S.1 INTRODUCTION

The U.S. Army Corps of Engineers (Corps) has issued a Supplemental Draft Environmental Impact Statement (SDEIS) to disclose direct, indirect, and cumulative effects of the Northern Integrated Supply Project (NISP or Project). The proposed Project is a regional water supply project designed to serve the current and a portion of the future water needs of 15 towns and water districts in Boulder, Larimer, Morgan, and Weld Counties within the Northern Colorado Water Conservancy District (District). Construction of the proposed Project would involve the discharge of fill material into jurisdictional waters of the United States, thereby requiring a Clean Water Act Section 404 permit from the Corps. The District, acting by and through the Northern Integrated Supply Project Water Activity Enterprise, notified the Corps that it will seek a Section 404 permit for the District's Preferred Alternative (Proposed Action).

The Corps published a Draft Environmental Impact Statement (DEIS) for NISP on April 30, 2008 for public comment. Substantial comments were received during three public hearings held for the DEIS as well as during the comment period. The Corps determined that additional analysis was required and that the purposes of the National Environmental Policy Act (NEPA) would be furthered through the issuance of a SDEIS. As a SDEIS, this document does not repeat information in the DEIS.

The Town of Berthoud withdrew as a Participant in NISP in April 2008 as the DEIS was being released to the public. Frederick requested the project yield previously allocated to Berthoud. In the DEIS, the NISP yield requests for the Town of Frederick, Town of Firestone, and City of Dacono were combined with the yield request for Central Weld County Water District that serves these communities. In the SDEIS, these Participants are discussed individually.

The public and federal and state agencies provided about 675 letters, emails, and oral statements on the DEIS. The Corps has taken these comments into consideration during the preparation of this SDEIS. The Corps' new alternatives, studies, data collection, modeling, and analyses (Table S-1) were in response to comments on the NISP DEIS. In 2009, the Corps decided that a common technical platform (CTP) would be developed for several key resources potentially affected by the proposed NISP and Halligan-Seaman Water Supply Projects (HSWSPs) (hereafter collectively referred to as the Projects). The CTP involves development of common

Halligan-Seaman Water Supply Projects (HSWSPs)

During the final stages of developing the NISP SDEIS, the Cities of Fort Collins and Greeley requested that separate EISs be prepared for their proposed water supply projects, the enlargement of Halligan Reservoir and the enlargement of Seaman Reservoir, respectively. The Corps concurred with this request and published a Notice of Intent to separate the EISs on February 4, 2015. The two projects have independent utility and require separate authorizations by the Corps. The NISP SDEIS refers to these projects as the HSWSPs; however, they are two separate projects that are now being analyzed in two EISs. The CTP hydrology modeling (Run 5 series), which includes the proposed Halligan and Seaman Reservoir enlargements, is still valid since the proposed actions for these projects have not changed. The Corps will continue to use the CTP for analysis of flow related effects for the two projects since the purpose of the CTP is to ensure a consistent approach is used between these projects and NISP.

protocols by which data are collected, the use of a common analytical approach, and the sharing of data between the NISP and HSWSPs EISs. The majority of the CTP information was developed for the mainstem of the Poudre River from the Canyon Gage to the confluence with the South Platte River. The following resources and analyses were prepared as part of the CTP for NISP and HSWSPs:

- Current Conditions, Future Conditions, and Cumulative Effects hydrologic modeling
- River morphology and sediment transport current conditions
- Aquatic biological resources current conditions
- Surface water quality current conditions
- Riparian and wetland resources current conditions

Table S-1. Post-DEIS studies, data collection, modeling, and revisions to the DEIS.

Resource/Topic	New Studies/Revisions	SDEIS Chapter, Section, or Appendix
Participants' Water Supply and Future Needs	Existing water supplies for the NISP Participants were updated through 2010. Estimated future water supply needs of the NISP Participants were updated through 2060.	Chapter 1, Sections 1.1 and 1.1.8
Water Conservation	NISP Participants' water conservation programs and plans were updated through 2010. A future conservation scenario was developed to further examine project need.	Chapter 1, Section 1.2.7
No Action Alternative	A new No Action Alternative for NISP was developed.	Chapter 2, Section 2.4
Elimination of Action Alternative	Alternative 4 – Glade Reservoir and SPWCP with Agricultural Transfers and Subalternative 4.2 evaluated in detail in the DEIS were not carried forward for detailed evaluation in the SDEIS. The new No Action Alternative for the SDEIS addresses the alternative of agricultural transfers and provides a reasonable range of alternatives for evaluation in the SDEIS.	Chapter 2, Section 2.2.6.2
Modification of Alternative Screening Criteria	The Corps eliminated timeliness in the purpose and need screening category and reevaluated the alternatives for the land use criterion in the practicable screening category. Previously eliminated concepts and elements were reevaluated.	Chapter 2, Sections 2.2.2, 2.2.3, and 2.2.4
Evaluation of Submitted NISP Alternatives	Two NISP alternatives, the Healthy Rivers Alternative and A Better Future for the Poudre River were considered but eliminated from detailed evaluation in the SDEIS.	Chapter 2, Section 2.2.5
New Action Alternative	A new action alternative that includes the proposed Cactus Hill Reservoir and SPWCP with diversions from the Poudre River near the Larimer-Weld Canal and New Cache Canal diversions was analyzed in detail.	Chapter 2, Section 2.7
Preferred Realignment of U.S. 287	CDOT selected the western alignment as their preferred alternative for the realignment of U.S. 287 associated with the District's Preferred Alternative. The northern alignment is eliminated from detailed analysis in the SDEIS.	Chapter 2, Section 2.2.6.2
Hydrology	New Poudre River modeling using a CTP for the NISP and HSWSPs EISs.	Chapter 3, Section 3.2

Resource/Topic	New Studies/Revisions	SDEIS Chapter, Section, or Appendix
Aquatic Biological Resources	In coordination with the USGS, established six representative 2-D hydraulic and aquatic habitat sites on the mainstem of the Poudre River (Poudre River study sites) to assess aquatic habitat with changes in flows. These sites involved detailed topographic survey and aquatic habitat mapping. In coordination with the Colorado Parks and Wildlife (CPW), developed site-specific habitat suitability curves for habitat utilization by Poudre River fish in different segments of the Poudre River based on more than 2,000 Poudre River observation points. Effects to aquatic habitat were reevaluated using new Poudre River CTP hydrology, 2-D modeling, and habitat suitability curves. New technical reports were prepared using 2-D modeling and the CTP hydrology.	Chapter 3, Section 3.12; Chapter 4, Section 4.12; Chapter 5, Section 5.12
Stream Morphology and Sediment Transport	An expanded review of historical aerial photography was undertaken to better define Poudre River channel and floodplain trends. A review of historical floodplain encroachment was undertaken to better define the trends of floodplain impacts. The reaches of the Poudre River used for the DEIS were reviewed and further subdivided to more accurately describe past trends and potential impacts on different segments of the Poudre River. The Poudre River segments were classified using the Rosgen classification (Level I/II). New technical reports were prepared using new and revised information and the CTP hydrology.	Chapter 3, Section 3.4; Chapter 4, Section 4.4; Chapter 5, Section 5.4

