Healthy Rivers, Healthy Communities
A Balanced Proposal for the Cache la Poudre River in Colorado

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Water Supply Security that Preserves Our Rivers

In this document, the Save The Poudre Coalition, a grassroots effort built from a wide range of Local, Regional, State, and National organizations provides a ***Healthy Rivers Alternative*** to the proposed Northern Integrated Supply Project (NISP). NISP includes the proposed Glade and Galeton Reservoirs and would take water from both the Cache la Poudre and South Platte Rivers to support growth in service areas stretching from Larimer County south to the Denver metro area. Our alternative, in comparison to a proposal pursued by the NISP proponents, achieves both water supply security and river conservation for the citizens of northern Colorado, and it does so at a much reduced cost that supports agriculture and protects the environment.

In addition to the ***Healthy Rivers Alternative***, we outline long-term proposals for instream flows and river restoration and policy and legislative solutions that will provide for a sustainable future for the Cache la Poudre River and the residents of northern Colorado. Together, these short- and long-term steps set a course of action that will allow the citizens to control the fate of their rivers and communities. The steps are based on the following principles:

To provide for healthy rivers and communities in the short-term, we need the following right now:

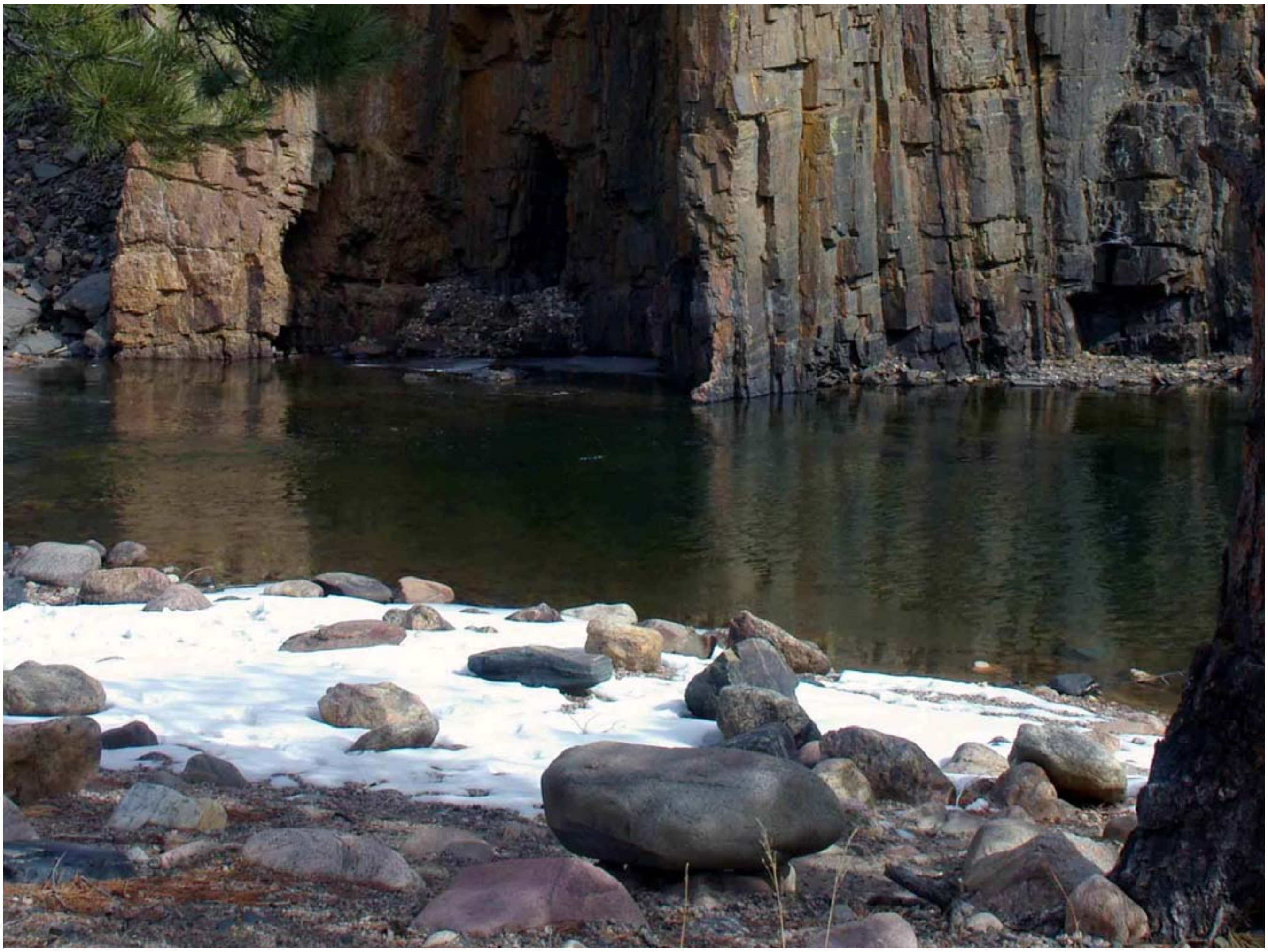
1. **A realistic assessment of future water needs of the NISP participants.** An analysis of population growth and water demand that realistically portrays the future need for water in NISP participant communities is needed before any decisions on future investments can be made. The NISP Draft Environmental Impact Statement (DEIS) is inadequate in analyzing the growth, water need, and conservation potential for NISP participant cities. As a consequence, its justification for the project dramatically overstates the future need for water to be provided by the project. A revised Purpose and Need analysis for the NISP project provides the foundation for a proposal that will meet the participants' needs without unnecessarily draining the river.

2. **A full range of alternative water supply options for NISP participants.** A number of viable options exist (in addition to those discussed in the DEIS) that would allow the NISP participants to meet their needs without draining the Cache la Poudre River of its last flows. Although these options individually provide only a portion of the water needed, when combined they go well beyond the NISP participants needs.

3. **A full range of alternative water storage options for NISP participants.** As with supply, there are a number of storage options that, taken together, would make needed water available. A system of these options would eliminate need for construction of the unnecessary and tremendously expensive Glade and Galeton Reservoirs.

4. **An accurate and current revised cost estimate for all of the options that might be used to meet the needs of NISP participants.** Significant increases in infrastructure costs over the last few years have rendered the cost estimates prepared for the NISP DEIS inaccurate and obsolete. A revised look at both the proposed project and the options described in this document allows residents of northern Colorado and decision makers to thoughtfully approach major investments.

A Healthy Rivers Alternative to NISP/Glade



Responsible Demand Management and Small-Scale Supply Options Eliminate the need for NISP

The Save The Poudre Coalition has devoted more than a thousand hours to the analysis of the NISP DEIS. This work has been performed by research scientists, analysts, attorneys, qualified professionals, and community members with expertise in issues related to this issue. In the course of our work, we have discovered numerous problems with the NISP proposal, starting with the underlying justification for the project and continuing through the analysis and proposed mitigation

Our review made it clear that it was essential for us to carefully analyze the proposed NISP project and prepare a positive alternative that would meet the needs of the NISP participants while reducing water withdrawal-associated impacts on the Cache la Poudre River. This alternative, the ***Healthy River Alternative***, is explained in detail here.

While alternatives are typically composed solely of action steps, the fundamental flaws with the project's justification as presented in the NISP DEIS required us to take a step back and in essence start from square one. It is also necessary to critique a number of elements of the DEIS to fully explain the alternative and its rationale. Consequently, we present our discussion of the alternative in five parts:

- A critique of the Purpose and Need section of the proposed NISP project as presented in the DEIS, explaining why this project justification is fundamentally flawed and incapable of serving as the foundation for further analysis;

- A revised projection of future water demands that honestly and accurately states the needs of the NISP participants while incorporating realistic population growth scenarios, alternative water supply options, alternative storage, and industry standards for best management practices;

- An overview of alternative water supply options that can meet the actual needs of the NISP participants;

- Cost estimates for the NISP project and the Healthy Rivers Alternative scenarios;

- A comparison of the environmental impacts of the proposed NISP with the impacts of the Healthy Rivers Alternative.

The Justification for NISP Presented in the DEIS is Fundamentally Flawed

In reviewing the NISP DEIS we determined that the population growth and water demand estimates provided by the project's participants were poorly done. A large number of major inconsistencies point to a speculative and severely flawed analysis of current water use and projected demand. Key failures of the DEIS include:

- The DEIS does not evaluate the role of water conservation or efficiency either as a way to reduce demand. This is counter to the regional trend toward lowered water consumption rates.

- The DEIS arbitrarily removed major industrial users from the analysis, which artificially lowered estimates of gallons per capita daily (gpcd) water use for the participants. It then compared these estimates, which represent just a portion of the residential use, with the total industrial, residential, and municipal gpcd figures from other communities.

- Water use levels reported for several of the participants were inconsistent with other published reports on water use.

