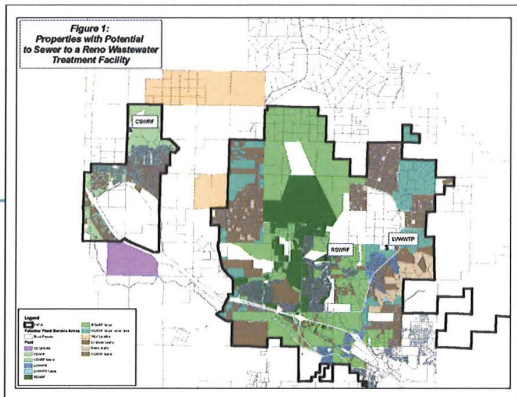
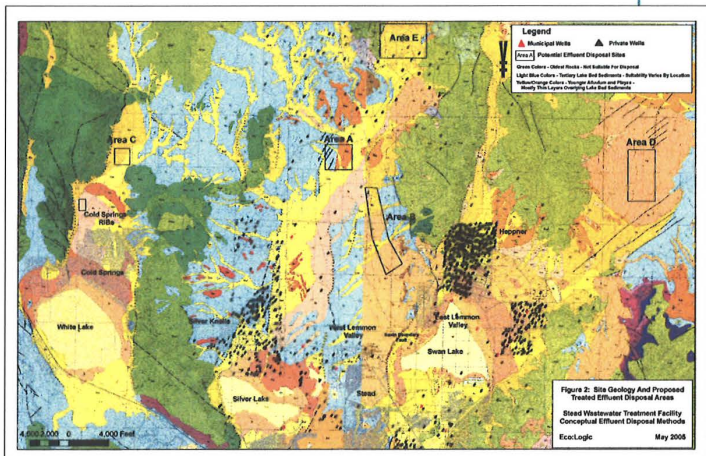


# North Valleys Effluent Disposal Options



Prepared for:  
 City of Reno and  
 Regional Water Planning Commission

Prepared by:  
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September 2005

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Consulting Engineers

PLF 1630

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## North Valleys Effluent Disposal Options

Project No. RENO04-002

Prepared For: City of Reno and Regional Water Planning Commission  
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Date: September 6, 2005  
Subject: Analysis of Effluent Disposal Options for the North Valleys

### INTRODUCTION

ECO:LOGIC is under contract to both the Regional Water Planning Commission (RWPC) and the City of Reno for evaluation of effluent disposal strategies in the North Valleys. The two separate scopes of work are complementary, not redundant. The RWPC scope focuses on long-term issues associated with management of wastewater in this closed basin such as water quality, viability of in-basin effluent disposal strategies, summarized reporting of water / wastewater / flood control infrastructure costs and coordination with ongoing flood control planning.

The City of Reno scope of work is more detailed, including an update to the projected wastewater flows, comprehensive examination of effluent disposal strategies both in-basin and via exportation to other basins, and investigation of the cost of wastewater treatment technologies that might be required for different effluent disposal strategies.

The results of these two sets of analyses are presented together in this report in order to present a comprehensive picture of the wastewater treatment and disposal options for the North Valleys that can be used by both project sponsors.

As of the date of this report, there is insufficient information to provide the water infrastructure and flood control costs that are a part of the RWPC scope of work. Separate contracts for water facility planning and flood control planning for the North Valleys was approved by the RWPC at its August 17<sup>th</sup>, 2005 meeting. This information will be presented at a later date as it is completed by ECO:LOGIC and Quad Knopf under separate contracts.

### PLANNING AREA AND LAND USE ASSUMPTIONS

This report summarizes the options for disposal of wastewater effluent that could be generated at the build-out of approved land uses within the portion of the Truckee Meadows Service Areas (TMSA) lying in the Stead/Lemmon Valley region of Washoe County. Also included in the analysis is a projection of additional wastewater flow that could be generated if proposed land use intensifications are approved through the local and regional planning processes. The

proposed land use intensification data was obtained from developers and is used for planning purposes only. Inclusion of these proposals is not intended to imply any level of local or regional approval and is included for informational purposes only. Additionally, the proposed intensifications represent the most current information at a particular point in time. Particular proposals will be in a state of flux until such time as they receive local and regional approvals.

The chief purpose of the memorandum, therefore, is to assist the City of Reno and RWPC in planning for long-range wastewater treatment and disposal needs for this region, including areas within the City of Reno, unincorporated areas, and areas outside the TMSA that have yet to receive development approvals but for which there is local knowledge of a desire for development.

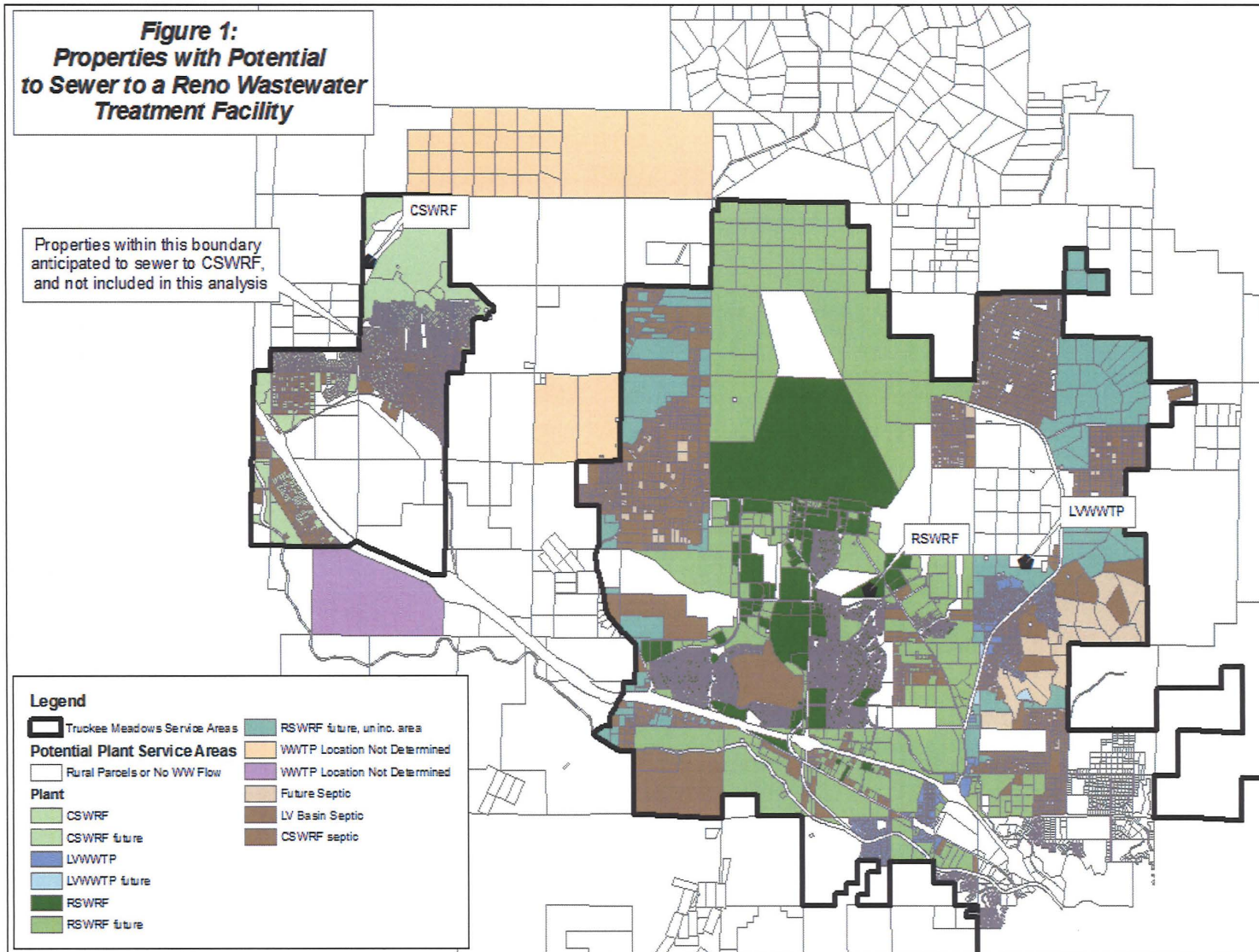
No analysis is provided with respect to Washoe County's Cold Springs Water Reclamation Facility (CSWRF) or the area where it currently provides service.

Figure 1 shows the location of existing wastewater treatment facilities in the North Valleys with parcels color coded based on where wastewater is currently treated as well as possible service areas for new treatment facilities.