Resource/Topic	New Studies/Revisions	SDEIS Chapter, Section, or Appendix
Water Quality	Effects to water quality in the Poudre and South Platte Rivers were reevaluated using new CTP hydrology and new water quality data. Review of new water quality regulations. Review of Hoffman 2012 report regarding potential effects to crop production with increasing canal water salinity. Review of new information on emerging contaminants in the Poudre River. Additional surface water quality data for numerous parameters were collected at 17 sites on the Poudre River and one location on the South Platte River near Kersey. Ground water quality was sampled at two springs tributary to the Poudre River. Water quality effects on Horsetooth Reservoir were evaluated using a two dimensional hydrodynamic water quality model. Soil and water quality water data were collected and historical data were reviewed at the proposed Glade, Cactus Hill and Galeton reservoir sites to assist in estimating water quality of the reservoirs, to evaluate effects of using Galeton water by irrigators, and to determine potential selenium and salinity contributions to the South Platte River from Galeton Reservoir. Water quality data for existing reservoirs comparable to potential new reservoirs (Glade, Galeton, and Cactus Hill) were used to estimate likely water quality in new reservoirs. New hydrologic data and anticipated reservoir operations for Glade, Cactus Hill, and Galeton Reservoirs were used to predict reservoir water quality using mass balance models developed for each reservoir. Information was collected on existing water treatment plant operation for entities using Horsetooth Reservoir as a domestic water source to analyze effects to those water treatment plants. New water quality technical reports were prepared using new data and CTP hydrology to assess potential impacts to temperature, dissolved oxygen, and nutrient and metal concentrations in the Poudre and South Platte Rivers, New reports also evaluated potential effects to existing and new reservoirs, water treatment plants, wastewater treatment plants, and irrigation water quality.	Chapter 3, Section 3.3; Chapter 4, Section 4.3; Chapter 5, Section 5.3
Ground Water	28 ground water monitoring wells and six river staff gages were installed and monitored at the six Poudre River study sites to determine ground water-surface water relationships. Ground water quality was sampled at the monitoring wells. At least one monitoring well at each 2-D hydraulic site was tested to determine hydraulic conductivity of the river alluvium.	Chapter 3, Section 3.5; Chapter 4, Section 4.5; See Figures 3-26 and 3-27

Resource/Topic	New Studies/Revisions	SDEIS Chapter, Section, or Appendix
Riparian and Wetland Areas	Wetland and riparian vegetation was mapped at each of the six Poudre River study sites to develop relationships between vegetation, ground water, and streamflows. Wetland and riparian resources mapping by CPW was reviewed and revised for the Poudre River corridor from the canyon mouth to the confluence with the South Platte River to determine the distribution of wetland and riparian resources. Data on tree recruitment were collected at each of the six Poudre River study sites. Data on the distribution of size classes of trees were collected along four 100-foot-wide belt transects at each Poudre River study site. Wetland functions were assessed at each of the Poudre River study sites using the Functional Assessment of Colorado Wetlands (FACWet) Method. The presence and distribution of noxious weeds were recorded and discussed for each of the Poudre River study sites. Historical aerial photos were reviewed to assess changes in land use and distribution of riparian communities along the Poudre River. The new CTP hydrology, 2-D modeling, information on ground water-streamflow relationships, and woody vegetation recruitment were used to reevaluate effects to mainstem Poudre River wetland and riparian resources associated with changes in Poudre River flows, and prepare new technical reports. An assessment of amount of wetlands associated with irrigation in the region was redone as a CTP study. Post-flood reviews of the Poudre River mainstem were conducted in 2010, 2011 and 2013.	Chapter 3, Section 3.9; Chapter 4, Section 4.9; Chapter 5, Section 5.9
Hazardous Materials	Monitoring of the ground water wells occurred at the former Atlas missile site near the proposed Glade Reservoir forebay to collect temporal data on the distribution and concentration of the trichloroethylene in ground water, and a new technical memo was prepared. Changes in Poudre River flows and hydraulics were evaluated to determine if reduced flows would affect a site along the Poudre River in Fort Collins contaminated by coal tar. An assessment of oil and gas development at the proposed Galeton Reservoir site was completed.	Chapter 3, Section 3.21; Chapter 4, Section 4.21
Costs/Financial Impacts	Construction costs for Glade Reservoir, Galeton Reservoir, and Cactus Hill Reservoir, and associated facilities were updated to 2010 dollars. Updated financial models were developed for the Participants to examine effects of the alternatives on water affordability.	Chapter 2, Section 2.9.1, Chapter 3, Section 3.20; Chapter 4, Section 4.20
Operations	An operations plan for the District's Preferred Alternative was developed.	Chapter 2, Section 2.5.1
Mitigation	The mitigation plan in the DEIS presented a range of potential mitigation measures. The mitigation plan has been revised and presents what is proposed by the District.	Appendix F

CTP information also was developed for wetlands associated with irrigated lands in the region to help estimate the effects of transferring irrigation water to municipal uses for the Projects' EIS alternatives. In addition, a history of the Poudre River was developed to provide a context for the proposed Project's potential effects on the Poudre River.

The CTP provides common information for the NISP and HSWSPs EIS teams and reviewers of the EISs for key resources that are potentially affected by the proposed projects. A strength of the CTP is that it brought together parties responsible for preparation of the EISs to reach consensus on a common approach, and then to work together toward development of the CTP. For example, the CTP current conditions hydrology took more than 3 years to develop and involved numerous reviews and inputs from the Corps, Division 1 Water Commissioner, hydrologists and water resource engineers for the EIS teams' third-party contractors, the District, and the cities of Fort Collins and Greeley.

