OMB Number: 4040-0004
Expiration Date: 8/31/2016

## Application for Federal Assistance SF-424

* 1. Type of Submission:
- [ ] Preapplication
- [x] Application
- [ ] Changed/Corrected Application

* 2. Type of Application:
- [x] New
- [ ] Continuation
- [ ] Revision

* If Revision, select appropriate letter(s):

* Other (Specify):

* 3. Date Received: 06/25/2015

4. Applicant Identifier:

5a. Federal Entity Identifier: 88-0488450

5b. Federal Award Identifier:

**State Use Only:**

6. Date Received by State:

7. State Application Identifier:

**8. APPLICANT INFORMATION:**

* a. Legal Name: Truckee Meadows Water Authority

* b. Employer/Taxpayer Identification Number (EIN/TIN): 88.0488450

* c. Organizational DUNS: 1044647680000

**d. Address:**

* Street1: 1355 Capital Blvd

Street2:

* City: Reno

County/Parish:

* State: NV: Nevada

Province:

* Country: USA: UNITED STATES

* Zip / Postal Code: 89520-3013

**e. Organizational Unit:**

Department Name: Natural Resources

Division Name:

**f. Name and contact information of person to be contacted on matters involving this application:**

Prefix: Mr.

* First Name: Laine

Middle Name:

* Last Name: Christman

Suffix:

Title: Resource Economist

Organizational Affiliation:

* Telephone Number: 775-834-8049

Fax Number: 775-834-8084

* Email: lchristman@tmwa.com

## Application for Federal Assistance SF-424

*** 9. Type of Applicant 1: Select Applicant Type:**

A: State Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

Bureau of Reclamation

**11. Catalog of Federal Domestic Assistance Number:**

15.514

CFDA Title:

Reclamation States Emergency Drought Relief

*** 12. Funding Opportunity Number:**

R15AS00047

* Title:

WaterSMART: Drought Contingency Planning Grants for Fiscal Year 2015

**13. Competition Identification Number:**

Title:

**14. Areas Affected by Project (Cities, Counties, States, etc.):**

Areas Affected by Project.pdf | Add Attachment | Delete Attachment | View Attachment

*** 15. Descriptive Title of Applicant's Project:**

Developing a Dynamic Drought Contingency Support Management System that Accounts for Information on Climate Change and Institutional Constraints

Attach supporting documents as specified in agency instructions.

Add Attachments | Delete Attachments | View Attachments

## Application for Federal Assistance SF-424

**16. Congressional Districts Of:**

* a. Applicant: NV-002 * b. Program/Project: NV-002

Attach an additional list of Program/Project Congressional Districts if needed.

Add Attachment | Delete Attachment | View Attachment

**17. Proposed Project:**

* a. Start Date: 08/01/2015 * b. End Date: 07/31/2017

**18. Estimated Funding ($):**

| | |
|---|---|
| * a. Federal | 109,095.00 |
| * b. Applicant | 181,638.00 |
| * c. State | 0.00 |
| * d. Local | 0.00 |
| * e. Other | 0.00 |
| * f. Program Income | 0.00 |
| * g. TOTAL | 290,733.00 |

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

☐ a. This application was made available to the State under the Executive Order 12372 Process for review on .

☒ b. Program is subject to E.O. 12372 but has not been selected by the State for review.

☐ c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)**

☐ Yes ☒ No

If "Yes", provide explanation and attach

Add Attachment | Delete Attachment | View Attachment

**21. *By signing this application, I certify (1) to the statements contained in the list of certifications** and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☒ ** I AGREE

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

**Authorized Representative:**

Prefix: * First Name: Jeff

Middle Name:

* Last Name: Tissier

Suffix:

* Title: Chief Financial Officer

* Telephone Number: 7758154234 Fax Number:

* Email: jtissier@tmwa.com

* Signature of Authorized Representative: Laine Christman * Date Signed: 06/25/2015

# BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 06/30/2014

## SECTION A - BUDGET SUMMARY

| Grant Program Function or Activity (a) | Catalog of Federal Domestic Assistance Number (b) | Estimated Unobligated Funds | | New or Revised Budget | | |
|---|---|---|---|---|---|---|
| | | Federal (c) | Non-Federal (d) | Federal (e) | Non-Federal (f) | Total (g) |
| 1. WaterSMART: Drought Contingency Planning Grants | 15.514 | $ 109,095.00 | $ 181,638.00 | $ | $ | $ 290,733.00 |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |
| 5. Totals | | $ 109,095.00 | $ 181,638.00 | $ | $ | $ 290,733.00 |

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## SECTION B - BUDGET CATEGORIES

| 6. Object Class Categories | GRANT PROGRAM, FUNCTION OR ACTIVITY (1) WaterSMART: Drought Contingency Planning Grants | (2) | (3) | (4) | Total (5) |
|---|---|---|---|---|---|
| a. Personnel | $ 105,901.74 | $ | $ | $ | $ 105,901.74 |
| b. Fringe Benefits | 49,244.31 | | | | 49,244.31 |
| c. Travel | 2,800.00 | | | | 2,800.00 |
| d. Equipment | 0.00 | | | | |
| e. Supplies | | | | | |
| f. Contractual | 109,095.00 | | | | 109,095.00 |
| g. Construction | 0.00 | | | | |
| h. Other | | | | | |
| i. Total Direct Charges (sum of 6a-6h) | 267,041.05 | | | | $ 267,041.05 |
| j. Indirect Charges | 23,692.00 | | | | $ 23,692.00 |
| k. TOTALS (sum of 6i and 6j) | $ 290,733.05 | $ | $ | $ | $ 290,733.05 |
| | | | | | |
| 7. Program Income | $ 0.00 | $ | $ | $ | $ |

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Prescribed by OMB (Circular A -102) Page 1A

## SECTION C - NON-FEDERAL RESOURCES

| (a) Grant Program | (b) Applicant | (c) State | (d) Other Sources | (e)TOTALS |
|---|---|---|---|---|
| 8. WaterSMART: Drought Contingency Planning Grants | $ 181,638.00 | $ | $ | $ 181,638.00 |
| 9. | | | | |
| 10. | | | | |
| 11. | | | | |
| 12. TOTAL (sum of lines 8-11) | $ 181,638.00 | $ | $ | $ 181,638.00 |

## SECTION D - FORECASTED CASH NEEDS

| | Total for 1st Year | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|---|
| 13. Federal | $ | $ | $ | $ | $ |
| 14. Non-Federal | $ | | | | |
| 15. TOTAL (sum of lines 13 and 14) | $ | $ | $ | $ | $ |

## SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

| (a) Grant Program | FUTURE FUNDING PERIODS (YEARS) (b)First | (c) Second | (d) Third | (e) Fourth |
|---|---|---|---|---|
| 16. WaterSMART: Drought Contingency Planning Grants | $ 90,818.98 | $ 90,818.98 | $ | $ |
| 17. | | | | |
| 18. | | | | |
| 19. | | | | |
| 20. TOTAL (sum of lines 16 - 19) | $ 90,818.98 | $ 90,818.98 | $ | $ |

## SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 157946

22. Indirect Charges: 23692

23. Remarks: Indirect charges reflect a 15% indirect rate



Funding Opportunity Number:R15AS00047 Received Date:Jun 25, 2015 05:36:54 PM EDT

OMB Number: 4040-0007
Expiration Date: 06/30/2014

# ASSURANCES - NON-CONSTRUCTION PROGRAMS



**PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.**

**NOTE:** Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.

2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.

3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.

5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).

6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C.§§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U. S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee- 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.

7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.

10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.

11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).

12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).

14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.

15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.

16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.

17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

19. Will comply with the requirements of Section 106(g) of the Trafficking Victims Protection Act (TVPA) of 2000, as amended (22 U.S.C. 7104) which prohibits grant award recipients or a sub-recipient from (1) Engaging in severe forms of trafficking in persons during the period of time that the award is in effect (2) Procuring a commercial sex act during the period of time that the award is in effect or (3) Using forced labor in the performance of the award or subawards under the award.

| SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL | TITLE |
|---|---|
| Laine Christman | Chief Financial Officer |
| APPLICANT ORGANIZATION | DATE SUBMITTED |
| Truckee Meadows Water Authority | 06/25/2015 |

**Standard Form 424B (Rev. 7-97) Back**

Areas Affected by Project:

Washoe County, Nevada

| | |
|---|---|
| **Title:** | Developing a Dynamic Drought Contingency Decision Support System that Accounts for Climate Change and Institutional Constraints |
| **Applicant:** | Truckee Meadows Water Authority |
| **Nature of Proposal:** | Update the Drought Contingency plan |
| **Project Manager:** | Laine Christman (Resource Economist)<br>Truckee Meadows Water Authority<br>1355 Capital Blvd.<br>Reno, NV 89502<br>Email: lchristman@tmwa.com<br>Office: (775) 834-8049, Fax: (775) 834-8003 |

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## Executive Summary

In the arid Western United States (U.S.), water has always been a scarce resource. A water purveyor is tasked with the responsibility of providing and maintaining reliable water supplies, in perpetuity, to ensure the well-being and economic vitality of stakeholders within its jurisdiction. Historically, water resource management plans have been quite static and reactionary to changes in water supply. As changes in the climate become increasingly prominent and erratic, managing for a sustainable supply of water resources has proven increasingly difficult. In order to achieve water supply sustainability in an uncertain future, the water purveyor must have a robust plan in place that specifies mitigation actions that insulate against future shocks to supplies and adapts to abrupt changes in short-term conditions. To design such a robust plan, the purveyor must incorporate scientific information regarding climate change in order to gain insight into both short-term and long-term shifts in environmental conditions in a given region. Moreover, the purveyor must consider current institutional constraints that regulate the allocation of water and can lead to a potential disconnect between what *should* be done and what *can* be done. In this proposal we propose a methodology that identifies both feasible and cost-efficient water management options for the Truckee Meadows Water Authority within the Truckee Basin, given multiple climate scenarios. Using a linear programming framework to optimize a suite of management options for each scenario, we will develop a decision support system that considers inputs on watershed-level climate change, water supplies, legislative and stakeholder constraints, and the costs of mitigation and response actions. The end result will be a updated Drought Contingency Plan that utilizes a dynamic decision support system which details a timetable outlining the optimal suite of actions to: i) provide adequate water resources; ii) satisfy cost recovery and all legal requirements; and iii) can adapt readily as conditions change within the Truckee Basin.

## Background

### *Truckee River Basin*

Like most of the western U.S., the Truckee Meadows region in Nevada is faced with increased demands for water and reductions in supply due to changes in climate and land-use. This arid region depends upon snow-fed water resources that are highly variable in terms of total supply year to year. Originating in California where the Truckee River flows out of the northern Sierra Nevada, the Truckee River is the primary water source for the Northern Nevada municipalities of Reno-Sparks, Fernley, and Fallon, is used by commercial interests in the largest industrial park in the United States on the outskirts of Sparks, feeds agriculture production and livestock grazing in the Truckee Meadows and Lahontan Valley region, and terminates in Pyramid Lake, which is owned by the Pyramid Lake Paiute Tribe and is home to an endangered (Cui-ui) and special status (Lahontan Cuthroat Trout) species. The Truckee River has many competing stakeholders and is one of the most litigated rivers in the U.S. Analysis of historical and current climate records within the Truckee River Basin indicate extreme weather events such

as drought and flooding will worsen in the foreseeable future (Dettinger and Cayan 1995; Regonda et al. 2005; Cayan et al. 2008). This creates significant challenges for water sustainability planning. Given unpredictability in water supply over time and competing water rights, drought contingency planning has proven to be a delicate balancing act between timing of water delivery to stakeholders and maintaining adequate storage for future use.

