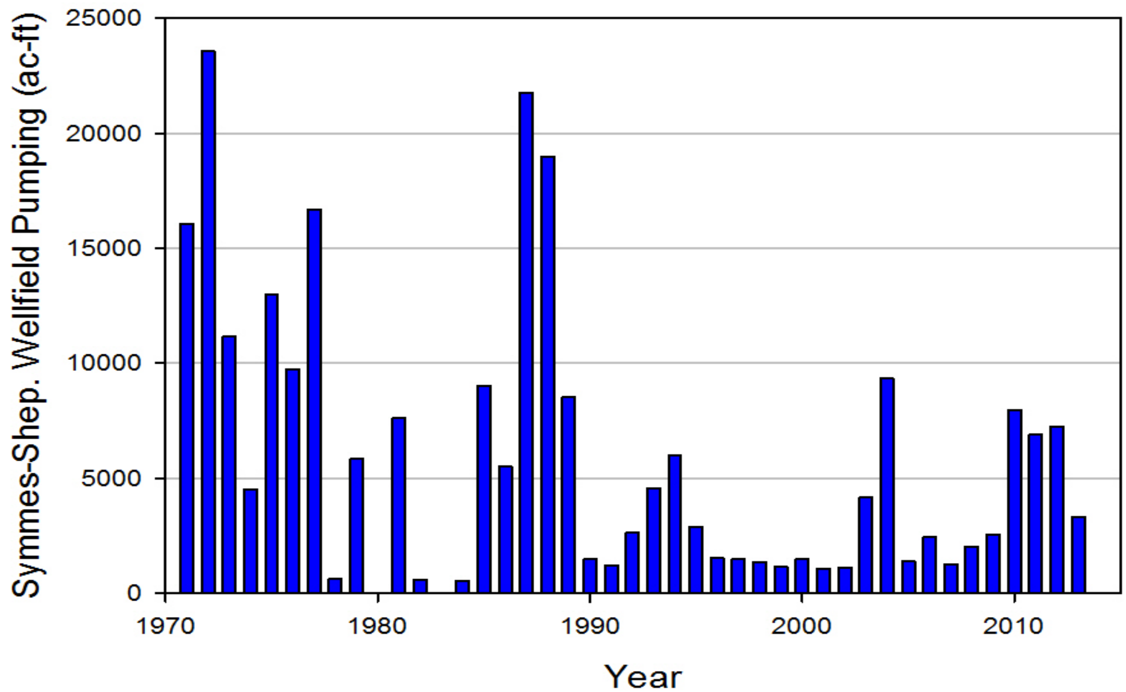
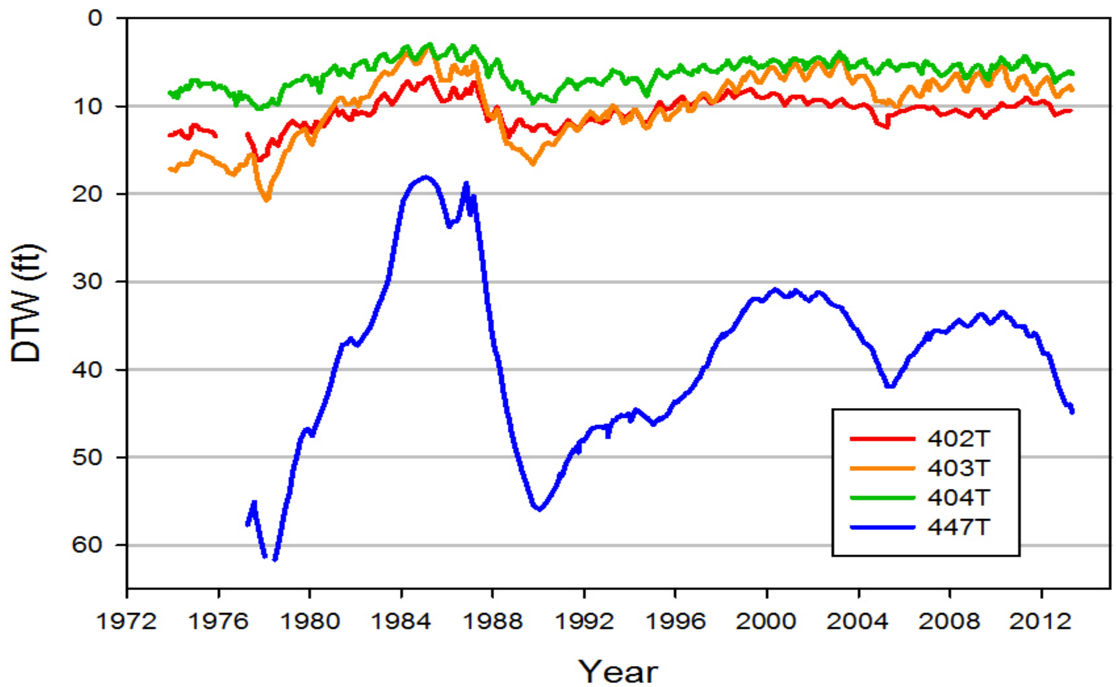


Figure 3.18. Pumping totals for the Symmes-Shepherd Wellfield

The Symmes-Shepherd Wellfield

In the 1970's and 80's, pumping in the Symmes-Shepherd Wellfield varied considerably (Figure 3.18). Under the Water Agreement, pumping has been reduced to approximately 1200 ac-ft to supply one mitigation project in most years; however, pumping for aqueduct supply increased considerably in the 2010, 2011, 2012, and 2013 runoff years. Groundwater levels in 2013-2014 declined and were below baseline in all test holes (Figure 3.19 and Table 3.2). The largest DTW declines occurred in 447T and the monitoring site wells located near the northern portion of the wellfield where most of pumping in 2013 occurred. The other test wells are located further from the pumping wells (403T) or are buffered somewhat by their proximity to the Los Angeles Aqueduct (402T, 404T, 510T, and 511T). Water levels in these wells has been relatively stable, but decreased small amounts in 2013-14.



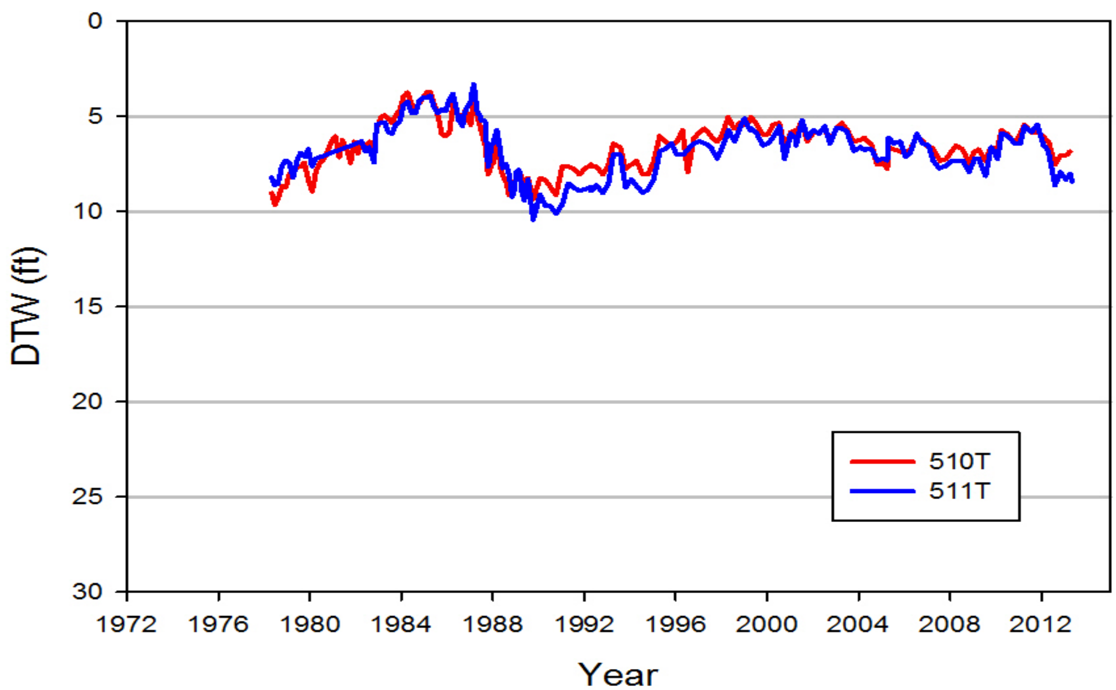


Figure 3.19 Hydrographs of indicator wells in the Symmes-Shepherd Wellfield.

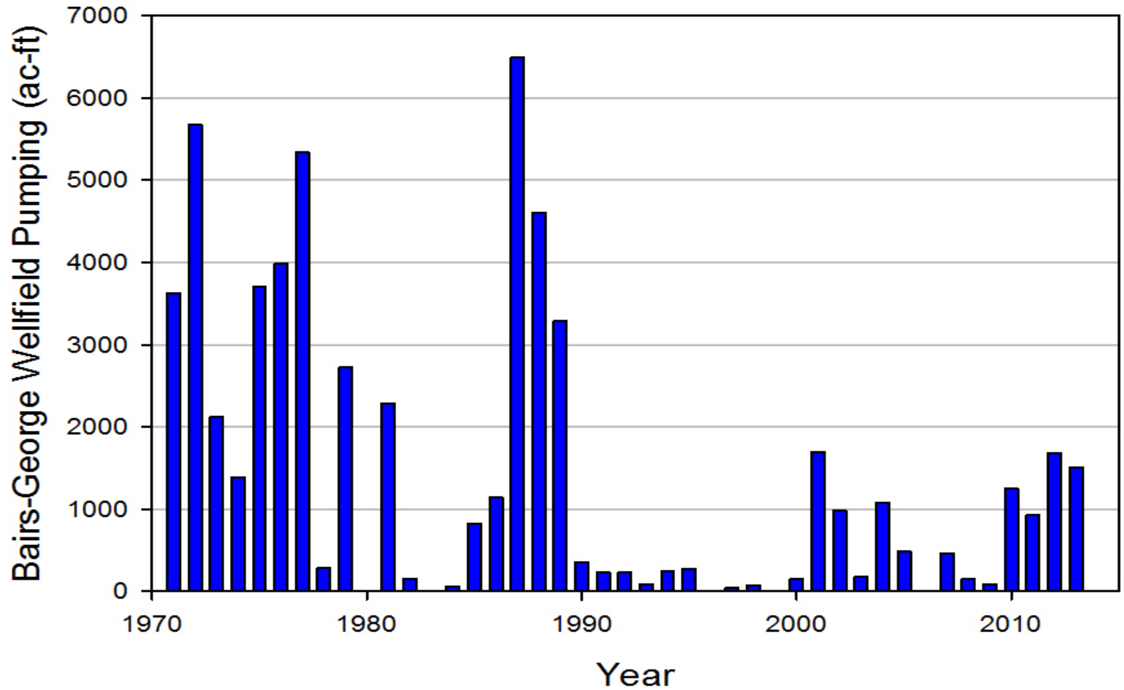


Figure 3.20. Pumping totals for the Bairs-Georges Wellfield.

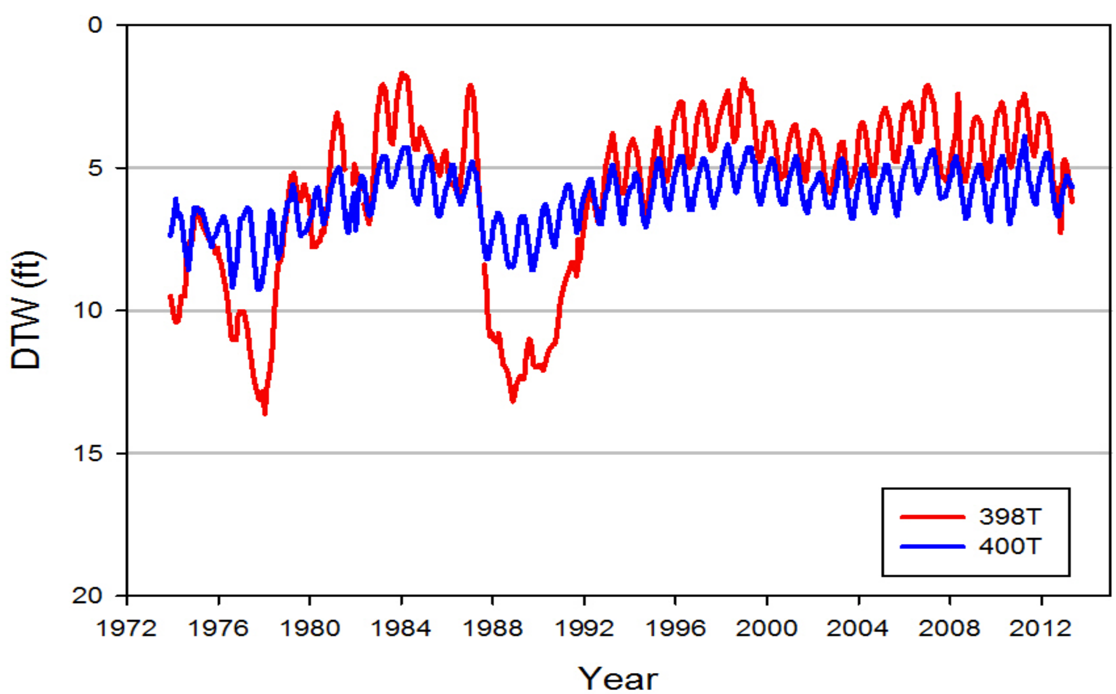


Figure 3.21. Hydrographs of indicator wells in the Bairs-Georges Wellfield.

The Bairs-Georges Wellfield

In the 1970's and 80's, pumping and water levels in the Bairs-George wellfield varied considerably (Figure 3.20), but under the Water Agreement, pumping has been reduced substantially. There are no projects supplied by groundwater in this wellfield, but in dry years one well is exempt (W343) and can be operated to supply irrigated pastures. As in other wellfields, pumping for aqueduct supply increased considerably in 2010, 2011,2012, and 2013 runoff years compared with the small amounts during the five preceding years. Since the mid 1990's groundwater levels in the two indicator test wells have been relatively stable (Figure 3.21). Water levels in 2013-2014 increased, and now both wells remain less than a foot below baseline in April 2014 (Table 3.2).

The Lone Pine Wellfield

Most pumping in the Lone Pine Wellfield has been to supply the town of Lone Pine and one mitigation project (approximately 1,300 ac-ft annually). Pumping increased occasionally (e.g. 2000) to offset LAA water previously supplied to Diaz Lake (Figure 3.22). Because of the relatively constant pumping for sole source uses, we do not routinely use indicator wells to analyze the annual operations plan for this wellfield. Hydrographs for test wells T564 and T591 are presented in Figure 3.23 to represent water levels near the town of Lone Pine where the LADWP pumping wells are located. Both wells exhibit seasonal fluctuations as well as water table response to increased recharge in wet years. In early 2010, LADWP and ICWD tested a new production well installed to increase aqueduct supply. This new production well has been modified and initial tests to determine well capacity and performance have been completed. No additional testing is scheduled for the 2014-15 runoff year.

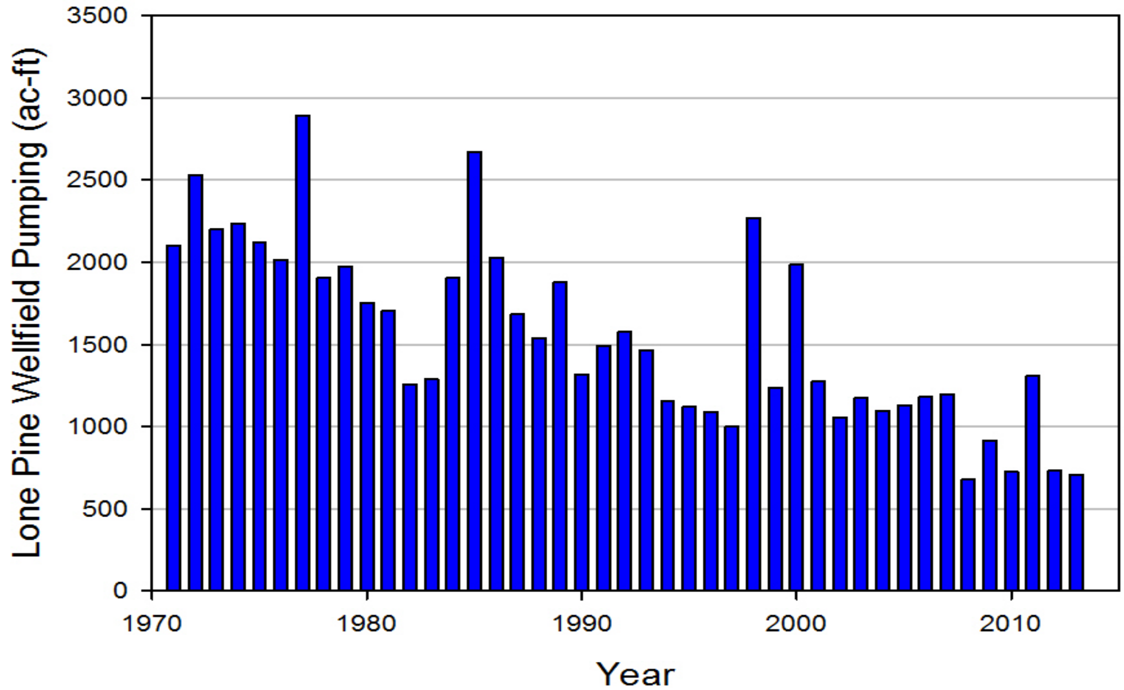


Figure 3.22. Pumping totals for the Lone Pine Wellfield.

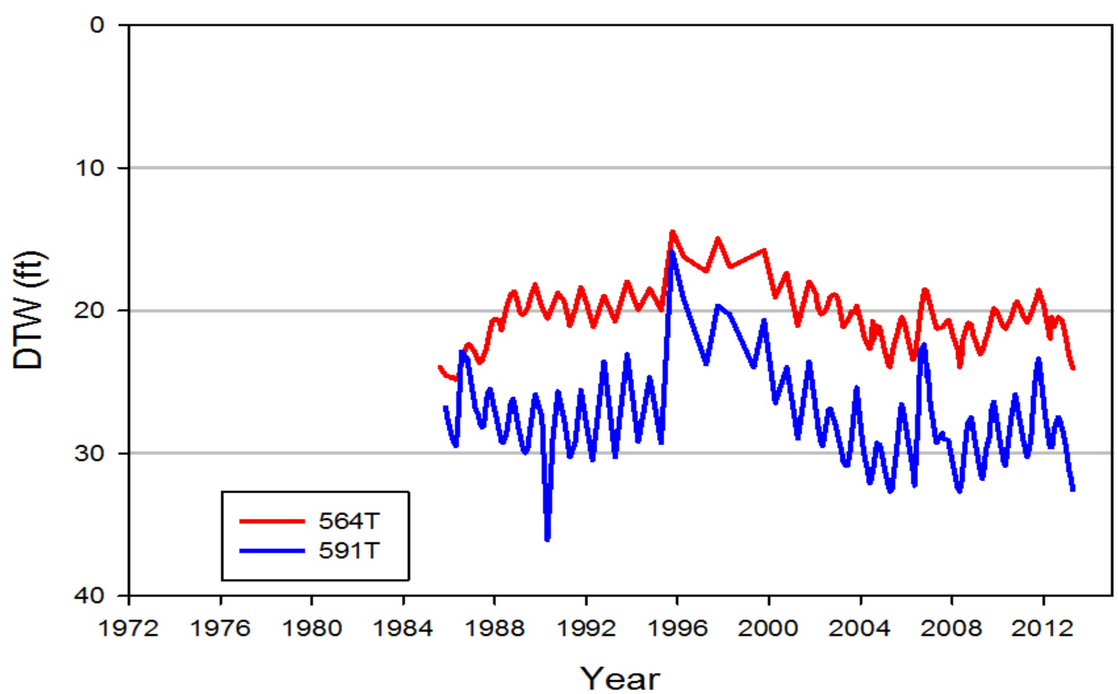


Figure 3.23. Hydrographs of selected test wells in the Lone Pine Wellfield.

Table 3.5. Selected Shallow Test Holes Adjacent to the Lower Owens River Project.

Test Well	Pre-LORP channel condition	Distance from River Channel (ft)
T467	Dry	700
T463	Dry	1070
T446	Wet	142
T448	Wet	457

Shallow Groundwater Adjacent to the Lower Owens River Project (LORP)

Base flows of 40 cubic feet per second were established in the lower Owens River in the 2007-2008 runoff-year. Five periods of higher flows to promote habitat have also been released down the Owens River channel. The effect of rewatering the LORP channel on the adjacent shallow aquifer was monitored to gain information on the surface-groundwater interaction as the project is implemented. A selected number of test wells along with the distance from the river channel are listed in Table 3.5. Two test wells are adjacent to a previously dry reach of the river and two are adjacent to the reach previously wetted by diversions from LAA or from groundwater discharge (Figure 3.24). Shallow groundwater levels rose quickly in 2007 in response to the establishment of base flows in the Lower Owens River. The increase in shallow water levels due to the LORP has resulted in groundwater levels near or above the highest levels experienced since 1972. Not surprisingly, the largest increases occurred in wells adjacent to previously dry channel. Water levels continue to rise in one well, 448T, suggesting the shallow aquifer adjacent to the river at that locations has not yet reached equilibrium. Test holes 467T, 463T, and 446T, appear to have reached equilibrium with the new flow regime.

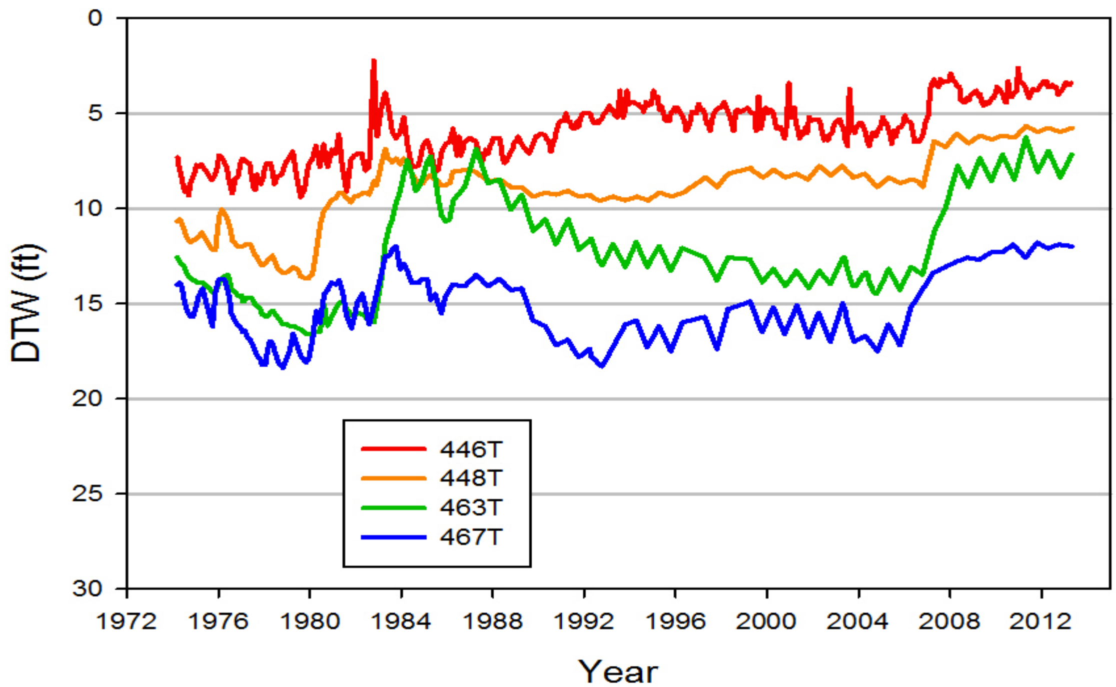


Figure 3.24. Hydrographs of selected test holes adjacent to the Lower Owens River Channel

References

Harrington, R. F., Multiple regression modeling of water table response to groundwater pumping and runoff, Inyo County Water Department report, 1998.

Steinwand, A.L, and R.F. Harrington. 2003. Simulation of water table fluctuations at permanent monitoring sites to evaluate groundwater pumping. Report to the Inyo/Los Angeles Technical Group, February 25, 2003.

SECTION 4: SOIL WATER CONDITIONS

Introduction

The Water Agreement established procedures to determine which LADWP pumping wells can and cannot be operated based on soil water and vegetation measurements (On/Off status). As part of the monitoring effort for the Agreement, the ICWD regularly measures depth to groundwater (DTW) and soil water content at 25 sites in wellfields and eight sites in control areas. Three of the wellfield sites are not used to determine the operational status of nearby pumping wells but are monitored to continue the data record. Each site is equipped with 1 to 6 soil water monitoring locations. Soil water measurements are collected using a neutron gauge calibrated for each site (Dickey, 1990; Steinwand, 1996).

The purpose for the On/Off procedures is to manage pumping to protect plant communities that require periodic access to the water table for long-term survival. Generally, the sites with On-status have wet soil and shallow water tables, and sites in Off-status have dry soil and deep water tables. Because the On/Off status is a comparison soil water and predicted transpiration, it sometimes is an unreliable indicator of whether groundwater conditions are adequate or whether water table recovery is necessary. To assist the evaluation of LADWP pumping proposals, the Water Department examined the DTW and soil water data to determine whether groundwater is accessible to plants at the permanent monitoring sites at the beginning of the 2014 growing season.

How well plants can access groundwater depends on the vegetation type as well as water table depth. In similar soils, a shallower water table is necessary to supply groundwater to grasses than shrubs because of the shallower roots of the grasses. For management purposes in the Water Agreement, shrub-dominated sites are assigned a root zone of 4 m (13.1 ft.); grass-dominated or mixed grass and shrub assemblages are assigned a root zone of 2 m (6.6 ft.). These approximate values are not the actual rooting depth at a particular monitoring site, but they are useful to compare with the soil depth that received recharge from groundwater.

> The purpose for monitoring soil water and the On/Off procedures is to manage pumping to protect plant communities that require periodic access to the water table for long-term survival.

Soil water in the root zone can be supplied by infiltration from the surface (rain or irrigation) or from contact with the water table. It is usually possible to discriminate deeper soil affected by groundwater from soil near the surface affected by infiltration based on the depth and timing of the measured changes in soil water content. Plant roots can utilize groundwater directly, and if the water table is within the root zone it is reasonable to conclude that groundwater is available. A rising water table can progressively wet the root zone from below and provide water to plants. Plant roots can also tap groundwater that is drawn into the soil above the water table by capillarity where it is held in soil pores or adsorbed to soil particles. Plant uptake during the summer depletes soil water, and when transpiration ceases in the fall, water from the moist soil above the water table will replenish the drier soil in the root zone via capillarity or through inactive plant roots even if the water table is stable or declining. This is a slow process and usually provides much less soil water recharge than a rising water table.

Results and Discussion

Monitoring results for available soil water, vegetation water requirement, water table depth, and the On/Off status for all sites are presented in the figures contained in Appendix A at the end of this section. (The graphs in Appendix A are periodically updated and available on the ICWD website.) At the beginning of the 2013-14 runoff year, six sites were in On-status, and remained so throughout the runoff year. No sites went into On status during the winter 2013-14. The six sites in On status as of May, 2014 were: L2, BP4, TA5, TS2, SS1, and BG2.

Hydrographs for the permanent monitoring sites are presented in Appendix A, and the minimum (shallowest) DTW measured during the fall and winter preceding the 2013 and 2014 growing seasons are presented in Table 1. The minimum DTW is a useful measurement because it is associated with the amount of groundwater recharge in the root zone before the beginning of the growing season. At most sites, the minimum DTW occurs in the spring. At sites BP1, 2, and 3 in Big Pine, the water table rises during the summer and reaches a minimum in the fall coinciding with the timing of diversions into the Big Pine canal for irrigation. For these three sites, the amount and depth of soil water recharge during the winter are related to the minimum water table depth in the fall.

The water table was deeper at most wellfield in 2014 compared with 2013 although the declines in general (24 of 33 sites) were smaller this year than last. The exceptions were the stable or small increases at TA1/2 and TA4. The water table at control sites was stable at most sites; BC1 experienced a large decrease in DTW and BGC experienced a small decline. Runoff during the two preceding winters (2012-13 and 2011-12) was much below normal and pumping was approximately the same, so a general decline was expected (see the Groundwater section of this report.) Average decline at wellfield sites was 0.35 m (approximately 1 foot). Only TS1 and IO1 experienced declines greater than 0.60 m. The cause of the relatively large water table rise at BC3 is unknown, but it follows an unusual period of water table decline or lack or winter recovery each of the last 2 years.

At most sites it was possible to discriminate groundwater recharge from surface infiltration because of the dry winter in 2013-14 (Tables 4.2 and 4.3). Infiltration was limited to depths within 0.3-0.5 m of the surface at most sites. At some sites, much of the precipitation that fell in October and November evaporated during the winter. The monitoring sites were grouped into simple categories to summarize the connection between soil water in the root zone and the water table. Brief descriptions of the three categories and the results are given below:

1. Connected: Water table fluctuations resulted in soil water recharge in the top half of the root zone at most monitoring locations within a site. Three wellfield and five control sites were placed in this category.

2. Partially connected: Water table fluctuations resulted in soil water recharge in the bottom half of the root zone at most monitoring locations within a site. Three wellfield and two control sites occur in this category. The control sites and TS3, TS4, and TS6 have ample soil water stored in the soil profile.

Table 4.1. Minimum DTW during the fall and winter preceding the growing seasons in 2013 and 2014. For some sites with a steadily declining water table, measurements near April 1 were compared for both years. Hydrographs for the sites are provided in Appendix A. Depths are below ground surface.

Site	2013 DTW	2014 DTW	DTW Change 2013-14†
	(m)	(m)	(m)
L1	7.79	8.22	-0.43
L2	7.22	7.56	-0.34
L3	5.12	5.32	-0.20
BC1	3.18	3.18	0.0
BC2	4.48	4.53	-0.05
BC3	2.64	1.52	1.12
BP1	4.39	4.84	-0.45
BP2	5.75	6.24	-0.49
BP3	5.08	5.29	-0.21
BP4	5.56	5.79	-0.23
TA1 & 2	2.15	2.11	0.04
TA3	5.74	6.25	-0.51
TA4	2.99	2.99	0.0
TA5	4.86	4.87	-0.01
TA6	4.19	4.74	-0.55
TAC	1.56	1.55	0.01
TS1	5.48	6.23	-0.75
TS2	3.85	4.26	-0.41
TS3	2.09	2.41	-0.32
TS4	2.38	2.48	-0.10
TS6	3.91	4.71	-0.8
TSC	1.17	1.14	0.03
IO1	3.57	4.44	-0.87
IO2	10.04	10.31	-0.27
IC1	0.98	0.99	-0.01
IC2	2.45	2.44	0.01
SS1	6.62	7.03	-0.41
SS2	NA††	NA††	
SS3	4.11	4.33	-0.22
SS4	6.25	6.47	-0.22
BG2	5.45	5.76	-0.31
BGC	2.71	2.87	-0.16

†: positive values denote a rise in the water table.
††: The monitoring well is dry at approximately 8.4 m.

Table 4.2. Soil depth below ground surface replenished by groundwater in 2013-2014 at control sites. Values are provided for each monitoring location within a site. DTW was measured in the associated test well, and the values do not account for elevation differences between the well and monitoring site.

Site	Dominant plant species	Root Zone	Minimum DTW	Groundwater recharge depth
		(m)	(m)	(m)
BC1	rabbitbrush, saltbush, greasewood, alk. sacaton	4	3.18	2.5, 1.1, 2.9
BC2	rabbitbrush, saltgrass	2	4.53	1.1, <1.3, 1.3, 0.3
BC3	rabbitbrush, saltgrass, saltbush	2	1.52	<0.5, <0.5, <0.5†
TAC	saltbush, rye grass, saltgrass, alk. sacaton	2	1.55	0.7, 0.7, 0.7, 1.1
TSC	alk. sacaton, rabbitbrush, greasewood.	2	1.14	0.9, 0.5, 0.5
IC1	saltbush, saltgrass, rabbitbrush	2	0.99	0.9, 0.9, 0.5
IC2	rabbitbrush, alk. sacaton	2	2.44	>1.9, 2.1, >3.7
BGC	saltbush, saltgrass	4	2.87	1.1, 1.5, 1.7

†: Less than symbols (<) denote locations where both infiltration and groundwater recharge contribute to increasing soil water content above the depth indicated

3. Disconnected: No recharge from groundwater occurred in the root zone. Nineteen wellfield sites and one control site occur in this category. The control sites and L2, BP4, TA4, TA5, SS1, SS3, and BG2 had retained soil water available to plants, but the water table at the beginning of the 2013 growing season is too deep to recharge the root zone. Soil at the other sites is dry.

Three sites were placed in a wetter category in 2014 compared with 2013, TA1, TA2, and BC3. The water table at those sites was stable or increased In 2013-14. In 2013-14, one control site IC2 exhibited stable soil water conditions and groundwater recharge was only noticeable below the 2m root zone (Figure 4.1). Other control sites had similar or slightly drier soil conditions but all control sites still had ample retained water in the soil above the water table. At the beginning of the 2014 growing season, the water table was capable of supplying water to the root zone at six wellfield monitoring sites (Figure 4.1), three fewer sites than in 2013. Nineteen sites were classified as disconnected including the three sites added this year: IO1, SS3, and SS4. Eight sites in the disconnected category still retain soil water following water table decline (L2, BP4, TA4, IO1, SS1, SS3, and BG2) or because the plant cover is low and the soil is always moist (TA5). The remaining eleven sites have dry soil throughout the root zone. As in previous years, interpretations for TA5 were atypical. Soil at this site was moist at lower depths but relatively unchanging. Plant uptake during the summer was not evident below two meters, and soil water recovery when plant uptake ceased in the fall or related to water table fluctuations was not evident. The DTW at TA5 is much below the 2m root zone, and the site was classified as disconnected as it was in 2013.

Monitoring locations at six sites, L1, BP1 TA3, IO1, SS1, and SS4 exhibited increasing soil water content at certain depths well above the water table while lower depths showed no change in water content. The change in water content at those sites was small (usually less than 0.03 $m^{3/}m^3$), sometimes barely detectable. Simple capillary rise to recharge shallower depths while not affecting unsaturated soil just above the water table is unusual. Water can be transported during winter from wetter, deeper soil layers through plant roots to recharge dry soil at shallower depths (Horton and Hart, 1998; Jackson et al., 2000) but without additional information, assigning that cause is speculative. Regardless of the exact mechanism causing the increase in soil water, the monitoring and On/Off management was able to measure and account for that source of water.

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Horton, J.L. and S.C. Hart. 1998. Hydraulic lift: a potentially important ecosystem process. Tree 13:232-235.

Jackson, R.B., J.S. Sperry, and T.E. Dawson. 2000. Root water uptake and transport: using physiological processes in global predictions. Trends Plant Sci. 5:482-488.

Steinwand, A.L, 1996. Protocol for Owens Valley neutron probe soil water monitoring program. Report to the Inyo/Los Angeles Technical Group, August 6, 1996.

Table 4.3. Soil depth below ground surface replenished by groundwater in 2012-2013 at wellfield sites. Values are provided for each monitoring location within a site unless the identification of a specific depth was uncertain. DTW was measured in the associated test well, and the values do not account for elevation differences between the well and monitoring site.

Site	Dominant plant species	Root Zone	Minimum DTW	Groundwater recharge depth
		(m)	(m)	(m)
L1	greasewood	4	8.22	>3.9, 3.3†, 3.5†
L2	alk. sacaton, greasewood, saltbush	2	7.56	>3.9 at all five locations
L3	alk. sacaton, saltgrass	2	5.32	1.1, 1.5, 0.9, 0.7, 0.9, 1.3
BP1	saltbush, greasewood	3	3.18	>3.7, >3.3, 1.5-2.5†, >3.9, >3.7
BP2	saltbush, rabbitbrush	4	4.53	>5.3, >3.9, >3.9
BP3	greasewood, rabbitbrush	4	1.52	>3.9 at all three locations
BP4	saltbush, greasewood	4	4.84	1.9-2.3†, >3.9, >3.9
TA1	alk. sacaton, saltbush	2	6.24	0.9
TA2	alk. sacaton, saltbush, greasewood, rabbitbrush	2	5.29	0.7
TA3	saltbush, alk. sacaton, sagebrush	2	5.79	>3.9, 2.3-2.5†, 2.5-2.7†
TA4	rabbitbrush, alk. sacaton	2	2.11	>3.1, >1.9, >1.9
TA5	greasewood, alk. sacaton	2	6.25	
TA6	saltbush, rabbitbrush	2	2.99	2.7, 3.1, 3.5
TS1	weeds, alk. sacaton	2	4.87	>3.9 at all five locations
TS2	sagebrush, saltbush, alk. sacaton	2	4.74	>3.9, >3.9, >3.3
TS3	saltgrass, alk. sacaton	2	1.55	0.7, 0.7, 1.1, 1.3, 1.5, 2.5
TS4	greasewood, alk. sacaton, saltbush, saltgrass	2	6.23	0.3†, 0.3†, 1.3, 1.1
TS6	alk. sacaton, saltbush, saltgrass	2	4.26	1.5
IO1	rabbitbrush, alk. sacaton, saltbush	2	2.41	1.3-1.7†, >3.9, >3.9
IO2	saltbush	4	2.48	>5.5, >3.9, >3.9
SS1	saltbush, greasewood	4	4.71	>5.5, 3.5†, >3.9
SS2	saltbush	4	1.14	>5.5, >3.9, >3.9
SS3	saltbush	4	4.44	>3.9, 3.3, >3.9
SS4	saltbush	4	10.31	>3.9, >3.9, 2.3†
BG2	inkweed, saltbush	4	0.99	>3.9, at all three locations

†: Soil water content at these depths increases slightly during winter well above the limit of capillarity above the water table suggesting that another recharge mechanism is operating. The change in water content is usually small (< 0.065 m^3/m^3).

††: The water table is deeper than the bottom of the monitoring well at 8.4m.

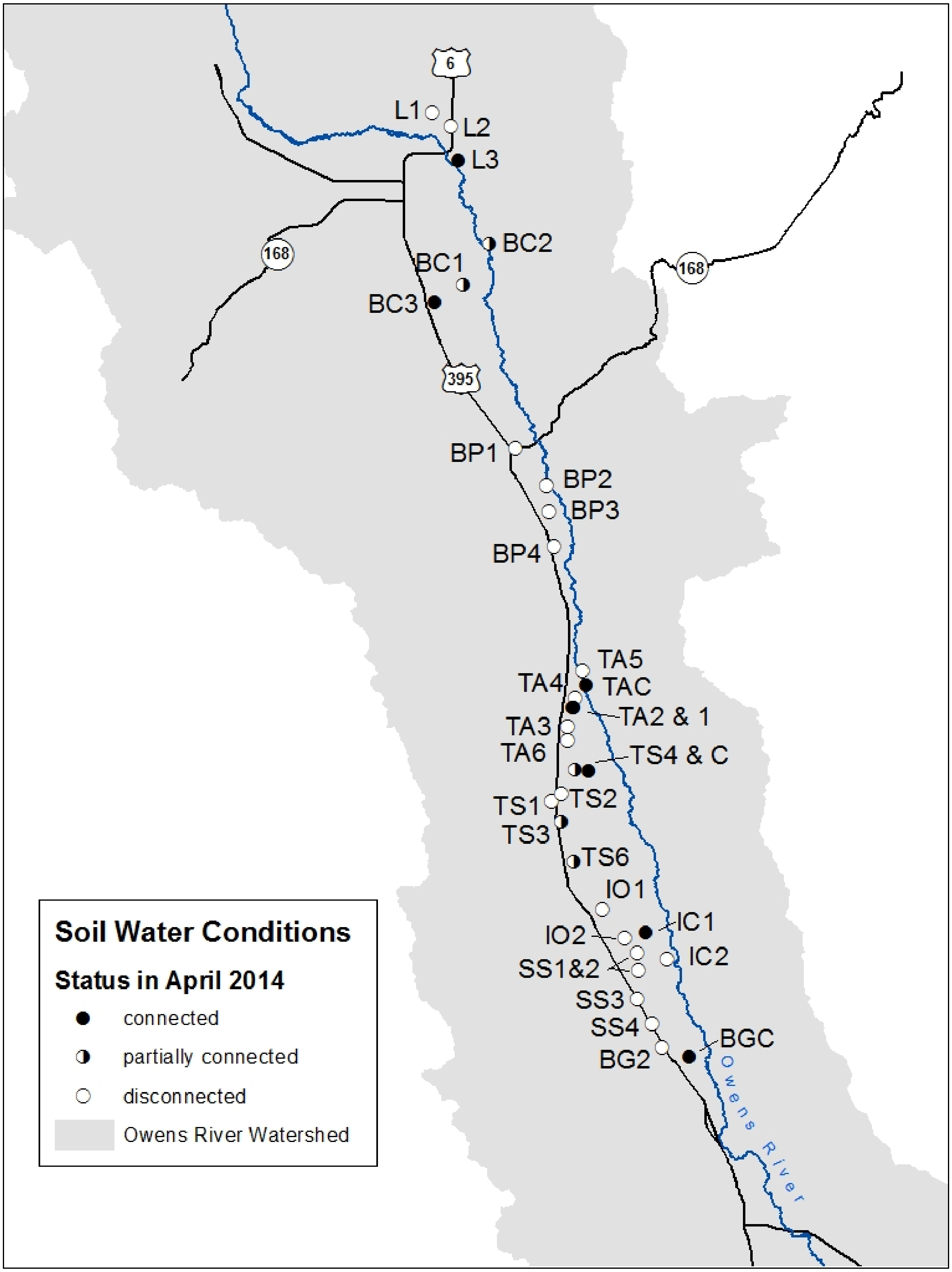


Figure 4.1. Owens Valley permanent monitoring sites and groundwater recharge classes.

Section 4, Appendix A

July 1 and October 1 On/Off calculation tables for the permanent monitoring sites and graphs containing the soil-plant water balance and groundwater data and. No sites entered On status between October, 2013 and April 2014.

Table A1. June 2013 monitoring site status and July 1 soil/vegetation water balance calculations according to Green Book, Section III.

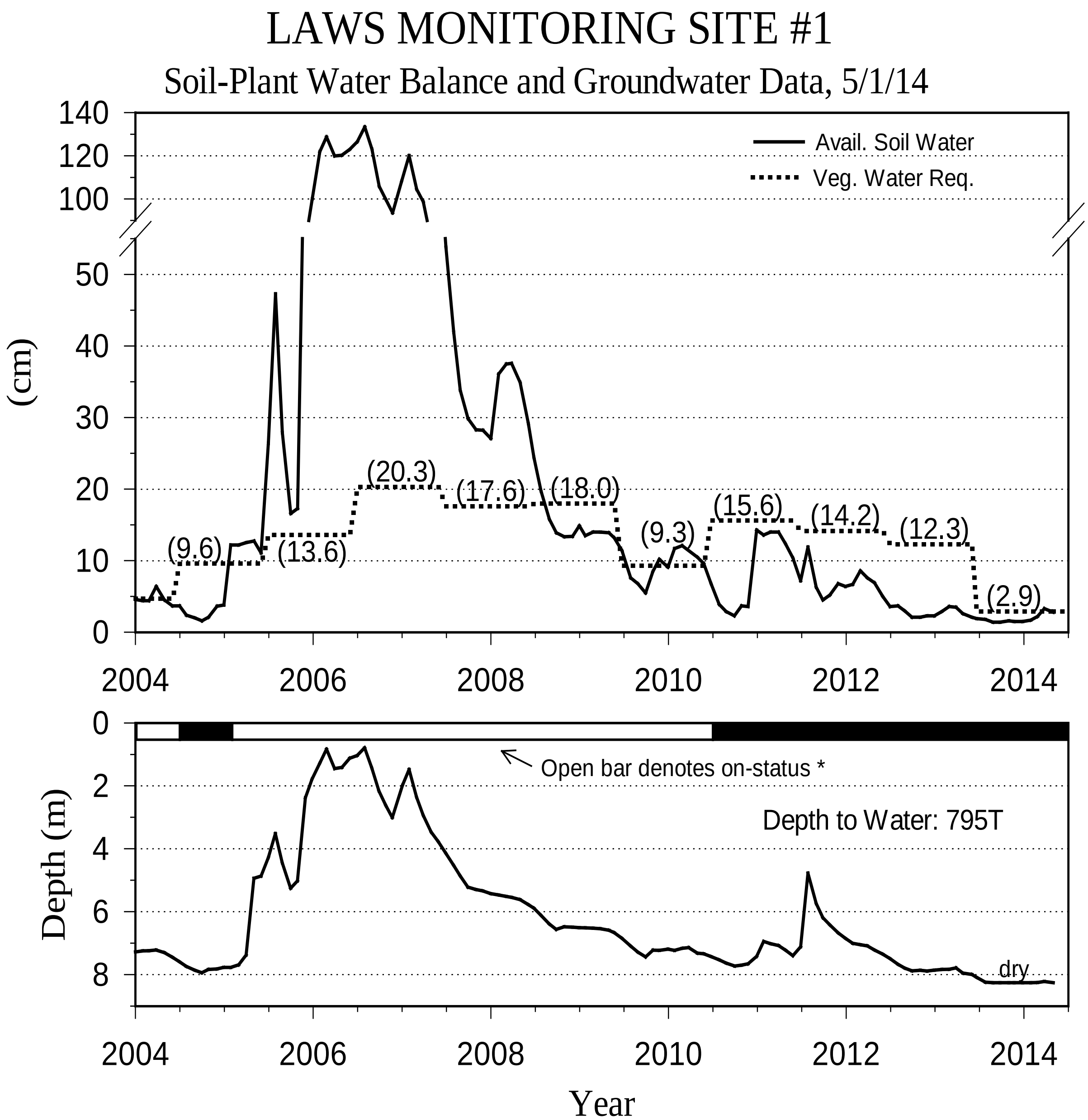
Site	June, 2013 Status	July, 2013 Veg. Water Req./ Soil AWC for turn-on	July 2013 soil AWC	July 2013 Status	Soil AWC required. for well turn-on
		(cm)	(cm)		(cm)
L1	OFF	1.7/15.6	1.9	OFF	15.6, OFF 7-10
L2	ON	3.4/NA	16.1	ON	NA
L3	OFF	3.1/25.2	9.5	OFF	25.2, OFF 10-11
BP1	OFF	2.5/22.9	4.5	OFF	22.9†, OFF 10-97
BP2	OFF	4.6/28.4	1.9	OFF	28.4, OFF 7-98
BP3	OFF	4.1/10.6	3.4	OFF	10.6. OFF 7-12
BP4	ON	5.7/NA	46.5	ON	NA
TA3	OFF	6.9/26.0	6.9	OFF	26.0, OFF 10-11
TA4	OFF	4.0/23.3	15.2	OFF	23.3, OFF 10-11
TA5	ON	1.1/NA	20.3	ON	NA
TA6	OFF	4.2/17.6	9.3	OFF	17.6, OFF 10-11
TS1	OFF	2.8/20.4	1.8	OFF	20.4†, OFF 10-96
TS2	ON	2.7/NA	8.5	ON	NA
TS3	OFF	8.7/32.9	25.7	OFF	32.9, OFF 10-12
TS4	OFF	20.4/55.9	36.8	OFF	55.9, OFF 10-11
IO1	OFF	26.1/42.2	24.5	OFF	42.2, OFF 10-98
IO2	OFF	2.1/18.9	4.4	OFF	18.9, OFF 7-11
SS1	ON	6.8/NA	23.2	ON	NA
SS2	OFF	2.9/25.6	2.9	OFF	25.6, OFF 7-11
SS3	OFF	5.7/33.8	22.4	OFF	33.8, OFF 10-11
SS4	OFF	2.6/15.9	6.6	OFF	15.9, OFF 7-05
BG2	ON	2.0/NA	24.0	ON	NA

†: These values of soil water required for well turn-on were derived using calculations based on percent cover that were routinely performed in the past. The values have not been updated to conform with the Greenbook equations in section III.D.2, p. 57-59.

Table A2. July 2013 monitoring site status and October 1, 2013 soil/vegetation water balance calculations according to Green Book, Section III.

