Appendix A
Chapter 531 Statues of Nevada, 2007

Senate Bill No. 487–Committee on Natural Resources

CHAPTER 531

AN ACT relating to water; providing for the regional management and conservation of water resources in certain portions of Washoe County; creating the Western Regional Water Commission; setting forth the powers and duties of the Western Regional Water Commission; creating the Northern Nevada Water Planning Commission to advise and assist the Western Regional Water Commission; repealing certain provisions relating to regional planning and management of water in certain counties; and providing other matters properly relating thereto.

[Approved: June 14, 2007]

Legislative Counsel's Digest:

Existing general law provides for regional planning and management of water by a water planning commission in counties whose population is 100,000 or more but less than 400,000 (currently Washoe County). Under that general law, a board of county commissioners is required to adopt a comprehensive plan for the supply of municipal and industrial water, quality of water, sanitary sewerage, treatment of sewage, drainage of storm water and control of floods and is required to take action by a two-thirds majority. This general law also provides for a water planning commission, which reports to and advises the board of county commissioners concerning issues relating to water resources. (NRS 540A.010-540A.310)

This bill repeals various provisions of that general law and creates by special legislation a new structure for regional planning of water resources in certain portions of Washoe County based on the unique conditions and circumstances existing in those areas. Under the Nevada Constitution, the Legislature may pass a special or local law if the subject matter of the law does not fall within one of certain enumerated categories and a general law cannot be made applicable because of special circumstances and conditions. (Nev. Const. Art. 4, §§ 20, 21) **Section 4** of this bill specifies the unique conditions and circumstances in these portions of Washoe County that justify special legislation for the purpose of regional planning and management of water resources.

Sections 23 and 25-28 of this bill create the Western Regional Water Commission (Regional Water Commission), which is governed by a Board of Trustees consisting of representatives of various public entities and interests. **Sections 36-41** of this bill create the Northern Nevada Water Planning Commission (Water Planning Commission), which reports to and advises the Board of Trustees of the Regional Water Commission.

Section 24 of this bill authorizes the City of Reno, City of Sparks, Washoe County, Sun Valley General Improvement District, South Truckee Meadows General Improvement District and Truckee Meadows Water Authority to provide certain additional power and duties to the Regional Water Commission by cooperative agreement. The cooperative agreement must be entered into before April 1, 2008.

Sections 34-52 of this bill require the development and adoption of a comprehensive plan for the area over which the Regional Water Commission has jurisdiction, which must address the supply of municipal and industrial water, quality of water, sanitary sewerage, treatment of sewage, drainage of storm water and control of floods. **Sections 30-35** of this bill authorize the Board of Trustees to: (1) plan for the implementation of a mechanism for scheduling the delivery of water supplies held by certain water purveyors before April 1, 2008; (2) develop a plan for the establishment of service territories by which those purveyors may provide new water service provided on and after April 1, 2008, if each of the public purveyors agree to the plan; (3) impose a fee for the planning and administration of certain activities; and (4) plan for water conservation by various means.

Section 56 of this bill creates a temporary statutory legislative committee to oversee the programs and activities of the Regional Water Commission.

THE PEOPLE OF THE STATE OF NEVADA, REPRESENTED IN SENATE AND ASSEMBLY, DO ENACT AS FOLLOWS:

Section 1. NRS 533.550 is hereby amended to read as follows:

533.550 1. Notwithstanding any other provision of law, a public body shall not sell or lease for a term of more than 5 years a water right owned by the public body unless the public body, after holding at least one public hearing at which public comment was solicited, has issued written findings that:

(a) The sale or lease of the water right is consistent with the prudent, long-term management of the water resources within the jurisdiction of the public body;

(b) The sale or lease of the water right will not deprive residents and businesses within the jurisdiction of the public body of reasonable access to water resources for growth and development;

(c) The sale or lease of the water right is a reasonable means of promoting development and use of the water right; and

(d) The means by which the water right is sold or leased reasonably ensures that the public body will receive the actual value of the water right or comparable economic benefits.

2. As used in this section, “public body” means the State or a county, city, town, school district or any public agency of this State or its political subdivisions. The term does not include a water district organized pursuant to a special act of the Legislature or a water authority organized as a political subdivision created by a cooperative agreement ~~[.]~~ ***or created by a special act of the Legislature.***

Sec. 2. NRS 540A.010 is hereby amended to read as follows:

540A.010 As used in this chapter, unless the context otherwise requires:

1. "Board" means the board of county commissioners.

2. "Commission" means the ~~[water planning commission]~~ ***Northern Nevada Water Planning Commission*** created by ~~[NRS 540A.080.]~~ ***section 36 of this Act.***

3. "Comprehensive plan" or "plan" means the plan developed ~~[pursuant to NRS 540A.130.]~~ ***by a regional water commission created by special act.***

4. "Division" means the Division of Environmental Protection of the State Department of Conservation and Natural Resources.

Sec. 3. Sections 3 to 53, inclusive, of this Act may be cited as the Western Regional Water Commission Act.

Sec. 4. 1. The Legislature hereby finds that:

(a) The provisions of section 22 of this Act describe a hydrologically unique area which is distinguished by the presence of Lake Tahoe and the Truckee River, a water system which is governed by a unique combination of state and federal law, by federal decree and by the Truckee River Operating Agreement; and

(b) The unique hydrological conditions of the area described in section 22 of this Act and the complex legal framework governing the use of water within that area are special circumstances and conditions to which a general law cannot be made applicable and necessitate this special Act which provides for a special structure for the coordinated planning and management of water resources in that area.

2. It is hereby declared as a matter of legislative determination that:

(a) The organization of the Western Regional Water Commission having the purposes, powers, rights, privileges and immunities provided in this Act will serve a public use and will promote the general welfare by facilitating unified and cooperative efforts to secure and develop additional water supplies, maintain and cooperatively establish policies for managing existing water resources and water supplies, provide for integrated regional water resources and management of water supplies, provide for integration of efforts to manage storm water, provide for protection of watersheds and provide for regional conservation efforts, subject to and in accordance with the Truckee River Operating Agreement.

(b) The planning for the acquisition, development, management and conservation of regional water supplies and any associated facilities by the Regional Water Commission is for a public and governmental purpose and a matter of public necessity.

(c) The geographical boundaries of the Regional Water Commission are within the area described in section 22 of this Act.

(d) The Regional Water Commission shall, in carrying out the provisions of this Act:

(1) Make full use of any available resources for sustainability, economic viability and maintenance of environmental values;

(2) Communicate the decisions and policies of the Regional Water Commission in an effective manner;

(3) Provide for a centralized system of decision making;

(4) Facilitate the effective coordination of land use and resource planning;

(5) Facilitate the effective and efficient planning, management and operation of facilities; and

(6) Plan for the effective stewardship of water resources, including, without limitation, ensuring the quantity and quality of surface water and groundwater and the control point and nonpoint sources of pollution.

(e) For the accomplishment of the purposes stated in this subsection, the provisions of this Act shall be broadly construed.

Sec. 5. As used in this Act, unless the context otherwise requires, the words and terms defined in sections 6 to 21, inclusive, of this Act have the meanings ascribed to them in those sections.

Sec. 6. "Board of Trustees" or "Board" means the Board of Trustees of the Regional Water Commission.

Sec. 7. "City of Reno" means the municipal corporation in Washoe County, created and existing pursuant to the provisions of chapter 662, Statutes of Nevada 1971, as amended.

Sec. 8. "City of Sparks" means the municipal corporation in Washoe County, created and existing pursuant to the provisions of chapter 470, Statutes of Nevada 1975, as amended.

Sec. 9. "Comprehensive Plan" means the plan developed pursuant to sections 34 to 52, inclusive, of this Act.

Sec. 10. "Division" means the Division of Environmental Protection of the State Department of Conservation and Natural Resources.

Sec. 11. "Facilities" means any facility necessary for the beneficial use of water supplies, including, without limitation, any diversion, dam, reservoir, other water storage facility for the water supplies, water conveyance, well, pump, treatment facility, storage tank, pipe, turnout and any other facility required to provide water services or to provide for the conservation of water or enhanced control of floods.

Sec. 12. "Planning area" means the area described in section 22 of this Act.

Sec. 13. "Public purveyor" means:

1. The Truckee Meadows Water Authority, or its successor;
2. The Washoe County Department of Water Resources, or its successor;
3. The South Truckee Meadows General Improvement District, or its successor;
4. The Sun Valley General Improvement District, or its successor; or
5. Any other governmental entity engaged in the retail delivery of potable water in the planning area.

Sec. 14. "Regional Water Commission" means the Western Regional Water Commission created pursuant to section 23 of this Act.

Sec. 15. "Truckee Meadows Water Authority" means the political subdivision of the State of Nevada created by a cooperative agreement effective December 4, 2000, pursuant to the provisions of NRS 277.080 to 277.180, inclusive.

Sec. 16. "Truckee River Operating Agreement" means all agreements relating to the implementation of Public Law 101-618, 104 Stat. 3324, as amended, including, without limitation, the Operating Agreement referenced in section 205(a) of Public Law 101-618, 104 Stat. 3324, as amended, whether entered into before, on or after April 1, 2008, to which the Truckee Meadows Water Authority, its predecessor or its successor, if any, is a party.

Sec. 17. "Washoe County" means the county created by and described in NRS 243.340.

Sec. 18. "Water Planning Commission" means the Northern Nevada Water Planning Commission created pursuant to section 36 of this Act.

Sec. 19. "Water Quality Settlement Agreement" means the Agreement entered into on October 10, 1996, by the City of Reno, the City of Sparks, Washoe County, the United States Department of the Interior, the United States Department of Justice, the United States Environmental Protection Agency, the Division and the Pyramid Lake Paiute Tribe, and any agreements entered into to implement that Agreement including, without limitation, any applicable provisions of the Truckee River Operating Agreement.

Sec. 20. "Water right" means any entitlement to the beneficial use of surface water or groundwater supplies, including, without limitation, an entitlement that exists by contract, by interest in real property, by decree or by rights granted or recognized by the State of Nevada, the State of California or any other governmental agency.

Sec. 21. "Water supplies" means surface water, groundwater, wastewater or effluent capable of being put to beneficial use.

Sec. 22. 1. The planning area in which plans for the use, management and conservation of water are to be made, pursuant to this Act, is the entire area within the boundaries of Washoe County except:

(a) Any land within the region defined by NRS 277.200, the Tahoe Regional Planning Compact;

(b) Land located within any Indian reservation or Indian colony which is held in trust by the United States;

(c) Land located within the Gerlach General Improvement District or its successor created pursuant to chapter 318 of NRS;

(d) Land located within the following administrative groundwater basins established by the United States Geological Survey and the Division of Water Resources of the State Department of Conservation and Natural Resources:

(1) Basin 22 (San Emidio Desert);

(2) Basin 23 (Granite Basin); and

(3) Basin 24 (Hualapai Flat); and

(e) Any land excluded by the Board pursuant to subsection 2 and not otherwise included pursuant to subsection 3.

2. The Board may exclude from the planning area any land which it determines is unsuitable for inclusion because of its remoteness from the water supplies which are the subject of the Comprehensive Plan or because it lies within a separate hydrologic basin neither affecting nor affected by conditions within the remainder of the planning area.

3. The Board may include within the planning area any land otherwise excluded pursuant to subsection 2 if it finds that the land requires alleviation of the effect of flooding or drainage of storm waters or requires another benefit from planning or management performed in the planning area.

Sec. 23. 1. The Western Regional Water Commission is hereby created. The Regional Water Commission is a body corporate and politic and a municipal corporation.

2. The property and revenues of the Regional Water Commission, any interest of any creditor therein and any possessory interest in or right to use that property which the Regional Water Commission may grant are exempt from all state, county and municipal taxation.

Sec. 24. By entering into a cooperative agreement pursuant to NRS 277.080 to 277.180, inclusive, the City of Reno, City of Sparks, Washoe County, Sun Valley General Improvement District, South Truckee Meadows General Improvement District and Truckee Meadows Water Authority may jointly authorize the Regional Water Commission to exercise such powers, privileges or authority that each of those entities may individually exercise pursuant to the laws of this State which are not inconsistent with the provisions of this Act.

Sec. 25. 1. The Regional Water Commission must be directed and governed by a Board of Trustees composed of the following nine members appointed pursuant to this section:

(a) Two members of the City Council of the City of Reno;

(b) Two members of the City Council of the City of Sparks;

(c) Two members of the Board of County Commissioners of Washoe County;

(d) One member representing the Truckee Meadows Water Reclamation Facility or its successor;

(e) One member designated by the Board of Trustees of the South Truckee Meadows General Improvement District or its successor; and

(f) One member of the Board of Trustees of the Sun Valley General Improvement District or its successor.

2. The City Council of the City of Reno, the City Council of the City of Sparks and the Board of County Commissioners of Washoe County shall each appoint one trustee from their membership for an initial term of 2 years.

3. The Board of Directors of the Truckee Meadows Water Authority or its successor shall appoint from its membership, for initial terms of 3 years:

(a) One trustee who is a member of the City Council of the City of Reno;

(b) One trustee who is a member of the City Council of the City of Sparks; and

(c) One trustee who is a member of the Board of County Commissioners of Washoe County.

➥ The trustees appointed pursuant to this subsection must be different persons than those appointed pursuant to subsection 2.

4. The Board of Trustees of the Sun Valley General Improvement District or its successor and the Board of Trustees of the South Truckee Meadows General Improvement District or its successor shall each appoint one trustee from its membership for an initial term of 3 years.

5. The owners of the Truckee Meadows Water Reclamation Facility or its successor shall jointly appoint one trustee for an initial term of 2 years.

6. After the initial terms, each trustee who is appointed to the Board serves for a term of 2 years. A trustee may be reappointed.

7. All trustees must be elected officials. No trustee may serve beyond his term of office.

8. The position of a trustee must be considered vacated upon his loss of any of the qualifications required for his appointment, and in such event, the appointing authority shall appoint a successor to fill the remainder of the unexpired term.

Sec. 26. Each member of the Board shall file with the County Clerk of Washoe County:

1. His oath of office.

2. A corporate surety bond furnished at the Regional Water Commission's expense, in an amount not to exceed $5,000, and conditioned for the faithful performance of his duties as a member of the Board.

Sec. 27. 1. The Board shall elect one of its members as Chairman and one of its members as Vice Chairman, and shall elect a Secretary and a Treasurer, who may be members of the Board. The Secretary and the Treasurer may be the same person. The terms of the officers expire on December 31 of each year.

2. The Secretary shall keep audio recordings or transcripts of all meetings of the Board and, in a well-bound book, a record of all the proceedings of the Board, minutes of all meetings, certificates, contracts, bonds given by employees and all other acts of the Board. Except as otherwise provided in NRS 241.035, the minute book, audio recordings, transcripts and records must be open to the inspection of all interested persons, at all reasonable times and places.

3. The Treasurer shall keep, in permanent records, strict and accurate accounts of all money received by and disbursed for and on behalf of the Board and the Regional Water Commission.

Sec. 28. 1. The Board shall meet regularly at a time and in a place to be designated by the Board. The Board shall provide for the calling of a special meeting when action is required before a regular meeting would occur.

2. Except as otherwise provided in this subsection, a majority of the members of the Board constitutes a quorum at any meeting. Each motion and resolution of the Board must be adopted by at least a majority of the members present at the meeting.

Sec. 29. The Regional Water Commission is a public employer within the meaning of NRS 286.070, and the provisions of chapter 286 of NRS apply to the Regional Water Commission and its employees.

Sec. 30. The Regional Water Commission may do all things necessary to accomplish the purposes of this Act. The Regional Water Commission has perpetual succession and, except as otherwise provided in sections 33 of this Act, has the following powers to:

1. Sue and be sued.

2. Enter into agreements with Washoe County, the Cities of Reno and Sparks, and any public purveyor.

3. Prepare, adopt, update and oversee the implementation of the Comprehensive Plan pursuant to sections 34 to 52, inclusive, of this Act.

4. Plan for the implementation of a mechanism for:

(a) Scheduling the delivery of water supplies held by public purveyors to maximize the yield of regional water supplies and facilitate the cooperative administration of regional water conveyance and treatment facilities for the benefit of the public purveyors.

(b) Maximizing conjunctive use by the public purveyors. As used in this paragraph, "conjunctive use" means the combined use of surface water and groundwater systems to optimize resource use.

5. Prepare, adopt and update a water conservation plan for the use of municipal, industrial and domestic water supplies within the planning area, and make recommendations for water conservation agreements among water purveyors and local governmental entities.

6. Study and recommend to the Board of County Commissioners of Washoe County, the City Council of the City of Reno and the City Council of the City of Sparks ordinances for the implementation of a water conservation plan adopted pursuant to subsection 5 and the Comprehensive Plan.

7. Contract with public purveyors or any other public entity for the provision of services to or by the Regional Water Commission and, in the performance of its functions, use the officers, agents, employees, services, facilities, records and equipment of any public purveyor, Washoe County, the City of Reno or the City of Sparks, with the consent of the respective public purveyor or governmental entity, and subject to such terms and conditions as may be agreed upon.

8. Employ or contract with such persons as it deems necessary and hire and retain officers, agents and employees, including fiscal advisers, engineers, attorneys or other professional or specialized personnel.

9. Seek, apply for and otherwise solicit and receive from any source, public or private, such contributions, gifts, grants, devises and bequests of money and personal property, or any combination thereof, as the Regional Water Commission determines is necessary or convenient for the exercise of any of its powers.

10. Participate with relevant agencies of the United States, the State of Nevada and other entities on issues concerning the supply of water.

11. Adopt such rules and regulations for the conduct of the affairs of the Regional Water Commission or of the Board as the Board may deem necessary or desirable.

12. Perform such other functions conferred on the Regional Water Commission by the provisions of this Act.

Sec. 31. The Board may develop a plan for the establishment of service territories within the planning area in which the public purveyors and all systems for the supply of water which are controlled or operated by the public purveyors may, on and after April 1, 2008, provide new retail or wholesale water services to new customers. A plan developed pursuant to this section does not apply to any public purveyor unless each public purveyor agrees to the provisions of the plan. The provisions of this section do not affect the ability of public purveyors to continue to provide retail and wholesale water services to customers who received that type of service before April 1, 2008, or pursuant to agreements for water service existing before April 1, 2008. In developing the plan, the Board shall:

1. Seek to ensure the coordination of the delivery of water at the lowest reasonable cost, considering all the facilities, improvement and operations required to provide that water as measured by the net present value of those facilities, improvements and operations existing at the time of the determination, generally using current dollars;

2. Seek to ensure that existing or future customers are not affected inequitably;

3. Seek to provide for the most effective management, development and integration of systems for the efficient use of water supplies and associated facilities; and

4. Consider:

(a) Any specific planning conducted by public purveyors before April 1, 2008, for existing or new customers;

(b) The topography of the service territories and the readiness and ability of public purveyors to serve customers with existing facilities;

(c) Any policies for land use that affect the service territories; and

(d) The rate of growth within the service territories projected over a reasonable period.

Sec. 32. The Board has and may exercise all rights and powers necessary or incidental to or implied from the specific powers granted in this Act. Such specific powers are not a limitation upon any power necessary or appropriate to carry out the purposes and intent of this Act.

Sec. 33. Notwithstanding the provisions of this Act, the Truckee Meadows Water Authority or its successor is and shall remain the entity with the sole and exclusive power and authority to negotiate and execute and to implement its obligations under that Agreement, as the successor in interest to Sierra Pacific Power Company. All water supplies provided or available to the Truckee Meadows Water Authority or its successor pursuant to the Truckee River Operating Agreement must be considered as acquired before April 1, 2008, and must be managed, scheduled and operated in accordance with that Agreement. Nothing in this Act alters the rights and obligations of the Water Quality Settlement Agreement, and all water supplies must be managed, scheduled and operated in accordance with the Water Quality Settlement Agreement.

Sec. 34. The Board may, upon the recommendation of the Water Planning Commission:

1. Adopt and revise the Comprehensive Plan;

2. Make recommendations concerning methods for conserving existing water supplies which are consistent with any other plans required by law;

3. Make recommendations concerning methods of collecting and treating sewage to protect and conserve water supplies;

4. Provide information to members of the public regarding present and potential uses of water; and

5. Make recommendations concerning the management and use of water within the planning area to:

(a) The governing body and the Planning Commission of Washoe County and the Cities of Reno and Sparks;

(b) The Governing Board for Regional Planning and the Regional Planning Commission established in Washoe County pursuant to NRS 278.0264 and 278.0262, respectively;

(c) The State Engineer;

(d) The Federal Government; and

(e) Such other entities as the Board deems appropriate.

Sec. 35. 1. To fund the planning and administration required by this Act and the implementation of the Comprehensive Plan, the Board may impose a fee at a rate not to exceed 1.5 percent of the amount otherwise billed, to be collected by each public purveyor and supplier of water from customers within the planning area. If the Board determines to impose such a fee, the Board must impose the fee by resolution after holding a hearing.

2. A public purveyor or supplier of water must state separately on its billings to customers the amount charged as a result of any fee imposed pursuant to subsection 1.

Sec. 36. 1. The Northern Nevada Water Planning Commission is hereby created in the planning area. The Water Planning Commission must consist of the following voting members who are residents of Nevada:

(a) The Director of Public Works for the City of Reno, or his designee;

(b) The Director of Public Works for the City of Sparks, or his designee;

(c) The Director of Water Resources for Washoe County, or his designee;

(d) A member of the South Truckee Meadows General Improvement District or its successor;

(e) The General Manager of the Sun Valley General Improvement District or its successor, or his designee;

(f) The General Manager of the Truckee Meadows Water Authority or its successor, or his designee;

(g) The General Manager of the Truckee Meadows Wastewater Reclamation Facility or its successor, or his designee;

(h) One member appointed by the governing body of the Indian reservation which is the largest in area in the planning area, if the planning area contains an Indian reservation, or, if there is not an Indian reservation located within the planning area or the governing body of the reservation does not appoint a member, one member appointed by the Board to represent the public at large;

(i) One member of the public at large appointed by the Board to represent environmental, biological, conservation or public concerns;

(j) One member appointed by the Board to represent owners of domestic wells;

(k) One member appointed by the Board of Supervisors of the Washoe Storey Conservation District or its successor; and

(l) Such additional members with expertise in any area that the Board determines is necessary, appointed by the Board.

➥ The terms of the ex officio members described in paragraphs (a) to (g), inclusive, are concurrent with the employment of those members in the respective positions specified in those paragraphs. The members appointed pursuant to paragraphs (h) to (l), inclusive, serve initial terms of 2 years.

2. After the initial terms, the term of office of each member appointed pursuant to paragraphs (h) to (l), inclusive, of subsection 1 is 3 years. A member may be reappointed. A vacancy must be filled for the unexpired term by the appointing entity.

Sec. 37. In addition to the voting members, the Water Planning Commission includes the following nonvoting members:

1. One member appointed by the Public Utilities Commission of Nevada;

2. One member appointed by the Consumer's Advocate of the Bureau of Consumer Protection in the Office of the Attorney General;

3. One member appointed by the Administrator of the Division;

4. One member appointed by the State Engineer;

5. One member appointed by the Chief of the Water Planning Section of the Division of Water Resources of the State Department of Conservation and Natural Resources;

6. One member appointed by the board of directors of the water conservancy district which is largest in area in the planning area;

7. One member appointed by the county or district board of health;

8. One member of the public at large appointed by the affirmative vote of a majority of the voting members; and

9. Additional members with expertise in an area that the majority of the voting members determines is necessary, appointed by the affirmative vote of a majority of the voting members.

Sec. 38. The members of the Water Planning Commission appointed pursuant to paragraphs (h) to (l), inclusive, of subsection 1 of section 36 of this Act or any alternative designees appointed pursuant to paragraphs (a) to (g), inclusive, of subsection 1 of section 36 of this Act may not hold any elective governmental office but may be engaged or employed in private enterprise or be employees of state or local government, and each member must be qualified pursuant to at least one of the following subsections:

1. A professional engineer licensed pursuant to the provisions of chapter 625 of NRS;
2. Experienced in comprehensive planning, natural resources or environmental protection;
3. A specialist in hydrologic science;
4. Experienced in law, management or planning related to water;
5. Experienced in municipal finance or resource economics;
6. Experienced in construction, planning or operation of facilities or systems for supplying or treating water, for collecting or treating sewage, for drainage of storm water or for control of floods; or
7. Knowledgeable in the areas of water conservation, biology, natural systems, water quality and water management.

Sec. 39. The Water Planning Commission shall establish a schedule for the selection of its Chairman for a term of 1 year, in rotation, from among the members.

Sec. 40. 1. The Water Planning Commission shall meet at the call of the Chairman or any three members. The Water Planning Commission shall establish a schedule of regular meetings and provide for the calling of a special meeting when action is required before a regular meeting would occur.

2. A quorum consists of a majority of the members. The affirmative vote of a majority of the members present is required to take action, unless a larger proportion is required by this Act for a particular action.

3. A member of the Water Planning Commission is not entitled to compensation for his services as a member.

Sec. 41. 1. The Water Planning Commission shall develop, and as necessary recommend revisions to, a Comprehensive Plan for the planning area covering the supply of municipal and industrial water, quality of water, sanitary sewerage, treatment of sewage, drainage of storm waters and control of floods. The initial Comprehensive Plan must be developed on or before January 1, 2011. The provisions of the comprehensive plan developed and revised pursuant to the former provisions of NRS 540A.130 before April 1, 2008, remain in effect until the Board adopts the initial Comprehensive Plan.

2. The Comprehensive Plan must consist of written text, appropriate maps and goals and policies to deal with current and future problems affecting the planning area as a whole with respect to the subjects of the Comprehensive Plan set forth in subsection 1. In developing the Comprehensive Plan, the Water Planning Commission shall consider any water resource plan developed by a public purveyor and, to the extent feasible and consistent with the objectives of the Regional Water Commission, seek to incorporate such a plan.

3. The Comprehensive Plan must:

(a) Describe the problems and needs of the planning area relating to the subjects of the Comprehensive Plan set forth in subsection 1;

(b) Identify the providers of services relating to the subjects of the Comprehensive Plan within the planning area and the area within which each provides service, including service territories of public utilities and public purveyors;

(c) Identify alternatives to reduce demand or increase water supply;

(d) Identify and provide for existing and future sources of water needed to meet the present or future needs of the planning area, including, without limitation, existing and future demand for water within each public purveyor's service territory;

(e) Define priorities and general location for additional major facilities needed to provide services relating to the subjects of the Comprehensive Plan set forth in subsection 1;

(f) Describe programs to mitigate drought, achieve conservation of water, protect wellheads and otherwise manage water;

(g) Provide for the development, acquisition and stabilization of surface water and groundwater supply in the planning area, including policies regarding dedication of privately held water resources by applicants for water service;

(h) Provide for the oversight of, protection of, regional management of and maximization of efficient conjunctive use of, the supply of surface water and groundwater and major water resource facilities in the planning area, including use of reclaimed water and recharge and recovery or underground storage and recovery of water, and the scheduling of the delivery of water supplies held by public purveyors;

(i) Identify and provide for the extent to which reuse or effluent water is to be put to beneficial use or discharged, directly or indirectly, into the Truckee River;

(j) Provide for the regional conservation and prevention of long-term depletion of surface water and groundwater resources in the planning area in support of the Comprehensive Plan;

(k) Provide for adequate supplies of municipal and industrial water, quality of water, sanitary sewerage, treatment of sewage, drainage of storm waters and control of floods within the planning area;

(l) Identify and provide for the peaking capacity required for delivery of water supplies to each public purveyor, if applicable, and the means by which such requirements will be met;

(m) Include a water budget identifying water supplies available to each public purveyor from all sources; and

(n) Seek to make full use of any unused capacity of facilities that are owned by public purveyors, if such use is otherwise economical and efficient.

4. The Water Planning Commission shall make recommendations to the Board for the adoption of, and any revisions to, the Comprehensive Plan.

Sec. 42. The Comprehensive Plan must include the following elements:

1. Quality of surface water, which must include, without limitation:

(a) Compliance with standards of quality for bodies of water;

(b) Locations and capacities of plants to treat wastewater;

(c) Intended quantity and quality of discharge from those plants and its reuse, service areas and interceptors; and

(d) Programs to attain protection from pollution by both concentrated and diffuse sources.

2. Quality of groundwater, which must include, without limitation:

(a) Compliance with standards of quality for hydrographic basins and septic tanks;

(b) Capacities for withdrawal of water from hydrographic basins;

(c) Programs to protect wellheads;

(d) Programs to clean up contaminated groundwater from hydrographic basins; and

(e) Programs to attain protection from pollution by both concentrated and diffuse sources.

3. Supply of surface water, which must include, without limitation:

(a) Existing and planned sources of surface water;

(b) Existing and planned uses for all surface water, including municipal and industrial uses, requirements for return flow, reserves for drought and future growth, uses to improve the quality of water, uses to provide habitat and uses in conjunction with underground water;

(c) Major facilities to convey and store surface water;

(d) Standards, service areas, rates of flow and reserves for storage; and

(e) Facilities to treat surface water.

4. Supply of underground water, which must include, without limitation:

(a) Existing and planned sources of underground water;

(b) Existing and planned uses for all underground water, including municipal and industrial uses, maintenance of minimum groundwater level and the need for recharge, reserves for drought and future growth, uses to improve the quality of water, uses to provide habitat and uses in conjunction with surface water;

(c) Major facilities to extract and convey underground water;

(d) Compliance with standards for treated and nontreated water, service areas, rates of flow and reserves for storage; and

(e) Facilities to treat and store underground water.

5. Control of floods and drainage of storm water, as it relates to surface water, which must include, without limitation:

(a) Minimum standards of design for controlling floods in the planning area;

(b) Nonstructural alternatives and standards for facilities to control floods in the planning area and single drainage basins;

(c) Regional facilities to control floods; and

(d) Generalized facilities and standards of design for single drainage basins.

6. Control of floods and drainage of storm water, as it relates to underground water, which must include, without limitation:

(a) Groundwater level and capacity for additional storage of water underground as a means of mitigating floods;

(b) Location and capacities of major facilities for controlling floods which utilize storage of water underground to mitigate floods; and

(c) Standards of design for devices to infiltrate storm water and other minor facilities for controlling floods which utilize storage of water underground to mitigate floods.

7. Cost and financing, which must include an estimate of the cost of each major facility, source of water or other requirement of the

Comprehensive Plan and an analysis of alternatives for financing and funding the facility, source or other requirement, or alternatives thereto, as well as the effect of the funding alternatives on other facilities included in the Comprehensive Plan. The estimate of cost must state the financial impact on persons within the planning area, including, without limitation, all direct and indirect costs of connecting to a system for supplying water, if applicable.

8. Recommendations for developing and implementing consistent policies of, and among, public purveyors concerning regional drought reserve standards, developer costs, impact fees, dedication of water rights and standards for the drainage of water.

9. Evaluation and recommendations regarding the consolidation of public purveyors in the planning area, which must include costs and benefits of consolidation, the feasibility of various consolidation options, analysis of water supplies, operations, facilities, human resources, assets, liabilities, bond covenants, and legal and financial impediments to consolidation and methods, if any, for addressing any such impediments.

Sec. 43. 1. The Comprehensive Plan must be consistent with and carry out the provisions of the Comprehensive Regional Plan adopted by the Governing Board for Regional Planning in Washoe County pursuant to NRS 278.0276 and the master plans and any other plans for the use of land which are adopted by governmental entities within the planning area.

2. The Comprehensive Plan must be consistent with and carry out or support the carrying out of all aspects of the Truckee River Operating Agreement and Water Quality Settlement Agreement.

3. The Comprehensive Plan must be consistent with the state water plan that is in effect at the time that the Comprehensive Plan is adopted.

Sec. 44. In developing the Comprehensive Plan, the Water Planning Commission shall:

1. Receive and consider information from public purveyors, public utilities and other entities supplying municipal and industrial water within the planning area;

2. Receive and consider information from entities providing sanitary sewerage, treatment of sewage, drainage of storm water and control of floods within the planning area;

3. Receive and consider information from entities concerned with water quality within the planning area;

4. Review and consider any plan or recommendation of the State Engineer concerning the development, conservation and use of water resources, existing water conservation plans, the regional plan and any master plan that has been adopted pursuant to the provisions of chapter 278 of NRS and any similar plan of a local government which applies to any area in the planning area, and may seek and consider the advice of each local planning commission and any other affected entity;

5. Coordinate and make consistent the elements of the Comprehensive Plan set forth in section 42 of this Act;

6. Consider existing applicable laws;

7. Recognize and coordinate the needs of the incorporated areas of the planning area with the needs of the unincorporated areas of the planning area; and

8. Receive and consider information from other interested persons.

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🡻2007 Statutes of Nevada, Page 3299🡻

Sec. 45. 1. Before submitting the Comprehensive Plan to the Board, the Water Planning Commission shall hold at least one public hearing on the Comprehensive Plan within the planning area.

2. Before acting on a proposed amendment to the adopted Comprehensive Plan, the Water Planning Commission shall hold at least one public hearing on the proposed amendment at a location in the planning area relevant to the proposed amendment.

3. Notice of the time and place of each hearing must be given by publication in a newspaper of general circulation in the planning area at least 10 days before the day of the hearing. If there is more than one newspaper of general circulation in the planning area, notice must be given by publication in at least two such newspapers.

4. The decision to submit the proposed Comprehensive Plan or any amendment to the adopted Comprehensive Plan to the Board must be made by resolution of the Commission carried by the affirmative votes of a majority of the total voting members of the Water Planning Commission. The resolution must refer expressly to the text, maps and descriptive or other matter intended by the Water Planning Commission to constitute the Comprehensive Plan or an amendment thereto.

Sec. 46. 1. An attested copy of the proposed Comprehensive Plan or an amendment thereto must be submitted by the Water Planning Commission to the Board.

2. Before taking any action on the proposed Comprehensive Plan or an amendment thereto, the Board shall convene a public hearing.

3. Notice of the hearing must be given at least 10 days before the date of the hearing. The notice must include, without limitation:

(a) A statement of the time, place and nature of the hearing;

(b) A statement of the legal authority under which the hearing is to be held; and

(c) A reference to the particular sections of any applicable laws.

4. Not less than 30 days before the hearing, the Board shall cause to be placed a copy of the proposed Comprehensive Plan or amendment thereto in the office of the County Clerk of Washoe County and publish notice that the Comprehensive Plan or amendment thereto is available for public inspection.

5. Each notice required by this section must be published in a newspaper of general circulation in the planning area. If there is more than one newspaper of general circulation in the planning area, notice must be given by publication in at least two such newspapers. The notice must be a display advertisement not less than 3 by 5 inches in size.

Sec. 47. 1. The Board shall not change or add to the proposed Comprehensive Plan or an amendment thereto as submitted by the Water Planning Commission until it has submitted the substance of the proposed change or addition to the Water Planning Commission in writing with its reasons for the change or addition.

2. The Water Planning Commission shall, if it agrees to the change or addition, revise the submitted Comprehensive Plan or amendment thereto accordingly. If the Water Planning Commission does not agree, it shall report to the Board in writing its reason for disagreeing and any alternative proposal.

3. In either case, the Water Planning Commission shall present its revision or report to the Board within 40 days after the Board's change or amendment is submitted to the Water Planning Commission.

4. If the Water Planning Commission does not agree with the proposed change or addition and the Board refuses to rescind its proposal or to accept an alternative proposal of the Water Planning Commission, the Water Planning Commission shall revise the originally submitted Comprehensive Plan or amendment thereto to incorporate the change or addition proposed by the Board.

Sec. 48. 1. After adoption by the Board, the Comprehensive Plan or an amendment thereto must be submitted for review to the Regional Planning Commission in Washoe County established pursuant to NRS 278.0262. The Regional Planning Commission shall review the Comprehensive Plan or amendment thereto only for consistency with the Comprehensive Regional Plan adopted pursuant to NRS 278.0276 and the master plans and any other plans for the use of land which are adopted by local governmental entities within the planning area. The Regional Planning Commission shall review the Comprehensive Plan or amendment thereto at one or more public hearings. Notice of the time and place of a hearing must be given in accordance with NRS 278.0276.

2. If the Regional Planning Commission fails to make a determination within 40 days after the submission of the Comprehensive Plan or amendment thereto, the Comprehensive Plan or amendment thereto shall be deemed to be consistent with the Comprehensive Regional Plan.

3. If the Regional Planning Commission determines that the Comprehensive Plan or amendment thereto is not consistent with the Comprehensive Regional Plan, it shall state its reasons why the Comprehensive Plan or amendment thereto is not consistent. Unless an appeal is filed pursuant to section 49 of this Act, the Water Planning Commission and the Board shall respectively develop and adopt, in accordance with sections 44 to 47, inclusive, of this Act, proposed revisions to the Comprehensive Plan or amendment thereto, and the Board shall resubmit the revised Comprehensive Plan or amendment thereto to the Regional Planning Commission.

Sec. 49. 1. An affected entity that disagrees with the reasons given by the Regional Planning Commission for its determination of consistency or inconsistency pursuant to section 48 of this Act may file an appeal with the Governing Board for Regional Planning in Washoe County not later than 10 days after the determination of consistency or inconsistency. As used in this subsection, “affected entity” means Washoe County, the City of Reno, the City of Sparks or any other governmental entity or public purveyor or a public utility providing services relating to the subject matter of the Comprehensive Plan within the planning area.

2. Within 45 days after its receipt of an appeal, the Governing Board for Regional Planning shall consider the appeal and issue its decision. If the decision of the Governing Board for Regional Planning is that the Comprehensive Plan or amendment thereto is not consistent with the Comprehensive Regional Plan, it shall state its reasons why the Comprehensive Plan or amendment thereto is not consistent. The Water Planning Commission and the Board shall then respectively develop and adopt, in accordance with sections 44 to 47, inclusive, of this Act, proposed revisions to the Comprehensive Plan or amendment thereto, and the Board shall resubmit the revised Comprehensive Plan or amendment thereto to the Regional Planning Commission for review.

Sec. 50. The adopted Comprehensive Plan must be reviewed by the Water Planning Commission on a schedule to be established by the Board, which must at least provide for review of the Comprehensive Plan within 5 years after its adoption and at least every 5 years thereafter. After each review, the Water Planning Commission shall submit to the Board any proposed amendment to the Comprehensive Plan or report that there are no amendments.

Sec. 51. 1. Except as otherwise provided in subsection 2, on and after the date the initial Comprehensive Plan is finally approved, no facility intended to provide a service relating to a subject of the Comprehensive Plan within the planning area may be constructed, if the facility is of such a kind or size as to affect the working of the Comprehensive Plan as distinct from providing normal service to customers, unless it is included in the Comprehensive Plan or has been reviewed and approved as provided in subsection 3.

2. The Comprehensive Plan may allow for the construction of facilities not included within the Comprehensive Plan in order to meet an emergency as defined in the Comprehensive Plan.

3. A proposal to construct a facility described in subsection 1 within the planning area must be submitted to the Water Planning Commission for review and recommendation to the Board concerning the conformance of the proposal with the Comprehensive Plan. The review must include an evaluation of stranded costs, the need for the facility within the planning area and the impact that construction of the facility will have on any potential consolidation of public purveyors. If the Water Planning Commission fails to make such a recommendation within 30 days after the proposal is submitted to it, the Water Planning Commission shall be deemed to have made a recommendation that the proposal conforms to the Comprehensive Plan. The Board shall consider the recommendation of the Water Planning Commission and approve or disapprove the proposal as conforming to the Comprehensive Plan. Any disapproval must be accompanied by recommended actions to be taken to make the proposal conform to the Comprehensive Plan. The Water Planning Commission and the Board shall limit their review to the substance and content of the Comprehensive Plan and shall not consider the merits or deficiencies of a proposal in a manner other than is necessary to enable them to make a determination concerning conformance with the Comprehensive Plan.

4. The Board shall provide, by resolution after holding a hearing, for the Water Planning Commission or its staff to make final decisions concerning the conformance of classes of proposed facilities to the Comprehensive Plan. A resolution adopted pursuant to this section must provide an opportunity for the applicant or a protestant to appeal from a decision of the Water Planning Commission or its staff to the Board.

Sec. 52. Any water right or source of water belonging to a governmental entity within the planning area must be used in accordance with the Comprehensive Plan.

Sec. 53. The provisions of this Act do not supersede the authority granted by law to the State Engineer, the State Environmental Commission and the State Department of Conservation and Natural Resources.

Sec. 54. NRS 540A.060, 540A.070, 540A.080, 540A.090, 540A.100, 540A.110, 540A.120, 540A.130, 540A.140, 540A.150, 540A.160,

540A.170, 540A.180, 540A.190, 540A.200, 540A.210, 540A.220, 540A.230, 540A.290, 540A.300 and 540A.310 are hereby repealed.

Sec. 55. The fee authorized pursuant to NRS 540A.070 must remain in effect and be collected by Washoe County and transferred to the Western Regional Water Commission, created pursuant to section 23 of this act, until such time as the Board of Trustees of the Regional Water Commission adopts a resolution pursuant to section 35 of this act imposing a new fee.

Sec. 56. 1. There is hereby created the Legislative Committee to Oversee the Western Regional Water Commission created pursuant to section 23 of this act. The Committee must:

(a) Consist of six Legislators as follows:

(1) One member of the Senate appointed by the Chairman of the Senate Committee on Natural Resources;

(2) One member of the Assembly appointed by the Chairman of the Assembly Committee on Natural Resources, Agriculture, and Mining;

(3) One member of the Senate appointed by the Majority Leader of the Senate;

(4) One member of the Senate appointed by the Minority Leader of the Senate;

(5) One member of the Assembly appointed by the Speaker of the Assembly; and

(6) One member of the Assembly appointed by the Minority Leader of the Assembly.

(b) Insofar as practicable, represent the various areas within the planning area.

(c) Elect a Chairman and a Vice Chairman from among its members. The Chairman must be elected from one House of the Legislature and the Vice Chairman from the other House. After the initial selection of a Chairman and a Vice Chairman, each of those officers holds office for a term of 2 years commencing on July 1 of each odd-numbered year. If a vacancy occurs in the chairmanship or vice chairmanship, the members of the Committee shall select a replacement for the remainder of the unexpired term.

2. Any member of the Committee who is not a candidate for reelection or who is defeated for reelection continues to serve until the next session of the Legislature convenes.

3. Vacancies on the Committee must be filled in the same manner as original appointments.

4. The members of the Committee shall meet throughout each year at the times and places specified by a call of the Chairman or a majority of the Committee.

5. The Director of the Legislative Counsel Bureau or his designee shall act as the nonvoting recording Secretary.

6. The Committee shall prescribe regulations for its own management and government.

7. Except as otherwise provided in subsection 8, four members of the Committee constitute a quorum, and a quorum may exercise all the powers conferred on the Committee.

8. Any recommended legislation proposed by the Committee must be approved by a majority of the members of the Senate and by a majority of the members of the Assembly appointed to the Committee.

9. Except during a regular or special session of the Legislature, the members of the Committee are entitled to receive the compensation provided for a majority of the members of the Legislature during the first 60 days of the preceding regular session, the per diem allowance provided for state officers and employees generally and the travel expenses provided pursuant to NRS 218.2207 for each day or portion of a day of attendance at a meeting of the Committee and while engaged in the business of the Committee. The salaries and expenses paid pursuant to this subsection and the expenses of the Committee must be paid from the Legislative Fund.

10. The Committee shall review the programs and activities of the Western Regional Water Commission. The review must include an analysis of potential consolidation of the retail distribution systems and facilities of all public purveyors in the planning area, which is described in section 22 of this act.

11. The Committee may:

(a) Conduct investigations and hold hearings in connection with its powers pursuant to this section.

(b) Direct the Legislative Counsel Bureau to assist in the study of issues related to oversight of the Western Regional Water Commission.

12. In conducting the investigations and hearings of the Committee:

(a) The Secretary of the Committee or, in his absence, any member of the Committee may administer oaths.

(b) The Secretary or Chairman of the Committee may cause the deposition of witnesses, residing either within or outside of the State, to be taken in the manner prescribed by rule of court for taking depositions in civil actions in the district courts.

(c) The Chairman of the Committee may issue subpoenas to compel the attendance of witnesses and the production of books and papers.

13. If any witness refuses to attend or testify or produce any books and papers as required by the subpoena issued pursuant to this section, the Chairman of the Committee may report to the district court by petition, setting forth that:

(a) Due notice has been given of the time and place of attendance of the witness or the production of the books and papers;

(b) The witness has been subpoenaed by the Committee pursuant to this section; and

(c) The witness has failed or refused to attend or produce the books and papers required by the subpoena before the Committee which is named in the subpoena, or has refused to answer questions propounded to him,

➥ and asking for an order of the court compelling the witness to attend and testify or produce the books and papers before the Committee.

14. Upon a petition pursuant to subsection 13, the court shall enter an order directing the witness to appear before the court at a time and place to be fixed by the court in its order, the time to be not more than 10 days after the date of the order, and to show cause why he has not attended or testified or produced the books or papers before the Committee. A certified copy of the order must be served upon the witness.

15. If it appears to the court that the subpoena was regularly issued by the Committee, the court shall enter an order that the witness appear before the Committee at the time and place fixed in the order and testify or produce the required books or papers. Failure to obey the order constitutes contempt of court.

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↓2007 Statutes of Nevada, Page 3304↓

16. Each witness who appears before the Committee by its order, except a state officer or employee, is entitled to receive for his attendance the fees and mileage provided for witnesses in civil cases in the courts of record of this State. The fees and mileage must be audited and paid upon the presentation of proper claims sworn to by the witness and approved by the Secretary and Chairman of the Committee.

17. On or before January 15 of each odd-numbered year, the Committee shall submit to the Director of the Legislative Counsel Bureau for transmittal to the Legislature a report concerning the review conducted pursuant to subsection 10 and any recommendations for legislation.

Sec. 57. 1. This section and section 56 of this act become effective on July 1, 2007.

2. Sections 1 to 23, inclusive, and 25 to 55, inclusive, of this act become effective on April 1, 2008.

3. Section 24 of this act:

(a) Becomes effective on:

(1) July 1, 2007, for the purposes of authorizing the entities set forth in that section to enter into the cooperative agreement specified in that section; and

(2) April 1, 2008, for all other purposes, if the cooperative agreement specified in that section is entered into before that date.

(b) Expires by limitation on April 1, 2008, if the cooperative agreement specified in that section has not been entered into before that date.

4. Section 56 of this act expires by limitation on July 1, 2013.

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2009 Amendments to Statues of Nevada, CHAPTER 531

↓2009 Statutes of Nevada, Page 673 ([Chapter 184, SB 111](#))↓

(a) Two members of the City Council of the City of Reno;

(b) Two members of the City Council of the City of Sparks;

(c) Two members of the Board of County Commissioners of Washoe County;

(d) One member representing the Truckee Meadows Water Reclamation Facility or its successor;

(e) One member designated by the Board of Trustees of the South Truckee Meadows General Improvement District or its successor; and

(f) One member of the Board of Trustees of the Sun Valley General Improvement District or its successor.

2. The City Council of the City of Reno, the City Council of the City of Sparks and the Board of County Commissioners of Washoe County shall each appoint one trustee from their membership for an initial term of 2 years.

3. The Board of Directors of the Truckee Meadows Water Authority or its successor shall appoint from its membership, for initial terms of 3 years:

(a) One trustee who is a member of the City Council of the City of Reno;

(b) One trustee who is a member of the City Council of the City of Sparks; and

(c) One trustee who is a member of the Board of County Commissioners of Washoe County.

➥ The trustees appointed pursuant to this subsection must be different persons than those appointed pursuant to subsection 2.

4. The Board of Trustees of the Sun Valley General Improvement District or its successor and the Board of Trustees of the South Truckee Meadows General Improvement District or its successor shall each appoint one trustee from its membership for an initial term of 3 years.

5. The owners of the Truckee Meadows Water Reclamation Facility or its successor shall jointly appoint one trustee for an initial term of 2 years.

6. After the initial terms, each trustee who is appointed to the Board serves for a term of 2 years. A trustee may be reappointed.

7. All trustees must be elected officials. No trustee may serve beyond his term of office.

8. The position of a trustee must be considered vacated upon his loss of any of the qualifications required for his appointment, and in such event, the appointing authority shall appoint a successor to fill the remainder of the unexpired term.

9. For the purposes of this section, the Mayor of the City of Sparks shall be deemed to be a member of the City Council of the City of Sparks.

Sec. 2. Section 36 of the Western Regional Water Commission Act, being chapter 531, Statutes of Nevada 2007, at page 3293, is hereby amended to read as follows:

Sec. 36. 1. The Northern Nevada Water Planning Commission is hereby created in the planning area. The Water Planning Commission must consist of the following voting members who are residents of Nevada:

(a) The Director of Public Works for the City of Reno, or his designee;

(b) The Director of Public Works for the City of Sparks, or his designee;

(c) The Director of Water Resources for Washoe County, or his designee;

(d) A member of the South Truckee Meadows General Improvement District or its successor;

(e) The General Manager of the Sun Valley General Improvement District or its successor, or his designee;

(f) The General Manager of the Truckee Meadows Water Authority or its successor, or his designee;

(g) The General Manager of the Truckee Meadows Wastewater Reclamation Facility or its successor, or his designee;

(h) One member appointed by the governing body of the Indian reservation which is the largest in area ~~[in]~~ ***and contiguous to*** the planning area ***;*** ~~[, if the planning area contains an Indian reservation, or, if there is not an Indian reservation located within the planning area or the governing body of the reservation does not appoint a member, one member appointed by the Board to represent the public at large;]~~

(i) One member of the public at large appointed by the Board to represent environmental, biological, conservation or public concerns;

(j) One member appointed by the Board to represent owners of domestic wells;

(k) One member appointed by the Board of ~~[Supervisors]~~ ***Directors*** of the Washoe ~~[Storey]~~ ***County Water*** Conservation District or its successor; and

(l) Such additional members with expertise in any area that the Board determines is necessary, appointed by the Board.

➥ The terms of the ex officio members described in paragraphs (a) to (g), inclusive, are concurrent with the employment of those members in the respective positions specified in those paragraphs. The members appointed pursuant to paragraphs (h) to (l), inclusive, serve initial terms of 2 years.

2. After the initial terms, the term of office of each member appointed pursuant to paragraphs (h) to (l), inclusive, of subsection 1 is 3 years. A member may be reappointed. A vacancy must be filled for the unexpired term by the appointing entity.

Sec. 3. This act becomes effective on July 1, 2009.

Appendix B

Truckee Meadows Water Authority 2016-2035 Water Resource Plan

Appendices Available Online at: http://www.tmwa.com/wp-content/uploads/docs/your_water/2035WRP/__2035_WRP_VolumeIII_Appendices.pdf

2016 – 2035 WATER RESOURCE PLAN

VOLUME I

ABSTRACT

ABBREVIATIONS

2025WRP	2005-2025 Truckee Meadows Water Resource Plan, Truckee Meadows Water Authority, March 2003
2030WRP	2010-2030Truckee Meadows Water Resource Plan, Truckee Meadows Water Authority, December 2003
2035WRP	2016-2035 Truckee Meadows Water Resource Plan
AF	Acre-Feet, an acre-foot is equal to 325,851 gallons
AF/yr	Acre-Feet/Year
CTMRD	Central Truckee Meadows Remediation District
DMPs	Demand-side management programs
DRI	Desert Research Institute
eDMPs	Enhanced demand-side management programs
JPA	Joint Powers Authority
M&I	Municipal and Industrial
NDEP	Nevada Division of Environmental Protection
NNWPC	Northern Nevada Water Planning Commission
non-TRA	non-Truckee Resource Area
NRS	Nevada Revised Statute
NVIP	North Valley Importation Project
PCE	tetrachloroethylene, a volatile organic compound
PLPT	Pyramid Lake Paiute Tribe
POSW	Privately-Owned Stored Water, as defined in the 1935 Truckee River Agreement
RWPC	Regional Water Planning Commission
SMPs	Supply-side management programs
STMGID	South Truckee Meadows General Improvement District
SVGID	Sun Valley General Improvement District
TCID	Truckee-Carson Irrigation District
TMWA	Truckee Meadows Water Authority
TMSA	Truckee Meadows Service Area
TRA	Truckee Resource Area
TROA	Truckee River Operating Agreement
UNR	University of Nevada, Reno

USEPA	U.S. Environmental Protection Agency
WCHD	Washoe County Health District
WDWR	Washoe County Department of Water Resources
WHPP	Wellhead Protection Plan

PREFACE

The Truckee Meadows Water Authority ("TMWA") was created in 2000 through execution of the "Cooperative Agreement" among the City of Reno, City of Sparks, and Washoe County ("JPA"). One of the main purposes in creating TMWA was to meet the "common interest in assuring that water resources be developed and managed to fulfill the present and future water needs of the greater Truckee Meadows community" and "to assure sufficient water supply to meet the needs of existing and future development." [JPA Recitals "A" and "D"]. Given its JPA directive authorizing TMWA to provide retail water service to customers within its retail service area, TMWA is required to ensure its customers' water demands can be met in the most efficient, cost-effective manner in both dry and non-dry years.

The JPA also requires that TMWA establish a water resource plan which identifies, among other things, "(i) water supplies available to TMWA from all sources and (ii) demand within the Authority's retail service area….and the means by which such requirements will be met." The focus of TMWA's water resource planning is meeting TMWA's primary mission to deliver potable drinking water to the residents and businesses of the greater Truckee Meadows area, in perpetuity. It is important to note the scope of TMWA's water planning process, as defined by its JPA directive, does not provide for municipal sewer, reclaim, flood control, storm drainage or groundwater remediation. Those functions are planned for by Reno, Sparks or Washoe County. All water-related utility planning efforts, including TMWA's water plan and facility plan, are incorporated into the Western Regional Water Commission's ("WRWC") *Regional Water Management Plan* (under revision at the time of this writing).

The purpose of recurring water resource planning efforts is to examine changes in conditions, circumstances, or risks that may influence TMWA's ability to: (1) meet the demands of its current customers and (2) determine the extent of TMWA's ability to service the future water needs of the greater Truckee Meadows area with current and/or future acquired water resources. TMWA's water resource plans analyze trends in climatic, demographic, economic, regulatory and legal influences that may pose a risk or impair TWMA's right to divert surface or groundwater and deliver potable water. A water resource plan also investigates TMWA's ability to acquire new sources of supply.

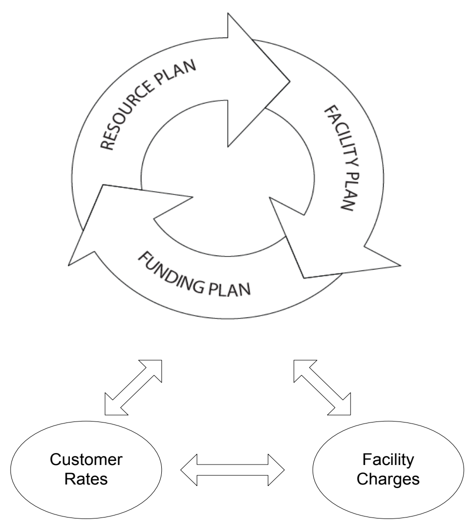
This *2016-2035 Water Resource Plan* ("2035WRP") is the third such plan produced by TMWA pursuant to the JPA since the utility's inception in 2001. The 2035WRP builds upon and incorporates themes and findings of prior TMWA and various regional water resource plans. TMWA's Board of Directors adopted its first plan, the *2005-2025 Water Resource Plan ("2025WRP"),* in March 2003 and adopted its second plan, the *2010-2030 Water Resource Plan ("2030WRP"),* in December 2009. The prior water resource plans provide the historical context of how events over the years have shaped the management of water resources available to the community. The use and distribution of the waters of Lake Tahoe and the Truckee and Carson Rivers have been a flashpoint of controversy for more than a century, with issues including how the waters should be divided between California and Nevada, how much water should go to agriculture, how much water should go to Pyramid Lake and its native fish, how to create opportunity for enhancing recreation and wildlife uses, and how water supplies should be allocated to meet the water demands of urbanization in the greater Truckee Meadows region. Comprehending these water resource plans is difficult without an exposure to the tumultuous history of complex legal and operational issues of the Truckee River system. To gain a fuller understanding of the contextual history of TMWA and water resource management for the greater Truckee Meadows region which began in the late 1800's the reader is encouraged to review the 2025WRP and the 2030WRP.

As a municipal provider of water service the water utility must take a very long-term planning perspective to ensure its available water resources are renewable, reliable and sustainable, in essence, in perpetuity. Ramifications from events that affect and shape the delivery of potable water take years to unfold. For example, fluctuations in population and economic conditions, such as dramatic growth during the 1980's through the early 2000's, or stagnation resulting from the 2007-2009 Recession, can positively or negatively impact water demand. Since future economic and population growth remain speculative, reliance on careful analysis of changes in economic trends is paramount to confident projections of future water demand. Moreover, the goals and objectives set by the community and its elected officials also evolve over time. In order to accommodate the land use entitlement and planning functions of the cities, counties and regional planning agencies, TMWA's water resource planning is designed to allow TMWA to meet the needs of anticipated future growth (if and when local land use planners and their governing bodies determine that such growth is appropriate). Should conditions warrant, with sufficient long-term view, the utility can anticipate and prepare for the construction of new water supply projects which can take decades to permit and complete. In order to develop adaptive strategies to meet both current and potential future water needs of the community, TMWA crafts its water resource plans to span a 20-year period. A 20-year plan provides a reasonable timeframe in which to assess potential changes and implement tractable and sustainable solutions. Planning for *the ability* of future municipal water supplies also furthers State policy to provide water which is safe for drinking and other domestic purposes, protects existing water rights and encourage efficient and non-wasteful use of limited water resources.

As economic and political conditions affect demand for water, seasonal fluctuations in Truckee River flows impact water supplies. Due to variability in climate and weather conditions, the form of precipitation (i.e., rain versus snow) and the timing of this precipitation affect Truckee River flows, TMWA's primary source of water supply, and TMWA's ability to capture those river resources. The December 1, 2015 implementation of the Truckee River Operating Agreement ("TROA") is a prime example of long-term planning for, and successful adaptation to, emerging water issues—some of which were identified in the 1970's. TROA is the culmination of decades of deliberative and careful water resource planning designed to address concerns over future water supply. TROA replaces the rigid and inflexible water management system for the Truckee River. The prior management system was dictated by decades-old court decrees and was originally designed to serve agriculture, small hydroelectric plants, now defunct paper mills, and a small, rural community. TROA now provides flexible Truckee River operating criteria, allowing TMWA the ability to adapt to future variability of climatic, hydrologic and economic conditions, while taking advantage of unused storage space in federal reservoirs. This new system means the Truckee Meadows community has a sustainable water supply that can meet demand for the 2035 planning horizon and beyond. TROA does this by allowing TMWA to use water when it needs it, and store it when it is not needed, rather than being required to let water flow past the Truckee Meadows as under old operating criteria. TROA also grants TMWA new rights to credit store and exchange waters in numerous upstream reservoirs, providing critical expanded drought protection to meet current and future municipal needs.

While changes to the supply of, and demand for, water resources cannot be accurately predicted and since it often takes years for extended dry or non-dry periods to be identified, TMWA is continually adapting its supply strategies to ensure it can meet the needs of its customers through such variability. In order to account for supply variability and develop dynamic, adaptive plans so as not to extend beyond the sustainability of available water resources, every five years TMWA updates its water resource plan. If water supply or other conditions significantly change within the regular 5-year update cycle, TMWA may update its Water Resource Plan more frequently.

Based on supply and demand projections, TMWA's water resource plan describes optimizing strategies to manage, develop and utilize available water resources, provides direction for facility planning to ensure a safe reliable supply of water, and identifies potential impediments to avoid or mitigate the legal use of TMWA's water resources. By integrating the long-term resource supply and demand with facility assessment and planning, TMWA ensures funding mechanisms are in place to meet current and projected future demand conditions. In addition to TMWA's water resource plan, TMWA prepares its 20-year water facility plan and regularly updated its funding plans to ensure the continued success of the utility in achieving its mission. The water resource and facility plans set forth how the utility will meet the policy directives outlined in the JPA and in other Board adopted documents, and by implication, regional objectives of the local governments as they comprise TMWA's Board of Directors. Both plans are operational in nature, in that they identify assets available to TMWA to generate high-quality, potable water supplies for current and future customers in a cost-effective manner. The water resource and facility plans form the basis for TMWA's funding plan which is the core of the utility's financial success. TMWA's 2035WRP is one component of the coordinated planning efforts addressing the water resource and facility challenges facing the utility and the region. The objective is to develop workable strategies that are cost effective and protect the financial integrity of TMWA—and by extension, shield customers from undue costs. A visual representation of the cyclical nature of TMWA's dynamic, integrated planning approach is shown below in Figure 1-1.



The cycle of planning, monitoring, analyzing, and updating is a continuous, dynamic process necessary to respond to changing economic and environmental factors that affect the greater Truckee Meadows current and future water supply.

SYNOPSIS OF THE 2016-2035 WATER RESOURCE PLAN

TMWA's 2035WRP is presented in three volumes:

- *Volume I – Abstract Truckee Meadows Water Authority 2016-2035 Water Resource Plan*
- *Volume II – Truckee Meadows Water Authority 2016-2035 Water Resource Plan*
- *Volume III – Appendices to Truckee Meadows Water Authority 2016-2035 Water Resource Plan*

This section of the Abstract contains a brief synopsis of each of six distinct chapters contained in *Volume II* within the water plan which are presented in the following order:

- Chapter 1, "Introduction", presents some of the key past and current trends and challenges that have shaped, or are projected to shape, the future of the greater Truckee Meadows region and the availability of water resources.
- Chapter 2, "Source Water Reliability", presents discussion of quality of surface and ground water sources, climate change and climatic effects, source/loss risk analysis, and water quality protection/response plans.
- Chapter 3, "Integrated Management of Water Resources", describes availability of water rights used by TMWA and how those resources are conjunctively managed to annually produce a sufficient amount of water to meet TMWA's water service demands in non-Drought and Drought-Situation years.
- Chapter 4, "Population and Water Demand Projections", presents forecasts of population and water demands for the planning horizon.
- Chapter 5, "Water Conservation Plan", describes the various conservation programs and measures that TMWA employs to reduce annual water use and minimize water waste in both non-drought and drought-situation years, including a comprehensive list of tools that the TMWA Board can employ to produce enhanced water savings based on water supply conditions at any given time.
- Chapter 6, "Future Water Resources", identifies potential future water resources.

Chapter 1

Economic development of the communities in and surrounding the Truckee Meadows is the primary driver and impetus to expand the pool of available water resources to meet the needs of the greater Reno/Sparks region in southern Washoe County. Over the past several decades water resource planning in the region focused its efforts on comparing smaller, incremental supply projects to the long-term water supply of the larger river settlement project, i.e., TROA. After nearly 40 years, the final components of TROA, signed on September 6, 2008, were completed in 2015 so that TROA could finally be implemented. This past August 2015 major milestones related to the Reno, Sparks and Washoe County obligation to supply 6,700 acre feet ("AF") of Truckee River water rights were completed. The final two lawsuits before TROA could be implemented were dismissed in September and November 2015. On December 1, 2015, TROA was implemented and TMWA began crediting storing water the same day -- the first time in history the water utility has been able to store water during a winter month. With the implementation of TROA, and the underlying elements of the Negotiated River Settlement ratified in PL 101-618 activated, the communities' water demands of up to 119,000 AF/yr within the Truckee Resource Area ("TRA")[1] can be reliably met as long as acceptable Truckee River water rights are dedicated to TMWA by future development prior to issuing new will-serve commitments. TROA provides greater flexibility in river operations, particularly during drought conditions as TMWA's drought storage potential increases, river flows are enhanced for endangered and threatened fish species, and water rights of the signatories and non-signatories to the agreement are protected. That is not to say work on other supply projects is discontinued. On the contrary, TMWA continues to track progress on various projects as it looks beyond TROA and the projected water needs of the region well beyond the planning horizon of this plan. The need and timing of future water supply projects will be dictated by future economic conditions and employment opportunities constrained by the availability and costs of developable land, water rights, rights-of-way, sewer treatment, Truckee River water quality, and related public infrastructure.

Introduced in the 2007 Nevada Legislative Session, SB487 proposed to create a new regional water resources entity in Washoe County. Pursuant to SB487 the cities of Reno and Sparks, the South Truckee Meadows General Improvement District ("STMGID"), the Sun Valley General Improvement District ("SVGID"), TMWA, and Washoe County formed a JPA to operate the WRWC in 2008. The WRWC is charged with facilitating cooperative resource management efforts among the existing water purveyors in southern Washoe County and to provide for integration of regional water supply and storm water management, subject to TROA. SB487 included a change of oversight and restructuring of the Regional Water Planning Commission ("RWPC") into the Northern Nevada Water Planning Commission ("NNWPC"), in addition to an evaluation of the possibility of merging water purveyors in the Truckee Meadows. The outcome of the process lead to the successful integration of STMGID and Washoe County's water systems into TMWA on December 31, 2014. From the aspect of treating and delivering potable water to customers, the consolidation enhanced efficiencies related to the operation of water production and distribution systems. The consolidation also allows for consistent water management strategies and the expanded use of surface water and reduced use of groundwater, thereby improving aquifer conditions in the various basins where TMWA operates. Although the merger expanded TMWA's planning and operational responsibilities, the addition of water systems did not burden TMWA since each system has its own resources and facilities for ongoing operations. However, it poses additional resource management challenges to ensure adequate supply within the expanded TRA. For those systems adjacent to TMWA's pre-merger service area, the enhancement in operations, allowing expansion of surface water use

[1] The introduction and use of the phrase "Truckee Resource Area" ("TRA") is used to designate TMWA's existing retail and wholesale service areas within which (1) TMWA will accept for dedication, subject to certain conditions, a Truckee River water source/right for the delivery of water to a service property that can be served with Truckee River resources and (2) facilities exist or can be constructed at a developers expense that can transport potable Truckee River water that once it has been diverted and treated at TMWA's Chalk Bluff or Glendale Water Treatment Facilities. TMWA operates 5 separate systems in hydrographic basins that are not served from the treatment plants and are grouped under the "non-TRA" designation. These designations are needed to track the surface and groundwater rights to be assigned to various service areas and whether the rights and their use are part of resources for TROA.

in lieu of groundwater use, is a significant benefit to TMWA's new customers in those areas, particularly in the southwest portion of the Truckee Meadows hydrographic basin.

Also acquired in the merger were 5 smaller satellite-groundwater-dependent systems which are grouped under a "non-TRA" category for resource tracking purposes since each system has resources and facilities to meet the build-out conditions established when the system was initiated. For this plan, TMWA did not contemplate the acquisition of additional, out-of-service-area resources for these small systems due to: the remoteness of the systems; no indication of impending development adjacent to these systems; limited or fully committed groundwater resources in the hydrographic basins where these systems are located; and the costs to bring other resources to these systems presently outweighs the benefits.

Chapter 2

Meteorologic conditions and resulting droughts are the most significant weather variables and source supply contamination are of greatest concern in assessing the quantity and quality of water supplies available for continued municipal uses. Studies completed by Desert Research Institute ("DRI") indicate that while the potential for climate change to alter the timing, type of, and quantity of precipitation is possible, continued monitoring of meteorologic trends is required; therefore, specific recommendations in management of the region's water supplies, or any restriction to implementation of water resources due to climate change, have not been produced by the various researchers investigation of this phenomenon. Low precipitation years that lead to low snowpack accumulations can affect the amount of water available to the Truckee River system; Lake Tahoe elevations provide an indication of the severity and duration of historic drought periods.

TMWA's source water, both surface and ground, is of very high quality, meeting, and in many cases, significantly exceeding all required drinking water standards. A Water Quality Assurance Program is implemented to ensure this high standard continues to be met for current and future customers. While there is a risk to surface water reliability from turbidity and toxic spill events, TMWA has sufficient well capacity and distribution storage to meet reduced customer demands during a water quality emergency until repairs are completed or the threat to supplies has passed; additional actions are available to TMWA in the event of extended off-river emergencies. TMWA's Wellhead Protection Plan ("WHPP") provides information by which TMWA can develop and implement groundwater protection strategies to mitigate potential threats to groundwater sources, including educational outreach. The WHPP is operated voluntarily, under local jurisdiction and control, and utilizes both U.S. Environmental Protection Agency ("USEPA") and Nevada Division of Environmental Protection ("NDEP") guidance and criteria to provide for State endorsement. Successful examples of the WHPP working include TMWA's cooperation with NDEP and Washoe County Health District ("WCHD") to mitigate the Sparks Solvent/Fuel Site Remediation, the Stead Solvent Site Remediation, and over the years mitigation of several leaking, underground storage tanks in and around the Truckee Meadows along with the Central Truckee Remediation District for the clean-up of tetrachloroethylene ("PCE") in the Reno/Sparks area. TMWA's Source Water Protection Program is designed to preserve and enhance available surface water and groundwater supplies and to address known and potential threats to water quality, and remains adaptive to changes in USEPA, NDEP or WCHD drinking water standards and regulations.

Results from the analyses about *Source Water Reliability* described in Chapter 2 identified major factors affecting TMWA's primary water supplies and TMWA's responsive mitigation measures as summarized here:

- Weather and source supply contamination are of greatest concern in assessing the quantity and quality of water supplies available for continued municipal uses.
- Changes in management of or any restriction to implementation of water resources due to climate change are not warranted at this time.
- Low precipitation years that lead to low snowpack accumulations affect the amount of water available to the Truckee River system; Lake Tahoe elevations provide an indication of the severity and duration of historic drought periods.
- Drought periods have established patterns, typically taking three years of consecutive dry winters to cause Lake Tahoe to fall to or below its rim; however, all the reservoirs may be replenished quickly with one or two wet winters.
- Hydrologic droughts (periods when TMWA availability to use physical supplies of water diminishes) occur after 3 or 4 years of meteorologic droughts conditions.
- Drought periods occur in the Truckee Meadows and have ranged in duration from a few years to 8 years with intervening "wet" and "dry" years within the drought period.
- TMWA's source water is of very high quality, meeting, and in many cases, significantly exceeding all required standards. A Water Quality Assurance program has been implemented to ensure this high standard continues to be met in the future.
- While there is a risk to source water reliability from turbidity and toxic spill events, TMWA has sufficient well capacity and distribution storage to meet reduced customer demands during a water quality emergency; additional actions are available to TMWA in the event of extended off-river emergencies. An earthquake event in 2008 tested TMWA's emergency response plan with a loss in water supply and demonstrated TMWA's ability to respond by having trained staff and available alternate water supplies.
- TMWA has a robust Source Water Protection Program in place designed to preserve and enhance available surface water and groundwater supplies and to address known and potential threats to water quality.

Chapter 3

At this time, Truckee River irrigation rights continue to be the major source of water supplies for the TRA. Through continued conversion and commitment to Municipal & Industrial ("M&I") use, the number of available Truckee River water rights available will meet the projected growth through the planning horizon. Noted is the fact that the water rights market is becoming more competitive as there are other demands for these rights, such as M&I use in the Fernley area or use as dilution flows for water quality enhancement in the Lower Truckee River. Other factors discussed that are affecting the future acquisition of water rights in an open market environment include issues of ownership and finding willing sellers of the water rights which will ultimately affect the price and availability of water rights. TMWA has over 7,000 AF of resources in its Rule 7 inventory, implying a 7 to 10 year supply depending on market demands. Significant price variation for water rights between 2005 and 2010 portends the future water rights market beyond the planning horizon. Including 8,000 AF of the North Valleys Importation Project ("NVIP"), TMWA's combined pool of resources for all its service areas over 188,000 AF of decreed, converted irrigation, groundwater, and storage rights.

TMWA conjunctively manages its water supplies during drought periods by utilizing a combination of natural river flows, groundwater pumping including extraction of accumulated volumes of injected surface water, releases of its upstream drought reserves, i.e., privately owned stored water ("POSW"). TMWA manages for uncertainty of its water supply, in terms of the overall quantity and the timing of its delivery, through storage of water in upstream reservoirs and injection of treated surface water through its network of wells into aquifers in Lemmon Valley, Spanish Springs and Truckee Meadows. When river flows are available, TMWA maximizes the use of surface water resources while minimizing the use of groundwater supplies. This approach allows TMWA to meet demands with surface water, and to rest and recharge specific wells when enough surface water is available. TMWA continually assesses the potential reduction to source water supplies due to variability of weather conditions. This continual reassessment of source water supplies and management tactics is the best defense against reservoir depletion as well as unnecessary economic stress to both the utility and customer base.

Significant to water resource planning is the selection of a drought period to estimate the yield of TMWA's resources during Drought Situations. In years when sufficient precipitation occurs, there is no need for TMWA to pump significant amounts from its wells or release any of its POSW in upstream reservoirs since the Truckee River can supply the majority of water to meet customer demands. TMWA manages its resources to take maximum advantage of Truckee River flows while minimizing use of its groundwater and upstream reserve supplies during non-Drought Situation years. Planning for water supplies during a critical-year in a drought period determines the maximum amount of water demand TMWA will be able to provide. As a result of implementing TROA and the continued dedication of river rights, TMWA is able to fully utilize TROA's demand limit of 119,000 AF. In addition, there are existing groundwater or creek resources that may be acquired or developed in the TRA over the planning horizon which provide over 140,000 AF of resources when added to TROA. During the negotiation and environmental process for TROA, its supply was designed to meet demands through the historic drought from 1987 to 1994. Scenarios developed for the 2035WRP tested TMWA's water supplies under TROA operations using hypothetical droughts with (1) back-to-back 1987-1994 plus 1987 hydrology and (2) repeating 2015 hydrology for 5-years over using projected demands over the 20-year planning horizon; results demonstrate an accumulation of upstream reserves in throughout the planning horizon.

The processes associated with the concepts of *Integrated Resource Management* described Chapter 3 derived from conjunctively managing surface rights, groundwater rights, and water production facilities include the following:

- TMWA has sufficient water resources to meet the demands of current customers.
- Within the TROA/TRA and subject to future water-rights-market conditions, Truckee River water rights are available to take advantage of 119,000 AF of demand TROA provides.

- There are sufficient groundwater resources to meet current demands through the planning horizon within the non-TROA/TRA.
- Including 8,000 AF of NVIP groundwater resource, TMWA's combined pool of resources in the TRA is over 188,000 AF of decreed, converted irrigation, groundwater, and storage rights.
- Current production capacities are:

	TRA	non-TRA
Chalk Bluff	90.0 MGD	na
Glendale	33.0 MGD	na
Subtotal Surface	123.0 MGD	na
Groundwater	100.0 MGD	17.0 MGD
Total	223.0 MGD	17.0 MGD

- Aquifer recharge has improved or stabilized groundwater levels in and around the injection wells thereby preserving TMWA's ability to utilize its groundwater resources to meet summer peaking and/or drought situation pumping requirements without degrading groundwater quality.
- Drought year cycles are rare events, similar to flood events. The estimated drought frequencies are:

8-year	1 in 230 years
9-year	1 in 375 years
10-year	1 in 650 years

- Published tree-ring studies have shown a dry winter like 2015 occurs with a frequency of 1 in 3,100 years.
- Drought yield of TMWA's TRA existing resources is a function of available resources and drought-year design. Based on available data, the 1987 to 1994 Drought remains the worse drought of record for the Truckee River and is the design criteria for TROA.
- Under TROA, hypothetical droughts were analyzed: (1) 9-year simulation of 2012 to 2015 actual hydrology plus 5 year repeating 2015 annual hydrology; (2) 20-year simulation of 2012 to 2015 actual hydrology plus 1987 to 1994+1987 hydrology repeated twice; and (3) 20-year simulation of 2012 to 2015 actual hydrology plus 2015 hydrology repeated 20 years indicate TMWA has sufficient dry-year reserves to meet demands, and in many years during the drought period accumulates drought reserves under TROA operations.
- The 2015/2016 winter and subsequent 2016 run-off projections indicate a moderate recovery-year but not necessarily an end to the drought period begun in 2012.

Chapter 4

The population model used for this plan, which implicitly accounts for environmental and economic conditions, forecasts population increasing at a decreasing rate of growth between

2016 and 2060. Projected Washoe County population for the year 2035 is 545,000 persons of which TMWA serves approximately 90 percent. The estimated water demand to support the projected population can be served and managed with TROA and existing groundwater resources through the planning horizon. In 2035, TMWA will have over 150,000 active water services and water will be delivered by TMWA to an estimated 475,000 persons living in the combined TRA and non-TRA service areas. The 2035 water demand projections for this plan indicate water demands will grow approximately 18,000 AF over the planning horizon, from approximately 83,000 AF forecasted for 2016 to 101,000 AF forecasted in 2035. TMWA has sufficient water production facilities to meet current and near-term demand; the timing of construction for new water production facilities to meet future demands will be developed in TMWA's upcoming *2016-2035 Water Facility Plan*.

The *Water Demand Forecast* projection process outlined in Chapter 4 presented TMWA's forecast of population, water demand, and numerous factors impacting the demand forecast are summarized as follows:

- A long term population projection through 2060 is developed using historic county population estimates from 1950 to 2014.
- TMWA's population forecast was found to be statistically similar to the 2014 State Demographer projections for Washoe County.
- Washoe County population is expected to see an average annual growth of 1.17 percent and a total population increase of over 101,000 persons from approximately 443,700 persons in 2015 to 551,300 by 2035.
- Based on expected growth, over 150,000 active water services are projected for the year 2035.
- Average water use, per service, is calculated based on usage data between 2009 to 2014. This approach captures recent changes in response to: (1) TMWA's billing structure; (2) average physical attributes of services; and (3) climate.
- Interacting average water usage with active service projections yields water demand projections through 2035.
- Total demand for water within is projected to increase approximately 83,000 in 2016 to 101,000 by 2035.
- Analysis of population and building trends show water demand increasing at a decreasing rate between 2015 and 2035 (i.e., while new growth will increase total production, per-service usage is expected to decline through time).

Chapter 5

Water conservation is achieved through efficient storage and delivery of the water supply and effective management of demand for that supply. Water supply management has been defined as the control of the water supply by the water purveyor or authority (Stephenson, 2012). Water demand management has been defined as "the development and implementation of strategies, policies, measures, or other initiatives aimed at influencing demand, so as to achieve efficient and sustainable use of this scarce resource" (Savenije and van der Zaag, 2002). TMWA's conservation plan contains the necessary elements to manage both the supply of its water resources as well as demand for those resources, and for meeting the requirements of the JPA, Nevada Revised Statute ("NRS") 540.313 through 540.151, and TROA. To address the state's water resource challenges, Nevada's Governor Sandovol released in December 2015 the *Nevada Drought Forum: Recommendations Report* which outlines, among other things, recommendations on the best water conservation practices. In addition to the legal mandates, TMWA's conservation plan is consistent with the recommendations identified in this report.

TMWA's conservation plan has two components: (1) supply-side management programs ("SMPs") are designed to reduce production and distribution losses and (2) demand-side management programs ("DMPs") are designed to conserve water supplies by limiting water waste, inefficient use, and overuse. TMWA's SMPs are actions taken to maintain water resources and provide alternative sources to potable water in a cost-effective manner, as well as to ensure water is delivered to customers in an efficient manner. Once water is delivered to the customers, TMWA's DMPs target customers' watering practices in order to promote efficient use of its available water resources. The region experiences meteorologic droughts[2] brought on by climatic conditions which may or may not affect TMWA's available water supplies in any given year. If meteorologic drought conditions persist, then hydrologic drought[3] conditions can ensue which begin to affect both natural river flows and, at times, TWMA's groundwater and upstream reservoir supplies (i.e., POSW). When a Drought Situation[4] is identified, TMWA evaluates what actions from customers may be necessary to reduce demands. As mentioned above, under TROA operations, managing drought reserves are significantly enhanced (i.e., increased storage potential) thereby reducing much of the pressure on water supplies and customers during Drought Situations. TMWA's four level Drought Situation classification system specifies the timing of enhanced DMP ("*e*DMPS") activities. This classification is directly linked to TROA's operation protocol and definitions regarding the need to reduce water use when water reserve supplies are impacted. This system is efficient in that it is tied to TROA operations and criteria, minimizes administrative burden and costs on TMWA, and improves TMWA's ability to create more meaningful, easier to understand information campaigns that relate needed reductions in customer use to available water supplies. Based on targeted savings for the year during drought periods TMWA enhances its DMP to promote further reduction in water consumption by its customers in the event the drought situation extends for another year. Program success is evaluated differently depending on the type of program and TMWA strives to provide the most meaningful effectiveness metrics, whenever possible.

Specific findings about TMWA's *Water Conservation Plan* presented in Chapter 5 include the following:

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[2] Meteorologic drought is often defined by a period of well-below-normal precipitation. The commonly used definition of meteorologic drought is an interval of time, generally of the order of months or years, during which the actual moisture supply at a given place consistently falls short of climatically appropriate moisture supply.

[3] Hydrologic drought refers to periods of below-normal streamflow and/or depleted reservoir storage.

[4] Pursuant to TROA: "**Drought Situation** means a situation under which it is determined by April 15, based on procedures set forth in Section 3.D, either there will not be sufficient **Floriston Rate Water** to maintain **Floriston Rates** through October 31, or the projected amount of **Lake Tahoe Floriston Rate Water** in Lake Tahoe, and including **Lake Tahoe Floriston Rate Water** in other **Truckee River Reservoirs** as if it were in Lake Tahoe, on or before the following November 15 will be equivalent to an elevation less than 6,223.5 feet Lake Tahoe Datum."

- TMWA's Conservation Plan meets the requirements of the JPA, NRS 540.313 through 540.151, and TROA.
- TMWA's conservation plan is consistent with the water conservation recommendations detailed in the 2015 Nevada Drought Forum: Recommendations Report.
- TMWA will continue to be fully engaged in the regional dialogue on responsible water use and will implement programs for its customers that benefit the region and support regional water use goals.
- TMWA's water demand management programs pursue measures to efficiently use its available water resources by addressing water waste, system deficiencies (e.g., leaks, pressure changes, etc.), public education and outreach, watering schedules, drought situations, and emergency conditions.
- Demand management programs may be progressively enhanced during Drought Situations to address the need to reduce water use when water reserve supplies are impacted.
- Enhanced DMPs may be necessary in response to natural disasters and other events that have potential to interrupt TMWA's available water supplies.
- TMWA will continue to be engaged in the regional dialogue on responsible water use and will implement programs for its customers that benefit the region and support regional water use goals.
- TMWA will continually assess the benefits of implemented programs and may modify programs to reflect new practices, technologies, and regional climate information.
- New and innovative ways to improve efficient water use will continue to be assessed, including expanded uses of non-potable supplies.

Chapter 6

Although TMWA can continue to convert Truckee River water rights, from irrigation to M&I, and provide for new development based on its current pool of resources in the growth prone areas of the Truckee Meadows and thus take full advantage of TROA, TMWA is active in evaluating aquifer storage and recovery and creek development projects, as well as monitoring various groundwater importation projects. The activities of the groundwater importation project sponsors are vital in order to have the next viable water resource available when demands dictate its need. In reviewing prior water plans, the number of water supply projects available for future development has decreased from a high of twenty to eight projects. The reduction in supply projects is a result of changes in conditions necessary to facilitate developing a project. For example, the loss in the number of potential reservoir sites is due to housing developments that have been built in the proposed reservoir site (e.g., Mogul Canyon west of Reno or Canoe Hill in the eastern foothills of Spanish Springs). The estimated supply from future water supply projects has also decreased over the past 20 years, from a high of 73,000 AF under the TROA supply scenario in the 1994/1995 planning period to the current estimate of 51,000 AF from all projects including TROA supplies. These changes are due to reductions in the number of potential supply projects as permitting processes are stalled or denied and/or as a result of changes in the scope of the project. For example, the North Valleys Importation Project ("NVIP") (subsequently purchased and implemented by Vidler Water Company) originally sought a permitted yield of 13,000 acre feet/year ("AF/yr"). The project is currently permitted for 8,000 AF/yr, and may be expanded to 13,000 AF/yr pending commitment of the 8,000 AF and demonstration of the sustainability of the resource. Also, plans are underway to construct a creek-treatment plant to help reverse declining groundwater supplies in the Mt. Rose area and support expanded use of creek water rights for future development. Although there has been a decline in the number of potential water supply projects and in the quantity available from these projects, the conclusion to draw is that future water supply development may reach beyond TMWA's TRA and non-TRA service areas, and ultimately be costly to implement.

Specific findings about TMWA's *Future Water Resources* presented in Chapter 6 include the following:

- In the TRA, TROA will provide 119,000 AF/yr, sufficient to meet the projected demands through the planning horizon.
- The NVIP place of use is in the North Valleys, the project is operational, and will yield 8,000 AF/yr.
- Plans are underway to construct creek-treatment plant(s) to help reverse declining groundwater supplies in the area and support expanded use of creek water rights for future development.
- There are several importation projects for the North Valleys area that are in various stages of permitting and/or design. Construction of these projects is subject to positive changes in economic conditions leading to increased demand for water supplies.
- TMWA will continue to closely monitor advancements in the potable reuse industry to determine its potential applicability to the Truckee Meadows.
- Over the years, numerous projects have been proposed but remain unbuilt due to lack of financing, permitting, conceptual design, institutional or regulatory constraints, etc.

KEY FINDINGS AND RECOMMENDED ACTIONS

This section of the Abstract contains the "Key Findings and Recommendation Actions" which (1) summarize the significant findings from each chapter of the 2035WRP and (2) provide specific recommendations for the Board to consider and act upon.

1.1 2016-2035 Water Resource Plan ("2035WRP")

***Findings**:*

Truckee Meadows Water Authority's ("TMWA's") prior water resource plans: (1) laid the foundation for an understanding of the region's water supply system; (2) summarized the history of municipal water supply in the Truckee Meadows up to and including the formation of TMWA; (3) presented legislative directives that modified regional water resource planning for the Truckee Meadows and led to the creation of the Western Regional Water Commission ("WRWC"); (4) analyzed economic influences at the local level that affect the growth activity and patterns for the Truckee Meadows resulting in a need to examine current population trends and their potential impact on future water demands and resource requirements; (5) confirmed the use of Truckee River flows during the historical 1987-1994 drought period as the basis for prudent water supply planning for the Truckee Meadows; and (6) provided ongoing analysis of future water supply options to meet the region's economic development needs. This 2035WRP continues the Board's previous direction to review conditions and influences affecting water supplies and local growth trends and what those influences may have on Truckee Meadows water resources and TMWA's plans and/or management strategies in the context of completion of the merger of the former Washoe County water utilities into TMWA in December 2014; completion of all conditions precedent to implement the Truckee River Operating Agreement ("TROA"); and current hydrologic conditions.

Recommendation:

Continue monitoring, reviewing and revising, where necessary, its water resource management strategies through its planning efforts, as presented in documents such as this 2035WRP, in response to current and future conditions including but not limited to changing conditions in meteorology, hydrology, community development, institutional/regulatory constraints, customer demands, or other factors affecting TMWA's water resource availability and delivery systems.

1.2 Consolidation of TMWA and WDWR Water Operations

***Findings**:*

In response to the WRWC legislative directive to evaluate the potential consolidation of water purveyors in the Truckee Meadows, staffs of TMWA and Washoe County Department of Water Resources ("WDWR") successfully merged the former Washoe County water utilities and the South Truckee Meadows General Improvement District ("STMGID") into TMWA on December 31, 2014.

Recommendation:

No further action required on this item.

1.3 TMWA Planning Area

Findings:

TMWA's retail service area grew by approximately 50 square miles in hydrographic basin where TMWA has facilities as the result of the consolidation of TMWA and WDWR Water Operations. In addition, the consolidation added facilities in hydrographic basins where TMWA did not have a presence (Basin 88-Pleasant Valley, Basin 89-Washoe Valley, and Basin 83-Truckee Canyon). Figure 1-1 shows TMWA's expanded retail area in relation to the Truckee Meadows Service Area ("TMSA") and the Western Regional Water Commission's planning area. Historically, TMWA's planning for the delivery of water has been focused on areas adjacent to its retail service area and within the TMSA.

Recommendation:

As a result of the merger and expansion of the area that TMWA now plans for, determine the role and extent of TMWA's water resource planning subject to the constraints of TMWA's Joint Powers Authority.

1.4 Truckee River Operating Agreement ("TROA")

Findings:

The five Mandatory Signatory Parties - TMWA, the Pyramid Lake Paiute Tribe ("PLPT"), the United States, California and Nevada - completed all conditions precedent to implement TROA in the fall of 2015; TROA was implemented on December 1, 2015. TROA's framework provides flexibility for river operations to allow parties to store water they previously could not store; significantly enhances TMWA's drought reserves; allows the exchange of water to optimize the use of Truckee River supplies without injuring the water rights on which the parties rely; and resolves future regulatory uncertainties surrounding the use of the Truckee River.

Recommendation:

Although implemented, continue to participate in any pending litigation or appeal that challenge the implementation of TROA.

1.5 Donner Lake Acquisition

Findings:

In fall 2015, the Truckee Carson Irrigation District ("TCID") began discussions with TMWA regarding the sale of TCID's interest in Donner Lake. After extensive negotiations, TCID and TMWA staff reached an agreement whereby TMWA would pay $17.2 million for TCID's Donner Lake water rights in addition to eliminating all pending litigation on Donner Lake between TMWA and TCID, and the withdrawal by TCID of all its pending appeals regarding TROA implementation. The purchase agreement was presented to and approved by both the TMWA and TCID boards on December 16, 2015. On January 4, 2016 TCID held a special election of the members of the irrigation district on whether TCID should sell the Donner Lake assets pursuant to the agreement; the members voted overwhelming to sell the assets. Upon close of escrow scheduled for February 2016, TMWA will add TCID's share of 4,750 acre feet ("AF") of Donner Lake water rights to its share, thereby owning all of the 9,500 AF of Donner Lake water rights. TMWA will manage the acquired portion of the Donner Lake water rights pursuant to TROA operations and Board direction; TROA allows using the rights for more credit storage and issuing new will-serve commitments within the 119,000 AF of demand TROA will supply.

Recommendation:

Continue to work to close escrow for the purchase of TCID's interest in the Donner Lake water rights.

2.1 Sustainability of Source Water Supplies - Climate Variability

Findings:

Climate change and meteorological droughts are the most significant variables with potential to change the quantity and quality of raw water supplies, particularly surface water supplies. While the weather pattern consistently provides precipitation during the winter and spring months, the type of precipitation (snow versus rain), amount of precipitation, water content of snow, and speed of snowmelt are variable from year to year. TMWA manages the uncertainty of its raw water sources through storage in upstream reservoirs, conjunctive use of surface and groundwater supplies, and continual assessment of threats to water supply reliability from weather. Studies by Desert Research Institute ("DRI") and University of Nevada, Reno ("UNR") indicate the potential for climate change to alter the timing, type of, and quantity of precipitation needs continued monitoring and study, but findings are inconclusive at this time as to the magnitude of impact that climate change will have on the greater Truckee Meadows region and its water resources over a long-term planning horizon. Over the past several years the use of tree ring studies have been found useful in understanding the climate history of Lake Tahoe, Truckee River, and Carson River watersheds. Through such studies a better understanding of the cycles of dry and wet years has been developed along with analyses of frequencies of occurrence, durations and magnitudes. However, the current body of research on tree ring chronologies have not been specific in the Truckee and Carson River watersheds, thus there is limited direct data on historic flows that can be used in planning.

Recommendation:

Continue to consider, when available, new findings from climate change research for the greater Truckee Meadows region; continue working with UNR, DRI, and other researchers to test climate change effects on TMWA's sources of supply; and engage UNR, DRI and/or other researchers to develop tree ring chronologies of the Truckee and Carson River watersheds for use in water resource planning and management during droughts and periods of drought recovery beyond historic, instrumental record.

2.2 Sustainability of Source Water Supplies - Surface Water Contamination

Findings:

While there is a risk to surface water reliability from turbidity and toxic spill events, research conducted in 1996 and again in 2007 by UNR on behalf of TMWA has shown no recorded river contamination event from rail or highway transportation. The 2007 study found that the area of highest risk is downstream of TMWA's treatment facilities in the City of Sparks where there is a rail yard and a large number of warehouses and shipping companies that load/unload trucks and rail cars. TMWA's Source Water Protection Program (including its Wellhead Protection Plan ("WHPP")) is designed to preserve and enhance available water supplies and to address known and potential threats to water quality. TMWA has sufficient well capacity and distribution system storage to meet reduced customer demands during a water quality emergency, and has emergency plans in place in the event of extended off-river emergencies. With the merger of WDWR and STMGID water systems into TMWA, system integration improvements will be implemented that are beneficial in terms of increasing the supply and/or quality of water supplies at minimum economic costs to ensure the delivery of water through the 20-year planning horizon and beyond.

Recommendation:

Continue to: (1) implement its source water protection strategies in cooperation with local entities; (2) maintain, as a minimum, the ability to meet daily indoor water use with its wells; and (3), for river outages lasting up to 7 days during the summer, maintain the ability to meet average daily water demands using its wells, treated water storage, and enhanced conservation measures.

