

Water Recycling

Water recycling is the treating and managing of municipal, industrial, or agricultural wastewater to produce water that can be productively reused. It:

- prevents pollution and maximizes resources by redirecting nutrient enriched treated wastewater from discharging into streams and lakes and onto beaches for other beneficial uses, and
- provides an additional source of water that can be used for beneficial purposes, such as irrigating farmland or landscapes, groundwater recharge, recreation purposes and in industry.

Water Facts are short reports on water resources issues of general interest. They are published periodically by the California Department of Water Resources and can be obtained free by contacting DWR Bulletins and Reports, P. O. Box 942836, Sacramento, CA 94236-0001; 916/653-1097.

Successful water recycling projects require:

- User acceptance and commitment
- Public support and acceptance
- Addressing institutional constraints
- Inclusion in local and regional water plans
- Environmental benefits
- Economic feasibility

History

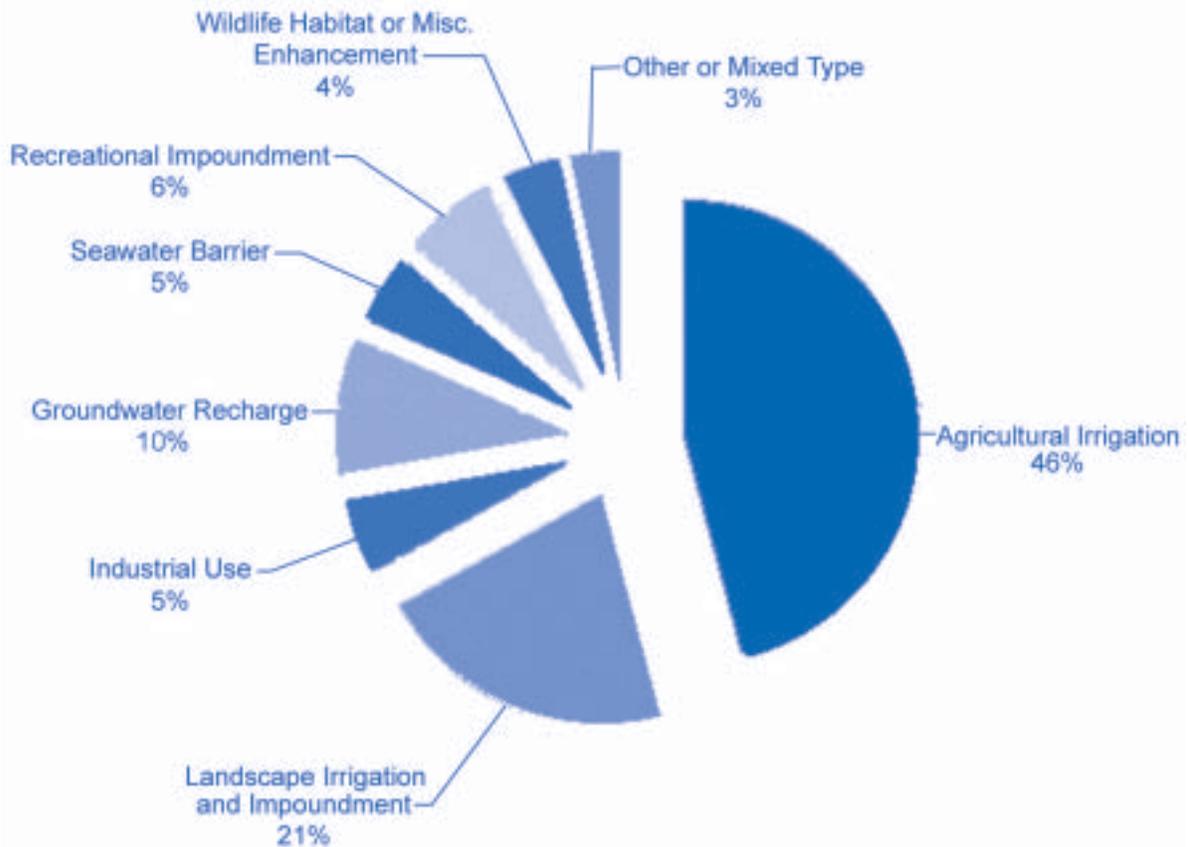
For more than a century, California has been using recycled water as a non-potable water supply. In the late 1800s farmers began using wastewater to grow crops and others started using it for landscape irrigation. Although early water recycling projects were initiated to control pollution, today, as fresh water becomes more scarce, the beneficial use of recycled water has become an attractive option. Recycled water has been used to recharge groundwater supplies, to help the environment, and in industry.

