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SUBJECT: Potential Contractual Interest in Water from Glade Reservoir for the Benefit of Instream Flows on the Poudre River

Linda and Kaylea:

The Colorado Water Conservation Board (CWCB) has requested Colorado Parks and Wildlife's (CPW) recommendations on the proposed acquisition of a contractual interested in stored water as part of Northern Colorado Water Conservancy District's (Northern) Northern Integrated Supply Project (NISP). The following is CPW's analysis and recommendations regarding the proposed dedication of stored water to instream flow (ISF) uses guided by recently enacted Senate Bill 18-170, codified at section 37-92-102(8), C.R.S. This is the first time that this new statute is being utilized; CPW is generally following the established procedures for water acquisitions for ISF uses. This new statute allows Northern to utilize the ISF program to provide legal protection for releases of water that are required in a state approved mitigation and/or enhancement plan. The NISP Fish and Wildlife Mitigation and Enhancement Plan (FWMEP or "Mitigation Plan") was approved by both the Colorado Parks and Wildlife Commission and the CWCB in 2017. The FWMEP included a requirement that Northern release water from storage to mitigate low flow conditions in the Cache la Poudre (CLP) River in the City of Fort Collins. Specifically, releases will be made from the to-be-constructed Glade Reservoir in amounts identified in the Mitigation Plan to provide ISF benefits to the CLP River. The new statute (described above) provides a mechanism by which the water releases are legally protected from diversion by other water users in compliance with the Mitigation Plan. The balance of this letter will address and describe CPW's analyses and final recommendations relating to the Northern - NISP proposal.

General Information

The reach benefitting from the proposed Mitigation Releases would extend from the Poudre River Delivery Pipeline to be located near the Hansen Supply Canal down approximately 11.5 miles to the proposed Poudre River Intake located near the Mulberry Wastewater Treatment Plant (the "Fort Collins reach"). Releases will be delivered from Glade Reservoir to the CLP

River via the Poudre River Delivery Pipeline and ultimately will be re-diverted from the river and delivered to NISP participants via the Poudre River Intake (Attachment - Exhibit 2). The Mitigation Releases are designed to address seasonal low flows within this reach of the CLP. It is important to point out that there are currently several points of dry-up within the subject reach of the CLP. The Mitigation Plan and IGA between the State of Colorado and the NISP Water Activity Enterprise contain the monthly schedule for deliveries ranging between 18 and 25 cfs into the Poudre River, up to 14,350 AF annually; the monthly deliveries are summarized in Table 1.

Table 1. Poudre River Mitigation Releases

Month	Acre-feet	cfs[1]
November	1,100	18
December	1,100	18
January	1,100	18
February	1,050	18
March	1,100	18
April	1,100	18
May	1,100	18
June	1,200	20
July	1,550	25
August	1,550	25
September	1,300	22
October	1,100	18
Total	**14,350**	

[1]Measured at the bottom of the Fort Collins reach, at the Poudre River Intake.

CWCB does not currently hold an ISF water right within this reach of the Poudre River. At this time, a new junior ISF water right appropriation is unattainable due to some very complex and well documented water availability issues. Currently, there are other ongoing efforts by local stakeholders to restore flows in the CLP River. The approval of SB 18-170 expanded opportunities to integrate these flow augmentation concepts with the NISP mitigation plan to achieve significant and lasting ISF benefits in the Poudre River as it flows through Fort Collins. By statute, new junior ISF appropriations can only preserve the natural environment, while acquisitions of water can be used to both preserve and improve the natural environment. The proposed acquisition of a contractual interest in 14,350 AF of stored water in Glade Reservoir and released for downstream uses could, depending upon underlying hydrologic conditions, be used in the intervening reach of the CLP River to **both** preserve and improve the natural environment.