The following changes to the proposed NISP facilities and operations have also been made since the DEIS was issued:

- **Galeton Reservoir** – Sized at 40,000 AF in the DEIS is now proposed to be expanded to 45,624 AF (maximum volume under the 1992 priority storage right). The high water elevation of Galeton Reservoir would change from 4,869 feet to 4,872 feet.
- **SPWCP Pumping Rate** – The maximum proposed pumping rate from the South Platte River for the SPWCP increased from 150 cfs to 200 cfs.
- **Pleasant Valley Pipeline** – The Fort Collins-Loveland Water District would use its own capacity in the Pleasant Valley Pipeline to receive its water by direct connection from Glade Reservoir.
- **Curtailment of Winter Diversions from the Poudre River** – NISP would not divert from the Poudre River when flows at the Watson Lake Fish Hatchery diversion weir are less than 50 cfs or the flows at the Fort Collins Boat Chute are less than 30 cfs.
- **Winter Flow Augmentation –** The District proposes to integrate a flow augmentation program with the operation of its Preferred Alternative to maintain a minimum of 10 cfs in the Poudre River on the downstream side of the Larimer-Weld Canal headgate. Augmentation flows would be released upstream of the Larimer County Canal headgate and re-diverted at the Timnath Reservoir inlet. Releases would be made from a 3,600-AF pool in Glade Reservoir from November 1 through April 30 and again September 1 through September 30 if water was available in September.
- **Cactus Hill Reservoir Size** – Cactus Hill Reservoir has been expanded from 180,000 AF as presented in the DEIS to 190,000 AF for Alternatives 3 and 4. The expansion of Cactus Hill Reservoir is in response to the new CTP hydrology modeling and its increased evaporation estimates for Cactus Hill Reservoir. The 190,000-AF size is estimated to provide the same yield as that estimated in the DEIS.

S.1.1 Major Issues Addressed by the SDEIS

The following sections summarize major issues addressed by the SDEIS. These issues are presented in greater detail in specific resource sections of Chapters 3 and 4 and in technical reports and memoranda prepared in support of the SDEIS.

S.1.1.1 Hydrology Modeling

New CTP hydrology modeling was prepared for the NISP and HSWSPs EISs (CDM Smith and DiNatale 2013). Previously, a Poudre River Basin MODSIM network was developed and used for hydrologic analyses associated with the NISP DEIS. Simultaneously in the mid-2000s, development of a different version of the Poudre Basin Network (PBN) model was underway for use in the NEPA process for the proposed HSWSPs. The CTP included the development of a modeling tool that 1) could be used for both EISs and 2) provided a common baseline for the analysis of hydrologic impacts associated with project implementation and reasonably foreseeable future actions (RFFAs). The final CTP version of the PBN represents a collaborative effort of the Project Applicants (District, Fort Collins, and Greeley), the Corps, and the third-party contractors with final determination and verification of model inputs and assumptions by the Corps and third-party contractors.

The following differences between the NISP DEIS model and the original HSWSPs PBN were addressed as part of the CTP effort:

- **Definition of "current" and "future" conditions** – The NISP DEIS modeling defined current conditions as 2005 and future conditions as 2020. For the CTP, the Current Conditions hydrology baseline was defined as river conditions in 2010. Future Conditions hydrology is based on demand projections and anticipated operational changes in 2050.
- **Study period for hydrology** – Based on public comments, the original 1950-1999 monthly model study period was extended through 2005 to include the drought of the early 2000s. The CTP process also provides a daily disaggregation of the monthly model results for 1980-2005.
- **Colorado-Big Thompson (C-BT) Project deliveries to Poudre River** – Allocations of C-BT water to Poudre Basin users were revised for current and future conditions using a C-BT Projection Tool developed by the District.
- **Agricultural Demands** – Modeled demands were adjusted to better reflect highs and lows in the historical streamflow record.
- **Representation of Fort Collins' South Side Ditch (SSD) Water Rights and Exchanges** – The participation of Fort Collins and integration of the Fort Collins System Model into the CTP process allowed for more detailed simulation of SSD operations than what was included in the NISP DEIS modeling.
- **Fish Hatchery and Recreational Flow Rates** – Water rights decrees and stipulations for the Watson Lake Fish Hatchery, Fort Collins Boat Chute, and the Fort Collins Environmental Learning Center were reviewed, and the CTP model was revised to better simulate minimum flow targets at these locations.
- **Winter Flow Augmentation** – As described previously, the District proposes to integrate a winter flow augmentation program with the operation of its Preferred Alternative to maintain a minimum of 10 cfs in about a 12-mile portion of Poudre River. The modeling for the District's Preferred Alternative includes the flow augmentation program.

Other model changes made as part of the CTP process include revisions to South Platte River flows above the Poudre River confluence to reflect 2010 and 2050 conditions and modifications to reservoir net evaporation factors, winter out-of-priority storage operations, and the naturalized flow time series. Each of these topics is addressed in greater detail in Appendix A of the NISP/HSWSPs Common Technical Platform Model Review Report (CDM 2011a).

S.1.1.2 Aquatic Resources

The evaluation of aquatic resources for the DEIS and SDEIS focuses on fish and benthic macroinvertebrates and their habitat in the Poudre River. An important step in the evaluation is modeling changes in habitat availability for fish with changes in flow that could result from the Project and its alternatives. The Physical Habitat Simulation (PHABSIM) model of the Instream Flow Incremental Methodology (IFIM) was used in both the DEIS and SDEIS to model changes in habitat. For the DEIS, existing PHABSIM information was used from several sources from data collected with a 1-D (one dimensional data collected at transects across the river) method. The 1-D data collection method was the accepted method in the 1980s and 1990s but is being replaced in some cases with 2-D methods (two-dimensional data collection that maps the entire stream bottom at a site). The 1-D PHABSIM data in the DEIS were not available for all sections of the river in the study area, did not model habitat for all species of interest, and was considered lower quality data than the 2-D PHABSIM information available for sites on the North Fork Poudre River for the HSWSPs EIS. Therefore, the Corps decided to model fish habitat availability for the SDEIS using data collected with the 2-D method necessitating the collection of supplemental data.

Six 2-D hydraulic and aquatic habitat sites were established in 2009, in coordination with the U.S. Geologic Survey (USGS), to represent habitat in the Poudre River downstream of the canyon mouth to the confluence with the South Platte River. These sites are representative of the six segments of the Poudre River where they are located because they have a range of channel forms and floodplain widths, diversity of aquatic habitat, and diversity of wetland and riparian communities that characterize their respective segments. Substantial information was collected at the six 2-D hydraulic modeling sites over lengths of the river from about 4,000 to 6,000 linear feet at each site from spring through fall 2009. Data collection included hydraulic parameters such as stream width, stream depth, and water velocity as well as parameters that are important to fish and other aquatic organisms including cover and substrate composition. This data collection and habitat modeling information is much more intensive and extensive than the information available for the DEIS and allowed a more in-depth evaluation of impacts in the SDEIS.

Although many studies using PHABSIM incorporate generic fish habitat use information in the habitat modeling, site-specific fish habitat use information was collected in 2009 as another component of PHABSIM modeling for the SDEIS. The habitat used by different fish species in the Poudre River was documented and the information was used to construct habitat suitability curves for the 2-D PHABSIM modeling for the SDEIS. Habitat suitability curves were constructed, in coordination with CPW, for several fish species native to the river in the study

area that use a variety of different habitats, such as small minnow species and larger sucker species. The suitability curves further tailor the habitat evaluation in the SDEIS to conditions that actually occur in the Poudre River.