Figure 1, *Municipal Recycled Water Use in California in 2002*, shows the use of recycled water by category during the year 2002 (State Water Resources Control Board, 2003). Out of a total of approximately 525,000 acre-feet per year, the survey indicates that agricultural irrigation uses about 46 percent of the total recycled water available annually, followed by landscape irrigation (21 percent), and groundwater recharge (14 percent including seawater intrusion barriers).

Policy

Treated wastewater for non-potable uses is crucial in a semi-arid area such as California, where public policy emphasizes water recycling. California law provides that the State's interest in conservation of water resources requires the maximum reuse of treated

Figure 1
Municipal Recycled Water Use in California in 2002



wastewater (Water Reuse Law, Water Code Sections 461-465). It also provides that the State should encourage Californians to develop water recycling projects to meet the State's water needs and augment surface and groundwater supplies (Water Reclamation Law, Water Code Sections 13500-13556).

In 1972, Congress passed the Clean Water Act (CWA), which limits pollution of the nation's waters. Then, in 1991, the California Water Recycling Act (California Water Code 13577) set recycling goals of 700,000 acre-feet of water annually by year 2000 and 1 million acre-feet annually by 2010. All of these laws help prompt more regulations, policies and public support to control treated wastewater.

In 2000, Senate Bill 2095 (Water Recycling in Landscaping Act) was approved by Governor Davis requiring any local public or private entity that produces recycled water and determines that within 10 years it will provide recycled water within the boundaries of a local agency, to notify the local agency of

that fact. In turn, local agencies are required to adopt and enforce within 180 days a specified recycled water ordinance, unless the local agency adopted a recycled water ordinance or other regulation requiring the use of recycled water in its jurisdiction prior to January 1, 2001.

In 2001, Assembly Bill 331 was passed requiring the Department of Water Resources to convene the 2002 Recycled Water Task Force with specified membership to advise the Department in investigating the opportunities and constraints to increasing the industrial and commercial use of recycled water.

The Task Force report to the Legislature, published in June 2003, contained a number of recommendations to guide the Legislature, State government, public agencies, the public and all water recycling stakeholders towards the safe and successful expansion of recycled water use to help meet the State's future water supply needs. The Task Force identified and adopted 26 issues with respective recommendations.

Progress has begun on several of the Task Force recommendations. For example, the SWRCB issued an Executive Memorandum to Regional Board Executive Officers on February 24, 2004, setting a new framework for regulating incidental runoff associated with recycled water use. AB 334 (Goldberg, Chapter 172, Statutes of 2003) gives communities additional flexibility to regulate water softeners as a source control measure. The following is a summary of the Task Force recommendations:

Funding for Water Recycling Projects: State funding for water reuse/recycling facilities and infrastructure should be increased beyond Proposition 50 and other current sources.

Community Value-Based Decision-Making Model for Project Planning: Local agencies should engage the public in an active dialogue and participation using a community value-based decision-making model in planning water recycling projects.

Leadership Support for Water Recycling: State government should take a leadership role in encouraging recycled water use and improve consistency of policy within branches of State government and local agencies should create well-defined recycled water ordinances and enforce them.

Educational Curriculum: The State should develop comprehensive education curricula for public schools; and institutions of higher education should incorporate recycled water education into their curricula.

State-sponsored Media Campaign: The State should develop a water issues information program, including water recycling, for radio, television, print, and other media.

Uniform Plumbing Code Appendix J: The State should revise Appendix J of the Uniform Plumbing Code, which addresses plumbing within buildings with both potable and recycled water systems, and adopt a California version that will be enforceable in the State.

DHS Guidance on Cross-connection Control: The Department of Health Services should prepare guidance that would clarify the intent and applicability of Title 22, Article 5 of the California Code of Regulations pertaining to dual plumbed systems and amend this article to be consistent with requirements included in a California version of Appendix J that the Task Force is recommending to be adopted.

Health and Safety Regulation: The Department of Health Services should involve stakeholders in a review of various factors to identify any needs for enhancing existing local and State health regulation associated with the use of recycled water.

