Assessment of Costs for Two Wastewater Disposal Strategies for the City of Blanco

Revised

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Introduction

The City of Blanco (City) is currently treating a daily average of about 0.145 MGD of wastewater. For planning purposes and to be consistent with the City's current permit amendment application, the Blanco Water Reclamation Task Force (Task Force) has requested that the Aqua Strategies team consider the costs of two scenarios, both of which are based on an average annual effluent production rate of 0.225 MGD. This daily effluent treatment rate also corresponds to the capacity of the wastewater treatment plant (WWTP). The first scenario involves the construction of sufficient on-site storage and acquisition of land for disposal through irrigation such that discharge would not be required, even in extreme events. An expansion of the City's Texas Land Application Permit (TLAP) would be required in this case. The other scenario also involves construction of a pond and the discharge of treated wastewater into the Blanco River during wet conditions using a Texas Pollutant Discharge Elimination System (TPDES) permit. The City would seek to continue to irrigate its own property, and that of neighbors through long-term agreements. Specifically, the two scenarios investigated are as follows:

1. No discharge to the Blanco River, where additional storage is built and the existing TLAP is expanded in order to preclude the need to discharge, even under prolonged and extremely wet conditions. Estimated costs include the construction of a large, lined storage pond that would be used as part of the system for the future sale of Chapter 210 reclaimed water.

2. A TPDES permit that allows overflow from the ponds to the Blanco River. This scenario would also involve increasing existing storage constructed near the WWTP site but it also includes the cost of construction of a pipeline through the Palmer property for disposal of the effluent, and additional treatment needed to meet anticipated Total Phosphorus levels in the range 0.15 to 0.25 mg/l in the discharge permit. This scenario would seek customers for the reclaimed water and not require a TLAP permit.

Technical approach and assumptions

The analysis concluded that both scenarios would benefit from a doubling of the existing storage to handle effluent production rates at 0.225 MGD. For the TLAP permit scenario, 100 acres of land would be needed to dispose of the treated effluent. This entire pond capacity and acreage would not be needed until the WWTP is handling closer to 0.225 MGD (60 percent more than the current rate of production) but are good numbers for planning purposes, consistent with the "Phase I" in the City's current permit amendment application.

For the TPDES scenario, no land is needed at all because all of the treated wastewater could be discharged into the Blanco River. However, that is not desired by either the Task Force or the City, and the City's engineer has expressed a desire to expand the storage on-site. The amount of land irrigated through agreements with adjacent landowners will dictate how much wastewater will be discharged to the river.

It is important to note that the schedule of use for a TLAP permit is different than what it would be under agreements with landowners growing hay. Under a TLAP agreement, TCEQ typically allows irrigation all year long, as long as the ground is not frozen or saturated. When reclaimed water is provided for hay production, for example, the landowners may not want that water outside of the growing season. This is an important distinction in the water balance assumption for the two scenarios. The table below shows the water use distribution assumed. For the TLAP permit scenario, the amounts would have to be negotiated with TCEQ but because there is a TLAP permit in place already for the City, and the land nearby has hay production (and therefore decent soil) the authors are confident the final numbers would not be too different. However, further assumptions have been made in the water balance calculations[1].

Table 1 – Assumed irrigation distribution for two scenarios (inches per day, average for month)[2]

Month	TLAP	TPDES
Jan	0.103	0.000
Feb	0.103	0.000
Mar	0.103	0.060
Apr	0.103	0.100
May	0.103	0.220
Jun	0.103	0.260
Jul	0.103	0.270
Aug	0.103	0.150
Sep	0.103	0.180
Oct	0.103	0.110
Nov	0.103	0.020
Dec	0.103	0.000

It is important to note, as the authors did in the previous report, that while both land for irrigation and storage are required for disposal of treated wastewater, there is a trade-off between the two. For this memo we have sought to minimize the cost of pond construction, and conversely maximize the amount of land being used, assuming that agreements with landowners could be obtained at very little cost to the City. The figure below (Figure 1) shows what the relationship between the two looks like for the City under both scenarios and reflecting different schedule of use of the treated wastewater. Numbers