The 2-D hydraulic information was also used to evaluate channel dynamics and sediment transport in the SDEIS in more detail. Changes to stream morphology and sediment transport can also have an important effect on aquatic biological resources. The new stream morphology information was also used in the evaluation of the project effects on fish and aquatic organisms.

S.1.1.3 Water Quality

The water quality assessment was revised in coordination with the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (WQCD) and EPA based on revised hydrology and additional surface water and ground water data collection and analysis. New information available for the SDEIS includes recent water quality data collected at numerous locations along the Poudre River, from discharges into the river, from ground water wells adjacent to the river, and from agricultural diversion ditches. Streamflows, temperature data, and other information were also collected for estimating impacts to the temperature of the Poudre River. Major water quality issues addressed in the SDEIS are listed in Table S-2.

Table S-2. Water quality issues addressed in the SDEIS.

Issues	Data Collection and Analysis Completed
Impacts to Poudre River and South Platte River stream temperature	Collection of additional stream temperature data for use in revised qualitative analysis and for use with future temperature modeling.
Impacts to Poudre River and South Platte River parameters of concern including those currently on the 303(d) list or that are approaching water quality standards	Collection of additional recent water quality data from all available sources and locations on the Poudre and South Platte Rivers in the study area. Evaluation of flow/concentration relationship and longitudinal changes in water quality to evaluate potential water quality effects for alternative diversions particularly at low flows.
Impacts to Poudre River and South Platte River dissolved oxygen	Collection of available dissolved oxygen data to assess potential impacts from changes in flow.
Potential impacts to Horsetooth Reservoir under Alternative 2 and for water treatment plant intakes at the reservoir	Acquisition of new water quality data for Horsetooth Reservoir from the City of Fort Collins and other sources of data to evaluate potential water quality effects of changes in reservoir operations using a two dimensional hydrodynamic water quality model.
Ground water contribution to Poudre River stream temperature and quality.	Collection of ground water quality data at multiple sites along the Poudre River.
Potential impacts to water quality in new reservoirs (Glade, Galeton, and Cactus Hill)	Mass balance modeling to predict new reservoir water quality based on reservoir operations, input sources, and site conditions. Collection of data from existing reservoirs of similar size and operations to provide a relative indication of new reservoir water quality.

S.1.1.4 Hazardous Materials

In response to comments on the DEIS, additional ground water monitoring was conducted in 2008 and 2009 at the Glade Reservoir site to gain additional temporal data for the trichloroethene plume relative to the 2003/2004 characterization sampling period and to determine if trichloroethene concentrations fluctuated seasonally. Information was also collected to allow

estimates in trends of trichloroethene concentrations and the size of the plume. A new technical memo addressing the trichloroethene plume was prepared.

The potential for changes in Poudre River flows to affect a site contaminated by coal tar next to the Poudre River in Fort Collins was assessed for the SDEIS.

Subsequent to the release of the DEIS, oil and natural gas wells have been drilled and are operating at the proposed Galeton Reservoir and Cactus Hill sites. The potential effects of the wells, drilling, and enhanced production (hydraulic fracturing) are assessed for the SDEIS.

S.1.1.5 Stream Morphology and Sediment Transport

The information used in the DEIS, supplemented by the collection of additional field data and pertinent literature and data sources, supported a more detailed investigation of the geomorphic and sediment transport characteristics of the Poudre River. In response to the DEIS comments, the SDEIS includes an assessment related to flushing flows, potential changes in riffle-pool sequences, deposition processes related to bed sediments, and the potential for threshold responses when assessing the long-term and cumulative impacts of proposed project alternatives. Furthermore, the work supporting the SDEIS was formulated to be consistent with the corresponding assessment for the HSWSPs EIS.

The assessment for the SDEIS describes the river in terms of: (a) the morphologic parameters related to the river corridor and the evolution of these parameters through time; and (b) the ability, or inability, of the river to move its sediment load through the corridor and the resulting geomorphic changes manifested by the potential for deposition or scour of material within the channel. The assessment includes:

- Evaluation of hydrologic conditions related to flood frequency and flow duration
- Analyses of channel hydraulic conditions through a range of flows
- Evaluation of trends related to geomorphic parameters and characterization of various reaches of the river
- Analyses related to stability of the channel bed
- Spells analyses related to duration, and frequency of selected flows pertaining to channel-forming discharges and riparian terraces
- Evaluation of cumulative stream power and sediment transport potential
- Analysis of the potential for aggradation or degradation

As part of the work completed for the SDEIS, a 2-D hydraulic model was formulated to support the evaluation of riffle-pool sequences and deposition processes related to bed sediments with respect to the geomorphic and sediment transport conditions within the river channel. The results of the 2-D hydraulic modeling also provided data in support of other resource specialists in the fields of aquatic habitat, water quality, and riparian vegetation.

S.1.1.6 Alluvial Ground Water – Surface Water Relationships

In 2009, ground water monitoring wells and stream crest gages were installed and monitored at each of the six 2-D hydraulic sites (Poudre River study sites) to determine ground water-surface water relationships to help respond to comments on the DEIS on the effect that changes in Poudre River flows would have on ground water levels along the Poudre River. Concern was also expressed that considerable regional ground water recharge may be occurring at the mountain front-valley transition zone, which could be adversely affected by diversions from the Poudre River by NISP. The monitoring of ground water levels, river stage, and ground water quality provided additional information to address ground water in greater detail in the SDEIS.

S.1.1.7 Riparian and Wetland Areas

Riparian and wetland areas associated with the mainstem of the Poudre River were assessed to determine the current distribution and quality of the resources and how changes in Poudre River flows might affect the resources. Additional studies for the SDEIS were undertaken to address comments on the DEIS. In 2009 and 2010, field studies were conducted to collect information on:

- Nonnative species
- Recruitment of woody riparian vegetation
- Size class distribution of riparian trees
- Wetland functional assessment
- Ground water – river stage/flow relationships

Additionally, wetland and riparian resources along the mainstem of the Poudre River were mapped using CPW riparian mapping and were reviewed for accuracy. Historical and recent aerial photography was reviewed to determine changes in the distribution of woody riparian vegetation at selected sites. The elevations of water bodies within the floodplain were determined relative to water surface elevations at a nearby location on the Poudre River to determine potential relationships between the river and riparian water bodies.

The effect of the transfer of irrigation water from agricultural lands in portions of Larimer and Weld Counties on wetlands in the No Action Alternative was assessed using a method developed for the SDEIS.