Previous facility planning for this region was limited to lands within the TMSA boundary. In the current planning effort, additional properties that are included in a proposed annexation to the City of Reno are also included (Cold Springs Annexation). The land use density used to evaluate the annexation area is that proposed by the developer and does not imply any local or regional government approval.

Within the TMSA boundary, there are some properties where developers have proposed to intensify land uses. A parallel analysis was performed for these properties to include wastewater flows generated from approved land uses, as well as the potential additional flow that could be generated with approval of the proposed intensifications.

Wastewater treatment facilities within the planning area include the Reno-Stead Water Reclamation Facility (RSWRF) owned by the City of Reno, the Lemmon Valley Wastewater Treatment Plant (LVWWTP) owned by Washoe County, and the Cold Springs Water Reclamation Facility (CSWRF) owned by Washoe County.



The last update to the 208 Water Quality Management Plan (WQMP) was in September 1994. At the time, the Cold Springs plant was not yet built. Within the WQMP, the North Valleys portion of Washoe County is divided into areas requiring sewer service and areas on individual septic disposal systems (Figure 1 of WQMP). Delineation of service areas for the North Valleys plants was not included in the plan.

Table 1 identifies each of the existing treatment facilities, its current capacity, and current means of effluent disposal.

TABLE 1  
EXISTING NORTH VALLEYS WASTEWATER TREATMENT FACILITIES

Facility	Capacity	Effluent Disposal Method	Comments
RSWRF City of Reno	1.10 MGD	Irrigation and Disposal to Swan Lake Playa	Under expansion to 2.0 MGD
LWWWTP Washoe County	0.30 MGD	Disposal to Swan Lake Playa	To be decommissioned and flows diverted to RSWRF, time uncertain
CSWRF Washoe County	0.35 MGD	Rapid Infiltration Basins	Under expansion to 0.7 MGD

### SUMMARY OF CONCLUSIONS

At build-out of the planning area, there is the potential for the City of Reno to need to manage a total potential wastewater flow of 7.0 MGD. This flow estimate is based on approved land uses, proposed intensification of land uses, the conversion of existing and future septic tanks, and the diversion of the LWWWTP flows to the Reno-Stead Water Reclamation Facility. Within the same planning area, there is the potential for up to 2,900 AF of effluent irrigation demand based on existing demands and landscaping requirements for yet undeveloped non-residential properties within the City of Reno's jurisdictional area.

Based on a treatment capacity of 2.0 MGD, disposal methods for the treated effluent from RSWRF presently include discharge to Swan Lake and effluent reuse. The recently constructed solids pump station and WAS pipelines tie to the collection system serving TMWRF. These facilities add limited capacity for indirect effluent disposal, and provide up to 0.9 MGD of capacity to pump raw wastewater from RSWRF to TMWRF.

Nine alternatives have been evaluated for the disposal of the remaining effluent that could potentially be generated. The alternatives include:

1. Expanded Effluent Reuse
2. Rapid Infiltration Basins
3. Direct Injection/Aquifer Storage and Recovery
4. Vadose Zone Infiltration Wells
5. Convey Sewage to TMWRF
6. Surface Discharge of Effluent to Bedell Flat
7. Pyramid Lake Discharge
8. Convey Effluent to Spanish Springs
9. Surface Discharge of Effluent to Long Valley Creek



An evaluation and ranking matrix was developed to compare the nine effluent disposal options, which considers such factors as cost, potential water resource benefits, operational flexibility, ease of implementation and requirements for agency/partner agreements.

The top three ranked disposal alternatives are:

Option 5: Convey a Portion of the Effluent to TMWRF, \$41.159 million

Option 1: Expanded Effluent Reuse, \$34.166 million

Option 4: Infiltration of Effluent with Vadose Zone Wells, \$33.950 million

Alternative 1, expanded effluent reuse and Alternative 4, vadose zone infiltration wells, are the lowest cost options. However, they do not appear to be independently capable of satisfying the total effluent disposal needs. Alternative 5, conveying a portion of the effluent to TMWRF, is the least cost alternative that could be implemented independently to handle projected increases in wastewater flows.

From a non-cost perspective, conveying a portion of the effluent to TMWRF is also the highest ranked alternative. This option appears to provide the greatest potential water resource benefits, has clear regulatory implementation requirements, and is a good option for either a portion of the effluent flow or as a stand alone alternative. One potential drawback to this alternative is that it would accelerate the time when TMWRF would need to make improvements to continue to comply with the Total Dissolved Solids TMDL on the Truckee River.

Expanded effluent reuse and vadose zone infiltration wells also rank high from a non-cost perspective. Effluent reuse would provide a non-potable irrigation supply and would lessen the demand on potable water resources in Stead. However, reuse is only a good disposal option during the irrigation season, and it would need to be combined with other disposal alternatives.

Vadose zone wells appear to be the best option for infiltrating effluent compared to RIBs and direct injection wells. From a water resource perspective, infiltrating a portion of the effluent would keep water in the basin to help balance the regional groundwater resource overdraft issue, and it may be possible to recover and use the water in the future. Vadose zone wells have a small land requirement and provide similar soil aquifer treatment benefits compared to RIBs.

These disposal options, implemented in some combination with one another, together with discharge of up to 2 MGD to the Swan Lake Playa and continuation of the existing reuse program, provide the best opportunity to cost effectively manage effluent disposal in Stead.

Further work is needed to fully define the effluent disposal implementation plan. This work includes establishing the recommended capacity of each disposal alternative, taking into consideration the ultimate planned capacity for the RSWRF, phasing opportunities, the seasonal variation in flow, and the physical constraints associated with each disposal method. An overview of the additional work required to develop the plan is presented at the end of this report.

## **DEVELOPMENT PROJECTIONS AND WASTEWATER FLOWS**

At build-out of the planning area, there is the potential for the City of Reno to need to manage a total potential wastewater flow of 7.0 MGD. This flow estimate is based on approved land uses, proposed intensification of land uses, the conversion of existing and future septic tanks, and the

diversion of the LVWWTP flows to the Reno-Stead Water Reclamation Facility. Within the same planning area, there is the potential for up to 3,300 AF of irrigation demand based on existing demands and landscaping requirements for yet undeveloped non-residential properties within the City's jurisdictional area.

A complete description of the methodology used to project the build-out of approved land uses, proposed land use intensifications, and resultant wastewater flows is contained in Appendix A. Following is a brief outline of the approach.

The Truckee Meadows Regional Planning Agency (TMRPA) has developed a GIS based model of approved land uses within southern Washoe County. The first release of the model was based on July 2004 assessor data from Washoe County, and approved developments within the Cities of Reno and Sparks, and Washoe County as of that time. TMRPA anticipates updating the model annually.

Wastewater flow factors were applied as attributes to the land use model, and multiplied by number of units or number of employees at the parcel level of detail to arrive at an estimate of wastewater flow for each parcel. Tracking wastewater flow at the parcel level in a GIS is a useful tool that provides the capability of summarizing flows within any sub-area of interest, whether it is a sewer-shed boundary for wastewater modeling, a political boundary, or a wastewater treatment plant service area.

Wastewater flows were first calculated for existing developed parcels, and then summarized to calibrate flow factors against existing known flows such as lift station flow records and total flow to the RSWRF. Individual parcel flows were also compared against water consumption records provided by the Truckee Meadows Water Authority for the winter months of 2003.

With parcel level calculation of flows, it was necessary to apply a methodology for estimation of non-residential flows. This is difficult because it's not possible to predict the type of development that may actually occur on a commercial or industrial property and water consumption can vary greatly. TMRPA staff has made an effort to predict building square footage for non-residential land uses based on analysis of the typical development that has already occurred in the area. From building square footage and master planned land use, TMRPA staff calculated an estimated number of employees per parcel. ECO:LOGIC then applied a flow-rate per employee to estimate future wastewater flow generation for these non-residential parcels.

Table 2 contains the summarized results of this analysis. The total potential flow from future development and conversion of septic tanks is 5,339,000 GPD average flow. Adding the existing flow for RSWRF and LVWWTP gives a total potential wastewater flow at build-out of this land use model of 6,984,000 GPD (rounded to 7.0 MGD for later use in this memo).

