

Executive Summary Northern Integrated Supply Project No Action Alternative Evaluation

Prepared for:
Northern Colorado Water Conservancy District
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Preface

MWH Americas, Inc. was contracted by the Northern Colorado Water Conservancy District and Participants in the Northern Integrated Supply Project (Consulting Services Agreement dated April 27, 2009, MWH Project No. 1006828) to develop and provide conceptual level information regarding the No Action Alternative for evaluation in the Supplemental Draft Environmental Impact Statement. This executive summary summarizes the main report, which is available under separate cover.

Executive Summary

The U.S. Army Corps of Engineers (Corps) prepared a Draft Environmental Impact Statement (DEIS) for the Northern Integrated Supply Project (NISP) proposed by the Northern Colorado Water Conservancy District (Northern Water) and the NISP Participants. The DEIS included a description of the No Action Alternative (NAA), or the alternative likely pursued by the Participants to meet their future needs if the Corps does not permit their Proposed Action or another Action Alternative.

Comments on the DEIS included a request for more detail on the specific features of the NAA including the general location of agricultural water transfers (ag transfers), confirmation of storage sites, details on conveyance and water treatment infrastructure and operations. The Corps is preparing a Supplemental Draft EIS (SDEIS) to address comments. MWH was contracted by Northern Water to provide the requested analysis and detail on the NAA. Discussions with Northern Water and the Participants revealed that the DEIS NAA was not feasible particularly due to its reliance on gravel pit storage, C-BT unit purchases, and groundwater use, and that substantial changes to the DEIS NAA were needed.

A process similar to that used in the DEIS to develop and evaluate project alternatives was used to develop the NAA. This process is summarized in Figure 1. Any NAA option would be composed of water supplies, storage, conveyance and water treatment configured to meet the requirements of the Participants in a manner that is consistent with providing 40,000 acre-feet (AF) of firm yield. MWH gathered concepts from the NISP DEIS Alternatives Evaluation Report, the Windy Gap Firing Project (WGFP) Alternatives Report, and discussions with staff of Northern Water and Participants. Some concepts were screened from future consideration because they were not feasible for the NAA. MWH assembled the remaining concepts into six preliminary NAA options. Based on feedback from the Participants, three final NAA options were further developed. A recommended NAA was chosen based on the performance of the three final NAA options in several categories such as water quality, effect on irrigated agriculture, and implementation uncertainty.