S.1.2 Organization of the SDEIS

The SDEIS provides new information that was not presented in the DEIS. Sections of the DEIS that did not change are referenced in the respective sections of the SDEIS. The Corps prepared this SDEIS because new information was gathered for several resources relevant to environmental concerns and bears on the Project or its impacts.

S.1.2.1 Contents of SDEIS

This SDEIS contains seven chapters. Chapter 1 describes the project purpose and need as defined by the Corps, USDI Bureau of Reclamation (Reclamation), and the District and provides a Project overview and background. Chapter 2 describes the District's Preferred Alternative and revisions since the DEIS to other alternatives considered as part of this SDEIS. Since issuance of the DEIS, the District developed a new No Action Alternative and the Corps developed a new action alternative, replacing Alternative 4 that was analyzed in detail in the DEIS. The Corps modified the screening criteria and reevaluated some previously eliminated alternatives. Additional alternatives suggested in comments on the DEIS were also considered and reviewed. Chapter 3 includes an updated description of the affected environment for sections that changed since the DEIS for water resources, water rights, geology, soils, vegetation, noxious weeds, wetlands and other waters, riparian resources, wildlife, fish and other aquatic life, species of concern, recreation, cultural resources, aesthetics and visual resources, traffic and transportation, land use, socioeconomic resources, hazardous sites, noise, air quality, and energy use. When the description of the affected environment has not changed since the DEIS, the appropriate DEIS section is referenced in the SDEIS section. Chapter 4 discloses new and revised potential environmental consequences (direct and indirect effects) of the District's Preferred Alternative and the other alternatives analyzed in detail in this SDEIS based on changes since the DEIS. Chapter 5 contains an analysis of the cumulative effects of the alternatives. Chapter 6 summarizes public participation and agency consultation and coordination. Chapter 7 is the reference list for the SDEIS. Appendix A Stream Flow and Stage Data in the DEIS has been replaced by information in corresponding technical reports and is so noted in the SDEIS. Appendix B Biological Assessment and Opinion and Appendix C Draft Programmatic Agreement remain unchanged from the DEIS and are referenced in the SDEIS. Appendix D presents the Corps' preliminary Section 404(b)(1) analysis for the alternatives and replaces Appendix D from the DEIS. Appendix E Poudre River Stream Morphology Reaches has been updated and is provided in the SDEIS. Appendix F, the District's Proposed Conceptual Mitigation Plan, is new for the SDEIS and replaces Chapter 5 of the DEIS.

S.1.2.2 Planned Activities After SDEIS Issuance

Before FEIS issuance, the Corps anticipates the District will complete the following activities:

- Coordinate with CPW to develop a mitigation plan that addresses impacts to fish and wildlife resources. The state fish and wildlife mitigation plan will be available for public review and comment and the Colorado Wildlife Commission will hold hearings on the mitigation plan.
- Describe planned road improvements, if needed to accommodate project-related traffic.
- Determine the method to return water to Glade Reservoir that was released from Glade Reservoir for streamflow augmentation.
- Refine all conveyance alignments.
- Develop a more comprehensive mitigation plan (see Section S.9, Mitigation).

Before FEIS issuance, or issuance of a Record of Decision as noted, the Corps anticipates completing the following activities:

- Update the description and potential effect of oil and gas well drilling activities at the Galeton Reservoir site.
- Update the effect of the NISP alternatives, including conveyance, on land use, growth, regional plans, and ownership.
- Complete an approved jurisdictional determination to determine the extent of jurisdictional waters of the U.S. within the study areas of the action alternatives.
- Finalize the effect analysis of the NISP action alternatives, including conveyance, on jurisdictional waters of the U.S.
- Prepare a Supplemental Biological Assessment that addresses changes to the District's Preferred Alternative that could have effects on federally listed threatened or endangered species and their designated critical habitat and reinitiate consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA. These actions will take place prior to issuance of the FEIS or a Record of Decision.
- Review the USFWS's Fish and Wildlife Coordination Act report, which will be prepared after the District has an approved state fish and wildlife mitigation plan.
- Incorporate appropriate mitigation measures from an approved state fish and wildlife mitigation plan in the FEIS.
- Complete Phase II water quality and stream temperature modeling in coordination with the WQCD and the EPA using WQCD protocols.
- Perform additional hydrological assessments at the proposed Galeton Reservoir site to determine if fluctuating reservoir levels at Galeton Reservoir have the potential to mobilize any future contaminant plumes from oil and gas development in the area.
- Update traffic volumes and impact assessment for roadways that could be affected by the NISP components.
- Assess carbon dioxide emissions associated with construction of all alternatives, following Council on Environmental Quality (CEQ) guidance, if finalized before the FEIS. The CEQ issued draft proposed guidance addressing GHG emissions in NEPA documents on December 24, 2014, with public comments due on February 23, 2015.
- Finalize a Programmatic Agreement regarding cultural resources management with the Colorado State Historical Preservation Officer (Appendix C of the DEIS).
- Respond to substantive comments on the SDEIS.

S.2 COOPERATING AGENCIES (EIS CHAPTER 1)

The Corps requested that six agencies and one local government with statutory authority or special expertise with an environmental issue participate in the EIS process as cooperating agencies (40 CFR 1501.6 and 1508.5): Reclamation, USFWS, U.S. Environmental Protection Agency (EPA), Colorado Department of Transportation (CDOT), Colorado Department of Natural Resources (CDNR), Colorado Department of Public Health and Environment (CDPHE) and Larimer County. Reclamation is a cooperating agency because the District would need a

Reclamation contract and special use permit to facilitate water delivery to the Participants for one option under its Preferred Alternative. Reclamation will initiate their ROD and contract negotiation process subsequent to issuance of the Corps' ROD and 404 permit if the Reclamation Action Option for the District's Preferred Alternative was permitted by the Corps. Reclamation will make a decision about issuance of a special use permit for the connection of the Glade to Horsetooth Pipeline in a ROD addressing contracting actions, or a separate decision if it was determined the pipeline would be needed.

The District's Preferred Alternative includes realignment of a segment of U.S. 287 at the proposed Glade Reservoir site. CDOT was responsible for selection of the preferred alignment of U.S. 287.

The EPA is a cooperating agency on issues for which the agency has special expertise. The USFWS is responsible for consultation with the Corps and the District under the Endangered Species Act (ESA) and the Fish and Wildlife Coordination Act. In the DEIS, Larimer County was a cooperating agency due to their statutory requirements to allow a decision to be rendered by the Larimer County Planning Commission for Location and Extent Review (CRS 30-28-110) for project components located in Larimer County. Subsequent to the DEIS, Larimer County initiated the process of adopting 1041 regulations for domestic water supply storage reservoirs. If the Corps permitted Alternative 2, the construction of Glade Reservoir may require a 1041 permit from Larimer County or alternatively, the County and the District may enter into an intergovernmental agreement that would specify the permitting process required by the County for Glade Reservoir and associated facilities located in Larimer County. Other authorizations by Larimer County could include approval of site plans and building permits.