Incidental Runoff: The State should investigate, within the current legal framework, alternative approaches to achieve more consistent and less burdensome regulatory mechanisms affecting incidental runoff of recycled water from use sites (implemented).

Uniform Interpretation of State Standards: The State should create uniform interpretation of State standards in State and local regulatory programs by taking specific steps recommended by the Task Force.

Water Softeners: The Legislature should amend the Health and Safety Code Sections 116775 through 116795 to reduce the restrictions on local ability to impose bans on or more stringent standards for residential water softeners. Within the current legal provisions on water softeners, local agencies should consider publicity campaigns to educate consumers regarding the impact of self-regenerative water softeners (implemented).

Uniform Analytical Method for Economic Analyses: A uniform and economically valid procedural framework should be developed to determine the economic benefits and costs of water recycling projects for use by local, State, and federal agencies.

Research Funding: The State should expand funding sources to include sustainable State funding for research on recycled water issues.

University Academic Program for Water Recycling: The State should encourage an integrated academic program on one or more campuses for water reuse research and education, such as through State research funding.

Funding Coordination: A revised funding procedure should be developed to provide local agencies with assistance in potential State and federal funding opportunities and a Water Recycling Coordination Committee should be established to work with funding agencies.

Regional Planning Criterion: State funding agencies should make better use of existing regional planning

studies to determine the funding priority of projects. This process would not exclude projects from funding where regional plans do not exist.

Funding Information Outreach: Funding agencies should publicize funding availability through workshops, conferences, and the Internet.

Department of Water Resources Technical

Assistance: Funding sources should be expanded to include sustainable State funding for DWR's technical assistance and research, including flexibility to work on local and regional planning, emerging issues, and new technology.

Project Performance Analysis: Resources should be provided to funding agencies to perform comprehensive analysis of the performance of existing recycled water projects in terms of costs and benefits and recycled water deliveries.

Recycled Water Symbol Code Change: The Department of Housing and Community Development should submit a code change to remove the requirement for the skull and crossbones symbol in Sections 601.2.2 and 601.2.3 of the California Plumbing Code.

Stakeholder Review of Proposed Cross-Connection Control Regulations: Stakeholders are encouraged to review Department of Health Services draft changes to Title 17 of the Code of Regulations pertaining to cross-connections between potable and nonpotable water systems.

Cross-Connection Risk Assessment: DHS should support a thorough assessment of the risk associated with cross-connections between disinfected tertiary recycled water and potable water.

Permitting Procedures: Various measures should be conducted to improve the administration and compliance with local and State permits.

Source Control: Local agencies should maintain strong source control programs and increase public awareness of their importance in reducing pollution and ensuring a safe recycled water supply.

Economic Analyses: Local agencies are encouraged to perform economic analyses in addition to financial analyses for water recycling projects and State and federal agencies should require economic and financial feasibility as two funding criteria in their funding programs.

Statewide Science-Based Panel on Indirect Potable

Reuse: As required by AB 331, the Task Force reviewed the 1996 report of the California Indirect Potable Reuse Committee and other related advisory panel reports and concluded that reconvening this Committee would not be worthwhile at this time. However, it is recommended to convene a new statewide independent review panel on indirect potable reuse to summarize existing and on-going scientific research and address public health and safety as well as other concerns such as environmental justice, economic issues and public awareness.

Benefits of Recycled Water

For many communities, an investment in recycled water could help solve other problems. It can be used to:

- control water pollution;
- restore wetlands and marshes;
- forestall a water shortage by conserving freshwater;
- provide additional reliable local sources of water, nutrients and organic matter for soil conditioning;
- provide drought protection;
- improve the economic efficiency of investments in pollution control and irrigation projects, particularly near urban areas; and
- improve social benefits by creating more jobs and improving human and environmental health protection.

How is Recycled Water Used?

Recycled water can satisfy most water demands as long as it is adequately treated. Figure 2, *Treatment Levels to Produce Recycled Water*, shows the most common treatment levels. It shows that quality improves and possible uses increase as the level of treatment increases. In uses where there is a greater chance of human exposure to the water, more treatment may be required.

In California recycled water can be used in a variety of ways, including agricultural irrigation, landscape irrigation, groundwater recharge, in industry, for the environment and recreation, and as indirect potable water source. Figure 3, *Direct and Indirect Recycled Water Use*, illustrates examples of planned and unplanned reuse types.