Site	July 1, 2013 Status	October, 2013 Veg. Water Req./Soil AWC for turn-on	October 2013 soil AWC	+40% annual ppt.	October 1 2013 Status	Soil AWC req. for well turn-on
		(cm)	(cm)	(cm)		(cm)
L1	OFF	2.9/15.6	1.4	NA	OFF	15.6, OFF 7-10
L2	ON	6.1/NA	13.6	13.6 + 6.3 = 19.9	ON	NA
L3	OFF	5.6/25.2	7.8	NA	OFF	25.2, OFF 10-11
BP1	OFF	4.6/22.9	2.7	NA	OFF	22.9†, OFF 10-97
BP2	OFF	8.6/28.4	1.1	NA	OFF	28.4, OFF 7-98
BP3	OFF	7.3/10.6	2.9	NA	OFF	10.6. OFF 7-12
BP4	ON	10.1/NA	43.2	43.2 + 6.6 = 49.8	ON	NA
TA3	OFF	12.9/26.0	6.8	NA	OFF	26.0, OFF 10-11
TA4	OFF	7.4/23.3	14.0	NA	OFF	23.3, OFF 10-11
TA5	ON	1.9/NA	20.8	20.8 + 6.6 = 27.4	ON	NA
TA6	OFF	7.7/17.6	9.7	NA	OFF	17.6, OFF 10-11
TS1	OFF	5.3/20.4	1.8	NA	OFF	20.4†, OFF 10-96
TS2	ON	4.9/NA	8.0	8.0 + 5.8 =13.8	ON	NA
TS3	OFF	16.0/32.9	21.7	NA	OFF	32.9, OFF 10-12
TS4	OFF	37.0/55.9	29.2	NA	OFF	55.9, OFF 10-11
IO1	OFF	48.6/42.2	21.0	NA	OFF	42.2, OFF 10-98
IO2	OFF	4.0/18.9	4.6	NA	OFF	18.9, OFF 7-11
SS1	ON	12.4/NA	19.3	19.3 + 5.2 = 30.8	ON	NA
SS2	OFF	5.4/25.6	4.1	NA	OFF	25.6, OFF 7-11
SS3	OFF	10.6/33.8	20.7	NA	OFF	33.8, OFF 10-11
SS4	OFF	4.9/15.9	4.2	NA	OFF	15.9, OFF 7-05
BG2	ON	3.7/NA	25.3	25.3 + 5.3 = 30.6	ON	NA

†: These values of soil water required for well turn-on were derived using calculations based on percent cover that were routinely performed in the past. The values have not been updated to conform with the Greenbook equations in section III.D.2, p. 57-59.



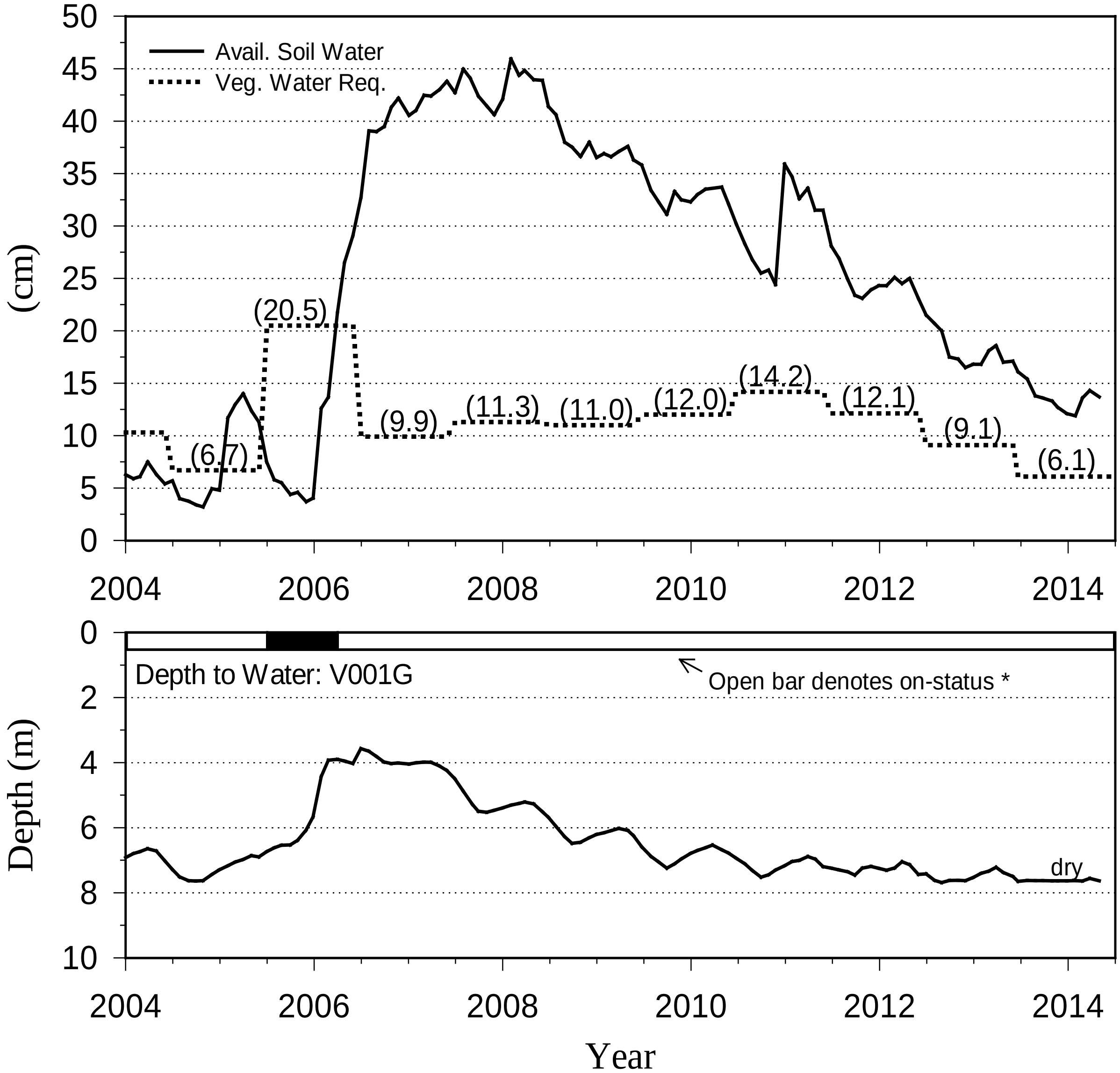
* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells- 247, 248, 249, 398

Soil water required for turn on (15.6 cm)

LAWS MONITORING SITE #2

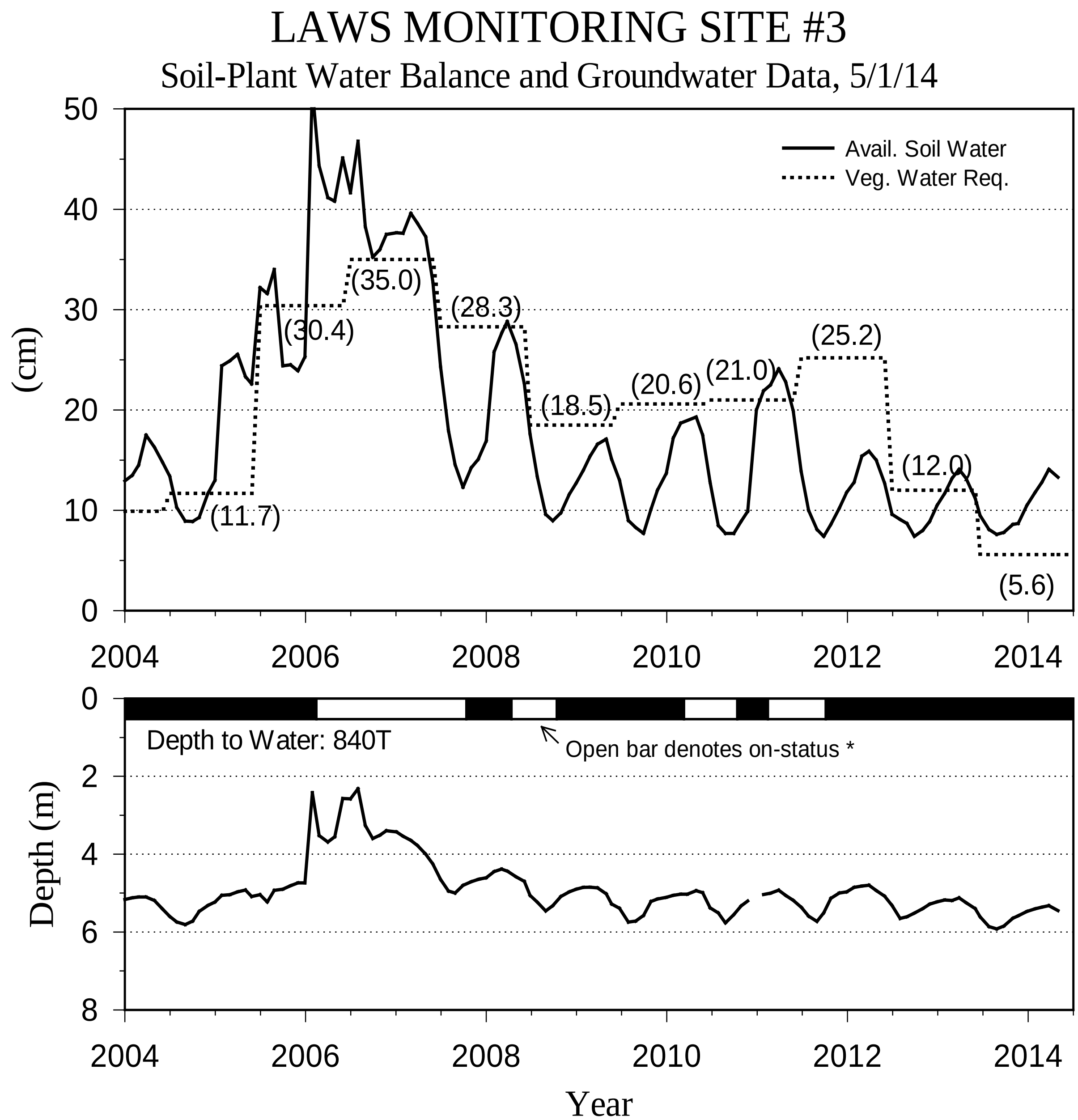
Soil-Plant Water Balance and Groundwater Data, 5/1/14



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 236, 239, 243, 244

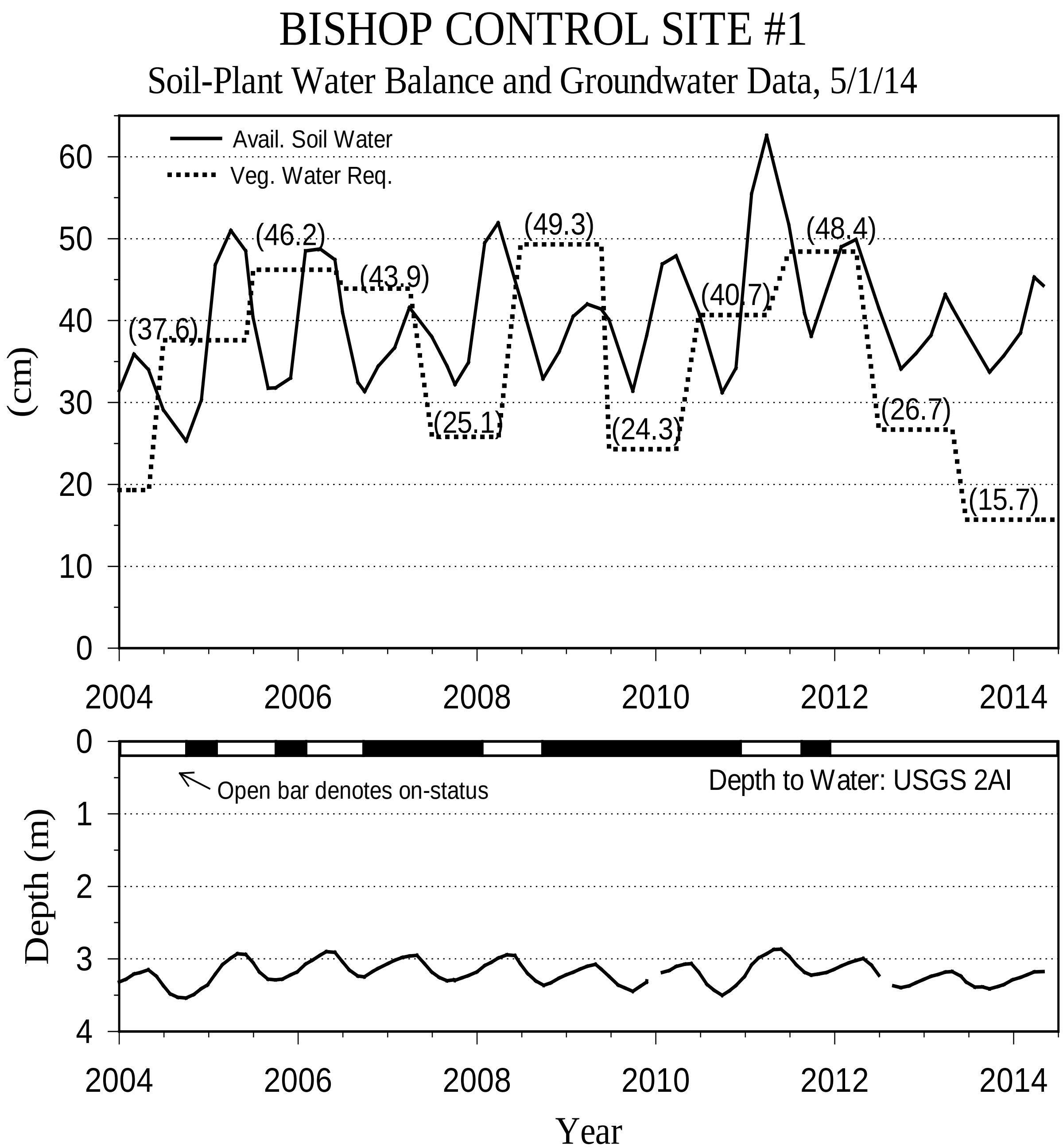
Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

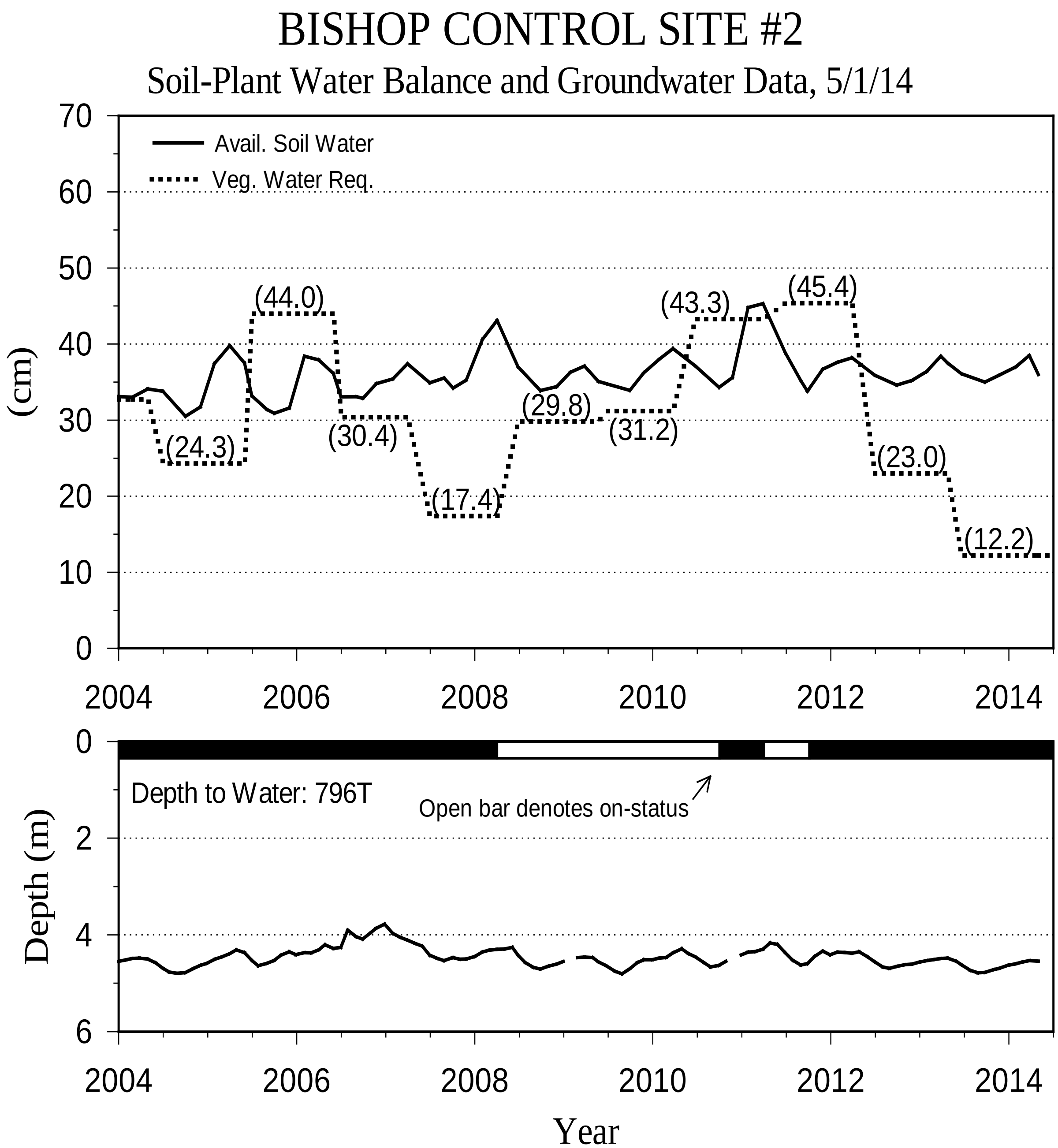
Linked pumping wells - 240, 241, 399, 376, 377

Soil water required for turn on (25.2 cm)



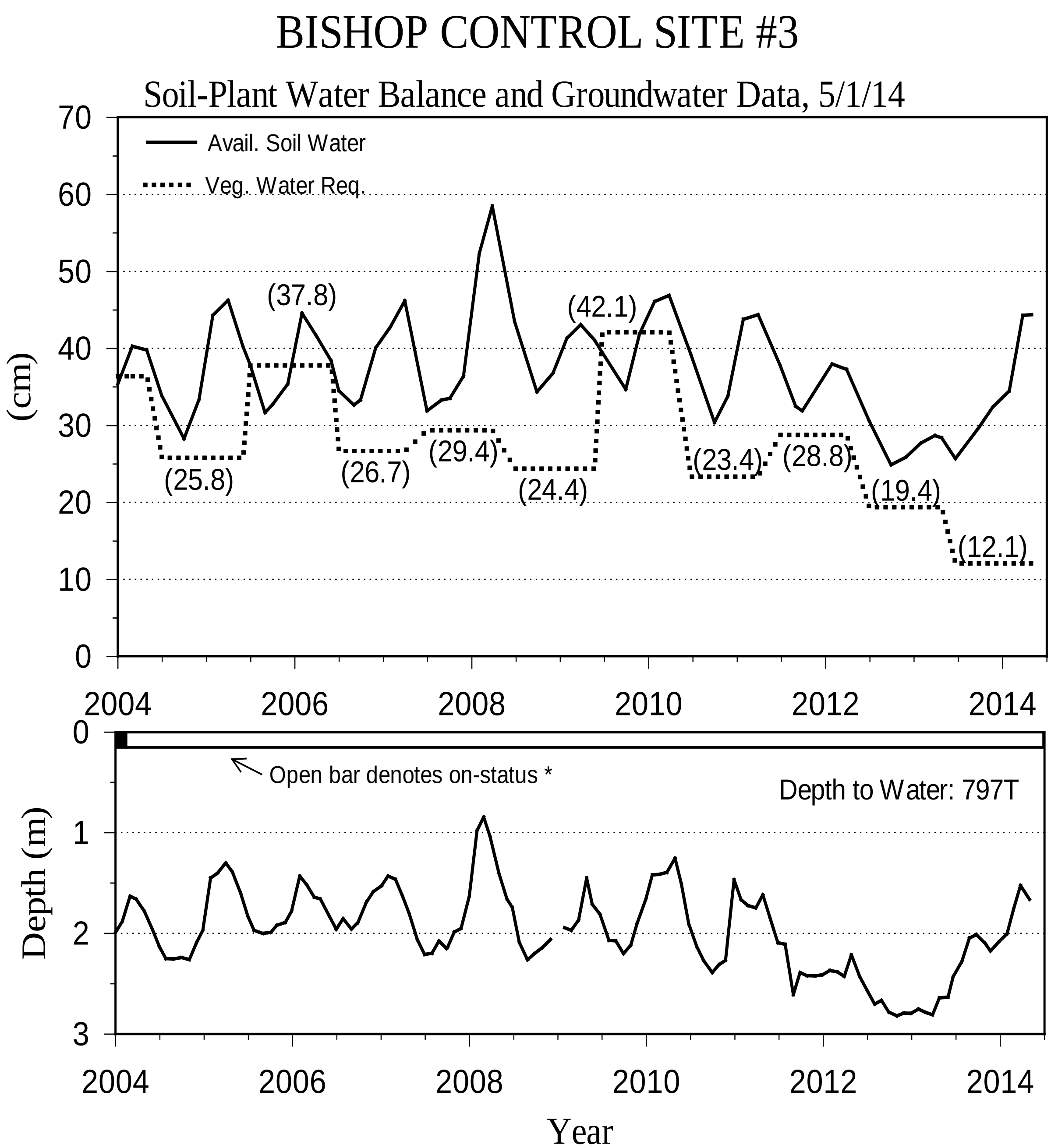
*On/off according to the Green Book Section III values for Veg. Water Req.

Soil water required for turn on (--)



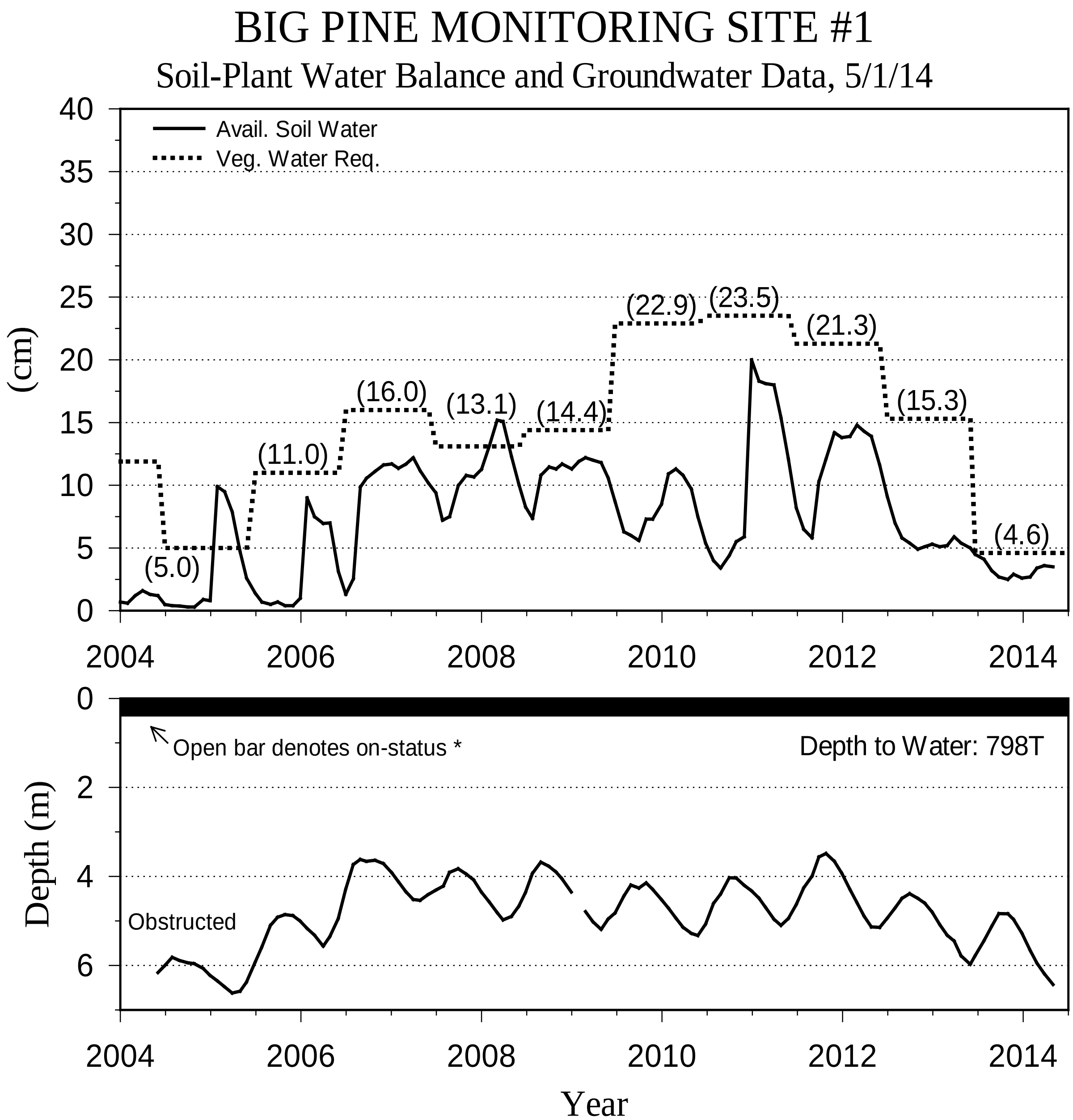
*On/off according to the Green Book Section III values for Veg. Water Req.

Soil water required for turn on (--)



*On/off according to the Green Book Section III values for Veg. Water Req.

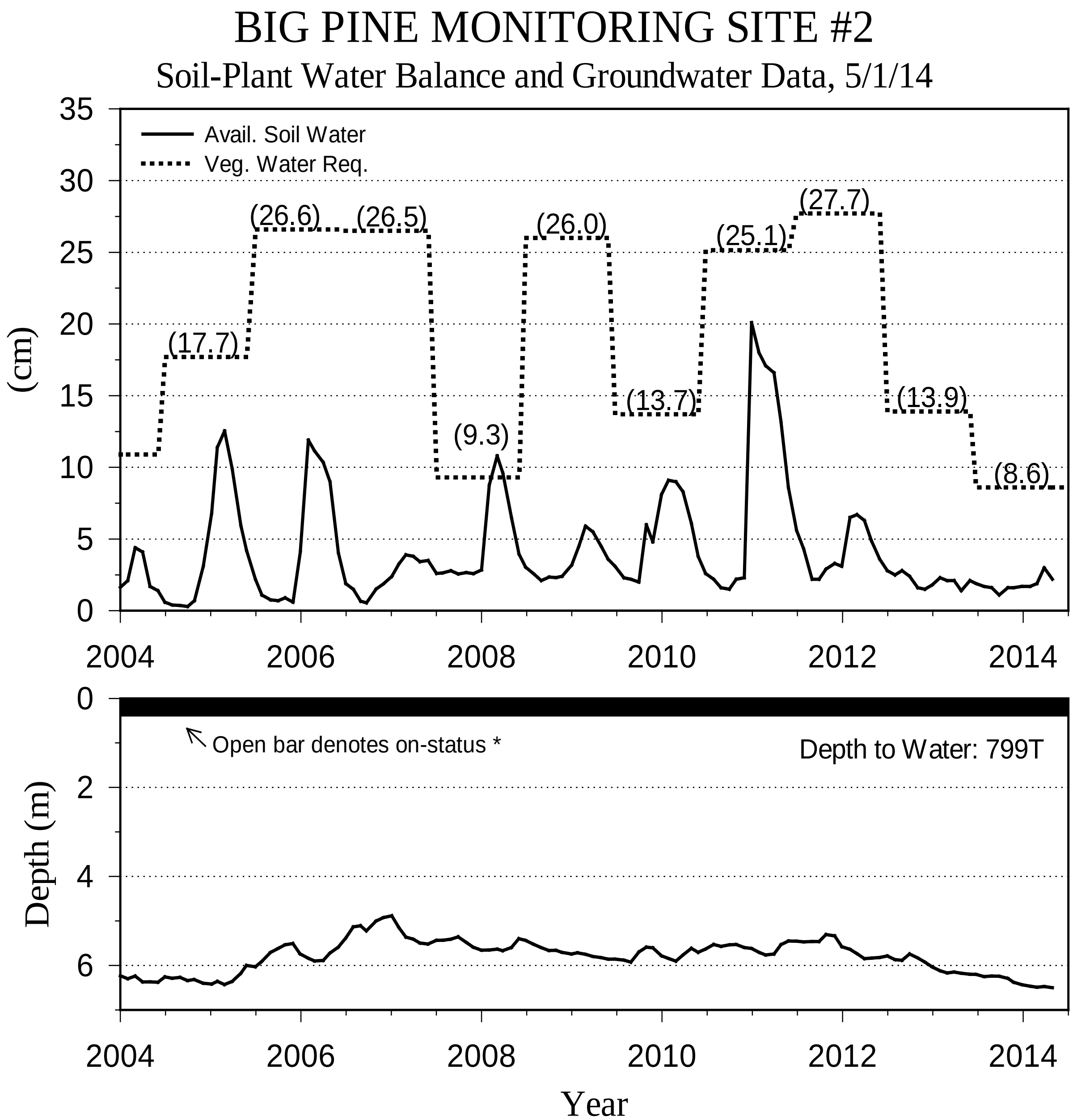
Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 210, 378, 379, 389

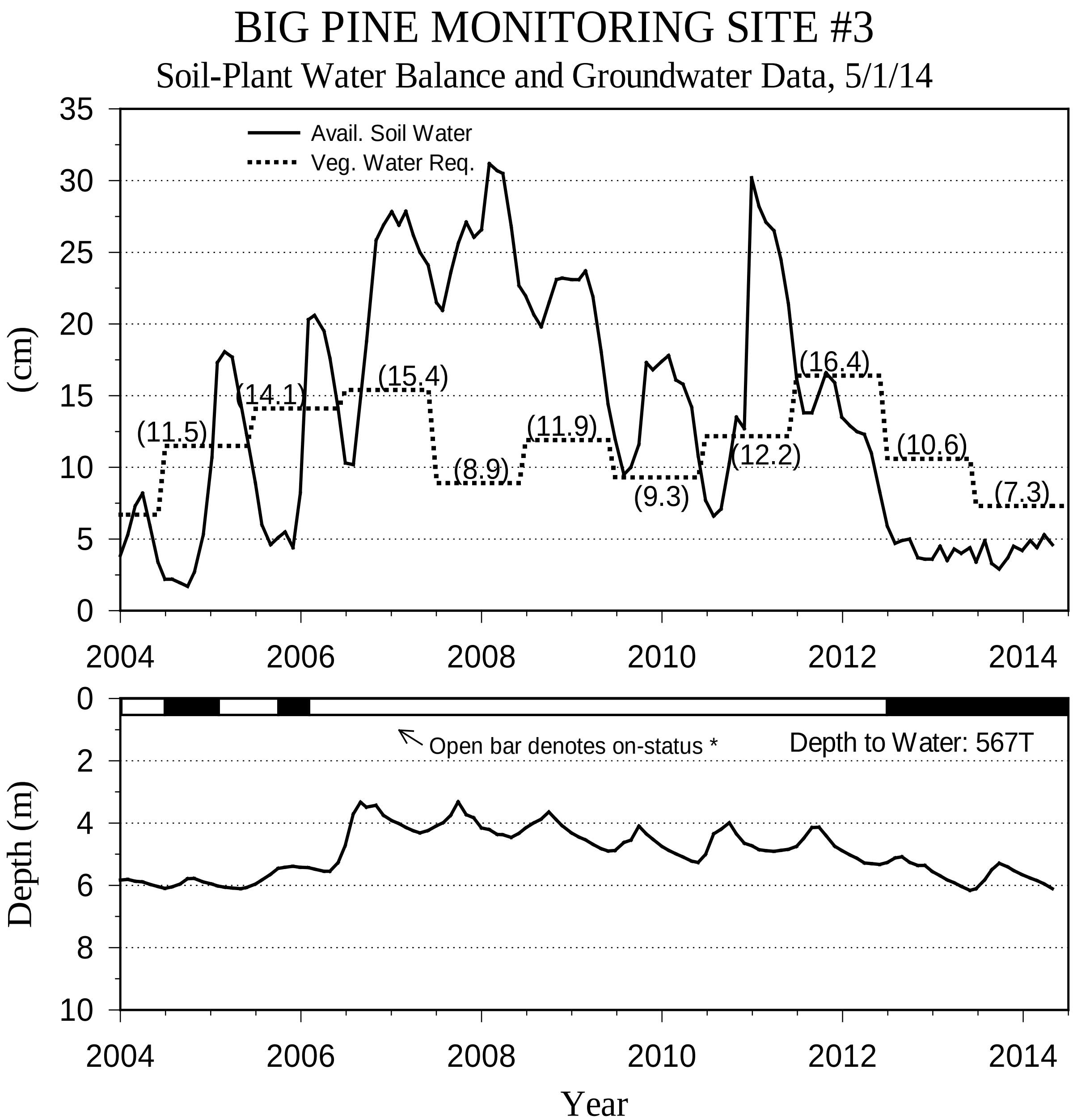
Soil water required for turn on (22.9 cm)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 220, 229, 374, 375

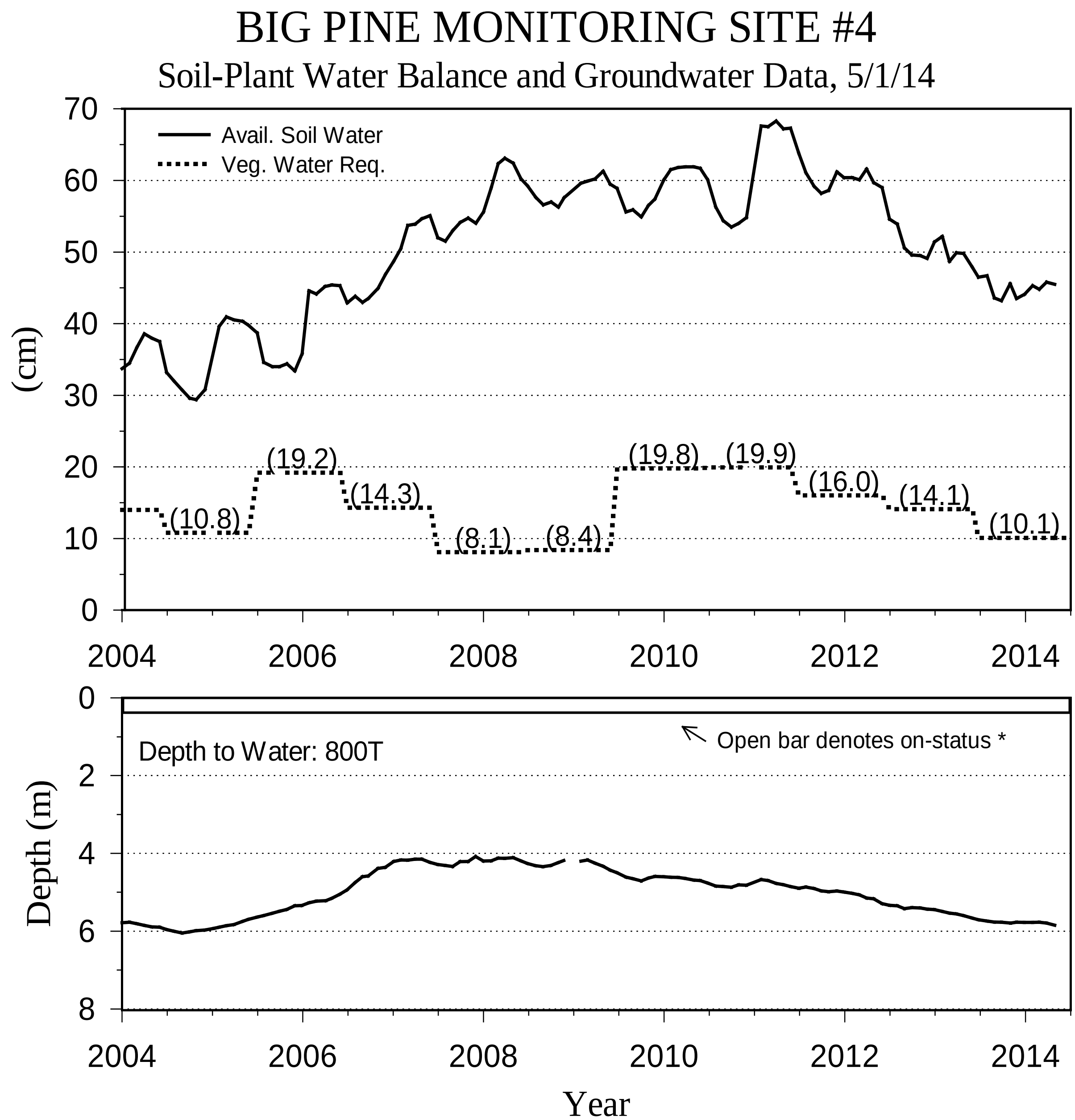
Soil water required for turn on (28.4 cm)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 222, 223, 231, 232

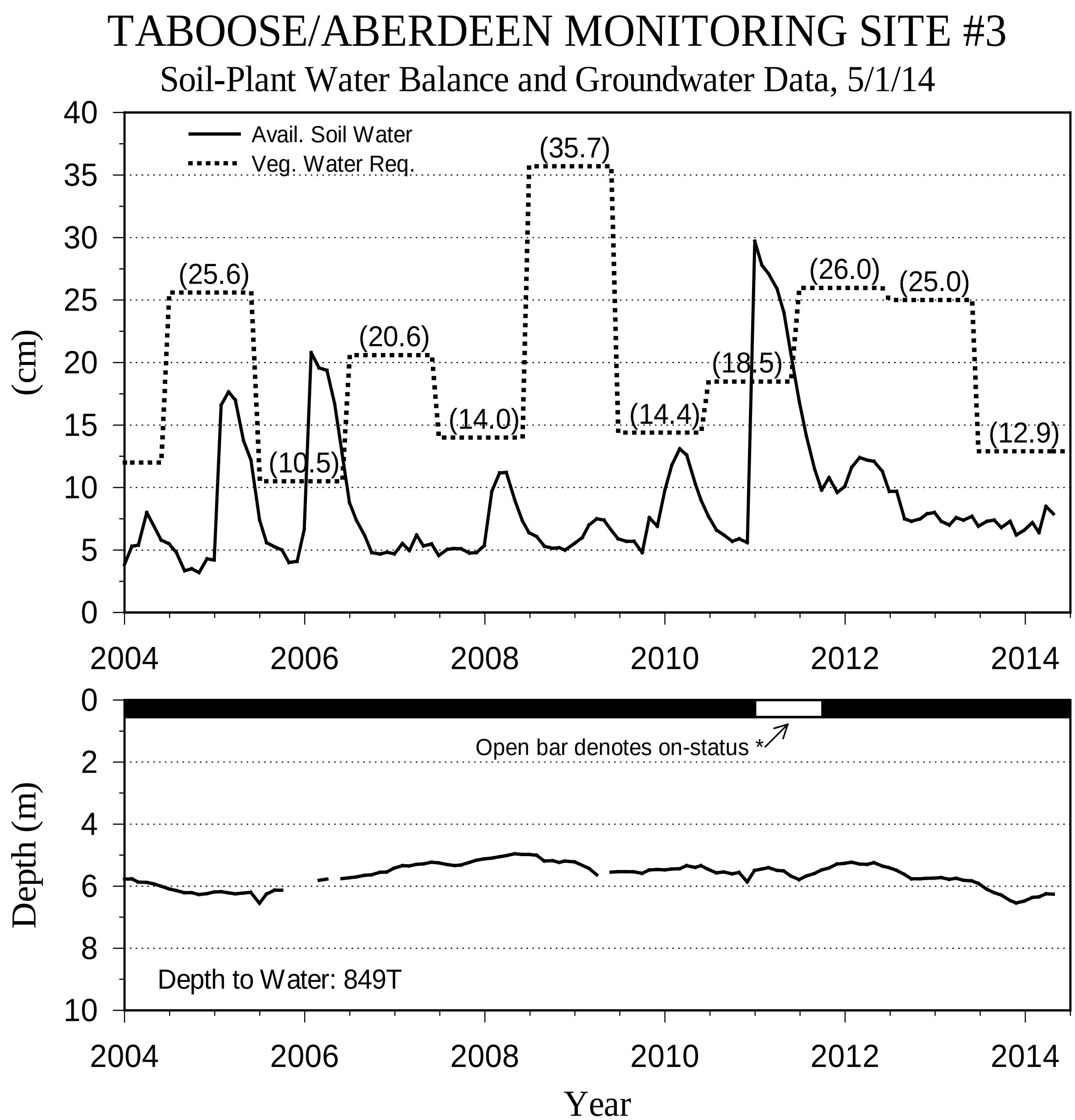
Soil water required for turn on (10.6 cm)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping well - 331

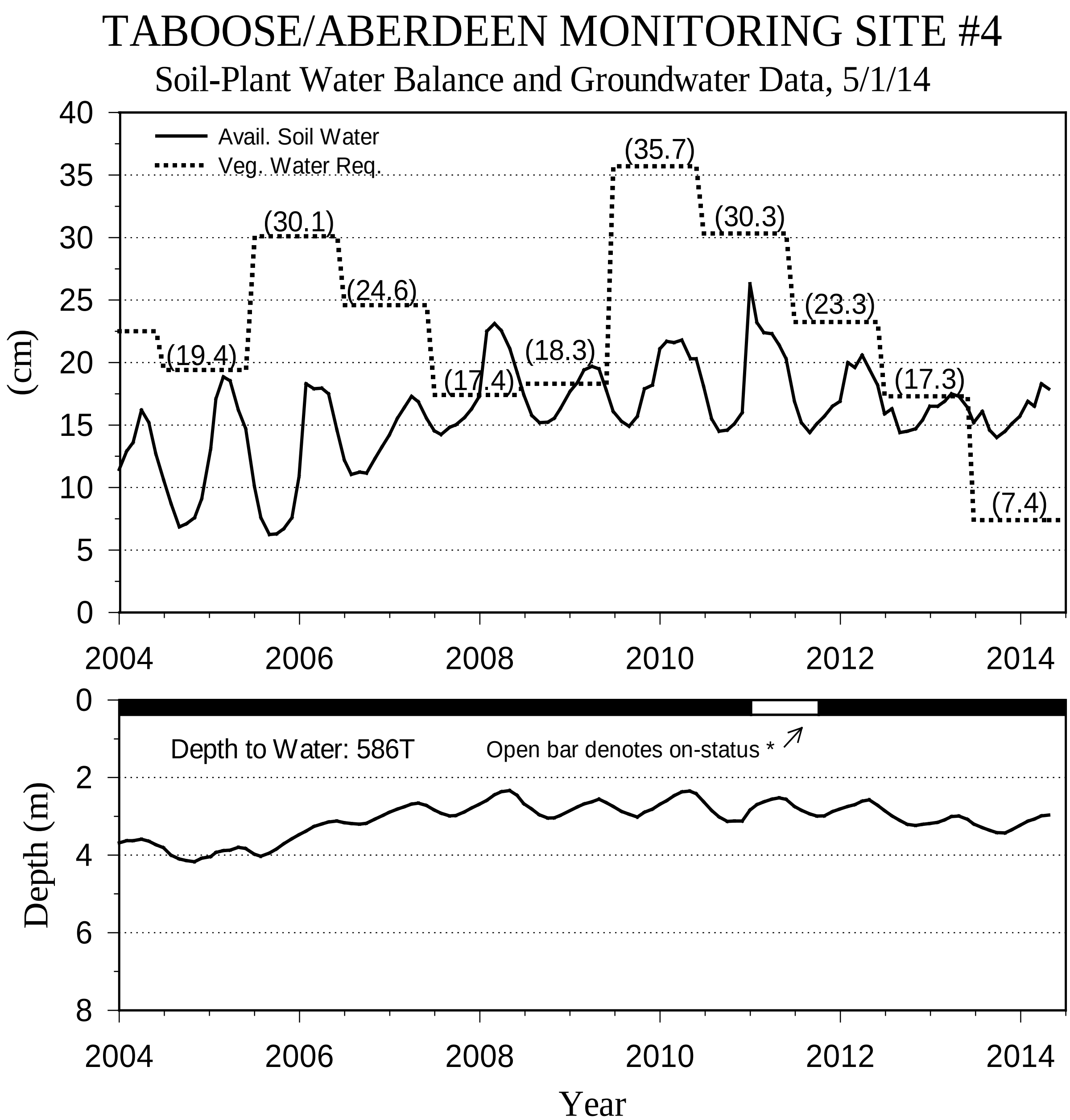
Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 106, 110, 111, 114

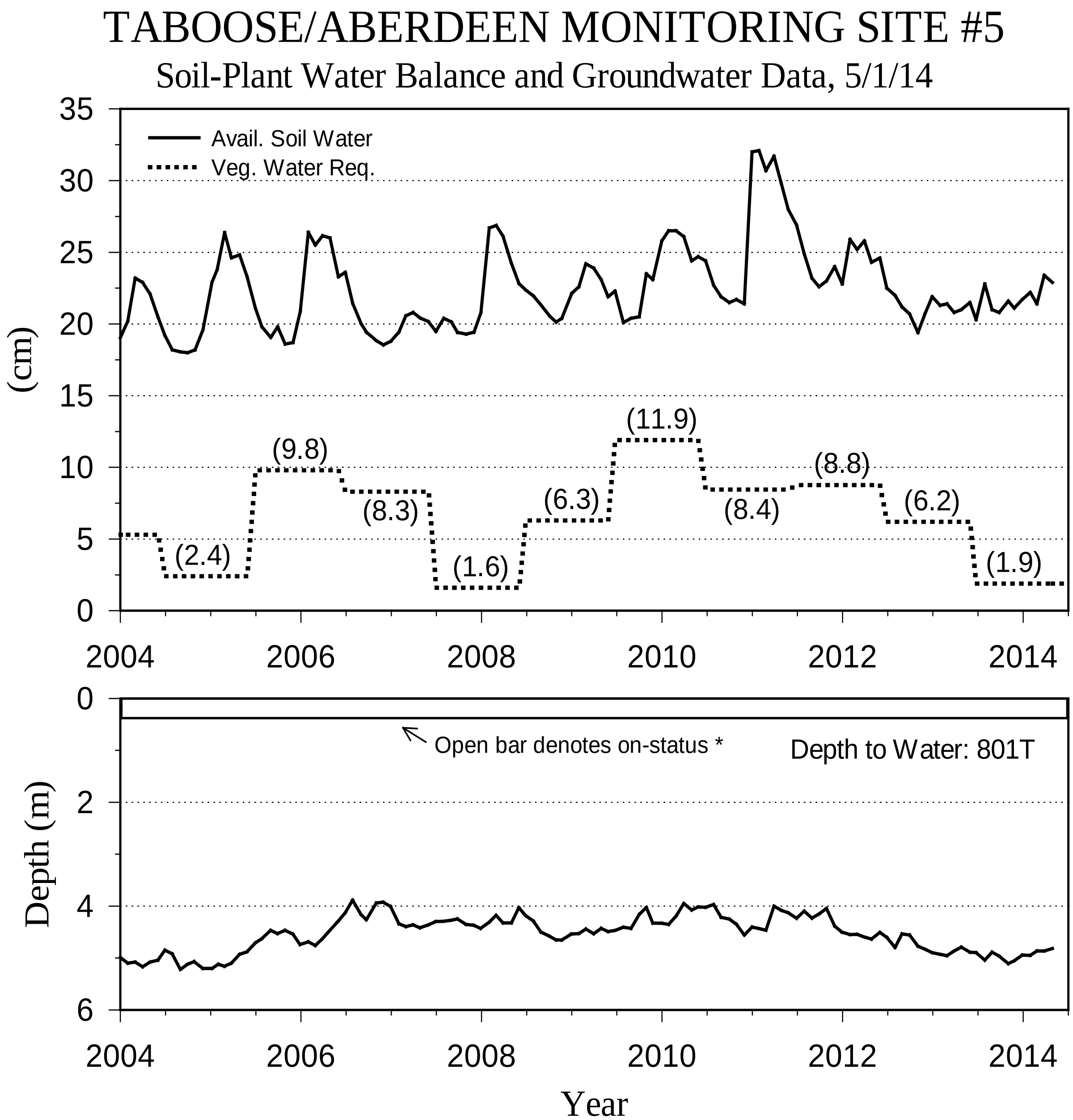
Soil water required for turn on (26.0 cm)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 342, 347

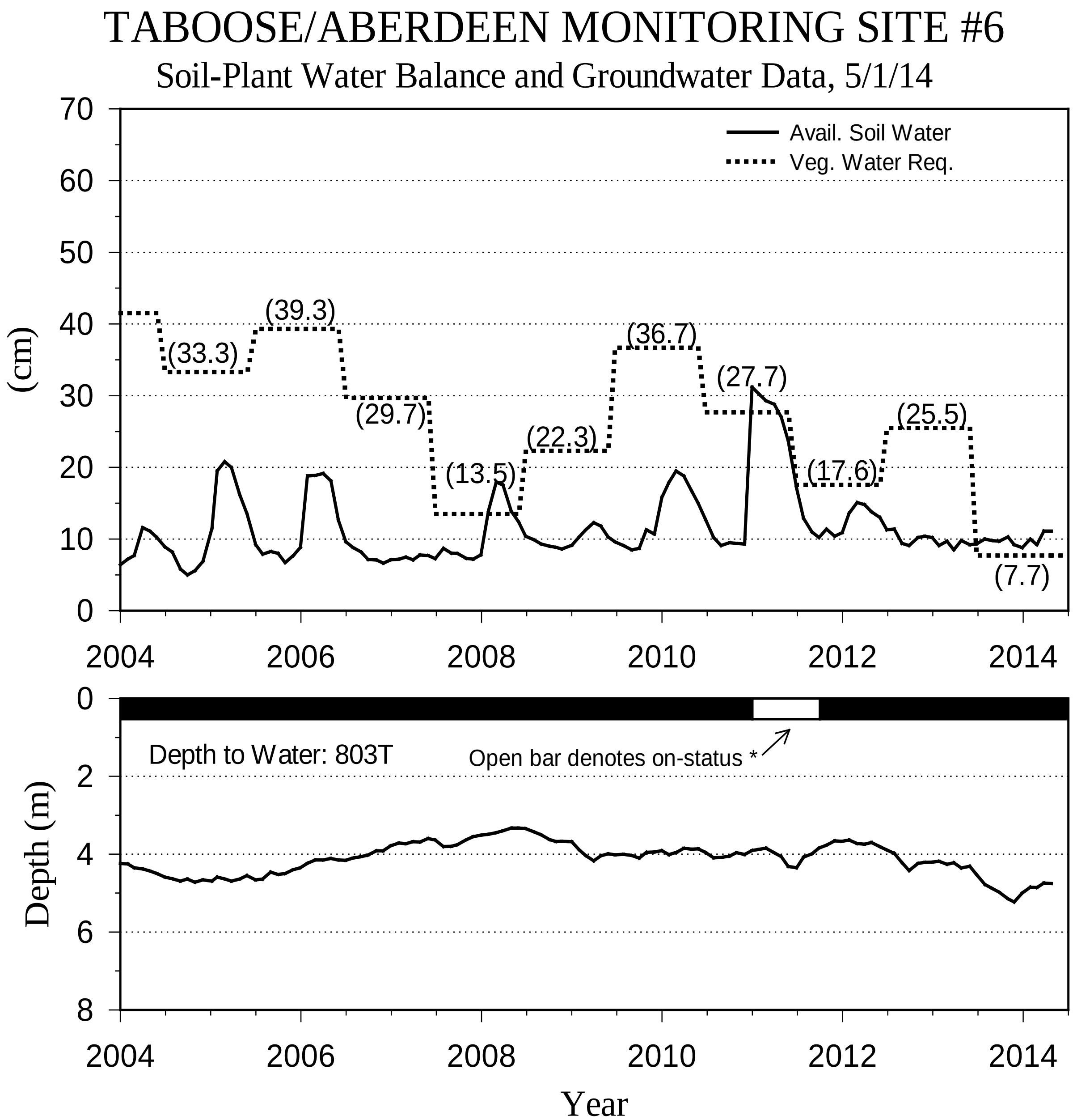
Soil water required for turn on (23.3 cm)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III value for Veg. Water Req.