The main purveyor of water for municipal use in the Reno-Sparks regions is the Truckee Meadows Water Authority (TMWA). TMWA captures water from the Truckee River for delivery to approximately 93,000 residential, commercial, and wholesale service connections. At the end of 2014, TMWA merged with the Washoe County District of Water Resources (DWR) adding 31,000 new service connections to TMWA's service area. Figure 1 depicts TMWA's service area within Washoe County, Nevada. In addition to Truckee River, TMWA's surface water supplies come from TMWA's Privately Owned Water held in Independence Lake, Donner Lake, and federal reservoir (Stampede Lake). Figure 2 is an general overview of the Truckee Basin River system. As well as surface waters TMWA also has groundwater from which to augment supplies when river flows are diminished. The total amount of projected water demanded within TMWA's service area for 2015 is approximately 83,000 acre feet (or 27,045,668,441 gallons). In compliance with state law, TMWA produces a 20-year water resource plan (WRP). The WRP details how TMWA's resources are maintained to ensure demand is met in perpetuity. The WRP explains the current state of TMWA's supplies and provides analysis and future supply and demand projections. The WRP also contains a comprehensive conservation plan that includes supply-side and demand-side programs designed to promote efficient water use, as well as, a drought response plan that outlines *enhanced* conservation programs in response to drought conditions. The WRP requires review every five years and currently TMWA is in the process of updating its WRP, making this proposed project very timely.

To address potential effects on water sustainability from changing hydro-climatic conditions, two ongoing studies have taken aim at the issue to better facilitate drought resiliency in the Truckee River Basin. Both studies utilize watershed-specific climate change models for predicting likely future climate scenarios within the region. Given these scenarios, each study assesses the vulnerabilities to water supplies and subsequently the associated users to provide outreach and information to stakeholders that will enhance water management decision-making. The first project is a National Science Foundation grant funded study titled "Water for the Seasons" (WftS). This study is a joint effort by the University of Nevada, Reno (UNR) and the Desert Research Institute (DRI). As a relevant stakeholder in the region, TMWA is collaborating as a participant in the WftS study. The other study, titled the "Truckee Basin Study", is one of a series of studies conducted by the Bureau of Reclamation (USBR) as part of the WaterSMART Initiative. Since the USBR maintains the federal reservoirs TMWA relies upon, TMWA has maintained an ongoing relationship with the USBR, and therefore, is included as a collaborative participant in the USBR study as well.

**Fig. 1** Truckee Meadow Water Authority's Service Area in Washoe County, Nevada

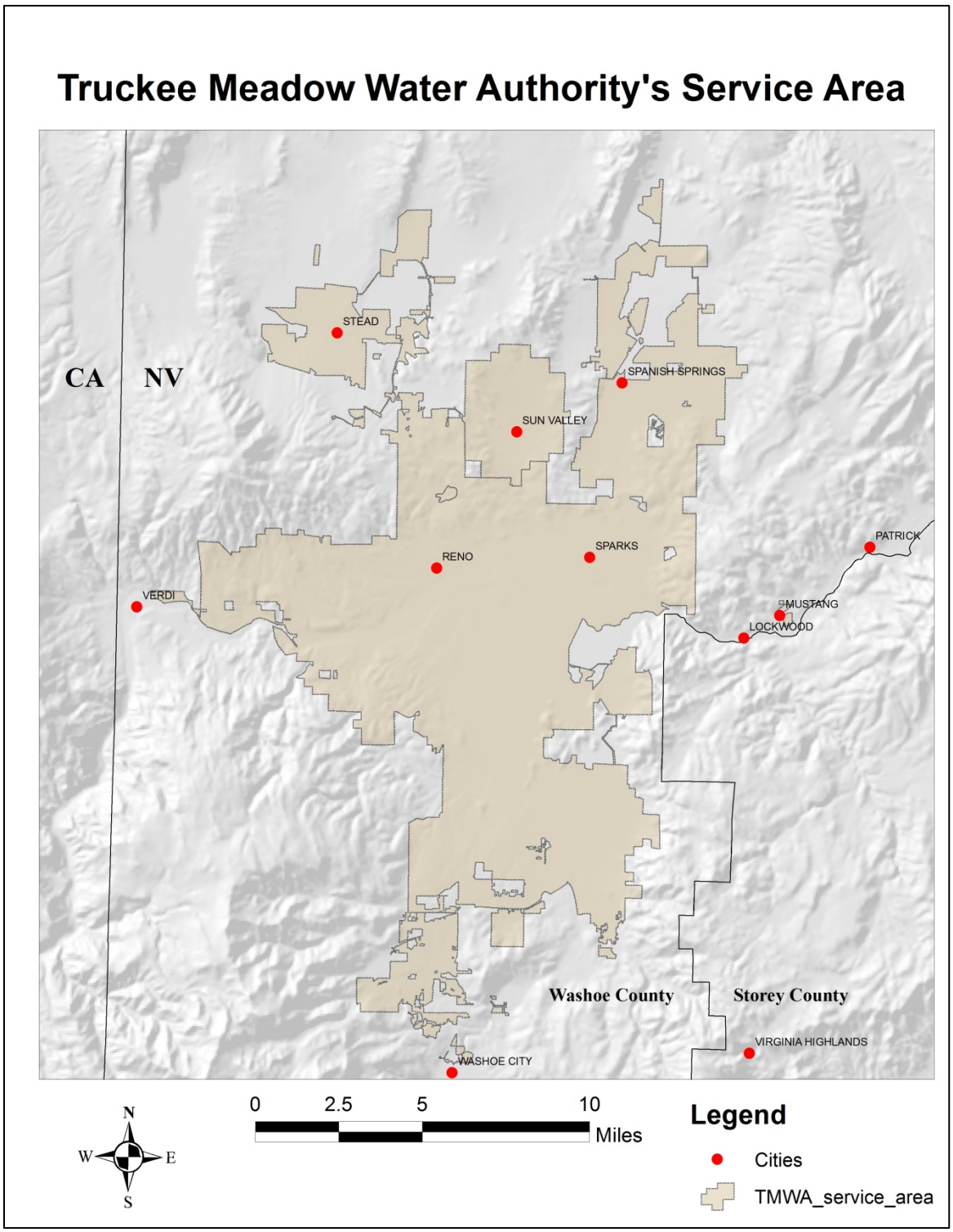
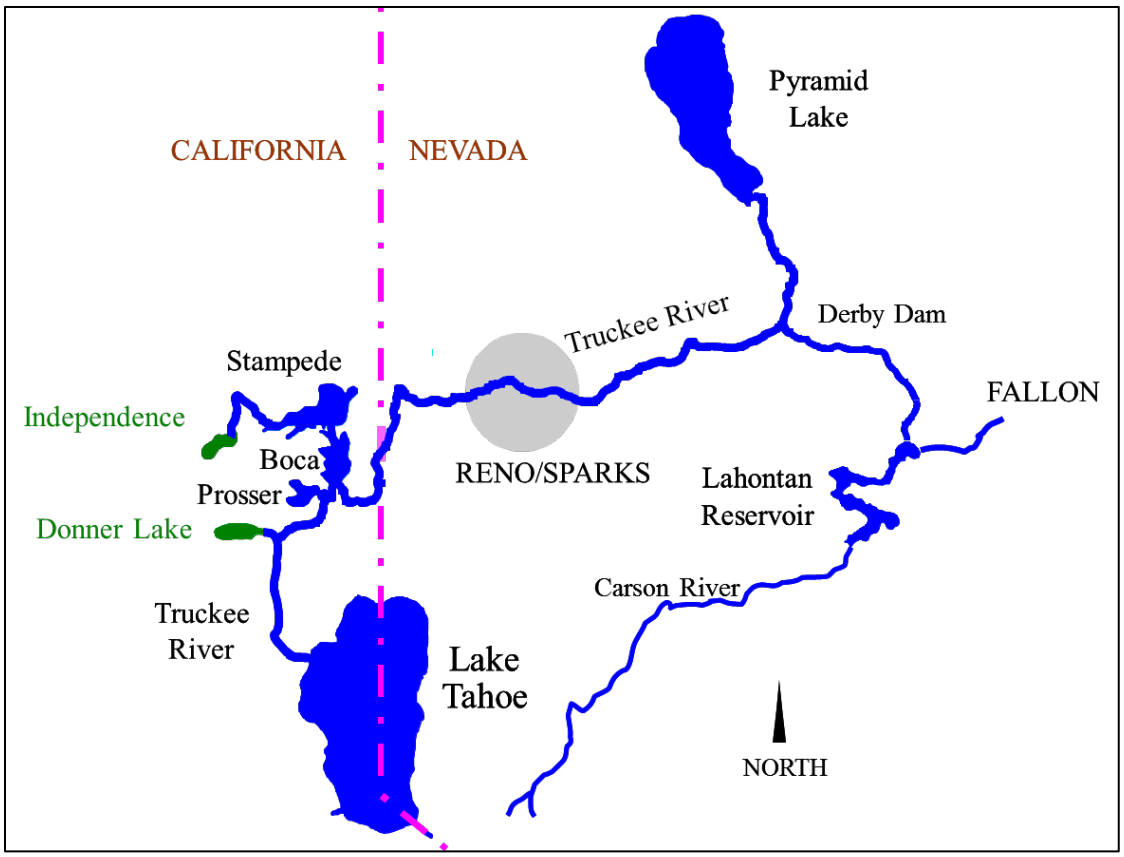


**Fig. 2** The Truckee River Basin System




*Water Rights*

The Truckee River originates in California at Lake Tahoe and flows to a terminal lake on Pyramid Lake Paiute tribal (PLPT) lands in Nevada. Given that the river flows through two states and an American Indian reservation, federal intervention was required to determine water rights. Over the last century of litigation, the water rights in the Truckee have become fully appropriated. Adjudications, such as the 1935 Truckee River Agreement and Orr Ditch Decree of 1944, specify water rights allocations to various entities, including the states of California and Nevada, TMWA, PLPT, the Truckee Carson Irrigation District (TCID). These adjudications also set minimum flow requirements for hydro-power generation and environmental preservation. Within the next year governance of Truckee River water operations will change when a new negotiated settlement, the Truckee River Operating Agreement (TROA), takes effect.

TROA was drafted to address uncertainties regarding stakeholder interests including: (1) whether the Truckee River reservoirs can be operated to accommodate the needs of the endangered and threatened species instead of providing water to water right holders; (2) the amount of water which California is entitled to use relative to the amount of water available for Nevada; (3) how California agencies charged with managing wildlife issues implement their regulatory programs such as increasing minimum releases or maintaining in-stream flows, and

would those efforts cause TMWA's reservoirs to be depleted increasing water shortages during a drought; (4) how the Orr Ditch Decree, which favors agricultural uses, adapts to changing uses or conversion of water uses from agricultural irrigation to municipal; (5) how tribal claims to higher priority water rights affect TMWA's water rights; and (6) what impacts all these unsettled issues have on TMWA's ability to maintain existing water supplies, grow its water supplies, and provide for the region's future demand for water.

TROA was signed by the Mandatory Signatory Parties (TMWA, PLPT, California, Nevada, the U.S.) on September 6, 2008. While Truckee River regulatory uncertainties may continue, TROA will provide for a new, more flexible framework for river operations that will allow parties to accommodate issues as they emerge. While providing incentives to the PLPT and the U.S. Fish and Wildlife Service that will accommodate maximum storage and improved fishery conditions, TROA will improve TMWA's ability to manage their share of the Truckee River water. In addition to preservation of historic water rights, the new agreement will expand TMWA's drought supply to 119,000 acre-feet and provide additional options that do not rely solely on storage so long as it does not interfere with the PLPT's right to all unappropriated water. While TROA will increase operational flexibility, it limits management actions to a given year. Thus, if climate change exacerbates drought persistence and/or the timing of precipitation amounts, additional decision-making analysis and a more dynamic Drought Contingency Plan (DCP) is required to increase the region's drought resiliency.