[1] For the water balance calculations, the authors assume no irrigation will occur the day after a rainfall of 0.25 inches or more, but can otherwise occur all year long, subject to the monthly distribution shown in the table.
[2] In the table, the TLAP numbers are assumed but likely close to what TCEQ would approve after full analysis. The Reclaimed water numbers reflect the distribution proposed in the City's TPDES permit amendment application.

presented reflect the desire for no discharge and the storage-irrigation scenario required to achieve that.

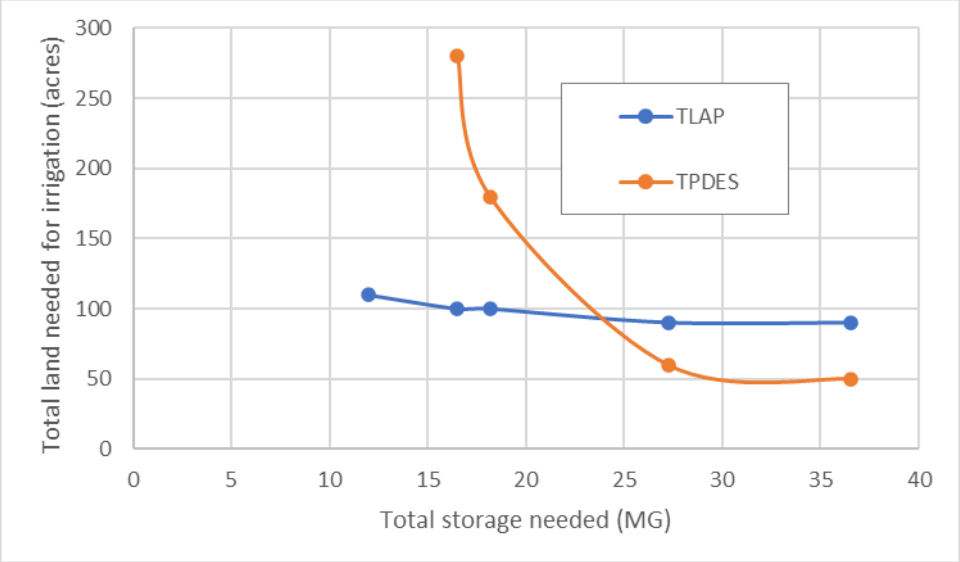

Figure 1 – Total storage needed versus total land needed for TLAP and TPDES scenarios, assuming no discharge to the Blanco River in either scenario.

If the City supports periodic discharge of treated wastewater to the Blanco River, a smaller pond could be constructed or less land used for irrigation. The Phase I Task Force study suggested approximately doubling the size of the existing ponds by building a new 9.2 MG structure. A pond this size would still result in the need to discharge periodically under the TPDES scenario, unless at least 180 acres of land can be secured for irrigation, but less often than with the current configuration (9.08 MG of storage and 26.07 acres of land under irrigation). Discharge to the river would inevitably be required at times unless additional storage were made available to the City and demand for reclaimed water continues to grow, especially outside of the growing season.

The following notes and assumptions are relevant in this analysis:

- The ponds are assumed to have total depth of 8 ft (6 ft water depth and 2 ft free board).
- Estimates include construction of berms on all existing ponds and the new pond by utilizing the excavated soil from new pond. Fortifying the berms of the existing ponds with the excavated material from the construction of the new pond would help maintain water quality by preventing runoff into the ponds, which currently occurs.
- The analysis assumes for Scenario 1 that a total of 100 acres of land can be acquired or leased to dispose of the treated wastewater through a TLAP permit with a neutral or net positive financial impact on the City. The amount the City is able to charge for reclaimed water in the future has yet to be negotiated for each potential tract of land, but the City would need agreements in place with a term of at least the life of the permit. TCEQ recommends and looks more favorably upon a longer term that allows for transition between permit renewals. It is

likely that the City will be able to obtain a steady cash inflow from reclaimed water in the future under both scenarios.