Linked pumping well - 349

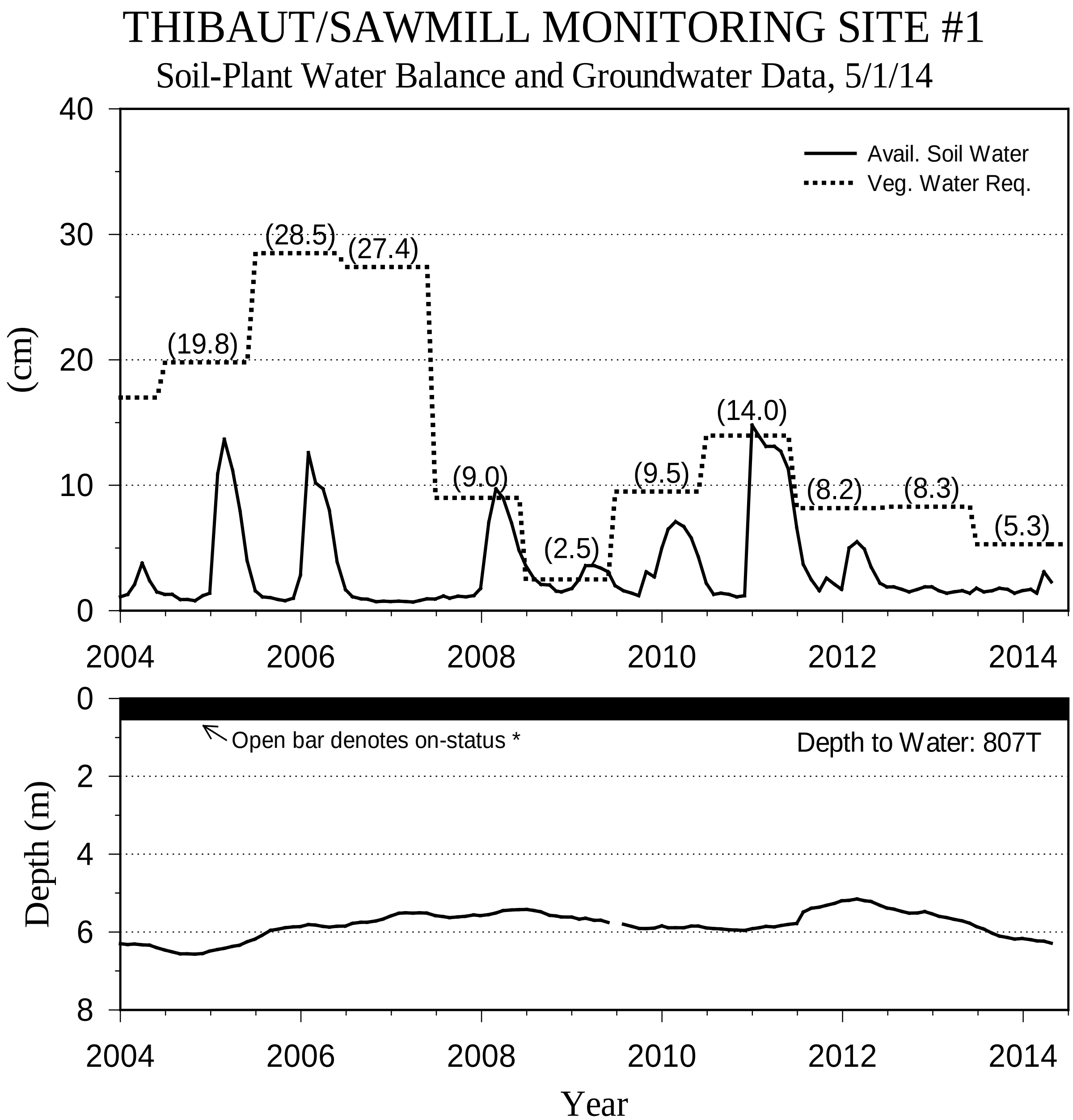
Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to Green Book Section III values for Veg. Water Req.

Linked pumping wells - 109, 370

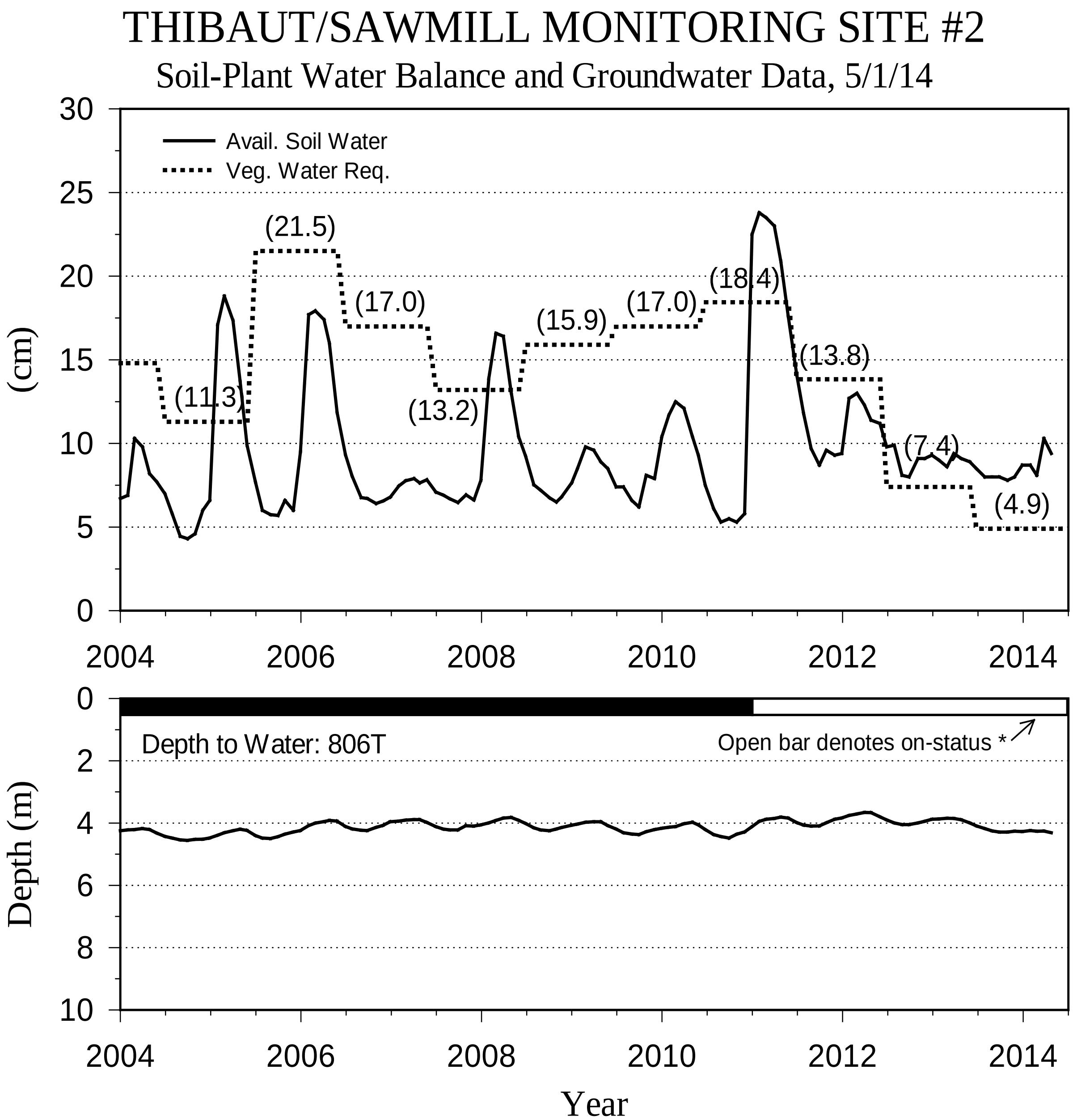
Soil water required for turn on (17.6 cm)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping well - 159

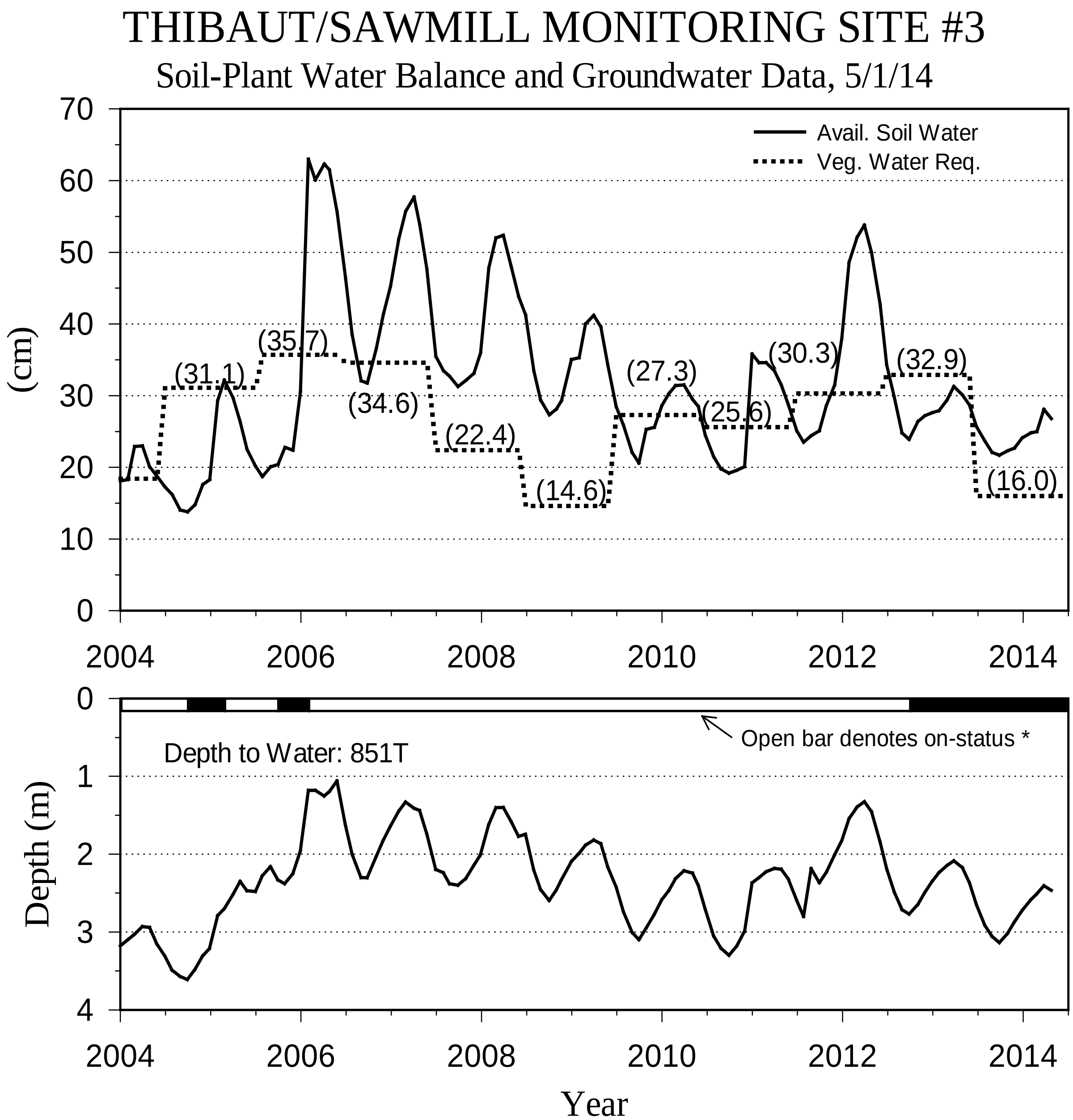
Soil water required for turn on (20.4 cm)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping well - 155

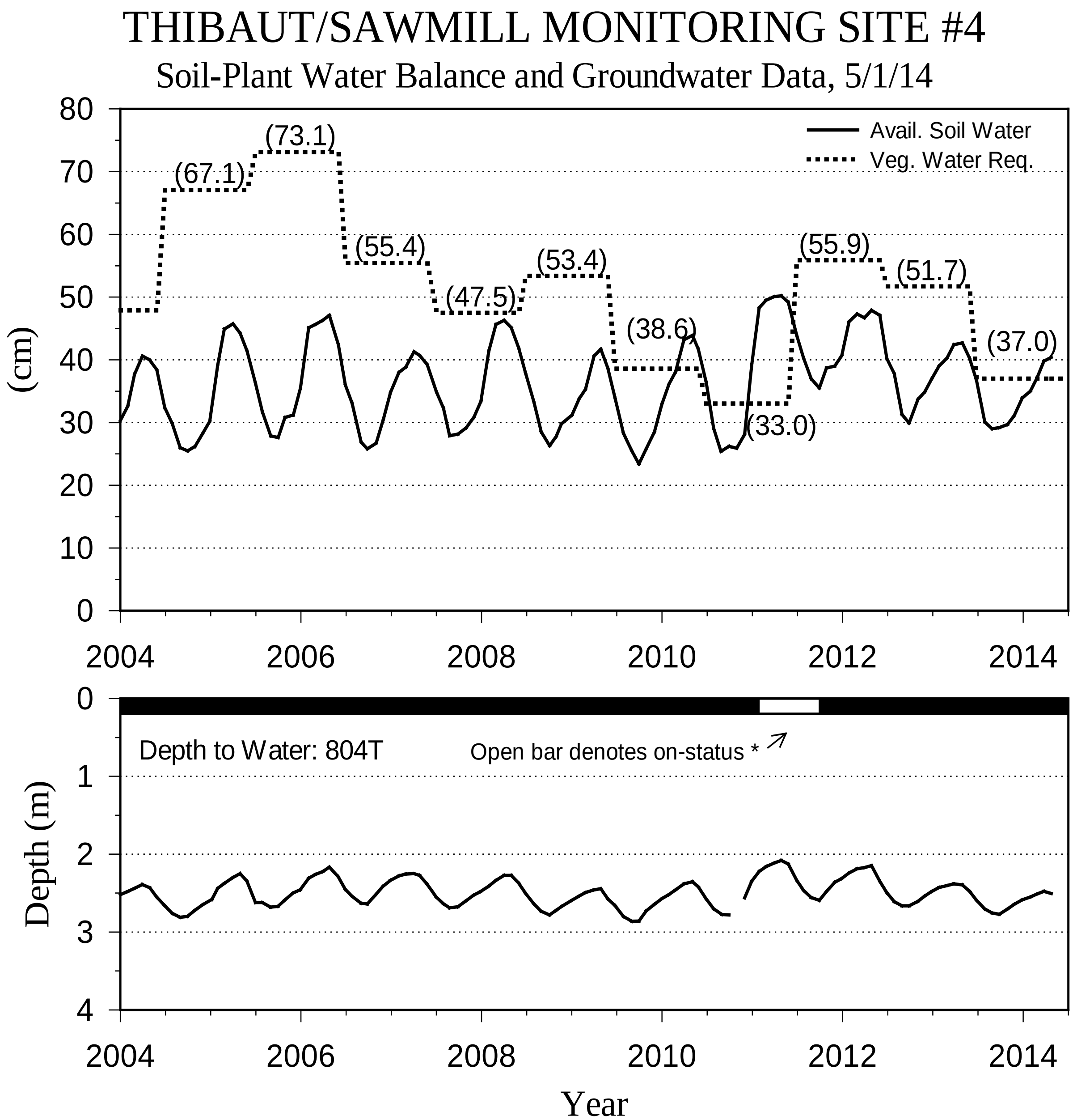
Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 103, 104, 382

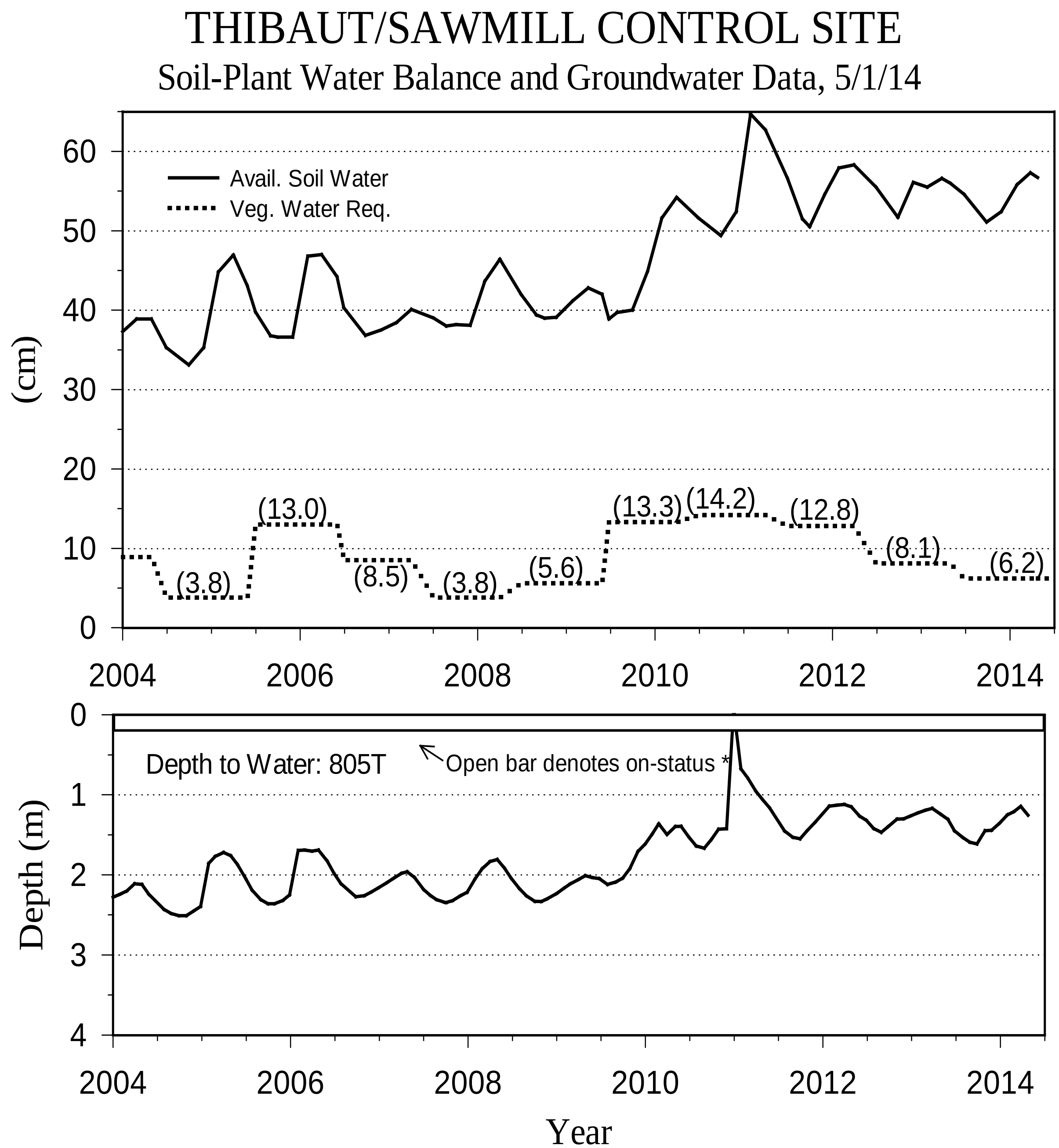
Soil water required for turn on (32.9 cm)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 380, 381

Soil water required for turn on (55.9 cm)

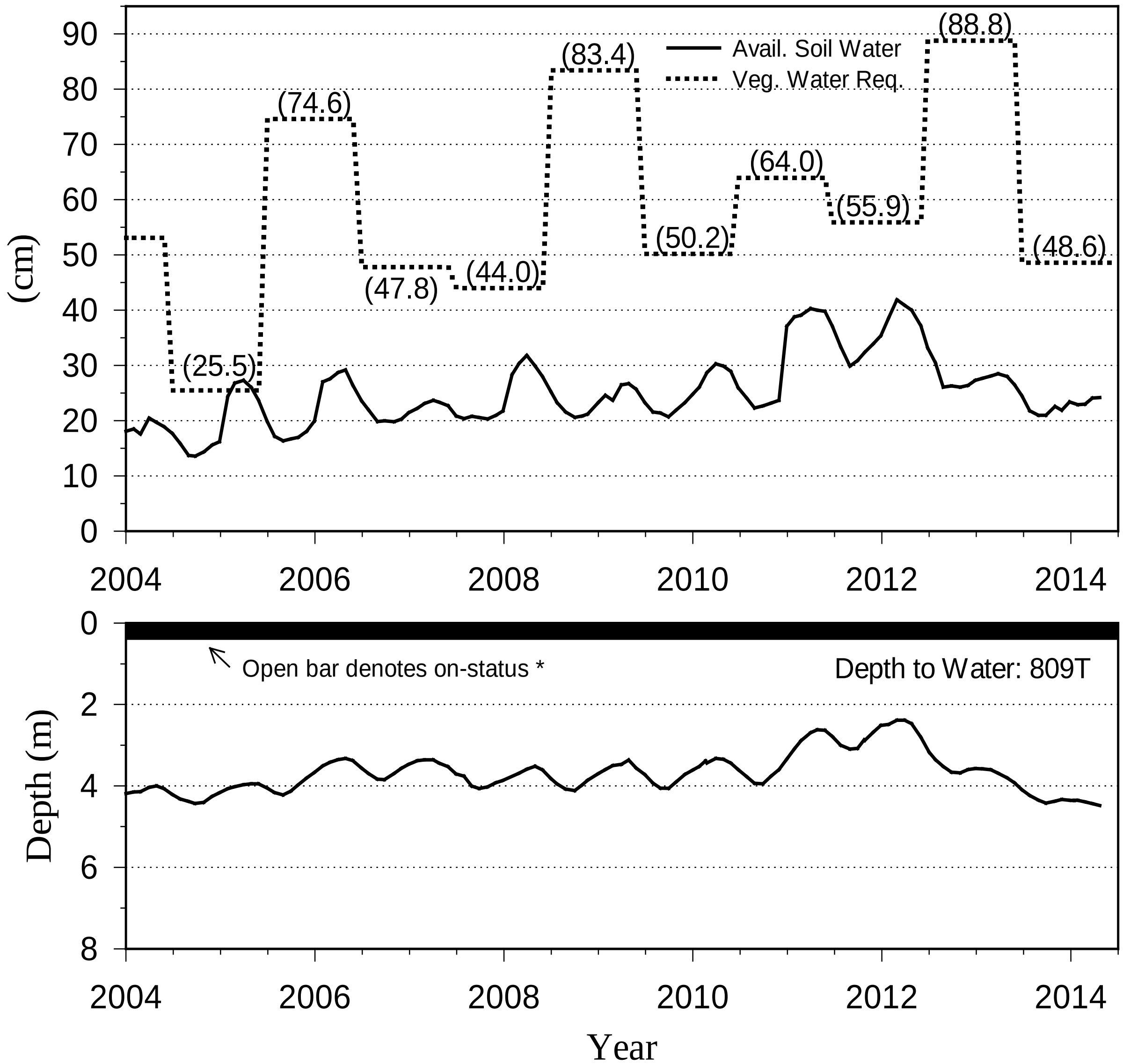


* On\off according to the Green Book Section III values for Veg. Water Req.

Soil water required for turn on (--)

INDEPENDENCE/OAK MONITORING SITE #1

Soil-Plant Water Balance and Groundwater Data, 5/1/14



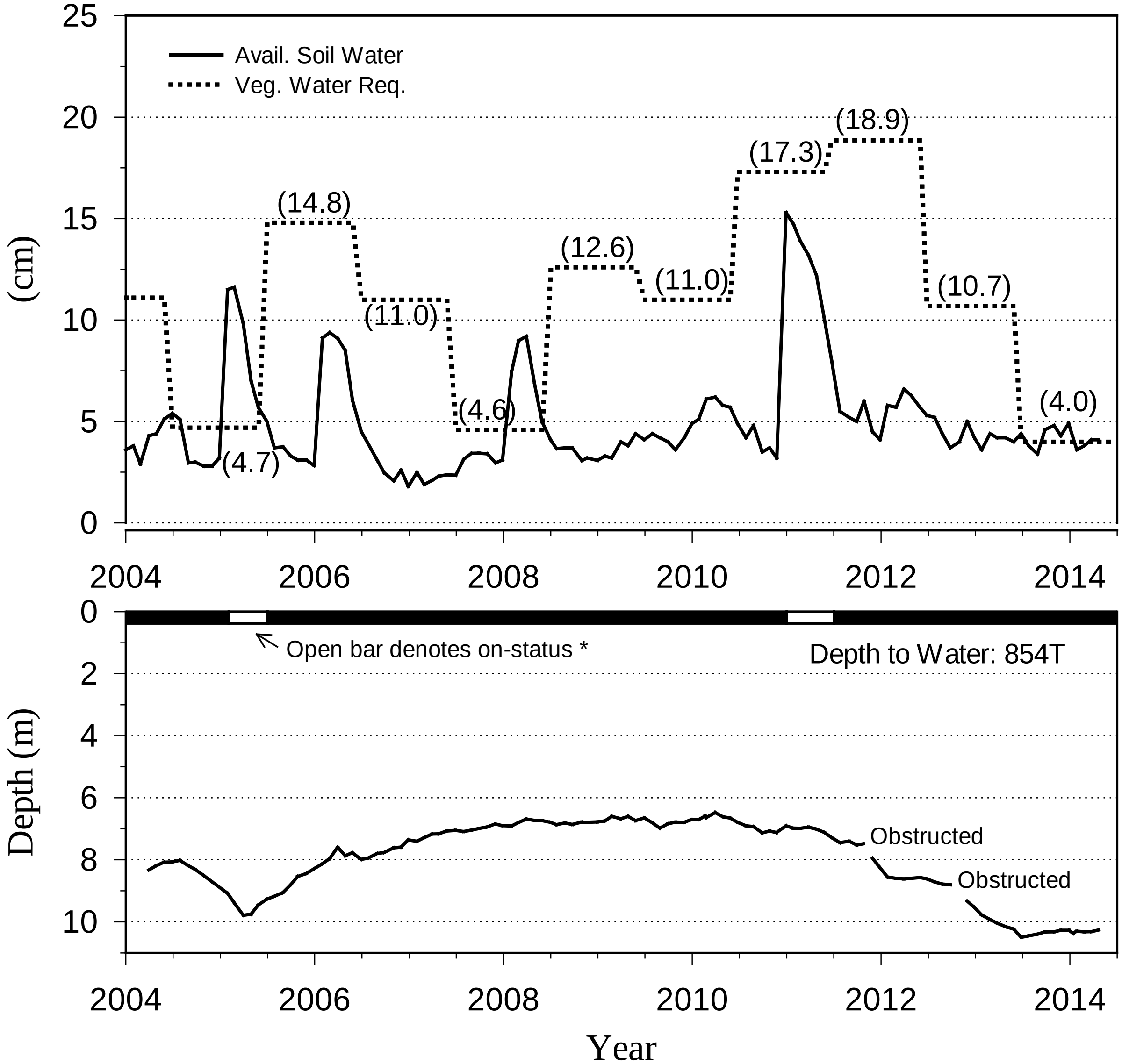
* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 61, 391, 400

Soil water required for turn on (42.2 cm)

INDEPENDENCE/OAK MONITORING SITE #2

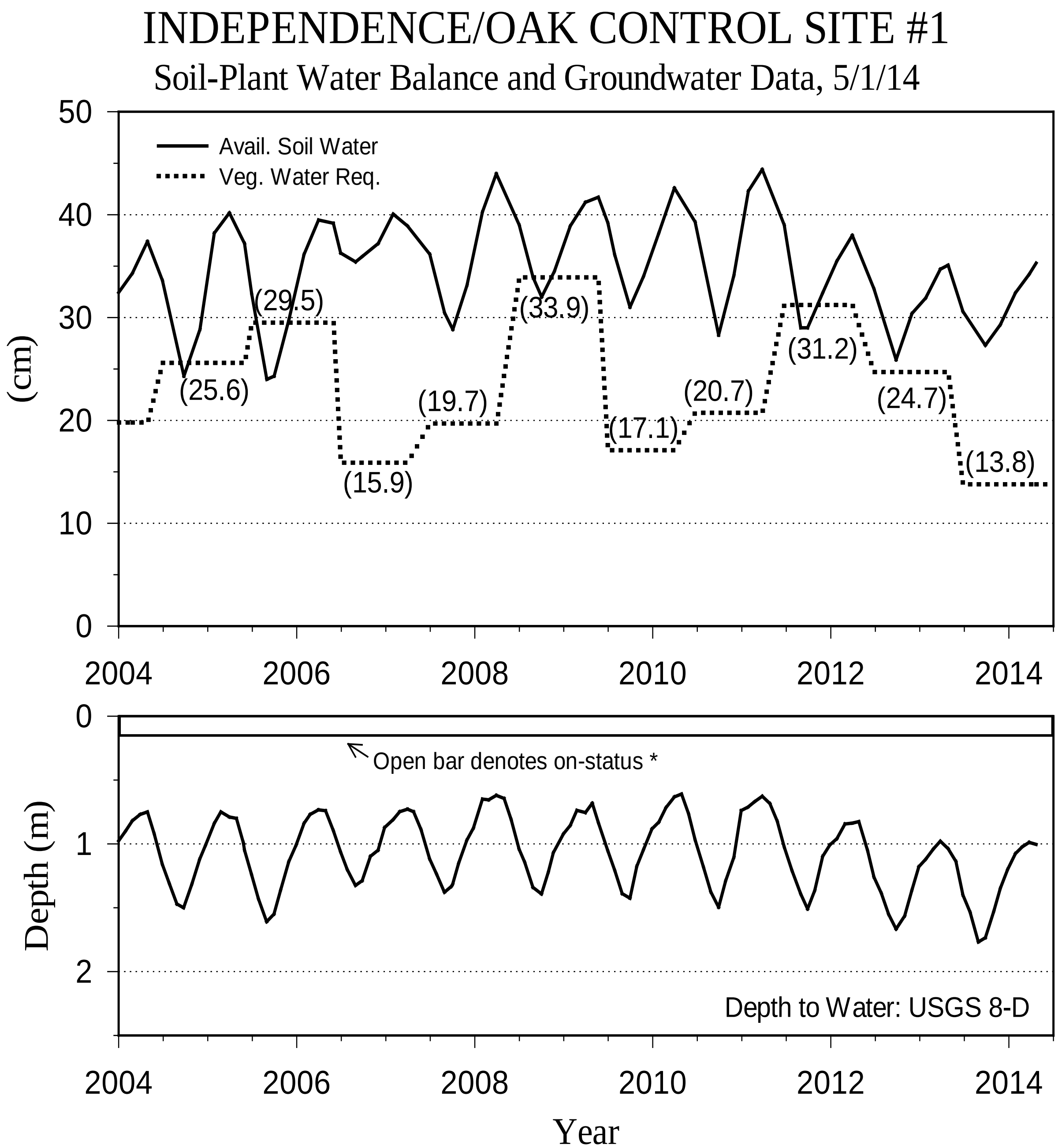
Soil-Plant Water Balance and Groundwater Data, 5/1/14



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

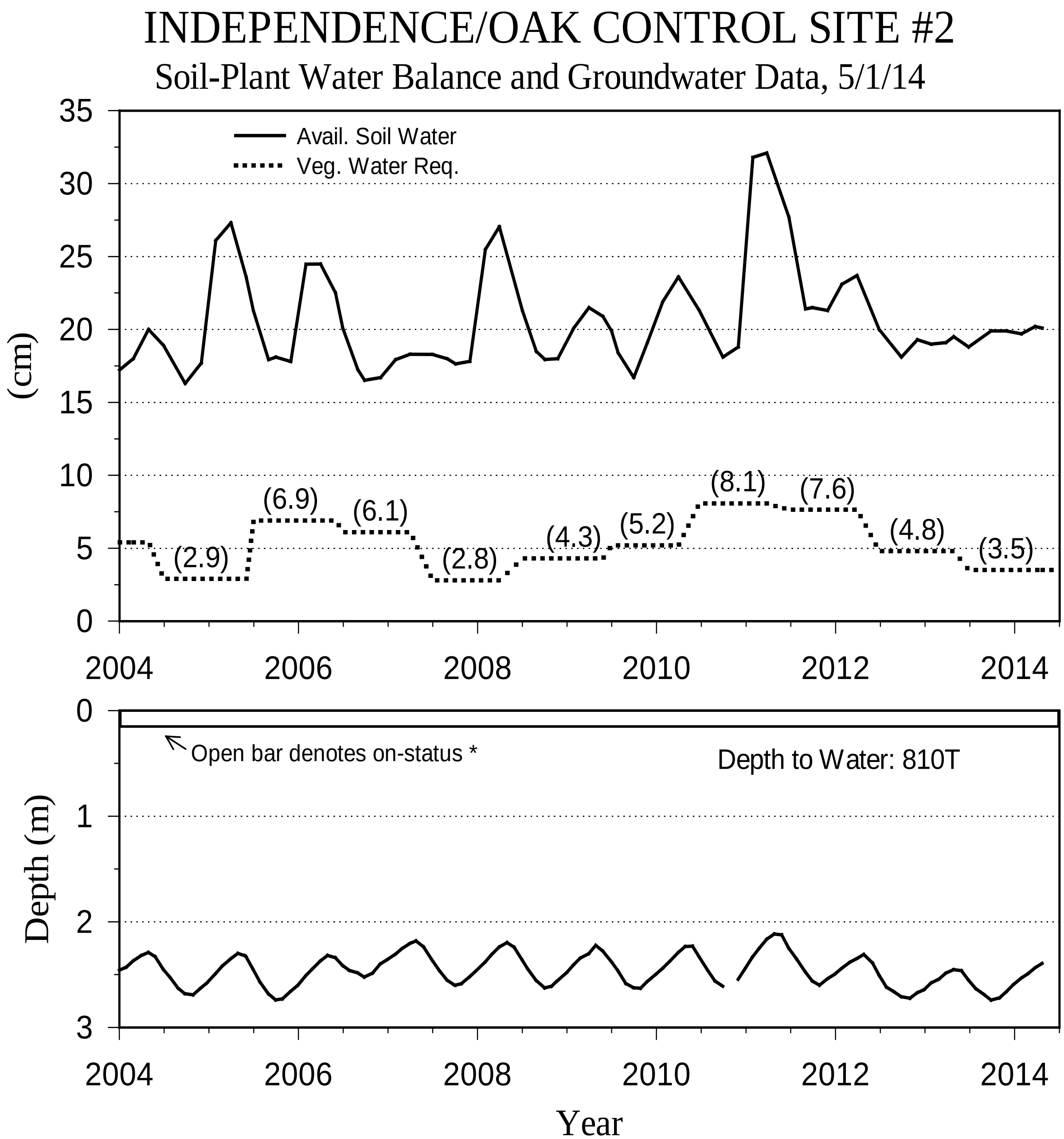
Linked pumping well - 63

Soil water required for turn on (18.9 cm)



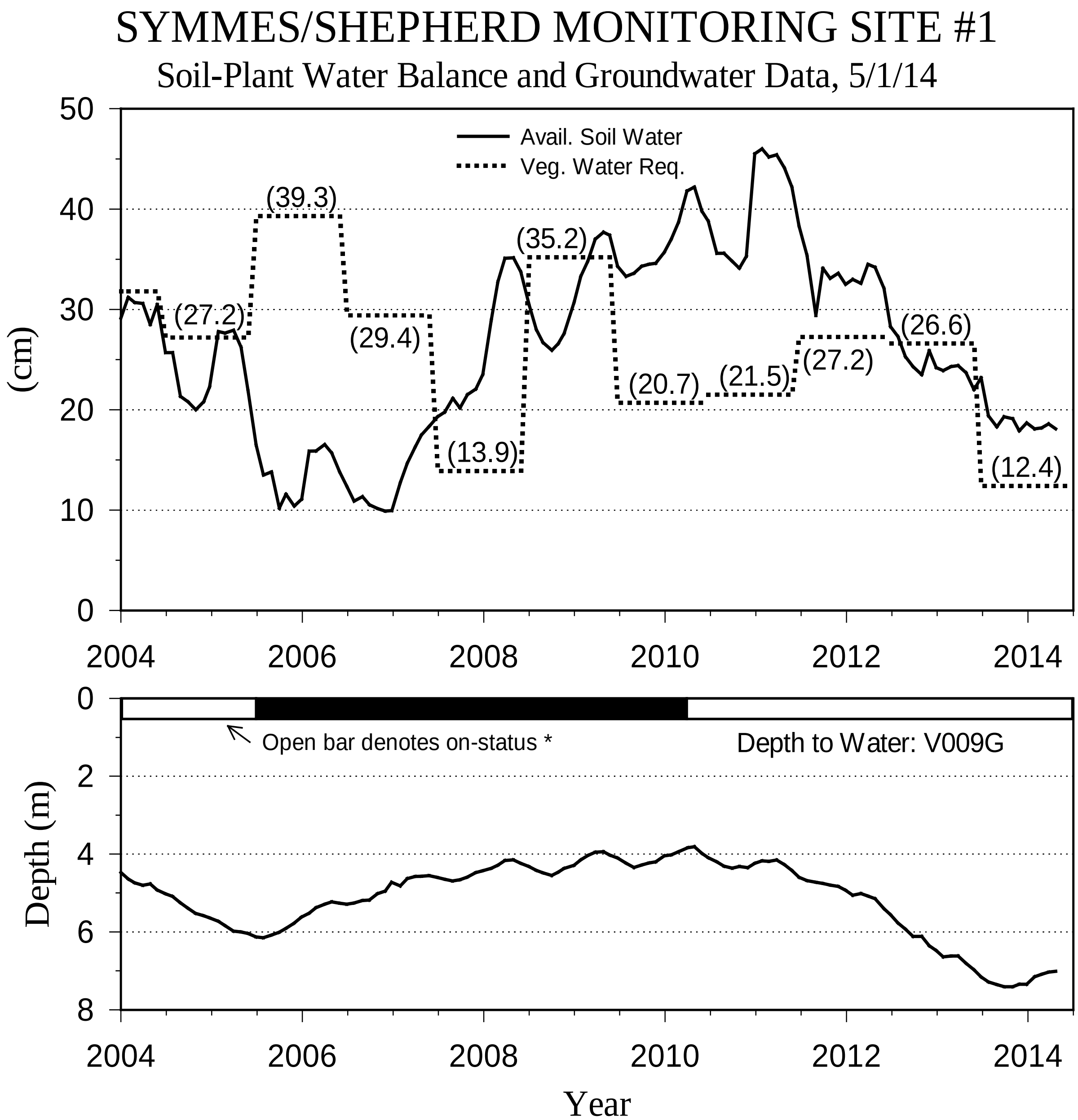
* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

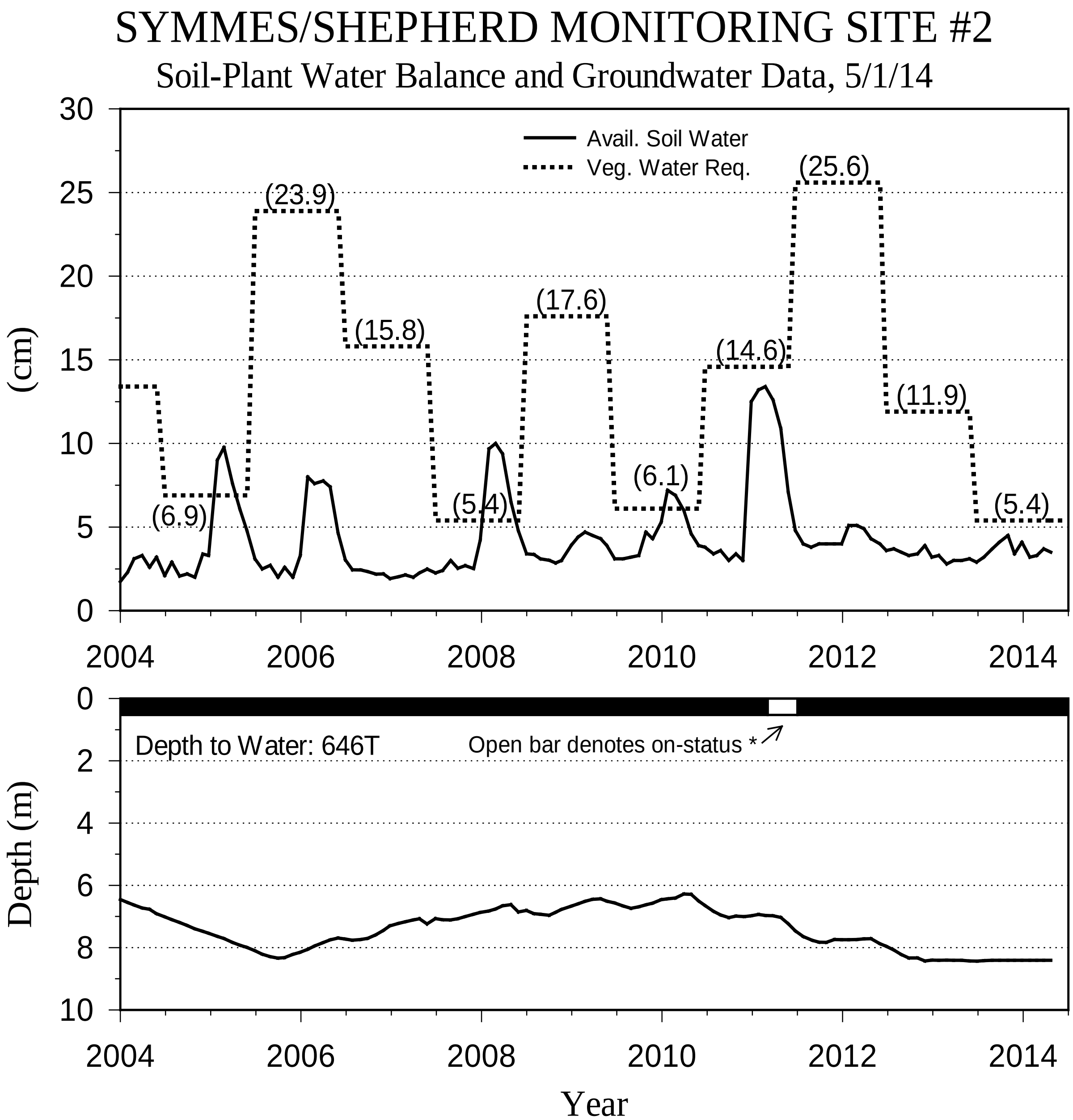
Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 69, 392, 393

Soil water required for turn on (--)