**Technical Description**

*Scope of Proposal*

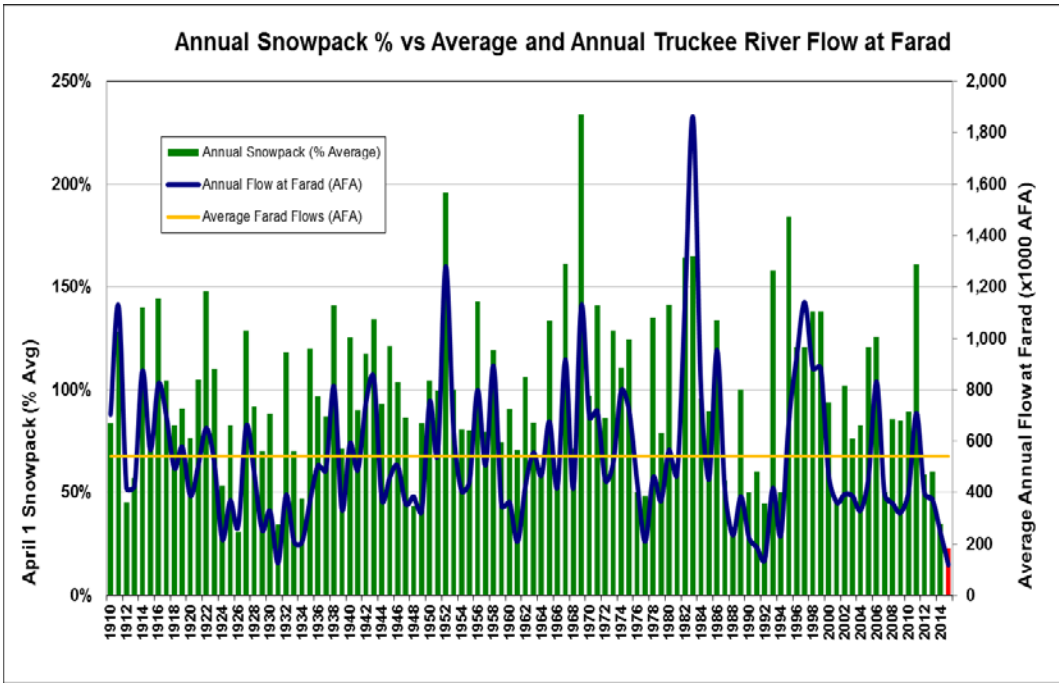
This proposal will address Task B (Update Drought Contingency Plan) of the WaterSMART funding opportunity R15AS00047. Given the existence of new scientific information related to future drought conditions and the impending changes and limitations to the laws governing stakeholders' water rights on the Truckee River, we propose to update TMWA's DCP by modifying TMWA's existing dynamic decision-support system (DSS) to account for new information on regional climate change and legislative changes (i.e., TROA). Through collaboration with the USBR and WftS investigators, TMWA intends to incorporate those studies' output into an optimization framework that will determine tangible solutions to persistent drought situations. The goals of this proposed study are as follows: i) for a given hydroclimatic trajectory, identify the institutional and legislative constraints that bind TMWA's current drought response plan; ii) determine management actions that optimize costs and benefits over time and satisfy legislative directives and operational feasibility; iii) collaborate with stakeholders, both internal and external to TMWA's jurisdiction, to identify mutually beneficial solutions; and iv) update TMWA's DCP to be dynamic in that it is able to address multiple hydroclimatic scenarios beyond those of historic record.

**Evaluation Criteria A**

*Need for a Drought Contingency Plan Update*

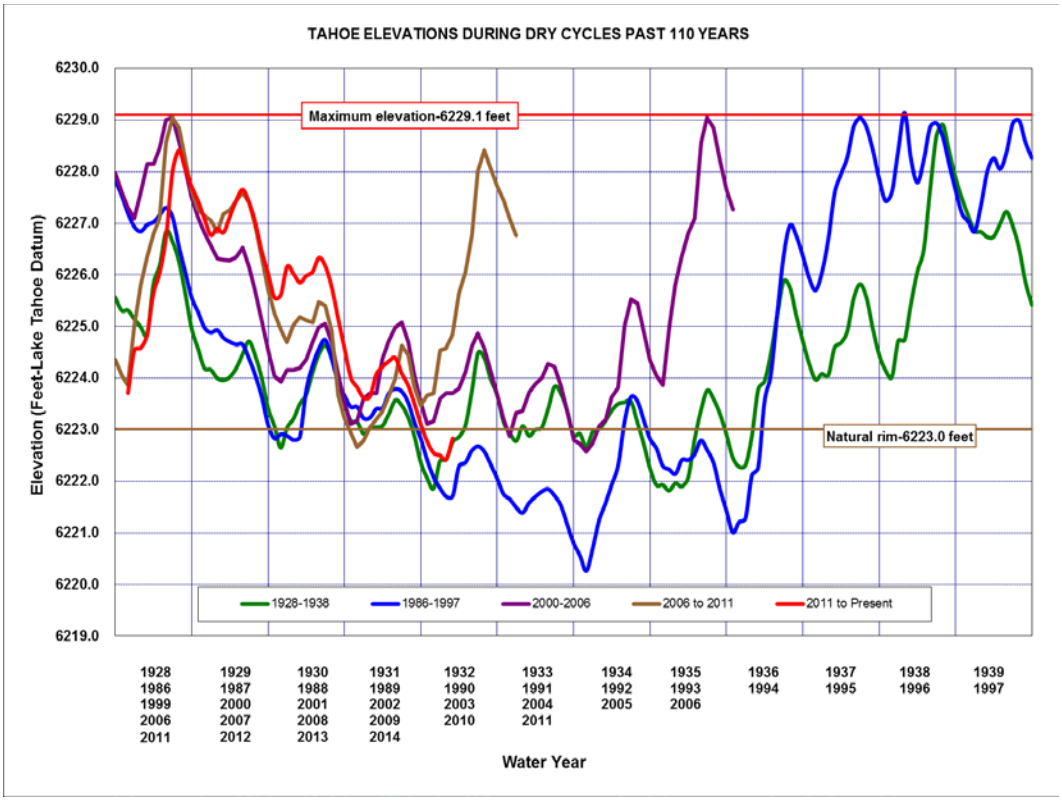
The majority of the Truckee River system is classified as a high desert environment, and the Truckee Meadows is situated at the eastern base of the Sierra Nevada Mountains. The water supply for the region is primarily spring runoff from the preceding winter's snowpack. According to historical records, the Truckee River Basin's snowpack and resulting river flows have always been variable. Prolonged periods of drought that last up to eight years are not uncommon (e.g., 1987 to 1994 drought). Conversely, it is not unreasonable for the region to experience flooding (e.g., the flood of 1997). Figure 3 provides a historical record of precipitation in the Truckee River Basin with the yellow horizontal line depicting the average flow over the past century.

**Fig. 3** Annual Snowpack vs River Flow in the Truckee River Basin,1910 - 2015



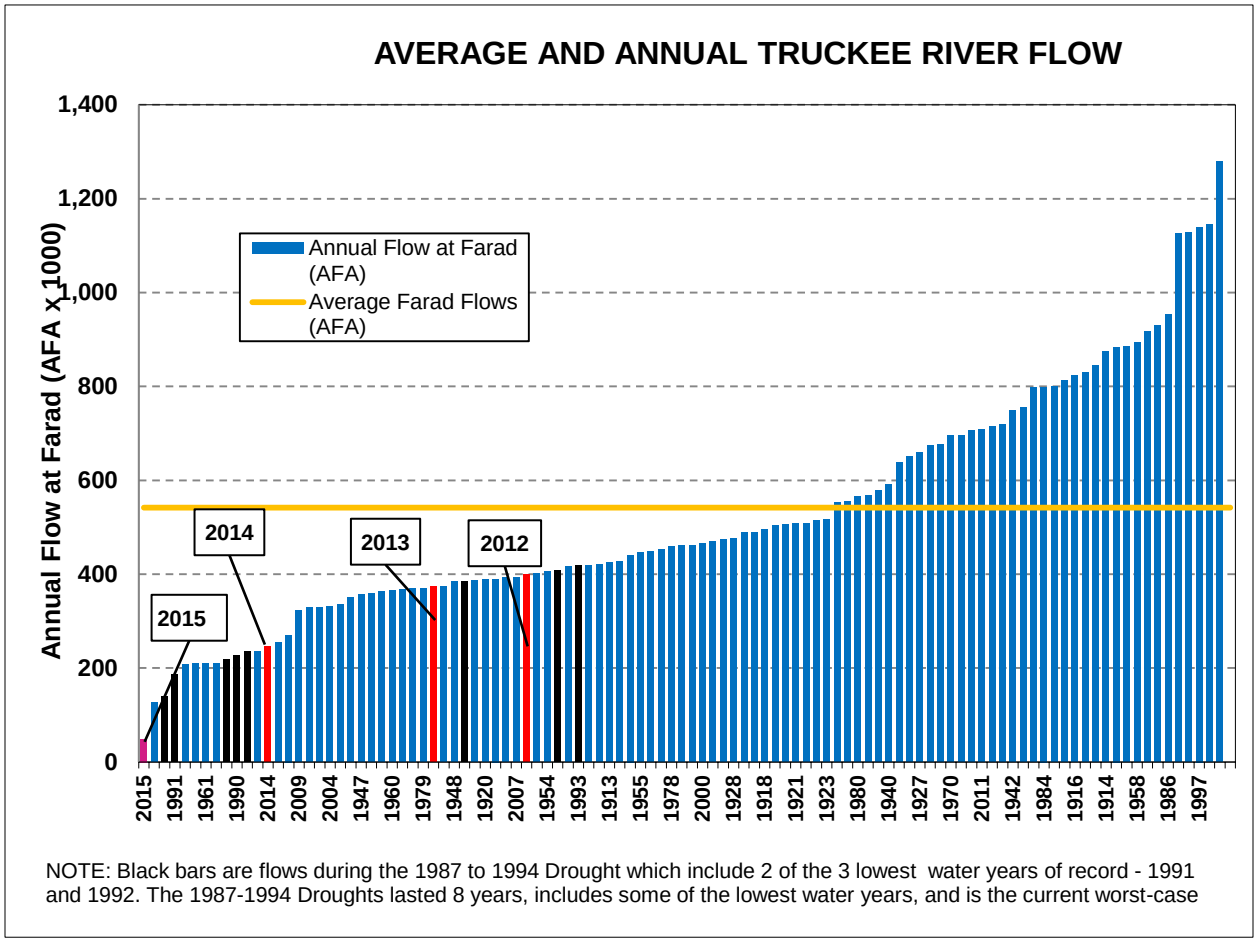

Lake Tahoe captures the majority of the snowpack that as it melts feeds into the Truckee River. The level of stored water in Lake Tahoe is directly affected by the variability in annual precipitation, making the elevation of Lake Tahoe a key indicator of the severity of drought cycles. Lake Tahoe serves as the largest storage reservoir for the Truckee Meadows area. Because of the large surface area of Lake Tahoe, it is particularly sensitive to evapotranspiration with nearly 50% of the water stored in the lake during normal years lost to evaporation. Figure 4, which depicts Lake Tahoe elevations over five persistent droughts between 1928 and 2014, illustrates the cyclical nature of dry and wet years in the Truckee Meadows.

**Fig. 4** Lake Tahoe Water Levels During Drought, 1928-2014




When Lake Tahoe is at its maximum elevation, it takes approximately three years of consecutive below-average snowpack to deplete the lake level to below its natural rim. Historically, as Figure 3 has shown even in times of prolonged drought, there are a few years when an above-average snowpack occurs. Moreover, as Figure 4 has illustrated the elevation of Lake Tahoe can be replenished to a level above the natural rim in a single season. However, the past four years (2012 to 2015) have exceeded the worst dry cycle on record, and 2015 had the lowest recorded snowpack on record resulting in consistently below-average flows in the Truckee River (see Figure 5).