After the Draft EIS was published, the CDNR became a cooperating agency to facilitate Federal and State coordination under the Fish and Wildlife Coordination Act and development of a State Fish and Wildlife Mitigation Plan pursuant to the requirements of Colorado Revised Statutes (CRS) 37-60-122.2. The CDPHE became a limited-scope cooperating agency due to their statutory authority under Section 401 of the Clean Water Act and their special expertise related to water quality issues, with their scope limited to addressing water quality assessment methodology and water quality impact analyses.

Additionally, implementation of any of the alternatives will require compliance with applicable state and local regulatory agency reviews, approvals, and permitting requirements.

S.3 PUBLIC AND AGENCY PARTICIPATION (EIS CHAPTER 1)

The NISP EIS process began on August 20, 2004 when the Corps published a Notice of Intent to prepare an EIS in the Federal Register. The following are key dates in the NISP EIS process:

Date	Action
August 20, 2004	Notice of Intent (69 Fed. Reg. 51640)
September 21, 2004	Agency scoping meeting
September 20, 21, and 22, 2004	Public scoping meetings
March 30, 2005	Additional public scoping meeting for proposed U.S. 287 realignment
January and February 2008	Preliminary DEIS reviewed by cooperating agencies
April 30, 2008	DEIS released for review and comment
June 16, 17, and 19, 2008	Public hearings on DEIS
September 13, 2008	End of public comment period for DEIS
February 17, 2009	Corps announces preparation of a SDEIS (74 Fed. Reg. 7406)
February 2009	Corps decides to develop a CTP for specific resources that could be affected by NISP and the HSWSPs

S.4 PURPOSE AND NEED (EIS CHAPTER 1)

S.4.1 Purpose and Need Statement

The Corps and District jointly developed the purpose and need statement as follows:

> *To provide the Project Participants with approximately 40,000 acre-feet of new reliable municipal water supply annually through a regional project coordinated by the District, which will meet a portion of the Participants' current and reasonably projected future additional water supply needs.*

The District reevaluated the NISP Participant demands in 2011. The Corps reviewed these 2011 demand projections in connection with the validity of the need and found that 40,000 AF of firm annual yield is still valid for NISP. The need for the project and the Corps' independent review of the 2011 demand projections are discussed in Section 1.2 of this SDEIS.

The Corps determined that "regional project" is an appropriate screening criterion for the alternatives screening process for NISP. The District is the permit applicant, not the 15 individual NISP Participants. As discussed in Section 1.1.2 of the DEIS, NISP would be constructed and owned by the District if the Corps issued a permit. While the District would retain ownership and operational responsibility of the project, the Participants would own a perpetual contract right to a defined portion of the project facilities and a defined portion of the water diverted by the project. The District is a regional water supply entity with responsibilities for water supply planning and management for the region and what it is proposing is a regional water supply project to meet the water supply needs of 15 Participants providing water to an area of about 945 square miles.

S.4.2 Basic Project Purpose

The Corps will evaluate the District's 404 permit application in accordance with EPA's Guidelines for Specification of Disposal Sites for Dredged or Fill Material ("404(b)(1) Guidelines"), 40 CFR 230. The basic project purpose is examined by the Corps to determine if

the project is water-dependent. A project is water dependent if it requires access or proximity to, or siting within, a special aquatic site in order to fulfill its basic purpose. The Corps determined that the basic project purpose for the NISP is to provide water. Because supplying water, whether for municipal, industrial or agricultural uses, does not fundamentally require access or proximity to, or siting within, a special aquatic site to meet this basic project purpose, the 404(b)(1) Guidelines stipulate that practicable alternatives (1) are presumed to exist and (2) that do not involve a discharge into a special aquatic site are presumed to be less environmentally damaging than the Preferred Alternative, unless clearly demonstrated otherwise. The District's Preferred Alternative is not "water dependent" for the purposes of the 404(b)(1) Guidelines and the rebuttable presumptions apply.

S.4.3 Overall Project Purpose

Determination of the overall project purpose is the Corps' responsibility. The Corps defines the overall project purpose in light of an applicant's stated objectives as well as the public's perspective (33 CFR 325 Appendix B, Section 9(b)(4)). The NISP overall project purpose is synonymous with the purpose and need statement for NISP. The Corps uses the overall project purpose to evaluate whether less environmentally damaging practicable alternatives are available and to help make a decision whether to issue or deny a Section 404 permit. The evaluation of alternatives under the 404(b)(1) Guidelines applies to all jurisdictional waters of the United States, not just special aquatic sites.

S.5 ALTERNATIVES ANALYSIS (EIS CHAPTER 2)

Regulations implementing NEPA require that an EIS "rigorously explore and objectively evaluate all reasonable alternatives," including the No Action Alternative (40 CFR 1502.14((a) and (d)). Reasonable alternatives, as defined by the CEQ, are "those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant." In contrast to reasonable alternatives under NEPA, the 404(b)(1) Guidelines define practicable alternatives as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purposes" (40 CFR 231.10(a)). These guidelines are the substantive environmental standards by which all Section 404 Permit applications are evaluated. By integrating the alternatives analysis for actions subject to NEPA and the 404(b)(1) Guidelines early in the process, the Corps ensured that the range of alternatives carried forward for detailed analysis in the EIS process met the Purpose and Need, and were practicable and reasonable.

S.5.1 Screening

S.5.1.1 Change in Screening Criteria and Re-evaluation of Some Alternatives

The alternative screening process for NISP was conducted in accordance with both NEPA and the 404(b)(1) Guidelines. The identification, verification, evaluation, and screening of all known alternatives were conducted by the Corps, with review and input from the cooperating agencies. Section 2.1.2, Alternative Screening, of the DEIS describes the screening process to develop alternatives for the DEIS. To ensure the alternatives analysis met the requirements of the 404(b)(1) Guidelines, the Corps reviewed the screening criteria used in the 2007 NISP EIS Alternatives Evaluation Report (HDR 2007a).

For the SDEIS, the Corps eliminated timeliness in the purpose and need screening category and reevaluated the alternatives for the land use criterion in the practicable screening category. The screening criteria described in Volume II of the NISP EIS Alternatives Evaluation Report (HDR 2007a) included land use considerations in the logistics criterion. For the SDEIS, the Corps reconsidered the rationale for the land use screening criterion and determined that all factors except local open space (e.g., city or local open space) remain valid. The Corps determined sites currently managed for local open space would be available for NISP purposes due to general limited ecological function in comparison to other nationally recognized natural areas and the applicant could condemn such land. The Corps determined local open space could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic project purpose (40 CFR 230.10(a)(2)). For the above reasons, the Corps no longer considers local open space an appropriate screening criterion for NISP.