TABLE 2  
DEVELOPMENT AND WASTEWATER FLOW PROJECTIONS

Area	Future Units	Future Non-Residential Building Square Footage	Future Estimated Employees	Future Increment of Wastewater Flow (Average GPD)
<b>City of Reno</b>				
Approved Development	6,040	55,599,000	60,300	1,994,000
<b>Unincorporated Washoe County</b>				
Approved Development	2,539	292,000	600	518,000
<b>Proposed Intensifications</b>				
Proposed Intensification – Reno area	6,957	13,471,000	33,000	1,820,000
Proposed Intensification – Uninc. area	1,761	0	0	352,000
Proposed Intensification Totals	8,718	13,471,000	33,000	2,172,000
<b>Approved and Proposed Totals</b>				
	<b>17,297</b>	<b>69,363,000</b>	<b>93,900</b>	<b>4,684,000</b>
Conversion of Existing Septic Tanks	2,349			617,000
Conversion of Future Septic Tanks	153			38,000
<b>Total Potential Future Increment including Septic Tanks</b>				<b>5,339,000</b>

Another component of the analysis was non-potable irrigation demand, a potential disposal option for effluent during the irrigation season. Existing demand during the 2004 irrigation season was 517 AF with effluent delivered to Mayors Park, the Sierra Sage Golf Course, and the North Valleys Regional Sports Complex. Future potential irrigation demands are difficult to estimate because it is largely dependent on the cost feasibility of extending new infrastructure. For the purposes of this analysis, potential irrigation demand for non-residential land uses was estimated based on City of Reno landscaping requirements. Based on this evaluation, there is a potential future irrigation demand of 2,819 AF/year. If this demand were 100% realized there could be a total future irrigation demand of 3,336 AF/year (rounded to 3,300 AF for later use in this memo).

#### EXISTING EFFLUENT DISPOSAL PRACTICES

Based on a treatment capacity of 2.0 MGD, disposal methods of the treated effluent from RSWRF presently include discharge to Swan Lake and effluent reuse. The recently constructed solids pump station and WAS pipelines tie to the collection system serving TMWRF. These facilities add limited capacity for indirect effluent disposal, and provide up to 0.9 MGD of capacity to pump raw wastewater from RSWRF to TMWRF, which increases operational flexibility and redundancy.

#### Discharge to Swan Lake

A prior analysis was performed to evaluate the potential increase in flood level in Swan Lake resulting from an increased discharge from the RSWRF. This analysis took into account the original 1987 FEMA flood insurance study, "Hydrologic Analysis of Silver Lake and Lemmon Valley Playas" (Nimbus Engineers, 1987) and current topographic data for the playa. Pertinent

methodology and flood insurance study information is presented in the RSWRF Expansion Preliminary Design Report<sup>1</sup>.

Four scenarios were evaluated, with each scenario including a potential discharge of 0.65 MGD from the LVWWTP during the month of March to Swan Lake. Scenario A represents the 100-year maximum storage volume, which accounts for an estimate of initial storage and the possibility of multiple events in the same season. Scenario B represents the current permitted condition, which incorporates the permitted discharge of 1.5 MGD from RSWRF to Swan Lake.

No effluent reuse is considered. Scenario C is based upon a discharge of 2.0 MGD from RSWRF to Swan Lake, with no reuse. Scenario D is based upon a discharge of 2.0 MGD, minus the existing reuse demand of 380 AF. Scenarios B, C and D assume that the effluent volume is completely separate from the flood volume, and that the two volumes are additive. This methodology provides a conservative estimate of changes to the Swan Lake water level.

In general, the maximum storage volume occurs in March. Increasing the discharge rate from the RSWRF from 1.5 MGD to 2.0 MGD may cause a small increase (0.09 to 0.12 feet) in the 100-year water surface elevation of the lake, as shown in Table 3.

TABLE 3  
SUMMARY OF SWAN LAKE DISCHARGE EVALUATIONS

Scenario	Scenario Description	FEMA Flood Volume (acre-feet)	Maximum Volume of Effluent in Lake (acre-feet)*	Maximum Estimated Flood Volume (acre-feet)	Stage Elevation (NAD 88)	Change in Max. Stage Elevation from 100-Year Event (ft)
A	100-year Event	11,598	0	11,598	4923.70	0.00
B	100-year Event & 1.5 MGD - No Reuse	11,598	430	12,028	4923.91	0.21
C	100-year Event & 2.0 MGD - No Reuse	11,598	664	12,262	4924.03	0.33
D	100-year Event & 2.0 MGD - Exist Reuse (380 AF)	11,598	608	12,206	4924.00	0.30

\* HEC-1 was used to produce conservative estimates for maximum effluent storage volumes in the playa during a dry year. These maximum effluent storage volumes were then added to the 100-year flood event storage volume. Effluent storage in the playa peaks in March. Effluent flows include 0.65 MGD from the Lemmon Valley WWTP during the month of March, and constant daily effluent flow from the RSWRF.

<sup>1</sup> RSWRF Expansion, Preliminary Design Report, April 2004. Technical Memorandum No. 8, "Wastewater Discharge and Effluent Reuse."

The permitted effluent discharges from the RSWRF and the LWWTP were not specifically quantified in the 1987 FEMA flood insurance study as components of the flood volume. Allowance was made for some initial storage in the playa, which one may reasonably infer takes into account other variable water contributions, such as the historical effluent discharges to the playa, carry-over storage from one year to another and other uncertainties.

The required minimum discharge of 490 AF to the Swan Lake wetlands, the existing permitted discharge of 1.5 MGD, and the proposed discharge of up to 2.0 MGD all may influence the 100-year maximum storage volume and the resultant water level of the playa to some extent. The potential increase of up to 0.09 to 0.12 feet associated with disposal of an additional 0.5 MGD is relatively insignificant considering other factors. Potentially more significant are the variables and assumptions used in the original FEMA analysis, the 0.3 foot FEMA rounding down correction, the allowance for initial storage, more accurate topographic information now available, and changes to development of the contributory drainage area that have occurred since 1985.

### **Effluent Reuse**

Under current operation, the RSWRF sends an average of 0.70 MGD, or about 65% of its total flow to be used for irrigation from March to October. All of the effluent is discharged to the Swan Lake playa from November to February. Approximately 0.05 MGD (33 AFA) of effluent is sent to Mayors Park, and 0.9 MGD (591 AFA) is sent to the Sierra Sage Golf Course. Effluent is also supplied to Washoe County's North Valley Regional Sports Complex, where the demand is expected to taper off to about 0.15 MGD (99 AFA).

### **Solids Pumping Station and Waste Activated Sludge Lines**

The City of Reno recently completed construction of improvements to the solids handling facilities at the RSWRF, consisting of a new Solids Pumping Station and sludge discharge pipelines to pump solids from the RSWRF to the Truckee Meadows collection system.

The available design capacity in the discharge pipelines is in excess of 650 GPM or 0.9 MGD. These facilities add limited capacity for indirect effluent disposal. These facilities have the capability of pumping raw wastewater from RSWRF to TMWRF as an interim solution to shave peak flows from the plant, which provides the RSWRF with operational flexibility, reliability and redundancy.

### **EVALUATION OF WATER QUALITY, REGULATORY REQUIREMENTS FOR REUSE / RECHARGE OF EFFLUENT, AND WASTEWATER TREATMENT TECHNOLOGIES**

In conjunction with evaluating options for effluent disposal, ECO:LOGIC has prepared a number of Technical Memoranda that provide information regarding effluent water quality, existing and proposed regulations in Nevada and other states with significant reuse regulations and programs, and the efficacy of various treatment technologies in removing certain constituents from wastewater effluent. A listing of these memoranda and brief description are included below for reference:

#### **Appendix E: A Suitability Analysis for Sub-Surface Application of RSWRF Effluent**

This memorandum compares the constituents in RSWRF effluent with drinking water standards.

#### **Appendix F: Wastewater Treatment Technology for Indirect Potable Recycled Water Uses**

This memorandum reviews the efficacy of various treatment technologies that have been used to treat wastewater effluent to a standard that is acceptable for indirect potable reuse based on various agency requirements.

**Appendix G: Removal of Endocrine Disrupting Compounds (EDCs) and Pharmaceutical and Personal Care Products (PPCPs)**

This memorandum provides a literature review of the current knowledge base regarding EDC and PPCP removal technologies.

**Appendix H: Preliminary Geochemical Model Prediction of Chemical Precipitation due to Wastewater Injection**

This memorandum reports the results of a preliminary model run using RSWRF and deep groundwater sample chemical analyses to predict the potential for precipitation and aquifer/well plugging to occur with recharge of wastewater effluent in the North Valleys.

**Appendix I: Preliminary Evaluation of Potential Total Dissolved Solids Accumulation**

This memorandum includes a preliminary review of the potential for increases in TDS within the aquifer in the North Valleys as a result of a number of existing and proposed water management strategies, including the potential recharge of wastewater effluent.