2.3 Sustainability of Source Water Supplies - Groundwater Contamination

Findings:

TMWA works closely with the Central Truckee Meadows Remediation District ("CTMRD") to characterize tetrachloroethylene ("PCE") contaminated groundwater and remove PCE contamination at affected wells. TMWA is also working with the CTMRD to remove PCE contamination at the source before groundwater can be impacted. A more ubiquitous contaminant, nitrate, has been impacting groundwater in several basins. A 2007 report by the WDWR funded by the Regional Water Planning Commission ("RWPC") titled *Septic Nitrate Baseline Data and Risk Assessment Study for Washoe County, Phase I: Prioritization of Study Areas and Assessment of Data Needs*, used available data to identify potential areas of septic nitrate contamination and identify data gaps. The report identified approximately 18,300 septic systems in Washoe County, and at least sixteen areas that have septic densities high enough to impact potable water supplies. Of these, it was determined that five study areas (Spanish Springs, Cold Springs, Washoe Valley, Heppner, and Golden Valley) had sufficient evidence linking water quality degradation to septic systems and required management action. Nine additional areas (Mt. Rose, Ambrose, Hidden Valley, Huffaker, Verdi, Geiger, Island 18, Mogul, and Pleasant Valley) are currently being studied. Two municipal wells in Spanish Springs Valley have already been shut down due to septic nitrate contamination. TMWA has sufficient well capacity and distribution storage to continue to provide safe drinking water in Spanish Springs, as well as remaining areas of concern. However, until areas of high septic density are converted to sewer, the flow of nitrate-contaminated effluent to drinking water aquifers will continue and concentrations may continue to increase.

Recommendation:

Continue to: (1) provide safe drinking water in all areas affected by PCE and septic effluent; (2) investigate the impact to groundwater from PCE and septic effluent; (3) work closely with local jurisdictions to find resources and strategies to convert residences and businesses on septic to sewer; and (4) utilize aquifer recharge as a potential strategy to keep contaminated water away from production wells.

2.4 Sustainability of Source Water Supplies - Groundwater Management

Findings:

Long-term water level declines in East Lemmon Valley, west Pleasant Valley and southwest Truckee Meadows due to reduced natural recharge resulting from low-precipitation and increased pumping by all users have made groundwater production more expensive and impacts to domestic well owners more likely in these areas. TMWA's current strategy to reduce impacts to groundwater levels relies on: (1) strategic and coordinated timing of its pumping; (2) passive groundwater recharge by increasing the duration and location of deliveries of surface water as often as possible to allow wells to rest and water levels to recover; and (3) active groundwater recharge to enhance groundwater supplies and drive water level recovery. Active groundwater recharge relies on the diversion and treatment of Truckee River and, upon the completion of the Mt. Rose Water Treatment Plant, Whites and Thomas Creek water during the winter months.

Recommendation:

Continue to: (1) reduce impacts to groundwater by pumping municipal wells strategically; (2) allow water levels to recover through passive groundwater recharge; and (3) force water level recovery through active groundwater recharge. Increasing the breadth and scope of all three of these activities in areas formerly served by WDWR will help groundwater levels recover in areas most affected by groundwater level declines.

2.5 Sustainability of Source Water Supplies – Aquifer Storage & Recovery

Findings:

Since its inception, TMWA's aquifer storage and recovery ("ASR") program has improved or stabilized groundwater levels in and around the injection sites thereby preserving TMWA's ability to utilize its groundwater resources to meet summer peaking and/or drought situation pumping requirements without degrading groundwater quality in the process. ASR is one element of TMWA's integrated management strategy to augment drought reserve supplies for later use during a Drought Situation. ASR can increase the natural supply of groundwater by storing surface water underground when excess supply and treatment capacity exist, and by mitigating groundwater contamination. TMWA has equipped its production wells to allow for treated Truckee River water to flow back into the wells during winter time operations. Through 2015, TMWA has replenished groundwater reserves in the region (Truckee Meadows, Spanish Springs and Lemmon Valley) with over 30,000 AF of treated surface water since it inception.

Recommendation:

Continue and expand the injection of treated surface water into groundwater aquifers to: (1) augment groundwater supplies which provide additional drought and peak-demand capacity; (2) reduce or eliminate water quality concerns; and (3) stabilize and increase groundwater levels. Increasing the breadth and scope of all three of these activities throughout the service area will help groundwater levels recover and may help reduce the impact from septic, industrial, and naturally-occurring contaminants.

3.1 Water Rights Availability

Findings:

TMWA's planning area grew as a result of the 2014 merger of the water systems formerly owned or operated by Washoe County. Because the majority of the water distribution system in the Truckee Meadows, Spanish Springs, Lemmon Valley and a portion of Pleasant Valley is integrated, this planning area can take advantage of Truckee River resources and the benefits of TROA. This planning area is referred to as the Truckee Resource Area ("TRA") [5]. The remote, satellite systems in Washoe Valley and east of the Truckee Meadows in the Truckee Canyon Segment must rely solely on groundwater for their water supply. These systems are referred to as the non-Truckee Resource Area ("non-TRA"). The non-TRA systems have sufficient resources to meet the need within the development (or subdivision) and TMWA does not anticipate significant expansion of the systems beyond those boundaries. Within the TRA, a review of available Truckee River water rights shows a sufficient number (potentially over 45,000 AF) of water rights exist to meet future-average-year-TMWA-water-service demands through the 2016 to 2035 planning horizon. However, acquiring and transferring many of these water rights, which are fractionated and have ownership problems, will require additional time and expense before the water right can be put to use. Over the past decades, demands for Truckee Meadows water rights have increased in response to a highly competitive development market, difficulties in finding willing sellers of significant quantities of water rights, and competing environmental and lower river uses of water rights for such things as Fernley's water supply or enhancing water quality both in the Lower Truckee River and groundwater aquifers. Since the number of Truckee Meadows water rights is limited, close coordination of the various river interests must occur to avoid undo stress on the water rights market. Additionally, the North Valleys Importation Project's ("NVIP") 8,000 AF of Honey Lake groundwater resource is available to meet future demands in the North Valleys.

Recommendation:

Continue to accept the dedication of Truckee River water rights in the growth prone Truckee Meadows, Spanish Springs and upper, west Pleasant Valley, which water rights are sufficient to support both TROA implementation and increased future development needs within TRA; recognize NVIP is available to meet future demands in the North Valleys, and unless other resources are available in the non-TRA systems, these systems are limited to the resources dedicated for the development within the system's service area.

[5] The introduction and use of the phrase "Truckee Resource Area" ("TRA") is used to designate TMWA's existing retail and wholesale service areas within which (1) TMWA will accept for dedication, subject to certain conditions, a Truckee River water source/right for the delivery of water to a service property that can be served with Truckee River resources and (2) facilities exist or can be constructed at a developers expense that can transport potable Truckee River water that once it has been diverted and treated at TMWA's Chalk Bluff or Glendale Water Treatment Facilities. TMWA operates 5 separate systems in hydrographic basins that are not served from the treatment plants and are grouped under the "non-TRA" designation. These designations are needed to track the surface and groundwater rights to be assigned to various service areas and whether the rights and their use are part of resources for TROA.

3.2 Current Water Resources

Findings:

TMWA's 2035 water use projection of 101,000 AF for the combined TRA and non-TRA can be satisfied with TMWA's current resources with continued dedication of river rights. Ultimately, within the TRA, TROA allows TMWA to meet a demand of 119,000 AF. Additionally, as a result of the merger, TMWA has added over 20,000 AF of groundwater rights committed to areas within the TRA and non-TRA which are not included in the TROA resource pool. Including NVIP, TMWA has over 188,000 AF of decreed, storage, and irrigation rights to generate water supplies for customer demands, sufficient to meet the projected demands over the planning horizon. Under TROA, TMWA uses its Privately Owned Stored Water ("POSW") and a portion of its unexercised water rights to generate sufficient upstream drought reserves to meet projected drought-year demands over the planning horizon. To ensure an adequate supply of water for all customers, TMWA's Rule 7 requires that applicants for any new water service dedicate sufficient water rights to meet the demand of their development. Applicants for new service are required to dedicate sufficient and acceptable water rights to TMWA which they may currently own or acquire on the open market or purchase a will-serve commitment from TMWA.

Recommendation:

Continue to acquire water rights to meet future water demands pursuant to its Rule 7.

3.3 Conjunctive Management of Water Resources

Findings:

The meteorologic drought, begun in 2012, created hydrologic drought[6] impacts in 2014 and 2015 which required TMWA to release some of its upstream drought reserves for the first time since 1992. As defined in TROA, the region has been in a Drought Situation (i.e., the level of Lake Tahoe had been projected to be below elevation 6223.5 feet on November 15 of a given year) since 2014. Scenarios testing operation of water supplies and drought reserves under TROA indicate that TMWA accumulates drought reserves under the 1987 to 1994 drought hydrology; under hypothetical droughts which repeated the 1987 to 1994 plus 1987 and a repeat of 2015 hydrology over the planning horizon demonstrate TMWA has sufficient drought reserves in all scenarios tested. When this 2035WRP was published in January 2016, the 2015/2016 winter and subsequent 2016 run-off projections indicate a moderate recovery-year but not necessarily an end to the drought period begun in 2012. Unfortunately, it cannot be known with certainty the duration of the current drought. However, with the successful implementation of TROA no alteration to TMWA's planning criteria is warranted at this time.

Recommendation:

Continue to rely on TMWA's pool of resources to meet current demands and recognize TROA can provide drought-year operational benefits in excess of current drought-year reserves thereby supporting future demands and continue to monitor TMWA's ability to

[6] The State of Nevada Drought Plan, a report prepared in 2012 by the Drought Response Committee comprised of the State Climate Office, Division of Water Resources, and Division of Emergency Management under direction of the Governor defines hydrologic drought as periods of below-normal streamflow and/or depleted reservoir storage.

meet current and future demands through the 1987 to 1994 drought period, the worst drought period of record, and based on factors such as demand growth, conservation improvements, hydrologic cycles, climate changes, etc., update the Board when future conditions evolve that require changes to the planning criteria or supply operation.

4.1 Population Projection

Findings:

TMWA's population forecast estimates total Washoe County population to increase by 95,000 from 450,000 in 2016 to 545,000 in 2035, or 21 percent; the estimated population served by TMWA will increase by 83,000 people from 392,000 in 2016 to 475,000 by 2035, or 21 percent. The population estimates may change over time as the pace of development within the region or its sub-area varies, and as the region moves towards greater intensification of land use. TMWA's forecast results are statistically similar to the State Demographer's near-term projections.

Recommendation:

Accept TMWA's population forecast as a reasonable estimate of future population growth to be used by TMWA for planning purposes in its planning areas.

4.2 Water Demand Forecast

Findings:

Water demand-per-service within TMWA's service areas has been decreasing over time resulting in slower total demand growth in TMWA's extended forecast. Based on the review of current growth and economic trends in the region, future water demand is anticipated to grow in the central Truckee Meadows but at a slower pace than historically seen. The water production forecast for a typical year indicates that from 2016 to 2035, production will increase from current estimates for 2016 of approximately 83,000 AF to a projected 2035 demand of approximately 101,000 AF, or about 18,000 AF. The 2035 production is well within the maximum 119,000 acre feet per year ("AF/yr") under TROA operations.

Recommendation:

Accept for planning purposes that the water demand projections are reasonable estimates for use in TWMA's planning areas.

5.1 Water Demand Management

Findings:

TMWA's Water Demand Management Programs include measures to enhance efficient use of water, reduce or eliminate water waste, and save water. Some specifics include change-out of old meters, leak repair, water theft prevention, numerous education materials including landscape design/retrofit information, Assigned-Day Watering, watering prohibited during the heat of the day, water audits, and Drought Situation responses. Combined, these measures are designed to satisfy the conservation goal agreed to in the 1996 Water Conservation Agreement between Reno, Sparks and Washoe County ("RSW"), TMWA, PLPT and the United States. Continued levels of spending will be in accordance with that agreement. TMWA works with the WRWC in developing conservation plans for the region, and cooperates with WRWC in implementing its conservation programs. The water conservation activities embodied in this 2035WRP satisfy Article 5(i) of the Joint Powers Authority ("JPA") agreement that formed TMWA and the Nevada Division of Water Resources requirements that public water systems have a water conservation plan as set forth in NRS 540.131 through 540.151. TMWA's Conservation Plan is also consistent with the water conservation recommendations detailed in the Nevada Drought Forum: Recommendations Report.

Recommendation:

Accept the Water Conservation Plan outlined in this 2035WRP.

6.1 Future Water Resources

Findings:

The selection of the next water supply project is strictly a function of a project's yield, ease of implementation, sustainability, and financial feasibility accompanied with existing regional economic conditions and market forces that may or may not favor the development of a future water supply project. It may be that in the future, as new technology becomes available or the political, regulatory or public opinion changes, new projects may be developed or projects previously thought infeasible may become feasible. In addition to the implementation of TROA, the NVIP was completed in 2008 and is available to supply 8,000 AF annually to the North Valleys. The pending completion to purchase Donner Lake provides TMWA additional ability to issue will-serve commitment pursuant to TROA to take advantage of the full 119,000 AF of demand TROA provides. As future economic conditions warrant, TMWA can also pursue other resource development projects that do not conflict with TROA requirements and will be necessary in order to meet water demands beyond the 2035 planning horizon.

Recommendation:

Continue to investigate, evaluate, and negotiate, where appropriate, other potential water supply projects consistent with and/or in addition to TROA.

TRUCKEE MEADOWS WATER AUTHORITY

2016 – 2035 WATER RESOURCE PLAN

VOLUME II

CHAPTERS 1 – 6

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ABBREVIATIONS

2025WRP	2005-2025 Truckee Meadows Water Resource Plan, Truckee Meadows Water Authority, March 2003
2030WRP	2010-2030Truckee Meadows Water Resource Plan, Truckee Meadows Water Authority, December 2003
2035WRP	2016-2035 Truckee Meadows Water Resource Plan
AF	Acre-Feet, an acre-foot is equal to 325,851 gallons
AF/yr	Acre-Feet/Year
Airport Authority	Reno-Tahoe Airport Authority
AMSL	Above Mean Sea Level
ASR	Aquifer Storage and Recovery
BAC	biologically activated carbon
BBER	Bureau of Business and Economic Research, University of Nevada Reno
BCC	Washoe County Board of County Commissioners
BDOC	biodegradable dissolved organic carbon
BLM	Bureau of Land Management
Board	Board of Directors for Truckee Meadows Water Authority
CC&Rs	Covenants, conditions and restrictions
cfs	cubic feet per second
Churchill	Churchill County
CIP	Capital Improvement Program
CSWRCB	California State Water Resources Control Board
CTMRD	Central Truckee Meadows Remediation District
CTP	Chalk Bluff Water Treatment Plant
CYE	Calendar Year End
DMPs	Demand-side management programs
DRI	Desert Research Institute
DWSRF	Drinking Water State Revolving Fund
eDMPs	Enhanced demand-side management programs
ELV	East Lemmon Valley
EMC	Enhanced Messaging Campaign
EPDTS	Entry Points to the Distribution System

FSA	Future Service Area
Fallon	City of Fallon
FSR	Fish Springs Ranch
ft	Foot
FY	Fiscal Year
gdp	gross domestic product
GIS	Geographic Information System
GMWS	General Metered Water Service Rate Schedule
gpcd	gallons per capita per day
gpm	gallons per minute
GTP	Glendale Water Treatment Plant
HOAs	Home Owners Associations
ILA	Interlocal Agreement
IPR	Indirect potable reuse
ISA	Interim Storage Agreement, 1994
ITRDB	International Tree-Ring Data Bank
IWP	Intermountain Water Project
JPA	Joint Powers Authority
LDV	Lower Dry Valley
LSC	Lower Smoke Creek
LMB	Local Managing Board
LV	Lemmon Valley
MCL	Maximum contaminant level
mg/l	milligrams per liter or parts per million (ppm)
µg/l	micrograms per liter or parts per billion (ppb)
MF	membrane filtration
MGD	Million Gallons per Day
M&I	Municipal and Industrial
MIS	Metered Irrigation Water Services Rate Schedule
MMWS	Multi-Family Metered Water Service Rate Schedule
MSA	Metropolitan Statistical Area
NAC	Nevada Administrative Code

NDEP	Nevada Division of Environmental Protection
NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act
NNWPC	Northern Nevada Water Planning Commission
Non-TRA	non-Truckee Resource Area
NPS	Non-Potable Service
NRS	Nevada Revised Statutes
NTM	North Truckee Meadows
NTU	Nephelometric Turbidity Unit
NVI	North Valleys Initiative
NVIP	North Valley Importation Project
O3	Ozonation
ODPS	Orr Ditch Pump Station
O/M	Operating/Maintenance
PARs	Preliminary Assessments Reports
PCE	tetrachloroethylene, a volatile organic compound
PCSs	Potential Contaminant Sources
PL	Public Law
PLPT	Pyramid Lake Paiute Tribe
POSW	Privately-Owned Stored Water, as defined in the 1935 Truckee River Agreement
POU	Place of use
ppb	Parts per billion
PSI	Pounds per square inch
PUCN	Public Utilities Commission of Nevada
RAA	Running Annual Average
Red Rock	Red Rock Valley Importation
RMWS	Residential Metered Water Service Rate Schedule
RO	Reverse osmosis
ROD	Record of Decision
RWPC	Regional Water Planning Commission
RSW	City of Reno, City of Sparks, and Washoe County
RWMP	Regional Water Management Plan

SB	Senate Bill
SCR	Senate Continuing Resolution
SDP	State Demographer's Projection
SDWA	Safe Drinking Water Act
Settlement	Truckee River Negotiated Settlement
Settlement Act	Truckee-Carson-Pyramid Lake Water Rights Settlement Act
Settlement Agreement	PLPT Fish Springs Ranch Settlement Agreement
Sierra	Sierra Pacific Power Company (NVEnergy)
SMPs	Supply-side management programs
SSIP	Silver State Importation Project
STM	South Truckee Meadows
STMFP	South Truckee Meadows Facility Plan, August 2002
STMGID	South Truckee Meadows General Improvement District
SSV	Spanish Springs Valley
SVGID	Sun Valley General Improvement District
TCE	Trichloroethylene, a volatile organic solvent
TCID	Truckee-Carson Irrigation District
TDS	Total Dissolved Solids
The Fund	Truckee River Fund
TMWA	Truckee Meadows Water Authority
TMWRF	Truckee Meadows Water Reclamation Facility
TMSA	Truckee Meadows Service Area
TRA	Truckee Resource Area
TROA	Truckee River Operating Agreement
TROM	Truckee River Operation Model
TRPA	Tahoe Regional Planning Agency
UDV	Upper Dry Valley
UNR	University of Nevada, Reno
U.S.	United States
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation, or BOR
USGS	United States Geological Survey
USEPA	U.S. Environmental Protection Agency

UV	ultra-violet radiation
VAR	Vector Autoregression Model
Vidler	Vidler Water Company
WCHD	Washoe County Health District
WCWCD	Washoe County Water Conservation District
WDWR	Washoe County Department of Water Resources
WHPP	Wellhead Protection Plan
WLV	West Lemmon Valley
WRP	Water Resource Plan
WRWC	Western Regional Water Commission
WSF	TMWA Rate Schedule Water System Facility Charges

CHAPTER 1 INTRODUCTION

This Introduction to the 2035WRP frames the more significant challenges to water resources that have developed since the last water resource plan ("WRP") and sets the context for this WRP. This 2035WRP builds upon the information developed and contained in prior WRPs as well as various regional planning efforts.

In March 2003 TMWA published, and the Board adopted, TMWA's *2005-2025 Water Resource Plan* ("2025WRP") which presented:

- History of municipal water supply in the Truckee Meadows;
- Description of the region's water supply system including conjunctive management of surface and groundwater;
- Confirmation of the use of Truckee River flows during the historical 1987-1994 drought period as the basis for TMWA's 9-year drought plan;
- Projected population and water demands;
- Conservation program; and.
- Potential future water resource options.

Subsequent to the Board review of its water resource plan strategies in Fall 2009, the Board adopted its *2010-2030 Water Resource Plan* ("2030WRP") in December 2009. The 2030WRP built on the foundation strategies established in the 2025WRP in addition to responding to then current issues involving:

- Legislative directives to consolidate water purveyors in Washoe County;
- Execution by the five Mandatory Signatory Parties (TMWA, Pyramid Lake Paiute Tribe ("PLPT"), California, Nevada, and the United States ("U.S.")) and seven other parties of the Truckee River Operating Agreement ("TROA") on September 6, 2008;
- Changes in population and demand projections as a direct result of the regional economic malaise from 2007-2009 when the 2030WRP was drafted; and
- Completion of the retrofit of flat-rate, single-family residences that were required to be retrofit as part of the 1989 Negotiated River Settlement.

Continuing with the Board's prior recommendations, this 2016-2035 Water Resource Plan ("2035WRP") reviews, updates, and/or modifies TMWA's water resource planning and management strategies due to a number of key events that have occurred over the past five years which include:

- The merger of Washoe County Community Development-Department of Water Resources ("WDWR") and South Truckee Meadow General Improvement District ("STMGID") water utilities into TMWA was completed December 31, 2014. Combining the three purveyors into one allows for a consistent water management strategy to be implemented across the majority of water consumers and water resources in southern Washoe County. While the merger allows for greater efficiency in water management planning, it also poses additional resource management challenges to ensure adequate supplies are available within the expanded Truckee Resource Area ("TRA")[1].

- A reversal of negative or stagnant economic trends dominating the region since 2007 which altered the economic activity and growth expectations for the Truckee Meadows. The region began experiencing a modest economic resurgence in late 2013 which continues today. This economic shift results in a need to examine the current population trend and its possible effect on water demand and future resource requirements.
- Completion of the remaining conditions precedent to implementing TROA since it was signed by the five Mandatory Signatory Parties in 2008. Favorable California State Water Resources Control Board approvals in 2012, California state court dismissal of an appeal in 2014, and recent Federal court rulings in 2014, paved the way for implementing TROA. This past August 2015 major milestones related to the Reno, Sparks and Washoe County obligation to supply 6,700 AF of Truckee River water rights were completed. The last two lawsuits were dismissed in September and November 2015 allowing TROA to be implemented December 1, 2105. With TROA in effect, the framework is now in place that provides greater flexibility in river operations, particularly during drought conditions as TMWA's drought storage potential increases, river flows are enhanced for endangered and threatened fish species, and water rights of the signatories and non-signatories to the agreement are protected.
- The region has experienced four years of a meteorologic drought that has produced consecutive lower-than-average snowpack years. The hydrologic drought conditions on the Truckee River began to develop in late 2014 – the third year of the meteorologic drought – and had little impact on TMWA's water supplies or drought reserves. The hydrologic drought conditions grew more severe in 2015 due to the lowest snowpack in 115 years of historical record keeping. The lack of precipitation has led to an extended drought period similar to 1991 through 1994 with the more regional impacts occurring in 2015.

Given these events, current water resource planning must consider the potential for prolonged drought years while accommodating for regional growth over the next 20 years. Projected changes in supply and demand will impact TMWA's water facility and capital improvement plans which, in turn, can impact the rates charged to customers, including facility charges for new development.

[1] The introduction and use of the phrase "Truckee Resource Area" ("TRA") is used to designate TMWA's existing retail and wholesale service areas within which (1) TMWA will accept for dedication, subject to certain conditions, a Truckee River water source/right for the delivery of water to a service property that can be served with Truckee River resources and (2) facilities exist or can be constructed at a developers expense that can transport potable Truckee River water that once it has been diverted and treated at TMWA's Chalk Bluff or Glendale Water Treatment Facilities. TMWA operates 5 separate systems in hydrographic basins that are not served from the treatment plants and are grouped under the "non-TRA" designation. These designations are needed to track the surface and groundwater rights to be assigned to various service areas and whether the rights and their use are part of resources for TROA.

Water Resource Plan Scope

One of the main purposes in creating TMWA was to meet the "common interest in assuring that *water resources be developed and managed to fulfill the present and future water needs of the greater Truckee Meadows community*" and "to assure sufficient water supply to meet the needs of existing and future development." (JPA Recitals "A" and "D"). As a result of the consolidation of the Washoe County Department of Water Resources Water Utility ("WDWR") and the South Truckee Meadows General Improvement District ("STMGID") into TMWA, described later in this chapter, TMWA's retail service area expanded by approximately 50 square miles and into hydrographic basins where TMWA previously did not supply retail water service. The area acquired is within the planning boundary of the WRWC, and the TMSA except for several remote, satellite service areas in Washoe Valley and near Wadsworth,

The map in Figure 1-1 shows the relationship of TMWA's retail service areas to the TMSA and the WRWC planning area.

It is important to note the scope of TMWA's water planning process, as defined by its JPA directive, does not provide for municipal sewer, reclaim, flood control, storm drainage or groundwater remediation. Those functions are planned for by Reno, Sparks or Washoe County. All water-related utility planning efforts, including TMWA's water plan and facility plan, are incorporated into the Western Regional Water Commission's *Regional Water Management Plan* ("RWMP") under revision at the time of this writing. TMWA is required to provide retail water service to customers within its retail service area, and the JPA authorizes TMWA to establish a water resource plan which shall reflect, among other things, water supplies available to TMWA from all sources to meet the demands within the retail service area. This water plan follows the process of previously Board approved plans in that the scope is directed towards planning water supplies for TMWA's existing and future customer demands for land to be developed within TMWA's existing retail service area and for those areas where is proves economically feasible to receive TMWA water service within the TMSA or beyond.

In January 2010, the Regional Planning Governing Board ("RPGB") adopted amendments to the Truckee Meadows Regional Plan ("Regional Plan") and the RPGB Regulations on Procedure as a result of 2008 Washoe County Ballot Question No. 3 ("WC-3"). The RPGB with support of the WRWC is responsible to respond to WC-3. In 2010 TMWA assisted the WRWC in their efforts to respond the RPGB in estimating the population that can be supported by the sustainable water resources identified in the RWMP and whether sufficient water resources were available to satisfy the projected water demand based on the population estimated by the 2010 Washoe County Consensus Forecast ("Consensus Forecast").

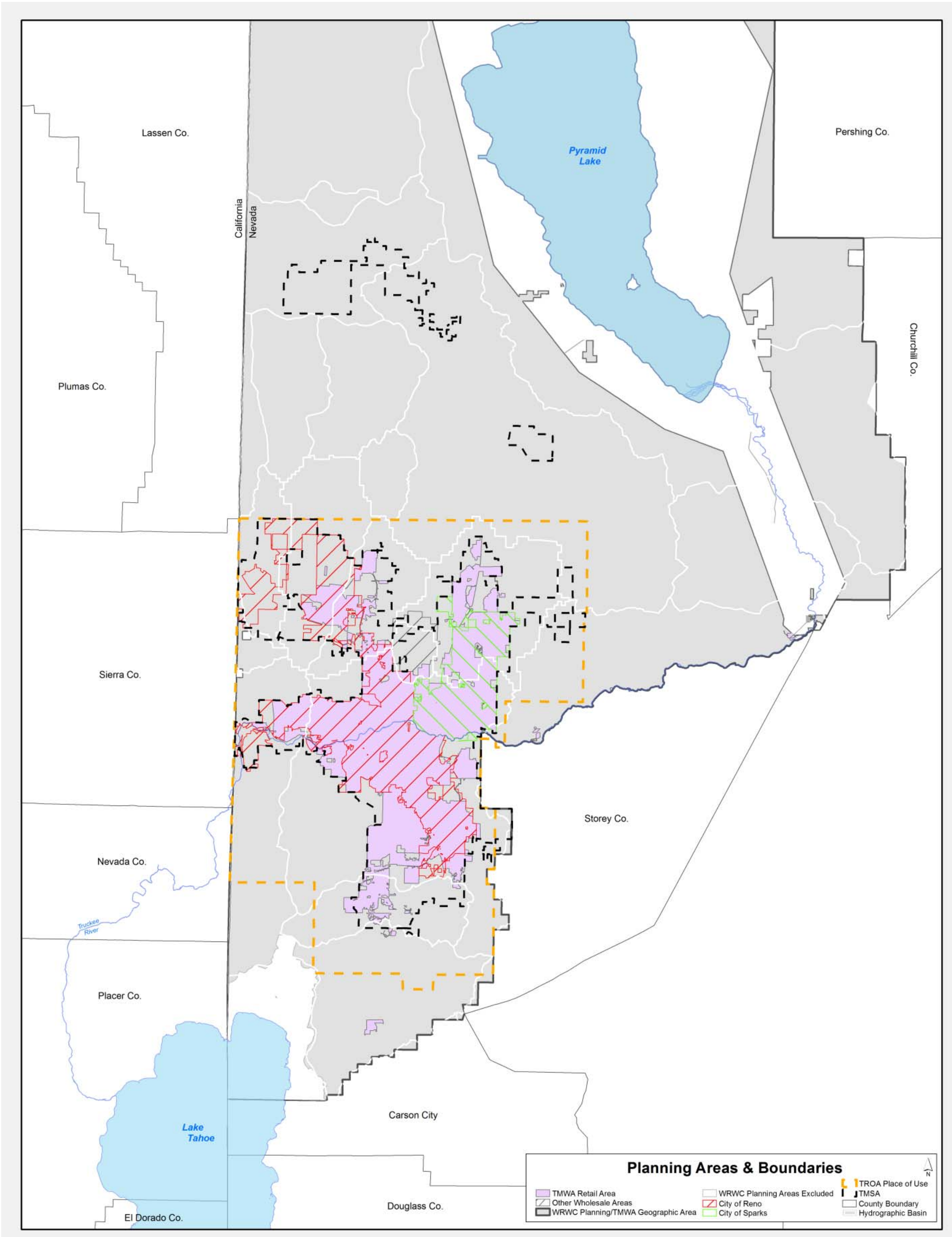


Figure 1-1. WRWC, TMSA and TMWA Planning Areas

The RWMP provides long-range planning-level estimates for water resources considered to be sustainable using the best available information. The RWMP identifies selected hydrographic basins within the Planning Area that presently provide municipal and industrial ("M&I") water, or that may in the future provide M&I water within the 20-year planning timeframe. In 2010, TMWA developed a long-range water demand projection for the entire County that yielded an annual demand of approximately 142,000 AF to support a population of approximately 590,500 persons as projected for the year 2030 by the 2010 Consensus Forecast. WRWC extended the projections to estimate the population that could be supported by the sustainable water resources of approximately 183,200 AF/yr (which assumed importing groundwater from hydrographic basins in Washoe County that are not presently providing water for M&I uses) and concluded that those resources could support a build-out population of about 741,000. The WRWC determined in 2010 that sustainable water resources identified in the 2011 Regional Water Management Plan are adequate to serve the 2030 population estimate provided in the Consensus Forecast. The 2014 Consensus Forecast projected a population of 564,000 persons in 2034. In 2012 and 2014, the WRWC reasoned that the sustainable water resources identified in 2010 were adequate to serve the Consensus Forecast 20-year population projections in each of those years.

Chapter 4 sets forth TMWA's current population estimate for 2035 to be 545,000 persons which estimate is the core of the Consensus Forecast for the revised RWMP. The downward trend in out-year populations while holding available resources constant will again meet the expectations of WC-3 when discussed in the upcoming release of the WRWC 2016 RWMP.

Legislative Directives

In 2007 the Nevada Legislature adopted Senate Bill ("SB") 487, codified as the Western Regional Water Commission ("WRWC") Act. The Bill was sponsored by the Interim Legislative Subcommittee created in 2005 by Senate Continuing Resolution ("SCR") 26, and enabled the creation of a new regional water entity in Washoe County to be effective April 1, 2008. Pursuant to this legislation, the cities of Reno and Sparks, the Sun Valley General Improvement District ("SVGID"), the South Truckee Meadows General Improvement District ("STMGID"), TMWA, and Washoe County, entered into a JPA to create the WRWC. The WRWC is charged with facilitating cooperative resource management efforts among the existing water purveyors in southern Washoe County and providing for integration of regional water supply and storm water management, subject to the TROA. This includes facilitating planning for the development, management and conservation of regional water supplies, maximizing conjunctive use by public water purveyors (excluding Gerlach and Incline Village), and facilitating the development of a plan to integrate public purveyor water systems to provide the most effective management and integration of systems. SB487 provided for a change of oversight and restructuring of the prior Regional Water Planning Commission ("RWPC") into the Northern Nevada Water Planning Commission ("NNWPC"). The WRWC began functioning and assumed oversight of the NNWPC in April 2008.

SB487 also created a legislative committee to oversee the WRWC, which met from time to time during the 2008, 2010 and 2012 interim legislative periods to review the WRWC's programs and activities and report to the Legislature. During that period, the Committee made the following recommendations for legislation: 2008, requiring coordination of water quality monitoring on the Truckee River and minor language changes in SB487; 2010, providing financial assistance for connecting to public water or sewer systems; and 2012, eliminating the Committee's statutory sunset date of July 1, 2013 and expanding its scope to study statewide water issues. The sunset provision was not removed, and the Committee expired by statutory elimination on July 1, 2013.

The WRWC adopted its first Comprehensive Regional Water Management Plan ("RWMP") for the planning area in January 2011. The RWMP includes the supply of municipal and industrial ("M&I") water, quality of water, sanitary sewerage, treatment of sewage, drainage of storm water and control of floods. The RWMP is in the latter stages of a required 5-year review, which is expected to be completed in December 2015. An update of the RWMP for the years 2016 to 2035 will be prepared and presented to the WRWC for adoption in 2016. Since TMWA is a major contributor to the potable water management elements of that plan, adoption by TMWA's Board of this 2035WRP is necessary in order that its findings may be incorporated into the RWMP.

Consolidation of TMWA, WDWR & STMGID

Since TMWA's inception in 2000, serious consideration had been given by TMWA's Board of Directors and Washoe County's Board of Commissioners ("BCC") to the possible integration of some or all functions of TMWA and WDWR. Formal direction was given to the WRWC to incorporate into its 2030 RWMP an "evaluation and recommendations regarding the consolidation of public purveyors in the planning area, which must include costs and benefits of consolidation, the feasibility of various consolidation options, analysis of water supplies, operations, facilities, human resources, assets, liabilities, bond covenants, and legal and financial impediments to consolidation and methods, if any, for addressing any such impediments." *[Western Regional Water Commission Act, Section 42(9)]*.

In furtherance of this directive, at its September 12, 2008 meeting, the WRWC asked staff from TMWA and WDWR to "conduct a focused financial analysis to assess the feasibility of some form of utility integration using their joint bond counsel and financial advisors…".[2] At the December 2008 WRWC meeting, the Phase One Financial Report was presented which consisted of a bond analysis addressing certain limitations and restrictions resulting from existing debt and what opportunities were available for refunding or refinancing existing debt. This analysis demonstrated that consolidating WDWR into TMWA by defeasing WDWR debt would be financially feasible within a reasonable time-frame, but that the converse – defeasing TMWA's debt – would not be a financially advantageous alternative. Staff of TMWA and WDWR met on numerous occasions to analyze the feasibility of whether the integration/consolidation of certain functions of the two entities was possible and, if so, whether efficiencies and benefits to the community would result. Preliminary assessment reports ("PARs") for System Planning and Engineering were delivered to WRWC at its March 13, 2009 meeting, and Operations and Water Resources at its July 10, 2009 meeting. Each of these PARs analyzed the potential opportunities for improving efficiency, customer service and reliability, as

[2] The WRWC Act requires analysis of consolidation of all "public purveyors" within the planning area, however, no analysis was conducted of the SVGID as it was generally concluded that this entity functions in a semi-autonomous fashion and that significant efficiencies in operations or resource management are unlikely to be achieved by consolidating their functions with a consolidated TMWA/DWR entity.

well as reducing long term operating and/or capital costs through some form of integration of WDWR and TMWA. The PARs were prepared by interagency teams of employees who were familiar with the topics and analyzed TMWA and WDWR water systems as one rather than two systems. The findings of the PARs generally indicated that operational and resource management efficiencies might be achieved through consolidation, that rate structures of the two agencies were sufficiently close that migration to one set of customer rates would not result in inequities to either customer base, and that no insurmountable labor issues were anticipated.

To facilitate the consolidation review, the WRWC appointed a Subcommittee on Integration/Consolidation in July 2009, which conducted two meetings with staff to consider certain aspects of consolidation. At its August 6, 2009 meeting the WRWC-Subcommittee concluded that the integration/consolidation process should proceed, and that the full WRWC Board recommend to the governing bodies of both utilities to develop an inter-local agreement ("ILA") to implement integration of the two agencies leading to full consolidation. The respective governing bodies took action in September 2009 to direct TMWA and WDWR staff to proceed with the development of an Inter Local Agreement to advance the integration/consolidation of WDWR water functions into TMWA.

TMWA and Washoe County executed the *Interlocal Agreement Governing the Merger of the Washoe County Department of Water Resources Water Utility into the Truckee Meadows Water Authority* dated January 29, 2010, which provides for the merger of WDWR into TMWA. Due diligence began in earnest in 2010 to further identify and/or clarify any potential legal obligations/constraints, complete financial analyses to determine the costs/benefits to the respective utility's customers, create an operating model of the combined systems to develop optimum production schedules and estimate related costs, and work out transition issues.

By October 2012, TMWA presented to the TMWA Board the results of its completed due diligence analyses and sought direction as to continue the process. At that time, the various steps to proceed with merger implementation included labor negotiations; transferring system control to TMWA; transfer customer billing information to TMWA; defeasing WDWR publically issued water debt to be assumable by TMWA; revising various WDWR loan and bond commitments; and completing other specific tasks identified in the ILA. During the due diligence process, it was identified that the merger of the WDWR system into TMWA would require some resolution with respect to continued operations of the STMGID[3] system. Through 2012, Washoe County and the STMGID Local Managing Board ("LMB") explored various options including merging STMGID as part of WDWR or STMGID becoming a stand-alone utility. The TMWA/WDWR merger was put on hold until these issues could be resolved.

[3] STMGID was a general improvement district created by Washoe County in 1981 for the basic purposes of furnishing storm drainage, sanitary sewer and water facilities. STMGID served approximately 3,700 customers in the south Truckee Meadows. Up until December 2012, the BCC served as the STMGID Board of Trustees, and a Local Managing Board ("LMB") comprised of five residents in the STMGID area acted as an advisory board to the BCC.

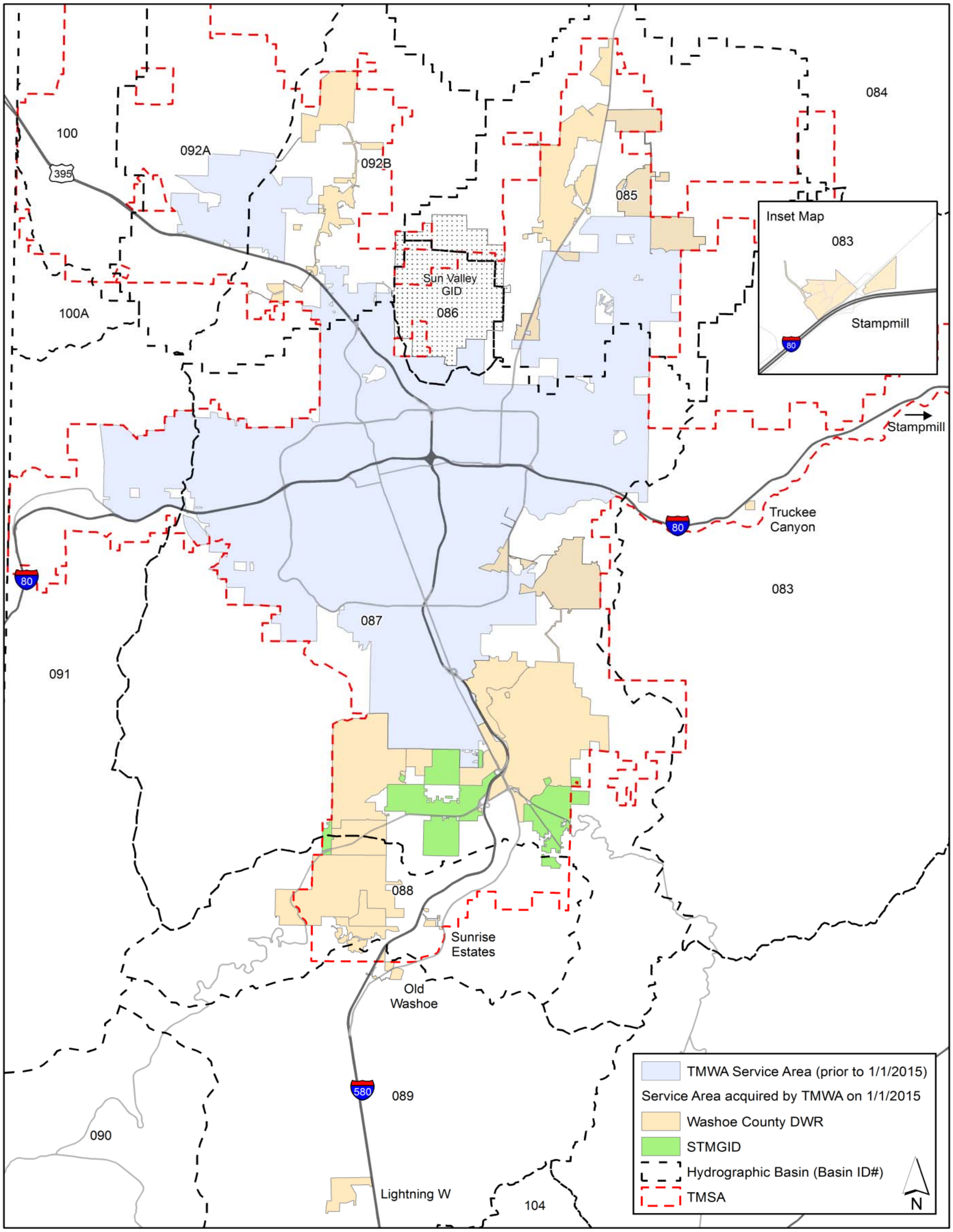


Figure 1-2. Pre-Merger Service Areas

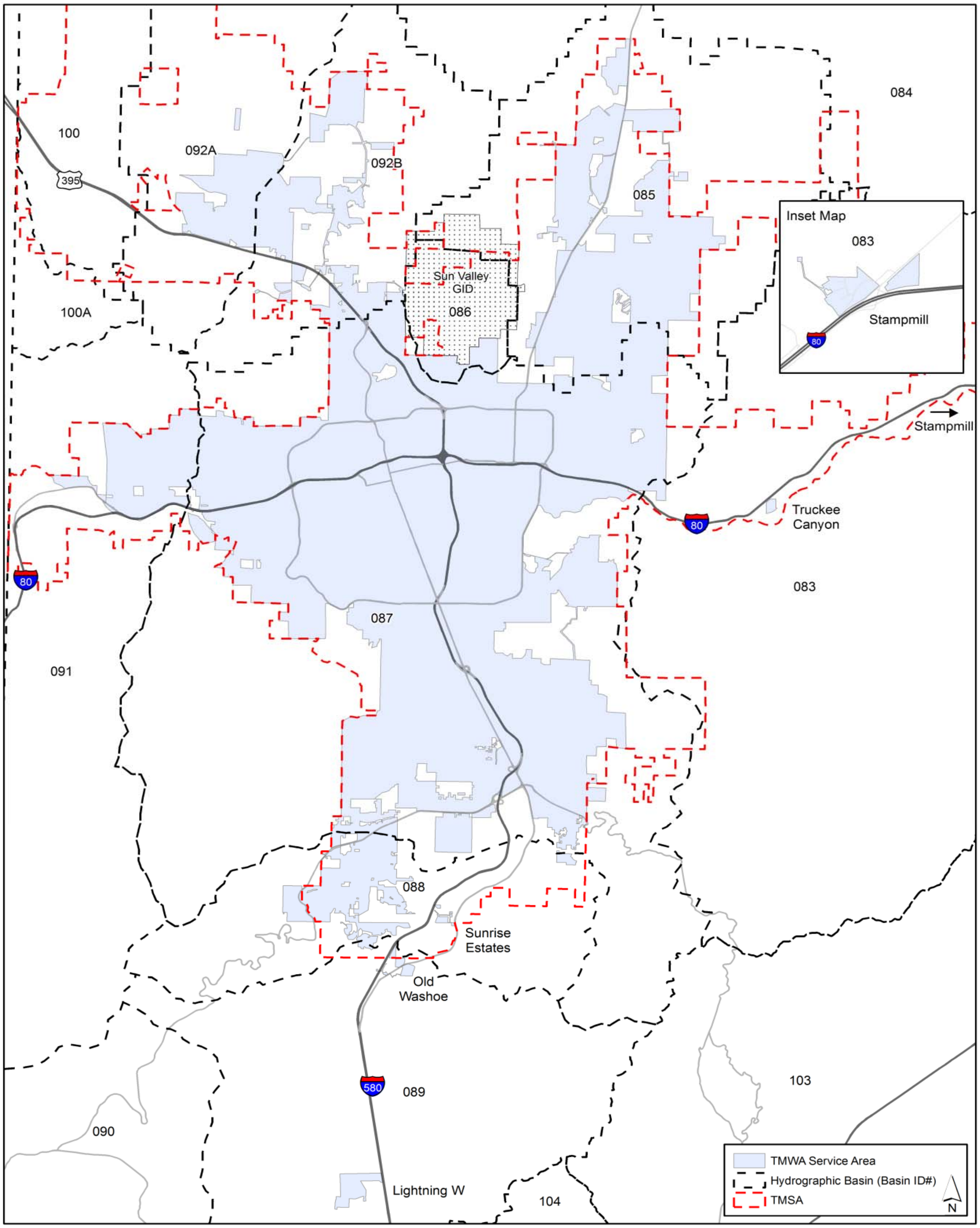


Figure 1-3. Post-Merger Service Area

By December 2012, the BCC elected to authorize the STMGID LMB with the sole responsibility to manage its affairs as a stand-alone entity. In the same month, STMGID submitted a merger term sheet to TMWA for TMWA Board consideration proposing a direct merger of STMGID into TMWA concurrent with the TMWA/WDWR merger. By June 2013, TMWA staff had completed its due diligence of a merger with STMGID with a favorable recommendation to the TMWA Board. Throughout 2014, TMWA and WDWR staff members worked long hours to complete all steps necessary and obligations within the various ILAs. On December 31, 2014, both the WDWR and STMGID water systems were successfully merged into and acquired by TMWA.

TMWA's prior WRPs focused on resource issues facing the utility and its conjunctive use of Truckee River resources and groundwater resources in the pre-merger TRA. Pre-merger, TMWA's planning area was limited to the southern-half of Spanish Springs (hydrographic basin 85), the northern-half of the Truckee Meadows (hydrographic basin 87), and the west-half of Lemmon Valley (hydrographic basin 92A). Post-merger, TMWA assumes a larger, regional role in resource planning and management. The following graphics illustrate the change in scope of TMWA's responsibility and service areas pre- and post- merger. The service area grew from about 109 to 156 square miles.

Due to the expansion of TMWA's service area, TMWA evaluation of water resources and facilities expanded to include all of Lemmon Valley, all of Spanish Springs, all of Truckee Meadows[4], Pleasant Valley (hydrographic basin 88), and in those areas in Washoe Valley (hydrographic basin 89) and the Tracy Segment (hydrographic basin 83) where small, satellite systems are located. The distribution systems located in hydrographic basins 83, 85, 86, 87, 88 (west portion), 91 and 92 are grouped in the TRA category since the integration of systems between these basins affords customers/development access to Truckee River resources (mainstem and tributary water rights) and the benefits of TROA's drought reserves. Table 1-1 highlights resources, customers and demands in the various planning basins included under the TRA designation.

[4] Includes Basin 86-Sun Valley and Basin 91-Truckee Canyon (Verdi) as TMWA does not have facilities or groundwater resources in those areas.

Table 1-1. Summary of TMWA's Customers, Resources and Usage by Hydrographic Basin

Description	TOTALS	Spanish Springs	Truckee Meadows [1]	Pleasant Valley-West	Lemmon Valley	Tracy Segment	Pleasant Valley-East	Washoe Valley	Honey Lake
		|--------------------- TRA			---------------------|	|-----------------non-TRA			------------------|
		85	87	88	92A & 92B	83	88	89	97
-------------------a---------------------	----b----	----c----	----d----	----e----	----f----	----g----	----h---	----i----	----j---
A. Service Connections									
1. Residential-single family	103,295	16,019	78,136	1,243	8,477	43	54	127	
2. Residential-multi-family	5,013	108	4,666		195				
3. Commercial/Industrial	6,793	273	6,203	13	296	10		6	
4. Irrigation	3,178	182	2,759	67	180	5		7	
5. Wholesale	1		1						
	-------	-------	-------	-------	-------	-------	-------	-------	-------
6. Total Connections	118,280	16,582	91,765	1,323	9,148	58	54	140	0
B. Rights (acre feet)									
1. Ground water-in basin	41,620	5,900	28,237	3,457	2,678	315	432	601	
2. Ground water-importation [2]	8,000								8,000
3. Surface water-converted ag rights[3]	71,990		71,990						
4. Surface water-decree[3], creek[4]	47,810		47,810						
5. Surface water-storage	22,250		22,250						
	-------	-------	-------	-------	-------	-------	-------	-------	-------
6. Total Resources	191,670	5,900	170,286	3,457	2,678	315	432	671	8,000
C. Sources (acre feet)									
1. Ground water-in basin extraction	23,782	1,783	19,879	1,420	623	14	10	53	
2. Ground water-importation	958								958
3. Surface water-retail	56,760		56,760						
4. Surface water-POSW	11,700		11,700						
	-------	-------	-------	-------	-------	-------	-------	-------	-------
5. Total Sources CYE2015	93,200	1,783	88,339	1,420	623	14	10	53	958

[1] Includes Basin 86 -Sun Valley and Basin 91 - Truckee Canyon (Verdi).
[2] Honey Lake water rights/resources are available to the North Valleys via the Vidler Pipeline.
[3] Converted ag and decree rights are used throughout the TRA.
[4] Converted creek ag rights are available for use in Basins 87 (southwest) and 88 (west portion).

The remote, i.e., satellite, systems TMWA now manages as a result of the merger are found in basins: 83 (Truckee Segment), 88-East (the area east of I-580 in Pleasant Valley), 89 (Washoe Valley) and 97 (Honey Lake)[5]. These systems are grouped in the non-Truckee Resource Area ("non-TRA") category because the systems were developed as standalone subdivisions, which upon recordation of a final map required sufficient resources to meet the full build-out requirements of the development. At this time, the resources to serve these developments are fully committed and cannot be expanded beyond the defined development area without additional investment in facilities and viable resources. For purposes of this plan, it is assumed that each of the satellite systems has sufficient resources and facilities dedicated to meet the build-out of the development over the planning horizon, and it is not foreseen that Truckee

[5] Honey Lake is unique in that TMWA has no customers and distribution facilities in the basin, just well production and transmission facilities, and is grouped in the non-TRA for convenience.

River resources are or will be available to these systems in the near-term. A brief summary of these systems and the basin in which they are located is presented in Table 1-2.

Table 1-2. Summary of Satellite Systems Resources and Customers

	Description	Start year	Lots & customer type	Dedicated water rights (acre feet)	2015 Production (acre feet)
	-------------------a---------------------	---b---	----c----	----d----	----e----
	Basin 83: Truckee Segment				
1	Truckee Canyon Water System	2000	10-commercial 2-irrigation	200	6
2	Stampmill Estates	1994	43- residential 2-commercial	115	9
	Basin 88: Pleasant Valley-East				
3	Sunrise Estates	1978	54-residential	432	10
	Basin 89: Washoe Valley				
4	Lightning W Estates	1997	62-residential 2-commercial 2-irrigation	443	37
5	Old Washoe Estates	1978	65-residential 4-commercial 5-irrigation	158	15
	Basin 97: Honey Lake	2007	na	na	na

The TRA includes the growth prone areas of Lemmon Valley, Pleasant Valley (west portion), Spanish Springs, and Truckee Meadows. For this plan, the discussion of water resources in the chapters that follow frames issues for each hydrographic basin but will be aggregated under the TRA classification and describes how TROA meets and exceeds future demand needs in the TRA while accruing more drought reserves than previously available to TMWA over the planning horizon.

Trends After 2007 Economic Downturn

Following significant economic activity, between 2002 and 2006, the median price of housing approximately doubled within Washoe County. The annual median price for residential homes peaked in 2006 at $345,000. Some of the reasons cited for this rapid price increase in housing related to (a) relatively low home prices compared to California and other western markets; (b) historically low mortgage rates and easy access to mortgage loans in existence during that time; (c) high consumer confidence and spending at the national level; (d) a strong national economy; (e) an influx of national home builders to the region selling new homes at higher than average prices; (f) a surge in immigration and demand for new housing in the region; (g) a stable and favorable business climate compared to other regions in the west; and (h) increasing costs of raw materials for new construction brought about by high demands. However, due to artificially-low interest rates and subprime lending practices, eventually mortgage rates adjusted and the price trend reversed itself. By 2011, median home prices had plummeted 57 percent from $345,000 to $149,000, a level below that of 2001. By 2014 however the median home price was estimated to be $230,000, indicating home buying was on the rise. Figure 1-4 shows the changes in the median housing price for Washoe County between 2001 and 2014.

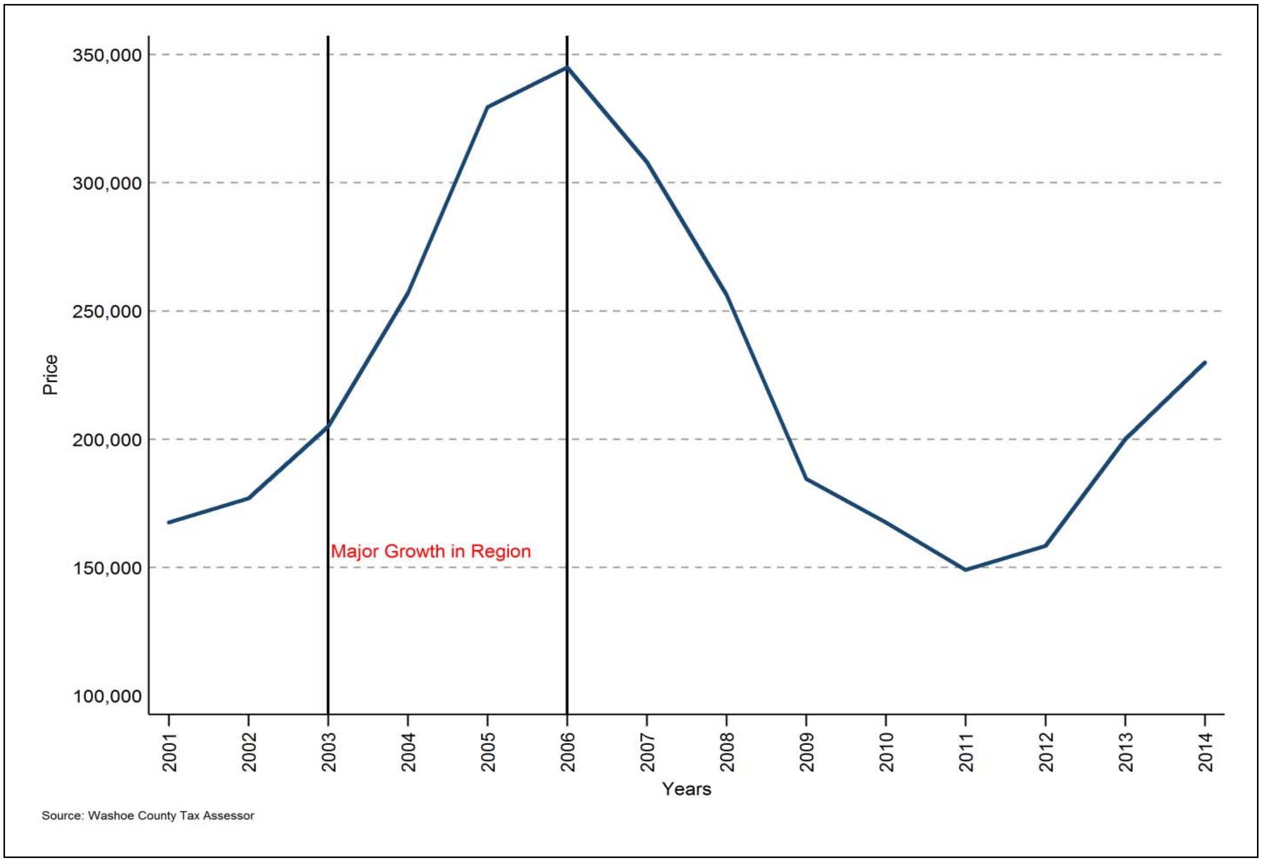


Figure 1-4. Median Housing Prices in Washoe County 2001 -2014

Figure 1-5 shows the development of land in the TMSA over the last 70 years. According to the Washoe County Assessor data 99,700 acres which includes roadways have been developed within the TMSA compared to current The Truckee Meadows Regional Planning Commission estimate of approximately 133,000 acres total developed and developable acreage within the TMSA. Historically, the development trend has been fairly constant over time. There was a brief spike in development in the middle 70's, followed by a consistent rise leading up to the economic downturn, at which time new development came to a relative halt. The reduced supply of developable land during the time period reflected in the graph is just another factor that contributed to increases in real estate prices experienced since the late 1990's through 2006 and will affect future development within the TMSA.

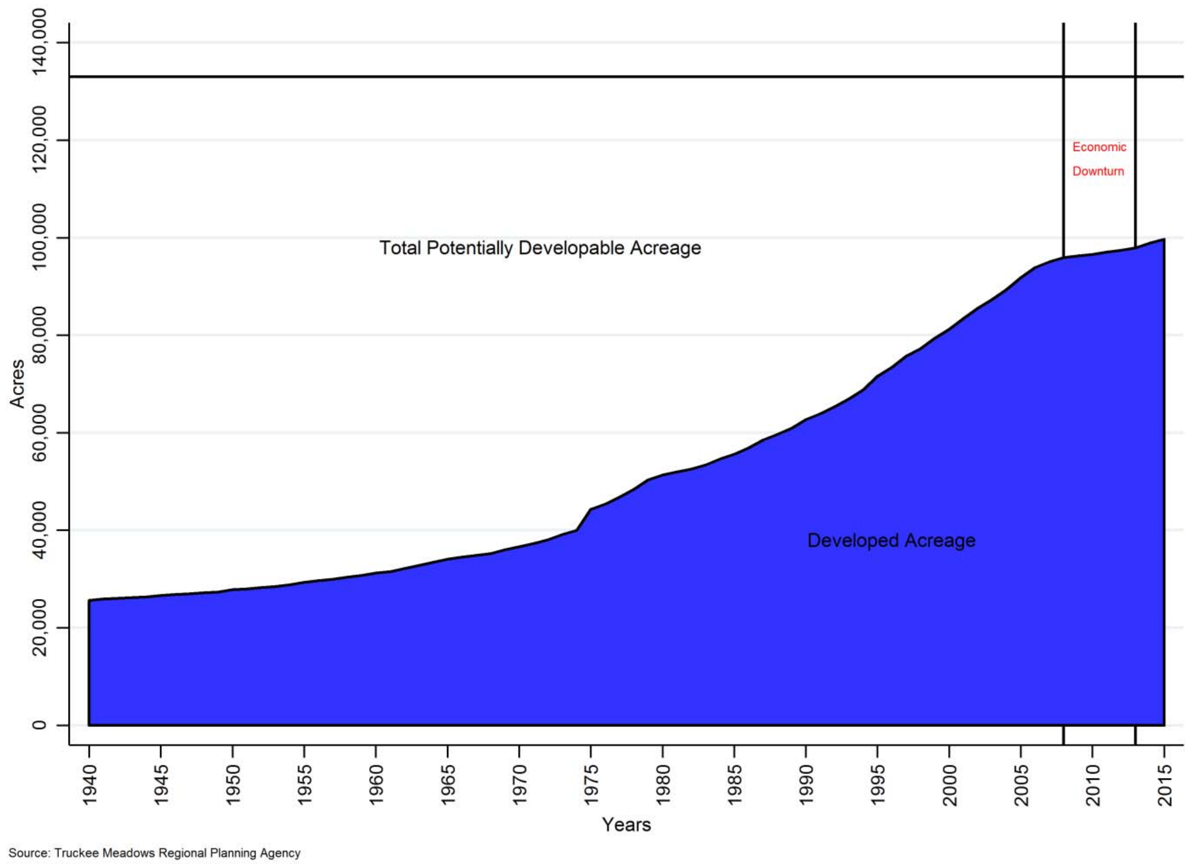


Figure 1-5. Developed and Undeveloped Acres in Washoe County

The ensuing credit crisis within the financial market signaled the start of a recession nation-wide. Economic conditions within the Reno MSA[6] had a significant downturn after the housing bubble crash of 2007/8. During the peak of the housing boom, the surge of people immigrating who were seeking lower home prices, relative to the national average, found increasing mortgage payments and little job opportunity after the decline. Declining income levels, a rapidly-contracting construction industry, and poor employment conditions in general, led to a dramatic drop in the number of employed persons within the Reno MSA (see Figure 1-6). In 2006, approximately 223,000 people were employed; however by 2011 employment numbers had decreased to 189,000. The result was an unemployment rate that had jumped over 200 percent from a record low of 3.8 percent in 2006 to 12.6 percent in 2011.

[6] Reno Metropolitan Statistical Area ("MSA") includes employment from Washoe and Storey Counties.

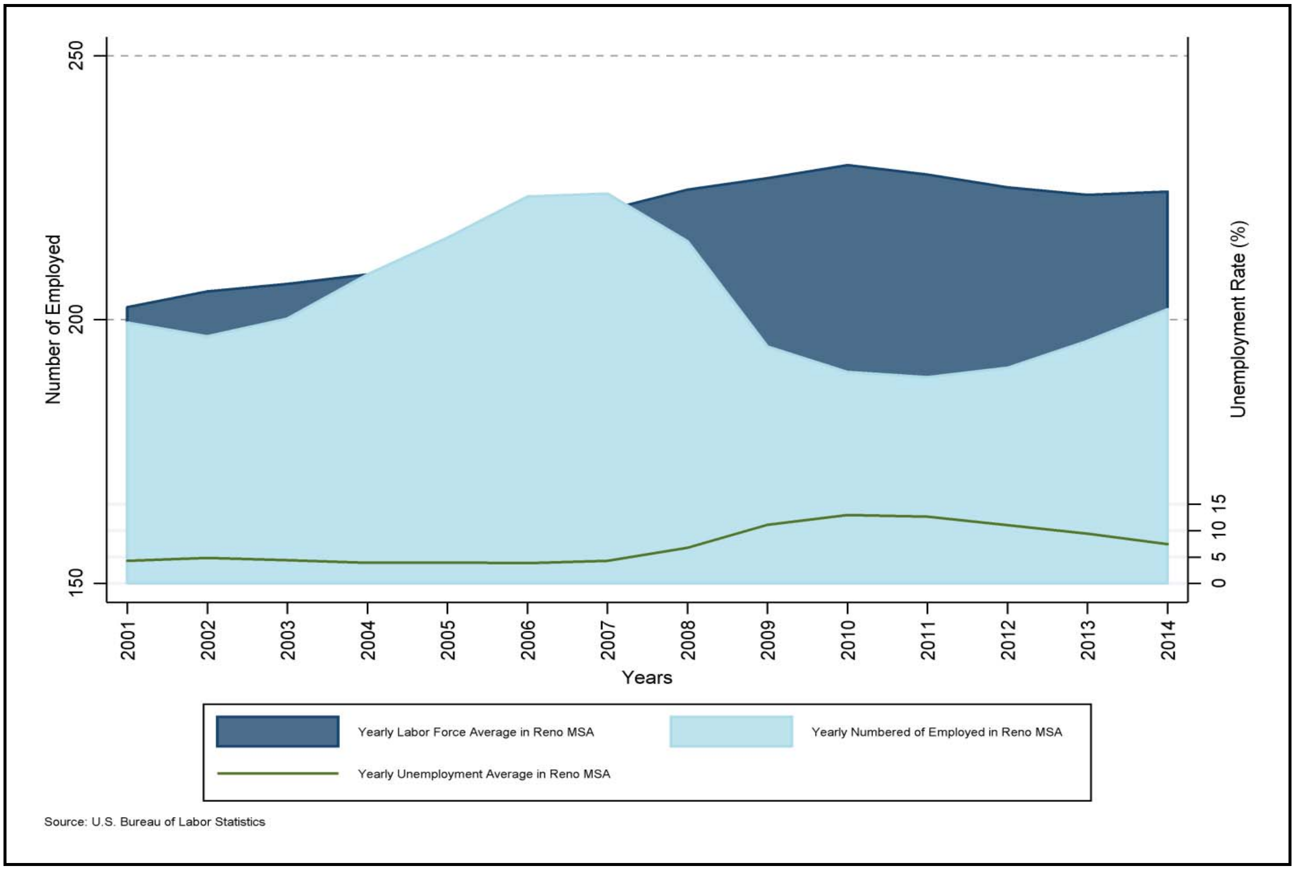


Figure 1-6. Employment Statistics in Reno MSA 2001 -2014

By 2012, indicators began to show signs of an economic recovery. Between 2010 and 2014 employment numbers rose 6 percent, and subsequently the rate of unemployment dropped from a unprecedented high of 13 percent in 2011 to 7.4 percent by 2014 (a rate only slightly higher than the average of 6.1 percent over the last 25 years). This increase in employment slowly began to raise the income levels within the Reno MSA. By 2012, per capita income had rebounded to $45,000 from $41,000 in 2010 (a gain of 9.7 percent), with the trend flattening over the next year.

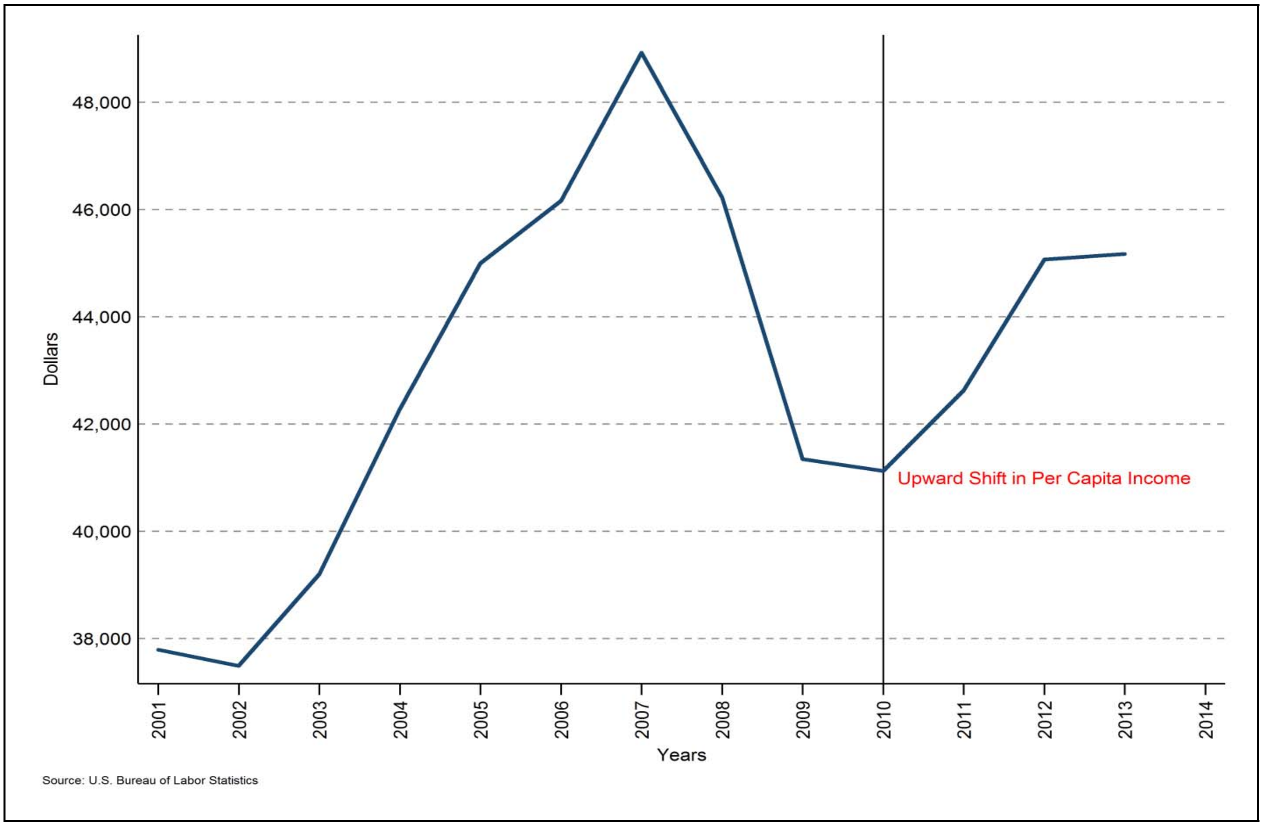


Figure 1-7. Per Capita Income Levels in Reno MSA 2001 -2013

Lagging behind the increase in level of income was home buying, which also exhibited a positive trend. Between 2011 and 2014 homeownership saw upward momentum as housing prices increased 37 percent during that period (see Figure 1-7). New residential housing hit a 10-year low in 2011 with only 538 housing permits issued by the local entities. By 2014, housing permits issued had increased 4-fold to 2,192. Prior to 2003, the median number of will-serve commitments issued by TMWA was 1,300 AF/yr. As the region experienced eight years' worth of development in a four year period (2002 to 2005), commitments more than doubled to 2,800 AF. Following the precipitous drop in new development activity beginning in late 2006, will-serve commitments reached a low point in 2010 (a level not seen since 1958) of 117 AF. Subsequently, as development began a modest rebound, will-serve commitments began to increase (see Figure 1-8).

Moving forward, based on the historic growth, the announcement of Tesla battery plant and other new projects, growth is likely to continue to be positive. It is projected the Reno MSA will see a 4.7 percent increase in employment between 2015 and 2019.[7] Given the relationship between economic growth, new housing development and home prices, as well as the price of water, it is expected that the price of water rights will increase - though at a much slower rate than previously experienced. Chapter 4 considers these trends and changes in employment leading to the development of revised population, dwelling unit and customer demand estimates for this 2035WRP.

[7] Estimate based on report by the Economic Development Authority of Western Nevada http://edawn.org/.

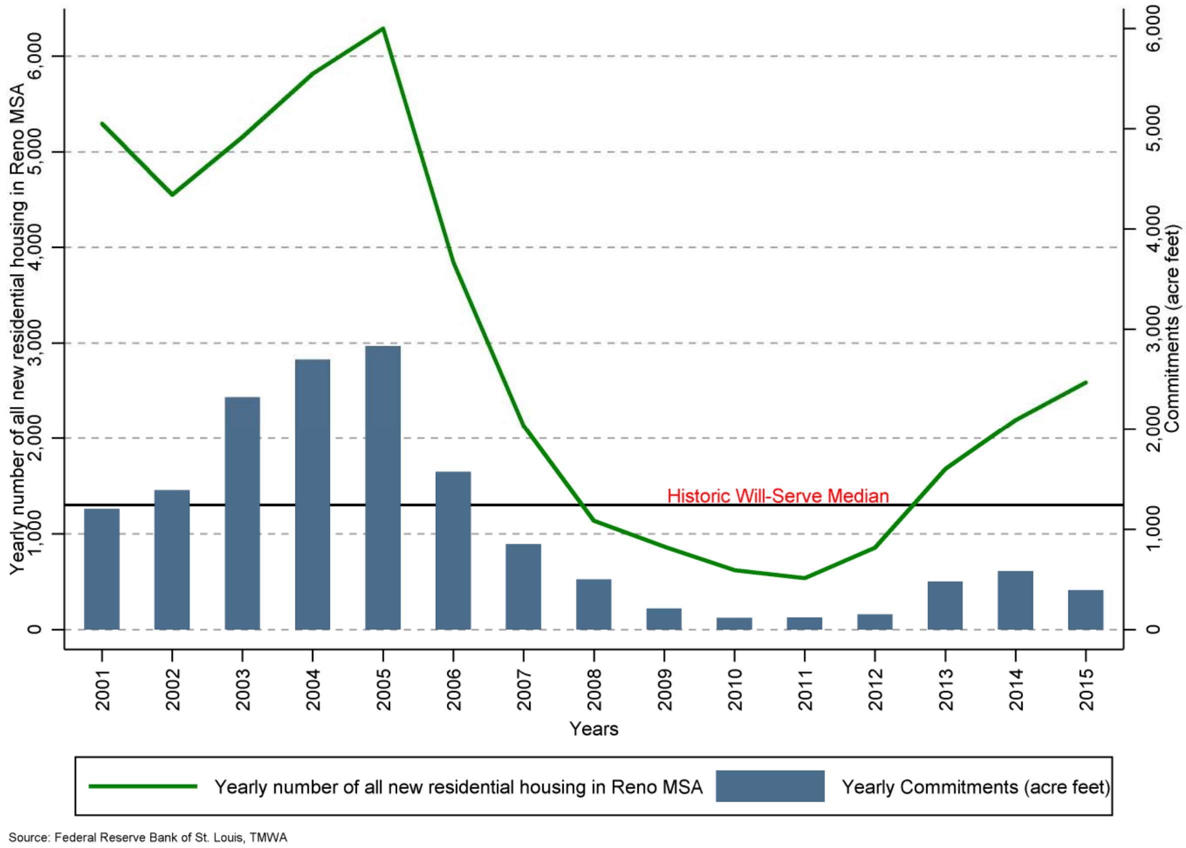


Figure 1-8. New Housing Permits and Annual Will-Serve Commitments 2001 -2015

Depending on the use of the land, commercial versus residential, and the resulting densities assigned to the land, the amount of water resources needed to meet this demand will vary. Analysis in Chapter 3 discusses the availability of Truckee River mainstem rights for future dedication to TMWA to support future will-serve commitments.

TROA Implementation

Pursuant to the *Truckee-Carson-Pyramid Lake Water Rights Settlement Act*, Public Law No. 101-618 (Nov. 16, 1990), Title II, 104 Stat. 3289 (the "Settlement Act"), Congress directed the Secretary of the Interior to negotiate an operating agreement with Nevada and California (and other parties) which, among other things, would provide for a more flexible and coordinated operation of Lake Tahoe, Boca Reservoir, Prosser Creek Reservoir, Martis Reservoir and Stampede Reservoir, and if owners of affected storage rights agreed, Donner and Independence Lake, while at the same time satisfying the exercise of water rights in conformance with the Orr Ditch Decree. TROA is that operating agreement.

TROA provides for modified river and reservoir operations that result in multiple benefits for water users, including benefits related to endangered fish species (spawning fish flows), recreation (minimum water levels in reservoirs), and significant additional drought storage for TMWA. Implementation of TROA solidifies the interstate allocation of water between Nevada and California as provided for in the Settlement Act.

On September 6, 2008, TROA was signed by the five Mandatory Signatory Parties: PLPT, the U.S., California, Nevada and TMWA. In November 2015 the parties completed all requirements to implement TROA, and it implemented December 1, 2015. TMWA began crediting storing water that the same day, the first time in history the water utility has been able to store water during winter months. TROA established a framework which provides greater flexibility for river operations allowing parties to exchange water to accommodate emerging issues without injuring the water rights on which they rely, and perhaps avoid future regulatory uncertainties surrounding the use of the Truckee River. Further discussion on the benefits of TROA is found in Chapter 3.

Purchase of Truckee Carson Irrigation District ("TCID") Interest in Donner Lake

In May of 1943, Sierra Pacific Power Company ("Sierra") and TCID acquired from the Donner Lake Company ownership of the dam and reservoir at Donner Lake and the right to store water in Donner Lake, as tenants-in-common. The Donner Lake water right allows for the impoundment of approximately 9,500 AF of water each year and the right to use Donner Lake as a reservoir for upstream storage. At that same time, Sierra and TCID entered into an agreement for the operation, maintenance, cost-sharing and use of Donner Lake Water, which requires, among other things, Sierra and TCID to operate the dam and controlling works at Donner Lake. In 2001, Sierra conveyed its interest in the Donner Lake water right and associated operating agreement to TMWA.

In the past, several attempts were been made by Sierra Pacific Power Company to purchase TCID's half of Donner Lake water but without success. TROA imposes various requirements on TMWA to develop additional municipal and industrial water supplies for new water service. Among those requirements, TMWA's acquisition of TCID's Donner Lake Assets is explicitly called out in TROA Section 4.C.1(b) whereby:

> "…..Water Authority [TMWA] shall use its best efforts to implement the following measures, to the extent legally, technically and economically feasible, to help meet the water demands of customers: ….
>
> (b) The acquisition and utilization of the rights currently owned by Truckee-Carson Irrigation District to store and use water in Donner Lake on a willing buyer/willing- seller basis, unless such right is acquired by another party….."

In fall 2015, TCID began discussions with TMWA regarding the sale of TCID's interest in Donner Lake. After extensive negotiations, TCID and TMWA staff reached an agreement whereby TMWA pays in total $17.2 million for the Donner Lake water rights in exchange for:

- TCID and TMWA will settle and resolve all litigation claims with respect to a 2006 action over their respective rights to the Donner Lake water right and their respective rights and obligations under the 1943 Indenture and the 1943 Operating Agreement, including whether the 1943 Operating Agreement is presently valid and enforceable.
- TCID will engage in a good faith effort to procure the dismissal of other TROA related litigation by all other remaining parties to those lawsuits, including the City of Fallon

and Churchill County.

- TCID agrees to not file any new litigation or challenges, legal or otherwise, to the adoption, validity, legality or enforceability of any of TROA's provisions.
- TMWA agrees to engage in a good faith effort to procure consents from other TROA parties to allow TCID to become a party to TROA.
- TMWA agrees TCID may seek to obtain the agreement of the United States and other appropriate TROA parties concerning upstream storage of Newlands Project Credit Water and Other Credit Water pursuant to the provisions of TROA, and modification of release dates of Newlands Project Credit Water. TMWA agrees it will not oppose such requests provided they do not result in injury to or conflict with TMWA's water rights, TMWA's rights under TROA or the Orr Ditch Decree.

The purchase agreement was presented to and approved by both the TMWA and TCID boards on December 16, 2015. On January 4, 2016 TCID held a special election of the member of the irrigation district on whether TCID should sell the Donner Lake assets pursuant to the agreement; the members voted overwhelming to sell the assets.

Upon close of escrow scheduled for February 2016, TMWA will add TCID’s 4,750 AF of Donner Lake water right to its share, thereby owning all 9,500 AF of the Donner Lake water right. TMWA will manage the acquired portion of the Donner Lake water right pursuant to TROA operations, which allows using the right for more credit storage and when used for new will-serve commitments, to be included as part of TMWA’s normal demand for purposes of TROA.

Water Resources During Drought Periods

The annual flow of water from the Truckee River system is dependent on the amount or size of the preceding years’ snowpack (see Figure 1-9) which can be highly variable from year-to-year. Simply stated, the larger the snowpack the greater the Truckee River flows; conversely, the smaller the snowpack the smaller the Truckee River flows; this topic is developed more fully in Chapter 2.

Beginning in 2012, snowpack accumulations have been near or below 50 percent of average. This 2035WRP comes as the region experienced its fourth consecutive year of exceptionally low-precipitation. Drought Situations[8] exist when there is inadequate natural flow in the Truckee River and there is not enough stored water in Lake Tahoe and/or Boca Reservoir to maintain required rates of flow to meet Floriston Rates, or the elevation of Lake Tahoe is projected to be less than half-a-foot above its natural rim on or before November 15 each year. Truckee River discharge data (1909 through present) and various tree-ring research efforts show drought periods can vary from a few years to as many as 8 to 10 years in duration.

[8] Pursuant to TROA: “**Drought Situation** means a situation under which it is determined by April 15, based on procedures set forth in Section 3.D, either there will not be sufficient **Floriston Rate Water** to maintain **Floriston Rates** through October 31, or the projected amount of **Lake Tahoe Floriston Rate Water** in Lake Tahoe, and including **Lake Tahoe Floriston Rate Water** in other **Truckee River Reservoirs** as if it were in Lake Tahoe, on or before the following November 15 will be equivalent to an elevation less than 6,223.5 feet Lake Tahoe Datum.”

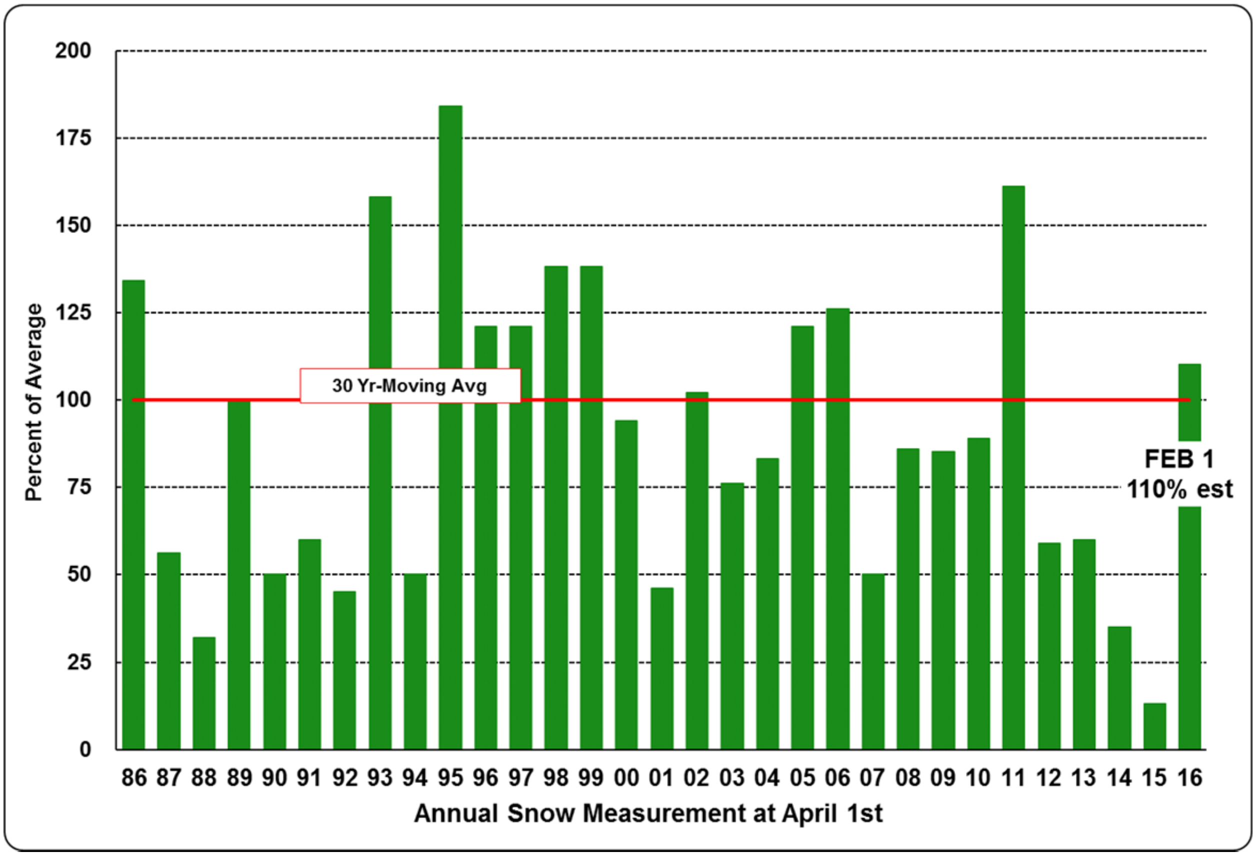


Figure 1-9. 1985 to 2015 April 1 Snowpack for the Truckee River Basin with Estimated February 1, 2016 Percent of Average

During the various drought periods, TMWA's drought reserves may not be impacted; Privately Owned Stored Water ("POSW") or drought reserves are only used to meet customer demand when the more critical dry years within the drought period are experienced. Based on past history it is not until at least the third dry or drought year in a row that upstream reserves may have to be used. In the 1987 through 1994 drought of record, only in the summer of 1991 and 1992 were upstream reserves required to meet demands. It is important to also note that the use of reserves has only occurred between the months of June and October, primarily during the irrigation season. In those years where Floriston Rates were not met through the irrigation season, by November flows in the Truckee River were once again sufficient enough to meet wintertime production needs. TMWA's current water planning is based on the hydrology of 1987-1994, the worst drought on record. In the current drought period, drought reserves were required to meet TMWA customer demands in both 2014 and more so in 2015. Although 2015 was the driest in the last 115 years with the lowest snowpack in recorded history, it cannot be stated with any certainty as to what the duration or direction the current drought period will take. This topic is discussed further in Chapters 2 and 3.

The core of TMWA's water supply for customers in the TRA is derived from the Truckee River. Consecutive years of low-precipitation in the Lake Tahoe and Truckee River basins produce dry conditions and drought periods in the TRA. The length of a drought period is solely a function of climatic/meteorological conditions, hydrologic drought conditions, and trends over a period of years. Determining a safe annual yield of available water resources during extended drought situations is the crux of this, and prior, water resource plans.

Summary

Water resource planning for the Truckee Meadows has become increasingly more complex in recent years and will continue to be more challenging as TMWA seeks to accommodate the region's current and future water supply needs. This chapter introduced some of the key issues facing the current and future development of water resources for the Truckee Meadows. The following chapters will take up other issues related to climate, source water reliability and sustainability, water right availability, water resource integration and conjunctive management of resources, demand-side management, and future supply opportunities. This 2035WRP relies and builds upon the information developed and contained in prior TMWA and various regional planning efforts. This 2035WRP plan will examine and analyze the water resource options available to TMWA to meet the water demands of its current and future customers. The plan is set forth as follows:

- "Key Findings and Recommendations" summarizes the significant findings of the 2035WRP and makes recommendations for further Board actions.
- Chapter 1, "Introduction", presents some of the key past and current trends and challenges that have shaped, or are projected to shape, the future of the greater Truckee Meadows region and the availability of water resources.
- Chapter 2, "Source Water Reliability", presents discussion of quality of surface and ground water sources, climate change and climatic effects, source/loss risk analysis, and water quality protection/response plans.
- Chapter 3, "Integrated Management of Water Resources", describes availability of water rights used by TMWA and how those resources are conjunctively managed to annually produce a sufficient amount of water to meet TMWA's water service demands in non-Drought and Drought-Situation years.
- Chapter 4, "Population and Water Demand Projections", presents forecasts of population and water demands for the planning horizon.
- Chapter 5, "Water Conservation Plan", describes the various conservation programs and measures that TMWA employs to reduce annual water use and minimize water waste in both non-drought and drought-situation years, including a comprehensive list of tools that the TMWA Board can employ to produce enhanced water savings based on water supply conditions at any given time.
- Chapter 6, "Future Water Resources", identifies potential future water resources.
- Chapter 7, "Summary", compiles the issues outlined in the plan with some suggested direction for the future of water resources for the greater Truckee Meadows region.

CHAPTER 2 SOURCE WATER RELIABILITY

This chapter explores the reliability of TMWA's total water supply in terms of both quantity and quality for municipal purposes. A water supply is considered to be reliable when in the event of adverse events, service to customers continues without interruption. There are three key areas of risk that needs to be addressed in order to ensure a perpetual and adequate water supply: climate changes (warmer / cooler average temperatures or wetter / dryer average conditions); weather caused events (such as floods, droughts, mud slides); and anthropogenic events (such as source contamination). Each of these risks requires its own level and type of risk assessment and plan for mitigation. While it not possible to completely remove the risk of any event, it is possible to develop plans and allocate resources to be used for mitigation when events occur.

Climate Change

Performing an accurate assessment of the risk associated with climate change requires a delineation of the differences between climate and weather; a discussion about how climate assumptions can translate into changes to expected weather patterns; and how different weather patterns may translate into different risks for TMWA to consider and develop plans. The following discussion about climate and weather is paraphrased in part from NASA's website[9] and is provided in Appendix 2-1.

The difference between weather and climate is a function of the measurement of time. Weather is atmospheric conditions over a relatively short period of time. Most people think of weather in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, wind, and atmospheric pressure (i.e., high and low pressure). Weather can change minute-to-minute, hour-to-hour, day-to-day, and season-to-season. Weather includes sunshine, rain, cloud cover, winds, hail, snow, sleet, freezing rain, flooding, blizzards, ice storms, thunderstorms, steady rains from a cold front or warm front, excessive heat, heat waves and more.

The National Oceanic and Atmospheric Administration's ("NOAA") National Weather Service ("NWS") is the lead forecasting outlet for the nation's weather and the keeper and provider of much weather data. Their mission states:

> "The National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community."

TMWA makes extensive use of NWS data in many analyses and daily treatment operations.

[9] NASA publication *What's the Difference Between Weather and Climate*?
http://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html

Climate is used in reference to how the atmosphere 'behaves" over relatively long periods of time; it is the average of weather over time and space. Some scientists will define climate as the average weather for a particular region and time period, usually spanning over 30 years. When scientists talk about climate, they are looking at averages of precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail storms, and other measures of the weather that occur over a long period in a particular place. To talk about climate change is to talk about changes in long-term average of daily weather. Today, children hear stories from their parents and grandparents about how snow was always piled up to their waists as they trudged off to school. Today in most areas of the country, children have not experienced those kinds of dreadful, snow-packed winters. If summers seem hotter lately, then the recent climate may have changed. In various parts of the world, some people have even noticed that springtime comes earlier now than it did 30 years ago. While anecdotal, these are all indicative of possible change in the climate. In addition to long-term climate change, there are shorter term climate variations. This so-called climate variability can be represented by periodic or intermittent changes related to El Niño, La Niña, volcanic eruptions, or other changes in the Earth system.

The study of climate is looking at how the description of weather is changing over longer periods of time. The National Academy of Sciences, a lead scientific body in the U.S., determined that the Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities. Yet, there is still some debate about the role of natural cycles and processes.

It is accepted that human activities have altered the chemical composition of the atmosphere through the buildup of greenhouse gases – primarily carbon dioxide, methane, and nitrous oxide. While the heat-trapping property of these gases is undisputed, it is uncertain exactly how Earth's climate responds to them. According to the U.S. Climate Change Science Program (http://www.climatescience.gov), factors such as aerosols, land use change and others may play important roles in climate change, but their influence is also highly uncertain at the present time.

The above discussion about climate and weather from NASA, clearly shows that the topic of climate and weather is both complex and filled with uncertainties about how all the interrelated components behave over time. What is known is that over the last 100 years global temperature has risen about 1 degree Fahrenheit, and most of that in the last 50 years.

Climate Predictions

Using the Global Climate Dashboard from Climate.gov, average global temperatures are expected to increase about 1 degree between the years 2010 and 2040, and by the year 2100 the change could be 2 to 6 degrees depending on the model selected. The climate scientists are unable to tell which model should be used because all the models are dependent upon expected human activities. The amount of warming associated with different human choices is also unknown because there are many details that are not known about how the climate will respond to continued increases in heat-trapping gases, particularly over longer time scales. The following figure from Climate.gov illustrates the range of possible global temperature changes.