Figure 2
Treatment Levels to Produce Recycled Water

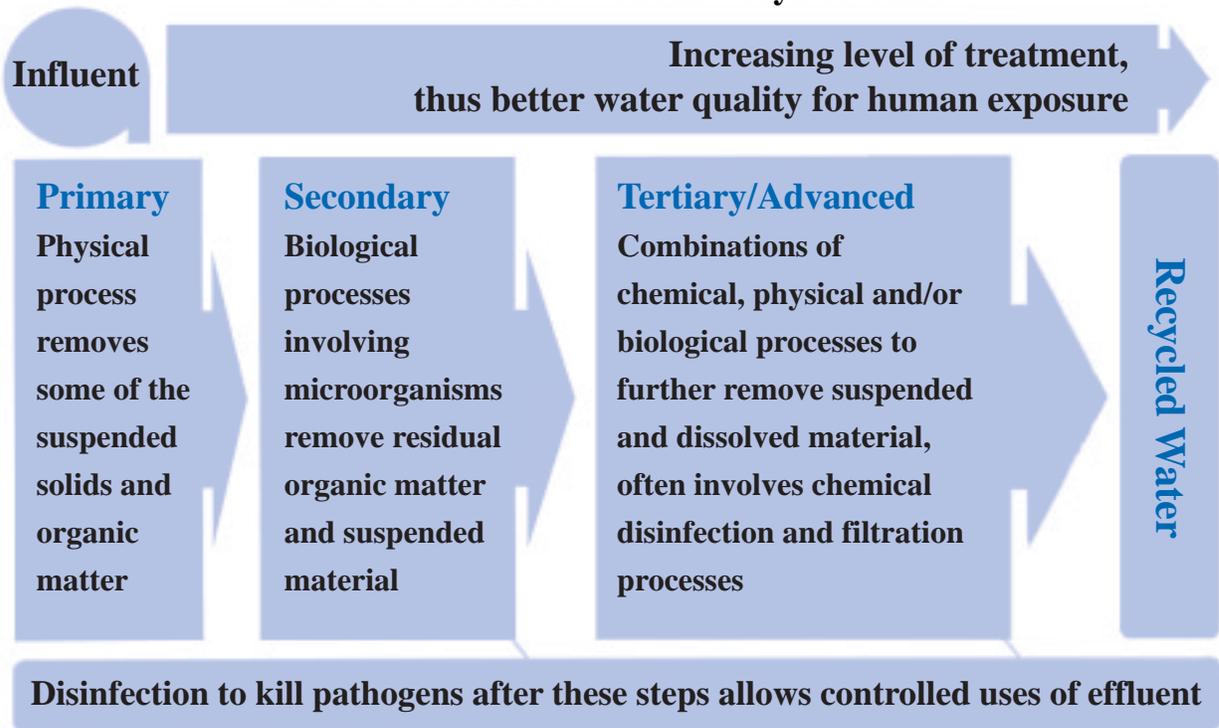
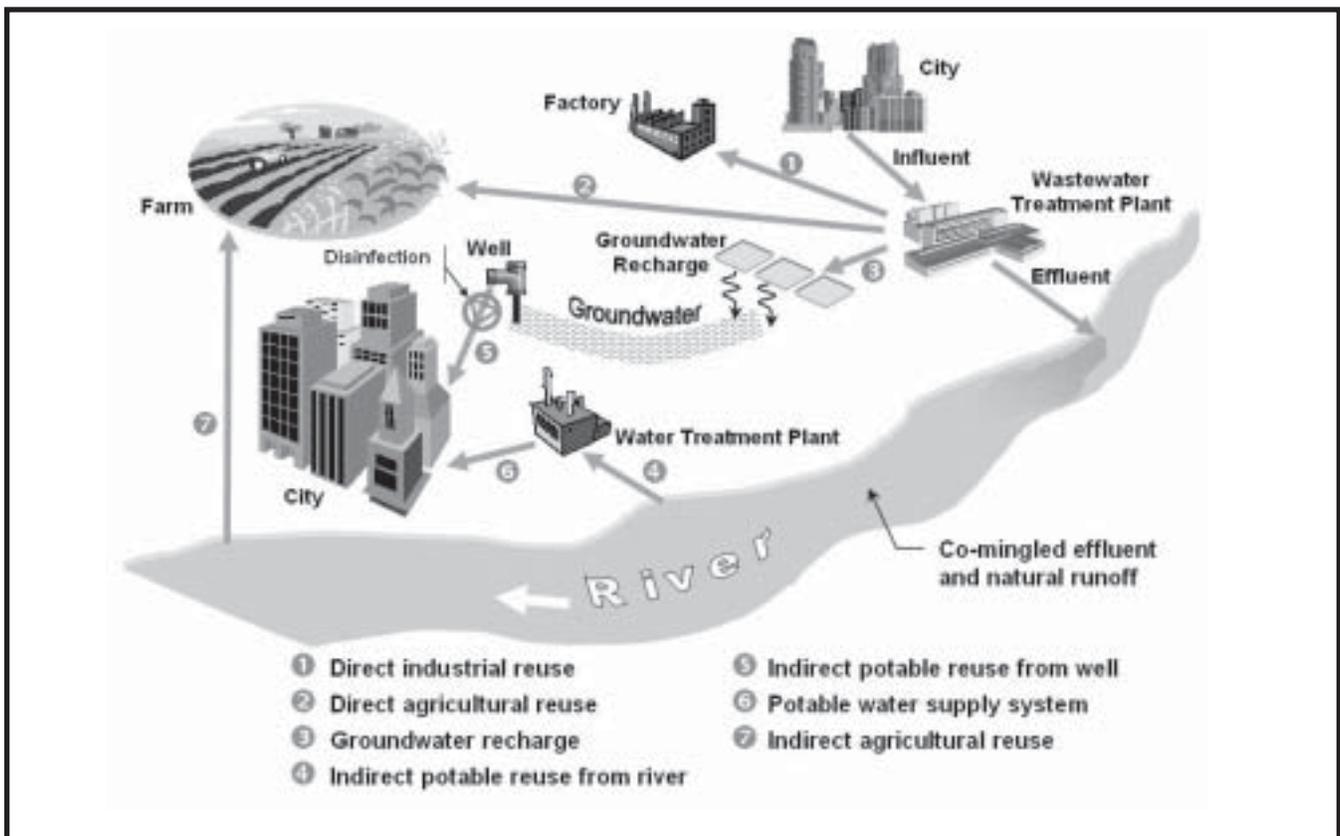