- Parts of the analysis combined water use data from one year with population data from another. Periods of high water use by the participants were arbitrarily removed from the analysis.

- Future projected population growth was inconsistent with current population trends.

These inconsistencies point to a severely flawed analysis. The results are water use estimates that are speculative and faulty, undermining the water demand analysis that the remainder of the document rests on.

An honest and accurate analysis of a community's projected water needs depends on an understanding of how the community uses water. An analysis of the distribution of water use sectors (residential, industrial, commercial and municipal/public safety) in future community growth, rational target water use goals for those water use sectors, and a clear understanding of existing water use are essential to demand projection.[1] To understand baseline needs and project water demand into the future, water providers must analyze water use over a period long enough to include droughts and other factors that influence water use.[2] It is not clear that the DEIS authors had access to such information, or if indeed the participants themselves had collected such information and done an analysis to project past and present water use by sector.

We do not believe that the decision makers tasked with reviewing and approving this project can make an informed decision into the actual purpose and need for the project unless these issues are addressed. The result is a severely flawed water use analysis that does not meet basic NEPA requirements under 40 CFR § Title 1502 et seq. The NISP DEIS does not divulge accurate information from which decision makers can accurately assess the purpose and need for the project, nor can the public adequately asses the efficacy of the analysis. We offer our revised water demand analysis below.

Reassessing Demand by Overhauling NISP Population Forecasts and Incorporating Cost-Effective Demand Management

Population Growth Projections in the NISP DEIS are Incorrectly Calculated

The annual percentage growth rates used in the NISP DEIS do not always correspond to the actual population estimates for the projected periods. Furthermore, the ranges provided for annual growth rates are far too broad. It would be more appropriate to calculate the population growth estimates based on the middle of the range growth rates for each participant. We believe that this is not only more accurate but even conservative (i.e., very unlikely to understate growth) given rising energy costs that are likely to slow growth rates in NISP project area and instead redirect growth to urban centers and transportation hubs.

Population Growth Projections in the NISP DEIS are Unachievably High

There is reason to question whether the growth rates projected in the NISP DEIS will be achieved by the NISP participants. A recent study of American housing trends analyzed the roots of the housing bubble and the mortgage foreclosure crisis, finding that high fuel costs were the largest contributing factor to the foreclosure

[1] One example that analyzes water use by industrial sector is the City of Aurora, Colorado *Water Conservation Plan* dated August 8, 2007. http://www.auroragov.org/stellent/groups/public/documents/article-publication/035857.pdf

[2] The city of Santa Fe has evaluated water demand going back to 1995 and has reduced water use by 4.2% per year through 2007. City of Santa Fe Water Conservation Office. http://www.santafenm.gov/DocumentView.asp?DID=2178

rate in suburban communities.[3] The work describes how the price of fuel is driving the U.S. housing market to restructure around transit and employment centers.

To see how this trend is affecting the NISP participants, we analyzed their foreclosure rates alongside new housing permits, and found the NISP participant regions have some of the highest foreclosure rates in the country (Figure 1 and Figure 2).[4] New housing permits in 2008 so far are half those in 1998,[5]when the population was significantly smaller. Gasoline price inflation is highly correlated with the foreclosure rate and drop in permits,[6,7] as residents find they can no longer afford to commute by automobile long distances to work or to retail centers.

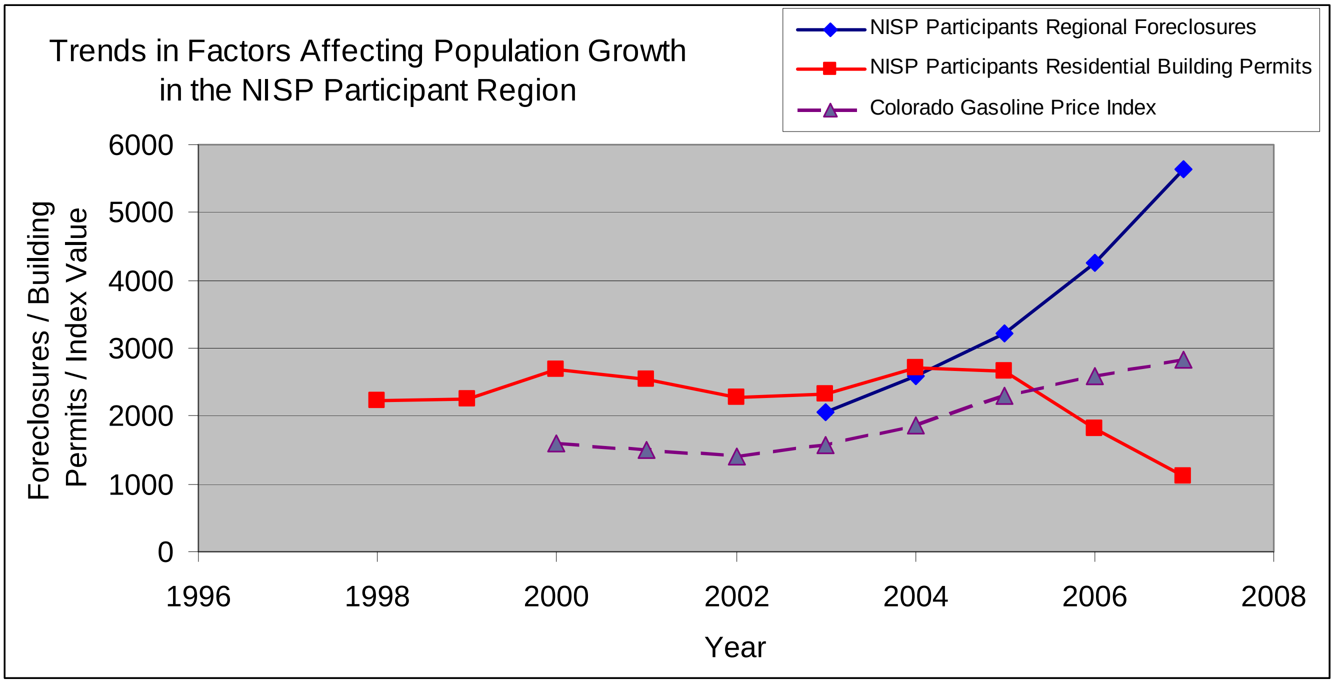


Figure 1. Indicators of significant uncertainty in population and water use growth projections for the NISP participants. As fuel price inflation soars, home mortgage foreclosures in the NISP participant region climbed well above the national average, and building permits sank to half that of recent levels. The foreclosure rate in Weld County is 1 out of very 29 homes.

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[3] Joe Cortright. 2008. Driven to the Brink: How the Gas Price Spike Popped the Housing Bubble and Devalued the Suburbs. CEOs for Cities. http://www.ceosforcities.org/newsroom/pr/files/Driven%20to%20the%20Brink%20FINAL.pdf, viewed on 7/7/2008.
[4] Mortgage foreclosure data provided by RealtyTrac. http://www.realtytrac.com/ContentManagement/pressrelease.aspx?ChannelID=9&ItemID=3988&accnt=64847, viewed on 8/31/2008.
[5] Building permit data were provided by Boulder, Larimer, Morgan, and Weld Counties, and the NISP participants.
[6] U.S. Department of Energy. http://tonto.eia.doe.gov/oog/ftparea/wogirs/xls/pswrgvwsco.xls, viewed on 8/31/2008. Data are scaled for comparison purposes.
[7] Average yearly fuel costs in Colorado are 95% correlated with mortgage foreclosures, and 70% correlated with the drop in building permits.