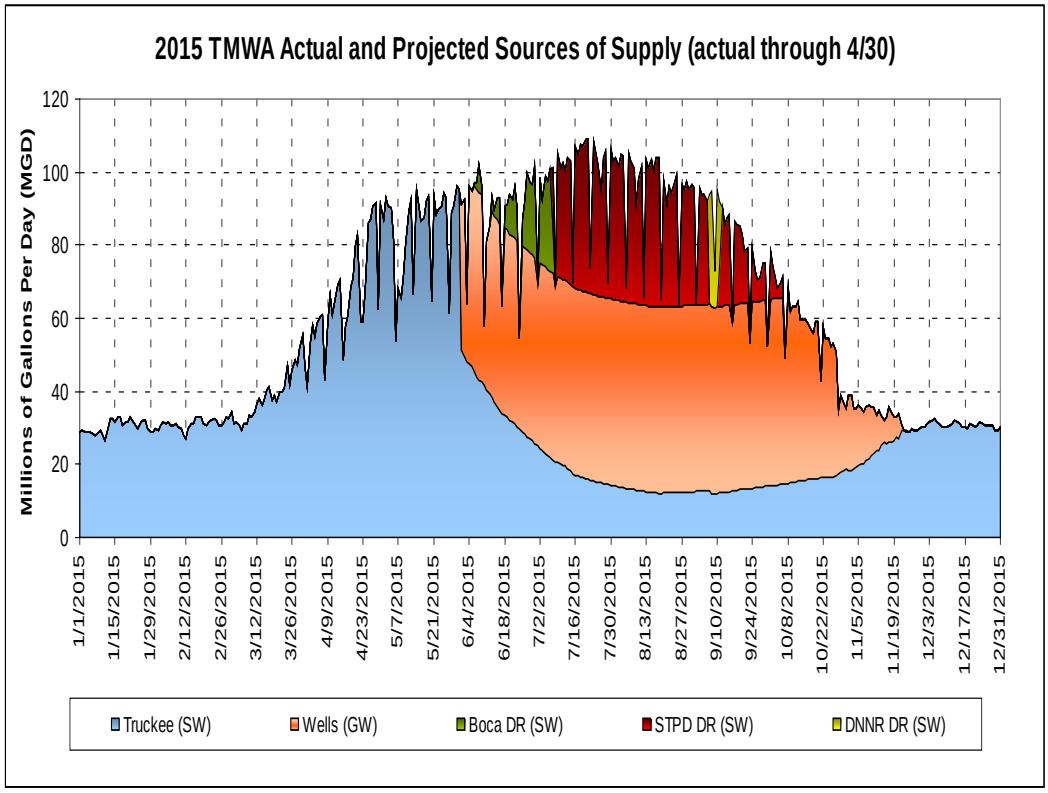
**Fig. 5** Average and Annual Truckee River Flow, 1997-2015




NOTE: Black bars are flows during the 1987 to 1994 Drought which include 2 of the 3 lowest water years of record - 1991 and 1992. The 1987-1994 Droughts lasted 8 years, includes some of the lowest water years, and is the current worst-case

As mentioned above, in addition to Lake Tahoe TMWA owns water rights in several other, smaller reservoirs in the Truckee River Basin, including Donner Lake, Independence Lake, and Stampede Lake (refer to Figure 2). During times when Lake Tahoe recedes below its natural rim, TMWA must use these reservoirs as well as groundwater to augment its supply. During dry periods, the intermittent above-average years help to bolster both the water level in Lake Tahoe and the additional reservoirs. However, if these intermittent wet years do not occur, a risk of storage depletion becomes a concern. Figure 6 illustrates TMWA's water supplies, by source, projected for 2015.

**Fig. 6** Water Supply Sources in the Truckee Meadows Area for 2015




Current climatological forecasts for the Truckee River Basin are bleak. Future projections in the Truckee River Basin estimate temperatures to rise by 5 to 6 degree Fahrenheit over the next century (Reclamation, 2011). Warmer temperatures are expected to increase evaporation and transpiration rates, so that the overall amount of runoff and recharge yielded from each unit of precipitation in the region is likely to decline (Overpeck, 2010). While there is some agreement regarding temperature rise, precipitation increases or decreases for the region are uncertain (Cayan et al., 2013), though precipitation variability and extremes are expected to increase as the climate system warms (Dettinger, 2011; Kunkel et al. 2013). These increases in precipitation variability are expected to develop on almost all timescales, including more severe storms and multi-year precipitation droughts (Cayan et al., 2013). In normal years, the natural reservoir capacity of Sierra Nevada snowpack is equivalent to roughly half of the total engineered reservoir space in the Truckee River Basin (Knowles and Cayan, 2004). Warming temperatures are changing the timing, form, and quantity of the snowpack, which is having significant impacts on TMWA and others that depend on both natural and engineered water reservoirs. As a result, warming temperatures and changes in precipitation in northern Nevada are expected to exacerbate sustained drought conditions (Cayan et al., 2010).

*Risks to Water Supplies*

Given the current climate projections in the Truckee Basin, there exists a range of future risks and vulnerabilities associated with changes to the basin's water resources. While impacts can be categorized into three groups, including risk to public health and safety, economic risks, and environmental risks, the risks associated with water supply decline are interdependent and must be managed for jointly.

Clean water is the foundation upon which a sustainable and a healthy society depends. Higher volumes of water improve water quality and promote higher quality drinking water. TMWA's commitment to quality drinking water is at the highest level, receiving presidential recognition in 2015[1]. Reduced Truckee River flows, warmer temperatures, or flooding result in higher turbidity, which increases the costs associated with water treatment operations. The evaluation of additional climate scenarios would inform the types of conditions under which TMWA's water treatment operations may experience adverse effects should such events become more prevalent. By maximizing river flows and optimizing operations, the proposed updated DSS and DCP will safeguard better TMWA's current level of excellence with respect to water quality in the face of a changing climate.

Within the Truckee Meadows area there are a host of economic sectors which rely upon a sustainable water supply. New residential and commercial development requires water right commitments in order to be permitted. As TMWA provides new will-serve commitments, this places additional demand on the current supply. In order to ensure water resource sustainability, TMWA must account for growth within its service area. Water users, such as TCID, rely on the Truckee River to sustain agricultural interests. Given that economic and population growth trends have been unstable since TMWA's DSS was first developed and new information is now available on climate conditions not experienced in the past century, an updated DSS and DCP will facilitate management in a new socio-economic and hydroclimatic environment. Through collaboration with external stakeholders via the Drought Planning Task Force, solutions that protect multiple stakeholders' economic interests can be identified. Such cooperative management will help foster trust among competing water users and reduce the likelihood of water-related tensions that result from drought

Maintaining adequate surface flows within the Truckee River has benefits beyond meeting consumer demand. Higher river flows benefit the riparian ecosystem as well. A variety of wildlife species depend on the habitat found in and along the Truckee River and Pyramid Lake including the endangered Cui-ui and threatened Lahontan Cutthroat Trout. The PLPT have a cultural connection to the preservation of these fish species. However, when drought diminishes natural river flows these federally protected species are prevented from annual spawning migrations. As well, recreational opportunities are enhanced through ecologic preservation. The

[1] http://www.waterworld.com/articles/2015/04/truckee-meadows-water-authority-receives-national-award.html

updated DCP will enhance TMWA's ability to maximize river flows during prolonged drought periods and protect these interests. Through the Drought Planning Task Force, TMWA will support WftS in outreach to stakeholders with vested interest in maintaining the river's ecologic services and work collaboratively to sustain riparian habitat given changes to the climate. Such cooperative management will help foster trust among competing water users and reduce the likelihood of water-related tensions that result from drought

*TMWA's Existing Drought Contingency Plan*

Identification of sustainable water resources for long-term planning purposes requires consideration of both the institutional and practical constraints. TMWA's current DCP includes a detailed conservation programs and a drought response plan. The conservation programs are a comprehensive list of supply-side and demand-side actions TMWA employs to promote efficient water usage annually. The drought response plan details a classification system for determining drought situations and provides a timetable for enhanced conservation programs, based on the severity level. The Appendix includes a copy of TMWA's most recent DCP.

Determination of drought situations are based on initial snowpack conditions and water levels in Lake Tahoe, starting in April, as well as, projections of the water supplies that will be needed (including river flows, groundwater, and reservoirs) over the course of the year. Currently TMWA delineates worst case conditions based on the longest recorded drought in the area (i.e., 1987 to 1994) and plans its drought storage and response actions with respect to those conditions. To date this strategy has proven sufficient to manage TMWA's water resources. Though proven effective, TMWA's current plan is highly static. Drought situations which trigger response actions are based upon one year projections. While the implementation of TROA brings additional flexibility to management in terms of storage capacity and timing of water release from reservoirs, the operational agreement only considers management actions within a single year.

If drought conditions worsen or precipitation patterns begin to change beyond current records as predicted, the existing plan may not be adequate for drought resiliency over a longer planning horizon. Moreover, there have been significant economic and legislative changes in the area. In order to adequately address these issues, TMWA must: i) update its existing DSS; ii) identify under which climate scenarios its existing plan fails to provide adequate water resources; iii) evaluate the constraints which limit its existing plan; iv) compare the costs and benefits associated with operating at the status quo versus implementing alternative strategies; v) define an optimal timetable of mitigation and response actions to ensure drought resiliency; and vi) develop a DCP that is dynamic in that it can account for and respond to multiple climate change scenarios.

**Evaluation Criteria B**

*Stakeholders*

Stakeholders who depend upon the Truckee River include sovereign tribal nations, agricultural producers, county governments, municipalities, industry, and environmental and recreational interests. These stakeholder groups represent the core issues embodied within the Truckee Basin region. Within TMWA's service area the internal stakeholders include residential, commercial, industrial, agriculture, and wholesale customers. TMWA engages with its internal stakeholder through a Standing Action Committee (SAC) that includes representatives from each of these customer classes. The role of the SAC is to convey specific interests to TMWA, discuss management strategies, and to relay relevant information regarding TMWA's operations and water supply conditions. SAC members help shape management approaches and communicate these efforts to constituents. TMWA will engage the SAC to recruit participants in the Drought Planning Task Force and provide the SAC with project updates and results as they become available. TMWA's governing body, the Board of Directors, is comprised of local government officials whom advise TMWA on operational and administrative policies. TMWA also works closely with the Western Regional Water Commission (WRWC). The role of the WRWC is to develop integrated water resource plans and foster support between all stakeholders within Truckee Basin. The WRWC is in strong support of this proposal and representatives will participate in the project and planning process as part of the Drought Planning Task Force (see the attached letter of support). TMWA's Board of Directors also supports this proposal and an Official Resolution will be submitted shortly after submission of this proposal. TMWA will also supply updates and results with both entities as the information becomes available.

The WftS study is engaging stakeholders (water managers and water rights holders) external to TMWA through a Stakeholder Affiliate Group (SAG). The SAG is comprised of representatives from the: PLPT; Fallon Paiute-Shoshone Tribe, TCID; City of Fernley; Carson Water Subconservancy; Tahoe Regional Planning Agency; USFWS Stillwater Wildlife Refuge, The Nature Conservancy; and TMWA. The role of the SAG is to work collaboratively with one another and with researchers to advise the research team about issues of importance to their communities pertaining to water supply/demand and provide continuous feedback to inform and refine climate and policy models. WftS researchers have communicated support of this proposed project and will provide TMWA with technical information on climate change scenario modeling (see the attached letter of support). Currently the WftS is conducting interview with representatives of organizations with water management responsibilities on the Truckee River and/or influence on decisions related to community climate resiliency. These organizations (approximately 75) include each of the already named stakeholders, in addition to others, such as the U.S. Department of Agriculture (USDA) Rural Development Office, the Nevada Governor's Office of Economic Development (GOED), Economic Development Agency for Western Nevada (EDAWN), and Northern Nevada Development Authority (NNDA), and relevant

County/City managers. Once identified, WftS will use the SAG to recruit representative to participate in the proposed project throughout the durations via the Drought Planning Task Force. In addition to model refinement and developing collaborative management strategies, SAG participants also will communicate the progress of the project to, and request feedback from, other key individuals and groups in the stakeholder communities they represent. Additionally, the USBR's regional office supports both the WftS study and the project proposed here. Its participation will provide technical feedback to define climate change scenarios, identify legislative constraints regarding federal reservoir operations, and support the development of a TMWA's DCP.