Figure 3
Direct and Indirect Recycled Water Use



Agriculture

California farmers use about 250,000 acre-feet of recycled water annually. A survey conducted in 1997 by the State Department of Water Resources and the Agriculture Committee of the WaterReuse Association indicated that 187,195 acre-feet of recycled water have been used on 61,553 acres of farm and ranch lands. It showed that recycled water in California is used to irrigate a wide variety of crops. In all, the survey found 52 different crops being grown with the help of recycled water. Its use for agriculture in California—and worldwide—has been shown to be economically and environmentally sound.



Landscape Irrigation

Over time, recycled water could be the main source of irrigation: for parks, playgrounds, golf courses, freeway landscaping, commercial and office building landscaping, and residential landscaping. In California, recycled water for landscape irrigation has increased from 40,000 acre-feet per year in 1987 to more than 111,000 acre-feet in 2002.



Groundwater Recharge

Recycled water can be used to recharge groundwater aquifers. It can replenish, restore, or protect groundwater against salt-water intrusion. Water spreading (percolation from a basin) and injection are the common groundwater recharge practices. High-quality water is necessary for injection. It may require advanced treatment such as reverse osmosis in addition to what is already required. In California, recycled water has been used to recharge aquifers since 1970s and according to the 2002 survey, ground-



water recharge including protection against salt-water intrusion accounts for approximately 15 percent of all recycled water annually. The portion of recycled water used for replenishing the groundwater keeps increasing as more groundwater recharge activities are undertaken.

Industry

The potential use for recycled water in industry is high. Recycled water can be purchased from a supplier. Or a factory, for example, can recycle its own effluent. As in other sectors, the use of recycled water in industry has increased from about 6,000 acre-feet per year in 1987 to more than 27,000 acre-feet a year in 2002. Industry can use recycled water for heat dissipation, power generation, and processing.



Environment and Recreation

Recycling can not only make extra water available, but also protect sensitive water bodies from pollution. Recycled water can help protect and maintain the environment. It has helped in the development of recreational lakes, marsh enhancement, and stream flow augmentation. It also can be impounded for urban landscape development. In 1987, about 10,000 acre-feet of water were used for such purposes. By 2002, such volume had increased to more than 53,000 acre-feet used for recreational impoundment and wildlife habitat enhancement.