## **DESCRIPTION OF EFFLUENT DISPOSAL OPTIONS EVALUATED**

At build-out of the land uses considered in this study, there could be a total wastewater flow of up to 7.0 MGD. Of this, an annual average of 2.0 MGD may be disposed using a combination of effluent reuse and discharge to the Swan Lake Playa under the pending permit for the RSWRF. Table 4 identifies nine alternatives that have been evaluated for the disposal of the remaining effluent that could potentially be generated. The level of treatment identified for each option is not necessarily based on current regulatory requirements, but rather on the current level of treatment at the RSWRF. This treatment level could exceed regulatory requirements for some disposal options. A detailed analysis of the treatment requirements and estimated costs is included in Appendices B and J.

For the purposes of comparing the alternatives, a flow-rate of 4.8 MGD was selected. 4.8 MGD represents a base case development potential over the next 20+/- years, and does not include conversion of existing septic systems, and proposed land use intensifications. The build-out flow of 7.0 MGD represents a number of assumptions, including local and regional approval of proposed land use intensifications in both the Lemmon Valley and Cold Springs hydrobasins.

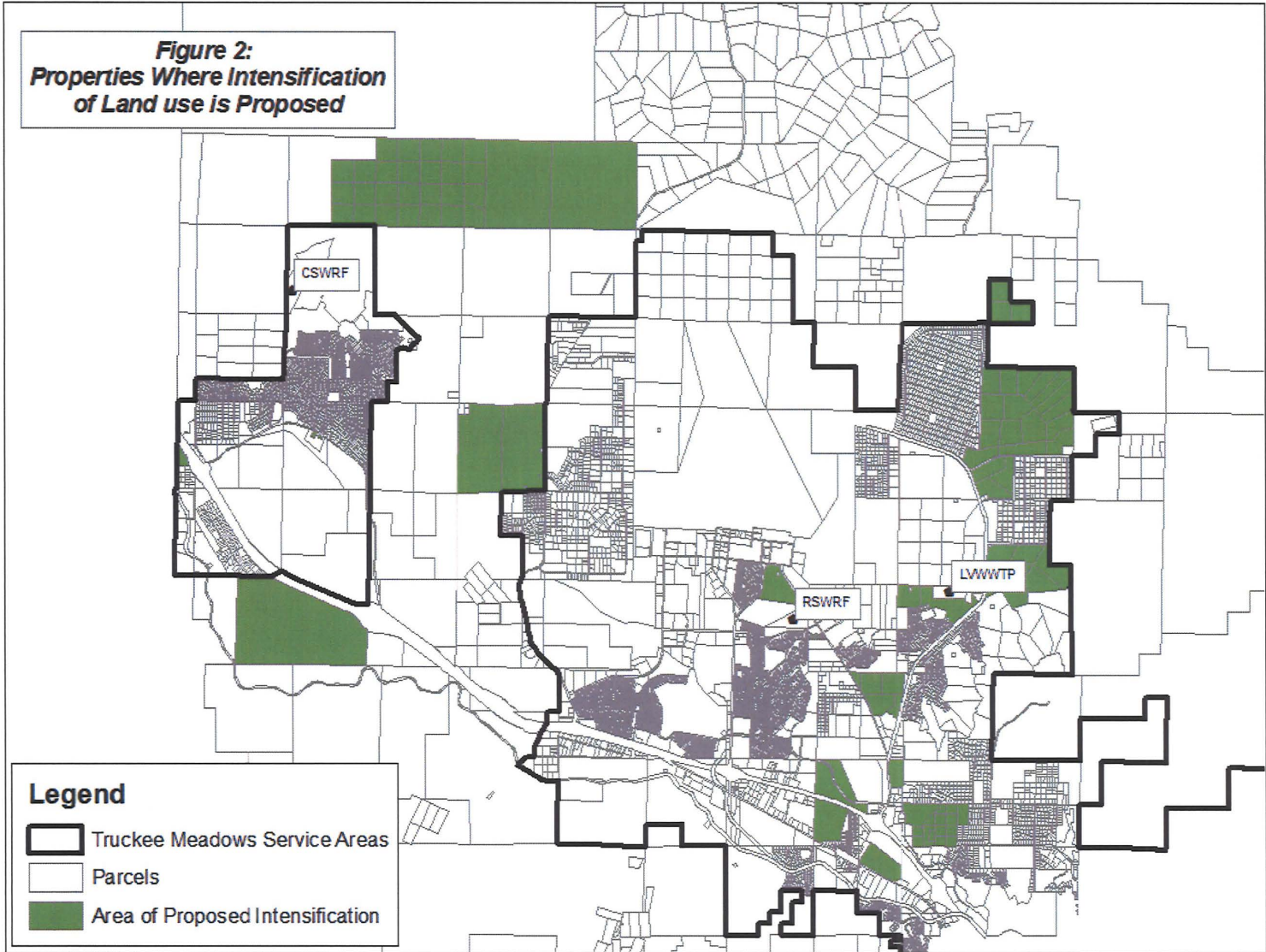
Options 2, 3 and 4 all involve infiltration of effluent by different methods in the Lemmon Valley hydrobasin. These infiltration methods include rapid infiltration basins (RIBs), direct injection and vadose zone wells. Appendix C includes a detailed evaluation of the different effluent infiltration methods, including a summary of their potential benefits and drawbacks, reliability issues, operations and maintenance requirements and the applicable regulatory framework. Groundwater infiltration selection criteria were developed, potential effluent disposal locations identified, and the different infiltration methods ranked relative to one another.

The nine effluent disposal options, the assumed level of treatment and treatment location are summarized in Table 4. Figure 2 depicts the general location of the disposal options, together with hydrobasin boundaries and a representation of the required disposal pipelines. Following

Figure 2, each disposal option is summarized, including a general description, information on the treatment and disposal facilities, a planning level estimate of cost, identification of potential stakeholders or partners, potential benefits and concerns, and water rights considerations.

TABLE 4  
EFFLUENT DISPOSAL OPTIONS

Option	Description	Level of Treatment	Treatment Location
1	Expanded Effluent Reuse	Tertiary	RSWRF
2	Rapid Infiltration Basins	Tertiary	RSWRF
3	Direct Injection/Aquifer Storage and Recovery	Membrane Bio-reactor/UV disinfection	RSWRF
4	Vadose Zone Infiltration Wells	Tertiary	RSWRF
5	Convey Sewage to TMWRF	Tertiary	RSWRF for 2.0 MGD, TMWRF for remainder
6	Surface Discharge of Effluent to Bedell Flat	Tertiary	RSWRF
7	Pyramid Lake Discharge	Tertiary	RSWRF
8	Convey Effluent to Spanish Springs	Tertiary	RSWRF
9	Surface Discharge of Effluent to Long Valley Creek	Membrane Bio-reactor w/UV disinfection	RSWRF or Cold Springs Satellite Plant





## **OPTION 1 – EXPANDED EFFLUENT REUSE**

Presently, it does not appear to be practical to extend effluent reuse facilities throughout the area for the purpose of serving all potential effluent demands. A more reasonable course of action would be to supply on-demand effluent reuse where it makes sense (no seasonal storage), and continue permitted discharges to the wetlands and Swan Lake. Potential new reuse customers include J.C. Penney and a local elementary/middle school, as the existing reuse pipeline is located near these two sites. Conversion of TMWA's Stead Main to an effluent reuse main would also allow RSWRF to serve sites outside of the Stead / Lemmon Valley area, such as Rancho San Rafael Park. The Stead Main is schedule to be replaced by TMWA as early as 2007.

### **Description of Treatment and Disposal Facilities**

The assumption is that the existing and planned level of wastewater treatment at the RSWRF would be continued. The plant would be expanded to 4.8 MGD with continuation of the existing tertiary treatment technologies.

- 2.0 to 4.8 MGD expansion (tertiary treatment): new reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, tertiary filters, chlorine contact basin, splitter box
- Effluent transmission: 314 hp, 3,600 GPM effluent pump station, 25,200 lf of 6" to 18" diameter pipe and a 2 MG diurnal storage tank

**Planning Level Estimate of Cost:** \$34,166,000

### **Potential Stakeholders/Partners**

Reuse customers, TMWA, Washoe County.

### **Potential Benefits**

Reclaimed water provides a non-potable water supply source to meet a portion of the area's irrigation needs. With the Stead Main conversion, areas presently supplied with raw or potable irrigation water are good candidates for reclaimed water.

### **Potential Areas of Concern**

Reliance on private parties to enter into effluent reuse agreements. TDS of RSWRF effluent will be higher than reclaimed water from TMWRF (future TDS estimated at 600 mg/l).