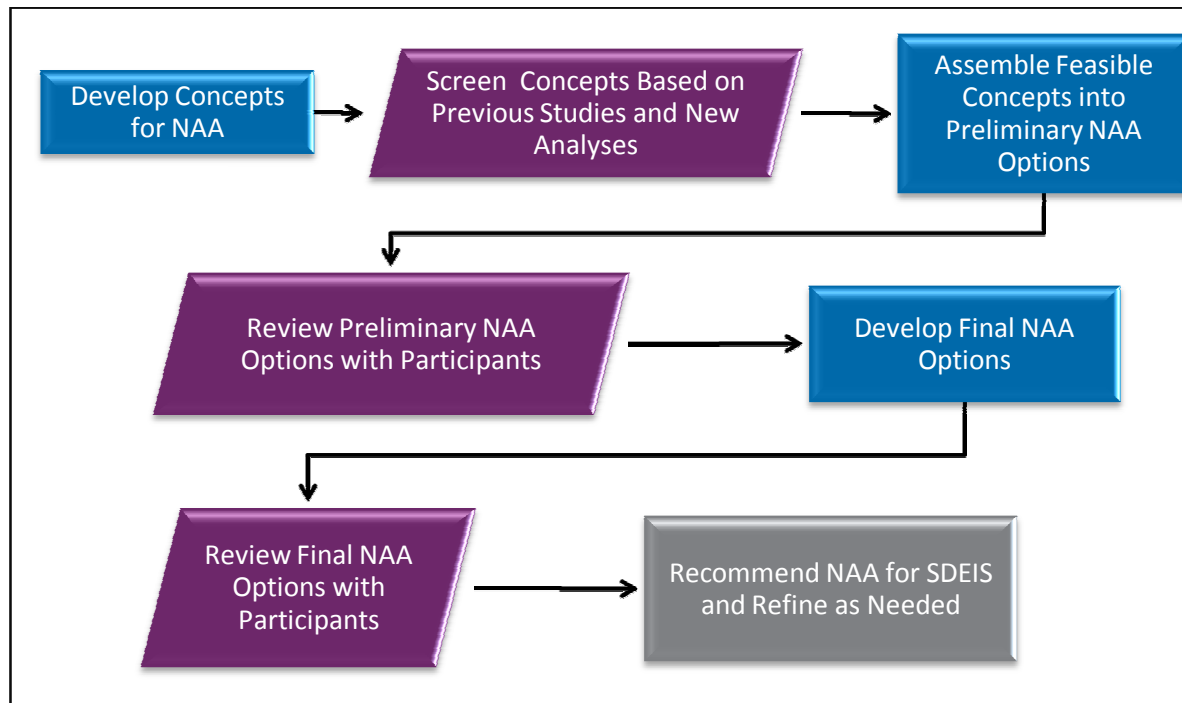


Figure 1. Process for Developing the NAA

No Action Alternative Requirements

Based on MWH's experience with previous National Environmental Policy Act (NEPA) projects and discussions with Northern Water, technical and operational requirements for development of the NAA were established at the outset of the project. These requirements are summarized below.

- **No Corps Action** - The NAA cannot include structural or non-structural components that would result in any type of individual Corps permit, including individual 404 permits, or other Corps action resulting in NEPA activities.
- **Firm Yield Delivery** - The NAA would need to provide the requested 40,000 AF of new reliable water supply (annual firm yield).
- **Water Quality** - The Participants must deliver to their customers treated water that meets drinking water standards and customer expectations; an upper limit of 400 milligrams per liter (mg/L) total dissolved solids (TDS) concentration was adopted for planning purposes.

No Action Alternative Concepts

The NAA will be comprised of four basic components: water supply, storage, conveyance, and water treatment. There are several potential concepts for each component. Concepts were analyzed and screened based on the analyses conducted in the DEIS and alternative evaluation studies, and based on experience with Northern Colorado water planning issues. A summary of the screening results is presented in Table 1.

Table 1. Summary of NAA Concept Screening

Component	Concepts Retained	Concepts Eliminated
Water Supply	- Native Water Rights - Ag transfers	- C-BT Unit Transfers - Rotational Fallowing - Dry-Year Leases - Groundwater
Storage	- Existing Facilities - New Reservoirs	- Gravel Pits - Aquifer Storage and Recovery
Conveyance	- Poudre Valley Canal - Southern Water Supply Pipeline - Dual Use Systems	- C-BT Facilities - Southern Water Supply Pipeline (west of Weld County) - Pleasant Valley Pipeline - Exchanges
Water Treatment	Advanced Finished Water Treatment	Pretreatment (and delivery to existing water treatment facilities)

C-BT = Colorado-Big Thompson

For the water supply component, native water rights and ag transfers were retained for further analysis. The following concepts were eliminated:

- Transfer of Colorado-Big Thompson (C-BT) Project units was eliminated because it is unlikely that an adequate supply of units will be available in the future to meet a significant portion of the NISP Participants' yield requirements. This is based on the number of units currently available, anticipated use of these units to serve a portion of un-met demand by NISP participants, competition from non-NISP participants, and current rules that prohibit "stock-piling" of C-BT units for future growth,
- Dry-year leases were eliminated because they only provide water in dry years, and would not meet the NISP requirement of providing 40,000 AF of water every year.
- Rotational fallowing was eliminated because it would require contracts with large numbers of irrigators and would involve large areas of land, likely more than 300,000 acres. It would be logistically difficult to implement permanent rotational fallowing on the large scale required for NISP. The rotational fallowing contracts that would be required by the municipalities would prohibit farmers from selling their water resulting in a cost that would be similar to the municipalities purchasing the water directly.
- Alluvial groundwater was eliminated because any alluvial groundwater development would also require surface water supplies to replace depletions, and bedrock groundwater was eliminated because it is a non-renewable and unreliable resource.

For the storage component, concepts consisting of the use of existing facilities and the development of new reservoirs were retained. The following concepts were eliminated:

- C-BT storage facilities were eliminated as storage options because there is very little excess storage capacity available (as witnessed by the need of Windy Gap Firming Project participants to develop additional storage to firm Windy Gap supplies) and because water quality would be degraded for non-NISP Participants.

- Gravel pits were eliminated because individually they would meet only a very small portion of the storage requirements, the availability of a large quantity of gravel pits for purchase and use is questionable, they are generally located too low in the basin to efficiently store water used for supplies, and the combination of multiple smaller storage facilities results in up to twice as much evaporative loss as fewer larger facilities.
- Aquifer storage and recovery (ASR) was eliminated because the alluvial geology in the study area does not support large-scale ASR development.