Non-potable Urban Uses

Numerous non-potable domestic and urban uses of recycled water can be identified. Examples of such urban uses include the use of recycled water for fire protection, air conditioning, toilet and urinal flushing, artificial snow making, concrete mixing and dust control.



Indirect-potable Uses

Indirect potable uses include the recharge of potable aquifers and the replenishment of surface reservoirs.

Groundwater recharge with recycled water and indirect potable water reuse in



general share many

of the public health concerns encountered in drinking water withdrawn from polluted rivers and reservoirs. Four water quality factors are of special concern where recycled water is used in such applications: (1) enteric viruses and other pathogens; (2) organic and inorganic substances including industrial and pharmaceutical chemicals, residual home cleaning and personal care products and other persistent pollutants; (3) salinity; and (4) heavy metals. The ramifications of many of these constituents in trace quantities are not well understood with respect to long-term health effects. For example, there are concerns about exposure to chemicals that may function as endocrine disruptors; also the potential for development of antibiotic resistance is of concern. As a result, regulatory agencies are proceeding with extreme caution in permitting water reuse applications that affect potable water supplies.

Water Recycling Goals

The Water Recycling Act of 1991 set California water recycling goals at 700,000 acre-feet a year by 2000 and 1 million acre-feet by 2010. However, the most recent survey available conducted by the State Water Resources Control Board indicates that the 2000 goal was not attained. Nevertheless, water recycling is now an important component in water management plans and policies. Chances are that the goal of 1 million acre-feet a year by 2010 will be met or exceeded. The Recycled Water Task Force projected that by 2030, if financial resources become available to water recycling projects, the total recycled water use would increase from the current about 525,000 acre-feet to over 2 million acre-feet a year. Of that amount, about 1.6 million acre-feet would be considered as new water supply.

Where Do You Get More Information?

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Visit Our Web Site

Water Recycling and Desalination Branch

www.owue.water.ca.gov/recycle

Department of Water Resources

www.water.ca.gov

The California Water Plan Update considers recycled water that would otherwise be lost to the state's hydrologic system—water that would normally flow to the sea or a salt sink—as new water supply.

Demand Sectors and Examples of Minimum Treatment Levels for Specific Uses to Protect Public Health

<i>Types of Use</i>	<i>Treatment Level</i>		
	<i>Disinfected Tertiary</i>	<i>Disinfected Secondary</i>	<i>Undisinfected Secondary</i>
Urban Uses and Landscape Irrigation			
Fire protection	<input checked="" type="checkbox"/>		
Toilet & urinal flushing	<input checked="" type="checkbox"/>		
Irrigation of parks, schoolyards, residential landscaping	<input checked="" type="checkbox"/>		
Irrigation of cemeteries, highway landscaping		<input checked="" type="checkbox"/>	
Irrigation of nurseries		<input checked="" type="checkbox"/>	
Landscape impoundment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> *	
Agricultural Irrigation			
Pasture for milk animals		<input checked="" type="checkbox"/>	
Fodder and fiber crops			<input checked="" type="checkbox"/>
Orchards (no contact between fruit and recycled water)			<input checked="" type="checkbox"/>
Vineyards (no contact between fruit and recycled water)			<input checked="" type="checkbox"/>
Non-food bearing trees			<input checked="" type="checkbox"/>
Food crops eaten after processing		<input checked="" type="checkbox"/>	
Food crops eaten raw	<input checked="" type="checkbox"/>		
Commercial/Industrial			
Cooling & air conditioning - w/cooling towers	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> *	
Structural fire fighting	<input checked="" type="checkbox"/>		
Commercial car washes	<input checked="" type="checkbox"/>		
Commercial laundries	<input checked="" type="checkbox"/>		
Artificial snow making	<input checked="" type="checkbox"/>		
Soil compaction, concrete mixing		<input checked="" type="checkbox"/>	
Environmental and Other Uses			
Recreational ponds with body contact (swimming)	<input checked="" type="checkbox"/>		
Wildlife habitat/wetland		<input checked="" type="checkbox"/>	
Aquaculture	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> *	
Groundwater Recharge			
Seawater intrusion barrier	<input checked="" type="checkbox"/> *		
Replenishment of potable aquifers	<input checked="" type="checkbox"/> *		
*Restrictions may apply			