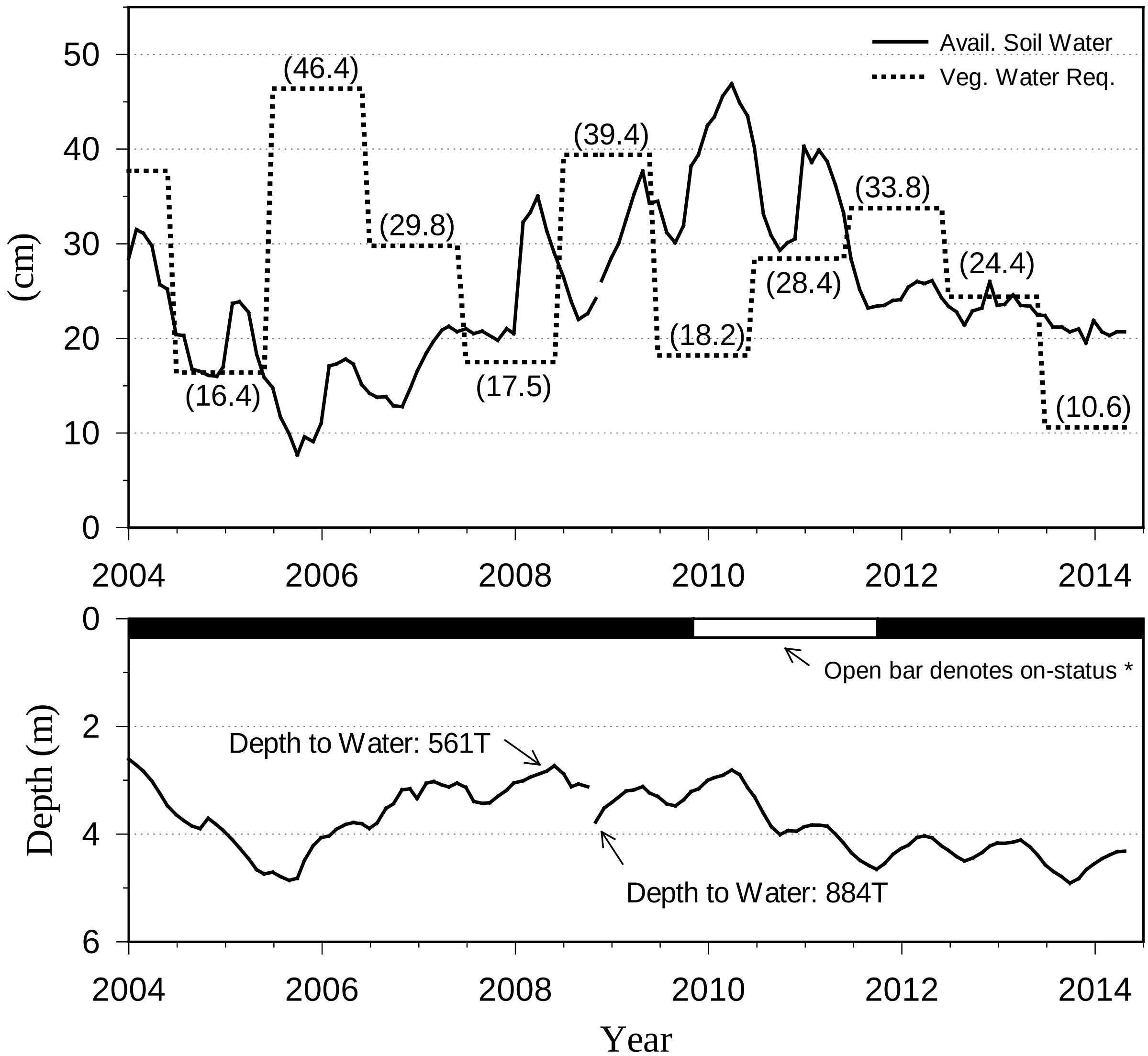
* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 74, 394, 395

Soil water required for turn on (25.6 cm)

SYMMES/SHEPHERD MONITORING SITE #3

Soil-Plant Water Balance and Groundwater Data, 5/1/14

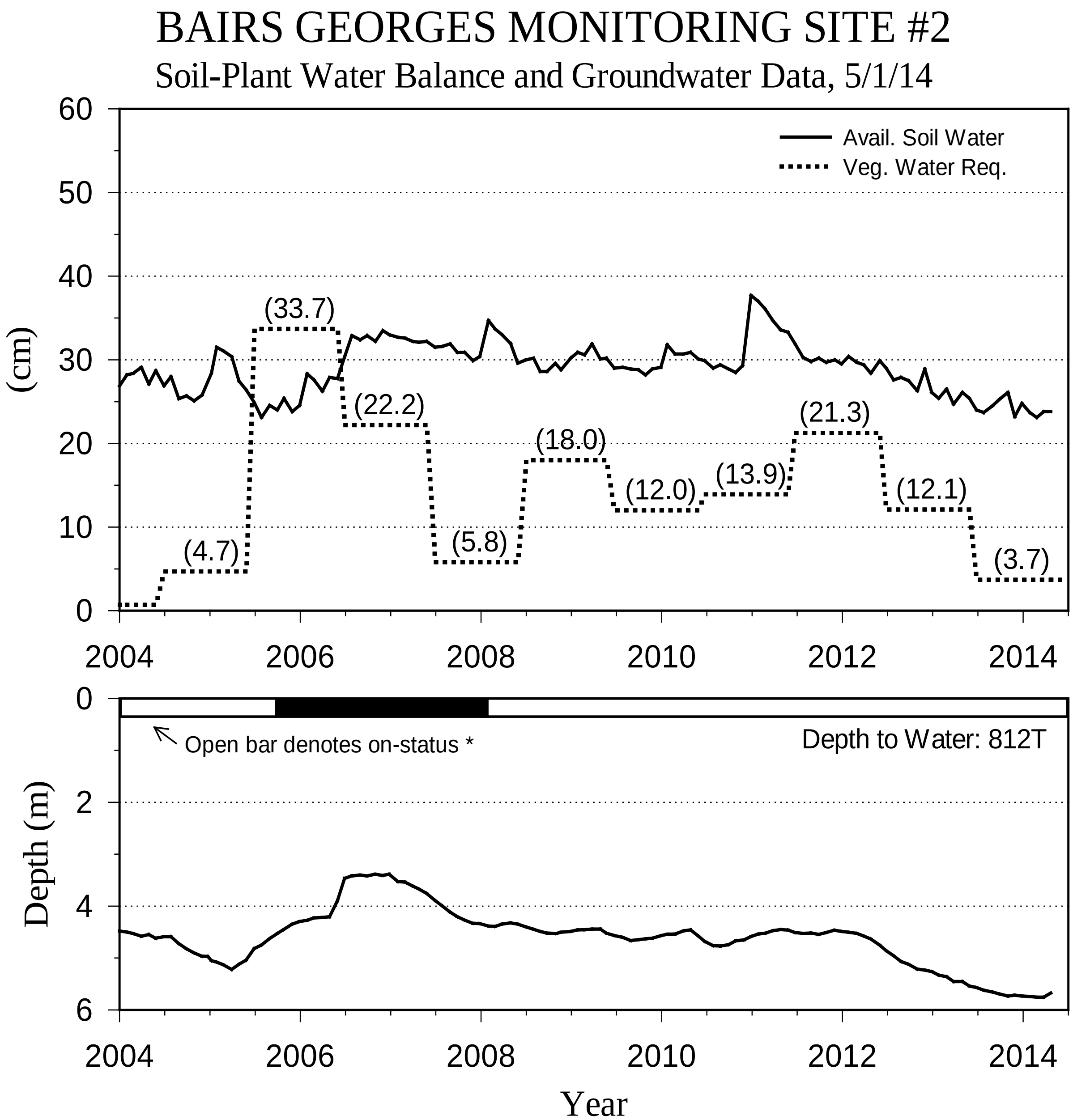


* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 92, 396

Soil water required for turn on (33.8 cm)

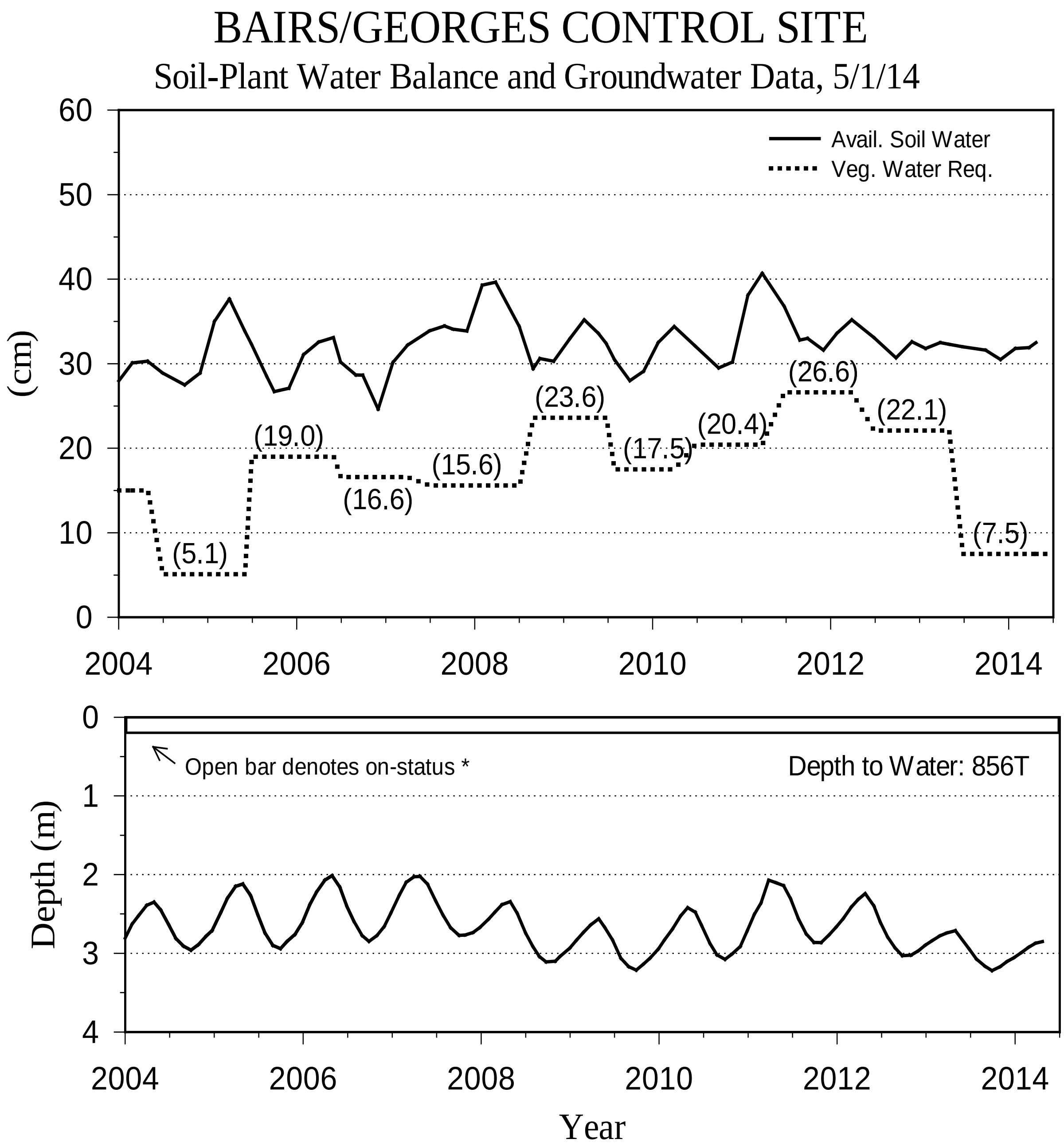
New soil water monitoring locations established Dec 1, 2008



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Linked pumping wells - 76, 403, 343, 348

Soil water required for turn on (--)



* Wells not necessarily operated when in on-status. On\off according to the Green Book Section III values for Veg. Water Req.

Soil water required for turn on (--)

SECTION 5: SALTCEDAR CONTROL PROGRAM

The goal of the Saltcedar Control Program is to eliminate existing saltcedar stands and prevent the spread of saltcedar throughout the Lower Owens River and associated wetlands to support the habitat restoration that is occurring in the LORP. This section of the 2013-14 ICWD Annual Report briefly describes work completed from October 2013 to March 2014. A more complete description of the progress of the saltcedar program is contained in the Lower Owens River Annual Report.

The goal of the Saltcedar Control Program is to eliminate existing saltcedar stands and prevent the spread of saltcedar throughout the Lower Owens River and associated wetlands to support habitat recovery.

Program Background

Saltcedar (*Tamarix ramosissima*) is an invasive non-native shrub or tree that can grow to 25 feet and live up to 100 years. Given favorable conditions, a tree can grow 10 to 12 feet in one season. Saltcedar competes with native vegetation and degrades wildlife habitat. Its presence in the southern Owens Valley has the potential to interfere with the LORP goals of establishing a healthy, functioning Lower Owens River riverine-riparian ecosystem.

References to the importance of managing saltcedar can be found in documents that guide the saltcedar program and govern the LORP:

- The LORP Monitoring, Adaptive Management, and Reporting Plan (MAMP), notes that saltcedar may increase in some areas of the river because of seed distribution with stream flows. The MAMP states that the potential risk of infecting new areas with saltcedar is considered a significant threat in all management areas

- The 1997 Memorandum of Understanding (MOU), between Inyo County, City of Los Angeles, Sierra Club, Owens Valley Committee, CA Dept. of Fish and Game and California State Lands Commission, expresses that saltcedar re-infestation in the LORP area would compromise the goal of controlling deleterious species whose "presence within the Planning Area interferes with the achievement of the goals of the LORP" (1997 MOU B. 4)

Parties to the Inyo/Los Angeles Long-Term Water Agreement (LTWA) recognized that even with annual control efforts saltcedar might never be fully eradicated, but that ongoing and aggressive efforts to remove saltcedar will be required. (Sec. XIV. A).

Project Management and Staff

The Saltcedar Control Program was created by the Agreement and is administered by the Inyo County Water Department, and managed by a Saltcedar Project Manager. Work crews are hired seasonally and consist of eight employees and one shared county employee. In addition, the California Department of Forestry and Fire Protection (Cal Fire) has provided work crews to assist in efforts to cut saltcedar and remove slash. In 2013-2014, the field season began in October and concluded in mid-March.

Methods

The Saltcedar Control Program uses chainsaws, brushcutters, herbicides, and fire to control saltcedar and to reduce saltcedar slash in the Owens Valley.

Work Accomplished

In 2013, work focused on eradicating saltcedar in the water-spreading basins that lie just to the west of the Lower Owens River and river-riparian area. These spreading basins are a concern because they harbor mature saltcedar thickets that function as seed sources for re-establishment of saltcedar within the LORP riparian corridor. The program cut and treated 176 acres in these spreading basins (Figure 5.1).

Surveying the river to locate and remove saltcedar is an annual and ongoing activity by ICWD and LADWP staff. Treating saltcedar in the LORP riparian area and especially new established plants is a priority of the Saltcedar program. At various times during the cutting season over the winter, crews worked along the river to treat resprouts and pull seedlings recorded the previous summer along the 106 miles of LORP river bank and floodplain as part of the LORP monitoring program. In addition, many mature plants that were discovered in the process of clearing the river were also treated.

Extensive saltcedar treatment in recent years has resulted in large amounts of woody slash accumulation on the landscape. Inyo County and Los Angeles reached agreement in 2012 on a slash treatment plan prepared by the ICWD. The preferred treatment method was stacking and burning slash. Following acquisition of required burn permits, in April 2012 the ICWD conducted test burns on several piles in spreading basins. The necessary equipment to provide the required water supply at burn sites was purchased during the intervening summer, and a more aggressive burn program began in the fall after burn restrictions were lifted. Approximately 120 piles of slash were burned during the 2013-14 field season by the Saltcedar Program crews and CalFire (Figure 5.1). The number of piles burned during the 2013-14 field season was significantly less than the previous year due to “no burn” restrictions implemented by Calfire during January and February 2014. The Saltcedar Program has safely burned a total of 780 piles of slash during the past two years.

Funding

Funding for the Saltcedar program comes from the Water Agreement and a grant from the California Wildlife Conservation Board (WCB). LADWP provided $69,481 in compliance with the Water Agreement. The Inyo County Water Department was awarded a new grant from the WCB for $385,000 in December 2011. LADWP has assisted the County in its efforts to renew the WCB grant and provided matching funds fulfilling their obligation under the 2004 Stipulation and Order to match up to $1,500,000 of any grant funds obtained by the County. In addition, LADWP provided the annual funding required by the Water Agreement. The 2013-14 program relied on these funding sources.

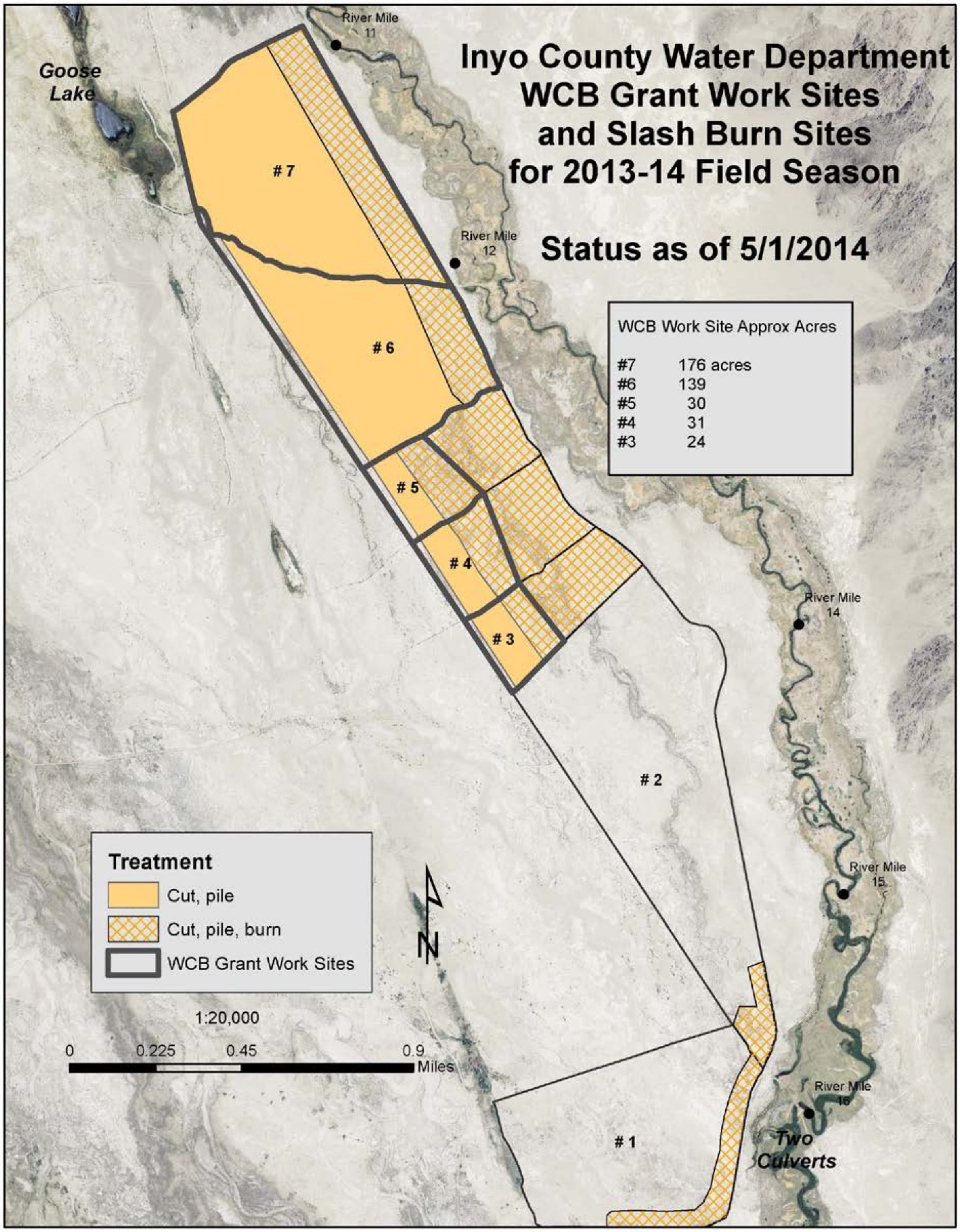


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Figure 5.1. Saltcedar areas treated during 2013-2014.

SECTION 6: MITIGATION PROJECTS STATUS

The Inyo County Water Department monitors and reports on the status of environmental mitigation projects in the Owens Valley.

Inyo County is also a partner in funding and implementing the Lower Owens River Project.

One on the roles of the Inyo County Water Department (ICWD) is to monitor and report on the status of environmental mitigation projects in the Owens Valley. More than 62 projects, spread throughout the Valley, mitigate for a range of environmental impacts due to abandonment of irrigated agriculture and groundwater pumping in the Owens Valley. These improvements range in size from single-acre spring projects to the 78,000-acre Lower Owens River Project (LORP). The majority of these projects are described in the Water Agreement and associated 1991 EIR (*Water from the Owens Valley to Supply the Second Los Angeles Aqueduct*), and in the 1997 MOU (*Resolving conflicts and concern over the 1991 EIR*), which can be found on the ICWD website (www.inyowater.org).

ICWD participates in the development of new projects, evaluates the effectiveness of ongoing mitigation, and oversees modifications of existing projects that have been changed by the Inyo/LADWP Standing Committee or the courts. The County is also responsible for funding half of the costs of the Lower Owens River Project.

This report provides background and status on all mitigation projects. Special attention is given to projects that are being actively managed, those that are just being implemented, those that are not meeting management goals, and projects in need of plan revisions.

This Mitigation Section is divided into three main parts:

- Background information on the mitigation projects, including project origins and the impact for which mitigation is being provided.
- Reports on projects that require special attention, or those that have changed status during the reporting period.
- Table of all the projects described in the 1991 EIR and MOU. Information found here includes the project origin, impact being addressed, management prescription, development stage, and project status.

The recently completed Independence Regreening, April 2014

Mitigation Projects Origins and Background

The Los Angeles Department of Water and Power (LADWP) is legally obligated to implement mitigation projects to enhance recreation, diversify land use, improve or create habitat for wildlife and vegetation, and mitigate for a range of impacts in the Owens Valley. Descriptions of mitigation projects are found in the collection of documents that govern the activities of the LADWP in the Owens Valley. These documents were developed over time and include the 1991 Long Term Water Agreement and associated EIR, the 1997 MOU, and other court stipulations and orders.

Although the environment of the Owens Valley had begun to suffer the effects of large-scale water diversions to supply water to Los Angeles Aqueduct beginning in 1913, all of the mitigation projects described in this report mitigate for impacts after 1970 that resulted from the operation of the second Los Angeles Aqueduct. The first aqueduct predates applicable California environmental laws and therefore was not a subject of the Inyo/Los Angeles Water Agreement. These mitigation projects will to a certain degree repair, restore and compensate for adverse impacts from the operation of the second aqueduct.

More than 58,000 acres of groundwater dependent vegetation is found in the Owens Valley. Between 1970 and 1990, increased groundwater pumping, and the resulting fluctuations in groundwater table, has had a significant effect on more than 1,000 acres; 655 acres of groundwater dependent vegetation has entirely died-off. Most of the mitigation projects include goals to improve vegetation in the Owens Valley.

Mitigation Alternatives

With respect to mitigation, the Water Agreement generally follows the framework of the California Environmental Quality Act (CEQA), which allows several alternative forms of mitigation. These are generally considered in sequence (i.e., with preference given to avoidance first and compensation last). These actions include:

- **Avoiding the impact altogether by not taking a certain action or parts of an action.**
  Local example: Well on/off provisions. When soil water and projected contribution from precipitation is inadequate to maintain vegetation, wells are not operated.
- **Minimizing impact by limiting the degree or magnitude of the action and its implementation.**
  Local example: Shutting down pumping wells, as was done at Five Bridges when groundwater drawdown degraded nearby vegetation.
- **Rectifying the impact by repairing, rehabilitating, or restoring the impacted environment.**
  Local example: Revegetation and regreening projects, which compensate for the effects of the abandonment of irrigated agriculture leading to areas of blowing dust and dirt.
- **Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.**
  Local example: Salt cedar control, ongoing irrigation of fields
- **Compensating for the impact by replacing or providing substitute resources or environments.**
  Local example: Lower Owens River Project, civic projects, recreational facilities, habitat enhancement projects, and fish hatcheries

Origin of Mitigation Efforts

Mitigation planning, development, and implementation are ongoing activities that are undertaken cooperatively with LADWP; however, the majority of mitigation projects in the Owens Valley were developed by the two parties during three discrete periods of time in response to court judgments or potential legal and administrative actions:

Environmental Projects (EP), 1970-1984

Between 1970 and 1984, LADWP committed about 10,000 acre-feet of water annually to implement twelve environmental projects. The primary purpose of these projects was to restore habitat that had been negatively affected or lost due to water gathering. These areas may have exhibited vegetation changes, or reduction in wildlife using a particular habitat. The goal was to provide a regular water supply to habitats such as ponds, lakes, sloughs, springs, and the Lower Owens River. Objectives differed between the projects, depending on the type of the impact that had occurred, but the overall goal of the environmental projects was to improve wildlife, forage, fisheries, and public recreation facilities.

In many instances it was impractical to mitigate at the original impact site, or the affected area was not well defined, or the impact was sporadic. In these cases a project was constructed at a site that would best accommodate the goals of the mitigation.

- **Farmer's Ponds**: Water is provided each fall to offer habitat for migrating waterfowl; two miles north of Bishop.
- **Buckley Ponds:** Water is provided for a warm-water fishery and waterfowl area; three miles southeast of Bishop.
- **Saunders Pond:** Water is provided to a warm-water fishery and waterfowl area; five miles southeast of Bishop.
- **Mill Pond:** Water is provided to a pond at a recreation area, either by creek flow or a well at the site; four miles northwest of Bishop; five miles west northwest of Bishop.
- **Klondike Lake:** Water is provided for permanent wildlife habitat area now incorporated in the Klondike Lake E/M Project; 2 mile north of Big Pine.
- **Tule Elk Field:** Water is provided to irrigate a pasture heavily used in summer by tule elk; between U.S. Highway 395 and Tinemaha Reservoir.
- **Seeley Spring:** Maintained by an LADWP well adjacent to Owens River to provide waterfowl and shorebird habitat larger than had existed at Seeley Spring; two miles south of Tinemaha Reservoir.
- **Calvert Slough:** Water is provided to maintain habitat consisting of a small pond and marsh area near the LADWP Aqueduct intake.
- **Little Blackrock Spring:** Water is diverted from ditch to maintain wetland area at original the spring site; west of the Aqueduct intake.
- **Lone Pine Pond:** Water is provided by natural seep or spring flow in river with supplemental releases from Alabama Gates (now incorporated in the Lower Owens River E/M Project); north of Lone Pine Narrow Gauge Road.
- **Lower Owens River:** Water releases began in 1975 to provide year-long minimal flows along the lower Owens River, as well as releases to Twin Lakes, Billy Lake, and Thibaut Ponds. The goal is to maintain waterfowl, marsh, shorebird, and upland gamebird habitat, as well as provide for a warm-water fishery. The project has now been replaced by the Lower Owens River Project, which provides water to all of the formerly dry stretch of the Owens River; the 78,000 acre project site is located east of the towns of Aberdeen, Independence, and Lone Pine.
- **Diaz Lake:** A supplemental water supply is provided to Diaz Lake recreational area. The accounting of water supplied to this project has been revised as part of the MOU 1600 ac-ft. projects described below. The lake is three miles south of Lone Pine.

Enhancement/Mitigation Projects 1985-1991

The Enhancement Mitigation (E/M) projects are environmental projects that were implemented prior to adoption of the 1991 EIR. The Water Agreement required that all E/M project continue. Some of these projects were included in the 1991 EIR as mitigation for impacts due to LADWP's water gathering activities. The amount of water allocated to these projects, along with the water used is reported in Table 1.

These projects addressed a number of environmental impacts and filled community needs. Projects include the revegetation of abandoned agricultural lands and lands that experienced vegetation loss due to groundwater pumping, delivery of water for public parks, improved wildlife habitat, and a partial rewatering of the lower Owens River. For each project, specific goals and objectives were established and environmental documentation was prepared in accordance with CEQA.

- **Millpond Recreation Area Project:** Located west of Bishop, it was the first E/M measure to be completed. Since October 1985, funds have been provided to operate the recreation area's sprinkler irrigation system that waters 18 acres of the community park, including two softball fields.
- **Shepherd Creek Alfalfa Lands Project:** Revegetated 198 acres of abandoned cropland adjacent to U.S. Highway 395 with sprinkler-irrigated alfalfa and windbreak trees. The property between Lone Pine and Independence had only sparse annual vegetation since 1976 and was a source of blowing dust creating a traffic hazard.
- **Klondike Lake Project:** Previously, the 160-acre lake located north of Big Pine had been filled only during above-normal runoff years. Now, less than 1,700 af of water maintains the lake year-round. Benefits include nesting and feeding areas for waterfowl, and recreation including skiing, windsurfing, and other water sports in summer months. Due to the shape and size of the Klondike lakebed, the full volume of water (2,200 af) allocated to the project was more than the lake required, so the project was modified to permanently reduce the water allotment. The balance of this unused water allocation was apportioned the Big Pine Ditch System and the Klondike South Shore Habitat Area.
- **Laws Historical Museum Project:** Provides a regular water supply to improve the native vegetation on a 21-acre parcel, provide for irrigated pasture on 15 acres, and establish windbreak trees, all adjacent to the museum.
- **640 acres near Laws:** Revegetate with non-groundwater dependent native plants (potential project that would require Standing Committee approval to implement).
- **Laws-Poleta Native Pasture Project:** Provides water for irrigation of 220 acres of sparsely vegetated land to reestablish native vegetation on abandoned pasturelands and increase livestock grazing capabilities.
- **McNally Ponds and Pasture:** Provides a regular water supply to existing ephemeral ponds (60 acres) in the Laws area to create waterfowl habitat, and to provide spring and summer irrigation to enhance and maintain existing vegetation on 300 acres of pastureland.
- **Independence Pasture Lands/and Spring Field Projects:** Provides approximately 910 acres of abandoned croplands and sparsely vegetated land with irrigation to create native pasturelands and provide water to native vegetation. Flood irrigation converted sparsely vegetated land east of Independence into productive native pasture. The project mitigated a source of blowing dust and stabilized soil previously affected by severe wind erosion.
- **Lone Pine Riparian Park:** Provides a continuous water supply to a ditch running through Russell Spainhower Park then easterly to supply water to Lone Pine Woodlot and Richards and Van Norman Fields projects.
- **Van Norman Field (160 acres) and Richards Field (160 acres):** Provides surface and pumped water to establish pastureland and increase livestock grazing capabilities on abandoned agricultural land.
- **Lone Pine Sports Complex:** At the request of the community, portions of the Lo-Inyo Elementary School and vacant LADWP property were converted to an outdoor sports complex consisting of baseball fields, soccer fields, and related parking, picnic and park areas.
- **Independence and Lone Pine Woodlots:** Two irrigated projects in Lone Pine and Independence provide a greenbelt and are harvested as sustainable source of firewood for those in need.
- **Independence Roadside Rest:** This project consisted of planting shade and windbreak trees and grass, installation of an irrigation system, and placement of picnic tables on a 1/2-acre site south of the town of Independence. The project is an aesthetic improvement over the previously blighted area.

- **Eastern California Museum:** This project enhanced the appearance of the Eastern California Museum grounds in Independence. It consisted of a small pond, trees, expanded lawn areas, and installation of an irrigation system.
- **Town Regreening Projects:** Three projects designed to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the towns of Big Pine, Independence, and Lone Pine. Lone Pine has been implemented; Big Pine and Independence should come into operation in 2014.
- **Lower Owens River Rewatering E/M Project:** This project provided up to 18,000 AFY of continuous flow of water in the previously dry (1913-1986) portion of the river channel, creating a warm water fishery and wildlife habitat in the southern Owens Valley. The project also supplies water to five small lakes along the river route providing improved waterfowl habitat in the region. This project has been superseded by the Lower Owens River Project, which was fully implemented in December 2006.
- **Hines Springs:** Create 1-2 acres of aquatic, riparian, and marshland habitats. Project will serve as a research project on how to reestablish a damaged aquatic habitat.

Enhancement Mitigation Evaluation (Table 6.1)

On April 10, 2012, LADWP sent Inyo County a letter with following subject, “Request for Inyo County (County) to participate in a process by which the Technical Group and/or the Inyo/Los Angeles Standing Committee resolve the Enhancement/Mitigation (E/M) project water supply imbalance”. This request was made under provisions of the Water Agreement Section XXVI.

The City asserts that the Water Agreement and the EIR require that if it is necessary to supply an E/M project with water, these projects will be supplied with groundwater or surface water that would be replaced with groundwater. They point out that this cannot always be accomplished because frequently wells designated to supply water to an E/M project are in off status according to the Water Agreement groundwater management provisions. LADWP claims that E/M projects use 4,000 acre-feet more water per year than is available from E/M wells.

LADWP’s proposed resolution:

> *LADWP proposes that the Technical Group conduct an evaluation of all E/M projects requiring water and that do not have an existing exempt source of groundwater. LADWP further requests that the Technical Group take appropriate action to either exempt specific E/M supply wells from the automatic turn-off provisions of the Water Agreement or recommend to the Standing Committee that it consider: (1) reducing or eliminating the water supplied to E/M projects that cannot be feasibly supplied with groundwater, or (2) modify the E/M projects that cannot be feasibly supplied with groundwater.*

At their September 26, 2012 meeting, the Standing Committee directed the Technical Group to conduct an evaluation of all Enhancement/Mitigation (E/M) projects. The first priority in the evaluation are the E/M projects requiring water that do not have an existing exempt source of groundwater and the Van Norman Field Project.

LADWP and Inyo County staff has met on multiple occasions, both in the office and out in the field to begin to work through this process. Initial investigation involved identifying individual project water supplies, learning how water is conveyed to or through a project, and how flow is measured. Also to be evaluated is the effectiveness of each of these projects as mitigation. Now staffs are now working to develop proposals that can be considered by the Technical Group.

Once these proposals are developed, the following is suggested (Greg James, May 1999 letter) as the procedure to modify or discontinue a mitigation measure:

1. If the Technical Group agrees to recommend a modification or discontinuation of an enhancement/mitigation project which is identified as a mitigation measure, the Technical Group should submit to the Standing Committee sufficient information to enable the Standing Committee to determine:
    a. That the proposed change will not have a new or adverse effect on the environment. In support of this conclusion the Technical Group should probably submit an initial study, together with any documentation required by CEQA, or a statement setting forth the reasons why no CEQA document is required.
    b. That the proposed change may cause a new or adverse effect on the environment, but with mitigation, the new or adverse effect will be mitigated to less than significant. The Technical Group should submit to the Standing Committee an initial study, together with either a mitigated negative declaration, or if necessary, an EIR. (The entity proposing the change in the mitigation measure [either the County or LADWP] should have the responsibility for preparing any necessary CEQA documentation.) 3
    c. That, the enhancement/mitigation project, as modified, will continue to reduce the identified adverse effect of the project to a level which is less than significant, and/or
    d. That, with the implementation of a new (or substitute) mitigation measure, the identified adverse effect of the project will continue to be reduced to a level which is less than significant.
    e. That, with the modification of the mitigation measure, and/or with the implementation of a new (or substitute) mitigation measure, mitigation will be provided at a level equal or greater than the level of mitigation provided by the mitigation measure without modification.

2. If the Standing Committee makes the required findings, the Standing Committee may approve the modification or discontinuation of the mitigation measure.

Following consideration by the Technical Group and approval by the Standing Committee any proposed change in project would require the following actions:

1. CEQA Review
2. Adoption of CEQA by the Los Angeles Board of Water and Power Commissioners
3. Approval of a proposed amendment to the Water Agreement by the Los Angeles Board of Water and Power Commissioners
4. Submission of a recommendation from the Inyo County Water Commission (the Water Commission acts as the County’s CEQA agency for purposes of projects arising out of the Water Agreement) to the Inyo County Board of Supervisors as to whether the County should adopt CEQA
5. Adoption of CEQA by the Inyo County Board of Supervisors

6. Approval of a proposed amendment to the Water Agreement by the Inyo County Board of Supervisors
7. Approval of an amendment to the Water Agreement by the Inyo County Superior Court
8. Determination by the Los Angeles Board of Water and Power Commissioners that the proposed modification of the Enhancement/Mitigation Project, will continue to provide mitigation equal to the mitigation that would be provided if the project were not modified
9. Agreement by the Inyo County Board of Supervisors and LADWP, acting through the Standing Committee, to approve the proposed modification to the Enhancement/ Mitigation Project

Additional Mitigation Projects , 1997 MOU and 2004 Amended Stipulation and Order

Section III.A. of the 1997 MOU identifies *Additional Commitments* that include studies, evaluations and commitments to specific issues. One of the issues brought forward in the MOU in Section III.A.3. is *Additional Mitigation* that requires a total of 1,600 acre-feet of water per year to be supplied by Los Angeles Department of Water and Power (LADWP). This water is to be used for the implementation of on-site mitigation measures at Hines Springs that were identified in the 1991 EIR and on-site or off-site mitigation that is in addition to the mitigation measures identified in the EIR for impacts at Fish Springs, Big and Little Seeley Springs and Big and Little Blackrock Springs.

- **Yellow-Billed Cuckoo (YBC) Enhancement Mitigation Project:** These projects located near Big Pine on Baker Creek and Hogback Creek near Lone Pine were designed to enhance vegetation conditions and direct land management actions to enlarge and enhance existing YBC habitat.
- **1600 acre-feet of water:** Commits 1600 acre-feet of water at seven sites. The initial project recommended by the MOU consultant was replaced by seven projects prepared by an Ad Hoc group of Inyo, LADWP, and California Dept. of Fish and Wildlife staff, local lessees, and representatives of the Owens Valley Committee and the Sierra Club. A report describing these projects can be found on the ICWD website.

Table 6.1. Water Supplied to E/M Projects 2004-2014 (from values provided in LADWP's Owens Valley Report).

		Runoff Year												
Project	Normal Year Water Supply (EIR)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	10-Year Average *Supplied*	10-Year *Actual*	10-Year EIR Total
McNally Canals Conveyance Losses	Inc. in Proj.	290	351	345	305	574	782	275	340	185	350	**380**	**3,797**	
McNallyLaws/Poleta Native Pasture Lands	660	1,682	1,269	1,241	1,396	1,320	1,764	1,267	2,306	1,460	1,149	**1,485**	**14,854**	**6,600**
McNally Ponds	4,000	0	1,522	1,491	0	0	0	368	857	0	0	**424**	**4,238**	**40,000**
Laws Historical Museum	150	32	59	99	147	63	131	152	105	138	112	**104**	**1,038**	**1,500**
Klondike Lake[1]	1,700	1,278	1,203	314	1,201	1,195	1,169	1,195	1,086	1,144	1,515	**1,130**	**11,300**	**17,000**
Lower Owens River Rewatering	18,000	8,910	7,566	5,904	0	0	0	0	0	0	0	**2,238**	**22,380**	**180,000**
Independence Pasturelands	2,350	2,489	3,330	2,785	3,272	2,588	1,962	2,397	2,545	2,324	1,852	**2,554**	**25,544**	**23,500**
Independence Springfield	1,500	280	519	1,850	1,962	1,554	1,530	1,356	1,136	1,188	958	**1,233**	**12,333**	**15,000**
Independence Ditch System	725	451	356	359	380	515	446	497	496	165	129	**379**	**3,794**	**7,250**
Independence Woodlot	120	276	190	226	237	335	220	569	175	334	150	**271**	**2,712**	**1,200**
Shepherd Creek Alfalfa Lands	990	1,072	1,152	1,206	1,100	1,183	1,166	1,212	1,073	1,019	884	**1,107**	**11,067**	**9,900**
Lone Pine Park/Richards Field	1,230	916	1,085	870	570	1,012	1,037	1,037	1,194	481	416	**862**	**8,618**	**12,300**
Lone Pine Woodlot	120	76	100	120	78	51	58	123	120	156	70	**95**	**952**	**1,200**
Lone Pine Van Norman Field	480	337	474	512	306	28	147	102	116	97	79	**220**	**2,198**	**4,800**
Lone Pine Regreening	95	238	180	107	232	228	283	257	298	223	216	**226**	**2,262**	**950**
Total	**14,120**	**9,127**	**11,439**	**11,180**	**11,186**	**10,646**	**10,695**	**10,807**	**11,847**	**8,914**	**7,880**	**10,372**	**103,721**	**141,200**

[1] Scoped at 2,200 af, but reduced in 2004 to 1,700 af; the balance transferred to the BP Ditch (500 af), and South Shore Habitat Area (200af).

Current Project Status

This section describes the current status of projects implemented under the Water Agreement. Particular attention is given to large projects that are underway or recently implemented. The ICWD has raised concerns that some projects are not fully implemented or not meeting project goals. These projects include the Lower Owens River Project, many revegetation projects, Klondike Lake South Shore Waterfowl Habitat Area.

Lower Owens River Project (LORP)

Environmental monitoring of the LORP is continuing to provide information used by scientists and project managers to evaluate project conditions and make adjustments to management when required. We have found that by many measures the LORP is a success, but in this 6th year of monitoring it is still too early to state that the goals of the LORP are on track to being fully met.

As in previous years, LORP monitoring activities were carried out in all management units (River-Riparian System, Blackrock Waterfowl Management Area, Off-River Lakes and Ponds, and the Delta Habitat Area). Work on the LORP in fiscal year 2013-14 conducted by LADWP and Inyo County included:

- Maintenance activity such as cleaning sediment accumulations and obstructions from water measurement facilities, ditch maintenance, fence repairs, and adjustments to flow control structures.
- Hydrologic monitoring and analysis of river baseflows and seasonal habitat flows, the ponded area of the Blackrock Waterfowl Management Area (BWMA), the level of the Off-River Lakes and Ponds, and baseflows, pulse flows, and seasonal habitat flows to the Owens River Delta.
- Biological and water quality monitoring included water temperature and dissolved oxygen monitoring, rapid assessment survey (RAS), avian census, and range monitoring. Not all monitoring tasks are conducted every year. A list of monitoring by year can be found in the LORP Adaptive Management and Reporting Plan, which can be found on the ICWD website: http://www.inyowater.org/LORP/DOCUMENTS/LORP_MonitoringAdaptiveManagmentPlan_042808.pdf
- Rangeland monitoring included irrigated pasture condition scoring and utilization trends. Woody species recruitment monitoring was added in September 2010 in order to assess potential livestock influences on regeneration of desirable woody species
- Other work included saltcedar control, weed abatement, and mosquito control

Complete observations from the 2013 field studies are found in the 2013 LORP Annual Report, which can be found on the ICWD website (www.inyowater.org).

Summary of 2013 LORP Observations

The development of the LORP has been monitored since water was reintroduced into the Owens River in December 2006. Based on this monitoring the mitigation project appears to be on track toward meeting goals, but certain observations are not reassuring:

In Late July 2013, a monsoonal storm event caused flash flooding in the watershed above the aqueduct. The aqueduct had been dewatered for repairs. Upstream of the Alabama Gates, floodwaters from the storm entered the aqueduct. To protect equipment and workers below the spillgates LADWP released up to 185 cfs from the Alabama gates into the LORP. This resulted in a substantial fish kill (more information can be found in the Adaptive Management Recommendations in the 2013 LORP Annual Report on the ICWD website). From that experience and other observations of fish stress in 2010, it appears to the project consultants that river water quality is approaching a critical point, where the balance between carbon created and stored in the river, and carbon that can effectively be removed from the system are out of balance and cannot be easily equalized by flow modifications within the bounds of the stipulated flow (40-200 cfs). If such were the case, the amount of flow needed to effectively move muck out of the river may also deplete the water of dissolved oxygen, endangering the fishery. Inyo County and LADWP staffs, along with the MOU consultants are discussing ways to improve water quality by changing the river hydrograph. It is expected that flows larger and smaller than those stipulated will be required. Parties to the MOU are being asked to allow revisions to the stipulation and order to allow for more appropriate flow management. This would include allowing the pumpback station discharge capacity to increase from 50 cfs to 110 cfs, and allowing baseflows above or below 40 cfs at times.

The dominance of cattails and bulrush (collectively referred to here, and in other places, as tules) along the waterline is a concern. Although tules are an expected natural feature in wetted areas of the Owens Valley, and are in many ways are beneficial, it was not expected that tules would dominate the LORP as they have. Tules influence riparian development, changing river flows, and limit certain habitat development. They have become a major impediment to river recreation and in some areas tules are reducing forage of rangeland. Inyo County and LADWP staffs, along with the MOU consultants are discussing ways in which tules might be best managed.

The goal of developing a Lower Owen River riparian canopy suitable for supporting canopy dependent habitat indicator species still remains elusive; recruitment of tree willow in the riparian area is occurring, but very slowly and in limited areas. During the 2013 Rapid Assessment Survey (a 10 day 200 mile survey in August walked along the edge of all wetted features in the LORP), tree willows seedlings or juveniles were found at 46 sites along the river and in the Delta Habitat Area. Only one instance of cottonwood recruitment was recorded this year. Only a few cottonwood recruits have been discovered since the beginning of the project.

LORP Seasonal Habitat Flow (SHF) and Blackrock Flooded Acreage

On May 20, 2013, the Standing Committee approved the seasonal habitat flow and Blackrock Waterfowl Management Area flooded acreage as recommended by the Technical Group.

With the Owens River runoff forecast at 54% of normal, the peak of the SHF released from the Intake was a modest 56 cfs. This minor change in flow was ramped up and down over five days.

In the Blackrock Waterfowl Management Area (BWMA), 270 acres of open water was maintained in Drew Slough. Other wetland units in the BWMA were to be burned to prepare them for flooding when needed, but dry conditions in the burn season prevented this. Burns are planned for the winter of 2014-15, weather permitting.

An additional 87 cfs was released from the Alabama Gates for one day on May 28, 2013 to wet up the flood plain to promote willow seed germination in the area east of Lone Pine that burned on February 26, 2013. This additional release required agreement by all parties to the MOU.

LORP Recreational Use Plan (RUP)

It is anticipated that the LORP will become a popular recreation area that will appeal to those who enjoy hiking, biking, bird watching, wildlife viewing, hunting and fishing and other outdoor activities. Increasing visitor use is expected each year for the first 10-15 years of the project.

A RUP will provide a mechanism to comprehensively identify resource-appropriate recreational opportunities and evaluate these in relation to: environmental and habitat objectives of the LORP; maintenance of warm water fishery, LADWP operations, cultural resources, cattle grazing and other agricultural activities. The LORP RUP will address community concerns that cultural resources and working landscapes be protected.

The development of the RUP has involved extensive public and stakeholder review. From this input, three options were presented to Inyo County Board to help narrow the scope of the project. With the Board instructions, a draft RUP was written and released to public in February 2012. A final preferred plan was presented to the Inyo County Board of Supervisors and the Inyo/Los Angeles Standing Committee in February 2013. Both bodies recommended that the plan proceed to a final design stage with environmental review.

LORP Summit

In early 2014, the LORP Scientific Team, made up of the MOU Consultants and Inyo/LADWP scientists, met on multiple occasions to discuss the status of the LORP relative to goals, and develop plans to adaptively manage the project. A LORP Summit, planned for late July 2014, will be held to discuss the state of the project with the MOU parties and advisory groups.

MOU Additional Mitigation Projects (AMP)

The 1997 MOU commits LADWP to implement additional mitigation that will provide 1,600 acre-feet of water per year to mitigate for impacts at springs in the Owens Valley that have lost some or all of their flow. On-site mitigation measures were developed at Hines Spring and the balance of the water was allocated other projects in the Owens Valley. The document, *Additional Mitigation Projects Developed by the MOU Ad Hoc Group* can be found at www.inyowater.org.

These projects which were fully implemented in March 2012 include: The *Hines Springs* project, consisting of a surface-water fed channel and a pumped water supplied channel to create ponded water or tule marsh habitat and provide water for cattle (on-site mitigation at Hines Springs was required in the 1991 EIR, 1997 MOU and in the 2004 and 2005 Stipulation and Order as mitigation for impacts at Fish Springs, and at Blackrock and Seeley Springs).; *Freeman Creek*, where water is being diverted back into ancestral washes to create a riparian corridor and support existing pasture; *North of Mazourka* Canyon Road project, where a new flowing well augments supply from an older well to create spring and seep habitat and provide stock water; the *Homestead* project southeast of Independence, which relies on a new flowing well to create a short flowing channel and a one-acre pond; the *Well 368* project includes a new artesian well to augment water for an existing Owens Valley Pupfish refuge. In addition, to these biological projects, *Diaz Lake* will be supplied a secure amount of water, which reduces the amount of water pumped by Inyo County to supply the lake. The annual balance of 1,600 af not used by the other projects will be used at *Warren Lake* to enhance shorebird and wildlife habitat.

Annual water commitments are as follows: Freeman Creek (215 af), Hines Spring Well 355 (240 af), Hines Spring Aberdeen Ditch, (145 af), North of Mazourka Canyon Road (300 af), Homestead (300 af; Figure 6.1), Well 368 (150 af), Diaz Lake (up to 250 af), and Warren Lake (the balance of 1600 af, if any).

Figure 6.1. Ponded water at the Homestead AMP.

Yellow-Billed Cuckoo Habitat Enhancement Project

Implementation of a project to enhance and maintain Yellow-Billed Cuckoo habitat was initiated in the spring of 2009. The project site was fenced and planting of cottonwood and willow began in the spring of 2010.