Conveyance concepts retained include the existing Poudre Valley Canal, the eastern spur of the Southern Water Supply Pipeline, and dual use systems, which would deliver non-potable water for irrigation of landscaped areas in new development. The following concepts were eliminated:

- C-BT conveyance facilities were eliminated as conveyance options because the introduction of water transferred from agriculture into the C-BT system would degrade water quality for non-NISP Participants.
- The southern portions of the Southern Water Supply Pipeline and the Pleasant Valley Pipeline were also eliminated due to contractual water quality requirements for delivery to non-NISP Participants.
- Exchanges were not included in the original development of NAA alternatives due to unreliability of exchange potential given future conditional water rights in basins that could supply NAA water. However, exchange rights would likely be filed for any of the options and exercised as exchange potential permits in order to maximize water quality and reduce pumping costs.

Conventional water treatment is not explicitly part of any of the Action Alternatives or the NAA and is expected to be the responsibility of the Participants. Advanced water treatment was retained as an NAA concept. Pretreatment was eliminated due to the inability to remove total dissolved solids (TDS) and other constituents of concern in the source water at a basic pre-treatment facility.

No Action Alternative Preliminary Options

MWH developed six NAA preliminary options prior to meeting with each of the Participants. Fact sheets illustrating the preliminary options, available in Appendix A, were discussed with the Participants at individual meetings.

Three categories of preliminary options were developed.

- **Preliminary Option A: Local Supplies/Local Storage** – Similar to the DEIS NAA, with smaller more localized projects.
- **Preliminary Option B: Northern/Balanced Supplies** – Larger regional project based mostly upon ag transfers from the Poudre and Big Thompson basins.
- **Preliminary Option C: South Platte Natural Pretreatment** – Poudre Basin water supplies for Participants located near the Poudre River, South Platte water supplies for the remaining Participants, and the use of shallow wells to divert, store and pre-treat South Platte supplies.

Preliminary Option B was further sub-divided to provide more definition on how the preliminary option could be developed.

- **Preliminary Option B.1: Balance Ag Transfer, Existing Storage** – Implementing enough ag transfer to meet yield requirements without constructing new storage.
- **Preliminary Option B.2: Northern Ag Transfer, Existing Storage, New Plains Reservoir** – Ag transfers in the Poudre and Big Thompson basins with a new reservoir on the plains (east of I-25).
- **Preliminary Option B.3: Northern Ag Transfer, New Foothills Reservoir** – Ag transfers from the Poudre Basin and development of new reservoir in the foothills, likely resulting in the best water quality of the Preliminary Option B sub-options.
- **Preliminary Option B.4: Balanced Ag Transfer, New Plains Reservoir** – A higher percentage of ag transfers in the Big Thompson Basin with a new reservoir on the plains (east of I-25).

All of the preliminary options involve a substantial amount of ag transfers, including the agricultural water storage rights associated with the transferred ditch company shares.

Final No Action Alternative Options

Based on feedback received from Participants and Northern Water, and subsequent technical analysis, three final NAA options were refined. Although preliminary NAA options included smaller, more individualized projects, the NAA development process led to final NAA options that are regional projects. Regional projects are more efficient in terms of infrastructure, total cost, and minimizing effects on irrigated agriculture. For the final NAA options, information was developed to document the source ditch system and quantity of irrigation dry-up; the potential diversion of native water supplies; specific storage sites and required volume; general alignments and required capacities of conveyance segments; general locations, capacities and description of the type of water treatment required; and the infrastructure required for delivery of treated or untreated water to the Participants. Table 2 summarizes the components of the final NAA options.

