SavethePoudre.org
Poudre Waterkeeper

P.O. Box 20, Fort Collins CO 80522
info@savethepoudre.org
www.savethepoudre.org

Colorado Parks and Wildlife Commission
c/o Commission Assistant and Ken Kehmeier
1313 Sherman St.
Denver, CO 80203
dnr_cpwcommission@state.co.us
ken.kehmeier@state.co.us

August 31, 2017

Dear Sir/Madam,

Save The Poudre: Poudre Waterkeeper (STP) provides the comments below on the draft Fish and Wildlife Mitigation and Enhancement Plan ("draft plan") for the Northern Integrated Supply Project (NISP). STP is a 501c(3) organization registered with the State of Colorado, dedicated to protecting and restoring the Cache la Poudre River of northern Colorado. STP has commented extensively on NISP throughout the 14-year federal permit review process.

**I. Lack of time:**

As the Commission is aware, the Northern Colorado Water Conservancy District (NCWCD) replaced its "Applicant Proposal" draft with a "Draft Final" draft on August 22, 2017. This new version contained extensive changes, especially to the sections dealing with bypass flows. This publication occurred after STP had conducted the bulk of its review of the applicant proposal. Although we have made every attempt possible to reconcile our comments with the final draft version before the Commission, the extremely limited time has compromised our ability (and we believe that of others) to perform a rigorous analysis on the efficacy of the changes. The comments submitted herein reflect a good faith effort to review the final draft plan (henceforth called "draft plan") and share our concerns with the Commission within the constraints placed by the review process. We have not, however, been able to completely examine and model the net benefits of the decision tree that implements the mitigation tiers in the draft plan.

**II. The Commission's Duty:**

Upon receipt of the draft plan, it is the duty of the Commission to "evaluate the probable impacts of the project based on the information submitted by the applicant." (*See* Colorado Code of Regulations (CCR) § 406-16, Regulation No. 1604(B)(3)) The Commission has broad authority to condition its adoption of the mitigation plan as the official state position on required mitigation for the project. The Commission is not obliged to accept the draft plan as presented. Rather, the Commission must evaluate the project impacts and may agree with the plan, or submit a report to the Colorado Water Conservation Board that evaluates the project impacts, makes mitigation recommendations of its own, and provides an analysis of the draft plan as submitted by NCWCD. (*Id.*, Regulation No. 1604(B)(3)(a)-(h)) As the Commission knows, but it bears repeating, the Legislature adopted HB1158 to ensure

> "…that fish and wildlife resources that are affected by the construction, operation, or maintenance of water diversion, delivery, or storage facilities should be mitigated to the extent, and in a manner, that is economically reasonable and maintains a balance between

the development of the state's water resources and the protection of the state's fish and wildlife resources.**"** (Colorado Revised Statutes (CRS) § 37-60-122.2.(1)(C) (emphasis added)).

**III. The Commission must reject the plan and require NCWCD to create a new plan:**

STP urges the Commission to reject the draft plan, not recommend it as the "Official State Position" regarding mitigation for the NISP, and instead prepare a report for the Colorado Water Conservation Board detailing the flaws in the mitigation plan and explaining, as our comments below highlight, that the mitigation plan proposed by NCWCD is critically deficient and cannot be said to effectively balance water needs with wildlife protection. In addition, we urge the Commission to require NCWCD to produce a plan that is based on best available science, and is an honest disclosure to the public of the many adverse effects to the ecology of the Poudre River that will inevitably occur if this project goes forward. An acceptable plan must discuss in detail the mitigation actions that will be implemented and how their effectiveness will be meaningfully evaluated. Approval of the draft plan in its current state would be a significant failure by the Commission to uphold its duties to protect Colorado's fish and wildlife resources for all Coloradans.

The burden is on the diverter, NCWCD, to develop a plan that includes specific, defined elements grounded in a "systematic evaluation of fish and wildlife resources and habitats using best available scientific information and professional judgment." (*See* Colorado Code of Regulations (CCR) § 406-16, Regulation No. 1604(A)(2)(c)(3)-(4)).

As our comments below detail, the draft plan proposed by the NCWCD fails to include required elements, and the elements it does include are not grounded in the best available scientific information or best professional judgment. Moreover, the draft plan does not present a complete discussion of the impacts of the NISP, including both direct and indirect impacts, and cumulative impacts, as required by law. (*See id.*) Likewise, the mitigation proposed in the draft plan is not certain to occur "concurrently with or prior to project development;" it is not proportional to project impacts; and it is not proposed to last for the entire period in which impacts to wildlife resources persist. (*See id.*, Regulation 1604(A)(2)(c)(5)).

Further, we believe that if the requirements the legislature demanded for mitigation plans were actually satisfied, it would become clear that the NISP is an ill-conceived project that will wreak havoc on the long-term stability and integrity of the Cache la Poudre River ecosystem. The impacts of the NISP cannot be mitigated in a manner that effectively maintains a balance between the development of the state's water resources and the protection of the state's fish and wildlife resources, as required by the Colorado legislature through HB1158 (Colorado Revised Statutes (CRS) § 37-60-122.2).