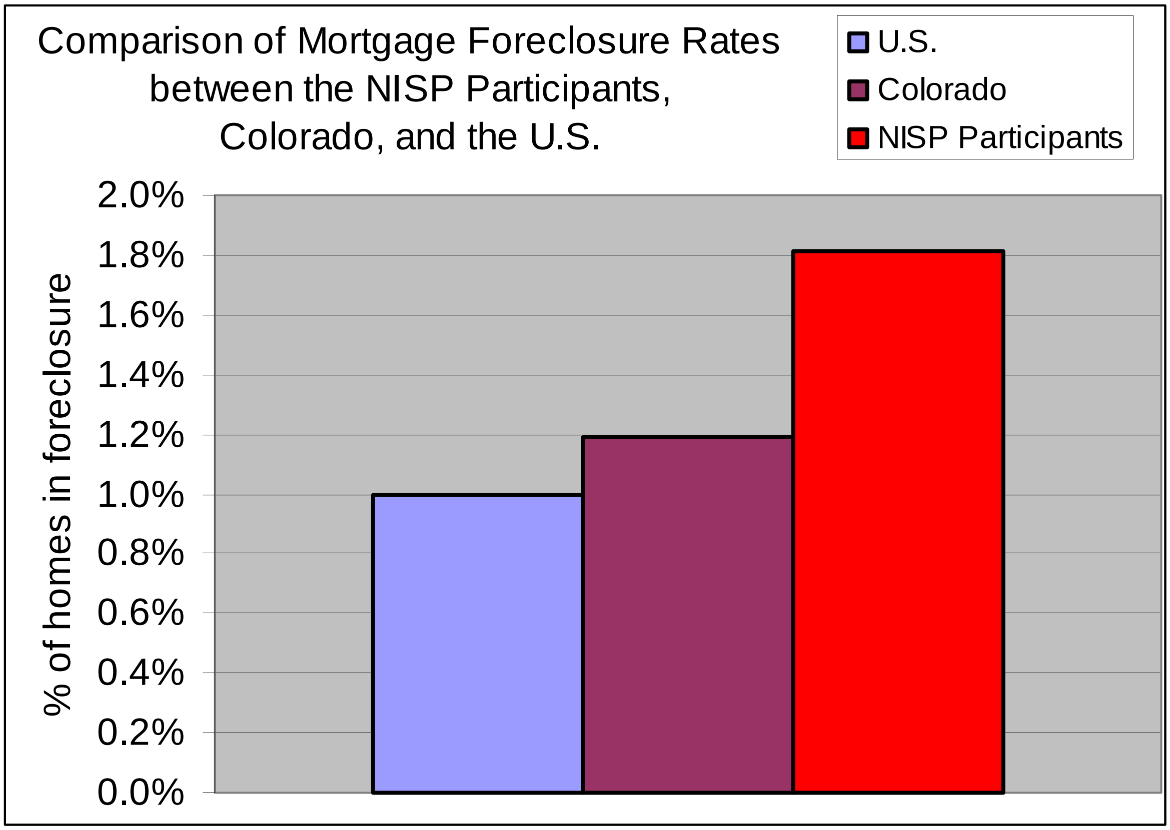

Figure 2. Population weighted mean percent in 2007 of all homes in Mortgage Foreclosure in the NISP participants region (Boulder, Larimer, Morgan, and Weld Counties) compared with the Colorado and U.S. statistics for home foreclosure.

For these reasons, we believe that the NISP participants are very unlikely to achieve the population growth scenario described in the NISP DEIS.

Revised Base Water Use Projections

In order to calculate a more reasonable and accurate water demand required by the NISP participants, we constructed revised scenarios of projected water demand over time. Population estimates were based on information in the NISP DEIS, using the mean average annual growth rate when a range was provided (Figure 3).[8] Build out figures from the DEIS were also observed. After population projections were re-calculated using the midline growth rates and respecting the listed build-out figures, total population in 2035 for the NISP participants is 375,613; 11% less than listed in the DEIS. In 2050 the population is projected to reach 440,920; 27% less than the DEIS projects.

[8] NISP DEIS, Table 1-4.

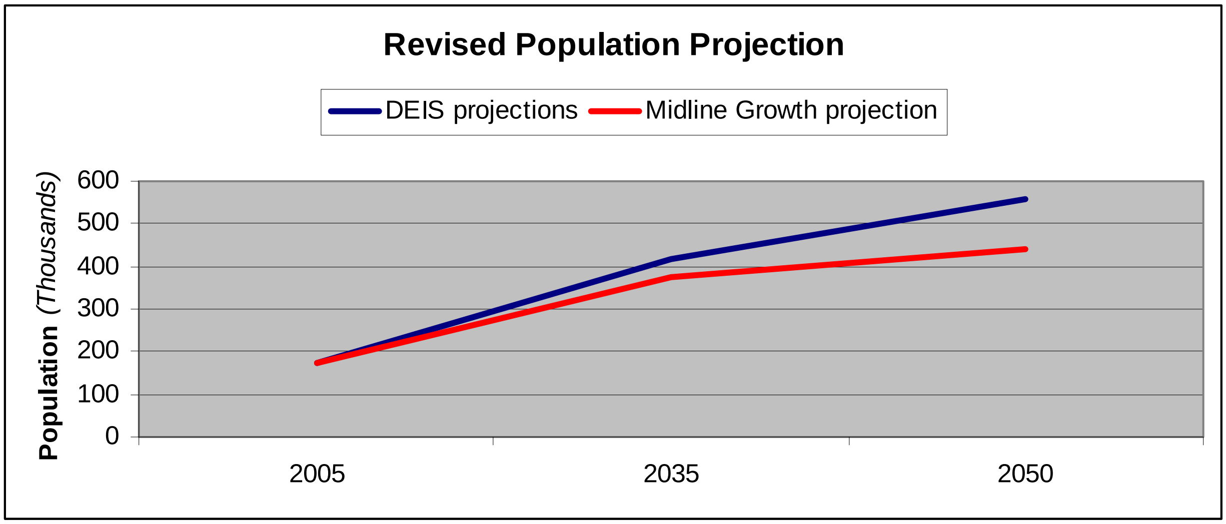

Figure 3. Projected midrange population trends in the NISP participants region.

Using these revised population projections we calculated the total required demand. Even with no decrease in levels of use, the lower population projection leads to decreased demand. We analyzed two modest conservation scenarios based on the following assumptions:

- We used current system-wide per capita figures as a basis for calculating future demand. Current per capita figures were calculated using data provided in the DEIS, Table1-3. These figures include all system-wide potable use and loss and thus is more reflective of where community use levels are than the GPCD figures provided in the DEIS that exclude large water users (Table 1).
- Final demand figures include a 10% system loss on top of the calculated potable demand. Ten percent is the level of system-wide loss that is deemed appropriate by the American Water Works Association.[9] Many NISP participants have loss levels much larger than 10%; reducing these losses will save a great deal of water and reduce overall demand.

Table 1. Recalculated 2003 Gallons Per Capita Per Day (GPCD) Figures for the NISP participants. Total population-weighted mean is 183 gpcd.

	Potable Deliveries	Total Potable Deliveries with Loss	2003 Population	System Wide GPCD
CWCWD	5,102	5,547	18,652	**265**
Eaton	577	698	3,702	**168**
Erie	1,474	1,706	9,039	**168**
Evans	1,572	2,465	11,754	**187**
FCLWD	5,732	6,368	30,189	**188**
Fort Lupton	866	1,158	7,071	**146**
Fort Morgan	2,619	2,867	10,994	**233**
Lafayette	3,478	3,754	24,996	**134**
LHWD	3,389	4,033	18,158	**198**
MCQWD	1,661	1,631	5,711	**255**
Severance	129	178	1,300	**122**
Windsor	1,609	2,040	13,984	**130**

[9] AWWA Leak Detection and Water Accountability Committee, "Committee Report: Water Accountability," Journal AWWA (July 1996): 108-111.

Water conservation, also known as demand management, in Colorado has changed dramatically over the past five years. After responding to the record drought of 2002, some water utilities have implemented widespread conservation programs, not just as a drought-management tool, but also as a means to secure permanent water conservation savings. These savings can increase system reliability, serve new growth, and decrease the need for new water development that can have detrimental impacts on Colorado's river environment, water recreation, and rural communities.

Demand Management Scenarios

Based on existing trends and examples from other Front Range water utilities, we next developed two straightforward, achievable demand reduction scenarios that utilize very modest conservation and efficiency measures to reduce the base water use projections described above.[10]

Conservation and efficiency represent a solid "no regrets" strategy – one that does not tie the utilities to expensive infrastructure or rising electricity costs, with no detrimental impacts on river systems or rural communities. While conservation programs come with a price tag, they are much smaller than the one for the proposed NISP components.[11]

Previous research has determined that many Front Range communities are planning to reduce use by 1% per year in the coming decade (Figure 4).[12] Savings will be largely realized through incentives to install more advanced and efficient fixtures, indoors and out; stronger water pricing; regulation; and behavioral changes. Based on observed conservation savings over the last decade 1% per year savings is not only achievable, but likely a conservative estimate. Moreover, many of these communities have significantly stronger and more established conservation programs in place than the NISP participants. They are also comparable to NISP participants in location, climate and quality of life. Consequently, a 1% per year reduction in water use is reasonable and in agreement with regional standards and has therefore been used to project more sensible demand requirement for NISP participants in each of the two scenarios below.

[10] Two recent studies contain examples of widely used demand reduction measures from Colorado and the Western U.S.: The Colorado Water Conservation Board's *Statewide Water Supply Initiative (SWSI) Phase 2 Report* (http://cwcb.state.co.us/IWMD/SWSITechnicalResources/SWSIPhaseIIReport/, viewed on 8/31/2008) and Western Resource Advocates (2008) *Smart Water: A Comparative Study of Urban Water Use Efficiency Across the Southwest* (http://www.westernresourceadvocates.org/media/pdf/SmartWaterBrochure.pdf, viewed on 8/31/2008).

[11] Conservation and efficiency measures per yielded acre foot range from $55 to about $10,000, averaging about a tenth of the cost per acre foot of firm yield from NISP. Demand reduction can be achieved through incremental payments built into utility fee structures without having to finance the large capital costs of major projects like NISP.