In the NISP EIS Alternatives Evaluation Report Volume II (HDR 2007a), the Corps considered a concept of supplying water for NISP through the development of, or participation in, other projects that are proposed to bring water across the Continental Divide or other mountain ranges to the Front Range of Colorado. Projects evaluated included the Colorado River Return Project, the Yampa River Project, and the Green River Pipeline Project. These concepts were eliminated in whole or in part for the DEIS because of the timeliness criterion. The reevaluation of the Colorado, Yampa, and Green river projects without timeliness as a criterion for the SDEIS is discussed in more detail in the addendum to the NISP EIS Alternatives Evaluation Report (ERO 2014a).

The Corps determined the issues of reliability and logistics are still appropriate reasons for eliminating the Colorado River Return Project as a water supply concept from detailed analysis in the EIS.

In 2011, the BLM revised the Little Snake Resource Management Plan and identified three segments of the Yampa River totaling 22 miles as eligible and suitable for inclusion in the National Wild and Scenic Rivers System. The Corps eliminated the Yampa River Project from detailed analysis because it would affect the free-flowing characteristics of the eligible and suitable Yampa River segments, result in depletive effects to the expected higher quality functions of the Yampa River that support its listing in contrast to the effects on aquatic

resources in the Colorado Front Range, and other reasonable water supply alternatives were available to avoid such effects.

The Million Conservation Resource Group proposed the Regional Watershed Supply Project (RWSP) in 2009 that embodied the Green River Pipeline Project concept. The Corps notified interested parties in 2011 that it has withdrawn the Section 404 permit application for the proposed RWSP and terminated the process to develop a Draft Environmental Impact Statement. In September 2011, Wyco Power and Water, Inc. (Wyco) filed a preliminary permit application to study the RWSP with the Federal Energy Regulatory Commission (FERC). FERC dismissed Wyco's application in 2012 as premature. The Corps concluded that the Green River concept and the water it provides is integral to the plans of those entities participating in developing the concept. The Corps also determined that the concept offers no identifiable environmental advantages, including effects to waters of the U.S., over the concepts evaluated in detail based on the initial resource concerns identified during the scoping process associated with the RWSP. For these reasons, the concept is eliminated from detailed analysis.

S.5.1.2 Healthy Rivers Alternative

During the 2008 public comment period on the DEIS, the Save the Poudre Coalition submitted the "Healthy Rivers Alternative" to the Corps as an alternative to NISP. The NISP need of 40,000 acre-feet per year (AFY) of annual firm yield has not changed since the DEIS was issued. The Healthy Rivers Alternative report proposed a lower need of 35,000 AFY based on Save the Poudre's analysis of the NISP Participants' future water demands and proposed reduction of system losses, and the options proposed in the Healthy Rivers Alternative to meet this lower demand.

As defined by Save the Poudre, the Healthy Rivers Alternative would not meet the NISP need of 40,000 AFY. The Corps determined the water supply concepts and elements used in the development of the Healthy Rivers Alternative may constitute viable components of an alternative. The Corps evaluated these individual components using the NISP alternative screening criteria. The Healthy Rivers Alternative describes four agricultural water transfer concepts that could potentially provide additional water supply to the NISP Participants:

- Rotational fallowing
- Use of Colorado-Big Thompson Project (C-BT) units
- Traditional agricultural transfers where a water provider purchases agricultural water rights and transfers the water to municipal use, and the associated farmlands are permanently removed from irrigated agricultural production
- Development displaced water where agricultural water is transferred to municipal use in a similar manner as traditional agricultural transfers, but is limited to transfers from irrigated land being developed for municipal use

Rotational fallowing was a component of several agricultural to municipal water right transfers considered in the DEIS. Since the DEIS was issued, new information has become available about rotational fallowing. The State of Colorado has sponsored studies and pilot projects that

involve rotational fallowing and other transfer methods that do not result in permanent dry-up. The review of new information regarding the rotational fallowing concept found that the NISP firm yield criterion could be met if NISP were able to acquire ownership of the water rights, but would fail the firm yield criterion if ownership was left with the agricultural users because the perpetuity of the supply would last only as long as the initial lease. There are currently no large-scale rotational fallowing programs in Colorado, and the most significant pilot project, the Super Ditch in the Arkansas Basin, has not shown a proven ability to deliver a firm water supply. As a result, the rotational fallowing concept has not progressed to the point of being considered a proven technology. Therefore, the scenarios evaluated in the DEIS and for the SDEIS involving rotational fallowing would fail the NISP proven technology and firm yield screening criteria, if irrigators retained ownership of the water rights.

The NISP firm yield screening criteria include providing at least 12,000 AFY of firm yield of the full 40,000 AFY firm yield requirement for a component of an alternative to be considered potentially feasible. To meet the firm yield screening criteria of 12,000 AF, 20,000 to 24,000 C-BT units would be required, assuming a quota of 0.6 or 0.5, respectively. Given the strong competition for C-BT units from non-NISP entities, diminishing C-BT availability, and the municipal caps in place by the District, it is not likely that NISP Participants would be able to acquire 20,000 to 24,000 of the remaining 28,000 C-BT units available for transfer to municipal ownership. It is more likely that NISP Participants would be able to continue to acquire smaller amounts of C-BT to augment their overall supply portfolio. Therefore, acquisition of additional C-BT water failed the firm yield criterion.

Traditional agricultural transfers were previously evaluated as a partial supply for NISP as part of Alternative 4 in the DEIS. Additionally, the water source for the revised No Action Alternative is comprised primarily of agricultural transfers from three large ditch companies in the Poudre and Big Thompson Basins and includes pro-rata use of storage within the existing agricultural reservoirs. The traditional agricultural transfers concept as proposed in the Healthy Rivers Alternative does not differ fundamentally from the Corps' previous analyses.

A sub-category of agricultural water transfers is referred to as development displaced water. Development displaced water is agricultural water transferred to municipal use in a similar manner as traditional agricultural transfers, but is limited to transfers from irrigated land being developed for municipal use. Based on 2060 population projections, the NISP Participants were estimated to develop onto 25,000 irrigated acres. Using estimates of consumptive use and farm efficiency from the State's consumptive use model, 36,600 AFY of water is delivered to farm headgates on these 25,000 acres. Use of the farm headgate delivery by municipalities is possible provided return flow obligations are met (e.g., by wastewater effluent and releases from gravel pits or other storage). The transferable consumptive use is 25,600 AFY. NISP Participants would face several challenges in acquiring development displaced water due to several factors, including potential ownership of the water rights (or shares in ditch companies) by other municipalities (e.g., purchase and lease-back programs already in place by others), water quality concerns, and lack of adequate infrastructure to deliver water to the potable water system. Assuming these challenges could be overcome, development displaced water satisfies the firm yield criterion for a partial supply.