**Evaluation Criteria C**

*Dynamic Drought Decision Support System*

The goal of any drought response plan is to provide a framework for making decisions on how to manage the supply and demand for water in times of scarcity. This approach is really a limited scope of "If Then" type of statements. For example, if the river supply is less than water demand then turn on groundwater well until demand is met. Or if supply is reduced, start conservation programs to reduce water demand to where supply equals demand. For small water utilities or relatively simple systems with few sources of supply this process is fairly straight forward. For a more complex water system where there are many sources of supply, many different options for conservation, ability to manage different water supply options over time and evaluate decisions through time, a structured analysis using optimization methods is a requirement. Therefore a linear program (LP) is generally a cornerstone to any DSS. A DSS has three broad components or interfaces; 1) a data collection, management, and display component. 2) a model for processing and analyzing the data for decision making, and 3) a display of decisions to be made, expected results and impacts on the system. All LP models are based on a set of four basic and simple components:

- **Decision variables** representing the quantities to be determined.
- **Objective function** represents how the decision variable affects the cost or value to be optimized (minimized or maximized).
- **Constraints** represent how the decision variables use resources, which are available in limited quantities, also can be considered operation rules.
- **Data** quantifies the relationships represented in the objective function and the constraints.

In the past 115 years of recorded data TWMA's service area has experienced two eight-year droughts and several shorter multi-year droughts. Many of the policies that can be used for drought resiliency (i.e., maximum level of water commitment, effects of watering restrictions, and changes in institutional rules) are best evaluated using optimization models that account for multiple time periods. Since the region has a history of prolonged droughts, in 2006 TMWA developed a DSS capable of analyzing drought management policies and determining optimal

strategies for multiple, 10-year planning horizons. LP is powerful and proven management tool in water resource management (Shih and ReVelle, 1994; Nishikawa, 1998; Tu *et al.,* 2003; Draper *et al.,* 2003; Zhou *et al.,* 2013). The DSS developed by TMWA makes of an LP model that can be adapted to any water utility.

In TMWA's LP model, the **decision variables** are how much water to supply to customers from which water source in which month over a 10 year planning horizon. The **objective function** is to minimize the total cost of supplying water over time, subject to system's defined **constraints**. The constraints are defined as rules that govern how the system must operate. 1. Water supplied must equal water demand. 2. Upper and lower capacity constraints for each facility and source of water supply. 3. Policy effects, such as conservation programs. In addition to the very precise information on the lease cost plan for balancing supply and demand, the modeling provides very precise information on binding constraints or system limits that can require additional resources, facilities, or conservation plans necessary to balance the community's needs.

TMWA's DSS utilizes a familiar spreadsheet software (Excel) which allows for a user-friendly graphical interface and relies on a network flow model based on an LP framework. The use of a DSS as an easy to use, optimization tool is well suited to the development of a dynamic DCP. TMWA's DSS can optimize monthly water supply operation plans using historic, simulated, and projected river flows, providing information relevant to managing active droughts and to supply and operational planning for future or continued droughts. For example, in 2006 the DSS model simulated the operation of the water supply as expected. All of the rules that are imposed in the form of cost coefficients and system constraints behave in a manner consistent with current operational practices. The DSS was able to generate useful comparative results and provided clear answers to the following four case studies questions:

1. What is the maximum level of water commitment that can be made given current operational and institutional policies, for any specified level of reliability associated with a water commitment?

2. How are the operations affected by conservation policies such as watering restrictions and/or conservation goals?

3. If there is a change in river supplies as the result of climate changes, can the DSS be used to evaluate it effects?

4. Can changes in the operational or institutional rules/policies result in higher levels of commitments and/or improved system reliability?

The DSS found that in all cases, using 100 years of historic data, that TMWA's policies were sufficient for drought management at that time. However, since 2006, the TMWA's service area has experienced numerous social, economic, legislative, and institutional changes. For example, between 2004 and 2014 Washoe County population increased 13.5%. And during the

last economic recession, between 2008 and 2010 Washoe County experienced a net decrease in population of 1.7% with growth resuming in 2010. This was caused, in a large part, by the housing market collapse. Since 2008, legislative directives have led to the consolidation of DWR with TMWA, which once completed in December 2014 resulted in a 33% increase in water service connections from approximately 93,000 to 124,000. Moreover, the region is in year four of a drought with one of the driest years currently on record. The combined impact of recent population and service connection changes coupled with the current drought requires that the current DSS be updated and expanded to accurately model the current status of the Truckee Meadows region.

A graduate student is identified as the best candidate to update TMWA's existing DSS. Working with Shawn Stoddard (TMWA's senior Resource Economist and the developer of TMWA's DSS model) and Laine Christman (TMWA's Resource Economist who has experience in LP modeling and decision support tool development (Christman and Rollins, 2015)) the student will modify the DSS to reflect current socio-economic and legislative conditions within the area. An updated DSS will be able evaluate current management strategies for likely climate scenarios identified by the WftS research team that extend beyond the 100 years of historic data. The input constraints include: a) initial and anticipated water supply conditions; b) alternative management actions and associated costs; c) demand requirements; and d) institutional and legislative directives. For each climate scenario, the DSS will identify an optimal strategy and/or binding constraints. The results of the DSS will feed a dynamic DCP that outlines a timetable of actions TMWA can take for short-term response actions and long-term mitigation of risks associated with prolonged drought conditions.

*Drought Monitoring*

TMWA actively monitors snowpack, river flows, and surface and groundwater storage levels. Determination of a Drought Situation for a given year takes place each April. Currently these processes are monitored for the TMWA service area by Senior Hydrologist Bill Hauck, and Hydro-geologists Randy Van Hoozer and Christian Kropf. These Drought Situations are classified by current and projected monthly river flows and surface and groundwater storage available to the Truckee River system for the coming year (see Fig. 6). Population forecasting and projected regional growth is monitored by Stoddard and Christman in order to determine projected long-term demands. Under normal circumstances when TMWA does not need to employ its water reserves, the standard conservation (detailed in the Appendix) that promotes efficient water use to meet demand. However, if a Drought Situation is identified and drought reserves are *not* adequate to meet demand, TMWA employs additional measures to ensure customers reduce their water use. If it is determined that natural river flows will *not* be maintained through the rest of the year, a declaration is made of a Drought Situation. The severity of the Drought Situation dictates the type of and timing in which TMWA implements its enhanced conservation actions.

In a broader context, WftS analyzes drought conditions by constructing meteorologically realistic extreme climate scenarios as a basis for exploring the most disruptive aspects of the region's hydroclimate and water supply/demand conditions with stakeholders (including both the Truckee and Carson Rivers). The construction of extreme climate scenarios can be used as inputs to for policy that might mitigate consequences. The WftS's approach differs from most climate impact studies in that it focuses on relatively few scenarios (see Stern et al., 2013; Vermeulen et al., 2013), rather than hundreds of Global Climate Model (GCM) projections created to represent all possible future conditions. Extreme drought event scenarios will be constructed based on historical data that reproduce and extend conditions considered to be the most challenging and disruptive. Scenarios will be assessed for meteorological plausibility and placed in a broader context of possible futures by comparisons to detailed observations from the instrumental period, prehistoric reconstructions, or elements of simulated-climate scenarios provided by the IPCC Fifth Assessment projections in the CMIP5 archives (Taylor et al., 2012) in addition to iterative assessments with the SAG.

*Vulnerability Assessment*

This study will consider TMWA service area and Truckee River vulnerabilities resulting from: (a) sustained drought conditions, which are expected to be exacerbated by warming temperatures and changes in precipitation in northern Nevada (Cayan et al. 2010) and (b) the potential convergences of drought and flood events in rapid succession. The constructed scenarios will be designed in collaboration with stakeholders to identify conditions beyond which current natural or management systems reach potential tipping points, where the biophysical or socioecological system transitions into a new state (Marten, 2005). Constructing extreme climate event scenarios that begin from historical circumstances will enhance the confidence of TMWA DSS and increase TMWA's ability to examine and mitigate vulnerabilities. Examples of plausible mega-drought conditions can be constructed by resampling detailed representations of hydroclimatic conditions from the modern era or simulated climates to exaggerate the frequency of the drought conditions. Climate data used to construct the extreme scenarios from both climate change projections and historical-era data are available at daily resolutions and span 60 to 200 years with spatial resolutions from 6 to 35 km, with the USBR and USGS already working to statistically "downscale" the data to these resolutions (e.g., Maurer *et al*., 2007; Maurer *et al*., in review). Additional downscaling required will be based on recent improvements in the constructed-analogs downscaling method (Hidalgo *et al*., 2008; Dettinger, 2013) for long scenarios, and with regional-scale weather models (e.g., the Weather Research and Forecast model; Skamarock *et al*., 2008) for shorter-term scenarios or components.

The climate scenarios generated will be used to drive the Truckee River Basin hydrologic model with collaborative modeling and agent-based models of the policy impacts and responses providing a mechanism for evaluating real-world impacts and available responses. Climatic scenarios can be recast to address shortcomings in the original scenario designs, to test

robustness of solutions, or explore new hydroclimatic challenges. A process of structured iterated collaborative interactions between researchers and stakeholders will yield collections of hydroclimatic scenarios that current arrangements can sustain, scenarios that will stress the current system, and evaluations of proposed policy options. System level characteristics such as tipping points and associated early-warning indicators can be derived from the process.

We propose to have TMWA's technical experts (Hauck, Van Hoozer, and Kropf) to work with WftS to create parameters that reflect climate scenarios that pose vulnerabilities to regional water resources. Those team members will support the student in translating climate scenarios into inputs (e.g., projected snowpack, monthly river flows, etc.) over a multi-year time period, using the existing LP model developed by Stoddard in 2006. This allows TMWA to evaluate how the status quo operational framework and legislative constraints perform against conditions previously not experienced and identify feasible solutions over a 10-year planning horizon. Using this optimization framework allows TMWA to determine actions necessary to protect against worst-case conditions well in advance and identify the constraints to actions. This methodology will set in place a DSS from which a dynamic, long-term DCP can result.

*Mitigation Actions*

TMWA is constantly engaged in supply-side water management, typically by performing capital improvement projects (CIPs). These improvements related to water conservation and drought resiliency through maintaining TMWA's existing water storage infrastructure and continually expanding its capture capacity. By upgrading pipes, pumps, meters, and other water delivery components, TMWA is able to minimize water loss within the system. TMWA's system loss is approximately 6%, which is well below the national average of 14% (EPA, 2012). Efficient water storage and delivery is critical to water sustainability. By expanding water storage capacity, TMWA increases its drought resiliency through conjunctive management of surface water and groundwater resources. Unlike conservation actions taken in response to yearly Drought Situations, CIPs are multi-year, multi-million dollar projects that require a high level of planning and engineering well before ground is broke. Since flexibility in CIPs planning is limited, optimization of future CIPs within the context of climate change is critical to determining cost efficient drought resiliency.

With the support of one of TMWA's planning engineers (TBD), the graduate student will include CIP planning parameterization (i.e., costs and capacity requirements) in the LP model. This will allow the student to estimate the costs and benefits associated with the timing of alternative mitigation plans. With the support of TMWA's technical experts identified above, the student will ensure the LP output for each scenario is reasonable. Working with Christman and Stoddard, the student will compare the resulting model output against TMWA's existing multi-year CIP plan to determine the optimal suite of projects that maximizes mitigation of risks associated while minimizing costs. If optimal solutions are not solvable or feasible, the student, Christman, and Stoddard will identify the binding constrains that preclude them.

*Response Actions*

TMWA conservation programs taken throughout the year depend upon supplies projections which determine the current Drought Situation. These programs are crucial to maintaining drought reserves through demand management. They are also highly flexible in that the severity of the Drought Situation dictates the level and timing in which enhanced programs are used to further reduce demand over the course of a year. Working with Christman and Stoddard the student will parameterize the LP model to reflect TMWA's current conservation programs and optimize a timetable for enhancing programs in response to persistent drought conditions beyond what have been experienced previously. Working with Christman and Stoddard, the student will compare the resulting model output on conservation actions against TMWA's existing conservation actions. This analysis will help to determine if enhanced response actions are needed earlier in the year or if additional measures are necessary for a drought lasting longer than currently planned for or expected. From this an updated DCP that better defines the scope and timing of conservation programs needed to respond to more severe and prolonged droughts will be developed.