[12] Western Resource Advocates. 2007. *Front Range Water Meter: Water Conservation Ratings and Recommendations for 13 Colorado Communities.* 2260 Baseline Road Suite 200, Boulder, CO 80302. http://www.westernresourceadvocates.org/watermeter/WaterMeterReport.pdf, viewed on 8/31/2008.

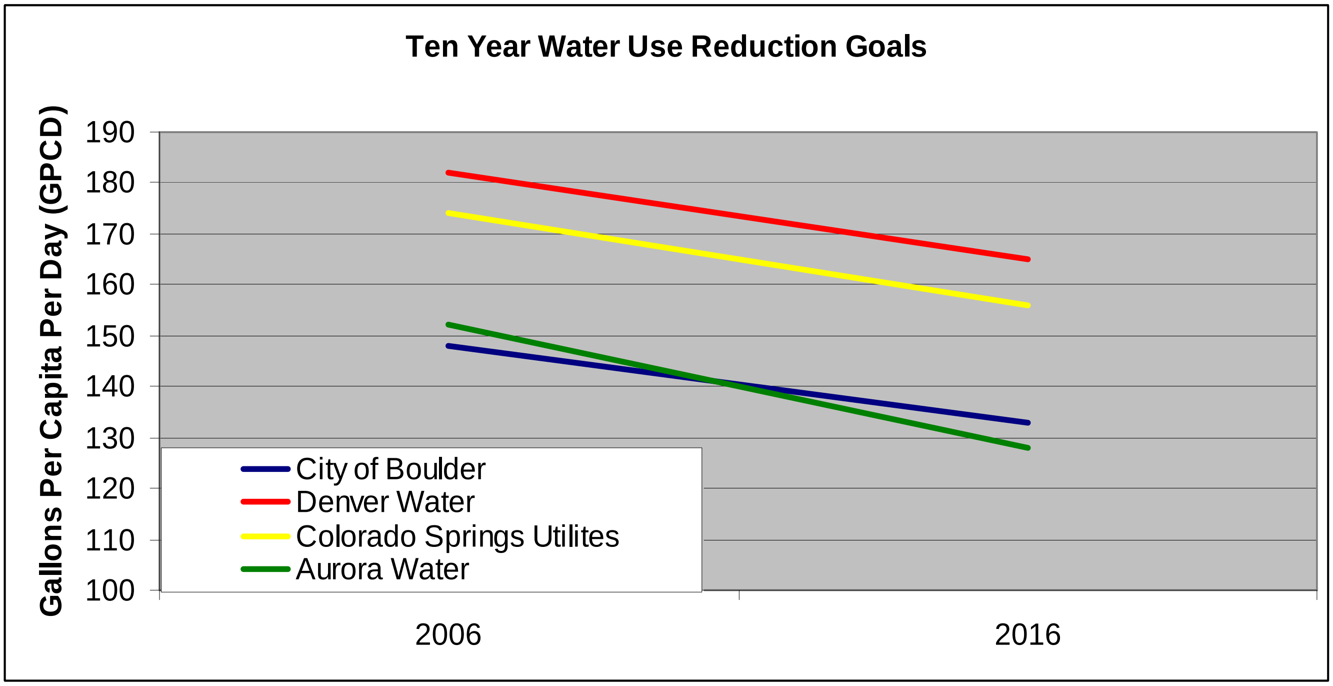

Figure 4. Ten year goals for reduction in system wide water use by various Front Range Water providers.

Our scenarios follow:

Scenario 1: In addition to the modified population projections above, scenario 1 assumes that integration of conservation and efficiency measures would lead to a 1% per year reduction in use, up to a total of 10%. For example, Fort Morgan, which in 2003 had a per capita demand of 233, would set a goal of reaching 210 GPCD system-wide. This demand-reduction figure would then be used to determine long term demand using the following formula.

$$\frac{\text{GPCD X POPULATION X 365days/year}}{\text{325,851Gallons/AF}} = \text{AF of Demand per year}$$

A 10% system-wide loss is added on top of the demand figure to yield TOTAL DEMAND.

Scenario 2: Using the 2003 use figures as a baseline, a higher level of conservation and efficiency is applied. This scenario assumes a 1% per year reduction, up to 20%. Fort Morgan, for example, which had a 2003 per capita demand of 233, would have a goal of reaching 184 GPCD, system-wide. This new GPCD figure would then be used to determine long term demand using the above formula. Again, a 10% system-wide loss is added on top of the calculated demand figure.

The result is a more refined and noticeably lower demand requirement to meet the needs of the NISP participants without sacrificing quality of life.

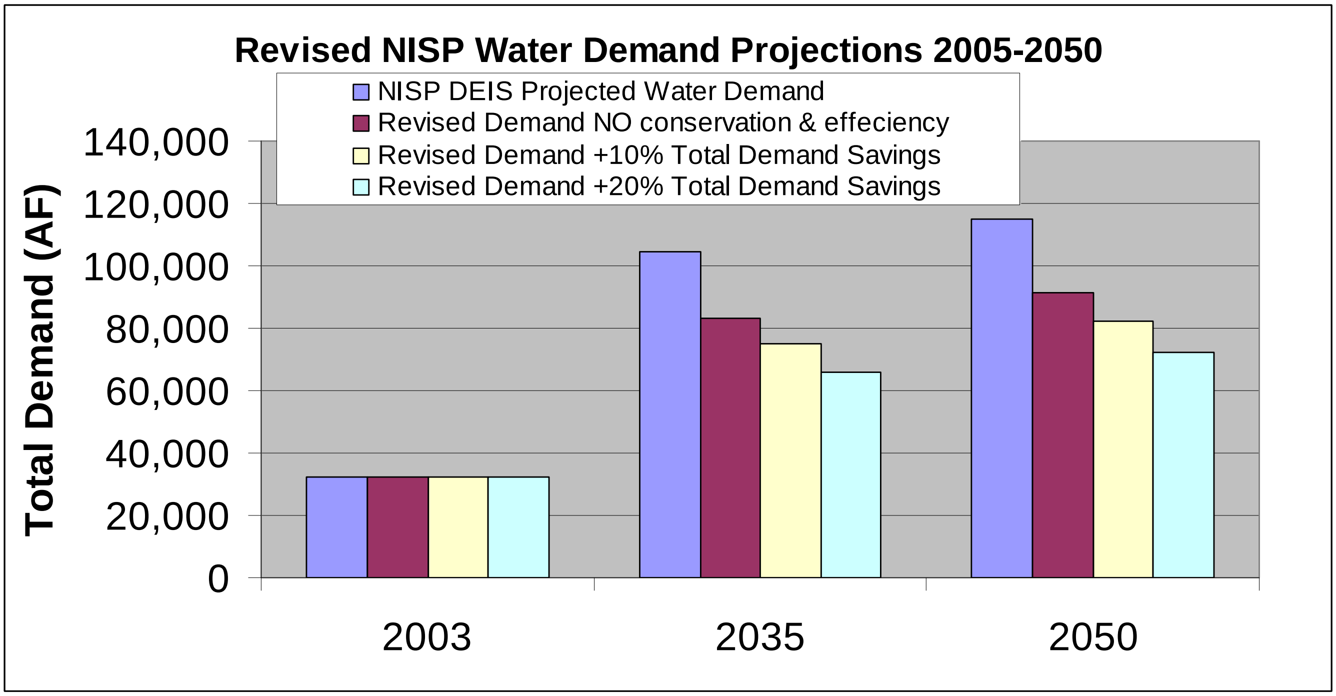

Figure 5. Revised NISP participants firm supply projections based on straightforward, achievable conservation and efficiency measures implemented over time to reduce demand.

According to the DEIS, Table1-2, current firm yield of NISP participants is 50KAF, projected to increase to more than 115,000 AF in 2050, which is 25,000 AF greater than the NISP proposed firm yield. Future demand, under the more conservative scenario 1 is projected to increase to nearly 85,000 AF annually, leaving 35,000 AF in additional water requirements above existing supply (Figure 5).

In summary, through conservative, realizable demand management scenarios the NISP participants will save themselves the cost to acquire, treat, deliver, and manage 30,000 AF of water. In the section that follows we show two recommendations for how to meet their projected water needs that won't require draining the Cache la Poudre River of any further water.

Alternative Water Supply Options

We evaluated three alternative water supply sources for the NISP participants. These supplies are "alternative" only in the sense that they do not require new water diversions from the Poudre River, building major debt-financed facilities, or relocating existing water diversions to new locations upstream. These alternative water sources utilize existing means practiced by water utilities around Colorado and the West.

After presenting potential sources for new water, we critique the NISP DEIS no-action alternative and present two possible scenarios for water supplies that meet the NISP participants' needs.