Field Data Collection

CPW and other interests have been analyzing and collecting field data on the Poudre River for over 10 years. CPW was approached by Larimer County Open Space Department and the City of Fort Collins Natural Areas Program in 2010 to investigate the applicability of the CWCB's ISF program to address instream flow and natural lake level protection opportunities on their lands. In 2014, CPW collected R2CROSS data at 6 sites within the Fort Collins city limits. These datasets were used to initiate discussions relating to flows necessary to preserve the natural environment through the City of Fort Collins. As stated above, the CLP through Fort Collins presents a fair number of complex water availability issues, so after some initial discussions between CPW and the City, the question of a new junior ISF water right was put on hold. The City and CPW were also both in the midst of complex discussions surrounding the environmental analyses that were underway for NISP and the Halligan/Seaman water supply projects. The state and local governmental agencies collectively agreed to wait for the outcome of these water project permitting processes and re-assess the ISF questions later. In particular, we decided to wait until the data that was generated for the environmental permitting processes was released and made available to the general public; we were collectively aware of some very detailed studies that were going to shed significant light on the CLP's ISF issues.

As part of the NISP Supplemental EIS, a Common Technical Platform (CTP) was developed to evaluate the interrelated and cumulative impacts from NISP and the Cities of Fort Collins/Greeley's Halligan/Seaman Projects. The CTP and the NISP Supplemental EIS were used as a platform for the development of the NISP Mitigation and Enhancement Plans. Aspects of the CTP will also be utilized in the future mitigation planning associated with the Halligan/Seaman Projects. The CTP documents include a comprehensive review of all available hydrologic and biologic data, water quality, and physical habitat modeling data. CPW has utilized the CTP data to enhance and refine the 2014 R2CROSS efforts (described above) and to support the work of local CLP collaborative efforts to improve flows in the entire CLP corridor from the canyon mouth down to Greeley (also described above). The CTP comprehensive report was prepared by GEI Consultants in 2013; a copy of this report can be found on the US Army Corps of Engineers website under the NISP Supplemental EIS tab.

As mentioned above, the CTP provides CPW with fisheries data and physical habitat modeling data that can be used to document the existing natural environment in the CLP, to develop ISF recommendations, and to evaluate various ISF proposals and scenarios. The scientific team who developed the CTP compiled data and information to develop reach-, species-, and life stage-specific habitat-flow relationships for the Poudre River; this was done using two-dimensional hydraulic modeling and physical habitat simulation software (PHABSIM). The resulting datasets contain habitat-flow relationships for various species of fish at different life stages. These datasets were used in conjunction with the R2CROSS results to develop segment-specific flow recommendations designed to preserve **and** improve the natural environment in the Poudre River.

R2CROSS is a standard setting methodology that is useful in recommending specific ISF amounts based on a set of hydraulic criteria. Standard-setting techniques tend to be a firm quantification for non-degradation of biological needs based on the retention of hydraulic characteristics in a critical low flow habitat. PHABSIM, on the other hand, is an incremental methodology that is most useful to evaluate various water management scenarios and the

associated changes in habitat conditions for certain life stages of fish. PHABSIM is a widely used technique for evaluating the incremental changes in species- or life stage-specific habitat due to changing flow scenarios; it is therefore very useful identifying impacts, potential improvements, or conducting trade-off analyses when one is looking at a change in hydrologic conditions.

In general, when a seasonal flow amount is identified (whether from R2CROSS or from PHABSIM), the lower limit can be considered to be the *amount needed to preserve the natural environment to a reasonable degree* and any flow over and above the lower limit (often times up to an upper limit or threshold) can be considered to be the range of flows where the data can be relied upon to assist in the CWCB finding that flows in this range can be used beneficially to *improve the natural environment*.