- Since the new pond in both scenarios would be at a different elevation compared to the existing ponds, a duplex pump system was included to pump effluent from the existing ponds to the new pond. The piping will have an isolation valve with bypass piping that can be used to drain water from the new pond to one of the existing ponds.
- Irrigation application rates for the TPDES scenario were based upon monthly application rates developed by the City Engineer and are consistent with the historical monthly irrigation distribution. Annual totals are slightly higher than what has been assumed under TLAP.
- Irrigation application rates under TLAP assumes a more uniform monthly distribution, consistent with what TCEQ typically allows. Volumes are assumed for Blanco.
- The ponds will have synthetic liners because of the lack of suitable clay nearby. The cost of the synthetic liners is comparable to that of clay.
- The authors of this memo and Tom Turk have discussed the need for a closed tank near the WWTP, to hold reclaimed water. This would make it easier to maintain Type 1 standards and would probably make it easier to manage reclaimed water onsite. The closed tank may not be needed, but if the City decides to build one, to make the system easier to manage, then it would benefit both scenarios (i.e. if not needed for one scenario, then it would not be needed for the other). The cost of the tank has not been included in either scenario.
- The cost of a new 9.2 MG pond was developed assuming the desire to maintain Type 2 reuse standards required for land application, but it is likely that Type 1 could be achieved based on nearby examples. Ten nearby wastewater reuse permits for Type 1 reclaimed water were found by the authors of this memo, but because of the difficulty in identifying such facilities in the TCEQ database the way it is set up, there are likely more. In a recent conversation with co-author Keith O'Connor (KIT), Louis Herrin (TCEQ) said that open Type 1 ponds were very common in Texas and "no big deal" to TCEQ for permitting.
- It is assumed that the O&M costs of the two scenarios are the same. Both scenarios consider the same volume of treated effluent, require agreements in place with adjacent landowners, and have opportunities for sale of reclaimed water. Both scenarios would benefit from construction of a pond to double storage, while the second scenario requires construction of a pipeline and a TPDES permit. Otherwise, the two scenarios are essentially the same in terms of operating costs.
- In order to meet TCEQ requirements associated with WWTP facilities, monitoring of the quality of the effluent is required. For a TPDES permit, the sampling must be done at the outfall, at a frequency described in the permit. For a TLAP permit, annual soil sampling is required at depths and for parameters specified in the permit. For a Chapter 210 reuse permit, monthly sampling is also required. The City is already sampling soil and effluent discharge, associated with their current TPDES/TLAP permit; sale of reclaimed water may involve some additional sampling.

Estimated costs

Table 2 – City of Blanco cost comparison for two scenarios

Expense	Scenario 1 TLAP permit	Scenario 2 TPDES permit
New Pond	$1,232,420	$1,232,420
Permitting*	$60,000	$0
Pipeline	$0	$200,000
Nutrient reduction	$0	$200,000
Land acquisition	TDB	$0
Litigation**	$0	$750,000
Total	**$1,292,420**	**$2,382,420**

* Note: Net costs, above those of Scenario 2.

** Assumed cost, which might be much higher.

The cost of the new 9.2 MG pond, recommended for the TLAP scenario, is estimated to be **$1,292,420.** This includes the costs of all the design, administration, construction, pipes, pumps and valves, engineering and administration, and a 25% contingency. Approximately $60,000 would likely be required to go through the process of obtaining a TLAP permit, which has been included in the table above. A total of 100 acres of land would be needed for irrigation, with costs (if any) to be determined.

For the TLAP scenario, the City would likely be responsible for construction of "purple pipe" to the properties where the irrigation would occur, and probably the costs of the irrigation systems themselves, but that would depend of the agreements that are executed with the landowners.