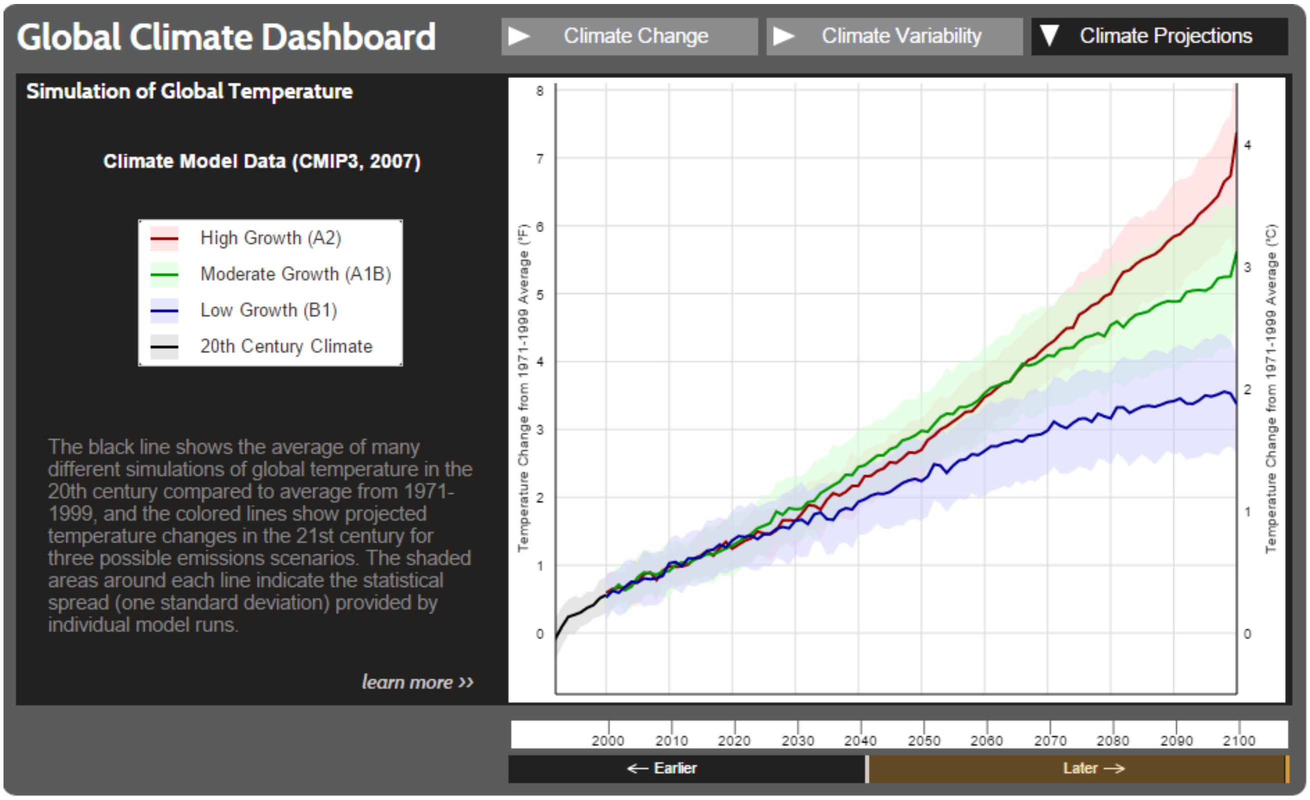


Figure 2-1. Global Climate Dashboard from Climate.gov

Translating Climate Predictions into Changes in Weather

Northern Nevada and California its neighbor to the west share the Lake Tahoe and Truckee River watersheds. In June 2015 the State of California Department of Water Resources ("CDWR") released a report "California Climate Science and Data for Water Resources Management" presenting their findings and methods of adapting climate change research to water resource planning which have some applicability to the greater Truckee Meadows water supplies. (Appendix 2-2).

In California there is an expectation of more frequent droughts with warmer temperatures. Extremes on the wet end of the spectrum are also expected to increase, due to more frequent warm, wet atmospheric river events and a higher proportion of precipitation falling as rain instead of snow.

Most climate model precipitation projections for California anticipate heavier and warmer winter precipitation in northern California. However there is less scientific detail on localized precipitation changes and this uncertainty needs to be taken into account. Lake Tahoe and the Truckee River basins are considered to be located in northern California and in what California calls the North Lahontan hydrologic region. In the Global Climate Models ("GCM"), California and western Nevada are simplified and represented by a handful of data points. The climate model simulations *do not* provide strong consensus regarding precipitation trends in most locations around the globe, including California. It is possible that throughout the 21st century, the total amount of precipitation statewide will remain, on average, about the same. However, the distribution, timing and type of that precipitation may vary. What is quite certain is that future years will continue to be subjected to natural climate variability, such as El Niño and other large-time-scale oscillations.

Climate modeling will continue to produce more realistic and improved capability to explore future conditions, as observations accumulate and better fundamental understanding is gained by scientists. These advances will lead to a better understanding of possible scenarios, including the frequency of extreme events such as drought and floods. At this time the climate models provide very limited information for water resource planning. CDWR has determined that the Northern Lahontan hydrologic region is subject to the following vulnerabilities:

- Increased air and water temperatures would place additional stress on sensitive ecosystems and species.
- Loss of snowpack storage may reduce reliability of surface water supplies and results in greater demand on groundwater resources.
- Magnitude and frequency of extreme precipitation events may increase, resulting in greater flood risk.
- Higher temperatures and longer dry seasons would increase wildfire risk.

CDWR suggest the following resource management strategies may prove benefit in addressing future water supply uncertainty:

- System Re-operations:
  - Changing existing operation and management procedures for a water resources system consisting of supply and conveyance facilities. TROA provides for the reoperations of the Truckee River and associated storage reservoirs.
- Conjunctive Management and Groundwater Storage:
  - Coordinated and planned use and management of surface water and groundwater resources to maximize the availability and reliability of water supplies.
- Surface Storage – Regional/Local:
  - Above-ground reservoirs to collect water for later release when needed. Surface storage has played a key role where the quantity, timing, and location of water demand frequently do not match the natural water supply availability.

As seen by the information from NASA, Climate.gov, and CDWR, TMWA can expect the regional climate to continue warming, the exact amount of warming cannot be determined at this time. Warming temperatures are expected to have an impact on water sources, however the current science is unable to provide estimates of what that impact will be over time. Regardless of the exact amount of climate change, resource management strategies such as system re-operations, conjunctive management, and surface storage are useful in managing the climate change impacts. These same tools are also used to manage known weather variability risk such as droughts, floods, rain versus snow events. In a way, TROA is a model for other systems to follow in that the Truckee River operations have been modified to meet current needs and has incorporated resource management strategies climate researchers have been recommending.

Weather Variability

Nevada is part of the Great Basin and for the most part is classified as a high desert climate. Few places in Nevada are as fortunate as the Truckee Meadows which has a river running through it, but that does not change the fact it is a desert with annual average rainfall of 7.5 inches per year. In essence, the region is in perpetual dry conditions interrupted by higher-than-average precipitation years, which makes it difficult to delineate when a drought has begun, will end, or how long a drought could last.

Weather, particularly precipitation in the form of snowpack, is the primary determinant in establishing drought conditions and the availability of surface and groundwater supplies in the various hydrographic basins where TMWA provides service. Precipitation replenishes the reservoirs and aquifers from which water is extracted. While the weather pattern consistently provides precipitation during the winter and spring months, the type of precipitation (snow versus rain) and timing of snowmelt runoff can vary greatly from year to year. Simply stated, a larger snowpack produces greater Truckee River flows; conversely, the smaller the snowpack the smaller the flow in the Truckee River. Figure 2-1 compares annual snowpack accumulations to annual Truckee River flows.

TMWA manages for uncertainty of its water supply, in terms of the overall quantity and the timing of its delivery, through storage of water in upstream reservoirs and injection of treated surface water through its network of wells into aquifers in Lemmon Valley, Spanish Springs and Truckee Meadows. When river flows are available, TMWA manages its surface water resources through conjunctive use with groundwater supplies. This conjunctive use management maximizes use of surface water when it’s available, thereby reducing groundwater pumping. This approach allows TMWA to meet demands with surface water, and to rest and recharge specific wells when enough surface water is available. TMWA continually assesses the potential reduction to source water supplies due to variability of weather conditions.

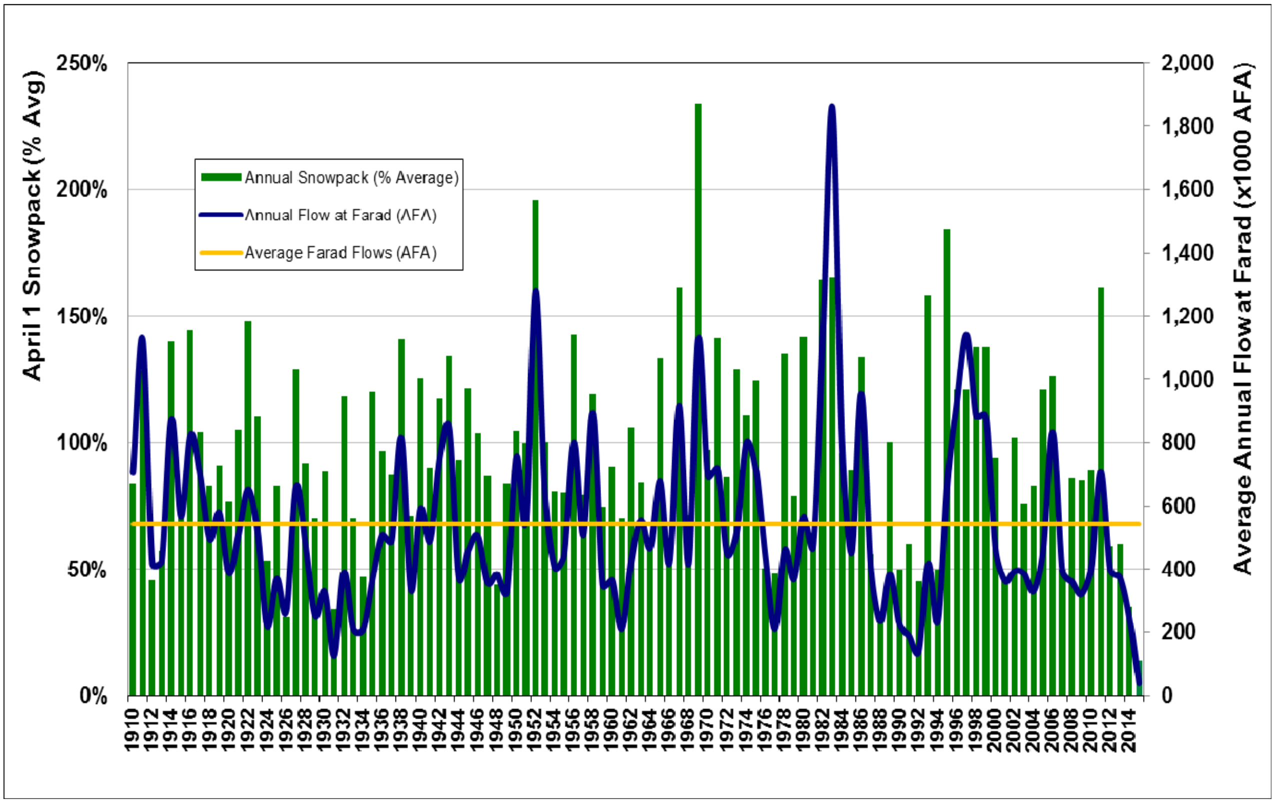


Figure 2-2. Annual Snowpack Percent vs Average and Annual Truckee River Flow at Floriston

Shortages in water resources due to seasonal weather variability can produce adverse environmental and economic conditions such as degradation of the land and the associated biologic ecosystem (i.e., stress to plants, animals, and habitat). Recent changes in the climate have been suggested as the culprit for the high degree of weather variability and deserve more attention as to the impacts to regional water resources. However, studies on the historic hydroclimatic conditions in the region reveal long periods with either extremely wet or dry conditions are common cyclical events when viewed from a much longer timeframe. In order to effectively manage for source water reliability given the uncertainty surrounding annual precipitation, such events and the frequency of their occurrence merit a closer investigation.

For a better understanding of how water resources can be impacted from extreme variability in the Truckee River Basin's weather patterns, TMWA partnered with the Desert Research Institute ("DRI") in 2006 and 2009 to research the possibility of climate change and global warming affecting the Truckee Meadows' water supplies (see Appendix 2-3). The results of that research indicated, at the time the study was done, that historic hydrological records are the best data available for future planning and scientific evidence remains inconclusive as to the effect of climate change on drought conditions within the Truckee Meadows. Since there is a high variability in regional climate data, it has proven difficult to definitively detect long-term climate trends, i.e., some studies project the region becoming wetter while others project a progressively drier environment over time. Given this "noise" in the data and a divergence in the predictions under various climate change models, the 2009 research concluded that continued investigation on this topic is warranted.

In 2015, TMWA partnered with the University of Nevada, Reno ("UNR") to investigate recent advances in the research of climate change (see Appendix 2-4). The preliminary report indicates that, despite the advancements on climate change research, the debate regarding variation in weather patterns, greenhouse gas emissions, and extreme drought is still ongoing. In many cases simulated climatic projections do not line up with observational data over time. However, it is better established that from a century's worth of hydrologic records that the high variability in local seasonal river flows is driven, in large part, by oceanic and atmospheric oscillations. Moreover, to adequately evaluate current changes to the availability of water resources as well as the likelihood of future extreme hydrologic conditions, one must take a much broader perspective that incorporates long-term trends into projections. This approach requires hydroclimatic data that extends far beyond modern records. In particular, tree-ring sampling can be used to extend hydroclimatic records many centuries beyond modern records providing insight into long-term changes in the region's hydrologic conditions.

This point is underscored by the fact that the Lake Tahoe Basin has endured hydroclimatic episodes that persisted for much longer than experienced in modern times. For example, analysis conducted in 2011 on submerged trees in Fallen Leaf Lake revealed a drought that persisted for two centuries (between 1100 and 1200 A.D.). While mega-drought episodes in the area are rare, shorter periods of wet and dry are more common in the region. Figure 2-2 is a map showing the two basins (Truckee indicated by the lime polygon and Carson indicated by the purple polygon) and the location of the tree-ring chronologies (green dots) analyzed in the 2015 report[10]. The report reviewed a variety of tree-ring chronologies that analyzed tree-ring datasets covering multiple watersheds throughout California and Nevada. Further analysis of the data delineated those datasets where correlation within the tree-ring chronology exists between the Truckee and Carson River Basins and regions in the sample in order to construct a workable tree-ring chronology. The tree-ring samples provide an extension to the dataset on the hydrologic conditions of those watersheds as far back 1500 A.D.

The report finds evidence of many occurrences over the past 500 years of wet and dry periods that persisted for multiple years. Of the 211 wet and dry episodes during this period, the average lasted for 2.4 years, with the longest episodes being a 9-year wet period in the early 1980s (1978-1986), and two 8-year droughts in 1841-1848 and 1924-1931. These findings point to different hydrologic patterns emerging in the new millennium when compared to the entire length of record. For example, in the last century this region has experienced three of the strongest wet periods (out of a total of six) and two of the strongest dry periods (out of a total of four) out of the top 10 wet and dry cycles of the past 500 years. However, given the wide range in the spatial locations of the chronologies, the report recommends collecting more tree-ring data from sites located in the Truckee and Carson River watersheds to improve the quality of long-term hydroclimatic picture within TMWA's service area.

[10] Tree-ring chronology data was provided by the Contributors of the International Tree-Ring Data Bank.

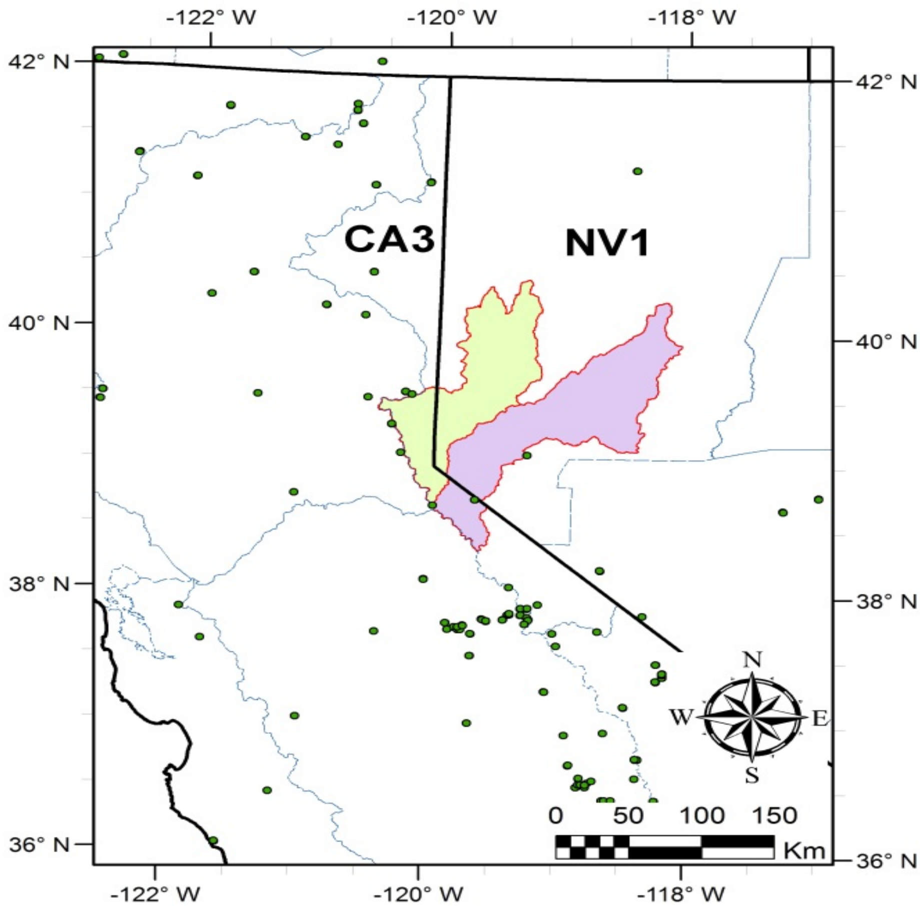


Figure 2-3. Location of Tree-Ring Chronologies Used in the 2015 Report

The 2015 report provides evidence that the highly cyclical nature of both wet and dry episodes is not a new phenomenon. However, given that half of the strongest 10 episodes occurred in the last century, it would suggest variations in weather extremes are becoming stronger and more frequent. This high degree of variability between wet and dry weather patterns, coupled with a high degree of uncertainty regarding the duration of either event, makes managing for water source reliability particularly challenging. Management becomes a delicate balance between selling enough water in wet years to keep costs of service low, and ensuring adequate conservation of storage is achieved during periods of drought. In order to confidently manage for both potential conditions, TMWA ensures its reserves are such that they can meet service demands for extended periods of drought, meanwhile assessing snowpack and river flows annually in order to reevaluate management strategies should conditions worsen or improve. This continual reassessment of source water supplies and management tactics is the best defense against reservoir depletion while mitigating the risk of unnecessary economic stress to both the utility and customer base.

Historically, TMWA's water resource management plans consider changes in water supply based on instrumental data on hydrologic conditions recorded over the past one hundred-plus years. However, as changes in the climate are projected to become increasingly prominent and erratic, managing for a sustainable supply of water resources in the future, could prove to become more complex. In order to best manage for water supply sustainability in an uncertain future, TMWA anticipates alternative actions that would insulate against future shocks to its supplies and adapts to abrupt changes in short-term conditions, given climate projects that span beyond the hundred years of hydrologic record. In order to design robust strategies to mitigate against potential climate change scenarios, TMWA incorporates the best available scientific information regarding regional climate change into its planning process. Moreover, with the merger with DWR and STMGID, as well as the recent implementation of TROA, TMWA's strategies have expanded to incorporate new operational and institutional constraints, in order to separate what strategies *should* be done from what strategies *can* be done.

In May of 2015, the USBR released the funding announcement for the WaterSmart: Drought Contingency Planning Grants for Fiscal Year 2015. The WaterSmart Program was established to provide federal assistance to water authorities in the areas of water efficiency and climate change resiliency. The two-year grant calls for the incorporation of the best science on climate change into water resource management within a collaborative, interagency framework. In June 2015, TMWA leveraged this opportunity by proposing a project to address the potential influence of water-shed level climate change on water resource management in the TMSA. Specifically, the project proposes that TMWA will collaborate with UNR and DRI to determine hydrology conditions under "worst case" climate changes scenarios. Through the use of paleoclimatology data such as tree ring samples, scenarios will be modeled based on extreme droughts that occur prior to the last century. Using this information TMWA will create a methodology that identifies both feasible and cost-efficient water management strategies within the TMSA, given various, potential climate change scenarios. Using a linear programming framework to optimize a suite of management options for each scenario, between 2016 and 2017, TMWA 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 robust drought contingency management plan that utilizes a dynamic decision support system which details a timetable outlining the optimal suite of actions to: i) provide adequate water resources to meet demand; ii) satisfy cost recovery and all legal requirements; and iii) can adapt readily as conditions change within the TMSA. Preliminary results of this effort are expected early 2017.

In addition to identifying management strategies to deal with potential climate change scenarios, part of the requirements of the federal funding award is that TMWA create an interagency Drought Planning Task Force. The Task Force is comprised of TMWA staff, government agencies' staff, representatives from TMWA's various customer classes, academics, as well as environmental and economic stakeholders within the TMSA. Over the two years of the project, the Task Force will hold a series of meetings to discuss the model's output and the management actions local agencies can take, in response to various climate change projections for the region. As well, the meetings will identify and discuss the implications and potential impacts from those actions. The entire project is slated to be completed by August, 2017.

TMWA is not the only agency taking a proactive approach to water supply sustainability. Given prolonged drought periods can occur in the region, DRI has been conducting cloud seeding in the Lake Tahoe and Truckee River Basins for more than 25 years. The purpose of cloud seeding technology is to enhance snowfall from storm events thereby increasing the overall snowpack in the Tahoe and Truckee Basins. DRI's cloud seeding program consists of three phases; 1) prepping the cloud seeding generators to distribute the seed when the proper storm presents itself; 2) applying seeding to the clouds of wintertime storms; and 3) analyzing the subsequent weather data during the cloud seeding periods to determine effectiveness. DRI's study estimates cloud seeding increases the precipitation rate by approximately 0.01 inches per hour. During the prior 18 seasons it has been estimated that the DRI state program yielded snow water increases ranging from 8,000 to 30,000 AF/yr, with an annual average of about 18,250 AF. For the 2014/15 winter season it was estimated the cloud seeding program increased the snow water by approximately 11,513 AF (See Appendix 2-5) for the complete report). However, while it cannot be estimated how much of the additional snowfall increases streamflow, groundwater recharge, or reservoir storage that would directly benefit TMWA and its customers, any increase in the snowpack can have a positive effect on the region's water supply.

Droughts

The State of Nevada defines drought as follows:

> "Drought is a complex physical and social phenomenon of widespread significance. Drought is not usually a statewide phenomenon; differing situations in the state make drought local or regional in focus. Despite all the problems droughts have caused, drought has proven difficult to define. There is no universally accepted definition because drought, unlike flood, is not a distinct event and drought is often the result of many complex factors acting on and interacting within the environment. Complicating the problem of a drought definition is the fact that drought often has neither a distinct beginning nor end. It is recognizable only after a period of time and, because a drought may be interrupted by short spells of one or more wet months, its termination is difficult to recognize. The most commonly used drought definitions are based on: 1) meteorological and/or climatological conditions, 2) agricultural problems, 3) hydrological conditions, 4) economic considerations and 5) induced drought problems. Each type of drought will vary in severity, but all are closely related and caused by lack of precipitation."[11]

The State of Nevada Drought Plan sets forth the State's definition for each of the five types of droughts. The role of a water purveyor is to secure reliable water resources to meet its customers' requirements, including mitigating the risks that droughts can impose on water resources. TMWA monitors meteorological[12], hydrological[13] and induced[14] droughts as these

[11] State of Nevada Drought Plan, a report prepared in 2012 by the Drought Response Committee comprised of the State Climate Office, Division of Water Resources, and Division of Emergency Management under direction of the Governor. See Appendix 2-6 for full report.

[12] Meteorological drought is often defined by a period of well-below-normal precipitation. The commonly used definition of meteorological drought is an interval of time, generally of the order of months or years, during which the actual moisture supply at a given place consistently falls short of climatically appropriate moisture supply.

[13] Hydrologic drought refers to periods of below-normal streamflow and/or depleted reservoir storage.

[14] Induced drought is a condition of shortage which results from over-drafting of the normal water supply. The condition is aggravated by negative precipitation experience and below normal streamflow or aquifer recharge. An induced drought is brought about by introducing agricultural, recreational, industrial or residential consumptions into an area which cannot naturally support them.

have direct effects on availability of surface water to water right holders along the Truckee River and availability of groundwater in hydrogeographic basins during low-precipitation years. TMWA's focus in water resource planning and management is in direct response to hydrologic and induced drought conditions. Depleted reservoir storage, both upstream and subsurface, has a direct impact on TMWA's water supplies during drought periods. Consecutive (three or more) years of low-precipitation in the Lake Tahoe and Truckee River Basins are likely to negatively impact the storage in both Lake Tahoe and Boca Reservoir. Three exceptionally dry years in a row (2012 to 2014) reduced upstream reservoir storage to a point where there was no water left to release into the Truckee River except for TMWA's drought reserves. The length of a drought period is solely a function of meteorological conditions over a period of years.

A good indicator of an impending dry-year water supply is snowpack accumulation. Measured on April 1 of each year, the water content of the snowpack is used to forecast the amount of water that will run off each spring to help fill upstream reservoirs and provide river flows through the year. Figure 1-9 shows snowpack for the Truckee River basin over the past 30 years.

The risk of continued drought conditions increases in lower-than-average-snowpack years. Although the focus of TMWA's supplies are Truckee River based, annual snowpack and precipitation accumulations in all basins where TMWA has resources is vitally important to support natural recharge to aquifers in those basins. Without consistent, sufficient precipitation in these basins, over-draft conditions may develop since domestic well owners and municipal providers must pump water year-in, year-out to meet demands. Issues affecting groundwater resources are discussed later in this chapter.

Since 1980, there have been four periods of varying degrees of hydrologic drought within the Truckee River system: 1987-1994 (8 years); 2001 to 2004 (4 years); 2007 to 2010 (4 years) and the current period of 2012-2015 (4 years). The past 30 years includes the 1987 to 1994 drought period which is considered the worst drought of record over the 115 years of recorded flows of the Truckee River. The severity of each drought's impact during those periods listed in the table is revealed by the quantity of upstream drought reserves (or POSW) that TMWA had to release during a particular year to meet customer demands.

Table 2-1. Loss of Floriston Rate and Use of POSW During Drought Periods Since 1980

	Year	Date Floriston not Met	Use of POSW	Year	Date Floriston not Met	Use of POSW	Year	Date Floriston not Met	Use of POSW	Year	Date Floriston not Met	Use of POSW
	-a-	---b---	---c---	-d-	---e---	---f---	-g-	---h---	---i---	-j-	---k---	---l---
1	1987		0	2000		0	2007		0	2012		0
2	1988	Aug 20	0	2001		0	2008	Nov 23	0	2013		0
3	1989		0	2002	Nov 28	0	2009	Oct 17	0	2014	Jul 29	4,900
4	1990	Aug 26	0	2003	Dec 8	0	2010		0	2015	Apr 7	11,700
5	1991	Jul 26	3,100	2004	Sep 23	0						
6	1992	Jun 5	9,000			0						
7	1993	Sep 26	0									
8	1994		0									

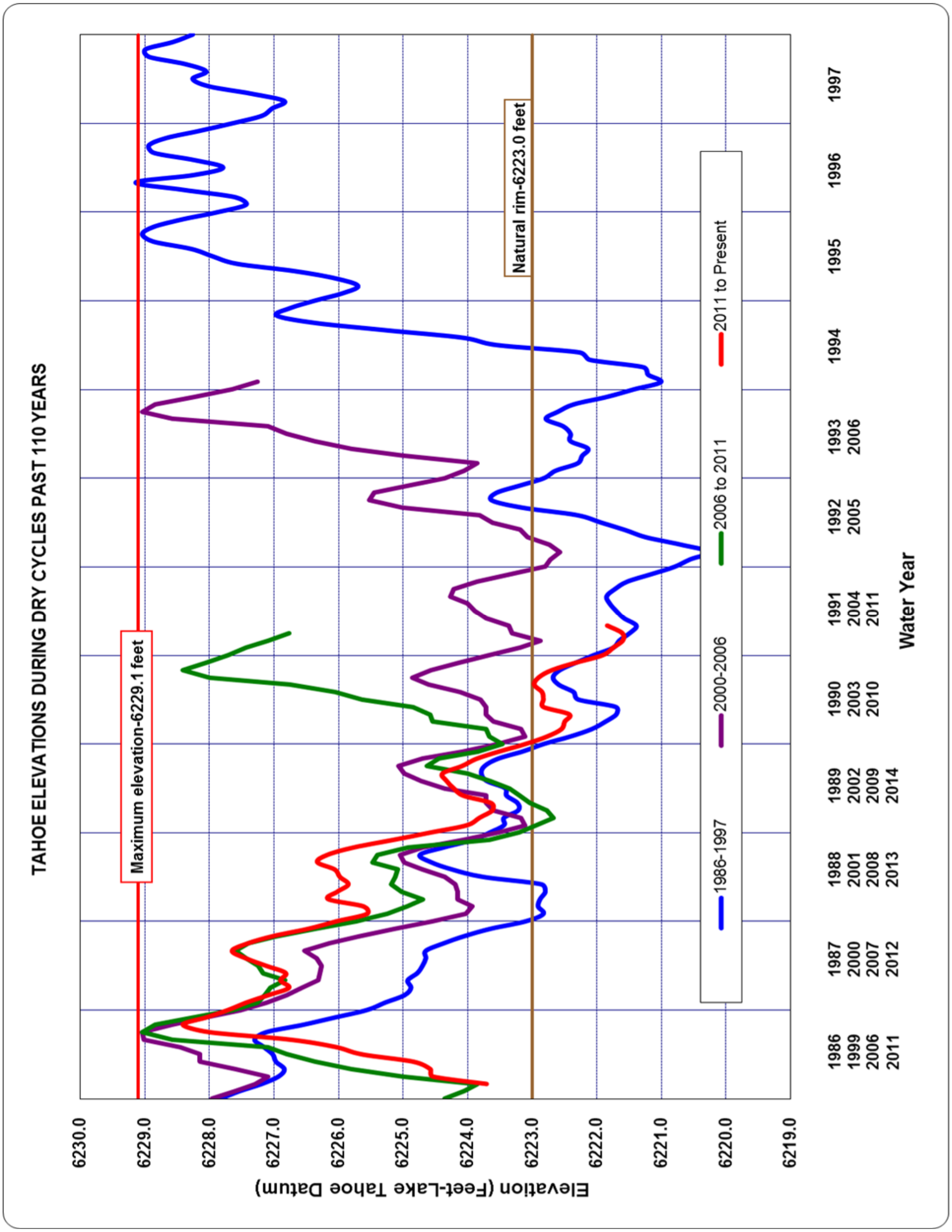


Figure 2-4. Lake Tahoe Elevations During Drought Periods

Figure 2-4 compares the four most recent drought periods. The similarity between drought periods is evident with differences appearing in the length of the drought period and its impact on the level of Lake Tahoe. Brief descriptions of the most recent drought periods follow.

1987 to 1994 Drought Period.

During the 1987/1988 winter, it became apparent that runoff from the snowpack would be significantly below normal. By August 20 of 1988, the Floriston Rates could not be met and POSW was needed by late August to meet customer demands. By the end of August, emergency steps were taken by local government to curb water use to maintain carryover storage for 1989. Outside water use was limited to one-day-a-week in late August. A comparison of water use during the months of August through October 1987 to water use during the same period in 1988, revealed that drought actions reduced production by about 3,400 AF, or about 15 percent reduction. Precipitation through the 1988/1989 winter produced a 100 percent of average snowpack for the Truckee River Basin. Floriston rates were met throughout the 1989 irrigation season. Water supply conditions returned to below average in 1990. Local irrigation ditches were cut-off in late August due to low flows in the Truckee River. Lake Tahoe dropped below its natural rim in September 1990, resulting in no flow into the Truckee River. The winter of 1990/1991 was one of the lowest precipitation periods on record prior to March of 1991. Even with the unusually heavy March precipitation, the snowpack in the Truckee River Basin only measured 60 percent of average on April 1, 1991. Local irrigation ditches were cut-off July 26 when Floriston Rates could not be met.

During 1992, Floriston Rates could not be met after June 5 the earliest date on U.S. District Court Water Master's records up to that date; it was the worst year of the drought period with snowpack less than 50 percent of average and no outflow from Lake Tahoe. After utilizing 9,000 AF of Independence Lake water (POSW), 8,500 AF remained in drought storage at the end of 1992. The net depletion of Independence Lake was 6,000 AF during 1992. The snowpack in 1993 was over 150 percent of average. As a result of the heavy snowpack during the 1992/1993 winter, the elevation of Lake Tahoe increased significantly rising above its natural outlet elevation. Although 1993 was a significant improvement over 1991 and 1992, it was not enough to enable Tahoe to sustain Floriston rates. Floriston Rates were only met until September 26, 1993.

The 1994 snowpack in the Truckee Basin was just 50 percent of average on April 1. The elevation of Lake Tahoe stayed below its natural rim from the fall of 1993 through all of 1994. No releases were able to be made from Lake Tahoe in 1994.

The abundant snowfall of 1995 and subsequent runoff brought the elevation of Lake Tahoe back above its natural outlet elevation. Tahoe rose 6 feet in 1995, ending up four feet above its rim in July 2015. The significantly, above average 1995 snowpack year was reinforced by above-average snowfall in 1996 which effectively ended the 1987 to 1994 drought period. Total natural flows during the 1987 to 1994 water years were 83 percent of the total natural flows from 1929 to 1936 water years and thus, more severe than the previous design drought period of 1928 to 1935.

2000 to 2004 Drought Period.

Reservoirs were full leading into the 2000/2001 snow season, but snowpack within the Truckee River Basin was below average in 2000 and continued that pattern again in 2001. While there was an improvement over 2001 in the amount of snowpack and runoff in 2002-2004, it was not enough to end the start of another drought period. Although TMWA did not need to utilize any POSW to meet customer demands during this drought period, the reduced water availability made it difficult to sustain the required Floriston Rates in December 2002 and again from late 2003 into early 2004. In September 2004 Floriston Rate storage was exhausted and normal-river flows were not met again until the end of February 2005 which ended up being a 125 percent of average snowpack year in the Truckee River Basin. Due to heavy precipitation and flooding in late December 2005/early January 2006 the elevation of Lake Tahoe rose significantly. In fact, almost 11 inches of precipitation was recorded at the United States Geological Survey ("USGS") Farad gauging station over a two week period (Dec 21, 2005 to Jan 3, 2006). An above average snowpack was recorded again (126 percent of average) in the Truckee River Basin in 2006. Lake Tahoe and all Truckee River Basin reservoirs filled as a result of the streamflow runoff that was produced the following spring. Those two consecutive above average snowpack years (2005 and 2006 respectively) effectively ended the 5-year drought period.

2007 to 2010 Drought Period.

Although the phenomenal snowpack of 2006 refilled Lake Tahoe, the 2007 snowpack was 50 percent of average and turned out to be the start of another drought period. Snowpack in the Truckee Basin was 51, 86, 85, and 89 percent of average for the years 2007, 2008, 2009, and 2010, respectively. Lake Tahoe dropped below its natural rim in October 2008 but the snowpack of 2009 was a slight recovery year and did not impact TMWA reserves in 2009 or 2010. The 161 percent of average snowpack in 2011 was sufficient to nearly fill Lake Tahoe and end this brief drought period. TMWA's drought reserves were not impacted and were not required for use during this drought period.

2012 to Present Drought Period.

This drought period followed on the heels of the 2007 to 2011 drought period recovery. Snowpack in the Truckee Basin was 59, 60, 35, and 13 percent of average for the years 2012, 2013, 2014, and 2015, respectively. The snowpack and runoff of 2015 ranked it as the worst year on record. Not since recordings began have there been four consecutive low-runoff years as severe as these four. On July 29, 2014 Floriston Rate water supplies were exhausted and TMWA had to release its drought reserves—POSW-- in August through September. The total amount of upstream reserve TMWA required in 2014 was 4,900 AF.

Due to the severe lack of the 2015 snowpack, Floriston Rate water supplies were exhausted on April 19, 2015. As natural river flows slowly diminished through May and June, the only ditch and diversions operating were TMWA's Highland Ditch that supplies the Chalk Bluff Water Treatment Plant ("CTP") and the Glendale Water Treatment Plant ("GTP") diversion. TMWA began releasing upstream reserves on June 18 and continued to do so through the month of October. TMWA began the 2015 summer season with approximately 27,000 AF in upstream storage and released approximately 11,700 AF through October 21, 2015 to meet customer demands.

At the time this plan was completed in January 2016, the snow season of 2015/2016 was projected above 114 percent of average implying a moderate recovery-year snowpack year following four consecutive dry years of the current drought period, but it could not be determined with certainty that the drought period ended pending completion of the snow season through March 2016.

In all drought periods described above, it took at least three consecutive, low-snowpack years for Lake Tahoe to fall to its rim prior to November. By definition, the region continues in a Drought Situation. However, with the implementation of TROA beginning December 1, 2015 TMWA began storing water ahead of the 2016 spring run-off and as a result anticipates starting the 2016 irrigation season with approximately 38,000 AF of upstream storage which is approximately 12,000 AF more than the beginning of the 2015 irrigation season of 27,000 AF. The 2015/2016 winter produced snowpack accumulations well average precipitation by year-end 2015. At the time this plan was completed in January 2016, the snow season of 2015/2016 was projected above 110 percent of average implying a moderate recovery-year snowpack year following four consecutive dry years of the current drought period, but it could not be determined with certainty that the drought period ended because potential precipitation for February and March 2016 had yet to be recorded.

Important observations to be drawn from reviewing the historical Truckee River hydrology and drought periods include:

- Truckee River supplies are available the majority of the year under meteorologic and hydrologic drought situations.
- Donner and Independence Lakes typically fill each spring under meteorologic and hydrologic drought situations.
- Drought periods vary in duration, from a few years up to 8 years based on recorded history.
- Truckee River water sources used to provide Floriston Rates diminish early in the late spring and/or summer of extreme, low-precipitation years.
- Water levels in the reservoirs, particularly Lake Tahoe, are depleted gradually over 3 to 4 years, but can refill rapidly ending a hydrologic drought period.
- "Recovery" or high-precipitation years may not end a drought period but do interrupt the drought period, helping replenish reserves and/or producing sufficient Truckee River flows for the following year and negating the need to use upstream reserves.

- Use of upstream reserves may not be necessary in every drought period; only in the extreme, low-snowpack years of a drought period does TMWA use its upstream reserves.

Climate change and drought are the most significant weather variables with potential to change the quantity and quality of the water supply. Studies completed by DRI indicate that while the potential for climate change to alter the timing, type of, and quantity of precipitation is possible, continued monitoring of meteorologic trends is required. Drought periods on the other hand have established historical patterns, with the most severe drought on record lasting eight years. TMWA plans for drought periods by utilizing a combination of natural river flows, groundwater pumping, POSW releases, and extraction of accumulated groundwater injections. Chapter 3 discusses the conjunctive management by TMWA of its available water resources -- annual river supplies, POSW in upstream lakes and reservoirs, credit water stored in Boca and Stampede Reservoirs under TROA operations, additional groundwater pumping, and aquifer recharge – in order to meet customer demands through the worst drought on record.

Source Water Contamination

This section begins with an overview of TMWA's water quality and identified potential risks of water supply contamination, and summarizes TMWA's Source Water Protection Program.

As detailed within the *2015 Water Quality Reports*, which can be found on TMWA.com, TMWA continues to provide high quality water that meets and exceeds all U.S. Safe Drinking Water Act ("SDWA") standards. In addition, TMWA's water meets and, in most cases is significantly better than, all U.S. Environmental Protection Agency ("USEPA") and Nevada State Health standards. On average, more than 1,200 laboratory tests are performed each month on over 210 samples taken from various locations in Reno, Sparks and Washoe County to ensure that TMWA's water meets all standards. In addition, TMWA takes samples from numerous locations in the distribution system on a monthly basis to continually demonstrate full compliance with the arsenic standard put into effect in January 2006 by the USEPA.

TMWA Source Water Quality Assurance Program

TMWA's water quality goal is the delivery of high quality potable water to its customers at a reasonable price. In order to achieve and maintain this goal, TMWA utilizes a water quality assurance program. TMWA utilizes the following components in its water quality assurance program:

- Protection of Source Water Quality: TMWA has a fully integrated and coordinated source water quality program designed to protect or improve the quality of TMWA's surface water and groundwater supplies.
- Potable Water Treatment: TMWA utilizes modern treatment facilities for its raw-surface-water and groundwater supplies and complies with all Federal and State drinking water regulations.

- Maintenance of Distribution System Water Quality: TMWA utilizes a highly skilled staff of scientists, engineers and operators who continually monitor water quality in the distribution system.
- Cross Connection Control: TMWA has an extensive and fully engaged backflow prevention and cross-connection control program. The purpose of the program is to prevent backflow of pollutants or contaminants from customer plumbing systems into TMWA's distribution system.

The water quality of the Truckee River is normally excellent. Surface water is of exceptional quality because base flows originate from Sierra Nevada Mountain snowpack runoff and seepage or spring flow. Typical water quality data are shown in Table 2-2. Mineral concentrations are very low, and turbidity levels are typically less than two nephelometric turbidity units ("NTU"). However, water in the Truckee River can have higher turbidity because of storm runoff and/or algae growth associated with low flows and warm temperatures in summer.

Table 2-2. Typical Mineral Concentrations of Surface Water

Constituent	Minimum	Average	Maximum
Total dissolved solids, mg/l	34	86	132
Total suspended solids, mg/l	1	13	20,000*
PH	6.8	7.7	9.6
Temperature, C	0.5	0.0	20.0

* High turbidity events only, such as the July 1992 flash flood on Gray Creek.

The reliability of this source is governed by the ability of TMWA's surface-water-treatment facilities to treat Truckee River water during possible events of high turbidity or chemical or biological contamination. Three types of contamination events are identified:

1. Turbidity events[15] – normally low frequency events that are usually flushed by river flows within hours.
2. Non-persistent toxic spills – spills of substances that would be flushed by river flows, usually within an 8 hour period.
3. Persistent toxic spills - spills lasting more than 2-4 days that do not flush through the river channel.

Higher than average turbidity events can occur in the Truckee River during periods of floods, storm runoff and/or algae growth associated with low flows and warm temperatures in summer. Turbidity at conventional filtration plants is removed through chemical stabilization (coagulation and flocculation), followed by sedimentation and filtration. All surface water is

[15] The term "turbid" or "turbidity" is applied to waters containing suspended matter that interferes with the passage of light through water.

treated at the CTP or the GTP before distribution. The modern treatment facilities at CTP and GTP have greatly reduced the water supply risks associated with turbidity events. Both CTP and GTP are designed to operate during intermittent turbidity events as high as 4,100 NTU lasting 5-10 days, but it is typically more practical to shut the plants down and let the most turbid water pass by to avoid significant clean-up efforts and costs at the treatment plants. Should a turbidity event that exceeds TMWA's ability to treat the water to required standards occur, it is possible to operate the system with only wells to supply an average day demand, more than sufficient to meet current indoor or winter daily demands of approximately 35-39 million gallons per day ("MGD").

Few toxic spills have occurred on the Truckee River and none were of major proportion. The most recent event was a sewage spill near Squaw Valley, California which occurred in the spring of 2015. The spill was diluted 1000:1 by the flow within the Truckee River; no noticeable impact was seen at either CTP or GTP. Major toxic spills that would render the Truckee River unusable have not been recorded. However, toxic spills into rivers throughout the United States do occur, such as the recent Gold King mine spill into the Animas River in Colorado. Some of the toxic spills have rendered water supplies unusable for an extended period of time. In the event of an incident on the Truckee River, the contaminant might be diluted and washed downstream within a day depending on the flow rate in the river at the time. TMWA might be able increase river flows through release of its stored water. These steps are likely to mitigate any contaminant that does not readily absorb into the river bed.

Past resource plans and a review of United States Department of Transportation data, resulted in the identification of several types of hazardous materials which are commonly carried through the Truckee River Watershed. They include:

Ammonia perchlorate	Hydrogen sulfide	White phosphorous
Anhydrous Ammonia	Nitro cellulose (wet)	Propargyl alcohol
Chlorine	Propane	Sulfuric Acid
Cyanide	Petroleum naphtha	Sodium hydroxide
Hydrochloric acid	Phosphoric acid	

These chemicals represent ingredients used in the formation of products ranging from rocket fuel to pesticides. Although most are extremely toxic it is likely that they would be flushed past TMWA's treatment plant intakes within one day. Chemicals that would likely adhere to the river bed include manufactured pesticides, herbicides, and fungicides. Each chemical would require a specific response depending on location, duration and other factors of the water quality emergency. In the event of a spill, it is possible to operate off of distribution storage and wells while the water quality emergency is being assessed.

In 2007 research was completed at the University of Nevada, Reno on behalf of TMWA (see Appendix 2-7) to quantify the risk of a spill to the Truckee River using data that was previously not available. The analysis has shown no recorded contamination event from rail or highway transportation. The data also suggests that accidents tend to occur more frequently during the loading and unloading of trucks and rail cars. This suggests that the area of highest risk is downstream of TMWA's treatment facilities in the City of Sparks where there is a rail yard and a large number of warehouses and shipping companies.

Also completed by the University of Nevada, Reno in 2008 was a risk analysis and assessment accompanied by the development of a contaminant transport model of the Truckee

River from Tahoe City to the GTP. Published results of this research are provided in Appendix 2-8 and include travel times for various classes of chemicals at different flow rates. The model is used to quantify the time periods required for the river to flush a spill from different possible locations.

While a toxic spill into the Truckee River is clearly a concern, this is an extremely rare event and such an event has not occurred to this date. However, depending upon the time of year, TMWA is able to operate without the river for a period of hours to days using system distribution storage and its production wells. A detailed plan cannot be developed for a major emergency on the Truckee River that would anticipate all possible combinations of circumstances requiring emergency actions. Variables include location, size, and type of spill; time of year; levels of reservoirs and streams; customer demands; and other factors. The supply of water available from TMWA’s production wells enables TMWA to meet demands for average indoor water use throughout the year. The merger and integration of WDWR and STMGID water systems into TMWA has resulted in additional interconnections with adjacent water systems. These water systems, located within South Truckee Meadows, Hidden Valley, Spanish Springs and Lemmon Valley, rely on groundwater wells and provide an increased source of off-river supply during an extreme event and/or extended river outage. The merger and integration of the WDWR water systems also brings additional off-river resources and facilities to TMWA, including Thomas, Whites and Galena Creek water resources, the Longley Lane groundwater treatment plant, and the North Valleys Importation Project (“NVIP”).

In addition to relying on its wells, other steps to reduce water use during an extreme event and/or extended river outage could include:

- Call for voluntary, then mandatory, water conservation including watering restrictions (e.g., once per week during summer months or no outside watering), reduced laundry at commercial properties, use of paper plates in restaurants, no use of potable water for non-potable purposes, and other measures.
- Engage all wells on the TMWA system for full operation subject to Health Department approval. This would include the use of wells that do not meet drinking water standards and do not pose an acute health risk.
- Modify flows in the Truckee River to either flush, dilute, or isolate the contaminant.
- Utilize extraordinary treatment processes in the pre-treatment section of the water plants. An example of this might be neutralizing pH through chemical additions in the pre-settling basins or addition of granular-activated carbon in the treatment process. The likelihood of these steps being successful will depend on the type of contaminant and its concentration.
- Acquire the use of all water in local irrigation ponds, recreational lakes, etc., to the extent that water can be conveyed to the TMWA's treatment plants through ditches or other means.
- Use isolated portions of the storm drain system and ditch system for conveying water from unusual source locations to the water treatment plants. This might include installing sandbag check dams in certain ditches, along with low-head pumps, in order to move water up-gradient in a ditch to a treatment plant. For

example, the creeks in the South Truckee Meadows might be conveyed to the GTP by collecting the water in Steamboat Creek, pumping it into Pioneer Ditch, and thence through step pumping to Glendale.

- Temporarily pump the discharge from the Sparks Marina to the GTP.
- When TROA is in effect utilize the emergency worse than worst case water supply to flush the river of contaminants.

Besides the types of spill events described above, there may be other events that interfere with the availability of Truckee River water. For example, in April 2008 an earthquake triggered a rock slide destroying a 200-foot ("ft") section of flume along the Highland Ditch in the Mogul area. This incapacitated the primary raw water supply for CTP just as customer demands were increasing with the onset of springtime temperatures. Raw water supply to CTP was quickly restored (that same day) via the Orr Ditch Pump Station ("ODPS") at a limited capacity of about 60 MGD, but more supply was required. The GTP was brought on-line early in order to help meet those increasing customer demands. Within a few weeks a temporary pumping station along the river was also set up to provide enough raw water in order for CTP to resume operating at its full capacity of 83 MGD. By July the damaged section of flume was bypassed with a 54-inch aboveground high density polyethylene pipe and gravity flow from the river to CTP was restored at a limited capacity of about 26 MGD. The ODPS was used to supplement the additional 57 MGD or so that the CTP required to operate at full capacity. The earthquake event fast-tracked the Mogul Bypass Project with approximately 8,400-ft of 69-inch steel pipe placed underground along with over 5,850 feet of reinforced concrete boxes to enclose the Highland Canal.

Though it cannot be predicted when a river interruption event will occur or what the nature of an event will be, TMWA plans for and practices scenarios to manage through emergency events. The more extraordinary measures that can be engaged are believed to only apply in an extreme, worse-than-historic event that would occur in the peak of the summertime irrigation with contamination occurring between Boca and the diversion point of the Steamboat Ditch. Most combinations of scenarios as to time, place, and nature of event are manageable with existing production facilities and management options without such drastic measures. It must be emphasized that these are broad guidelines only. They are not intended as a definitive instruction list as to the response which should be taken in any given emergency situation. The event, if it occurs, must be evaluated on its specific conditions, and a response plan devised accordingly.

Source Water Protection Program

Surface Water. With the exception of the Thomas, Whites and Galena Creek resources acquired from the merger of WDWR and STMGID water systems and a small appropriated water right from Hunter Creek, all of TMWA's surface water rights used for municipal water supply come from the Truckee River. Attitudes have changed over the years and today the Truckee River, its tributaries, and watershed are recognized as a pristine, high quality water source that must be maintained and protected. Several governmental agencies[16] are charged with protecting the Truckee River and its watershed. All of the local agencies derive their authority from the Clean Water Act and the USEPA.

In support of Truckee River source water protection and TMWA's reliance on the Truckee River for most of its water supply, the Truckee River Fund ("the Fund") was established by TMWA in 2005. The Fund is used to support projects that protect and enhance water quality or resources of the Truckee River, or its watershed. In addition, the Fund provides TMWA a vehicle for not only responding to the numerous requests from outside groups and organizations that are involved in promoting and improving the health of the Truckee River system and watershed, but a means to encourage matching funds for the projects. Participation in these projects benefits the primary water source for the community and, in the long-run, TMWA customers. The Fund's Advisory Committee reviews potential new project proposals typically twice a year.

To-date the Fund has approved and funded 126 diverse projects that further the Fund's goals. Examples include river riparian cleanup and restoration, aquatic invasive species inspections and removal efforts, planning and reconstruction of the Pioneer Dam, Independence Lake Forest and Wildfire Management Plan, and many others completed or underway listed at www.truckeeriverfund.org.

Groundwater. Groundwater protection is an important element of the water quality assurance program. Summaries of the groundwater water quality and quantity conditions in each hydrographic basin where TMWA groundwater production wells are located can be found in Appendix 2-9. Each summary includes a brief history of the basin, the number of production and domestic wells within each basin, the history of groundwater pumping, the water level history and response to groundwater pumping, identifies potential threats to groundwater quality, and the challenges that TMWA is addressing or may need to address related to groundwater quality and

[16] The Tahoe Regional Planning Agency ("TRPA") is a bi-state planning agency authorized by Federal Government. Its goal is to ensure that anthropogenic activities, including new development, do not degrade the quality of Lake Tahoe, its tributaries, or watershed. Standards are strictly enforced by TRPA to minimize sediment and nutrient loading to the lake, and TMWA certainly benefits from this enforcement and its programs. In California, the Lahontan Regional Water Quality Control Board enforces water quality standards on the Truckee River and tributaries outside of the Tahoe Basin. This Board derives its authority from the federal government and the Clean Water Act. The Nevada Division of Environment Protection ("NDEP"), under authority derived by the Clean Water Act, has a mission to preserve and enhance the environment of the state in order to protect public health, sustain healthy ecosystems, and contribute to a vibrant economy.

quantity issues with cooperation with WDWR, Reno, Sparks, Washoe County, and the NDEP.

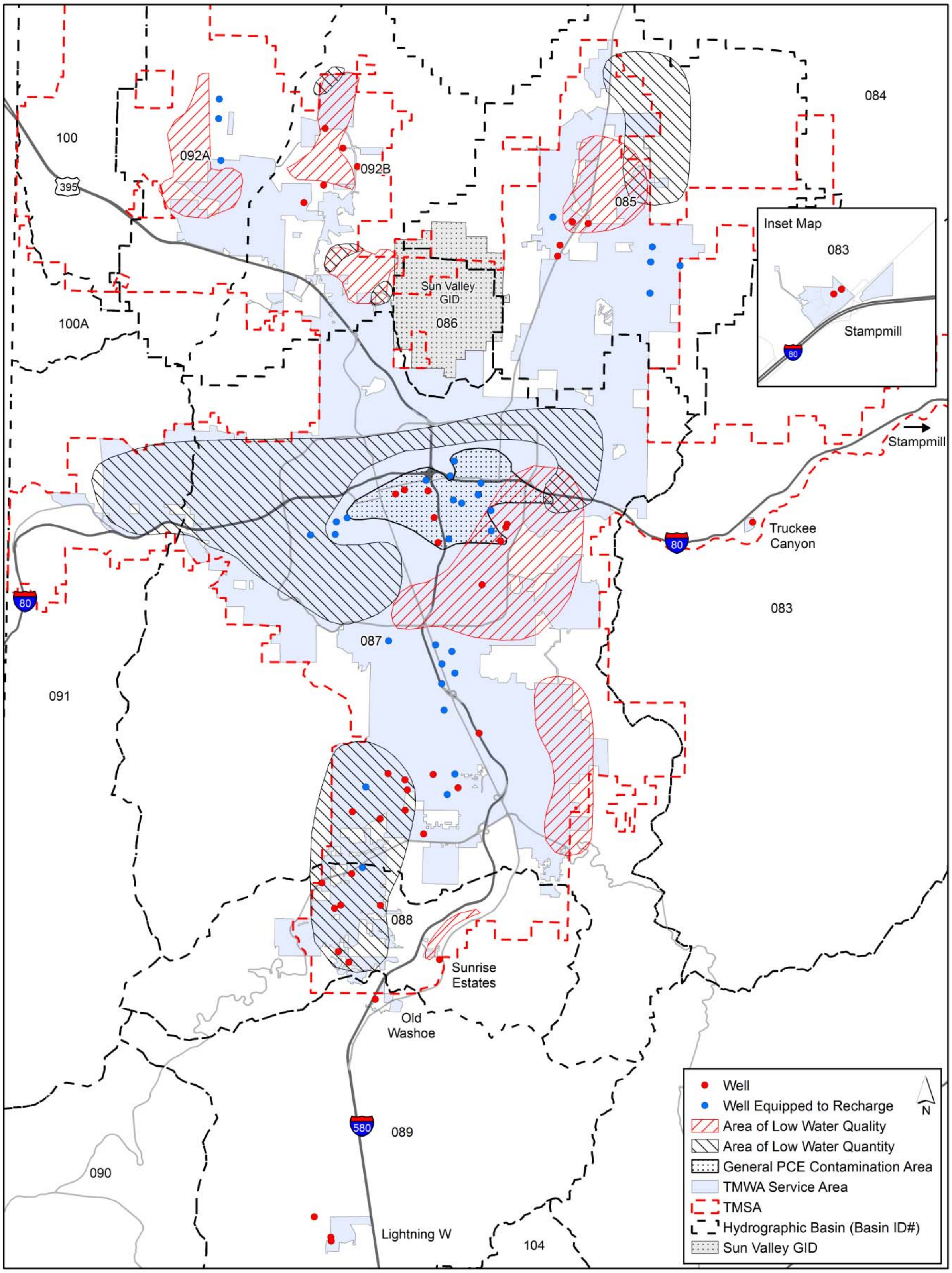


Figure 2-5 depicts rough outlines of the extent and nature of some of the current threats to groundwater.

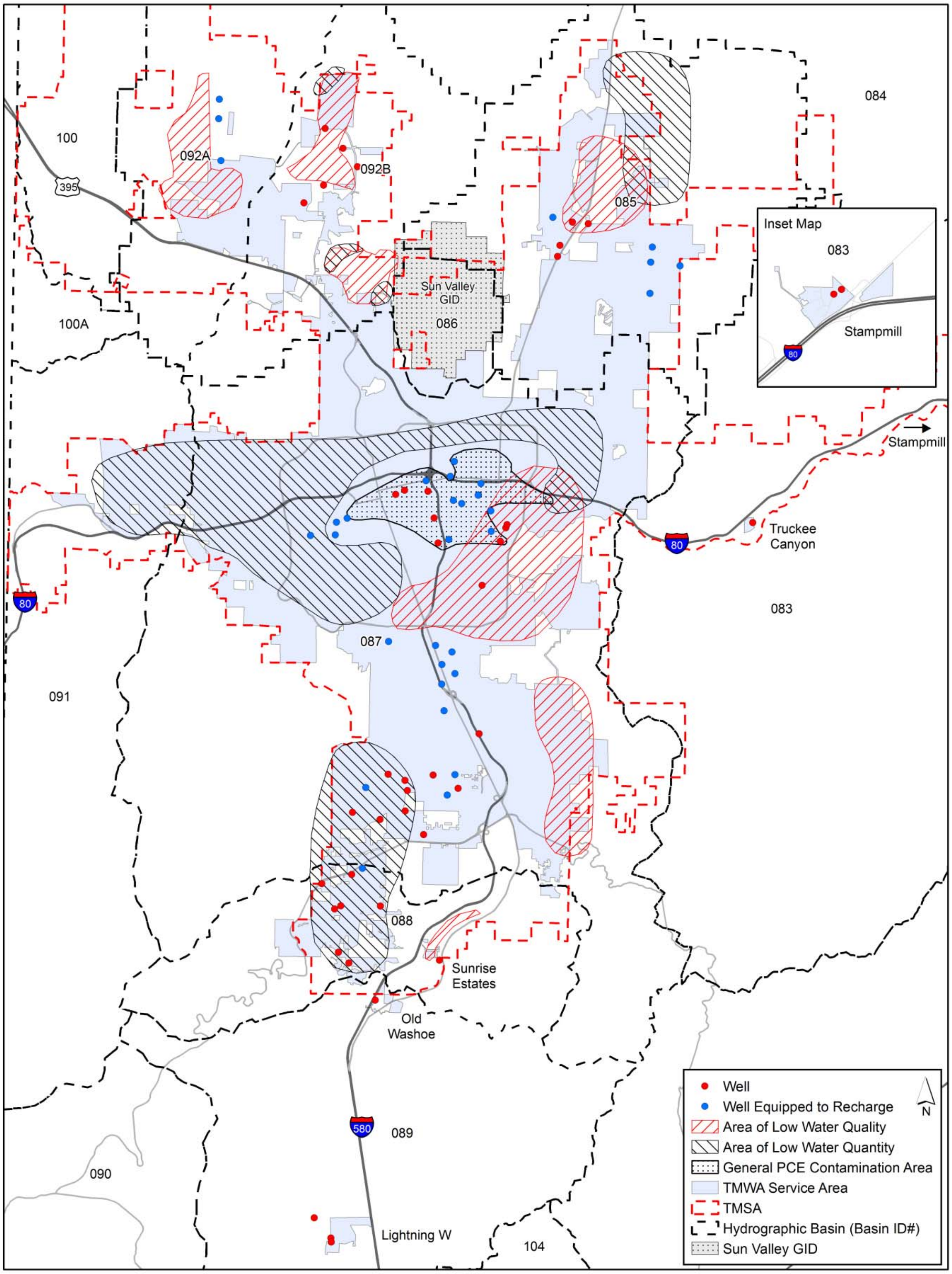


Figure 2-5. Production and Recharge Wells and Areas of Water Quality Concern

In 1986, amendments to the SDWA mandated that each state develop a Wellhead Protection Program ("WHPP") for the purpose of protecting groundwater that serves as a source for public drinking water supplies. The driving philosophy behind these efforts is that the cost of *cleaning up* contamination far exceeds that of *preventing* contamination.

In 1996, the first WHPP was completed for the Hidden Valley system and endorsed by the NDEP. Additional WHPPs were completed in 1998 (STMGID), 2000 (Lemmon Valley), 2005 (Mt. Rose), and 2008 (Spanish Springs) and were endorsed by the NDEP. The first WHPP TMWA completed was in 2005 and was endorsed by NDEP. Groundwater protection has received even more emphasis with the 2015 update and integration of the previously-endorsed TMWA WHPP and the former WDWR and STMGID WHPPs into one unified groundwater protection plan. TMWA's 2015 WHPP is a comprehensive action plan to protect aquifers and TMWA's production wells from further sources of contamination.

Through a concerted effort, TMWA has incorporated USEPA and NDEP suggested elements of a comprehensive 2015 WHPP by:

- Coordinating and actively engaging with a team of local participants, including water quality experts and regulators from Washoe County Health District ("WCHD"), Reno, and Sparks jurisdictions.
- Updating five groundwater flow models through 2014 for each of the major basins where TMWA operates groundwater wells: West Lemmon Valley ("WLV"), East Lemmon Valley ("ELV"), Spanish Springs Valley ("SSV"), North Truckee Meadows, and South Truckee Meadows.
- Utilizing these updated models to develop 2-, 5-, 10-, and 20-year travel times and capture zones for each of the active groundwater wells that TMWA operates. These capture zones help identify where water that ultimately reaches a well comes from over a certain period of time.
- Performing exhaustive database and records searches with the USEPA, NDEP, WCHD, and other sources to develop an inventory of active and Potential Contaminant Sources ("PCSs") in these basins that may pose a threat to groundwater quality.
- Overlaying the capture zones and the PCSs to better assess threats to groundwater quality at each well.
- Developing management strategies for the identified and potential contaminant sources.
- Planning for the location of new wells.
- Developing contingency plans to address potential contamination events.

The WHPP is an active tool used by TMWA for the coordinated protection of public drinking water resources. The WHPP provides information by which TMWA can develop and implement groundwater protection strategies, including educational outreach. The WHPP is operated voluntarily, under local jurisdiction and control, and utilizes both USEPA and NDEP guidance and criteria to provide for State endorsement. TMWA's recently completed 2015 WHPP is available for review in Appendix 2-10 and will be submitted to the State for endorsement.

TMWA's current overall groundwater protection action plan (which incorporates specific wellhead protection items) is fully integrated with other local agencies and includes the following elements:

- Actively implementing the comprehensive WHPP.
- Updating the WHPP regularly to identify and manage new PCSs.
- Actively observing over 100 monitoring wells located within the North Truckee Meadows, South Truckee Meadows, WLV and ELV, SSV, Pleasant Valley, Washoe Valley, and Honey Lake Valley ("HLV"). These monitoring wells are owned by TMWA, the Central Truckee Meadows Remediation District ("CTMRD"), and several privately-owned domestic well owners. TMWA monitors water levels in these wells on a monthly to quarterly basis.
- Coordinating with the CTMRD for sampling and analysis of a number of monitoring wells for organic constituents in the North Truckee Meadows. The results of this testing, along with additional sampling and testing of production wells by TMWA and the CTMRD, allows TMWA to be proactive in joint groundwater remediation efforts and to prudently plan the location of future wells and groundwater treatment facilities.
- Collecting and analyzing water quality samples at monitoring wells in SSV and HLV on an annual basis to assess trends in groundwater quality in these areas.
- Working closely with agency partners to determine the short and long-term impact of septic effluent to groundwater quality in basins throughout Washoe County where groundwater is relied on for drinking water supply.

The need to protect source waters gathered momentum when in 1987 TMWA's predecessor, Sierra, identified the presence of the organic solvent tetrachloroethylene ("PCE") in some of their production wells. This solvent has been used since the 1930's in a variety of commercial/industrial operations such as commercial dry cleaning, paint manufacturing, and auto repair.

In the mid-1990's and 2000's, TMWA implemented groundwater treatment at a number of wells which had become contaminated from PCE. Shortly after treatment was implemented, local governmental entities created the CTMRD to provide administration to the PCE clean-up effort and to collect funds necessary for the construction, operation and maintenance of the treatment facilities.

The PCE contamination occurs in eight plumes located along the current and historical commercial/industrial corridors along old U.S. 40 (Fourth Street/B Street/Prater Way), Virginia Street, and Kietzke Lane. Mitigation of the legacy (the responsible parties are unknown) PCE contamination is managed by the CTMRD which has paid for three air-stripping treatment facilities that remove PCE from five TMWA wells: Kietzke, Mill, High, Morrill, and Corbett. Two of the five PCE wells (Mill and Corbett) are piped to GTP. The other three PCE containing wells (High Street, Morrill, and Kietzke) have standalone air-striping facilities but may be piped to GTP in the future. The CTMRD program has achieved success in plume capture and containment resulting from the implementation of a prescriptive pumping schedule of the TMWA wells which are fitted with PCE removal technologies. The PCE plumes do not appear to be moving or growing. TMWA works and communicates closely with the CTMRD concerning

PCE removal and treatment at TMWA wells and is also proactive in the up-to-date delineation of PCE Plumes (see Figure 2-5). To-date, more than 4,150 pounds of PCE has been removed since 1996.[17]

In addition to CTMRD mitigation efforts, there are other, ongoing mitigation efforts being managed by NDEP including:

- Sparks Solvent/Fuel Site Remediation. TMWA is an active team participant in monitoring the clean-up effort of this groundwater contamination site. Mitigation efforts are supervised under NDEP Permit UNEV-97207. TMWA's priority is the quality assurance of the clean-up operation with containment such that existing and future production wells are not compromised by movement of solvent/petroleum based plumes. Figure 2-5 depicts the approximate extent of the existing contaminant plume.
- Stead Solvent Site Remediation. TMWA is an active team participant in the monitoring of the clean-up of solvent groundwater pollution on the southern boundary of the Stead Airport in the WLV hydrographic basin. TMWA's goal is to ensure that clean-up and containment efforts are performed in such a way that nearby TMWA production wells are not compromised by movement of the solvent based plume. Clean-up of trichloroethylene ("TCE") related material since 1999 at the Stead Solvent Site has successfully reduced the spread of the contaminant plume. All cleanup plans are developed and supervised under the direction of NDEP.
- Contaminated Site Assessments, Monitoring, Remediation, and Closure. As part of its WHPP implementation efforts, TMWA has identified eight active or recently closed contaminant release sites in relatively close proximity to TMWA production wells. All eight sites are being investigated or remediated under the supervision of NDEP and the WCHD. As part of the investigation and remediation process, TMWA receives and evaluates quarterly reports concerning these sites, closely monitors water quality of nearby production wells, and provides input to regulatory/enforcement agencies as necessary.

The arsenic concentration in treated Truckee River water is typically below 2 parts per billion ("ppb"), and the arsenic concentration in the wells varies from below 10 ppb to as high as 88 ppb. Attaining the allowable maximum contaminant level ("MCL") for arsenic of 10 ppb from groundwater sources is an issue for TMWA's well operations. At 10 ppb, 11 of TMWA's production wells are affected. Four of the wells that exceed the 10 ppb MCL (Greg, Pezzi, Poplar #1, and Terminal) are piped to GTP for treatment and/or blending with treated surface water, while two other wells (View Street and Poplar #2) may require special mitigation for arsenic in the future. TMWA's compliance plan is based on three USEPA accepted methods of mitigation: (1) blending higher arsenic concentration source water with lower arsenic concentration source water; (2) minimizing use of higher-arsenic-concentration-source water throughout the year to achieve a running annual average ("RAA") of less than 10 ppb at the Entry Points to the Distribution System ("EPTDS"); and, (3) treatment. Because of TMWA's ability to maximize

[17] Further information about the CTMRD can be found on the Washoe County website at: https://www.washoecounty.us/csd/utility/ctmrd/downloads.php

Truckee River water and minimize groundwater use to the summer months, USEPA recognizes the annual running average of TMWA's water supplies to comply with drinking water standards for arsenic. As a result of TMWA's cost effective arsenic compliance plan, it received an award in February 2007 from the NDEP and the USEPA, and the President's Award from Partnership for Safe Water in 2015. The NDEP Drinking Water State Revolving Fund ("DWSRF") awards recognize the most innovative projects that effectively use state revolving funds to protect public health, comply with the SDWA, and rank high on a public health benefits priority list.

Table 2-3 summarizes data on 13 of TMWA's production wells with arsenic above or near 10 ppb and the mitigation action taken at each well in order to ensure compliance with drinking water standards.

Table 2-3. TMWA Wells Affected by Arsenic and Compliance Actions

	Well Name	Ref.	Average Arsenic Value (ppb)	Treat at Glendale	Sample at EPTDS*	RAA** (ppb)
	-------a-------	--b--	----c----	----d----	----e----	----f----
1	Terminal Way	1	88	X		1.84
2	Poplar No. 1	1	85	X		1.84
3	Pezzi	1	72	X		1.84
4	Mill Street	1	37	X		1.84
5	Greg Street	1	19	X		1.84
6	Corbett	1	17	X		1.84
7	Morrill Avenue		12		X	4.42
8	Silver Lake		10		X	4.61
9	High Street		9		X	4.42
10	Kietzke Lane		9		X	4.71
11	Sparks Avenue		9		X	4.87
12	Poplar No. 2		7		X	3.97
13	View Street	2	5		X	2.38

[1] Well output blended and treated with surface water at Glendale Treatment Plant
[2] The historical arsenic concentration has been as high as 13 -ppb; however extensive aquifer recharge activities (underground blending) result in a current wellhead concentration of approximately 5 -ppb
* EPTDS - Entry Point To Distribution System
** RAA - Running Annual Average, average of four quarterly As testing results

Summary

This chapter has described major factors affecting TMWA's primary water supplies and finds that:

- Weather and source supply contamination are of greatest concern in assessing the quantity and quality of water supplies available for continued municipal uses.
- Changes in management of or any restriction to implementation of water resources due to climate change are not warranted at this time.
- Low precipitation years that lead to low snowpack accumulations affect the amount of water available to the Truckee River system; Lake Tahoe elevations provide an indication of the severity and duration of historic drought periods.
- Drought periods have established patterns, typically taking three years of consecutive dry winters to cause Lake Tahoe to fall to or below its rim; however, all the reservoirs may be replenished quickly with one or two wet winters.
- Hydrologic droughts (periods when TMWA availability to use physical supplies of water diminishes) occur after 3 or 4 years of meteorologic droughts conditions.
- Drought periods occur in the Truckee Meadows and have ranged in duration from a few years to 8 years with intervening "wet" and "dry" years within the drought period.
- TMWA's source water is of very high quality, meeting, and in many cases, significantly better than all required standards. A Water Quality Assurance program has been implemented to ensure this high standard continues to be met in the future.
- While there is a risk to source water reliability from turbidity and toxic spill events, TMWA has sufficient well capacity and distribution storage to meet reduced customer demands during a water quality emergency; additional actions are available to TMWA in the event of extended off-river emergencies. An earthquake event in 2008 tested TMWA's emergency response plan with a loss in water supply and demonstrated TMWA's ability to respond by having trained staff and available alternate water supplies.
- TMWA has a robust Source Water Protection Program in place designed to preserve and enhance available surface water and groundwater supplies and to address known and potential threats to water quality.

CHAPTER 3 INTEGRATED MANAGEMENT OF WATER RESOURCES

Prior to significant population increases beginning in the late 1960's (see Figure 3-1), water supply planning was not as complex as the utility was able to rely on the combination of its decreed rights, the conversion of irrigated lands and associated water rights to municipal use, some groundwater, and upstream storage. However, continued, and at times rapid, growth in population in and around the Truckee Meadows challenged the region's ability to engage new water supplies, secure associated water rights, and optimize the management of existing water supplies given the various operating rules applied to the Truckee River.

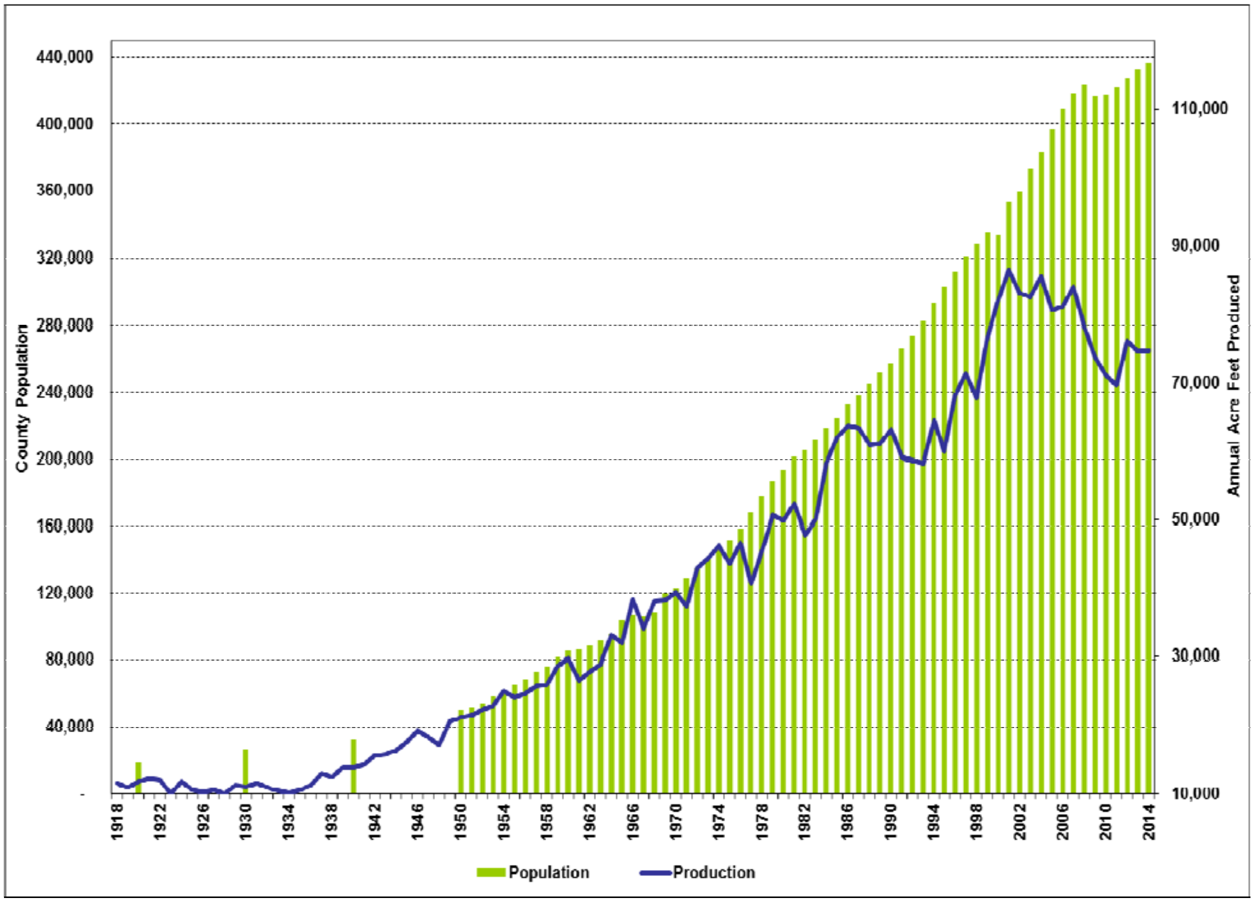


Figure 3-1. Comparison of Washoe County Population to TRA Production

This chapter examines the relationship between water resources, including all reservoir storage rights, the use and availability of Truckee River surface water rights, and ground water rights, and TMWA's surface and groundwater production facilities. The analyses in this chapter include information related to the integration of former WDWR groundwater resources as a result of the recent merger of WDWR and STMGID into TWMA. The chapter discusses TMWA's integration of water rights and production facilities creating opportunity for the conjunctive management making it possible for TMWA to meet its service demands in drought and non-drought years for customers within reach of the TRA and non-TRA.

The dominate source of supply within TRA is from the Truckee River. To create a viable water supply with over 80 percent of that supply being Truckee River resources requires acquiring (1) sufficient water rights and (2) sufficient dry-year reserves or back-up supplies to support those water rights when Truckee River supplies are not available. Significant to the discussion is the fact that after 30-plus years of resource planning for TMWA customers and the region, all the prerequisites to implement TROA occurred in 2015 setting the context for this and future water plans. The implementation of TROA dramatically improves TMWA's drought operations by expanding the opportunity to store and carryover more water during times of the year that previous river operating requirements prevented.

Negotiated River Settlement and the Truckee River Operating Agreement

The Negotiated Settlement ("Settlement") of the Truckee River will provide drought reserves for the Truckee Meadows as well as quiet much of the controversy surrounding the operations of the Truckee River system to provide our current water supplies. The Preliminary Settlement Agreement ("PSA") signed May 23, 1989 between Sierra and PLPT was a successful first step to begin solving many Truckee River issues. On November 16, 1990 the Settlement Act (Public Law ("PL") 101-618) was enacted. PL 101-618 provides for the interstate allocation of water between California and Nevada on the Carson River, the Lake Tahoe Basin, and the Truckee River Basin subject to the finalization of a new operations agreement for the Truckee River, i.e., TROA[18]. The interstate allocation is an important resolution between the two states and gives TMWA the assurance of what water will continue to flow over the state line and into Nevada. Fulfillment of the Act that was assumed by TMWA in 2001, allows TMWA to store a portion of its irrigation water rights and POSW in federal reservoirs for drought use in exchange for waiver of its hydroelectric water rights. Water rights currently owned by TMWA but any unexercised portion of the water rights would be stored in available space in the federal reservoirs for use during droughts periods. Some storage under TROA is firm storage which does not evaporate or suffer losses unless it is the only water in the reservoir. Some storage is non-firm storage which spills when the reservoir fills and, in non-Drought Situation years, such storage in excess of certain base amounts is turned over to the U.S. and PLPT to be used for recovery of endangered species and support of the fishery in the lower Truckee River. Total projected demand that TROA will support is 119,000 AF/yr and, in addition, it provides additional drought reserves in the case of a worse-than-worst drought of record. TROA provides TMWA customers with certainty regarding the operation of the system and additional drought supplies for existing as well as new customers. The agreement creates benefits for those who did sign, and non-injury to the water rights of those who do not sign. PL 101-618 also provided for the 1994 Interim Storage Agreement to bridge the Truckee Meadows drought supply until TROA could take effect. That agreement will be superseded by the final TROA agreement.

TROA was signed by the five mandatory signatory parties--TMWA, State of Nevada, State of California, U.S., and PLPT -- on September 6, 2008; it was the culmination of 17-years of difficult negotiation of a new agreement for the operation of the federal reservoirs and TMWA's

[18] The five mandatory, signatory parties to TROA are TMWA, State of Nevada, State of California, U.S., and PLPT. The following parties also signed TROA: Carson/Truckee Water Conservancy District; City of Reno; City of Sparks; Sierra Valley Water Company; City of Fernley; Washoe County; North Tahoe Public Utility District; Truckee Donner Public Utility District; and Washoe County Water Conservation District.

share of Donner Lake and Independence Lake. As its name implies, the Truckee River Negotiated Settlement is a negotiated agreement among many parties. The Truckee Meadows community both gains and gives up something as part of the Settlement. TMWA's customers are the major participants to making the Settlement a reality, and are also its major beneficiaries. Since TMWA's water customers are the taxpayers and sewer customers of Reno, Sparks, and Washoe County, many of the Settlement's benefits overlap jurisdictional lines in the Truckee Meadows. Many of the benefits have not and cannot be quantified for the purposes of the analysis as a resource but have been and will continue to be taken into account by the community in its support for the Settlement. In addition, since both states benefit from the interstate allocation of the Truckee and Carson Rivers and from the Tahoe Basin, there are other parties in the two states who indirectly benefit from the Settlement even without having participated.

Benefits and requirements of the Settlement are summarized here:

- Interim drought storage for the TMWA customers until Settlement becomes effective.
- Permanent drought storage for TMWA customers to support demands up to 119,000 AF.
- Certainty associated with the Interstate Allocation of the Truckee and Carson Rivers as well as the Tahoe Basin between California and Nevada.
- Certainty regarding the continued operation of the reservoirs to support existing water rights.
- Improved flexibility of river operations to accommodate changing circumstances, policies and values while protecting historic water rights from injury.
- Improved timing of river flows for the threatened and endangered fish species in Pyramid Lake.
- Enhanced minimum reservoir releases.
- Protection from claims that would harm TMWA's water rights.
- Increased recreational pools in the reservoirs.
- Improved fisheries and riparian habitat.
- Improved water quality enhancement through flow augmentation and retiming of flow.
- Water storage for California municipal and industrial use as well as environmental uses.

The river system is already the beneficiary of increased communication and cooperation, and solutions are being found regularly to areas of previous impasses through completion of TMWA's retrofit of water meters on flat-rate service, TMWA's annual conservation activities, the 1994 Interim Storage Contract, the 1996 Water Quality Settlement Agreement (between Reno, Sparks, Washoe County, PLPT and the U.S.), the Tahoe-Truckee Sanitation Agency water quality settlement, and PLPT's setting of water quality standards. After signing in 2008, several steps had to occur before TROA could be implemented. The following actions, completed in August and September 2015, were the final two requirements before TROA could be implemented:

- Provision of 6,700 AF of water rights for water quality purposes under Section 1.E.4 of TROA by RSW was satisfied by RSW in August 2015. Through cooperative efforts with WRWC and TMWA, RSW were able to provide mainstem Truckee River water rights to satisfy this obligation. RSW and PLPT executed the Agreement

Regarding Satisfaction of the Obligation of the City of Reno, City of Sparks and Washoe County Pursuant to Section 1.E.4 of the Truckee River Operating Agreement to Provide 6,700 AF of Water Right on August 26, 2015. Preparations are underway to file with the State Engineer the transfer applications on all 6,700 AF that are due by December 31, 2015.

- Coincident with the provision of the 6,700 AF by RSW, is a joint filing by PLPT and the State of California in California state court to dismiss with prejudice that certain action entitled Pyramid Lake Paiute Tribe v. California et al., Civil S-181-378-RAR-RCB; this was filed October 2015 with the order to dismiss the case issued on November 2, 2015. The Mandatory Signatory Parties to TROA filed on August 25, 2015 the Joint Notice of Filing Re: Stipulation of Mandatory Signatory Parties to Truckee River Operating Agreement in that certain action entitled United States of America, et al. v. The Orr Water Ditch Co., et al., Re: Petition to Modify or Amend Final Decree, Case No. 3:73-cv-031-LDG, in the U.S. District Court for the District of Nevada to which they mutually stipulate and agree that there has been a final resolution of that certain action entitled United States v. Truckee-Carson Irrigation District, et al., No. Civ. R-2987-RCB, in the U.S. District Court for the District of Nevada. As of this writing, response to either motion has not been received.

Still pending before various appeal courts are the following challenges to all prior decisions made by the U.S., Nevada State Engineer, California State Water Resources Control Board, and the Orr Ditch Court and include:

- The Operating Agreement was first published in the Federal Register on December 5, 2008, and its promulgation as a regulation became final on January 5, 2009. TCID, Churchill County (“Churchill”) and the City of Fallon (“Fallon”) have initiated litigation in the U.S. District Court challenging the regulation under the Administrative Procedure Act, 5 U.S.C. §§ 551, et seq., and under the Federal Advisory Committee Act, 5 U.S.C. App. 2 §§ 1, et seq. That same litigation also challenges the adequacy of the Final Environmental Impact Statement for TROA. The U.S. has filed an answer in this matter, and the PLPT, TMWA, City of Fernley, and the Washoe County Water Conservation District (“WCWCD”), have been allowed to intervene. It is difficult to estimate when there will be a decision on its merits. It is likely that there will be an appeal from any decision by the U.S. District Court.
- A motion to modify the Orr Ditch Decree was submitted to the Court in United States v. Orr Water Ditch Company, et al. for approval of modifications to the Orr Ditch Decree on November 17, 2008. The motion has been opposed by TCID, Churchill, and Fallon, and numerous owners of water rights. After determining how pleadings, motions and other papers will be served in this matter on represented parties and on approximately 900 unrepresented parties, the Court gave the Mandatory Signatory Parties until February 1, 2011 to file a definitive Amended Motion to Modify the Orr Ditch Decree, with all necessary supporting information. That Amended Motion was filed and fully briefed by all parties. On September 30, 2014, the Court entered an Order granting the Amended Motion to Modify, and an Order which amends the Orr

Ditch Decree as requested in the Amended Motion. Therefore, this required action has taken place. TCID and other represented parties filed appeals in December 2014.

- On October 29, 2012, the California State Water Resources Control Board issued Decision 1651 approving the petitions to change the water rights for Boca Reservoir, Prosser Creek Reservoir, Stampede Reservoir, and Independence Lake. On March 7, 2013, TCID, Churchill, and Fallon filed a Petition for Writ of Administrative Mandamus in state court in California challenging Decision 1651. On April 18, 2014, the Petition was dismissed without leave to amend for failure to join indispensable parties. On May 21, 2014, TCID, Churchill and Fallon appealed that dismissal to the Third District Court of Appeal in Sacramento, California.
- Approval of changes to water rights in Nevada to allow TMWA to hold the consumptive use component of some of its irrigation water rights in storage was approved by the Nevada State Engineer Order No. 6035 on March 19, 2010. TCID, Fallon and Churchill appealed the State Engineer's decision to the Orr Ditch Court. On March 31, 2014, the Orr Ditch Court denied the Petition, and affirmed the State Engineer's decision. TCID, Churchill, and Fallon appealed the Orr Ditch Court's decision to the Ninth Circuit Court of Appeals on May 21, 2014.
- The Nevada State Engineer's ruling on unappropriated Truckee River water, State Engineer Ruling No. 4683, must be final, and the Orr Ditch Court must have made a determination that the Truckee River in Nevada is fully appropriated and closed to new appropriations. The Nevada State Engineer Ruling granted the unappropriated Truckee River water to the PLPT. The Ruling was appealed to the Third Judicial District Court of the State of Nevada, and the State Engineer's Ruling was affirmed. That District Court decision was appealed to the Nevada Supreme Court by Fallon. On March 30, 2009, the City of Fallon dismissed that appeal, and Ruling No. 4683 is now final. On September 30, 2014, the Orr Ditch Court made the determination that the Truckee River is fully appropriated and closed to new appropriations. Therefore, the required actions have taken place. The September 30, 2014, Order has been appealed by TCID and others.

The pendency of court challenges to TROA did not delay TROA's entry into effect beginning December 1, 2015.[19]

Water Rights

Identification of sustainable water resources for 20-year planning purposes requires consideration of both the legal and practical availability[20] of water rights that can be converted from irrigation to M&I uses. This includes Truckee River mainstem, Truckee River tributaries/creek and groundwater rights. Sustainability, in the context of water resource planning, may be defined as the ability of a water resource to meet present needs while, over the life of the water resource, taking advantage of opportunities for future generations to optimize

[19] Chapter 1 described the pending sale of TCID's share of Donner Lake to TMWA. As a condition of that sale all appeals described here will be dismissed with prejudice removing all challenges to TROA and its implementation.
[20] Availability is a function of factors such as economic, hydrologic, environmental, financial, or legal factors that may constrain and pose opportunity for resource development.

potential future economic, social and environmental benefits the water resource may provide. Water resources accepted by TMWA for will-serve commitments must meet these criteria.

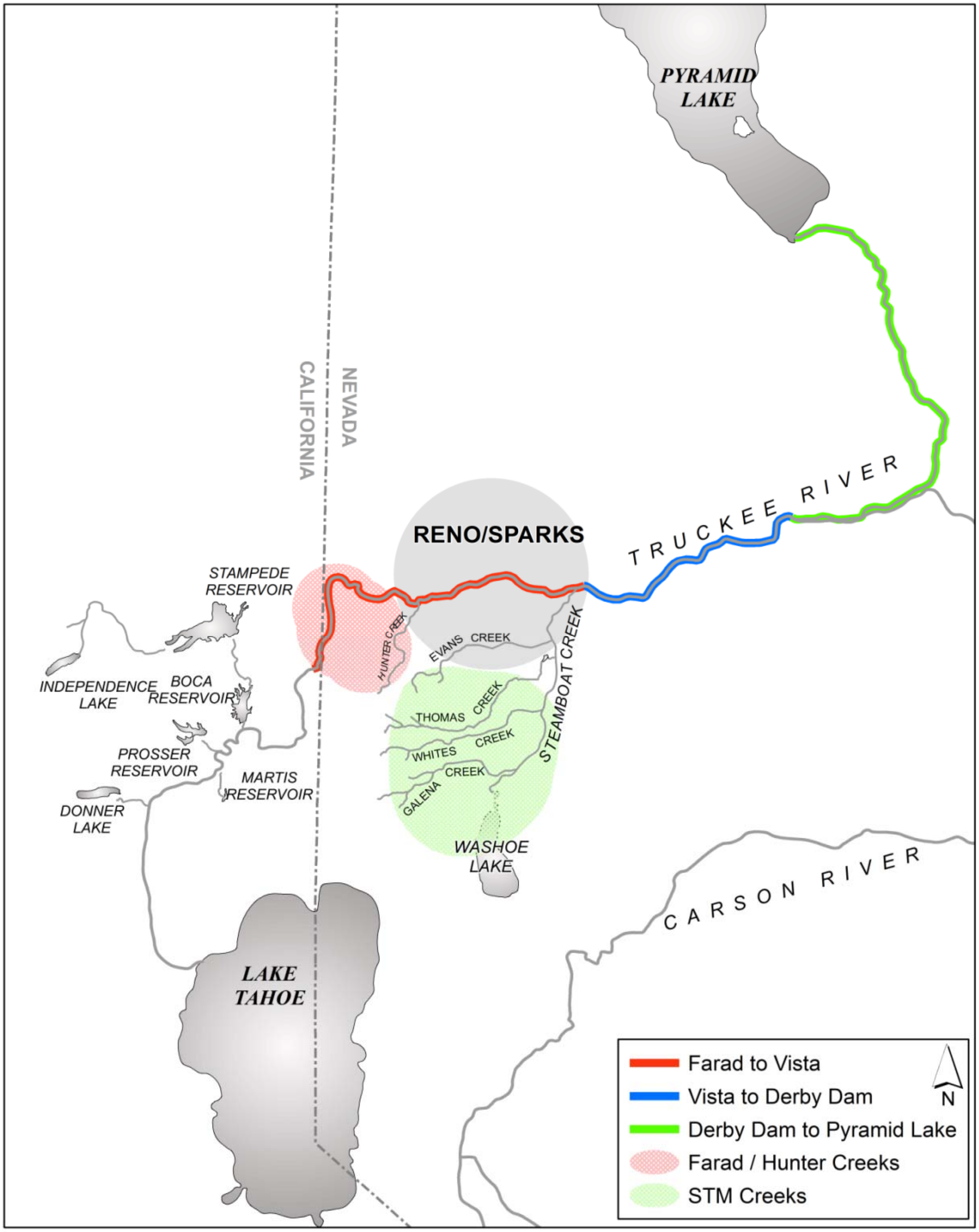
Besides water rights established by decree, surface and groundwater rights in Nevada are generally established by the appropriation system defined in statute and administered by the State Engineer. TMWA coordinates with and often relies on the State Engineer to determine the sustainable yield of water supplies. For example, the State Engineer makes an assessment of the perennial yield[21] based upon the best available science before allowing appropriation of groundwater from a hydrographic basin. TMWA also relies on its Rule 7 to govern the acquisition and dedication of water resources prior to the issuance of will-serve commitments. TMWA may acquire through dedication or purchase rights in the future as the need for resources arises, but before accepting a water right for a will-serve commitment, TMWA considers a water right's source, priority, quantity, dry-year supply/yield, permitability, unencumbered ownership, and the long-term ability to provide water. In this manner, TMWA ensures that future resources can be sustained in perpetuity.

All surface water rights and State Engineers rulings to the waters of the Truckee River and its tributaries have been adjudicated through court decrees. The Orr Ditch Decree, issued in 1944, established the number of water rights by priority, by owner, and by quantity associated with the Truckee River and all its tributaries. It is important to note that although water rights can be subdivided and/or converted from one use to another, for example agriculture to municipal use, the overall total number of surface water rights available from the Truckee River will not change from the amount of water rights defined in the Decree.[22] In addition to the Orr Ditch Decree, the Truckee River is currently governed by several operating agreements, which will be superseded by TROA when it is implemented. TROA is designed to provide long-term sustainable water operations for the multiple stake-holders on the Truckee River system through the continued use of converted irrigation rights to M&I purposes. This is crucial since TMWA derives approximately 80-90 percent of its M&I water for the TRA from the Truckee River. The Truckee Meadows is fortunate to have significant storage capacity in upstream reservoirs and Lake Tahoe to integrate with other resources to maximize the yield of the Truckee River. TROA further enhances the ability to maximize storage for drought supplies.

Figure 3-2 identifies the various reaches and more accessible water rights in "creek areas" of the Truckee River. The water rights within each reach or creek have varying priorities and yields that impact the ability to build a sufficient, consistent supply. For example, the Derby Dam to Pyramid Lake reach is of keen interest to PLPT and the Cities because during critical years, when flows are low, the water quality of the river as influenced by discharge of the treated effluent in the river at Vista can impact in-stream habitat. Transfer of direct diversion irrigation water rights to this reach could be used to mitigate low-flow conditions.

[21] Perennial yield is defined as "the amount of usable water of a groundwater reservoir that can be withdrawn and consumed economically each year for an indefinite period of time. It cannot exceed the sum of the Natural Recharge, the Artificial (or Induced) Recharge and the Incidental Recharge without causing depletion of the ground water reservoir." Also referred to as Safe Yield. http://water.nv.gov/programs/planning/dictionary/wwords-S.pdf

[22] The State Engineer granted Permit No. 4683 which granted PLPT right to all unappropriated water (e.g., flood waters) over and above Orr Ditch rights.