Natural Environment Data

Over the past several decades, CPW and others have conducted field surveys of the fishery resources on this segment of the Poudre River; much of this data was summarized in the GEI CTP report. This data can be used by the CWCB to make the conclusion that a natural environment exists and that this natural environment that can be preserved and improved to a reasonable degree with the water being made available from the acquisition. The CLP River in the Fort Collins reach is a somewhat diverse fishery consisting of both native and non-native species. As the River emerges from the Poudre Canyon, it is typical of a cold-water fishery, containing both rainbow and brown trout. As the river flows to the south and east through Fort Collins, the physical habitat changes, flow alterations become more significant, and water temperatures rise. The fishery transitions from a cold water fishery to a mixed cold water/cool water fishery. Primarily due to warmer temperatures, brown trout become more prevalent than rainbows and other species start to show up in sampling efforts - namely carp, fathead minnows, suckers, and dace.

CPW Flow Recommendations

In response to the Northern NISP Mitigation Release proposal, CWCB asked CPW to provide our recommendations relative to flows within the Fort Collins reach that will preserve and/or improve the CLP natural environment to a reasonable degree.

To develop these flow recommendations, CPW used a composite of the three R2CROSS sites within the subject reach, Lyons Park, Shields Avenue, and Linden Avenue and two of the CTP's PHABSIM sites, Watson Lake and Martinez Park to characterize and analyze the reach of the CLP River that will benefit from the NISP Mitigation Releases (see Figure 1). CPW believes that it is appropriate to examine all of this data, both R2CROSS and PHABSIM, to come up with flow recommendations for the CLP to preserve and improve the natural environment. The R2CROSS results (developed utilizing the standard methodologies described in Nehring, 1981 and Espegren, 1996) are summarized in Table 2.

