PRRIP – ED OFFICE MEMORANDUM

TO: PROGRAM SIGNATORIES

FROM: JERRY KENNY AND THE EXECUTIVE DIRECTOR'S OFFICE

SUBJECT: PROGRAM WATER PLAN, PLAN A AND PLAN B

DATE: JUNE 24, 2016

CC:

Introduction

The J2 Reservoir in one form or another has been a prominent feature of the Program Water Plan since 2009. Escalating costs and difficulty in renegotiation of the Water Service Agreement have heightened the need for an alternate plan that does not have a J2 component. This memorandum briefly presents and discusses the alternate plans, Plan A that has a J2 Reservoir as its central element and Plan B which does not include a J2 reservoir component.

Two tables are provided at the end of this memorandum summarizing key aspects of the alternate Program Water Plans:

- Plan A includes the J2 Reservoir, surface and groundwater leasing, Broad-scale Recharge, and Slurry Wall Gravel Pits. Plan A as defined provides 54,180 acre-feet of score at a cost of approximately $93.5 million moving forward. Adding in to-date and other near term future Water Plan expenditures puts it about $1.4 million over the current indexed Water Plan budget.
- Plan B does not include the J2 Reservoir but does include all of the other components of Plan A, and adds an agricultural water "acquire and retire" component. The lost score from the deletion of the J2 Reservoir is compensated for by increased contributions by Broad-scale Recharge and Slurry Wall Gravel Pits in addition to the new agricultural water acquire and retire component. Plan B provides 53,180 acre-feet of score at a cost of approximately $90.5 million moving forward. Adding in to-date and other near term future Water Plan expenditures puts it about $1.2 million over the current indexed Water Plan budget.

In developing the tables, both capital and O&M costs have been estimated and an annual equivalent cost per acre-foot metric calculated as well. The capital costs are important for cash flow considerations as those are large up-front costs necessary to bring the project into a functioning form. O&M costs are generally smaller in magnitude, but an annual burden and not insignificant over a 50-year project life. Only the J2 Reservoir, Broad-scale Recharge, and Slurry Wall Gravel Pit concepts have a significant O&M component. Further refinement of the O&M components and cash flow analysis is needed, so the focus of the dollar estimates are on the capital costs that are on the immediate horizon. Regardless, similar assumptions and methods were used in all cases, so the numbers provide a suitable basis for comparison. In addition to the capital cost and O&M cost differences, some projects are "owned water" and some are "leased water" which also has up-front versus annual cost considerations. To provide a better basis of comparison of all project components, the annual equivalent cost per acre-foot metric has been included as well. While all costs have not been estimated to the same level of certainty, and in many cases cannot, we have not included confidence bands or probable ranges in these tables as they complicate the presentation and otherwise detract from the simple story that is likely sufficient for decision making.

Scores have been developed using the standard methodologies and in all cases have fundamentally the same degree of certainty.

A variety of other metrics are possible to quantify or describe the plans, but these were selected as the most focused and relevant for inclusion in the summary tables.

Plan A

Plan A is heavily reliant on the J2 Reservoir, it is the center-piece of the plan and supplies almost half of the water, over 26,000 acre-feet. The J2 Reservoir configuration considered for this analysis is a one-cell facility with a storage capacity of 10,500 acre-feet, and land acquisition costs at $15,000 per acre. RJH best estimate construction costs were used (not the -20%, nor the +30% estimates) for the economic calculations. Even with the currently escalated costs for the J2 Reservoir, it still appears to be the best single source of supply, providing the lowest cost and most cost effective source of water in significant quantities from a

single facility. However, there are still many uncertainties associated with J2, the potential for further cost escalations and land acquisition difficulties chief among them.

The other components of Plan A include:

- Leasing surface water from Wyoming's account in Pathfinder Reservoir and Nebraska irrigation canal companies, power districts and individual irrigators. Many of the lease agreements are in place with ultimately about 10,000 acre-feet coming from this source.

- Leasing recharged groundwater from Nebraska irrigation canal companies and power districts. Existing canals of irrigation systems are used to recharge excess flow. Some over winter recharge is possible, but most systems are limited to spring and fall operations. Most of the lease agreements are in place, some are temporary until all permits are in place, with ultimately about 6,500 acre-feet coming from this source.