Development-Displaced Water

The NISP participants have developed major plans to expand their boundaries and dry up irrigated lands within their new growth boundaries. According to the 2002 U.S. Census of Agriculture conducted by the Department of Agriculture, and the Natural Resource Conservation Service (NRCS) National Resources Inventory (NRI), irrigated lands in the NISP participants region comprise 63-67% of the land onto which the participants intend to expand (Figure 6).

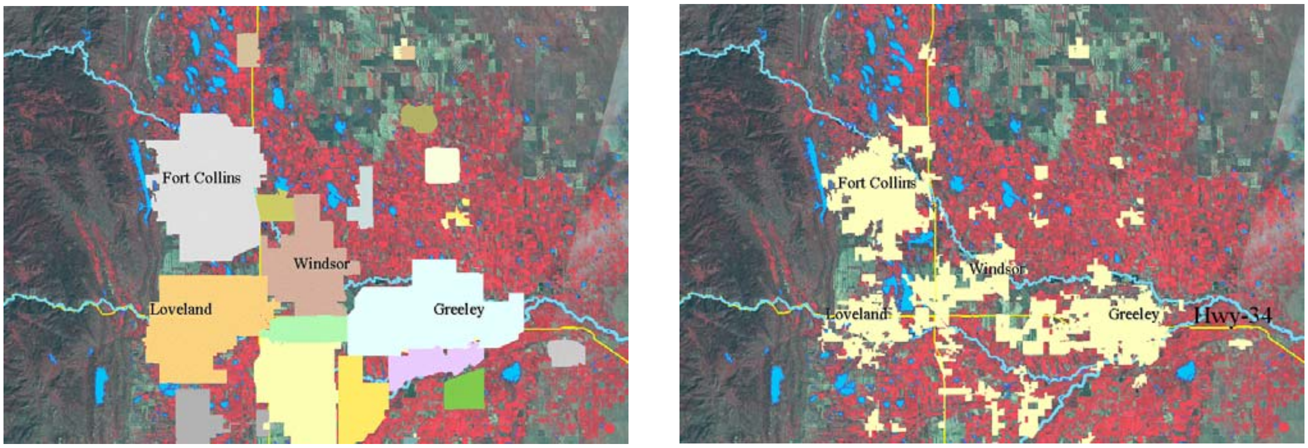

Figure 6. Projected development buildout in the Northern part of the NISP participant region by 2035 (left) compared with development in 2007 (right). The bright red circles and rectangles in the images are irrigated agricultural lands. Source: Northern Colorado Water Conservancy District.

Careful water use would allow them to use the water from these formerly irrigated lands to supply their needs. But the NISP DEIS does not address this critical source of supply. Why not?

If there is to be an open and honest discussion about helping agriculture and providing sources of water supply for the exurban expansion of the NISP participants, water supply projections must include irrigation water tied to lands developed within the NISP participants' annexations. This discussion must also include the measures that the participants are taking and, in most cases, not taking, to reduce their water supply requirements and therefore reduce the need to dry up irrigated land for municipal and industrial (M&I) development.

Based on the NISP DEIS population projections, we estimate the participant towns and water districts would occupy a developed land "footprint" or about 126,000 acres, which would be about 76,000 acres more land than they occupied in 2005 under the revised population growth scenario above. Irrigated agriculture occupies about 48,000 acres of that new land that would be developed,[13] on which about 33,300 AF of water is used for irrigation and should be available for M&I uses.[14, 15, 16]

It appears that nearly all of the water that would be provided by the NISP project would be available from the displacement of irrigation water off of newly developed lands.

Rotational Fallowing Agreements

Rotating Fallow Agreements are contracts between municipal and agricultural water uses whereby municipalities pay irrigators to regularly fallow some of their fields in return for contract payments equal to or exceeding the value the water would yield if used to irrigate crops. It has been successfully applied at large scales in California and other parts of the West.

Some advantages of rotating fallow agreements include but are not limited to:

- Provide financial stability to irrigators who are routinely affected by fluctuating crop prices.
- Irrigators remain in operation while M&I uses a portion of agricultural water supplies.

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[13] 76,000 acres x 63% (average proportion of ag land in irrigated agriculture) = about 48,000 acres of irrigated land.
[14] U.S. Department of Agriculture Census of Agriculture. http://www.agcensus.usda.gov/
[15] U.S. Department of Agriculture National Agricultural Statistics Service. http://www.nass.usda.gov/
[16] Broner, I. and J. Schneekloth. 2003. *Seasonal Water Needs and Opportunities for Limited Irrigation for Colorado Crops.* Extension Bulletin 4.718, Colorado State University Extension Service, Fort Collins, Colorado.

- Irrigators use cropland fallow intervals to rest cropland, benefitting soils and improving crop yields, while allowing for irrigation infrastructure improvements and critical maintenance operations that improve system efficiency.
- M&I users and irrigators establish long-term economic linkages that benefit the community and the region.
- Irrigators may choose to retire lands that are difficult to irrigate or suffer from soil salinity, compaction, erosion, declining crop yields, or other issues.

The NISP DEIS alternatives analysis features a rotating fallow agreement scenario that we believe artificially inflated implementation costs while creating a contracting scenario of unrealistic complexity.[20] The scenario required purchasing 103,000 AF of water and then leasing back 91,000 AF to irrigators, yielding 12,000 AF, only 10% of the purchased volume.

A recent survey of South Platte basin irrigators found that that 63% of interviewed farmers would be willing to participate in a rotational land fallowing program, if compensated adequately with a mode for compensation estimates of $400/ acre-foot.[17]

The four largest ditch operators in the Poudre River system are the North Poudre Canal, Larimer County Canal, Larimer & Weld Irrigation Canal, and the New Cache la Poudre Co. Ditch (aka Greeley No. 2). About 55% of the native and imported water in the river,[18] or 226,092 AF, is diverted by these ditches.[19] Rotating fallow agreements with just these four companies have the potential to yield at least 22,600 AF of water, assuming 50% consumptive use and fallowing intervals of once every five years. This represents just a small portion of the opportunities for rotating fallow agreements in the Poudre River, Big Thompson, Little Thompson, St. Vrain, and South Platte watersheds, when combined.

Alternative Water Supply Scenarios

The NISP DEIS conducted an alternatives analysis that sought to identify possible sources of water supply for the project.[20] The alternatives analysis set an arbitrary 30% threshold figure for the firm yield supply, whereby an alternative would be required to provide a minimum of 30% of the proposed 40,000 AF firm yield in order to be included in the project. The alternatives analysis provided no substantive basis for using a firm yield cutoff threshold value. We eliminate the threshold in this analysis in order to provide greater flexibility for lower cost supply options, in conjunction with the revised demand value, having corrected for errors in the population forecasts and per capita water use figures adjusted for cost-effective conservation measures. Based on the analysis presented in the above section on population growth and demand management, we assume that demand can be reduced by 5,000 AF from 40,000 AF to 35,000 AF, well within the range of reasonable reductions.

In our analysis, we first look at the NISP DEIS No Action Alternative (NAA), assuming that the NISP participants would purchase and transfer existing agricultural water rights and C-BT shares if NISP was not built. The primary changes to what is found in the DEIS will be to reduce the demand forecast from 40,000 AF to 35,000 AF in accordance with our revised estimates to assume that phase the purchase and development of agricultural rights and C-BT shares in accordance with their needs or that they will lease water back to irrigators

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[17] James Pritchett, Jennifer Thorvaldson, Neil Hansen, Ajay Jha. 2008. Water Leasing: Opportunities and Challenges for Colorado's South Platte Basin. Presented at WAEA Annual Meeting, June 26th, 2008, Big Sky, Montana. http://www.kysq.org/Lease.pdf, viewed on 8/31/2008.

[18] We use the word *native* to identify water that originates in the Cache la Poudre River Watershed. More than a hundred thousand acre feet of water is *imported* into the watershed from the Laramie River (via the Laramie River Tunnel), The Michigan River (Via the Michigan Ditch), and the Colorado River (via the Grand Ditch). Most of the *imported* water is diverted from the river for irrigation and M&I uses near the mouth of the Poudre River Canyon.

[19] NISP DEIS p. 3-11.

[20] HDR Engineering 2007. NISP Alternatives Analysis.

until needed, either of which will reduce the cost to the participants.[21] We then reexamine the assumptions of the NAA to incorporate modified estimates of what storage will actually be required by agricultural transfers and by what C-BT shares might yield and, finally, we incorporate rotational fallowing along with agricultural transfers and C-BT purchases.

These scenarios assume no changes in existing points of diversion, or that points of diversion are moved to the furthest possible point downstream to improve flows.