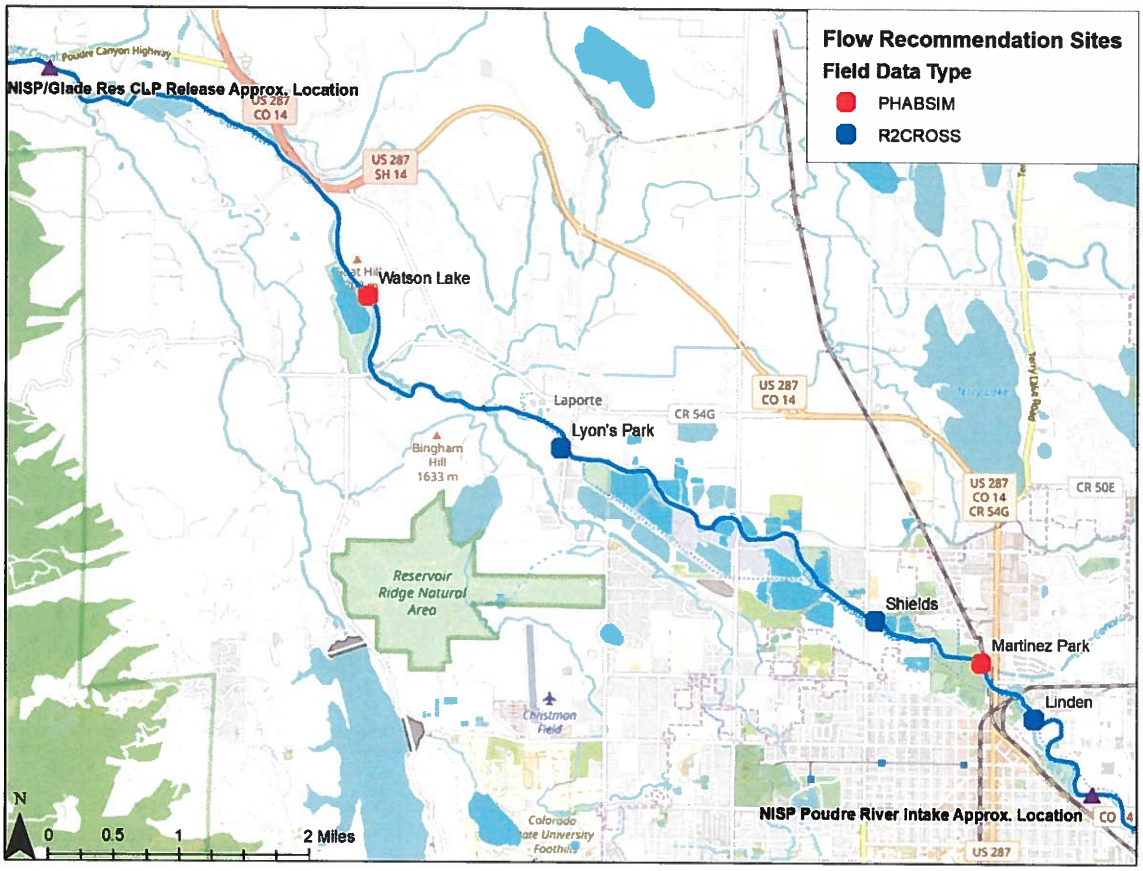

Figure 1. Map of R2CROSS and PHABSIM Sites

Table 2. Seasonal In-Range R2CROSS Flow Recommendations		
R2X Site	**Winter Flow Recommendation (flow meeting 2 of the 3 hydraulic criteria)**	**Summer Flow Recommendation (flow meeting all 3 hydraulic criteria)**
Lyons Park	98	209
Sheilds	82	170
Linden Street	Outside of Range of Accuracy	117
Average	**90**	**165**

Figure 2 and Figure 3 below are the PHABSIM weighted usable area (WUA) vs. flow relationships (WUA curves) for the two PHABSIM sites, Watson Lake and the Martinez Park:

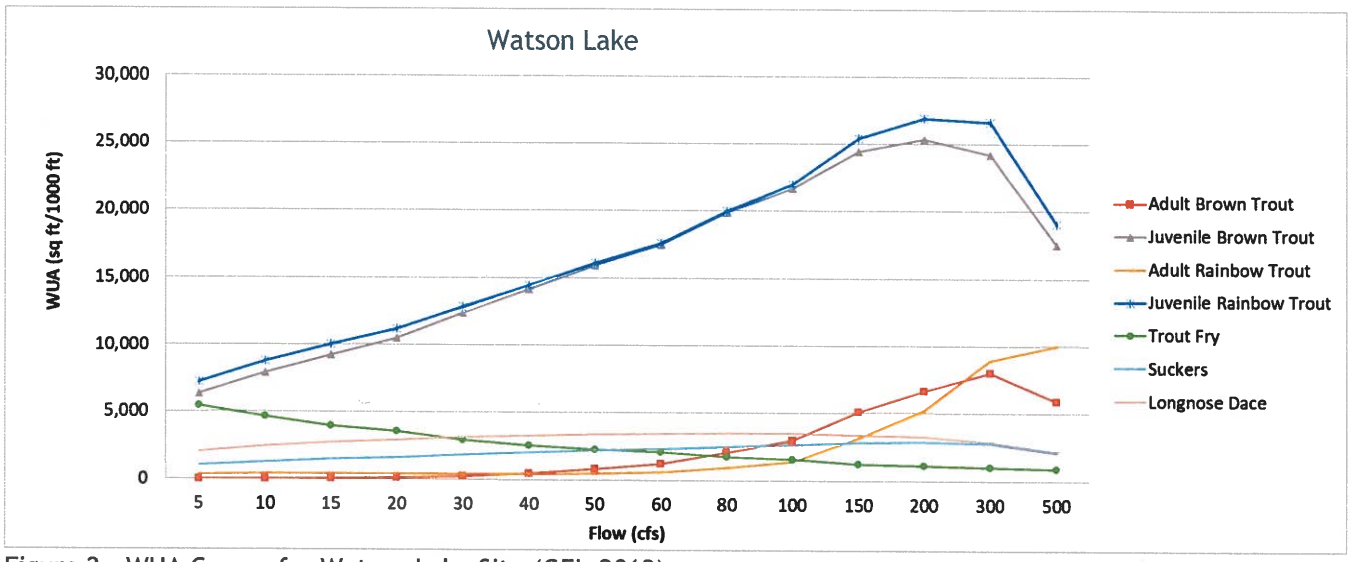

Figure 2. WUA Curves for Watson Lake Site (GEI, 2013)