On March 18-19, 2011, the Center Fire began at the western edge of the Baker Creek, which, fanned by 70 mile-per-hour wind, destroyed the bulk of the forest canopy deemed most suited for the cuckoo. There are indications that the area will naturally recover. Three months after the fire, new growth had sprouted from charred willow stumps. It is unknown how long it will take the habitat to return to a condition that will support breeding cuckoos, however the Hogback Creek site experienced a catastrophic fire in 1998, and by 2009 had reestablished a dense tree canopy. Black Locust removal is continuing, and new poles were planted in 2013 to replace plantings that failed to thrive.

In 2013, LADWP reported a significant decline in canopy cover and understory in parts of the project area. They attribute this to mowing, which was needed to plant poles, and to a lower water table. A review of well hydrographs in the immediate area does not show a decline in the water table.

To prevent having to reopen planning efforts, LADWP is strictly adhering to a planting plan that places poles in dry areas where the planting couldn't possibly survive. ICWD will be working with LADWP to explore options to change the planting plan so the project has a better chance of success.

Revegetation Projects Identified in the 91 EIR and Irrigation in the Laws Area (ILA) MND

Revegetation projects mitigate for environmental damages due to groundwater pumping and/or discontinuation of agriculture (Figure 6.2). A mitigation plan for these projects dates back to August 1999 (www.inyowater.org).

It is frequently quoted that active revegetation is a slow process, which may require a decade or more to achieve, but despite well over a decade of research and considerable experimentation, the majority of these projects have not met goals. LADWP reported in 2012-13 that only four of sixteen revegetation parcels have met required cover and composition goals (Table 6.2). None of the abandoned agricultural revegetation projects are near meeting targeted goals. To date, the only revegetation efforts to have succeeded were those that came back naturally once the water table was allowed to recover. In these instances no improvements other than fencing and the elimination of grazing were needed.

The majority of the revegetation projects require some form of irrigation to support transplanted stock (irrigation will be discontinued once plant cover and composition meets goals for a parcel, and those goals can be sustained unirrigated for a specified period of time). However, most of these projects are not supplied adequate irrigation and as a result have not achieved revegetation goals.

Members of the public, Inyo County Water Commission, the ICWD, and other agencies have voiced concern about the lack of progress, especially in the Laws area, where after nine years little revegetation has occurred and blowing dust from these parcel continues to impact the property and health of nearby residents.

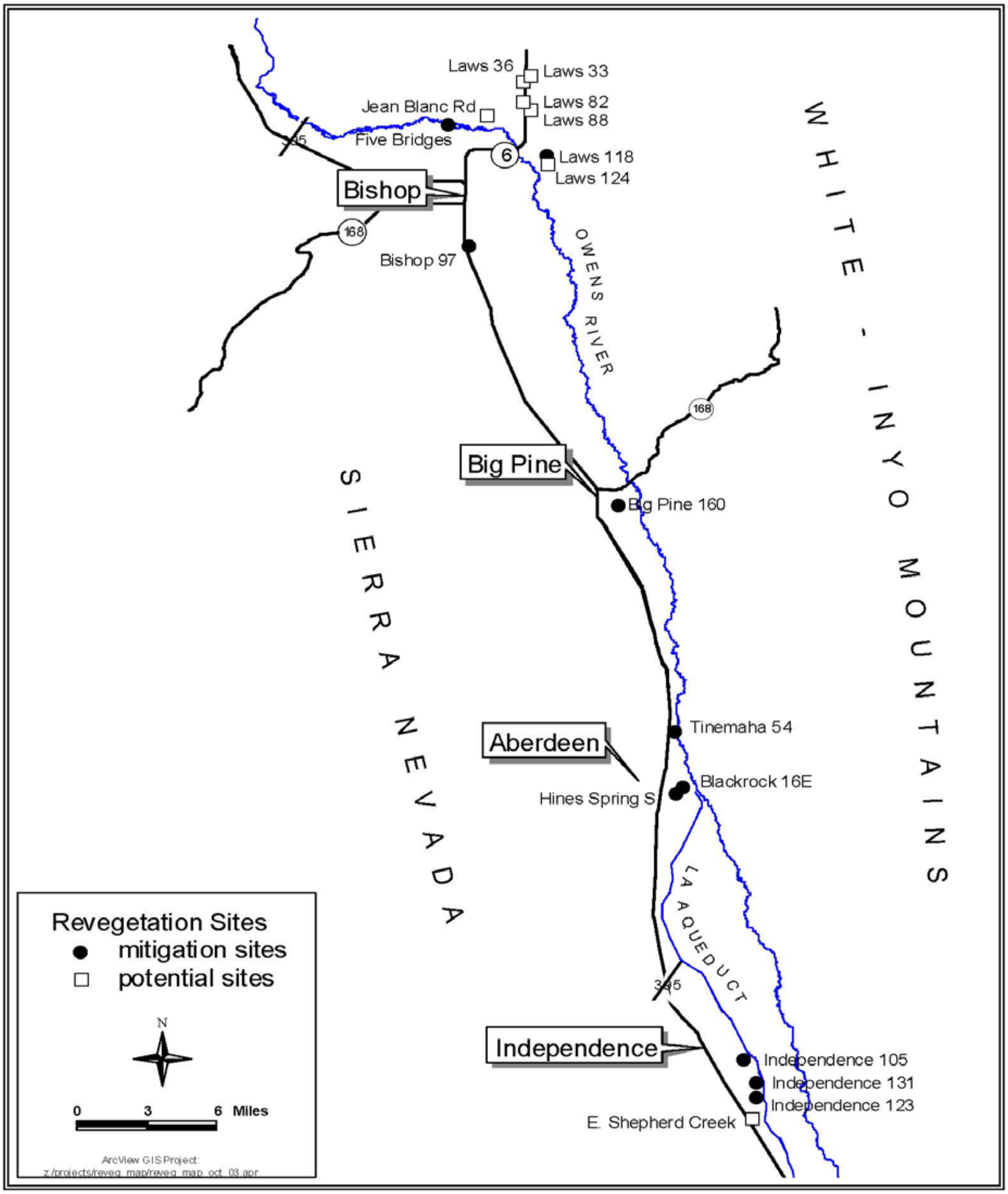

Figure 6.2. Locations of revegetation sites in the Owens Valley described in the 1991 EIR.

Beginning in 2013 LADWP has been steadily increasing the amount of effort they are putting into the ILA projects. As of 2014, a dedicated revegetation manager is overseeing the planting and irrigation, which seems to be improving the project's implementation. Irrigation has been installed in all parcels and thousands of plants are being installed. Transplants that have not established are being removed and replaced with new plants when stock is available. Once the crews are finished planting the ILA parcels they plan to begin work on the EIR revegetation projects.

Revegetation Mitigation Projects Described in the 1991 EIR

The 1991 EIR identified mitigation for lands that were made barren due to increased groundwater pumping, or the abandonment of agriculture. The 1997 MOU, which supplements the 1991 EIR, describes the goals for the revegetation projects:

> *The content of the mitigation plans will be in accordance with the EIR, which provides that on-site mitigation will be accomplished through revegetation with native Owens Valley species and through establishment of irrigation. The mitigation plans may include schedules for conducting research and testing revegetation techniques.*
>
> *As reliable methods are developed for large-scale revegetation applicable to the different characteristics of the affected areas, the initial revegetation goals contained in the EIR, or in the initial plan, for each site will be refined or modified as necessary. In refining or modifying the revegetation goals for the affected areas, a preference will be given to revegetation that will restore the area to vegetation conditions similar to those that previously existed. If this cannot be feasibly and reliably accomplished because of the characteristics of the area, or for other reasons, the next preference will be to establish perennial vegetation comparable to that in nearby areas. If this is not feasible, revegetation with other native Owens Valley species will be the preferred goal.*

Beginning in 1991, studies and test plots were used to examine various methods that could be used to effectively and efficiently revegetate arid lands. Based on these studies and experiments, revegetation plans called for in the 1997 MOU and Long-Term Water Agreement (LTWA) were released in August 1999. The plans are titled, *Revegetation Plan for Impacts Identified in the LADWP, Inyo County EIR for Groundwater Management* and can be found on the ICWD website.

All the revegetation projects were fenced in 1999 to eliminate disturbances. Experimental techniques were tried at plots within some sites to test various methods of revegetation with the goal of developing techniques that could be applied to all projects. Sites were prioritized according to the difficulty of the project and threat of continued degradation. At sites where natural recruitment was taking place, passive techniques--simply fencing the land--was all that was called for. At the most disturbed sites where top-soil had eroded, it was established through studies that systematic irrigation would be required to cultivate native perennial transplants.

The status of these projects is as follows:

- **Laws 118**: in 2011, 18 acres were drill seeded. In 2012 a buried drip irrigation line was installed, and a new fence was constructed. The site was found to have 2% cover when surveyed in 2012, so the parcel is not meeting cover goals. LADWP reports that they will likely not plant this parcel until after 2015, which is after they have completed planting Laws parcels 90, 94, 95, and 129. The Irrigation in the Laws MND (2003) specifies that 32 acres of parcel 118 is to be flood irrigated to create and maintain native pasture; however this section has not been irrigated. LADWP is working with the lessee to get water onto the land.
- **Bishop 97**: approximately 35 acres were drill seeded in 2011, and a buried drip system was installed on approximately 16 acres. This parcel has 4.8% native perennial cover. The goal for this project is 15% cover. As of 2014, it doesn't appear that seeding has improved cover.
- **Five Bridges**: Water was release from C Drain three times during the growing season. Water spread was assessed visually. Permanent transects and photo points were monitored, and weed control continued. LADWP is not following the approved mitigation plan for Five Bridges, which requires flood irrigation from high flows from the Owens River. A revised plan for this project had been circulated, but has not been approved by the Technical Group. Under LADWP's management plan, the percent of native perennial cover and composition of that cover, as measure by LADWP, varies quite a bit from year to year, but generally the cover has been in decline during this seven year period, which was recorded in LADWP's annual report. ICWD has requested that LADWP apply water earlier in the growing season for rare plants in the area. In 2014, the first water of the season will be released at the end of May.
- **Big Pine 160**: About 20 acres were drill seeded in 2011. LADWP is still evaluating a water source and designing an irrigation supply. Transects conducted in August 2012 found 3% native perennial cover. Additional drill seeding was accomplished in 2013; however, even though precipitation followed the seeding, there was no evidence of germination.
- **Laws 118**: This parcel was divided in two, with the eastern section incorporated in the Irrigation in Laws Area project. This is the parcel west of the Laws Poleta Road. LADWP reports that in 2013 a drip irrigation system was installed that covers much of the parcel. This area will be planted once the Irrigation in the Laws parcels are planted out.
- **Tinemaha 54**: No work has been reported by LADWP. This parcel is not meeting cover and composition goals. A 2012 survey found 2.14% cover.
- **Blackrock 16E**: The site has attained cover and composition goals, and no work was reported.
- **Hines South**: This project has not been implemented. Planning was to begin after the Hines Spring projects were completed in March 2012. Although the Hines Springs projects were implemented by deadline they are not fully performing as designed due to the character of the soils at the site. A decision was made to delay planning for three years in order to allow an assessment of the Hines Spring project. It is expected that planning will be completed by March 2015.
- **Independence 105** and **Independence 123**: It is reported that these sites have attained cover and composition goals.
- **Independence 131N**: This parcel was surveyed in the summer of 2012 and transects show that vegetation cover was 16.2%, which is just below the required 17% vegetation cover goal; however, the revegetation plan allows that when cover is 90% of the stated goal it is considered rehabilitated.

- **Independence 131S**: approximately 21 acres were drill seeded. LADWP reported in 2011 that buried drip irrigation was to be installed in 2012.

The 1999 mitigation plan for these revegetation projects provides that, “After seven years, these overall goals should be reexamined to assess whether they are realistic or need revision. Assessment will include the level of effort expended on the project and a statistical evaluation of the status of the cover and composition of desirable and weedy species”. It has been 13 years and no reevaluation has taken place.

Irrigation in the Laws Area MND (ILA), Revegetation Projects (233 acres)

These revegetation projects are the result of the reclassification of some of the formerly irrigated land in the Laws area. In the 1990’s the Laws Ranch agricultural fields were supplied irrigation water for pasture and alfalfa until a dispute between the lessee and LADWP ended with the lessee abandoning the field. LADWP did not continue irrigation, topsoil was lost and the fallow ground became a major source of blowing dust.

In order for the Laws Ranch to be efficiently irrigated, Inyo County and LADWP agreed to redesignate these formally irrigated parcels from Type E (lands supplied with water) to Type A (vegetation that can survive on available precipitation). In trade, certain parcels in the Laws area were reclassified Type E, so that an equivalent acreage remained irrigated.

Three parcels in the Laws area that had been irrigated farmland will be revegetated: Laws 90 (101 acres; Figure 6.3), Laws 95 (46 acres), and Laws 129 (47 acres). Another two Laws parcels, which are mapped as abandoned agricultural land, Laws 94 (40 acres) and a portion of Laws 118 (18 acres) surrounding Laws 129 will also be planted.

The mitigation plan for the Irrigation Project in the Laws Area, MND, entitled, *Revegetation Plan for Lands Removed from Irrigation Laws Parcels 90, 95, and 129 and Abandoned Agricultural Land Parcel 94* was released in 2003 (www.inyowater.org). The plan describes restoring native perennial cover that closely approximates the vegetative cover and species composition of nearby parcels with similar ecological site descriptions. All parcels are to be irrigated until the project is complete; when, after two years of having discontinued irrigation and other activities, the prescribed cover and composition is maintained.

The plan provides specific goals for total vegetative cover, species composition, and a project schedule. The cover and composition goals are: a minimum 10% cover of native perennial vegetation composed of 10 native perennial species at Laws 90, 94, 95, and 8 native perennial species in Laws 129/118 by 2013.

LADWP reports that the planting on all of the Laws parcels will be complete by 2014-15, but has not provided a revised plan and schedule that describes when project goals are expect to be met. The Plan for the Irrigation Project in the Laws Area requires that beginning in 2010, if revegetation is not on schedule, the annual report is to be expanded. The Water Department has asked LADWP to provide the expanded report and a new timeline. Inyo County is working with LADWP to revise the plan, which should be completed in 2014. The revised Plan will be submitted to the Technical Group for review and approval. The Irrigation Project in the Laws Area, MND will be amended with the revised plan.

Although LADWP is years behind schedule, they are making a concerted effort to accelerate work on these projects. They have two greenhouses for propagating native transplants, which allows them to place thousands of deep-rooted transplants at buried drip emitters in the project parcels. New drip irrigation systems had being installed, or expanded to allow for additional plantings in 2014.

While progress on these projects is evident, the Water Department still has concerns that these projects will not meet the Plan's cover and composition goals. Plants, including perennial grasses, are being placed at water emitters on a grid with 10 foot grid spacing. Even if all transplants survived (as of 2011, it appeared that less than 60% survived), and each individual plant attained a full canopy, plants placed with such a large spacing would be unlikely to attain a 10% cover. LADWP suggests that cover will expand with new recruitment, but there is little evidence that recruitment is occurring in the Laws parcels. As well, LADWP is not monitoring survivorship, and has not committed to replacing transplants that have died.

Another concern is competition for resources by weedy species, primarily tumbleweed (*Salsola tragus*), which covers much of the land in these parcels. Weeds are taking advantage of moist soils at the drip emitters and competing with transplants (Figure 6.3). Under the mitigation plan, Salsola is not a species LADWP is required to treat, but without management, many of the new transplants will be needlessly lost. In 2014, LADWP is experimenting with emergent herbicide to control weeds, including tumbleweed.

Figure 6.3. Laws 90 in the Irrigation in the Laws Area project February 2012. Plantings are staked in cages surrounded by weedy annuals.

Table 6.2: Status of revegetation projects.

Guiding Document	Project name	Acres	Impact[3]	Met goal	Percent Live Native Cover: Goal %	Percent Live Native Cover: Reported %	Number of Species: Goal	Number of Species: Reported
91 EIR/97 MOU	LAWS 118	107	ABAG	NO	11.5	2.0 [4]	11	Not reported
91 EIR/97 MOU	BISHOP 97	124	ABAG	NO	15.0	4.8 [4]	12	Not reported
91 EIR/97 MOU	FIVE BRIDGES	300	GP	NO	60.0	47.0/74.0 (2 sites)	4	5/6 (2 sites)
91 EIR/97 MOU	BIG PINE 160	211	ABAG	NO	17.7	3.0 [4]	10	Not reported
91 EIR/97 MOU	TINEMAHA 54	0.4	GP	NO	33.0	2.1 [4]	3	Not reported
91 EIR/97 MOU	BLACKROCK 16E	7.5	GP	YES	34.0	37.0	6	14
91 EIR/97 MOU	HINES SOUTH[2]	11.5	GP	NO	33.0	–	TBD	–
91 EIR/97 MOU	INDEPENDENCE 105	42	GP	YES	25.0	>25.0	4	>4
91 EIR/97 MOU	INDEPENDENCE 123	42	GP	YES	17.0	>17.0	4	>4
91 EIR/97 MOU	INDEPENDENCE 131 N	23	GP	YES	17.0	16.2 [4]	4	5
91 EIR/97 MOU	INDEPENDENCE 131 S	50	GP	NO	17.0	6.2 [4]	4	Not reported
ILA*	LAWS 90	94	ABAG	NO	10.0	Not surveyed	10	Not surveyed
ILA	LAWS 94	47	ABAG	NO	10.0	Not surveyed	10	Not surveyed
ILA	LAWS 95	44	ABAG	NO	10.0	Not surveyed	10	Not surveyed
ILA	LAWS 118/129	50	ABAG	NO	10.0	Not surveyed	8	Not surveyed
ILA	LAWS 27 (SEED FARM)	118	ABAG	NO	10.0	Not surveyed	8	Not surveyed

YES (green)	Met Goals - Project Complete
YES (yellow)	Determined by LADWP to have met goals in 2012
NO (red)	Not meeting goals

*ILA, Irrigation in the Laws Area MND

[1] 32 acres removed for irrigation

[2] An acreage figure has not been established

[3] Abandoned agriculture, lands removed from agriculture (ABAG); increased groundwater pumping (GP)

[4] Surveyed August 2012

Two parcels identified from mitigation in the Irrigation in the Laws Area MND, totaling 162 acres, have not been implemented. The 32 acre portion of Laws 118 that is to be converted to irrigated pasture has not received water, and Laws 50, which has been the subject of complaints from The Great Basin Unified Air Pollution Control District, has yet to be fully implemented.

Five Bridges

In 1988, approximately 300 acre of vegetation in the Five Bridges area, located about 3.5 miles north of Bishop, was observed to have died off or was in decline. The impact was attributed to local groundwater pumping and the effects of drought. A mitigation plan for the site was developed in 2002, but the Technical Group never approved it. The mitigation goals are to restore the area to a complex of vegetation communities with similar species composition and cover as existed prior to impact. The goal will be attained when alkali meadows have live cover of 60% that is composed of four perennial species and riparian areas attain live cover of 90% composed of four perennial species. In the unadopted plan, these goals were to be attained at the end of the 2007 growing season. Five Bridges is presently managed using controlled burns, grazing restrictions, weed control, and water spreading.

Beginning in 2004, LADWP's Annual Owens Valley Report provides transect results from two alkali meadow sites. Since 2004, species composition goals have been met; however, vegetation cover in these same areas has varied greatly over time. Of interest is survey data (Table 6.3) that show a general decline in alkali meadow vegetation cover at the two reported permanent transect sites. Transect L4 had met, or nearly met, required cover only during the first four years in which project data had been reported, but for the last five years cover has greatly declined. The most recent figures for transect L4 and L5, reported in 2013, show a dramatic decline in cover. Transect L5 has generally met 60% cover goals, but like L4, cover has trending downward. LADWP's annual reports noted the decline, and LADWP staff believes that cover changes likely corresponded with high river flows and dips, as well as to off-site water management, pepperweed eradication efforts, and drought. They point out the general increase in vegetation since cover was first measured; in 1989 cover at L4 was 3.9% and L5 was 15.9%.

Table 6.3. Species Cover and Composition at Five Bridges, recorded by LADWP 2003-2012 (values in red are below project goals).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
L4 Transect % Cover	59	61	68	61	52	47	39	47	21	13
L4 Transect Composition	5	4	4	4	5	5	5	5	5	5
L5 Transect % Cover	78	89	93	70	74	43	61	74	68	34
L5 Transect Composition	6	7	7	7	6	7	6	6	6	6

Klondike Lake, South Shore Waterfowl Habitat Area (SSHA)

Klondike South Shore Habitat Area is to be provided 200 acre-feet of water per year for the purpose of creating and maintaining an open-water habitat for waterfowl and a shallow-flooded habitat for shorebirds.

LADWP had encountered problems conveying the assigned volume of water between Klondike Lake and the adjoining SSHA. There is very little gradient between the lake and the SSHA, so that less than half the water allocation could be supplied in most years. In 2011 an addition water gate was opened between the lake and habitat area, and water delivered to the site was reported to be 200 af in 2011-13.

Encroachment by emergent vegetation in the project area is a concern (Figure 6.4). Tules have largely displaced open water habitat in much of the project area that was first flooded. With the switch in the primary water delivery point, new areas of open water have developed and are being used by shorebirds and waterfowl, off-setting the loss of open water elsewhere in the project area.

A program to manage tules and restore habitat will need to be designed and implemented once the most recently created habitat has fully established.

Figure 6.4. Klondike Lake.

New and Revised Projects in 2013 : Implementation of the Independence Eastside Regreening Project and Big Pine NE Regreening Project, and modification to Van Norman Field Project

Independence Eastside Regreening (30 acres)

This project, which mitigates for impacts due to groundwater pumping and surface water diversions, consists of constructing a new water supply well in the town of Independence and irrigating approximately 30 acres immediately north of Market St. and east of Clay St.

From 2002 to 2008, the project underwent several rounds of review and consideration by Inyo County. In April 2009, the Standing Committee revised the scope of the project to allow sprinkler irrigation and relocate the well to the east to reduce pump noise at neighboring residences. The change in scope also allowed for an onsite stable and corral.

The Technical Group had evaluated and approved the new well at the site and by September 2012 LADWP had drilled the new well, and selected a lessee. The area was fenced beginning in the winter of 2013 and "No Public Access" signs have been posted. The project area had been a popular pedestrian route from town to the fields to the east. Independence residents asked the LADWP to allow continued access and LADWP accommodated this by relocating the north fence line. A number of mature trees were left within the project boundary. The sprinkler irrigation system was installed in April 2014 (Figure 6.5), and the area is ready for planning by the lessee in 2014-15.

Figure 6.5. LADWP worker clearing the newly installed irrigation line at the Independence Eastside Regreening project.

Big Pine Northeast Regreening (30 acres)

The Inyo County/ LADWP Technical Group approved an amended mitigation plan in the spring of 2010. The Big Pine Canal was identified as a source of project water. Replacement water up to 150 AFY will be supplied by Well 375. The effect of pumping Well 375 to supply this project has been modeled and water drawdown is expected to be insignificant, with no effect to vegetation or neighboring wells. Pumped throughout the irrigation season, at 150 AFY, the model predicted a groundwater decline of less than 0.2 feet near Big Pine.

The new project scope allows for sprinkler irrigation or flood irrigation. The original project description anticipated flood irrigation. Sprinklers were installed, which will reduce the project's water demand from 150 AFY to 90 AFY.

LADWP had completed a Negative Declaration (ND) in November 2011 and began work to identify a lessee and build project infrastructure, but in April 2012 the Owens Valley Committee, Sierra Club, and Big Pine Paiute Tribe filed a legal challenged on the grounds that an EIR was required. In November 2012 the court ruled that LADWP's original CEQA document, the 1991 EIR, described the project and that a ND was adequate for the project to proceed.

The site was prepared beginning in the winter of 2013, and the irrigation was installed in March and April 2014 (Figure 6.6). The parcel is ready for planting by the lessee.

Figure 6.6. Big Pine Northeast Regreening (April 9, 2014).

Van Norman Field E/M Project Expansion (~10 acre addition)

On May 20, 2013, The Standing Committee agreed to modify the Van Norman Field Enhancement/Mitigation (E/M) Project by adding approximately ten acres of the Lone Pine High School Farm to the Van Norman Field E/M Project. The total acreage of the modified Van Norman Field E/M Project will be approximately 170 acres. The additional acreage incorporates the entire Lone Pine High School student farm, which leased by Los Angeles Department of Water and Power (LADWP) to Lone Pine High School. The approximately ten additional acres will be irrigated pasture (Figure 6.7). Pumped water will be supplied to the Lone Pine Student Farm from the new E/M well 425, which is the sole source of water for the VNF project. The total annual water supply for the project will remain at 480 acre-feet per year, which will result in an annual water distribution within the project boundaries of approximately 2.8 acre-feet per acre.

The environmental analysis of the new well found that the replacement for well 390 will cause less potential drawdown under groundwater dependent vegetation than the old well, and that in its new location it would provide more efficient irrigation and potentially expand the area that can be irrigated. The school farm pasture will be supplied with water that will be delivered by drip, sprinkler, or flood irrigation. Water will be conveyed to the school farm from the main VNF ditch, which has served the VNF since before 1964. All water supplied to the VNF will be used within the boundary of the project area for agriculture or groundwater recharge. Water will be regulated to maintain water onsite; no tail water will be produced.

Figure 6.7. The Van Norman Field E/M project expansion will include new pasture on the north end of the Lone Pine High School Farm.

Summary of All Mitigation Projects

All mitigation projects are summarized in the following table that contains general information about each project, including its origin, description, impact mitigated, plan, development stage and status as of June 3, 2014. Projects in the table are arranged north to south.

The *Mitigation Origin* column lists the project starting point and any subsequent consideration of the project over time. Many of the Enhancement Mitigation projects (E/M) that were implemented prior to the 1991 EIR were continued. Some of the pre 1985 Environmental Projects (EP) were identified as mitigation in the EIR. The Impact Number, if provided, is from Section 7 of the 1991 EIR, and associates the mitigation measure with the pre-project setting and type of environmental impact being mitigated; it also describes the significance of the environmental impact. Non-E/M projects were largely developed in response to an impact that occurred subsequent to the EIR. Some non-E/M projects provide substitute mitigation, or mitigation not specific to an impact identified in the 1991 EIR.

The *Impact* column summarizes the environmental impact being mitigated. The *Prescription* column describes the activities and goals from the associated mitigation plan or other agreement. The project's state of development, relative to the project's goals, is reported in the *Development Stage* column. The *Status* column summarizes recent project activity.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Laws/Poleta Native Pasture (southeast of Laws) (216 acres)	E/M 1985-1990[1] 1991 Owens Valley EIR Impact No. 10-16	The Laws area has lost all or part of its vegetation cover due to increased groundwater pumping, abandonment of irrigated agriculture to supply water to the second aqueduct, livestock grazing and drought.	Annually provide water to approx. 216 acres in two locations to enhance and maintain existing vegetation and increase livestock grazing capacities while continuing the activity that caused the impact. (First implemented 1988).	Implemented and ongoing.	One pasture is adjacent to and east of Hwy. 6 (160 acres, parcel 44). Only the eastern half of the pasture has been effectively irrigated. LADWP had reported that they couldn't separate this project's water accounting from adjacent irrigated parcels. LADWP reports these projects were supplied a combined 1,149 acre-feet in 2013-14.
McNally Ponds and Native Pasture (348 acres)	E/M 1985-1990 1991 Owens Valley EIR Impact No. 10-18	The Laws area has lost all or part of its vegetation cover due to increased groundwater pumping, abandonment of irrigated agriculture to supply water to the second aqueduct, livestock grazing, and drought.	Create waterfowl habitat by annually filling ponds Sept-Jan. Enhance and maintain vegetation and increase livestock grazing capacities by irrigating 107 acres of native vegetation and ~200 acres of native pasture. (First implemented 1986-1987).	Implemented and ongoing This project and Laws Poleta Native Pasture received no water in 2013-14	In the past, the Inyo Board of Supervisors has approved water reductions due to drought conditions. LADWP currently describes the water supply to the ponds as provided only when water is diverted from the Owens River to the McNally canals. The adjacent 100-acre pasture has low patchy grass cover. The other pasture located 1 ½ miles SE of Laws (200 acres) was irrigated and maintaining grass cover. During the 2013-14 runoff year, neither the ponds or pond-adjacent pasture received any water. To compensate, approximately 100 acres of pasture adjacent to Bishop Creek Canal was irrigated. Inyo and LA will examine this project during the E/M Evaluation study now underway.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
640 acre potential revegetation near Laws	E/M 1985-1990 1991 EIR Impact No. 10-18	The Laws area has lost all or part of its vegetation cover due to increased groundwater pumping, abandonment of irrigated agriculture to supply water to the second aqueduct, livestock grazing and drought.	Standing Committee to consider revegetating with non-groundwater dependent native plants and continuing the activity that caused impact.	In progress	The Standing Committee has not evaluated the need for mitigation of this area. Desert Aggregates expanded gravel mine operation includes at least 174 acres in the western part this potential mitigation site.
Five Bridges area revegetation (300 acres)	1991 Owens Valley EIR Impact No. 10-12	Between 1987 and 1988, two wells in the Five Bridges area that were pumped to supply water to enhancement mitigation projects contributed to a lowering of the water table under riparian and meadow areas along Owens River. Approximately 300 acres of vegetation were affected, and within this area, approximately 36 acres lost all vegetation due to a wildfire. EIR v1 (10-58)	Manage pumping to restore water table levels, supply surface water, and restore meadow and riparian vegetation through active revegetation efforts. Inyo and LA are responsible for plan development and implementation.	In progress	Water has been spread over the affected area since 1988. By the summer of 1990, revegetation of native species had begun on approximately 80 percent of the affected area. LADWP and Inyo County had been developing a plan to revegetate the entire affected area with riparian and meadow vegetation. The planning effort stalled in 2003 and has not proceeded beyond a draft that has not been implemented. Providing surface water to the site has increased cover in some areas. The area north of the river that was originally in the impact area appears to have declined in cover and requires attention but his area was not addressed in the draft mitigation plan. In March 2005, LADWP informed the Water Department that limited grazing in some enclosures had resumed. The project is affected by a widely fluctuating water table, invasive weeds, and irregular water

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
					deliveries. The Technical Group needs to develop a final mitigation plan for the area.
Farmers Pond	EP 1970-1984 1991 EIR Impact No. 10-18	The Laws area has lost all or part of its vegetation cover due to increased groundwater pumping, abandonment of irrigated agriculture to supply water to the second aqueduct, livestock grazing and drought.	Water provided in fall of each year to offer increased habitat for migrating waterfowl; two miles north of Bishop.	Implemented and ongoing	Implemented and ongoing
Revegetation near Laws (160 acres)	Non-E/M Project 1991 EIR Impact No. 10-18	The Laws area has lost all or part of its vegetation cover due to increased groundwater pumping, abandonment of irrigated agriculture to supply water to the second aqueduct, livestock grazing and drought. EIR v1 (10-66)	Native plant revegetation. Mitigated Negative Declaration (MND) allows approx. 32 acres to be converted to flood irrigated pasture.	Incomplete	The Technical Group implemented a 10-acre study plot in 2001 in lieu of initiating the planting of container plants as required in the Mitigation Plan. The mitigation project area has decreased in size due to the Laws Irrigation MND.
Laws Museum Pastures (21 and 15 acres)	E/M 1985-1990 1991 EIR Impact No. 10-18	Significant adverse vegetation decrease and change have occurred in the Laws area due to a combination of factors, including abandoned agriculture, groundwater pumping, water spreading in wet years, livestock grazing, and drought.	Enhance the museum grounds by irrigating pastures east and west of the museum. This project was revised in the Laws reirrigation MND.	Implemented and ongoing	Both museum pastures had a cover of weedy species in the recent past, but seem to be improving. The condition of project and irrigation system will be monitored. LADWP reports that the project was supplied 112 acre-feet of water in 2013-14 Inyo and LA will examine this project during the E/M Evaluation study underway

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Laws area	1991 EIR Impact No. 10-18	Significant adverse vegetation decreases and changes have occurred in the Laws area due to a combination of factors, including abandoned agriculture, groundwater pumping, water spreading in wet years, livestock grazing, and drought.	Monitor and reduce groundwater pumping where suspected impacts have occurred. Mitigate according to the Agreement, if necessary.	Incomplete	County and LADWP are in disagreement over the need to operate the McNally canals to avoid impacts to vegetation. Monitoring of select vegetation parcels is ongoing.
Millpond Recreation Area	EP 1970-1984; E/M 1985-1990	Non-specific compensation.	Pay for costs of running well to provide water to pond and thus create wet habitat.	Implemented and ongoing	Implemented and ongoing.
Buckley Ponds	EP 1970-1984 1991 EIR Impact No. 11-1	Non-specific compensation.	Provide habitat for warm-water fishery and waterfowl by maintaining a year-round pond.	Implemented and ongoing	Implemented and ongoing.
Bishop Area Revegetation Project (Bishop 97, 120 acres)	Non-E/M Project 1991 EIR Impact No. 10-16	Non-specific compensation.	Revegetate with non-groundwater dependent native vegetation.	In progress	In progress, but behind schedule. LADWP estimates that successful revegetation could take a decade or longer. Fencing to eliminate disturbance has been installed. The Mitigation Plan (MP) provided that test plots would be implemented if the area did not demonstrate vegetation recovery. Vegetation cover was re-sampled in 2003 to compare with 1999 baseline cover. Results showed little to no change. Another

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
					survey is planned for 2012. The MP provides that revegetation efforts would be expanded in 2009, five years after implementation of test plots. In 2011-12 drip irrigation was expanded and about 2,180 containerized plants were planted. The parcel was surveyed in 2012 and found to have attained a 4.8% native perennial cover.
Saunders Pond	EP 1970-1984	Non-specific compensation.	Provide wet habitat by maintaining operation of year-round pond.	Implemented and ongoing	Implemented and ongoing.
Klondike Lake	EP 1970-1984; E/M 1985-1990 1991 EIR Impact No. 11-1	Non-specific compensation.	Improve waterfowl habitat and provide recreation in the Big Pine area. The Big Pine Ditch MND (2004) reduced the water supply to 1,700 acre-feet, provided maintenance of native pasture and wetland habitats adjacent to Lyman ditch, and committed LADWP to maintain a described a lake level. Up to 200 acre-feet/year would be used for a native habitat area. (First implemented 1987).	In progress .	Motorized recreation on the lake has been limited to prevent the introduction of the freshwater quagga mussel. LADWP reports runoff year 2013-14 water use was 1,515 acre-feet. Inyo and LA will examine this project during the E/M Evaluation study underway In 2013, vehicles had been driven through the wetlands in the project area. This is based on 2013 Google earth imagery.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Klondike South Shore Waterfowl Management Area (160 acres)	1991 EIR Impact No. 11-1 Addition to Klondike Lake project 2005	Compensation for the inability to supply water to the Klondike Lake Project.	When initiated, the Klondike Lake Project was expected to use 2,200 AF, but the project requires less than 1,500 AF. South Shore project was initiated to create waterfowl habitat just south of the lake with water that could not be delivered to Klondike Lake. Two hundred AF was allocated for this purpose.	In progress	The elevation between the Lake and the Project is minimal and sediment in the water conveyance limited flow to the project. A new water gate was installed and from the 2011-12 runoff year to present, a full 200 af allocation was supplied. With the use of the new water gate new habitat has been created and is being used by desired species; however the original project area receives little water and is almost completely tule chocked. A habitat management plan needs to be prepared for this project. It has been the practice of LADWP to release water to the project area during waterfowl migration season, usually beginning releases in late winter, but as of April 2013 water had not been supplied to the project. In 2013, vehicles had been driven through the wetlands in the project area. This is visible on Google Earth imagery.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Big Pine Northeast Regreening (30 acres)	E/M 1985-1990 1991 EIR Impact No. 10-19	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Manage pumping in accordance with the Agreement and establish irrigated crop.	In progress	The Inyo County/ LADWP Technical Group approved an amended mitigation plan in the spring of 2010. Modifications include a change in water source. The Big Pine Canal will serve as a source of project water. Replacement water, (equal to or less than 150 AFY) will be supplied by Well 375. The new project scope allows sprinkler irrigation as well as flood irrigation. It is estimated that sprinklers will reduce the project's water use from 150 AFY to 90 AFY. In April 2012, a lawsuit seeking to declare the ND inadequate and asking that a full EIR be developed was presented. The Court found that the CEQA document was appropriate and the case was dismissed in 2013. The IC Water Commission was shown this project and others in the Big Pine area in September 2013. The project area has been fenced, sprinkler irrigation installed, and the soil prepared for planting. The project should be fully implemented in 2014-15.
Big Pine Ditch System	Non-E/M Project 1991 EIR	Non-specific compensation.	Establish/restore ditch system through Big Pine.	Implemented and ongoing	This project was completed in the summer of 2010, and provides water to 85% of Big Pine residents. The IC Water Commission toured this project

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
	Impact No. 10-19				and others in the Big Pine area in September 2013.
Big Pine Revegetation (East Big Pine) (20 acres)	E/M 1985-1990 1991 EIR Impact No. 10-19	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	This is an undefined potential enhancement/mitigation (E/M) project that will become a native plant site if permanent irrigation is infeasible Establish an irrigated crop while continuing the activity that caused the impact.	Incomplete and ongoing	Portion of parcel 160 to west of BP Canal. LADWP reports "The site was fenced in 2007 to eliminate disturbances and encourage natural revegetation. If this area does not revegetate naturally, it will be included with LADWP's ongoing revegetation efforts." The IC Water Commission was shown this project and others in the Big Pine area in September 2013. LADWP reports that they drill seeded 3.2 acres in February of 2014.
Revegetation near Big Pine (Big Pine 160) (160 acres)	Non-E/M Project	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Revegetate with non-groundwater dependent native species while continuing the activity that caused the impact.	Incomplete and ongoing	LADWP reports, "The site has been fenced. Permanent transects were run in 2006. In the spring of 2011 approximately 20 acres were drill seeded with locally collected seed." Transects run in August 2012 show 3% native perennial cover. LADWP reports that they drill seeded 28 acres in February of 2014. The native seed was installed in time for a 1.35" rain event. The IC Water Commission saw this project and others in the Big Pine area in September 2013.
Steward Ranch	Non-E/M	Compensation for loss of well.	Compensation agreement with ranch	Implemented	Mitigation agreement is in place.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
	Project 1991 Owens Valley EIR Impact No. 9-14		owner.	and ongoing	
Fish Springs Hatchery	EP 1970-1984; Non-E/M Project 1991 Owens Valley EIR Impact No. 10-14	CDFW fish hatchery and the LORP serve as compensatory mitigation.	No on-site mitigation will be implemented at Fish Springs, however, the CDFW fish hatcheries at these locations serve as mitigation of a compensatory nature by producing fish that are stocked throughout Inyo County.	Implemented and Ongoing	Implemented
Tule Elk Field	EP 1970-1984	Non-specific compensation.	Provide water in summer to field used by tule elk between U.S. Highway 395 and Tinemaha Reservoir.	Implemented and ongoing	The water supply to this project has been reduced since 2002. ICWD does not agree the project allocation is sufficient in all years to meet project goals.
Big and Little Seeley	EP 1970-1984 1991 Owens Valley EIR Impact No. 10-14	Non-specific compensation.	Maintained by LADWP well adjacent to Owens River to provide year-round waterfowl and shorebird habitat larger than had existed at Seeley Spring Two miles south of Tinemaha Reservoir LADWP well number 349, discharges water into a pond approximately one acre in size. This pond provides a temporary resting place for waterfowl and shorebirds when the pumps are operating or Big	Implemented and ongoing	Implemented and ongoing.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
			Seeley Spring is flowing. Riparian vegetation has become established around this pond. (EIR v1, 10-62)		
Calvert Slough	EP 1970-1984	Non-specific compensation.	Water provided to maintain habitat for a small pond and marsh area near LADWP Aqueduct Intake.	Inactive	This project has not been receiving a regular water supply since 1998. LADWP reported that low flows in the creek do not allow supplying the project because of high ditch losses and the off status of the two wells upstream of the project. No water was supplied to this project for seven years (1998-2004).
Hines Spring (1,600 af project)	E/M 1985-1990; 1997 MOU; 204 and 2010 Stipulation and order. 1991 EIR Impact No. 10-11	Ground water pumping has lowered depth to water to a level where springs and seeps no longer flow. Associated riparian and wetland vegetation is lost.	The Hines Spring vent and its surroundings will receive on-site mitigation. Water will be supplied to the area from an existing, but unused, LADWP well at the site. As a result, approximately one to two acres will either have ponded water or riparian vegetation. Hines Spring will serve as a research project on how to re-establish a damaged aquatic habitat and surrounding marshland. Riparian trees and a selection of riparian herbaceous species will be planted on the banks. The area will be fenced. (EIR) v.1 10-62)	In progress	The initial concept, to provide water at the spring vent, proved impractical. MOU Parties entered into an ad hoc process and agreed to build two projects at the spring site; 1) water from Well 355 now supplies water to a small pond used by livestock. The solar power source designed to power Well 355 would be insufficient, so the project was modified to include a new above-ground power line to the project; 2) Aberdeen Ditch. A 2700' pipeline now supplies water to a ditch just to southeast of the former spring that will be used by livestock.
Taboose/Hines Spring – Blackrock Areas Revegetation	Non-E/M Project	Ground water pumping has lowered depth to water to a level where	Manage pumping and revegetate with native species.	In progress	This mitigation measure consists of 3 sites that total approx. 115 acres.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Project (80 acres)	1991 EIR Impact No. 10-11	springs and seeps no longer flow. Associated riparian and wetland vegetation is lost.	These lands will not be permanently irrigated, but will be revegetated with native Owens Valley vegetation not requiring irrigation except during initial establishment.		Hines Spring. A mitigation plan and schedule for will be developed by March 8, 2015; 3 years after the Hines Spring mitigation project had been completed. Tin 54 (0.3 acres) 108 alkali sacaton plants were planted in 1999. A drip irrigation system has been utilized. Blk 16E 7.2 acres. LADWP reports that based on 2010 transects the project has attained the cover and composition goals in the revegetation plan. The cover goal is 35%
Little Blackrock Springs	EP 1970-1984 1991 EIR Impact No. 10-14	Ground water pumping has lowered depth to water to a level where springs and seeps no longer flow. Associated riparian and wetland vegetation is lost.	LADWP will continue to supply water from Division Creek to the site of the former pond at Little Blackrock Springs, to maintain marsh vegetation at this site will thus be maintained.	Implemented and ongoing	An operations plan is needed. LADWP had reported that the Goodale Bypass Ditch that supplies the project normally runs all year at less than 1 cfs, providing approx. 700 acre feet a year.
Big Blackrock Springs	Non-E/M Project 1991 EIR Impact No. 10-14	Ground water pumping has lowered depth to water to a level where springs and seeps no longer flow. Associated riparian and wetland vegetation is lost.	No on-site mitigation will be implemented at Big Blackrock Springs; however, the CDFW fish hatcheries at these locations serve as mitigation of a compensatory nature by producing fish that are stocked throughout Inyo County.	Implemented and ongoing ICWD calculates runoff year 2009-10 water use was 13,354 acre-feet	The fish hatchery is in place.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Thibaut/Sawmill marsh habitat	Non-E/M Project 1991 EIR Impact No. 10-20	Ground water pumping has lowered depth to water to a level where springs and seeps no longer flow. Associated riparian and wetland vegetation is lost.	The Blackrock Waterfowl component of the LORP will provide compensatory and some on-site mitigation. Vegetation impacts will be mitigated under the Agreement.	Implemented and ongoing	Implemented under the LORP.
Independence Pasture Lands (610 acres)	E/M 1985-1990 1991 EIR Impact No. 12-1	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Develop and irrigate pasture or alfalfa fields (first implemented 1987-1988).	Implemented and ongoing	Site topography prevents flood irrigation from reaching some portions of the project. LADWP reports runoff year 2013-14 water use was 1,853 af.
Billy Lake	EP 1970-1984 1991 EIR Impact No. 11-1	Non-specific compensation.	Maintain wet habitat to provide waterfowl habitat in the region.	Implemented and ongoing	Included in the LORP. Billy lake is managed under the LORP Monitoring, Adaptive Management, and Reporting Plan as an Off River Lake.
Independence East Side Regreening (30 acres)	E/M 1985-1990 1991 EIR Impact No. 12-1	Regreening projects implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the towns of Big Pine, Independence, and Lone Pine. Water is supplied from LADWP to promote and maintain vegetation.	Manage pumping and establish irrigated crop.	In Progress	The Technical Group evaluated and approved a new well at the site, and CEQA was completed. LADWP has drilled the new well and put out a request for proposals to identify a lessee. The project should be fully implemented in 2014.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Independence Woodlot (21 acres)	E/M 1985-1990 1991 EIR Impact No. 10-13	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Create irrigated crop.	Implemented and ongoing	Lone Pine FFA is managing the project, with some wood going to Independence residents and other wood being sold in Lone Pine to support FFA activities. An operations plan is needed based on management guidelines agreed to by Inyo Co. and LADWP. The project was supplied 150 af water during 2013-14.
Independence Springfield (283 acres)	E/M 1985-1990 1991 EIR Impact No. 12-1	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Manage pumping and establish native pasture or alfalfa (first implemented 1988).	Implemented and ongoing	40 acres were identified as still requiring mitigation. Water supply during runoff year 2013-14 was 958 acre-feet.
Additional regreening w/in Independence Springfield (40 acres)	E/M 1985-1990 1991 EIR Impact No. 12-1	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Revegetate with native pasture.	Not Implemented	LADWP in their 2014 annual report said they are “currently planning to irrigate an additional 40; however LADWP staff claim that, an internal review of the projects in the Independence area found that the Independence Springfield is approximately 300 acres in area and has an irrigation allotment of approximately 1,500 acre-feet per year, which meets the goals of the project.”