Re-evaluating the Cost of the NISP DEIS No Action Alternative

The basis for costing the NAA is Table 2.5 (DEIS, page 2-44). The NAA assumes: 1) individual participant acquisition of water *as needed over time* in response to growing demand for urban water; 2) that such supplies will be broadly available and are not dependent on a small number of select canals; and 3) that, with the exceptions of the Eastern Group and Ft. Lupton, every acre foot (AF) of purchased agricultural water will require an acre-foot of storage (an assumption we will examine below).[22] The table proposes (or implies) that the needed water would be provided by acquisition of 58,400 AF of agricultural water rights (to provide 29,200 AF of firm yield, i.e., a consumptive use estimate of 50 percent) and 21,600 units of C-BT (each share providing 0.5 AF of yield).[23]

According to Table 2.5, the DEIS assumes that the cost of acquiring the agricultural water will be $6,000 per acre-foot (of which 50 percent will be available for transfer) and that an acre-foot of storage will cost $4,000,[24] and that C-BT shares will be $11,000.

For purposes of assessing the effect of phasing on costs we will use the same assumptions that Charles Howe employed in his DEIS comments.[21] We assume that: 1) the water will be acquired in four equal increments of 8,750 AF; 2) the shares will be purchased at 10 year intervals, starting now; and 3) the ratio of agricultural shares to C-BT shares will be that of Table 2.5. Based on these assumptions, each increment, undiscounted, will cost $173.9 million. With all of these assumptions in place we estimate the present value of costs assuming inflation free discount rates of 4%, 5%, and 6%. The results appear in Table 2 below.

Table 2. Present Value (PV) of the NISP No Action Alternative, assuming need of 35,000 AF by 2050 and staging of development.

	Discount Rate, 4%	Discount Rate, 5%	Discount Rate, 6%
PV, 1st Increment	$173.9 million	$173.9 million	$173.9 million
PV, 2nd Increment	$117.5million	$106.7 million	$97.1 million
PV, 3rd Increment	$79.3 million	$65.6 million	$54.2 million
PV, 4th Increment	$53.6 million	$40.1 million	$30.3 million
TOTAL	$424.3 million	$386.3 million	$355.5 million

[21] For a fuller discussion of phasing and its impact on costs see Charles W. Howe letter to Chandler Peter, June 11, 2008.
[22] According to Table 2-5, the Eastern Group will only need 6,200 AF of storage of 9,800 AF of purchased agricultural rights and Ft. Lupton will need 3,000 AF of storage for 6,000 AF of purchased agricultural water rights.
[23] The 0.5 acre-foot figure seems very conservative since a quota of 0.5 is the lowest ever imposed by NCWCD and is typically imposed in wet years when outdoor water demands will be low.
[24] The NISP DEIS grossly underestimates the availability of alternative storage on the Poudre River and South Platte basins. Storage capacity is widely available in existing reservoirs and gravel pits, to the extent that there is a widely known and well-established cost for existing storage of $4,000/AF (Source – *Aggregates Manager* Magazine, June 2006). For a recent analysis of available storage, see Don W. Deere, P.E., Colby J. Hayden, P.E., and Glen G. Church, P.E. 2007. *Gravel Pit Reservoirs: Colorado's Water Storage Solution.* pp. 158-173 in Wiltshire, R.L., Parekh, M.L., and Gross, C.M. (editors), GEO-Volution: The Evolution of Colorado's Geological and Geotechnical Engineering Practice (Proceedings of the 2006 Biennial Geotechnical Seminar, Nov. 10, 2006, Denver, CO; Sponsored by The Geotechnical Group of the Colorado Section of ASCE, Rocky Mountain Section of the Association of Environmental and Engineering Geologists; and Colorado Association of Geotechnical Engineers). Reston, VA: ASCE / Geo Institute, 978-0-7844-0890-2, 2007, 215 pp., Geotechnical Practice Publication No. 4 (Barcode: RMI MK31592).

These costs are well below the costs of over $800 million for the NAA offered in the DEIS.

We believe these costs provide a good starting point for examining alternatives that will meet NISP participant needs and, at the same time, not further degrade the already stressed Cache la Poudre River.

Option 1: an Alternative with Modified Assumptions about Storage Needed for Agricultural Transfers and the Value of C-BT Shares

The DEIS assumes that agricultural water transfers generally provide 0.5 AF of transferrable water for every acre-foot purchased, but that the storage requirement is, as described above, equivalent to the AF purchased. It is true that agricultural water rights are usually limited to the months from May through October,[25] so that providing water for year-round urban need does require storage, but we challenge the need as assumed in the DEIS, i.e., one unit of storage for every unit of purchased water. We believe that the storage requirement should be adjusted both for the consumptive use component of the water that can be transferred and for the pattern of use. Urban demand follows a seasonal variation in which between 70% and 75% is used in the months from May through October and 25% to 30% from November through April.[26, 27] Between the consumptive use correction and the need to store water for winter use we assume that the storage requirement can be reduced by 60% of that which appears in Table 2-5 of the DEIS (i.e., from 51,800 AF to 21,000 AF) and by an additional 2,880 AF to account for the reduced future demand from 40,000 AF to 35,000 AF, leading to a storage requirement estimate of 18,120 AF.

The need for C-BT shares in the NAA is based on an assumed "quota" of 0.5 AF/unit/year to establish a "firm" yield. The latter figure seems unduly conservative to us since a quota of 0.5 is the lowest ever imposed by the NCWCD and is imposed in wet years when outdoor water demands are low. The long-term average share value is 0.7 and we think it is the more proper figure to use. The C-BT system has substantial storage and with this in mind we believe that "conservative assumption" about share value ignores this as well as the decision process used by the NCWCD to set a share value. We use 0.7 in this second alternative and based on this assumption approximately 13,500 shares would be needed to provide 9,450 AF of yield.

The first ten year increment of costs for this alternative would now be $138.8 million and the subsequent incremental costs would be discounted as they were above. The results, again assuming discount rates of 4%, 5%, and 6%, are shown in Table 3.

Table 3. Option 1: Present Value (PV) of Costs Assuming Need of 35,000 AF, Staging of Development, Reduced Storage Needs, and Higher C-BT Share Value. Dollar figures are in millions.

	No Discount	Discount Rate, 4%	Discount Rate, 5%	Discount Rate, 6%
PV, 1st Increment	$ 131.9	$ 131.9	$ 131.9	$ 131.9
PV, 2nd Increment	$ 131.9	$ 89.1	$ 80.9	$ 73.7
PV, 3rd Increment	$ 131.9	$ 60.2	$ 49.7	$ 41.1
PV, 4th Increment	$ 131.9	$ 40.7	$ 30.5	$ 23.0
TOTAL	$ 527.6	$ 321.9	$ 293.0	$ 269.7

These cost estimates represent a substantial reduction from the cost of the NISP DEIS proposed action alternative.

[25] U.S. Geological Survey, National Water Information System. Stream flow data from station 06752260, Cache la Poudre River at Fort Collins, CO. http://waterdata.usgs.gov/co/nwis/uv/?site_no=06752260&PARAmeter_cd=00065,00060, viewed on 8/31/2008.
[26] Western Resource Advocates. 2007. *Front Range Water Meter: Water Conservation Ratings and Recommendations for 13 Colorado Communities.*
[27] City of Fort Collins. 2007. *Water Conservation Plan.* http://www.ci.fort-collins.co.us/water/pdf/conservation-plan-20071004.pdf, viewed on 9/10/2008.

Option 2: An Alternative that Incorporates Rotational Fallowing with Agricultural Transfers and C-BT Shares

For purposes of this alternative we assume that rotational fallowing can supply slightly more than a third of our estimate of demand or 12,000 AF/year and that two thirds (or 8,000 AF) of this will supplant the agricultural transfers component of our above alternatives and one-third the C-BT component. In other words, to meet a demand of 35,000 AF of demand, 12,000 AF will come from rotational fallowing, 15,800 AF from agricultural transfers, and 7,200 AF from C-BT shares (not unreasonable for C-BT, given the flexibility of share purchases).

Assuming that the fallowing will come with a storage requirement comparable to agricultural transfers, the storage will be increased from 18,120 AF to approximately 21,600 AF. Regarding costs of rotational water, we assume that the basic cost (i.e., compensation to irrigators) is $400/ acre-foot, that additional administrative costs will be 25% or $100/AF and that the present value of the time stream of costs ($500/year/acre-foot) is approximately (depending on the discount rate) $5,000/acre-foot. With these assumptions the first increment of costs is $112.3 million. With this as the incremental cost, the discounted present value for this alternative, again for three discount rates, is in Table 4.

Table 4. Option 2: Present Value (PV) of Costs Assuming Need of 35,000 AF, Staging of Development, Reduced Storage Needs, Higher C-BT Share Value, and Agricultural Fallowing.

	No Discount	Discount Rate, 4%	Discount Rate, 5%	Discount Rate, 6%
PV, 1st Increment	$ 112.3	$ 112.3	$ 112.3	$ 112.3
PV, 2nd Increment	$ 112.3	$ 75.8	$ 68.9	$ 62.7
PV, 3rd Increment	$ 112.3	$ 51.2	$ 42.3	$ 35.7
PV, 4th Increment	$ 112.3	$ 34.6	$ 26.0	$ 19.6
TOTAL	$ 449.2	$ 273.9	$ 249.5	$ 229.6

The introduction of rotational fallowing, given the cost assumptions we have made, leads to another alternative cost reduction.