Table 2. Final NAA Options Component Summary

Component Associated Preliminary NAA Option	Option 1 North and South Systems	Option 2 No New Storage	Option 3 Large Plains Reservoir
	A	B.1	B.2
Water Supply ⁽¹⁾	• Ag transfer 44,100 acres • Average yield 41,300 AF • Sources: Poudre, Big Thompson & S. Platte • Junior rights with 4,957 AF average yield	• Ag transfer 91,000 acres • Average yield 64,000 AF • Sources: Poudre & Big Thompson	• Ag transfer 62,000 acres • Average yield 43,900 AF • Sources: Poudre & Big Thompson • Junior rights with 877 AF average yield
Storage	• Shares in existing ag reservoirs • Acquire Cobb Lake 22,300 AF • New Berthoud Hill Reservoir 25,000 AF	Shares in existing ag reservoirs	• Shares in existing ag reservoirs • New Cactus Hill Reservoir 120,000 AF
Conveyance	• Existing canals, existing and new pipelines • North and south systems not connected • Dual use system	• Existing canals, existing and new pipelines • Connected raw water system	• Existing canals, existing and new pipelines • Connected raw water system
Water Treatment	• Advanced water treatment and high recovery RO for 16 percent of supply with ZLD and evaporation ponds for brine disposal • 30 percent of supply untreated for delivery in dual use systems	Advanced water treatment	Advanced water treatment

MGD = million gallons per day, RO = reverse osmosis, ZLD = zero liquid discharge

Notes:

- ⁽¹⁾ Average yield of water supplies is diverted water at headgate. Water supplies required are greater than firm yield (40,000 AF) to account for reservoir evaporation and undiverted flow during times when water cannot be delivered or stored.

The following paragraphs generally describe each option.

- **Option 1: North and South Systems** - The Participants generally located near the Poudre River (Evans, Windsor, Fort Collins-Loveland Water District, Severance, and Eaton) would develop northern water supplies and an associated storage facility. The remaining Participants, all located further south, would develop water supplies from the Lower South Platte Basin and store them in a separate storage reservoir located near the water sources.

The North System would use ag transfers from the Poudre Basin, existing reservoir storage in agricultural systems, and purchase of the existing Cobb Lake to serve the northern Participants. Use of multiple smaller reservoir facilities such as gravel pits was originally considered, but ultimately not included.

The South System would use ag transfers from the Big Thompson and South Platte basins, existing reservoir storage in the Big Thompson Basin, and a new reservoir east of I-25 near Berthoud to serve the southern Participants. Because the South System would rely on South Platte supplies that generally have high levels of TDS, about 4 million gallons per day (MGD) of the flow would be treated via high-recovery reverse osmosis (RO). Brine disposal would be accomplished through a combination of evaporation ponds and zero liquid discharge (ZLD). To reduce the amount of advanced water treatment required, Option 1 also includes a non-potable system that would deliver untreated water to selected Participants for use in dual-use distribution systems to be constructed in new development.

- **Option 2: No New Storage** – The premise of this option is to minimize the need for new storage. Because existing agricultural reservoirs typically do not have a significant carryover storage component (i.e., they are filled and drained annually to meet consumptive use (CU) requirements), enough agricultural CU would be purchased to meet firm yield requirements in the driest year of the planning period.

Option 2 involves the transfer of water from irrigated land in Larimer & Weld and New Cache systems in the Poudre Basin, and the Home Supply system in the Big Thompson Basin. Transferred water would continue to be diverted from the Poudre and Big Thompson Rivers at the existing diversion locations. Larimer & Weld and New Cache water would be delivered directly to Big Windsor Reservoir. Home Supply water would continue to be delivered to Lonetree Reservoir southwest of Loveland. From these existing reservoirs, water would be delivered to two regional advanced water treatment plants that would serve the northern and southern Participants.

- **Option 3: Large Plains Reservoir** - This option was based on using a large new reservoir and identifying ag transfer supplies based on their ability to be delivered to the reservoir.

Option 3 involves the transfer of water from irrigated land in Larimer & Weld and New Cache systems in the Poudre Basin, and the Home Supply system in the Big Thompson Basin. As with Option 2, transferred water would continue to be diverted at the existing diversion locations and delivered to Big Windsor Reservoir and Lonetree Reservoir. Cactus Hill Reservoir would be constructed and used for carryover storage, and would be filled from both Big Windsor Reservoir and through the existing Poudre Valley Canal. Water would be delivered to two regional advanced water treatment plants that would serve the northern and southern Participants.

Comparison of NAA Options

A qualitative screening process was used to evaluate the three final options and assist Northern Water and the Participants in selection of a recommended NAA for the SDEIS. In order to perform this screening, a list of decision criteria was developed using the NAA requirements

described earlier. All of the alternatives meet the requirements for permitting and delivering 40,000 AF of firm yield. A total of 6 criteria were developed from the remaining three categories of requirements (reliability, water quality and reasonableness), based on comments received from project Participants and Northern Water. A summary of the criteria and qualitative evaluation is presented in Table 3.