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
					ICWD will follow up
Symmes/Shepherd wellfield revegetation (60 acres)	Non-E/M Project 1991 EIR Impact No. 10-13	Increased groundwater pumping from wells in the Symmes-Shepherd area has caused a substantial reduction of vegetation cover in approximately 60 acres in three areas immediately to the east of the pumping wells. The affected vegetation was previously supplied by shallow groundwater and surface seeps. EIR v1 (10-59)	A revegetation program will be implemented for these effected areas utilizing native vegetation of the type that that has died off. Water may be spread as necessary in these areas to accomplish the revegetation. EIR v1 (10-59)		Two of the four sites included in this mitigation measure is behind schedule. The 3 sites total approx. 115.2 acres. Ind 123 (28.4 acres) did not have test plots implemented in 2002 as scheduled in the Mitigation Plan. LADWP in 2011 reports that goals have been attained. Ind 131, north and south. (73.2 acres). The Technical Group implemented revegetation test plots in Dec. 2001. A final report from the consultant was received in Nov. 2003. LADWP's consultant conducted additional revegetation studies, and reports on methods and results from this effort have not been made available. The schedule in the Mitigation Plan called

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
					for expanding revegetation efforts for Ind 123 and 131 in 2007. LADWP reports in 2011 that the north plot is not attaining goals. Transects will be run in 2012. The south plot was drilled with native seed in 2011. Transects will be run in 2012. Ind 105 (13.6 acres) cover data increased from 1999 to 2001, thus no active revegetation activities are planned. The initial cover of 8.1% increased to 13.5%. The goal for the site is 17% perennial native cover. The site has attained prescribed cover and composition goals.
Shepherd Creek Alfalfa Field (200 Acre)	E/M 1985-1990 1991 EIR Impact No. 12-1	Dust mitigation	Manage pumping and establish irrigated crop on about 200 ac. (first implemented 1986).	Implemented and ongoing	Alfalfa planted and maintained on approx. 185 acres. LADWP reports that water supply for runoff year 2013-14 was 884 af.
Expand Shepherd Creek Alfalfa (60 acres)	E/M 1985-1990 1991 EIR Impact No. 12-1	Dust mitigation	Expand E/M project to east of Hwy 395 if vegetation cover in that area remains sparse.		The Technical Group does not have mitigation or monitoring plans for this mitigation measure. LADWP has conducted vegetation transects and concluded that vegetation cover has increased from baseline and thus the mitigation is not necessary.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Reinhackle Spring	Non-E/M Project 1991 EIR Impact No. 16-11	Increased groundwater pumping has periodically reduced the flow from Reinhackle Spring. This spring is the source of water for a large pasture area and supports many large tree willows. EIR v1 (10-61)	Manage groundwater pumping to avoid reductions in flow, and monitor and maintain vegetation to avoid significant change or decrease as provided in the Agreement and the Green Book.	Under investigation	A 2004 study concluded that the water flowing from Reinhackle Spring is similar in composition to aqueduct water and not similar to the deep aquifer samples or up-gradient shallow aquifer wells. Testing to monitor the effect of pumping conducted May 2010 to April 2011. Data from these tests are being analyzed. A draft management plan is under consideration by the Technical Group.
Lone Pine Ponds	EP 1970-1984; E/M 1985-1990 1991 EIR Impact No. 11-1	Non-specific compensation.	Wildlife enhancement. Similar to Buckley Ponds and Saunders Pond; water provided by natural seep or spring flow in river with supplemental releases from Alabama Gates (now incorporated in lower Owens River E/M Project); north of Lone Pine Station.	Implemented and ongoing	Included in the LORP. The Lone Pine Ponds are managed under the LORP Monitoring, Adaptive Management, and Reporting Plan as a component of the River-Riverine system.
Lone Pine East Side Regreening (11 acres)	E/M 1985-1990 1991 EIR Impact No. 10-16	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Create irrigated pasture.	Implemented and ongoing	Pasture appears to be receiving water and is in good condition. LADWP did not break out water use for this project in runoff year 2013-14.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
Lone Pine Woodlot (12 acres)	E/M 1985-1990 1991 EIR Impact No. 10-16	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Revegetate and provide irrigation.	Implemented and ongoing	Lone Pine FFA irrigates the woodlot and distributes wood according to plan developed by the Technical Group LADWP reports water use was 70 af for runoff year 2013-14 (~60% of allocation)
Richards Field (189 acres)	E/M 1985-1990 1991 EIR Impact No. 10-16	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Create irrigated pasture or alfalfa field (first implemented 1987).	Implemented and ongoing	This project had been modified without Standing Committee approval. During the non-irrigation season, water normally flows to the project after flowing through Lone Pine Riparian Park. LADWP informed the Water Dept. that the project will no longer receive water during the non-irrigation season. Water to this project is not measured separately from the park supply. LADWP reports water use for Richards Field and Lone Pine Park was 416 af for runoff year 2013-14.
Van Norman Field (160 acres)	E/M 1985-1990 1991 EIR Impact No. 10-16	Regreening project implemented to enhance the aesthetics of abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.	Create irrigated pasture or alfalfa field.	Implemented and ongoing	LADWP reports water use was 79 acre-feet for runoff year 2013-14. The project is allocated 480 afy, but because of the parcel's irregular topography, and the sanding in of the on-site well, the project has not been supplied its full water allocation. A replacement well was drilled in the

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
					fall of 2012 and began production in April 2014. The new well is located in a position that should allow the establishment of additional acres of pasture. In 2013, as part of an E/M evaluation, Inyo County and LADWP agreed to expand the project to include irrigating an adjacent 10 acre parcel operated as a school farm by Lone Pine High School. On April 29, 2014 the Standing Committee agreed to The Standing Committee agreed to: “Modify the Van Norman Field Enhancement/Mitigation (E/M) Project by adding approximately ten acres of the Lone Pine High School Farm to the Van Norman Field E/M Project. The total acreage of the modified Van Norman Field E/M Project will be approximately 170 acres. The approximately ten additional acres will be irrigated pasture. The total annual water supply for the project will remain at 480 acre-feet per year, which will result in an annual water distribution within the project boundaries of approximately 2.8 acre-feet per acre.”
Lone Pine West Side Regreening	E/M 1985-	Regreening project implemented to enhance the aesthetics of	Create irrigated pasture.	Implemented	Pasture looks to be in good condition.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
(7 acres)	1990 1991 EIR Impact No. 10-16	abandoned agricultural or pasture lands in areas around the town. Water is supplied from LADWP to promote and maintain vegetation.		and ongoing	LADWP reports water use was 216 af for runoff year 2013-14.
Diaz Lake	EP 1970-1984	Non-specific compensation.	Provide supplemental water to recreation area and create wet habitat.	Implemented and ongoing	Under the Additional Mitigation project description, Diaz Lake will be supplied a secure source of water, which reduces dependence on water pumped by Inyo County up to 250 afy. LADWP's lease with Inyo County (Lease No. 1494, in effect until June 30, 2015) has been updated to reflect these additional water supply commitments and accounting requirements of this project agreed to by LADWP.
Lower Owens Rewatering Project	E/M 1985-1990 1991 EIR Impact No. 10-14	The Lower Owens Rewatering Project was initiated in 1986 by the LADWP and Inyo County to improve habitat for shorebirds, waterfowl, and fish in the river corridor and at the Delta. The project was one of 25 Enhancement/Mitigation Projects jointly implemented between 1985 and 1990.	Re-water the Owens River to create wet habitat for wildlife. Project includes off-river lakes and ponds. Under the project, 18,000 acre-feet of water per year were to be released from the Blackrock Spillgate to maintain continuous flow in the Lower Owens River from the Blackrock area to the Owens River Delta (first implemented, step 1, 1986).	Replaced	Superseded by the LORP. Billy lake is managed under the LORP Monitoring, Adaptive Management, and Reporting Plan as an Off River Lake.
Lower Owens River Project	1991 DEIR;	The LORP is a in-kind compensatory mitigation for impacts related to	The Lower Owens River Project settles more than 24 years of litigation	Implemented	Project implemented. In December 2006, when a 40 cfs baseflow was

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
	MOU 1997 1991 EIR Impact No. 10-14	LADWP's groundwater pumping that are difficult to quantify or mitigate directly such as the drying up of springs, seeps and loss of wetlands.	between the Department and Inyo County over groundwater pumping and water exports. The project is intended to mitigate for a host of lost environmental values in the reach of the Owens River from the Los Angeles Aqueduct Intake to Owens Lake, and associated springs and seeps and off-river lakes and ponds. 64 miles of the Owens River channel will be rewatered. The project includes the Delta Habitat Area, Off-river Lakes and Ponds, and a 1500 acre Blackrock Waterfowl Management Area	and ongoing	established. A permanent base flow of 40 cfs was established on February, 20, 2007. In February 2008, Los Angeles initiated the first seasonal habitat flow. Adaptive management requires ongoing monitoring, which is described in the Monitoring, Adaptive Management, and Reporting Plan. Additional information about the status of the LORP can be found at www.inyowater.org.
Meadow/riparian vegetation dependent on agricultural tailwater	1991 EIR Impact No. 10-14	Decrease in irrigated land resulted in reduction or withdrawal of tailwater and associated loss of dependent vegetation.	LORP serves as compensatory mitigation.	Replaced	LORP serves as compensatory mitigation.
Salt Cedar Control Program	1991 EIR Impact No. 10-6	Between 1970 and 1990, LADWP continued to spread surplus water in wet years in the spreading areas created by the dikes east of Independence between the aqueduct and the river. This activity increased soil moisture and water tables, but also fostered conditions favorable to the spread of salt cedar, which was established prior to 1970.	Implement salt cedar control program in accordance with the Agreement.	Ongoing implemented	The program also monitors and maintains cleared areas. The current program is focused on clearing saltcedar thickets in water spreading basin adjacent to the Lower Owens River and burning slash. In 2013-14, program staff cut 176 acres, burned about 120 slash piles, and treated 106 miles of Owens River bank and floodplain.

Project	Mitigation Origin	Impact	Prescription	Development Stage	Status
		(91 EIR)			
Irrigated fields, including Cartago and Olancha	1991 EIR Impact No. 10-16	Decrease in irrigated land resulted in reduction or withdrawal of tailwater and associated loss of dependent vegetation.	Continue irrigation practices since 1981-82 and thereafter.		Ongoing. Irrigated lands are not directly monitored; lessees are relied upon to indicate if there are changes in water for irrigation.
Fish Springs, Big and Little Seeley, and Big and Little Blackrock	1991 EIR Impact No. 10-14	Ground water pumping has lowered depth to water to a level where springs and seeps no longer flow. Associated riparian and wetland vegetation is lost.	Monitor and maintain vegetation to avoid significant change or decrease as provided in the Agreement and the Green Book.		The Technical Group does not have a plan for monitoring flows or vegetation at springs and seeps. Ecosystem Sciences has developed an inventory of springs and seeps. According to the MOU, the inventory should provide baseline data adequate for monitoring change.

[1] DEIR, V1 (p. 5-19)

[2] DEIR, V1 (p. 5-20)

[3] Last status report Oct 2008

SECTION 7: RARE PLANTS

Abstract

The Inyo County Water Department monitors populations of *Sidalcea covillei* (Owens Valley checkerbloom) and *Calochortus excavatus* (Inyo County star tulip) each year in accordance with the provisions of the Long Term Water Agreement. Between 1993 and 2013, estimates for 24 *S. covillei* populations ranged from an average of 2 to 101,879 individuals; and estimates for 28 *C. excavatus* populations ranged from an average of 0 to 568 individuals. Population size estimates are based on counts or sampling and extrapolation of above-ground detections. Both species are perennial geophytes that exhibit dormancy in unfavorable years. Annual population size estimates are for the non-dormant portion of the population and are thus likely underestimates of the true population size, especially in dry years. A combination of water table depth, grazing, and heterospecific competition, likely influences the above-ground vegetative growth, investment in reproductive structures and the relative proportion of bulb dormancy in any given year. These factors were qualitatively recorded but were not directly measured by ICWD in 2013.

Introduction

The Long Term Water Agreement requires management of rare species to be consistent with applicable laws. The ICWD monitors populations of two plant species that could potentially be affected by groundwater pumping,

The Green Book requires monitoring of rare plant populations in the Owens Valley. This report contains a brief update of the status of the populations sampled by the Inyo County Water Department in 2012 and 2013. Two species of rare plants have been monitored between 1993 and 2013; the Owens Valley checkerbloom, *Sidalcea covillei* (SICO), and Inyo County star tulip, *Calochortus excavatus* (CAEX). Both species are geophytes and can persist in a dormant state below the soil surface during unfavorable periods for above-ground vegetative growth. SICO is listed as endangered by the state of California, and is a US Fish and Wildlife species of concern. Both species are listed under CNPS List 1B.1 (rare, threatened, or endangered in CA and elsewhere). The Water Department has monitored, in total, up to 24 SICO populations and up to 28 CAEX populations.

Characteristics of SICO

SICO occurs from about 1100 - 1300 m elevation in alkali meadows that are periodically wet from nearby streams, springs, or ground water in the Owens River drainage. SICO's carbohydrate-rich roots allow it to survive dry periods but continuously dry periods are incompatible with population maintenance. SICO grows to 20-60 cm (Figure 7.1). The leaves are fleshy and waxy in texture. The inflorescence is an open panicle of several flowers. The leaves and flower sepals are coated in tiny branching hairs. According to Halford (1994), SICO population demographics are influenced by annual precipitation, timing and intensity of cattle grazing, competition by upland shrubs and rhizomatous grass species, and activities that influence surface and groundwater sources. Owens Valley checkerbloom flowers from April through June.

Figure 7.1. Sidalcea covillei (Owens Valley Checkerbloom). Photo by Inyo County Staff.

Characteristics of CAEX

CAEX is endemic to Inyo and Mono Counties and ranges between 1300 - 2000 m. According to USFWS (1998), CAEX reproduces by seed and by offset bulbils from the main bulb. The seeds of *Calochortus* are relatively large and lack obvious adaptations for long-distance dispersa (Figure 7.2). Plants may persist up to ten years. The relative proportion of carbohydrate storage in below-ground bulbs and above-ground tissues is likely dependent on the antecedent water regime and life stage. In dry years, CAEX can remain dormant in bulb form. The presence of a dormant seedbank is unknown.

Figure 7.2. Calochortus excavatus (Inyo County Star Tulip). Photo by Inyo County Staff.

Methods

ICWD sampled 12 SICO populations and 27 CAEX populations within the Owens Valley in 2013; one new CAEX site was added in 2012. The number of sites evaluated for population estimates is determined by staffing levels in May and early June.

Calochortus sampling

Currently there are 58 known sites supporting CAEX being monitored, all of which are in the Owens Valley in Inyo County. The Water Department monitors 27 CAEX populations annually, LADWP monitors approximately six populations and the Bureau of Land Management monitors eight populations. The 27 populations monitored by the Water Department are located on land owned by LADWP. Individual CAEX plants were counted using walking grids located within previously mapped population boundaries.

Sidalcea sampling

SICO populations were sampled by first mapping known population locations into polygons and then either sampling individuals via randomly located quadrats, or via hand counts of flagged individuals within mapped sub-populations. Polygon boundaries were marked with flags and mapped by walking the perimeter with a GPS unit. Quadrats (approximately $1m^2$) were randomly sampled within the polygon. Locations of quadrats were selected using a random bearing and a random number of paces (i.e. three sets of random paces were generated: 1-20, 1-30, 1-40 for small vs. larger polygons). The number of quadrats sampled increased with the size of the polygon; 10 was the minimum number of quadrats sampled.

Qualitative site condition score

In a qualitative assessment, four factors were each given a score and the sum of these qualitative scores was then assigned to the overall site score. The factors included: the level of grazing (i.e. none (3), light(2), moderate(1), heavy(0)), abundance of invasive species (none (3), few (2), many(1)), apparent available soil moisture(saturated(3), moderately wet(2), slightly wet(1), dry(0)) and rare plant vigor (robust(3), good(2), poor(1)) were recorded at each site. These values for each of the four factors were summed to derive the qualitative overall site quality score for each site (i.e. excellent (10-12), good (8-9), fair (6-7), or poor (2-5)).

Results

Sidalcea

Of the 12 SICO populations sampled in 2013, six maintained population estimates within the range of estimates from 1993-2012 and five populations in 2013 exceeded the highest estimate for the period 1993-2012 (Table 7.1). Across these 12 populations, estimates ranged from 0 to 9405 individuals. Five sites had poor quality (site quality 3, 4, 5), two had fair quality (site quality 6, 7) and five populations had good quality (site quality 8, 9).

Calochortus

Of the 27 CAEX populations sampled in 2013, in six sites population estimates were lower than the average of all previous sampling years (Table 7.2). These sites had either poor or fair conditions. At 10 sites, no CAEX were detected. In dry years, dormancy is common in bulbiferous perennials and above ground detection is expected to be lower than in wet years. In total, 13 sites were in poor condition, 10 sites were in fair condition and four sites were in good condition. Out of the 20 sites that maintained population estimates within the range of 1993-2012 estimates, three were in good condition, five were in fair condition and 12 were in poor condition.

Table 7.1. SICO population estimates during the period 1993-2013. Columns indicate: population estimates between 1993 and 2012; the average estimate from the period 1993-2012, Avg.; the 2013 population estimate, 2013; and the overall site quality in 2013, SiteQual. Grey shading indicates populations that were below the average and range of most previous sampling years, and pink shading indicates the site quality evaluation measured conditions as fair or poor in 2013.

SICO	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*Avg*	*2013*	*SiteQual*
1	---	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0	---	---
2	---	46457	78817	64299	---	---	---	---	---	---	---	---	---	---	---	---	---	---	11101	17068	43548	---	---
3	2000	2400	72156	27901	---	---	---	---	---	---	---	---	---	---	---	---	---	---	9716	9145	20553	---	---
4	826	17356	10126	9674	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	29162	13429	---	---
5	1800	2976	3657	10676	---	---	---	---	---	---	---	---	---	---	---	---	---	---	62	946	3353	---	---
6	66600	124714	169367	74003	---	---	---	---	---	---	---	---	---	---	---	---	---	---	97343	79245	101879	---	---
7	64388	156288	84653	25149	---	---	---	---	---	---	---	---	---	---	---	---	---	---	11285	14064	59305	---	---
8	---	---	181	221	350	520	625	586	754	918	921	872	834	808	715	503	350	---	400	682	602	2345	8
9	---	1100	1496	1582	1476	---	---	---	---	---	---	---	---	---	---	---	---	---	803	507	1161	677	8
10	---	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	335	168	758	9
11	92155	68126	198418	141568	---	---	---	---	---	---	---	---	---	---	---	---	8000	---	57590	57279	89019	---	---
12	---	0*	2000	500	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	110	870	93	6
13	3000	---	19396	8652	---	---	---	---	---	---	---	---	---	---	---	---	3000	---	6633	4663	7557	9405	8
14	22275	59999	77355	89502	---	---	---	---	---	---	---	---	---	---	---	---	80	4630	3444	2721	32501	9070	7.5
15	---	600	9731	5545	---	---	---	---	---	---	---	---	---	---	---	---	---	323	378	257	2806	9	4
16	---	---	---	---	---	---	---	---	---	---	5	5	5	2	2	2	0	0	1	0	2	0	3
17	5000	41239	51002	20196	---	---	---	---	---	---	---	---	---	---	---	---	1200	20655	19568	22924	22723	53777	8
18	---	35	200	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	61	99	45	5.5
19	150	115000	90974	---	69743	---	41275	42351	39938	---	---	---	---	---	---	---	5000	---	18829	17300	44056	---	---
20	106	67	171	131	129	152	223	94	113	53	75	44	72	91	70	44	0	14	8	1	83	0.0	4

SICO	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*Avg*	*2013*	*SiteQual*
21	35000	---	28668	12868	---	---	---	---	---	---	---	---	---	---	---	---	---	28582	24909	9278	***23218***	**---**	**---**
22	---	---	97452	43438	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	33144	***58011***	**---**	**---**
23	0	12	0	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	***3***	**---**	**---**
24	---	10	---	2	1	---	---	---	---	---	---	---	---	---	---	---	---	---	10	0	***5***	***0***	**4.5**

Table 7.2. CAEX population estimates during the period 1993-2013. Columns indicate: population estimates between 1993 and 2012; the average estimate from the period 1993-2012, Avg; the 2013 population estimate, 2013; and the overall site quality in 2013, SiteQual. Grey shading indicates populations that were below the long-term average of previous sampling years. Pink shading indicates the site quality as fair or poor in 2013.

CAEX	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*Avg*	*2013*	*SiteQual*
1	26	152	91	80	220	116	208	177	699	337	388	392	128	181	234	64	15	51	62	195	***191***	***27***	4.5
2	---	---	---	2	1	---	---	0	0	0	---	0	0	---	0	0	---	---	---	---	***0***	***---***	---
3	18	6	58	21	25	21	17	10	6	23	18	5	8	15	18	26	6	13	8	12	***17***	***4***	7
4	72	46	50	104	45	100	133	98	27	13	103	7	140	112	143	68	1	---	5	29	***68***	***1***	5
5	282	31	500	450	400	250	---	687	658	991	1124	85	837	203	927	1227	68	94	38	257	***479***	***190***	7.5
6	105	77	180	200	111	92	114	236	432	340	286	214	408	262	167	269	145	---	198	389	***222***	***541***	10
7	---	---	---	---	---	---	8	0	---	---	---	---	---	---	---	---	---	---	35	57	***25***	***31***	8.5
8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	17	15	***16***	*5*	7.5
9	---	---	---	---	7	16	2	0	4	1	6	0	8	8	1	8	1	7	3	0	***5***	***0***	5.5
10	15	0	0	57	45	2	19	6	88	65	173	7	77	95	51	37	1	14	6	0	***38***	***0***	5
11	---	---	---	---	---	50	---	44	84	96	296	82	290	457	76	183	23	276	265	40	***162***	***11***	7
12	---	---	---	---	---	---	---	---	---	---	---	---	852	662	399	780	174	626	516	533	***568***	***568***	9
13	12	33	42	31	6	3	7	14	10	0	19	16	34	42	6	30	10	39	21	18	***20***	***0***	5.5
14	0	0	69	9	3	10	0	0	14	0	51	0	39	19	0	49	7	14	6	12	***15***	***0***	4.5
15	78	0	315	19	100	200	41	54	124	21	348	30	186	40	54	213	62	183	62	22	***108***	***0***	5.5
16	---	---	---	---	---	---	---	---	---	---	---	---	166	296	18	567	34	350	135	107	***209***	***8***	5
17	0	2	5	1	2	4	4	0	4	0	2	0	0	1	0	1	0	0	2	0	***1***	***0***	4
18	120	26	450	32	14	23	0	0	1	0	2	0	260	99	0	355	2	380	151	0	***96***	***0***	5.5
19	---	200	400	92	90	90	100	318	627	527	1643	81	1502	506	263	1793	361	1220	814	81	***564***	***36***	7.5
20	13	0	118	17	1	47	17	3	19	0	6	0	10	14	0	43	2	28	26	1	***18***	***0***	5
21	0	---	---	33	30	74	67	82	43	53	36	0	28	34	5	6	0	2	11	0	***28***	***12***	7.5
22	---	97	400	200	18	100	150	167	592	4	673	6	681	575	177	1162	0	61	165	2	***275***	***0***	5

CAEX	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*Avg*	*2013*	*SiteQual*
23	---	---	---	---	---	---	---	---	---	345	1081	255	661	191	170	1616	505	448	141	60	***498***	***222***	8
24	15	1	56	55	50	17	64	76	45	20	13	7	16	86	26	59	6	42	55	4	***36***	***2***	6.5
25	---	---	36	7	2	15	17	3	1	0	3	2	17	8	5	4	3	2	0	1	***7***	***0***	5
26	1	0	21	3	4	15	6	5	6	5	8	4	17	6	5	14	4	3	11	3	***7***	***3***	7.5
27	55	1	380	150	50	100	248	689	548	90	368	90	321	130	171	320	5	155	92	11	***199***	***12***	6.5
28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1974	***1974***	13	6

Discussion

Population estimates are sampled differently for the two rare species monitored. Because the population dynamics and life history of SICO allows for larger population sizes, population estimates are determined from sampling. Therefore, greater variance between years may be expected in SICO population estimates when compared with smaller population numbers present in the CAEX populations which allow for individual counts. Because of this difference, SICO populations were considered using both the long-term average and the range, while the CAEX populations were examined using only the long-term average.

Sidalcea

Following the 2013 sampling season, two SICO populations were below the range of conditions sampled in past census efforts, however only one of these populations had 'poor' site quality; the other was assessed as 'fair' quality (see Table 1). In 2011, SICO site 5 was 71 times lower than the long term average. In 2012, this population recovered to within the historical size range. This site was not sampled in 2013. In 2011, site 20 has been well below the long-term average for the last four years, likely due to dry soils. This population has declined to 8.6% of its long-term average and 7.5% of the site's 1991 population count. No detections were recorded in 2013 in this population. The three other sites that were below the long-term range in 2011 were rated in 'good' site condition. Of these three sites, site 2 and site 7 both increased in 2012 compared to 2011; they were not sampled in 2013. Site 9 decreased in 2013 compared to 2011 and was evaluated as in good condition. Fewer sites were sampled in 2013 owing to time constraints and limited technician staffing.

Calochortus

Of the 27 CAEX populations sampled in 2013, six populations were below the long-term range of variability compared to 2011 in which all populations were within the range of 1993-2010 variability. In 2011, 16 populations were below the long-term average of all previous year's estimates; and in 2013, 24 populations were below the long-term average of previous year's estimates (Table 2). At 18 of the 24 below-average sites, the overall site quality was evaluated as poor or fair. In 2013, zero detections were recorded at ten sites compared to only one site in 2011 where no plants were found. These ten sites were all rated as poor condition. In 2011, of the 10 sites that maintained population numbers within the long-term range of variability, eight were in good site condition, while seven were evaluated as fair to good. In 2013, 19 sites had population estimates within the range of 1993-2012 variability. However in ten of these sites, no individuals were detected in 2013. For low density sites, lack of detection is not unexpected in dry years.

Environmental site factors including water availability, cattle and/or horse grazing and abundance of invasive species appears to be related to population abundance. Qualitative assessments of these factors were assessed in 2013 and in previous years.

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SECTION 8: VEGETATION CONDITIONS

A primary goal of the Long Term Water Agreement between Inyo County and Los Angeles Department of Water and Power is to manage groundwater and surface water while maintaining healthy groundwater-dependent plant communities in the Owens Valley.

This report presents an analysis of the 2013 vegetation conditions

Abstract

A primary goal of the Long Term Water Agreement between Inyo County and Los Angeles Department of Water and Power is to manage groundwater and surface water in a manner compatible with the continued persistence of healthy groundwater-dependent ecosystems of the Owens Valley. Each year the Inyo County Water Department monitors selected vegetation parcels within the valley to evaluate the degree to which these goals are being met. In this report which covers the 2013 growing season, we report on valley-wide vegetation cover and composition for parcels influenced by pumping (wellfield parcels) and parcels not influenced by pumping (control parcels). When considered individually, 20 of 59 reinventoried wellfield parcels were significantly below baseline; the degree of persistence of these changes varied from a few years to longer than a decade for several parcels. Line-point-transect data and spectral mixture analysis (SMA) of Landsat TM data were used to independently evaluate temporal trends and relative magnitudes of vegetation change over time. In this report, we also revisit a methodological issue of how best to statistically compare baseline data to reinventory years; specifically, we revisit the justification for the need to control the family-wise error rate by correcting for multiple comparisons. This discussion centers on interpreting what a statistically significant vegetation decline in a single year means ecologically compared to a decline that persists over multiple years in a row. We discuss the management actions currently required given a significant change detected in a single year and thus the risk of false positives in a management context. On the other hand, we discuss the potential ecological consequences of a persistent change and associated risk of declaring the apparent change nonsignificant (false negative).

Introduction

This report presents an analysis of the 2013 vegetation conditions measured by the Green Book Line Point Transect (hereafter LPT) Monitoring Program. Each year, the Inyo County Water Department monitors vegetation conditions on the floor of the Owens Valley. The primary goal of this monitoring, according to the Green Book are to detect any *"SIGNIFICANT DECREASES AND CHANGES IN OWENS VALLEY VEGETATION FROM CONDITIONS DOCUMENTED IN 1984 TO 1987"*. Vegetation live cover and species composition documented during the 1984-87 mapping effort were adopted as the baseline for comparison with each annual reinventory according to the Long-Term Water Agreement (Agreement). The reference measurements collected within individual areas mapped with similar vegetation (parcels) are referred to as baseline.

The Green Book describes certain decreases and changes in vegetation community types that must be avoided under the Agreement. Baseline vegetation communities in which evapotranspiration exceeds precipitation were classified as groundwater-dependent communities and are referred to as Types B, C, and D (Type A persists on precipitation and Type E is irrigated land). The associated higher cover and diversity of Type B, C, and D communities is maintained by shallow groundwater, as precipitation alone is inadequate to meet the water demand of these communities (Sorensen *et al.* 1991, Steinwand *et al.* 2006). For these parcels, according to the Green Book, *"THE GOAL IS TO MANAGE GROUNDWATER PUMPING AND SURFACE WATER MANAGEMENT PRACTICES SO AS TO AVOID CAUSING SIGNIFICANT DECREASES IN LIVE VEGETATION COVER"* and to prevent a significant amount of vegetation from changing to a *"VEGETATION TYPE THAT PRECEDES IT ALPHABETICALLY (FOR EXAMPLE, TYPE D CHANGING TO EITHER C, B, OR A VEGETATION)."* Type D is riparian vegetation, Type C is a meadow community, Type B is a meadow with a woody shrub component, and Type A have cover or species composition that can be supported by precipitation alone. Type A communities use groundwater when available. A change from a grass-dominated meadow (Type C) to a shrub-dominated meadow (Type B), could be enabled by one or a combination of different drivers that influence the probability of woody species establishment including livestock grazing and water table decline. Livestock grazing typically favors dominance of unpalatable woody species over time. A high water table favors life history traits associated with herbaceous species more tolerant of periodic inundation and waterlogged soils than greasewood, rabbitbrush or saltbush (Groeneveld and Or 1994). Hence shrubs are only precluded at meadow sites periodically inundated and may establish with only slight lowering of the water table. Under these conditions shrub establishment may increase over time as established individuals reach reproductive maturity, and the rate of infilling of woody species may be accelerated by livestock grazing. Prescribed burns will reduce woody species cover, especially for those species top-killed by fire; and the rate of post-fire recovery of the woody component will depend on the spatial distribution of resprouting individuals, viable seedbank within the burn interior and seed sources beyond the burn perimeter.

The procedure for determining whether decreases and/or other significant effects on the environment have occurred or are occurring in a given management area is described as a three-step process in the Green Book: (1) measurability of vegetation change, (2) attributability of vegetation change to LADWP groundwater pumping or surface water management and (3) degree of significance defined by the magnitude, extent, duration and permanency of the change along with other factors including air quality, human health, impact to species of concern, etc. Measurability in this context is synonymous with statistical significance. The primary objective of the vegetation annual report is to report on the statistical significance (measurability) of vegetation change compared to baseline. The second criterion, evaluating whether a statistically significant change in vegetation is caused by water management (attributability), is beyond the scope of this report owing to the need for a comprehensive analysis on a case by case basis for each vegetation parcel. For the third criterion, whether or not the impact is significant, statistical significance is necessary but not sufficient; the measurable change must be demonstrated to be attributable to groundwater pumping or changes in past surface water management, and the impact must be shown to be persistent (i.e. not within the natural range of ecological variability associated with natural runoff variability alone).

A large proportion of groundwater-dependent parcels were mapped during baseline as Type C alkali meadows (61%), and the Agreement seeks to prevent these meadows from changing to shrub-dominated communities (Type B), a change that can be caused by increased depth to groundwater (Naumberg *et al.* 1996, Elmore *et al.* 2006). Alkali meadow comprises 0.1% of the vegetation community types in California and 80% of alkali meadow communities are located within the Owens Valley (Davis *et al.* 1998). Local groundwater management will in large part determine the likelihood that these groundwater-dependent ecosystems persist in a changing environment. Vegetation change across the Owens Valley was evaluated at both the valley scale and for each of 111 individual parcels sampled in 2013. At the valley-wide scale we evaluated plant community cover and composition in parcels affected by groundwater pumping nearby pumping wells and for parcels that were generally further east of the wellfields. At the individual parcel scale, we (a) quantified the change in perennial vegetation cover since baseline, (b) assessed whether the relative proportion of woody vegetation (hereafter shrub), gramminoid vegetation (hereafter grass) and non-gramminoid herbaceous vegetation (hereafter herb) has changed compared to baseline and (c) quantified the temporal trends of grass and shrub proportion for each parcel.

Methods

The Owens Valley is located in east-central California, entirely within Inyo County. The valley is bounded by the Sierra Nevada to the west and the White/Inyo Mountains to the east. Runoff from the Sierra Nevada maintains a shallow water table in the valley that historically supported groundwater-dependent ecosystems.

From September 1984 to Nov 1987, LADWP inventoried and mapped vegetation on 2126 vegetation parcels (223,168 acres) in Owens Valley encompassing a range of plant communities including those dependent on groundwater. In the summer of 2013, ICWD resampled 111 parcels (many of which have been sampled continuously since 1991) using the line point protocol described in the Greenbook (a complete list is contained in Appendix 1). According to Manning (1994, pp. 2-3), reinventoried parcels were initially selected based on meeting one or more of the following criteria: (1) parcels contained a permanent monitoring site; (2) baseline data was collected for the parcel; (3) parcel was in close proximity to a pumping well; (4) information of past and current land use for parcel was available; (5) parcel was representative of one of the plant communities originally mapped during baseline; (6) soil characterization was available for the parcel; (7) characterization of the landscape position was available for the parcel. The average size of these vegetation parcels in which sampling was conducted was 88.1 acres (range 13.5-565.2 acres) and the total acreage of all parcels combined was 9,690.9 acres. Between 14 and 36 transects were sampled in each vegetation parcel in 2013.

Transect locations within the reinventoried parcels have been randomized each year to guard against systematic bias with respect to unknown baseline transect locations. In a different approach, LADWP has measured permanently located transects within the reinventoried parcels since 2004, providing another data set by which to evaluate vegetation change over the last decade. The advantage of permanent transects is to provide more power in detecting smaller changes in vegetation cover and composition since the same locations are measured each year to within GPS accuracy. The identified disadvantage is the uncertainty in how these data should be compared to baseline (i.e. permanent transects could produce a biased cover estimate higher or lower than baseline). The rerandomized sampling scheme has, in principle, lower power in detecting small interannual changes but should not have a persistent directional bias high or low as is possible with the permanent transect scheme. Improvements to the change detection methodology using the baseline years as reference values is an ongoing area of research. Fortunately, Landsat TM data are available for the baseline period to present. The use of this satellite imagery as a spatially explicit quantitative link between baseline and current conditions could inform the optimum permanent-transect locations for a sufficient on-the-ground comparison to baseline. This topic will be explored in the coming year. In this report, the focus is on the long-term rerandomized line point data set (1991-present).

Criteria for control or wellfield groups

Parcels were classified as either control or wellfield based on criteria derived from groundwater drawdown during the period of maximum pumping rate that occurred between 1987 and 1993. Two water table estimation methods were used to provide numerical criteria for these parcel classifications: (1) ordinary kriging, a geostatistical approach that relies on the spatial correlation structure of the test well data for weighting in order to interpolate groundwater depth for an entire parcel, and (2) groundwater-flow modeling estimates of groundwater drawdown contours shown on the baseline maps (Danskin 1998, Agreement Exhibit A: Management Maps, Harrington and Howard 2000, Harrington 2003). Parcels were designated as either wellfield or control depending on whether drawdown estimates from both kriged test well data and groundwater modeling were above or below critical values. Parcels were assigned wellfield status if (1) kriged DTW estimates exceeded 1-m water-table drawdown and (2) they were located at sites corresponding to modeled drawdown contours greater than 10 ft. Parcels were assigned control status if (1) kriged DTW estimates were less than 1-m and (2) they were located at sites corresponding to modeled drawdown contours less than 10 ft. If the kriged DTW estimates were not reliable owing to inadequate test well coverage near vegetation parcels (Harrington 2003), then the groundwater-flow model estimate of the 10-ft drawdown contour was used as the sole criteria to designate parcels as either wellfield or control. An exception to the above criteria was applied to parcels associated with drawdown contours greater than 10-ft yet located near a surface water source (specifically, a canal, sewer pond, creek, river, or a ground water seepage source) that would buffer against local drawdown effects—these parcels were classified as control. Some parcels assigned the wellfield designation currently have higher water tables than during 1987 to 1993, but they retain the wellfield designation owing to their proximity to pumping wells.

Statistical Analyses

Changes in vegetation cover and composition from baseline were evaluated at the valley-wide scale via comparisons of parcel groups (wellfield vs. control) and at the individual parcel scale using each parcels' multi-year transect data. All statistical analyses were performed using R Version 3.0.2 (R Core Team 2013). The following R packages were used: 'plyr' (Wickham 2011), 'reshape' (Wickham 2007), 'multcomp' (Hothorn et al. 2008), 'nlme' (Pinheiro *et al.* 2013), and 'car' (Fox and Weisberg 2011). Statistical significance was declared at the $\alpha = 0.05$ level. In reporting results, the term significant refers to statistical significance.

Analysis Variables

At the transect level, the data for each transect during a particular year represent the counts of vegetation cover 'hits' from a 50-m line-point transect sampled every 0.5 m—thus 100 hits are possible per transect. Perennial cover was chosen for analysis because annual species are not dependent on ground water. Perennial cover was further categorized by life form categories grass, herb, and shrub in this analysis.

In order to analyze the changes in the composition of total perennial cover, the proportion of shrub, herb and grass cover in comparison to total perennial cover was calculated at the transect level. Transect data are summarized for each year using the arithmetic average, creating a history of cover over time for each parcel. Other measurements taken each year at the parcel level include depth to water (DTW) and cover based on a spectral mixture analysis (SMA) of Landsat TM imagery (Elmore 2001). DTW values were not available for 2011-2013 during the writing of this report. SMA values were not available for 2012-2013 due to discontinuation of Landsat 7 data use in previous years. Landsat 8 data will be available for the 2014 growing season and will be included in the 2014-15 annual report.

A change profile for each parcel in the continuous parcel data was computed as the change in mean perennial cover for each reinventory year from baseline perennial cover. Each parcel is classified by its Holland type and by its status as either wellfield or control.

Analysis Data Sets

The number of parcels sampled each year as well as the number of transects sampled per parcel has varied due to staffing and technology changes. Thus, some parcels have varying numbers of transects sampled across time. Other parcels have not been sampled continuously during the entire monitoring period. In 2013, 111 parcels were sampled. For determinations of change from baseline, several subsets of the entire data set were used as follows:

1. **Parcels missing baseline transect data** (*n* = 11): The set of parcels resampled in 2013 for which baseline transect data is unavailable.
2. **Full transect data** (*n* = 100): The set of parcels with transect data from both the current year (2013) and at least one associated transect conducted during the baseline monitoring period (1985-1987) (*n* = 100). These parcels were further identified as belonging to the control or wellfield parcel group.
    a. Wellfield (*n* = 63)
    b. Control (*n* = 37)
3. **Continuous parcel data** (*n* = 36): The subset of full transect data that was sampled in every year from 1992 to the present. The year 1992 was chosen for the continuous parcel data because the sample size was greater than the set of parcels sampled each year from 1991 to the present. The baseline year was assigned to the nominal value of 1986 for these data. These data were further identified as either control or wellfield and by alkali meadow.
    a. Wellfield (*n* = 24)
        i. Continuous transect data – alkali meadow wellfield (*n* = 15)
    b. Control (*n* = 12)
        i. Continuous transect data – alkali meadow control (*n* = 10)

4. **Regression data set** (*n* = 97): The subset of full transect data with at least 10 years of data including the nominal baseline year.
    a. Wellfield (*n* = 61)
    b. Control (*n* = 36)

Analysis of parcel groups: wellfield vs. control

MANOVA was used to assess whether there was a difference in level or shape of the change profile over time between wellfield and control parcels. This allowed a direct evaluation of the effects of parcel status (wellfield or control) and time (1992-2013) on changes from baseline. The change profile was defined as the difference between the mean annual cover for each year and baseline. To allow for arbitrary changes in variance from year to year, and also for arbitrary dependence between errors from year to year, a fully unstructured correlation matrix was used. To avoid confounding the evaluation of the effects of environmental conditions on cover with the effects of varying the sample size between years, analyses were performed on the continuous parcel data and on the alkali meadows subset of the continuous parcel data. Model fit was assessed using graphical analysis of residuals.

To assess directly whether there was a change from baseline across parcels in mean perennial cover or mean grass cover, a paired t-test was used. Tests were performed using the full parcel data. Wellfield and control parcels were analyzed separately.

Analysis of covariance (ANCOVA) was used to assess whether there were differences in the linear trend of total perennial, grass cover, herb cover and shrub cover wellfield and control parcels. This analysis was performed using the continuous parcel data (1986, 1992-2013 = 23 years). The grouping variable was parcel status (wellfield or control), and the continuous variable was cover regressed on time. Linear trends were subsequently estimated using simple linear regression. Model fit was assessed using graphical analysis of residuals.

Individual parcel analyses

To evaluate in which parcels and in which year(s) total perennial cover has significantly differed from baseline, analysis of variance (ANOVA) followed by Dunnett's method of multiple comparisons was used to evaluate significant changes compared to baseline for each year that the parcel was sampled. To automatically adjust for unequal variance in the measurements taken across time, a weighted ANOVA was performed, using weights that were the reciprocals of the variance at each year. Dunnett's method controls the overall Type I error (finding a significant effect when there is none) when multiple comparisons are employed (Zar, 1999). This method could only be used for parcels in which baseline data contained more than one transect. The results from the weighted ANOVA and Dunnett's multiple comparisons were grouped into three categories: significantly below baseline, no difference from baseline, and significantly above baseline. These data were displayed on maps of the parcel data. In tandem with the Dunnet's method has been used previously in ICWD vegetation annual reports. There are however conceptual problems with using corrections for multiple comparisons in an ongoing monitoring program. With each additional year added to the data set, the power to detect significant changes is reduced. This is because in controlling the family-wise error rate to 0.05 or one in twenty false positives out of twenty years, the critical significance value is made more stringent for each individual test proportional to the number of years in the data set. Effectively this means employing corrections for multiple comparisons steadily decreases the power of the test with increasing data, an undesirable property for a monitoring program. To place each year's comparison to baseline on equal footing, we employ a two-sample t-test that allows for unequal variances (Welch's t test or Satterwaite's method). We provide the comparison of these different methods and a brief discussion on the merits of each.

To assess whether composition had changed within each vegetation parcel, a regression of shrub proportion (shrub cover/total perennial cover), grass proportion, and herb proportion over time was performed for all parcels in the full transect data with at least 10 years of vegetation data (including baseline) (regression data set, n = 97 total, n = 36 control, n = 61 wellfield.

Results

Analysis of parcel groups: wellfield vs. control

Comparison of change profiles between wellfield and control groups–MANOVA results

Figure 8.1 displays the change profiles for wellfield and control parcels that were continuously sampled, as well as for the alkali meadows subset of these parcels. Figure 8.2 presents the overall cover by each lifeform category.

The change from baseline of mean perennial cover of wellfield parcels (n = 24) differed from the change from baseline of mean perennial cover of control parcels (n = 12) (n = 22 yrs (1992-2013), p = 0.01213, Figure 8.1). Inter-annual trends or the shape of the change profile in the two groups have been similar during the reinventory period and thus evidently the level of the difference between the change profiles drives these results. Specifically, cover in the control parcel group was higher than or close to baseline while cover in the wellfield parcel group was generally lower than or close to baseline. For the alkali meadow parcel group sampled each year during this same time period (1992-2013), the general pattern and level of difference were similar; however, the comparison between wellfield (n = 15) and control (n = 10) parcels was not significant (n = 22 yrs, p = 0.4015, Figure 8.1).

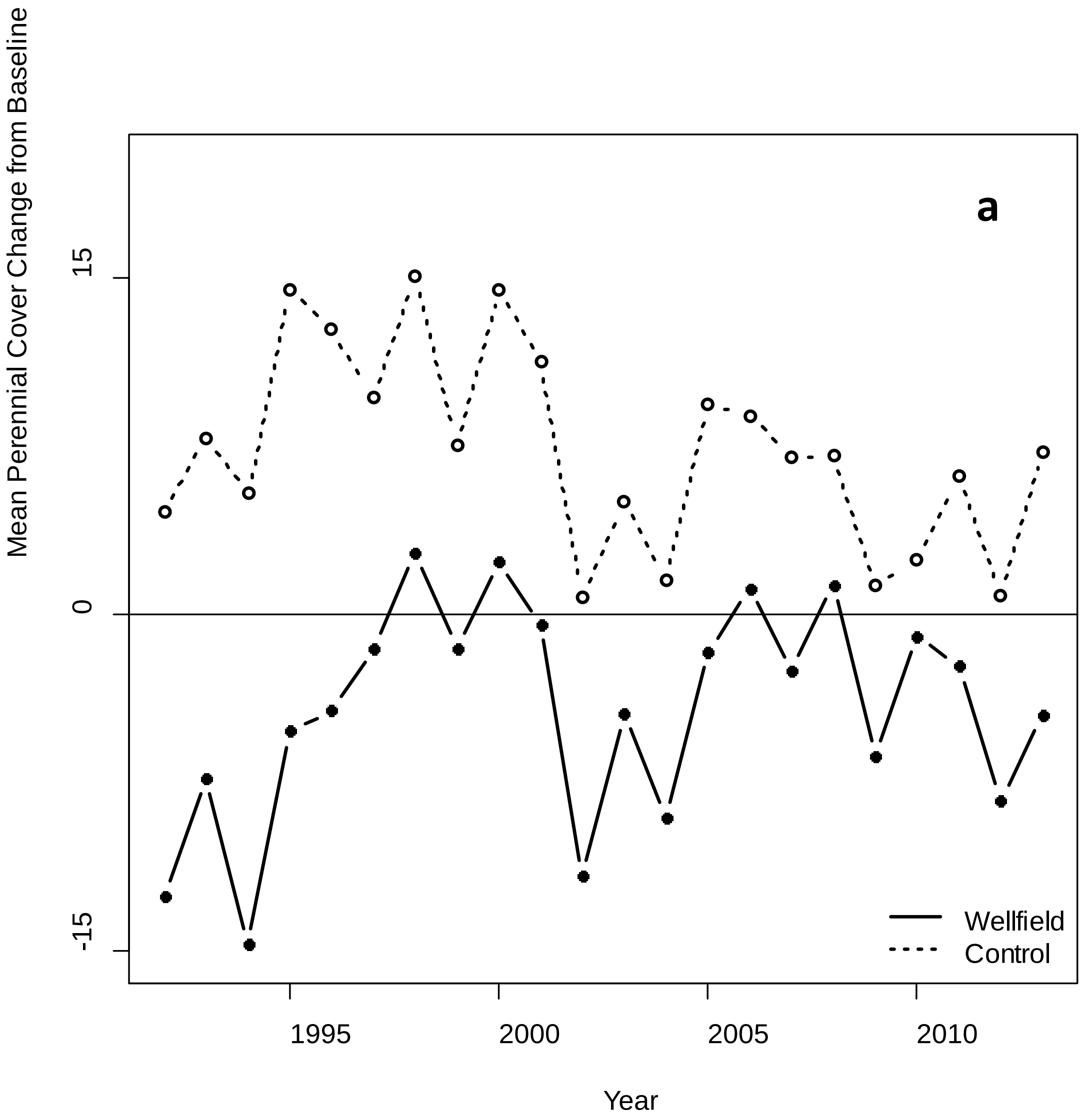


Figure 8.1. The mean change from baseline of mean perennial cover for the parcels sampled each year between 1992 and 2013. (a) For all parcels with continuous samples (n = 36). (b) For alkali meadow parcels with continuous samples (n = 25).

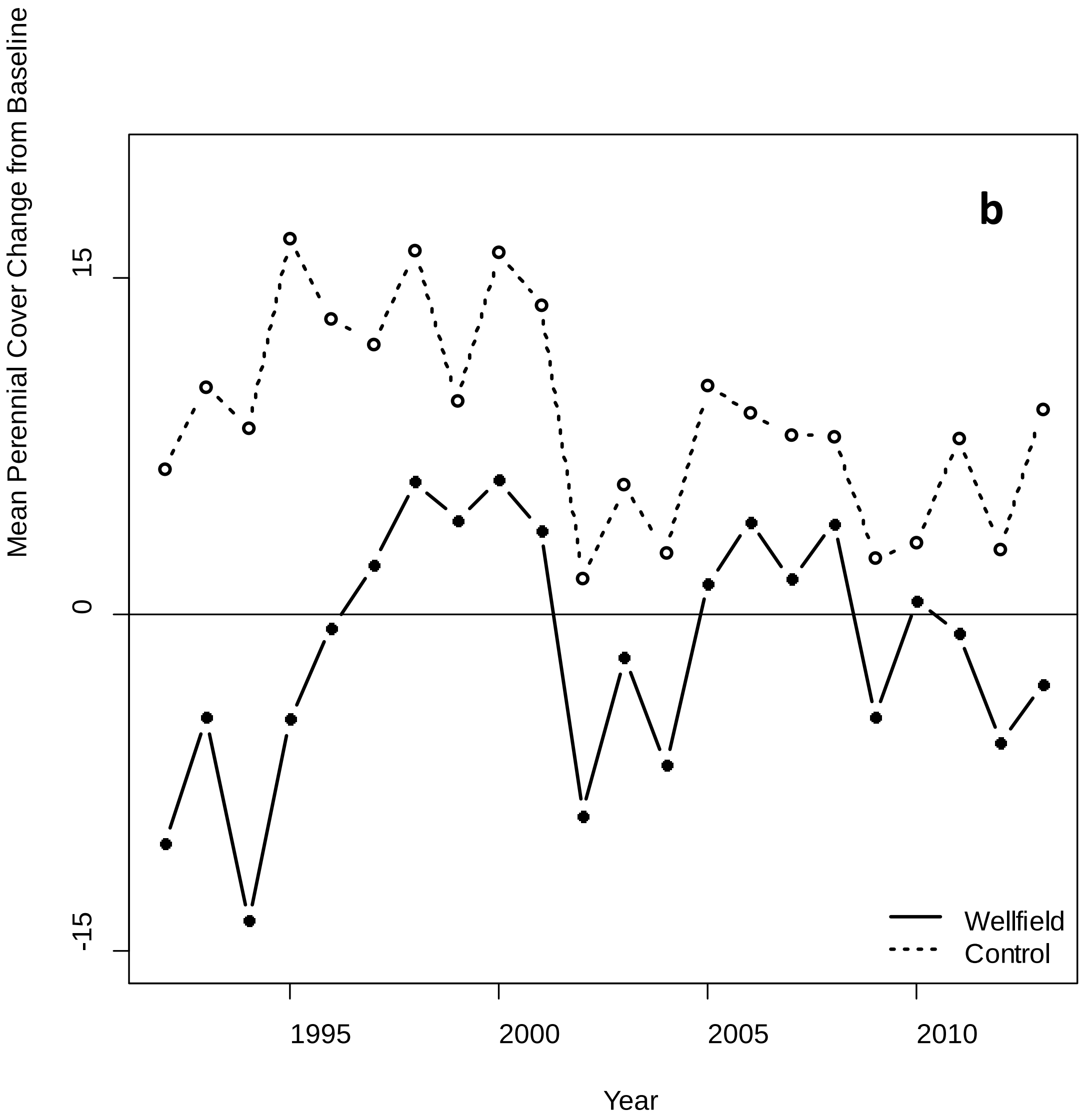


Figure 8.1 [cont.]. The mean change from baseline of mean perennial cover for the parcels sampled each year between 1992 and 2013 (a) For all parcels with continuous samples (n = 36). (b) For alkali meadow parcels with continuous samples (n = 25).