Need to perform field investigations to verify the structural integrity of the Stead Main.

### **Water Rights Considerations**

Implementation of the Stead Main conversion to effluent may free up Truckee River water rights for new development within the Central Truckee Meadows. Secondary use water rights for the effluent could be sold to help offset the costs of the required distribution system infrastructure. Use of reclaimed water would extend the use of potable water supplies to the area.

## **OPTION 2 - RAPID INFILTRATION BASINS (RIBS) IN LEMMON VALLEY HYDROBASIN**

Review of slopes, geology, locations of municipal and domestic wells, runway setbacks, land use, and land ownership have resulted in the identification of an area with potential for location of rapid infiltration basins that is generally north of the airport on Washoe County, Airport Authority, or BLM land. One limitation to the potential use of RIBs is the land requirement for the disposal area.

### **Description of Treatment and Disposal Facilities**

The assumption is that the existing and planned level of wastewater treatment at the RSWRF would be continued. The plant would be expanded to 4.8 MGD with continuation of the existing tertiary treatment technologies.

- 2.0 to 4.8 MGD expansion (tertiary treatment): new reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, tertiary filters, chlorine contact basin, splitter box
- Effluent transmission: 214 hp effluent pump station, 29,600 lf of 14" pipe
- Estimate 56 acres of RIB disposal area (50,000 gpd/acre)

**Planning Level Estimate of Cost:** \$37,680,000

### **Potential Stakeholders/Partners**

Washoe County, TMWA, Airport Authority, BLM

### **Potential Benefits**

Keeps water in the basin to help balance the water resources in the valley, maintaining the ability to extract it again at a later date.

### **Potential Areas of Concern**

It would be important to perform field investigations to verify infiltration rates and sub-surface storage capacity to ensure sustainability as a long-term disposal strategy. Issues that may be of concern include the long-term build-up of salts in the aquifer and the fate of chemical constituents that may be present in the effluent, but that are not currently regulated by NDEP. Column testing for soil attenuation or advanced treatment, along with groundwater modeling, could provide clarity on long-term treatment and management strategies.

### **Water Rights Considerations**

Future extraction of effluent for satisfaction of non-potable demands could offset demands on potable water. There is no benefit with respect to Truckee River water rights; return-flow water rights would still be required for dedication under this option.

### **OPTION 3 - DIRECT INJECTION / ASR IN LEMMON VALLEY HYDROBASIN**

There are several potential advantages to direct injection of effluent over RIBs in this area. There are a couple of options that have emerged with respect to sites. One is a canyon in private ownership on the north end of the study area where injection and recovery wells could be placed about a mile apart, allowing the potential for soil attenuation of constituents in the effluent. Another possibility is to locate a well injection field on the Airport Authority property where there is adequate distance from domestic and municipal production wells. Injection wells could be designed with the intent to minimize direct mixing of effluent and potable water bearing strata. State regulatory requirements are not clear (there are no currently permitted direct injection facilities in Nevada). The assumption is that advanced tertiary treatment would be required (membrane bio-reactor (MBR) with ultra-violet (UV) disinfection).

#### **Description of Treatment and Disposal Facilities**

- 2.0 to 4.8 MGD expansion (MBR with UV): New reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, filter feed pump station, membrane filters and UV facilities, splitter box
- Effluent transmission: 214 hp effluent pump station, 29,600 lf of 14" pipe
- Injection wells: 6 injection/recovery wells (combined) and pilot program to evaluate injection flow-rate potential.

**Planning Level Estimate of Cost:** \$42,376,000

#### **Potential Stakeholders/Partners**

Airport Authority, TMWA, Washoe County, private property owners if injection wells are located north of airport

#### **Potential Benefits**

Keeps water in the basin to help balance the water resources in the valley, and provides for possible future recovery. The location of facilities is more flexible than RIBs without runway buffer requirements. The recovery infrastructure would be constructed as part of the project.

#### **Potential Areas of Concern**

It would be important to perform field investigations to verify infiltration rates and sub-surface storage capacity to ensure sustainability as a long-term disposal strategy. Issues that may be of concern include the long-term build-up of salts in the aquifer and the fate of chemical constituents that may be present in the effluent, but that are not currently regulated by NDEP. Pilot testing and groundwater modeling would be necessary to determine injection rates and sub-surface storage capacity. There are currently no clear regulatory requirements for treatment and monitoring of direct injection wells in Nevada and there is also the potential for public concern regarding perceived impacts to the quality of potable groundwater resources. Column testing for soil attenuation or advanced treatment, along with groundwater modeling could provide clarity on long-term treatment and management strategies.

**Water Rights Considerations**

Future extraction of effluent for satisfaction of non-potable demands could offset demands on potable water. There is no benefit with respect to Truckee River water rights; return-flow water rights would still be required for dedication under this option.

## **OPTION 4 – VADOSE ZONE INFILTRATION WELLS IN LEMMON VALLEY HYDROBASIN**

Review of slopes, geology, locations of municipal and domestic wells, runway setbacks, land use, and land ownership have resulted in the identification of an area with potential for location of vadose zone wells that is generally east and north of the airport on Washoe County, Airport Authority, or BLM land. Vadose zone wells may be more favorable than RIBs since the land requirement for the disposal facilities is significantly less.

### **Description of Treatment and Disposal Facilities**

The assumption is that the existing and planned level of wastewater treatment at the RSWRF would be continued. The plant would be expanded to 4.8 MGD with continuation of the existing tertiary treatment technologies.

- 2.0 to 4.8 MGD expansion (tertiary treatment): new reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, tertiary filters, chlorine contact basin, splitter box
- Effluent transmission: 200 hp effluent pump station, 29,600 lf of 14" pipe

**Planning Level Estimate of Cost:** \$33,950,000

### **Potential Stakeholders/Partners**

Washoe County, TMWA, Airport Authority, BLM

### **Potential Benefits**

Keeps water in the basin to help balance the water resources in the valley, and water is available for possible future recovery. Compared to RIBs, vadose zone wells have a much smaller land requirement than RIBs, and they provide a similar benefit of soil attenuation prior to the effluent mixing with the underlying groundwater.

### **Potential Areas of Concern**

Need to perform field investigations to verify infiltration rates and sub-surface storage capacity to ensure sustainability as a long-term disposal strategy. Need to consider long-term effects of salt build-up.

Consider fate of chemicals that may be present in effluent. This is not currently a regulatory concern, but may be an issue in the future. Column testing for soil attenuation or advanced treatment, along with groundwater modeling could provide clarity on long-term treatment and management strategies.

### **Water Rights Considerations**

Future extraction of effluent for satisfaction of non-potable demands could offset demands on potable water. There is no benefit with respect to Truckee River water rights; the same return flow water rights dedication currently required would still be required under this option.

## **OPTION 5 - CONVEY SEWAGE TO TMWRF**

Presently, waste activated sludge is pumped through two parallel 8- and 6-inch mains from the existing clarifier No. 1 at the RSWRF and discharged into the City's existing collection system at Golden Valley. The solids are conveyed through the collection system and ultimately processed at TMWRF. The available capacity of these mains to convey WAS and raw or screened sewage to TMWRF is approximately 450 gallons per minute. The existing pump station and pipeline capacity could be expanded to send additional wastewater to TMWRF for treatment and disposal. The existing interceptor system through the City of Reno to TMWRF would likely need to be upgraded to accommodate these additional flows. The current TMWRF expansion will provide excess treatment capacity in the near-term to accommodate these additional flows. Permanent capacity could be provided in future planned TMWRF expansions.

### **Description of Facilities**

- Transmission facilities: 240 hp effluent pump station, 23,700 lf of 14" pipe
- Upgrades to City of Reno's North Virginia interceptor system

**Planning Level Estimate of Cost:** \$41,159,000

### **Potential Benefits**

This disposal option makes use of the existing treatment and disposal capacity at TMWRF, spreading costs for treatment out over time as development continues. If effluent from Stead is allowed to return to the river, it may help maintain river flows below Derby Dam and provide additional water resources to Pyramid Lake.

### **Potential Areas of Concern**

Although treatment capacity is available at TMWRF, additional flows from Stead would increase nitrogen, phosphorous and total dissolved solids (TDS) loading to TMWRF. TMWRF effluent discharged to the Truckee River is subject to stringent TMDL limitations for these constituents. Assuming that groundwater, rather than Truckee River water, is imported to Stead for future growth, rather than Truckee River water, the future RSWRF effluent will contain higher TDS concentrations compared to existing conditions. It is noted that TDS is a regional issue that is a regional concern for the planning of TMWRF expansion and effluent disposal, due to the greater role of groundwater in the TMWRF service area, regardless of whether or not TMWRF receives wastewater flows from the North Valleys.

