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September 3, 1997  
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Dick Goecke  
Director of Public Works  
City of Las Vegas  
400 E. Stewart Avenue  
Las Vegas, NV 89101

SEP 10 1997

**Subject: Water Pollution Control Facility - Reclamation Savings**

Dear Dick:

As you requested, I have reviewed the cost savings that may occur if the City was to utilize the WPCF effluent for golf course irrigation.

#### **SUMMARY**

Costs to deliver water to the Sunrise Golf Course and to the new "Whispering Pines" Golf Course are minimal. Facilities already exist that can be easily modified by the developer at no cost to the City. Significant savings may result from the avoidance of treatment not required for reclamation quality water, specifically dechlorination, nitrification and phosphorus removal. The total of these savings could be as high as \$340,000 per year or about \$0.26 per 1000 gallons of reclaimed water. It appears to be in the City's best interests to pursue delivery to these golf courses, even if some minor improvements must be made to accommodate them.

#### **EXISTING CONDITIONS**

There is very little required in the way of improvements to deliver water to both the Sunrise Golf Course and the new ("Whispering Pines") Golf Course. Reclamation water is currently available at the Nevada Power Company pump station. This pump station could be easily modified, with NPC permission, to add pumps in the second wetwell. The existing 48-inch line to the old Mormon Farm pump station is still in good shape and could easily be tapped to send water to the Sunrise Golf Course. It is assumed that if the City provided effluent to either of these locations, that the golf course developers would pay for the costs of pumping and delivery to their facilities. Based on this the costs for supplying effluent to the golf courses are practically non-existent.

#### **CURRENT SAVINGS**

The second part of this analysis is the determination of what potential savings there may be by avoiding discharge of the reclaimed effluent to the wash. As shown in Table 1, if both the Sunrise and the new course were irrigated with City effluent, an average of 3.5 (3.48) MGD and a maximum of 5 (4.97) MGD, would no longer go to the Wash. This avoided discharge has both a current and a future value.

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**Table 1. Reclamation Flows, MG (Bold numbers indicate projected amounts)**

Month	Sunrise Golf Course	New Golf Course	Total
Jan	22	7	29
Feb	31	10	41
Mar	66	22	88
Apr	85	28	113
May	116	39	154
Jun	109	36	145
Jul	110	37	146
Aug	<b>110</b>	37	147
Sept	<b>100</b>	33	133
Oct	90	30	120
Nov	85	28	113
Dec	30	10	40
Total:	953	318	1,271
Maximum Flow, MGD	3.73	1.24	4.97
Average Flow, MGD	2.61	0.87	3.48

The most obvious current savings by avoiding discharge to the Wash would be the avoidance of dechlorination. Dechlorination is required to prevent toxicity in the Wash and would not be required for reclamation flows. In fact, the presence of some chlorine will keep the reclamation lines from fouling. This savings, as indicated in Table 2, is about \$6,500 per year or about \$5 per MGD.

**Table 2. Sodium Bisulfite Savings (based on average dosage of 2.5 mg/l, \$.50/gallon @ 25% Solids)**

Golf Course	Flow, MG/yr	Savings lb/year	\$/year	\$/MG
Sunrise	1,000	20,850	5,000	5
New	300	6,255	1,500	5
Total	1,300	27,105	6,500	5

In addition to dechlorination, it would also not be necessary to include nitrification for reclaimed water. Nitrification to remove ammonia, toxic to aquatic life, is not required for reclamation. This savings is not as straight forward, because flows bypassed around nitrification would still have to be filtered but could not be allowed to mix with the nitrified flows. There is currently no mechanism to bypass flow around nitrification that keeps the filtered effluents separate. Bypassing nitrification would require major changes to the filter complex or the construction of a

separate filtration facility for the reclamation flows. However, there would still be significant savings by avoiding the construction of 5 MGD of nitrification facilities. As shown in Table 3, the savings for not constructing 5 MGD of nitrification still exceed the costs of building a separate 5 MGD filtration facility. In addition, there are significant operating savings for energy and chemicals. The overall savings could be as much as \$138,000 per year or \$109 per million gallons.

**Table 3. Nitrification Avoidance Savings**

Capital Costs Savings		
Filtration		
Automatic Split		(\$45,000)
Influent Pumping		<del>(\$300,000)</del>
Reclamation Filters		(\$900,000)
Nitrification		
Aeration Basins		\$900,000
Diffused Air		\$260,000
RAS/WAS pumping		\$250,000
Clarifiers		\$70,000
<b>Subtotal</b>		<b>\$235,000</b>
Contingency	@ 25%	\$58,750
Engineering	@ 20%	\$47,000
<b>Subtotal</b>		<b>\$575,750</b>
SAY		\$575,000
<b>Average Annual Cost Savings</b>		<b>\$67,000</b>
Operating Cost Savings		
Energy		\$30,000
Materials		\$26,000
Soda Ash		\$15,000
<b>Average Annual Savings</b>		<b>\$71,000</b>
<b>Total Annual Savings</b>		<b>\$138,000</b>
<b>Savings per MG</b>		<b>\$109</b>

Based on bypassing 5 MGD max flow and 3.5 MGD ave flow around nitrification, new filtration facilities required to avoid mixing unnitrified reclamation flows with nitrified effluent

Assumes that operating costs for filtration are the same whether filtered in existing facility or on proposed reclamation filters

**FUTURE SAVINGS**

The future value of avoiding discharge to the Wash is based upon prediction of newer and tougher discharge standards. In July 1997, the joint Las Vegas Valley dischargers issued a report entitled "Wastewater Needs Assessment Study". This study speculates on the future of discharge standards to the Wash, including both ammonia and phosphorus. As shown in Table 4, the ammonia concentration limit for the City of Las Vegas will continue to get smaller as loads are

reallocated based on relative flow and as flows increase. Phosphorus concentration limits will also do the same, except that the study also considers a 50% reduction in the Waste Load Allocation, resulting in a very low future discharge concentration of .07 mg/l.