*Operational and Administrative Framework*

TMWA's operations are influenced by the daily water delivery needs of its customers and institutional and legal directives including minimum flow requirements and flood protection. Through optimizing mitigation and response actions over climate scenarios as proposed, TMWA will update its DCP to account for drought condition beyond those experienced over the past century. Based on the DSS results, Christman and Stoddard, along with the student, will evaluate how the existing operational and administrative framework would need to change to adapt to climate scenarios. Along with other TMWA staff mentioned above, they will identify the framework that is dynamic in its ability to facilitate both optimal mitigation actions and response actions over the course of a 10-year planning horizon. Through the Drought Planning Task Force, TMWA will collaborate with stakeholders to discuss institutional and legislative constrains that prohibit maximizing water resources and define mutually beneficial strategies that enhance Truckee River water resources and promote drought resiliency.

*Plan Update*

The DSS will allow an updated DCP to be created for a 10-year planning horizon. Due to changing hydroclimatic conditions as well as evolving socio-economic and legislative factors, a optimized plan beyond 10 years may not hold. Therefore every five years or, if significant changes to the area occur, the DSS will require updating and rerunning. Subsequently the DCP will be reevaluated and modified if the most recent DCP proves to be insufficient against the new information. TMWA staff members Hauck will continue to monitor water flows and surface storage, Van Hoozer and Kropf will provide groundwater modeling and well testing and analysis, and Stoddard and Christman will analyze water demand and service area growth

projections. Each year these conditions will be evaluated within the DSS framework to determine the appropriate actions necessary to ensure drought resiliency long-term. Also as sufficient new information on climatological process becomes available, the DSS will be updated accordingly. As well TMWA will continue engagement with stakeholders via the Drought Planning Task Force and other committees on an annual basis.

*Milestones and Deliverables*

| Milestones | Timeline |
|---|---|
| • Identify all participants in Drought Planning Task Force. | Year 1 |
| • Modify TMWA's existing LP model to reflect current institutional and legislative framework. | Year 1 |
| • Develop climate change scenarios in collaboration with WftS and stakeholders via workshops (held as needed). | Year 1 |
| • Presentation of final climate change scenarios to Drought Planning Task Force. | Year 1 |
| • Parameterization of hydrologic factors inputs given climate change scenarios. | Year 1 |
| • Calculate optimal solution to scenario-specific LP model for a 10 year planning horizon given. | Year 2 |
| • Identify optimal solutions and any constrains that preclude optimization. | Year 2 |
| • Compare optimal solutions to current Drought Contingency Plan. | Year 2 |
| • Present results to stakeholders and interest groups and discuss planning process and identify mutually beneficial strategies. | Year 2 |
| • Develop a Drought Contingency Plan based on Decision Support System results. | Year 2 |
| • Present updated DCP to Board of Directors and Western Regional Water Commission for formal adoption. | Year 2 |
| • Support WftS's outreach to stakeholders. | Year 2 |
| • Prepare project results for publication. | Year 2 |
| **Deliverables** | |
| • Report on climate scenarios and DSS parameters | Year 1 |
| • Documentation on Generalizable Decision Support System model | Year 2 |
| • Updated dynamic Drought Contingency Plan. | Year 2 |
| • Outreach materials on how climate change impacts water utility operations | Year 2 |
| • Presentations on dynamic water resource planning under climate change | Year 2 |
| • Publication on project results in peer-reviewed industry journal | Year 2 |

**Evaluation Criteria D**

*Nexus with the USBR*

Currently TMWA is a participant in two USBR studies. The first is the Boca Dam project which is a study to determine the risk to the Boca Dam (a federal reservoir which provides water TMWA has rights to) should a large earthquake occur. As a stakeholder to those stored waters, TMWA shares the cost associated with that study as well as any costs associated with dam enhancement. The second project, discussed in previous sections, is the Truckee Basin Study. TMWA is an active participant in providing information and input into the climate scenarios identified within that report (currently in draft form). The proposed project will benefit the USBR's Truckee Basin Study immensely by incorporating the information developed in that study (which applies to TMWA service area) directly into the TMWA's planning process. TMWA will also engage the USBR's regional office representatives in the DSS and DCP process by relying on them for technical assistance and feedback regarding the model's results.

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University of Nevada, Reno
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1 June 2015

To USBR WaterSMART Proposal Committee,

am writing on behalf to the *Water for the Seasons* (WftS) Project Team to express our strong support for proposal submitted by Truckee Meadows Water Authority (TMWA) to USBR WaterSMART: Drought Contingency Planning Grants for Fiscal Year 2015 (FOA: R15AS00047). Water for the Seasons (WftS) is a program that partners scientists with community water managers and water rights holders in the Truckee-Carson River System (TCRS), to explore new strategies and solutions for dealing with droughts and other extreme climate events. This four year study is funded by the National Science Foundation and the U.S. Department of Agriculture, and uses the TCRS in pilot study to learn how to best link science with decision-making in snow-fed arid land river systems. By working collaboratively with stakeholders, WftS aims to create a model for improving community climate resiliency, or ability to adapt to extreme climatic conditions (see attached Fact Sheet for additional details).

The WftS Project is collaboration between researchers and extension educators from the University of Nevada-Reno, University of Nevada Cooperative Extension, Desert Research Institute, U.S. Geological Survey, and Ohio University. We commit to sharing hydroclimatic models and drought climate scenarios with TMWA in support of this proposal. As a member of the WftS Stakeholder Affiliate Group (SAG), TMWA will also be engaging stakeholders from the Truckee River System in conjunction with the WftS SAG workshops and activities as they develop drought contingency decision tools and plans.

TMWA's proposed project would leverage the investments previously made by USBR WaterSMART in support of the Truckee River Study and the continued investments being made by NSF/USDA in support of the Water for the Seasons Project. The proposal by TMWA to develop of an interactive drought contingency plan will put into action the research findings and models produced by both of these projects and be a significant contribution to the stakeholder communities of the Truckee River System.

Sincerely,

Maureen I. McCarthy, PhD
Director, Academy for the Environment
Project Director, Water for the Seasons Project

**Academy for the Environment**
University of Nevada, Reno/MS-436, Reno, NV 89557
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University of Nevada Cooperative Extension

**Fact Sheet-08-00**

# Water for the Seasons:
## Sustaining Water and Climate Resiliency in the Truckee-Carson River System

Maureen McCarthy, Project Director, UNR Academy for the Environment; Loretta Singletary and Staci Emm, UNR Cooperative Extension; Kelley Sterle and Karen Simpson, UNR Graduate Research Assistants; Greg Pohll, Seshadri Rajagopal and Justin Huntington, Desert Research Institute; Michael Dettinger and Rich Niswonger, US Geological Service; Derek Kauneckis, Ohio University.

### Project Overview

*Water for the Seasons (WftS)* is a program that partners scientists with community water managers and water rights holders in the Truckee-Carson River System (TCRS), to explore new strategies and solutions for dealing with extreme climate events such as droughts and floods. This four year study is funded by the National Science Foundation and the U.S. Department of Agriculture, and uses the TCRS in a pilot study to learn how to best link science with decision-making in snow-fed arid land river systems. By working collaboratively with stakeholders, WftS aims to create a model for improving community **climate resiliency**, or ability to adapt to extreme climatic conditions.

### Truckee-Carson River System (TCRS)

The Truckee and Carson Rivers originate in the Sierra Nevada, and rely on winter snowpack and spring runoff as their primary sources of water (see Figure 1). The TCRS provides water for municipalities, agriculture, industry, recreation, tourism, fisheries and wildlife habitat.

In snow-fed arid land river systems such as the TCRS, the duration and timing of storms and runoff are critical factors that determine quality of life, making these communities particularly vulnerable to complex and unexpected drought and flood events.

The TCRS was selected for this pilot study because it is a prime example of a snow-fed, arid-land river system, which within a relatively small geographic area encompasses many of the major water management challenges common to communities in the American West.

### What is a Climate Resilient Community?

Climate-related extremes such as heat waves, floods, droughts and wildfires impact natural ecosystems, threaten food and water supplies, and put human lives and infrastructure at risk. In the Southwestern United States, climate change has already been linked to heat waves, drought and wildfires. Predictions for the future include declining water supplies, reduced agricultural yields, human health impacts and changes to snowpack (Garfin et al., 2014).


**Figure 1. Map of the Truckee-Carson River System.**

A **climate resilient community** is one that has developed the capacity to adapt or respond effectively to change in the face of extreme climate events. Its stakeholders understand, acknowledge, anticipate and absorb extreme climate events, and possess the capacity to reorganize as necessary to maintain essential community functions and identity (Moench, 2014).

## Who is Involved?

The majority of the TCRS lies within the State of Nevada, however, most of the system's precipitation falls and is stored within the State of California, leading to enduring conflict among TCRS stakeholders (Wilds, 2010). [Add something about TROA] For this reason, stakeholder involvement in the WftS project is especially important, and will improve the practicality and usefulness of the research (Bergold & Thomas, 2012).

Researchers from the University of Nevada, Reno, University of Nevada Cooperative Extension, Desert Research Institute, U.S. Geological Survey and Ohio University will work with a **Stakeholder Affiliate Group (SAG)** to guide research activities during the four years of this program. The SAG will include representatives from many of the diverse communities that use and depend on water from the TCRS, including federal, state and local water managers, representatives from the Fallon-Shoshone Tribe and Pyramid Lake Paiute Tribe, agricultural producers, natural resource managers, urban planners and economic developers. The diversity of the SAG is important to the integrity of the research, as climate change and extreme climate events are likely to affect each group differently.

## Project Goals

Water for the Seasons will create a framework for engaging diverse stakeholder communities in the effort to improve water sustainability and climate resiliency in the TCRS. WftS does not aim to resolve historical water allocation disputes, but to enhance knowledge for water managers and water right holders to adapt to a changing climate. The result will be an integrated suite of models that can be used for planning purposes by water managers, agricultural producers and municipalities in snow-fed arid land systems around the world. **Goals of WftS are:**

**Goal 1.** Use stakeholder knowledge to define extreme climate scenarios that impact water supply and demand.

**Goal 2**. Model water supply and demand outcomes that result from these climate scenarios.

**Goal 3.** Integrate human decision-making with hydroclimatic models to understand water sustainability and climate resiliency.

**Goal 4.** Assess the transferability of the TCRS models to snow-fed arid land systems globally.

## Developing a Collaborative Model

WftS will work with the SAG to examine the resiliency of natural and built environments in the TCRS under extreme climate scenarios and land-use changes. Interviews with TCRS stakeholders will provide diverse perspectives and historical knowledge about droughts, floods and other extreme climate events.

The suite of models will integrate:

- Surface and groundwater data, evapotranspiration rates and climate variables.
- Reservoir storage and water release options.
- Water use priorities under different climate scenarios.

By using an iterative process for broad stakeholder engagement, WftS will integrate human decision-making with hydrology and climate models that encourage communities to adapt to climate change.

## Desired Outcomes

WftS stakeholders have listed the following desired outcomes:

*Resiliency Planning Outcomes:*

- Generate climate change options and information to help decision-makers better manage water resources during extreme climate events.
- Improve efficiency of water rights transfers on individual farmers' lands to better use scarce water supplies.

*Climate Adaptation Outcomes:*

- Evaluate climate change impacts on the river system and surrounding communities.
- Produce information to help with climate adaptation strategies.
- Develop groundwater projections and estimate water balances for the region.
- Provide "big-picture" supply/demand scenarios under different climate change scenarios.

*Decision-making Process Outcomes*:

- Develop a regional stakeholder group, and increase collaboration and communication among stakeholders.
- Educate the public and stimulate public discussion.

## Want to know more?

Program updates and information are available via the UNR *Academy for the Environment*'s website: http://environment.unr.edu/academy/waterfortheseasons.html and Cooperative Extension's *Living with Drought* website: http://www.unce.unr.edu/programs/sites/drought/.

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# WESTERN REGIONAL WATER COMMISSION

NORTHERN NEVADA WATER PLANNING COMMISSION

P.O. Box 11130, Reno, NV 89520 · Tel: (775) 954-4665 · Fax: (775) 328-3640


June 15, 2015

Dear Review Committee,

I am writing to express support for the Truckee Meadows Water Authority's (TMWA) proposal titled "Developing a Dynamic Drought Contingency Decision Support System that Accounts for Climate Change and Institutional Constraints" for submission concerning Task A of the Bureau of Reclamation's (BOR) Water Smart Drought Contingency Planning Grant. Since its formation in 2000, TMWA has excelled in developing a proactive approach to water management and drought planning and this is a good opportunity to further its planning process.

