



TO: GOVERNANCE COMMITTEE
FROM: EXECUTIVE DIRECTOR'S OFFICE
SUBJECT: COMPARISON OF WATER SOURCE OPTIONS FOR THE COTTONWOOD RANCH BROAD-SCALE RECHARGE PROJECT
DATE: JUNE 16, 2017

This memorandum provides a discussion and cost comparison for pipeline and well field options to supply excess flows to the Platte River Recovery Implementation Program's (Program) Cottonwood Ranch (CWR) Broad-Scale Recharge (BSR) project for purposes of flow retiming.

Concept Options:

The pipeline option involves delivery of excess flows in the Central Nebraska Public Power and Irrigation District's (CNPPID) Phelps County Canal (Canal) to a pipeline head gate near mile 12 of the Canal. An underground pipeline would then convey the flows by gravity to the CWR BSR site. The CNPPID would design, construct, own and operate the delivery infrastructure. The Program may (or may not) be charged for pipeline design and construction but would be charged annually for the volume diverted into the head gate (a standard annual escalator would apply).

The wellfield option involves diverting excess flows from the Platte River through a wellfield immediately adjacent to the south bank of Platte River. The pumps would extract groundwater from the alluvium in close enough proximity to the channel that surface water depletions would be immediate (or as close to immediate as possible). The water would then be conveyed to the CWR BSR site through a pipeline. The Program would design, construct, own and operate the wellfield and conveyance infrastructure and be responsible for all associated costs.

Economic Evaluations:

Economic evaluations have been developed for one wellfield scenario and three pipeline scenarios. The wellfield scenario is based on a conceptual wellfield design developed by the Executive Director's Office (EDO) in conjunction with Bill Hahn, a special advisor to the EDO. The pipeline scenarios are reflective of a conceptual pipeline design developed by the CNPPID and a range of associated potential water service agreement terms. Each scenario is described below.

Wellfield: Program pays for the design, construction and operation of 28 near-channel irrigation-style wells, as well as associated conveyance infrastructure, power infrastructure and annual operating and maintenance costs.

Pipeline (Original): Program pays for the design and construction of the pipeline (estimated at \$1,000,000 by the CNPPID) and for the delivered water at a rate of \$30.08 per acre-foot (AF) with an annual escalation rate of 3%.



Pipeline (Buyback):	Program pays for the design and construction of the pipeline and for the delivered water at a rate of 50% of the original offer (\$15.04/AF with an annual escalation rate of 3%) until the total discounted cost paid to the CNPPID for delivered water is equal to \$500,000. The rate would then increase to 100% of the original offer (\$30.08/AF with an annual escalation rate of 3%).
Pipeline (No Capital):	CNPPID pays for the design and construction of the pipeline and the Program pays for the delivered water at a rate of 100% of the original offer (\$30.08/AF with an annual escalation rate of 3%).
Pipeline (Reduced):	CNPPID pays for the design and construction of the pipeline and the Program pays for the delivered water at a rate of \$25/AF with an annual escalation rate of 2%.

The economic evaluation required estimates of capital and annual costs of each concept, as well as analysis timeframes and discount rates used to project costs into the future. The capital and annual costs were developed using the initial designs of each concept and standard annual operating, maintenance and replacement costs, as well as the assumption that each concept would be used to deliver 100 AF per day (AF/d) to the CWR BSR site for a total of 90 days per year¹. The analysis periods considered are 22 and 50 years. The 22-year period was considered because it is the length of the water service agreement proposed by the CNPPID, and the 50-year period was included to evaluate a longer-term scenario. The annual inflation rate for all annual costs was set to 3% (unless noted otherwise) and the annual discount rate was set to 6%. Both of these rates are consistent with market standards in water resources economics. The total discounted costs of the wellfield and pipeline scenarios described above are presented in **Table 1**. Additional details and assumptions made by the EDO are presented in **Appendix A**.

Table 1: Total discounted costs for 22 and 50-year analysis periods for the wellfield and pipeline scenarios.

Scenario	Total Discounted 22-Yr Cost	Total Discounted 50-Yr Cost
	[Million \$]	[Million \$]
Wellfield	4.74	6.00
Pipeline (Original)	5.62	8.35
Pipeline (Buyback)	5.10	7.83
Pipeline (No Capital)	4.62	7.35
Pipeline (Reduced)	3.50	5.12

¹ It is likely that the pipeline would have the ability to deliver up to 160 AF/d but the delivery rates were held constant at 100 AF/d (the estimated maximum yield from the wellfield) to ensure a direct comparison.



In the 22-year scenario, the pipeline is more expensive than a wellfield unless the capital costs are eliminated (no capital and reduced scenarios in **Table 1**). In the 50-year scenario, the cost of the pipeline exceeds the cost of the wellfield in all scenarios unless the capital costs are eliminated, the cost per acre-foot of water is dropped from \$30.08 to \$25, and the inflation rate is reduced to 2% (reduced scenario in **Table 1**). Although not shown, it should be noted that at the reduced rate of \$25/AF the capital cost of \$1,000,000 can be added OR the escalation rate can be increased to 3% and the cost to the Program would still be near the \$6 million of the wellfield.