### **Potential Stakeholders/Partners**

TMWRF entities, the Pyramid Lake Paiute Tribe, NDEP

### **Water Rights Considerations**

Effluent originating from North Valleys groundwater rights is useful for expansion of the TMWRF effluent reuse system in that there is no return-flow requirement. Additionally, if wastewater from the North Valleys is permanently sewered to TMWRF, there would be no return-flow requirement for Truckee Meadows water rights that might be dedicated for service in this area, making such dedication attractive for new development. The downside to this is that it could place more pressure on the limited availability of Truckee River water rights.

Additionally, some of the surface water rights held by TMWA in the North Valleys have no return-flow requirement, and could be considered a new return-flow resource if effluent reaches TMWRF from this area.

## **OPTION 6 - SURFACE DISCHARGE OF EFFLUENT IN BEDELL FLAT**

The proposed discharge point is located on Bureau of Land Management (BLM) property (Bird Springs area) north of the Reno-Stead Airport and east of Red Rock Road. This location naturally drains into the top of the Bedell Flat hydrobasin, ultimately discharging to Long Valley Creek at North Red Rock Road and US 395, a very low probability event given that effluent discharged at this location would need to travel approximately 14 miles across relatively level terrain before entering California and Long Valley Creek.

A portion of the discharged water may be recoverable using groundwater wells with potential recovery for beneficial use in the future. Secondary treatment is all that should be required of this option; however, the RSWRF already meets tertiary treatment standards, so it is thought that this level of treatment would be continued.

### **Description of Treatment and Disposal Facilities**

- 2.0 to 4.8 MGD expansion (tertiary treatment): new reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, tertiary filters, chlorine contact basin, splitter box
- Effluent transmission: 900 hp effluent pump station, 78,000 lf of 10/14" pipe
- Wetland disposal area

**Planning Level Estimate of Cost:** \$43,005,000

### **Potential Benefits**

Discharging effluent to the headwaters of the Bedell Flat hydrologic basin would be protective of public health and the environment. No municipal or domestic wells are near the proposed discharge point. Beneficial habitats could be created, similar to those supported by the current discharge of effluent to Swan Lake. Furthermore, it is likely that much of the water would infiltrate into the aquifer, increasing the water resources available for future use.

### **Potential Areas of Concern**

If wetland / wildlife habitat is created, it may be very difficult in the future to reduce the amount of water supplied to the wetlands, limiting the future use of this effluent for other purposes.

### **Potential Stakeholders/Partners**

Effluent discharge to Bedell Flat was discussed previously with representatives of BLM. Although non-committal, BLM was open to the concept, provided that a sustainable wildlife habitat could be incorporated into the project at the discharge location.

### **Water Rights Considerations**

Water right permit applications should be filed on the treated effluent that recharges the Bedell Flat basin to protect Reno's interests in that water. Conceivably, those water rights could be sold in the future to support irrigation or other beneficial uses.



## **OPTION 7 - PYRAMID LAKE DISCHARGE**

The proposed discharge point is located immediately east of Warm Springs Valley. Effluent would discharge into a drainage that flows east into Pyramid Lake within approximately six miles from the discharge point. This project could be sized for different capacities depending on what phased or ultimate disposal capacity is required. There are a couple of options for pipeline routing from Stead to Spanish Springs. Once in Spanish Springs, the pipeline would follow Pyramid Highway to the Pyramid Lake Paiute Tribe property.

### **Description of Treatment and Disposal Facilities**

- 2.0 to 4.8 MGD expansion (tertiary treatment): new reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, tertiary filters, chlorine contact basin, splitter box
- Effluent Transmission: 430 hp effluent pump station, 155,000 lf of 12/14" pipe.

**Planning Level Estimate of Cost:** \$56,092,000

### **Potential Stakeholders/Partners**

The Pyramid Lake Paiute Tribe, BLM for pipeline R/W

### **Potential Benefits**

This alternative provides high quality water directly to Pyramid Lake without affecting TMDL limitations for TMWRF and the Truckee River. Beneficial habitats would be created along the drainage, including small wetland areas that would be similar to those supported by the current effluent discharge to Swan Lake. This water could also be used as "make-up" water for implementation of the Winnemucca Wetland TDS mitigation project.

### **Potential Areas of Concern**

Agreement with the Pyramid Lake Paiute Tribe is required to implement this option.

### **Water Rights Considerations**

If treated effluent is discharged directly to Pyramid Lake, the return-flow water rights dedication requirements for potable will-serve commitments based on Truckee River water in Stead will be eliminated, making the use of these rights more attractive for new development. However, this will place additional demands on the Truckee River resource outside of the central Truckee Meadows, further increasing competition for limited Truckee River water rights. With the water going directly to Pyramid Lake, there may be an opportunity to use these water rights for other regional water quality benefits. For example, if the Winnemucca Wetlands Restoration project was implemented, this water could be used to offset the amount of water removed from Pyramid Lake for establishment and maintenance of the wetlands.

## **OPTION 8 - CONVEY EFFLUENT DIRECTLY TO SPANISH SPRINGS**

Similar to RIBs in Lemmon Valley, the assumption is that the existing and planned level of wastewater treatment at the RSWRF would be continued. The plant would be expanded to 4.8 MGD with continuation of the existing tertiary treatment technologies.

The effluent pipeline to Spanish Springs would run along the Eagle Canyon Road alignment, connecting to the existing Sparks reclaim infrastructure near the Spanish Springs High School. From there, the existing 20" City of Sparks pipeline would convey effluent to RIBs at either the Martin Marrietta property or the Boneyard Flat playa.

### **Description of Treatment and Disposal Facilities**

- 2.0 to 4.8 MGD expansion (tertiary treatment): new reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, tertiary filters, chlorine contact basin, splitter box
- Effluent transmission: 460 hp effluent pump station, 69,000 lf of 10/14" pipe
- Estimate 56 acres for RIB disposal area

**Planning Level Estimate of Cost:** \$44,598,000

### **Potential Stakeholders/Partners**

TMWRF entities, WCDWR, Spanish Springs Valley residents

### **Potential Benefits**

This alternative uses effluent from Stead to recharge and balance the aquifer in Spanish Springs, and to offset a portion of the reclaimed water demands in Spanish Springs that might otherwise be supplied by TMWRF effluent. This in turn keeps more of the higher quality TMWRF effluent in the river.

### **Potential Areas of Concern**

It would be important to perform field investigations to verify infiltration rates and sub-surface storage capacity to ensure sustainability as a long-term disposal strategy. Issues that may be of concern include the long-term build-up of salts in the aquifer and the fate of chemical constituents that may be present in the effluent, but that are not currently regulated by NDEP. Column testing for soil attenuation or advanced treatment, along with groundwater modeling, could provide clarity on long-term treatment and management strategies.

### **Water Rights Considerations**

There is no benefit with respect to potable will-serve commitments based on Truckee River water rights, the same return flow water rights dedication currently required would still be required under this option. However, by displacing TMWRF effluent in the Sparks reclaimed water system, more water rights and TMWRF effluent would be available to enhance flows in the Truckee River.

## **OPTION 9 - SURFACE DISCHARGE OF EFFLUENT IN LONG VALLEY CREEK**

The proposed discharge point is located immediately south of Bordertown in Nevada. Effluent discharged into the drainage would flow north into Long Valley Creek in California within approximately one-half mile from the discharge point. This project could be sized for different capacities depending on what phased or ultimate disposal capacity is required. It could also be combined with a seasonal storage reservoir that would allow continued discharges when natural flows in Long Valley Creek diminish.

The proposed pipeline alignment follows the existing effluent reuse piping from RSWRF through Sierra Sage Golf Course, then parallels US 395 north toward Bordertown. The alignment diverges from US 395 south of Bordertown and heads west across undeveloped land ultimately discharging into a small drainage located in Nevada.

### **Description of Facilities**

- 2.0 to 4.8 MGD expansion (MBR with UV): New reactor basin, new blower building, secondary clarifier, RAS/WAS pump station, filter feed pump station, membrane filters and UV facilities, splitter box
- Effluent Transmission: 460 hp effluent pump station, 48,000 lf of 14" pipe

**Planning Level Estimate of Cost:** \$42,054,000

### **Potential Stakeholders/Partners**

NDEP, Sierra and/or Lassen County, Lahontan Regional WQCB, CA Dept of F&G, downstream irrigators

### **Potential Benefits**

With appropriate treatment, the water would be beneficial to the stream environment, and could be put to beneficial use by downstream irrigators in California. This option could be used alone or in conjunction with other viable disposal options to reduce the potential increase in water levels due to effluent discharges to Swan Lake.