This is a timely funding opportunity for two reasons. First, it extends TMWA's proactive drought planning process within a much more long-run context. Second, it leverages results from two existing climate change studies: BOR's Truckee Basin Study, for which the draft final report is in review, and a collaborative, National Science Foundation-funded project between the University of Nevada Reno (UNR) and Desert Research Institute (DRI), titled "Water for the Seasons".

The Truckee Basin Study conducted, and the Water for the Seasons study is currently conducting, research regarding watershed-specific climate change within the Truckee River Basin and each study produces tentative, future climate scenarios. TMWA's incorporation of these studies' results and its collaboration with other water users and stakeholders to update TMWA's drought contingency plan is important in pursuing drought resiliency and water sustainability based on the best scientific data available. I am certain this project can mesh useful research outcomes and the water management process. The Northern Nevada Water Planning Commission would be interested in participating as a stakeholder in the planning process.

Sincerely,

Jim Smitherman,
Program Manager
Western Regional Water Commission
Northern Nevada Water Planning Commission

JS:jld

Laine,
At your request, I'm providing this message in support of TMWA's application for a SECUREWater Drought Contingency Plan which I understand TMWA is current preparing.

As you know, Reclamation's Truckee Basin Study, under development for almost 3 years, is nearing completion. TMWA has participated in the development of the basin study since its inception as a Partner agency. The Truckee Basin Study has identified a number of potential climate change impacts to water supplies and demands across the Truckee basin, from its headwaters near Lake Tahoe, to its terminus at Pyramid Lake. Based upon a comprehensive assessment of potential future climate conditions, there is a broad consensus that temperatures will rise and precipitation patterns will become more variable in the Truckee Basin. Longer droughts may be become more commonplace and the periodic floods experienced in the Truckee River basin may increase in frequency.

The Truckee Basin Study was developed specifically to investigate potential climate changes to the Truckee system and to identify a range of adaptation strategies to identified climate impacts. The Truckee Basin Study developed over 40 different adaptation strategies with the cooperation and input from stakeholders and the Partner agencies like TMWA, Tahoe Regional Planning Agency, Placer County Water Agency and the Truckee River Flood Management Authority. Several of the adaptation strategies identified were in response to anticipated longer drought periods and a need for improved drought resiliency, including conservation, storage and conveyance improvements.

TMWA's application for SERCURwater funding for a proposed Drought Contingency Plan is entirely consistent with several of the strategies and follow-on activities suggested in the Truckee Basin Study. We wholeheartedly support TMWA's application for funding for this important and timely project and urge the reviewers of TMWA's funding application to favorably consider TMWA's application.
Please feel free to contact me if any questions regarding the Truckee Basin Study or our support for TMWA's application for funding.
Thanks,
--

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# TRUCKEE MEADOWS WATER AUTHORITY

# 2015 DROUGHT-YEAR RESPONSE PLAN

**Submitted to:**

**NEVADA DROUGHT FORUM**

**May 1, 2015**

## INTRODUCTION

In response to Governor Sandoval's establishment of the Nevada Drought Forum on April 8, 2015 to assess the drought in Nevada, the Truckee Meadows Water Authority ("TMWA") submits, pursuant to that order, its current plans to enhance its conservation activities and programs for calendar year 2015.

As the largest water purveyor in Washoe County, serving approximately 90% of the region's municipal water customers, TMWA is a key player in developing the region's responsible water use mission and takes the lead role in implementing programs that support that mission. TMWA has a comprehensive and extensive demand-side management program ("DMP") outlined in Chapter 5 of its 2010-2030 Water Resource Plan. The DMP includes a section that describes in general terms how the utility responds to consecutive, low-precipitation years in a drought cycle with enhanced conservation activities. As water supply conditions oscillate between normal and below normal snowpacks, TMWA and its customers are able to respond to the degree and duration of conservation warranted by supply conditions. TMWA continually assess the benefits from these measures and may modify programs to reflect new practices and technologies. Success of a program is evaluated differently depending on the type of program, and may be measured by customer participation, water saved, estimated reduction of peak day usage, and visibly improved water management practices.

The region's 2015 snowpack was the lowest in recorded history. On April 1, 2015 snowpack in the Truckee River Basin was 16% of average, and snowpack in the Lake Tahoe Basin was 0% of average. As a result, the 2015 water supply outlook is bleak.

- The most recent runoff forecasted for the Truckee River is 37% of average between April and July. This is the most likely projection assuming average hydrologic conditions over the next couple of months. And the forecast for Lake Tahoe is also below average once again. Tahoe's projected rise this year is just 26% of average or 0.45 feet between now and its peak.
- Upstream reservoir storage is worse than last year through this same point in time. As of this writing the elevation of Tahoe is 6222.85 feet, which is 0.15 feet below the invert of the outlet gates (-18,190 acre-feet of storage); releases of water into the Truckee River are impossible under these conditions. Last year on this day, the elevation of Lake Tahoe was 6224.34 feet elevation (or 1.34 feet above the rim) and there was 162,700 acre-feet in storage behind the dam. Forecasts indicate that the spring run-off season has passed and only natural (or base) flows will be seen in the river as no water will be available to augment required river flows from any reservoir on the Truckee system.

In preparation for these types of dry years, TMWA builds up water in its upstream and groundwater reserves to have available to meet customer demands. TMWA's privately owned stored water ("POSW") in upstream reservoirs to start the summer of 2015 is over 26,000 acre feet which is about 1,500 acre feet less than 2014. TMWA is enhancing its existing DMP to seek

at least 10 percent reduction in water use in 2015 in the event the 2015/2016 winter is another low-precipitation snow season.

## 2015 ENHANCED DEMAND MANAGEMENT PLAN

### *A. Situation Analysis and Planning Criteria*

Developed for prior water resource plans, the following classification table is a simplified representation to improve customer understanding between climatologically induced droughts and its effect on Truckee River water supplies. This classification system suggests enhancements to the annual, baseline conservation measures that can be deployed depending on the water available from the Truckee system as a drought cycle progresses and oscillates year-over-year.

| | *Non-Drought Situation* | *Drought Situation* | |
|---|---|---|---|
| | Supplies are Normal | Supplies are Adequate [River Flows Drop-Off After Labor Day] | Supplies are Impacted [River Flows Drop-Off Before Labor Day] |
| | a | b | c | d |
| A *Assigned Day Watering* | | | | |
| Monday | No water day | No water day | No water day |
| Even addresses: | Tuesday, Thursday and Saturday | Tuesday, Thursday and Saturday | Tuesday, Thursday and Saturday |
| Odd addresses: | Wednesday, Friday, and Sunday | Wednesday, Friday, and Sunday | Wednesday, Friday, and Sunday |
| B *Water Day Time Restrictions* | | | |
| Between Memorial Day and Labor Day | 12 to 6 PM | 12 to 6 PM | 11 AM to 7 PM |
| C *Public Education & Advertising* | Standard programs | Standard programs | Increased programs |
| D *Water Waste Prevention* | Standard enforcement | Standard enforcement | Increased enforcement |
| E *Other Actions* | | | |
| Though not inclusive, these enhancements could be deployed depending on the severity of the circumstances and the potential impact to supplies | | | Expand water day time restrictions<br>Reduce the number of watering days<br>Set daily watering allotments<br>Drought rates |

NOTE: The term "supplies" refers to (1) Truckee River water available from natural flows plus releases from Federally operated reservoirs to support Floriston Rates and (2) TMWA's Privately Owned Stored Water held in Independence and Donner Lakes and Federal reservoirs.

Based on current conditions, the Truckee Meadows is in a Drought Situation with reserve supplies being impacted (column “d”).

The above classification system is further delineated to provide general guidelines on when enhanced “DMP” measures need to be deployed and when, at the least, associated

media-messaging on water supply conditions and enhanced calls for reductions in water use need to begin. Those guidelines are presented below.

| State of Supply to Truckee Meadows Service Areas | | Month May | Jun | Jul | Aug | Spt | Oct |
|---|---|---|---|---|---|---|---|
| **Non-Drought Situation** | | SDMP | SDMP | SDMP | SDMP | SDMP | SDMP |
| **Drought Situation** | | | | | | | |
| Supplies Adequate (Loss of Floriston rates after Labor Day) | | SDMP | SDMP | SDMP | SDMP | SDMP | SDMP |
| Supplies Impacted | Level 1 | SDMP | SDMP | EMB | EDMP | EDMP | SDMP |
| (Loss of Floriston rates before Labor Day) | Level 2 | SDMP | EMB | EDMP | EDMP | EDMP | SDMP |
| | Level 3 | EMB | EDMP | EDMP | EDMP | EDMP | SDMP |

SDMP - standard conservation program, upstream reserves not used

EDMP - enhanced conservation program, upstream reserves used

EMB - enhanced message begins at least a month prior to loss of Floriston Rates

Based on the preceding discussions and current projection of 2015 Truckee River supplies for the region, the current classification is for a drought situation and supplies (i.e., upstream reserves and underground reserves) to be impacted at Level 3. TMWA will take steps in 2015 to make customers more aware of current conditions including the fact that low precipitation years have just as severe an impact on upstream reservoir supplies as they do on underground supplies.

### *B. Communication Objectives and Strategies*

Specific communications and actions TMWA staff began implementing in March 2015 are delineated below. The primary objectives of TMWA's DMP include:

1) Targeting at least a 10% reduction in water use during the irrigation season months beginning June through October
2) No watering between 11 a.m. and 7 p.m. from Memorial Day through Labor Day
3) Increased enforcement of no-waste
4) Increased frequency of advertising and messaging about current supply conditions.

Specific measures to achieve TMWA's primary objectives are grouped under three headings: System Management, Public Education and Other Demand Management Measures. The specific measures that comprise TMWA's DMP, the target audiences, and the primary benefit to TMWA of each program are summarized in this table:

| DMP Category | Primary Benefit | Target Audience |
|---|---|---|
| A. System Management | | |
| Coordination of Treated Effluent Use | 3, 4 | Irrigation |
| Leaks and System Repairs | 1, 4 | All users |
| Meter Replacement | 1 | All users |
| Non-Potable Water Service | 3, 4 | Irrigation |
| System Pressure Standards | 1, 4 | All users |
| Unauthorized Use of Water | 1, 4 | Construction |
| B Public Education | | |
| Assigned-Day Watering | 1, 2, 3, 4 | All users |
| Distribution of Water Savings Devices & Information | 1, 2 | Residential |
| Education Programs for Kids | 2 | Children |
| Homeowner Workshops | 1, 2 | Residential |
| Landscape Retrofit | 1, 3 | Irrigation & residential |
| Water Audits | 1, 2 | Residential & business |
| Water Waste Prevention | 1 | All users |
| C. Other Measures | | |
| Codes and Ordinances | 1 | All users |
| Program Management and Droughts | 1, 2, 3, 4 | All users |
| Program Management and Emergency Supply Conditions | 1, 2, 3, 4 | All users |
| Water Management Programs | 1, 3 | Large water users |
| Water Rates | 1, 4 | All users |

1 - Reduces water waste
2 - Education
3 - Peak day savings
4 - Minimize operation and maintenance to distribution facilities

**Objective 1--** To communicate the water conservation target (Reduce water use by ***at least 10%***) to meet water supply goal

Measurable targets, as proposed, are an important part of communications during a drought. Included in the messaging will be descriptions or indicators to water users as to how much their water use has changed in response to diminishing flows of the Truckee River and/or preserving groundwater.

**Objective 2--** To promote responsible water use and best practices as identified by Nevada Landscape Association (NLA) and University of Nevada Cooperative Extension (UNCE).

Responsible water use needs to be practiced at all times by all residents and businesses. This message will be continually communicated—that the Truckee Meadows is an arid, high-desert environment. Responsible water use can mitigate some of the drought impacts. TMWA will be partnering with the NLA and UNCE to provide more information on how residents and businesses can use less water than usual and still preserve their landscaping.