Revised Cost Estimates for the NISP DEIS Action Alternatives

In their analysis of the cost projections for the NISP project,[28] Western Resource Advocates found that the NISP DEIS and technical reports did not include more than $350 million in costs associated with the project. These costs include: (a) construction costs inflation linked to the spike in energy and raw materials prices, (b) funds needed to renovate existing drinking water and wastewater treatment facilities affected by the project, and (c) finance costs not included in the project costs, discussed below.

Energy/Cement/Steel Price Inflation Impacts NISP

The construction cost estimates in the NISP DEIS and technical reports are based on reports from 2003 to 2006, before the recent spike in construction materials and energy prices. Since that time, price inflation for critical construction cost line items such as diesel fuel, cement, and steel have risen nearly 100%, leading to dramatically rising construction costs for major projects like reservoirs. Since 2006, major construction projects in Colorado have run over predicted budgets by 30 to 50%.[29, 30, 31] In their analysis of the NISP project costs,[28] Western Resource Advocates applied inflation indices used by the Corps of Engineers to previous costs

[28] Western Resource Advocates. 2008. *Revised Construction Cost Estimates for the NISP Project.* 2260 Baseline Road, Suite 200, Boulder, CO 80302.

[29] Elkhead Reservoir construction costs increased by 50% from $20 million to $30 million. Source: Colorado River Water Conservation District, Elkhead Reservoir Enlargement Project website, http://www.crwcd.org/page_28, viewed August 31, 2008.

[30] FasTracks in Denver is expected to cost $1.8 billion more, a 30% increase. Source: *Fastbacks Price Tag Jumps.* Denver Post, August 21, 2008. http://www.denverpost.com/breakingnews/ci_10259704, viewed August 31 2008.

[31] Costs for the Lake Powell Pipeline escalated 22% between 2005 and 2008.

estimates done by the project proponents, finding that construction costs are likely to be at least $77 million (18%) higher than the DEIS estimate.

Renovations to Existing Drinking Water and Sewage Treatment Facilities

The City of Fort Collins reported in their summary of comments on the NISP DEIS that the city would incur additional costs of $75-125 million to upgrade water treatment facilities in order to meet post-NISP discharge permit conditions.[32] If the proposed pipeline is built between the existing Horsetooth Reservoir and the proposed Glade Reservoir, $50-90 million in additional costs to upgrade potable water treatment facilities would be required. Additional yearly operating costs of at least $3 million would be incurred. This represents a total cost burden (in 2008 dollars) to the City of Fort Collins of $125 - $215 million.

Several other utilities would be affected by the NISP project, but have not published estimates of the financial impacts of the NISP project would have on their facilities or operating costs. These include the Eastern Larimer County Water District and the Fort Collins-Loveland Water Districts, which use water from Horsetooth Reservoir, and the Boxelder Sanitation District and sewage treatment facilities for Timnath, Severance, Windsor, and Greeley, all of whom discharge treated sewage into the Poudre River and draw from the Poudre River for drinking water supplies.

Project Financing Costs

The NISP Master Financing Plan recommends that the Participants finance the NISP project using a combination of cash payments, revenue bonds, and a guaranteed loan from the Colorado Water Conservation Board's revolving loan fund.[33] Using the scenarios recommended in the plan, we project the financing costs to be $140 – $260 million (in present value).

Total Revised Cost for NISP

Tables 5 and 6 show the revised cost estimate for the NISP project based on the above analyses:

Table 5. Comparison of total costs (not discounted) of NISP, including financing costs, under the Draft EIS estimate and two revised estimates. Dollar figures are in millions. Financing assumes a down payment of $85,200,000 (20% of the Draft EIS cost projection), a 30 year term, and 4.45% bond rate. The third row includes cost of upgrades to the Fort Collins water and sewage treatment facilities, which range from $125,000,000 to $215,000,000.

Cost Category	Construction Costs	Financing Costs	Total Cost
Draft EIS Estimate	$ 426	$ 220	$ 646
Revised Construction Costs Estimate	$ 503	$ 269	$ 772
Revised Construction Costs + Upgraded Treatment Plants	$ 628-718	$ 350-408	$ 978-1,126

[32] City of Fort Collins. Agenda item #24 summary for September 2, 2008 City Council Meeting. http://citydocs.fcgov.com/?cmd=convert&vid=72&docid=1303915, viewed on 8/29/2008.
[33] Red Oak Consulting. November, 2006. NISP Master Financing Plan Final Report, prepared for the Northern Colorado Water Conservancy District.

Table 6. Comparison of total costs (discounted into 2008 dollars) of NISP, including financing costs, under the Draft EIS estimate and two revised estimates. All costs are in millions of dollars. Financing assumes a down payment of $85,200,000 (20% of the Draft EIS cost projection), a 30 year term, and 4.45% bond rate. The financing costs are discounted into present value (2008 dollars) based on a 5% discount rate. With a higher bond rate, financing costs will be more substantial.

Discount Rate	4%	5%	6%	Financing Costs	Total Cost assuming 5% discount rate
NPV - DEIS Estimate	$ 331	$ 311	$ 293	$ 140	$ 451
NPV - Revised Construction Costs, No Treatment Plant Upgrades	$ 390	$ 367	$ 346	$ 172	$ 539
Revised Construction Costs + Upgraded Treatment Plants	$ 493-567	$ 465-536	$ 440-507	$ 223-260	$ 688-796

Based on a total non-discounted project cost of $978 - $1,126 million, the cost per acre foot would be $24,450–28,150, at the upper end nearly three times that described in the NISP DEIS. The total discounted cost at 5% would be $688 – $796 million, or $17,200 – $19,900 per acre foot.

We wish to emphasize that these revised estimates are conservative. They are based on the low end of the range of bond interest and inflation rate figures that will likely apply to NISP if it is built. For example, cost overruns like those seen in other recent projects, which were 2.5 to 4 times higher than the Corps of Engineers inflation indices, would drive construction costs far higher than even these revised estimates. Higher revenue bond interest rates (possibly up to 5.5%) would drive financing costs higher. Either of these contingencies, either separately or combined, would drive the total project cost well over $1 billion.

Cost for the Healthy Rivers Alternative

We estimate the demand reduction measures will cost the NISP participants $28-92 million, based on the range of conservation and efficiency costs from the Colorado Statewide Water Supply Initiative (SWSI), Phase II report.[34] The actual costs would depend on the measures best suited for each NISP participant. Based on the preceding analysis, we estimate the non-discounted cost for the Healthy Rivers Alternative to be $449 - $528 million, or $11,225 - $13,200 per acre foot. Discounted costs would be $250 - $393 million, or $6,250 - $9,825 per acre foot.

Comparing NISP with the Healthy Rivers Alternative

The NISP DEIS projected devastating consequences for agriculture if the document's action alternatives were not enacted. Our own analysis and that of other expert reviewers indicates that the DEIS analysis was faulty, transparently flawed and subject to major revision.[35] Here is a summary of the problems in the analysis:

- Total agricultural lands impacted by the no-action alternative were artificially inflated upwards by the use of faulty calculations and incorrect equation factors. As a result the document proposed agricultural impacts from the no-action alternative that were more than twice what is likely.

[34] http://cwcb.state.co.us/NR/rdonlyres/C65D6406-3EE0-4E44-9C5E-E1655D814CB8/0/S2_ConservationEfficiency.pdf, viewed on 8/31/2008.
[35] Save The Poudre Coalition. 2008. *A Review of the Likely Agricultural Impacts from the Northern Integrated Supply Project.* http://www.SaveThePoudre.org.

- The action alternatives received a cursory analysis that did not include issues that affect tens of thousands of farmland. For example, diverting and storing the Grey Mountain Right (which is the last remaining peak flows left in the river) would harm hundreds of irrigators in the Lower Poudre and South Platte watersheds who depend on the Grey Mountain Right for well augmentation. The Grey Mountain Right is likely diverted for irrigation from the South Platte in Colorado and Nebraska, drying up at least 13,000 irrigated acres if NISP went forward.

- Thousands of acres of cropland served by the South Platte Water Conservation Project would likely become saline, and existing crops could require up to 60% more irrigation water just to maintain current yields because of the salinity of South Platte River water.

- The DEIS used a blatantly faulty method to estimate the farmland irrigation-associated wetlands affected by the no-action alternative, providing an estimate of wetlands affected (1,384 acres) that is probably at least ten times too large. It downplayed the poor habitat value of most irrigation-associated wetlands, while virtually ignoring most riparian-associated wetlands along the Poudre River.

- The DEIS failed to document the agricultural lands displaced by the expansion of the NISP participants, estimate at about 76,000 acres between now and 2050.