**IV. Our general comments on the draft plan:**

The draft mitigation plan proposed by the Northern Colorado Water Conservancy District (NCWCD) does not meet these essential requirements and therefore is fundamentally and fatally flawed. In general:

A. The draft plan makes promises, but extensive loopholes implemented at the discretion of the NISP applicant, NCWCD, provide no assurances to the public that essential mitigation actions will be implemented when necessary. Consequently, the draft plan fails to provide any meaningful enforcement or accountability for mitigation outcomes and is instead structured to support NCWCD's desired water yield.

B. The draft plan offers no analysis of the likelihood of success, or the benefits of the proposed mitigation actions, in relation to the impacts of the project. Although the draft plan presents a number of proposed actions, it fails to establish that any actions, individually or collectively, would meaningfully mitigate the impacts of the proposed project. Further, the draft plan repeatedly states that it is mitigating impacts described in the NEPA process Draft Environmental Impact Statement (DEIS) and the Supplemental DEIS (SDEIS) documents, but those documents do not fully describe the impacts of NISP and are highly controversial.

C. The draft plan proposes mitigation for water quality and water temperature impacts even though such impacts have not been fully analyzed or even disclosed in the NEPA process. Further, the SDEIS, the most current NEPA documentation, is based on a river flow analysis that ignores the most recent ten years of flow data collected on the river. If the analysis had incorporated all of the best available data – as is required by law – the SDEIS' statistical findings and expected impacts would have been dramatically altered. The draft plan fails to explain how effective mitigation can be implemented for impacts that are not yet fully understood.

D. The draft plan does not consider the effects of ongoing and accelerating climate change effects on NCWCD's ability to achieve its mitigation goals. Without such an analysis, the draft plan fails to account for how the proposed mitigation actions will function in the real world.

E. HB 1158 requires that NISP "maintains a balance between the development of the state's water resources and the protection of the state's fish and wildlife resources", but the draft plan completely fails to address the fact that 63% of the flow in the Cache la Poudre River has already been diverted out of the river before the river reaches downtown Fort Collins. Thus, the river is already terribly out of "balance".

F. The proposed "conveyance realignment" mitigation in the draft plan stops at the Timnath Inlet which is just past Lemay Avenue in Fort Collins. As such, the entire downstream stretch of the Poudre River – including at the Colorado State University "Environmental Learning Center" and out to the confluence with the South Platte River near Greeley – would not be mitigated with any base flow and suffer the extreme negative impacts of NISP.

**V. Adaptive Management:**

The draft plan asserts that NCWCD will address uncertainty in impacts of the NISP and mitigation of those impacts through the concept of "adaptive management" (see Section 2.8). While this is an appropriate paradigm for management under uncertainty, the draft plan fails to acknowledge and discuss ley elements required for a defensible adaptive management plan. This means that the draft plan fails entirely to ensure that mitigation is certain to occur "concurrently with or prior to project development;" it is proportional to project impacts; and will last for the entire period in which impacts to wildlife resources persist, as required by law. (*See id.*, Regulation 1604(A)(2)(c)(5)).

STP has attached a comprehensive analysis of the draft plan's adaptive approach as Attachment A – this analysis was prepared by Dr. Barry Noon of Colorado State University. The key concerns include:

- The draft plan fails to recognize that each infrastructure component of the project will lead to irreversible changes to the Cache la Poudre River watershed. The result is that the range of possible management actions in response to adverse environmental effects becomes progressively more limited following each stage of construction, and that appropriate adaptive responses to undesirable outcomes are no longer possible.

- The draft plan incorrectly characterizes adaptive management as a process with a finite timeline. This is incorrect. Adaptive management requires an ongoing assessment of the state of the river and the need to continually make state-dependent management decisions to sustain the river's ecological integrity.

- The draft plan fails to account for the cumulative impacts of the many construction activities, and subsequent changes to the river's flow regime, that will inevitably occur. A defensible cumulative effects analysis is a NEPA requirement.

- The draft plan fails to account for climate change and the very real possibility of a long-term decline in river flows due to decreasing snowpack, increased evaporation, increased watershed evapotranspirational demand, and increasingly-variable rainfall.

**VI. Our specific comments on the draft plan:**

1. Sections 5.2.1.2 and 5.2.1.3 of the draft plan describe fish passage at the new structures planned for the Poudre Valley Canal diversion (replacement structure) and on the South Platte River (new diversion structure), respectively. The draft plan does not, however, specifically mention which fish species would benefit and how the structure will be designed for fish passage. The structure of any fish passage must be designed with the specific species in mind. Section 5.2.1.3 states for the South Platte diversion that, "Obermeyer crest gates would allow fish migration in the South Platte During most times of the year when the SPWCP is not diverting." It is unclear how to interpret "most times of the year" - is that 51% of the time? 99% of the time? The plan appears to be directed towards benefiting introduced sportfish (non-native brown trout and rainbow trout) at the expense of native fishes (who are preyed upon by brown trout and rainbow trout) and whose habitat requirements are different from introduced sportfish (Fausch and Bestgen 1997, Scheurer *et al.*2003, Cathcart and Fausch 2010). NCWCD should clearly specify the design and operation of the fish passage components, the fish species targeted to benefit from the fish passages, and what actions will be taken to mitigate against failure of the passages. By not doing so, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not conducting a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