- Broad-scale recharge would involve recharge using large areas, employing short berms to allow flooding to shallow depths in the fall and spring. These shallow depth ponds could provide habitat value for the spring and fall whooping crane migration, but that aspect has not been well vetted yet. This approach is in contrast to only the use of existing canals as described above. Broad-scale recharge could be developed in association with the irrigation systems we currently have lease agreements with and/or as totally separate operations. Approximately 3,400 acre-feet of score could be developed primarily through use of 366 acres on or in the vicinity of the Cottonwood Ranch Complex.

- Slurry Wall Gravel Pits are exactly what the name describes, and would provide surface water storage. The impermeable slurry wall around the pit would key into an impermeable layer, generally present at depths of 30 to 80 feet in many locations, providing the containment that allows water storage. Water would be delivered into the pits by gravity, but would have to be pumped out. Approximately 8,000 acre-feet of score could be

developed at a two-cell 4,200 acre-foot facility located on the Plum Creek Complex.

Broad-Scale Recharge has been under consideration for some time as a potential component of the Water Plan, the magnitude required initially dependent on how successful leasing became and now also on the selected size of the J2 Reservoir. Slurry Wall Gravel Pits is a more recent concept to the Water Plan developed to compensate for the loss of storage as a result of J2 reducing from a two-cell to a one-cell facility. Increasing the score from the lower end of the milestone range to the higher end could come from increasing the scores from Broad-scale Recharge and Slurry Wall Gravel Pits.

Advantages provided by a J2 Reservoir over storage in these types of facilities are significant and include the ability to have greater regulation and control of the water; the ability to make large releases to contribute flow management schemes; the operation and maintenance of the J2 facilities would be in the hands of an entity experienced in the O&M of similar facilities; greater reliance on a surface water source allowing measurement and in-channel protection of the water upon release.

Plan B

Plan B does not include the J2 Reservoir but does include all of the other components of Plan A, and adds an agricultural water acquire and retire component. The lost score from the deletion of the J2 Reservoir is compensated for by increased contributions by Broad-scale Recharge and Slurry Wall Gravel Pits and the addition of the agricultural water acquire and retire component. All other components of Plan A remain unchanged in Plan B.

The key concept for the J2 Reservoir was retiming of excess flow via storage. The storage function of J2 has to be replaced by aquifer or alternate surface storage to capitalize on the retimed water concept. Excess flow no longer destined for J2 would be available to and stored in broad-scale recharge basins and slurry wall gravel pits.

Plan B represents a credible, yet less certain, path for achieving the water milestone in a reasonable timeframe. The focus of the difference between Plan A and Plan B are in the following three components:

- Broad-scale Recharge would function as described in Plan A, but would be expanded from the 366-acre Cottonwood Ranch facility to include two new locations totaling 600 acres. These facilities would likely be associated with an existing irrigation system for delivery considerations, but could be either on the north side or the south side of the river or some combination. The estimated total score from all of these facilities is 12,000 acre-feet.

- Slurry Wall Gravel Pits would function as in Plan A, but would be expanded from the two-cell facility at Plum Creek to include a two-cell facility in the Cottonwood Ranch Complex vicinity and a three-cell facility on the Elm Creek Complex. The total storage capacity of all these facilities would be 11,400 acre-feet providing a score of 19,900 acre-feet.

- Agricultural Water Acquire and Retire is an entirely new component of Plan B and would be similar in concept to the surface water leasing except the Program would permanently acquire the water rather than having term lease agreements. Marginal lands would be bought, water removed, and the land resold as dryland. Other than some transaction costs, the dollars paid would be for the water acquired as we would not retain the land itself or the ongoing tax or upkeep cost burden. As currently conceived 500 to 1,000 acres a year would be acquired, converted to dryland, and resold within a one- to two-year window. Land irrigated by surface water, groundwater, or comingled would be considered. Properties both upstream and downstream of Lake McConaughy would be considered. A total of about 8,500 acres would be permanently retired from irrigation, yielding approximately 4,800 acre-feet of score