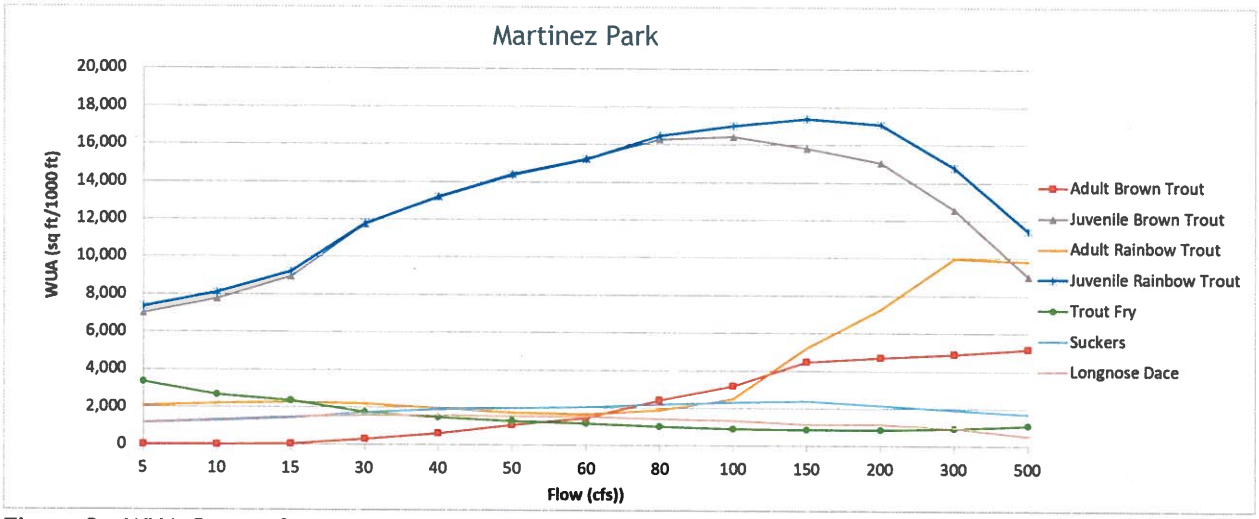

Figure 3. WUA Curves for Martinez Park Site (GEI, 2013)

The averaged R2CROSS results point toward a winter season flow recommendation of 90 cfs and a summer season flow recommendation of 165 cfs. In general, R2CROSS flow recommendations should fall in the sub-optimal range; this does not appear to be true in this case. After examining the PHABSIM results for the Fort Collins reach of the CLP River, CPW believes that the channel geometry measured at the three R2CROSS sites was significantly altered as a result of the 2013 floods and we conclude that the winter season flow appear somewhat reliable but require some refinements using the PHABSIM data. The channel alterations seem to have a greater impact on the summer season flow recommendations (due primarily to the bankfull channel indicators); we will therefore rely more heavily on the PHABSIM data for the summer season flow recommendations.

We believe that it is useful to discuss some differences and similarities that are evident in the PHABSIM results. First, note the similarities of the juvenile curves at both sites. Both rainbow and brown trout juvenile habitat curves follow the same pattern at both sites. The adult

brown trout curves also follow similar patterns from site to site, but the Martinez Park site appears to have better brown trout habitat from 150 cfs to 500 cfs. The adult rainbow curves are also quite similar from site to site. The major difference in all of these curves is the flow at which habitat is maximized (the optimum flow) and the slight differences at which habitat increases within certain ranges of flow. Due to all of these similarities from site to site and due to the fact that at any given time, both adult and juvenile life stages are present in the river, it is reasonable to combine the two PHABSIM sites and to also combine the species into two general categories - "all adult trout" and "all juvenile trout".