2. Section 5.2.1.3 of the draft plan states that, "The SPWCP diversion structure would only nominally increase upstream water depth, and the pool would be contained entirely within the existing channel and would not affect wetlands." This is nonsense – any diversions from the river are going to decrease the potential for overbank flows to sustain wetlands, hyporheic flows, and groundwater storage linked to riparian wetlands downstream (Save The Poudre 2010). NCWCD must provide a meaningful quantitative analysis of the likely adverse effects on wetlands resulting from the diversion structure and specify appropriate mitigation. By not doing so, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by failing to adequately disclose and address direct, indirect, on-site, off-site, and cumulative impacts.

3. Section 5.2.2.2 of the draft plan states that, "Northern Water has agreed to curtail in priority NISP diversions under the Grey Mountain storage right to the extent that these curtailments would help satisfy the Watson Lake Fish Hatchery and Fort Collins Boat Chute water rights." The Fort Collins Boat Chute water right has never been "called" (City of Fort Collins, personal

communication), and the right is so junior that STP cannot project a scenario under which it would be called. NCWCD must provide an analysis supporting the fact that the Fort Collins Boat Chute water right is relevant to the mitigation proposed if they include it here. By not doing so, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by failing to adequately disclose and address direct, indirect, on-site, off-site, and cumulative impacts.

4. Section 5.2.2.4 of the draft plan states that NCWCD will not operate the low flow mitigation conveyance "…during initial NISP operations before full NISP demands are met…" As written, this loophole relieves NCWCD of low-flow mitigation for at least a decade or longer, since at least one of the NISP participants does not anticipate requiring the full allocation of NISP water until after 2030. NCWCD must specify a meaningful upper boundary on the length of time that this loophole will apply. By not doing so, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(5), including by failing to include mitigation that occurs "concurrently with or prior to project development," is proportional to project impacts, and will last for the entire period in which impacts to wildlife resources persist.

5. Section 5.2.2.4 of the draft plan states, "The refined conveyance approach is intended to avoid, minimize and enhance water quality and the aquatic and riparian environments." No one evaluating this plan, including STP, can estimate the effectiveness of the conveyance because the proposal is based on the inadequate and flawed water quality and water temperature impact analyses presented in the NISP SDEIS (Save The Poudre 2015). In addition, how the conveyance will mitigate against otherwise adverse effects on the aquatic and riparian environment is not described in the draft plan. It is impossible for NCWCD to propose meaningful mitigation for the impacts that are not yet understood and appropriately disclosed. NCWCD must withdraw this mitigation proposal now and reassess them if and when an adequate impact analysis has been performed and published. If it fails to do so, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing impacted resources and mitigation measures with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

6. Table 5 in the draft plan, credited to the SDEIS, presents "flow metrics" projected to occur while NISP is operating. STP cannot find any basis in the SDEIS documentation for these data. Further, Table 5 is not referenced in the draft plan text, so no context for its data is provided and its inclusion in the draft plan is misleading. NCWCD must clarify its data source, the biological relevance of Table 5, and/or correct the data presented in Table 5 and provide context for its inclusion within the draft plan. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not conducting its assessment in the draft plan with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

7. The proposed capping of peak flows at 2,800 cfs is significantly lower than that recommended in other analyses (Bartholow 2010) and is counter to well-established understandings about the importance of flow regimes (amount and duration of flow) and natural variability to sustain watershed and ecological functions (Poff *et al.* 1997, Lytle *et al.* 2017). The plan provides no basis or explanation for capping the volume of the mitigation "pool" at 1,200 AF. For example, if this volume of water is used to achieve the proposed peak mitigation flow of 2,800 cfs, it would be depleted in just over 5 hours. The proposed Glade Reservoir multi-level release structure is

proposed to allow a maximum flow of 112 cfs, an amount far too small to meet ecological objectives to support meaningful releases for peak flow mitigation. NCWCD is proposing to "mitigate" peak flow losses by simply not diverting flows from the river from one to three few days every several years. From numerous hydrological studies conducted over the last several decades, it is known with high scientific certainty that this flow augmentation is grossly inadequate. To call it an "enhancement", as claimed in the draft plan, is ludicrous. The assertion that this is an adequate flow regime to sustain ecological function and outputs brings into question the scientific foundation and credibility of the draft plan. NCWCD must provide a science-based justification for the peak flow cap and mitigation pool size, demonstrate how the proposed cap and pool size will effectively mitigate the impacts of NISP, and appropriately characterize the proposed mitigation as a reduction of diversion volumes not as an enhancement. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing mitigation measures with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

8. Section 5.2.2.6 (Tables 6 and 7) of the draft plan fails to provide a basis for the tier thresholds, and no analysis is provided for why the reservoir volumes for these thresholds were set at the levels proposed. As the decreed operative tier each year will be the primary criteria for determination of the bypass flows, it is essential that the thresholds be based on sound science and have a solid footing in both project operations and aquatic ecology. NCWCD must provide a rigorous defense for the thresholds provided; until NCWCD does so, the tiers and the entire bypass mitigation proposal are not credible. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing mitigation measures with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