Our analysis of the NISP project impacts on irrigated agriculture suggest that the NISP no action alternatives would impact about the same amount of irrigated land as would the action alternatives. Table 7 indicates that all of the NISP project alternatives would affect roughly the same amount of irrigated land. The complexity of water use and water law in Colorado, and the high degree of demand in all sectors means that the Grey Mountain Right and virtually all other water that originates in the Poudre River basin is currently diverted and used either in the Poudre River or downstream on the South Platte.

The proponents of the NISP project are simply squeezing the water supply balloon — they claim NISP reduces pressure on Ag water supplies in the Poudre River basin, but in reality it increases pressure on irrigators drawing water from the South Platte River. And it places even greater pressure on South Platte Basin irrigators drawing from wells, who rely increasingly on the Grey Mountain right and existing flows in the Poudre for their well augmentation. We did not estimate those impacts, but including them would drive the NISP impacts on agriculture even higher.

We would also like to point out that the exurban expansion plans of the NISP participants may be the least agriculture-friendly aspect of this project. Whether they seek water supplies from NISP, the Healthy Rivers Alternative, or some other means, their expansion plans will lead to developing about 76,000 acres of agricultural land, of which about 48,000 is currently irrigated. This would free up about 60,000 AF of water supply for the participants.

The Healthy Rivers Option 2 offers the greatest potential to reduce the impact on agriculture. Adopting comprehensive conservation and efficiency measures and implementing rotating fallow agreements with farmers reduces demand for agricultural water transfers, while providing a reliable income stream to irrigators. Adopting very modest conservation measures to reduce water demand by 20% in 2050 would require 8,500 AF less water for the NISP participants in addition to the savings already in the Healthy Rivers Alternative. Doubling the proportion of their supply from rotating fallow agreements would require 12,000 AF less from agricultural water transfers.

Table 7. Summary of NISP DEIS irrigated cropland loss estimates compared with the Healthy Rivers Alternative.

Irrigated Agriculture	Irrigated Acreage Lost	Dryland Acreage Lost	Total Ag Acres Impacted
NISP DEIS No Action Alternative			
Ag Water Transfers	20.938	-	20.938
C-BT Transfers	6,563	-	6,563
total	**27,501**	**-**	**27,501**
Alternative 2-4 (Action Alternatives)			
Grey Mountain Right Diversion	13,889	-	13,889
Soil Salinity Impacts	1,600	-	1,600
Saline Irrigation Water Impacts	2,400	-	2,400
Reservoir Development	200	3,121 - 6,037	3,321 – 6,237
total	**18,089**	**3,121 - 6,037**	**21,210 – 24,126**
Healthy Rivers Alternative, Option 2[36]			
Ag Water Transfers	10,972	-	10,972
C-BT Transfers	5,000	-	5,000
Rotating Fallow Agreements	-	-	-
total	**15,972**	**-**	**15,972**

Based on expert reviewer analysis of the NISP DEIS, we offer the following comparison between the Healthy Rivers Alternative Option 2 with the NISP DEIS action alternatives (Table 8).

[36] From Save The Poudre Coalition's analysis of the impacts of NISP on Agriculture, at 1.44 AF/acre, 15,800 AF of water would irrigate about 10,972 acres of land in the Poudre River basin.

Table 8. Summary of impacts of the NISP DEIS action alternatives compared with the Healthy Rivers Option 2.

Impact Category	NISP Action Alternatives	Healthy Rivers Option 2
Water Quality	↓ Regulatory action by the State of Colorado and the Federal Environmental Protection Agency would be likely in order to protect public health and safety.	↔ Maintains the remaining peak flows in the Poudre river, supports restoration of base flows and addition to peak flows, greatly improving water quality and eliminating the need for regulatory actions.
Maintain and Support Agriculture	↓ Lead to the dry up at least 60,000 acres of irrigated land, and lead to increased salinity of irrigated soils in the farmland served by the proposed Galeton Reservoir. Crop yields would drop significantly and at least 6,000 acres of land likely would need to be retired because of salt buildup.	↑ Implementing conservation and efficiency measures though demand-side management while securing water supplies through rotating fallow agreements and development-displaced water reduces pressure for agriculture water transfers and provides a new secure income stream to farmers and ranchers, particular during drought years.
Riparian-associated wetlands	↓↓ Lost river flows would drop the water table, impacting existing cottonwoods and willows. Loss of peak flows would end the process that builds new seedbeds for cottonwoods and willows, leading to long-term decline of the riparian forest.	↔ Retaining peak flows makes river restoration efforts possible and much more likely to succeed.
Irrigation-associated wetlands	↓↓ NISP would dry-up more than 60,000 acres of irrigated farmland, leading to the loss of wetlands associated with the irrigation of those lands. The salinity of South Platte River water used to replace much cleaner Poudre River water would degrade existing irrigation-associated wetlands. Loss of irrigated lands through reduced flows on the South Platte would degrade existing irrigation-associated wetlands.	↔ Implementing water conservation and efficiency measures, and securing water through rotating fallow agreements with farmers will minimize the impacts of irrigated land dry-up. Pursuing aggressive conservation and efficiency measures and rotational fallowing agreements could mean relatively little irrigated land dry-up. Depending on the mix of water supply options the NISP participants choose, agricultural water transfers and purchasing C-BT units from agriculture would impact irrigation-associated wetlands.
Aquatic ecosystem	↓↓ Peak flows are critically important to the Poudre River aquatic ecosystem. Loss of peak flows would lead to a cascade of impacts leading to a likely collapse of the current aquatic ecosystem. River Restoration efforts that would improve the aquatic ecosystem would be much less likely to succeed.	↔ Retaining peak flows maintains the existing aquatic ecosystem and water quality levels, while making river restoration efforts possible and much more likely to succeed.
Riparian ecosystem	↓↓ Peak flows are critically important to the Poudre River riparian ecosystem. Loss of peak flows would lead to a cascade of impacts leading to the long-term, highly visible decline of the riparian ecosystem. River Restoration efforts that would improve the riparian ecosystem would be much less likely to succeed.	↔ Retaining peak flows maintains the existing riparian ecosystem on the river, while making river restoration efforts possible and much more likely to succeed.
Recreation	↓ Loss of peak flows likely to lead to the collapse of the existing aquatic ecosystem due to silt buildup, higher water temperatures, buildup of algae, loss of native plants, and channel constriction. Existing quality trout fishery between the Poudre River Canyon mouth and I-25 would be highly degraded. Whitewater sports downstream of the Poudre River Canyon	↔ Retaining peak flows sustains the existing trout fishery, supports water-based recreation such as kayaking, canoeing, tubing, and supports whitewater parks. Preserving the riparian and aquatic ecosystem will maintain current recreation and support current investments in open space, natural areas, and recreation infrastructure along the river. Successful

	mouth would be limited to a few weeks a year only in wet years. Whitewater parks in Bellvue, LaPorte, Fort Collins, Windsor, Greeley, or other locations downstream of NISP diversion dams would not be possible.	restoration efforts are highly likely to improve recreation substantially.
Total Cost	↑↑ Revised costs for NISP proposed action conservatively estimated at $ 688 - $ 796 million, or $17,200–19,900 per AF (discounted into present value). Estimate likely to rise as other utility districts evaluate NISP impacts on water supply and sewage treatment plant permit requirements. Additional construction cost inflation and revenue bond interest rate increases would raise costs much higher.	↓ Costs conservatively estimated at $265 - $301 million, or $6,626 - $7,516 per AF. Construction cost inflation could raise costs of alternative storage options.
Protect threatened and endangered species	↓ The long-term survivial of the Preble's meadow jumping mouse would be placed in jeopardy. Construction of the proposed Glade reservoir jeopardizes Bell's twinpod, a globally-imperiled plant species found only on the hogback at the Glade site and a very few other sites in Colorado.	↔ Helps to maintain existing populations of Preble's meadow jumping mouse. Prevents degradation of habitat for Bell's twinpod. Successful restoration efforts likely to improve existing habitat and may create new habitat for Preble's meadow jumping mouse as well as two threatened plant species found in Colorado (Ute ladies' tresses orchid and Colorado butterfly plant).
Groundwater quality	↓ Removing peak flows will degrade the Poudre River alluvial aquifer, likely lead to reduced water quality, and hamper the efforts of downstream irrigators to continue irrigating from groundwater sources.	↔ Maintaining existing flows sustains existing alluvial aquifer levels and supports downstream irrigators' efforts to continue irrigating using groundwater sources. Successful restoration efforts are highly likely to improve aquifer levels and support well augmentation efforts by downstream irrigators.
Cleanup of superfund site under proposed Glade Reservoir	↓ The trichloroethylene (TCE) plume under the site for the proposed Glade Reservoir forebay would be much more difficult to clean up due to increased groundwater flow pressures from Glade, and water quality in the reservoir would be threatened by TCE contamination via the forebay.	↑ Existing proposed cleanup efforts are much more likely to succeed without groundwater flow pressure from Glade.