Strategies for Water Reclamation:
The Role of Policy and Technology in the Las Vegas Water Supply

Final Report – ESD.10 Introduction to Technology and Policy

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Executive Summary

The goals of this report are to: (i) consider Las Vegas’ current water reclamation and reuse strategies using a case study framework to examine policy and reclamation technology issues in urban areas; and (ii) using this case study, develop general recommendations and best practices to guide the implementation of water reclamation technologies in the U.S. To accomplish these goals, the committee assessed: (i) the state of the art in water reclamation; (ii) how water management issues and the role of water reclamation are framed in Las Vegas; (iii) the perspectives and alignment of different groups of stakeholders involved in water management issues; and (iv) reclamation technology and policy interactions with respect to public perception, health, environment, regulation and incentives, and security issues.

Securing access to quality potable and non-potable water sources is a topic of increasing international and domestic concern due to growing population needs, urbanization, and changing climate. Many cities currently approaching the limits of their available water sources are exploring options for extending their water resources through other means. One approach to alleviating water shortages involves reducing demand for potable water by utilizing treated, reclaimed wastewater for non-potable purposes, such as landscape irrigation.

In 2003, the Department of the Interior launched its Water 2025 report, identifying Las Vegas as one of the six cities facing "chronic water supply problems in the West" (Bureau of Reclamation, 2003). Given its location in a water constrained area, coupled with a primary reliance on its allocated 5% of the Colorado River water, Las Vegas faces unique challenges in securing a safe, reliable water supply into the future (SNWA, 2006a). Las Vegas' water problem is exacerbated by large population growth amidst its worst drought in history (SNWA, 2006d; City of Las Vegas, 2006c). At the same time, the city is among the cleanest producers of reclaimed water in the U.S., and is engaging in innovative solutions to secure additional resources through negotiations with neighboring states, and the development of additional groundwater and surface water resources (CWC, 2006a; SNWA, 2006a). Las Vegas is implementing water reclamation as one of a number of extensive water conservation measures to manage its demand for potable water.

Las Vegas is currently discharging most of its highly treated effluent to Lake Mead for "return flow credits," a practice which ultimately enables increased withdrawals from the Colorado River but creates unplanned indirect reuse of potable water. Additionally, reclamation is helping offset potable water demands via Las Vegas' combined system of water reclamation facilities (SNWA, 2006a). These include centralized facilities and smaller decentralized treatment plants that directly supply non-potable reclaimed water to golf courses and other large point source users, as well as on-site water reclamation systems used by smaller-scale point source users such as hotels and resorts (CCWRD, 2006a; 2006d; City of Las Vegas, 2006a; 2006b; KUED, 2006). As Las Vegas develops its in-state water resources, which are not eligible for return flow credits, such direct non-potable water reuse will further increase in importance. Within this context, the committee has chosen to examine Las Vegas' water reclamation and reuse strategy in greater detail.
The new contributions of this report include:

- Providing an analysis of wastewater reclamation and reuse policies using a case study framework and applying them to a large U.S. city, Las Vegas;
- Applying wastewater technology and policy issues considered in previous NRC reports and U.S. wastewater reuse studies;
- Extrapolating specific best practices from the Las Vegas case study to guide implementation in other communities considering reclamation strategies; and
- Developing recommendations on wastewater reclamation for application at the national level.

From the Las Vegas case study, the committee also developed a set of generalized best practices when for states and municipalities to consider when implementing water reclamation projects in the U.S., outlined below.

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<th>Best Practices in Implementing Water Reclamation and Reuse Projects</th>
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<td>1) Issue framing is critical in developing successful wastewater reclamation and reuse programs and should be given specific attention through a formalized process.</td>
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<td>2) Identify stakeholders and involve them early in the decision-making process.</td>
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<td>3) Conduct extensive public education, with transparency in the dissemination of information on the benefits and risks associated with water reclamation projects.</td>
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<td>4) Develop an incentive-based framework to promote wastewater reuse.</td>
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<td>5) Consider the implementation of a combination of different wastewater reclamation and reuse systems based on specific demand requirements from end-users.</td>
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<td>6) Implement environmental management systems, such as EMS under ISO 14000 to quantify, manage, and mitigate environmental risks associated with water reclamation practices.</td>
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Based on the findings of the Las Vegas case study, the committee recommends the following:

- **The establishment of an entity within the EPA to work closely with states and local municipalities to advance and support wastewater reclamation.** This entity will provide a comprehensive service for local agencies considering the implementation or expansion of wastewater reclamation projects. In addition to serving as a clearinghouse on current regulatory, technological, health, and environmental considerations in wastewater reclamation, this entity will work with relevant authorities to establish or review national policies, guidelines, and strategies to advance efforts in wastewater reclamation.
• **The development and coordination of guidelines by EPA for state and municipal wastewater treatment and distribution regulations organized by non-potable end use to address any analysis gaps.** The EPA should work closely with states and municipalities to establish uniform design, construction, operation, and maintenance guidelines to minimize variability in program implementation and processes. These guidelines, if adopted, can help a state organize its utilities treatment and distribution systems by unifying the fragmented requirements of local, state, and federal regulation. Given the variability of current wastewater programs and the level of treatment discrepancies between states and municipalities, integration of wastewater system guidelines should occur on a federal level to insure wastewater treatment and distribution components are standardized through regulation.

• **The development of a Health Management System framework to facilitate control, auditing, and the quantification of uncertain health risks in water reclamation.** Although management systems are not sufficient to guarantee public safety, a comprehensive framework for control and assessment can help mitigate serious health risks. These systems should, at minimum, include preliminary risk assessment, water quality monitoring, health and safety testing, and the evaluation of overall system reliability (NRC, 1998: 3).

In addition, the committee recommends the following areas for further research:

• **The tools and frameworks to evaluate the efficacy of a flexible combination of wastewater reclamation and reuse systems need to be developed.** The development of integrated, consistent metrics pertaining to the efficiency and effectiveness of combination of different wastewater reclamation systems (centralized, decentralized and on-site) as a whole, is important towards investment decisions in new water reclamation infrastructure as well as in determining how well existing systems are performing. These metrics need to encompass the system as a whole, from the sources of wastewater, through treatment, all the way to distribution and end use.

• **There is an urgent need for further research on water quality monitoring and treatment, specifically with regards to: (i) estimating risks to health and the environment, (ii) the long term health effects of contaminants in reclaimed water, (iii) detection and monitoring of pathogen levels in reclaimed water, and (iv) methods for assessing and improving water reclamation system reliability.** Despite the effectiveness of advanced water treatment processes, there are inherent uncertainties in the effectiveness and reliability of these systems. As a result, further research is essential in mitigating the risks to human health posed by indirect reuse of potable water.