Map Document: (W:\projects\water_resources\River_System_general\projects\mxd\RiverSystem_reaches.mxd)

Figure 3-2. Primary Tributaries and Reaches of the Truckee River

TMWA's accumulation of Orr Ditch Decree irrigation rights was begun by TMWA's predecessor Sierra in the 1900's. Figure3-3 compares the accumulation of TMWA's water rights (irrigation, groundwater, and Decree rights) over time to the annual production of water. The graph shows that until the 1960's, the demands of customers were satisfied using the utility's base decree rights along with storage from Donner and Independence Lakes. As demands increased, more irrigation rights were acquired. In addition, groundwater resources began to be developed in the late 1950's and 1960's because the utility was limited in the amount of surface water it could treat, particularly in the winter months due to icing of the river and ditches. Adding wells was a less expensive alternative than adding surface water treatment plants in order to have production capacity to meet a growing summer peak demand. This strategy was heavily employed in the 1980's and 1990's in order to ensure peak-production capacity throughout the distribution system which was expanding further and further away from the centrally located surface water treatment plants adjacent to the Truckee River.

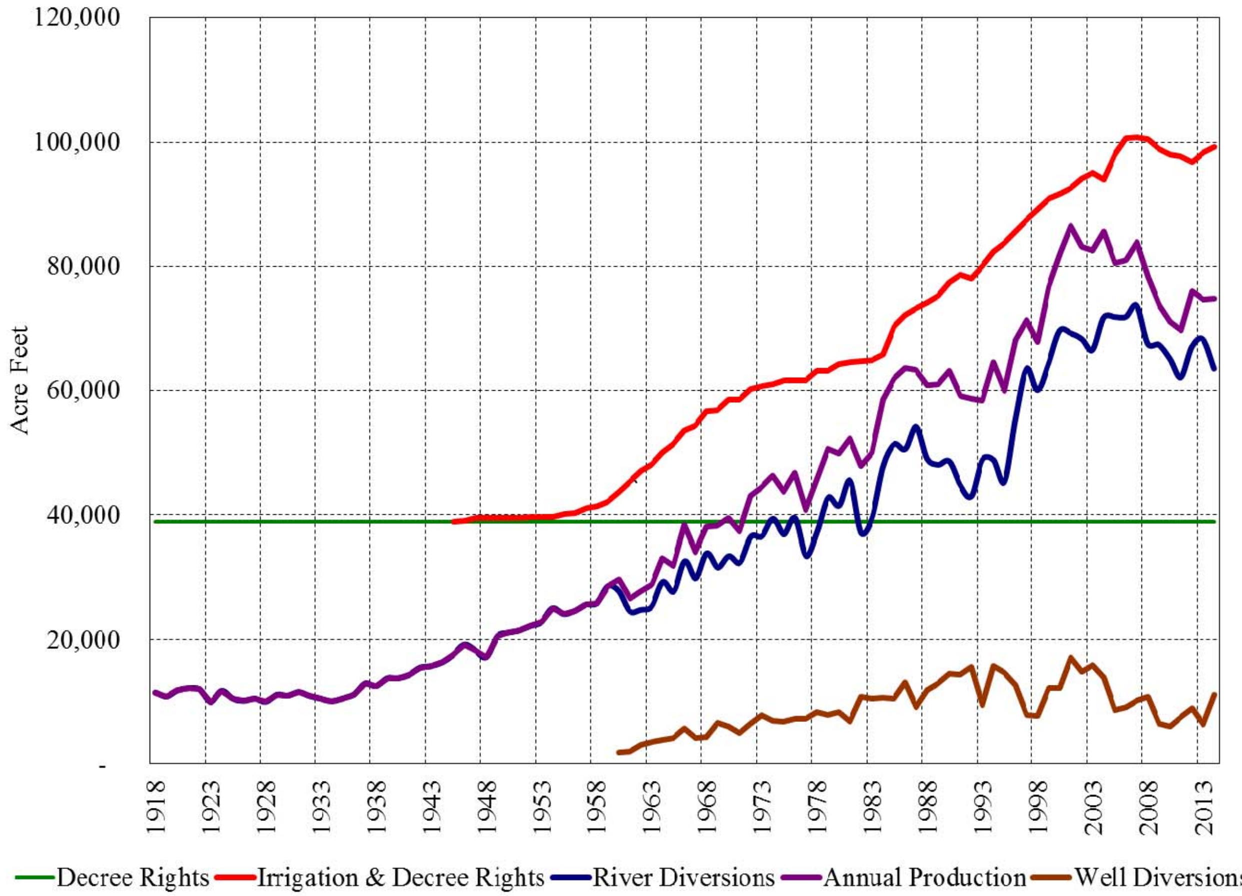


Figure 3-3. Historic Water Diversions, Production, and Acquisitions of Water Rights

This operational strategy changed dramatically in 1994 with the advent of year-round operation of Phase I of CTP (Phase II was completed in 1996 and Phase III completed in 2004). The GTP, originally completed in 1976, underwent significant upgrades in 1996 to comply with Safe Drinking Water Act. It, too, can operate year-round if needed. Given Chalk Bluff's ability to operate as the baseload surface water plant for both winter and summer demands, TMWA can utilize more of its surface water resources thereby preserving groundwater for use during the heavy summer demand months of July through September. This strategy allows better management of resources for drought and non-drought conditions and increases summer peaking capacity. Coupled with the continued acquisition and conversion of water rights from agricultural to M&I, this strategy has enabled TMWA to meet a larger drought-year demand and has thereby allowed the utility to continue to issue will-serve commitments in response to local government development plans and approvals.

After acquiring a water right, TMWA files applications to change the points of diversion, place of use, and manner of use with the Nevada State Engineer. TMWA's primary diversion points for surface water include the Highland Ditch and the Orr Ditch Pump Station for the CTP and the Glendale Diversion Dam for the GTP.

All TMWA's surface and ground water resources make up the water resources that are TROA dependent and were acquired to meet the demands of the pre-merger TRA. In addition to its decreed municipal water rights, TMWA has acquired and converted to M&I use over 69,000 AF of irrigation rights to meet the wholesale and retail will-serve commitments of its customers. These transferred irrigation rights are used in conjunction with TMWA's other groundwater and storage rights to create its water supply. The priorities of the acquired rights vary from very early, e.g., 1861, to later priorities of the early 1900's.

With the merger of STMGID and WDWR, the TRA expanded to include the former wholesale service areas of Washoe County and the retail area of STMGID. Through the merger process TMWA is in the process of adding over 20,000 AF of groundwater rights, some of which are within the expanded TRA and some in various hydrographic basins of the non-TRA. Table 3-1 identifies quantities of water rights that are included in the TRA or non-TRA and then within those designations quantities of water rights that are TROA dependent or not. Excluding 8,000 AF of Vidler groundwater resource, TMWA's combined pool of resources in the TRA is over 179,000 AF of decreed, irrigation, groundwater, and storage rights, and over 9,000 AF of groundwater resources in the non-TRA.

Table 3-1. TMWA Water Rights

		TRA		non-TRA	
	TOTALS	TROA	non-TROA	TROA	non-TROA
a	b	c	d	e	f
Surface water-converted ag rights	71,990	61,158	10,832		
Surface water-decree, creek	44,843	41,476	3,366		
Surface water-POSW	22,250	22,250			
Surface Resources	139,083	124,884	14,199	0	0
Groundwater	41,620	15,950	24,322		1,348
Ground water-importation	8,000				8,000
Groundwater Resources	49,620	15,950	24,322	0	9,348
TOTALS	188,703	140,834	38,521	0	9,348

The combined production of systems in the TRA totaled 83,100 AF in 2014 and 78,700 AF in 2015. Production in the non-TRA systems was 230 AF (plus 276 AF from Vidler) in 2014 and 77 AF (plus 958 AF from Vidler) in 2015.

TMWA's Rule 7 requires that future applicants for new water service dedicate sufficient water rights to service their development. Applicants for new service can buy water rights in the open market and dedicate sufficient, acceptable water rights to the utility or, if the applicant chooses to acquire from TMWA, the applicant pays for a will-serve commitment based on TMWA's costs incurred in acquiring, processing and maintaining its Rule 7 inventory. The availability of Truckee River water rights for future dedication within the TRA are subject to market conditions for water rights. The water rights market is a free market environment where the quantity of rights sold takes place between willing sellers and willing buyers. These exchanges are governed by the expectation of sellers attempting to maximize their return and the willingness of buyers to pay the market clearing price for the commodity. It takes a tremendous amount of time and effort to research the title information with respect to establishing who owns which and how many water rights, and then negotiate a transaction between a willing seller and a willing buyer.

The 1944 Orr Ditch Decree sets the total number of mainstem and tributary water rights at 224,000 AF. The original use of the water rights was for agricultural irrigation purposes. Over time the number of water rights used for irrigation has diminished significantly as TMWA acquired and converted the agricultural water rights to M&I use; Figure 3-4 illustrates the transition of water rights from agricultural to M&I.

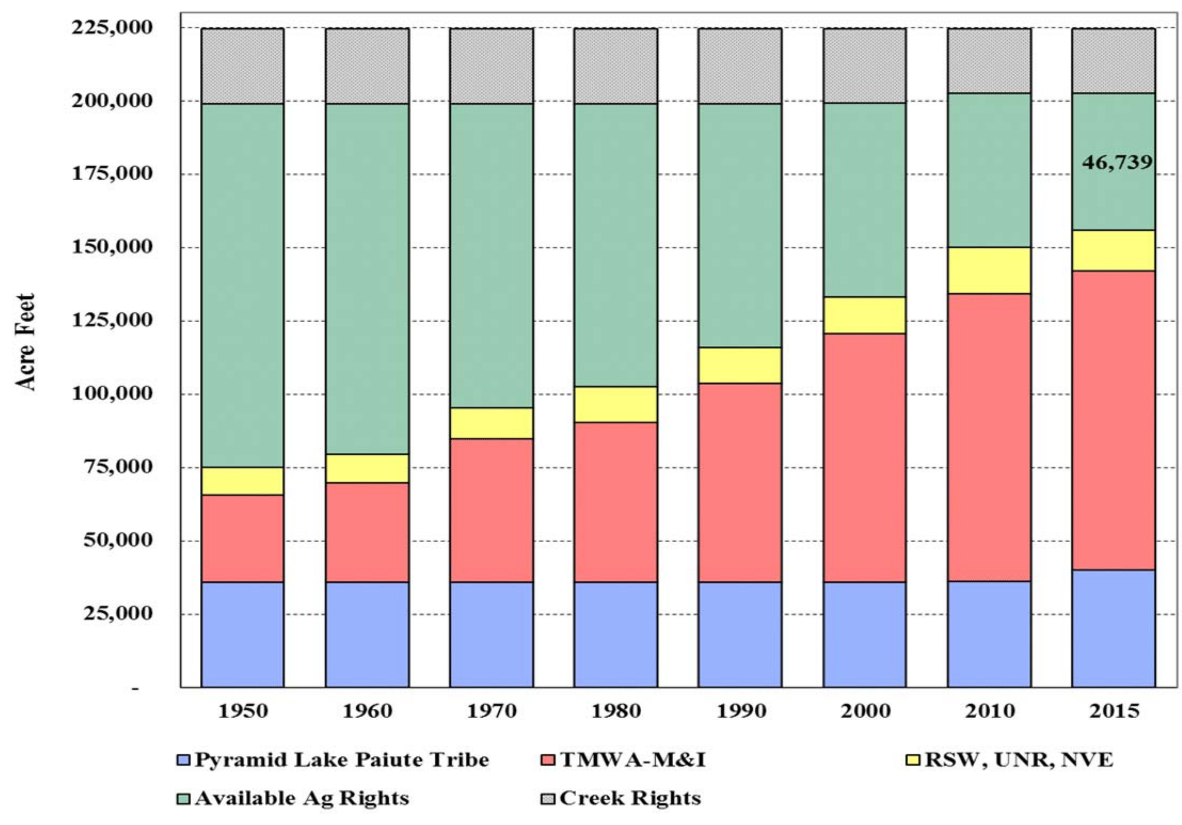


Figure 3-4. Number of Orr Ditch Decree Water Rights Held by Major Entities

Identified in the graph are ownership interests of large blocks of water rights, such as TMWA. The 'green' section shows the change in the number of mainstem irrigation water rights and indicates over 46,000 AF could be available for future acquisition and dedication in the TRA.

Although it appears a significant block of water rights is available for future will-serve commitments, the process of acquiring water right(s) is complicated by the fact that water rights in the state of Nevada, including Truckee River rights, are private property bought and sold in a free, open market. In addition to the economic pressures mentioned above, other issues affecting Truckee River water rights that may be available for dedication to TMWA or acquired through the purchase by the utility include:

- *Ownership*. Prior to 1979 the utility was solely responsible for the acquisition of water resources. However, since that time, water rights have been dedicated by project sponsors to the utility to meet a project's demand, or the utility purchased small quantities of water rights via Rule 7 and then subsequently sold will-serve commitments to meet the project's demand. Ownership of a water right is ultimately transferred to the utility through recordation of a deed with the County Recorder.

  TMWA has an obligation to protect its customers' interests and resources by accepting only transferable, usable water. Title to a water right is evidenced by a deed recorded at the County Recorder. This may be a deed of the real property including the water rights as appurtenances, or a deed for only the water rights. When TMWA accepts a water right and issues a will-serve commitment, it becomes obligated to provide water service to new projects in perpetuity. Although TMWA takes great care to ensure that it receives clear title to water rights offered for dedication and avoid potential conflicts in title and subsequent encumbrance of TMWA's resources, recording of ownership of water rights in Nevada has historically been somewhat haphazard, and it is sometimes difficult to obtain a complete and accurate chain of title. Such factors will limit TMWA's ability to accept certain water rights.

  Another complication with ownership of available Truckee River water rights is finding the owner. Based on Federal Water Master records, mainstem water rights and Truckee Meadows creek rights are fractionated in more than 40,000 pieces spread over more than 30,000 individual parcels, ranging in size from hundredths of an acre-foot on up. The complexities associated with fractionated water rights will require tremendous amounts of time and effort to research the information with respect to which water rights a seller owns and may be willing to sell.

- *Use*. Clear title does not necessarily imply the utility has the ability to "use" the water right. The State Engineer is required by State law to ensure that any change of use of a water right does not negatively affect other existing uses and is not detrimental to the public interest. This analysis takes place after the State Engineer has received an application from the developer or utility telling the State Engineer that the utility owns the water right and wants to change the use of the water, usually from agricultural to M&I use.

  The change application process is intended to consider the propriety of changing the point of diversion, place of use, or manner of use of a water right, but does not adjudicate conflicting claims to title. The State Engineer reviews the abstract of title and all other transfer documents relating to the actual water right referenced in the application. If the State Engineer is satisfied that the utility owns the water right and all the acre feet associated with the water right, he issues a permit. It is important to recognize that the State Engineer's review is substantive and not simply ministerial, and the process is necessarily time consuming.

There are instances when the State Engineer finds fault with the ownership claim or with the amount of acre feet in the application. When this happens, the utility must resolve the ownership question or correct the amount of acre feet, because, in most cases with old water rights, applications, or permits, the acquisition by the utility was incorrect or the original grantee is gone.

- *Yield*. The third issue facing the acquisition and use of any water right, Truckee or groundwater based, is how much water the water right will actually produce during a drought period. Prior to a water right being accepted as to its ownership and use, the "yield" of the right must be known, and/or the water right may require the dedication of other types of water rights to support the underlying right during drought years. For example, in June 2015 TMWA instituted a process in its facility planning Area 15 wherein if the developer wants to use groundwater rights from Basin 88, he/she must provide an equivalent amount of Whites Creek, Galena Creek or Thomas Creek water right to support the groundwater right. The plan is to treat these creek rights primarily during winter months and deliver to customers and/or inject in the ground so as to reduce groundwater pumping in the basin, thereby allowing the aquifer to recover.

With constrained amounts of river supplies resulting at times from hydrologic drought conditions, TMWA continuously works to maximize the yield it receives from its existing water rights -- decreed, converted irrigation, storage, and groundwater -- to generate a water supply that will meet the current and future needs of its customers. Despite the issues surrounding the ongoing development, acquisition, and management of water rights in the Truckee Meadows, over the years TMWA has acquired a sufficient number of water rights to meet current customer demands as well as maintaining rights available for new will-serve commitments through its Rule 7 processes. TMWA has rules in place to protect current customers and provide opportunity for new development to receive water service. TMWA will continue to have a role in optimizing the water resources available to it to meet future water supply requirements subject to existing constraints on the water rights market.

Currently, total non-Drought Situation year demands are estimated between 80,000 to 84,000 AF. This equates to future dedications of between 39,000 to 35,000 AF of Truckee River irrigation water rights to take advantage of 119,000 AF/yr TROA build-out demand. As noted above there are potentially over 46,000 AF available for future dedication not including over 7,000 AF TMWA has in its Rule 7 account as off this writing. In addition, there is 8,000 AF from Vidler available for future commitments.

Water Production and Facilities[23]

The facilities employed to produce water for TMWA's customers are described in this section. The wells typically supply between 10 to 15 percent of total water production during non-Drought Situations, but during Drought Situations groundwater production ranges between 20 and 30 percent of total water production.

Chalk Bluff Water Treatment Plant

CTP is TMWA's largest surface water treatment plant, capable of producing approximately 90 MGD of finished treated water. CTP was constructed in phases: Phase I completed in 1994, Phase II completed in 1996, and Phase III completed in 2004. The CTP treats raw water via a conventional water treatment process through settling of heavy solids, screening, flocculation and sedimentation, filtration, and chlorination. The plant is designed for modular expansions to an ultimate treatment capacity of 120 MGD. The next expansion of 15 MGD (nominal treatment capacity) will be accomplished primarily through the addition of mechanical equipment, such as four additional filters and two flocculation bays, to existing structures.

The plant sits on Chalk Bluff overlooking the Truckee River on the west side of Reno. Untreated (raw) water is delivered to the plant by gravity via the Highland Canal or by pumps with approximately 70 MGD capacity via the Orr Ditch Pump Station ("ODPS"). ODPS is located 1,000 feet due south of the plant on the river. The pumping station was built in conjunction with the construction of CTP and was expanded to a capacity of 70 MGD in 2008. The ODPS has been used to supplement supply to the Chalk Bluff plant at times of the year when the Highland Ditch cannot provide 100 percent of the raw water required to keep the plant at full load (typically June-September), or when the canal is taken out of service for scheduled maintenance or repairs. Due to ice formation for a brief period of time in the winter months, the ditch is also sometimes taken out of service in favor of the ODPS.

The Highland Canal has a nominal capacity of 95 MGD, and is approximately 7.3 miles in length from the diversion dam to CTP. The ditch conveys raw water via gravity to the CTP through a series of concrete-lined open channel sections, flumes, and siphons.

Glendale Water Treatment Plant

GTP is the smaller of TMWA's surface water treatment plants and is located in Sparks just east of the Grand Sierra Resort. The plant borders the north side of the Truckee River and diverts raw water from the river about 500 feet upstream of the plant. The plant was originally built in 1976 and upgraded in 1996 (filtration and flocculation improvements). It employs the same treatment processes as CTP and also is authorized to filter at the same filtration rate as

[23] Though not used in the production of treated water, TMWA operates four hydroelectric power-generating facilities located on the Truckee River upstream of Reno/Sparks. These hydroelectric plants are valuable assets, because of the historic diversion rights associated with hydroelectric generation, and the clean, renewable hydroelectric energy that they (3 operating plants since Farad has been inoperable since the Flood of 1997) generate offsets up to 100% of TMWA's power use and up to 50% of TMWA's annual electrical power costs.

CTP. TMWA operates the plant under a District Health variance granted in 1997 that brings the net surface treatment capacity of the plant to 33.0 MGD. Groundwater from six wells[24] can be pumped to GTP and treated for arsenic and blended with surface water for distribution into the system. With the groundwater the combined output of GTP is 45 MGD.

The current capacities of the two surface water treatments plants are summarized here:

	Design Capacity	Net Production Capacity	Planned Capacity
Chalk Bluff	95.0 MGD	90.0 MGD	120.0 MGD
Glendale	37.5 MGD	33.0 MGD	45.0 MGD

Annual production (in acre feet) for from CTP and GTP are summarized here:

	2011	2012	2013	2014	2015
Chalk Bluff	61,678	62,661	62,260	56,409	52,935
Glendale	4,417	4,413	6,029	7,131	3,835
	--------	--------	--------	--------	--------
Total	65,095	67,075	68,289	63,540	56,760

Production Wells

A summary of TMWA's production wells including the location by hydrographic basin, the rated production capacity of the well, the year of installation, whether a TRA or non-TRA well, whether a TROA or non-TROA related well, rehabilitation information and the last 5-years of production is provided in Table 3-2 .

TMWA has 81 active production wells, 68 available to meet the demand of its customers in the TRA and 13 available for service in the non-TRA systems. Another 14 wells are completed but require pumps to be added at a future date, 3 are used for backup purposes, 8 are offline due to water quality issues or low water yield, and 3 are used for construction water purposes due to low water quality. Of the 68 wells in the TRA, 25 wells were part of TMWA's pre-merger inventory. All or a portion of the water rights and all their future production is to be included as contributing toward the water demands to be calculated under TROA operations, whereas the water rights and water production from all other active production wells is over and above the total demand provided under TROA operations.

Forty-four (44) of the active production wells are in Truckee Meadows Basin 87, 8 active production wells are in West and East Lemmon Valley Basins 92A and 92B, 8 active production well are located in Spanish Springs Basin 85, 9 active production wells are in Pleasant Valley Basin 88, 4 active production wells are in Washoe Valley Basin 89, 3 active production wells are located in Tracy Segment Basin 83, and 5 active production wells are in Honey Lake Valley Basin 97.

[24] GTP can treat water from the Mill, Corbett, Greg, Terminal, Pezzi, and Poplar #1 wells. The combined output of those wells is about 16 MGD, which in drought years is used to augment the reduced Truckee River flows into GTP. In non-drought years, when Truckee River water is available and its use is maximized, groundwater use from these wells is substantially reduced.

Table 3-2. Production Well Statistics

	Well Name	Service Start Year	Rated Capacity [MGD]	Cum Rated Capacity [MGD]	Date Last Rehab	No. of Rehabs	Rehab Reason	TRA	TROA	2011 [AF]	2012 [AF]	2013 [AF]	2014 [AF]	2015 [AF]
	---------------a-------------	-----b----	-----c-----	-----d-----	---e---	---f---	---g---	---h---	---i---	---j---	---k---	---l---	---m---	---n---
Spanish Springs (Basin 85)														
1	Desert Springs 1	1990	0.6	0.6	2012	1	A	Y		175	106	250	223	48
2	Desert Springs 2	1963	0.6	1.2				Y		166	209	195	246	67
3	Desert Springs 3	1979	1.1	2.3				Y		-	218	59	114	0
4	Hawkings	2008	4.3	6.6				Y		807	1,112	8	2	553
5	Spring Creek 2	1988	0.7	7.3	2012	1	A	Y		82	107	147	142	50
6	Spring Creek 5	2000	1.4	8.7				Y		192	353	252	256	256
7	Spring Creek 6	1997	2.5	11.2	2015	1	A	Y		469	228	209	0	461
8	Spring Creek 7	2000	2.9	14.1				Y		400	384	349	454	347
										------	------	------	------	------
										2,292	2,717	1,469	1,438	1,783
Truckee Meadows (Basin 87)														
1	21st St	1991	2.0	2.0	2013	1	A	Y	Y	165	360	14	184	546
2	ArrowCreek 1	1995	0.5	2.5				Y		124	99	89	72	119
3	ArrowCreek 2	1995	1.1	3.6				Y		262	293	236	259	369
4	ArrowCreek 3	1998	0.7	4.3				Y		245	222	199	304	340
5	Corbett Elementary	1993	2.1	6.4	2005	1	C	Y	Y	470	470	866	459	693
6	Delucchi Ln	1972	0.8	7.2	2013	1	A	Y	Y	-	51	-	84	228
7	Double Diamond 1	1981	0.8	8.0				Y		151	258	268	199	50
8	El Rancho Blvd	1992	1.2	9.2	2010	3	A	Y	Y	-	109	28	235	310
9	Fourth St	1971	2.2	11.4	2010	1	A	Y	Y	64	400	24	352	444
10	Galletti Way	2000	2.3	13.7				Y	Y	162	305	82	418	83
11	Glen Hare WCSD	1999	1.7	15.4	2010	1	A	Y	Y	-	31	6	260	435
12	Greg St	1967	2.0	17.4	2014	2	A	Y	Y	38	91	19	219	604
13	Hidden Valley 3	1984	1.4	18.8				Y		1,546	949	767	1,000	377
14	Hidden Valley 4	1985	1.4	20.2				Y		-	709	928	639	631
15	Hidden Valley 5	1992	0.6	20.8				Y		229	286	257	-	207
16	High St	1961	2.2	23.0	2008	1	A	Y	Y	950	1,052	1,049	1,029	971
17	Holcomb Ln	1988	1.0	24.0	2010	2	A	Y		526	-	31	132	270
18	Hunter Lake Dr	1995	3.3	27.3				Y	Y	-	61	-	571	773
19	Kietzke Ln	1972	3.3	30.6	2012	1	A	Y	Y	1,473	1,457	1,377	1,487	1,289
20	Lakeside Dr	1985	0.9	31.5				Y		149	165	38	215	308
21	Longley Ln	2000	2.2	33.7	2015	1	A	Y	Y	-	632	191	394	635
22	Hidden Valley 1 (Longley plant)	2005	3.6	37.3				Y		409	453	411	583	207
23	Mill St	1960	2.6	39.9	2013	2	B	Y	Y	554	578	1,357	799	1,041
24	Morrill Ave	1963	2.0	41.9	2008	1	A	Y	Y	907	943	895	900	763
25	Patriot (Huffaker) Blvd	1990	1.8	43.7	2012	1	A	Y	Y	-	172	18	111	546
26	Pezzi	1974	1.3	45.0				Y	Y	20	-	52	363	862
27	Poplar #1	1963	2.3	47.3	2009	1	A	Y	Y	48	-	33	283	656
28	Poplar #2	1967	2.2	49.5	2013	2	A	Y	Y	0	250	-	277	680
29	Reno High	1991	3.3	52.8				Y	Y	105	130	8	694	1,012
30	Sierra Plaza	2002	2.0	54.8				Y	Y	128	-	18	217	611
31	South Virginia St	1969	1.5	56.3	2012	1	A	Y	Y	676	-	31	207	273
32	Sparks (Nugget) Ave	1967	0.9	57.2	2013	2	B	Y	Y	-	57	27	80	181
33	STMGID 1	1984	1.1	58.3				Y		424	600	529	483	204
34	STMGID 11	2000	0.7	59.0				Y		391	520	477	332	134
35	STMGID 12	2011	1.0	60.0				Y		-	365	576	439	117
36	STMGID 2	1984	0.4	60.4				Y		184	213	193	188	65
37	STMGID 3	1984	0.7	61.1				Y		298	258	248	279	90
38	STMGID 4	1981	0.3	61.4				Y		71	78	68	50	60
39	STMGID 5	1988	1.1	62.4				Y		350	359	345	315	301
40	STMGID 6	1988	2.1	64.5	2011	1	B	Y		747	765	659	807	1,021
41	Swope Middle School	1993	0.9	65.4	2013	1	A	Y	Y	-	15	1	127	225
42	Terminal Way	1961	1.7	67.1				Y	Y	25	-	38	232	536
43	Thomas Creek	1978	0.6	67.7				Y		227	191	173	190	53
44	View St	1969	2.4	70.1	2014	2	B	Y	Y	163	273	75	400	560
										------	------	------	------	------
										12,282	14,222	12,699	16,869	19,879

A Clean/check well
B Loss of production
C Replace pump

TRA: production from these well can service the Truckee Resource Area
TROA: all or a portion of water rights on the well are TROA components

Table 3-2. Production Well Statistics (cont)

	Well Name	Service Start Year	Rated Capacity [MGD]	Cum Rated Capacity [MGD]	Date Last Rehab	No. of Rehabs	Rehab Need	TRA	TROA	2011 [AF]	2012 [AF]	2013 [AF]	2014 [AF]	2015 [AF]
West Lemmon Valley (Basin 92A)														
1	Air Guard	1968	1.6	1.6	2009	3	B	Y		-	255	18	13	254
2	Silver Knolls	2006	1.7	3.3	2010	3	A	Y		-	65	0	0	-
3	Silver Lake	2005	3.2	6.5				Y		149	-	32	440	272
										149	320	50	454	526
East Lemmon Valley (Basin 92B)														
1	Lemmon Valley 5	1970	1.2	1.2				Y		257	288	193	197	69
2	Lemmon Valley 6	1998	0.3	1.5				Y		96	89	129	48	5
3	Lemmon Valley 7	1970	0.6	2.1				Y		145	161	141	130	23
4	Lemmon Valley 8	1974	0.9	3.0				Y		69	96	110	132	-
5	Lemmon Valley 9	1997	0.8	3.8				Y		-	-	-	-	-
										567	634	573	507	97
West Pleasant Valley (Basin 88)														
1	Mt Rose 3	1990	0.4	0.4				Y		107	124	159	86	89
2	Mt Rose 5	1990	1.0	1.4	2015	1	C	Y		360	374	424	440	271
3	Mt Rose 6	2000	0.8	2.2				Y		329	395	363	372	424
4	St James 1	1995	0.5	2.7	2014	1	B	Y		108	74	64	94	107
5	St James 2	1995	0.6	3.3	2014	1	B	Y		137	84	84	68	74
6	STMGID 7	1983	0.2	3.5				Y		62	36	50	27	42
7	Tessa 1 (East)	2000	1.2	4.7				Y		210	297	377	506	301
8	Tessa 2 (West)	1999	0.9	5.6	2015	1	B	Y		142	354	284	141	112
										1,455	1,738	1,805	1,735	1,420
Tracy Segment (Basin 83)														
1	Stampmill 1	1979	0.6	0.6						14	11	13	14	4
2	Stampmill 2	1979	0.3	0.9						14	12	14	13	5
3	Truckee Canyon 1	1997	0.1	1.0						11	18	17	18	6
										39	41	45	45	14
East Pleasant Valley (Basin 88)														
1	Sunrise Estates 1	1983	0.4	0.4						39	161	66	34	10
Washoe Valley (Basin 89)														
1	Lightning W 1	1994	0.1	0.1						24	32	32	35	7
2	Lightning W 2	1963	0.2	0.3						0	68	-	-	9
3	Lightning W 3	2008	0.3	0.6						71	66	68	63	21
4	Old Washoe Estates 3	1994	0.2	0.8						45	54	48	53	15
										140	220	149	151	53
Honey Lake Valley (Basin 97)														
1	Fish Spring Ranch Well 1 (A)	2006	4.3	4.3						-	-	-	35	14
2	Fish Spring Ranch Well 2 (B)	2006	2.9	7.2						-	-	-	8	409
3	Fish Spring Ranch Well 3 (C)	2006	2.2	9.4						-	-	-	66	31
4	Fish Spring Ranch Well 4 (D)	2006	2.2	11.5						-	-	-	0	410
5	Fish Spring Ranch Well 5 (E)	2006	3.2	14.8						8	-	-	167	93
										8	-	-	276	958
81	<-Total Wells	Total Capacity (MGD):		117.1										
68	<- TRA	TRA Capacity (MGD):		100.1				68	25	16,971	20,054	16,856	21,508	24,740
13	<-non-TRA	n-TRA Capacity (MGD):		17.0										

A Clean/check well
B Loss of production
C Replace pump

TRA: production from these well can service the Truckee Resource Area
TROA: all or a portion of water rights on the well are TROA components

The majority of wells pump water directly into the distribution systems after chlorination. However, water from 5 wells (Morrill, Kietzke, High, Mill and Corbett) undergoes air-stripping treatment for PCE removal, and water from 6 wells (Mill, Corbett, Greg, Terminal, Pezzi and Poplar #1) is pumped to GTP for arsenic removal. TMWA's TRA production wells have an overall rated capacity of approximately 100 MGD. TMWA seeks to maximize use of surface water throughout the TRA and uses its TRA wells for summer peaking and when needed during Drought Situation years, with the exception of wells in Basin 88-west and Basin 87-southwest which are necessary to meet some winter months demands. All non-TRA systems are groundwater dependent therefore the wells operate daily year-round.

Over time, wells can lose production capacity. Factors contributing to these declines may include chemical reactions between the groundwater, aquifer materials, and well casing leading to changes in the chemical and/or hydrogeologic characteristics of the well system. These changes can lead to precipitation of minerals that clog the well's screens or by biofouling whereby biological microorganisms combine with trace minerals in groundwater to plug the well's screens. When the production rate or water quality of a well is affected negatively, TMWA begins an analysis to determine the cause of the decline and then takes action to rehabilitate the well so that the well production and water quality can be improved. Although well abandonment and drilling of a new well can mitigate the loss of well production, it is considered a last resort due to the expense to replace a well.

TMWA actively monitors its production wells with the goal of detecting those wells that need rehabilitation. The rule of the thumb for initiating rehabilitation work on a well is upon identification of a 20 percent to 25 percent loss of its design production rate. The rehabilitation program avoids the cost of drilling a replacement well, especially in view of the diminishing well sites within TMWA's services areas that can provide sufficient, high quality production capacity at minimal capital outlay. Well rehabilitation has occurred at more than 25 wells, some of which have been "rehabbed" multiple times. TMWA's approach to well rehabilitation involves the use of a combination of industry established methods along with monitoring and testing steps specific to the conditions found at each distinct well. Various issues and/or well characteristics, primarily a decrease in well yield, have initiated the rehabilitation of each well. Where extensive rehabilitation work was performed, the well's productive capacity was improved and/or restored. Fortunately, TMWA's wells have yet to experience water quality deterioration problems with the exception of sand production at some wells. Table 3-2 indicates those wells that have been rehabbed.

Conjunctive Operation of Surface and Groundwater Resources

Chapter 1 introduced and defined the TRA and non-TRA. For planning purposes in the non-TRA the groundwater resources available to the satellite systems are restricted to the individual system and are sufficient to meet the build-out needs within the established system over the planning horizon. Since these systems have no opportunity to benefit from Truckee River resources, planning conjunctive use within these areas in not possible.

The discussion in the remainder of this section relates to the conjunctive operation of Truckee River resources (mainstem water rights and upstream storage rights) and groundwater rights in the TRA which are combined and managed pursuant to TROA. Resource management within the TRA is subdivided into two categories: (1) surface and groundwater resources dedicated and committed for will-serve commitments that make-up the TROA supply and reservoir operations and (2) groundwater and creek water rights dedicated and committed for will-serve commitments that do not rely on TROA storage. The majority of groundwater rights held by TMWA, pre-merger, are part of the TROA demand. Any groundwater and creek water rights not dependent on TROA storage that have been acquired by TMWA are not included in TROA and are over and above the commitments and associated demands recognized under TROA. Included in this group of rights are the groundwater rights TMWA acquires through the purchase of water systems such as the Silver Lake Water Distribution Company in 1999 or the groundwater or creek rights TMWA acquired as a result of the merger with WDWR and STMGID in 2014. At the time of acquisition, those rights were adequate to meet the full demands of the customers to whom the water resources were committed without TROA support. In the TRA, those water resources that are supported by TROA operations and drought reserves will serve a demand of 119,000 AF; those water resources in the TRA not supported by TROA operations (e.g., prior WDWR groundwater commitments in Lemmon Valley) will serve a demand of approximately 25,000 AF.

The CTP and GTP make it possible for TMWA to utilize surface water year-round thereby eliminating the need for winter groundwater pumping throughout the TRA with exception of Basin 87-southwest. TMWA manages its plants to maximize surface water production and limit or compress its groundwater pumping to help meet peak summer customer demands. This conjunctive operation of surface and groundwater supplies allows TMWA to increase its pumping during higher summer demands and beyond the summer months when necessitated by lack of river supplies during extreme dry years[25]. This operational procedure also reduces facility use and overall cost of water production and creates the opportunity to aggressively pursue TMWA's aquifer storage and recovery program ("ASR") with potential for its expansion to serve more demand as described in Chapter 6.

The map in Figure 3-5 shows the location of TMWA's production wells and which of those wells are equipped for recharge.

[25] The benefits of conjunctive management of TMWA's surface water and groundwater resources were recognized and resulted in the issuance by the State Engineer of "Groundwater Management Order 1161" on May 15, 2000. Order 1161 resolved several issues with respect to TMWA's ability to exercise its groundwater permits and provides the opportunity for improving the Truckee Meadows aquifer by: reducing over the long-term, the average-annual pumping of the Truckee Meadows aquifer; building up a credit of underground banked surface water for later extractions during droughts; and allowing up to 22,000 AF to be pumped for three consecutive years if sufficient credit has been accumulated during non-drought periods.

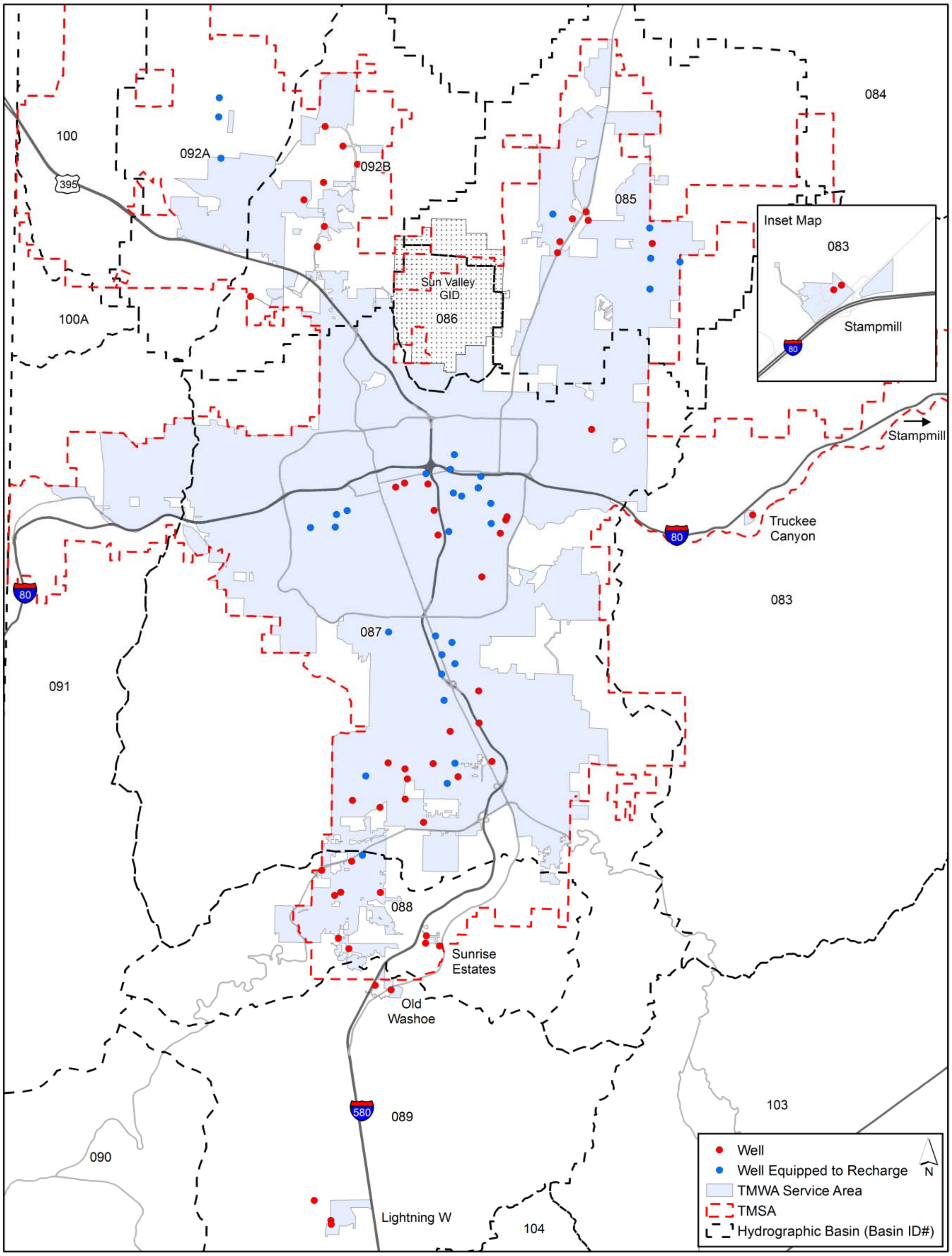


Figure 3-5. Production and Recharge Wells

In the winter season, many of the production wells are used to inject or recharge treated surface water into the groundwater aquifer for storage, water quality mitigation for marginal arsenic concentration wells, and future drought year use. TMWA's injection of treated water is governed by quantity permits issued by Nevada Division of Water Resources ("NDWR"), and quality permits issued by NDEP. TMWA has injected through FYE 2015 25,100 AF, 4,650 AF, and 720 AF in the Truckee Meadows, LVW, and SSV Hydrographic Basins, respectively. [26] Table 3-3 summarizes TMWA's recharge activities since 2001.

Table 3-3. Aquifer Storage and Recovery History by Basin (units in acre feet)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Mill Street															
2	High Street															
3	Kietzke Lane															
4	Morrill Avenue															
5	So. Virginia															
6	Fourth Street	452	309	152	139	82	113	90	158	107	71	15			189	216
7	Peckham Lane															
8	View Street	433	259	353	598	264	202	179	290	68	61	78	195	218	158	395
9	Poplar #2	46	70	9	44	37	2			7	3		41	5	21	
10	Greg Street	135	137	177	164	41				16	56		191	34	13	142
11	Delucchi Lane													1	12	54
12	Sparks								19	18	5		14	8		
13	Poplar #1															
14	Pezzi															
15	Terminal Way															
16	Lakeside Drive	258	218	292	194	192	213	148	268	198	232	215	104	150	166	368
17	Holcomb Lane	39	187	123	72	17	137		39	48	87		3		72	119
18	Patriot															
19	21st Street	202	192	259	172	108	151	108	153	116	91				68	125
20	Reno High	216	142	173	26	50	213	181	254	184	134				86	222
21	El Rancho	216	178	255	139	97	103	62	118	22	76		43	136	124	136
22	Corbett					1										
23	Swope															
24	Hunter Lake	332	175	246	34	22			120	253	190				52	284
25	Glen Hare	117	62	99	15	9			61	70	70				45	110
26	Galetti	239	234	262	218	119	175	149	223	177	41				99	163
27	Longley Lane	10	14												15	24
28	Sierra Plaza															14
29	STMGID 1															2
30	STMGID 2															11
31	STMGID 11															30
32	Picollo															49
	TRUCKEE MEADOWS	2,693	2,177	2,401	1,815	1,038	1,308	918	1,704	1,283	1,117	308	590	551	1,122	2,464
33	Silver Knolls								32	19	131	130	118	164	114	161
34	Air Guard	242	205	180	157	137	163	136	117	106	150	99	81	117	86	121
35	Silver Lake	149	88	83	84	93	147	136	171	191	192	89	63	87	76	117
36	Sherwin Williams															
	W LEMMON VALLEY	391	293	263	240	230	309	273	320	317	472	319	263	368	276	399
37	Hawkins Ct (Tucker)								51	391	444	470	422	442	396	985
38	Desert Springs 4												23	227	160	70
	SPANISH SPRINGS								51	391	444	470	445	669	556	1,055
	TOTALS (AF)	3,084	2,469	2,664	2,056	1,268	1,617	1,191	2,074	1,991	2,033	1,097	1,298	1,588	1,954	3,918

[26] Appendix 3-1 contains the FYE 2105 semi-annual ASR reports for each basin filed with NDEP and NDWR.

Since its inception, TMWA's ASR has improved or stabilized groundwater levels in and around the injection sites thereby preserving TMWA's ability to utilize its groundwater resources to meet summer peaking and/or Drought Situation pumping requirements without degrading groundwater quality in the process. ASR is one element of TMWA's integrated management strategy to augment drought reserve supplies for later use during a Drought Situation. ASR, together with TMWA's POSW and credit water releases and increased groundwater pumping, create opportunity to maximize and expand service commitments while meeting critical-year-water-supply requirements during drought periods; this is a primary purpose of water resource planning for the Truckee Meadows. Under TROA the drought needs within the TRA will be met with TROA drought supplies, and only those water rights which need not be stored under TROA will be available for recharge purposes. The ASR drought reserve development can then be utilized to support demands above TROA's 119,000 AF supply.

Lake Tahoe is the largest storage reservoir on the Truckee River system; 95 percent of the water stored upstream and carried-over to the next year to be used to provide normal river flows can be captured in the lake. The top 6.1 feet of the lake is used as a storage reservoir. River flows, or Floriston Rates[27], are almost entirely dependent upon Lake Tahoe's elevation at any point in time throughout the year. Availability of Truckee River water, TWMA's primary water supply, can be negatively impacted during low snowpack years. When the elevation of the lake approaches its natural rim (6223.00-feet), Floriston Rates drop-off shortly thereafter. Figure 3-6 presents the history of recorded month-end elevations for Lake Tahoe. If these rates of flow fall off during the typical summertime demand season, it impacts TMWA's water production operations. Since typically 85 percent of TMWA's raw water is derived from the Truckee River, it is easy to see why Lake Tahoe is the best barometer regarding the health of our region's water supply. Depending on the projected elevation of Lake Tahoe determined by April 15 each year for the remainder of the year, enhanced demand-management measures described in Chapter 5 may need to be implemented depending on the projected impact to TWMA's drought reserves.

Figure 3-7 shows a 16-year history of daily river flows (the "blue area") measured at Farad compared to TMWA's daily diversion of surface water (the "green area") and groundwater and POSW (the "red area"). The graphic illustrates that the "red area" demand must be satisfied with increased groundwater production and/or releases of POSW. In the summer months of the driest years groundwater and/or POSW is used to meet demands when river supplies are not available. The reader should note, however, that in all years natural river flows make-up the majority portion of TMWA's water production requirements.

[27] Floriston Rates are the minimum required rates of the flow in the Truckee River that must cross the California/Nevada state line daily, which is measured near Farad, California

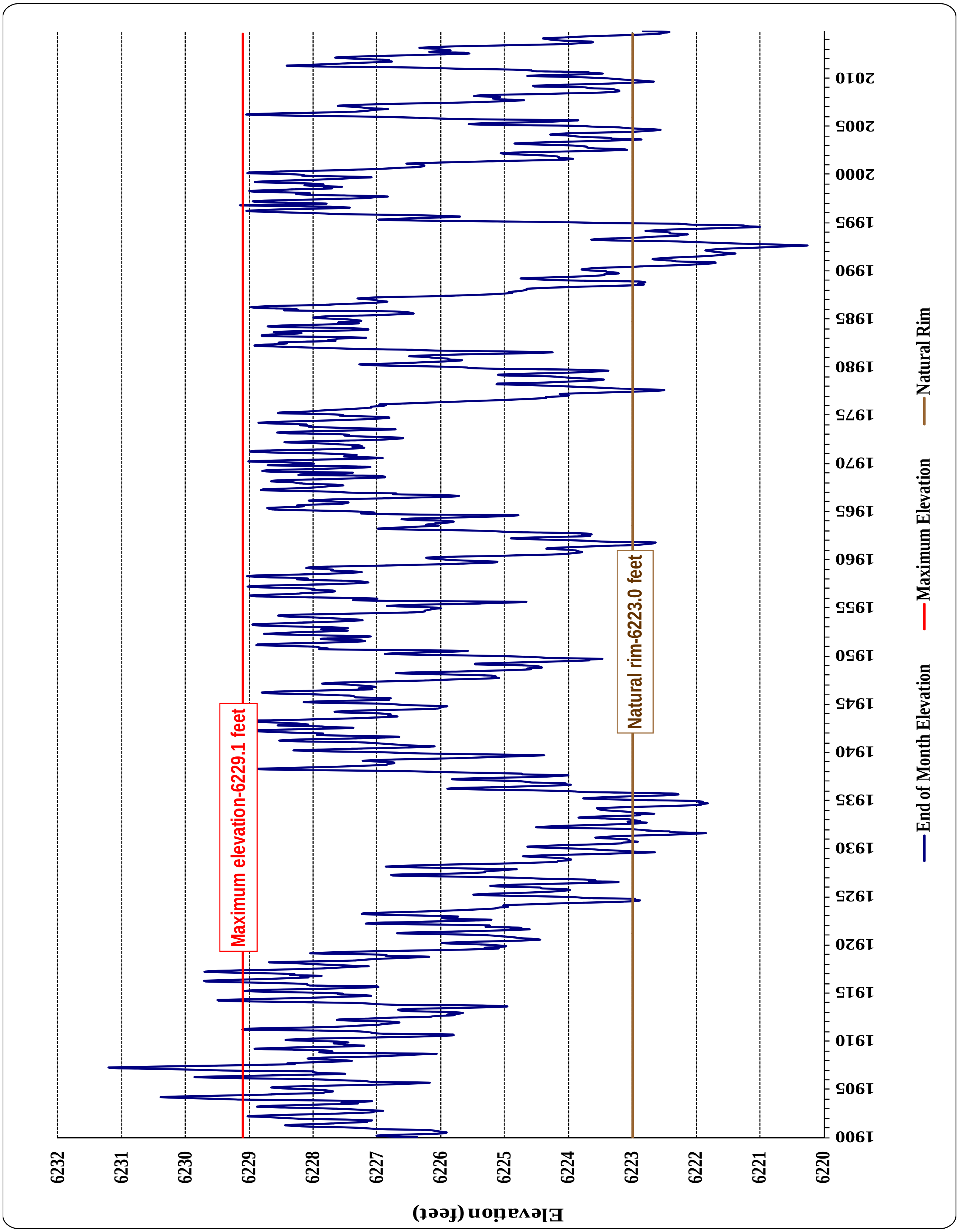


Figure 3-6. Lake Tahoe Elevations

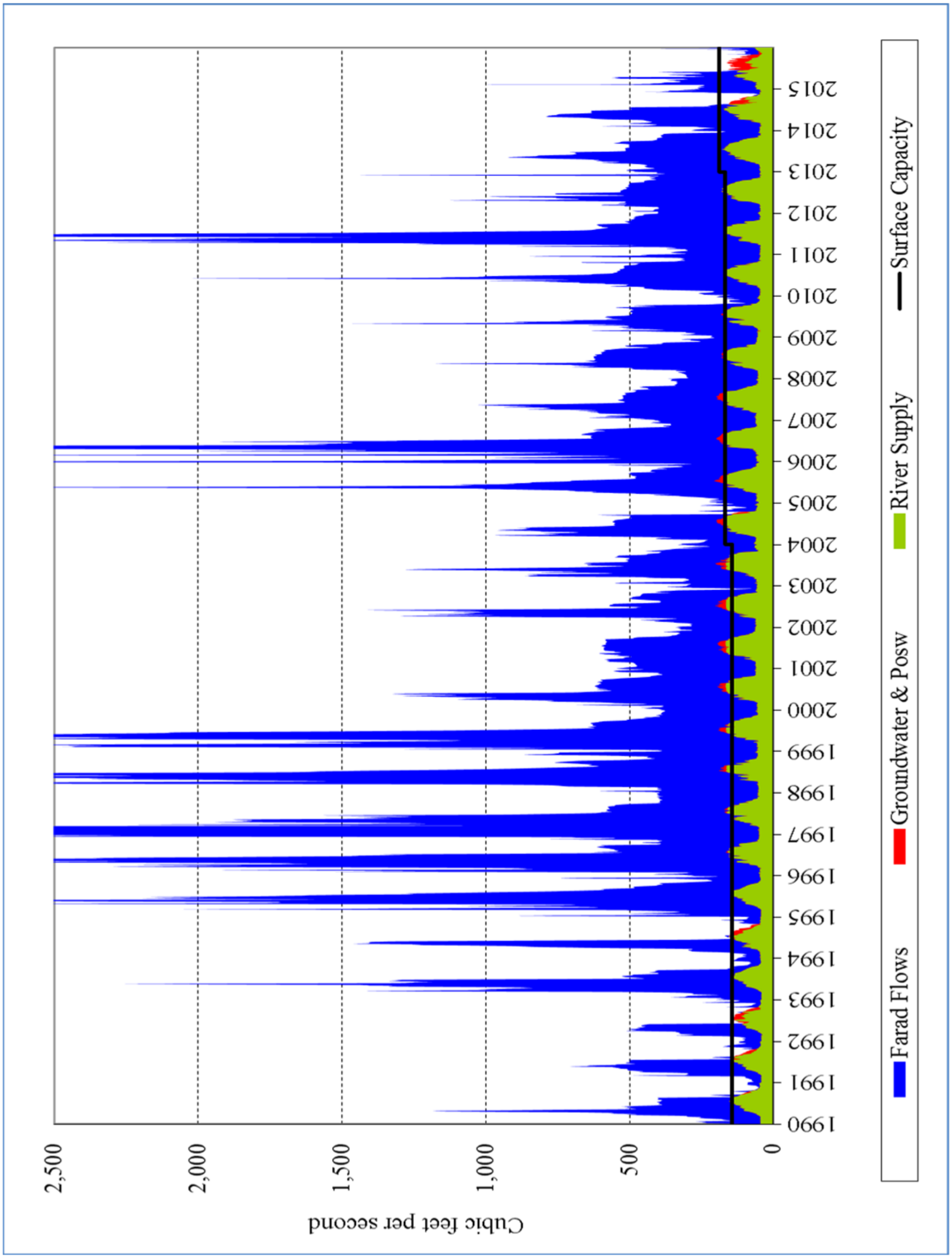


Figure 3-7. 1990 to 2014 Daily River Flows (in acre feet)

Although the resource management schemes vary between non-Drought and Drought Situation years, experiences during prior droughts demonstrate the region's ability to manage its water resources during these dry periods which management is significantly simplified under TROA operations. A comparison of non-Drought and Drought Situations operating strategies highlights the differences in resources management required in order to optimize available resources. The two resulting management scenarios ultimately determine the type of production facilities necessary to produce potable supplies. The non-Drought and Drought Situation overall resource management strategies include:

Non-Drought Situation:

- Maximize surface water diversions every month.
- Maximize establishment of POSW and credit water per TROA operations.
- Limit groundwater use (attempting to pump an average less than 15,950 AF annually) to the critical months: July, August, and September, and eliminate its use as early as possible in October. No groundwater should be used in April, and if possible, preferably delay its use until May or June.
- Retain and carry-over POSW and credit stored water during the year per TROA operations.
- Aquifer recharge, when required for operational purposes.

Drought Situation:

- Maximize surface water diversions every month while river supplies are available. This may require bringing GTP on-line earlier in the spring and implementing aquifer recharge operations early in the fall.
- Maximize establishment of POSW and credit water per TROA operations.
- Request early fill of reservoirs from California Dam Safety.
- Optimize the use of credit water, POSW and groundwater during the months of June through October.
- Enhance water conservation measures as appropriate to reduce customer use.
- Under TROA, if the drought lingers, exchange or trade credit water with other TROA parties, and move water out of Tahoe as soon as practicable to have it available for release from other reservoirs.

The 1987-1994 Drought was the most severe drought on record and is the benchmark for water resource planning criteria. Previous hydrologic analyses in prior water plans confirmed that TMWA is managing its resources to withstand a repeat of 1987 to 1994 hydrology. The analyses test for impacts during years when there is not enough natural flow in the Truckee River and TMWA must use some of its upstream reserves. The effect of one summer month when Floriston Rates are not met does not necessarily impact upstream reserves. Only consecutive months without meeting Floriston Rates during the irrigation season can significantly impact upstream reserves as happened beginning in August through September 2014 and June and through September 2015.

Analyses of California blue oak tree-ring data in the 2025WRP concluded that drought periods of 8-, 9-, or 10-years are rare occurrences with frequencies of 1 in 230 years, 1 in 375 years, and 1 in 650 years, respectively. While there has not been any new tree ring data collected since the 2003 study, a preliminary dendrochronological reconstruction of water-year streamflow was performed using as predictors the western U.S. tree-ring chronologies available from the public-domain International Tree-Ring Data Bank ("ITRDB") dataset and stream flows from the Carson River (see Appendix 2-4). The Carson River does not have reservoirs compared to the Truckee River and is therefore a more natural flowing river providing better correlation with select tree-ring cores. This reconstruction of the Carson River extended from 1500 to 2001, a period five times longer than the instrumental record. The reconstruction of the Carson River had 211 wet and dry spells with an average duration of 2.4 years, with the longest episodes being a 9-year wet period (1978 to 1986), and two 8-year droughts in 1841-1848 and 1924-1931. These three episodes were also the strongest found in the 502 year history in the reconstruction dataset. Table 2 from Appendix 2-4 summarizes the top 10 strongest wet and driest periods within the reconstruction dataset.

Table 3-4. The 10 Strongest Episodes Identified in the 502-year (1500-2001) Reconstructed Carson River Streamflow

Start (year)	End (year)	Episode	Duration (yrs)
1978	1986	Wet	9
1841	1848	Dry	8
1924	1931	Dry	8
1534	1540	Wet	7
1601	1606	Wet	6
1564	1569	Wet	6
1941	1946	Wet	6
1578	1582	Dry	5
1987	1992	Dry	6
1905	1909	Wet	5

This reconstruction of the Carson River provides some insight into the severity of dry periods on the eastern slopes of the Sierra Nevada range but also finds that up-to-date and more local tree-ring chronologies are needed to increase its reliability of conclusions as to the severity and durations of drought periods on the Carson and Truckee Rivers. Furthermore, a September 2015 report in the journal, *Nature Climate Change*, performed a similar multi-century evaluation of Sierra Nevada snowpack on tree-ring data. This short report (Appendix 3-2) shows the rarity of the 2015 dry snowpack year, and 2015 is considered to be the driest in 500 years with an estimated return interval of 3,100 years. The report also pointed to the possibility that a few years in the sixteenth century could have been drier.

Although the region is in the fourth year of a drought period, it cannot be determined with certainty when this drought period will end or how long it will be. Ongoing analyses of climate variability, specifically developing reliable streamflow datasets for the eastern slopes of the Sierra Nevada range affecting the Truckee Meadows, is recognized as a requirement by all researchers in the field. Based on available data and research results from studies for the Truckee Meadows, the 1987 to 1994 Drought remains the most severe drought on record. Figure 3-9 illustrates the calculated drought reserves TMWA is able to accumulate under TROA operations at full demand of 119,000 AF.

The last four years (2012, 2013, 2014, and 2015) have been the driest back-to-back winters in recorded history, producing the smallest amount of runoff ever seen over a four year period in the Truckee River system. Out of 115 years of actual hydrologic data available for the Truckee River, 2015 was the driest on record. It had the lowest recorded snowpack and the lowest recorded natural runoff. It was also 12% drier than the previous driest year on record which was 1977. Water year 2015 is by any definition the worst water year on record. To put water year 2015 in perspective, Figure 3-8 sorts the annual Truckee River flows from low to high (left to right) on the x-axis. These annual flows represent the total volume of water that crosses the California-Nevada Stateline at Farad, California. The graph shows water year 2015 to be lowest on record; it remains to be determined what the length of the current drought period will be and if the combination of water years since 2012 will supply more or less water than the combination of water years between 1987 to 1994 (identified in the graph by the black bars).

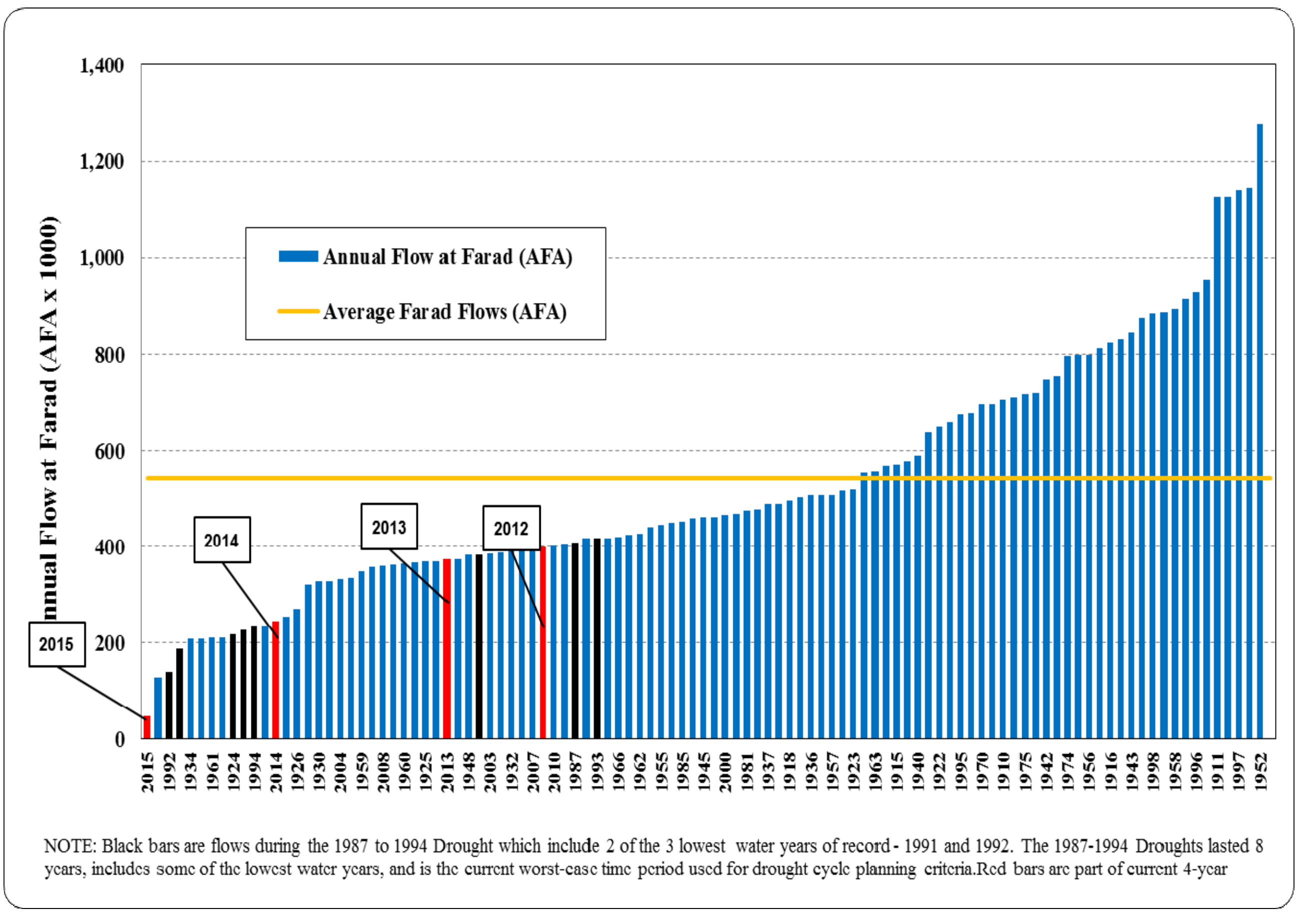


Figure 3-8. Average and Annual Truckee River Flows at Farad (in acre feet)

Previous planning efforts relied on a Fortran-based model developed by Sierra in the 1970's and revised to meet the rigors of the TROA EIS process. The Truckee River Operation

Model ("TROM") was used extensively during TROA analysis and negotiation. By inputting municipal and irrigation demands, water right diversions, timing constraints, and hydrologic record, the model tracked all sources and uses of Truckee River flows. TROA, which creates various categories of credit water storage, exchange and release priorities, increased the complexities of river operations accounting which required the development of a new, more sophisticated model. Shortly after signing TROA in 2008, the U.S. Bureau of Reclamation ("USBR") took the lead in consultation with Federal Water Master and the other TROA signatory parties to develop a forecasting, operations and accounting model of the Truckee River in a software package called RiverWare. In side-by-side comparison RiverWare and TROM produce the same results when testing the resiliency of the 1987 to 1994 hydrology and its ability to meet TROA's annual build-out demand of 119,000 AF. However, with the RiverWare tool, the Water Master and the parties to TROA are able to plan for and manage their various water rights, reservoir storage, and releases under TROA operations.

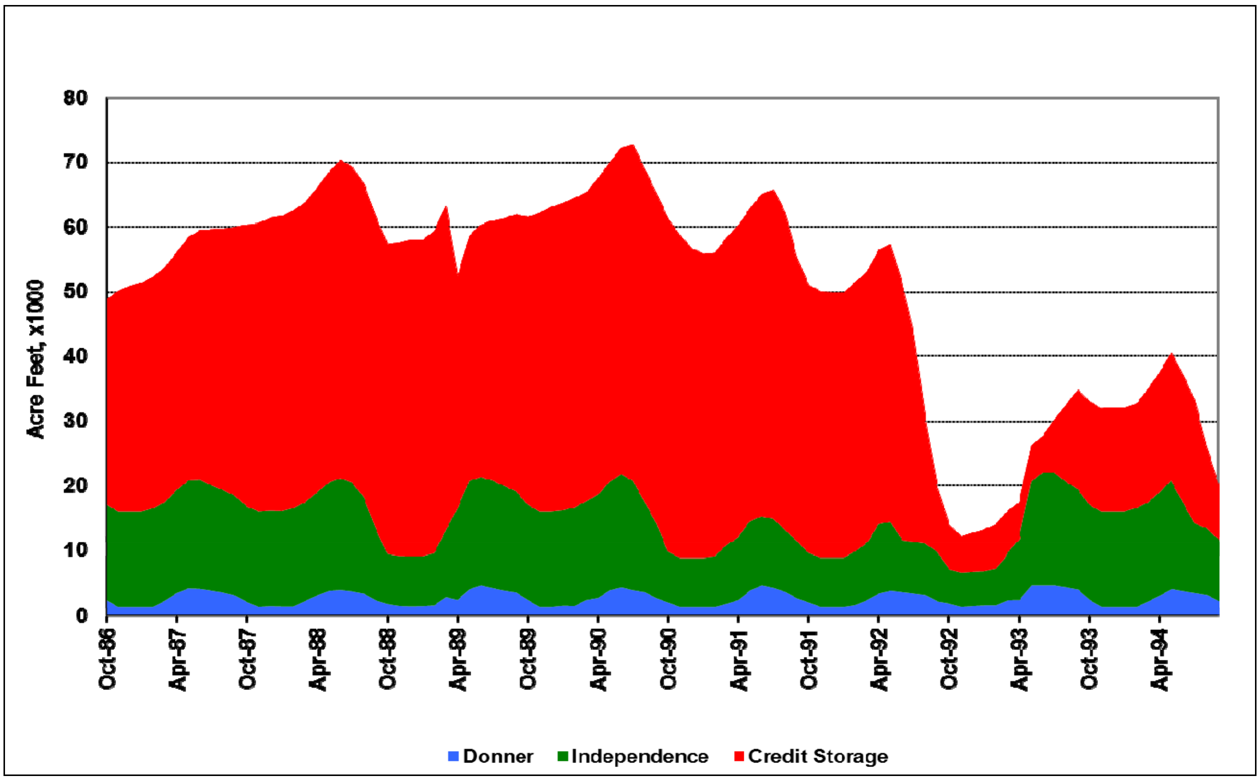


Figure 3-9. Projected Reserves Under the 8-Year Drought Design and TROA 119,000 AF Demand Limit

Under TROA operations during the 8-year drought design (1987 to 1994) at 119,000 AF of demand TMWA continues to accumulate drought reserves through the drought period. The "lumpy" nature of the graphs in Figure 3-9 reflect annual declines in reservoir storage due to (1) releases required for dam safety requirements to ensure there is sufficient flood storage capacity in the winter months; (2) release of credit water for dry demands; or (3) turnover of credit water to Fish Credit Water in Stampede or Boca reservoirs for fish purposes in non-Drought Situation years.

Water Supply Planning Scenarios under TROA Operations

To test the robustness of the region's water supply (in particular the back-up water supply), a hypothetical, 9-year worse-than-worse-case hydrologic scenario was developed and processed through the RiverWare operations model. Starting with actual 2012 to 2015 hydrology for the first four years, 5 years of 2015 hydrology were added on for to complete the dataset for years 2016-2020. The "9YR-SIM" was simulated under both a TROA and non-TROA operating conditions. The 9YR-SIM used for this analysis is over two times more severe than the drought of record (1987-1994) plus the additional dry year (1987) currently used for planning purposes. The simulation used projected 2015 demands within the TRA of 70,000 AF.

Without TROA upstream-drought reserves would run out in year seven of the modeled worse-than-worst-case drought; in other words, reserves are exhausted if 2015 hydrology is repeated three more years after actual 2015 hydrology. However with TROA, the results show that at current demands the region can withstand a hypothetical drought more than 2 times as severe as the drought of record and by the end of 9YR-SIM, TMWA would not only be able to meet demand at current levels, but actually continue to build up and accumulate additional drought storage. By the summer of 2020, the model predicts more than 46,000 AF of additional drought reserves would be available for use; reserve water supplies that would not be there if not for TROA. Supplies would be more than sufficient to meet summer water demand throughout the hypothetical hydrology.

To further stress-test TMWA's upstream drought reserves under TROA operations to the next level, two additional hydrologic scenarios or simulations were performed to test the robustness of the region's back-up water supply. Two twenty (20) year hypothetical worse-than-worse-case scenarios were used. The first 20-year simulation ("Repeat1987") was a repeat of the 1987-1994 drought of record plus the 1987 hydrology, starting at the same initial point as the first scenario (the 9-year simulation referenced above). That starting point was October 1, 2016 (start of Water Year) after the four driest back to back years in recorded history (115 years record keeping). The second scenario ("Repeat2015") repeated actual 2015 hydrological conditions for an additional 20 years starting from October 1, 2016. Both model runs used forecasted customer demands and assumed increases to groundwater pumping capacity of 15 MGD over the 20-year planning horizon.

The results of the Repeat1987 model using RiverWare validate the previous analyses for the TROA EIS using TROM. The 1987-1994 Drought is considered to be the drought-of-record is the standard for TROA and TMWA planning. It was the worst drought this region has experienced. The results of the model run suggest that not only can this region withstand a repeat of the 1987-1994 drought over the course of the next 20 years under TROA, but that combined upstream drought reserves would continue to grow and reach over 90,000 acre-feet. During the 20-year run more or less reserves were used to meet demand depending on the available river flows. Figure 3-10 shows TMWA's cumulative combined upstream storage over the 20 year simulation period.

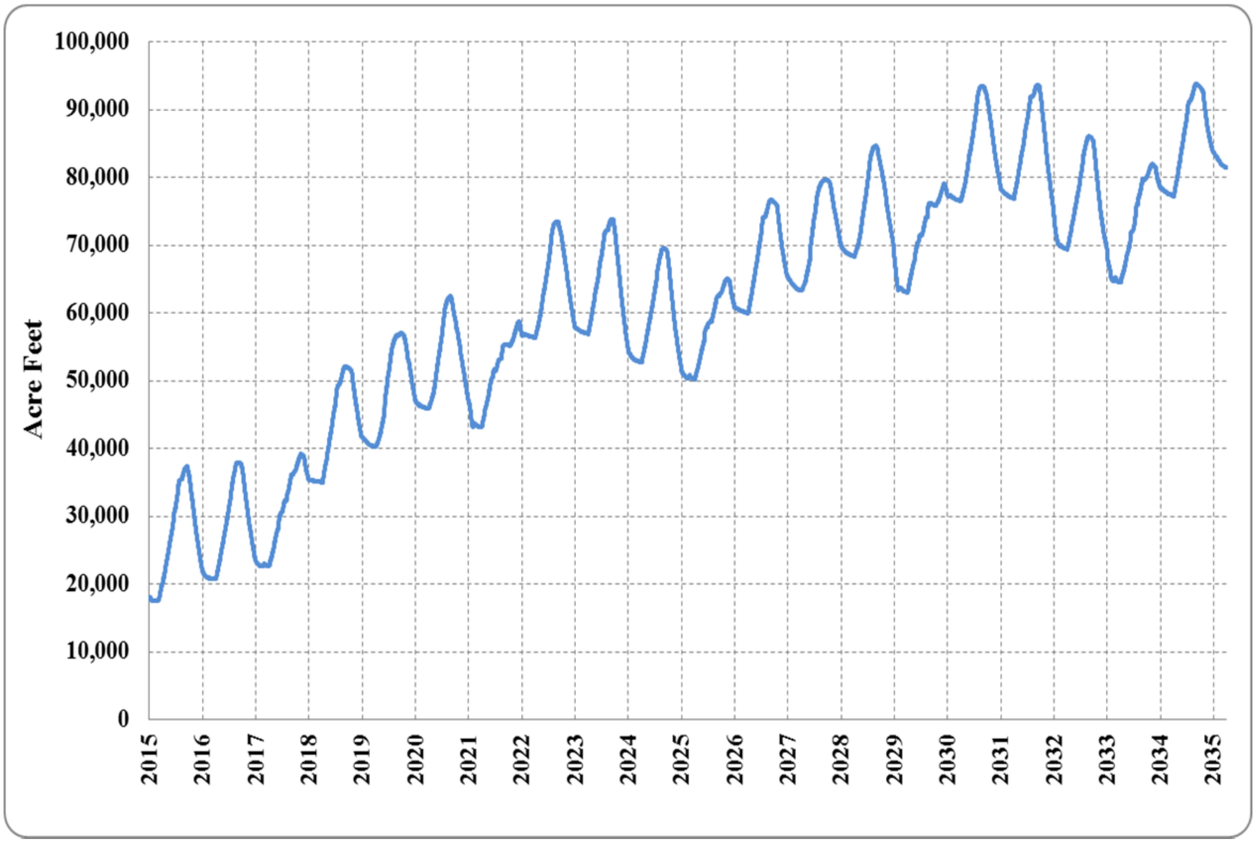


Figure 3-10. 20-Year Projected Drought Reserves Simulating Back-to-Back Hydrology of 1987-1994 plus 1987

The results show very clearly that under TROA the region's water supply is extremely resilient. When drought reserves are needed to supplement natural river flows during the peak summer demand months, storage is used during that period, but is quickly refilled over the course of the next winter and spring. By the time reserves may be for the following summer's demands, upstream reserves have been refilled and upstream reserves are in most years identical to the previous year's reserves, or in some cases, many times better.

Despite a repeat of 2015 hydrological conditions for 20 years following the four (4) driest years in recorded history (a statistically improbable scenario), TMWA's upstream reserves in the Repeat2015 scenario are not only sufficient, but actually increase throughout the planning horizon. The results once again illustrate the importance of the Truckee River Operating Agreement to this community. Figure 3-11 shows TMWA's projected cumulative reserves over the simulation period.

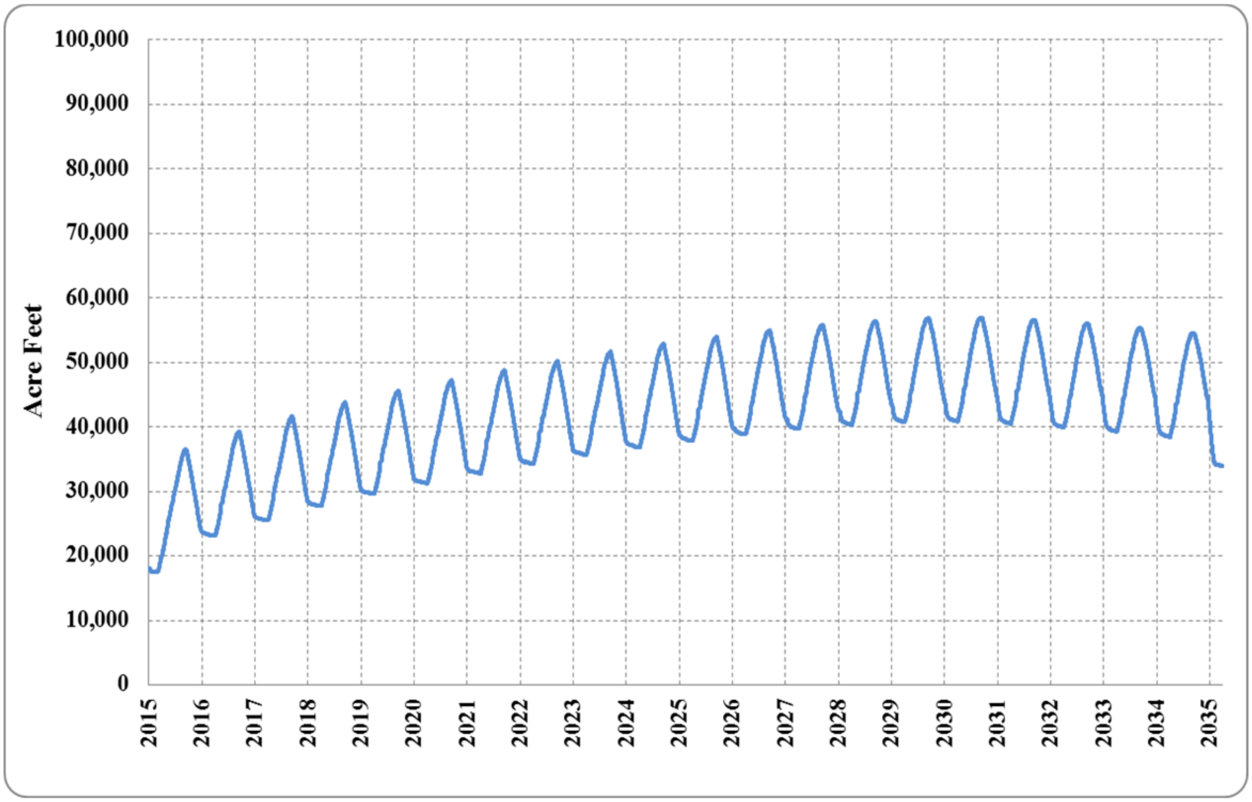


Figure 3-11. 20-Year Projected Drought Reserves Simulating 2015 Hydrology for 20 Years

The extreme robustness of TMWA's upstream drought reserves under the new Truckee River Operating Agreement is very evident. Three (3) statistically improbable hydrologic simulations were run to stress the system. One 9-year and two 20-year statistically improbable hydrological events were performed to demonstrate the robustness of TMWA's integrated management of it available water sources. In every case, upstream drought reserves, while released at one point or another throughout the course of the simulation, were not only more than adequate to meet TMWA's projected customer demand, but actually improved by the end of the model run. See Appendix 3-3 for reports on these scenarios.

Summary

This chapter has described TMWA's existing water rights and water production facilities. The key points of the analysis derived from conjunctively managing surface rights, groundwater rights, and water production facilities are:

- TMWA has sufficient water resources to meet the demands of current customers.
- Within the TROA/TRA and subject to future water-rights-market conditions, Truckee River water rights are available to take advantage of 119,000 AF of demand TROA provides.

- There are sufficient groundwater resources to meet current demands through the planning horizon within the non-TROA/TRA.
- Including 8,000 AF of NVIP groundwater resource, TMWA's combined pool of resources in the TRA is over 188,000 AF of decreed, converted irrigation, groundwater, and storage rights.
- Current production capacities are:

	TRA	non-TRA
Chalk Bluff	90.0 MGD	na
Glendale	33.0 MGD	na
Subtotal Surface	123.0 MGD	na
Groundwater	100.0 MGD	17.0 MGD
Total	223.0 MGD	17.0 MGD

- Aquifer recharge has improved or stabilized groundwater levels in and around the injection wells thereby preserving TMWA's ability to utilize its groundwater resources to meet summer peaking and/or drought situation pumping requirements without degrading groundwater quality.
- Drought year cycles are rare events, similar to flood events. The estimated drought frequencies are:

8-year	1 in 230 years
9-year	1 in 375 years
10-year	1 in 650 years

- Published tree-ring studies have shown a dry winter like 2015 occurs with a frequency of 1 in 3,100 years.
- Drought yield of TMWA's TRA existing resources is a function of available resources and drought-year design. Based on available data, the 1987 to 1994 Drought remains the worse drought of record for the Truckee River and is the design criteria for TROA.
- Under TROA, hypothetical droughts were analyzed: (1) 9-year simulation of 2012 to 2015 actual hydrology plus 5 year repeating 2015 annual hydrology; (2) 20-year simulation of 2012 to 2015 actual hydrology plus 1987 to 1994+1987 hydrology repeated twice; and (3) 20-year simulation of 2012 to 2015 actual hydrology plus 2015 hydrology repeated 20 years indicate TMWA has sufficient dry-year reserves to meet demands, and in many years during the drought period accumulates drought reserves under TROA operations.
- The 2015/2016 winter and subsequent 2016 run-off projections indicate a moderate recovery-year but not necessarily an end to the drought period begun in 2012.

References

2005-2025 Water Resource Plan, Truckee Meadows Water Authority, March 2003.

2010-2030 Water Resource Plan, Truckee Meadows Water Authority, December 2009.

CHAPTER 4 WATER DEMAND PROJECTIONS

Water demand was projected through the year 2035 to ensure that TMWA will have the necessary water resources and facilities to serve its service area population. Projected water demand is based on projected population and water service connections through the planning period. Projected water demand has four main components: (1) Residential demand, (2) Commercial demand, (3) Irrigation demand, and (4) System losses. Each of these components is projected using established historic water demand factors. The projections include estimates of land use consumption, growth in dwelling units and commercial buildings, and were developed in a four-step modeling process as follows:

- Future population is projected for Washoe County.
- The number of single-family buildings, multi-family dwelling units, and commercial buildings are projected as a function of the population projection.
- A relationship between active water services and buildings is developed to project number of new active water services, including water use coefficients which are estimated for each class of customers using historic billed water use.
- Combine the building projections with the water services and water use coefficients to create the total water demand projection.

Water Demand Factors

The total demand for water is dependent on three general demands or uses: (1) residential consumption of water for internal household purposes; (2) commercial consumption of water as an input to producing goods and services in the local economy (i.e., each business has a demand for water that is dependent of the type of business and the building that it occupies); and (3) residential and commercial consumption of water for irrigation purposes. The quantity of water used for irrigation purposes depends on the type and size of landscaping that is being maintained and the weather. During periods of warm or hot temperatures irrigation increases as the landscape requires more water and during periods of cooler temperatures and/or rain, less water is required.

Residential demand is characterized by the number of people living in the community and the type of dwelling units. As the number of persons increase one can expect an increase in dwelling units and thus an increase in the residential demand for water. As people live in a community, they create the need for jobs and the demand for goods and services. The commercial demand for water is dependent on the population, the health of the economy, and types of commercial enterprises. Most separate irrigation water services are installed at commercial property and multi-family complexes, as such the number of irrigation services can be projected as a function of multi-family services and commercial services.

The core variables that are used to project water demand are population, economic health, and land use / building patterns.

Population and Economy

Population growth and employment are an inter-related time-series. In general, the population of a community grows faster during periods of low unemployment as the prospects of new jobs are good[28] (i.e., unemployment rates below 6 percent) and grows slower during periods of higher unemployment. Employment is the primary variable affecting population growth as evidenced by historic events in Nevada.

Employment statistics for the State of Nevada have been collected since 1976. Figure 4-1 shows how employment and population are related for the State of Nevada. During the 1970's through 1987, Nevada saw relatively slow population growth as the unemployment rate was consistently above 6 percent. Starting about 1988, population grew at a faster rate as the unemployment rate was generally below 6 percent, and in some years fell to record lows of less than 4 percent unemployment. When the unemployment rate increased in 2006 and continued to increase rapidly to what are now record highs, population growth slowed to almost no growth beginning in 2008.

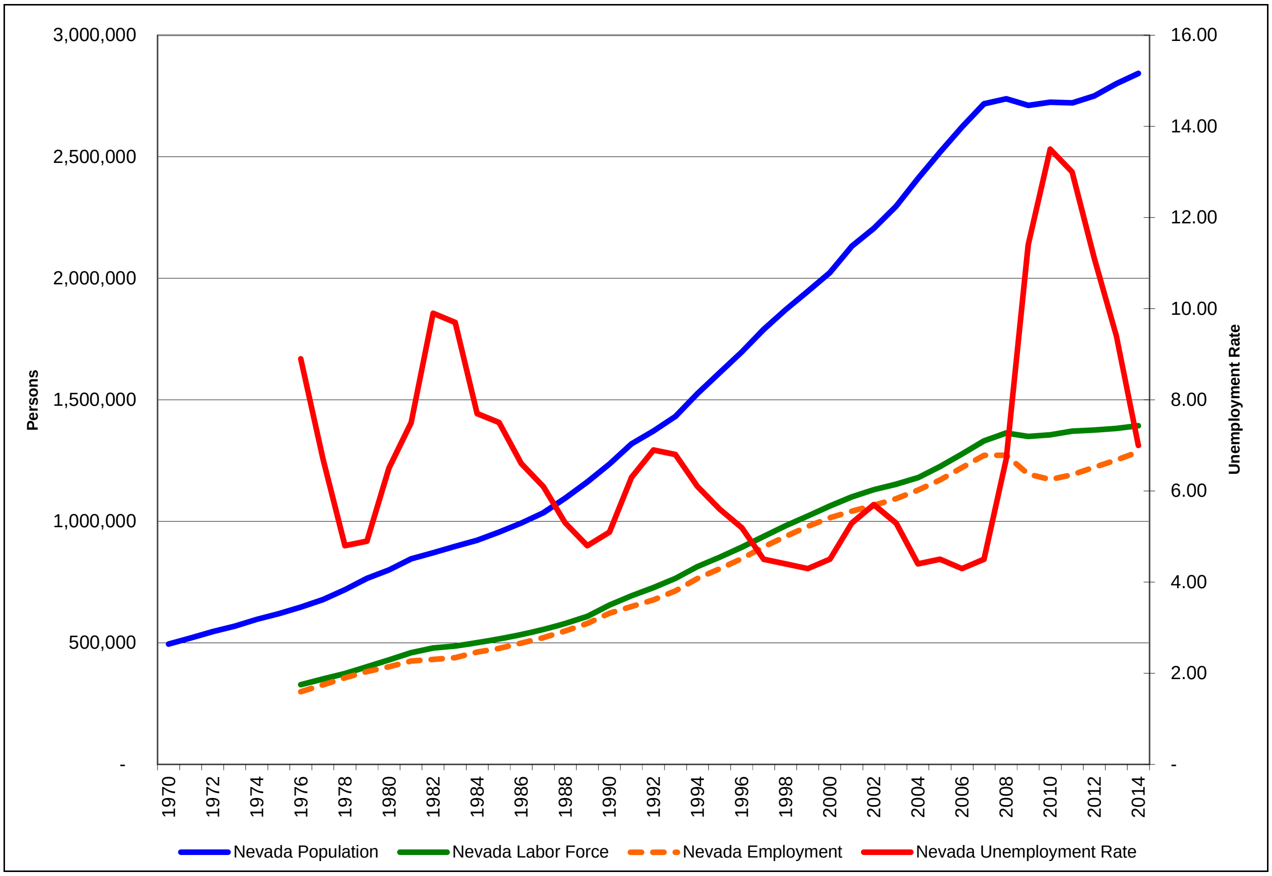


Figure 4-1. Nevada Population, Employment, and Unemployment 1970 to 2014

The employment trends in Washoe County are very similar to the State-wide trends shown above. Washoe County employment statistics from 1990 to 2009 are available from the

[28] In most regions an unemployment rate of 5 percent or lower is considered full employment.

Bureau of Labor Statistics. Figure 4-2 shows how the County experienced relatively stable population growth and low unemployment rates during the 1990's through 2006. Since late 2006, Washoe County has seen record unemployment rates and a flattening of the labor force that has translated into a period of slow population growth and a period of population contraction as people left the region in search of jobs.

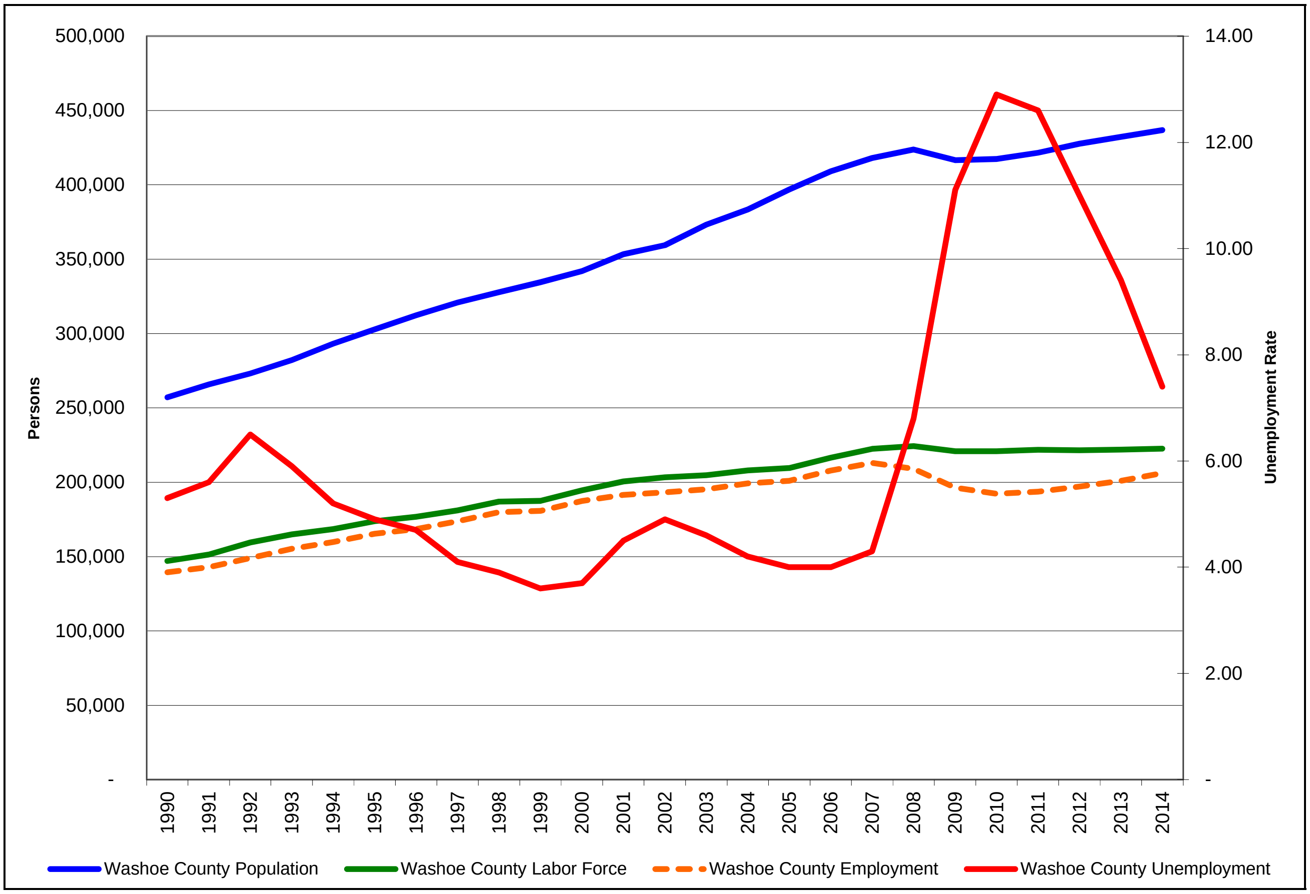


Figure 4-2. Washoe County Population, Labor force, Employment and Unemployment Rates 1990 - 2014

TMWA began using a logistic curve model of projecting population in its 2030WRP. The logistic curve model considers environmental and economic conditions to be implicit as opposed to an employment driven model that is directly dependent on employment data.

In developing a population projection, an important consideration is length of time period to be projected and available sources of data. This 2035WRP requires a projection through the year 2035. Ideally, the source data series should be at least 21 years and cover similar economic conditions. Annual population estimates for Washoe County are available for the years 1950 to 2014. This meets the need of a long time-series. This time-series covers the recessions of the 1970's and 1980's and the periods of high growth seen in the early 2000's.

Appendix 4-1 describes in detail the population model development, a summary of the population model, the logistic curve model, and its statistical properties; a brief description is included below.

Logistic Curve Model

Many of the extrapolation methods that can be used to project populations are not constrained by any limits on growth. This implies that population growth (or decline) can go on forever and in many cases this is not a reasonable assumption. The logistic curve, one of the best-known growth curves in demography, solves the resource constraint problem by including an explicit ceiling on population. It is a symmetric sigmoid shape (S-shape) curve that has an initial period of slow growth, followed by increasing growth rates, followed by declining growth rates that eventually approach zero as population size levels off at its upper limit. The idea of limits on growth is intuitively plausible and is consistent with many theories of population growth, geographic impediments such as public lands and unbuildable terrain, growth constraints created by water resources and government policies, and in-fill of existing vacant residential sites. The population model developed for Washoe County is called a Keyfitz (1968) curve and is described as:

$$Pop_t = \alpha / \left(1 + \beta 1 * e^{-\beta 2 * t}\right)$$

Where t is time index (1950 = 1), Pop_t is population in time t, α is population ceiling, $\beta 1$ and $\beta 2$ are shape parameters.