9. Section 5.2.2.6 of the draft plan fails to provide protection for impacts on fish habitat. Given the uncertainties and the relative lack of information about peak flow requirements to sustain ecological processes for the Cache la Poudre, NCWCD must take the prudent approach and err on the upper side of uncertainty and the worst-case scenario. The mitigation proposed is well below the lower bound of uncertainty (Bartholow 2010). The draft plan refers to "maintaining spawning habitat" but does not indicate which fish species, other than introduced brown trout and rainbow trout, would benefit. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing fish and wildlife resources impacted with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment. NCWCD must correct these errors and specify which impacts will be mitigated by the proposed actions.

10. Section 5.2.2.6 of the draft plan presents a loophole stipulation that tier 3 conditions will be in effect during the entirety of the initial fill period. In our reservoir volume analyses utilizing streamflow reconstructions based on tree ring data from the Cache la Poudre River watershed (Woodhouse and Lukas 2006), we projected climatic conditions that could extend the initial fill period between two and four decades. Since the year 1615 (when the streamflow reconstruction began), the river has experienced at least eight periods where it would take ten or more years to fill the proposed reservoir. NCWCD must specify a meaningful upper bound on the length of time that this loophole will apply. Absent such a specification, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(5), including by failing to include

mitigation that occurs "concurrently with or prior to project development," is proportional to project impacts, and will last for the entire period in which impacts to wildlife resources persist.

11. Table 6 in the draft plan, under "Other Terms and Conditions", reads that, "bypassed flow will not be diverted by another upstream or downstream water right." The draft plan fails to explain how this requirement would be implemented, verified, or how such a requirement could be legally enforced. As written, such terms or conditions could be used to decline to implement a bypass flow unless it could be documented that the water was not being diverted by another user prior to reaching the South Platte River, a potentially impossible task. NCWCD must provide an explanation of how this loophole will be implemented and who will make the determinations necessary. Absent such analysis, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(5), including by failing to include mitigation that occurs "concurrently with or prior to project development," is proportional to project impacts, and will last for the entire period in which impacts to wildlife resources persist.

12. Section 5.2.2.6 of the draft plan states that tier 1 conditions would occur 43% of years, tier 2 37% of years, tier 3 20% of years. The draft plan states that these statistics are based on 2015 data (prior to development of the mitigation proposed here). We note that these statistics apply only if no loopholes blocking implementation of the proposed bypass mitigation are applied. However, section 5.2.2.6 and Table 6 stipulate loopholes that allow NCWCD to avoid implementing mitigation actions if the NISP yield is potentially compromised (NCWCD would be in the sole position to decide if NISP yield might be compromised by a mitigation action) and under certain other conditions (such as initial fill). Further, in the SDEIS, the project proposes "operational flexibility", leaving the NISP participants with the opportunity to fill the reservoirs with water from sources other than the Grey Mountain Right (GMR) or the South Platte Water Conservation Project Rights (SPWCPR). Such fill presumably would be broadly defined under "NISP yield." This includes water rights bought and sold between the existing NISP participants, and other entities who may buy into the reservoir, a likely outcome considering that the NISP participants propose to be able to buy and sell NISP shares with other parties on the open market. Such a wide loophole, combined with excessive operational flexibility, gives NCWCD unacceptable flexibility to interpret conditions that affect water delivery under NISP, without requirements to sustain essential ecological processes downstream of the diversion. Such latitude is inconsistent with meaningful and enforceable mitigation requirements. As a result, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(5), including by failing to include mitigation that occurs "concurrently with or prior to project development," is proportional to project impacts, and will last for the entire period in which impacts to wildlife resources persist. NCWCD must specify under which conditions constrained yield and operational flexibility will restrict mitigation of project impacts and provide a rigorous analysis of the efficacy of mitigation so restricted, so that the implementation of the tier structure may be independently analyzed and verified.

13. Section 5.2.2.7 of the draft plan proposes mitigation actions based on the inadequate and flawed water quality and water temperature impact analyses presented in the NISP DEIS (Save The Poudre 2008). In addition, possible mitigation actions needed to minimize adverse effects on the aquatic and riparian environment are not actually described in the draft plan. It is impossible for NCWCD to propose meaningful mitigation for the impacts that are not yet understood and appropriately disclosed. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing mitigation

measures with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment. NCWCD must withdraw these mitigation proposals now and reassess them if and when an adequate impact analysis has been performed and published.

14. Section 5.2.2.7 of the draft plan presents mitigation proposals that are inappropriately based on flows at the Canyon Gage and on water quality and temperature measurements taken immediately below the Hansen Canal. Adverse water quality and temperature impacts of NISP would be expressed most severely between the Lincoln Street Gage and the Environmental Learning Center. Both are miles downstream of the Canyon Gage and the outlet of the Hansen Canal. Meaningful mitigation can only be established and monitored if relevant data are collected and analyzed. NCWCD must establish monitoring sites located in proximity to the locations of the most severe impacts and redevelop this section to rely on those sites. Unless and until this occurs, the draft plan will not ensure mitigation occurs concurrently with project development, be proportional to impacts, or last for the entire period in which impacts persist, as required by Regulation No. 1604(A)(2)(c)(5).