Table 3. Relative Comparison of NAA Options

Criteria	Option 1	Option 2	Option 3
	North and South Systems	No New Storage	Large Plains Reservoir
System Reliability & Flexibility	• Low operational flexibility due to unconnected systems	• Lack of carryover storage • Low operational flexibility due to lack of storage	
Water Quality	• South system raw water TDS greater than water quality standard • Lack of maturity of ZLD process	• Raw water quality poorer than Carter Lake	• Raw water quality poorer than Carter Lake
Effect on Irrigated Agriculture	44,100 acres retired	91,000 acres retired	62,000 acres retired
Construction & Water Cost	Estimated to be within comparable range for all options.		
O&M Cost	• Operation of dual-use systems • Extra cost and energy requirements for RO & brine disposal		
Implementation Uncertainty	• Uncertainty in future regulations and environmental concerns for brine disposal	• High percentage of ag transfers from individual ditch companies may be unattainable • Cost estimate uncertainty due to high reliance on ag water purchases	

Note: Shading indicates, where information clearly differentiates, a preference of one option over another. Green = higher preference, Pink = lower preference.

The evaluation and screening of NAA options was reviewed with the Participants, Northern Water and the consulting team that prepared this report. The following is brief discussion of each option.

- **Option 1 – North and South Systems:** This option evolved from Option A in the preliminary options analysis, which was a more “localized” option somewhat similar to the No Action Alternative in the DEIS. Because of limited water supplies near many of the Participants, and challenges with numerous smaller storage facilities such as gravel pits and small new reservoirs, the option became a “North System” and “South System” option involving two smaller reservoirs and water supplies from the Poudre Basin to the South Platte Basin.

Due to water quality issues in the South Platte Basin, RO facilities would be required for the South System. The certainty to which an RO system could be developed at the treatments rates required in Colorado is questionable, primarily due to brine disposal issues and high energy costs. Implementation of dual-use systems in certain Participant communities without existing dual use systems was included to reduce the amount of RO treatment required. Additionally, due to lack of interconnection between the two systems, the combined system provides less water supply and operational flexibility for the NISP Participants as a whole. This option would have the least amount of impacts to irrigated agriculture due to the use of South Platte water supplies. However, the tradeoff is reduced water quality requiring RO treatment.

- **Option 2 – No New Storage:** This option, which originally was termed Option B.1 in the preliminary options analysis, was developed as an option that would not require construction of new storage facilities, and utilize storage in existing agricultural storage facilities to the maximum extent possible. Because agricultural storage systems along the Front Range have typically been developed as seasonal storage facilities without a significant carryover storage component, storage in these facilities does not provide the level of drought protection required for municipal water supplies. Similarly, because less storage is available, this option would have the greatest impact on irrigated agriculture because municipal entities would have to continue to rely primarily on transferred direct flow yield during dry years (which is typically much lower than average or wet year yield) rather than relying on carryover storage during dry years. Due to a lack of storage, this option would not be able to take advantage of new junior water rights that could divert currently unappropriated water.

Staged construction and implementation of this option would likely be easier than other options due to fewer required infrastructure requirements at the outset. However, there could also be issues in conversion of existing storage facilities from an agricultural water supply, which primarily has a defined release to augment late season irrigation requirements, to a municipal water supply that requires releases throughout the year and a desired carryover storage component.

- **Option 3 – Large Plains Reservoir** – This option, which originally was termed Option B.2 in the preliminary options analysis, was developed as a regional solution, and involves the construction of a single larger plains reservoir that could be developed without an individual Corps permit, and a mid-level amount of ag transfers. The option would provide the maximum amount of flexibility to the Participants due to a reasonable

amount of carryover storage, interconnection amongst all Participants, and proven technologies (i.e. it would not require large-scale RO treatment).

Implementation of the final NAA options requires a continued regional partnership between the NISP Participants. More independent NAA options could be possible, but they would result in greater impact to irrigated agriculture. During Participant meetings, all Participants expressed continued interest in a regional project. As part of the NISP process, the Participants have developed the organizational structure and planned implementation strategies that could be adapted directly to this regional solution.

In general, the Participants were concerned about the quantity of agricultural dry-up for all options, the uncertainties surrounding the development of Options 1 and 2 regarding the availability of water supplies and implementation of RO, and the overall cost of implementing any of the options. Ultimately, using the information presented in Table 3, it was determined that Option 3 represents the most likely future action by the Participants if the NISP Proposed Action could not be permitted.

