Constructed Wetlands Play Integral Role in Providing Water Supply through Indirect Potable Reuse in North Texas

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INTRODUCTION

The Dallas-Fort Worth greater metropolitan area in north central Texas has been among the fastest growing areas in the nation since the 1950s. This is due, in part, to having reliable supplies of water to support the demands of the growing population. The population of the 16-county area surrounding the DFW metro area is projected to grow from 6.7 million to over 11 million by the year 2050. To sustain this growth, water providers must plan and implement a variety of water supply strategies. One such strategy is indirect potable reuse of treated effluent. Two wholesale water providers in north Texas are using large constructed wetland systems as the main component in indirect potable reuse projects. Not only do these projects provide a reliable source of raw water supply, but also multiple ancillary benefits, including enhanced wetland habitat; education and research opportunities; outdoor recreation (wildlife observation, photography, hunting); and preservation of greenspace.

DISCUSSION

The North Texas Municipal Water District (NTMWD) and Tarrant Regional Water District (TRWD) have developed indirect potable reuse projects utilizing some of the largest constructed wetland systems in the United States. These systems are geographically located about fifty miles apart but generally function in a similar manner. Highly treated effluent is discharged from wastewater treatment facilities located within the service area of the respective water district and is conveyed downstream via the East Fork or Main Stem of the Trinity River. Several miles downstream, this water is diverted from the river and pumped into a free-water surface constructed wetland where it is polished to remove suspended solids, nutrients, and wastewater-derived organic compounds. Each wetland system includes sedimentation basins, for initial gravity settling, followed by multiple wetland cells for further treatment. The wetland-polished water is then pumped into a surface water supply reservoir where it is blended with other inflows and undergoes approximately one year detention time before being pumped from the lake, treated, tested, and reintroduced into the water supply system. The NTMWD East Fork Wetland is located near Seagoville, Texas, and the TRWD George W. Shannon Water Recycling Wetland is located near Richland-Chambers Reservoir. TRWD also plans a future sister-project near Cedar Creek Reservoir. Specific data on the NTMWD and TRWD systems is shown in Table 1.

Implementation of the Wetlands, Cost of Water, and Impacts to the Environment

The raw water produced from the NTMWD and TRWD constructed wetland systems, as well as that projected from the future TRWD wetland system, is very cost effective in comparison

to many of the other water supply strategies recommended. For example, several new reservoirs are in the planning and permitting phase. The cost of raw water from new reservoirs being considered ranges from \$0.41 to \$1.12/m^3 (\$1.55 to \$4.24/1000 gallons). In contrast, the cost of raw water from the wetland systems has ranged from \$0.17 to \$0.30/m^3 (\$0.63 to \$1.15/1000 gal). Furthermore, new reservoirs will impact several thousands of acres of land and can take decades to plan, permit, design, construct, and commission. The reuse wetlands can be placed into operation within 5 to 6 years; will occupy a fraction of the footprint of a reservoir; and can produce an annual water yield comparable to a new reservoir.

Table 1. Indirect Potable Reuse Wetlands in North Texas.

Wetland System	Surface Area		Design Flow Rate		Year Completed	Sed. Basins	Wetland Cells	Water Supplied to Reservoir	
	ha	ac	L/s	MGD				m^3	gal
NTMWD EF	809	2,000	4,031	92	2009	3	24	$3.5x10^8$	$9.2x10^{10}$
TRWD RC	818	2,022	4,163	95	Ph1 – 2009 Ph2 - 2013	5	20	$9.3x10^7$	$2.5x10^{10}$
TRWD CC (future)	728	1,800	3,550	81	--	--	--	--	--

Water Quality

Each system is monitored regularly for a number of water quality constituents. Because the wetland outflow is introduced to a surface water reservoir, the constituents of interest are total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP). TP is the limiting nutrient for algal growth in local reservoirs. Water quality data are shown in Table 2.

Table 2. Water Quality Data.

Wetland System	Avg. C_{in} (mg/L)			Avg. C_{out} (mg/L)			Conc. Reduction		
	TSS	TN	TP	TSS	TN	TP	TSS	TN	TP
NTMWD EF	68	9.1	1.9	45	3.0	0.76	33%	67%	60%
TRWD RC	139	8.5	1.0	15	2.3	0.44	89%	73%	57%

Ancillary Benefits

Not only do these wetland systems provide water quality improvement, but also a number of other benefits. For example, the TRWD wetland is located within the Richland Creek Wildlife Management Area. Each year this wetland is frequented by hundreds of visitors, including hunters that harvest migratory waterfowl from its waters. The John Bunker Sands Wetland Center is located at the NTMWD wetland. The Wetland Center has partnered with regional school districts, wildlife and conservation organizations, and research institutions to develop premier environmental education programs, specializing in Middle School and High School Field Studies.

CONCLUSIONS

Constructed wetlands have played an integral role in providing reliable, high quality raw water supply in north Texas through indirect potable reuse. These systems also provide a number of other benefits to the communities.

REFERENCES

Freese & Nichols, Inc., Alan Plummer Associates, Inc., CP&Y, Inc., and Cooksey Communications (2015) *2016 Region C Water Plan*. Region C Water Planning Group.