15. Section 5.2.2.8 of the draft plan states that, "NISP shall not be obligated to operate at a ramping rate of less than 500 cfs in 24 hours if impacts on yield are expected." The draft plan fails to establish who will make such a determination. The draft plan also fails to present a justification for such a decision after clearly stating, in the same section, that such a diversion "can be detrimental to fish, especially during spawning periods." NCWCD must provide a science-based criteria for limitation on the mitigation and specify who will make the determination of impacts on yield. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing mitigation measures with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

16. Section 5.2.2.8 of the draft plan also fails to provide a comprehensive biological basis for the 500 cfs ramping rate limitation. Native cottonwood and willow regeneration, for example, requires a much slower ramping down rate to support seedling establishment after peak flows (*Stettler 1996*). NCWCD must provide a science-based criteria for this ramping rate. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(3)-(4), including by not assessing mitigation measures with a systematic evaluation of fish and wildlife resources and habitats using best available scientific information and best professional judgment.

17. Section 5.3.1.2 of the draft plan proposes channel structure modifications. Recent evidence from the 2013 flood on the St. Vrain river watershed indicates that the proposed structural modifications to the channel could be completely undone by the next major flood in the Cache la Poudre watershed (Boulder County Parks and Open Space Staff, personal communication). NCWCD does not explain what would happen in the event such mitigation measures fail within the project timeline. NCWCD must clearly establish standards under which the channel structure modifications would be restored and how the restoration would be funded before this proposed mitigation can be seen as effective. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(5), including by failing to include mitigation that occurs "concurrently with or prior to project development," is proportional to project impacts, and will last for the entire period in which impacts to wildlife resources persist.

18. Section 5.3.1.3 of the draft plan lists a total of 102 acres of land for "Areas under consideration" for riparian vegetation improvements. In its analysis of wetlands and riparian area impacts of NISP, STP found that between 1,420 and 2,170 acres of critical riparian areas downstream of the NISP diversion are likely to be adversely affected by the NISP project. The proposals in the draft plan would mitigate just 5-7% of the riparian areas and wetlands affected by the project (Save The Poudre 2010). The impacted area includes 700 acres of wetlands. NCWCD must specify meaningful mitigation for the entirety of the impacts expected under NISP. Absent this, the draft plan does not satisfy the requirements of Regulation No. 1604(A)(2)(c)(5), including by failing to include mitigation that occurs "concurrently with or prior to project development," is proportional to project impacts, and will last for the entire period in which impacts to wildlife resources persist.

Thank you for your consideration of these comments. Please notify us via email that you have received these comments in full.

Sincerely,

Gary Wockner, Ph.D., Executive Director, Save The Poudre: Poudre Waterkeeper

Mark Easter, Chair, Save The Poudre: Poudre Waterkeeper Board of Directors

Save The Poudre: Poudre Waterkeeper
PO Box 22, Fort Collins, CO 80522

**Literature Cited**

Bartholow, John M. 2010. Constructing an Interdisciplinary Flow Regime Recommendation. *Journal of the American Water Resources Association* (JAWRA) 1-15. DOI: 10.1111/j.1752-1688.2010.00461.x

Boulder County Parks and Open Space Operations Staff. 2017. Personal Communication.

Cathcart, C. Nathan and Kurt D. Fausch. 2010. Implications of a Depressed Thermal Regime on Native Fish Species of the North Fork Cache la Poudre River. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Final Report to The Nature Conservancy, Contract COFO-2009SVP, May 2010.

Fausch, Kurt D. and Kevin R. Bestgen. 1997. Ecology of Fishes Indigenous to the Central and Southwestern Great Plains. In Knopf, Fritz L. and Fred B. Samson (Eds), Ecology and Conservation of Great Plains Vertebrates.

Lytle, David A., David M. Merritt, Jonathan D. Tonkin, Julian D. Olden, and Lindsay V. Reynolds. 2017. Linking river flow regimes to riparian plant guilds: a community-wide modeling approach. Ecological Applications, 27(4), 2017, pp. 1338–1350.

Poff, N. LeRoy, J. David Allan, Mark B. Bain, James R. Karr, Karen L. PRestegaard, Brian D. Richter, Richard E. Sparks and Julie C. Stromberg. 1997. Bioscience 47(11) 769:784.

Save The Poudre: Poudre Waterkeeper. 2008. Comment Letter to the U.S. Army Corps of Engineers on the NISP Draft Environmental Impact Statement.

Save The Poudre. 2010. NISP's impacts on riparian areas including wetlands along the Cache la Poudre River.

Save The Poudre: Poudre Waterkeeper. 2015. Comment Letter to the U.S. Army Corps of Engineers on the NISP Supplemental Draft Environmental Impact Statement.