Using population values from 1950 to 2014 the model was estimated as:

$$Pop_t = 612{,}579.8 / \left(1 + 11.93398 * e^{-0.0536284 * t}\right)$$

Where "t" is time in years starting at t = 1 for 1950. The R^2 = 0.9995 shows that this model is a very good fit to the historic data. Figure 4-3 plots the estimation results of this model.

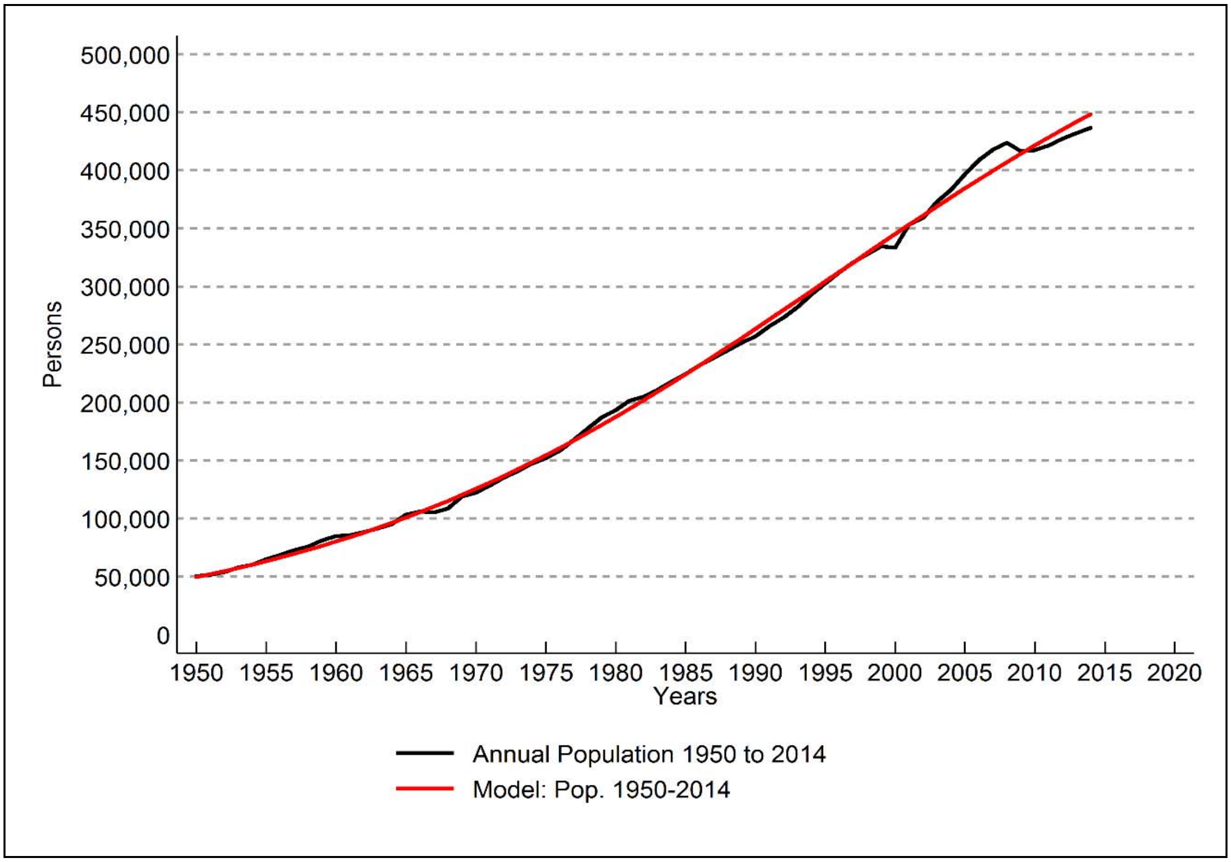


Figure 4-3. Population Logistic Curve Models Results

The results of the logistic model are shown in Figure 4-3. The model fits the data well and has a $R^2 = 0.99$. Figure 4-4 compares the model with the State Demographer's projection ("SDP") and the 2014 Consensus Forecast; the results of these three different models provide essentially the same projection through 2025.

The State Demographer's population projection is one of two other population projections produced locally for planning; the other projection is the Washoe County Consensus Forecast. The consensus forecast was last published by the Truckee Meadows Regional Planning Agency in 2014 based on data that was provided by TMWA, the State Demographer in early 2014 and two national sources Global Insight, and Woods and Poole. The national sources are based on slightly older data due to the nature of the time to provide a forecast on such a large scale. TMWA and the State Demographer are able to provide timelier forecast by using more locally derived data sources.

The Demographer's projections are based on the REMI model and were last published in the fall of 2014. The REMI model is based on economic data since 2001 and thus has a limited ability to project population during this recession but is based on detailed local employment and economic data and can be compared with the logistic model.

As shown in Figure 4-4, through the year 2025 there is no statistical difference between the logistic curves and the SDP. For the years 2025 to 2035 the SDP takes a more linear path and trends upwards. Since there is no statistical difference between the logistic curve and the SDP, (the SDP is contained entirely within the 95 percent confidence interval), the logistic curve model is used as the population model for this 2035WRP.

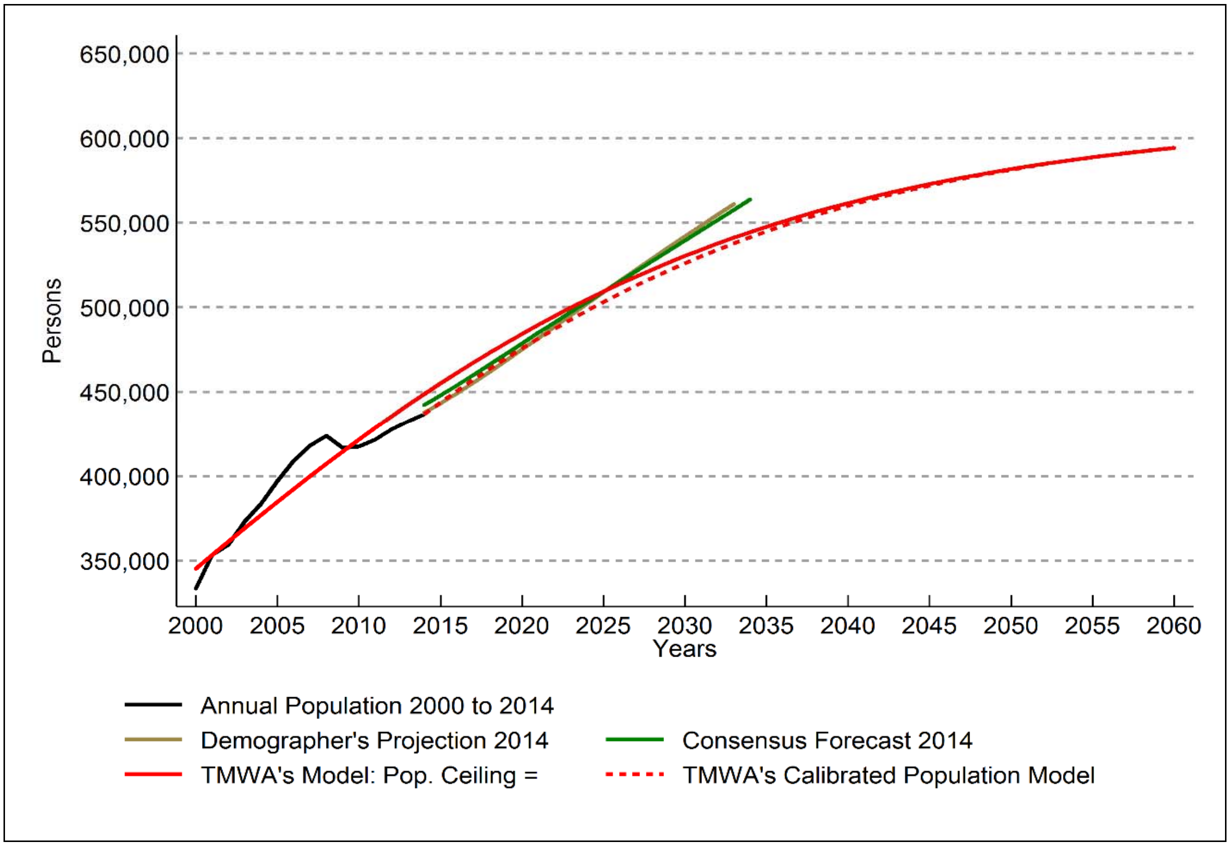


Figure 4-4. Comparison of Logistic, Demographer's, and Consensus Projections

Figure 4-5 shows the population projected to 2100 and compares the general trend with the SDP and the historic data used to estimate the model. The projected county population is expected to level out over time consistent with a logistic curve growth model. This model estimates the long-run population ceiling of 612,579 persons estimated to occur after 2100 with a 95 percent confidence interval of 576,493 to 648,666 persons.

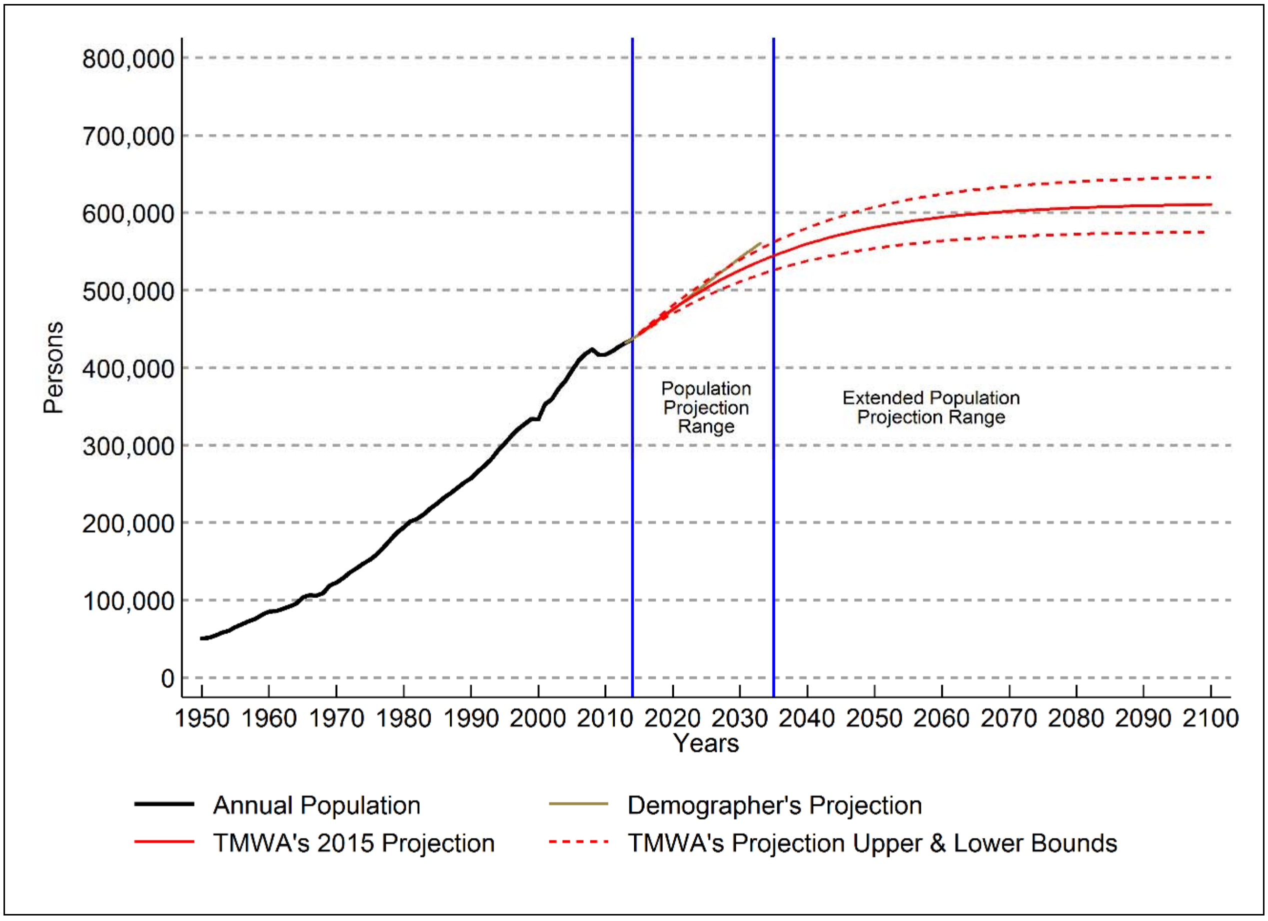


Figure 4-5. Population Projection Results

Table 4-1 provides the Washoe County projections for 2015 to 2060 to be used as the basis for the water demand projection. Washoe County is projected to gain a total of 150,630 persons between 2016 and 2035. This represents a 33.9 percent increase in population with an annual average increase of 0.65 percent.

Table 4-1. Population Projections 2015 to 2060

	Washoe County	TMWA (TRA+non-TRA)		Washoe County	TMWA (TRA+non-TRA)
	-----a-----	-----b-----		-----c-----	-----d-----
2015	443,729	386,752	2038	554,358	483,278
2016	450,488	392,607	2039	557,241	485,708
2017	457,072	398,383	2040	559,995	488,085
2018	463,476	403,965	2041	562,624	490,398
2019	469,699	409,397	2042	565,133	492,545
2020	475,740	414,720	2043	567,526	494,637
2021	481,596	419,797	2044	569,807	496,646
2022	487,267	424,740	2045	571,981	498,606
2023	492,754	429,457	2046	574,052	500,363
2024	498,058	434,052	2047	576,024	502,057
2025	503,178	438,515	2048	577,901	503,752
2026	508,118	442,905	2049	579,688	505,389
2027	512,879	447,048	2050	581,387	506,785
2028	517,463	451,094	2051	583,003	508,225
2029	521,874	454,825	2052	584,539	509,457
2030	526,115	458,450	2053	585,999	510,795
2031	530,188	462,016	2054	587,387	512,116
2032	534,099	465,610	2055	588,705	513,095
2033	537,850	468,748	2056	589,956	514,356
2034	541,445	472,037	2057	591,145	515,373
2035	544,890	474,929	2058	592,273	516,199
2036	548,187	477,712	2059	593,344	517,261
2037	551,342	480,497	2060	594,359	518,160

The disaggregation of population within TMWA's retail and its one wholesale area and the balance of the county is a function of the location of dwelling units. An analysis of land use and distribution of the buildings in the different utility service areas and hydrographic basins provide the base data for projecting dwellings, commercial buildings, and the general consumption of land.

Data Construction and Trends

The Washoe County population is projected using a time-series from 1950 to 2014. Since no formal similar time-series for land use or building construction in Washoe County exists, it was constructed using information embedded in the County Assessor's data files. The County Assessor is the only source of detailed land use and building inventory for the entire county. A July 2014 snapshot of the assessor's data was downloaded from Washoe County's website for use in developing the projection of land consumption and building structures. The data provides a very detailed snapshot of what is known about each parcel and buildings that currently exist on each parcel. This database, when combined with a GIS parcel boundary database provides sufficient information for developing building(s) and dwelling unit history that can be used as part of the water demand projections.

Using a GIS application, each parcel was attributed with a utility service area and hydrographic basin. In this manner the database was used to model Washoe County land use, dwelling unit history, profile and distribution, and the distribution and development of commercial buildings. Figure 4-6 shows the constructed historic data from 1955 to 2014, historic population, and the general trend in persons-per-dwelling unit. The persons-per-dwelling unit is used to disaggregate the population into utility service areas and hydrographic basins. The construction of the persons-per-dwelling unit time-series was possible because of the long-life of buildings. The statistical models of dwellings and building presented below uses data from 1955 to 2014 due to a stable statistical relationship between numbers of dwellings to growth in population during that time span.

The Assessor's building data is reclassified into four classes that map to TMWA's customer classes. Dwelling units on domestic wells, while not served by any utility, are accounted for in the projection. Single-family dwelling units (generally single family homes, townhouses, or condominiums) are serviced under the TMWA Residential Metered Water Service ("RMWS") rate class. Multi-Family dwelling units are apartments, duplexes, and any multi-family structure that would be billed on TMWA's Multi-family Metered Water Service ("MMWS") rate. Last is the commercial building group which includes any non-residential buildings that would receive water on the General Metered Water Service ("GMWS") rate. Figure 4-6 and Figure 4-7 show the data used for the models and the projected units.

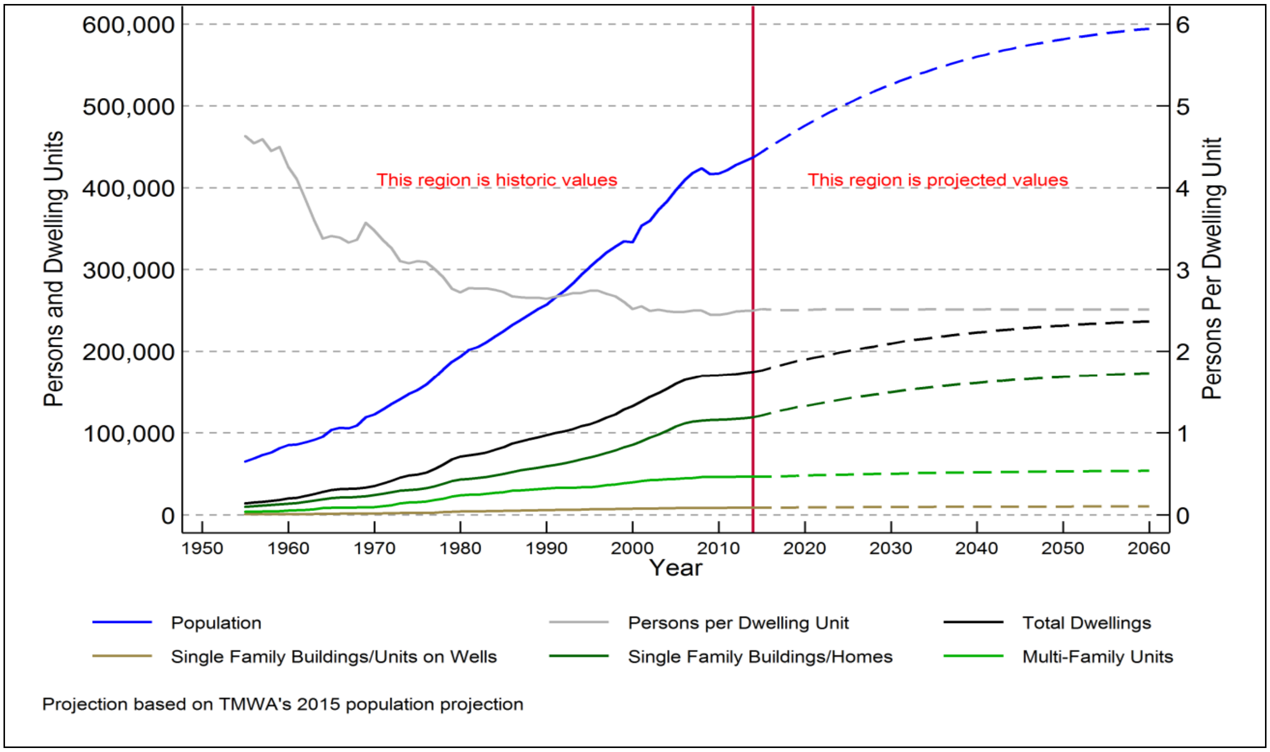


Figure 4-6. Washoe County Population, Dwelling Data and Projected Values

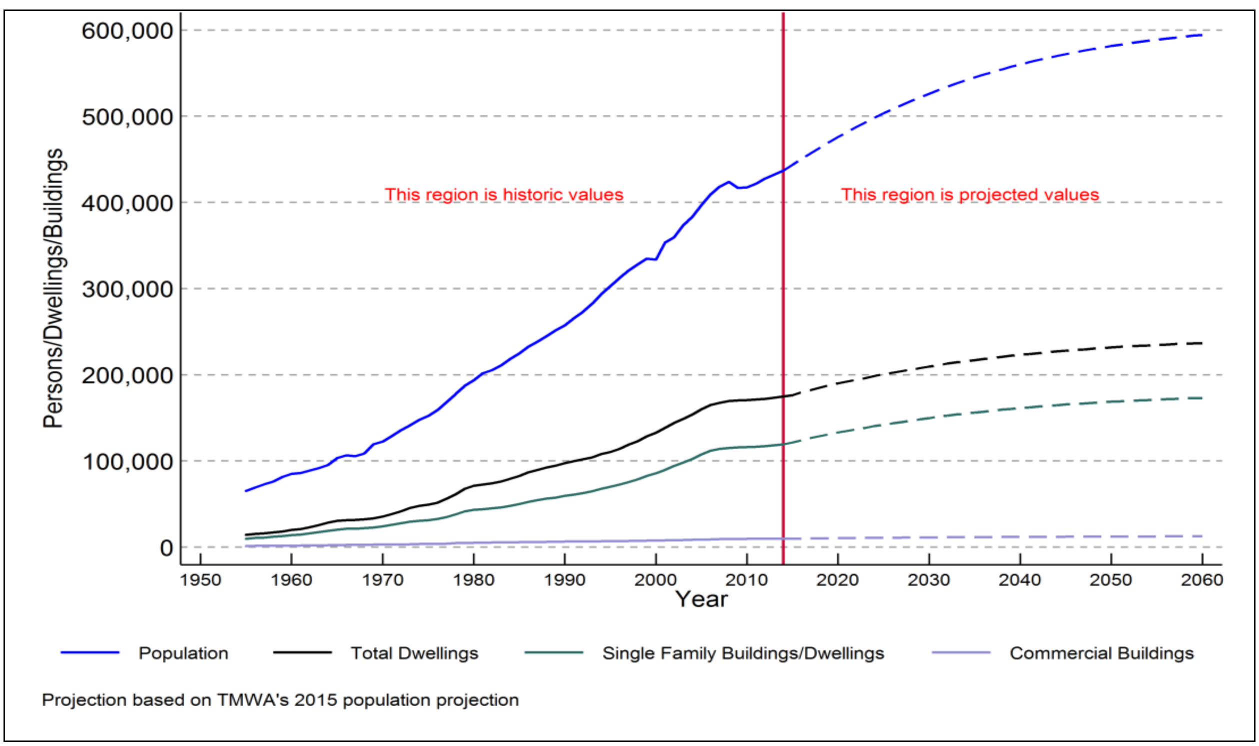


Figure 4-7. Washoe County Commercial Buildings Data and Projections

As a component of the model for dwelling units, Figure 4-8 shows the development of land over time and the projected amount of land that is projected to be developed through 2060.

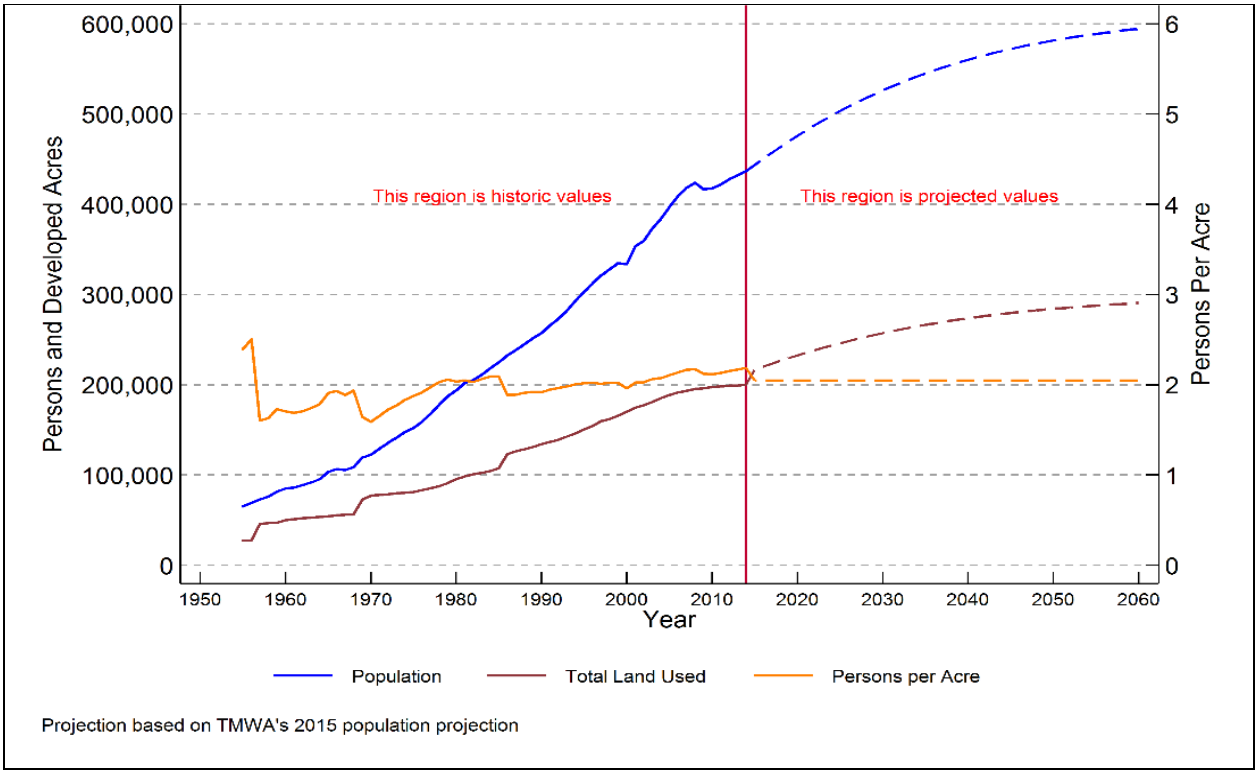


Figure 4-8. Washoe County Land Development Data and Projection

Statistical Analysis

Residential housing is the largest use of land, thus the development of land was best explained by trend of population over time. Figure 4-8 shows the projected development of land and the resulting persons per developed acre. The stock of single-family buildings, multi-family dwelling units and commercial buildings in a given year is related to prior changes in population, number of new buildings constructed and current inventory of dwelling units.

Population is an exogenous variable to the building model. When population projections change then the building projections will change in response to the new population projections. This modeling process uses a vector autoregression model ("VAR"). The three classes of dwelling units and commercial buildings are inter-related and dependent on past values of each class along with current and past population values. A VAR is a common statistical method for modeling multiple variables that are related through time; the full statistical analysis is presented in Appendix 4-2.

This model estimated the relationship between dwellings on wells, single-family dwellings, multi-family units and commercial buildings with population from the population projection model. The final step is to estimate the trend in land development as a function of population over time. To summarize, the modeling process:

- Population is projected using a logistic curve model.
- Single-family homes, multi-family dwelling units and commercial buildings are modeled and projected as a function of past and projected population using a VAR model.
- Land development is projected as a trend of past and projected population.

The persons-per-dwelling unit and persons per developed acre are used as a measure of model quality. The population densities display how well the models are meeting the needs of the projected population. If the model is performing well at modeling the past trend, then there should be little change in the trends in the densities.

Persons-per-dwelling unit has remained stable since 1980 and the resulting projected dwelling units maintain the mix of units that will meet the future population needs. The persons-per-dwelling-unit is also used as the means to allocate county population to county sub-areas based on projected new dwelling units in a sub-area.

The county projection is disaggregated into sub-areas listed here.

Utility Service Areas

ID Code	Name
TR	TMWA Retail Area
SV	TMWA Wholesale (Sun Valley)
WC	Washoe County (Non-TMWA)

Hydrographic Basins

ID Code	Name
083	Tracy Segment
085	Spanish Springs
086	Sun Valley
087	Truckee Meadows
088E	Pleasant Valley East
088W	Pleasant Valley West
089	Washoe Valley
091	Truckee Canyon
092	Lemon Valley
000	All Other Basins in County

Sub-area projections are derived from the County total projection using a ratio share analysis that allows for trends in the area shares over time, while requiring the sum of the shares to always equal 1. This ensures that in any projection year the sum of the sub-areas will always equal the County total.

Figure 4-9 and Figure 4-10 show the disaggregation of population, units and commercial buildings for TMWA retail area and the one wholesale service area. It is these values that form the basis for the water demand projections.

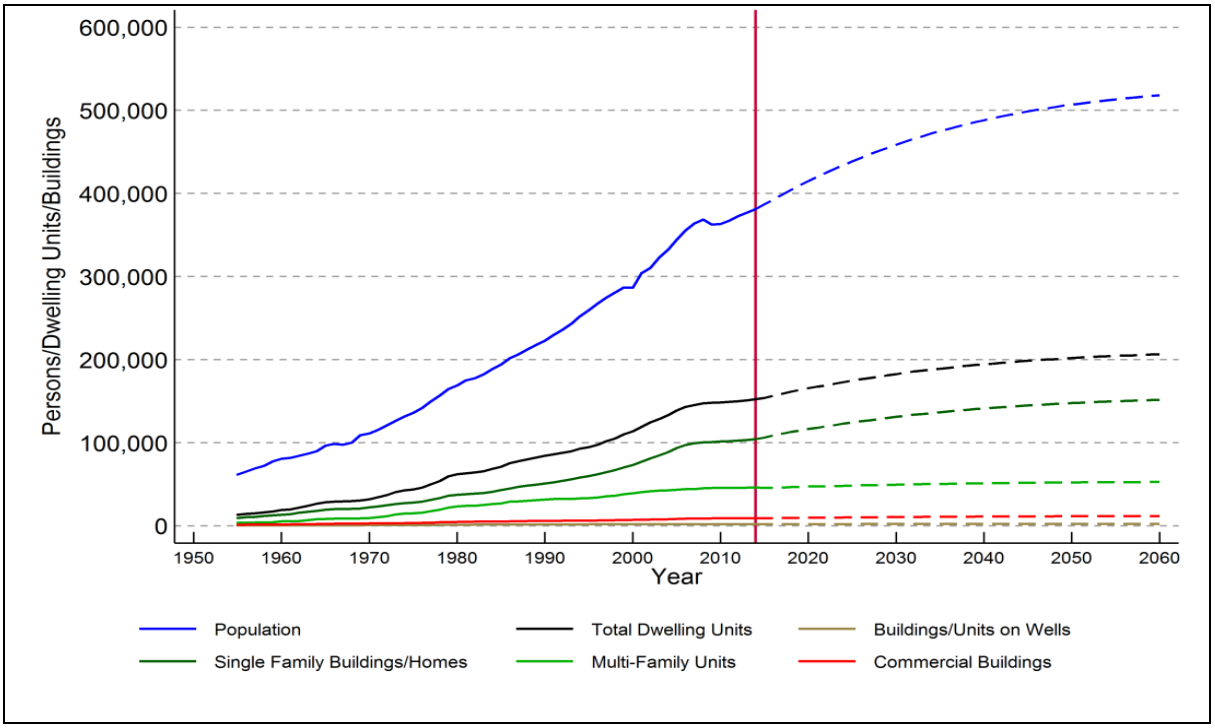


Figure 4-9. Dwelling Units and Commercial Buildings in TMWA's Retail Service Area

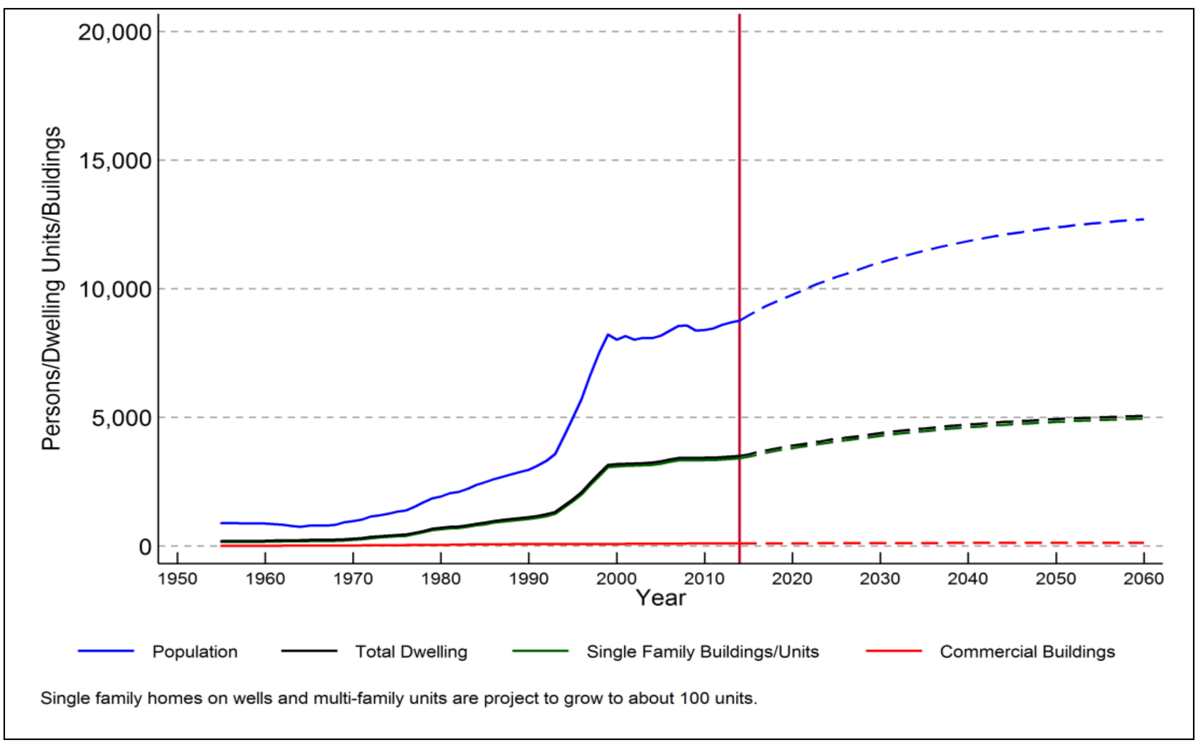


Figure 4-10. Dwelling Units and Commercial Buildings in TMWA's Wholesale Service Area (SVGID)

Water Demand Projections

In order to estimate the water service projections over the next 20 years, the analysis relies on a time-series of the building information within the service area from 2009 to 2014. In some instances the Assessor's data does not match TMWA's billing records due to differences in how the data was recorded or potential data entry errors. For example, not every parcel and building is served by TMWA and some buildings or properties may have more than one water service. To translate the dwelling and building projections into actual water services, an adjustment factor, based on the historic building data, is applied to each water service class.

To estimate the coefficients for water demand, by service class, the analysis considers water usage over the same 5 year period (2009 to 2014). This truncated analysis was done to account for the fact that the majority of TMWA's current customers have transitioned to a metered rate schedule in that timeframe. Since nearly all flat-rate customers have transitioned to metered rate, water demand projections are only made for metered-water service. The small number of remaining flat-rate services are pending the installation of a meter and thus will be considered a metered service moving forward. Moreover, it also reflects any recent physical changes to the structure which the service provides (e.g., an average reduction in the lot size, changes in preferences for landscaping, increased water efficient practices, etc.). This consideration also allows the estimates to capture any recent trends in the regional climate (e.g., increased temperature and weather variability). More a full description of how the water demand projections are estimated, see Appendix 4-3.

The results of this analysis indicate over the next 20 years:

- Total demand for water is projected to increase approximately 81,700 AF in 2015 to 101,400 by 2035.
- 95 percent of single family residences may be served by a single service under RMWS, the remainder may share a RMWS service or be on an individual domestic well.
- 75 percent of all future commercial buildings may be served under a single GMWS service while the remaining 25 percent may share a GMWS service.
- Metered residential services (RMWS and MMWS) account for 70 percent (or 62 percent and 8 percent, respectively) of the total projected demand through 2035.
- The RMWS share of total demand is expected to increase by 2 percent while the shares of total demand by MMWS, GMWS, and MIS are expected to decrease by less than 1 percent.

For the RMWS and GMWS classes, counts on total number of water services and total buildings for each year between 2009 to 2014 are divided to compute a ratio of active water services to buildings. For MMWS, active service ratios are computed by dividing the service counts by total number of multi-family dwelling units. Table 4-2 provides the active service ratios for RMWA, MMWS, and GMWS between 2009 and 2014.

Table 4-2. Active Water Service Ratios per Year

Year	Average Number Multi-Family Units (MMWS)	Ratio of Active: Single Family Units (RMWS)	Ratio of Active: Multi-Family Units (MMWS)	Ratio of Active: Commercial Units (GMWS)
	----a----	----b----	----c----	----d----
2009	10.12	0.85	1.10	0.73
2010	10.27	0.87	1.14	0.73
2011	10.26	0.87	1.12	0.73
2012	10.23	0.88	1.08	0.73
2013	10.23	0.89	1.09	0.73
2014	10.21	0.89	1.09	0.73
2015	10.20	0.90	1.13	0.74

For MIS, which do not have a direct counter-part (building count) in the Assessor's data, service ratios cannot be projected using the method described above. However, MIS are typically attached to either multi-family complexes or commercial properties; therefore, a regression model of MIS services, as a function of MMWS and GMWS, is used to estimate coefficients on the ratio of active MIS. The regression coefficients are interacted with the active service projections for MMWS and GMWS to project active MIS. The projected services between 2015 and 2035 are displayed by service class in Table 4-3.

Table 4-3. Current and Projected Active Retail Water Services 2015 - 2035

Year	Single Family Units (RMWS)	Multi-Family Units (MMWS)	Commercial Units (GMWS)	Metered Irrigation Services (MIS)	Total Services
	----a----	----b----	----c----	----d----	----e----
2015	103,438	4,955	6,714	3,539	118,646
2016	105,854	4,977	6,792	3,570	121,193
2017	108,066	4,991	6,891	3,604	123,552
2018	109,954	5,049	7,011	3,658	125,672
2019	111,699	5,102	7,091	3,697	127,589
2020	113,328	5,135	7,143	3,724	129,330
2021	114,877	5,154	7,183	3,741	130,955
2022	116,458	5,154	7,237	3,757	132,606
2023	118,090	5,175	7,318	3,787	134,370
2024	119,730	5,211	7,406	3,825	136,172
2025	121,164	5,242	7,480	3,856	137,742
2026	122,437	5,283	7,537	3,884	139,141
2027	123,698	5,304	7,574	3,903	140,479
2028	124,985	5,312	7,614	3,916	141,827
2029	126,369	5,332	7,670	3,939	143,310
2030	127,740	5,351	7,736	3,964	144,791
2031	128,982	5,381	7,806	3,994	146,163
2032	130,105	5,417	7,861	4,022	147,405
2033	131,096	5,435	7,901	4,039	148,471
2034	132,058	5,453	7,934	4,054	149,499
2035	133,080	5,463	7,967	4,067	150,577

NOTE: One wholesale (LVS) customer is included in the total.

Coefficients on the average water use per service class, presented in Table 4-4, are calculated using an average of the average annual water use for each hydrographic basin within the TMWA retail service by basin, between 2009 and 2014. This "averaged" average is used to compensate for variation in the weather conditions as well as changes in the number of active water services, per year.

Table 4-4. Average Water Use Per Service (units x1,000 gallons)

HydroBasin	Average*	GMWS	MIS	MMWS	RMWS
----a----	----b----	----c----	----d----	----e----	----f----
083	149.574				
085		326.897	1140.281	359.942	161.962
086		171.500	735.500	191.033	98.797
087		632.300	895.303	421.011	144.493
088E					254.778
088W		301.545	1036.000		262.587
089		375.800	118.000		368.748
092		600.937	849.244	636.457	110.447

* Average use in smaller basin service areas

By multiplying the averaged water use by the projected number of services, the result is a water demand forecast, by service type. Table 4-5 presents the water demand forecasts for each service class, the system loss and total production.

Table 4-5. Projected Retail Water Use by Class Through 2035 (in acre feet)[29]

	RMWS	MMWS	GMWS	MIS	LVS	Subtotal	System Loss	Total Production
	----a----	----b----	----c----	----d----	----e----	----f----	----g----	----h----
2015	46,252	6,494	12,716	9,777	1,869	77,108	4,626	81,735
2016	47,332	6,523	12,864	9,860	1,903	78,481	4,709	83,190
2017	48,321	6,541	13,050	9,952	1,937	79,801	4,788	84,589
2018	49,165	6,617	13,277	10,101	1,972	81,131	4,868	85,999
2019	49,945	6,687	13,429	10,209	2,007	82,277	4,937	87,213
2020	50,674	6,730	13,527	10,283	2,043	83,259	4,996	88,254
2021	51,366	6,755	13,604	10,330	2,080	84,136	5,048	89,184
2022	52,074	6,755	13,707	10,374	2,118	85,028	5,102	90,129
2023	52,803	6,782	13,860	10,458	2,156	86,058	5,163	91,221
2024	53,537	6,829	14,026	10,563	2,195	87,150	5,229	92,379
2025	54,178	6,870	14,167	10,649	2,234	88,098	5,286	93,383
2026	54,747	6,924	14,275	10,726	2,274	88,947	5,337	94,283
2027	55,311	6,951	14,345	10,779	2,315	89,701	5,382	95,083
2028	55,886	6,962	14,420	10,814	2,357	90,440	5,426	95,866
2029	56,504	6,988	14,526	10,879	2,399	91,296	5,478	96,774
2030	57,118	7,013	14,651	10,947	2,443	92,172	5,530	97,703
2031	57,673	7,052	14,784	11,030	2,486	93,026	5,582	98,608
2032	58,175	7,099	14,888	11,108	2,531	93,802	5,628	99,431
2033	58,619	7,123	14,964	11,155	2,577	94,438	5,666	100,105
2034	59,049	7,147	15,027	11,196	2,623	95,042	5,703	100,745
2035	59,506	7,160	15,090	11,232	2,670	95,658	5,739	101,398

[29] System losses are estimated at 6 percent based on review of production and to metered consumption.

Figure 4-11 shows the projected retail water sales and provides a graphical view of the projected trends by service class. Of note is the slowdown of growth that starts after 2035. This is directly related to the slowing of population growth in these later years.

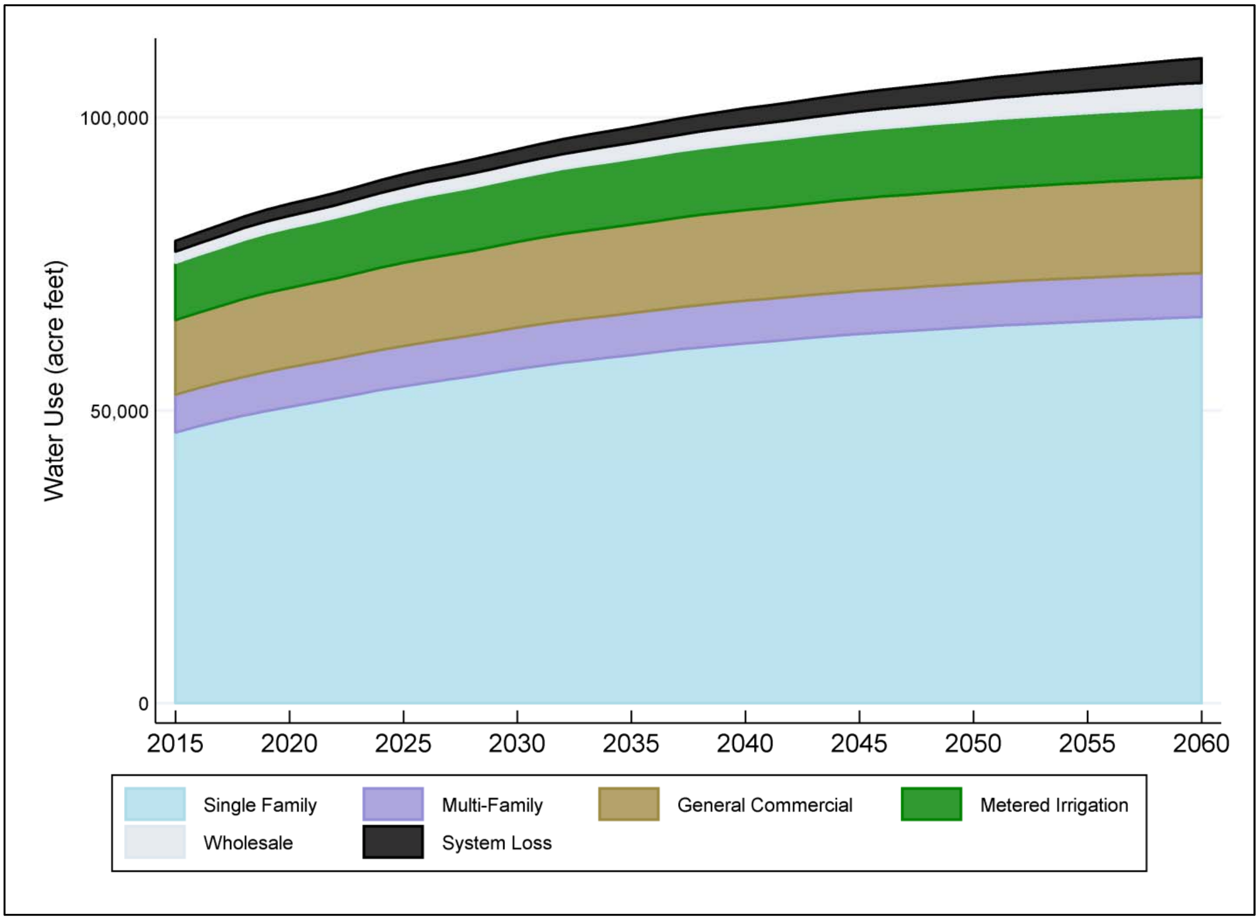


Figure 4-11. Projected Retail Water Use by Class Through 2060

Table 4-6 presents the projected water production within the TRA and non-TRA by hydrographic basin. The system loss is calculated using an estimate of 6 percent of the total demand.

Table 4-6. Projected Retail Water Use Through 2035 by Hydrographic Basin

	TRA						non-TRA				
	Spanish Springs	Sun Valley	Truckee Meadows	Pleasant Valley-West	Lemmon Valley	Subtotal	Tracy Segment	Pleasant Valley-East	Washoe Valley	Subtotal	TOTAL
	85	86	87	88	92A & 92B		83	88	89		
	----a----	----b----	----c----	----d----	----e----	----f----	----g----	----h----	----i----	----j----	----k----
2015	8,917	221	62,115	1,020	4,294	76,567	26	55	136	217	76,784
2016	9,115	225	63,161	1,044	4,378	77,923	26	56	140	222	78,145
2017	9,298	229	64,180	1,065	4,452	79,224	27	56	144	227	79,450
2018	9,460	236	65,241	1,083	4,526	80,546	28	57	146	230	80,776
2019	9,605	239	66,136	1,101	4,590	81,671	28	58	148	234	81,905
2020	9,740	242	66,879	1,117	4,650	82,628	29	59	150	238	82,866
2021	9,864	244	67,536	1,133	4,699	83,476	29	60	152	240	83,716
2022	9,994	247	68,201	1,148	4,753	84,343	29	61	154	244	84,587
2023	10,131	251	68,993	1,163	4,811	85,349	30	62	155	247	85,595
2024	10,272	254	69,837	1,180	4,874	86,417	30	63	157	250	86,667
2025	10,392	257	70,572	1,194	4,926	87,340	30	64	160	254	87,594
2026	10,495	259	71,227	1,206	4,976	88,163	31	64	162	256	88,420
2027	10,601	261	71,785	1,219	5,017	88,884	31	65	162	258	89,142
2028	10,703	264	72,333	1,232	5,059	89,590	31	65	164	260	89,850
2029	10,824	267	72,976	1,244	5,107	90,418	32	66	165	263	90,681
2030	10,934	269	73,640	1,259	5,158	91,260	32	67	169	268	91,528
2031	11,039	272	74,294	1,271	5,207	92,083	32	68	171	271	92,354
2032	11,134	274	74,890	1,281	5,248	92,826	32	68	173	273	93,099
2033	11,219	275	75,354	1,291	5,283	93,422	33	69	174	275	93,697
2034	11,295	277	75,797	1,300	5,318	93,988	33	69	175	277	94,264
2035	11,377	279	76,243	1,310	5,354	94,563	33	70	176	279	94,843

Summary

This chapter included TMWA's population forecast, building projections, water demand forecast, and factors impacting the demand forecast. The results are summarized:

- A long term population projection through 2060 is developed using historic county population estimates from 1950 to 2014.
- TMWA's population forecast was found to be statistically similar to the 2014 SDP for Washoe County.
- Washoe County population is expected to see an average annual growth of 1.17 percent and a total population increase of over 101,000 persons from approximately 443,700 persons in 2015 to 551,300 by 2035.
- Based on expected growth, over 150,000 active water services are projected for the year 2035.
- Average water use, per service, is calculated based on usage data between 2009 to 2014. This approach captures recent changes in 1) TMWA's billing structure; 2) average physical attributes of services; and 3) the climate.
- Interacting average water usage with active service projections yields water demand projections through 2035.
- Total demand for water within is projected to increase approximately 83,000 in 2016 to 101,000 by 2035.
- Analysis of population and building trends show water demand increasing *at a decreasing rate* between 2015 and 2035 (i.e., while new growth will increase total production, per-service usage is expected to decline through time).

CHAPTER 5 WATER CONSERVATION PLAN

Introduction

In the arid Western U.S., water is a scarce resource necessary not only for the well-being of a community's inhabitants, but also for the ecologic and economic vitality of a region. Nevada, and of interest to this plan, Washoe County, is characterized as a high desert environment that is in a constant state of drought, intermixed with brief periods of wet conditions. Such conditions imply efficient water use is not a concept that applies only during dry times, but is rather a way of life in Northern Nevada.

As the water purveyor for approximately 90 percent of Washoe County residents, TMWA has a substantial responsibility as a steward of the region's water resources. In southern Washoe County, the majority of the water resources come from seasonal snow melt that flows down the Truckee River. From year-to-year, the amount of snow melt can fluctuate greatly. In response to these climatic conditions, a robust conservation plan must be in place to successfully manage water supply and demand so that there exists an adequate bank of water reserves available during persistent dry hydrology conditions.

Water conservation is achieved through efficient storage and delivery of the water supply and effective management of demand for that supply. Water supply management has been defined as the control of the water supply by the water purveyor or authority (Stephenson, 2012). Water demand management has been defined as "the development and implementation of strategies, policies, measures, or other initiatives aimed at influencing demand, so as to achieve efficient and sustainable use of this scarce resource" (Savenije and van der Zaag, 2002). TMWA's conservation plan contains the necessary elements to manage both the supply of its water resources as well as demand for those resources. TMWA's conservation plan has two components: 1) supply-side management programs ("SMPs") designed to reduce production and distribution losses and 2) demand-side management programs ("DMPs") designed to conserve water supplies by limiting water waste, inefficient use, and overuse. TMWA's SMPs are actions taken to maintain water resources and provide alternative sources to potable water in a cost-effective manner, as well as to ensure water is delivered to customers in an efficient manner. Once delivered, TMWA's DMPs target customers' watering practices in order to promote efficient use. During periods of extended drought, TMWA's DMPs can be enhanced to promote further reduction in water consumption by its customers. This chapter discusses TMWA's Conservation Plan and how its SMPs and DMPs are used in response to non-drought and drought periods based on annual projected hydrologic conditions.

To support the many benefits of effective conservation, the target goals of TMWA's conservation plan include:

1. Minimizing source water supply disruptions
2. Preserving community and customers' landscaping assets
3. Maintaining a low cost of service
4. Ensuring environmental preservation

Minimizing Source Water Supply Disruptions

When there is not enough Truckee River water to be shared between TMWA and other water rights stakeholders in the region, the priority of water rights dictates the amount of water provided to each stakeholder. TMWA is the largest holder of senior Truckee River irrigation water rights on the Truckee system. However, when the natural flow in the river is not able to provide adequate quantities of water for consumption, reductions in water use can decrease the amount of water to be released from TMWA's upstream and underground reserves. By banking or storing water in reservoirs when allowed under certain river operations, TMWA can minimize, if not prevent, supply interruptions to its treatment plants.

At the water user level, there are steps customers can take to ensure their water services are uninterrupted. When pipes break or leaks occur, not only is it an inconvenience to the customer, it wastes water in the process. TMWA is committed to ensuring its water delivery system stays up-to-date and in good working order. Also, TMWA takes every opportunity to educate customers on how to inspect and maintain their water systems on their property so the water stays on.

Preserving Community and Customers' Landscaping Assets

Property characteristics associated with landscaping add substantial economic value to the property. Government entities and property owners invest significant amounts of time and money in landscape-related assets, both at the time of installation and its ongoing maintenance. Developed land is required by local ordinances to meet specific landscape requirements as part of the building permit process. TMWA requires a sufficient amount of water rights be dedicated for each new development and meet its obligation to serve water to the property in perpetuity. TMWA's Conservation Program is designed to promote efficient demand in general and lower demands during periods of drought, without requiring customers to sacrifice their investment in their landscape assets.

Maintaining a Low Cost of Service

The facility and operating costs to capture, treat and deliver water are the main components that determine the amount customers pay for service. While the majority of costs related to water production are fixed (i.e., there is a very high initial capital cost), there is a portion of that cost associated with system repair and maintenance that can vary annually. When demand for water is efficient, an optimal amount of water is produced and delivered. With optimal supply through the delivery system, wear and tear on the system's components (e.g., pumps, valves, pipes, meters, etc.) is minimized, prolonging their lifecycle. Capital improvement projects ("CIPs") designated to replace aging parts of the system are part of TMWA's supply-side management. Therefore, through effective demand-side management, TMWA is able to keep the associated supply-side management costs low, which in turn provides stable prices to its customers over time[30].

[30] Since 2002, on average, TMWA's per unit cost of service has increased by 13 percent, an increase less than the national average of 31.6 percent adjusted for inflation

Ensuring Environmental Preservation

Maintaining adequate surface flows within the Truckee River has benefits above meeting customer demand. Higher river flows have benefits to the riparian ecosystem as well[31]. A variety of wildlife species, such as the Cui-ui and Lahontan Cutthroat Trout, depend on the habitat of in Lake Tahoe, along the Truckee River, and its terminus, Pyramid Lake. In times of drought, natural river flows are diminished, which has adverse impacts on native species of fish and other wildlife that rely on the riparian system. By conserving water, upstream reservoirs stay fuller longer. This additional storage allows TMWA to ensure river flows are supplemented during times when the level of Lake Tahoe cannot provide sufficient outflow, which indirectly benefits the riparian habitat along the Truckee River.

TMWA's Water Conservation Plan

TMWA's conservation plan extends beyond a responsibility for resource stewardship and must fulfill specific provisions—including water conservation requirements per the JPA, the NRS, regional planning, and TROA. Under NRS 540.131, every water purveyor in Nevada must submit a water conservation plan to the State. This plan must include provisions related to: 1) increasing public education awareness; 2) encouraging reductions in the size of lawns and use of drought-tolerant plants; 3) managing for leaks in the supply system; and 4) increasing the reuse of effluent water. TMWA's current Conservation Plan's contains DMPs and SMPs that meet these requirements (Fig. 5-1). Figure 5-1 provides a diagram illustrating how various elements of TMWA's Conservation Plan meet these NRS requirements (NOTE: expansion of TMWA's water resources (i.e., wells and groundwater supplies) are discussed in Chapters 2 and 6).

The statute also mandates a contingency plan be in place to ensure potable water is available during drought conditions and a schedule for how such a plan will be implemented. The end of this chapter outlines TMWA's Drought Response Plan, which provides how TMWA classifies drought conditions pursuant to TROA, the enhanced DMPs it takes given a certain drought condition, and an explicit timeline for when those enhanced actions occur. In 2007, a mandate was added to NRS 540.141 requiring each conservation measure specified in a purveyor's conservation plan to have an associated estimate outlining the amount of water that will be conserved each year, stated in gallons per-person, per-day (see NRS 540.141 1.(g)). In addition, the NRS now states the rates charged for water will maximize conservation and the plan must estimate the manner in which rates will affect consumption (see NRS 540.141 2.(b)).

[31] Riparian systems include those lands or areas situated along the banks of a watercourse.

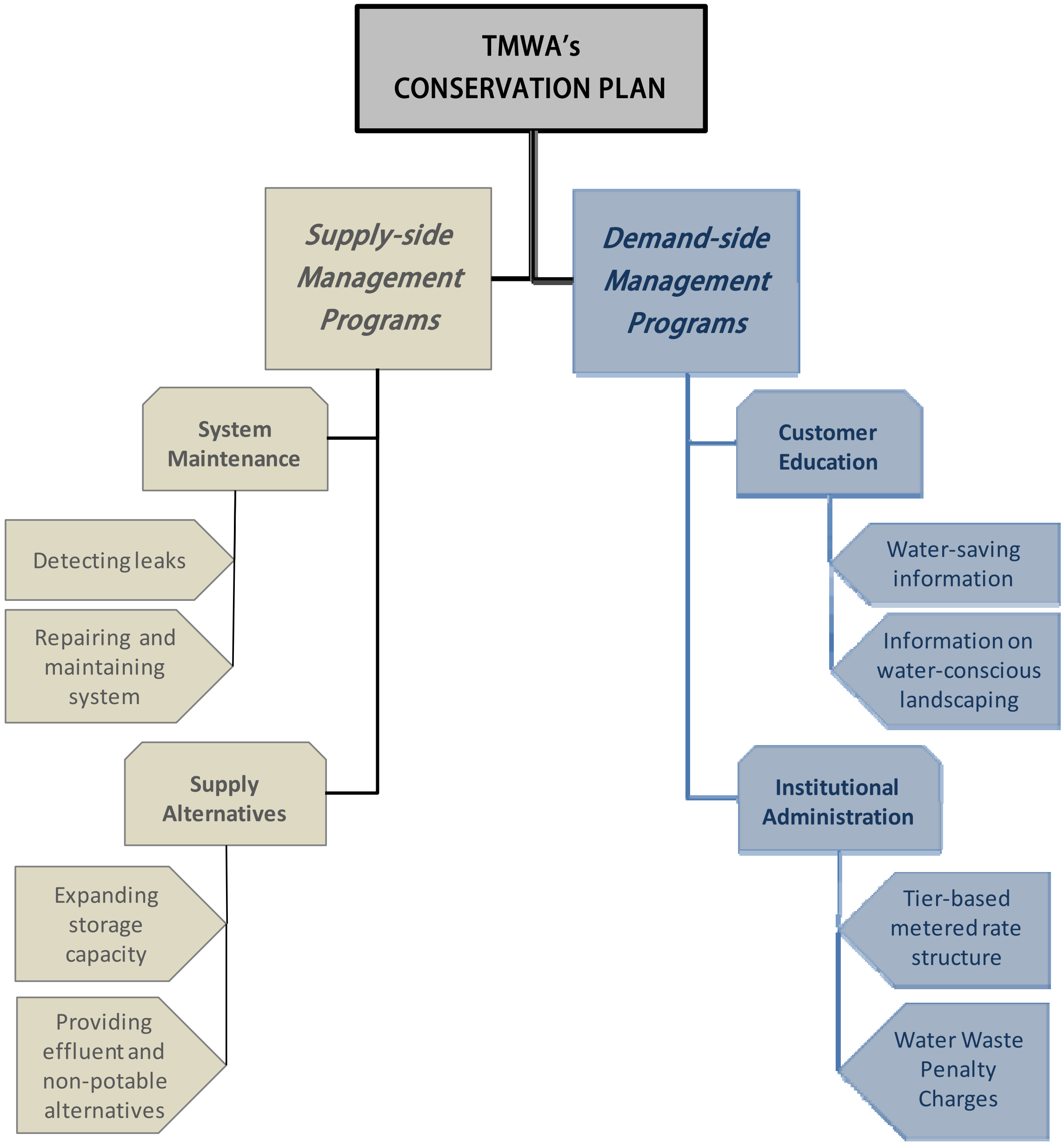
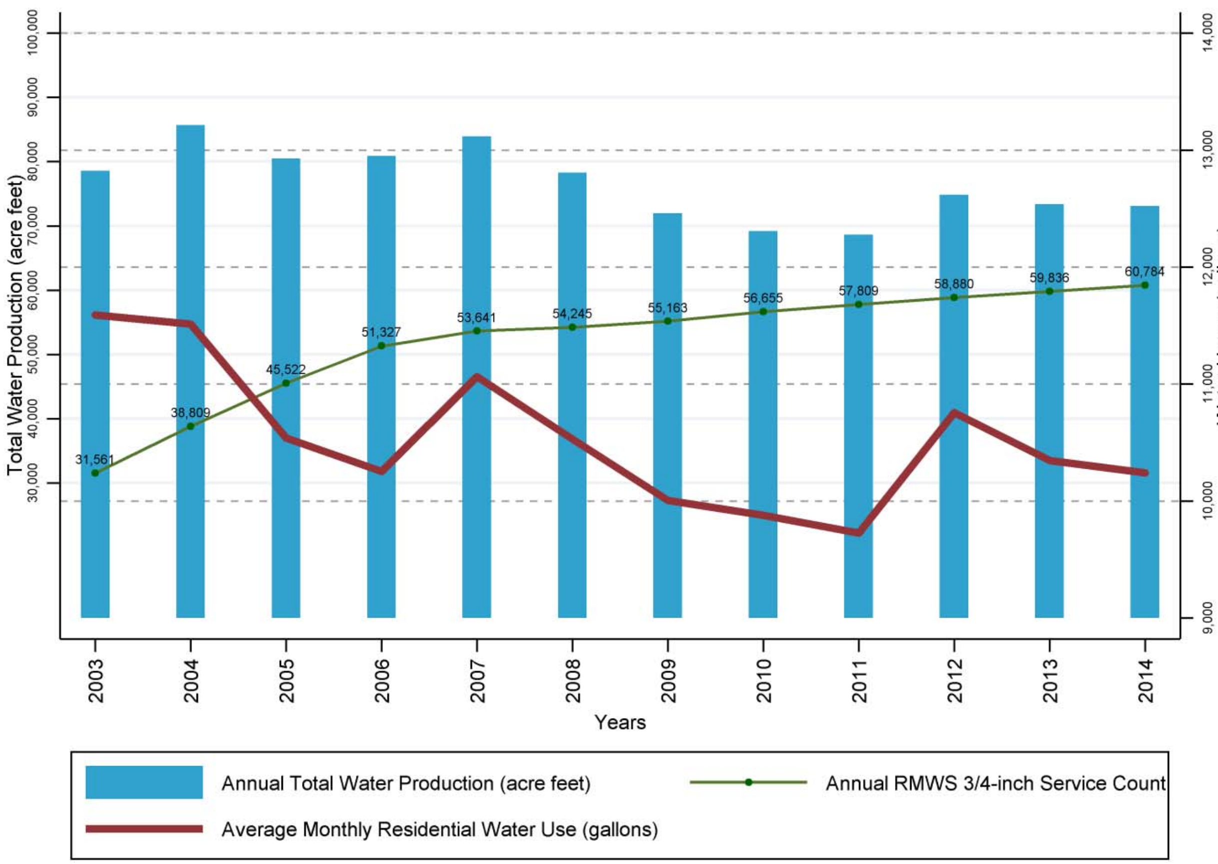


Figure 5-1. Diagram of TMWA's Conservation Plan as Related to NRS 540.131

In 2015, in order to address mounting concerns over drought, Governor Sandoval created the Nevada Drought Form. Six meetings were held between June and November of that year. In September 2015, the Governor held a Drought Summit at the State's capital, Carson City. As a culmination of those efforts, the Governor released the *Nevada Drought Forum: Recommendations Report in December of 2015*. To address the state's water resource challenges, the report outlined, among other things, recommendations on the best water conservation practices. Those conservation recommendations include all water purveyors' conservation plans include: (1) metering of all water connections; (2) the development of water efficiency standards for new development; (3) tiered rate structures to promote conservation; (4) time-of-day and day-of-week water restrictions; and (5) a request that local political subdivisions explore the implementation of water conservation measures where Covenants, Conditions, and Restrictions are in place. The following sections of this chapter outline TMWA's specific programs within its Conservation Plan, of which, are consistent with the recommendations identified in this report and have been deployed by TMWA for many years. A copy of the Nevada Drought Forum: Recommendations Report can be found in Appendix 5-1.

Overall, residential water use in the TMWA service area has become more efficient over time. By 2014, the average RMWS household used 11.6 percent less water than the average household in 2003. TMWA's total water production has decreased by 7 percent while its number of RMWS services has nearly doubled during this same time period. Figure 5-2 shows this change in per-service efficiency since TMWA's inception. While the graph below shows a clear decline in individual water consumption overall, there are issues that can confound or preclude estimations of 'per-person, per-day' water savings for individual DMPs required under the NRS. Moreover, the effectiveness of SMPs do not directly relate to 'per-person, per-day' savings. SMPs are not savings *by* customers but rather savings on the supply-side that accrue in the distribution system. For such programs (e.g., leak repair, meter replacement, non-potable use, etc.) a 'percent of the total supply' savings is a more meaningful metric from which to estimate effectiveness.



Note: Residential usage includes 3\4-inch RMWS, which account for the majority of TMWA's service population.

Figure 5-2. Average Residential Water Use and Total Production between 2003 and 2014

The major roadblock to quantifying efficacy of DMP's, for which 'per-person, per-day' metrics can be determined, is lack of data. Take for example educational programs (e.g. multi-media messaging, online resources, in-person workshops, etc.). It is not feasible to track the information to which customers have been exposed to each program. Even if such tracking was feasible, customers are exposed to information via a host of different formats, so any attempt to delineate the effect of any one program from another would prove unreliable in the uncontrolled environment. In such contexts, the combined effect of individual programs is the only possible estimate of effectiveness. This chapter provides estimates of benefits from each activity and states the measure of gallons saved 'per-person, per-day' whenever possible (or meaningful). For programs in which 'per-person, per-day' estimates are not relevant, the most meaningful metric will be provided. Programs for which there is no data available from which to estimate effectiveness will be noted.

In early 2015, TMWA partnered with the University of Nevada to conduct research on how different forms of communication and messaging influence customer behavior using a controlled study (i.e. treatment and control groups). TMWA is also investigating how customers conserve water in times of drought, their attitudes about drought, and their attitudes about TMWA's drought communication efforts. Results from this investigation will be available by the spring of 2016. These studies will offer a deeper understanding into the scope and effectiveness of TMWA's water conservation programs.

TMWA's Conservation Plan will continue to serve as the cornerstone of the region's efforts to conserve local water resources. Given primary reasons for TMWA's Conservation Plan is to promote efficient use of water resources and minimize water waste, each program within the plan plays a unique role in meeting these goals. While many of the water conservation benefits outlined above are interrelated, each program within the Conservation Plan is designed to elicit a specific response from a targeted customer base, in order to achieve a specific set of goals. Table 5-1 summarizes each program, along with its targeted goal(s) and customer(s).

Table 5-1. TMWA's Standard Conservation Plan Programs

Water Conservation Plan	Target Goal	Target Customer
Supply-side Management Programs/Activities		
System Maintenance		
Leaks and System Repairs	1,3	All users
Meter Replacement	1,3	All users
System Pressure Standards	1,3	All users
Supply Alternatives		
Non-Potable Water Service	1,3	Irrigation
Demand-side Management Programs/Activities		
Customer Education		
Conservation Consultant Program	2,3	Residential
Water Audits/Water Usage Reviews	1,2,3	Residential & Business
Public Workshops	1,2,3	Residential
School Educational Programs	1,2,3	Residential
Standing Advisory Committee	1,3,4	All users
Online Resources	1,2,3,4	Residential & Business
Conservation Materials	1,2,3	Residential & Business
Multi-media Messaging	1,2,3,4	All users
Institutional Administration		
Water Rates	2,3	All users
Assigned-Day Watering	1,2,3	All users
Watering Time Restrictions	1,2	All users
Water Waste Restrictions	1,2,3	All users
Unauthorized Use of Water	1,3	All users
Landscaping Regulations	2,3,4	All users

Target Goal
1. Minimize service disruptions
2. Preserve customers' landscaping assets
3. Maintain a low cost of service
4. Ensure environmental preservation

Supply-side Management Programs/Activities

To ensure water resources are captured and delivered to customers in an efficient manner, the majority of TMWA's SMPs are CIPs that maintain the integrity of its water system's infrastructure.

System Maintenance

As system components wear out, there is a greater potential for water loss. TMWA is constantly engaging in CIPs that reduce water loss within the delivery system by detecting and repairing aging infrastructure. TMWA continually monitors and maintains its water system infrastructure in order to ensure service disruptions are minimized. TMWA is also very conscious about the cost-effectiveness and expected benefits of system maintenance. Therefore, TMWA incorporates the likelihood and consequences of water main failure to reduce risks to the system associated with unplanned outages and emergency repair costs.

Leaks and System Repairs. Over time, parts of the water-system infrastructure degrade and require repair or replacement. TMWA actively monitors for leaks in the system. When assessing leak repairs, maintenance scheduling considers the safety to the general public and work crews, while providing minimal interruptions to public and private services, as well as minimal overtime expenditures. If water leaks are not large, not causing a safety problem, and are reported outside normal working hours, response staff will determine the urgency of the needed repairs and schedule repair work accordingly.

When the source of the leak is determined, TMWA implements a proactive maintenance program to fix the problem. Once the underground locations of other utilities are determined, the crew will excavate the leak site and make repairs. In the case of a leaking poly-butylene pipe, the crew will usually replace the entire service, as this type of pipe has proven particularly prone to repeated leaks. All leaks are reported and entered into a database.[32] Below are the number of main and service repairs since January 2012.

Fiscal Year	Mains Repaired	Services Repaired	Totals
2012	60	147	207
2013	58	216	274
2014	69	224	293
2015	49	287	336

In order to keep leak occurrences to a minimum, TMWA prioritizes system repairs and replaces aging infrastructure on a continual basis, before an incident occurs. Prioritization is given to pre-1960 systems made of steel, cast iron, concrete, or riveted steel. Coordination with local agencies' street and highway replacement programs has proven to be the most cost effective and least disruptive approach to system replacement and rehabilitation for TMWA customers. See Appendix 5-2 for more information on TMWA's Main Replacement Program.[33]

Quantification of Effectiveness: TMWA's system-wide leakage rate is very low at 3.1 leaks per 100 miles per year, indicating very high service levels currently exist. On average, TMWA loses approximately 6 percent of total supply through system leaks, well below the national average of 16 percent[34]. This 6 percent also includes non-revenue water (i.e., unmetered, authorized use in firefighting as well as hydrant testing and flushing) and apparent losses (i.e., unmetered, unauthorized use resulting from water theft). This means the real loss of water is some percentage lower than the reported amount. In 2014, TMWA produced approximately 75,000 AF of water. When compared to the national average for water loss, due to TMWA's proactive maintenance schedule,

[32] TMWA's Computerized Maintenance Management System was deployed beginning CY012; prior to that time leak data records are not as reliable

[33] Appendix 5-2 provides a narrative of the analytic process and findings with maps provided to give the reader a general characteristic of the range of TMWA's main replacement.

[34] Source: Water Audits and Water Loss Control for Public Water Systems, USEPA July 2013

the reduced system loss resulted in 7,500 AF of water loss adverted that year. This equates to an additional 6.7 MGD available for customers.

Meter Replacement. In order to effectively identify leaks and other forms of water loss in the system, accurate metering is critical. Since the internal workings of a meter wear out over time, TMWA's Meter Replacement Program replaces meters as soon as they begin to show signs of failure (e.g., seemly incorrect readings). This practice ensures meters remain in good working condition yet still allows for an extended return on the investment. It is anticipated that TMWA will spend approximately $8.9 million in FYs 2016-2020 on meter and meter reading device replacement. As meters are replaced, additional water savings may be achieved, since improvements are made to the system when leaks in older facilities are found and repaired during the process.

Quantification of Effectiveness: At the time this report was written, no measure of water saved from meter replacement had been estimated.

System Pressure Standard. Pursuant to the Nevada Administrative Code ("NAC") 445A, TMWA's engineering design criteria plans for a max-day-demand-residual pressure of 40 pounds per square inch ("PSI") to be maintained at the customer's service connection. Pressures exceeding 125 PSI may increase the propensity for main breaks or accelerate the development of leaks, both on TMWA and customer facilities. Excessive pressure results in more water delivered through the tap since flow rate is proportional to pressure. This can result in such forms of water waste as sprinkler overspray and higher leakage flow rates.

Quantification of Effectiveness: At the time this report was written, no measure of water saved from TMWA's pressure standard had been estimated.

Supply Alternatives

In order to maximize the amount of potable water available to customers, TMWA actively seeks out opportunities to provide non-potable or effluent sources of water whenever possible.

Non-Potable Water: TMWA has a Non-Potable Service ("NPS") tariff to provide customers that can use sources of non-potable water – either untreated Truckee River water or poor quality ground water – for specific applications with minimal capital investment. The non-potable water service is available at a reduced rate, providing incentive for qualified customers to switch to this service. The service reduces TMWA peak day demand and lowers system capacity needs. Irrigation and construction sites utilize NPS to conserve potable water, enabling existing water resources to go further.

Specific facility needs for each service connection are identified in the service agreements between TMWA and the customer receiving non-potable service. The recipient of the service demonstrates each site's ability to tolerate the interruptible nature of the service (due to system or drought requirements) and/or the potential to switch between treated and untreated water. For example, TMWA has worked with the Washoe

County School District, one of TMWA's largest municipal customers, to implement non-potable watering solutions at Reno High School.

TMWA also coordinates with the Truckee Meadows Water Reclamation Facility ("TMWRF") to provide use of effluent water in lieu of TMWA's water supplies. TMWA has agreements with Reno, Sparks and Washoe County to ensure that the use of treated effluent is being applied for irrigation purposes at suitable sites where the infrastructure is, or is planned to be, installed. Providing service connections with effluent leaves capacity for new municipal demand that requires treated water. TMWA's rules require that new service applicants submit verification of whether or not the site applying for municipal, treated water is designated to be, or is within feasible range to be, serviced by effluent water. If the project meets the effluent provider criteria for service, treated effluent will be provided for irrigation purposes instead of potable water from TMWA. Replacement water rights are provided as required by TROA.

Quantification of Effectiveness: On average, TMWA's NPS supplies 34 million gallons of non-potable water annually, which saves approximately 93,000 gallons of potable water each day for use by other customers. Effluent water use reduces demand for TMWA's potable and non-potable water resources. On average, 3,810 AF of effluent water is provided to qualifying customers annually, which keeps 3,401,353 gallons of TMWA's water resources available for other services on a daily basis.

Demand-Side Management Programs/Activities

While many communities use conserved water to serve new growth, TMWA uses conserved water to ensure adequate supplies are provided to its existing customers. Once delivered to the customer, TMWA promotes efficient water use through its proactive DMPs. By utilizing a mix of education-based programs and institutional administration, TMWA's DMPs directly target customer behavior to promote efficient water use year-round and lower demands during periods of extended drought. By lowering demand during drought periods, DMPs reduce or eliminate the need for TMWA to use its drought reserves (aka POSW).

Customer Education

TMWA is deeply committed to public education about conservation and efficient water use. TMWA utilizes every opportunity to promote education. Since water use during the irrigation season is on average four times higher than during the winter months, much of TMWA's public education focuses on the efficient use of water for landscaping. TMWA facilitates efficient use by distributing information through various forms of communication including in-person workshops and events, multimedia messaging, and printed materials.

<u>Multi-media Messaging:</u> TMWA is committed to providing the public with the most recent information regarding the state of the local water supply. Using media outlets such as radio, television and billboards, TMWA produces targeted advertising to get its messages to customers. TMWA also uses social media platforms (i.e., Facebook, Twitter, YouTube and Google Plus) to help spread information regarding changing conditions in

weather and the water supply, as well as, tips for efficient water use. TMWA also works with local news stations to help pass on accurate, up-to-date drought information to its customers.

Quantification of Effectiveness: Given the inability to track the customers whom were exposed to different forms of multi-media messaging, it is not possible to determine the individual effect the materials have on conservation. As of the writing of this report TMWA has 1,231 Facebook followers, 1,201 Twitter followers, and 17 Google Plus followers. Such participation rates are noted when considering the effectiveness of various messaging components. Moreover, when asked to reduce water consumption (via all forms of communication), customers' responses are on par with what TMWA requires to help withstand periods of drought. In 2014, a drought situation occurred in August and lasted through September. During this time, TMWA's request for customers to reduce their use by 10 percent compared to their use in 2013 was met favorably. This was the *first* time since TMWA's founding in 2001 that TMWA asked for a specific reduction in use beyond the annual DMP deployment. This request resulted in an average of 8.5 million gallons saved per-day in 2014 by TMWA customers. It is important to note that while the multi-media messaging campaign directly requested the 10 percent reduction, the subsequent educational programs detailed below help facilitate this additional reduction by customers. Therefore, the effectiveness of programs should be evaluated at the aggregate. More information regarding TMWA's Conservation Plan under drought situations can be found in the Drought Response Plan section. See Table 5-6 for a comparison in retail sales, by customer class, for the months of August and September in 2013 and 2014.

<u>Conservation Consultant Program:</u> TMWA's conservation consultants provide customers information regarding responsible water use, reducing water waste, and TMWA's regulations. During the irrigation months, TMWA ramps up its efforts by hiring additional seasonal consultants to provide both residential and business customers with additional information about leaks and water waste associated with outdoor watering. TMWA's water conservation consultants investigate water waste complaints and provide tips to customers that help curb excessive water usage and facilitate lower monthly bills.

Quantification of Effectiveness: At the time this report was written, no measure of water saved from TMWA's Conservation Consultant Program had been estimated.

<u>Water Audits/Water Usage Review:</u> In 2003, TMWA began a water audit program. The Water Usage Review Program is co-sponsored by TMWA and the WRWC. At the request of the customer, a TMWA technician will conduct an analysis of the customer's current water usage practices and provide recommendations on how the customer can reduce their water consumption and subsequently their monthly bill. Customer response to TMWA's Water Usage Review Program is extremely positive. As of December 2014, nearly 20,000 customer usage reviews have been completed (see Table 5-2). While the majority of water usage reviews are initiated by a customer's concern about a high bill, TMWA monitors spikes in individuals' water use to proactively assist customers in

achieving a balance between water savings and maintaining a healthy landscape as well as detecting potential leaks.

*Quantification of Effectiveness***:** Preliminary analysis on the difference in means was performed on 1,239 RMWS customers who requested a water audit between 2003 and 2013. To be included in the comparison study, these customers had *at least* one full year of information on water consumption before a water usage review was conducted. Comparison of RMWS customers' monthly water consumption before and after an audit request was made indicated an average annual per-service water savings of 6.5 percent[35]. The greatest total savings (in terms of gallons per month) came at the peak of the irrigation season. During the months of June, July, and August, approximately 1,400 gallons per month (or 6.0 percent) were saved per customer service each month equating to a savings of 47 gallons 'per-service, per-day' during the peak of the irrigation season. At the time this report was written, analysis on effectiveness on commercial customers had not been performed.

Table 5-2. TMWA Customer Water Audits 2003 to 2014

Year	Residential	Commercial	Total	Cumulative Total
2014	1,351	162	1,513	19,754
2013	1,351	126	1,477	18,241
2012	1,522	141	1,663	16,764
2011	1,838	206	2,044	15,101
2010	2,949	381	3,330	13,057
2009	2,375	300	2,675	9,727
2008	2,196	265	2,461	7,052
2007	1,804	221	2,025	4,591
2006	661	70	731	2,566
2005	771	123	894	1,835
2004	431	66	497	941
2003	402	42	444	444

Public Workshops: Over the course of a year, TMWA provides regular workshops regarding landscaping and irrigation. Topics include: tree care, irrigation system start up, sprinkler maintenance, landscape and xeriscape design, and proper winterization. TMWA also co-sponsors seminars that address landscape design, operation and maintenance of irrigation systems, and related topics. During years when drought conditions are present, TMWA holds special workshops that help customers understand TMWA's water delivery system, how TMWA responds to drought conditions, and how customers can take action to help reduce water usage.

Quantification of Effectiveness: TMWA workshops are offered as an educational resource to promote conservation through efficient water use. Effectiveness is measured by both demand for the workshops and attendance. In 2014 and 2015, enrollment demand was such that additional sessions were offered most of which enjoyed capacity

35 This difference in average usage is significant at the 99 percent level of convention.

attendance. Unfortunately, it is not feasible to estimate the per-person, per-day water savings such programs would have but, like all of TMWA's customer-education efforts, the emphasis is placed on correcting wasteful behavior by increasing awareness of effective conservation practices.

School Educational Programs. TMWA representatives regularly engage students and teachers regarding northern Nevada's water resources through classroom participation and presentations.

Quantification of Effectiveness: Given the privacy concerns about connecting student participation in TMWA's educational programs to actual customer usage, it is not possible to determine the individual effect this form of education has on conservation. Regardless, early involvement in conservation is an important component in TMWA's conservation plan.

Online Resources. A key part of TMWA's educational messaging centers around understanding the region's water resources. TMWA's main website (www.tmwa.com) directs customers to information on local water supplies and how they are managed. Table 5-3 outlines the various online resources available to customers to help them use water efficiently and avoid water waste. In addition to its primary website, TMWA also deploys situation-specific "micro-sites". These temporary online resources contain enhanced messages that address specific concerns and goals during times of drought. Refer to this chapter's Drought Response Plan section for details on designating drought classifications. It is possible that some or all of these micro-sites will be incorporated into TMWA's primary website when it is updated.

Quantification of Effectiveness: Given the inability to directly track the conservation response of customers who access each website for information on efficient water usage, it is not possible to determine the impact such websites have on conservation. Regardless, these online resources are important components in TMWA's Conservation Plan and its positioning as a community leader in promoting responsible water use.

Table 5-3. TMWA's Online Conservation Resources

Program	Website	Description
Truckee River Flows and Storage	www.tmwastorage.com	Tracks water storage in the largest reservoir on the Truckee River system, Lake Tahoe.
Water Conservation Overview	http://tmwa.com/conservation	An overview of why conservation is important and directs customers to additional conservation links.
Water Conservation Checklist	http://tmwa.com/conservation/checklist	Tips to save indoor and outdoor water use
Winterization Tips	http://tmwa.com/conservation/winterize	A guide to winterizing residential homes
Finding and Repairing Leaks	http://tmwa.com/conservation/leaks	Provides information and links to online videos that help locate water leak.
Water Efficient Landscape Guide	http://www.tmwalandscapeguide.com	An interactive guide to help customers design and evaluate their landscaping choices.
Principles of Xeriscape	http://tmwa.com/conservation/xeriscape	Seven horticultural principles of xeriscape.
tmwa.com/save	www.tmwa.com/save	This micro-site was launched to provide customers with a simple list of things they can do to reduce their water use "at least 10%," (that summer's goal). The site will be updated as needed to support future conservation campaigns.

Conservation Materials: TMWA provides a multitude of written materials regarding ways customers can use water efficiently, reduce their usage, and avoid water waste. These conservation materials include:

- Direct Mail - In addition to providing detailed information on how water usage affects their monthly bill, TMWA uses its billing system to convey conservation messages and facts directly on customer's bills. These bill inserts serve as reminders about summer and winter habits that can conserve water.

- Landscape Design PDF resources – These downloadable PDF resources, found at TMWA's *Water Efficient Landscape Guide* website, provide detailed information on landscaping, irrigation, and plant and turf maintenance.
- Door hangers - Whenever a TMWA conservation consultant visits a home or business to remind customers of their watering times, a door hanger is left containing a variety of pertinent materials such as water times and restrictions, tips on tree and lawn care, etc.
- Water saving devices – Upon request by customers or whenever a TMWA conservation consultant visits a customer's premise, TMWA provides sprinkler timers, hose nozzles, low-flow shower heads, dye tabs, flow-rate bags, or faucet aerators to further assist customers in their water saving efforts.
- Enhanced Drought Information Materials – During times of drought, TMWA provides materials regarding detailed information and specific actions customers can take to help TMWA manage water demand. These enhanced materials include table tents for restaurants, stickers for public restrooms, and letters to homeowner's associations, etc. Refer to this chapter's Drought Response Plan section for details on designating drought classifications.

Quantification of Effectiveness: Given the inability to track the customers who receive different conservation materials, it is not possible to determine the individual effect the material have on conservation. Regardless, these printed resources are important components in TMWA's conservation plan.

Institutional Administration

TMWA has internal rules and regulations that apply to water supply services. Under state law, TMWA is not authorized to supply service to any customer who does not comply with all regulations. TMWA regulations can be found at http://tmwa.com/customer_services/waterrules/. Additionally, local governments and agreements within private developments have codes regarding landscaping design and water conservation practices. In general, municipal codes are designed to work in tandem with TMWA's rules and regulations.

Water Rates. In order to ensure customers use water responsibly and adequately recover costs, metered rates are employed. Municipal service rates are assessed using an inverted block structure with three to five tiers. This increasing rate structure allows for low costs associated with indoor water use and incentivizes customers to use outdoor water efficiently to avoid going into the more expensive tiers. Irrigation services pay a constant rate per 1,000 gallons, which varies according to a seasonal rate structure. During the peak summer months of June through September the rate is higher than during the off-peak months of October through May. This helps encourage conservation-related behaviors such as scheduling new plantings for cooler months when less intensive watering will be required. As part of the merger agreements with WDWR and STMGID, rate structures for their former customers have been maintained as of June, 2015. TMWA will continue to use a tiered volumetric billing rate structure for all non-irrigation services. Every few years, water rates and cost of service are reevaluated to account for customer base growth and system component requirements. For the most up-to-date water rates schedules, go to http://tmwa.com/customer_services/waterrates/.

Quantification of Effectiveness: Research conducted by the University of Nevada, Reno Department of Economics indicates that, on average, a 10 percent increase in price is associated with a 2 percent decrease in water usage by residential customers.

Assigned-Day Watering. Since 2010, TMWA has recommended a three-times-per-week, Assigned-Day Watering schedule, with a no-watering restriction on Monday to allow for treatment-operations recovery. The water days schedule and restrictions on times of the day under Assigned-Day Watering is summarized here:

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
All “EVEN” addressed services	No	Yes	No	Yes	No	Yes	No
All “ODD” addressed services	No	No	Yes	No	Yes	No	Yes

Quantification of Effectiveness: TMWA began studying watering schedules beginning in 2004 through 2008 before converting from 2-day-a-week (required until such time that over 90 percent of the flat-rate single family residences were retrofit with a meter which occurred in 2009) to 3-day-a-week watering. Study results found that the three-day-a-week schedule results in less overwatering and waste than the prior 2-day-a-week watering schedule: during the 2-day-a-week schedule it was determined that over 55 percent of customers either were watering 3-days-a-week or were over-watering on their assigned days (see Appendix 5-3 for full report). However, because the system was not fully metered and the change in water schedule went into effect system-wide, no estimate of gallons ‘per-person, per-day’ could be made as the metered data did not exist at the time.

Watering Time Restrictions. Along with Assigned-Day Watering, TMWA discourages watering during the hottest, and typically the windiest, part of the day. Thus, there is a restriction on time-of-day watering between Memorial Day and Labor Day; there is no watering from 12:00 p.m. to 6:00 p.m. during this time of year. During drought years, these no-watering times are expanded by two hours: 11:00 a.m. to 7:00 p.m. Refer to this chapter’s Drought Response Plan section for details on designating drought classifications.

Quantification of Effectiveness: Water loss due to evaporation and wind has many associated factors (e.g., temperature, relative humidity, etc.) that vary daily, making estimating the effectiveness of the regulation problematic. At this time, no specific method of measuring effectiveness has been estimated for restricting water-times. However, watering-times are still considered an important regulation regarding water use efficiency.

Water Waste Penalties. In 2004, TMWA enhanced its rules by adding penalties for water waste violations and for watering on non-assigned days or times, which are billed directly to the customer. These rules provide for a warning followed by an increasing penalty of up to $75 per occurrence for repeat violations. However, TMWA has discretion on issuing citations and goes to great length to avoid penalties by instead using education to instruct customers on responsible water use. Many times customers are simply unaware that they are wasting water due to broken or misaligned sprinkler heads.

*Quantification of Effectiveness***:** To date, TMWA has issued 297 penalties to commercial and residential water users. While the behavior is typically corrected, it is difficult to determine the amount of water saved through issuance of penalties.

Unauthorized Use of Water. Use of water without dedicated water rights or without TMWA's permission is not allowed under TMWA's rules. Examples of unauthorized use may include: two active service lines on a premise where one service is not being billed, an illegal tap off a water main, or an unauthorized hook-up to a fire hydrant. TMWA's rules and tariffs are designed to cover all costs to the utility in cases of illegal service taps, damage to TMWA facilities, and/or theft of water at $1,000 per occurrence. Use of fire hydrants as a water source is also illegal under municipal ordinances except for approved city vehicles. TMWA monitors its system to locate and correct unauthorized water use on an ongoing basis.

Quantification of Effectiveness: Since illegal water use is not separately metered it is difficult to estimate how much water is saved by identifying fraudulent water usage. Regardless of the impact, preventing and stopping illegal use is important to keeping customer rates low, preventing service disruption, and facilitating effective firefighting operations.

Landscaping Regulations. The Cities of Reno and Sparks, and Washoe County have landscape ordinances that regulate the types of landscaping developed land must have. In general, these municipal ordinances are designed to support TMWA's conservation efforts and allow enforcement of penalties to water wasters. TMWA conducted an initial review of the municipal ordinances, for Washoe County and the cities of Reno and Sparks related to water conservation and landscaping mandates, in 2005. In April of 2015, the codes for the three entities were revisited to 1) determine what changes have been made to these code provisions since TMWA last reviewed them, and 2) identify recommendations to the Reno City Council, Sparks City Council, and Washoe County Board of Commissioners regarding revisions to the current ordinances, as well as, the potential addition of new requirements. In a series of meetings with municipal planners, staff from the Washoe County District Health Department, and representatives from the building industry, TMWA identified fundamental changes in the landscaping/water conservation codes that occurred since 2005 and discussed recommendations to ensure new development planning in the region was more water-conscious. The major recommendations for new developments included: (1) expanding the minimum width of narrow turf strips to 8 feet with a 2 foot setback from any impervious surface; (2) setting a maximum total area requirement for allowable turf by zoning district; (3) setting a minimum requirement for drought-tolerant landscaping; and (4) requiring hydro-zoning (i.e., grouping plants with similar watering needs) irrigation plans be implemented whenever possible. A copy of the report can be found in Appendix 5-4.

Additional, legal agreements for private master developments can have regulations (e.g. Home Owners Associations' ("HOAs") rules and regulations) beyond what is required under municipal ordinances. During times of drought, TMWA asks HOAs to allow their residents the ability to comply with TMWA's requests for customers to reduce their water use without penalty. In 2005, a piece of legislation, NRS 166.330, was passed prohibiting HOAs from "unreasonable" restrictions of homeowners utilizing drought-tolerant landscaping on properties within their jurisdictions. However, in order for the homeowner to convert his or her landscaping from the approved vegetation type(s) to a drought-tolerant variety, the homeowner must first submit a detailed architectural plan of the new landscaping design. The HOA has the right to review the plan and can approve or deny the request; however, the HOA cannot deny a plan unreasonably, i.e., if, to the maximum extent possible, the altered design is compatible with the overall style of the community. While this statute clearly applies to all covenants, conditions and restrictions ("CC&Rs") that were established *after* the adoption of the law on October 1, 2005, it remains to be determined if such a law can apply to CC&R's prior to that date without impairing the existing contract.

Quantification of Effectiveness: Since municipal ordinances apply to all properties within a jurisdiction and these ordinances can vary both within and between jurisdictions, it is not possible to estimate the water savings that results from changes to municipal ordinances designed to further reduce water waste.

Drought Response Plan

Under normal circumstances when TMWA does not need to use its drought reserves, the aforementioned DMPs are adequate to promote efficient water use. However, if a Drought Situation is identified within the Truckee River Basin and drought reserves are required, TMWA's customers are expected to take additional actions to reduce their water use. Depending on the severity of the drought and the available quantity of TMWA's drought reserve water PSOW supplies (i.e., Independence Lake, Donner Lake, Stampede Reservoir), the aforementioned DMPs may be modified to achieve water reductions necessary to ensure TMWA's drought reserves are adequate to meet customer demand in the current and succeeding years. In these situations TMWA historically requests a 10 percent reduction in use and implements *enhanced* demand-side management programs ("*e*DMPs") to achieve this target reduction. The level and timing of which *e*DMPs are deployed can vary during the year, given the severity of the Drought Situation.

Pursuant to the operating criteria outlined in TROA, determination of a Drought Situation[36] takes place in April. That determination is dictated by the amount of water available

[36] Pursuant to TROA: "**Drought Situation** means a situation under which it is determined by April 15, based on procedures set forth in Section 3.D, either there will not be sufficient **Floriston Rate Water** to maintain **Floriston Rates** through October 31, or the projected amount of **Lake Tahoe Floriston Rate Water** in Lake Tahoe, and

for the Truckee River system based on available stored water in Lake Tahoe and Boca Reservoir, snowpack amounts, and run-off estimates for the current year; together these are early indications of when river flows will no longer support Floriston Rates. When the elevation of Lake Tahoe and subsequent Truckee River flows fall off significantly earlier than normal, this creates operational challenges for TMWA, forcing TMWA to use additional groundwater pumping and/or its POSW in order to meet the demands of its water customers during the irrigation season. For a full discussion of drought period operations, refer to Chapter 2.