**Table 4. Future WLA Concentration for Ammonia and Phosphorus, mg/l**

Year	Projected Maximum Month Flow	Ammonia				Phosphorus			
		Current Allocation lb/mo	Current Allocation mg/l	Redistributed Allocation lb/mo	Redistributed Allocation mg/l	Current Allocation lb/mo	Current Allocation mg/l	Reduced Allocation lb/mo	Reduced Allocation mg/l
1997	56.5	401	0.85	363	0.77	138	0.29	60	0.13
2000	61	401	0.79	349	0.69	138	0.27	59	0.12
2005	71	401	0.68	347	0.59	138	0.23	59	0.10
2010	81	401	0.59	345	0.51	138	0.20	59	0.09
2015	91	401	0.53	357	0.47	138	0.18	61	0.08
2020	100	401	0.48	369	0.44	138	0.17	63	0.08
2025	110	401	0.44	382	0.42	138	0.15	66	0.07

Redistributed allocations for ammonia and phosphorus based on "Needs Assessment" and COH memo 6/17/97

Phosphorus based on reallocation and reduction to one half the current allocation

Bold indicates interpolated amounts

As indicated in Table 4, the future ammonia discharge concentration in 2025 could drop to as low as .42 mg/l. Stress testing done in 1996, "Nitrification and Filtration Treatment Capacity and Performance Certification", indicate that when the diffused air equipment is functioning properly that effluent ammonia averages less than 0.30 mg/l and is less than .36 mg/l 90 percent of the time. Based on this it is likely that the City will be able to meet future discharge standards well into the future with the current technology. This also means that there will be no additional benefit to be gained by avoiding future expensive ammonia removal through reclamation.

Pilot testing at the WPCF in 1991, indicated that phosphorus could be removed down to about .15 mg/l through the addition of alum and polymer at filtration. To get down to the .07 mg/l indicated in Table 4 will require the addition of conventional rapid mix, flocculation and chemical clarification facilities prior to filtration. Table 5 shows the estimated capital costs for these facilities and Table 6 shows the anticipated operation and maintenance costs. As indicated in Table 7, reclamation for the golf courses has the potential of saving \$195,000 per year or about \$150 per million gallons. These savings would begin immediately upon a new reduced standard going into effect.

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**Table 5. Capital Costs for Additional Phosphorus Removal**

Item	Cost
Chemical Clarifiers	7,900,000
Yard Piping and Structures	1,500,000
Influent Pump Station	2,750,000
Chemical Mixing	1,200,000
Sludge Pumping	144,000
Chemical Feed	260,000
Subtotal	13,754,000
Contingency	30% 4,126,200
Engineering	20% 2,750,800
Total	20,631,000
Say	21,000,000

**Table 6. Annual Operating Costs for Additional Phosphorus Removal**

Item	Energy	Materials	Labor	Chemicals	Total
Chemical Clarifiers	\$4,000	\$31,000	\$75,000		\$110,000
Influent Pump Station	\$200,000	\$54,000	\$112,000		\$366,000
Chemical Mixing	\$100,000	\$1,150	\$75,000		\$176,150
Chemical Feed	\$300	\$200	\$2,200	\$300,000	\$302,700
Sludge Pumping	\$2,000	\$11,000	\$10,000		\$23,000
Subtotal	\$306,300	\$97,350	\$274,200	\$300,000	\$977,850
SAY					\$1,000,000

**Table 7. Average Annual Costs of Additional Phosphorus Removal**

Item	MG	\$/yr
Capital Costs		\$2,500,000
Operating Costs		\$1,000,000
Total		\$3,500,000
Cost per MG	24,000	\$150
Reclamation Savings	1,300	\$195,000

Capital costs amortized over 20 years at 10%, costs per MG based on average annual flow of 65mgd in 2015

**CONCLUSION**

The total potential savings for golf course reclamation are given in Table 8. As shown, the total annual savings could be as much as \$340,000 per year or \$264 per million gallons. This also

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works out to be about \$0.26 per 1000 gallons. Since potable water costs are about \$1 per 1000 gallons delivered, it would appear that the City should take advantage of this opportunity and continue to pursue arrangements to make reclamation water available to both golf courses.

**Table 8. Summary Savings for Golf Course Reclamation**

Item	Annual Savings	Savings/MG	Savings/1000 gallons
Avoid Dechlorination	\$6,500	\$5	\$0.01
Avoid Nitrification	\$138,000	\$109	\$0.11
Avoid New Phosphorus Standards	\$195,000	\$150	\$1.15
Total	\$339,500	\$264	\$0.26

Very Truly Yours



David A. Pivetti, P.E.  
Senior Vice President

DAP/cdh