Sheurer, Julie A., Kevin R. Bestgen, and Kurt D. Fausch. 2003. Resolving Taxonomy and Historic Distribution for Conservation of Rare Great Plains Fishes: Hybognathus (Teleostei: Cyprinidae) in Eastern Colorado Basins. Copeia, 2003(1), pp. 1–12

Stettler, R.F. 1996. Biology of Populus and its implications for management and conservation. National Research Council Canada.; National Research Council of Canada; NRC Research Press. Ottawa : NRC Research Press , c1996

Woodhouse, Connie A. and Jeffrey J. Lukas. 2006. Multi-Century Tree-Ring Reconstructions of Colorado Streamflow for Water Resource Planning. Climatic Change (2006) DOI: 10.1007/s10584-006-9055-0

August 25, 2017

TO: Mark Easter, Gary Wockner, and the STP Board
RE: Northern Water Fish & Wildlife Proposal (with a specific focus on adaptive management and cumulative effects—UPDATED)
FROM: Barry R. Noon, Professor, Colorado State University

**Adaptive Management**

In the following, I will clarify the concept of adaptive management, its key components, its proper interpretation, and its limitations. I will also discuss the role that adaptive management plays in the responsible management of our natural resources with a specific focus on sustaining the Cache La Poudre River from the canyon mouth near Ted's Place till its confluence with the South Platte River.

Northern Water is proposing to construct a dam near the canyon mouth. In anticipation of its construction, they have prepared a document entitled "Fish and Wildlife Mitigation and Enhancement Plan (Applicant Proposal), June 9, 2017". The City of Fort Collins has responded to this document (hereafter referred to as "FC response"). Both documents refer frequently to the adaptive management paradigm. I will use **bold font** to emphasize concepts that I believed were underappreciated in the Northern Water and FC response documents.

There is a pervasive misunderstanding of the adaptive management concept and its essential components. This misunderstanding, and subsequent misapplication, is commonplace in most, if not all, federal and state land management agencies. Most common is the naïve belief that by invoking adaptive management, the action agent (Northern Water in this case) is somehow free of all responsibility for a careful, thorough, up-front analysis of their proposed management actions (e.g., dam construction and associated infrastructure) and its possible short-term, long-term, and **irreversible** consequences. A common assertion by the action agent can be characterized by the following refrain: "If we screw-up, we will simply respond in an adaptive fashion, fix our mistakes, and everything will be OK." This naïve perspective, which reflects a shallow understanding of the core components of adaptive management, is pervasive in the Northern Water document and carried forward into the Fort Collins City Council response.

In the following, I will succinctly review the logic and key components of an adaptive management approach to responsible environmental management. At the end of this document, I provide some key references to the adaptive management literature. The article by Williams et al. (2009), published by the U.S. Department of the Interior, is a particularly lucid introduction to the topic.

Adaptive management: 1) is an approach to decision-making under conditions of high uncertainty about management outcomes; 2) is a process for making recurrent decisions to achieve management objectives in the context of **dynamic environmental conditions**; 3) uses

the outcomes from management actions to **learn** about system response to management and reduce uncertainty associated with future decisions; and 4) is a process that requires **feedback** between management actions and assessment (i.e., monitoring data) where each influences the other.

In addition, adaptive management requires: 1) a clear statement of objectives and desired management outcomes, and their measurement units; 2) a range of management options (this is the domain of the decision-space); 3) models of systems dynamics and projected system responses following implementation of specific management actions; 4) a monitoring program; and 5) a process for decision-making under uncertainty about realized management outcomes.

Adaptive management is the appropriate management framework because all of Earth's ecosystems are embedded within a dynamic, non-stationary world. This is true no matter where you live in the world, **including northern Colorado**. There are numerous sources of environmental stochasticity (variation) arising from: 1) the inherent natural variation of environmental systems; 2) rapid, human-induced changes to the environment (note the dramatic changes in land-use and land-cover in Colorado over the last 50 years); 3) non-stationary changes in the environment as a consequence of **climate change** (completely ignored in the Northern Water document); and 4) changing social values. This is not an exhaustive list—there are many more sources of uncertainty. One significant consequence of living in a stochastic world is uncertainty about the outcomes of human actions. Increased understandings that arise from targeted scientific studies can reduce, but never completely eliminate, uncertainty about outcomes.

How should responsible action agencies (i.e., Northern Water) respond to high levels of uncertainty? I believe they should proceed cautiously, increase their emphasis on environmental sustainability, manage in an adaptive fashion, and use management actions to accelerate understanding of system dynamics and resilience to change. To do otherwise is socially and morally irresponsible. In addition, and perhaps most important, action agents **should not take any actions that are irreversible and limit the range of possible future management actions**.