In addition to a 9.2 MG pond, recommended for both scenarios, the TPDES scenario involves the cost of design and construction of a wastewater discharge pipeline. Mr. Tom Turk, the City's engineer, has estimated the construction costs to be $446,160, including contingencies. It is understood that the City would be responsible for only half the cost of the pipeline, up to a maximum of $200,000. There are no significant O&M costs associated with the pipeline as the discharge would flow by gravity to the river. However, water quality sampling and reporting, perhaps as frequently as daily, would be required at the outfall when the facility is discharging to the river.

Another cost involves additional treatment (nutrient reduction) which would likely be required of the City in order to obtain the TPDES permit. In the Phase 1 report, the capital cost of Biological Nutrient Reduction and more effective alum dosing was estimated to cost $200,000. A slight increase in O&M due to pumping and additional alum might also be incurred.

Capital costs for the pond and pipeline TPDES scenario are estimated at **$2,382,420**. Mr. Palmer would be required to pay an additional $246,160 for the pipeline in this scenario.

An important consideration for the TPDES scenario, factored into these costs, is the potential for litigation if the City decides to move forward with a TPDES permit. The estimated cost of litigation to the City in a contested case of this kind would likely exceed $750,000, included in the estimate provided above, depending on the path taken after the public hearing and based on a nearby and recent example.

Discussion

For both scenarios doubling the size of the existing storage is recommended, with construction of a new 9.2 MG pond. If the City decides to go with Scenario 1, it is important that it identifies land for the TLAP permit as soon as possible, and determine what these costs are, if any. With a TLAP permit, some additional water conveyance lines, "purple pipes", will be needed to get the treated effluent to the parcels of land being used. In either scenario, the City should identify customers for Chapter 210 reclaimed water sooner, rather than later. If the City chooses Scenario 2, the volume of reclaimed water sold will dictate the frequency and volume of discharge to the river.

The rate of expansion of wastewater production put forward by the City is fairly aggressive. For example, the rate of production put forward in the City's permit application for Phase 1 is 0.225 MGD, which is 60 percent greater than the current rate of production. Even if the population grows at this rate there is a distinct possibility that the wastewater generated in new developments is treated and disposed of on-site, rather that pumped to the existing wastewater treatment plant, precluding the need for a permit with a production rate this high. An alternative approach would be to phase the permitting up to 0.225 MGD, such that there is less of a need for storage and land. This should be explored with the City, the Task Force and TCEQ.

Table 3. Cost Estimates of 9.2 MG Pond

Description	Units	Quantity	Unit Cost	Total
CIVIL				
Excavation	CY	66,500	$4	$266,000
Berm	CY	29,000	$6	$174,000
Synthetic Liner	SF	265,500	$0.75	$199,200
In-situ Material over Synthetic Liner	CY	9,667	$2	$39,400
3-inch Force Main	LF	1,000	$25	$25,000
			SUBTOTAL CIVIL	***$703,600***
MECHANICAL				
Packaged Fiberglass Pump Station (1 duty + 1 standby @ 50 gpm each)	EA	1	$50,000	$50,000
Pond Aerators	EA	2	$15,000	$30,000
3-inch Swing Check Valve	EA	3	$549	$1,700
3-inch Plug Valve	EA	1	$758	$800
Miscellaneous Piping	LS	1	$2,000	$2,000
			SUBTOTAL MECHANICAL	***$84,500***
ELECTRICAL & INSTRUMENTATION				
Misc Electrical & Instrumentation	LS	1	$12,000	$12,000
			SUBTOTAL ELECTRICAL & NSTRUMENTATION	***$12,000***
GENERAL REQUIREMENTS				
Mobilization	LS	5%	$40,005	$40,100
Other Division 1 Requirements	LS	5%	$40,005	$40,100
			SUBTOTAL GENERAL EQUIREMENTS	***$80,200***
			SUBTOTAL =	$880,300
			CONTINGENCY (25%) =	$220,075
			ENGINEERING AND ADMINISTRATIVE COSTS (15%) =	$132,045
			TOTAL ITEMS =	**$1,232,420**