TMWA uses a three-stage Drought Situation classification system (see Table 5-4). Per TROA, in a non-drought situation the elevation of Lake Tahoe is such that natural river flows will maintain Floriston Rates through Labor Day. Under this situation, no reserves are projected to be used, thus no *e*DMPs are necessary since demands typically are reduced after Labor Day. Similarly, when a Drought Situation is identified but Lake Tahoe and Boca Reservoir supplies remain adequate to maintain Floriston Rates until after Labor Day, no *e*DMPs need be deployed. While customer irrigation demands may remain high after Labor Day, even potentially requiring POSW to meet those demands, a certain amount of POSW must be released anyway to be in compliance with federal flood regulations. However, during a Drought Situation, if Lake Tahoe and Boca Reservoir supplies are not sufficient to maintain Floriston Rates in any month before Labor Day, then one of three levels of *e*DMP is identified and actions outlined to ensure customer demands are reduced in the current year and drought reserves are maintained in the event a successive Drought Situation occurs the following year.

including **Lake Tahoe Floriston Rate Water** in other **Truckee River Reservoirs** as if it were in Lake Tahoe, on or before the following November 15 will be equivalent to an elevation less than 6,223.5 feet Lake Tahoe Datum."

Table 5-4. TMWA's Drought Situation Classification System

	NON-DROUGHT SITUATION	DROUGHT SITUATION	
	Reserve Supplies NOT Released	**Reserve Supplies Release AFTER Labor Day (Level 1)**	**Reserve Supplies Release BEFORE Labor Day (Level 2, 3, or 4)**
A. Watering Restrictions Between Memorial Day and Labor Day	12 to 6 P.M.	12 to 6 P.M.	11 to 7 P.M.
B. Public Education and Advertising	Standard programs	Standard programs	Increased programs
C. Water Waste Prevention	Standard enforcement	Standard enforcement	Increased enforcement
D. Other Actions			Additional *enhanced* DMP are deployed depending on the severity of the drought and time of impact to water supplies. These include but are not limited to; 1) Drought Rates during irrigation season 2) Reduced number of watering days 3) Daily water allotments set 4) See Appendix 5-5 this Chapter for other options

The following figure provides a generalized flowchart of this cyclical drought monitoring process. Pursuant to TROA, the process includes determination of whether or not a Drought Situation exists, its level of severity, and the potential impact on TMWA's drought reserves. From this determination a timeline for TMWA's Drought Response Plan can be developed.

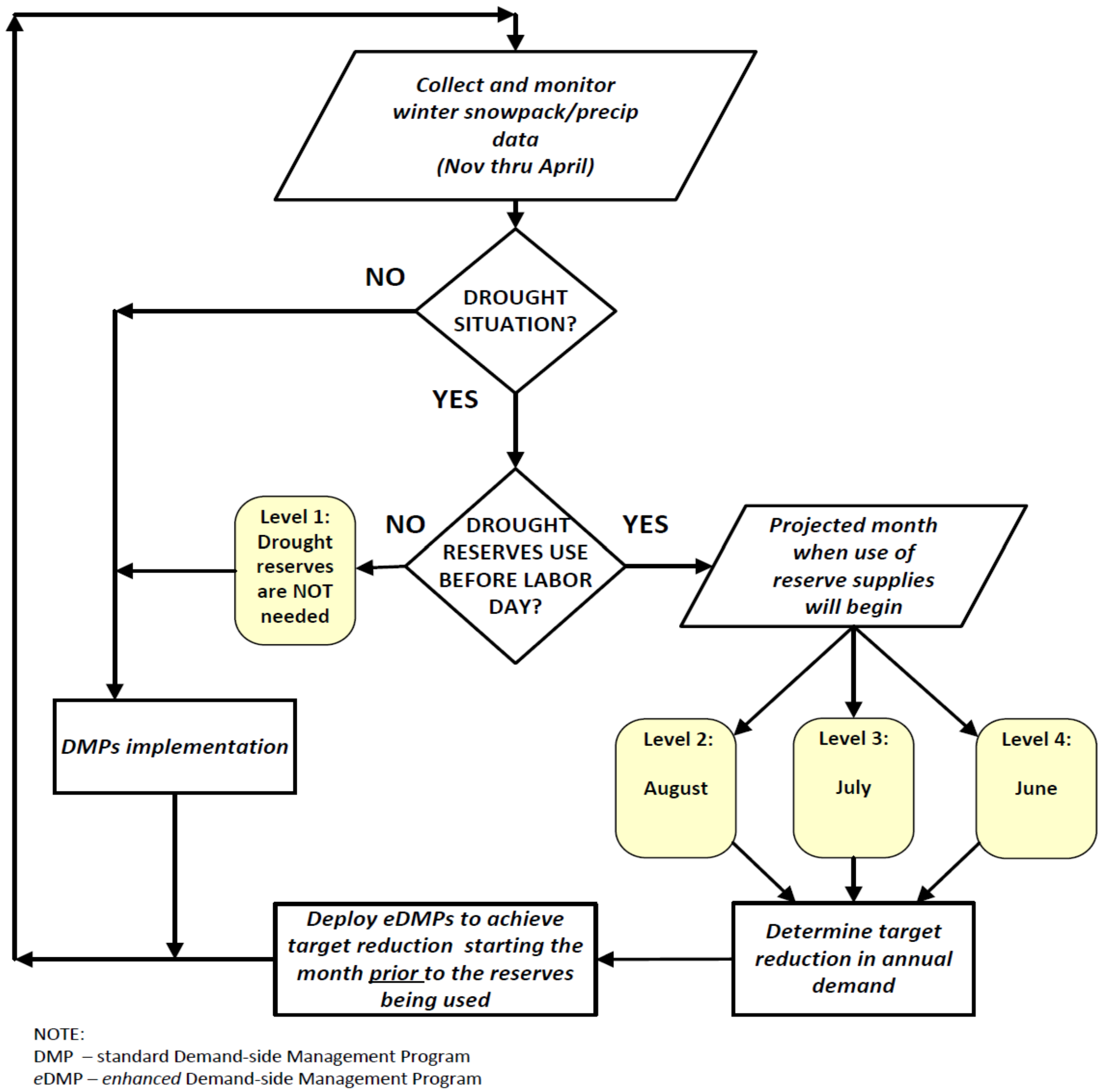


Figure 5-3. Drought Situation and Demand-side Management Response Flowchart

Each level of drought severity depends upon when Floriston Rates are anticipated to be lost. Once the level is known, TMWA will employ its enhanced messaging campaign ("EMC"), which provides the public with additional information on current water supply conditions and the target reduction TMWA will be expecting from its customers in the coming months. TMWA's Drought Situation classification system is presented in Table 5-5 along with recommended timing of TMWA's EMC and *e*DMPs, given the level of the Drought Situation.

Table 5-5. TMWA's Enhanced Demand Management Programs by Drought Situation

		Month					
		May	Jun	Jul	Aug	Sept	Oct
Non-Drought Situation		DMP	DMP	DMP	DMP	DMP	DMP
Drought Situation Reserve supplies **not** needed before Labor Day	Level 1	DMP	DMP	DMP	DMP	DMP	DMP
Reserve supplies needed *before* Labor Day	Level 2	DMP	DMP	EMC	*e*DMP	*e*DMP	DMP
	Level 3	DMP	EMC	*e*DMP	*e*DMP	*e*DMP	DMP
	Level 4	EMC	*e*DMP	*e*DMP	*e*DMP	*e*DMP	DMP

DMP - standard demand-side management program
*e*DMP - *enhanced* demand-side management program
EMC - enhanced message campaign begins at least a month prior to *e*DMP deployment

Quantification of The Drought Response Plan TMWA initiated in 2014 is a good example of the Plan's effectiveness. In April of 2014 a *Drought Situation: Level 2* was identified. Factors for this classification included a seasonal snowmelt which would result in Lake Tahoe falling below its rim in the Fall and Floriston Rates were expected to drop-off by late-July. This meant, in addition to groundwater pumping, release of POSW would be required in the late summer months. Starting in July, TMWA began its EMC by asking its customers to reduce their water use by 10 percent compared to their use in 2013 in the coming months. Overall, TMWA's customers responded well to the request for a voluntary reduction of 10 percent. Table 5-6 shows the reduction in use by TMWA's customer classes.

Table 5-6. Month Retail Water Sale for August and September 2013 and 2014

		Sept 2013 Use (x1000 gal)		2014 Use (x1000 gal)		Percent Change	
Customer Class	**Services**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**
Single Family Metered	88,256	38	43.90	32	37.80	-11.80	-9.50
Single Family Flat Rate	3,866	84	101.50	70	84.50	-14.70	-12.30
Commercial	4,405	49	213.20	42	189.30	-5.70	-4.60
Metered Irrigation	2,328	218	417.90	192	373.80	-6.70	-4.90

Note: this study looks only at water services with 2013 & 2014 data.

In April of 2015, due to the worst snowpack on record it was determined that the drought period would extend into the next irrigation season. In response to these hydrologic conditions, TMWA elevated the Drought Situation to *Level 4*. In May of 2015—two months earlier than 2014—TMWA began its EMC and customers were asked to reduce their use by at least 10 percent in the coming months, again compared to 2013's usage. In the subsequent months the following *e*DMPs were deployed:

- television advertising,
- increased radio advertising,
- dedication of a conservation website (tmwa.com/save),
- increased Conservation Consultant staffing,
- conservation-car wraps (10 vehicles),
- internet advertising,
- table tents at restaurants stating water was served upon request,
- stickers in commercial restrooms reminding people to save 10 percent,
- increased educational programs, and;
- letters to HOAs requesting they not fine residents who let their lawns turn brown.

There was also a significant increase in media engagement with TMWA staff being interviewed almost daily. Table 5-7 compares the monthly retail water sales for June through September between 2013 and 2015. In addition, to TMWA normal customer classes, the table also shows the reduction by the newly acquired DWR and STMGID customer classes. In both years, customers went above and beyond with the average reduction being greater than the 10 percent requested.

Table 5-7. Monthly Retail Water Sale for June through September 2013 and 2015

		2013 Use (x1000 gal)		2015 Use (x1000 gal)		Percent Change	
Customer Class	**Services**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**
Single Family Metered - TMWA	68,193	78	88.90	61	69.80	-19.70	-16.40
Single Family Metered - DWR	16,999	98	111.80	78	89.20	-19.10	-16.00
Single Family Metered - STMGID	3,164	146	160.40	112	125.10	-20.30	-18.50
Single Family Flat Rate - TMWA	3,473	185	219.60	137	165.40	-23.10	-21.60
Single Family Flat Rate - DWR	103	140	139.40	107	101.10	-24.60	-27.00
Single Family Flat Rate - STMGID	78	154	153.40	103	109.70	-29.10	-27.30
Commercial	4,945	92	423.20	71	368.20	-10.00	-8.70
Metered Irrigation	2,398	437	853.50	350	681.50	-18.00	-15.10

Note: this study looks only at water services with 2013 & 2015 data.

These past drought years exemplify the robustness of TMWA's Drought Response Plan and provide a good case study of how the eDMPs are flexible and can adequately control water demand given any level of drought severity. Should a drought occur, whose magnitude exceeds the worst drought on record, TMWA is engaged in a two-year, USBR-sponsored project to address climate change. TMWA will collaborate with UNR and DRI, to determine hydrologic conditions under "worst case" climate changes scenarios. The results will provide insight into the effectiveness of TMWA's current Drought Response Plan, given potential climate changes scenarios. It will also propose the level of need for an updated management framework should the existing Plan fail. The project's deliverable will be generalizable Decision Support System that can optimize water resource management given any water utility's situation. The final results of this two-year study will be available in July of 2017. Refer to Chapter 2 for more details about this project.

Demand Management Programs and Emergency Supply Conditions

Natural disasters and other unforeseen events can interrupt TMWA's available water supplies. These include floods, extreme low precipitation years, earthquakes, equipment failure, or distribution system leaks. Sometimes the events are localized within the distribution system and sometimes the whole community can be affected in which cases the government can declare a state of emergency. Under such cases, TMWA's goal is to minimize service disruptions and, when necessary, the community is asked for, and has responded favorably to, increased and more aggressive conservation messages and calls for water use reductions and restrictions. Some of the *e*DMPs to be used during a state of emergency include mandatory water conservation (i.e., once-per-week or no outside watering during summer months, reduced laundry at commercial properties, use of paper plates in restaurants, no use of potable water for non-potable purposes, heavy fines for water wasters, temporary "drought" rates, etc.). For more information on potential DMPs please see Appendix 5-5.

TMWA's personnel train for management operations under various emergency situations. This training has proven successful as water supply interruptions have been mitigated as swiftly and efficiently as possible such as the April 2008 earthquake in Mogul which destroyed the Highland Flume thereby precluding gravity-fed delivery of water to the Chalk Bluff Water Treatment Plant. TMWA mitigated the incident by 1) turning on its Orr Ditch Pump Station and installed temporary pumps to feed Chalk Bluff, 2) turning on its Glendale Water Treatment Plant, 3) turning on its wells as needed for irrigation demands, and 4) installing temporary piping around the Highland Flume failure to deliver more water to Chalk Bluff. These actions avoided any water supply interruptions for TMWA customers. Increased conservation by TMWA customers during emergencies is just one element of successfully managing water supply interruptions. Chapter 2 describes the types of response tactics TMWA deploys during emergency situations.

Summary

TMWA’s Conservation Plan includes a comprehensive list of SMPs and DMPs. As water supplies fluctuate year to year—due to fluctuations in the seasonal snowpack—these programs ensure TMWA and its customers are able to conserve to the degree which is warranted. TMWA’s current Conservation Plan meets or exceeds the state regulations (i.e., JPA, NRS, TROA) and recommendations for best practices (i.e., The Nevada Drought Forum: Recommendations Report). The success of any one program is evaluated depending on its scope and TMWA’s ability to collect data on the participants and amount of water saved. Such metrics may include: the number of gallons saved (in total gallons or as a percent), the level of customer participation, estimated reduction of peak day usage, visibly improved water management practices, or the number of customers receiving water conservation education. Moving forward, TMWA will continue to assess the benefits from each SMP and DMP and may modify any to reflect new practices, technologies, or information regarding regional climate change.

The following highlights of this chapter include:

- TMWA’s Conservation Plan meets the requirements of the JPA, NRS 540.313 through 540.151, and TROA.
- TMWA’s conservation plan is consistent with the water conservation recommendations detailed in the *2015 Nevada Drought Forum: Recommendations Report*.
- TMWA will continue to be fully engaged in the regional dialogue on responsible water use and will implement programs for its customers that benefit the region and support regional water use goals.
- TMWA’s water demand management programs pursue measures to efficiently use its available water resources by addressing water waste, system deficiencies (e.g., leaks, pressure changes, etc.), public education and outreach, watering schedules, and drought/emergency conditions.
- Demand management programs may be progressively enhanced during Drought Situations to address the need to reduce water use when water reserve supplies are impacted.
- Enhanced DMPs may be necessary in response to natural disasters and other events that have potential to interrupt TMWA’s available water supplies.
- TMWA will continue to be engaged in the regional dialogue on responsible water use and will implement programs for its customers that benefit the region and support regional water use goals.
- TMWA will continually assess the benefits of implemented programs and may modify programs to reflect new practices, technologies, and regional climate information.
- New and innovative ways to improve efficient water use will continue to be assessed, including expanded uses of non-potable supplies.

CHAPTER 6 FUTURE WATER RESOURCES

Introduction

This 2035WRP has demonstrated that TMWA currently and for the foreseeable future will continue to rely on the conversion of Truckee River water rights from irrigation to M&I use to meet projected growth in the TRA with limited expansion of groundwater resources in the non-TRA. In the TRA, TROA provides the ability to further utilize Truckee River water rights to meet demands up to 119,000 AF/yr in conjunction with the conversion of irrigation rights, optimization of its recharge and conjunctive use opportunities. In addition to the TROA's demands TMWA has over 20,000 AF of groundwater and over 3,000 AF of creek resources that are over and above the TROA resources as well as 8,000 AF/yr of groundwater available from the North Valleys Importation Project ("NVIP") (should resources be needed to meet new demands in the North Valleys).

This chapter discusses various water-resource management strategies that can be implemented or pursued in order to meet growth beyond the TROA supply. Discussed first are recharge and conjunctive use opportunities which take advantage of existing facilities and water resources to bolster TMWA's ability to reliably meet projected demands. The discussion focuses on future potential expansion of the NVIP, implementation of the Mt. Rose Fan Groundwater Sustainability Project, and Expanded ASR. The focus then shifts to other potential water supply projects that TMWA continues to monitor and consider for future demands beyond TROA.

Conjunctive Management Strategies with Existing Facilities and Resources

North Valleys Importation Project

NVIP is sponsored by Vidler Water Company ("Vidler"). In 2006, Vidler owned over 13,000 AF of irrigation water rights in the Honey Lake groundwater basin (referred to as the "Dedicated Water Rights"). The State Engineer had issued a ruling that the Dedicated Water Rights could be transferred interbasin for municipal use in southern Washoe County, but final permits were pending approval. Vidler had completed National Environmental Policy Act ("NEPA") review processes permitting the transportation of 8,000 AF of the Dedicated Water Rights through a pipeline to the North Valleys area of Washoe County.

Between 2006 and 2008, Washoe County entered a series of agreements with Vidler related to the interbasin water pipeline project which set forth various terms related to the construction and dedication of infrastructure, dedication of water rights, banking of water rights credits, and temporary use of Dedicated Water Rights. Washoe County was to acquire title to the Dedicated Water Rights while Vidler retained rights to sell and assign water credits for future will-serve commitments supplied by the Dedicated Water Rights.

The PLPT objected to the project, asserting that it would harm PLPT's existing and claimed water rights in the Honey Lake Valley, Smoke Creek Desert and Pyramid Lake Basins. These objections led to various litigious challenges by PLPT, which were ultimately settled pursuant to the *Pyramid Lake Paiute Tribe Fish Springs Ranch Settlement Agreement* dated May 30, 2007 ("Settlement Agreement").

Under the Settlement Agreement, construction of the NVIP project would be allowed to move forward in return for two payments from Vidler of $3.6 million each (plus interest since 2007) and the transfer of several thousand acres of land to PLPT. PLPT would then waive the claims against Vidler for impacts or injuries to existing and claimed Tribal water rights for this project. PLPT would also drop the claims against the BLM. PLPT further agreed that Vidler would have the right to pump and transfer up to 13,000 AF from the project to "the End Users for the use of the End Users for any purpose and at any location allowed by the State Engineer" and to manage the project. The Settlement Agreement further requires Vidler to pay PLPT 12 percent of the gross sales price for each acre foot of water rights in excess of the 8,000 AF.

For the settlement to be implemented in full, the United States had to authorize PLPT to waive their claims and ensure that the U.S. does not take action against Fish Springs on behalf of PLPT after enacting the full settlement. This required Congressional approval to allow PLPT to waive their claims, prohibit the U.S. from taking action on behalf of PLPT after the agreement is enacted and release the U.S. from liability for PLPT's waived claims. H.R. 3716 was signed into law on September 20, 2014 approving the Settlement Agreement.

In connection with the acquisition of the assets of the WDWR, on December 31, 2014 Washoe County assigned and TMWA assumed all of Washoe's right, title and interest in and to the Banking Agreement, Dedication Agreement and License Agreement on the terms set forth in an Assignment, Assumption and Consent Regarding Water Banking Trust Agreement.

TMWA has agreed "to hold and reserve a quantity of water rights credits (the "Water Rights Credits") equal to the amount of municipal permits issued by the State Engineer" which could be used by Vidler to satisfy water rights dedication requirements in connection with future requests for will-serve commitments. Vidler is ready to issue will-serve commitments for up to 8,000 AF of the Water Rights Credits. The remaining 5,000 AF of Water Rights Credits shall be held by TMWA and, no will-serve commitments will be issued on such remaining credits until all necessary permits have been obtained.

Vidler reserved "the exclusive beneficial interest" in all Dedicated Water Rights in excess of 8,000 AF, such excess rights defined as the "Additional Water Rights." Vidler intends to import these Additional Water Rights into the TMWA service area at the time sufficient evidence of the resource sustainability exists. Vidler reserved to itself the exclusive right to all of the capacity in the infrastructure up to 13,000 AF, "for the purpose of transporting the Dedicated Water Rights, including the Additional Water Rights and any other Vidler water rights." Vidler shall be solely responsible for all costs in upgrading, constructing and equipping project infrastructure to transport all or any portion of the Additional Water Rights, which infrastructure Vidler shall dedicate to TMWA.

Prior to the time when all of the Water Rights Credits are "in actual use for municipal service", TMWA is authorized to use some or all of the water rights associated with the Water Rights Credits not otherwise committed to will-serve commitments "for its general temporary purposes, including groundwater recharge or conjunctive use management."

TMWA's North Valleys Integration Project, an $18 million pipeline project funded by TMWA and to be reimbursed as development occurs, will be constructed in 2016 and integrate the NVIP into the North Virginia Pump System, making available the full 8,000 AF of water supply to the North Valleys.

Groundwater Sustainability on the Mt. Rose Fan

TMWA is enhancing groundwater resources in the Mt. Rose Fan area through conjunctive use management of surface water and groundwater. Due to dependence upon groundwater and the continued decline in water levels aggravated by the ongoing drought in this area, it is necessary to provide a supplemental source of supply for the water systems located on the upper Mt. Rose and Galena Fan areas. These areas currently rely on groundwater wells for 100 percent of their water supply and the continuing drought situation, and domestic and municipal well pumping, has severely limited the amount of natural recharge to local aquifers. With the full resources consolidated water utility available, immediate construction of the facilities to implement conjunctive use management has begun. This will improve reliability for both TMWA customers and domestic well owners by mitigating the continued decline of groundwater levels in the area.

TMWA is implementing a $7.8 million conjunctive-use plan for the Mt. Rose/Galena Fan area, consisting of three projects which will provide the ability to deliver treated surface water from the Truckee River to the area:

- Arrowcreek/Mt. Rose Conjunctive-Use Facilities
- Expanded Conjunctive-Use Facilities/ASR Program
- STMGID Conjunctive-Use Facilities

The Arrowcreek/Mt. Rose Conjunctive-Use Facilities, Phase 1 will deliver up to 1,500 gpm of surface water primarily during the winter months. This allows TMWA to not pump its production wells in the Arrowcreek and Mt. Rose water systems. These facilities consist of three booster pump stations and about 3,600 feet of 10-inch pipe on Zolezzi Lane. When installed, the project will deliver water to the Arrowcreek No. 3 Tank, located below the Thomas Creek Trail parking lot off Timberline Drive. This $2.8 million project is scheduled for construction in the summer of 2015; the facilities are planned to be operational by November of 2015.

TMWA is also expanding its ASR in this area. ASR occurs during the fall, winter and spring. The first wells scheduled to be equipped for recharge are Arrowcreek 2, Tessa West and Mt Rose 3. An additional component of the overall ASR program is Phase 2 of the Arrowcreek/Mt. Rose conjunctive-use facilities. Scheduled to be constructed in 2016-2017, Phase 2 will consist of an additional $1.2 million of system improvements. This will allow delivery of surface water into the upper portions of the Mt. Rose/Galena water system for use in recharging additional wells.

The third project, the $3.8 million STMGID Conjunctive-Use Facilities, will provide surface water primarily during the winter months for an area which primarily serves former STMGID customers, located in the vicinity of the Saddlehorn neighborhood. The facilities will be constructed in 2017/2018, benefiting TMWA customers and domestic well owners by providing surface water to protect and restore groundwater resources. The project will consist of a new booster pump station and about 8,100 feet of 10-inch pipe to be located on Arrowcreek Parkway. These facilities will deliver about 1,000 gpm to the STMGID Tanks 4 and 5 zones during the winter months.

Effective June 1, 2015, TMWA's Board of Directors adopted revisions to its rules, water rights dedication policies and Water Service Facility Charges ("WSF") for the Mt. Rose/Galena

Fan area. These changes affect new development in the area. The newly adopted rules and WSF charges along with existing water rights dedication rules require developers in this area to dedicate supplemental surface water (creek) supplies when dedicating groundwater for new service in the area. Supplemental surface water resources (Whites, Thomas and/or Galena creeks) are a key component of the conjunctive resource management plan and necessary to ensure a sustainable water supply for existing customers, domestic well owners and new development in these areas.

Surface water from Whites, Thomas and Galena creeks has historically been used for agricultural irrigation. These creeks remain a key part of the regional water resources for the South Truckee Meadows. For instance, the creeks are used to augment the South TRMWF reclaimed water (i.e., purple pipe) supply. The State Engineer also permits the use of these creek rights for water service.

In order to develop supplemental surface water supplies that will provide for the long-term sustainability of the local groundwater aquifer, TMWA is implementing a plan to construct a small water treatment plant off of Whites and Thomas Creeks— this plan was approved as part of Washoe County's 2002 South Truckee Meadows Facility Plan ("STMFP"). The STMFP recognized that, "The upper treatment plant is an integral component of the recommended water supply plan. Most importantly, it will provide recharge water and/or offset winter groundwater pumping in the upper Mt. Rose fan area."

The Mt. Rose Water Treatment Plant ("MRTP") is planned to be constructed to with for a production capacity of up to 4 MGD. When adequate Whites and Thomas Creek flows are available, a portion of the flow will be diverted to the MRTP leaving sufficient flows to maintain wildlife and habitat needs, as well as downstream irrigation requirements. A methodology called the "Tennant Method" was utilized to estimate the amount of flow needed to maintain "Good" habitat conditions in each of the creeks. The Tennant Method is a widely accepted methodology used specifically for this purpose and takes into consideration the needs of the plant communities, fisheries, and wildlife. TMWA is using the Tennant Method flow rates and the downstream water right diversions to set flow objectives for the creeks. Based on these flow objectives, an analysis was performed to quantify the potential yield from the creeks. It is anticipated that of the 4,852 AF/year of water rights available for M&I use off of Whites and Thomas Creeks, an estimated 3,200 AF will be diverted in a typical year. Depending on the time of year, diversions to the plant will be reduced or stopped because the natural flow in the creeks falls below the flow objectives. A future analysis using similar methodology will be performed to quantify the potential yield from Galena Creek in order to estimate additional surface water supplies that could also be developed to help provide additional long-term sustainable water supplies for the area.

Aquifer Storage and Recovery

TMWA defines ASR as the injection of treated surface water into the underground aquifer for later withdrawal. Chapter 3 provided a background of TMWA's recharge activities in the Truckee Meadows, Lemmon Valley, and Spanish Springs. ASR can increase the natural supply of groundwater by storing surface water underground when excess supply and treatment capacity exist, and by mitigating groundwater contamination. TMWA has equipped its production wells to allow for treated water to flow back into the wells under pressure during winter time operations.

As part of the overall 119,000 AF/yr supply of TROA, TMWA can pump an average of 15,950 AF/yr. TMWA can pump groundwater in excess of 15,950 AF/yr with or without combining with other water rights as long as those other water rights do not rely on storage under the TROA. In the TRA, new groundwater projects in excess of this 15,950 AF can be pumped separately or paired with water rights that do not rely on TROA storage and will not be counted against TROA's 119,000 AF demand. Chapter 3 described the management of Truckee River resources requires not only the acquisition of irrigation water rights but also increasing the amount of drought reserves to back-up the Truckee River rights during Drought Situations. TMWA backs up Truckee River rights by expanding its drought reserves by increasing upstream storage (i.e., TROA) or increasing the ability to pump more groundwater. The greater the ability to pump groundwater during a drought-year, the greater number of surface water rights that can be supported thereby expanding the number of commitments that can be made through the dedication of more surface water rights.

An additional ASR opportunity may exist with using former WDWR well facilities in Spanish Springs for recharge; there may be sufficient capacity that could be used during drought years to extract additional groundwater. The yield would be calculated by assuming that Spanish Springs would be served by Truckee River water eight months of the year and their full groundwater rights would be utilized during the four summer months for peaking. No additional well capacity would be required to operate in this manner; however, additional injection, booster and/or pressure reducing facilities may be necessary. Prior to TROA taking effect, TMWA may use any of its water rights for ASR; after TROA takes effect it will be necessary to ensure that the obligations to store water rights under TROA are fulfilled before water rights are utilized to support this project. The amount of water rights available to this project would be utilized to calculate how many surface water rights this recharge concept would support. The project is over and above TROA's 119,000 AF demand limit.

<u>Integrated Water Management</u>

Regional water and wastewater challenges facing the Truckee Meadows include such complex issues as ensuring sustainable water supplies to meet existing and future demands within the Truckee Meadows Service Area ("TMSA"); maintaining the appropriate water quality discharge standards and treatment capacity requirements at several of our region's wastewater treatment plants; and addressing competing needs for the region's limited water resources to meet commitments to water supply, water quality, instream flows and the environment. Many of these regional water issues are interrelated and their affects go beyond individual watershed boundaries. Solutions to one system, such as water, wastewater or flood control will likely affect the needs and costs of one or more of the other systems. In addition to being challenging, resolving many of these water issues will be expensive. Clearly, an integrated water management approach that utilizes the region's common water resources and facilities to their optimum advantage has the potential to not only reduce costs, but also increase the level of service, enhance water quality and provide environmental benefits.

To help advance solutions to these regional water management issues, a process referred to as the North Valleys Initiative ("NVI") was undertaken by the NNWPC and the WRWC from May 2008 through July 2010. The NVI process was a collaborative effort among key staff from the City of Reno, the City of Sparks, WDWR, SVGID and TMWA, designed to identify recommended solutions to many of the region's water issues.

The North Valleys is one area within our region that is expected to see an increase in population in the near future. Large tracts of land within the North Valleys have been master planned for commercial and residential development. This includes the Reno Tahoe Airport Authority ("Airport Authority") property in Stead, which is one of the largest tracts of undeveloped commercial and industrial property in the region. The Airport Authority property will be instrumental in providing a new employment center as the area develops.

Much of the area's future water supply requirements will be satisfied by the NVIP and TMWA's North Virginia pumping system. These water supply facilities augment the local groundwater resources, and both are currently available to serve the Stead and Lemmon Valley areas. With additional improvements, these facilities can also be extended to provide much needed water supplies to Cold Springs. Although these water supply sources are substantial, long-term development potential of the area may be constrained as a result of ultimate water supply and wastewater disposal limitations. Because of their proximity and similarities concerning water supply and wastewater disposal, a coordinated regional water planning effort for the Stead, Lemmon Valley and Cold Springs areas is currently being pursued.

The NVI process evaluated an alternative to traditional effluent reuse and disposal practices, referred to as potable reuse. Potable reuse is the process of purifying wastewater to such a high quality that the water can be put back into the drinking water supply. Indirect potable reuse ("IPR") is a process whereby the purified water is stored in an environmental buffer such as a lake or aquifer before re-entering the drinking water supply. The NVI process evaluated one potential IPR concept, whereby treated wastewater would be purified and recharged to replenish the local aquifer. The NVI process concluded that IPR could provide for an efficient use of water resources; defer expenditures on future water importation projects; and provide a safe, local, drought proof, reliable water supply as well as a potential solution to groundwater basin over-drafting. Potential long term accumulation of salts, public acceptance and a lack of regulatory guidance in Nevada are some of the challenges that would need to be overcome.

Presently, the NDEP has established a Reuse Steering Committee which is undertaking a comprehensive review of the reuse program for treated effluent, with a goal of providing strategic direction for future reuse in Nevada. Categories of reuse being evaluated include urban, agricultural (food and non-food crops), impoundments, environmental, industrial, groundwater recharge (non-potable) and IPR. Presently, several states including California, Florida, Montana and Texas have specific regulations for indirect potable reuse, and several additional states including North Carolina, Pennsylvania, Virginia and Washington allow IPR on a case by case basis.

IPR and groundwater replenishment must demonstrate safe, reliable water quality, practicality, affordability and public acceptance. Today, coastal communities like Orange County, California utilize reverse osmosis ("RO"), high-energy ultra-violet radiation ("UV") and peroxide treatment as part of their IPR Groundwater Replenishment System. Because RO brine disposal to the ocean is not readily available, this approach may be neither affordable nor appropriate for many inland areas like Reno. Coincident with the NVI process, the City of Reno conducted an alternative treatment demonstration project at the Reno-Stead Water Reclamation Facility for regulatory evaluation using membrane filtration (“MF”), peroxide, ozonation (“O3”), and biologically activated carbon (“BAC”). Data from Reno’s MF-Peroxide-O3-BAC pilot project has shown that the following process capabilities can be accomplished:

- Reduces contaminants to very low and non-detectable concentrations;
- Avoids increasing the corrosivity of the product water, a serious concern for IPR in arsenic-rich aquifer formations;
- Significantly reduces biodegradable dissolved organic carbon (“BDOC”) concentrations to minimize bio-fouling of IPR aquifer injection wells;
- Removes O3 transformation byproducts.

Compared to RO-UV-Peroxide systems found in Orange County, Reno’s MF-Peroxide-O3-BAC process eliminates treatment and disposal of RO process reject water, and has the benefits of multi-barrier treatment for all major categories of contaminants of concern, provides reliability; lower capital costs; lower operating and maintenance (“O/M”) costs and simpler O/M tasks; and lower energy use.

Recently, grant funds for a nation-wide study by the WaterReuse Research Foundation have been secured by a local consulting firm working in collaboration with American Water (the largest investor-owned U.S. water and wastewater utility company) to further the advancement of this promising technology. In 2016, a similar MF-Peroxide-O3-BAC demonstration project will be conducted locally at Washoe County’s South TMWRF, with involvement of technical staff from Reno, Sparks, Washoe County and TMWA. The results of this effort will allow the potable reuse industry to make informed decisions on the viability of ozone-BAC to meet regulatory goals and future water supply needs.

Conceptually, an IPR project might be well suited for areas such as the North Valleys or the South Truckee Meadows. IPR in these locations could improve the utilization of existing water resources and water rights, since the Water Reclamation Facilities for these areas do not return the treated water to the Truckee River. The purified water could be recharged using infiltration basins or injection wells in areas generally isolated from domestic wells, blended with ambient groundwater, and recovered using TMWA’s municipal wells after the water is retained in the aquifer for a period of months to years and has travelled a minimum distance through the ground.

There is the potential to expand the local water supplies by several thousand AF/yr through implementation of a safe, drought proof and reliable IPR project. Reported capital costs for the MF-Peroxide-O3-BAC treatment process are in the range of $5 to $10 million per MGD of treatment capacity, not including site specific costs for piping from the treatment facility to an infiltration or injection site, and development of the recharge infrastructure. This compares to $20 to $40 million per MGD of treatment capacity for an RO based treatment system where zero liquid discharge of the RO brine waste stream is required.

TMWA will continue to closely monitor national, state-wide and local advancements in the potable reuse industry to determine its potential applicability to the Truckee Meadows.

Bedell Flat ASR

As part of TMWA's overall conjunctive use management strategy, TMWA is working with the City of Reno and Washoe County to initiate an evaluation of the feasibility of an integrated water resource ASR program in Bedell Flat. Bedell Flat was identified in previous analysis performed by the City of Reno in 2007 as having potentially favorable geologic conditions for disposal of treated effluent. Furthermore, several potential reservoir sites ranging in size up to 30,000 AF were identified within Bedell Flat as part of the *2007 City of Reno / Washoe County TMSA/FSA Water, Wastewater and Flood Management Facility Plan*. With completion of the NVIP in 2008, transmission pipeline infrastructure is in place along the east side of the basin which could be improved to convey stored water from Bedell Flat into the North Valleys. Water stored or banked in Bedell Flat could serve as a non-Truckee River based drought or emergency water supply for the region.

Bedell Flat is located in southern Washoe County, about 13 miles north of Stead and appears to have favorable hydrogeologic characteristics for a large scale ASR program (see Figure 6-1).

Bedell Flat is a relatively small (51 square miles), undeveloped hydrographic basin comprised of federal lands administered by the Bureau of Land Management. Depths to water range from less than 5 feet in the northwest, where surface drainage exits the basin, to at least 140 feet near the middle of the basin. Additionally, geologic materials appear favorable as the basin is drained and nearly impermeable playa sediments are notably absent.

Several water resource ASR options are under consideration within Bedell Flat. These options include: injection of potable water using ASR wells off of the existing NVIP pipeline; infiltration of highly treated wastewater along a natural drainage referred to as Bird Spring Wash; infiltration of highly treated wastewater through a proposed engineered infiltration gallery, also known as a spreading basin or rapid infiltration basin (RIB); or a combination of these. Geologic/hydrogeologic feasibility investigations and environmental clearance and permitting work are proposed to gain an understanding of the feasibility, scope and cost of a water banking program in Bedell Flat.

Figure 6-1. Location of Bedell Flat Hydrographic Basin

Potential Water Supply Projects

There are a number of water importation projects being pursued by private developers who may be willing to bring these water supplies to the region. Also, the water supplies provided by TROA, ASR and conjunctive use can be timed either near term or into the future without losing the opportunity to pursue those projects. These water supplies are analyzed from the standpoint of long term water quantity and water quality because if the projects are not sustainable in perpetuity, TMWA and its customers would be required to make up for such lack of water or water quality. However, to the extent these private developers find their projects to be environmentally permitable, cost effective and worth the financial risk they may take, TMWA would integrate these projects into its water resource supply mix and would accept will-serve commitments against these supplies before other supplies are fully allocated.

For this discussion it is assumed that future water resource projects will be implemented in the most economical fashion by the appropriate entity, such as Vidler, with the ability to assume the risk and invest the time and effort for permitting, design, construction, and financing of a water supply project - a function that TMWA does not currently undertake at this time due to the inherent risks of stranding investment until will-serve commitments can be sold and facility charges collected to cover the cost of developing a project.

The following is a partial list of potential water supply projects that TMWA may be able to use to expand future supplies. The following information summarizes the status of proposed water importation projects in hydrographic basins outside of the Truckee Meadows, however, detailed information is limited. The information is based on data currently available and is by no means exclusive to any new project, combination of projects, or future configuration of how the water resources could be integrated into TMWA's system.

<u>Intermountain Water Project</u>

Sponsored by Intermountain Water Supply, Ltd., the Intermountain Water Project ("IWP") is permitted for 3,564.1 AF/yr for municipal water from three close-in basins to supply water to the North Valleys. Interbasin transfers have been approved as follows: Bedell Flat, 368.1 AF/yr, Lower Dry Valley ("LDV"), 2,000 AF/yr, Upper Dry Valley ("UDV"), 996 AF/yr, and Newcomb Lake, 200 AF/yr. The project received a record of decision ("ROD") from BLM for a pipeline and related infrastructure from the LDV and Bedell Flat well sites to Lemmon Valley as well as an Environmental Assessment for a power line from NV Energy's transmission line on Red Rock Road to the Bedell Flat well site and pump station. Right-of-way grants and easements over private land have been secured for the LDV and Bedell Flat well sites. Private easements have also been secured for the Newcomb Lake well site and a portion of the UDV well sites.

Test wells have been drilled and pumped in LDV which indicate a sustainable yield of 25 percent more water than is currently permitted. The project can be developed in increments as demand requires, starting with Bedell Flat and moving through the five LDV well sites and thereafter to Newcomb Lake and UDV. Washoe County has issued the IWP a Special Use Permit.

Lower Smoke Creek Importation.

The Lower Smoke Creek ("LSC") project is located just north of Pyramid Lake in Basin 21 in Washoe County. Much of the water in Basin 21 is held primarily by one owner through various entities, including Bright-Holland Co., a Nevada corporation and Jackrabbit Properties LLC, a Nevada limited liability company. In the mid-2000's Jackrabbit and Bright Holland assembled water rights in Basin 21 and executed an option to sell with Granite Fox Power, LLC also known as Sempra. The option agreement at the time encompassed approximately 28,000 AF of groundwater and surface water combined. It was Sempra's intent to use the water for a $2 billion coal fired power plant within Basin 21. Subsequently, Sempra decided not to proceed with the power plant project and as a result, released its options to purchase the water. Jackrabbit and Bright Holland, in turn, executed a water development agreement with LSC Development, which intends to develop a water importation project rather than a power plant project. The first phase of the water importation project is intended to capture the water in the southern portion of Basin 21 and pipe the water to Winnemucca Ranch and other planned developments consistent with the relevant water resource plans. The second phase would extend the pipeline to transport water from the northern portion of Basin 21. Basin 21 has a yield substantiated by the USGS of 16,000 AF and is currently being adjudicated. Sempra completed extensive groundwater testing and modeling, which confirmed the long term sustainability of the water resource. LSC Development updated the modeling to reflect a municipal water project. With this existing information, including USGS gauges in place since 1986, the abovementioned water rights will support approximately 10,500 to 14,000 AF of municipal water annually, subject to State Engineer approvals.

Other Conceptual Projects

The following project descriptions come from various water supply plans that have never made it past the concept or permit stage. They provide ideas for future water supply possibilities; little is known of the status of these projects, but economics may someday stimulate renewed interest.

Dixie Valley Ground Water Importation. This supply alternative proposes to develop ground water in Dixie Valley and transport it via a pipeline over the Stillwater Range to Lahontan Valley. The water could support growth in the Fallon area, provide irrigation water, or augment supplies in the Lahontan Valley wetlands. Water from Dixie Valley utilized in the Lahontan Valley could displace the use of Truckee River water. Water rights thereby freed-up on the Truckee River could be transferred upstream.

Long Valley, California, Ground Water Recharge and Importation. Long Valley, California is located north of Reno and west of Bordertown, Nevada. The owners of Evans Ranch, Inc., have filed applications with various California governing agencies to recover an estimated 3,300 AF of surplus surface water from the Long Valley Creek system and use this water to recharge ground water supplies in the valley. The surface water would replace ground water which would be withdrawn and transported for use in the lower (Nevada) portion of Evans Ranch and/or quasi-municipal uses in developing areas in Washoe County, Nevada.

Red Rock Valley Importation. The Red Rock Valley Importation ("Red Rock") project proposes to transport between 1,000 to 1,300 AF of water from the Red Rock groundwater basin to the north end of WLV. TMWA entered into a purchase agreement with Red Rock subject to satisfying certain conditions of supply (e.g., 1,000 AF minimum State Engineer permit) and facility construction. In January 2008 the State Engineer issued a permit for 855 AF with conditions that allow the project to expand up to 1,273 AF. Through 2008 Red Rock's project sponsors progressed with design and planning which led to filing an application for a Special Use Permit with Washoe County in December 2008. The Board of Adjustment denied the application at its March 4, 2009 meeting and the BCC also denied an appeal in May 2009.

Silver State Importation Project. Silver State Importation Project ("SSIP"), also called the Washoe County Ground Water Importation Project, is a proposal to develop ground water sources in 19 hydrographic basins in central and northern Washoe County for importation into the Truckee Meadows. The plan was originally created to provide drought year water supplies for the Truckee Meadows served by TMWA and year-round supplies to Lemmon Valley, SSV, Cold Spring Valley, Warm Springs Valley, and adjacent areas. SSIP was proposed to proceed in five stages over a 50-year period. The final project includes 372 miles of buried steel pipeline ranging in size from 14 to 60 inches, 8 pumping stations, 42 production wells, and underground terminal storage.

Sierra Valley Water Rights. Since the late 1800s, a diversion ditch has carried up to 60 cfs of water for agricultural use from the Little Truckee River above Stampede Reservoir out of the Truckee Basin to Sierra Valley, California, in the Feather River basin. The Little Truckee River diversions are inversely proportional to the Sierra Valley natural runoff, i.e., the lower the available flows in the native Sierra Valley streams, the higher the diversions from the Little Truckee River. Thus, these rights have a higher drought yield than a normal year yield, but the ability to store these rights would be required.

Summary

This chapter presented the status of various ground and surface water projects. The majority of them have been reviewed and analyzed in various water resource plans over the past 20 years. The projects discussed here are not all inclusive, but are projects that have been studied in the past or continue to be considered potentially viable. The selection of the next water supply project is strictly a function of the project's yield, ease of implementation, sustainability, and financial feasibility as determined by existing regional economic conditions and market forces that would or would not favor the development of a future water supply project. It may be that in the future as new technology becomes available or the political, regulatory or public opinion changes, new projects may be developed or projects previously thought infeasible may become feasible. Specific conclusions are:

- In the TRA, TROA will provide 119,000 AF/yr, sufficient to meet the projected demands through the planning horizon.

- The NVIP primary place of use is in the North Valleys, the project is operational, and will yield 8,000 AF/yr.
- Plans are underway to construct creek-treatment plant(s) to help reverse declining groundwater supplies in the area and support expanded use of creek water rights for future development.
- There are several importation projects for the North Valleys area that are in various stages of permitting and/or design. Construction of these projects is subject to positive changes in economic conditions leading to increased demand for water supplies.
- TMWA will continue to closely monitor advancements in the potable reuse industry to determine its potential applicability to the Truckee Meadows.
- Over the years, numerous projects have been proposed but remain unbuilt due to lack of financing, permitting, conceptual design, institutional or regulatory constraints, etc.

Appendix C
Glossary

Glossary

Definitions for water-related terms are taken from *Water Words Dictionary*, published by the Nevada Department of Conservation and Natural Resources, Division of Water Resources, Water Planning Section. Other sources include the Washoe County Comprehensive Plan and Webster's Dictionary. A small number of definitions are also found in Sections 6 through 21 of the Act, see Appendix A.

100-year flood plain: The area of a flood plain subject to a 1 percent chance of flooding in any given year.

208 Studies: Refers to Section 208 of Public Law 92-500 as amended (Clean Water Act), which requires population projections, water quality needs, and waste treatment needs be projected and a plan developed to show how water quality standards will be met.

303(d) list: Clean Water Act-required list of water quality impaired surface waters.

acre-foot (af): A unit commonly used for measuring the volume of water; equal to the quantity of water required to cover 1 acre (43,560 square feet) to a depth of 1 foot and equal to 43,560 cubic feet or 325,851 gallons.

activated sludge: the floc produced in raw or settled wastewater due to the growth of bacteria and other organisms in the presence of dissolved oxygen.

ALERT: A flood alert system known as "Truckee Meadows Early Warning Flood ALERT System".

allotment management plan: A livestock management plan specific to federal range allotments depicting season of use, seasonal location of livestock, and permitted numbers of livestock.

alluvial: Describes soil or earth material which has been deposited by running water, as in a riverbed, flood plain, or delta.

alluvial fan: A fan-shaped deposit of generally coarse material created where a stream flows out onto a gentle plain.

application, water right: An official request for permission to initiate a water right or to change an existing water right. The application will typically consist of the following information: (1) total amount of water to be diverted or pumped; (2) rate of flow (diversion); (3) point of diversion or pumpage; (4) point or place of use; (5) manner of (beneficial) use; (6) period of use (continuous pumpage, seasonal diversion, etc.). The application process is the first step in a process of obtaining a certificate of use or a *perfected water right*. This process includes (1) the filing of the application, which establishes the priority date for appropriation purposes; (2) the permit which is issued by the State Engineer or other approving authority; (3) the proof of completion which is filed by the applicant; (4) the proof of beneficial use which is also filed by the applicant; and (5) the certificate or perfected water right which is issued by the State Engineer or other approving authority.

appropriate (water rights): To authorize the use of a quantity of water.

(prior) appropriation doctrine: The system for allocating water to private individuals used in most western states. The doctrine of *prior appropriation* was in common use throughout the arid west as early settlers and miners began to develop the land. The prior appropriation doctrine is based on the concept of “first in time, first in right”. The first person to take a quantity of water and put it to *beneficial use* has a higher priority of right than a subsequent user. Under drought conditions, higher priority users are satisfied before junior users receive water. Appropriative rights can be lost through nonuse; they can also be sold or transferred apart from the land.

aquatic: (1) consisting of, relating to, or being in water; living or growing in, on, or near the water. (2) taking place in or on the water.

aquifer: A geologic formation, a group of formations, or a part of a formation that is water bearing. A geological formation or structure that stores or transmits water, or both. Use of the term is usually restricted to those water-bearing units capable of yielding water in sufficient quantity to constitute a usable supply.

aquifer recharge: Flow to groundwater storage from precipitation, infiltration from streams.

area plan: Plans adopted by Washoe County which cover specific sub-areas of the unincorporated County. These plans provide basic information on the natural features, resources, and physical constraints that affect the development of the planning area. They also specify detailed land use designations which are then used to review specific development proposals and to plan services and facilities.

artificial recharge: The designed (as opposed to the natural or incidental) replenishment of groundwater storage from surface water supplies. There are five common techniques to effect artificial recharge of a groundwater basin: (1) *water spreading,* consisting of the basin method, stream-channel method, ditch method, and flooding method, all of which tend to divert surface water supplies to effect underground infiltration; (2) *recharge pits* designed to take advantage of permeable soil or rock formations; (3) *recharge wells,* which work directly opposite of pumping wells although they have a limited scope and are better used for deep, confined aquifers; (4) *induced recharge,* which results from pumping wells near surface supplies, thereby inducing higher discharge toward the well; and (5) *wastewater disposal,* which includes the use of secondary treatment wastewater in combination with spreading techniques, recharge pits, and recharge wells to reintroduce the water to deep aquifers, thereby both increasing the available groundwater supply and further improving the quality of the wastewater. Also referred to as *induced recharge*. Also see *natural recharge, induced recharge, incidental recharge*, and *perennial yield*.

base flow: 1) The flow that a perennially flowing stream reduces to during the dry season; 2) The fair-weather or sustained flow of streams; 3) The volume of flow in a stream that is not derived from surface run-off.

beneficial use (of water): The cardinal principle of the (prior) *appropriation doctrine*. A use of water that is, in general, productive of public benefit and which promotes the peace, health, safety, and welfare of the people of the State. A *certificated water right* is obtained by putting water to a beneficial use. The right may be lost if beneficial use is discontinued. A beneficial use of water is a use which is of benefit to the appropriator and to society as well. The term encompasses considerations of social and economic value and efficiency of use. In the past, most reasonably efficient uses of water for economic purposes have been considered beneficial. Usually, challenges have been raised only to wasteful use or use for some non-economic purpose, such as preserving in-stream values. Beneficial use can include the use of water for recreation, fish and wildlife purposes, or preservation of the environment. Also see *appropriate (water rights)*.

best management practices (BMPs): Accepted methods for preventing or controlling *non-point source pollution*; may include one or more conservation practices.

biomass: (1) The total mass of living matter within a given unit of environmental area; (2) plant material, vegetation, or agricultural waste used as a fuel or energy source.

bioremediation: Simply, the use of biological techniques to clean up pollution. More specifically, the use of specialized, naturally occurring microorganisms with unique biological characteristics, appetites, and metabolisms as a form of waste cleanup. A critical underpinning of this process is the ability to economically generate a sufficient biomass of the appropriate microbes to accomplish in weeks or months what would normally take nature years to do. Typically, this is done either by applying a sufficient concentration of such microbes directly to the polluted area or by applying various concentrations of chemicals which, in turn, stimulate and foster the rapid growth of appropriate microorganisms.

blending: Mixing of product water from a desalting plant with conventional water to obtain a derived dissolved solids content, or mixing brine effluents with sewage treatment plant effluents to reduce evaporation pond size. (In this document blending describes mixing surface water with groundwater that exceeds a drinking water standard (e.g. arsenic) to achieve the standard.)

caliche: A soil layer near the surface, more or less cemented by secondary carbonates of calcium or magnesium precipitated from the soil solution. It may occur as a soft, thin soil horizon, as a hard, thick bed just beneath the solum, or as a surface layer exposed by erosion.

Capital Improvements Program (CIP): A plan for capital expenditures to be incurred each year over a fixed period of several years setting forth each capital project, identifying the expected beginning and ending date for each project, the amount to be expended in each year, and the method of financing those expenditures.

certificated water right: The right granted by a State water agency to use either surface or groundwater. Certificated water rights have been put to a *beneficial use*. Also see *application*, *water right* and *vested water right*.

channel capacity: The maximum rate of flow that may occur in a stream without causing over-bank flooding.

coliform: Bacteria associated with human and animal waste. Used as an indicator of the possible presence of disease-causing microorganisms. All drinking water sources are routinely monitored for coliform “counts”.

commitment: An allocation of a water resource that is granted through a “will serve” letter from a municipal water purveyor to a project(s).

comprehensive plan: (natural resource) A plan for water and related land resources development that considers all economic and social factors and provides the greatest overall benefits to the region as a whole.

conjunctive use: The combined use of surface and groundwater systems to optimize resource use.

consumptive use: The portion of water withdrawn from a surface or groundwater source that is consumed for a particular use (e.g. irrigation, domestic needs, and industry) and does not return to its original source or another body of water. The terms *consumptive use* and *non-consumptive use* are traditionally associated with water rights and water use studies, but they are not completely definitive. No typical consumptive use is 100 percent efficient; there is always some return flow associated with such use either in the form of a return to surface flows or as a groundwater recharge. Nor are typically non-consumptive uses of water entirely non-consumptive. There are evaporation losses, for instance, associated with maintaining a reservoir at a specified elevation to support fish, recreation, or hydropower, and there are conveyance losses associated with maintaining a minimum stream-flow in a river, diversion canal, or irrigation ditch.

contact stabilization: A modification of the activated sludge process wherein a contact basin provides for the rapid adsorption (adhesion to the surface of solids) of the waste. A separate tank is provided for stabilization of the solids before they are reintroduced into the raw wastewater flow.

contaminants: (water quality) In a broad sense, any physical, chemical, biological, or radiological substance or matter in water. In more restricted usage, a substance in water of public health or welfare concern. Also, an undesirable substance not normally present or an unusually high concentration of a naturally occurring substance in water, soil, or other environmental medium.

contamination (water): Impairment of the quality of water sources by sewage, industrial waste, or other matters to a degree that creates a hazard to public health. Also, the degradation of the natural quality of water as a result of man's activities. There is no implication of any specific limits, since the degree of permissible contamination depends upon the intended end use, or uses, of the water.

cryptosporidium: Protozoan associated with domestic animal waste in surface water supplies, principally sheep and cattle, that causes serious health problems. The EPA has mandated water treatment processes to help protect surface water supplies from cryptosporidium.

cubic foot per second (cfs): A unit expressing rate of discharge, typically used in measuring stream flow. One cubic foot per second is equal to the discharge of a stream having a cross section of 1 square foot and flowing at an average velocity of 1 foot per second. It also equals a rate of 448.83 gallons per minute.

cultural resource: The tangible and intangible aspects of cultural systems, living and dead, that are valued by a given culture or contain information about the culture. Cultural resources include, but are not limited to, sites, structures, buildings, districts, and objects including plants and animals associated with or representative of people, cultures, and human activities and events.

cumulative impact: An effect which is a result of several related projects. Each increment from each project may not be noticeable but cumulative impacts may be noticeable when all increments are considered together.

customer: a person served by a utility

debris flow: A moving mass of rock fragments, soil, and mud with more than half of the material being larger than sand size.

denitrifying treatment system: a system that receives sewage or nitrate-laden water and, through biological denitrification, chemical reduction or ion exchange, and with proper maintenance, reduces the nitrate level of the effluent to less than 10 mg/l total nitrogen.

designated groundwater basin (administered basins)—Nevada: In the interest of public welfare, the Nevada State Engineer, Division of Water Resources, Department of Conservation and Natural Resources, is authorized by statute (NRS 534.120) and directed to designate a groundwater basin and declare Preferred Uses within such designated basin. The State Engineer has additional authority in the administration of the water resources within a designated water basin.

development code: Document that incorporates all county or city development-related ordinances and standards to ensure conformity with the Washoe County Comprehensive Plan.

discharge permits: Permits obtained through the Nevada Division of Environmental Protection to discharge water into area rivers, streams, and groundwater.

discount factor: In the case of some water resources such as groundwater and tributary creeks, there are more water rights available than can be supported by the sustainable yield of the resource. In an effort to manage the available resources such that commitments do not exceed the sustainable yield, a water rights dedication policy may be developed that requires a greater than 1:1 dedication of water rights to commitment ratio.

dissolved oxygen: The oxygen dissolved in water, wastewater, or other liquid; usually expressed in milligrams per liter, parts per million, or percent of saturation. Adequate concentration of dissolved oxygen is necessary for the life of fish and other aquatic organisms and the prevention of offensive odors.

drinking water standards: Drinking water standards established by state agencies, the US Public Health Service, and the EPA for drinking water throughout the United States.

drinking water standards (Nevada): The primary objective of Nevada's drinking water standards is to assure safe water for human consumption. To this end, the State of Nevada has established statewide primary and secondary drinking water standards at least as rigorous as those required by the EPA. *Primary drinking water standards* limit contaminants (constituents) which may affect consumer health. *Secondary drinking water standards* were developed to deal with the aesthetic qualities of drinking water.

domestic well: A well on a property that serves the water needs of a single family residence pursuant to state law.

drought: There is no universally accepted quantitative definition of drought. Generally, the term is applied to periods of less than average precipitation over a certain period of time sufficiently prolonged to cause a serious hydrological imbalance. In a less precise sense, it can also signify nature's failure to fulfill the water wants and needs of man. (The definition of drought specific to this plan can be found in Chapter 2.)

ecosystem: A community of animals, plants, and bacteria, and its interrelated physical and chemical environment. An ecosystem can be as small as a rotting log or a puddle of water, but current management efforts typically focus on larger landscape units such as a mountain range, a river basin, or a watershed.

effluent: Discharged wastewater such as the treated wastes from sewage plants and septic tanks.

effluent reuse: Reusing wastewater from a treatment facility in lieu of other water sources for a variety of water uses including but not limited to irrigation, dust control, and aquifer recharge.

emergency: As referred to and limited in its application to policy 4.1.a, emergency means:

Acts of nature or man including but not limited to floods, earthquakes, volcanic eruptions, extreme weather, toxic spills, radiation events causing loss of water, wastewater or flood control facilities, or capacity of these facilities to supply needs of the region.

Unforeseen events that can be defined as an emergency by a vote of the NNWPC and accepted by the WRWC.

endangered species: Any plant or animal species (or distinct vertebrate population segment) on the verge of extinction throughout all or a significant area of its range; identified by the Secretary of the Interior as “endangered”, in accordance with the 1973 Endangered Species Act.

endemic: (ecology) Confined to, or *indigenous* in, a certain area or region, as an endemic plant or animal.

environmental assessment (EA): A report on a proposed project or action that presents the first thorough examination of alternative plans to positively demonstrate that the environmental and social consequences of the project or action were considered. If it is shown that such activities would, in fact, significantly impact the environment or are otherwise deemed controversial, then an *environmental impact statement (EIS)* will normally be required.

environmental impact statement (EIS): A report required by Section 102(2)(c) of Public Law 91-190 for all major federal or federally funded projects which significantly impact on the quality of the human environment or are environmentally controversial. The EIS is a detailed and formal evaluation of the favorable and adverse environmental and social impacts of a proposed project and its alternatives. Also see *environmental assessment (EA)*.

evapotranspiration (ET): The combined processes by which water is transferred from the earth surface to the atmosphere; evaporation of liquid or solid water plus transpiration from plants. Evapotranspiration occurs through evaporation of water from the surface, evaporation from the capillary fringe of the groundwater table, and transpiration of groundwater by plants (phreatophytes) whose roots tap the capillary fringe of the groundwater table. The sum of evaporation plus transpiration.

facility: Pursuant to the Act and for the purposes of the Regional Water Plan, facility(ies) means flood control, storm drainage, waste water or water infrastructure, including but not limited to, plants to treat waste water, interceptors, facilities to convey and store surface water, facilities to treat surface water, facilities to extract and convey underground water, facilities to treat and store underground water, devices to infiltrate storm water, regional facilities to control floods, facilities to control floods in single drainage basins and facilities for controlling floods which utilize storage of water underground to mitigate floods.

Federal Emergency Management Agency (FEMA): Agency responsible for administering the National Flood Insurance Program.

fish credit water: Specific to this plan, water reserved in upstream reservoirs for release for fisheries in the lower Truckee River and Pyramid Lake. Drought reserve water converts to fish credit water if snow-pack is deemed adequate on an agreed upon date.

flood hazard areas: Areas in an identified flood plain.

flood plain: The portion of the flood plain outside the floodway which is covered by floodwaters during the 100-year flood. It is generally associated with shallow, standing, or slowly moving water rather than deep, rapidly flowing water.

floodway: The channel of a river or stream and those parts of the flood plains adjoining the channel which carry and discharge the floodwater or flood flow of any river or stream.

Floriston Rates: rates of flow of in the Truckee River measured at the Farad Gage, consisting of average flows of 500 cubic feet per second each day from March 1 through September 30, and 400 cubic feet per second each day from October 1 through the last day of February.

flow augmentation: The addition of water to a stream especially to meet in-stream flow needs. (In this plan it also means addition of water to a stream to meet water quality standards.)

General Improvement District (GID): A public entity created under the provisions of NRS 318 and granted by the County Commission to provide specific services to a limited geographical area. A GID may be formed to provide one or a combination of services including road maintenance, parks and recreation activities, water and sanitary sewer service.

geothermal: Terrestrial heat, usually associated with water as around hot springs.

giardia: *Giardia lamblia* is a protozoan which causes gastrointestinal illness. It is found in surface waters and associated with wild animal waste. The EPA has mandated water treatment processes to help protect surface water supplies from *giardia*.

gray water: Wastewater from a household or small commercial establishment which specifically excludes water from a toilet, kitchen sink, or dishwasher, or water used for washing diapers.

greenbelt: An area where measures are applied to mitigate fire, flood, and erosion hazard including fuel management, land use planning, and development standards. More traditionally, an irrigated landscaped buffer zone between development and wildlands, usually put to additional uses (e.g. golf courses, park).

groundwater: Any subsurface water.

groundwater basin: A groundwater reservoir together with all the overlying land surface and underlying aquifers that contribute water to the reservoir. In some cases, the boundaries of the successively deeper aquifers may differ in a way that creates difficulty in defining limits of the basin. A groundwater basin could be separated from adjacent basins by geologic boundaries or by hydrologic boundaries.

groundwater discharge: Subsurface water discharge.

groundwater flow model: (1) A digital computer model that calculates a hydraulic head field for the modeling domain using numerical methods to arrive at an approximate solution to the differential equation of groundwater flow. (2) any representation, typically using plastic or glass cross-sectional viewing boxes, with representative soil samples, depicting groundwater flows and frequently used for educational purposes.

groundwater production facilities: A water supply well used by a water purveyor.

habitat: The native environment where a plant or animal naturally grows or lives.

hazardous material: An injurious substance including pesticides, herbicides, toxic metals and chemicals, liquefied natural gas, explosives, volatile chemicals, and nuclear fuels.

hydraulic gradient: (*i*) The gradient or slope of a water table or *piezometric surface* in the direction of the greatest slope, generally expressed in feet per mile or feet per feet. Specifically, the change in static head per unit of distance in a given direction, generally the direction of the maximum rate of decrease in head. The difference in hydraulic heads (h_1 or h_2) divided by the distance (L) along the flowpath, or $i = (h_1 \text{ or } h_2) / L$. A hydraulic gradient of 100 percent means a 1-foot drop in head in 1 foot of flow distance.

hydrographic area: (Nevada) The 232 subdivisions (256 hydrographic areas and hydrographic sub-areas) of the 14 Nevada hydrographic regions (or basins) as defined by the State Engineer's Office, Department of Conservation and Natural Resources, Division of Water Resources. Primarily these are sub-drainage systems within the 14 major drainage basins. Hydrographic areas (valleys) may be further subdivided into hydrographic sub-areas based on unique hydrological characteristics (e.g. differences in surface flows) within a given valley or area.

hydrographic basin: This term is essentially synonymous with hydrographic area or sub-area as defined by the Nevada State Engineer's Office, Department of Conservation and Natural Resources, Division of Water Resources.

hydrology/geology matrix score: Refer to the Southern Washoe County Groundwater Recharge Analysis (January 2001) in which a methodology was developed for determining whether a site is suitable for recharge.

hydropower: Power produced by falling water.

impervious: Resistant to or incapable of penetration by water or plant roots.

incidental recharge: Groundwater recharge (infiltration) that occurs as a result of human activities unrelated to a recharge project; for example, irrigation and water diversion (unlined canals). Also see *artificial* (or *induced*) *recharge*, *natural recharge*, and *perennial yield*.

incorporated city: Area(s) / neighborhood(s) organized for the purpose of self-government. Reno and Sparks are the only incorporated cities in Washoe County.

indigenous: Existing, growing, or produced naturally in a region.

induced recharge: The designed (as opposed to the natural or incidental) replenishment of groundwater storage from surface water supplies. There exist five common techniques to effect artificial recharge of a groundwater basin: (1) *water spreading,* consisting of the basin method, stream-channel method, ditch method, and flooding method, all of which tend to divert surface water supplies to effect underground infiltration; (2) *recharge pits* designed to take advantage of permeable soil or rock formations; (3) *recharge wells,* which work directly opposite of pumping wells although they have a limited scope and are better used for deep, confined aquifers; (4) *induced recharge,* which results from pumping wells near surface supplies, thereby inducing higher discharge toward the well; and (5) *wastewater disposal,* which includes the use of secondary treatment wastewater in combination with spreading techniques, recharge pits, and recharge wells to reintroduce the water to deep aquifers, thereby both increasing the available groundwater supply and also further improving the quality of the wastewater. Also referred to as *artificial recharge*. Also see *natural recharge*, *incidental recharge*, and *perennial yield*.

infiltration: The flow of fluid into a substance through pores or small openings. It connotes flow into a substance, unlike the word *percolation*, which connotes flow through a porous substance. Also the process whereby water passes through an interface, such as from air to soil or between two soil horizons.

influent: The input stream of a fluid, such as water into a reservoir or waste into a sewage treatment plant.

infrastructure: (1) An underlying base or foundation, especially for an organization or a system. (2) The basic facilities, services, and installation needed for the functioning of a community or society, such as transportation and communication systems, water and power lines, and public institutions including schools, post offices, and prisons.

in-stream flow: Non-consumptive water requirements which do not reduce the water supply. Examples of in-stream flows include (1) aesthetics—water required for maintaining flowing streams, lakes, and other bodies of water for visual enjoyment; (2) fish and wildlife—water required for fish and wildlife; (3) navigation—water required to maintain minimum flow for waterborne commerce; (4) quality dilution—water required for diluting salt and pollution loading to acceptable concentrations; and (5) recreation—water required for outdoor water recreation such as fishing, boating, water skiing, and swimming.

inter-basin transfer (of water): A transfer or diversion of water (either ground or surface) from one drainage or hydrographic basin to another.

lagoon system: (water quality) Scientifically constructed ponds in which sunlight, algae, and oxygen interact to restore water to a quality equal to effluent from a secondary treatment plant.

land use: The primary or primary and secondary use(s) of land such as single family residential, multi-family residential, commercial, industrial, or agriculture. The description of a particular land use should convey the dominant character of a geographic area and thereby establish the types of activities that are appropriate and compatible with primary use(s).

load allocation: The portion of the pollution load of a stream attributable to human-caused nonpoint source of pollution.

local flood management staff: Each local government has assigned one or more staff members the responsibility of designing and reviewing flood management projects. These staff members are also responsible for reviewing certain proposed projects to address concerns of drainage and flooding.

low impact development: Low impact development (LID) is a new comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds. This design approach incorporates strategic planning with micro-management techniques to achieve superior environmental protection, while allowing for development or infrastructure rehabilitation to occur. This innovative approach can be used to help meet a wide range of Wet Weather Flow (WWF) control and community development goals.

minimum stream flows: The specific amount of water reserved for support of aquatic life, minimization of pollution, or recreation. It is subject to the priority system and does not affect water rights established prior to its institution.

mitigation: An action designed to lessen or reduce adverse impacts; frequently used in the context of environmental assessment.

municipal service providers: Local governments or public or private utilities that provide for water supply, wastewater treatment, collection, disposal, effluent reuse or storm water / flood control services.

municipal water: Municipal water may come from either ground or surface water sources. Once water has entered a municipal water system, from whatever source, it will be considered municipal water.

National Environmental Policy Act (NEPA): A 1970 Act of Congress which is our basic national charter for protection of the environment.

National Flood Insurance Program (NFIP): A program for subsidizing flood insurance that is not privately available for properties subject to flood hazard.

native groundwater: (See *endemic.*) Groundwater originating and stored within a specific hydrographic basin.

natural recharge: The replenishment of groundwater storage from naturally occurring surface water supplies such as precipitation and stream flows. Also see *artificial* (or *induced*) *recharge*, *incidental recharge*, and *perennial yield*.

Negotiated Settlement: The generally used title for Public Law 101-618, omnibus legislation passed by the 101st Congress at the end of its 1990 session and intended to settle a number of outstanding disputes concerning the Truckee and Carson Rivers. The legislation authorized an ambitious environmental restoration program to benefit the Lahontan Valley wetlands, Pyramid Lake, and the lower Truckee River. It also established a framework for resolving separate but closely related water-resource conflicts involving the Pyramid Lake Paiute and Fallon Paiute-Shoshone Tribes, the Cities of Reno and Sparks, the States of Nevada and California, and the *Newlands Project*. The legislation contains two primary titles: TITLE I **-** The Fallon Paiute-Shoshone Indian Tribal Settlement Act and TITLE II - The Truckee–Carson–Pyramid Lake Water Rights Settlement Act. Four of the seven main elements of the Negotiated Settlement specific to this plan are:

- **Promote the Enhancement and Recovery of Endangered and Threatened Fish Species**—A recovery program is to be developed for the Pyramid Lake endangered fish species cui-ui *(Chasmistes cujus)* and the threatened fish species Lahontan cutthroat trout *(Oncorhynchus clarki henshawi)* in compliance with the Endangered Species Act and the Truckee–Carson–Pyramid Lake Water Rights Settlement Act. Water rights acquisitions are authorized for this purpose.
- **Encourage the Development of Solutions for Demands on Truckee River Waters**—An operating agreement is to be negotiated for the Truckee River—*The Truckee River Operating Agreement (TROA*), covering procedures for using storage capacity in upstream reservoirs in California consistent with recovery

objectives for listed Pyramid Lake fishes. This includes the implementation of the terms and conditions of the *Preliminary Settlement Agreement* between SPPCo and the Pyramid Lake Paiute Tribe.

- **Pyramid Lake Paiute Tribe Issues Settlement**—A tribal economic development fund of $40 million was established for the Tribe to provide for the settlement of water, fish, and other issues. Another fund of $25 million was established for the Pyramid Lake fishery.
- **Interstate Water Apportionment Settlement**—Facilitate an interstate allocation of the water of the Truckee River, Carson River, and Lake Tahoe between the states of California and Nevada.

Newlands Project (Nevada): One of the first of the US Department of the Interior, Bureau of Reclamation's irrigation projects; completed in 1915 to provide water for domestic, irrigation, and other water needs to a defined service area in the town of Fernley and the lower Carson River Basin near the City of Fallon, Churchill County, in Western Nevada.

nitrogen: Natural element found in atmosphere, soil, and water. In aqueous state can take form as nitrate, nitrite, and ammonium, ammonia and nitrogen gas. High concentrations may cause harmful health effects and low concentrations can be fatal to freshwater fish. Safe Drinking Water Act sets limits of concentration. Often associated with animal and human waste.

No Adverse Impact: The results of activities that do not exacerbate flood damage to another property or community or are mitigated or have been accounted for within an adopted community-based plan.

non-consumptive use: Non-consumptive water use includes water withdrawn for use that is not consumed; for example, water withdrawn for purposes such as hydropower generation. This also includes uses such as boating or fishing where the water is still available for other uses at the same site. The terms *consumptive use* and *non-consumptive use* are traditionally associated with water rights and water use studies, but they are not completely definitive. No typical consumptive use is 100 percent efficient; there is always some return flow associated with such use either in the form of a return to surface flows or as a groundwater recharge. Nor are typically non-consumptive uses of water entirely non-consumptive. There are evaporation losses, for instance, associated with maintaining a reservoir at a specified elevation to support fish, recreation, or hydropower, and there are conveyance losses associated with maintaining a minimum stream flow in a river, canal, or ditch.

non-potable: Describes water that is not suitable for drinking.

non-point source pollution: Pollution discharged over a wide land area, not from one specific location. These are forms of pollution caused by sediment, nutrients, or organic and toxic substances originating from land use activities and carried to lakes and streams by surface runoff. Non-point source pollution occurs when the rate of materials entering these waterbodies exceeds natural levels. Non-point source pollution includes agricultural return flows that are "one specific location" when in a return flow ditch, but they are not regulated as "point sources" (requiring a discharge permit) under the *Clean Water Act*. See *point source*.

nutrients: Elements or compounds essential to life, including carbon, oxygen, nitrogen, phosphorus, and many others.

open space / open space use: Current employment of land, the preservation of which conserves and enhances natural or scenic resources, protects streams and water supplies, or preserves sites designated as historic pursuant to law.

peaking: Generally describing the peak water demand for municipal water systems and expressed as a ratio to base demand (e.g. 2:1 peaking).

percolation: The movement, under hydrostatic pressure, of water through the interstices of a rock or soil. (1) Movement of water within a porous medium such as soil without a definite channel. (2) The entrance of a portion of the stream flow into the channel materials to contribute to groundwater replenishment.

perennial stream: A stream that flows from source to mouth throughout the year.

perennial yield (groundwater): The amount of usable water of a groundwater reservoir that can be withdrawn and consumed economically each year for an indefinite period of time without causing long-term depletion of the groundwater reservoir. Also referred to as *safe yield*.

perfected water right: A water right which indicates that the uses anticipated by an applicant, and made under permit, were made for *beneficial use*. Usually, it is irrevocable unless voluntarily canceled or forfeited due to several consecutive years of nonuse. Also see *appropriation doctrine*.

permeability: For a rock or an earth material, the ability to transmit fluids. It is measured by the rate at which a fluid of standard velocity can move through a material in a given interval of time under a given *hydraulic gradient*. Permeability for underground water is sometimes expressed numerically as the number of gallons per day that will flow through a cross section of 1 square foot, at 60°F, under a hydraulic gradient of 100 percent. Permeability is equal to velocity of flow divided by hydraulic gradient.

permitted water right: The right to put surface or groundwater to beneficial use that is identified by a document issued by the Nevada State Engineer prior to the filing of satisfactory proof of "perfection of application" in accordance with NRS Chapter 533. If proof of beneficial use is accepted by the Nevada State Engineer, then the water right permit can be converted into a certificated water right. If proof of beneficial use is not made to or accepted by the Nevada State Engineer, then the right to claim title to the water may cease.

pH (hydrogen ion concentration): A convenient method of expressing the acidity or basicity of a solution in terms of the logarithm of the reciprocal (or negative logarithm) of the hydrogen ion concentration. The pH scale runs from 0 to 14; a pH value of 7.0 indicates a neutral solution. Values above 7.0 pH indicate basicity (basic solutions); those below 7.0 pH indicate acidity (acidic solution). Term originally derived from *Potential of Hydrogen*.

planning horizon: The overall time period considered in the planning process that spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions that would influence the planning decisions. In Washoe County, the planning horizon is 20 years.

playa: Generally a dry or intermittently dry lakebed in the lowest spot of a closed valley. Salt contents are generally quite high.

point source pollution: Pollutants discharged from any identifiable point, including pipes, ditches, channels, sewers, tunnels, and containers of various types which require a discharge permit. Also see *non-point source pollution*.

potable water: Water that is drinkable. Specifically, fresh water that generally meets the standards in quality as established in the EPA *Drinking Water Standards* for drinking water throughout the United States.

potential water supply deficiency: The difference between potential water supply requirements associated with existing commitments plus future potential water requirements (based on approved land use plans) and water supply availability, as determined by the current Water Resource Baseline or Water Resource Budget.

Preliminary Settlement Agreement (Nevada): An agreement reached between the Pyramid Lake Paiute Tribe and Sierra Pacific Power Company (SPPCo) on May 23, 1989. The agreement provides SPPCo the ability to store its water rights in federally operated reservoirs along the Truckee River in California at times when it is not needed for M&I water supply in the Reno-Sparks metropolitan area. In exchange, excess water in storage is used for fisheries when drought conditions are not in effect. Also, SPPCo forgoes its right to single-use hydroelectric flows in the Truckee River under the Orr Ditch Decree, thereby enabling the United States and the Tribe to store water for fishery benefit at certain times of the year. The agreement is incorporated into Public Law 101-618 (the Negotiated Settlement) by reference.

price elasticity: Measures the percentage change in quantity demanded in response to a percentage change in price.

primary treatment: The removal of suspended and floatable solids which will settle out of sewage and industrial wastes. Primary treatment plants generally remove 25 to 35 percent of biological oxygen demand and 45 to 65 percent of total suspended matter.

proposed projects: Projects that have not yet received local government approval. Types of project include anything that may have an impact on water resources, including but not limited to residential, commercial or industrial or recreational development, roads and airports.

proposed land use changes: Proposed land use changes include master plan, land use or zoning changes or changes to the Truckee Meadows Services Area boundary.

reasonable development potential: The 2003 Regional Plan Update identifies a preferred pattern of development in the region, specifically in Regional Plan policies 1.2.1 and 1.2.2. This preferred pattern of development includes a focus on downtown development and infill as well as intensification along transit corridors. In some areas of the community, the zoning has no upper limit and, therefore, allows for infinite densities, at least in theory. In reality, infill and intensification will occur at a reasonable rate, and certain assumptions about development potential are used to reflect that development potential.

recharge: Flow to groundwater storage from precipitation, infiltration from streams, and other sources of water.

reclaimed wastewater: Wastewater that becomes suitable for a specific beneficial use as a result of treatment or brackish water demineralized for use.

reclamation: The act of reclaiming or cleaning up contaminated groundwater, usually as a result of toxic waste. Also the reclaiming of waste, desert, marshy, or submerged land for cultivation, preservation, reuse, etc.

Regional Wastewater Reclamation Facilities Master Plan: The three local governments contracted with Carollo Engineers to develop a Regional Wastewater Reclamation Facilities Master Plan. This work was used to develop the majority of the wastewater element of the 1995–2015 Regional Water Plan.

regression analysis: A statistical technique used to establish relationships between variables.

remediation: Corrective action often associated with groundwater depletion or contamination. See reclamation.

retrofit: To furnish or provide with new equipment or parts unavailable at the time of original manufacture or construction.

reuse: Water that is discharged by one user and used by others. It can also mean water discharged by one unit and used by other units in the same plant.

reverse osmosis: (water quality) An advanced method of water or wastewater treatment that relies on a semi-permeable membrane to separate waters from pollutants. An external force is used to reverse the normal osmotic process, resulting in the solvent's moving from a solution of higher concentration to one of lower concentration.

riparian: Related to or located on the bank of a natural watercourse.

riparian habitat: The land and plants bordering a watercourse or lake.

rural: When used in the context of the Truckee Meadows Regional Plan, rural development areas include residential uses on lots of over one acre in size, up to ten acres, and supportive non-residential and public development.

safe yield: The rate at which water can be withdrawn from an aquifer without causing eventual depletion or contamination of supply. More commonly referred to as *Perennial Yield* and *Sustained Yield*. Generally consists of the rate of *natural recharge*, *artificial* (or *induced*) *recharge*, and *incidental recharge*.

satellite plant: (water quality) Specific to this plan, a wastewater treatment facility in an outlying area, not connected to the main plant.

secondary treatment: (water quality) Treatment (following primary treatment) which generally removes 80 to 95 percent of the biochemical oxygen demand and suspended matter. It may be accomplished by biological or chemical-physical methods. Activated sludge and trickling filters are two of the most common means of secondary treatment. Secondary treatment provides very little nutrient removal.

sedimentation: Strictly, the act or process of depositing sediment from suspension in water. Broadly, all the processes whereby particles of rock material are accumulated to form sedimentary deposits. Sedimentation, as commonly used, involves not only aqueous but also glacial, aeolian, and organic agents.

septic system: An on-site treatment system consisting of a septic tank, a disposal field and interconnecting lines. Septic systems are normally used when more advanced treatment alternatives are not available.

septic tank: (1) A sewage disposal tank in which a continuous flow of waste material is decomposed by anaerobic bacteria. (2) A tank used to detain domestic wastes to allow the settling of solids prior to distribution to a leach field for soil absorption.

service: A connection served by a utility.

significant hydrologic resources (SHR): When used in the context of the Truckee Meadows Regional Plan, significant hydrologic resources are either federally significant (e.g. wetlands meeting federal definition) or regionally significant (e.g. stream environments, playas, spring-fed stands of riparian vegetation, and wetlands not meeting the federal definitions).

sludge: (1) Semisolid material such as the type precipitated by sewage treatment. (2) Mud, mire, or ooze covering the ground or forming a deposit, as on a riverbed.

smart growth: An approach to development that has grown out of the concern that current development patterns, dominated by "sprawl", are no longer in the long-term interest of cities, towns or rural communities. Although its definition may be open to interpretation and principles flexible, smart growth advocates generally agree that the most effective approach is to minimize sprawl and to maximize the use of space in existing urban developments through housing infill, mixed land use, and other projects that increase population density, including transit-oriented development, with easily-accessible transit centers.

special assessment district: A legally established area for the express purpose of levying a special fee for public improvements that are of a special rather than general benefit.

sphere of influence: When used in the context of the Truckee Meadows Regional Plan, the area adjacent to a city's incorporated area, planned for urban and/or suburban development, into which the city may annex during the plan's time frame.

spread: Method of recharging a groundwater basin by diverting water to a highly pervious area for percolation into the basin.

sub-basin: (1) A portion of a sub-region or basin drained by a single stream or group of minor streams. (2) The smallest unit into which the land surface is subdivided for hydrologic study purposes.

subdivision: Any land, vacant or improved, which is divided or proposed to be divided into five or more lots (versus a parcel map for four or less), parcels, sites, units, or plots for the purpose of any transfer or development or any proposed transfer or development of the original parcel.

suburban: When used in the context of the Truckee Meadows Regional Plan, suburban development includes residential uses at generally one to three single family units per acre and supportive nonresidential and public development.

surface water: Water on the surface of the earth. Surface water withdrawals include water taken from streams, rivers, ponds, lakes, reservoirs, and springs and all effluent and other wastewater.

sustainable yield: The sustainable yield of a resource or combination of resources is the quantity of water that may be diverted in a specific period of time (usually a year, but may be other units of time) that is consistent with protecting the social, environmental and economic uses of the water resources. For an aquifer, this quantity may be related to the average annual recharge, with adjustments to reflect: the protection of important environmental uses of groundwater, to account for economic impacts of increased pumping lift and drilling costs, and to account for changes in recharge that may occur due to urbanization and artificial recharge.

For surface water resources, the sustainable yield is a function of many factors including the seasonal variations in flow of the source, seasonal pattern of the demand to be satisfied, the quantity and priority of the water rights available for use, the availability and management of storage, and its conjunctive use with other resources including groundwater. It is recognized that sustainable yield may be determined and revised from time to time utilizing new reports and information developed by recognized agencies and sources.

threatened species: Any plant or animal species likely to become an "endangered" species in the foreseeable future throughout all of the significant area of its range or natural habitat; identified by the Secretary of the Interior as "threatened" in accordance with the 1973 Endangered Species Act.

total maximum daily load (TMDL): The maximum quantity of a particular pollutant that can be discharged into a body of water without violating a water quality standard.

transpiration: (1) The quantity of water absorbed, transpired, and used directly in the building of plant tissue during a specified time period. It does not include soil evaporation. (2) The process by which water vapor escapes from a living plant, principally through the leaves, and enters the atmosphere.

Tribe: In this plan, the Pyramid Lake Paiute Tribe of Indians, also "PLPT".

tributary: A stream that joins another stream or body of water.

trihalomethane: Disinfection by-product formed when chlorine (as a disinfectant for municipal water supplies) is added to water that contains organic matter. Concentrations are regulated by the Safe Drinking Water Act.

Truckee River Operating Agreement: The Truckee River Operating Agreement is incorporated in Section 205 of *Public Law 101–618* (the *Negotiated Settlement*) and requires that the US Secretary of the Interior negotiate an operating agreement for the Truckee River with the States of Nevada and California, and other parties. The intent of the TROA is to supplant the current *Truckee River Agreement* and provide for the comprehensive management of the Truckee River waters in California and Nevada, as well as to provide important long-term drought protection for the Reno–Sparks (Nevada) Metropolitan Area.

The primary purpose of the TROA is to improve management of Truckee River reservoirs located in California by expanding existing operations for the benefit of M&I water use, increase drought storage, aid in the recovery of endangered and threatened fish species, and, in general, improve fish and wildlife habitat within the Truckee River Basin. This would be accomplished by "networking" reservoir releases and storage (i.e., unify reservoir operations for a common objective and into a single schedule) in a manner that would not infringe on existing water storage, release, or use rights or flood control requirements. The TROA would also allow for the exchange, transfer, and release of waters from the upstream reservoirs to improve the likelihood of maintaining in-stream flows for fish and wildlife. The TROA is intended to provide a number of substantive benefits to users of Truckee River waters. These benefits may be listed in four fundamental areas:

> [1] ***Reservoir Management*** — Improve river flow and river management by improving flexibility, coordinate reservoir storage and release, allow transfers and exchanges among various reservoirs to reduce spills, provide for recreational pools, etc., create a water credit system, promote more efficient use of existing water supplies, allow for the storage of "other waters", centralize Truckee River water management, improve water accounting (budgeting) and forecasting,

eliminate releases solely for power generation, permit storage of water savings from conservation in the Reno–Sparks Metropolitan Area, and provide for greater water marketing among private water rights holders;

[2] ***Fish and Wildlife*** — Enhance spawning potential of the Pyramid Lake endangered cui-ui (Chasmistes cujus) and threatened Lahontan cutthroat trout (Oncorhynchus clarki henshawi) fish species through improved overall river operations, commitment of specified waters, increased water availability, and mitigation of significant adverse environmental impacts;

[3] ***M&I Use*** — Provide additional M&I drought relief storage for the Reno–Sparks Metropolitan Area through an M&I Water Credit System;

[4] ***Conservation*** — Promote water conservation in the Reno–Sparks Metropolitan Area through water metering and various conservation programs.

turbidity: The term "turbid" is applied to water containing suspended matter that interferes with the passage of light through the water or in which visual depth is restricted. The turbidity may be caused by a wide variety of suspended materials, such as clay, silt, finely divided organic matter, microscopic organisms, and similar substances. Turbidity in water has public health implications due to the possibilities of pathogenic bacteria encased in the particles and thus escaping disinfection processes. Turbidity interferes with water treatment (filtration) and affects aquatic life. Excessive amounts of turbidity also make water aesthetically objectionable.

urban: When used in the context of the Truckee Meadows Regional Plan, urban development is development of three or more residential units per acre, and comparable non-residential and public development.

vested water right: The water right to use either surface or groundwater acquired through more or less continual beneficial use prior to the enactment of water law pertaining to the source of the water. These claims become final through adjudication. Also see *certificated water right* and *perfected water right*.

visual resource: The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

volatile organic chemicals (VOCs): Chemicals of an organic nature (containing hydrogen, oxygen, and carbon) which readily volatilize, or travel from water into air. Most such substances are industrial chemicals and solvents. The EPA maintains a listing of VOCs that are regulated with respect to maximum contaminant levels (MCLs) as part of the Safe Drinking Water Act.

waste load allocation: The amount of a particular pollutant a point source (e.g. wastewater treatment facility) can discharge over a specified period of time into a receiving water. Allocations are a result of agreed upon water quality standards for a stream.

wastewater: (1) Water that carries wastes from homes, businesses, and industries; a mixture of water and dissolved or suspended solids. (2) That water for which, because of quality, quantity, or time of occurrence, disposal is more economical than use at the time and point of its occurrence. Wastewater to one user may be a desirable supply to the same or another user at a different location.

water balance: An accounting of all the inputs and outputs of a hydrologic system.

water budget: An accounting of the inflows and outflows of water to and from a system.

water conservation: (1) Any beneficial reduction in water use or water loss. (2) A reduction in consumptive use, diversions from the Truckee River, and groundwater pumping.

water purveyors: Refers to public and private utilities that provide water service pursuant to state law.

water quality: A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. Also see *drinking water standards* and *drinking water standards (Nevada)*.

water quality standard: A plan for water quality management specifying the use (recreation, fish and wildlife propagation, drinking water, industrial or agricultural, etc.) to be made of the water; criteria to measure and protect these uses; implementation and enforcement plans; and an antidegradation statement to protect existing water quality.

water resource: All surface, ground, and wastewater in a specified area.

water rights: (Nevada) The legal rights to the use of water. They consist of adjudicated water rights, *appropriative water rights*, and reserved water rights.

watershed: (1) All lands enclosed by a continuous hydrologic drainage divide and lying upslope from a specified point on a stream. Also referred to as *water basin*. (2) A ridge of relatively high land dividing two areas that are drained by different river systems. Also referred to as *water parting*.

watershed rule: In response to the EPA's withdrawal of the July 2000 final "TMDL" rule, the agency is now working on a regulation known as the Watershed Rule. EPA reports that the proposed rule is an information-based approach to watershed planning and a better way of addressing impaired waters. EPA envisions a framework that advances state and local efforts to achieve the highest attainable designated uses by promoting flexible and effective watershed approaches. An unofficial draft rule proposes to revise the impaired waters program and support pollutant trading within watersheds. The proposed rule would involve revision to the Water Quality Planning and Management Regulation and the NPDES sections of the Clean Water Act.

water yield: Runoff, including groundwater outflow that appears in the stream, plus groundwater outflow that leaves the basin underground. Water yield is the precipitation minus the *evapotranspiration*.

wellhead: (1) The source of a well or stream; (2) A principal source, a fountainhead. (3) The physical structure, facility, or device at the land surface from or through which groundwater flows or is pumped from subsurface, water-bearing formations.

wellhead protection program (WHPP): Programs intended to protect and preserve the quality of groundwater used as a source of drinking water. A typical wellhead protection program will have a number of critical elements to include (1) delineating the roles and responsibilities of state agencies, local governments, and water purveyors; (2) delineation of wellhead protection areas; (3) contaminant source inventories; (4) management options; (5) siting of new wells; (6) contingency and emergency planning; and (7) public participation. Typically, steps taken to protect and preserve the quality of a well are far less costly than actions necessary to restore a contaminated well.

wellhead protection area: Specific capture zone delineations contained in approved wellhead protection programs, or, in the absence of an approved wellhead protection program, a 2,500 foot radius circle around existing and planned groundwater production wells or domestic wells.

wetlands: An area at least periodically wet or flooded, where water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (e.g. bogs, marshes, swamps, mudflats, and fens).

wildland: A non-urban, natural area which contains uncultivated land, timber, range, watershed, brush, or grassland.

"worst drought of record": The series of years when water supply was the least ever recorded. In this plan, that period is from 1987 through 1994.

zoning: A local ordinance that divides a community into districts and specifies allowable uses and development standards for each, consistent with the adopted community master plan.