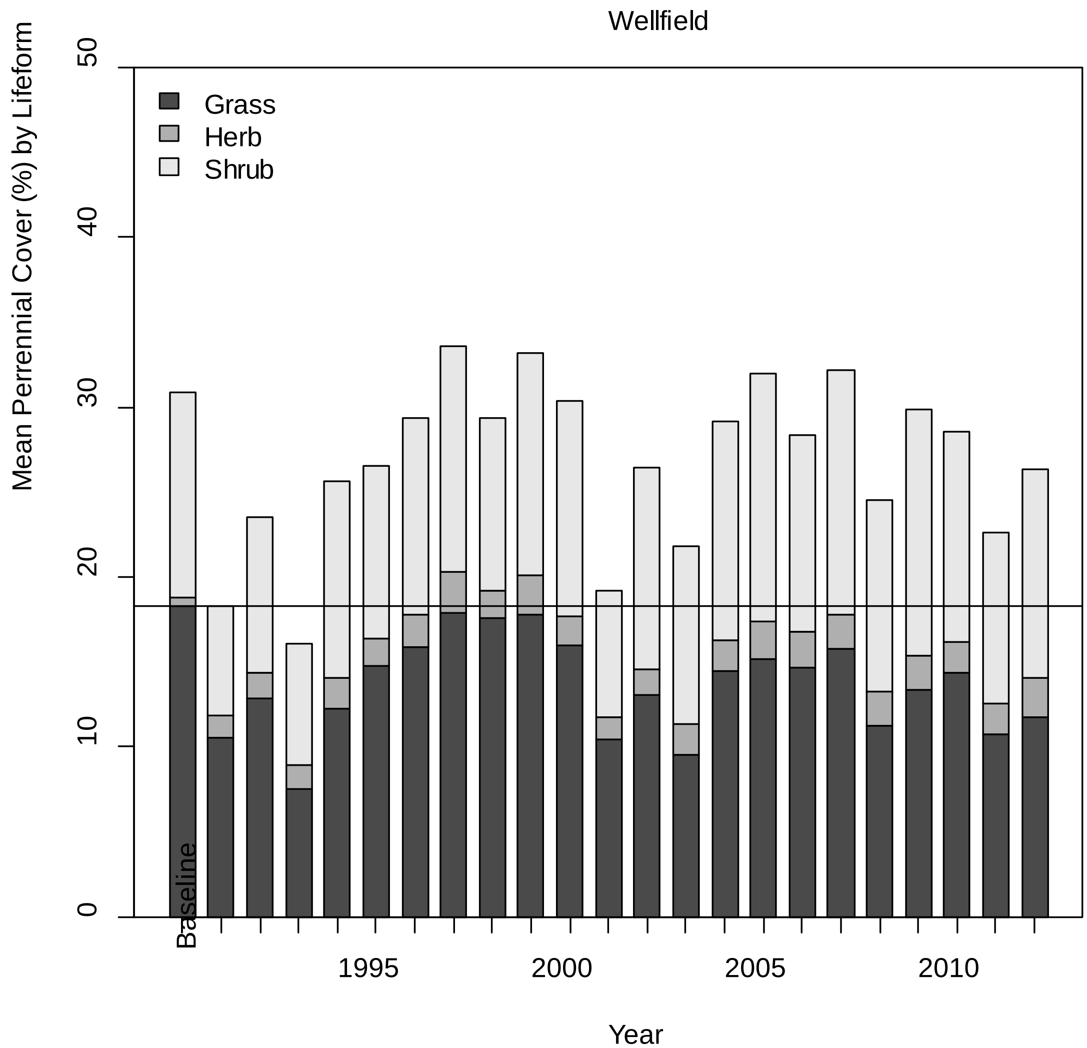


Figure 8.2. Time profile of grass, herb and shrub cover for baseline and each reinventory year for the continuously sampled control and wellfield parcels, sampled each year between 1992 and 2013 (n = 24 wellfield parcels, n = 12 control parcels, n = 23 yrs including nominal baseline year). Horizontal line shows the mean baseline grass cover value.

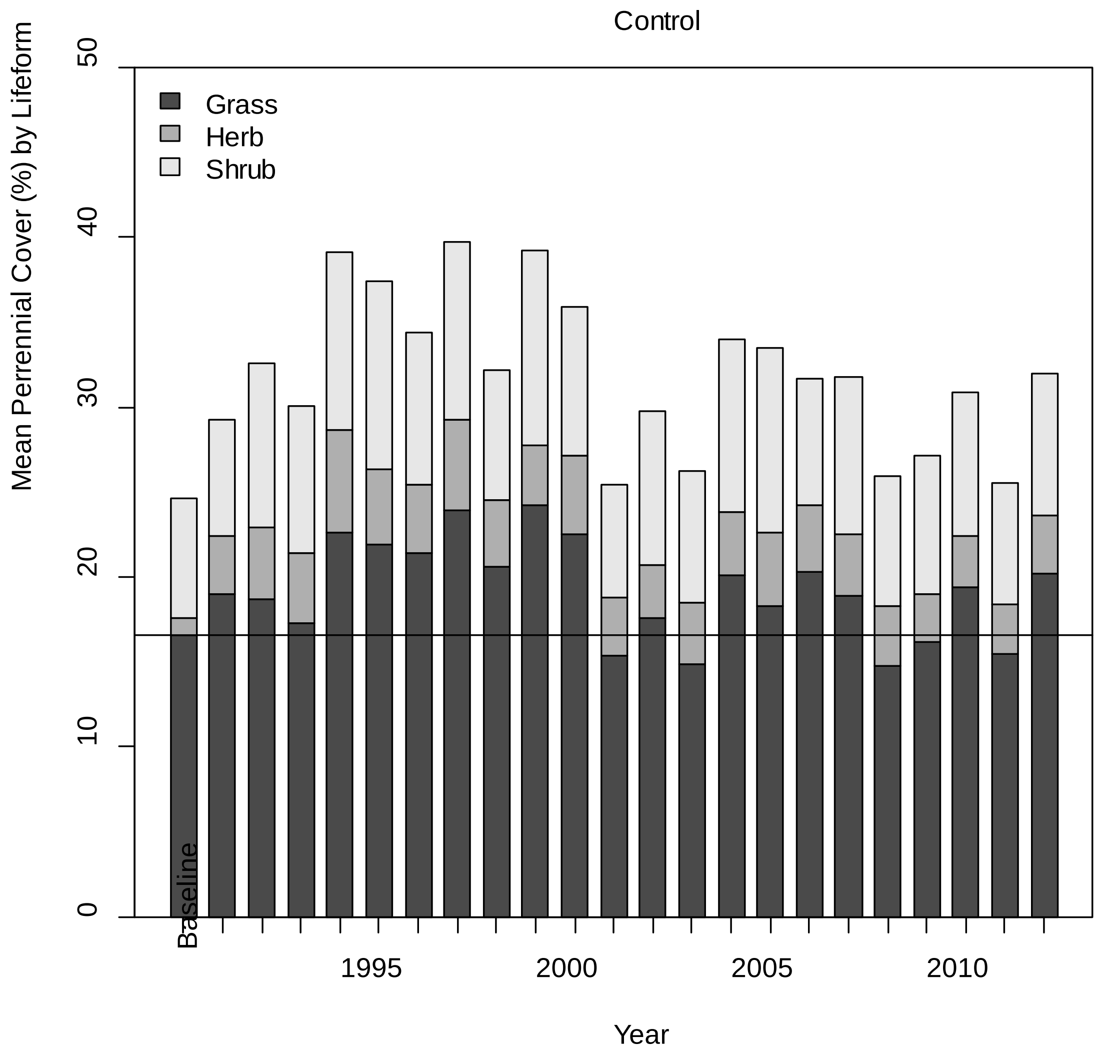


Figure 8.2 [cont.]. Time profile of grass, herb and shrub cover for baseline and each reinventory year for the continuously sampled control and wellfield parcels, sampled each year between 1992 and 2013 (n = 24 wellfield parcels, n = 12 control parcels, n = 23 yrs including nominal baseline year). Horizontal line shows the mean baseline grass cover value.

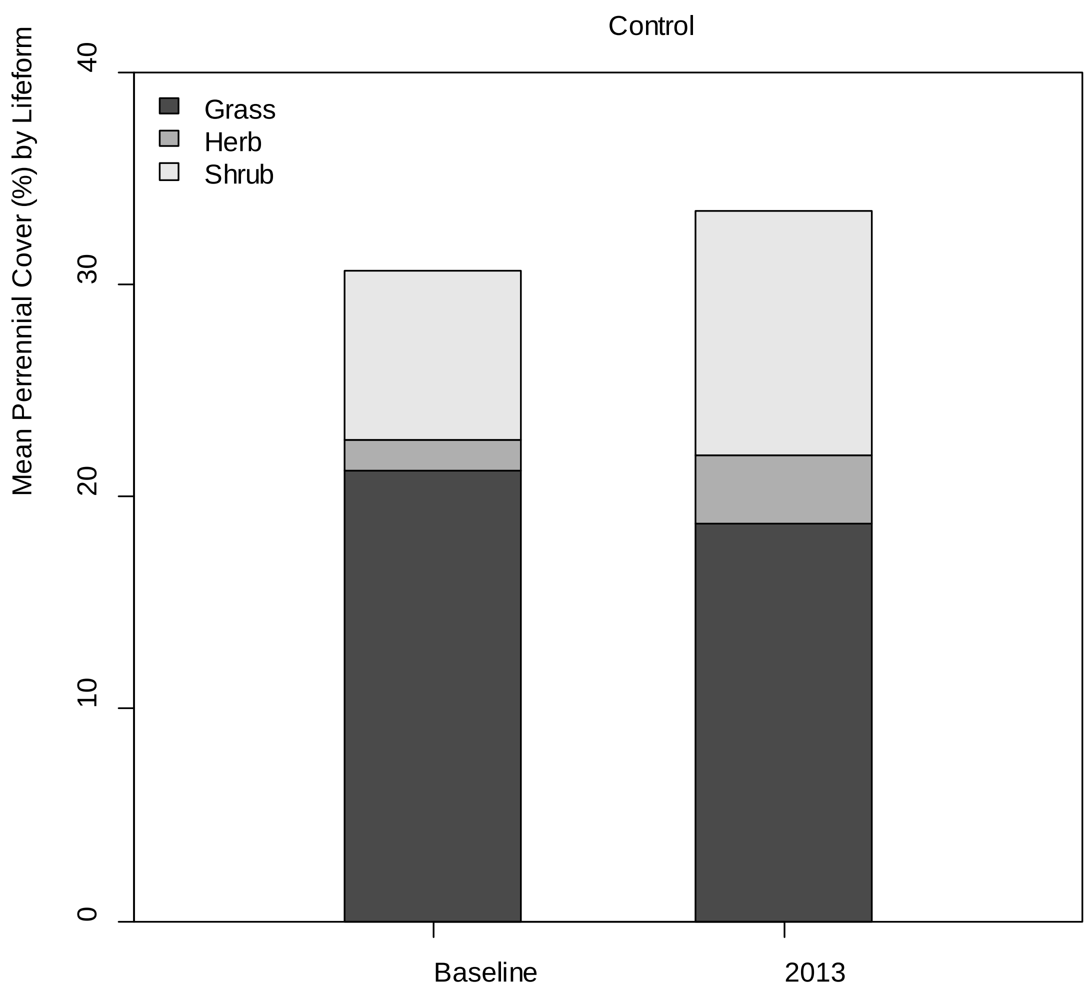


Figure 8.3. Mean perennial cover partitioned by lifeform for baseline and 2013 calculated for all parcels sampled in 2013 that have baseline transect data (n = 37 for control parcels, n = 63 for wellfield parcels).

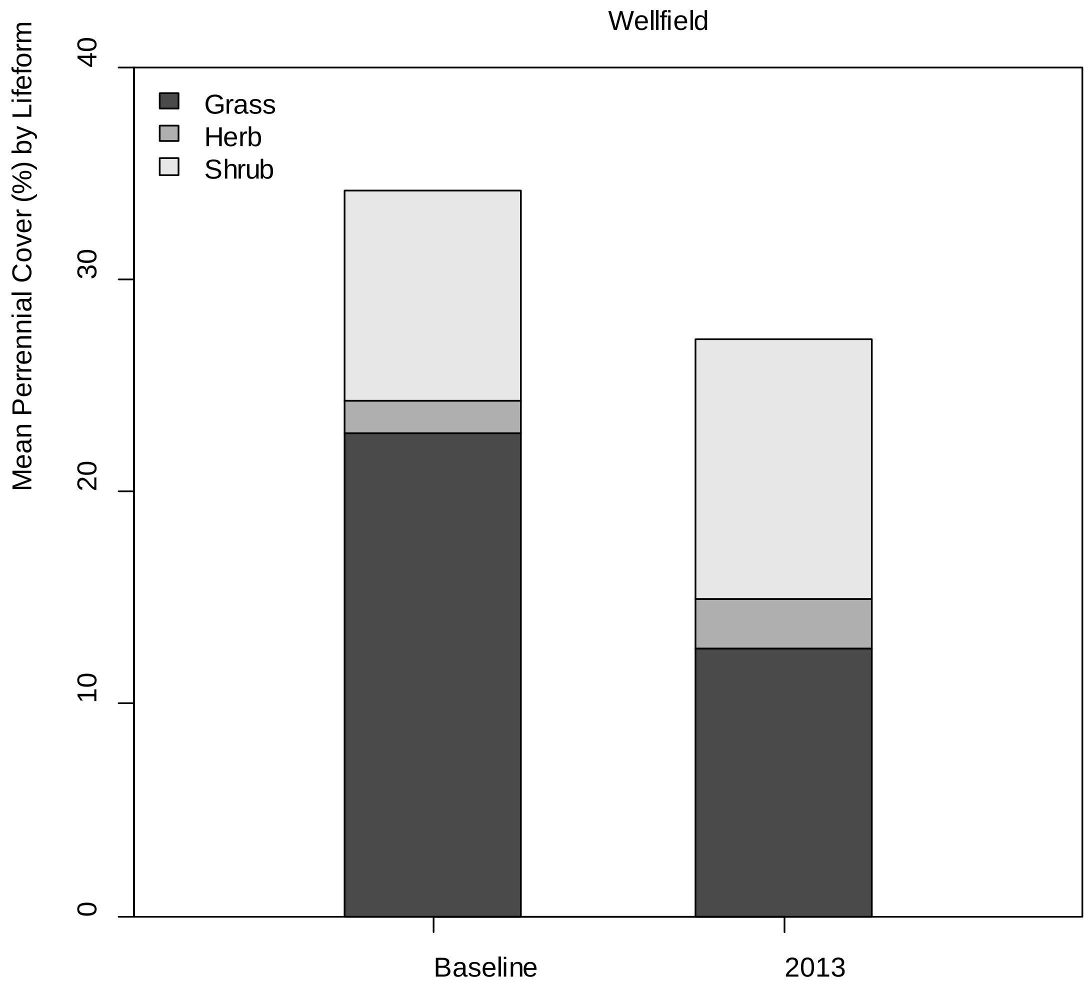


Figure 8.3 [cont.]. Mean perennial cover partitioned by lifeform for baseline and 2013 calculated for all parcels sampled in 2013 that have baseline transect data (n = 37 for control parcels, n = 63 for wellfield parcels).

Difference in 2013 vs. baseline cover for wellfield and control groups

In 2013, mean perennial cover in wellfield parcels calculated from the full transect data set (n = 100) was 26.7%, a significant decline (7.5%) from the mean baseline of 34.2% (n = 63, p = 0.0002, Figure 8.3). Mean perennial cover in control parcels calculated from the full data set in 2013 was 33.5%, an increase (2.8%) from the mean baseline of 30.6% (n = 36, p = 0.2527, Figure 8.3).

In 2013, mean perennial grass cover in wellfield parcels calculated from the full transect data set (n = 100) was 12.3%, a significant decline (10.4%) from the mean baseline of 22.7% (n = 63, p < 0.0001, Figure 8.3). Mean perennial grass cover in control parcels calculated from the full data set in 2013 was 18.7%, a decline (2.5%) from the mean baseline of 21.25% (n = 36, p = 0.37061, Figure 8.3).

Composition change for wellfield vs. control groups

Formal tests for difference in slope over time between control and wellfield were not significant for total perennial cover, grass cover, or herb cover; however, shrub cover change over time was significantly different between wellfield and control parcels (ANCOVA, n = 23 yrs, p = 0.046).

Using the continuous data (1992-2013) (n = 24 wellfield parcels, n = 12 control parcels), simple linear regression was used to assess linear trends over time. Mean perennial cover on time was not statistically significant in control parcels (n = 23 yrs, R^2 = 0.04, p = 0.3437, Figure 8.4a) or wellfield parcels (n = 23 yrs, R^2 = 0.02, p = 0.4924, Figure 8.4a). Mean perennial grass cover on time was not statistically significant for control parcels (n = 23 yrs, R^2 = 0.06, p = 0.2565, Figure 8.4b), or wellfield parcels (n = 23 yrs, R^2 = 0.03, p = 0.4493, Figure 8.4b). Mean perennial herb cover on time was not statistically significant in control parcels (n = 23 yrs, R^2 = 0.01, p = 0.6405, Figure 8.4c) but was in wellfield parcels (n = 23 yrs, R^2 = 0.37, p = 0.0023, Figure 8.4c). Mean perennial shrub cover on time was not statistically significant in control parcels (n = 23 yrs, R^2 = 0.01, p = 0.6314, Figure 8.4d) but was in wellfield parcels (n = 23 yrs, R^2 = 0.18, p = 0.042, Figure 8.4d).

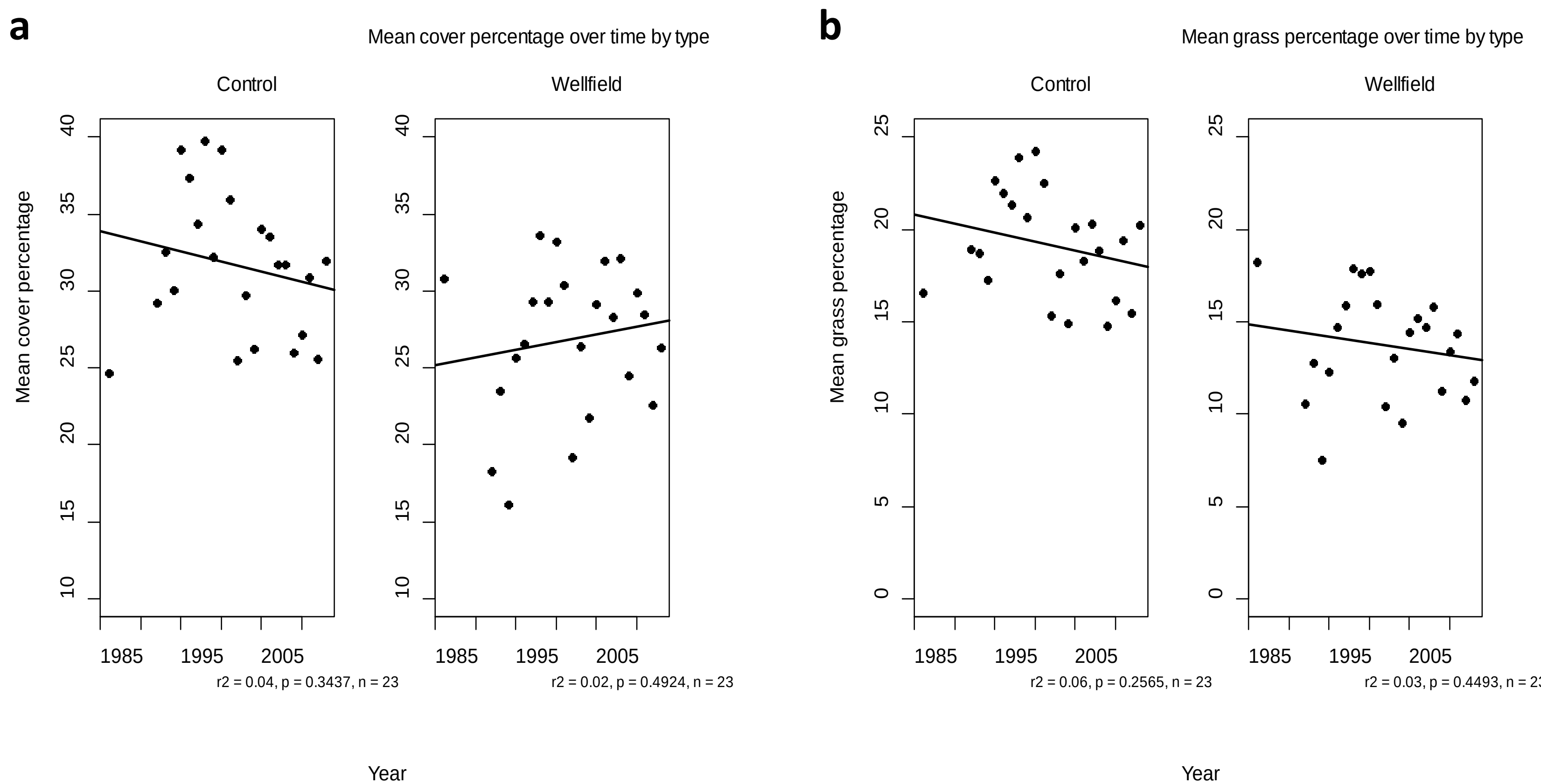
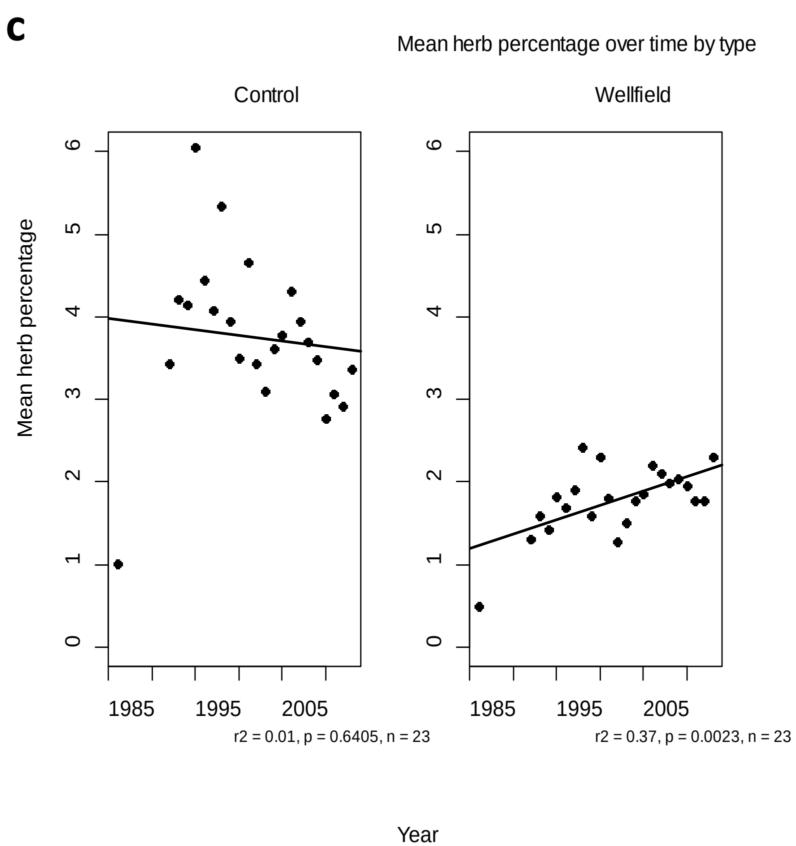


Figure 8.4. Trend of perennial cover (a), grass cover (b), herbaceous cover (c), and shrub cover (d) over time in wellfield and control parcels computed from parcels in the continuous transect data set (n = 24 wellfield parcels, 12 control parcels, n = 23 years including nominal baseline year).



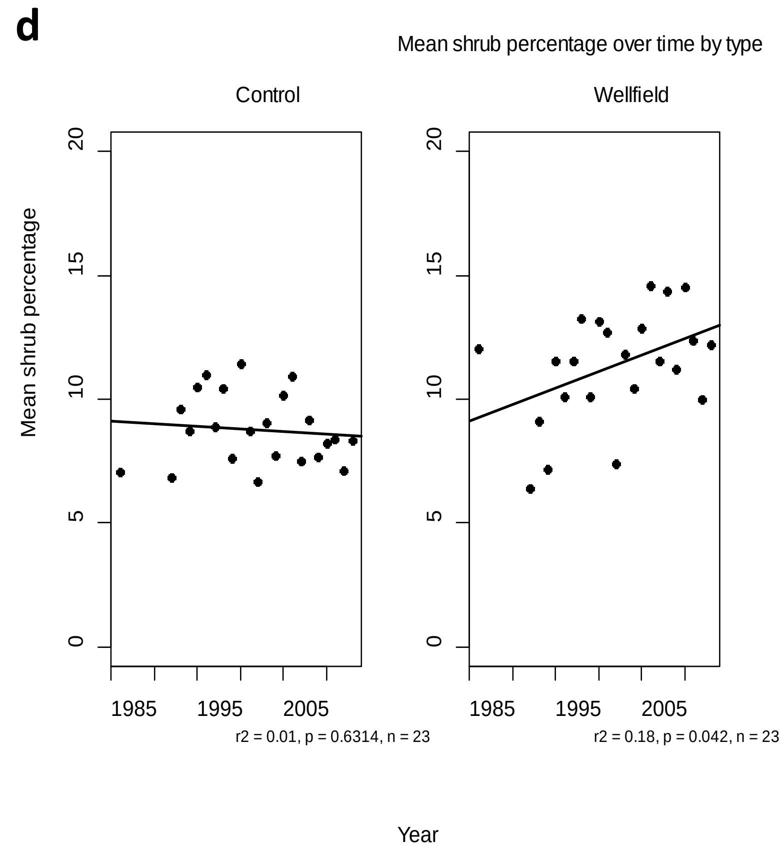


Figure 8.4 [cont.]. Trend of perennial cover (a), grass cover (b), herbaceous cover (c), and shrub cover (d) over time in wellfield and control parcels computed from parcels in the continuous transect data set (n = 24 wellfield parcels, 12 control parcels, n = 23 years including nominal baseline year).

Individual parcel analysis

In 2013, perennial cover in 20 out of 59 sampled wellfield parcels (34%) with baseline transect data were significantly below baseline. Eleven of these 20 parcels were originally classified as alkali meadow during baseline; two were classified as desert sink scrub; two were classified as Nevada saltbush scrub; two were classified as rush/sedge meadow and one was classified as desert greasewood scrub.

Significant changes in perennial cover, determined by weighted ANOVA with Dunnet's pairwise comparison, are presented here by wellfield and Holland class along with corresponding maps of the parcel locations and the time series of perennial cover from baseline to 2013. Appendix 2 contains all parcels sampled at least one year between baseline and 2013 (*n* = 169) and associated results of (1) weighted ANOVA on cover for the entire time period (baseline-2013) followed by Dunnet's pairwise comparison (2) SMA cover values for baseline through 2011 and (3) DTW values for baseline through 2010.

Laws wellfield

As of 2013, 10 out of the 18 (56%) reinventoried LAWS wellfield parcels were significantly below baseline when evaluated from line point transect data. Five of these 10 parcels were classified as alkali meadow, one as desert greasewood scrub, two as rabbitbrush meadow and two as rush/sedge meadow.

Alkali meadows: LAW035 has been below baseline perennial cover over the last 11 consecutive years since 2003 by an average of over 20% perennial cover (Figure 8.5). LAW052 has been below baseline for all 18 years sampled by a similar magnitude as LAW052 (Figure 8.6). LAW065 has below baseline for the last five consecutive years but by a much lesser magnitude of around 5% cover (Figure 8.7). LAW072 has been below baseline for the last seven consecutive years (Figure 8.8), and LAW078 has been below baseline for the last five consecutive years (Figure 8.9)

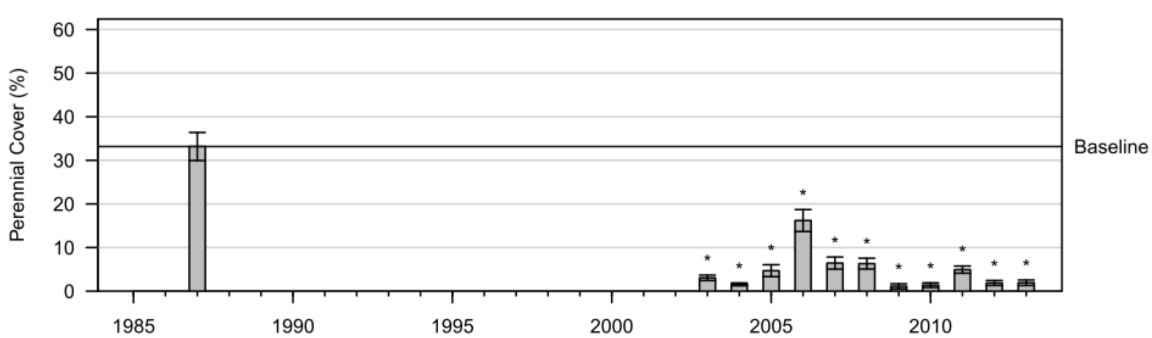


Figure 8.5. LAW035 perennial cover from baseline to 2013.

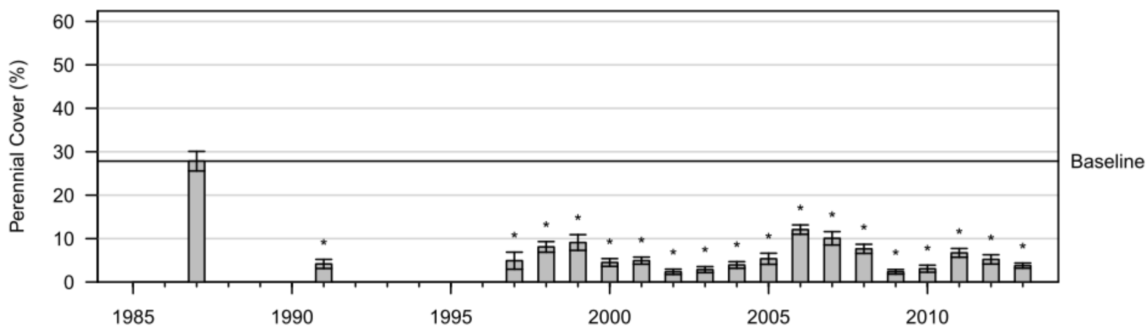


Figure 8 6. LAW052 perennial cover from baseline to 2013.

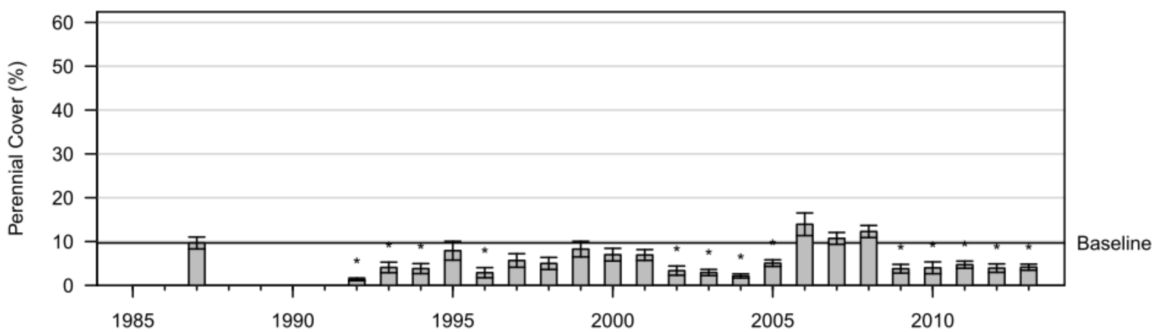


Figure 8.7. LAW065 perennial cover from baseline to 2013.

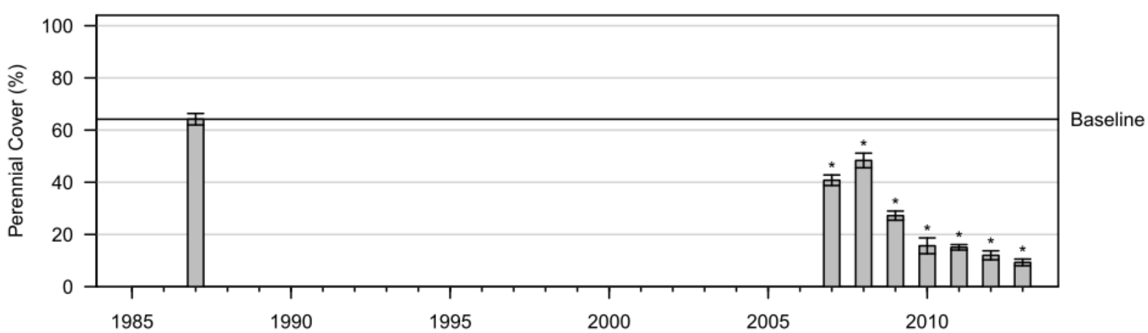


Figure 8.8. LAW072 perennial cover from baseline to 2013.

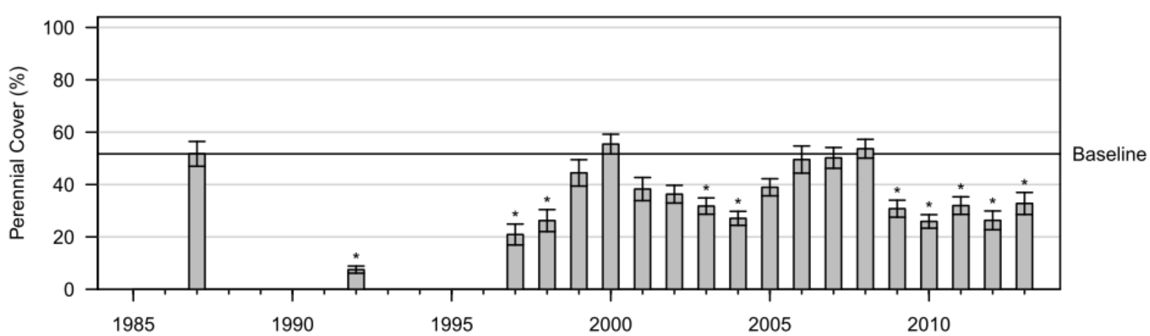


Figure 8.9. LAW078 perennial cover from baseline to 2013.

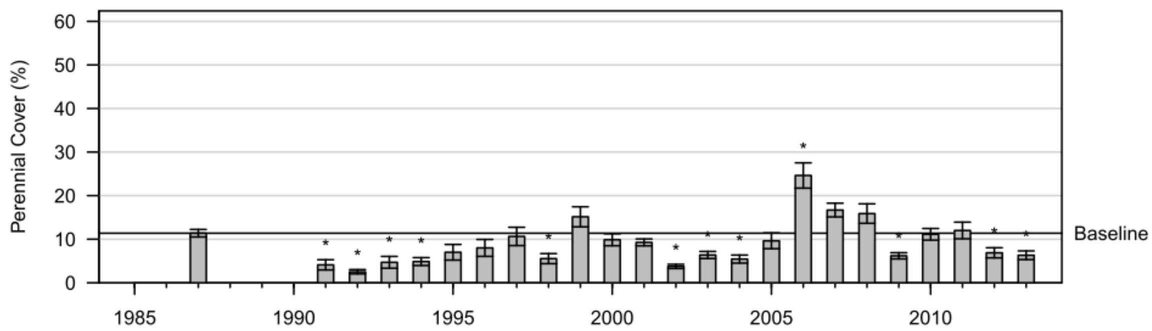


Figure 8.10. LAW063 perennial cover from baseline to 2013.

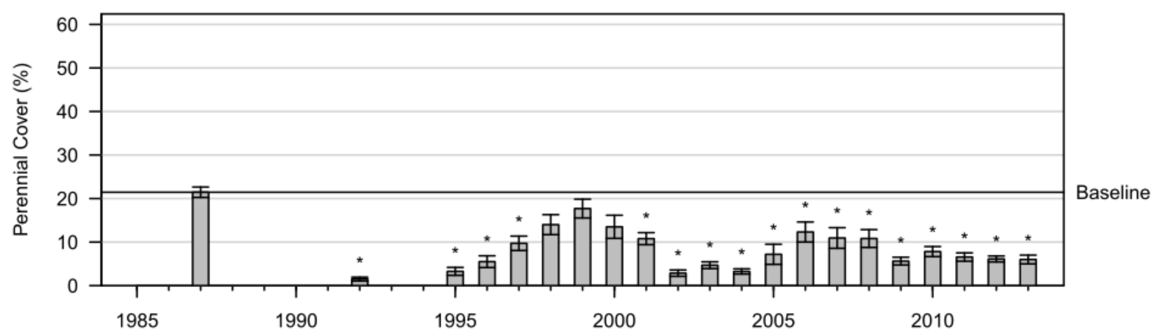


Figure 8.11. LAW062 perennial cover from baseline to 2013.

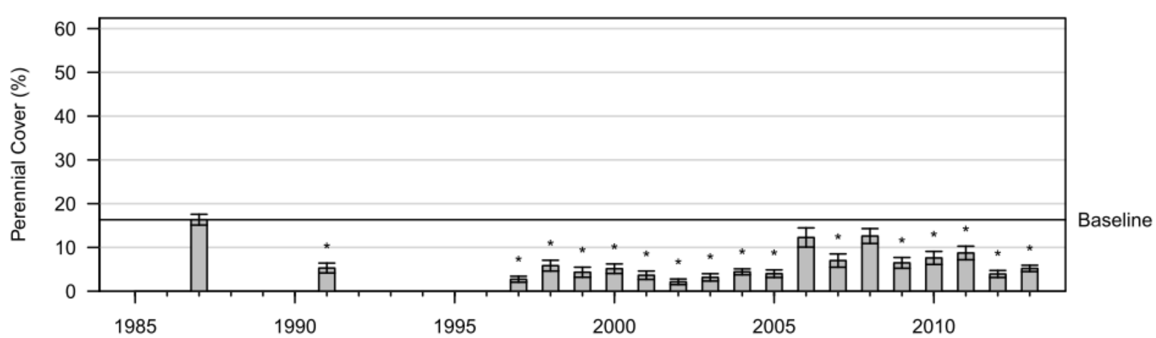


Figure 8.12. LAW082 perennial cover from baseline to 2013.

Desert greasewood scrub: LAW063 was below baseline in 2012 and 2013 (Figure 8.10)

Rabbitbrush meadow: LAW062 has been below baseline for the last 13 consecutive years. LAW082 has been below baseline in 16 of 18 years sampled and the last five consecutive years. (Figures 8.11, 8.12)

Rush/sedge meadows: LAW043 has been below baseline in each of nine years sampled since 2003. LAW070 has been below baseline in all seven years it was sampled (Figures 8.13, 8.14)

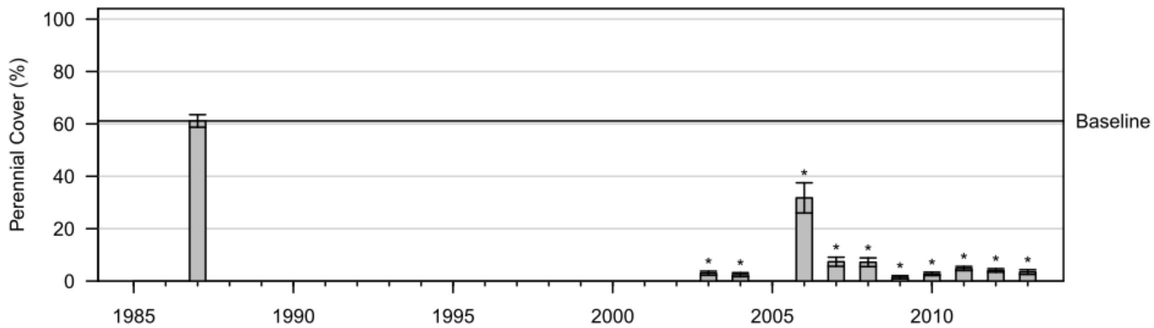


Figure 8.13. LAW043 perennial cover from baseline to 2013.

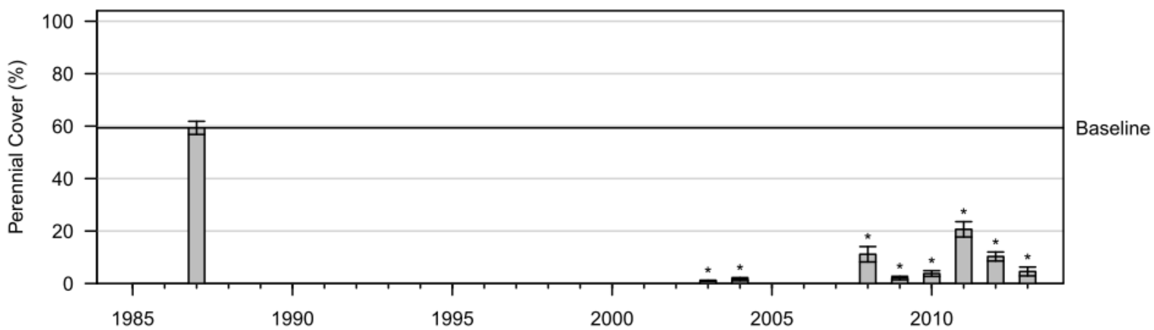


Figure 8.14. LAW070 perennial cover from baseline to 2013.

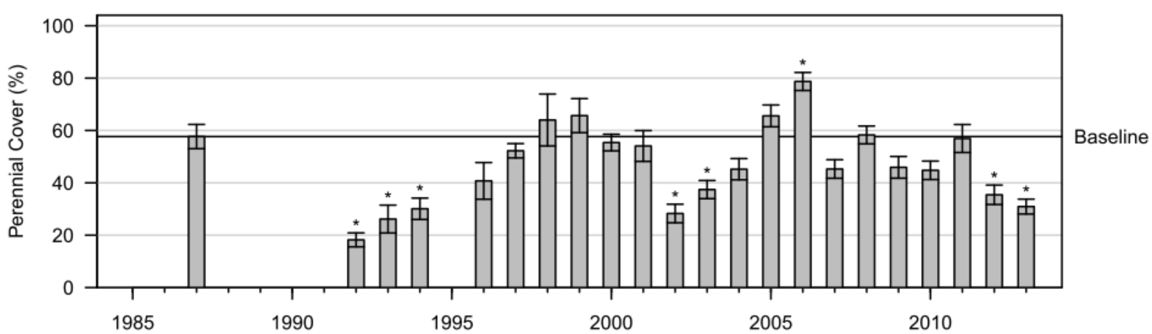


Figure 8.15. FSL123 perennial cover from baseline to 2013.

Bishop wellfield

Alkali meadow In 2013, one alkali meadow parcel, FSL123, was below baseline in the Bishop wellfield (Figures 8.15, 8.16).

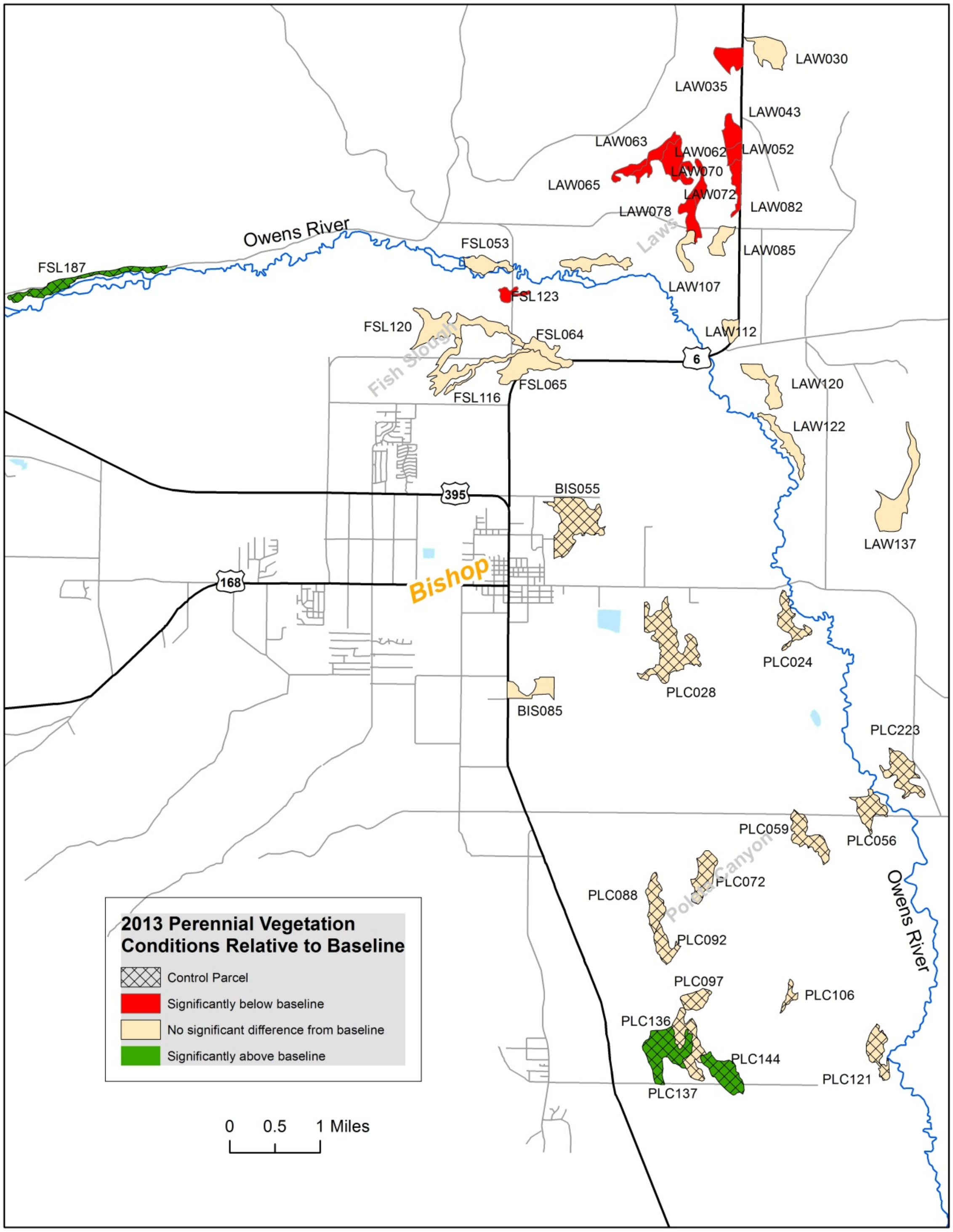


Figure 8.16. Parcels in the Bishop wellfield area color-coded by statistical difference relative to baseline according to 2013 results using a weighted ANOVA followed by Dunnett's comparisons to a control group method. The 13 parcels that had no baseline transect data and could not be evaluated with weighted ANOVA, were grouped into the no difference from baseline category.