Plan B is heavily reliant on Broad-scale Recharge and Slurry Wall Gravel Pits, and as these approaches are well proven technology in places like Colorado, one could be optimistic about their success. But, a key aspect of the viability of the Slurry Wall Gravel Pit concept is the presence of a sufficiently impervious impeding layer

at a reasonable depth that provides the bottom of the storage pit into which the slurry wall keys. Early evidence points toward such an impeding layer 3 to 5 feet thick at a depth of 30 to 80 feet in many locations, but investigations addressing the presence, extent, and characteristics of the impeding layer will not be complete for several months. In the case of recharge, whether in canals or on a broad-scale, it is a passive means of adding water to the river, and under Nebraska water law is considered natural flow upon its entry into the river and subject to diversion. The Kearney Canal is the only downstream diversion on the river below Cozad, so the threat from diversion is nominal as recharge water would enter below Cozad and Kearney Canal is normally fully supplied under current conditions. If recharge water is actively captured, measured, and pumped into the river it can be protected. So, while familiar technology to many, broad-scale recharge and slurry wall gravel pits may both be relatively new concepts to the broader Program stakeholder group and have not been as thoroughly investigated as has a J2 Reservoir.

Plan B stands in sharp contrast to Plan A in that Plan B relies on a broader spectrum of basic components, and the basic components themselves consist of a more distributed set of infrastructure. So, rather than a single reservoir that alone supplies over half of the milestone supply, you would have 2 or 3 large recharge basins and 6 or 7 slurry wall gravel pits. This is beneficial in that you cannot be held hostage by recalcitrant land owners, as many different locations are probably equally as suitable for broad-scale recharge basins or slurry wall gravel pits, and the Program already owns some of the sites we could use. This is also beneficial in that one can implement the plan incrementally, learning and improving as time passes. Incremental implementation also allows benefits to be realized more rapidly rather than having to wait for the completion of a single source reservoir.

But Plan B has the disadvantage of being operationally more complex, and has a lesser ability to precisely manage, regulate, and protect the water. The ability to make large releases for the purposes of a flow management scheme will be limited under Plan B in comparison to simply opening big gates at the J2 Reservoir under Plan A. And, the diffuse components of Plan B will require establishing an institutional structure for operating and maintaining the facilities. This structure could be within the Department of the Interior, the Nebraska Department of

Natural Resources, a Natural Resource District, the Executive Director's Office of the Program, or some other existing or created entity.

The inclusion of a significant agricultural water acquire and retire component under Plan B will have perception and political ramifications locally, but as conceived it is a relatively small number of acres that would be spread out over a very wide area. Marginal lands would be bought, water removed, and the land resold as dryland . Other than some transaction costs, the dollars paid would be for the water acquired as we would not retain the land itself or the ongoing tax or upkeep cost burden. Third party impacts including reduced tax revenue would not be a significant adverse impact at any level.

Under Plan A, Broad-scale Recharge and Slurry Wall Gravel Pits provided the primary means for expansion, but they have moved from the supporting supply role into the primary supply role and more of their yield potential has already been utilized in getting to the 50,000 acre-feet milestone level. However, further capacity for expansion exists for both, but primarily from the Slurry Wall Gravel Pit component as 7,000 acre-feet of additional existing pits have been identified between Lexington and Cozad. Leasing and acquire and retire components could be expanded as well. Expansion to the 70,000 acre-feet milestone number under Plan B is possible, but potentially at a higher price than Plan A.

Plan A:

Type	Project	Cost (2016-2019)	Score (AF)	Annual Equivalent Cost ($/AF/yr)	Notes
Reservoir	J-2 Regulating Reservoir	$ 69,000,000	26,300	$ 140	Includes construction cost from RJH for 10,500 AFY storage; $15,000 per acre for 720 acres (full footprint); does not include water delivery costs/O&M in total cost; note that cost with 30% construction contingency and $25,000/ac may be as high as $93M
Leased Surface Water	CPNRD	$ 1,882,632	1,800	$ 162	Water service agreement with CPNRD for surface water in 3 canals; preliminary score based on an estimated 3,000 AFY of transferred surface water returns
	NPPD	$ 494,378	400	$ 277	Dawson Cty Canal surface water transfer from 887 irrigated acres, which equates to 718 AFY of water; preliminary score based on 718 AFY of surface water returns
	CNPPID Irrigator	$ 2,280,000	1,700	$ 279	Leases with individual irrigators in system based on 2,000 to 3,000 acres; water available in McConaughy and entered into the EA; assume 9" of CU per acre
	CNPPID Storage	$ 1,899,181	1,800	$ 315	Lease with CNPPID for storage water in McConaughy from 2017-2019, assuming 2,250 AFY available in McConaughy at $250/AF; assumes no inflation in cost/AF
	NPNRD	$ -	-	$ -	Potential leases for surface water in the NPNRD; no identified projects at this time
	Pathfinder	$ -	4,000	$ 61	Water service agreement with WWDO for 38,400 AF at Pathfinder or 4,800 AFY from 2012-2019; score approved by the GC; score could increase with additional lease in 2017-2019, based on 3 years of 9,600 AFY releases
	Glendo Reservoir Re-Purpose	$ -	-	$ -	Potential future storage water leasing project from reservoir storage re-purposing; yield would begin after 2019
	No-Cost NCCW	$ -	260	$ -	Entered into the McConaughy EA free of charge each year since 2001
Leased Recharge Water	Phelps County Canal	$ 618,128	1,960	$ 66	50% interest in project or a modeled 4,100 AF of deliveries, includes 1 well for recapture at 160 AFY; score could increase if recharge proportion increases to 75%; based on the score analysis and accepted score by the GC
	Elwood	$ 397,022	660	$ 118	Recharged water entering Plum Creek and Platte River assuming 1,000 AFY delivered into the reservoir and a 50% score efficiency; includes a recapture well at 160 AFY
	CPNRD	$ 1,251,974	1,700	$ 120	Water service agreement with CPNRD for recharge in 3 canals based on preliminary score estimate using 3,900 AFY of deliveries into the canals for recharge operations; includes $0.5M for pond construction; score may increase with additional pond construction for recharge operations
	NPPD	$ 125,509	500	$ 120	Dawson/Gothenburg canal recharge per draft water service agreement; no preliminary score estimated; cost assumed equal to $27/AF beginning in 2016 and escalating at 3% per year
	CPNRD Groundwater Market	$ 900,000	1,700	$ 273	Groundwater leases through CPNRD market; assume $300k/year from 2017-2019 for up to 4,000 acres of groundwater irrigation
Own	CO Augmentation Water	$ -	-	$ -	Recharged water in the South Platte and available for the Program from Tamarack III
	Broad-Scale Recharge	$ 5,474,609	3,400	$ 252	Assuming recharge at Cottonwood Ranch, Morse and Anderson tracts at 8,500 AFY of deliveries on 366 acres of land with an infiltration rate of 0.1-0.3 ft/day.
	Acquire and Retire Ag Water	$ -	-	$ -	Assume no water right retirements
	Slurry Wall Gravel Pit	$ 9,000,000	8,000	$ 115	Assuming 1 pit is slurry walled at the Cook/Dyer tract (2 cellls) with a total storage volume of 4,200 AF; cost based on Applegate Group, Inc. analysis of the Lindstrom pit and including construction of a pump station; score based on a similar method as J-2 Regulating Reservoir model; cost includes 3 years of pumping at $29k/yr and 3 years of water delivery; project requires low-permeability layer at a reasonable depth (assumed to be 30 ft) for slurry wall construction.
	TOTAL	**$ 93,323,434**	**54,180**		

Costs and scores are projected and subject to change.

Budget:

Expenditures To-Date (5/31/16):	$	24,120,186
Initial J-2 Reservoir Payment Deducted from Expenditures:	$	14,800,000
Net Expended:	**$**	**9,320,186**
Adjusted Water Plan Budget (2016 $):	$	104,000,000
Projected 2016-2019 costs for WP-1 and WPs 5-9:	$	2,712,600
Remaining Budget for WAP Projects:	**$**	**91,967,214**
Anticipated Future WAP Expenditures:	$	93,323,434
End Budget (+/-):	**$**	**(1,356,220)**

Plan B:

Type	Project	Cost (2016-2019)	Score (AF)	Annual Equivalent Cost ($/AF/yr)	Notes
Leased Surface Water	CPNRD	$ 1,882,632	1,800	$ 162	Water service agreement with CPNRD for surface water in 3 canals; preliminary score based on an estimated 3,000 AFY of transferred surface water returns
	NPPD	$ 494,378	400	$ 277	Dawson Cty Canal surface water transfer from 887 irrigated acres, which equates to 718 AFY of water; preliminary score based on 718 AFY of surface water returns
	CNPPID Irrigator	$ 2,280,000	1,700	$ 279	Leases with individual irrigators in system based on 2,000 to 3,000 acres; water available in McConaughy and entered into the EA; assume 9" of CU per acre
	CNPPID Storage	$ 1,899,181	1,800	$ 315	Lease with CNPPID for storage water in McConaughy from 2017-2019, assuming 2,250 AFY available in McConaughy at $250/AF; assumes no inflation in cost/AF
	NPNRD	$ -	-	$ -	Potential leases for surface water in the NPNRD; no identified projects at this time
	Pathfinder	$ -	4,000	$ 61	Water service agreement with WWDO for 38,400 AF at Pathfinder or 4,800 AFY from 2012-2019; score approved by the GC; score could increase with additional lease in 2017-2019, based on 3 years of 9,600 AFY releases
	Glendo Reservoir Re-Purpose	$ -	-	$ -	Potential future storage water leasing project from reservoir storage re-purposing; yield would begin after 2019
	No-Cost NCCW	$ -	260	$ -	Entered into the McConaughy EA free of charge each year since 2001
Leased Recharge Water	Phelps County Canal	$ 618,128	1,960	$ 66	50% interest in project or a modeled 4,100 AF of deliveries, includes 1 well for recapture at 160 AFY; score could increase if recharge proportion increases to 75%; based on the score analysis and accepted score by the GC
	Elwood	$ 397,022	660	$ 118	Recharged water entering Plum Creek and Platte River assuming 1,000 AFY delivered into the reservoir and a 50% score efficiency; includes a recapture well at 160 AFY
	CPNRD	$ 1,251,974	1,700	$ 120	Water service agreement with CPNRD for recharge in 3 canals based on preliminary score estimate using 3,900 AFY of deliveries into the canals for recharge operations; includes $0.5M for pond construction; score may increase with additional pond construction for recharge operations
	NPPD	$ 125,509	500	$ 120	Dawson/Gothenburg canal recharge per draft water service agreement; no preliminary score estimated; cost assumed equal to $27/AF beginning in 2016 and escalating at 3% per year; assume same AEC as CPNRD recharge
	CPNRD Groundwater Market	$ 900,000	1,700	$ 273	Groundwater leases through CPNRD market; assume $300k/year from 2017-2019 for up to 4,000 acres of groundwater irrigation
Own	CO Augmentation Water	$ -	-	$ -	Recharged water in the South Platte and available for the Program from Tamarack III
	Broad-Scale Recharge	$ 18,800,000	12,000	$ 252	Assuming recharge at Cottonwood Ranch, Morse and Anderson tracts at 8,500 AFY of deliveries on 366 acres of land with an infiltration rate of 0.1-0.3 ft/day; assuming 2 additional potential recharge sites at 21,600 AFY of deliveries on 600 acres total with an infiltration rate of 0.4 ft/day; assuming 90 days of deliveries annually; costs include land costs at $5,000/acre, water delivery and O&M from 2017-2019
	Acquire and Retire Ag Water	$ 27,900,000	4,800	$ 223	Assuming 8,500 acres at 0.95 AF per acre for corn and 60% score efficiency; land cost at $7,000 per acre less dryland lease cost of $3,500 per acre
	Slurry Wall Gravel Pit	$ 33,900,000	19,900	$ 115	Assuming 3 pits are slurry walled at the Elm Creek Complex (3 cells), Cottonwood Ranch (2 cells) and the Cook/Dyer tract (2 cells) with a total storage volume of 11,400 AF; cost based on Applegate Group, Inc. analysis of the Lindstrom pit and includes cost of pump stations; cost includes land purchase of Lindstrom and additional land for Elm Creek and water delivery costs for 3 years; score based on a similar method as J-2 Regulating Reservoir model; cost includes 3 years of pumping at $114k/yr; project requires low-permeability layer at a reasonable depth (assumed to be 30 -50 ft) for slurry wall construction
	TOTAL (w/o J2 Reservoir)	**$ 90,448,825**	**53,180**		

Costs and scores are projected and subject to change.

Budget:

Expenditures To-Date (5/31/16):	$	24,120,186
Refund from J-2 Reservoir Payment:	$	12,000,000
Net Expended:	**$**	**12,120,186**
Adjusted Water Plan Budget (2016 $):	$	104,000,000
Projected 2016-2019 costs for WP-1 and WPs 5-9:	$	2,712,600
Remaining Budget for WAP Projects:	**$**	**89,167,214**
Anticipated Future WAP Expenditures:	$	90,448,825
End Budget (+/-):	**$**	**(1,281,611)**