Recommended No Action Alternative

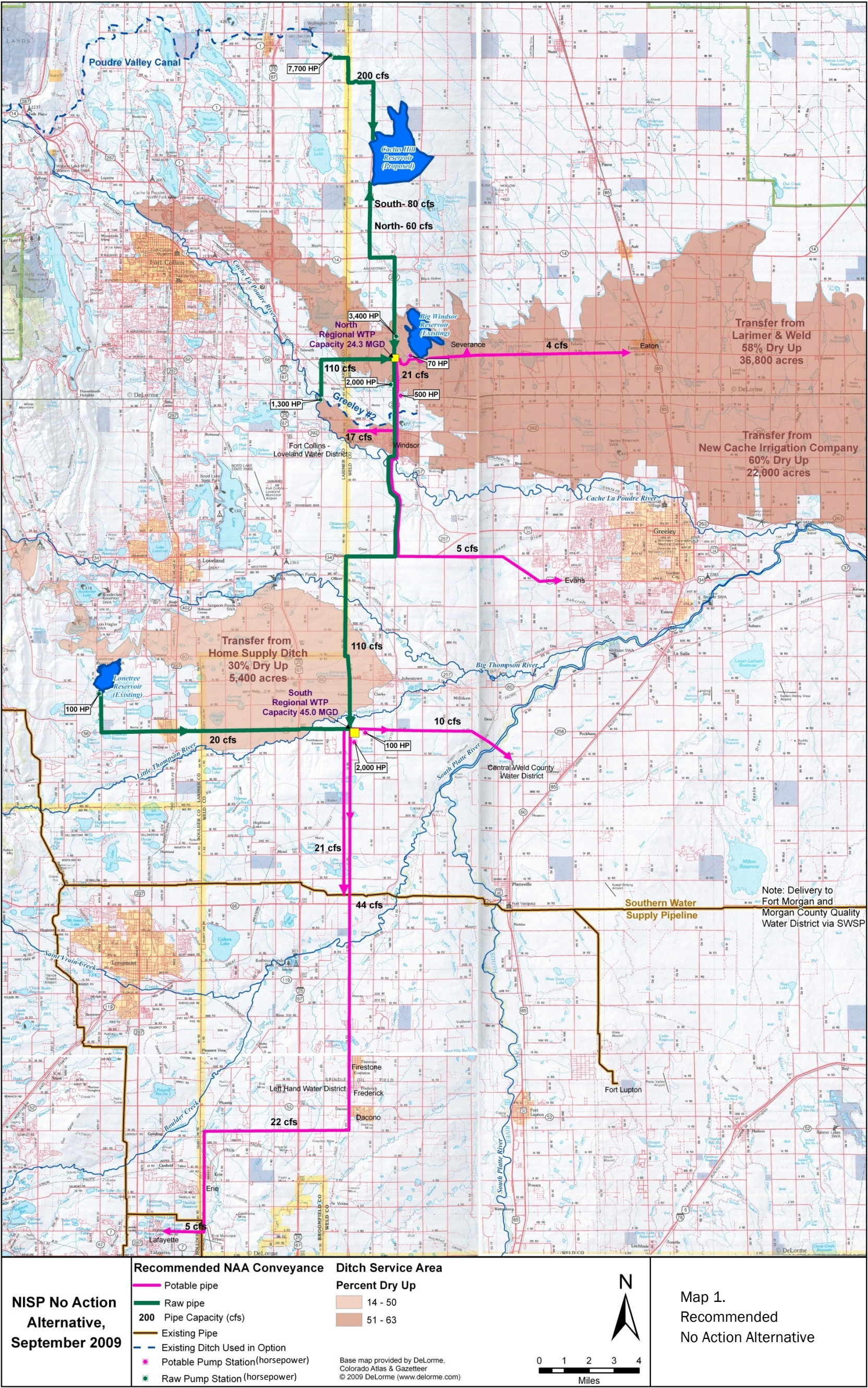
The recommended NAA is based on Option 3, and is shown on Map 1. Based on supplemental analysis and review, some refinements were made to Option 3, primarily to the amount of water supply assumed to be available from certain ditches. Details regarding the recommended NAA were developed to a level of detail that would provide adequate information for evaluation of environmental and socioeconomic effects by the Corps in the SDEIS.

Water Supply

Table 4 summarizes the water right transfers and associated existing storage within each system required to meet NISP firm yield delivery requirements to the North and South system Participants. All transferred water supplies are located in the Poudre and Big Thompson basins for ease of conveyance to storage and water treatment facilities.