### **Potential Areas of Concern**

The time to implement this project may be considerable due to the involvement of the California regulatory community and stakeholders. Once the water is discharged, there is no potential for Nevada to reclaim the water, and it is out of the City's control.

### **Water Rights Considerations**

If additional water supplies are imported to the Stead area, whether surface or groundwater, the community will not have the potential opportunity to manage these resources to achieve other regional water objectives. For example, the water would not be returned to the Truckee River or Pyramid Lake, either directly or indirectly. If some portion of the effluent is not reclaimed and used for irrigation of new development in Stead, then additional water supplies will be required to meet future irrigation demands.

## EVALUATION AND RANKING OF ALTERNATIVES

Table 5 summarizes the estimated costs to implement each of the alternatives, based on the 4.8 MGD development scenario.

**TABLE 5  
ESTIMATED COSTS – 4.8 MGD DEVELOPMENT SCENARIO**

	Disposal Option 1	Disposal Option 2	Disposal Option 3	Disposal Option 4	Disposal Option 5	Disposal Option 6	Disposal Option 7	Disposal Option 8	Disposal Option 9
	Expended Effluent Reuse	Rapid Infiltration Basin	Direct Injection/ASR	Vadose Zone Infiltration Wells	Convey Sewage above 2 MGD to TMWRF	Surface Discharge of Effluent to Bedell Flat	Pyramid Lake Discharge	Convey Effluent Directly to Spanish Springs	Surface Discharge of Effluent to Long Valley Creek
Assumed Treatment Level Required=>	Tertiary	Tertiary	MBR/UV	Tertiary	TMWRF Capacity	Tertiary	Tertiary	Tertiary	MBR/UV
Incremental treatment cost from 2 to 4.8 MGD [1]	\$26,414,000	\$26,414,000	\$31,090,000	\$26,414,000	\$33,600,000	\$26,414,000	\$26,414,000	\$26,414,000	\$31,090,000
Disposal Piping/Pumping [1]	\$7,752,000	\$6,786,000	\$6,786,000	\$6,786,000	\$7,559,000	\$16,591,000	\$29,678,000	\$13,704,000	\$10,964,000
Disposal Facilities [1]	n/a	\$4,480,000	\$4,500,000	\$750,000	n/a	n/a	n/a	\$4,480,000	n/a
<b>Total</b>	<b>\$34,166,000</b>	<b>\$37,680,000</b>	<b>\$42,376,000</b>	<b>\$33,950,000</b>	<b>\$41,159,000</b>	<b>\$43,005,000</b>	<b>\$56,092,000</b>	<b>\$44,598,000</b>	<b>\$42,054,000</b>
<b>Relative Rank</b>	<b>2</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>1</b>	<b>7</b>	<b>8</b>	<b>6</b>	<b>9</b>

Notes:

[1] See Appendix J for Cost Estimate Details and Appendix B for evaluation of RSWRF expansion and technologies. April 2005 ENR 7355

To compare the nine effluent disposal options, an evaluation and ranking matrix was developed, which considers such factors as cost, potential water resource benefits, operational flexibility, ease of implementation and requirements for agency/partner agreements. Each of the alternatives were rated relative to one another, and given a score from 1 to 5. A score of 1 represents the least desirable alternative, and a score of 5 represents the most desirable. Table 6 summarizes the scores and relative ranking of the alternatives. Appendix D contains supporting information that documents the relative benefits and drawbacks of each alternative.

TABLE 6  
RANKING OF EFFLUENT DISPOSAL OPTIONS

Disposal Alternative	Name	Cost/MG Needed	Water Resource Benefit	Operational Flexibility	Ease of Implementation	Agency/Partner Agreement Required	Total Possible Points	Relative Ranking
		30	25	10	15	20	100	1 - 9
1	Expanded Effluent Reuse	4	4	4	5	4	83	2
2	Rapid Infiltration Basins in LV Hydrobasin	4	4	4	3	3	73	4
3	Direct Injection/ASR in LV Hydrobasin	3	4	3	2	2	58	5
4	Vadose Zone Infiltration Wells in LV Hydrobasin	4	4	4	4	4	80	3
5	Convey Sewage to TMWRF	4	5	5	4	5	91	1
6	Surface Discharge of Effluent in Bedell Flat	3	3	5	2	2	57	7
7	Pyramid Lake Discharge	1	3	5	1	1	38	8
8	Convey Effluent Directly to Spanish Springs	2	3	4	3	3	56	6
9	Surface Discharge of Effluent in Long Valley Creek	2	1	5	1	1	34	9

Score: 1 (least desirable), 5 (most desirable)

Review of the benefits and drawbacks of the nine effluent disposal options leads to several conclusions. The estimated cost for the 4.8 MGD base case development scenario ranges from \$33.95 to \$56.09 million. Alternative 3, expanded effluent reuse and Alternative 4, vadose zone infiltration wells, are the lowest cost options. However, based on the information available, they do not appear to be independently capable of satisfying the total effluent disposal needs. Effluent reuse is an irrigation season alternative, and is not available during the winter months. Vadose zone wells, although an attractive alternative, will be limited by the ability of the aquifer in Lemmon Valley to accept large volumes of treated effluent. Additional investigation is required to quantify the amount of effluent that could be infiltrated without causing undesirable effects. The reader is referred to Appendix C for detailed information on the feasibility of infiltration disposal methods, including vadose zone wells.

Alternative 5, conveying a portion of the effluent to TMWRF, is the least cost alternative that could be implemented independently to handle projected increases in wastewater flows. This option involves the construction of a new pump station and pipeline from RSWRF to the collection system in Golden Valley, and utilizes available treatment and disposal capacity at TMWRF.

The remaining alternatives are higher in cost, due in large part to the extensive piping required, additional treatment requirements and related facility costs.

From a non-cost perspective, conveying a portion of the effluent to TMWRF is also the highest ranked alternative. This option appears to provide the greatest potential water resource benefits, including the potential to transfer water rights below Derby Dam to benefit Pyramid Lake, and/or the potential to use water rights from Stead for TMWRF reuse commitments without providing a make-up return flow requirement. Optional strategies might also increase the water rights pool in the central Truckee Meadows for other regional benefits. Conveying the effluent to TMWRF has clear regulatory implementation requirements, and it is a good option for a portion of the effluent flow or as a stand alone alternative. One potential drawback to this alternative is that it would accelerate the time when TMWRF would need to make improvements to continue to comply with the TDS TMDL on the Truckee River.

Expanded effluent reuse and vadose zone infiltration wells also rank high from a non-cost perspective. Effluent reuse would provide a non-potable irrigation supply and would lessen the demand on potable water resources in Stead. If existing potable water irrigation demands were replaced with treated effluent, it could also free up existing committed resources for new development. However, reuse is only a good disposal option during the irrigation season, and it would need to be combined with other disposal alternatives.

Vadose zone wells appear to be the best option for infiltrating effluent compared to RIBs and direct injection wells. From a water resource perspective, infiltrating a portion of the effluent would keep water in the basin to help balance the regional groundwater resource overdraft issue, and it may be possible to recover and use the water in the future. Vadose zone wells have a small land requirement and provide similar soil aquifer treatment benefits compared to RIBs. On the other hand, injection wells place the treated effluent directly into the groundwater aquifer without the benefit of soil aquifer treatment. Potentially higher levels of treatment, added costs and regulatory requirements are additional drawbacks to direct injection.

Conveying treated effluent to Spanish Springs for infiltration by RIBs is the next highest ranked alternative. This option uses the water to help balance the regional water resource overdraft issue in Spanish Springs, but does nothing to address the same issue in Lemmon Valley where the water would originate. However, the effluent could be used to offset TMWRF reuse

commitments, and may increase the water rights pool in the central Truckee Meadows for other regional benefits. Agreements with Sparks and Washoe County would be required to implement this alternative, but similar negotiations are currently taking place for disposal of TMWRF effluent in Spanish Springs.

Conveying treated effluent outside of the basin, including discharge to Bedell Flat, Pyramid Lake and Long Valley Creek, are the lowest ranked options. Although these options may provide good potential water resource benefits and operational flexibility as stand-alone alternatives, the permitting requirements and implementation agreements would be significant and time consuming. Of the three options, discharging effluent to Bedell Flat is the best ranked alternative. It would keep the water in Nevada, available for future use, and a large area is available to provide for long-term water storage. This option may require a commitment of water to support created wetlands and habitat, but it is a good long-term alternative that would take time and significant effort to implement.