Appendix D
Source Document List

Regional Water Plan
Source Documents

1	AGRA Infrastructure, 2000, *Water and Wastewater Facility Plans on Industrial Zoned Lands Along the Lower Truckee River within Washoe County*, prepared for Washoe County Department of Water Resources
2	AMEC Infrastructure, 2001, *Sparks Effluent Pipeline Extension Facility Planning Amendment*, prepared for City of Sparks
3	AMEC, 2001, Sparks Effluent Pipeline Extension to Spanish Springs, Phases 4 & 5, prepared for Sparks
4	Brown & Caldwell 2009, *North Virginia Interceptor Improvement Project*, prepared for City of Reno
5	CH2MHill / Stantec Consulting, 2008, *Draft Facility Plan Update, South Truckee Meadows Water Reclamation Facility 6-MGD Expansion Project*, prepared for Washoe County Department of Water Resources
6	ECO:LOGIC, 2001, *Panther Valley Water Co., 600K Water Tank*, prepared for Panther Valley Water Users
7	ECO:LOGIC, 2002, *South Truckee Meadows Facility Plan*, prepared for Washoe County Department of Water Resources and South Truckee Meadows General Improvement District
8	ECO:LOGIC, 2004, *Reno/Stead Wastewater Treatment Facility Solids Pumping*, prepared for City of Reno
9	ECO:LOGIC, 2004, *Reno-Stead Water Reclamation Facility Plan*, prepared for City of Reno
10	ECO:LOGIC, 2004, *Warm Springs Ranch Wastewater Treatment Facility Plan,* prepared for Washoe County Department of Water Resources
11	ECO:LOGIC, 2006, *Steamboat and Tributary Municipal Water Supply Yield Analysis*, prepared for Washoe County Department of Water Resources
12	ECO:LOGIC, 2007, *City of Reno and Washoe County TMSA/FSA Water Wastewater and Flood Management Facility Plan*, prepared for City of Reno and Washoe County Department of Water Resources
13	ECO:LOGIC, 2007, *Spanish Springs Water Facility Plan Update*, prepared for Washoe County Department of Water Resources
14	ECO:LOGIC, 2007, *Stead Water Main Replacement (North Virginia / Stead Pumping System Improvement Project)*, prepared for TMWA
15	ECO:LOGIC, 2009, *Draft Spanish Springs Water Facility Plan*, prepared for Washoe County Department of Water Resources
16	ECO:LOGIC, 2009, *Draft North Valleys Water Facility Plan*, prepared for Washoe County Department of Water Resources
17	ECO:LOGIC, 2009, *Draft South Truckee Meadows Water Facility Plan*, prepared for Washoe County Department of Water Resources
18	ECO:LOGIC, 2010, *Regional Integrated Wastewater System Planning*, prepared for the Western Regional Water Commission
19	ECO:LOGIC, 2010, The *North Valleys Imitative: Advancing Solutions to Regional Water Issues*, prepared for the Western Regional Water Commission
20	Envirosientists, Inc. 2005, *Intermountain Water Project*, prepared for Washoe County Department of Water Resources
21	Kennedy/Jenks Consultants / AMEC, 2001, *Truckee Meadows Storm Water Quality Management Program*, prepared for Truckee Meadows Interlocal Storm Water Committee and the Nevada Division of Environmental Protection
22	Kennedy/Jenks Consultants / Stantec Consulting, 2005, *Spanish Springs Valley Water Reclamation Facility Plan*, prepared for Washoe County Department of Water Resources
23	Kennedy/Jenks Consultants, 2002, *Cold Springs Wastewater Facility Plan*, prepared for Washoe County Department of Water Resources

Regional Water Plan
Source Documents

24	Kennedy/Jenks Consultants, 2003, *Truckee Meadows Construction Site Discharge Best Management Practices Handbook*, prepared for Truckee Meadows Interlocal Stormwater Committee and Regional Water Planning Commission
25	Kennedy/Jenks Consultants, 2004, Truckee Meadows Structural Controls Design Manual, prepared for the Truckee Meadows Regional Storm Water Permit Coordinating Committee and the Regional Water Planning Commission
26	Kennedy/Jenks Consultants, 2005, *Truckee Meadows Watershed Protection Manual – A summary of the Watershed Protection Activities and Programs Developed in Conjunction with the Watershed Management Facilitator Scope of Work,* prepared for City of Reno, City of Sparks, Washoe County, the Regional Water Planning Commission and the Nevada Division of Environmental Protection.
27	Kennedy/Jenks Consultants, 2007, *Truckee Meadows Industrial & Commercial BMP Handbook*, prepared for City of Reno, City of Sparks, Washoe County and the Nevada Department of Transportation.
28	Kennedy/Jenks Consultants, 2007, Truckee Meadows Low Impact Development (LID) Handbook, Guidance on LID Practices for New Development and Redevelopment, prepared for City of Reno, City of Sparks, Washoe County, the Regional Water Planning Commission and the Nevada Division of Environmental Protection
29	Kennedy/Jenks Consultants, 2007, *Update to the Truckee Meadows Structural Controls Design Manual*, prepared for the Truckee Meadows Regional Storm Water Permit Coordinating Committee and the Regional Water Planning Commission
30	Kennedy/Jenks Consultants, 2008, *Nevada Contractors Field Guide for Construction Site Best Management Practices (BMPs)*, prepared for City of Reno, City of Sparks, Washoe County, the Regional Water Planning Commission, the Nevada Division of Environmental Protection and the Clark County Regional Flood Control District.
31	Kennedy/Jenks Consultants, 2008, *Update to the Truckee Meadows Construction Site Best Management Practices Handbook*, prepared for the Truckee Meadows Storm Water Permit Coordinating Committee
32	Kennedy/Jenks Consultants, 2009, *Truckee River Restoration and Construction Site Permitting Handbook Update*, prepared for Washoe County and the Northern Nevada Water Planning Commission.
33	Shaw Engineering, 2003, Sun Valley General Improvement District Water System Master Plan, prepared for Sun Valley General Improvement District
34	Shaw Engineering, 2004, Sun Valley General Improvement District Wastewater System Master Plan, prepared for Sun Valley General Improvement District
35	Shaw Engineering, 2004, Sun Valley West Basin Water System Improvements, prepared for Sun Valley General Improvement District
36	Shaw Engineering, 2007, Sun Valley General Improvement District Water System Master Plan Update, prepared for Sun Valley General Improvement District
37	SPPC, 2001, *Spanish Springs #4 & Northgate #3 Water Storage Tanks*
38	Stantec Consulting, 2002, *Lawton/Verdi Wastewater Facility Plan*, prepared for Washoe County Department of Water Resources
39	Stantec Consulting, 2004, *Hidden Valley Water System Facility Plan*, prepared for Washoe County Department of Water Resources
40	Stantec Consulting, 2008, *City of Sparks TMSA/FSA Conceptual Facility Master Plan*, prepared for City of Sparks
41	TMWA 2009, *2010-2030 Water Resource Plan*
42	TMWA, 2010, *2010-2030 Water Facility Plan*
43	Vpoint, 2001, *UNR Farms Effluent Re-use Pipeline Extension*, prepared for City of Reno
44	WCDWR, 2002, *Spanish Springs Nitrate Occurrence Project Facility Plan*, prepared for Washoe County Department of Water Resources

Appendix E
Washoe County Question #3

WC #3

Shall The Truckee Meadows Regional Plan be amended to reflect and to include a policy or policies requiring that local government land use plans be based upon and in balance with identified and sustainable water resources available within Washoe County?

DESCRIPTION OF EFFECT

The Truckee Meadows Regional Plan recognizes that the region is "resource constrained" and that water is one of the resources that is constrained; however, no current policies or ordinances are in place at either the regional or local level to make this regional plan provision meaningful. Currently identified water resources within Washoe County with good near-term (20-year) potential availability are estimated at 175,000 acre feet annually - or enough to support a population of approximately 550,000 to 600,000. The current identified TMSA (20-year service area designated for urban development) in the regional plan requires an estimated water demand of 236,000 acre feet annually and the long-term (beyond 20-years) service area requires an estimated service demand of 383,000 acre feet annually. The effect of this initiative - if affirmed - would require the amendment of the Truckee Meadows Regional Plan to reflect and contain policies requiring that future land uses and known potentially available water resources within Washoe County be in balance. By law, the regional policies would have to be adopted within local government master plans and, as applicable, ordinances.

Argument “In Favor” of WC #3

A yes vote on WC-3 would direct local governments to live within our water means by linking land use planning to known water resources. This community’s challenge is to provide a clean reliable supply of water for the health of our people, our economy and the natural environment for future generations.

Logic dictates that land use plans and water resources should be in balance. Passage of this question does not stop growth as some have indicated but it ensures healthy sustainable economic growth. Backers of the initiative and our elected officials should have the same objective – that is, planning realistically for the future when additional resources, such as water, are no longer available or too costly to obtain.

A yes vote on this question will require the Regional Plan to identify water resources that match development patterns and zoning densities for the future. Although the Regional Plan recognizes that natural resources are constrained, it does not require the identification of water resources nor does it promote efficient development patterns that ensure a sustainable community when the water to supply new development is no longer available twenty-plus years from now.

Nevada Revised Statute 278.160(8)(g) says a master plan adopted in Washoe County must provide "An estimate of the total population which the natural resources of the city, county or region will support on a continuing basis without unreasonable impairment."

Planning: According to Webster's dictionary the word means "any detailed scheme, program, or method worked out beforehand for the accomplishment of an object; or goal." Presently it would appear that the plan for economic viability and stability for Reno, Sparks and Washoe County is to do all our growing in the next 20 years, deplete our resources and let tomorrow take care of tomorrow.

Currently developers are required to bring paper water rights. That does not get the community wet water, associated infrastructure, or identify what the costs would be and who would pay. When the current identified water resources have been utilized, where do we go from there? There is no plan! Vote yes on WC-3.

The above argument was submitted by the Ballot Question Committee composed of citizens in favor of this question as provided by NRS 295.121

Rebuttal to Argument "In Favor" of WC #3

The arguments in favor of this ballot question are misleading, incorrectly cite Nevada law and ask you to defer local land use decisions to a regional plan, rather than local elected officials. Based on these arguments, voting "no" on this question is necessary.

The folks in favor of this question cite 278.160(8)(g) and Webster's Dictionary as authority to remove land use planning from the local level and reallocate it to the regional plan. First, there is no NRS 278.160(8)(g)!! This is what happens when you leave planning to persons who are unfamiliar with planning law, mistakes are made which can negatively impact our community.

Instead of relying upon piecemeal citations, real Nevada law states, "[t]he planning commission shall prepare and adopt a comprehensive, long-term general plan for the physical development of the city, county or region which in the commission's judgment bears relation to the planning thereof." NRS 278.150(1). Local planning commissions are appropriately responsible for master plans in Nevada, as they understand the nuances of their local jurisdictions.

The above rebuttal was submitted by the Ballot Question Committee composed of citizens in opposition to this question as provided by NRS 295.121

Argument "In Opposition" to WC-3

This ballot initiative is redundant to long-established Nevada water laws that already encourage and require water sustainability. Water rights must be acquired and dedicated before a new building permit is issued and, in the case of subdivisions, water sufficient to serve the new parcels must be acquired and dedicated before final approvals are granted.

This check-and-balance system ensures that no new development occurs without the appropriate amount of sustainable water.

For example, let's say a developer wants to build a new daycare facility. Assuming the developer did not obtain the water when purchasing the land, the developer must go into the open market to purchase the water before receiving any final approvals. If the water is too expensive or unavailable, no development may occur. Alternatively, if the developer purchases the water required for the facility, the developer may move forward (assuming compliance with other applicable laws) with a building permit and construction of the facility. This structure prevents the development of a daycare facility, or a supermarket, or a 1,000 home subdivision, if no water is available for the project.

If passed, this ballot initiative would require the Regional Plan to determine the sufficiency of water for projects. The Regional Plan is the "big picture" policy guide for Reno, Sparks and Washoe County. Appropriately, it does not include the "nuts-and-bolts" of a local development projects which is left to local ordinances. Regional staff are not equipped to review technical water data and determine, analyze and forecast when, where and how future development shall occur. These project-specific tasks are appropriately handled at the local level where project-specific details, such as water sustainability, are reviewed and approved.

If this question is passed, water rights must be acquired before projects are even conceptualized. This disconnect will cause speculators to hoard water and significantly drive up the price of water rights which will increase construction costs of new businesses and homes and will impair the health of our local economy.

Bottom line: this ballot question undercuts our local governments and stalls the prosperity and economic growth experienced in Washoe County in the last decade.

The above argument was submitted by the Ballot Question Committee composed of citizens in opposition to this question as provided by NRS 295.121

Rebuttal to Argument "In Opposition" of WC #3

Vote yes on WC -3. Balancing water with population and land use should be a major consideration in planning. That's what planning is about. Zoning changes and density increases are often approved without regard for available, efficient, and cost-effective water supply, delivery and disposal. WC-3 would make this happen. You do not borrow or write a check for what you can't afford. Requiring balance is not redundant.

A recent study by UNR indicates that we currently have land use plans approved for 56,254 residential units that aren't built yet, and only 1/4 of these have water rights committed. Water rights for building these homes do not necessarily represent "real water."

The price of water rights is market driven as our community saw during the 2004-2006 housing bounce. Water rights are always going to be subject to market speculation. Current law mitigates against the “hoarding” of water rights, thus negating the argument of the opponents that a balanced plan will result in higher costs and impair the local economy.

Decisions we make now regarding how efficiently we use our water, and where we build and expand our communities, speak to what quality of life we will have for future generations.

The above rebuttal was submitted by the Ballot Question Committee composed of citizens in favor of this question as provided by NRS 295.121.

Appendix F
Deleted in 2016 Regional Water Management Plan

Appendix F
Truckee Meadows Water Authority Rule 7

Truckee Meadows Water Authority

RULE 7

REQUIREMENTS FOR WILL-SERVE COMMITMENT LETTERS

A. Applicability

This Rule applies to and sets forth the responsibilities and requirements of a Person applying to the Authority for a Will-Serve Commitment letter from the Authority for the delivery of water to a new Service or Modified Service.

B. Definitions

1. Terms not defined in this Section shall have the meaning set forth in Rule 1.

2. As used in this Rule:

   a. "Applicant" shall mean the Person applying for a Will-Serve Commitment letter.

   b. "Authority Water Resources" shall mean water resources owned by the Authority and previously held within the Will-Serve Commitment Inventory.

   c. "Current Usage" shall mean the annual quantity of water actually delivered to a Service Property based on most recent usage data as determined by Authority pursuant to Section I.2, generally expressed in acre-feet per annum or acre-feet per year.

   d. "Dedicated Water Resource" shall mean water resource credits, water rights, or water rights and necessary facilities accepted for dedication by an Applicant prior to the issuance of a Will-Serve Commitment letter, in order to meet the actual Demand of a new Service or Modified Service and/or Deficit Demand.

   e. "Deficit Demand" shall mean the difference, as determined by the Authority pursuant to Section I.2, between the Current Usage at the Service Property and the Demand recognized in the Will Serve Commitment letter or Historic Demand, if any, to a Service Property.

   f. "Demand" shall mean the estimated annual quantity of water to be delivered to a Service Property, generally expressed in acre-feet per annum or acre-feet per year.

   g. "Historic Demand" shall mean the estimated annual quantity of water, as determined by Authority, historically delivered by Authority or Authority's predecessor to a Service Property.

   h. "Permitted Water Right" shall mean a water right for which the Authority has been issued a permit by the Nevada Division of Water Resources to use for municipal purposes in the Authority's place of use and to be diverted at the Authority's points of diversion.

   i. "Will-Serve Inventory" shall mean the inventory of uncommitted water resources owned by the Authority which may be made available to Applicants to support an Applicant's Will-Serve Commitment pursuant to this Rule.

j. "Truckee Meadows Resource Area ("TMRA")" shall mean the portion of the Service Area within which the Authority will accept for dedication, subject to Section F.3, any Truckee River water source/right for the delivery of water to the Service Property.

C. Will-Serve Commitment Letter Required

1. When Required. All Applicants for new Service or Modified Service must file an Application with the Authority for, and if the Authority determines that water resources are required to service the Demand of the new Service or Modified Service, a Will-Serve Commitment letter must be obtained for such service.

2. Methods to Obtain. A Will-Serve Commitment letter may be obtained from the Authority by the dedication to the Authority of Dedicated Water Resources as provided in Section F or by purchase from the Authority as provided in Section G.

D. Responsibilities and Requirements of Applicant

1. The Applicant shall submit, at the time of application for a Will-Serve Commitment letter, plans and specifications sufficient for the Authority to estimate Demand of the new Service or Modified Service as follows:

   a. Subdivision plat or parcel map with square footages of lots, including landscaping plans for common irrigation areas showing turf areas with square footage and drip areas with water use calculations; and/or

   b. Site plan(s) with layout of project, including plumbing and mechanical plans, and landscaping plans showing turf areas with square footage and drip areas with water use calculations; and/or

   c. Any other information that the Authority may reasonably require to estimate annual Demand.

2. An Applicant with project(s) requiring Irrigation Service(s) must furnish with the application a written determination by the Local Government with jurisdiction over the sale of Reclaimed Water as to the extent to which the Local Government will commit to provide Reclaimed Water to the Applicant for some or all of the Irrigation Service Demand.

   Use of Reclaimed Water is subject to the requirements of the Authority and NAC 445A to protect and separate the Authority's Potable supplies from Non-Potable water sources. If Applicant project(s) cannot be served by Reclaimed water or backflow protection devices do not meet Authority's Standards, the Applicant must supply water resources pursuant to Section F or G of this Rule sufficient to meet the Irrigation Service(s) Demand for the project(s).

E. Methodology for Calculating Demand and Water Resources Requirement

1. The Applicant's Demand for new Service or Modified Service within the TMRA shall be computed as follows:

Type of Unit	Demand (Acre Feet Per year)
Single family residential lot based on square foot lot size, with a minimum Demand of .12 acre feet per lot	$\frac{1}{1.1 + (10{,}000 / \text{Lot size})}$
Mobile home parks with separate irrigation (per space)	0.25
Demand per unit for apartments, duplexes, condominiums, or townhouse units (excluding outside, utility room, laundry room and/or recreation uses)	0.12
Commercial or Industrial Services (including residential utility room/ recreation areas)	The best available data and estimating procedures as determined by the Authority shall be used or estimated average annual Demand as furnished by the Applicant or Customer and accepted by the Authority shall be used.
Irrigation	3.41 acre feet per acre, or, for drip systems, the Demand as calculated by a landscape architect or other qualified professional and verified by the Authority.

The Applicant's Demand for new Service or Modified Service outside the TMRA shall be estimated using best available data and estimating procedures as determined by the Authority.

2. The acre feet required for a new Service or Modified Service will be computed as follows:

Total Acre Feet Required (AFA) = Total Project Demand x Multiplier

Multiplier = (a) for mainstream Truckee River Rights the multiplier shall be 1.11.

(b) for groundwater rights, the multiplier shall be 1.00.

(c) for all other water resources listed in Section F, the multiplier shall be such other number and/or other water sources/rights sufficient to provide an acceptable water supply, including but not limited to return-flow requirements, as determined by the Authority on a case by case basis.

F. Obtaining a Will-Serve Commitment Letter by Dedication of Water Rights

1. Requirement. When an Applicant seeks issuance of a Will-Serve Commitment letter from Dedicated Water Resources, the Applicant must dedicate to the Authority water rights sufficient to meet the Demand of the new Service or Modified Service as calculated pursuant to this Rule. Dedication of water rights will typically occur through conveyance to the Authority of title to the water rights. Under limited circumstances consistent with the Authority's discretion set forth in Section F.3, the Authority may consider acquisition of water rights for dedication through exchanges, leases, future purchases, or other acquisition agreements. Except in case where the Authority has expressly agreed to accept a temporary dedication or except as provided in Section I, dedication of water rights is irrevocable.

2. Types of Water Rights Eligible for Dedication. Water rights acceptable for dedication to the Authority may be comprised of one or a combination of the following. For purposes of calculating the quantity of water rights required for dedication, different multipliers may apply as set forth in this Rule to different types of water rights and/or water sources.

   a. Mainstream Truckee River rights with a multiplier as set forth in Section E.2 of this Rule.

   b. Other water rights of acceptable quantity and quality to the Authority with a multiplier as set forth in Section E.2 of this Rule.

   c. Credits associated with the conversion of a domestic well to the Authority's water system as allowed by the Nevada Division of Water Resources.

   d. Groundwater rights permitted for the Authority's use by the Nevada Division of Water Resources with a multiplier as set forth in Section E.2 of this Rule.

   e. Imported or other water sources/rights and additional facilities/treatment necessary to implement or utilize these water sources which the Authority determines provide a sufficient water supply to meet the Demands of the new Service or Modified Service with a multiplier as set forth in Section E.2 of this Rule.

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f. Credits established pursuant to this Section I of this Rule.

The Authority may require analysis of drought-year supply or yield of the water right(s), Nevada Division of Water Resources approval of transfer, and/or special conveyance to the Authority's facilities as conditions of accepting dedication of the aforementioned water rights.

3. Acceptance or Rejection of Water Rights. The Authority shall have the right, in its sole discretion, to accept or reject any water right(s) offered for dedication based upon its application of Section F.2 and its consideration of the following:

   a. Whether the priority, quantity, ability to put the water right(s) to beneficial use, drought-year supply, yield, and quality of the water right(s) is sufficient to meet the Demand of the project for new Service or Modified Service;

   b. Whether the water right(s) can be successfully changed under applicable law to allow their use by the Authority for municipal and industrial purposes, at the Authority's place of use, and for diversion at the Authority's points of diversion; and

   c. Whether the Applicant can show unencumbered and clear title to ownership of the water right(s).

G. Obtaining a Will-Serve Commitment Letter by Purchase from the Authority

1. The Authority may maintain and make available from its Will-Serve Inventory of water resources available for commitment to support a Will-Serve Commitment letter to an Applicant's Project within the TMRA as provided in this Section. The Authority shall determine the price of purchasing a Will-Serve Commitment based on a weighted averaged of all direct and indirect costs associated with the acquisition of water rights held in the Will-Serve Inventory, which shall include, but not be limited to:

   a. The actual purchase or lease price of the water rights;

   b. The cost or value of water rights determined through exchanges or trades of different various types of water rights or water resources identified in Section F.2 of this Rule;

   c. The Authority's cost to research, verify and acquire title to the water rights;

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d. The Authority's cost to change the point of diversion, place and manner of use of the water rights through the Nevada Division of Water Resources;

e. An annual carrying charge pursuant to the weighted average interest on the Authority's debt calculated and applied on a daily basis; and

f. Miscellaneous fees and office expenses associated with acquiring the water rights.

2. Will-Serve Commitment letters utilizing Will-Serve Inventory can only be purchased to the extent of the demand of Applicant's project and to the extent sufficient inventory exists in the Will-Serve Inventory. Only Applicants eligible under Section G.4 may purchase Will-Serve Commitment letters. Priority among eligible Applicants to purchase Will-Serve Commitment letters shall be on a first come, first served basis determined by the date Authority has received a complete application for the New or Modified Service. The Authority will notify an Applicant with priority in writing of the availability of sufficient inventory to serve the demand of Applicant's project certified mail, hand delivery, fax, or email, and will reserve such inventory until 5:00 PM PST of the tenth full business day following delivery of such notice. In the event the Applicant does not purchase the Will-Serve Commitment letter by 5:00 PM PST of the tenth full business day following such notice, the Authority will release the inventory to the next eligible Applicant, and the Applicant electing not to purchase the Will-Serve Commitment letter shall forfeit its priority and move to the end of the line of all then eligible Applicants.

3. The price of purchasing a Will-Serve Commitment letter utilizing the Will-Serve Inventory will be established by the Authority in the following manner:

   a. Within fifteen (15) days of the end of each month, the Authority will calculate the general price associated with the acquisition of water rights in the Will-Serve Inventory by dividing the costs associated with the acquisition of water rights by the remaining balance of water rights in inventory. The resulting price shall be effective on the first business day of the following week; or

   b. In the event additional water rights are acquired, the Authority shall determine a new price by dividing the costs associated with the acquisition of water rights by the remaining balance of water rights in inventory. The resulting price shall become effective on the first business day of the following week,

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4. The Applicant may purchase a Will-Serve Commitment letter sufficient to meet the Demand for the Applicant's Project within the TMRA from the Authority only if the following conditions are met:

   a. No water rights are appurtenant to the location at which new Service or Modified Service is being sought; or

   b. The Applicant does not have any water rights banked with or previously conveyed to the Authority or other Local Government which remain uncommitted to a Project but could be available for Applicant's Project; or

   c. The Applicant does not own any water rights that could be dedicated to the Authority pursuant to Section F of this Rule; and

   d. The Authority has a sufficient inventory of water rights in the Will-Serve Inventory to meet the Demand for the Applicant's Project.

   Where the Applicant is a Local Government or State agency seeking New or Modified Service, the Applicant may be granted an exemption to Section G.4(c) if Applicant's Water Resource(s) are committed to current or future water quality purposes, return flow requirements, effluent reuse, recharge, drought reserve, protection against demand fluctuations or such other appropriate water resource management or public use purposes approved by the Board.

   Where the Applicant is a Wholesale Service applying for New or Modified Service on behalf of the owner of a retail project within the Wholesale Service's retail service area, Section G.4 shall apply to the owner of the of retail project as if the owner of the retail project were the Applicant.

H. Fees and Issuance of Will-Serve Commitment Letter

1. Fees Related to Dedication of Water Rights. Prior to the acceptance of Dedicated Water Resources to the Authority, Applicants will pay fees provided in Rate Schedule BSF to research and verify title, and the Applicant shall provide the Authority all documents and maps evidencing the water rights, including but not limited to (i) Nevada Division of Water Resources Application to Change and supporting Map and/or Report of Conveyance, and Abstract of Title; and (ii) copies of permits and/or certificates issued by the Nevada Division of Water Resources evidencing water rights, and Applicant is responsible for the costs as determined by the Nevada Division of Water Resources for the submission of a Report of Conveyance, Abstract of Title and all related documents as part of the application process with the Nevada Division of Water Resources.

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2. Fees for Issuance of Will-Serve Commitment letter. In addition to any other fees in this Rule, Applicants shall pay fees provided in Rate Schedule BSF to prepare the documents necessary to issue each Will-Serve Commitment letter.

3. Water Meter Retrofit Fund Fees. Applicants for New or Modified Service within the TMRA relying on any water right other than the conversion of domestic well, imported water sources or groundwater rights for a Will-Serve Commitment letter will pay to the Authority's water meter retrofit fund the sum of $1,830.00 per AF of Demand related to the new Service or Modified Service and to Deficit Demand prior to the issuance of the Will-Serve Commitment letter.

4. The Applicant is responsible for delivery of the Authority-issued Will-Serve Commitment letter and accompanying documentation to appropriate government entities.

5. Banking Water Rights. The Authority may, in its sole discretion, allow any Person to bank water rights with the Authority for future use by any Person. In the event an individual, any joint venture, partnership, corporation or other entity desires to dedicate water rights to the Authority for the Authority to hold or bank for the future use by the Applicant, or Applicant's designated successor, for a Will-Serve Commitment letter, the Applicant, or Applicant's designated successor, will pay applicable fees set forth in this Section and execute a banking agreement with the Authority. The Applicant, or Applicant's designated successor, shall be billed by the Authority for any fees such as Extension of Time associated with maintaining banked water rights in good standing with the Nevada Division of Water Resources.

6. Issuance of Will-Serve Commitment Letter After Dedication of Water Rights. After the Applicant has satisfied the requirements of Section F and paid the fees under Section H, and the Authority has accepted the Dedicated Water Resource, the Authority shall:

   a. Prepare the necessary documentation to deed the Dedicated Water Resource to the Authority or Local Government;

   b. Record such deed at the County Recorder; and

   c. Upon execution of such deed and acceptance of the Dedicated Water Resource by the Authority, issue a Will-Serve Commitment letter to the Applicant for new Service or Modified Service at the location requested by Applicant.

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7. Issuance of Will-Serve Commitment Letter After Purchase. After an Applicant has satisfied the requirements of Section G, paid the price determined in Section G, and paid the fees under Section H, the Authority will issue a Will-Serve Commitment letter to the Applicant for new Service or Modified Service at the location requested by the Applicant.

8. Obligation to Serve. Until such time as the Authority has issued a Will-Serve Commitment letter to an Applicant and facilities are installed pursuant to the Authority's rules to delivery water to the Project, the Authority is not obligated to provide the new Service or Modified Service.

9. Will-Serve Commitments Appurtenance. Will-Serve Commitment letters issued by the Authority and Historic Demand are appurtenant to the Service Property.

I. Project Cancellation, Expiration or Termination and Adjustments

1. A Will-Serve Commitment letter is automatically revoked and shall be null and void without further notice from the Authority on the date (i) Applicant provides written notice to the Authority that Applicant's project is canceled; or (ii) approval for Applicant's project expires or is terminated by the applicable governing body. In such event and upon written request of the Applicant:

   a. The Authority shall reconvey to the Applicant any water rights dedicated by the Applicant pursuant to Section F of this Rule for the revoked Will-Serve Commitment Letter; or

   b. In the Authority's sole discretion, the Authority may hold or bank Dedicated Water Resources or Authority Water Resources in connection with the revoked Will-Serve Commitment letter for the use by the Applicant, or Applicant's designated successor or assign, for a new Will-Serve Commitment letter for another project(s); or

   c. The Authority shall refund to the Applicant, without interest, the full amount paid to the Authority by the Applicant under Sections H.3 and G as applicable provided (i) the Applicant submits a written request for such a refund to the Authority within ninety (90) days of the issuance of the Will-Serve Commitment letter, or (ii) the total amount eligible for refund is $100,000 or less. In the event the Authority grants a refund under this subsection, the Authority will return the Authority Water Resources supporting the revoked Will-Serve Commitment Letter to the Will-Serve Inventory; or

d. The Authority shall credit (credit in acre feet) the Applicant, or Applicant's designated successor or assign, the amount of Water Resources purchased by Applicant under Section G, which credit can be applied to Application(s) for new Service and Modified Service within the Authority's TMRA as directed in writing by the Applicant, or Applicant's designated successor or assign.

2. Will-Serve Commitment Adjustments and Issuance of Water Resource Credits. Adjustments to the quantity of water resources committed to a Service Property may be made pursuant to this Section where:

   a. An existing building(s) or facility(ies) has been demolished or removed and service to the Service Property is disconnected. A water resource credit (credited in acre-feet) will be issued to the owner of the Service Property under this Section I.2.a equal to the Demand in the Will-Serve Commitment letter or Historic Demand, if:

      (1) The owner of the Service Property on which service is to be disconnected records a deed restriction with the County Recorder in form acceptable to Authority declaring that there is no entitlement to water resources and/or water service from the Authority benefiting such parcel(s) at the Service Property; and

      (2) Service at the Service Property is retired in accordance with Rule 6.

   After completion of the requirements of Section I.2.a(1) and I.2.a(2) the Authority's commitment to deliver water to the Service Property shall be deemed revoked and any Applicant for the delivery of water to the Service Property must submit an Application for new Service and satisfy all requirements in this Rule, including supplying water resources pursuant to Section F or G prior to issuance of a Will-Serve Commitment letter for the new Service at the Service Property.

   b. The projected Demand of a new Service or Modified Service at the Service Property is less than the Demand in the Will-Serve Commitment letter or the Historic Demand at the Service Property, in which event a water resource credit (credited in acre-feet) will be issued to the owner of the Service Property under this Section I.2.b equal to the difference. If the projected Demand of the new Service or Modified Service is greater than the Demand in the Will-Serve Commitment letter or the Historic Demand at the Service Property, no adjustment will be made or water resource credit issued, and the Applicant must dedicate sufficient water resources to the Authority in accordance with this Rule equal to the projected increase in Demand plus any Deficit Demand at the Service Property prior to the issuance of a new or revised Will-Serve Commitment letter for any new Service or Modified Service at the Service Property.

c. The owner(s) of a Service Property requests an adjustment of Demand based on Current Usage at the Service Property and:

   (1) The Service Property is not located on a parcel created by subdivision plat (or map) pursuant to NRS Chapter 278;
   (2) The Demand being adjusted is not a Residential Service;
   (3) The person(s) requesting the adjustment owns all real property at the Service Property benefitted by the quantity of water committed to the Service Property; and
   (4) There is at least three (3) or more years of continuous metered water use data or other historic Demand data as determined by the Authority to establish the Current Usage for the Service Property being adjusted.

If the Service Property satisfies the requirements of Section I.2.c and Demand in the Will-Serve Commitment letter or Historic Demand is greater than the Current Usage, Authority shall issue a water resource credit (credited in acre-feet) to the owner of the Service Property equal to the difference and issue a revised Will-Serve Commitment letter to the Service Property. If a Deficit Demand exists at the Service Property no adjustment will be made or water resource credit issued.

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3. Water resources supporting any water resource credits issued by the Authority to the owner of a Service Property are owned by the Authority and shall be held for the benefit of the owner(s) of the Service Property, or his designated successor or assign subject to the terms and conditions set forth in Authority's water resource banking agreement. Water resource credits:

    a. Shall be issued in acre feet and shall state quantity in terms of Demand;

    b. May be used in connection with an application for new Service or Modified Service and is acceptable to meet the Demand under this Rule;

    c. Must be used in the Authority's Service Area;

    d. In areas where sewer flows are returned to the Truckee River, additional resources must be supplied pursuant to Sections F or G for sufficient for return flows;

    e. Shall be issued to the owner of the Service Property;

    f. May be sold, assigned or transferred to other parties upon notification to and written approval from the Authority and only to the extent the water resource credits exceed one acre foot. The Authority may assist with such sales on request.

J. General Provisions

1. Nothing in this Rule shall be construed to usurp the planning functions of the Local Governments. Applicants shall be deemed in compliance with the provisions of this Rule if the Applicant causes the Local Government(s) to sell or lease to the Authority, pursuant to such Local Government(s) Ordinances, sufficient resources from resources held by the Cities or County, if such procedure is required by local Ordinance.

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Appendix G
Findings and Recommendations Regarding Landscape Ordinances

TMWA TECHNICAL ADVISORY COMMITTEE LANDSCAPE SUBCOMMITTEE
Findings and Recommendations
5/11/05

INTRODUCTION

The following document presents the findings and recommendations for potential local government action concluded by the Truckee Meadows Water Authority ("TMWA") Technical Advisory Committee ("TAC") Landscape Subcommittee. This subcommittee was appointed by the TAC at the August 31, 2004 public meeting to address the following issues which were raised by TMWA staff:

1. Increasing customer complaints regarding standards of landscaping approved by the local governments.

2. Lack of consistency in enforcement of the water conservation elements of the ordinances.

The subcommittee first convened September 21, and held an additional 4 meetings with the final meeting taking place December 7, 2004. The subcommittee voting members were:

Jim Smitherman, Washoe County
Fred Turnier, City of Reno
Neil Krutz, City of Sparks

The following staff members and their consultants provided valuable input during the course of these meetings:

Terri Svetich, City of Reno
Donald Naquin, City of Reno
Chris Conway, Kennedy-Jenks
Trevor Lloyd, Washoe County
Gregg Finkler, Washoe County

FINDINGS

- The greatest impact for water efficiency is to concentrate on the landscape/irrigation design plan. Landscape design issues that influence water efficiency such as buffering and drainage (runoff management) are best coordinated with the regional stormwater quality management program.

- Only a cursory review is performed for landscape/irrigation design plans when they are submitted to the local governments. Local governments rely on the professionals in the private sector to accurately design irrigation systems.

- There is no thorough checklist of water-efficient landscape/irrigation design principles followed during irrigation plan review.

- The term ‘encouraged’ in the codes is not enforceable. Many of the water-efficient principles are only ‘encouraged’.

- Local governments trust that the letter of completion certified by the plan preparer satisfies the code requirements.

- Water users will be more favorably inclined to make water efficient changes if there is economic incentive to make changes.

- Facilities that are dedicated to local governments, such as parks, do have to conform to rigorous design standards as set by the agency, typically the parks department.

- Typically, maintenance sections of the codes are enforced when a complaint is filed. Due to resource constraints, these sections are not routinely pursued.

- Ordinances are directed at new development and place few, if any, efficiency or maintenance requirements on existing customers.

- Enforcement is not sufficient to ensure that irrigation equipment is adequate to efficiently irrigate small areas of turf.

- Many existing water users have inefficient irrigation systems. There are limited resources to improve efficiency (such as enforced maintenance requirements or retrofit assistance).

RECOMMENDATIONS and ROLE OF RESPONSIBILITY

- New development requirements to be handled by local government ordinances. Items that require ongoing management to be defined as either handled by local government or the water purveyor in their rules.

- Funding mechanisms needed. For new development new fees can be collected through additional inspection or other plan/permit fees. For water purveyor additional work, the most likely source of new funds would be customer rates.

New Landscaping

- Local governments need dedicated staff for irrigation plan check and water efficiency requirements per code. To conduct job effectively, remove term 'encouraged' in current ordinances. Alternatively, hire professional firms to perform work.

- For landscaping with separate irrigation meters, require an annual outdoor water budget by watering zone as part of the submitted Irrigation Plan.

- Require an irrigation efficiency standard that is agreed upon by local experts (such as Cooperative Extension). Addition of an irrigation efficiency requirement and water budget to each of the agency codes would provide consistency of work among landscape architects and across jurisdictions. Calculations for irrigation efficiency and water budget to be submitted by Landscape Architect.

- Require buffer areas at the base of slopes next to impervious materials (for example next to sidewalks, asphalt areas etc) to allow runoff to drain into the soils.

- Inspection of irrigation system to be performed by a Certified Landscape Irrigation Auditor to ensure that the system is performing as designed with the required irrigation efficiency standard set forth in the code. This certification would be submitted by the Landscape Irrigation Auditor as part of the final checklist along with the documentation submitted by the preparer of the plans that the final landscaping meets landscaping code requirements.

- Small turf areas should be limited to a minimum width of 8 feet; 10 feet is preferred.

- **Established Landscaping**

- Ongoing maintenance should be required for existing customers with regular irrigation audits, education, and a tracking procedure. For new development, follow-up audits should be required periodically (perhaps every 5 years) as accountability for long-term maintenance of irrigation system or landscaping (by property owner) is inconsistently enforced.

- Coordinate rigorous irrigation checks for large water-using sites (commercial sites with separate metered irrigation).

- Information to customers, including new developments, on responsibility of areas to be maintained and bill payment.

Applicable to both new and established landscaping is the need for more professional education in the green industry, including landscape architects. In particular, public outreach must accompany any change in standards with revisions to the landscape ordinances.

Appendix H
Implementation of Programs Regarding Outdoor Watering

Discussion of Regional Landscaping Problems and Suggested Solutions

May 2004

by Harry Fahnestock

Due to the soil conditions in this region, soil should be amended before planting landscape lawn areas. Amending the soil costs more and takes some extra work, but the benefits are many including healthier lawns and huge water savings.

The region's soil ranges from coarse decomposed granite to hard-packed clay. The coarse sandy texture of granitic soil allows water and nutrients to quickly pass downward through the soil profile resulting in wasted water and nutrients, and more frequent irrigation to maintain plant health. Through the addition of organic compost that closes up the porosity and holds moisture and nutrients in the root area, the frequency and volume of water applied can be reduced measurably.

Clay soils consist of tightly packed fine-grained particles that restrict water, air and nutrient passage. More frequent irrigation is required, since this soil type accepts only a small amount of water at a time. Runoff commonly occurs with these types of soils because many automatic irrigation time clocks only allow 3 cycles when 4 or more cycles may be needed to apply a smaller amount of water more frequently. The addition of organic compost in this case breaks up the closely packed soil particles and allows for the movement of water, air and nutrients through the soil, particularly in the root zone.

In most new developments, particularly single family dwellings, little if any good soil and/or amendments are used with the site soil. Most landscape suppliers have topsoil mixes that contain different types of compost that are added to topsoil, which make good planting mediums. Site soil can usually be amended with organics eliminating the need to bring in more soil.

Kentucky bluegrass and tall fescue are the two most predominant varieties of grass used in our region, and while some perennial rye grass and fine fescue is used, they are usually in a mix with Kentucky bluegrass. Kentucky bluegrass roots have their greatest density in the top 8 to 10 inches of soil and tall fescue roots may be found 6 to 10 feet deep. For a healthy water efficient lawn, good soil should be at least 8 to 12 inches in depth. Two inches of sand placed on top of native soil results in layering and since sand is very porous, most of the root mass will be concentrated in this layer. As the weather becomes warmer, the moisture from this top layer evaporates first and, since this is where most of the roots are concentrated (the water reservoir), the lawn is stressed and turns brown. A common response is to apply more water.

The turf industry is continually developing new grasses. Buffalo grass, Texas blue, blue gramma are just a few that are known for their low water requirements and more are being tested as this is written. Unfortunately many of these grasses will not grow well here, some are highly allergenic, some do not offer functionality such as play and recreation areas and some just have very little aesthetic appeal. The new improved varieties of Kentucky blue grass and tall fescue are still the best type of grass for this area. Both are cool season grasses. Both have also been characterized as high water users. High waster use, however, is not inherent in the plant but is a result of a lack of education and poor water management.

Different types of grasses are discussed in the following article, *Focus on Water Management –Not the Type of Grass*, written by the author for a nursery magazine.

> Being limited to cool season grass varieties in this region is not all bad because there are a number of choices, including Kentucky bluegrass, perennial rye grass, new generation tall fescue (including dwarf fescue and fine fescue). There are also varieties of buffalo grass and other grasses being developed that will provide even more choices in the future.
>
> The turf industry and end users now have turf grasses that are more drought tolerant, require less water, are more disease and pest resistant, can be mowed less frequently and very short, and use less fertilizer. These grasses also help maintain the environmental, functional and aesthetic benefits that make lawns the universally most desired component in the landscape.
>
> So while trying to decide which of these grasses is the best choice, probably any of them will work, depending on the use. A lot of time can be spent discussing the hundreds of varieties and you will still come back to the same point – generally they all do the job they are supposed to do and newer varieties may give you some measure of added benefit(s).
>
> Too much emphasis has been placed on the type and variety of grass, particularly when it comes to water needs. Kentucky bluegrass has had the finger pointed at it for years as being a high water user. The truth is that Kentucky bluegrass can be watered at deficit levels much lower than evapotranspiration rates and maintain vigor and functionality. With extreme cutback of irrigation it will eventually go dormant and spring back to life when water is available. The newer generation of tall fescues has been touted as being 'more' drought tolerant due to physiological mechanisms and their deep rooting. The fact is that the turf grasses we are using are very capable of using less water than we are applying – any actual high water use on lawns is the result of poor water management.
>
> At a Water Symposium in Salt Lake City, Utah, the industry has been shown that while the average water requirement for lawns was 21 inches per season, people were applying in excess of 50 inches and some commercial properties were using in excess of 70 inches. This enforces the premise that most people water much more than needed. Another impact of this water abuse is runoff. A lot of the excess water ends up running off adding to non-point source pollution. After 15 years of twice a week watering and the awareness of the sensitive nature of our

water supply, our usage in this area is undoubtedly not as abusive as described in Salt Lake City, but that does not mean our water use is as efficient as it should be.

In a recent ET Controller study conducted in conjunction with the Washoe County Regional Water Planning Commission (RWPC), it was found that the irrigation efficiency of a number of systems was less than fifty percent. Sixty five percent is the minimum recommended for use in the industry. The RWPC is going to investigate increasing the sixty five percent as an important component of conservation. The RWPC is also pursuing stronger enforcement of the landscape codes.

An illustration of the amount of water that must be used to provide 12 inches of water follows:

System Efficiency	Inches of Water
50%	24
60%	20
70%	17.15
80%	15
90%	13.33

Example: If your irrigation system has an efficiency of 60%, you must apply 67% more water than needed.

Landscape professionals and homeowners need to become much more aware of good water management. Better design, installation and maintenance of irrigation systems is no longer 'sounds good' material – apathy in this area will invite more stringent restrictions of our landscapes, and not just turf areas.

In our region, irrigation schedules should be changed a minimum of six times during the irrigation season. What is evapotranspiration (ET) and how do you use it in managing landscapes? There are new irrigation clocks that can be set for the whole season, programming in all of the changes that will be necessary ahead of time. ET controllers are now available and some preliminary testing is showing substantial savings while taking the management out of the users hands – the biggest problem. Following the BMP's of landscape construction and maintenance is of great importance and are the areas of the greatest potential savings of water. Focusing on these rather than the type of grass is best.

Visit the Washoe County web site at www.washoeet.dri.edu to learn about evapotranspiration, daily rates and information about how much to water with different sprinkler heads.

The turf industry has extensive studies on every variety of turf grass known to man including how much water they require, how little water they can survive on, what nutrients they require, what soils and climates they will grow in, how much oxygen they produce, how much carbon dioxide they remove from the atmosphere and many more things. Very little is known about woody ornamental shrubs and trees commonly used in our landscapes but there is a pervasive mentality that says its okay to have them in the landscape but look out for that high water guzzling grass.

A study conducted at the University of Nevada Las Vegas by Dr. Dale Devitt[1] concluded that the ornamental trees and shrubs (some 'native') that he used in his study will use far more water than the equivalent canopy area of tall fescue, particularly when they reach maturity. Other studies of plants commonly used in the landscape are currently being conducted and initial reports indicate the same findings as do Dr. Devitt's.

Harry Fahnestock is the owner of Western Turf, a member of the Washoe County Regional Water Planning Commission, RWPC Advisory Committee on Conservation, past President of Nevada Landscape Association and Chairman of the NLA Water Resources Committee

[1]Devitt,D.A, D.S. Neuman, D.C. Bowman and R. C . Morris. 1995. Comparative water use
of turfgrass and ornamental trees in an arid environment. Journal of Turfgrass Management. 1:47-63.

Appendix I
5-Year Capital Improvement Projects List

Table I.1: Full List of 5-Year CIPs

PROVIDER SERVICE	PROJECT NAME	FUNDING SOURCE	ESTIMATED COST IN FY 2015/2016 DOLLARS -- FISCAL YEAR ENDING 2016	2017	2018	2019	2020	5-YR TOTAL
TRUCKEE MEADOWS WATER AUTHORITY								
WATER ADMINISTRATIVE OUTLAYS	GIS System Mapping Equipment	RATES	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000
WATER ADMINISTRATIVE OUTLAYS	Desktop Computer Upgrades	RATES	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
WATER ADMINISTRATIVE OUTLAYS	Network Server/Storage upgrades	RATES	$275,000	$175,000	$175,000	$175,000	$175,000	$975,000
WATER ADMINISTRATIVE OUTLAYS	Network Security Upgrades	RATES	$150,000	$150,000	$150,000	$150,000	$150,000	$750,000
WATER ADMINISTRATIVE OUTLAYS	Computer/Network Licensing	RATES	$150,000	$150,000	$150,000	$150,000	$150,000	$750,000
WATER ADMINISTRATIVE OUTLAYS	Furniture -Office Equipment	RATES	$25,000	$25,000	$25,000	$25,000	$25,000	$125,000
WATER ADMINISTRATIVE OUTLAYS	Dump trucks/Vac Trucks/Backhoe Replacements	RATES	$270,000	$125,000	$285,000	$380,000	$160,000	$1,220,000
WATER ADMINISTRATIVE OUTLAYS	Crew Trucks / Vehicles	RATES	$709,000	$690,000	$288,000	$190,000	$362,000	$2,239,000
WATER ADMINISTRATIVE OUTLAYS	Security-ER Projects	RATES	$250,000	$150,000	$150,000	$150,000	$150,000	$850,000
WATER CUSTOMER SERVICE	Meter Reading Equipment	RATES	$60,000	$0	$60,000	$0	$60,000	$180,000
WATER CUSTOMER SERVICE	New Business Meters	CONNECTION FEES	$250,000	$250,000	$250,000	$250,000	$250,000	$1,250,000
WATER CUSTOMER SERVICE	Mueller Pit Replacements former Washoe County	RATES	$125,000	$125,000	$125,000	$375,000	$125,000	$875,000
WATER CUSTOMER SERVICE	Mueller Pit Replacements former STMGID	STMGID RESERVE	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
WATER CUSTOMER SERVICE	Meter -ERT-RTR Replacements	RATES	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$6,250,000
WATER DISTRIBUTION	D'Andrea #3 pump station	CONNECTION FEES	$100,000	$0	$0	$0	$0	$100,000
WATER DISTRIBUTION	Pressure Regulator Rehabs/Rebuilds	RATES	$500,000	$650,000	$500,000	$450,000	$450,000	$2,550,000
WATER DISTRIBUTION	Pressure Regulator Replacments (Roll Seal)	RATES	$400,000	$400,000	$400,000	$400,000	$400,000	$2,000,000
WATER DISTRIBUTION	Pump Station Rehabilitations, Rebuilds	RATES	$0	$0	$0	$1,000,000	$1,000,000	$2,000,000
WATER DISTRIBUTION	Land Acquistions	RATES	$500,000	$500,000	$500,000	$500,000	$500,000	$2,500,000
WATER DISTRIBUTION	Standby Generator Additions/Replacements	RATES	$650,000	$650,000	$150,000	$150,000	$150,000	$1,750,000
WATER DISTRIBUTION	General Distribution Line Oversizing/Extensions	CONNECTION FEES	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
WATER DISTRIBUTION	Street & Highway Main Replacements	RATES	$4,500,000	$5,000,000	$5,000,000	$5,500,000	$5,600,000	$25,600,000
WATER DISTRIBUTION	Galv/Poly Service Line Replacements	RATES	$400,000	$400,000	$400,000	$400,000	$400,000	$2,000,000
WATER DISTRIBUTION	Paloma PRS and Main Tie	CONNECTION FEES	$0	$0	$0	$750,000	$0	$750,000
WATER DISTRIBUTION	North Valleys Integration Project (17%)	RATES	$3,026,000	$0	$0	$0	$0	$3,026,000
WATER DISTRIBUTION	North Valleys Integration Project (83%)	CONNECTION FEES	$14,774,000	$0	$0	$0	$0	$14,774,000
WATER DISTRIBUTION	Stead Main Replacement Ph. 2	CONNECTION FEES	$5,000,000	$0	$0	$0	$0	$5,000,000
WATER DISTRIBUTION	Surge Street Main Replacement	RATES	$0	$0	$0	$230,000	$0	$230,000
WATER DISTRIBUTION	Sun Valley #1 Pump Station Replacement	RATES	$0	$0	$1,000,000	$0	$0	$1,000,000
WATER DISTRIBUTION	NAC Deficiencies - Saddlehorn, Toll Rd, STMGID East	STMGID RESERVE	$340,000	$360,000	$100,000	$2,400,000	$0	$3,200,000
WATER DISTRIBUTION	Mt. Rose Well #1 Pump Station Replacement	RATES	$0	$50,000	$1,000,000	$0	$0	$1,050,000
WATER DISTRIBUTION	Lakeridge PS Replacement & Park Ridge Cir. PRS	RATES	$0	$1,900,000	$0	$0	$0	$1,900,000
WATER DISTRIBUTION	Longley PS Capacity Increase	CONNECTION FEES	$0	$0	$500,000	$0	$0	$500,000
WATER DISTRIBUTION	STMGID Conjunctive Use Facilities	STMGID RESERVE	$200,000	$1,500,000	$2,100,000	$0	$0	$3,800,000
WATER DISTRIBUTION	Arc Flash Improvements	RATES	$100,000	$100,000	$100,000	$0	$0	$300,000
WATER DISTRIBUTION	Arrowcreek-Mt. Rose Conjunctive Use Ph. 1	STMGID RESERVE	$2,800,000	$0	$0	$0	$0	$2,800,000
WATER DISTRIBUTION	Arrowcreek-Mt. Rose Conjunctive Use Ph. 2	STMGID RESERVE	$0	$1,200,000	$0	$0	$0	$1,200,000
WATER DISTRIBUTION	California-Marsh 24" Main	RATES	$0	$100,000	$900,000	$0	$0	$1,000,000
WATER DISTRIBUTION	Galena Creek Main Crossing Replacement	RATES	$0	$300,000	$0	$0	$0	$300,000
WATER DISTRIBUTION	STM Capacity Improvements Ph. 1	CONNECTION FEES	$0	$0	$400,000	$0	$0	$400,000
WATER DISTRIBUTION	Bonnie Ln & Snow Flower Main Ties	CONNECTION FEES	$0	$0	$0	$620,000	$900,000	$1,520,000
WATER DISTRIBUTION	Booth, Sharon Way & Monroe 24" Main Replacements	RATES	$0	$0	$0	$100,000	$3,100,000	$3,200,000
WATER DISTRIBUTION	South Virginia 24" Main (Kumle to Peckham)	CONNECTION FEES	$0	$0	$0	$100,000	$900,000	$1,000,000
WATER DISTRIBUTION	Satellite Hills PS Replacement & SS #1 PS Main Tie	RATES	$1,350,000	$0	$0	$0	$0	$1,350,000
WATER DISTRIBUTION	Desert Springs Pressure Improvements	RATES	$0	$400,000	$0	$0	$0	$400,000
WATER DISTRIBUTION	Spring Creek South Zone Conversion	RATES	$700,000	$0	$0	$0	$0	$700,000
WATER DISTRIBUTION	NE Sparks Tank Feeder Main Relocation	CONNECTION FEES	$0	$900,000	$0	$0	$0	$900,000
WATER DISTRIBUTION	Hidden Valley Intertie pumping capacity	RATES	$100,000	$500,000	$0	$0	$0	$600,000
WATER DISTRIBUTION	West Hidden Valley Main Repl.	RATES	$0	$1,000,000	$0	$0	$0	$1,000,000
WATER DISTRIBUTION	Piping Rock Main Replacement	RATES	$0	$0	$0	$0	$500,000	$500,000
WATER DISTRIBUTION	Desert Springs Water Mains Rehabilitations	RATES	$0	$0	$1,280,000	$0	$1,280,000	$2,560,000
WATER DISTRIBUTION	Sierra Pump Station Replacement (25%)	RATES	$250,000	$0	$0	$0	$0	$250,000
WATER DISTRIBUTION	Juniper Hill Modifications & Hunter Creek Main Ret.	RATES	$500,000	$0	$0	$0	$0	$500,000
WATER DISTRIBUTION	Verdi Main Oversizing	CONNECTION FEES	$375,000	$0	$0	$0	$0	$375,000
WATER GROUNDWATER DEVELOPMENT	Well Rehabilitation & NAC Compliance	RATES	$850,000	$850,000	$850,000	$850,000	$850,000	$4,250,000
WATER GROUNDWATER DEVELOPMENT	Lemmon Valley Well #9 Electrical Service	CONNECTION FEES	$50,000	$0	$0	$0	$0	$50,000
WATER GROUNDWATER DEVELOPMENT	Air Guard Well Replacement	RATES	$500,000	$900,000	$0	$0	$0	$1,400,000
WATER GROUNDWATER DEVELOPMENT	Double Diamond Well #3 (equipping)	CONNECTION FEES	$1,000,000	$0	$0	$0	$0	$1,000,000
WATER GROUNDWATER DEVELOPMENT	Innovation Well Drilling and Equipping	CONNECTION FEES	$1,000,000	$0	$0	$0	$0	$1,000,000
WATER GROUNDWATER DEVELOPMENT	Huffaker Place Well Equipping	CONNECTION FEES	$1,000,000	$0	$0	$0	$0	$1,000,000
WATER GROUNDWATER DEVELOPMENT	Sunrise Well #3 Replacement	RATES	$0	$750,000	$0	$0	$0	$750,000
WATER GROUNDWATER DEVELOPMENT	Callamont Well #1 & #2 Equipping	CONNECTION FEES	$0	$0	$0	$0	$1,000,000	$1,000,000
WATER GROUNDWATER DEVELOPMENT	STMGID Well Improvements (bypass, chlorine)	STMGID RESERVE	$50,000	$110,000	$50,000	$50,000	$50,000	$310,000
WATER GROUNDWATER DEVELOPMENT	Old Washoe Well #1 Replacement	RATES	$350,000	$0	$0	$0	$0	$350,000
WATER GROUNDWATER DEVELOPMENT	Campello Intertie Recharge Capacity Increase	RATES	$0	$0	$150,000	$0	$0	$150,000
WATER GROUNDWATER DEVELOPMENT	Desert Springs Well #4 Recharge Improvements	RATES	$0	$0	$0	$130,000	$0	$130,000
WATER GROUNDWATER DEVELOPMENT	Truckee Canyon Well #3 Equipping	CONNECTION FEES	$0	$0	$0	$80,000	$0	$80,000
WATER HYDROELECTRIC	Flume, Forebay, Diversion, and Canal Improvements	RATES	$365,000	$510,000	$560,000	$260,000	$400,000	$2,095,000
WATER HYDROELECTRIC	Hydro Plant Equipment Replacement/Upgrades	RATES	$150,000	$0	$70,000	$70,000	$0	$290,000
WATER HYDROELECTRIC	Hydro Plant Generator Rewinds	RATES	$0	$0	$350,000	$350,000	$350,000	$1,050,000
WATER METER RETROFIT & WATER RIGHTS	Water Meter Retrofits	CONNECTION FEES	$300,000	$300,000	$300,000	$300,000	$300,000	$1,500,000
WATER METER RETROFIT & WATER RIGHTS	Water Right Purchases	CONNECTION FEES	$500,000	$500,000	$500,000	$500,000	$500,000	$2,500,000
WATER RAW WATER SUPPLY	Highland Canal-Upgrades-Downstream of CB	RATES	$225,000	$225,000	$225,000	$225,000	$225,000	$1,125,000
WATER RAW WATER SUPPLY	Highland Canal-Upgrades-Diversion to CB	RATES	$1,000,000	$225,000	$100,000	$100,000	$100,000	$1,525,000
WATER RAW WATER SUPPLY	Donner Dam Repairs	RATES	$150,000	$600,000	$0	$0	$0	$750,000
WATER RAW WATER SUPPLY	TROA Implementation	GRANT	$175,000	$275,000	$225,000	$0	$0	$675,000
WATER STORAGE	Tank/Reservoir Fix & Finish, Drainage, Access	RATES	$760,000	$780,000	$860,000	$800,000	$800,000	$4,000,000
WATER STORAGE	Peavine Tank Replacement - 2 MG	RATES	$2,500,000	$0	$0	$0	$0	$2,500,000
WATER STORAGE	Sun Valley #2 Steel Tank - 1.25 MG (67%)	RATES	$0	$0	$1,172,000	$0	$0	$1,172,000
WATER STORAGE	Sun Valley #2 Steel Tank - 1.25 MG (33%)	CONNECTION FEES	$0	$0	$578,000	$0	$0	$578,000
WATER STORAGE	Former STMGID Tank Recoating	STMGID RESERVE	$170,000	$0	$220,000	$0	$300,000	$690,000
WATER STORAGE	Zone 11 Tank - 2.5 MG	STMGID RESERVE	$0	$3,000,000	$0	$0	$0	$3,000,000
WATER STORAGE	D'Andrea #3 Tank	CONNECTION FEES	$100,000	$0	$0	$0	$0	$100,000
WATER STORAGE	Fish Springs Ranch #2	CONNECTION FEES	$0	$0	$0	$0	$100,000	$100,000
WATER STORAGE	Rattlesnake Tank Ring Addition	CONNECTION FEES	$0	$0	$0	$800,000	$0	$800,000
WATER TREATMENT	Orr Ditch Diversion/Pump Station Improvements	RATES	$500,000	$0	$0	$0	$0	$500,000
WATER TREATMENT	Treatment Plants- Fix & Finish	RATES	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$5,000,000
WATER TREATMENT	Emergency Operations Addition	RATES	$0	$1,200,000	$0	$0	$0	$1,200,000
WATER TREATMENT	SCADA Rehab/Plant Operating Software Upgrade	RATES	$915,000	$475,000	$265,000	$265,000	$265,000	$2,185,000
WATER TREATMENT	Glendale Clearwell #2	RATES	$0	$0	$0	$0	$150,000	$150,000
WATER TREATMENT	Mt. Rose Creek Water Treatment Plant	CONNECTION FEES	$1,000,000	$6,000,000	$1,200,000	$0	$0	$8,200,000
WATER TREATMENT	Lightning W Water Treatment Improvements	RATES	$0	$0	$0	$200,000	$0	$200,000
WATER TREATMENT	Eagle Canyon Blending T-Main Phase 2	RATES	$0	$100,000	$1,800,000	$0	$0	$1,900,000
WATER TREATMENT	Truckee Canyon Water Treatment Improvements	CONNECTION FEES	$0	$0	$0	$250,000	$0	$250,000
TOTAL TRUCKEE MEADOWS WATER AUTHORITY			**$54,994,000**	**$37,105,000**	**$28,018,000**	**$22,230,000**	**$24,732,000**	**$167,079,000**

Table 1: Full List of 5-Year CIPs

PROVIDER SERVICE	PROJECT NAME	FUNDING SOURCE	ESTIMATED COST IN FY 2015/2016 DOLLARS -- FISCAL YEAR ENDING 2016	2017	2018	2019	2020	5-YR TOTAL
WASHOE COUNTY								
WATER	Golden Valley Water Rights Purchase	RATES	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
SEWER	Field Creek Reservoir Water Quality Management	RATES	$0	$500,000	$0	$0	$0	$500,000
SEWER	Dorothy Towne (Zircon) Lift Station Improvements	RATES	$700,000	$0	$0	$0	$0	$700,000
SEWER - STMWRF	STMWRF Solids Management Facility (66.7% rates)	RATES	$6,670,000	$0	$0	$0	$0	$6,670,000
SEWER - STMWRF	STMWRF Utility Operations Building	RATES	$188,000	$0	$0	$0	$0	$188,000
SEWER - STMWRF	STMWRF Enhancement Projects	RATES	$1,075,000	$990,000	$0	$0	$750,000	$2,815,000
SEWER - CSWRF	Cold Springs WRF Enhancement Projects	RATES	$100,000	$0	$0	$0	$0	$100,000
SEWER	SW Vista Lift Station Sewer Main Extension and Lift Station Abandonment	RATES	$200,000	$0	$0	$0	$0	$200,000
SEWER	Horizon Hills Sewer System Improvements	RATES	$0	$0	$0	$225,000	$225,000	$450,000
SEWER	Sewer Interceptor Inflow and Infiltration	RATES	$1,000,000	$150,000	$150,000	$150,000	$150,000	$1,600,000
SEWER	Sewer Financial Connection Fee and Rate Study	RATES	$200,000	$0	$0	$0	$0	$200,000
SEWER	Sewer Asset Management Program	RATES	$400,000	$40,000	$40,000	$40,000	$40,000	$560,000
SEWER - STMWRF	STMWRF Rehab Projects	RATES	$705,000	$100,000	$90,000	$90,000	$90,000	$1,075,000
SEWER	Lift Station Rehab Projects	RATES	$140,000	$40,000	$40,000	$40,000	$0	$260,000
SEWER - CSWRF	Cold Springs WRF Rehab Projects	RATES	$100,000	$0	$0	$0	$0	$100,000
SEWER - LVWRF	Lemmon Valley WRF Rehab Projects & 0.5MGD new capacity	RATES	$350,000	$0	$7,500,000	$0	$0	$7,850,000
SEWER	Sewer Interceptor Video Inspection	RATES	$100,000	$40,000	$25,000	$100,000	$40,000	$305,000
SEWER - STMWRF	STMWRF Solids Management Facility (33.3% connection fees)	CONNECTION FEES	$3,330,000	$0	$0	$0	$0	$3,330,000
SEWER	Pleasant Valley Interceptor Reach 4 - Land Acquisition	CONNECTION FEES	$150,000	$0	$0	$0	$0	$150,000
SEWER - STMWRF	STMWRF New Capacity to 6 MGD	CONNECTION FEES	$0	$0	$0	$0	$35,000,000	$35,000,000
SEWER	Pleasant Valley Interceptor Reach 3A -Construction	CONNECTION FEES	$0	$0	$0	$0	$3,000,000	$3,000,000
SEWER	Pleasant Valley Interceptor Reach 3B -Construction	CONNECTION FEES	$0	$0	$0	$0	$4,000,000	$4,000,000
SEWER	Pleasant Valley Interceptor Reach 3C -Construction	CONNECTION FEES	$0	$6,000,000	$0	$0	$0	$6,000,000
SEWER	Lemmon Valley (Stead) Master Plan	CONNECTION FEES	$150,000	$0	$0	$0	$0	$150,000
SEWER	Regional Effluent Management Program	CONNECTION FEES	$200,000	$0	$0	$0	$0	$200,000
SEWER - STMWRF	STMWRF Master Plan	CONNECTION FEES	$200,000	$0	$0	$0	$0	$200,000
SEWER	Spanish Springs Master Plan	CONNECTION FEES	$250,000	$0	$0	$0	$0	$250,000
SEWER - CSWRF	Cold Springs WRF Expansion Facility Plan	CONNECTION FEES	$200,000	$0	$0	$0	$0	$200,000
SEWER	Phased Sewering Project Phase 1B - Army Corps Grant Match at 25%	GRANT	$0	$876,000	$0	$0	$0	$876,000
SEWER	Phased Sewering Project Phase 1B - Army Corps Grant at 75%	GRANT	$0	$1,650,000	$0	$0	$0	$1,650,000
RECLAIM	Huffaker Hills Reservoir Lining Improvements - Phase 2	RATES	$2,200,000	$0	$0	$0	$0	$2,200,000
RECLAIM	Field Creek Pump Replacement	RATES	$75,000	$75,000	$75,000	$0	$0	$225,000
RECLAIM	Huffaker Reservoir Water Quality Management	RATES	$100,000	$500,000	$0	$0	$0	$600,000
RECLAIM	Reclaim Truck Fills	RATES	$0	$100,000	$0	$0	$0	$100,000
RECLAIM	Reclaimed Water Asset Management Program	RATES	$200,000	$25,000	$25,000	$25,000	$25,000	$300,000
RECLAIM	Evaluation of Field Creek and STMWRF Reclaim Pumps	RATES	$50,000	$0	$0	$0	$0	$50,000
RECLAIM	Reclaimed Water Transmission Main Extensions	CONNECTION FEES	$200,000	$200,000	$200,000	$200,000	$200,000	$1,000,000
TOTAL WASHOE COUNTY			**$19,308,000**	**$11,361,000**	**$8,220,000**	**$945,000**	**$43,595,000**	**$83,429,000**
CITY OF RENO								
SEWER - TMWRF	Fiscal Year 2015 Estimated Expenditures in Fiscal Year 2016	CONNECTION FEES	$1,115,000	$0	$0	$0	$0	$1,115,000
SEWER - TMWRF	Fiscal Year 2015 Estimated Expenditures in Fiscal Year 2016	RATES	$4,997,000	$0	$0	$0	$0	$4,997,000
SEWER - TMWRF	Fiscal Year 2016 Estimated Expenditures in Fiscal Year 2017	RATES	$0	$513,000	$0	$0	$0	$513,000
SEWER - TMWRF	Fiscal Year 2016 Estimated Expenditures in Fiscal Year 2017	CONNECTION FEES	$0	$288,000	$0	$0	$0	$288,000
SEWER - TMWRF	Fiscal Year 2017 Estimated Expenditures in Fiscial Year 2018	RATES	$0	$0	$1,218,000	$0	$0	$1,218,000
SEWER - TMWRF	Fiscal Year 2018 Estimated Expenditures in Fiscial Year 2019	RATES	$0	$0	$0	$353,000	$0	$353,000
SEWER - TMWRF	Fiscal Year 2019 Estimated Expenditures in Fiscial Year 2020	RATES	$0	$0	$0	$0	$5,180,000	$5,180,000
SEWER - TMWRF	Fiscal Year 2019 Estimated Expenditures in Fiscial Year 2020	CONNECTION FEES	$0	$0	$0	$0	$115,000	$115,000
SEWER - TMWRF	Centrate Pretreatment Project Evaulation/Design	RATES	$204,000	$0	$0	$0	$226,000	$430,000
SEWER - TMWRF	Construction Assistance Oversight Coordination of AMERESCO	RATES	$158,000	$0	$0	$0	$0	$158,000
SEWER - TMWRF	Construction Assistance Oversight Coordination of AMERESCO	CONNECTION FEES	$18,000	$0	$0	$0	$0	$18,000
SEWER - TMWRF	AMERESCO Project	RATES	$6,698,000	$0	$0	$0	$0	$6,698,000
SEWER - TMWRF	AMERESCO Project	CONNECTION FEES	$744,000	$0	$0	$0	$0	$744,000
SEWER - TMWRF	Nitrification System Valve Replacement	RATES	$1,476,000	$0	$0	$0	$0	$1,476,000
SEWER - TMWRF	Plant Wide Water Systems 2 & 3 Piping Upgrades	RATES	$741,000	$1,283,000	$714,000	$0	$467,000	$3,205,000
SEWER - TMWRF	Clairifier Basin Concrete and Steel Rehab	RATES	$134,000	$134,000	$148,000	$148,000	$154,000	$718,000
SEWER - TMWRF	HVAC Upgrade	RATES	$1,259,000	$1,208,000	$535,000	$0	$0	$3,002,000
SEWER - TMWRF	Activated Sludge Flow Improvments	RATES	$0	$710,000	$0	$0	$0	$710,000
SEWER - TMWRF	Substation Electrical Rehab	RATES	$0	$1,036,000	$0	$0	$0	$1,036,000
SEWER - TMWRF	Nitrificaton Tower Rehab & Improvments	RATES	$0	$406,000	$829,000	$829,000	$1,867,000	$3,931,000
SEWER - TMWRF	Nitrificaton Tower Rehab & Improvments	CONNECTION FEES	$0	$102,000	$207,000	$207,000	$467,000	$983,000
SEWER - TMWRF	Advanced Nirrogen Treatment Pilot Study	CONNECTION FEES	$192,000	$0	$0	$0	$0	$192,000
SEWER - TMWRF	Septage Receiving Access Road	RATES	$275,000	$0	$0	$0	$0	$275,000
SEWER - TMWRF	Sludge Bed Relocation Design	RATES	$137,000	$0	$0	$0	$0	$137,000
SEWER - TMWRF	Rapid Infiltration Basin Permitting & Design	CONNECTION FEES	$240,000	$0	$0	$0	$0	$240,000
SEWER - TMWRF	Media Storage Facility	RATES	$0	$275,000	$0	$0	$0	$275,000
SEWER - TMWRF	Structural Concrete Evaluation Phase 2	RATES	$0	$343,000	$0	$0	$0	$343,000
SEWER - TMWRF	Evaluation of Post Aeration Air diffusers	RATES	$0	$824,000	$0	$0	$0	$824,000
SEWER - TMWRF	TWAS Air Saturation	RATES	$0	$55,000	$0	$0	$0	$55,000
SEWER - TMWRF	Gravity Thickner Bypass	RATES	$0	$247,000	$0	$0	$0	$247,000
SEWER - TMWRF	Heat Loop System Upgrades	RATES	$0	$445,000	$0	$0	$0	$445,000
SEWER - TMWRF	Heat Loop System Upgrades	CONNECTION FEES	$0	$49,000	$0	$0	$0	$49,000
SEWER - TMWRF	Outdoor Lighting Rehabilitation	RATES	$0	$782,000	$0	$0	$0	$782,000
SEWER - TMWRF	Ingersoll Air Compressor and Dryer	RATES	$0	$0	$318,000	$0	$0	$318,000
SEWER - TMWRF	Blower Building Air Intake	RATES	$0	$0	$172,000	$0	$0	$172,000
SEWER - TMWRF	Digester Cover #2 Repair	RATES	$0	$0	$618,000	$0	$0	$618,000
SEWER - TMWRF	Standby Power Phase 1	RATES	$0	$0	$0	$261,000	$1,029,000	$1,290,000
SEWER - RSWRF	Clarifier Addition/Diurnal Storage	RATES	$0	$698,000	$8,027,000	$0	$0	$8,725,000
RECLAIM	RSWRF Reuse upgrades and expansion	RATES	$0	$0	$125,000	$3,300,000	$2,000,000	$5,425,000
SEWER	Sewer Collection System	RATES	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$70,000,000
STORM	Reno Storm Drainage	RATES	$1,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$9,000,000
TOTAL CITY OF RENO			**$33,388,000**	**$25,398,000**	**$28,911,000**	**$21,098,000**	**$27,505,000**	**$136,300,000**

Table I.1: Full List of 5-Year CIPs

PROVIDER SERVICE	PROJECT NAME	FUNDING SOURCE	ESTIMATED COST IN FY 2015/2016 DOLLARS -- FISCAL YEAR ENDING 2016	2017	2018	2019	2020	5-YR TOTAL
CITY OF SPARKS								
SEWER - TMWRF	Fiscal Year 2015 Estimated Expenditures in Fiscal Year 2016	CONNECTION FEES	$510,000	$0	$0	$0	$0	$510,000
SEWER - TMWRF	Fiscal Year 2015 Estimated Expenditures in Fiscal Year 2016	RATES	$2,284,000	$0	$0	$0	$0	$2,284,000
SEWER - TMWRF	Fiscal Year 2016 Estimated Expenditures in Fiscal Year 2017	RATES	$0	$234,000	$0	$0	$0	$234,000
SEWER - TMWRF	Fiscal Year 2016 Estimated Expenditures in Fiscal Year 2017	CONNECTION FEES	$0	$132,000	$0	$0	$0	$132,000
SEWER - TMWRF	Fiscal Year 2017 Estimated Expenditures in Fiscial Year 2018	RATES	$0	$0	$557,000	$0	$0	$557,000
SEWER - TMWRF	Fiscal Year 2018 Estimated Expenditures in Fiscial Year 2019	RATES	$0	$0	$0	$162,000	$0	$162,000
SEWER - TMWRF	Fiscal Year 2019 Estimated Expenditures in Fiscial Year 2020	RATES	$0	$0	$0	$0	$2,367,000	$2,367,000
SEWER - TMWRF	Fiscal Year 2019 Estimated Expenditures in Fiscial Year 2020	CONNECTION FEES	$0	$0	$0	$0	$53,000	$53,000
SEWER - TMWRF	Centrate Pretreatment Project Evaulation/Design	RATES	$93,000	$0	$0	$0	$104,000	$197,000
SEWER - TMWRF	Construction Assistance Oversight Coordination of AMERESCO	RATES	$72,000	$0	$0	$0	$0	$72,000
SEWER - TMWRF	Construction Assistance Oversight Coordination of AMERESCO	CONNECTION FEES	$8,000	$0	$0	$0	$0	$8,000
SEWER - TMWRF	AMERESCO Project	RATES	$3,062,000	$0	$0	$0	$0	$3,062,000
SEWER - TMWRF	AMERESCO Project	CONNECTION FEES	$340,000	$0	$0	$0	$0	$340,000
SEWER - TMWRF	Nitrification System Valve Replacement	RATES	$674,000	$0	$0	$0	$0	$674,000
SEWER - TMWRF	Plant Wide Water Systems 2 & 3 Piping Upgrades	RATES	$339,000	$587,000	$326,000	$0	$213,000	$1,465,000
SEWER - TMWRF	Clairifier Basin Concrete and Steel Rehab	RATES	$61,000	$61,000	$67,000	$67,000	$71,000	$327,000
SEWER - TMWRF	HVAC Upgrade	RATES	$576,000	$552,000	$245,000	$0	$0	$1,373,000
SEWER - TMWRF	Activated Sludge Flow Improvments	RATES	$0	$324,000	$0	$0	$0	$324,000
SEWER - TMWRF	Substation Electrical Rehab	RATES	$0	$474,000	$0	$0	$0	$474,000
SEWER - TMWRF	Nitrificaton Tower Rehab & Improvments	RATES	$0	$186,000	$379,000	$379,000	$853,000	$1,797,000
SEWER - TMWRF	Nitrificaton Tower Rehab & Improvments	CONNECTION FEES	$0	$46,000	$95,000	$95,000	$213,000	$449,000
SEWER - TMWRF	Advanced Nirrogen Treatment Pilot Study	CONNECTION FEES	$88,000	$0	$0	$0	$0	$88,000
SEWER - TMWRF	Septage Receiving Access Road	RATES	$125,000	$0	$0	$0	$0	$125,000
SEWER - TMWRF	Sludge Bed Relocation Design	RATES	$63,000	$0	$0	$0	$0	$63,000
SEWER - TMWRF	Rapid Infiltration Basin Permitting & Design	CONNECTION FEES	$110,000	$0	$0	$0	$0	$110,000
SEWER - TMWRF	Media Storage Facility	RATES	$0	$125,000	$0	$0	$0	$125,000
SEWER - TMWRF	Structural Concrete Evaluation Phase 2	RATES	$0	$157,000	$0	$0	$0	$157,000
SEWER - TMWRF	Evaluation of Post Aeration Air diffusers	RATES	$0	$376,000	$0	$0	$0	$376,000
SEWER - TMWRF	TWAS Air Saturation	RATES	$0	$25,000	$0	$0	$0	$25,000
SEWER - TMWRF	Gravity Thickner Bypass	RATES	$0	$113,000	$0	$0	$0	$113,000
SEWER - TMWRF	Heat Loop System Upgrades	RATES	$0	$203,000	$0	$0	$0	$203,000
SEWER - TMWRF	Heat Loop System Upgrades	CONNECTION FEES	$0	$23,000	$0	$0	$0	$23,000
SEWER - TMWRF	Outdoor Lighting Rehabilitation	RATES	$0	$358,000	$0	$0	$0	$358,000
SEWER - TMWRF	Ingersoll Air Compressor and Dryer	RATES	$0	$0	$146,000	$0	$0	$146,000
SEWER - TMWRF	Blower Building Air Intake	RATES	$0	$0	$78,000	$0	$0	$78,000
SEWER - TMWRF	Digester Cover #2 Repair	RATES	$0	$0	$282,000	$0	$0	$282,000
SEWER - TMWRF	Standby Power Phase 1	RATES	$0	$0	$0	$119,000	$471,000	$590,000
SEWER	Radio Site Upgrades Phase 2	RATES	$200,000	$0	$0	$0	$0	$200,000
SEWER	Annual Sewer System Rehab	RATES	$400,000	$400,000	$400,000	$400,000	$400,000	$2,000,000
SEWER	Annual Sewer System Street Improvement Coordination	RATES	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
SEWER	Rate Study 5 Year Update	RATES	$0	$75,000	$0	$0	$0	$75,000
SEWER	Sewer Water Rights/TROA	RATES	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
SEWER	Annual Contingency for Emergencies	RATES	$250,000	$100,000	$100,000	$100,000	$100,000	$650,000
STORM	Sparks Marina Pump Station Rehabilitation	RATES	$450,000	$0	$0	$0	$0	$450,000
STORM	Bergin Way Storm Drain System	RATES	$100,000	$500,000	$0	$0	$0	$600,000
STORM	Annual Storm Drain Street Improvement Coordination	RATES	$500,000	$500,000	$500,000	$500,000	$500,000	$2,500,000
STORM	Annual Storm Drain System Dam, Ditch, Flood & Drainage Structures	RATES	$200,000	$200,000	$200,000	$200,000	$200,000	$1,000,000
STORM	Rate Study 5 Year Update	RATES	$0	$50,000	$0	$0	$0	$50,000
STORM	FEMA CRS/CAV	RATES	$50,000	$50,000	$50,000	$50,000	$50,000	$250,000
STORM	Storm Drain Outreach Maintenance Program	RATES	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000
STORM	Annual Contingency for Emergencies	RATES	$250,000	$100,000	$100,000	$100,000	$100,000	$650,000
RECLAIM	Effluent Metered Site Upgrades	RATES	$25,000	$25,000	$25,000	$25,000	$25,000	$125,000
RECLAIM	Annual Contingency for Emergencies	RATES	$150,000	$50,000	$50,000	$50,000	$50,000	$350,000
RECLAIM	Effluent Master Plan	RATES	$150,000	$0	$0	$0	$0	$150,000
RECLAIM	Rate Study 5 Year Update	RATES	$0	$25,000	$0	$0	$0	$25,000
FLOOD	North Truckee Drain Relocation Phase 3	RATES	$25,000,000	$0	$0	$0	$0	$25,000,000
TOTAL CITY OF SPARKS			**$36,320,000**	**$6,241,000**	**$3,790,000**	**$2,437,000**	**$5,960,000**	**$54,748,000**

Table I.1: Full List of 5-Year CIPs

PROVIDER SERVICE	PROJECT NAME	FUNDING SOURCE	ESTIMATED COST IN FY 2015/2016 DOLLARS -- FISCAL YEAR ENDING 2016	2017	2018	2019	2020	5-YR TOTAL
SUN VALLEY GENERAL IMPROVEMENT DISTRICT								
WATER	MP 5th Wood/5th Lean	RATES	$172,000	$0	$0	$0	$0	$172,000
WATER	MP Combine Sidehill & Chimney Pressure Zones	RATES	$0	$134,000	$0	$0	$0	$134,000
WATER	MP 2nd 6th Dist Main between Leon/Lupin	RATES	$190,000	$0	$0	$0	$0	$190,000
WATER	MP Chocolate 6" D Main	RATES	$182,000	$0	$0	$0	$0	$182,000
WATER	MP Klondike 7th	RATES	$123,000	$0	$0	$0	$0	$123,000
WATER	MP no Rank Juniper Terrace PS	RATES	$0	$597,000	$0	$0	$0	$597,000
WATER	MP no rank Sidehill/Chimney Seismic	RATES	$10,000	$0	$0	$0	$0	$10,000
WATER	MP no rank Facility O&M	RATES	$26,000	$0	$0	$0	$0	$26,000
WATER	paint tanks	RATES	$10,000	$10,000	$10,000	$10,000	$0	$40,000
WATER	tank inspections	RATES	$0	$0	$0	$15,000	$0	$15,000
WATER	misc.	RATES	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000
WATER	actuators	RATES	$30,000	$30,000	$0	$0	$0	$60,000
WATER	Owner Buy out items building seat	RATES	$50,000	$0	$0	$0	$0	$50,000
WATER	New Vacon Purchase	RATES	$190,000	$0	$0	$0	$0	$190,000
WATER	CCR Transfer	RATES	$2,000	$2,000	$2,000	$2,000	$2,000	$10,000
SEWER	Regrade MH 18 to 19	CONNECTION FEES	$250,000	$0	$0	$0	$0	$250,000
SEWER	Regrade MH 62 to 63	CONNECTION FEES	$0	$0	$210,000	$0	$0	$210,000
SEWER	MP South Basin 12" Parallel Main	CONNECTION FEES	$450,000	$0	$0	$0	$0	$450,000
SEWER	MP Upper East Basin 12" Parallel Main	CONNECTION FEES	$147,000	$0	$0	$0	$0	$147,000
SEWER	MP East 7th 10" Parallel Main	CONNECTION FEES	$0	$0	$150,000	$0	$0	$150,000
SEWER	MP MV 1 abandonment	RATES	$0	$0	$52,000	$0	$0	$52,000
SEWER	MP MV 2 Rehab	RATES	$0	$0	$300,000	$0	$0	$300,000
SEWER	MP 3 to 5 year Intercepter Cleaning and Videoing	RATES	$100,000	$0	$0	$0	$0	$100,000
SEWER	Sparks Treatment Plant Capital Expend	RATES	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000
SEWER	Misc	RATES	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000
SEWER	10 year cleanout	RATES	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000
SEWER	Gepford 200 ft Carol & Leon	RATES	$0	$0	$0	$100,000	$0	$100,000
SEWER	Owner Buy out items building seat	RATES	$50,000	$0	$0	$0	$0	$50,000
SEWER	New Vacon Purchsae	RATES	$190,000	$0	$0	$0	$0	$190,000
TOTAL SUN VALLEY GENERAL IMPROVEMENT DISTRICT			**$2,247,000**	**$848,000**	**$799,000**	**$202,000**	**$77,000**	**$4,173,000**
CENTRAL TRUCKEE MEADOWS REMEDIATION DISTRICT								
WATER	PCE Remediation - Kietzke Lane Well Treatment Sys.	RATES	$76,000	$3,000	$3,000	$0	$0	$82,000
WATER	PCE Remediation - Mill Street Well Treatment Sys.	RATES	$7,000	$3,000	$3,000	$0	$13,000	$26,000
WATER	PCE Remediation - Morrill Avenue Well Treatment Sys.	RATES	$23,000	$94,000	$16,000	$0	$0	$133,000
WATER	PCE Remediation - NEW PCE Treatment Facilities (SPARKS, POPLAR#2)	RATES	$0	$3,200,000	$0	$1,600,000	$0	$4,800,000
TOTAL CENTRAL TRUCKEE MEADOWS REMEDIATION DISTRICT			**$106,000**	**$3,300,000**	**$22,000**	**$1,600,000**	**$13,000**	**$5,041,000**
TOTAL TRUCKEE MEADOWS WATER AUTHORITY			$54,994,000	$37,105,000	$28,018,000	$22,230,000	$24,732,000	$167,079,000
TOTAL WASHOE COUNTY			$19,308,000	$11,361,000	$8,220,000	$945,000	$43,595,000	$83,429,000
TOTAL CITY OF RENO			$33,388,000	$25,398,000	$28,911,000	$21,098,000	$27,505,000	$136,300,000
TOTAL CITY OF SPARKS			$36,320,000	$6,241,000	$3,790,000	$2,437,000	$5,960,000	$54,748,000
TOTAL SUN VALLEY GENERAL IMPROVEMENT DISTRICT			$2,247,000	$848,000	$799,000	$202,000	$77,000	$4,173,000
TOTAL CENTRAL TRUCKEE MEADOWS REMEDIATION DISTRICT			$106,000	$3,300,000	$22,000	$1,600,000	$13,000	$5,041,000
GRAND TOTAL			**$146,363,000**	**$84,253,000**	**$69,760,000**	**$48,512,000**	**$101,882,000**	**$450,770,000**

Source: TMWA, Washoe County, Reno, Sparks, SVGID, and CTMRD.

Table I. 2 TMWA Detailed CIP 2021-2035

Project	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
							Fiscal Year Ending								
							All Figures in Thousands of Dollars								
Raw Water Supply-Improvements															
Highland Canal-Upgrades-Downstream of CB	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225
Highland Canal-Upgrades-Diversion to CB	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$50	$50	$50	$50	$50
Highland Canal Headworks Siphon Replacement	$950	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Donner Dam Repairs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TROA Implementation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Supply-Raw Water Supply	**$1,275**	**$325**	**$325**	**$325**	**$325**	**$325**	**$325**	**$325**	**$325**	**$325**	**$275**	**$275**	**$275**	**$275**	**$275**
Ground Water-Development															
Double Diamond Well #3 (equipping)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
STMGID Well Improvements (bypass, chlorine)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lemmon Valley Well #9 Electrical Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Air Guard Well Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Old Washoe Well #1 Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Innovation Well Drilling and Equipping	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Huffaker Place Well Equipping	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sunrise Well #3 Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Campello Intertie Recharge Capacity Increase	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Desert Springs Well #4 Recharge Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Truckee Canyon Well #3 Equipping	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Callamont Well #1 & #2 Equipping	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Double Diamond Well #4 (equipping)	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lemmon Valley Well #8 Replacement	$1,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Groundwater Treatment Plant - Sparks	$0	$1,000	$22,000	$1,000	$0	$0	$0	$0	$500	$11,000	$500	$0	$0	$0	$0
Double Diamond Well #5 (equipping)	$0	$0	$0	$0	$0	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Thomas Creek Well #1 Replacement	$0	$0	$0	$1,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sierra Reflections Wells #1-#3	$0	$0	$0	$0	$1,250	$1,250	$1,250	$0	$0	$0	$0	$0	$0	$0	$0
Well Rehabilitation & NAC Compliance	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850
Subtotal - Groundwater Development	**$3,100**	**$1,850**	**$22,850**	**$3,350**	**$2,100**	**$3,100**	**$2,100**	**$850**	**$1,350**	**$11,850**	**$1,350**	**$850**	**$850**	**$850**	**$850**
Treatment Improvements															
Treatment Plants- Fix & Finish	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Emergency Operations Addition	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Eagle Canyon Blending T-Main Phase 2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SCADA Rehab/Plant Operating Software Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mt. Rose Creek Water Treatment Plant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Orr Ditch Diversion/Pump Station Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Truckee Canyon Water Treatment Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lightning W Water Treatment Improvements	$60	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Glendale Clearwell #2	$3,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Treatment Improvements	**$4,060**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**
Distribution Improvements															
Pressure Improvements															
Pressure Regulator Rehabs/Rebuilds	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450
Pressure Regulator Replacments (Roll Seal)	$400	$400	$400	$400	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Table I.2: TMWA Detailed CIP 2021-2035

Project	Fiscal Year Ending														
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
							All Figures in Thousands of Dollars								
Pump Station Rehabilitations, Rebuilds	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Land Acquistions	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
Standby Generator Additions/Repl.	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150
Satellite Hills PS Replacement & SS #1 PS Main Tie	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
D'Andrea #3 Pump Station	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sierra Pump Station Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pump Station Oversizing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NAC Deficiencies - Saddlehorn, Toll Rd, STMGID East	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mt. Rose Well #3 Pump Station Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lakeridge PS Replacement & Park Ridge Cir. PRS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Desert Springs Pressure Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sun Valley #1 Pump Station Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Longley PS Capacity Increase	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Idlewild BPS/Intertie Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Paloma PRS and Main Tie	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Broken Hills BPS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Truckee River HLs PS #1 & #2 & Main ties	$1,200	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Verdi #1 & #2 PS & US 40 Expan.	$250	$1,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Matera Ridge BPS's #1-#3	$0	$0	$1,000	$1,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
The Pines #1-#3 Pump Stations	$0	$0	$0	$0	$1,000	$1,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0
Beaumont #3 Pump Station	$0	$0	$0	$0	$0	$0	$0	$1,000	$1,000	$0	$0	$0	$0	$0	$0
Sunny Hills BPS's #1-#4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,000	$1,000	$1,000	$1,000	$0	$0
Spanish Springs #2 PS Capacity Increase	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$500	$0	$0	$0
Ventana Point #1 & #2 Pump Stations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,000	$1,000	$0
Disc Drive Low-Head Pump Station	$0	$0	$0	$0	$0	$0	$0	$0	$1,800	$0	$0	$0	$0	$0	$0
Water Mains/Service Lines															
North Valleys Integration Project	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stead Main Replacement Ph. 2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Hidden Valley Interties & Pumping Capacity	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Juniper Hill Modifications & Hunter Creek Main Ret.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Verdi Main Oversizing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Spring Creek South Zone Conversion	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
STMGID Conjunctive Use Facilities	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Arc Flash Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Arrowcreek-Mt. Rose Conjunctive Use Ph. 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Arrowcreek-Mt. Rose Conjunctive Use Ph. 2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
California-Marsh 24" Main	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NE Sparks Tank Feeder Main Relocation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
West Hidden Valley Main Repl.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
STM Capacity Improvements Ph. 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pebble & Tamarisk Main Replacements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Surge Street Main Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bonnie Ln & Snow Flower Main Ties	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Booth, Sharon Way & Monroe 24" Main Replacements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
South Virginia 24" Main (Kumle to Peckham)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Piping Rock Main Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Table I.2: TMWA Detailed CIP 2021-2035

Project	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	Fiscal Year Ending														
	All Figures in Thousands of Dollars														
Broken Hills Transmission Mains	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NW & NE Transmission Mains	$2,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plumb-Arlington-Urban 24" Main Replacements	$100	$3,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stead Golf Course Main Replacement	$2,200	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Verdi-Mogul-Boomtown Feeder Mains	$0	$6,500	$9,500	$0	$1,650	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Matera Ridge Transmission Mains	$0	$0	$1,500	$1,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SE Sparks Feeder Mains Phase I	$0	$0	$0	$0	$0	$0	$3,650	$0	$0	$0	$0	$0	$0	$0	$0
Gravity Zone Mains, Sullivan, Oddie, W. Fourth	$0	$0	$0	$0	$0	$0	$0	$2,320	$1,070	$0	$0	$0	$0	$0	$0
SE Sparks Feeder Mains Phase II	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$760	$0	$0	$0	$0
NE Sparks Feeder Mains-Phase VI	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,650	$0	$0	$0
Pyramid Hwy Parallel Main, SS2 Disch.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,730	$0	$0
STM Capacity Improvements Ph. 2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,575	$0
Wingfield Springs Improvements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$200
NE Sparks Feeder Mains-Phase VII	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,960
General Distribution Line Oversizing/Extensions	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
Street & Highway Main Replacements	$5,700	$5,800	$5,900	$6,000	$6,100	$6,200	$6,300	$6,400	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500
Galv/Poly Service Line Replacements	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400
Subtotal Distribution Improvements	**$14,450**	**$19,300**	**$21,900**	**$11,000**	**$13,350**	**$9,800**	**$13,550**	**$12,320**	**$12,970**	**$10,100**	**$10,860**	**$16,250**	**$13,830**	**$13,675**	**$11,260**
Storage Improvements															
Tank/Reservoir Fix & Finish, Drainage, Access	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800
Former STMGID Tank Recoating	$0	$570	$0	$0	$0	$0	$0	$0	$0	$0	$170	$0	$220	$0	$300
D'Andrea Tank #2 - 0.3 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Peavine Tank Replacement - 2 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Zone 11 Tank - 2.5 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sun Valley #2 Steel Tank - 1.25 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Rattlesnake Tank Ring Addition	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sommersett #3 Tank (B&D) - 0.5 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Broken Hills Tank	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Highland Zone Storage - 5 MG	$9,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lower Verdi Tank - 1.5 MG	$0	$0	$3,400	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fish Springs Terminal Tank #2 - 2.5 MG	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Caughlin #2 Tank SW Reno - 1.5 MG	$0	$0	$0	$0	$1,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sierra Reflections Storage	$0	$0	$0	$0	$1,500	$0	$0	$1,500	$0	$0	$0	$0	$0	$0	$0
Matera Ridge Storage	$0	$0	$0	$1,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Boomtown Tank - 1.5 MG	$0	$0	$0	$0	$0	$3,300	$0	$0	$0	$0	$0	$0	$0	$0	$0
Arrowcreek #2 Tank - 2 MG	$0	$0	$0	$0	$0	$0	$2,000	$0	$0	$0	$0	$0	$0	$0	$0
The Pines Tank (B&D) - 0.5 MG	$0	$0	$0	$0	$0	$0	$540	$0	$0	$0	$0	$0	$0	$0	$0
Lemmon Valley Tank #4 - 2 MG	$0	$0	$0	$0	$0	$0	$0	$2,200	$0	$0	$0	$0	$0	$0	$0
Desert Springs Tank #3-B - 2 MG	$0	$0	$0	$0	$0	$0	$0	$0	$2,560	$0	$0	$0	$0	$0	$0
Sunny Hills Storage	$0	$0	$0	$0	$0	$0	$0	$0	$0	$750	$750	$750	$750	$0	$0
Beaumont #2 Tank (B&D) - 0.5 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$600	$0	$0	$0	$0	$0
Northgate #4 Steel Tank (B&D) - 0.75 MG	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$750	$0	$0
Subtotal Storage Improvements	**$9,800**	**$2,370**	**$4,200**	**$4,300**	**$4,800**	**$4,100**	**$3,340**	**$4,500**	**$3,360**	**$2,150**	**$1,720**	**$1,550**	**$2,520**	**$800**	**$1,100**
Total CIP Costs	**$32,685**	**$24,845**	**$50,275**	**$19,975**	**$21,575**	**$18,325**	**$20,315**	**$18,995**	**$19,005**	**$25,425**	**$15,205**	**$19,925**	**$18,475**	**$16,600**	**$14,485**

Source: Truckee Meadows Water Authority.