Table 4. Recommended NAA - Water Rights Transfer Summary

Ditch System	Transferable Ditch CU (AF/ac)	Irrigated Land Affected (acres)	Average Annual Yield (AF)	Percent of Total Ditch Shares	In-Ditch Storage Transferred (AF)
Larimer & Weld	0.54	36,800	19,900	58%	13,569
New Cache	0.97	22,000	21,300	60%	6,145
Home Supply	0.74	5,400	4,000	30%	5,998
Total	0.70	64,200	45,200	55%	25,712



Total water supplies for the recommended NAA are approximately 45,200 AF, while the total annual firm yield of the NAA is 40,000 AF. The 5,200 AF of water supplies that are in excess of the 40,000 AF required for annual delivery to the Participants would be consumed as evaporation in the reservoirs or spilled when the transferred agricultural water is available during times when carryover storage is full. Yield estimates are approximate and based upon the hydrologic modeling techniques described in the main report.

Alternate point of diversion (APOD) or exchange water rights would be filed for the NAA. Water transferred from the Larimer & Weld and New Cache systems would be diverted through the Poudre Valley Canal when the APOD or exchange would not injure senior water rights to provide the higher quality source water for delivery and storage and to reduce pumping costs. The APOD/exchange operation should be included in the hydrologic analysis of the NAA in the SDEIS.

In addition to water rights transfers, a junior water right would be filed in the Poudre Basin. On average, this water right would yield about 900 AF per year. Even in wet years the junior water right would not yield a large amount of water. This water would be diverted through the existing Poudre Valley Canal to Cactus Hill Reservoir.

Storage

Water would be stored in existing reservoirs that are part of the Larimer & Weld, New Cache, and Home Supply systems. Regulating, carryover, and terminal storage would be held in pro-rata ownership in several reservoirs connected to these systems, including the Larimer and Weld high mountain system, the Poudre Valley Canal system, Terry Lake, Timnath Reservoir, Big Windsor Reservoir, Lonetree Reservoir, Mariano Reservoir, and Lon Hagler Reservoir. Big Windsor Reservoir would be a key facility in the NAA, serving as a terminal storage facility for the north water treatment plant, and partially serving as terminal storage for the south water treatment plant. Lonetree Reservoir would be the other key existing reservoir, as it would serve as terminal storage for the south water treatment plant. Reservoirs would be operated in a manner to optimize water quality. This would require rotating releases among reservoirs to prevent excessive evapoconcentration of salts from occurring in any one reservoir.

Cactus Hill Reservoir, at a capacity of 120,000 AF, would be constructed to store water from the Poudre River system. The reservoir size was selected to reduce the amount of ag transfers required. Cactus Hill Reservoir is included as part of Alternatives 3 and 4 in the DEIS and has already received extensive environmental review.

Conveyance

New pipelines and pump stations required for the recommended NAA are summarized in Table 5. Cactus Hill Reservoir would be filled via a pipeline from Big Windsor Reservoir and short pipeline from the Poudre Valley Canal. The pipeline from Big Windsor Reservoir to Cactus Hill Reservoir would be a bi-directional pipeline, which would allow releases from Cactus Hill Reservoir back to Big Windsor Reservoir and the North Water Treatment Plant. Raw water from the New Cache system would be diverted from the Greeley No. 2 Ditch to the North Water Treatment Plant and Big Windsor Reservoir. Raw water would be delivered from Lonetree Reservoir to the South Water Treatment Plant through a pipeline.

Water Treatment

In a worst case scenario where supplies cannot be exchanged to a higher diversion point, the average raw water TDS would be about 350 mg/L, less than the secondary maximum contaminant level (MCL) of 500 mg/L and the assumed water quality goal for the NAA of 400 mg/L. Therefore, the two new water treatment plants would not require RO. However, if supplies are diverted at the ditch headgates, the NAA would be obtaining 43 percent of supplies downstream of municipal wastewater discharges and developed areas. There is potential to improve NAA raw water quality by exchanging New Cache water to diversion points further upstream. The amount of water that can be exchanged is not known at this time because the NISP hydrologic model continues to be modified. Due to the potential for lower raw water quality, the Participants would likely construct advanced water treatment facilities.

Table 6 summarizes the water treatment plant average and maximum month design flow rates.