### RECOMMENDATIONS

Of the nine disposal alternatives evaluated, it is recommended that the City continue to evaluate the top 3 alternatives and develop a plan for their timely implementation. The top three disposal alternatives are:

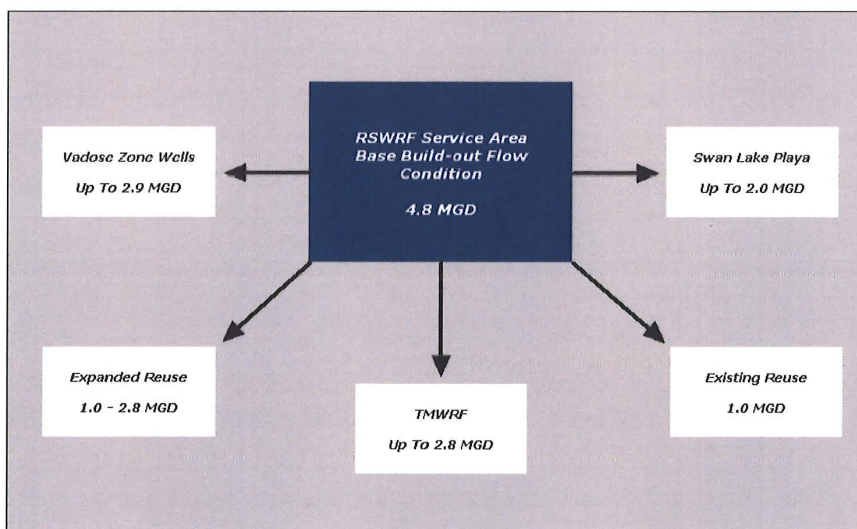
Option 5: Convey a Portion of the Effluent to TMWRF

Option 1: Expanded Effluent Reuse

Option 4: Infiltration of Effluent with Vadose Zone Wells

These disposal options, implemented in some combination with one another, together with discharge of up to 2 MGD to the Swan Lake Playa and continuation of the existing reuse program, provide the best opportunity to cost effectively manage effluent disposal in Stead and maximize the potential secondary water resource benefits. The existing and recommended disposal alternatives are depicted in Figure 3.

FIGURE 3  
RECOMMENDED DISPOSAL ALTERNATIVES BASED ON 4.8 MGD DEVELOPMENT SCENARIO

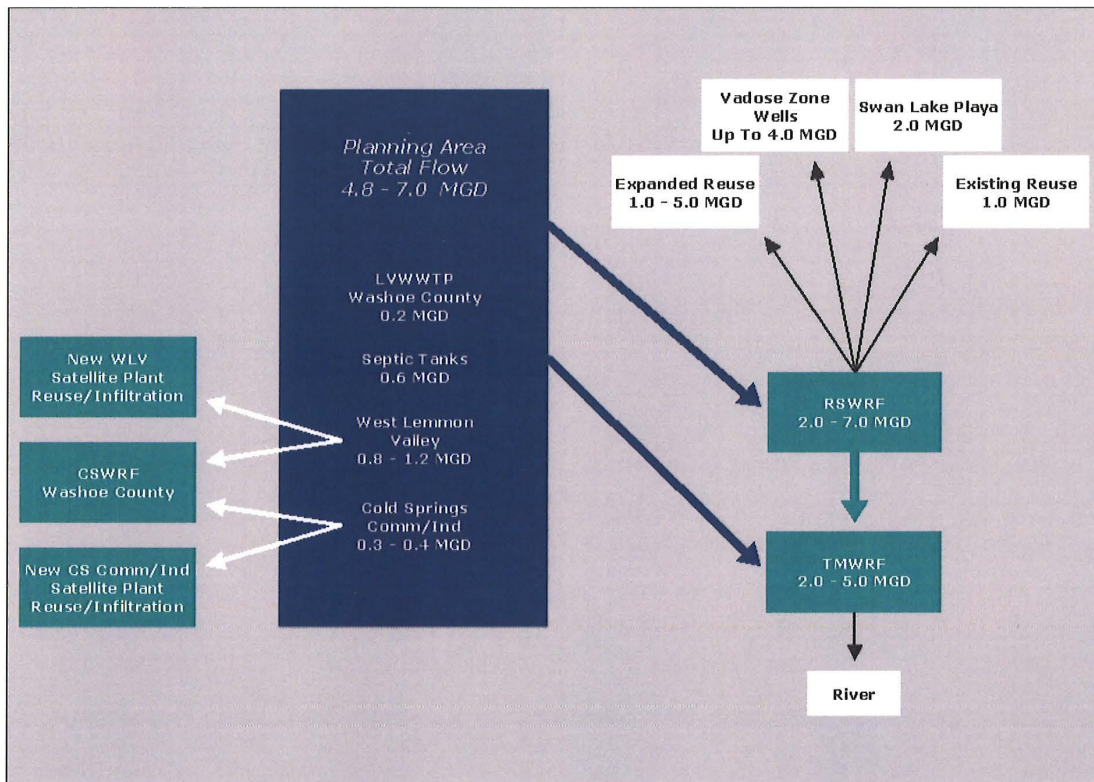


Upon approval by the City of Reno of the recommended disposal alternatives, further work is needed to fully define the effluent disposal implementation plan. This work includes establishing the recommended capacity of each disposal alternative, taking into consideration the ultimate planned capacity for the RSWRF, phasing opportunities, the seasonal variation in flow, and the physical constraints associated with each disposal method. An overview of the additional work is presented in the following section.

### NEXT STEPS

The nine effluent disposal options were compared and evaluated using the base case development scenario in Stead, which results in a projected wastewater flow of 4.8 MGD. In the future, if the Lemmon Valley WWTP decommissioning, septic tank conversions and/or proposed land use intensifications in Lemmon Valley and Cold Springs move forward and are ultimately approved, the potential wastewater flow generated in the Reno Stead WRF service area may approach 7.0 MGD. Figure 4 shows the potential sources and variation in wastewater flow from the planning area, and the range of disposal capacity required. To fully define the effluent disposal implementation plan, the following additional work must be completed.

FIGURE 4  
RECOMMENDED DISPOSAL ALTERNATIVES BASED ON 7.0 MGD DEVELOPMENT SCENARIO





### **Disposal to TMWRF**

- Determine the estimated costs and impacts to TMWRF from disposal of RSWRF treated effluent, including effects to the discharge permit and Total Maximum Daily Load (TMDLs) from accelerated flow increases, changes in timing of future improvements, and rate impacts. (The City of Reno does not plan to pump raw sewage or increase capacity of the existing solids pump-over facility. The additional flow diverted to TMWRF would be treated effluent.)
- Evaluate different capacity options and timing for the 4.8 MGD, 7.0 MGD or other development scenarios, considering operational flexibility and other potential benefits.
- Develop a capital improvement program for the North Virginia interceptor that can accommodate the timing of flows that would be diverted to TMWRF.
- Evaluate water rights strategies to maximize potential secondary water resource benefits.

### **Expanded Effluent Reuse**

- Identify target effluent reuse customers to pursue.
- Investigate changes to the existing reuse permitting requirements that may be more favorable and encouraging to new customers.
- Define facilities, estimated costs, and revenue requirements.
- Pursue the Rancho San Rafael Park option, quantify mutual benefits to Reno, Washoe County Parks and TMWA, confirm feasibility, define facilities and estimated costs.

### **Infiltration of Effluent with Vadose Zone Wells**

- Obtain right to perform pilot testing on private property.
- Conduct pilot testing program, see separate memos / recommendations.
- Prepare a better estimate of the long-term disposal capacity and TDS accumulation in the local aquifer. Determine the need for additional effluent treatment to meet drinking water standards and/or reduce TDS to acceptable levels.
- Evaluate the feasibility and permitting requirements for a separate pipeline to the playa for disposal of concentrated effluent.

### **Other**

- A separate satellite wastewater treatment plant evaluation analysis was performed for one or more satellite treatment facilities to serve new development within the planning area. Based on the long-term disposal capacity determined for TMWRF, vadose zone wells and effluent reuse, the costs and merits of one or more satellite wastewater treatment plants will be compared to the conveyance, treatment and disposal costs at RSWRF.
- Based on the outcome of the above work, develop the effluent implementation plan, including a detailed facilities plan, with estimated timing and costs.
- Coordinate effluent playa disposal requirements with any proposed flood control improvements.