Table I.3: Sparks Stormwater CIP Through Buildout

Area	Location	Estimated Costs	
		inflation factor [1]	*1.09*
		2011 Dollars	**2016 Dollars**
2	Steiner and Snider	$577,000	$630,749
4	East Prater Way	$1,874,000	$2,048,567
6	Rockwood Drive	$604,000	$660,264
6	Glen Meadow Drive	$193,000	$210,978
6	Glen Meadow Drive	$338,000	$369,485
9	Glendale Ave to Truckee River	$4,736,000	$5,177,169
9	Glendale Ave to Truckee River	$8,390,000	$9,171,547
1	Marina Connection	$1,936,000	$2,116,343
4	Wabash Circle	$811,000	$886,546
6	Sparks Blvd.	$263,000	$287,499
4	East Prater Way	$3,443,000	$3,763,723
4	Wabash Circle	$818,000	$894,199
8	Prater Split Mainline	$9,822,000	$10,736,941
8	Prater Split Mainline	$5,289,000	$5,781,682
8	Prater Split Mainline	$5,601,000	$6,122,746
8	Prater Split Mainline	$5,737,000	$6,271,414
8	Prater Way	$2,604,000	$2,846,568
8	Prater Way	$2,404,000	$2,627,938
2	Glendale Avenue	$806,000	$881,081
6	North Truckee Drain	$47,000	$51,378
9	15th St.	$87,000	$95,104
2	East Glendale	$65,000	$71,055
8	Greenbrae & Stanford	$150,000	$163,973
9	Glendale Ave and S. 21st St.	$1,886,000	$2,061,685
5	Sattelite Dr. at Vista	$170,000	$185,836
8	Prospect & Greenbrae	$222,000	$242,680
8	Greenbrae & Stanford	$1,637,000	$1,789,490
8	Prospect & Greenbrae	$808,000	$883,267
8	Pyramid Way	$1,045,000	$1,142,344
8	Prospect & Greenbrae	$222,000	$242,680
8	4th Street	$419,000	$458,031
9	Freeport Blvd	$1,233,000	$1,347,857
9	Freeport Blvd	$1,293,000	$1,413,446
9	Rock Blvd	$2,437,000	$2,664,012
9	Prater Way	$635,000	$694,152
11	Greg Ct. & Coney Island Dr.	$515,000	$562,973
7	Brierley Way	$1,141,000	$1,247,287
9	Pacific Ave to S. Rock Blvd	$3,313,000	$3,621,613
9	Sullivan Ln./21st St.	$3,527,000	$3,855,548
9	Rock Blvd	$1,226,000	$1,340,205
8	Greenbrae & Stanford	$1,456,000	$1,591,630
8	Prater Way	$717,000	$783,790
8	Prater Way	$920,000	$1,005,700
1	C St. and D St.	$1,256,000	$1,372,999
8	Lincoln Way	$732,000	$800,187
8	Glen Carran Circle	$138,000	$150,855
10	Greg St.	$226,000	$247,052
9	El Rancho Dr.	$212,000	$231,748
9	F St. & 18th St.	$314,000	$343,250
9	F St. & 18th St.	$278,000	$303,896
6	Penny and Dana Way	$900,000	$983,837
9	Greenbrae Dr.	$1,983,000	$2,167,721
1	Nicholas Avenue	$461,000	$503,943
4	Ashley Park Drive	$77,000	$84,173
8	L Street	$72,000	$78,707
8	4th Street	$208,000	$227,376
8	4th Street	$1,250,000	$1,366,440
2	Overmyer and Watson	$434,000	$474,428
9	S. Rock Blvd	$170,000	$185,836
9	Pacific Ave to S. Rock Blvd	$1,449,000	$1,583,978
9	Greenbrae Dr.	$615,000	$672,289
9	Ash Ave. & El Rancho Dr.	$624,000	$682,127
8	Probasco to E. I St.	$898,000	$981,651
9	Glendale Ave & S. 21st St.	$1,197,000	$1,308,503
8	Courtland to E. I St.	$3,561,000	$3,892,715
9	Greenbrae Dr.	$1,417,000	$1,548,997
3	North Truckee Drain	$810,000	$885,453
3	North Truckee Drain	$986,000	$1,077,848
3	North Truckee Drain	$1,519,000	$1,660,498
10	S. Standford Way to Truckee River	$1,987,000	$2,172,094
1	South Stanford Way	$269,000	$294,058
2	Private Street	$207,000	$226,283
7	Salomon Cir. To Vista	$4,412,000	$4,822,988
7	Salomon Circle	$7,998,000	$8,743,032
Total Sparks Stormwater CIP		**$118,077,000**	**$129,076,137**

Source: City of Sparks Stormwater Master Plan, 2011.

[1] Inflated by the increase in the ENR CCI between December 2011 and December 2015.

Table I.4: TMWRF Alternatives Cost Comparison

Description	Enhanced Coagulation	Advanced Oxidation Process (Ozone)	Microfiltration/ Reverse Osmosis
		2013 Dollars	
Construction Cost [1],[2]	$36,064,000	$24,649,000	$156,437,000
Engineering, Legal, and Administration (30%)	$10,819,000	$7,395,000	$46,931,000
Project Cost	**$46,883,000**	**$32,044,000**	**$203,368,000**
Annual O&M	$9,312,000	$1,474,000	$4,425,000
Net Present O&M Cost (at 3% for 20 years)	**$138,539,000**	**$21,929,000**	**$65,833,000**
Total Net Present Worth	**$185,422,000**	**$53,973,000**	**$269,201,000**
		2016 Dollars	
Construction Cost [1],[2]	$36,912,951	$25,229,240	$160,119,546
Engineering, Legal, and Administration (30%)	$11,073,885	$7,568,772	$48,035,864
Total Estimated Project Cost in 2016 Dollars	**$47,986,836**	**$32,798,013**	**$208,155,409**

Source: Enhanced Nitrogen Removal Planning Study, December 2013.

[1] August 2013 costs.

[2] Class 5 construction cost estimate with expected accuracy between +50 and -30 percent.

Table I.5: 20-Year CIPs for Wastewater Treatment Plants

	Description of Improvements	Estimated Cost [1] 2021-2035
		2016 Dollars
Cold Springs	Expansion phase 2, effluent filter and pump system, solids management, expansion phase 3	$47,500,000
Lemmon Valley	Build 1.5 MGD additional capacity, bringing total plant capacity to 2.0 MGD	$22,500,000
Reno-Stead	Expand plant from 2.0 MGD to 4.8 MGD	$37,000,000
South Truckee Meadows	Four tertiary filters and preliminary treatment facilities screen No. 3	$7,700,000
Truckee Meadows	Enhanced Coagulation (mid-range cost) - inflated to 2016 Dollars - see Table J.4	$47,987,000
TOTAL		**$162,687,000**

Source: Washoe County and Reno staff, and the 'South Truckee Meadows Water Reclamation Facility Plan Update Technical Memorandum No. 7., Jan 2016.

[1] Very high planning-level estimates subject to change.

Table I.6: Estimated Costs of New Sewer Collection Systems to Serve New Development

Agency	2020	2025	2030	2035
	Cumulative Estimated New Lineal Feet of Sewer Collection			
Reno	291,729	607,392	936,971	1,264,964
Sparks	128,007	275,633	422,701	557,032
Sun Valley	19,656	23,283	51,453	63,209
Washoe County	164,772	330,923	502,417	704,937
	Cumulative Estimated Cost of New Sewer Collection			
	Cost per Lineal Foot [1]	*$60*		
Reno	$17,503,700	$36,443,500	$56,218,300	$75,897,900
Sparks	$7,680,400	$16,538,000	$25,362,100	$33,421,900
Sun Valley	$1,179,400	$1,397,000	$3,087,200	$3,792,600
Washoe County	$9,886,300	$19,855,400	$30,145,000	$42,296,200
	Incremental Estimated Cost of New Sewer Collection			
Reno	$17,503,700	$18,939,800	$19,774,800	$19,679,600
Sparks	$7,680,400	$8,857,600	$8,824,100	$8,059,800
Sun Valley	$1,179,400	$217,600	$1,690,200	$705,400
Washoe County	$9,886,300	$9,969,100	$10,289,600	$12,151,200

Source: TMRPA, Reno, Sparks, Washoe County, SVGID.

[1] Cost estimate provided by local engineers.

Table I.7: Estimated Growth in the TMSA by Wastewater Treatment Plant

Reclamation Facility	2015	Anticipated Cumulative Growth			
		2020	2025	2030	2035
Housing Units by Receiving Treatment Plant					
Truckee Meadows	135,591	142,601	149,603	157,195	163,957
South Truckee Meadows	15,693	18,438	21,335	23,774	26,512
Reno-Stead	7,654	8,988	10,567	12,263	13,444
Cold Springs	2,088	2,320	2,585	3,381	5,235
Lemmon Valley	959	1,374	2,262	2,975	3,495
Total	**161,985**	**173,720**	**186,353**	**199,587**	**212,642**
Population by Receiving Treatment Plant					
Truckee Meadows	317,417	356,697	374,396	393,554	410,629
South Truckee Meadows	35,780	45,501	52,634	58,651	65,403
Reno-Stead	17,471	21,992	25,871	30,038	32,940
Cold Springs	4,740	5,866	6,535	8,496	13,035
Lemmon Valley	2,041	3,416	5,589	7,333	8,642
Total	**377,450**	**433,472**	**465,025**	**498,072**	**530,649**

Source: TMRPA Scenario 1a with deduction for septic.

Table I.8: Estimated Growth in the TMSA by Jurisdiction

Jurisdiction	2015	Anticipated Cumulative Growth 2020	2025	2030	2035	Total Change
Housing Units by			*Cumulative Number of Units*			
Reno	103,973	111,453	119,547	127,998	136,408	32,435
Sparks	38,831	41,498	44,573	47,637	50,436	11,605
Sun Valley	5,946	6,114	6,145	6,386	6,486	540
Washoe County	13,235	14,655	16,088	17,566	19,312	6,077
Total	**161,985**	**173,720**	**186,353**	**199,587**	**212,642**	**50,657**
Population by			*Cumulative Population*			
Reno	238,511	272,490	292,282	312,947	333,512	95,001
Sparks	95,266	108,448	116,487	124,494	131,809	36,543
Sun Valley	14,197	15,554	15,633	16,245	16,501	2,304
Washoe County	29,476	36,980	40,624	44,385	48,827	19,352
Total	**377,450**	**433,472**	**465,025**	**498,072**	**530,649**	**153,200**

Source: TMRPA Scenario 1a with deduction for septic.

Table I.9: Estimated Lineal Feet of Sewer Line per Housing Unit

Agency	Collection System Miles	Housing Units Served	Lineal Feet Sewer Line per Housing Unit
		[2],[3]	rounded
Reno [1]	769.00	103,973	39
Sparks	356.20	38,831	48
Sun Valley [2]	132.00	5,946	117
Washoe County	290.00	13,235	116

Source: Reno, Sparks, Washoe County, SVGID.

[1] Reno does not own the line from the main to the property line.

[2] Sun Valley has about a dozen more sewer customers than water customers (properties have their own well).

[3] Data from TMRPA Regional Housing Study. While these numbers may not exactly match each agency's records, it is used to keep apples-to-apples comparisons.

Table I.10: Water Systems Depreciation

Item	TMWA	Sun Valley
Salaries and benefits	$19,034,741	$589,267
Services and supplies	$23,180,670	$1,565,316
Subtotal Operating Expenses	**$42,215,411**	**$2,154,583**
Depreciation	**$27,899,449**	**$750,323**
Total Operating Expenses	$70,114,860	$2,904,906
Depreciation as % of Operating Expenses	66%	35%
Months of Operating Expenses	**8**	**4**

Source: 2015 Comprehensive Annual Financial Report for each agency.

Table I.11: Wastewater Systems Depreciation

Item	Fiscal Year Ended June 30, 2015			
	Reno	Sparks [2]	County [1]	Sun Valley
Salaries and benefits	$8,031,932	$3,526,014	$4,352,402	$589,766
Services and supplies	$9,712,116	$9,908,155	$10,308,288	$1,108,952
Joint sewer plant	$12,834,120	$1,982,905	$0	$0
Subtotal Operating Expenses	**$30,578,168**	**$15,417,074**	**$14,660,690**	**$1,698,718**
Depreciation	**$9,445,388**	**$6,029,968**	**$6,067,184**	**$710,427**
Total Operating Expenses	$40,023,556	$21,447,042	$20,727,874	$2,409,145
Depreciation as % of Operating Expenses	31%	39%	41%	42%
Months of Operating Expenses	**4**	**5**	**5**	**5**

Source: 2015 Comprehensive Annual Financial Report for each agency.

[1] Water operations fund. In December 2014 water operations consolidated with TMWA.

[2] Includes storm drain, effluent, and flood mitigation operating expenses.

Appendix J
Current Residential Water and Sewer Rate and Fee Schedules

Table J.1: Current Single Family Residential Water Rate Schedules by Agency

TMWA Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$18.54
1-inch	$20.40
1 1/2-inch	$23.20

Volume Charge Range of Use (in Gallons)			Charge per 1,000 gallons	Tier
Zero	to	6,000	$1.72	Tier 1
6,001	to	25,000	$2.78	Tier 2
greater than		25,000	$3.25	Tier 3

TMWA - OLD STMGID Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$9.49
1-inch	$11.61
1 1/2-inch	$16.47

Volume Charge Range of Use (in Gallons)			Charge per 1,000 gallons	Tier
Zero	to	6,000	$1.36	Tier 1
6,001	to	20,000	$1.80	Tier 2
20,001	to	40,000	$2.21	Tier 3
40,001	to	65,000	$2.58	Tier 4
greater than		65,000	$2.73	Tier 5

TMWA - OLD DWR Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$17.43
1-inch	$22.42
1 1/2-inch	$32.07

Volume Charge Range of Use (in Gallons)			Charge per 1,000 gallons	Tier
Zero	to	6,999	$2.62	Tier 1
7,000	to	20,999	$3.27	Tier 2
21,000	to	40,999	$3.93	Tier 3
greater than		41,000	$5.25	Tier 4

SVGID Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$22.23
1-inch	$24.25
1 1/2-inch	$28.27

Volume Charge Range of Use (in Gallons)	Charge per 1,000 gallons
Uniform Charge	$2.34

Source: City of Reno, City of Sparks, Washoe County, SVGID.

Table J.2: Comparison Bills for a Single Family Residential Customer using 15,000 Gallons / Month

	TMWA			
Bill Component	**OLD STMGID**	**OLD DWR**	**TMWA**	**SVGID**
	[1]	[1]		
Base Monthly Charges				
Service Charge	$9.49	$17.43	$18.54	$22.23
Subtotal Base	**$9.49**	**$17.43**	**$18.54**	**$22.23**
Volume Charges	***15,000***	***gallons***		
Tier 1	$8.16	$18.34	$10.32	$35.10
Tier 2	$16.20	$26.16	$25.02	$0.00
Tier 3	$0.00	$0.00	$0.00	$0.00
Tier 4	$0.00	$0.00	$0.00	$0.00
Tier 5	$0.00	$0.00	$0.00	$0.00
Subtotal Volume	**$24.36**	**$44.50**	**$35.34**	**$35.10**
Total Base and Volume Charges	**$33.85**	**$61.93**	**$53.88**	**$57.33**
Other (Pass Through Charges to Other Agencies)				
Right of Way Toll (5%) [2]	$1.69	$3.10	$2.69	$0.00
Regional Water Management Fee (1.5%)	$0.51	$0.93	$0.81	$0.86
CTM Remediation District [3]	$0.85	$0.85	$0.85	$0.85
Subtotal Other Charges	**$3.05**	**$4.88**	**$4.35**	**$1.71**
Total Monthly Charges	**$36.90**	**$66.80**	**$58.23**	**$59.04**

Source: City of Reno, City of Sparks, Washoe County, SVGID

[1] Closed tariff. All new customers will pay TMWA rates.

[2] Although SVGID customers do not pay a right of way toll; wholesale water charges include a right of way toll which customers absorb in their rates.

[3] Fiscal year 2014 average fee for residential customer outside of contaminated area.

Table J.3: Current Multi-Family Residential Water Rate Schedules by Agency

TMWA Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$18.54
1-inch	$20.40
1 1/2-inch	$23.20

Volume Charge Range of Use (in Gallons)			Charge per 1,000 gallons [1]	Tier
Zero	to	4,000	$1.72	Tier 1
greater than		4,000	$2.78	Tier 2

TMWA - OLD STMGID Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$9.49
1-inch	$11.61
1 1/2-inch	$16.47

Volume Charge Range of Use (in Gallons)			Charge per 1,000 gallons	Tier
Zero	to	6,000	$1.36	Tier 1
6,001	to	20,000	$1.80	Tier 2
20,001	to	40,000	$2.21	Tier 3
40,001	to	65,000	$2.58	Tier 4
greater than		65,000	$2.73	Tier 5

TMWA - OLD DWR Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$17.43
1-inch	$22.42
1 1/2-inch	$32.07

Volume Charge Range of Use (in Gallons)			Charge per 1,000 gallons	Tier
Zero	to	28,999	$2.62	Tier 1
29,000	to	150,999	$3.27	Tier 2
151,000	to	600,999	$3.93	Tier 3
greater than		601,000	$5.25	Tier 4

SVGID Residential Water Service Rate Schedule

Service Size	Base Charge
3/4-inch	$22.23
1-inch	$24.25
1 1/2-inch	$28.27

Volume Charge Range of Use (in Gallons)	Charge per 1,000 gallons
Uniform Charge	$2.34

Source: City of Reno, City of Sparks, Washoe County, SVGID.

[1] Multiplied by number of units per billing period.

Table J.4: Comparison Charges for Multi-Family Residential Customer using 8,000 Gallons / Month

Bill Component	TMWA OLD STMGID	TMWA OLD DWR	TMWA TMWA	SVGID
	[1]	[1]		
Base Monthly Charges				
Service Charge	$9.49	$17.43	$18.54	$22.23
Subtotal Base	**$9.49**	**$17.43**	**$18.54**	**$22.23**
Volume Charges	***8,000***	***gallons***		
Tier 1	$10.88	$20.96	$6.88	$18.72
Tier 2	$0.00	$0.00	$11.12	$0.00
Tier 3	$0.00	$0.00	$0.00	$0.00
Tier 4	$0.00	$0.00	$0.00	$0.00
Tier 5	$0.00	$0.00	$0.00	$0.00
Subtotal Volume	**$10.88**	**$20.96**	**$18.00**	**$18.72**
Total Base and Volume Charges	**$20.37**	**$38.39**	**$36.54**	**$40.95**
Other (Pass Through Charges to Other Agencies)				
Right of Way Toll (5%) [2]	$1.02	$1.92	$1.83	$0.00
Regional Water Management Fee (1.5%)	$0.31	$0.58	$0.55	$0.61
CTM Remediation District [3]	$8.86	$8.86	$8.86	$8.86
Subtotal Other Charges	**$10.18**	**$11.36**	**$11.24**	**$9.47**
Total Monthly Charges	**$30.55**	**$49.75**	**$47.78**	**$50.42**

Source: City of Reno, City of Sparks, Washoe County, SVGID

[1] Closed tariff. All new customers will pay TMWA rates.

[2] Although SVGID customers do not pay a right of way toll; wholesale water charges include a right of way toll which customers absorb in their rates.

[3] Fiscal year 2014 average fee for residential customer outside of contaminated area.

Table J.5: Current Residential Sewer Rate Schedules by Agency

Agency	Base Charge	Usage Charge per 1,000 Gallons
Single Family		
Reno	$44.15	$0.00
Washoe County	$35.44	$0.00
Sparks	$32.03	$0.00
SVGID	$17.14	$4.29
Multi-Family		
Reno	$36.36	$0.00
Washoe County	$35.44	$0.00
Sparks	$32.03	$0.00
SVGID	$17.14	$4.29

Source: City of Reno, Washoe County, City of Sparks, SVGID.

Table J.6: Comparison of Combined Water and Sewer Bill for Single Family and Multi-Family Residential

Unit	Reno	Sparks	Washoe County	SVGID
Single Family		*15,000 gallons of water usage*		[1], [2]
Water	$58.23	$58.23	$66.80	$59.04
Sewer [1]	$44.15	$32.03	$35.44	$42.88
Total	**$102.38**	**$90.26**	**$102.24**	**$101.92**
Multi-Family		*8,000 gallons of water usage*		
Water	$47.78	$47.78	$49.75	$50.42
Sewer [2]	$36.36	$32.03	$35.44	$34.30
Total	**$84.14**	**$79.81**	**$85.19**	**$84.72**

Source: City of Reno, City of Sparks, Washoe County, SVGID

[1] SVGID bills single family sewer customers based on average winter months water consumption of 6,000 gallons.

[2] SVGID bills multi-family sewer customers based on average winter months water consumption of 4,000 gallons.

Table J.7: Current Sewer Connection Fees

Name	Single Family *per unit*	Multi-Family *per unit*	Residential Unit Shared Kitchen or Rooming House Kitchen *per bedroom*	Rooming House *per room rental*	Industrial/ Commercial *per fixture*
	[1]	[2]			[3]
Reno [1],[2],[3]	$6,376	$5,445	$2,271	$2,041	$295
Sparks	$4,367	$4,367			$262
Washoe County	$5,500	$5,500			$280
SVGID [4]					
3/4"	$6,340				
1"	$7,982				
1.5"	$10,582				
2"	$13,482				
3"	$20,482				
4"	$30,482				
6"	$55,482				

Source: Reno, Sparks, Washoe County, SVGID.

[1] Reno - mobile home estates or subdivisions pay the same rate as single family per mobile unit space.

[2] Reno - mobile home parks pay the multi-family fee per space.

[3] Reno's industrial connection fee cannot be less than a single family connection fee.

[4] SVGID charges all customer categories based on meter size.

Table J.8: Current Water Connection Fees

Name	TMWA Area #	Area Facility Cost	Supply and Treatment Cost	Storage Facilities Cost	Total
Sun Valley GID Fee per New Connection					**$11,244**
Truckee Meadows Water Authority [1]		*$ per GPM*	*$ per GPM*	*$ per GPM*	*$ per GPM*
Central Reno	0	$0	$4,163	$933	**$5,096**
South Truckee Meadows	1	$958	$4,163	$933	**$6,054**
Sparks - East Reno	2	$1,711	$4,163	$933	**$6,807**
Sparks - Inside McCarran Blvd	2a	$856	$4,163	$933	**$5,952**
Northwest Reno - Northgate/Mogul	3	$1,575	$4,163	$933	**$6,671**
Sparks - Pyramid/Spanish Springs	4	$2,877	$4,163	$933	**$7,973**
Sparks - The Vistas	5	$4,555	$4,163	$933	**$9,651**
Sun Valley - Sullivan Pump Zones	6	$1,309	$4,163	$933	**$6,405**
Verdi	7	TBD	TBD	TBD	**TBD**
Sierra - North Virginia Pump Station	8	$4,168	$4,163	$933	**$9,264**
Horizon Hills	8a	$4,023	$4,163	$0	**$8,186**
Lakeridge - Plumas Pump Station	9	$1,838	$4,163	$933	**$6,934**
Stead - Silver Lake	10	$5,623	$4,163	$933	**$10,719**
Southeast Truckee Meadows	11	$2,828	$4,163	$0	**$6,991**
Spanish Springs	12	$5,789	$4,163	$0	**$9,952**
Lemmon Valley	13	$2,734	$0	$0	**$2,734**
Heppner [2]	13a	$1,011	$0	$0	**$1,011**
Fish Springs	13b	$4,237	$0	$0	**$4,237**
STIMGID West/Thomas Creek	14	$655	$4,163	$0	**$4,818**
Arrowcreek/Mt. Rose [3]	15	$12,568	$0	$0	**$12,568**

Source: SVGID and Truckee Meadows Water Authority.

[1] TMWA costs are the unit cost in dollars per gallons per minute of Maximum Day Demand.

[2] Charge Area 13a is subject to an additional charge of $5,490 per lot for on-site distribution improvements.

[3] Component of fee includes estimated cost of acquiring supplemental resource supply. Fee may be reduced to $7,618 upon Applicant dedication of an acceptable combination of ground water and creek water rights to satisfy supplemental conjuctive use supply as determined by the Authority pursuant to its Rule 7.

Appendix K
Regional Water Plan Cost Burden Analysis

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Feasibility Memorandum

To: **Jim Smitherman**, Program Director

From: Catherine Hansford **Date:** May 9, 2016

Subject: **Draft Truckee Meadows Regional Water Plan Cost Burden Analysis**

Purpose

This memorandum examines the cumulative effect of development fees for similar types of development in different parts of the Truckee Meadows Service Area (TMSA) to understand the differences in total development costs. While each local government imposes development fees to cover the costs of service to new developments the cumulative impact of fees can be overlooked. The purpose of this analysis is to find what key factors affect financial feasibility of new development in different geographic areas and in particular what role water-related fees have on feasibility of new development. The analysis also examines the potential role for water-related fees and other fees to incentivize development in the TMSA infill areas (transit-oriented corridors and regional centers).

The analysis contained herein is a high-level analysis and as such it does not provide details as to how each of the fees were determined by their respective agencies, nor does it provide any recommendations for change. The analysis is intended to fulfill Section 42.7 of the WRWC Act, specifically that "the estimate of cost (of each major facility, source of water or other requirement of the Comprehensive Plan) must state the financial impact on persons within the planning area, including, without limitation, all *direct and indirect costs of connecting* to a system for supplying water".

Methodology

A cost burden analysis and feasibility tests were developed for Reno, Sparks, and unincorporated Washoe County (the County). The analysis was conducted for five residential land use types: rural residential, low density residential, medium density residential, low density multi-family, and high density multi-family. These land use types were selected with assistance from the Truckee Meadows Regional Planning Agency (TMRPA). Characteristics of these land use types are summarized in **Table 1** on the following page.

Table 1
Residential Land Use Characteristics

Category		Density	Lot Size	Lot Sq. Ft. [1]	Type of Home
RR	Rural Residential	2 or less DU/acre	1/2 acre or greater	29,000	Single Family
LDR	Low Density Residential	2.01 - 7.26 DU/acre	6,000 - 21,779 sq ft	13,600	Single Family
MDR	Medium Density Residential	7.27 - 14.5 DU/acre	3,000 - 5,999 sq ft	4,400	Single Family
LDMF	Low Density Multi-Family	14.51 - 30 DU/acre			Townhomes, Condominiums
HDMF	High Density Multi-Family	> 30 DU/acre			Rental Apartments

Source: TMRPA and HEC.
[1] Used for calculation of TMWA fees.

The analysis compares the cost of development with current market sales prices for each unit to determine financial feasibility of each residential land use type. Two financial feasibility tests are developed. The Residual Land Value and Infrastructure Cost Burden Feasibility Tests are tools to determine the maximum financial burden a development can carry and maintain profitability.

Test 1: Residual Land Value Test
The Residual Land Value test is used by real estate developers and investors to evaluate the financial feasibility of different unit types and densities on a piece of property. The project must generate a profit (a positive residual land value) to incent land development.

Figure 1 shows the relationship between residual land value and land development cost. The final sales price of a developed property less the development costs and builder profit results in the residual land value, or the price that a builder is able to pay for property and still have a financially feasible project.

- For greenfield projects (developed outside of the urban core), the sales price of the land must fund the land development costs, which includes purchase of the land, entitlement costs, planning documents, overhead and other soft costs) and a reasonable profit given the costs and risks of entitling the project and paying for necessary infrastructure and environmental mitigation to incent land development.

- For infill projects, a builder is buying land that already has public infrastructure in place, although many times the infrastructure requires upgrading or replacement. Land costs are higher in infill areas than greenfield areas to reflect the value of the installed infrastructure. The land prices for infill projects are determined by market comparisons of similar land sales. Greenfield land prices are also determined by market conditions but also take into account the greenfield land developer's rate of return requirements to recover land acquisition, entitlement, and other infrastructure and mitigation costs.

Figure 1
Residual Land Value Calculation Illustration

Residual Land Value = Amount a builder will pay a land developer

Sales Price per Unit

Less

Land Development Costs

- Water Utilities Fees
- Other Fees (City/County, other local governments)
- Land Costs
- Building Costs
- Backbone Infrastructure (Onsite & Offsite)
- Environmental Mitigation
- Site Development & Reclamation Costs
- Marketing and Financing Costs

Less

Builder Profit

Equals

Residual Land Value

For both greenfield and infill projects, the land value is highly influenced by a combination of current market conditions and the level of development fees. Land values can experience dramatic swings between recessionary downturns and economic booms. During the Great Recession finished lots were selling at less than the cost to create a finished lot. In average market conditions, connection/impact fees can greatly influence land prices in some regions. If home prices and other development costs are constant, then an increase in development fees causes a reduction in land price. In hot markets, development fee increases may have no impact on home sales prices or land prices. In recessionary markets, development fee increases may cause a greater than 1 to 1 land price reduction because of their impact on project feasibility.

Test 2: Infrastructure Cost Burden Test

As shown in **Figure 1** the total infrastructure cost burden consists of all backbone infrastructure and public facilities costs allocated to the development plus applicable fees, including building permit processing fees, County or City and regional fees, utility connection fees, and school district fees (if any – there are none in Washoe County).

For single family residential, if the total cost burden per dwelling unit is less than 15 percent of the finished home price, then a project is considered to be financially feasible. If it is between 15 and 20 percent the project is likely feasible; above 20 percent the project is most likely not feasible. For multi-family residential, if the total cost burden per dwelling unit is less than 5 percent of the finished unit price, then a project is considered to be financially feasible. If it is between 5 and 8 percent the project is likely feasible; above 8 percent the project is most likely not feasible. These feasibility thresholds are based on HEC's experience in conducting financial feasibility analyses for numerous proposed development projects over the past two decades.

There are ways in which a development project can mitigate against a high cost burden, such as reallocating some of the cost burden to other land uses (for example in a mixed use project). In addition, the infrastructure costs will be fine-tuned and possibly reduced as engineering studies are completed closer to actual construction. Also, future development projects could be required to contribute to funding off-site costs currently assigned to a project, thus reducing that project's obligation.

Assumptions

Many assumptions were made to conduct the two financial feasibility tests. Assumptions were developed for each land use type using current market data. In particular the following assumptions were developed:

- Housing characteristics (lot size per unit and building square feet per unit)
- Sales price per unit (single family and low density multi-family) and apartments property value per unit
- Land cost per lot (single family) and per unit (multi-family)

- Construction cost per unit
- Land improvements cost per unit
- Water rights cost per unit
- Soft costs per unit

Housing Characteristics and Sales Price per Unit
The analysis examined the current housing market in Reno, Sparks, and the unincorporated County areas. Current listings of homes in each of the areas was obtained from local realtors and website searches.

Table 2 shows median and average listed sales prices for new and resale units in Reno, Sparks, and the unincorporated county. Unsurprisingly sales prices are higher for larger lots and homes and lower for smaller lots and homes.

Single Family and Low Density Multi-family. The only rural residential units on the market are in unincorporated Washoe County. There are no medium density or low density multi-family units currently for sale in the unincorporated county. Of the five residential land use types there are more low density residential units for sale than any other land use type. There is a similar volume of medium density and low density multi-family residential units listed for sale.

Apartments. There are no apartment complexes in unincorporated Washoe County. Apartment rental rates are, on average, slightly higher in Reno than Sparks. Rent per square foot averages $1.03 in Sparks, and $1.09 in Reno.

Table 3 shows sales prices for new units only by area. **Table 4** shows sales prices for resale units only by area. Sales prices per square foot are higher for new units than resale units. Sales prices for new units are used for the financial feasibility tests because the analysis examines the feasibility of developing new units. Since there are no low density multi-family units currently for sale the feasibility tests use a derived sales price per unit for this land use category. The derived sales price is calculated by multiplying the average resale unit price by the ratio of price between resale and new medium density single family residential units (1.2).

Table 2
Housing Characteristics by Area – New and Resale Units

Area	RR	LDR	MDR	LDMF	HDMF
All Areas					**rent**
Median Sales Price	$593,650	$366,995	$258,495	$135,950	n.a.
Average Sales Price	$521,300	$389,339	$271,430	$161,841	$1,145
Sq Ft (average)	2,673	2,451	1,649	1,271	1,083
Sales Price or Rent per Sq Ft	$195.02	$158.86	$164.56	$172.42	$1.06
Number of Data Points	10	125	56	56	58
Reno					**rent**
Median Sales Price	n.a.	$389,950	$302,990	$189,000	n.a.
Average Sales Price	n.a.	$434,946	$308,882	$182,492	$1,136
Sq Ft (average)	n.a.	2,594	1,860	1,247	1,046
Sales Price or Rent per Sq Ft	n.a.	$167.66	$166.08	$146.30	$1.09
Number of Data Points	0	65	21	23	30
Sparks					**rent**
Median Sales Price	n.a.	$340,970	$249,900	$127,300	n.a.
Average Sales Price	n.a.	$344,444	$248,958	$147,448	$1,155
Sq Ft (average)	n.a.	2,292	1,523	1,202	1,123
Sales Price or Rent per Sq Ft	n.a.	$150.26	$163.44	$122.71	$1.03
Number of Data Points	0	36	35	33	28
Unincorporated County					**rent**
Median Sales Price	$593,650	$360,000	n.a.	n.a.	n.a.
Average Sales Price	$521,300	$333,164	n.a.	n.a.	n.a.
Sq Ft (average)	2,673	2,300	n.a.	n.a.	n.a.
Sales Price or Rent per Sq Ft	$195.02	$144.83	n.a.	n.a.	n.a.
Number of Data Points	10	24	0	0	0

Source: Toll Brothers, Lennar, DR Horton, Desert Wind Homes, Ryder Homes, Del Webb, NewHomeSource.com, realtor.com, zillow.com, apartmentguide.com, forrent.com. calc all

Figure 2 shows that the median price of new low density units and the median price of new medium density units are very similar across the three areas.

Figure 2
Median Sales Price per New Unit by Area

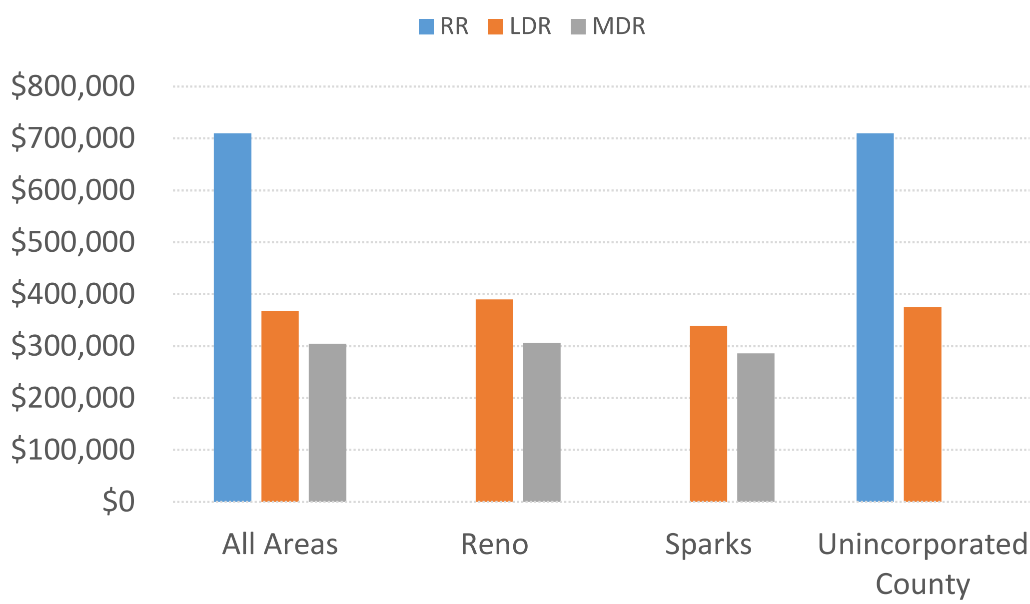


Figure 3 shows that prices are also similar across the three areas for resale units; however, low density multi-family fetches a higher price in Reno. Resale prices for rural residential in unincorporated Washoe County is much lower than prices for new rural residential units. This latter finding may simply be a function of the volume and location of the rural residential units currently on the market and not reflective of the entire stock of rural residential units.

Figure 3
Median Sales Price per Resale Unit by Area

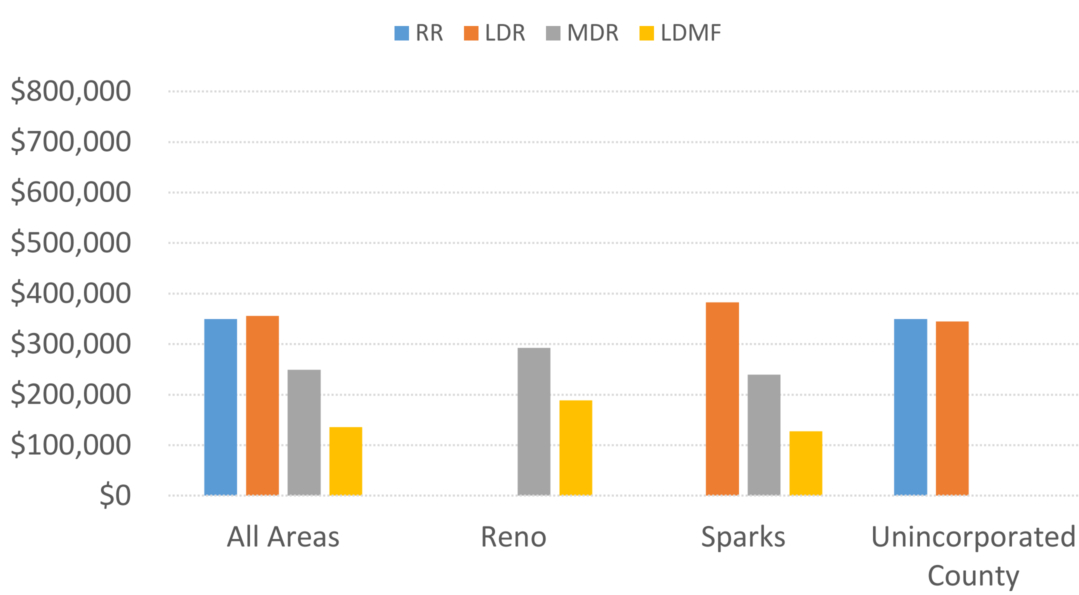


Table 3
Housing Characteristics by Area – New Units

Area	RR	LDR	MDR	LDMF
All Areas				
Median Sales Price	$709,900	$367,950	$304,490	n.a.
Average Sales Price	$716,775	$398,962	$309,498	n.a.
Sq Ft (average)	3,373	2,510	1,758	n.a.
Sales Price or Rent per Sq Ft	$212.54	$158.97	$176.08	n.a.
Number of Data Points	4	105	18	0
Reno				
Median Sales Price	n.a.	$389,950	$305,990	n.a.
Average Sales Price	n.a.	$434,946	$323,038	n.a.
Sq Ft (average)	n.a.	2,594	1,839	n.a.
Sales Price or Rent per Sq Ft	n.a.	$167.66	$175.67	n.a.
Number of Data Points	0	65	11	0
Sparks				
Median Sales Price	n.a.	$338,875	$285,990	n.a.
Average Sales Price	n.a.	$340,686	$288,220	n.a.
Sq Ft (average)	n.a.	2,271	1,630	n.a.
Sales Price or Rent per Sq Ft	n.a.	$149.99	$176.82	n.a.
Number of Data Points	0	32	7	0
Unincorporated County				
Median Sales Price	$709,900	$374,835	n.a.	n.a.
Average Sales Price	$716,775	$339,704	n.a.	n.a.
Sq Ft (average)	3,373	2,776	n.a.	n.a.
Sales Price or Rent per Sq Ft	$212.54	$122.37	n.a.	n.a.
Number of Data Points	4	8	0	0

Source: Toll Brothers, Lennar, DR Horton, Desert Wind Homes, Ryder Homes, Del Webb, NewHomeSource.com, realtor.com, zillow.com, apartmentguide.com, forrent.com.
calc new

Table 4
Housing Characteristics by Area – Resale Units

Area	RR	LDR	MDR	LDMF
All Areas				
Median Sales Price	$350,000	$356,000	$249,450	$135,950
Average Sales Price	$390,983	$338,818	$253,397	$161,841
Sq Ft (average)	2,207	2,142	1,598	1,220
Sales Price or Rent per Sq Ft	$177.17	$158.17	$158.55	$132.62
Number of Data Points	6	20	38	56
Reno				
Median Sales Price	n.a.	n.a.	$292,450	$189,000
Average Sales Price	n.a.	n.a.	$293,310	$182,492
Sq Ft (average)	n.a.	n.a.	1,883	1,247
Sales Price or Rent per Sq Ft	n.a.	n.a.	$155.78	$146.30
Number of Data Points	0	0	10	23
Sparks				
Median Sales Price	n.a.	$382,425	$239,900	$127,300
Average Sales Price	n.a.	$374,516	$239,143	$147,448
Sq Ft (average)	n.a.	2,460	1,497	1,202
Sales Price or Rent per Sq Ft	n.a.	$152.23	$159.80	$122.71
Number of Data Points	0	4	28	33
Unincorporated County				
Median Sales Price	$350,000	$345,000	n.a.	n.a.
Average Sales Price	$390,983	$329,894	n.a.	n.a.
Sq Ft (average)	2,207	2,063	n.a.	n.a.
Sales Price or Rent per Sq Ft	$177.17	$159.95	n.a.	n.a.
Number of Data Points	6	16	0	0

Source: Toll Brothers, Lennar, DR Horton, Desert Wind Homes, Ryder Homes, Del Webb, NewHomeSource.com, realtor.com, zillow.com, apartmentguide.com, forrent.com.

calc resale

For apartment complexes HEC researched the current listings of multi-family product for sale. **Table 5** shows the current listings and prices. All of the apartment complexes are resale of existing product. Per conversation with Johnson, Perkins and Griffin, apartment complex specialists in Reno, the existing stock is old, Class B or C product, and the average sales price per unit ($77,600) is not reflective of new apartment complex prices. Because this data cannot be used for the financial feasibility tests HEC has imputed a sales price per unit for new apartments. The assumptions used to calculate the imputed price were developed based on data provided by the National Apartment Association and other sources listed in **Table 6**. The imputed price is $155,000 per unit for all areas.

Table 5
Multi-Family Units Sales Prices – Resale of Older Stock Only

Location	Address	Price	Units	Price per Unit	Sub Type
Reno	465 W 2nd Street	$849,000	26	$32,654	Mid/High Rise
Reno	790 Brinkby Avenue	$3,800,000	48	$79,167	Garden/Low Rise
Reno	485 Linden Street	$995,000	21	$47,381	Garden/Low Rise
Reno	3421 Neil Rd.	$2,254,000	34	$66,294	Garden/Low Rise
Reno	495 Morrill	$1,995,000	9	$221,667	Garden/Low Rise
Reno	3891 Neil Road	$1,250,000	15	$83,333	Garden/Low Rise
Reno	629 Spokane St	$399,000	6	$66,500	Garden/Low Rise
Reno	923 W 2nd St	$497,700	8	$62,213	Garden/Low Rise
Reno	1275 Berrum Street	$450,000	7	$64,286	Garden/Low Rise
Reno	901 Virbel ln	$385,000	6	$64,167	Garden/Low Rise
Reno	1680 Mill Street	$493,700	8	$61,713	Mid/High Rise
Sparks	231 1st Street	$715,000	11	$65,000	Garden/Low Rise
Sparks	1475 Vista del Rancho Parkway	$13,589,439	152	$89,404	Garden/Low Rise
Reno	923 W 2nd St APT 2	$497,700	8	$62,213	Garden/Low Rise
Reno	228 Mill St	$625,000	8	$78,125	Garden/Low Rise
Sparks	1917 Victorian Ave # 8	$795,000	8	$99,375	Garden/Low Rise
Reno	531 Colorado River Blvd	$695,000	8	$86,875	Garden/Low Rise
Reno	1508 Locust St	$495,000	6	$82,500	Garden/Low Rise
Sparks	634 15th St	$600,000	8	$75,000	Garden/Low Rise
Reno	1275 Berrum Ln	$450,000	7	$64,286	Garden/Low Rise
Average Price per Unit				**$77,608**	

Source: www.loopnet.com and www.zillow.com. mf list

Table 6
Imputed Sales Price for New Apartment Units

Item	Reno	Sparks	County
		1,050 sq. ft. / unit	
Monthly Rental Revenue per Unit [1]	$1,082	$1,082	$1,082
Annual Rental Revenue per Unit	**$13,000**	**$13,000**	**$13,000**
Vacancy Rate [2]	3.1%	3.1%	3.1%
Estimated Annual Revenue	**$12,596**	**$12,596**	**$12,596**
Annual Expenses per Unit [3]	$4,786	$4,786	$4,786
Net Operating Income per Unit	**$7,809**	**$7,809**	**$7,809**
Cap Rate	5.00%	5.00%	5.00%
Calculated Property Value per Unit	**$155,000**	**$155,000**	**$155,000**

mf price

Source: REIS Q3 2015 apartment cap rate trends, Johnson Perkins Griffin real estate appraisers and consultants, 3rd quarter 2015 data for the Reno/Sparks Metro Area, and the 2014 Survey of Operating Income and Expenses in Rental Apartment Communities by Christopher Lee, published by the National Apartment Association.

[1] Calculated using $1.03 per square foot from Johnson Perkins Griffin apartment survey 3rd quarter 2015 for the Reno/Sparks Metro area.

[2] Average vacancy rate was 3.11% in the 3rd quarter 2015 for 2 bed, 2 ba. apartments.

[3] Estimated at 40% of gross potential rent.

Land Costs by Residential Land Use

Vacant land costs for multi-family units were based on two recent transactions in the Truckee Meadows. Information was provided by Johnson Perkins Griffin of Reno. **Table 7** lists vacant land currently on the market with residential uses allowed. The price per acre is highly variable based on location and allowable land uses (some properties are mixed use while others are residential only). Some properties have greater developed infrastructure than others. In addition, some property prices include water rights. The median price per acre was used in the analysis as it represents the mid-point of prices for vacant land in the region. Currently listed properties have a median price per acre of $60,000 for undeveloped land in the Truckee Meadows.

Table 7
Vacant Land Listings (Residential Uses Allowed)

Place	Address	Acres	Listed Price [1]	Price per Acre
Reno	2nd Street and US 395	17.2	$9,000,000	$522,952
Reno	Sandestin Drive	33.5	$700,000	$20,921
Reno	Bennie Lane	30.0	$1,750,000	$58,314
Reno	N Virginia Street	127.0	$12,700,000	$100,000
Reno	9355 Pan American Dr	20.1	$985,981	$49,005
Reno	North Virginia	65.1	$6,378,500	$98,010
Reno	15865 Toll Road	81.4	$1,250,000	$15,362
Reno	N Virginia Street	22.3	$2,900,000	$130,162
Reno	Dandini and Spectrum Blvd	22.5	$4,163,574	$185,130
Reno	Virginia St near Mt Rose Hwy	88.7	$14,000,000	$157,871
Reno	N Virginia and Seneca	19.9	$1,920,000	$96,386
Reno	I-395S	46.0	$2,000,000	$43,478
Reno	S Virginia St	155.0	$3,000,000	$19,355
Reno	S Virginia St	164.0	$2,500,000	$15,244
Reno	N Virginia Street	240.0	$4,500,000	$18,750
Median Price per Acre (rounded)				**$60,000**

Source: www.loopnet.com. land

[1] Price for some listings includes water rights.

Water Utilities Fees

Of all the development fees, the most variable fee, which is dependent on location, is the Truckee Meadows Water Authority (TMWA) fee. **Map 1** on the following page shows the water system facility charge areas for TMWA's WSF rate schedule. Because these fees vary widely within Reno, Sparks, and the County, the feasibility analysis shows total cost burden in two of TMWA's fee areas for each jurisdiction.

In Reno, the analysis uses TMWA areas 0 and 10. Area 0 includes most of the central Truckee Meadows. Area 10 encompasses the Stead – Silver Lake area in the North Valleys area.

In Sparks, the analysis uses TMWA areas 2a and 12. Area 2a includes Sparks within the McCarran ring and Area 12 includes Spanish Springs.

For the unincorporated portion of the County the analysis uses TMWA area 8a (Horizon Hills in the northwest of the TMSA) and area 15 (Arrowcreek/Mt. Rose in southwest Truckee Meadows). Fees for the six areas in the analysis are summarized in **Table 8.**

Map 1
TMWA Water System Facility Fee Areas Map

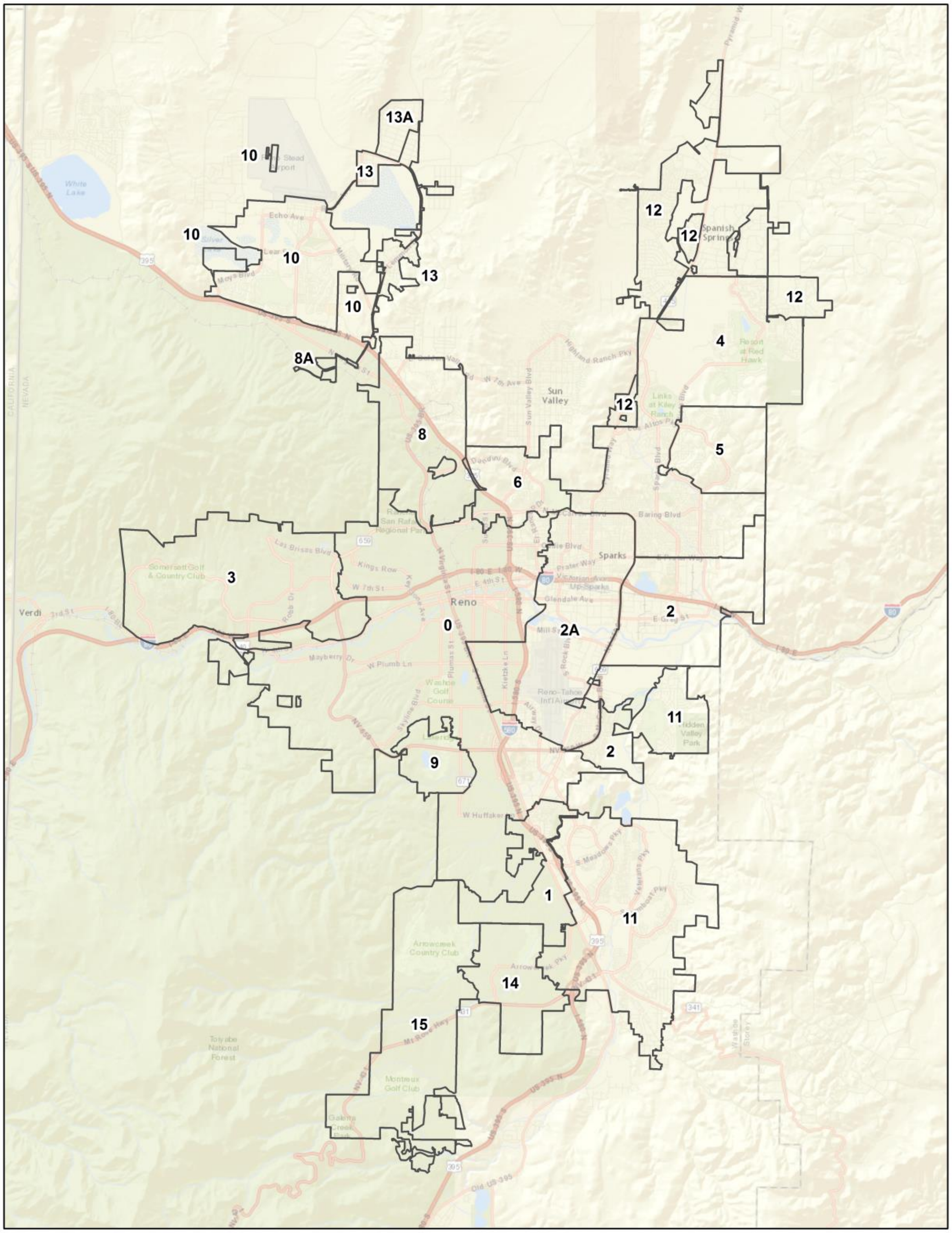


Table 8
TMWA WSF Area Fees

Area	Name	Area Facility Cost	Supply and Treatment Cost	Storage Facilities Cost	Total
		$ per GPM	*$ per GPM*	*$ per GPM*	*$ per GPM*
0	Reno	$0	$4,163	$933	$5,096
10	Reno (Stead-Silver Lake)	$5,623	$4,163	$933	$10,719
2a	Sparks	$856	$4,163	$933	$5,952
12	Sparks (Spanish Springs)	$5,789	$4,163	$0	$9,952
8a	Washoe (Horizon Hills)	$4,023	$4,163	$0	$8,186
15	Washoe (Arrowcreek/Mt. Rose)	$12,568	$0	$0	$12,568

Source: Truckee Meadows Water Authority. tmwa

Land Development Costs

Table 9 shows the calculation of land development costs per unit for each residential land use type. The per unit development costs are used for all areas in the analysis (Reno, Sparks, and unincorporated Washoe County). Construction costs, land improvement costs, water rights and soft costs assumptions were developed based on conversations with local developers.

Table 9
Land Development Costs per Unit

Development Cost	RR	LDR	MDR	LDMF Condo	HDMF Apt
Sales Price	$715,000	$400,000	$310,000	$195,000	$155,000
Lot Size (Acres)	0.67	0.31	0.10	0.07	0.03
Building Square Feet	3,400	2,500	1,750	1,250	1,050
Land Cost per Lot / Unit [1]	**$40,000**	**$20,000**	**$5,000**	**$17,000**	**$16,000**
Construction Cost per Sq Ft	$75	$72	$70	$70	$70
Estimated Total Construction Cost	**$255,000**	**$180,000**	**$122,500**	**$87,500**	**$73,500**
Land Improvements Cost per Sq Ft	$17	$18	$19	$20	$20
Infrastructure Cost (estimate)	**$57,800**	**$45,000**	**$33,250**	**$25,000**	**$21,000**
Water Rights [2]	$5,191	$4,087	$2,224	$900	$900
Soft Costs (5% of construction)	$12,750	$9,000	$6,125	$4,375	$3,675
Financing Cost (10% of construction)	$25,500	$18,000	$12,250	$8,750	$7,350
Builder Profit (7.5% of sales price)	$53,625	$30,000	$23,250	$14,625	$11,625
Est. Development Costs per Unit	**$449,866**	**$306,087**	**$204,599**	**$158,150**	**$134,050**

Source: HEC. dev cost

[1] Based on vacant land listings for single family, and recent transactions for multi-family (data provided by Johnson Perkins Griffin of Reno).

[2] Uses TMWA Rule 7 groundwater rights cost of $7,500 per acre foot.

Feasibility Test Results

The financial feasibility tests results are presented for Reno, Sparks, and unincorporated Washoe County.

Reno

Development fees for Reno are shown in **Table 10.**

Table 10
Estimated Reno Cost Burden per Unit

	RR	LDR	MDR	LDMF Condo	HDMF Apt
Units per acre	1.5	3.2	10.0	15.0	30.0
					2 bd, 2 ba unit
Lot Size (sq. ft.)	*29,000*	*13,600*	*4,400*	*2,900*	*1,500*
Unit Building Size (sq. ft.)	*3,400*	*2,500*	*1,750*	*1,250*	*1,050*
Garage (sq. ft.)	*600*	*400*	*400*	*200*	*carport*
Price per Sq. Ft.	$210	$160	$177	$156	$148
Sales Price per Unit [1]	**$715,000**	**$400,000**	**$310,000**	**$195,000**	**$155,000**
Water Utilities Fees					
TMWA Fees Area 0	$7,842	$5,371	$3,055	$764	$764
Sewer Connection Fee	$6,376	$6,376	$6,376	$5,445	$5,445
Subtotal Water Utilities Fees	**$14,218**	**$11,747**	**$9,431**	**$6,209**	**$6,209**
Other Fees					
Building Permit [2]	$1,736	$1,375	$1,075	$835	$761
Mechanical Permit	$260	$206	$161	$125	$114
Plumbing	$347	$275	$215	$167	$152
Electrical	$347	$275	$215	$167	$152
Plan Review Fee [2]	$1,128	$894	$699	$543	$495
Park Fees [3]	$1,000	$1,000	$1,000	$1,000	$938
Regional Road Impact Fee [4]	$4,291	$4,291	$4,291	$2,788	$2,788
Subtotal Other Fees	**$9,110**	**$8,317**	**$7,655**	**$5,625**	**$5,400**
Total Estimated Fees in TMWA Area 0	**$23,329**	**$20,063**	**$17,086**	**$11,835**	**$11,610**
Cost Burden as % of Price [5]	**3%**	**5%**	**6%**	**6%**	**7%**
TMWA Fees Area 10	$16,496	$11,297	$6,425	$1,608	$1,608
Total Estimated Fees in TMWA Area 10	**$31,982**	**$25,989**	**$20,457**	**$12,678**	**$12,453**
Cost Burden as % of Price [5]	**4%**	**6%**	**7%**	**7%**	**8%**

Source: City of Reno. hd costs

[1] Sales price for multi-family is imputed.
[2] City of Reno Valuation Plan Check and Building Permit Fees effective Sept. 1, 2014.
Plan Review Fee equals 65% of Building Permit Fee.
Mechanical Permit fee equals 15% of Building Permit Fee.
Plumbing Permit and electrical permit fees equals 20% of Building Permit Fee.
VB construction type for building valuation calculation.
[3] Park Fees (residential construction tax): 1% of the valuation of the construction per unit, not to exceed $1,000.
[4] Fee schedule for the south service area as of March 2016.
[5] As a guideline, single family development in the region is feasible if the burden is <15%, likely feasible between 15%- 25%, and possibly feasible (dependent on circumstances) if the burden is greater than 25%. Multi-family development is feasible if the burden is <5%, likely feasible between 5%-8%, and possibly feasible if the burden is greater than 8%.

Total fees range from $11,600 per apartment unit to $23,300 per rural residential unit for development in TMWA fee area 0. In TMWA fee area 10 fees range from $12,500 per apartment unit to $32,000 per rural residential unit. Cost burden as a percentage of sales price is 3% to 7% for single family units and 6% to 8% for multi-family. Single family units are financially feasible. Multi-family units may be feasible in some locations, depending on property characteristics and funding sources.

Table 11 presents the residual land value test for Reno. The residual land value test also demonstrates that single family unit development in Reno is clearly feasible, condominium/townhome development most likely feasible, but apartment development not feasible unless costs are below the average used in this analysis, or sales price per unit is higher, or there are other means by which the developer can make apartments profitable to develop that is not reflected in this analysis.

Table 11
Reno Residual Land Value

		RR	LDR	MDR	LDMF Condo	HDMF Apt
	Units per Acre	1.5	3.2	10	15	30
	Unit Building Size (sq. ft.)	3,400	2,500	1,750	1,250	1,050
Sales Price per Unit	**A**	**$715,000**	**$400,000**	**$310,000**	**$195,000**	**$155,000**
Costs - TMWA Area 0						
Water Utilities Fees	Table 10	$14,218	$11,747	$9,431	$6,209	$6,209
Other Fees	Table 10	$9,110	$8,317	$7,655	$5,625	$5,400
Land and Building Development Costs	Table 9	$449,866	$306,087	$204,599	$158,150	$134,050
Costs of Selling	5% of sales price	$35,750	$20,000	$15,500	$9,750	$7,750
Total Costs	**B**	**$508,945**	**$346,150**	**$237,185**	**$179,735**	**$153,410**
Fees as % of Total Costs		*5%*	*6%*	*7%*	*7%*	*8%*
Residual Land Value in TMWA Area 0	**C = A-B**	**$206,055**	**$53,850**	**$72,815**	**$15,265**	**$1,590**
Residual Land Value as % of Price	**D = C/A**	**29%**	**13%**	**23%**	**8%**	**1%**
Costs - TMWA Area 10						
Water Utilities Fees	Table 10	$22,872	$17,673	$12,801	$7,053	$7,053
Other Fees	Table 10	$9,110	$8,317	$7,655	$5,625	$5,400
Land and Building Development Costs	Table 9	$449,866	$306,087	$204,599	$158,150	$134,050
Costs of Selling	5% of sales price	$35,750	$20,000	$15,500	$9,750	$7,750
Total Costs	**B**	**$517,598**	**$352,076**	**$240,555**	**$180,578**	**$154,253**
Fees as % of Total Costs		*6%*	*7%*	*9%*	*7%*	*8%*
Residual Land Value in TMWA Area 10	**C = A-B**	**$197,402**	**$47,924**	**$69,445**	**$14,422**	**$747**
Residual Land Value as % of Price	**D = C/A**	**28%**	**12%**	**22%**	**7%**	**0%**

Source: HEC. resid value

Sparks

Table 12 shows total fees per unit in Sparks in TMWA areas 2a and 12.

Table 12
Estimated Sparks Cost Burden per Unit

	RR	LDR	MDR	LDMF Condo	HDMF Apt
Units per acre	1.5	3.2	10	15	30
					2 bd, 2 ba unit
Lot Size (sq. ft.)	*29,000*	*13,600*	*4,400*	*2,900*	*1,500*
Unit Building Size (sq. ft.)	*3,400*	*2,500*	*1,750*	*1,250*	*1,050*
Garage (sq. ft.)	*600*	*400*	*400*	*200*	*carport*
Price per Sq. Ft.	$210	$160	$177	$156	$148
Sales Price per Unit [1]	**$715,000**	**$400,000**	**$310,000**	**$195,000**	**$155,000**
Water Utilities Fees					
TMWA Fees Area 2a	$9,160	$6,273	$3,568	$893	$893
Sewer Connection Fee [2]	$4,367	$4,367	$4,367	$4,367	$4,367
Storm Drain Connection	$1,111	$1,111	$1,111	$1,111	$1,111
Truckee River Flood Mgmt [3]	$200	$200	$200	$200	$200
Subtotal Water Utilities Fees	**$14,838**	**$11,951**	**$9,246**	**$6,571**	**$6,571**
Impact Fees [4]					
Sanitary Sewer Fee	$239	$239	$239	$239	$239
Flood Control Fee	$564	$564	$564	$198	$198
Regional Parks & Rec Fee	$619	$619	$619	$619	$619
Fire Station Projects Fee	$286	$286	$286	$286	$286
Regional Road Impact Fee [5]	$3,855	$3,855	$3,855	$2,505	$2,505
Subtotal Impact Fees (Service Area 1)	**$5,563**	**$5,563**	**$5,563**	**$3,847**	**$3,847**
City Fees					
Building Permit [6]	$2,465	$1,922	$1,470	$1,107	$1,008
Plan Review Fee	$1,934	$1,508	$1,153	$868	$790
Planning Plan Review Fee	$1,323	$1,032	$789	$594	$541
Fire Prevention Plan Review Fee	$567	$442	$338	$255	$232
Parks Fee [7]	$1,000	$1,000	$1,000	$1,000	$1,000
Mechanical Permit Fees [8]	$2,579	$2,011	$1,538	$1,158	$1,054
Electrical Permit Fees	$153	$113	$79	$63	$53
Plumbing Permit Fees	$20	$20	$20	$20	$20
Subtotal City Fees	**$10,041**	**$8,048**	**$6,387**	**$5,064**	**$4,697**
Total Estimated Fees in TMWA Area 2a [3]	**$28,534**	**$23,654**	**$19,288**	**$13,939**	**$13,572**
Cost Burden as % of Price [9]	**4%**	**6%**	**6%**	**7%**	**9%**
TMWA Fees Area 12	$15,316	$10,488	$5,966	$1,493	$1,493
Total Estimated Fees in TMWA Area 12	**$36,597**	**$29,777**	**$23,594**	**$16,081**	**$15,714**
Cost Burden as % of Price [9]	**5%**	**7%**	**8%**	**8%**	**10%**

Source: City of Sparks. sp hd costs

[1] Sales price for multi-family is imputed.

[2] 2016 fee schedule.

[3] Not applicable in TMWA Area 2a.

[4] Impact fees only apply to service area #1 (Spanish Springs). Impact fees excluded from total fees in TMWA Area 2a.

[5] Fee schedule for the north service area as of March 2016.

[6] Permit fees calculated using ICC Building Valuation Data to determine the principal amount, which is used to calculate permit fees. Type of Construction is VB for building valuation calculation.

[7] Park Fees (residential construction tax): 1% of the valuation of the construction per unit, not to exceed $1,000.

[8] Mechanical permit fees are 100% of the principal amount calculated by inserting the mechanical valuation into the valuation table.

[9] As a guideline, single family development in the region is feasible if the burden is <15%, likely feasible between 15%- 25%, and possibly feasible (dependent on circumstances) if the burden is greater than 25%. Multi-family development is feasible if the burden is <5%, likely feasible between 5%-8%, and possibly feasible if the burden is greater than 8%.

In TMWA Area 2a which is within the McCarran ring, cost burden as a percentage of price is less than 8% for all residential land use types except high density multi-family, which is 9%. This result indicates all land use types are financially feasible, although multi-family may only be feasible in some locations. In TMWA Area 12 (Spanish Springs) TMWA's fee is higher and the City charges impact fees. Single family unit development is still clearly feasible in Spanish Springs; however, multi-family housing feasibility is questionable.

The residual land value test for Sparks confirms that single family development is financially feasible. Land developer profit is estimated between 13% and 29% in TMWA Area 2a and between 11% and 27% in TMWA Area 12. Townhome and condominium multi-family housing is feasible but apartments are not unless costs are below the average used in this analysis, or sales price per unit is higher, or there are other means by which the developer can make apartments profitable to develop that is not reflected in this analysis. The residual land value test for Sparks is shown in **Table 13** below.

Table 13
Sparks Residual Land Value

		RR	LDR	MDR	LDMF Condo	HDMF Apt
	Units per Acre	1.5	3.2	10	15	30
	Unit Building Size (sq. ft.)	3,400	2,500	1,750	1,250	1,050
Sales Price per Unit	A	**$715,000**	**$400,000**	**$310,000**	**$195,000**	**$155,000**
Costs - TMWA Area 2a						
Water Utilities Fees	Table 12	$14,838	$11,951	$9,246	$6,571	$6,571
Impact Fees	Table 12	$0	$0	$0	$0	$0
City Fees	Table 12	$10,041	$8,048	$6,387	$5,064	$4,697
Land and Building Development Costs	Table 9	$449,866	$306,087	$204,599	$158,150	$134,050
Costs of Selling	5% of sales price	$35,750	$20,000	$15,500	$9,750	$7,750
Total Costs	B	**$510,495**	**$346,085**	**$235,732**	**$179,535**	**$153,068**
Fees as % of Total Costs		*5%*	*6%*	*7%*	*6%*	*7%*
Residual Land Value in TMWA Area 2a	C = A-B	**$204,505**	**$53,915**	**$74,268**	**$15,465**	**$1,932**
Residual Land Value as % of Price	D = C/A	**29%**	**13%**	**24%**	**8%**	**1%**
Costs - TMWA Area 12						
Water Utilities Fees	Table 12	$20,994	$16,166	$11,644	$7,171	$7,171
Impact Fees	Table 12	$5,563	$5,563	$5,563	$3,847	$3,847
City Fees	Table 12	$10,041	$8,048	$6,387	$5,064	$4,697
Land and Building Development Costs	Table 9	$449,866	$306,087	$204,599	$158,150	$134,050
Costs of Selling	5% of sales price	$35,750	$20,000	$15,500	$9,750	$7,750
Total Costs	B	**$522,213**	**$355,864**	**$243,692**	**$183,981**	**$157,514**
Fees as % of Total Costs		*7%*	*8%*	*10%*	*9%*	*10%*
Residual Land Value in TMWA Area 12	C = A-B	**$192,787**	**$44,136**	**$66,308**	**$11,019**	**($2,514)**
Residual Land Value as % of Price	D = C/A	**27%**	**11%**	**21%**	**6%**	**-2%**

Source: HEC. sp resid value

Unincorporated Washoe County

Table 14 shows total fees per unit in unincorporated Washoe County in TMWA fee areas 8a and 15.

Table 14
Estimated Unincorporated County Cost Burden per Unit

	RR	LDR	MDR	LDMF Condo	HDMF Apt
Units per acre	1.5	3.2	10	15	30
					2 bd, 2 ba unit
Lot Size (sq. ft.)	*29,000*	*13,600*	*4,400*	*2,900*	*1,500*
Unit Building Size (sq. ft.)	*3,400*	*2,500*	*1,750*	*1,250*	*1,050*
Garage (sq. ft.)	*600*	*400*	*400*	*200*	*carport*
Price per Sq. Ft.	$210	$160	$177	$156	$148
Sales Price per Unit [1]	**$715,000**	**$400,000**	**$310,000**	**$195,000**	**$155,000**
Water Utilities Fees					
TWMA Fees Area 8a	$12,598	$8,627	$4,907	$1,228	$1,228
Sewer Connection Fee [2]	$5,450	$5,450	$5,450	$5,450	$5,450
Subtotal Water Utilities Fees	**$18,048**	**$14,077**	**$10,357**	**$6,678**	**$6,678**
Other Fees					
Building Permit [3]	$2,520	$1,992	$1,551	$1,209	$1,071
Plan Review Fee [4]	$1,260	$996	$776	$604	$535
Regional Road Impact Fee [5]	$4,291	$4,291	$4,291	$2,788	$2,788
Park Fees [6]	$1,000	$1,000	$1,000	$1,000	$911
Subtotal Other Fees	**$9,071**	**$8,278**	**$7,618**	**$5,601**	**$5,305**
Total Estimated Fees in TMWA Area 8a	**$27,119**	**$22,355**	**$17,975**	**$12,279**	**$11,982**
Cost Burden as % of Price [7]	**4%**	**6%**	**6%**	**6%**	**8%**
TMWA Fees Area 15	$19,341	$13,245	$7,534	$1,885	$1,885
Total Estimate Fees in TMWA Area 15	**$33,862**	**$26,974**	**$20,602**	**$12,936**	**$12,640**
Cost Burden as % of Price [7]	**5%**	**7%**	**7%**	**7%**	**8%**

Source: Washoe County. wc hd costs

[1] Sales price for multi-family is imputed.
[2] Ordinance No. 1536 sewer connection fees were $5,100 in 2008; fees are increased by $50 every January 1.
[3] Assume Type of Construction is VB for building valuation calculation.
Building Permit Fee includes mechanical, plumbing, and electrical fees.
[4] Plan Review fee equals 50% of Building Fee for single family dwellings.
[5] Fee schedule for the south service area as of March 2016.
[6] Park Fees (residential construction tax): 1% of the valuation of the construction per unit, not to exceed $1,000.
[7] As a guideline, single family development in the region is feasible if the burden is <15%, likely feasible between 15%- 25%, and possibly feasible (dependent on circumstances) if the burden is greater than 25%. Multi-family development is feasible if the burden is <5%, likely feasible between 5%-8%, and possibly feasible if the burden is greater than 8%.

In unincorporated Washoe County the feasibility test results are similar to Reno. Total fees range from $12,000 per apartment unit to $27,100 per rural residential unit for development in TMWA fee area 8a. In TMWA fee area 15 fees range from $12,600 per apartment unit to $33,900 per rural residential unit. Cost burden as a percentage of sales price is 4% to 7% for single family units and 6% to 8% for multi-family. Single family units are financially feasible. Multi-family units may be feasible in some locations, depending on property characteristics and funding sources.

Table 15 presents the residual land value test for unincorporated Washoe County. The residual land value test also demonstrates that single family unit development in the County is clearly feasible, condominium/townhome development most likely feasible, but apartment development not feasible unless costs are below the average used in this analysis, or sales price per unit is higher, or there are other means by which the developer can make apartments profitable to develop that is not reflected in this analysis.

Table 15
Unincorporated County Residual Land Value

		RR	LDR	MDR	LDMF Condo	HDMF Apt
	Units per Acre	1.5	3.2	10	15	30
	Unit Building Size (sq. ft.)	3,400	2,500	1,750	1,250	1,050
Sales Price per Unit	**A**	**$715,000**	**$400,000**	**$310,000**	**$195,000**	**$155,000**
Costs - TMWA Area 8a						
Water Utilities Fees	Table 14	$18,048	$14,077	$10,357	$6,678	$6,678
Other Fees	Table 14	$9,071	$8,278	$7,618	$5,601	$5,305
Land and Building Development Costs	Table 9	$449,866	$306,087	$204,599	$158,150	$134,050
Costs of Selling	5% of sales price	$35,750	$20,000	$15,500	$9,750	$7,750
Total Costs	**B**	**$512,735**	**$348,442**	**$238,074**	**$180,179**	**$153,782**
Fees as % of Total Costs		*5%*	*6%*	*8%*	*7%*	*8%*
Residual Land Value in TMWA Area 8a	**C = A-B**	**$202,265**	**$51,558**	**$71,926**	**$14,821**	**$1,218**
Residual Land Value as % of Price	**D = C/A**	**28%**	**13%**	**23%**	**8%**	**1%**
Costs- TMWA Area 15						
Water Utilities Fees	Table 14	$24,791	$18,695	$12,984	$7,335	$7,335
Other Fees	Table 14	$9,071	$8,278	$7,618	$5,601	$5,305
Land and Building Development Costs	Table 9	$449,866	$306,087	$204,599	$158,150	$134,050
Costs of Selling	5% of sales price	$35,750	$20,000	$15,500	$9,750	$7,750
Total Costs	**B**	**$519,478**	**$353,060**	**$240,700**	**$180,836**	**$154,440**
Fees as % of Total Costs		*7%*	*8%*	*9%*	*7%*	*8%*
Residual Land Value in TMWA Area 15	**C = A-B**	**$195,522**	**$46,940**	**$69,300**	**$14,164**	**$560**
Residual Land Value as % of Price	**D = C/A**	**27%**	**12%**	**22%**	**7%**	**0%**

Source: HEC.
wc resid value

Findings

Feasibility Tests

The feasibility tests results should not be taken as representative of all areas in the TMSA. The analysis assumes that sales prices and land use development costs per unit are constant across the TMSA. In reality, pockets of development will vary greatly from this average approach. By keeping sales prices and land use development costs the same the analysis can better determine the relative importance of development fees, and in particular water-related fees, on the feasibility of residential land development in different parts of the TMSA.

The analysis shows that single family development is financially feasible for all greenfield and likely most infill development in the TMSA. Townhome and condominium unit development is feasible in much of the TMSA. Apartment development is not feasible in the TMSA unless sales prices per unit improve or unless the developer's costs are lower per unit than assumed in the analysis[1]. In infill areas, developer costs may be lowered by assistance from redevelopment agency funding, federal and state grants and tax credit financing making what this analysis shows as questionable project feasibility profitable and feasible.

Although water utility fees represent a large portion of total development fees they are not a large portion of total development costs. The residual land value test tables show development fees are only 5% to 10% of total development costs. Despite this finding, water utility fees (water and sewer combined) can be a factor in determining feasibility of development in any area of the TMSA. The analysis results suggest that a developer will determine total development costs among competing sites. If land costs, construction costs, and soft costs are similar and cannot be changed for each site then development fees have a larger impact on site selection. As discussed on page 2, the impact of development fees on site selection by developers is largely dependent on the general state of the economy.

[1] Per conversation with Johnson, Perkins, and Griffin of Reno, sales prices per unit are improving. There are several apartment complexes in the development pipeline.

Table 16
Feasibility Test Results Comparisons

Area	RR	LDR	MDR	LDMF Condo	HDMF Apt
RENO					
Residual Land Value					
TMWA Area 0	$206,055	$53,850	$72,815	$15,265	$1,590
TMWA Area 10	$197,402	$47,924	$69,445	$14,422	$747
Cost Burden					
TMWA Area 0	3%	5%	6%	6%	7%
TMWA Area 10	4%	6%	7%	7%	8%
SPARKS					
Residual Land Value					
TMWA Fees Area 2a	$204,505	$53,915	$74,268	$15,465	$1,932
TMWA Fees Area 12	$192,787	$44,136	$66,308	$11,019	($2,514)
Cost Burden					
TMWA Fees Area 2a	4%	6%	6%	7%	9%
TMWA Fees Area 12	5%	7%	8%	8%	10%
WASHOE COUNTY					
Residual Land Value					
TWMA Fees Area 8a	$202,265	$51,558	$71,926	$14,821	$1,218
TMWA Fees Area 15	$195,522	$46,940	$69,300	$14,164	$560
Cost Burden					
TWMA Fees Area 8a	4%	6%	6%	6%	8%
TMWA Fees Area 15	5%	7%	7%	7%	8%

Source: HEC. sum test

Impact of Water and Sewer Fees on Development
Table 17 shows total development fees per unit for each residential land use type in each area. The table highlights the percentage of development fees that are for water, sewer, regional roads (RTC), and the local jurisdiction.

Illustrations of the percentage shares of development fees are shown in **Figure 4 (Reno), Figure 5 (Sparks)** and **Figure 6 (unincorporated County).** Each figure shows a low density residential unit and a condominium unit in two of TMWA's fee areas.

Table 17
Fees by Jurisdiction and TMWA Fee Area

Area	RR	LDR	MDR	LDMF Condo	HDMF Apt
RENO - TMWA AREA 0					
Total Fees	$23,329	$20,063	$17,086	$11,835	$11,610
City Fees	21%	20%	20%	24%	23%
RTC Fees	18%	21%	25%	24%	24%
Water Fees	34%	27%	18%	6%	7%
Sewer Fees	27%	32%	37%	46%	47%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
RENO - TMWA AREA 10					
Total Fees	$31,982	$25,989	$20,457	$12,678	$12,453
City Fees	15%	15%	16%	22%	21%
RTC Fees	13%	17%	21%	22%	22%
Water Fees	52%	43%	31%	13%	13%
Sewer Fees	20%	25%	31%	43%	44%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
SPARKS - TMWA AREA 2A					
Total Fees	$28,534	$23,654	$19,288	$13,939	$13,572
City Fees	39%	39%	39%	44%	43%
RTC Fees	14%	16%	20%	18%	18%
Water Fees	32%	27%	18%	6%	7%
Sewer Fees	15%	18%	23%	31%	32%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
SPARKS - TMWA AREA 12					
Total Fees	$36,597	$29,777	$23,594	$16,081	$15,714
City Fees	36%	37%	40%	48%	47%
RTC Fees	11%	13%	16%	16%	16%
Water Fees	42%	35%	25%	9%	9%
Sewer Fees	12%	15%	19%	27%	28%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
WASHOE COUNTY - TMWA AREA 8A					
Total Fees	$27,119	$22,355	$17,975	$12,279	$11,982
County Fees	18%	18%	19%	23%	21%
RTC Fees	16%	19%	24%	23%	23%
Water Fees	46%	39%	27%	10%	10%
Sewer Fees	20%	24%	30%	44%	45%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
WASHOE COUNTY - TMWA AREA 15					
Total Fees	$33,862	$26,974	$20,602	$12,936	$12,640
County Fees	14%	15%	16%	22%	20%
RTC Fees	13%	16%	21%	22%	22%
Water Fees	57%	49%	37%	15%	15%
Sewer Fees	16%	20%	26%	42%	43%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: City of Reno, City of Sparks, Washoe County, and HEC. sum fee

Figure 4
Composition of Fees in Reno

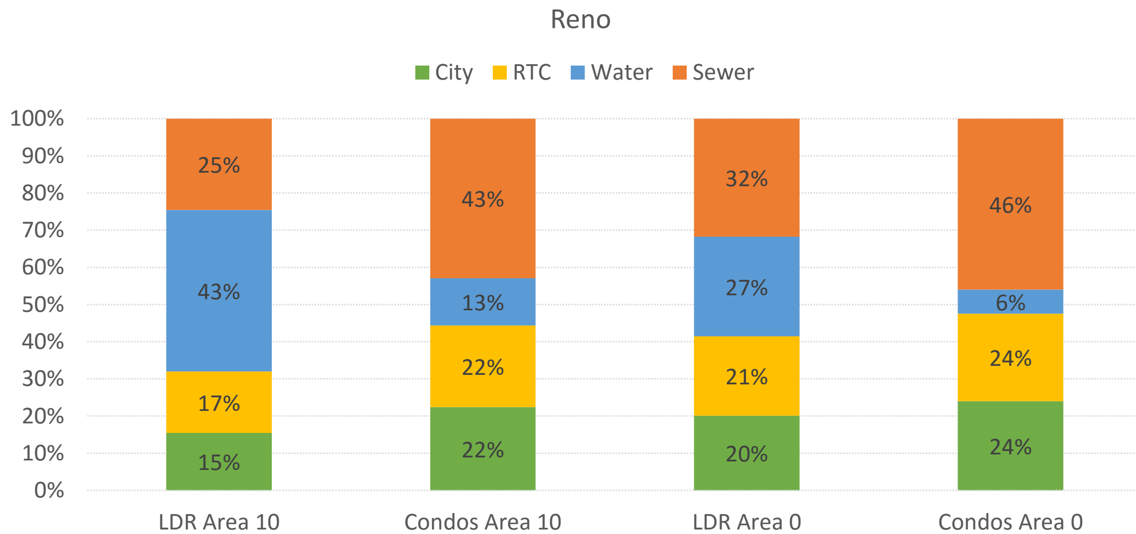


Figure 5
Composition of Fees in Sparks

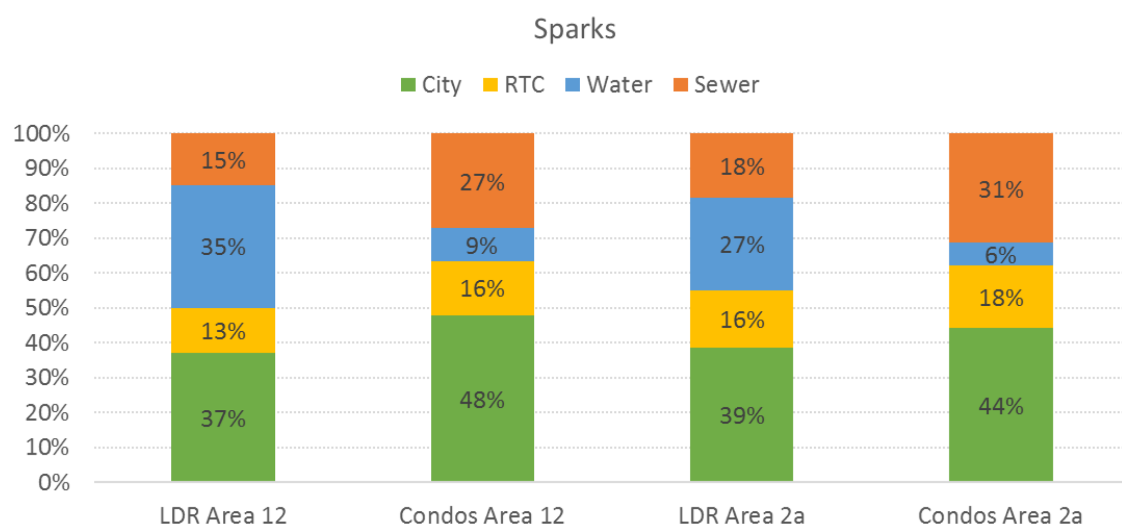
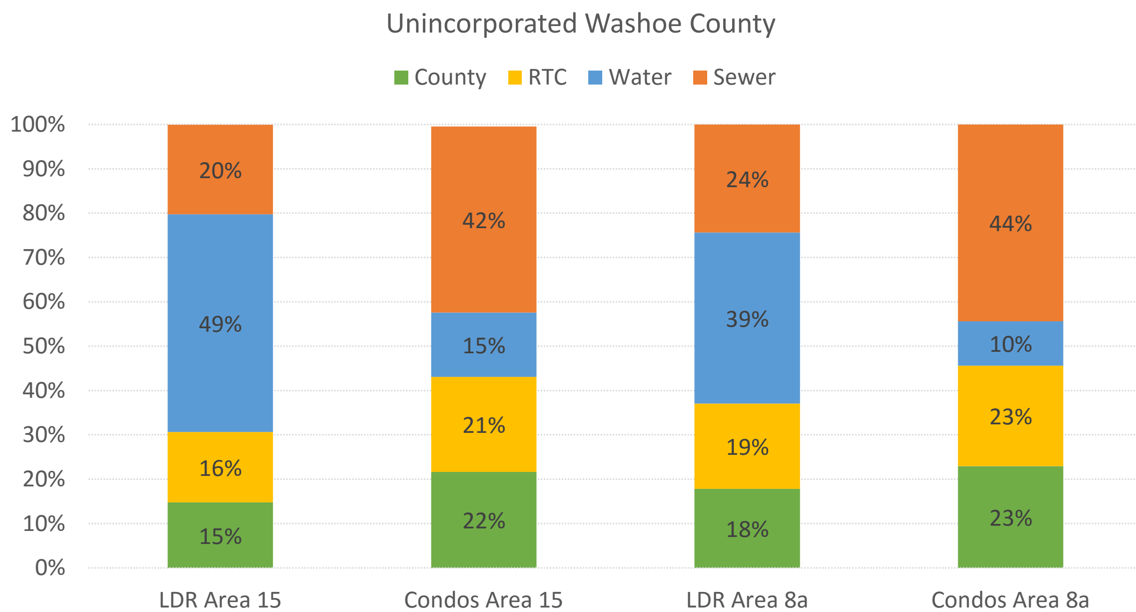


Figure 6
Composition of Fees in Unincorporated Washoe County



Generally, water fees are a larger component of total fees for larger homes and a smaller component of fees for smaller units. This result occurs because TMWA fees are based on demand estimates for each land use type. The smaller a unit is typically the less water it uses. Water fees are 20%-35% of total fees in the urban cores and 30%-55% of total fees outside of the urban cores for single family units. Water fees are 6%-7% of total fees in the urban cores and 10%-15% of total fees outside the urban cores for multi-family units.

Sewer fees are a larger component of total fees for smaller units than for larger units. Sewer fees range 30%-50% of total development fees for multi-family units and 10%-35% of total development fees for single family units. Sewer fees are flat charges for residential development, regardless of unit size density of development. One exception to this is the City of Reno's sewer connection fee which is lower for multi-family development than single family development. Sewer fees do not vary by area within a jurisdiction like the water fees do.

TMWA water fees encourage infill development. *TMWA's fees reflect the cost of infrastructure by service area which is lower in the urban cores (closer to the water treatment plants and large distribution reservoirs) and higher further away from the urban cores (higher distribution costs). Smaller units which are found in urban cores use less water than larger units that are typically found outside of the urban cores.*

Due to the structure of sewer connection fees, sewer costs are a much larger proportion of total fees per unit for multi-family units than single family units. Sewer connection fees do not vary by sub-area for Reno, Sparks, or the unincorporated County. As currently structured, sewer connection fees do not encourage infill development. Charging the same connection fee per unit assumes that all residential unit types use the sewer infrastructure in equal proportion; in other words, all residential unit types discharge the same annual flow of similar strength to the system. While indoor water use does not vary in the same manner as outdoor water use by residential unit type it is nevertheless influenced by a number of functions, predominantly the number of persons living in the unit. Because typically more people live in single family units than multi-family units, many sewer providers set connection fees (and rates) lower for multi-family units than single family units. Revisions to the structure of sewer connection fees are currently being considered in Sparks and Reno (North Valleys). There are several methodologies that can be used to establish nexus between land uses and the structure of sewer connection fees.

Appendix L

Comments

2016 Regional Water Management Plan

Comments received from Nevada Division of Environmental Protection
April 4, 2017

<u>Page 4-28, PLPT region of the Truckee River:</u> The text should recognize the following - The lowest portion of the Truckee River was found to be the most sensitive to phosphorus during low flows with DO criterion violations ranging from approximately 10% of days to 25% of days upstream of Marble Bluff Dam depending upon phosphorus concentrations.

<u>Page 4-28, last paragraph:</u> Revise paragraph to something similar to the following. I believe this more accurately captures the chain of events:
After completion of the technical analysis, no immediate action was taken by NDEP to complete the WQS review due to considerations regarding the proposed PLPT WQS review. On March 19, 2014, NDEP met with PLPT to discuss the status of NDEP's Truckee River WQS review. During this meeting, Tribal representatives indicated their intention to initiate their own review of their Truckee River WQS, and the group discussed how the outcome of the PLPT review could impact the NDEP review. Clean Water Act regulations require NDEP to set WQS that provide for the attainment and maintenance of the PLPT WQS. On April 1, 2014, PLPT submitted a formal request that NDEP delay its WQS review in order to allow time for the Tribe to complete its WQS review. NDEP agreed with the request and suspended the WQS review until completion of the PLPT WQS. Upon completion of the PLPT WQS review, NDEP determined that there were not enough significant changes that could be made to the regulations to warrant continuing with their WQS review.

<u>Page 4-29, 5th paragraph:</u> Please consider adding the following in the text or possibly as a footnote :
While NDEP supported this change in the DRP criterion, the desire for consistency was not the reason. According to NDEP, the primary reason for the revision was due to the fact that the low flow WQ modeling by LimnoTech indicated that DO criterion violations in the Marble Bluff Dam area would decrease from about 25% of the days to about 10% of the days with a decrease in the DRP concentrations from 0.05 mg/L to 0.022 mg/L, respectively. During their March 2015 meeting, NDEP had discussed these modeling results with the PLPT staff. However, this justification was never included in the PLPT WQS review supporting documents.
This text provides a more complete picture of the basis for the change and what transpired. In our August 18, 2015 comment letter on the PLPT proposed changes (see attached), NDEP reminded PLPT why we were supportive of the changes to the DRP criterion.

<u>Page 4-43, 1st paragraph:</u> It is important to recognize that Steamboat Creek is not on the 303(d) List for phosphorus due to the lack of a total phosphorus water quality standard in the lower creek. However, Steamboat Creek contributes significant phosphorus load to the Truckee River. According to the 1994 TMDL, about 1/3 of the nonpoint source phosphorus load comes from the Steamboat Creek watershed.

WESTERN REGIONAL WATER COMMISSION

P.O. Box 11130, Reno, NV 89520 · Tel: (775) 954-4657 · Fax: (775) 328-3699

2016 WATER MANAGEMENT PLAN WORKSHOP
MARCH 30, 2017

COMMENT SHEET

- **NAME and CONTACT INFORMATION (Optional):**

FOR THE RECORD

Please see attached

1) NO NEW SALES OR PROPERTY TAX FOR FLOOD CONTROL
NO ON AB 375
We already pay sales tax for that

2) NO to Well Metering!

Jeff Church
www.RenoTaxRevolt.com
800-554-9519

TAXPAYER ALERT JUST SAY NO TO NEW TAXES
PROPOSED NEW SALES AND/OR PROPERTY TAX IN WASHOE COUNTY
www.RenoTaxRevolt.com

As predicted the ink is not even dry on the new WC1 sales tax set to start in April 2017 making Washoe County the highest in the state at 8.26%, Now they want more!

Here are just some reasons to say no to AB 375:

We already pay a 1/8c sales tax for flood control generating millions of dollars for flood control.

The flood control project and tax is believed to be limited to the Truckee River effects. It does nothing to help north valleys, those in south Reno flooded by the Steamboat ditch etc.

We just passed a WC1 sales tax and that money and media reports already show that we were duped and mislead. Contrary to promises some WC1 money went to administrators and their cars. Others for projects at extremely high costs above the western states average.

The money ends up going to salaries and pay raises!
History has shown that local government can't be trusted to spend your tax money wisely.

When you have dedicated money (vs general fund) developers have no incentive to cut costs or low bid. They know the money is there for their taking.

Washoe already receives millions in flood funding from the state and federal government.

Those people that knowingly built in flood plains have an obligation to mitigate the effects via so many options rather than another tax on the backs of taxpayers area wide. They can buy flood insurance, spend their money to make their property more flood resistant, and they can legally create a special assessment district and tax themselves rather than pass it on to all of us.

Increasing sales tax only in Washoe harms retailers and chases business to Fernley and Carson, especially on big ticket purchases. Buyers can save hundreds by buying a car elewhere It also harms the poor and middle class.

There will be plenty of more sales tax increase schemes to follow. It won't end here. Pay attention to the big high dollar backers: politicians that get big donations and builders, unions and others that will personally profit at the expense of taxpayers.

The proposed tax may be illegal and represents and end around the Gibbons' Tax Restraint Initiative, a voter-approved constitutional amendment that requires the support of two-thirds of lawmakers on any bill that "creates, generates, or increases any public revenue."

Two main legal questions that could tie this up for years in litigation: (1) Does the legislature have the authority to ignore the Gibbons Tax Initiative and pass the issue on to the County Commission and voters of Washoe County?

No good reasons to say yes to more taxes and so many good reasons to say no!
WWW.RENOTAXREVOLT.COM