Table 5. Recommended NAA – Conveyance Summary

Segment	Capacity (cfs)	Diameter (inches)	Length (miles)	Pump Station Horsepower
Raw Water - Cactus Hill Reservoir Inlet	200	48	6	1 @ 7,700 HP
Raw Water - Cactus Hill Reservoir to North Water Treatment Plant (bidirectional)	80 (south) 60 (north)	42	9	1 @ 3,400 HP
Raw Water - New Cache to North Water Treatment Plant	110	66	4	1 @ 1,300 HP
Finished Water - North Water Treatment Plant to FCLWD / Evans	5 - 21	16-30	17	1 @ 500 HP
Finished Water - North Water Treatment Plant to Eaton	4	14	9	1 @ 70 HP
Raw Water - North Water Treatment Plant to South Water Treatment Plant	110	66	21	1 @ 2,000 HP
Raw Water - Lonetree Reservoir to South Water Treatment Plant	20	36	15	1 @ 100 HP
Finished Water - South Water Treatment Plant to CWCWD	10	20	11	1 @ 100 HP
Finished Water - South Water Treatment Plant to Lafayette	5 - 44	20-48	24	1 @ 2,000 HP
Finished Water - South Water Treatment Plant to SWSP	21	36	5	--

Table 6. Recommended NAA - Water Treatment Plant Summary

Segment	Average Month Flow (MGD)	Max Month Flow (MGD)
North Water Treatment Plant (Advanced)	12.5	24.3
South Water Treatment Plant (Advanced)	23.2	45.0
Total	35.7	69.3

There are a variety of potential water treatment designs that could be selected by the Participants to meet their water quality goals. One potential design would be similar to the Peter Binney Water Purification Facility in Aurora. A similar plant for the recommended NAA would use the following treatment steps:

- Precipitative softening
- UV advanced oxidation
- Granular media filtration, and
- Carbon adsorption

Treated water would be delivered to the Southern Water Supply Pipeline for delivery to Morgan County Quality Water District and Fort Morgan. Although this pipeline currently carries raw water, it is of higher quality than the NAA water, and the raw NAA water may be acceptable to the receiving municipalities.

Recommended NAA Opinion of Probable Construction Cost

An opinion of probable construction cost for the recommended NAA is summarized in Table 7. All estimates are at a conceptual level.

Table 7. Recommended NAA Conceptual Level Opinion of Probable Construction Cost

Component	Cost
Storage – Cactus Hill Reservoir	\$120M
Water Treatment (beyond conventional)	\$40M
Conveyance	\$160M
Unlisted Items at 10%	\$30M
Subtotal	\$340M
Contingency at 25%	\$90M
Base Construction Cost	\$440M
Engineering, construction management, legal, administrative at 13%	\$60M
Water Rights Acquisition, Revegetation, Legal and Engineering	\$300M - 400M
Total	\$800M – 900M

MWH developed cost estimates for water rights acquisition and revegetation. The cost of water is presented as a range due to the uncertainty in the future cost of large ag transfers. Several different sources of information were consulted to develop costs for water transfers, including reported transactions for the last 10 years, a review of current cash-in-lieu rates for municipalities, and discussions with sources knowledgeable with particular irrigation systems. Estimated share prices for each basin were increased by 25 percent to account for the market's reaction to large scale water transfers. Revegetation, legal and engineering fees were also included. This resulted in a range of \$5,900 to \$8,600 per AF of municipal yield for the Poudre Basin, \$11,200 to \$13,800 per AF for the Big Thompson Basin, and \$13,800 to \$16,400 per AF for water obtained in the Denver Metro Area. Costs for Denver Metro Area shares were not used for the Recommended NAA.

All other costs were based on cost information developed by Integra Engineering and GEI for the SDEIS action alternatives using engineering information provided by MWH.

No Action Alternative Implementation

Implementation of the NAA would differ from that of the NISP Proposed Action due to the additional time required to procure and change agricultural water rights. Transfer of ditch shares from agricultural to municipal use would be a lengthy process for the Participants, and include initial studies and purchase offerings to individuals within the ditch companies involved, procurement of shares, a change case in water court, performing actual dry-up and revegetation, and finally, construction of facilities and delivery of water. Because of the uncertainty involved in water rights procurement and change cases, it is likely that the Participants would chose not to construct facilities until an adequate quantity of shares were purchased to justify construction and the entire change case was complete. Construction of facilities would likely commence with pipelines from the Greeley No. 2 Ditch and Lonetree Reservoir to the water treatment plants and associated facilities. Cactus Hill Reservoir and associated facilities would be the last portion of the project to be constructed.