Both the Northern Water and Fort Collins City Council response documents discuss the role of environmental monitoring. However, these documents fail to emphasize the key aspects and significance of monitoring. There are many relevant monitoring variables that collectively characterize the state of the Poudre River. Relevant state variables include flow, flow duration, the seasonal pattern of flow, water temperature and turbidity, macroinvertebrate abundance, fish species composition, abundance and distribution, and many others. Monitoring data are needed to: 1) establish the initial state of the Poudre River system; 2) provide a basis for comparing predicted management outcomes to realized outcomes; 3) learn about system dynamics and discover what management actions are successful (or unsuccessful); and 4) provide estimates for subsequent **state-dependent management decisions**. The last point is an essential, but poorly understood and often missing, aspect of the adaptive management

process. This component formally links the monitoring data to subsequent management actions by viewing management as a state-dependent decision making process.

Careful selection of monitoring state variables is also essential for a successful adaptive management program. Most important is that the set of monitoring state variables provide an unambiguous assessment of the degree to which the management objectives have been achieved. In addition, the set of monitoring state variables should be collectively **complementary** and **comprehensive**. Complementary state variables have minimal overlap in their information content. The set of monitoring state variables is comprehensive if they collectively span the full range of environmental conditions of the ecological system being managed.

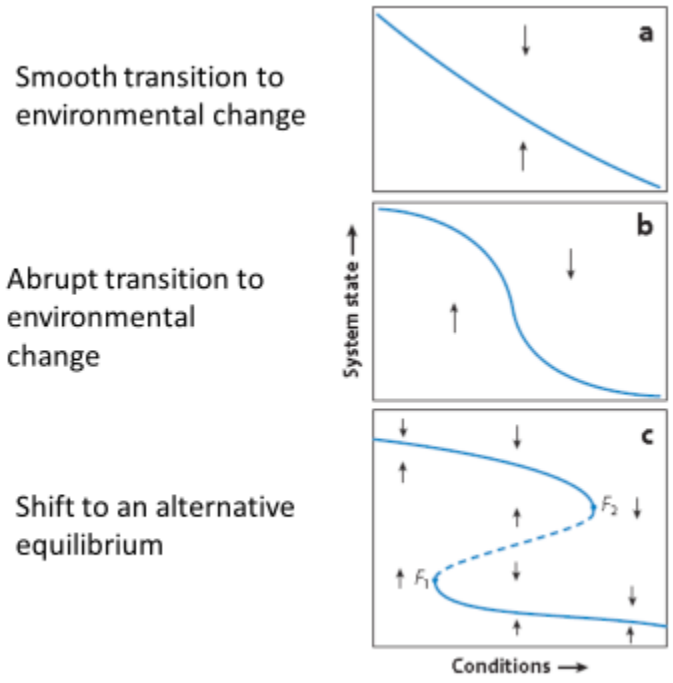
**Cumulative Effects**

The Council on Environmental Quality (1978) states that cumulative effects are collective impacts on the environment, or individual organisms, that result from the accumulation of past, present and reasonably foreseeable future actions regardless of the sources of the effects. The National Environmental Policy Act (1969) requires cumulative effects analyses for proposed large-scale projects like Glade Reservoir. NEPA has helped slow environmental degradation, but it has also fallen short of Congress' original intent to avoid serious environmental harm. With the challenges of global climate change, species extinctions, and increasing energy and water demands for growing populations, the cumulative effects analysis component of NEPA is more important than ever. Unfortunately, the Northern Water Fish and Wildlife Report has no discussion of the many cumulative effects associated with the construction and possible future operation of Glade Reservoir.

Cumulative effects can occur in both space and time. Temporal accumulation occurs when the interval between disturbance events is less than the system's recovery time. Spatial accumulation occurs when the spatial proximity between disturbances is smaller than the distance required to disperser the disturbance. Associated with disturbance events are stressors—processes that induce adverse effects on individuals, populations, communities, or ecosystems. Stressors are chronic or acute pressures that lead to directional changes in the state of species populations or ecological systems. An extreme case of a chronic stressor is an event—dam construction, for example—that represents a permanent transformation of an ecosystem. Such events expose ecological systems to continual stress which can only be attenuated, if at all, by constant remedial management actions. Such actions are always expensive and often ineffective.

Two or more stressor events can accumulate, in time or space, in various ways. Events may accumulate in an additive fashion where the combined stress is simply the sum of the individual events. Unfortunately, what is more common in ecological systems is for multiple stressor events to combine in a multiplicative fashion. In this case, the combined stress greatly exceeds the sum of stressors acting individually. The synergistic effect of multiple stressors acting on an ecological system often leads to non-linear changes in ecosystem state variables and the

potential for threshold events. Such ecological thresholds are abrupt, non-linear changes in one or more state variables in response to environmental drivers or disturbance events. Passing a threshold can result in shifts to alternative stable states that are highly undesirable. These concepts are illustrated graphically in the following figure. For example, consider the y-axis to represent the state of riparian vegetation expressed as acres of suitable habitat for wildlife. The x-axis represents time since dam construction, which is a proxy measured for decline in the annual variance of peak flow events from April to June (in units of $cfs^2$).