Pipeline - Pros, Cons and Uncertainties:

Pros:

- Easily designed, permitted, constructed and operated. Likely, the pipeline could be constructed in late 2017 or early 2018 and could be operational in 2018.
- Capacity, as estimated by the CNPPID, would be about 65 to 80 cfs. This would allow for filling of the CWR BSR recharge areas and provide additional water to downstream water action plan projects (likely reducing water supply costs associated with those projects).

Cons:

- Owned and operated by a non-Program entity (CNPPID).
- More expensive than construction of a wellfield in the near-term unless capital costs are eliminated and more expensive than a wellfield in the long-term unless water delivery and/or associated escalation rates are reduced.

Uncertainties:

- Operations would need to be coordinated with the CNPPID. Unknown how operations would be influenced by irrigation demands (i.e., could water be delivered during irrigation season?).
- Terms of pipeline operation and costs of water would need to be renegotiated at the end of the water service agreement. Rates beyond the agreement are unknown.

Wellfield – Pros, Cons and Uncertainties:

Pros:

- Cheaper (in most scenarios) to design, construct and operate when compared to the pipeline.
- Program would own and operate infrastructure, and would have total control over its use (subject to necessary federal, state and local laws and operating guidelines).



- Deliveries could take place whenever excess flows are available (i.e., would not be affected by irrigation deliveries).

Cons:

- Capacity would likely max out near 50 cfs, which would allow for the filling of the CWR BSR recharge areas but would only provide minimal (if any) water for downstream water action plan projects.
- More uncertainty than is associated with pipeline scenarios.

Uncertainties:

- Permitting the project may require both state (NDNR) and local (Tri-Basin NRD) permits to pump surface water using a network of near-bank irrigation-style wells.
- The maximum yield of the project has been estimated to be 50 cfs with 28 wells, but this is subject to revision based on subsurface conditions, and surface water, groundwater and recharge dynamics.
- Design, construction, and operations costs are more uncertain than the pipeline scenarios as they were based on a reconnaissance-level design.



Appendix A: Concept Assumptions and Costs

Wellfield Infrastructure:

Item	Qty	Unit	Unit Cost	Cost	Notes
Structure/Pump	1	LS	\$30,000	\$30,000	Past projects.
Pipe (Length)	500	FT	-	-	
Pipe (Diameter)	8	IN	-	-	
Pipe	4000	IN-FT	\$1.25	\$5,000	Estimate.
Electric	500	FT	\$3.00	\$1,500	Estimate.
Miscellaneous				\$20,000	Additional infrastructure, etc.
Total Per Well				\$60,000	Rounded to nearest \$10,000
Total				\$1,680,000	28 wells
Total w/ 20%				\$2,016,000	

HDR Engineering (the Program contractor designing the CWR BSR project) reviewed these cost estimates. The EDO confirmed that our costs are within HDR's estimated range of \$1.8 to \$3.5 million.

Wellfield Design:

Assumed to be equal to 10% of the infrastructure total: **\$201,600**.

Power Infrastructure:

Item	Qty	Unit	Unit Cost	Cost	Notes
New Line	5	MI	\$50,000	\$250,000	Prelim discussions w/ provider.
Service	28	EA	\$5,000	\$140,000	Prelim discussions w/ provider.
Total				\$390,000	

Annual Operating and Maintenance:

Assumed to be equal to 1.25% of wellfield infrastructure total: **\$25,200**. Escalated at 3% and discounted 6% annually.

Annual Cost of Power:

Assumed to be equal to \$9.86/AF of water pumped: **\$88,740**. Escalated at 3% and discounted 6% annually.

Pump Replace Costs:

Assumed to be equal to **\$12,000** per well every 20 years. Escalated at 3% and discounted 6% annually.



TO: GOVERNANCE COMMITTEE
FROM: EXECUTIVE DIRECTOR'S OFFICE
SUBJECT: ADDENDUM TO "COMPARISON OF WATER SOURCE OPTIONS FOR THE COTTONWOOD RANCH BROAD-SCALE RECHARGE PROJECT"
DATE: JULY 11, 2017

This is an addendum to the memorandum titled "Comparison of Water Source Options for the Cottonwood Ranch Broad-Scale Recharge Project" sent to the Governance Committee on Friday, June 16, 2017. This addendum outlines a new scenario proposed by the Central Nebraska Public Power and Irrigation District (CNPPID). The scenario is described below and **Table 1** from the original memo has been updated to reflect its economic evaluation.

Economic Evaluations:

Pipeline (Reduced/Buyback): Program pays for the design and construction of the pipeline (estimated at \$1,000,000 by the CNPPID) but does not pay for the delivered water until the total discounted cost of the delivered water exceeds the cost of the design and construction. The Program would then pay for the delivered water at a rate of \$25 per acre-foot (AF) with an annual escalation rate of 2% (beginning in 2017).

The following is **Table 1** from the June 16 memo, updated with the newest scenario offered by the CNPPID. In each analysis period considered (22 and 50 years), this scenario is most similar to the 'Reduced' scenario and is cheaper than the wellfield option

Table 1: Total discounted costs for 22 and 50-year analysis periods for the wellfield and pipeline scenarios.

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Pipeline (Original)	5.62	8.35
Pipeline (Buyback)	5.10	7.83
Pipeline (No Capital)	4.62	7.35
Pipeline (Reduced)	3.50	5.12
Pipeline (Reduced/Buyback)	3.46	5.08