**Objective 3--** To provide information on water supply and drought conditions that will foster the understanding that, "we are all in this together."

Better decisions are made and behaviors change when data and information are provided that justify conservation recommendations. Knowledge of TMWA's water system and water supply help people connect their efforts to overall results.

**Target Audiences:**

This year, messages will be delivered with varied communication methods and timing to the audiences identified below. For each audience, the message is educational and tailored to how they use water. Education about best practices, drought updates and where interested persons can learn more about these topics forms the basis of the messages.

- TMWA customers—residential (homeowners 25+ years)
  Advertising campaign-mass media, news coverage, direct customer communications (bills, emails, etc.), social media

- TMWA customer—commercial
  Direct communications, advertising, news coverage

- TMWA customers—Home Owners Associations (HOAs)
  Direct communications

- Domestic Well Owners—direct communications

- Community at large
  Adverting campaign, news coverage, social media

- Local media
  Direct communications

**Communication Strategies:**

Communication strategies are overall approaches used to achieve stated objectives and are explained below.

Advertising Campaign: The media buy is expanded this year and will be based on a strategic media mix to effectively reach TMWA's target audience of age 25+, single family homeowners. Advertisements will be placed in local print, radio, television, billboards, venues and social media channels. Added value (contributed space) is sought on all placements either in more space, website content, on-air contests, etc. Television stations will be offering weather sponsorships where forecasters can provide up-to-date information. The campaign will utilize a new creative team this year, who will be focused on acknowledging the problem and inviting people to be part of the solution. Campaign dates: May-September.

Content/Messaging: TMWA will convey the conservation message (Save *at Least* 10%), and the actions or changes in water use required – including expanded no-watering times (11 a.m. – 7 p.m.), sprinkler run-time guidelines, and required watering schedules (assigned days). Other content to be distributed includes landscaping best practices to achieve the goal, all facets of drought information, water supply updates, promotion of water audits, etc. These messages will appear in all forms of communication strategies—online, news releases, FAQ's, videos, infographics, emails, bill inserts, etc. TMWA is partnering with the NLA and UNCE to establish best practices for preserving landscaping during a drought. Staff will be using these recommendations to inform the community. Staff began with, "landscaping preparation helps" the first week of April. Staff will keep Board Members briefed so they have information needed to answer their constituents' questions and to encourage conservation in the community. This will not only include monthly Board Reports, but updates from the General Manager, as needed.

News Coverage: The local media and weather forecasters play an important role in conveying the conservation and drought message to the community. Staff will start with desk sides this month and are always responsive to incoming requests. Tools used to convey the message include: editorial board meetings, desk sides, interviews, press release, media, FAQs, infographics, tours, etc. This effort has already begun.

Direct Customer Communications: Monthly inserts, envelope backers, bill messages, etc. will contain all messages. Conservation messages began with the April bill insert. In addition to traditional direct customer mailing, customer-specific (social-norm type messaging) mailings will be used in some areas. Social-norms, direct-mail programs provide customers with additional information about their personal waster use and how their use compares over time with similar users, and/or compares with other users in their own neighborhood. As part of this messaging the customer could be given a water-use target and told how their current use compares similar homes in their neighborhood.

Website: TMWA.com will be linked to a specific microsite for all drought information and landscaping resources. Staff will promote this through all forms of media, including TMWA's blog and social media. A new conservation video and an infographic/app will be developed which would compare available inventory of water resources (groundwater and drought reserves) to the savings goal and show how the community is achieving that goal.

Social Media: To foster conversations and sharing, staff will utilize daily postings, paid and boosted ads, videos, photos, and infographics on various social media channels, including local media, Facebook and Twitter. Active listening is also part of what staff does every day—answering what needs to be answered, looking for trends for future content, and sharing good content from others.

Conservation Staff Program: TMWA will have an enhanced presence in the community this year for two primary reasons. First, there is a heightened awareness of water usage due to the fourth year of drought. Second, the addition of the former Washoe County Department of Water Resources and South Truckee Meadows General Improvement District customers adds a significant base to the service area, most of which have not been exposed to assigned watering days and TMWA's conservation programs in general. TMWA is doubling the amount of conservation staff from previous summers, and will have an increased focus on waste.

Internal Communications: An educated staff helps manage interactions with customers in and outside of work. TMWA staff will be fully briefed on all drought topics through staff meetings and internal "*from the source"* e-mail communications.

Customer Workshops: TMWA workshops will feature irrigation and landscaping best practices. New this year will be a water supply workshop at the beginning of the season to help customers understand how TMWA responds to drought conditions and what customers can do to help. These will be promoted in all forms of customer communications, news coverage and social media. Staff is also working to add more technical workshops through partnerships with NLA and UNCE.

Community Engagement: Staff will schedule additional presentations to community groups, citizens' advisory groups and be present at community events to dispense drought information. Constant updates on supply and conservation will go out in all forms of communication, including TWMA's e-newsletter. Tree consultations will be promoted, as well as the Community Forestry and TMWA Landscape websites.

Restaurant and Business Outreach: Tent cards for restaurants were distributed, promoting conservation and ordering water, "only if you need it." In several bigger venues, like the Aces Baseball Stadium, mirror stickers will be placed above the restroom sinks with a friendly reminder about saving water.

"Conservation Champions"/Good Water User Program: TMWA is targeting the media and partners (NLA and UNCE) to help us recognize those who are saving water, and doing things right. This includes residential customers as well as commercial and HOA's. Staff is also exploring a Top 100 *Savers* list.

Public Service Billboards: Staff will be contacting entities that have billboards to ask for a conservation message to be included, i.e., NDOT highway readers, hotel billboards, etc.

Commercial Customer and HOA Engagement: Through the data collected last year on water use, a program will be started to communicate directly with commercial customers and HOA's. Staff has conducted a focus group with members of TMWA's Standing Advisory Committee, as well as met with the NLA and UNCE. Using what is learned, staff will be implementing the following tactics: direct communications to association managers, establishing a network of contacts of all large users, partnering to institute more technical workshops for landscapers, etc. A presentation has been given to the presidents of HOA's/ Associations to engage this group to determine best time, tactics and practices to encourage conservation.

Engagement of Governmental Agencies: Work directly with the local agencies encouraging them to set the example for the community at parks, schools, etc. Staff has approached the fire departments to request they curtail fire hydrant flushing where they can. Also, on a longer-term basis, TMWA will be engaging the planning departments to look at landscaping requirements.

**If Conditions Worsen (from situational analysis):**

Other actions mentioned below may be considered (not included in this year's timeline at this time) depending on how the water supply conditions unfold during the 2015 irrigation season.

- Water-use restrictions that would be considered: no sod or seed planting, no fountain operation, and car wash limits
- Expand advertising campaign through October
- Direct mail campaign to areas suffering more impacts than others
- Direct mail from the General Manager and/or Board Chairman to targeted audiences encouraging conservation
- Drought rates, increasing water violation fines, etc.
- Town Hall Meetings
- Moderated web chats
- Bus advertising
- Press conference(s)

### *C. Supply Improvement Projects*

TMWA currently has 27 groundwater wells permitted for Aquifer Storage and Recovery ("ASR"). The ASR program recharges the groundwater aquifers with treated surface water in the off-peak months (approximately October through April) that is stored underground and used when needed to augment drought supplies. With the consolidation of the former Washoe County Water Utility and the South Truckee Meadows General Improvement District into TMWA, staff is aggressively pursuing the permitting of an additional 30 groundwater wells for ASR in

Spanish Springs and southern portion of the Truckee Meadows which will enhance the ability to store water in the underground aquifers.

Also, three other major drought-related projects are planned in the southwest Truckee Meadows for the Mt. Rose-Galena fan areas. These areas currently rely on groundwater wells for 100 percent of their water supply and the continuing drought situation has severely limited the amount of natural recharge to the local aquifers.

The first project consists of water system improvements to deliver up to 1,500 gallons per minute of off-peak water supply for conjunctive use in the Arrowcreek and ultimately the Mt. Rose water systems. Phase 1 of the proposed improvements consist of about 3600 feet of 10-inch pipe on Zolezzi Lane along with two new booster pump stations to get the water up into the Arrowcreek system where it can be used as the primary source of supply during the winter off-peak season and allow the municipal wells to rest. The $2.8 million project is scheduled for construction in the summer of 2015 with a planned in-service date in November 2015 to allow use throughout the off-peak water season. Phase 2 of the project to be constructed in 2016-2017 consists of an additional $1.2 million of improvements to deliver some of the supply up into the Mt. Rose/Galena water system to provide a source of supply for conjunctive use in those areas.

A project to provide a surface water supply to establish a conjunctive use program for the former STMGID West system is also planned. The $3.8 million project consists of a new booster pump station near the reclaim water reservoir on Arrowcreek Parkway and approximately 8,100 feet of 14-inch pipe up Arrowcreek Parkway. The new system will ultimately allow up to 2,500 gallons per minute of surface water supply to be put into storage in the STMGID #4 & #5 storage tanks for use within the distribution system during the off-peak season. The phased project is scheduled for completion in 2018.

TMWA is currently performing a siting study to locate a new 2.0 million gallon per day (mgd) water treatment plant on the upper Mt. Rose fan near the Thomas and Whites Creeks. The new plant will treat creek water to provide a more reliable supply for the area. The $8.2 million project is scheduled for completion in 2018.

In the valley below, TMWA is proceeding with the completion of three new production wells including the Double Diamond #3 well, the Innovation well located off of Longley Lane and the Huffaker Place well to provide up to 3,000 gallons per minute of new groundwater supply during the peak season. Total project costs will approach $3.0 million and the new supply is scheduled to be available in the summer of 2016.

In the North Valleys, TMWA will construct 29,000 feet of 24-inch pipe on Lemmon Drive to allow 100 percent of the Fish Springs groundwater supply (currently 6,500 gallons per minute up to 8,000 acre-feet per year) to be available for use within the North Valleys areas. This groundwater supply will offset an equal amount of surface water supplies that are normally pumped from the Truckee Meadows to the North Valleys areas and will help TMWA to conserve additional upstream drought reserves should the drought continue. The $17.8 million project is

currently under design with construction scheduled to begin sometime in the late summer or fall of 2015 with an in-service date of June 1, 2016.

# University of Nevada, Reno
# Office of Sponsored Projects Policy

**Policy Title:** Facilities and Administrative Rates

**Date:** December 2012 **Revision:** 1 **Page:** 1 of 2

Facilities and Administrative Costs (F&A), also known as indirect costs and overhead, are those costs that cannot be separately identified with a specific project, but which are nevertheless incurred by the University of Nevada, Reno as a consequence of conduct of a sponsored project. They are costs that are incurred for common or joint objectives and therefore, cannot be identified readily and specifically with a particular sponsored project. The University cannot afford to accept funds for activities without receiving the total (direct and F&A) costs of proposed research and scholarly activities. When the University must pay these costs from their own funds, money must be diverted from other needs.

F&A rates to be used in the submission of proposals for grants and contracts to outside agencies are computed by the controller's office. The F&A rates listed below should be used on all proposals submitted to federal and nonfederal agencies and organizations for research and instruction grants and contracts and other sponsored activities. These rates are effective December 12, 2012.

| | On-Campus | Off-Campus |
|---|---|---|
| Research grants and contracts | 43.5% | 26% |
| Instruction grants and contracts | 53% | 26% |
| Other sponsored activities | 31.0% | 25.6% |

The following distribution of F&A recovery monies from grants and contracts has been approved effective July 1, 2005:

| | |
|---|---|
| President/Provost | 4.5% |
| Vice President for Research (includes OSP, TTO, OHRP, Building Bonds, Intramural Funding & Cost Share) | 60.25% |
| College | 7.75% |
| Department | 7.75% |
| PI | 7.75% |
| Administration and Finance | 4.88% |
| Property Acquisition | .75% |
| Development/Alumni | 3.75% |
| Scholarship | 2.62% |

Fund 1207 and 1210 exists with separate accounts to reflect these distributions and any further allocations of college/school F&A recovery directed by each college/school. All F&A recovery and expenditure of the same shall be recorded in these funds.