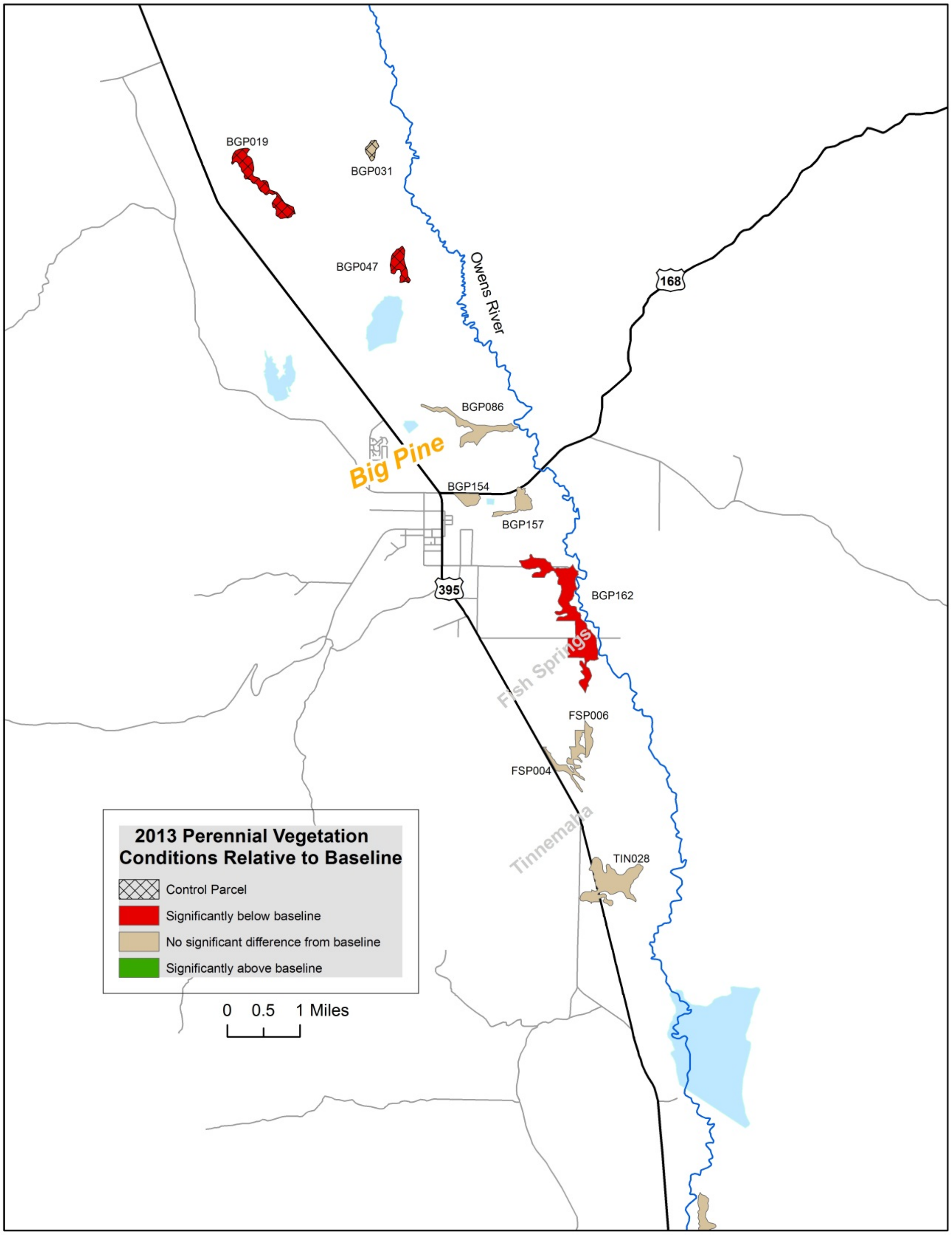


Figure 8.17 Parcels in the Big Pine wellfield area color-coded by statistical difference relative to baseline according to 2013 results using a weighted ANOVA followed by Dunnett's comparisons to a control group method. The 13 parcels that had no baseline transect data and could not be evaluated with weighted ANOVA, were grouped into the no difference from baseline category.

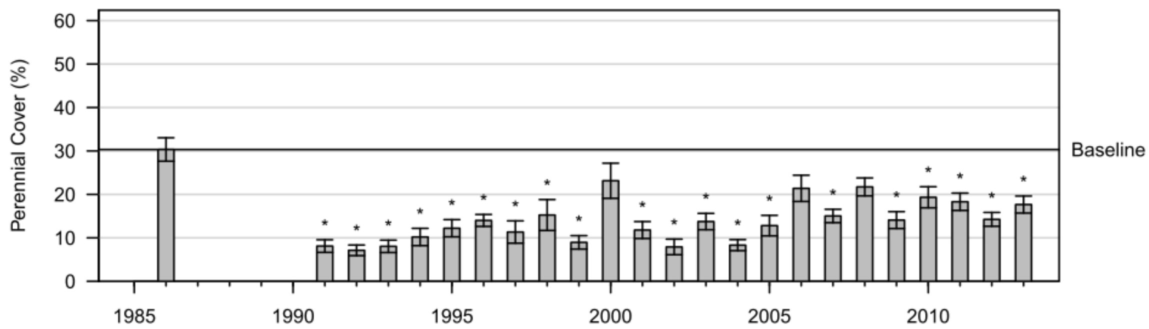


Figure 8.18. BGP162 perennial cover from baseline to 2013.

Big Pine wellfield

Wellfield parcel BGP162 has been below baseline in 20 out of 23 yrs since 1991 and consecutively for the last five years (Figures 8.17, 8.18). It is classified as a Nevada saltbush scrub.

Taboose-Aberdeen Wellfield

In 2013, three out of 14 wellfield parcels were significantly below baseline in the Taboose-Aberdeen (TA) wellfield (Figures 8.19-8.21). Two were classified as alkali meadow and one as Nevada saltbush scrub during baseline. Locations of the parcels are shown in Figure 8.26.

Alkali meadows: The two alkali meadow parcels were BLK009 and BLK033 (Figures 8.19 and 8.20).

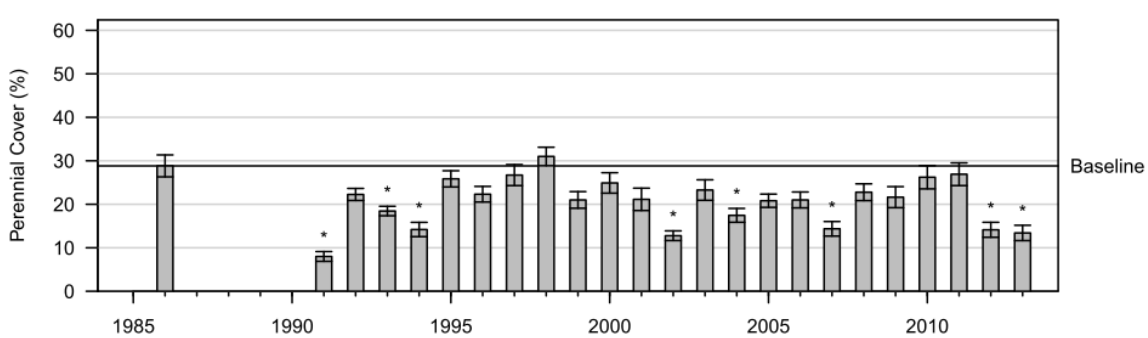


Figure 8.19. BLK009 perennial cover from baseline to 2013.

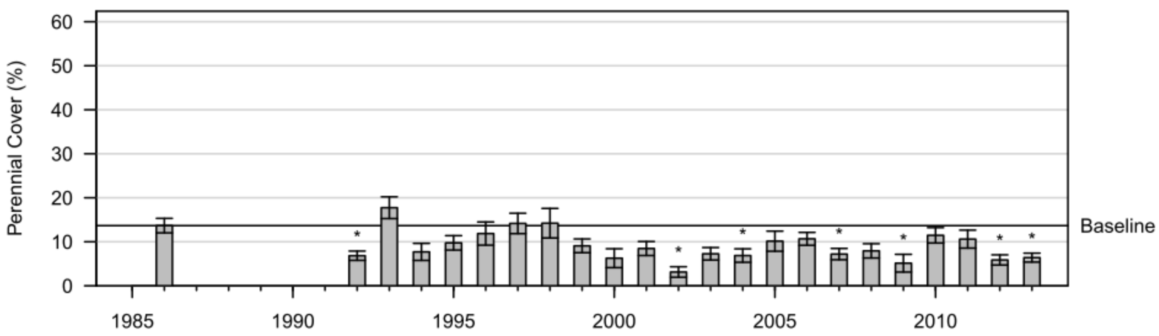


Figure 8.20. BLK033 perennial cover from baseline to 2013.

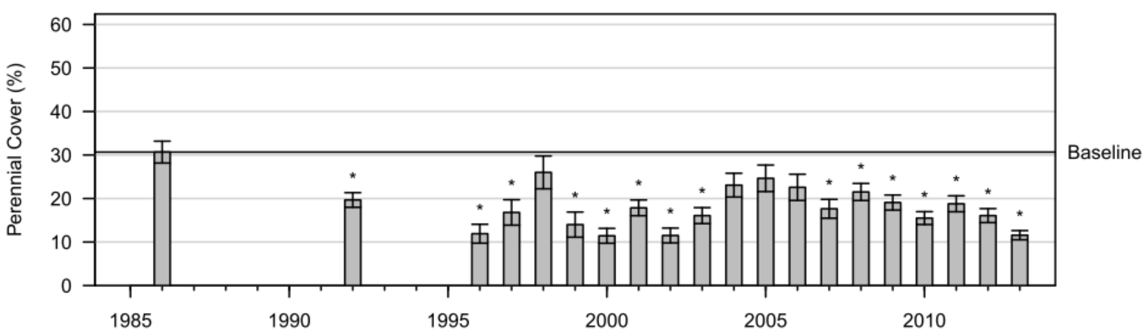


Figure 8.21. BLK021 perennial cover from baseline to 2013.

Nevada saltbush scrub BLK021 has been below baseline in 15 of 19 reinventory years and consecutively for the last seven years (Figure 8.21).

Thibaut-Sawmill Wellfield

In 2013, four out of 13 wellfield parcels (two Alkali meadow parcels and two desert sink scrub parcels) were significantly below baseline in the Thibaut-Sawmill (TS) wellfield (Figures 8.22-8.25). Locations of the parcels are shown in Figure 8.26.

Alkali meadow BLK075 was below baseline in 2012 and 2013 and has been 10% below baseline since 2001 (Figure 8.22). BLK094 has been below baseline in 16 of the last 22 reinventory years and consecutively for the last 10 years since 2003 (Figure 8.23).

Desert sink scrub BLK077 and BLK096 were below baseline in 2012 and 2013 (Figures 8.24 and 8.25).

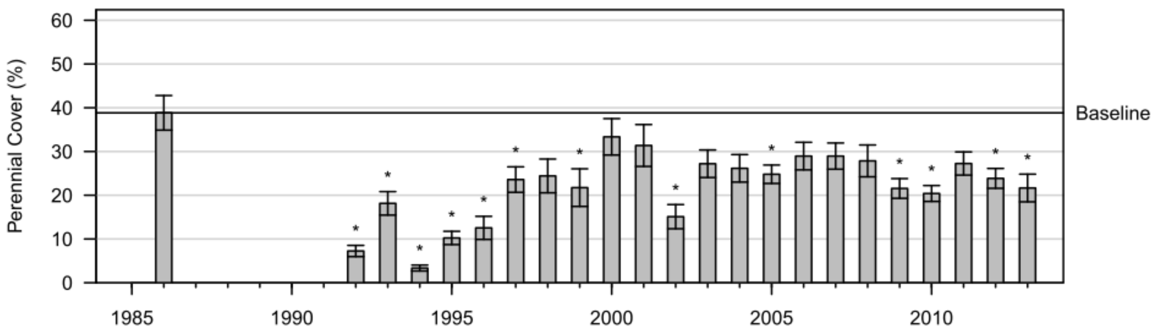


Figure 8.22. BLK075 perennial cover from baseline to 2013.

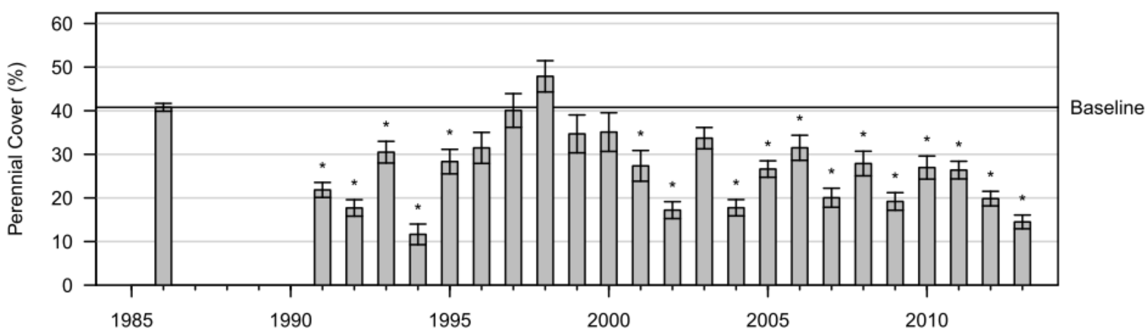


Figure 8.23. BLK094 perennial cover from baseline to 2013.

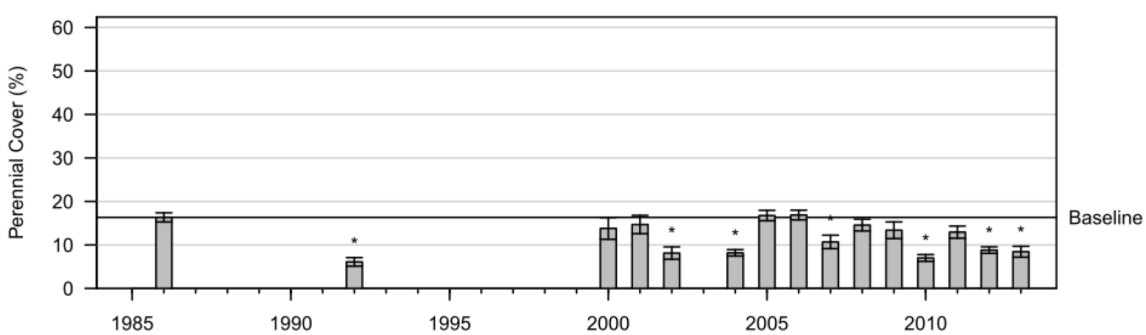


Figure 8.24. BLK077 perennial cover from baseline to 2013.

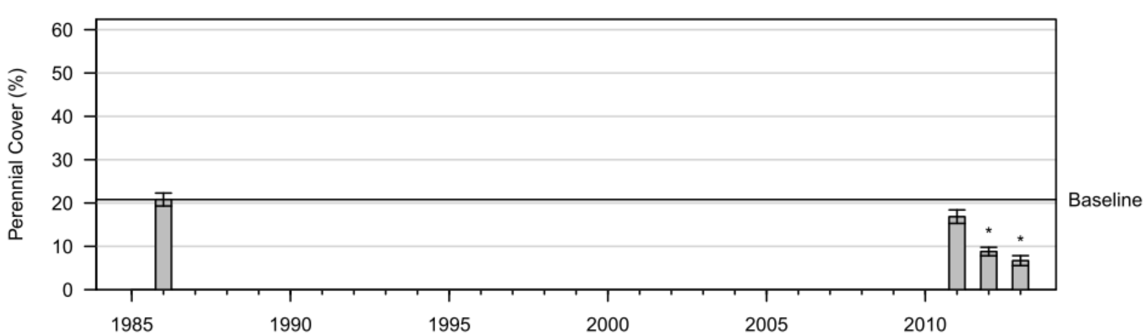


Figure 8.25. BLK096 perennial cover from baseline to 2013.

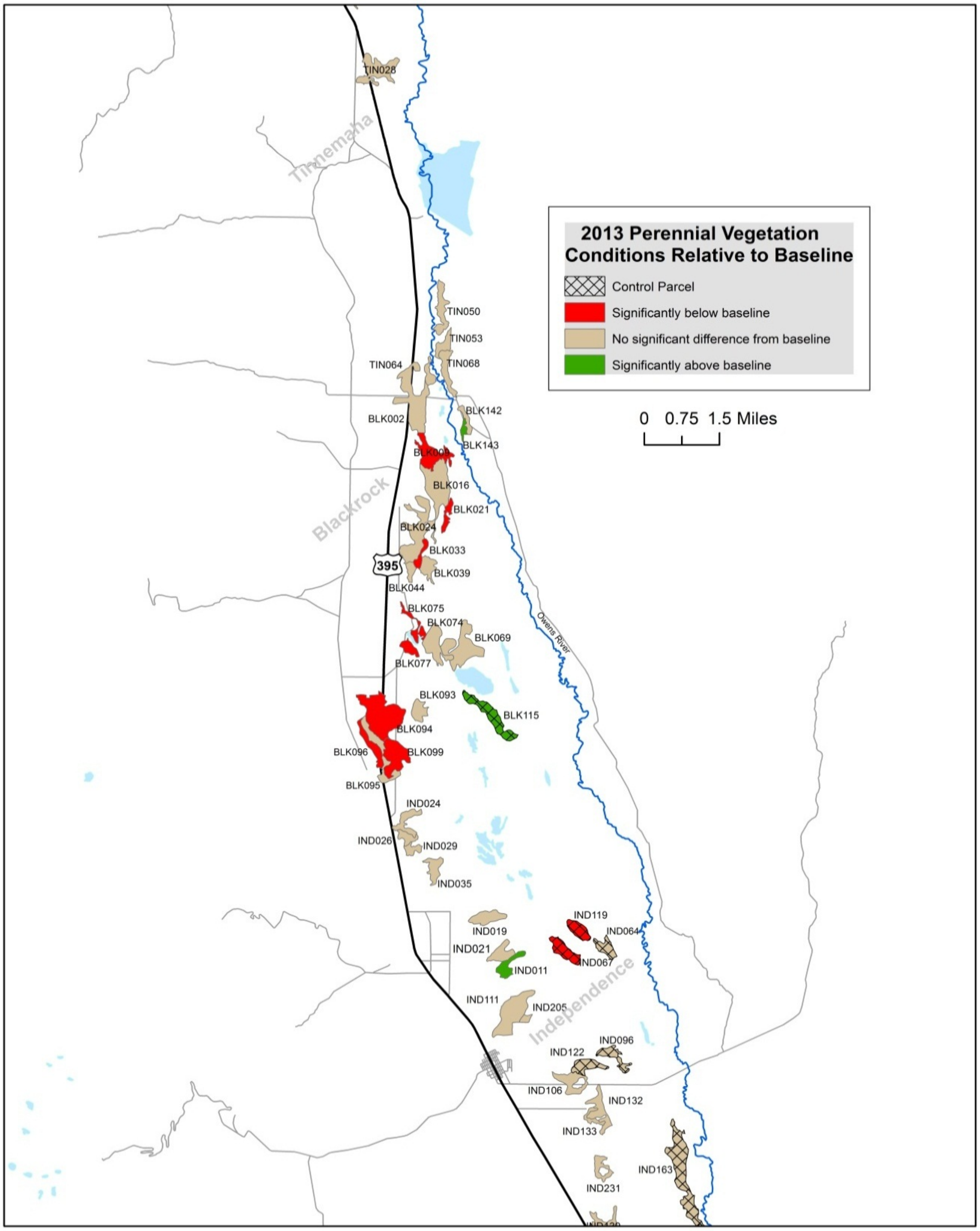


Figure 8.26. Parcels in the Taboose-Aberdeen and Thibaut-Sawmill wellfield areas color-coded by statistical difference relative to baseline according to 2013 results using a weighted ANOVA followed by Dunnett's comparisons to a control group method. The 13 parcels that had no baseline transect data and could not be evaluated with weighted ANOVA, were grouped into the no difference from baseline category.

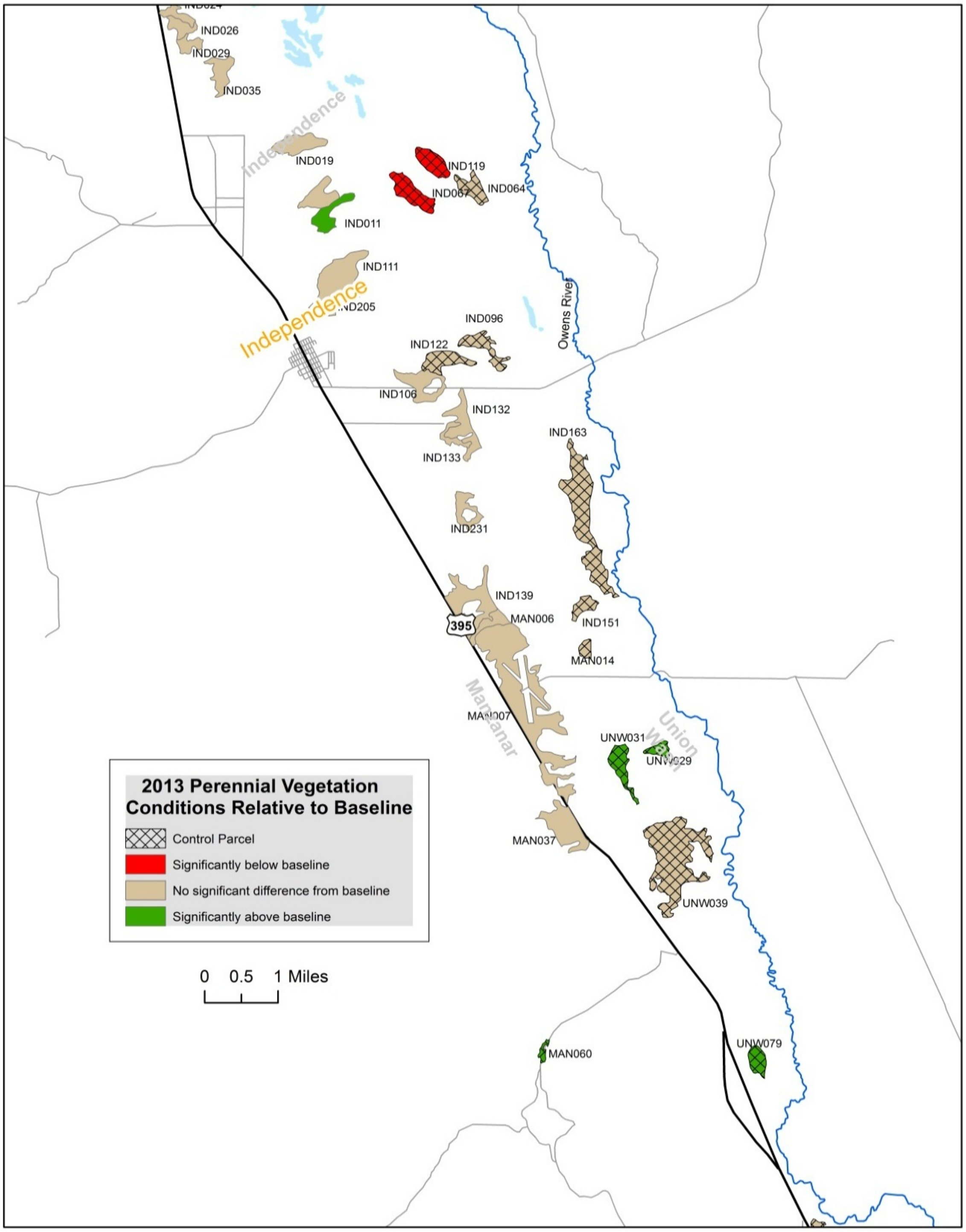


Figure 8.27. Parcels in the Independence-Oak, Symmes-Shepard and Bairs-George wellfield areas color-coded by statistical difference relative to baseline according to 2013 results using a weighted ANOVA followed by Dunnett's comparisons to a control group method. The 13 parcels that had no baseline transect data could not be evaluated with weighted ANOVA, and were grouped into the no difference from baseline category.

Independence-Oak Wellfield

Shrub cover in parcel IND011 significantly increased over time (Appendix 3). In summary, one out of six (17%) of the Independence-Oak wellfield parcels had increasing shrub proportion (Figure 8.27).

Symmes-Shepard Wellfield

Shrub cover in parcel IND132 significantly increased over time (Appendix 3). In summary, one of six (17%) of the Symmes-Shepard wellfield parcels had increasing shrub proportion (Figure 8.27).

Bairs-Georges Wellfield

In 2013 the only wellfield parcel, MAN037, in Bairs-Georges wellfield, was not below baseline perennial cover nor did it have increasing shrub cover (Figure 8.27, Figure 8.28).

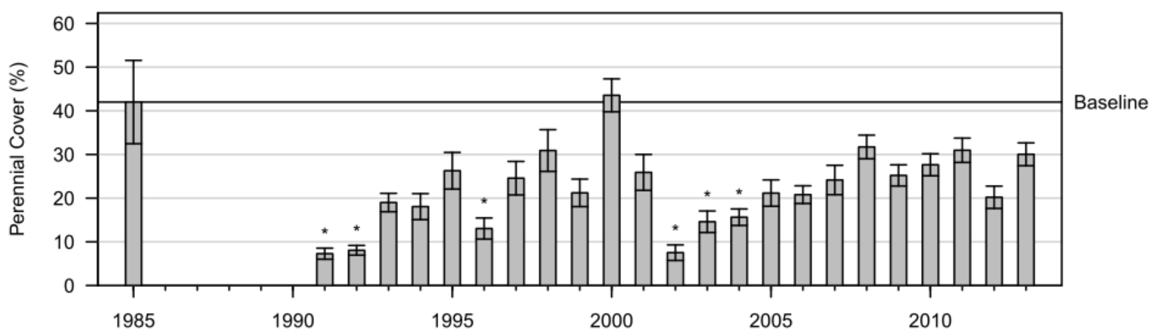


Figure 8.28. MAN037 perennial cover from baseline to 2013.

Lone Pine Wellfield

In 2013 perennial cover in LNP045 was not significantly below baseline in 2013 (Figure 8.29, Figure 8.30).

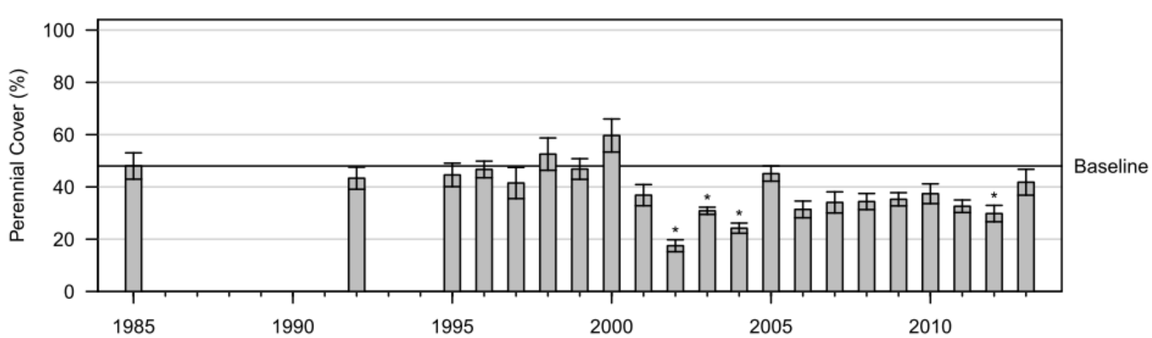


Figure 8.29. LNP045 perennial cover from baseline to 2013.

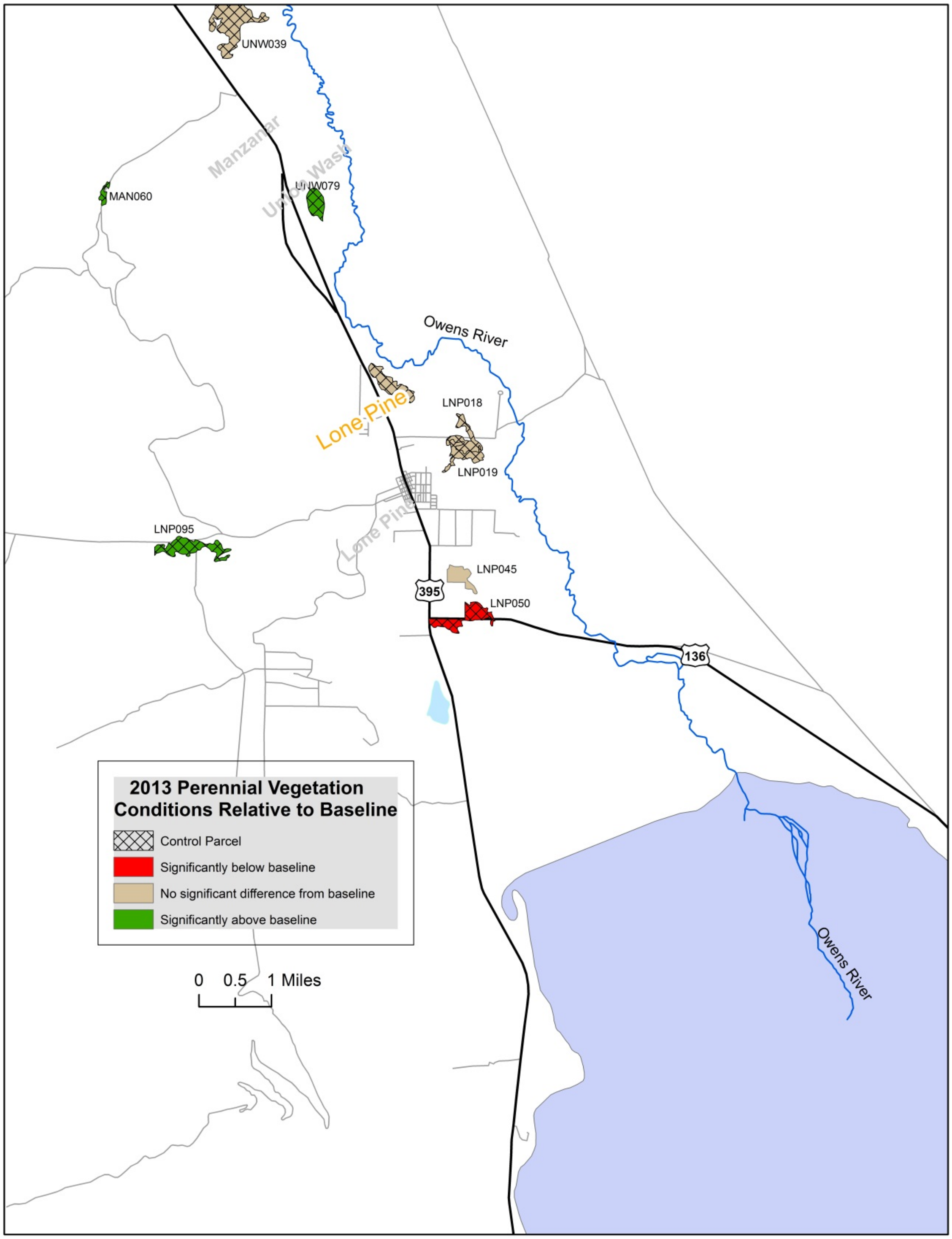


Figure 8.30. Parcels in the Lone Pine wellfield area color-coded by statistical difference relative to baseline according to 2013 results using a weighted ANOVA followed by Dunnett's comparisons to a control group method. The 13 parcels that had no baseline transect data could not be evaluated with weighted ANOVA, and were grouped into the no difference from baseline category.

Dunnett's test vs. Welch's t test

The comparison between Dunnett's test and Welch's t-test yielded expected trends of more years significantly different from baseline using the Welch's t-test. The loss of power of the Dunnet's test was not as extreme as what would be expected from the more conservative corrections such as the Bonferroni correction (Dunn 1961). The 18 parcels with the most persistent change are shown in Table 8.1. Total years below baseline for these parcels were comparable, the difference averaging only one year. The number of consecutive years below baseline counting back from present were also similar averaging about one year difference. However, on a case by case basis, the different statistical procedures could lead to different interpretations of the persistence of the change. For example, BGP162 according to Welch's t-test has been significantly below baseline for the past 13 years while the Dunnet's test suggests that a significant change has only persisted for the last 5 years (see Figure 8.17). These results are revisited in the discussion.

Table 8.1. Comparison between the number of years declared 'statistically significant' with Dunnet's test and Welch's two-sample t-test. Dunnet's test corrects for multiple comparisons, by making the critical value needed to obtain significance more stringent as the number of years in the data set increase. The critical t-value for the Welch's test is not influenced by the number of years in the data set.

		Total years below baseline		Consecutive years below baseline to present	
Parcel	n	Dunnett's test	Welch's t test	Dunnett's test	Welch's t test
LAW052	18	18	18	17	17
LAW062	20	17	19	13	14
BGP162	23	20	22	5	13
BLK094	23	17	19	10	13
LAW035	11	11	11	11	11
LAW043	10	10	10	8	8
BGP019	8	8	8	8	8
BLK021	19	15	15	7	7
LAW072	7	7	7	7	7
LAW070	8	8	8	6	6
BLK075	22	13	17	2	5
LAW082	18	16	16	5	5
LAW065	22	13	14	5	5
BGP047	18	13	13	5	5
LAW078	18	10	12	5	5
LNP050	19	10	11	3	5
IND067	16	10	10	5	5
UNW031	7	7	7	5	5

Individual parcel changes in shrub and grass proportion

Shrub proportion in 46 of 97 parcels (regression data set, n = 61 wellfield, n = 36 control) was significantly correlated with time (Appendix 3). Eight of these 46 parcels had significantly decreasing shrub proportion and 37 parcels had significantly increasing shrub proportion (Appendix 3). Twenty-three of the 37 parcels that showed increasing shrub proportion over time were wellfield parcels while 14 were control parcels.

Grass proportion in 43 of 97 parcels was significantly correlated with time (Appendix 3). Thirty-five of these 43 parcels had significantly decreasing grass proportion and eight parcels had significantly increasing grass proportion (Appendix 3). Twenty-two of the 35 parcels that showed decreasing grass proportions over time were wellfield parcels while 13 were control parcels.

Herb proportion in 13 of 97 parcels was significantly correlated with time (Appendix 3). Eleven of these 13 parcels had significantly increasing herb proportion and two parcels had significantly decreasing herb proportion (Appendix 3). Ten of the 13 parcels that showed increasing herb proportion over time were wellfield parcels while three were control parcels.

Discussion

In general, there have been statistically significant cover and composition changes at the aggregated wellfield and control group level and also for individual parcels. The majority of the individual parcels that had statistically significant change were from the wellfield group.

Analysis of parcel groups: wellfield vs. control

Comparison of change profiles between wellfield and control groups

The change from baseline of mean perennial cover of wellfield parcels from 1992-2013 differed significantly from the change from baseline of mean perennial cover of control parcels. The finding of statistical significance for this test could in theory be due to either shape or level differences between the change profile of wellfield and control parcels. The shape of the change profile was quite similar for both parcel groups and thus the significance may be interpreted as being due to differences in overall level, with the wellfield group change from baseline, significantly below that of the control group.

Difference in 2013 vs. baseline cover for wellfield and control groups

The significant decrease in both total cover and grass cover in wellfield and control groups is likely an effect of multiple factors. Some decrease in vegetation cover is expected in dry years, though cover in the wellfield group decreased by 7.27% cover compared to an increase in 2.8% cover for the control parcels. The decline in grass cover was also greater in the wellfield group compared to the control group (10.40% decrease compared to 2.5% in control parcels). It is possible for the grass component to decline more than the total change in cover because shrub cover simultaneously increased in wellfield parcels and shrub and herb cover increased in control parcels (see below).

Composition change for wellfield and control group

Using the continuous data set, simple linear regression showed shrub and herb cover in wellfield parcels increased significantly and did not change in control parcels. Some baseline values have high leverage in the regressions and thus significant change during the reinventory period may have been masked with the inclusion of baseline values that fell outside the linear trend during the reinventory period. These regressions suffer from small sample sizes, especially the control group, with only 12 parcels used to calculate the annual means for the regression. Even with low sample size for wellfield parcels (n = 24), however, the correlation with shrub cover was strong, showing consistent increases over the reinventory period. A linear model, however, did not explain variation in grass cover over time in contrast to findings from the full data set—that grass cover is significantly below baseline in 2013.

In the case of grass cover, a linear model is mechanistically inappropriate for modeling long-term vegetation composition, but is adequate for quantitative description of short-term trends. The period over which linearity should hold would be during grass cover decline in association with water table drawdown beyond the root zone or grass cover increase in association with water table recovery. When there are several episodes of both water table drawdown and subsequent recovery within a time period of interest, the expectation is for grass cover to lag behind the water table drawdown accounting for biological processes of dieback and regrowth. A simple linear model would not capture these ecohydrological linkages and indicate erroneously that change was not linked to water table drawdown when assessed over a time period with fluctuations in water table level. For example, Jabis (2012) discussed why a linear model may not have captured variation in grass cover in wellfield parcels:

> *"Lack of correlation with grass cover and time in wellfield parcels during the entire time period [baseline-2011] may be due to increased runoff and low pumping between the years 1995-1998. Although grass cover is currently below baseline and has remained in that condition since the 2001 growing season, recovery between 1997 and 2000 stabilized grass cover change for a period of approximately four years restoring cover to near baseline conditions".*

Thus fluctuations in pumping level or other environmental factors and not time *per se* drive change in composition. And the appropriateness of linear models to describe shrub, herb or grass cover over time is predicated on time covarying with the salient entities and rates of processes that directly limit population demographics.

With a decline in grass owing to a drop in the ground water table, shrub establishment is predicted to increase. Subsequent recovery of the water table may partially recover the grass component. Yet, deep-rooted shrubs may not decline with subsequent water table drawdown beyond the grass root zone. Each additional drawdown beyond the grass root zone may further facilitate shrub infilling and loss of the grass component. This hypothesis is consistent with the observed linear increase in shrub proportion over time, while grass cover is more strongly dependent on the fluctuating degree of ground-water pumping and consequently whether the water table is adequate to wet the shallow rooting zone.

Individual parcel analysis

Difference in 2013 vs. baseline cover for individual parcels

All wellfield areas in the valley contain one or more parcels with reduced perennial cover in 2013 except for Independence-Oak, Symmes-Shepard, and Bairs-Georges wellfields. In total, 20 wellfield and 5 control parcels were below baseline cover values. Over half of the wellfield parcels below baseline (56%) were classified as alkali meadow during baseline.

Dominant species in these meadow communities require more water than is available via precipitation and thus obtain needed water within a zone of soil that is saturated with groundwater, or immediately above this zone in the capillary fringe. Reduction in water table beyond a maximum rooting depth of 2-2.5 m is incompatible with shallow-rooted species of meadow ecosystems (Elmore et al. 2006). With water-table reductions, establishment and dominance of deep-rooted woody species is predicted based on empirical evidence and theory (Stromberg et al. 1996; Cooper et al. 2006; Trammell et al. 2008; Goedhart and Pataki, 2010). In alkali soils, reductions in the groundwater table reduce dissolved salt content that accumulates via wicking to the surface via capillary action (Cooper et al. 2006; Patten et al. 2008). In addition to a lack of salt replenishment to the soil surface with water table reductions, subsequent precipitation events further leach remaining salts to deeper horizons. The consequent decreases in soil salt content could increase site-suitability for non-halophytic species (Patten et al. 2008) and reduce site-suitability for halophytes (plants adapted to saline environments). *Distichlis spicata*, or saltgrass, a native halophytic dominant of alkali meadow, could be expected to decrease in distribution and abundance in association with both decreases in the groundwater table and consequent decreases in soil-surface salt content. To allow long-term persistence of meadow ecosystems and alkali meadow in particular, water management in the Owens Valley requires maintenance of a shallow saturated zone of soil necessary to maintain populations of meadow species.

Trends in individual parcel composition change

The decrease in grass cover and increase in shrub cover in the wellfield parcels is consistent with the causal link between water table reductions beyond the 2 to 2.5-m grass root zone, favoring deeper-rooted woody shrubs. Control parcels, however, also increased shrub cover in 11 of 33 parcels and decreased grass cover in 13 of 33 parcels. Since control parcels are outside the influence of ground-water pumping, this effect could be due to other factors such as livestock grazing (Brown and Archer 1999, Van Auken 2000, Berlow *et al.* 2002, Eldridge *et al.* 2011).

For parcels influenced by groundwater management, repeated drawdown below the maximum rooting depth of grasses may result in establishment and dominance of shrubs. Depending on the degree of grass decline, water management alone may be inadequate to recover the former grass component without additional management such as prescribed fire and reseeding. Land and water management practices, including reduced pumping in impacted areas, in combination with water spreading, prescribed burning (to reduce woody vegetation) and revegetation of alkali meadow species where appropriate may allow recovery of ground-water dependent meadows at sites already transitioning to woody-dominated communities. Lack of action in arresting these transitions during early warning signs of composition shifts, will require more intensive action later on with the likelihood of success shrinking rapidly as the local species pool is reduced.

Corrections for multiple comparisons unnecessary

To proceed through the three-step process of determining a significant impact to justify whether it must be mitigated, first a determination of measurability must be made. A determination of measurability will be made if any of the relevant factors considered indicate even a small documentable change in vegetation cover or composition has occurred.

To determine measurability the change in vegetation must be determined to be statistically significant (p. 23, Box I.C.1.a.ii, Green Book). Statistical significance, however, is a binary characterization that depends on arbitrary designation of significance levels most traditionally set at 0.05. And the alpha level or type I error rate is not specified in the Green Book. The Technical Group has employed the 0.05 alpha level or type I error rate as the standard for statistical significance, meaning one out of twenty samples are expected to produce significant results assuming no change actually occurred. This false positive result may have serious life threatening consequences in certain contexts. The Federal Drug Administration is concerned about type I errors in clinical studies because they risk approving ineffective medicine. In the context of the Green Book vegetation monitoring no such consequences exist with single false positives because such a finding would not be considered a significant impact if the following years showed vegetation cover and composition comparable to baseline. What would be of concern is a persistent multi-year decline without periodic recovery to baseline conditions, especially in wet years. A few years below baseline during dry years is more or less expected, especially in wellfields where the water table is already depressed. Because a single false positive does not impose immediate mitigation requirements, the correction for multiple comparisons is justifiably unwarranted in this vegetation monitoring context. On the other hand, the false negative error rate is of greater concern because failing to characterize a change as significant when it is in fact significant could lead to inaction during a short period of opportunity for arresting an undesirable change in plant community structure and ecosystem function. The practice of categorizing changes as either significant or not significant in the measurability step based on the 0.05 alpha level should probably be replaced with agreed upon thresholds of cover and composition specific to the management area that serve as quantitative indicators for when certain management actions (e.g. cessation of pumping/ livestock grazing, prescribed burning, reseeding/outplanting native species) should be taken to maintain the ecological integrity of the managed ecosystems.

In recent years the Technical Group has informally used corrections for multiple comparisons to guard against false positives. In applied research, significance tests function mainly to assist assessment of the existence, sign, and magnitude of effects. The concern over the maximum probability that one or more type I errors might have been made in some arbitrarily defined set of tests in our view is unwarranted. Although the Dunnet's test is not as conservative as other corrections and yields comparable results to the two-sample t test, the reality that the multiple comparison correction impose a loss power with the addition of each year of data is an undesirable property for a monitoring program where each annual comparison to the reference values should not be influenced by the number of annual records in the data.

A more useful practice might be to focus on the magnitude of change, the precision of the estimate and the persistence or natural reversibility of the change. This approach would always simultaneously consider criteria from the measurability step (magnitude of change and precision of estimate) and degree of significance step (i.e. persistence of change, propensity to cross into an alternative ecological stable state) as a matter of annual reporting. A multiyear trend of declining vegetation cover that is on a trajectory for significant ecological change should invoke an attributability analysis as a matter of course to evaluate whether the apparent change can be arrested or reversed by changing water management practices.

Control and wellfield parcel designations

In this report, the control parcels and wellfield parcels were compared as groups in relation to their relative changes from baseline values. This comparison gives a broad evaluation of how wellfield parcels aggregated into one metric compare to the control parcels as a group. However, the individual parcel is the management unit at which assessment of significant changes in vegetation with respect to site-specific water management is performed. And for this scale, the control parcel designations are of less value. For these case-by-case analyses, there is no availability of a pure control in the experiment sense. To disentangle the influence of natural climatic variability with that from climate variability in addition to groundwater pumping, the Green Book, in describing certain steps in an attributability analysis, invokes making use of control sites to inform whether an apparent ecological change could be attributed to groundwater extraction or changes in surface water management. The idea is simple. If all ecological and environmental factors are equal between two sites except for differences in water gathering activities, the difference in the ecological response over time should be attributable to the difference in water management. The problem is that the ecologically similar historic meadows associated with the landscape position on the toe slopes of alluvial fans are heavily influenced by water gathering activities. The parcels assigned as controls are in general further east of the wellfields, have different landuse histories, edaphic characteristics, water table elevations, and biomass productivity. These eastern positions in the landscape are in general unsuitable to leverage as controls because of differences in water table and ecological similarity. Owing to a lack of a pure control that could be used to extract a quantitative effect of water management on vegetation, the logical approach to quantifying the effect of groundwater pumping on vegetation is to use a combination of groundwater modeling to quantify the influence of pumping and natural climatic variability on the hydrology of the site, and statistical modeling that describes the relationship between how cover varies as a function of depth to groundwater and surface water inputs. This relationship needs to be quantified over the full range of depth to water values possible for an ecological site that influence community composition and structure from high cover groundwater-dependent meadow to sparser cover shrub-dominated communities that persist on inputs from precipitation alone.

Conclusions

Vegetation conditions following the 2013 monitoring season can be summarized by four main findings. First, during the time period 1992-2013, the change profile of the wellfield parcel group was different from the control parcel group, with the decrease in wellfield group cover below that of the control group. Second, overall perennial cover and grass cover for wellfield parcels considered as a group in 2013 was significantly below baseline while grass cover in control parcels considered as a group was not significantly different from baseline. Third, within the wellfield parcel group, the relative proportion of shrub cover has significantly increased. Finally at the individual parcel level of analysis, 20 wellfield parcels were significantly below their baseline cover values and 24 wellfield parcels underwent significant increases in shrub cover.

Future directions

As part of the resolution of the Blackrock 94 dispute both Inyo County and LADWP will enter into a facilitated process with the Ecological Society of America (ESA) to develop and implement vegetation monitoring procedures and detailed analytical procedures for determining if a measurable change in vegetation has occurred, is occurring, or will occur. The monitoring methods and procedures shall be able to compare vegetation cover and composition to the vegetation cover and composition obtained during LADWP's initial vegetation inventory between 1984 and 1987. The monitoring methods and analytical procedures shall also be able to distinguish and recognize trends in vegetation cover and composition. The Parties shall use the vegetation monitoring and analytical procedures in determining if any change in vegetation cover or composition is measurable pursuant to Water Agreement IV.B and Green Book Section I.C. The progress of this ESA-facilitated process and any amendments to the vegetation monitoring program, data analysis and interpretation will be reported on in the 2014-15 annual report.

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Section 8 Appendices

Appendices are on the Water Department's web site: http://www.inyowater.org in the section containing Inyo County Water Department Annual Reports.

Appendix 1. Parcels sampled in 2012. Column headings indicate: wellfield or control status, *W/C*; plant community type based on Holland (1986), *Plant Community*; number of acres in the parcel, *Acres*; presence of baseline transect data, *BaseTransData*; presence of Greenbook line point data during the entire time period from 1992-2011, *LPT'92-2011*; and presence of line point data during the complete reinventory period from 1991-2011, *LPT'91-2011*.

Appendix 2. Figures 1-169 show mean perennial vegetation cover plotted over time for the 169 vegetation parcels sampled since 1991 using the Green Book Line Point monitoring program, and SMA average cover data (through 2011), and depth to water (through 2010). Asterisks depict years that perennial cover is significantly different from the baseline period (sampled between 1984 and 1987) using a weighted ANOVA followed by Dunnett's multiple comparisons. Thirteen parcels do not have raw transect data and thus could not be analyzed with ANOVA. In these cases, the baseline cover value is shown without error bars.

Appendix 3. Shrub, herb and grass proportion regressed against time in parcels with baseline transect data and at least 10 years of line point data. Columns indicate: wellfield or control parcel status, *W/C*; sample size, *n*; coefficient of determination, R^2; p-value, *p*; slope parameter estimate, *slope*; upper and lower 95% confidence interval for the slope parameter, *95% Confidence Interval*; direction (positive or negative) of the relationship, *Slope direction*. Bold text in p-value column, indicates significant regressions at $\alpha = 0.05$.

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