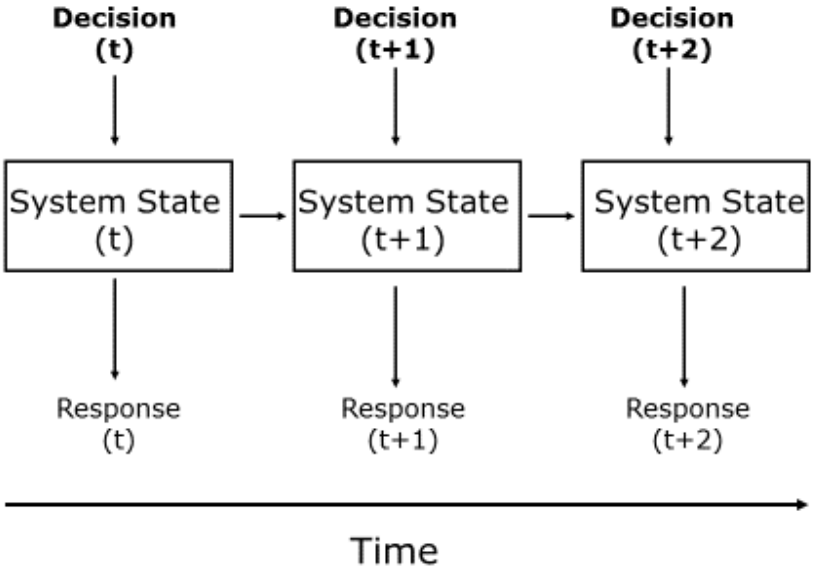

**Concerns Regarding Northern Water's Adaptive Management Proposal**

Given the above discussion of the essential components required of a defensible adaptive management program, and the inescapable cumulative effects that will accompany dam construction, I found the discussion in the Northern Water Fish & Wildlife Proposal to be severely lacking in many respects. I will focus on my key concerns:

1) The most egregious deficiency was the failure by Northern Water to acknowledge that as each component of the proposed dam/reservoir construction is implemented, the potential range of management actions available to address inevitable/unanticipated threats to the Poudre River become more and more constrained. Each aspect of the proposed project will effectively lead to irreversible changes to the Poudre River watershed. The consequence is that unanticipated threats to the River's sustainability become progressively more and more difficult (impossible) to address. The Northern Water assessment fails to recognize that p**rogressive reduction in the breadth of the**

**management decision space fundamentally undermines their ability to manage the River in an adaptive fashion**.

2) Adaptive management, and environmental monitoring, are viewed as actions with a finite time horizon. This is incorrect. **The adaptive management process is never complete** unless the system being managed no longer exists. The River will constantly change over time and space and unexpected surprise events will inevitably occur. There will always be a need to manage in an adaptive fashion and management decisions should always be based on the current state of the River. The continuous adaptive management process is illustrated below.




3) A failure to account for the **cumulative effects** of construction activities. The Northern Water Report completely ignores the topic of cumulative effects. There is no doubt that there will be significant cumulative effects, in both space and time, associated with the construction of Glade Reservoir and that these effects will accumulate multiplicatively. An additional concern is that the most adverse environmental effects may only become apparent after a significant time lag—a common occurrence when ecological system are disturbed by multiple stressors. The combination of chronic cumulative effects coupled with time lags sets the stage for surpassing ecological thresholds. The most likely threshold-crossing event precipitated by the construction of Glade Reservoir is for the Poudre River to cease to be a river. Given the decline in the magnitude and duration of peak flows, loss of seasonal and annual variation in flow events, and the subsequent incision of the river channel, the Poudre will become a drainage ditch will minimal ecological and recreational value to the citizens of Colorado. In reality, if this threshold is surpassed as a consequence of dam construction, the change with be effectively

irreversible. There is very high scientific certainty that construction of Glade Reservoir will lead to these adverse changes.

4) A failure to acknowledge the reality of **climate change** and the **very high likelihood of declining flows in the Poudre River watershed into the future**. It is well-known that Colorado is experiencing the consequences of climate change. These effects are documented by increases in stream temperatures, declines in soil moisture and spring snowpack, and a larger percentage of precipitation falling as rain instead of snow (Dettinger et al. 2015; Goble and Doesken 2017). All these climate change induced stressors to the River are projected to increase into the future.

**Suggested Readings**

Dettinger, M., B. Udall, and A. Georgakakos. 2015. Western water and climate change. Ecological Applications 25:2069-2093.

Goble, P., and NJ Doesken. 2017. Colorado's climate and forests: An update on snowpack's developing relationship with climate change and the El Nino Southern Oscillation. Colorado Water, March/April 2017.

Noon, BR. 2003. Conceptual issues in monitoring ecological resources. Pages 27-71 In: DE Busch and JC Trexler (editors), Monitoring Ecosystems: Interdisciplinary Approaches for Evaluating Ecoregional Initiatives. Island Press.

Thom, R., T. St. Clair, R. Burns, and M. Anderson. 2016. Adaptive management of large aquatic ecosystem recovery programs in the Unites States. J. Environmental Management 183:424-430.

Williams, BK. 2011a. Adaptive management of natural resources—framework and issues. J. Environmental Management 92:1346-1353.

Williams, BK. 2011b. Passive and active adaptive management: approaches and an example. J. Environmental Management 92:1371-1378.

Williams, BK, RC Szaro, and CD Shapiro. 2009. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group. USDI, Washington, DC.