CPW did not consider the "Trout Fry" curve in the development of flow recommendations for the CLP. Trout fry, in general, seek out low velocity areas near the margins of any stream or river and it tends to be relatively stable irrespective of the flow; fry habitat decreases at higher flows as the overall quantity of low velocity habitat decrease. Therefore, adult and juvenile trout were the primary drivers of the flow recommendations. We also calculated the flows at which 90% and 50% of the optimum level of habitat occurs; all of this data was used to develop and/or refine the "preserve" flow recommendations.

The 90 cfs R2CROSS winter flow recommendation appears to be a little high when one looks at the optimum or near optimum (90%) flows for juvenile trout. We therefore recommend a slightly lower flow (80 cfs) for the winter season to preserve the natural environment. 80 cfs is the mid-point between the 50% flow for juveniles (22 cfs) and the 50% flow for adults (137 cfs). For the summer season "preserve" flow, we recommend 114 cfs; this flow is the mid-point of the 90% flow for juvenile trout (91 cfs) and the 50% flow for adult trout (137 cfs). CPW is of the opinion that 80 cfs in the winter season and 114 cfs in the summer season are the flow targets to preserve the natural environment to a reasonable degree in the Fort Collins reach of the CLP River. In general, trout habitat is stable or increasing in this range of flows in the CLP.

When flows increase above 80 cfs in the winter and 114 cfs in the summer, this is the hydrologic range where habitat is, in general, rapidly increasing and approaching optimum levels. This is, by definition, the range of flows where "improvement to the natural environment" is possible. In general, optimum habitat for adult trout is reached in the 300 to 500 cfs range but that needs to be balanced with the fact that juvenile trout habitat is maximized at flows in the 100 to 200 cfs range (flows above this range are actually detrimental to this critical life stage). This balancing act is largely an issue of professional judgment. CPW believes that during the winter months, improvement of the natural environment can be realized in the range of flows from 80 cfs up to 150 cfs; 150 cfs represents the mid-point of the optimum flow for juvenile trout for both species at the two PHABSIM sites. Similarly, during the summer months, CPW is of the opinion that flows from 114 cfs up to 260 cfs are flows where a significant improvement is possible. 260 cfs represents the mid-point between the average adult trout optimum (356 cfs) and the average juvenile optimum (163 cfs) for both species at both sites.

All of these flow levels are significantly higher than the Mitigation Releases in Table 1, but it important to note that there will be times and points within the Fort Collins reach when the Mitigation Releases are not the only water in the river. The converse is also true; there will be points in both time and space where the NISP Mitigation Releases might be the only water in the river (the "Dry Up Points"). These flow recommendations will allow the CWCB to protect the NISP Mitigation Releases from diversion under all circumstances. It is CPW's understanding that the contract between CWCB and Northern will address the issue of transit losses and

measuring devices to ensure that the NISP Mitigation Releases will be present in the entire Fort Collins reach at all times.

Based on the approach described above, the recommendations summarized in Table 3 are both the amount needed to preserve the natural environment and the upper limits of flows that will result in an improvement to the natural environment.

Table 3. Flow Recommendation Summary		
	Preserve ISF target rates	**Improve ISF target rates**
Winter Flow Recommendation (Nov 1-March 31)	Up to 80 cfs	Between 80 cfs and 150 cfs
Summer Flow Recommendation (April 1-Oct 31)	Up to 114 cfs	Between 114 cfs and 260 cfs

CPW staff and Commission invested considerable time in developing the Mitigation Plan with Northern and we are eager to put SB 18-170 to work to implement the Plan's elements. CPW is ready to assist in advancing this aspect of the NISP project and the Mitigation Plan. CPW looks forward to working with the Board's staff and Northern when the project is finalized and releases are implemented.

As always, CPW staff will be in attendance at the September 2018 CWCB meeting in Steamboat Springs to provide testimony or to answer any questions that the Board might have relating to this agenda item. Thank you for the opportunity to assist in this matter.

Sincerely,

Jay Skinner
Katie Birch
CPW Instream Flow Program Coordinators

CC: Conovitz, Spohn, Bettige, Armstrong, Nichols, Corday