The nature of development displaced water is a local water supply. Water is derived from lands within the NISP Participant future planning areas and will likely be integrated into local water systems and used for meeting a portion of the Participants' future water needs, provided other legal and logistical challenges can be overcome. Acquisition of development displaced water by individual Participants does not constitute a regional project and therefore fails the regional project criterion. For the preceding reasons, the Corps eliminated the "Healthy Rivers Alternative" from detailed analysis.

S.5.1.3 A Better Future for the Poudre River Alternative

In 2012, after the end of the DEIS comment period, Western Resource Advocates submitted to the Corps an alternative to the NISP; it was called "A Better Future for the Poudre River". Western Resource Advocates developed the alternative to incorporate more current Colorado State Demography Office population projections, revised NISP Participant demands and supplies, data from the Colorado 2010 Statewide Water Supply Initiative, and other recent reports. The Better Future Alternative relied on water from growth onto agricultural lands, conservation, reuse, and cooperative agreements with agriculture. Based on Colorado State Demography Office population estimates, recent NISP Participant per capita water use, and applying passive conservation savings, the Western Resource Advocates calculated that water requirements for NISP Participants would total 72,100 AF in 2030 and 109,100 AF in 2060, 27,000 AF and 34,300 AF less than current NISP projections for 2030 and 2060, respectively. The Corps concluded the NISP need of supplying 40,000 AF of water is supported by the anticipated population growth in the Participant's service areas (see Chapter 1). The Corps also developed a Conservation Scenario as one of three demand projections (see Section 1.2.8 in Chapter 1). The Conservation Scenario assumes that the combination of passive and active conservation would reduce total water requirements for the Participants by 35,252 AF by 2060. Western Resource Advocates' suggested supplies of traditional agricultural transfers from urban growth onto previously irrigated lands and agricultural-urban cooperation were components to the previously discussed Healthy Rivers Alternative. Western Resource Advocates' suggested supply of 4,900 AF by 2030 from reuse was a minor component to the alternative's total supply. Existing reuse by the Participants was considered as a component of their existing supplies; any future reuse would contribute to meeting future 2060 water demands not met by NISP. For the preceding reasons and the reasons discussed in the previous section on the Healthy Rivers Alternative (Section S.5.1.2), the Corps eliminated the "A Better Future for the Poudre River" alternative from detailed analysis.

S.5.2 Alternatives Analyzed in Detail

Following alternative screening, the Corps then combined the retained concepts and elements to develop a reasonable range of alternatives. The key characteristics that differentiate the NISP alternatives from each other are presented in Table S-3. The alternatives developed for detailed analysis reflect the combined retained concepts and elements. The four alternatives analyzed in detail in this SDEIS are:

- No Action Alternative (Alternative 1) — Cactus Hill Reservoir (120,000 AF) and Agricultural Water Transfer
- Alternative 2 — Glade Reservoir (170,000 AF) and the South Platte Water Conservation Project (SPWCP) (District's Preferred Alternative)
- Alternative 3 — Cactus Hill Reservoir (190,000 AF), Poudre Valley Canal Diversion, and the SPWCP
- Alternative 4 — Cactus Hill Reservoir (190,000 AF), Multiple Diversion Locations, and the SPWCP

For the SDEIS, the No Action Alternative considers what the Participants would do to meet their need of 40,000 AFY of new firm yield if the Corps did not issue a Section 404 permit to the District for construction of NISP. In 2010, the Participants identified a new No Action Alternative (MWH 2010) for the SDEIS that assumes the Participants would collectively pursue a regional project, independent of the District, in the event of a permit denial for the proposed NISP. The No Action Alternative presented in the SDEIS would deliver water to the Participants by transferring agricultural water supplies from the Poudre River and Big Thompson River Basins, using a pro rata amount of existing storage in those systems, and constructing a new reservoir at the Cactus Hill Reservoir site. Key components of the No Action Alternative are:

- Transfer of water from 64,200 acres of irrigated land in the Larimer-Weld, New Cache, and Home Supply irrigation systems to municipal use
- Storage of water in the existing Big Windsor Reservoir, Lonetree Reservoir, and a new 120,000-AF Cactus Hill Reservoir
- Construction of two new regional water treatment plants
- Construction of 121 miles of water pipelines and nine pumping stations
- Realignment of three, two-lane Weld County roads totaling 10.3 miles
- Realignment of 6.8 miles of a 230-kV electric transmission line owned by Platte River Power Authority

The District's Preferred Alternative would deliver water to the Participants by using existing water rights, constructing a new reservoir at the Glade Reservoir site, and developing the SPWCP. Key components of the District's Preferred Alternative are:

- Diversion from the Poudre River at the Poudre Valley Canal for the District's Grey Mountain water right, SPWCP exchanges with the Larimer-Weld Canal and New Cache Canal, and reservoir exchanges with Terry Lake, Big Windsor Reservoir, and Timnath Reservoir
- Storage of water diverted from the Poudre River in a new 170,000 AF Glade Reservoir
- Augmenting flows in the Poudre River by releases from a designated 3,600-AF pool in Glade Reservoir with a target of maintaining a 10-cfs flow below the Larimer-Weld Canal headgate in November 1 through April 30 and September 1 through September 30
- Construction of the SPWCP, which includes a new South Platte River diversion and storage in a the new 45,624 AF Galeton Reservoir

- Construction of new pumping stations and water pipelines, the length of which would depend on whether Reclamation issued a contract and special use permit
- Realignment of 7 miles of U.S. 287 near Laporte, Colorado
- Realignment of four electrical transmission line structures totaling 0.6 mile of a 69-kV line owned by Poudre Valley REA

Table S-3. Major characteristics of alternatives.

Characteristic	Alternative 1	Alternative 2 Reclamation Action Option	Alternative 2 No Reclamation Action Option	Alternative 3	Alternative 4
Water Supply Source	Acquisition and transfer of irrigated agricultural water rights and minor new junior water rights on the Big Thompson and Poudre Rivers	Existing water rights on the Poudre and South Platte Rivers		Same as Alternative 2	Same as Alternative 2
Diversion Location	Historical diversion locations for the transferred agricultural water rights and exchanges to the Poudre Valley Canal when feasible	Diversions from the Poudre River at the Poudre Valley Canal SPWCP diversion on the South Platte River		Same as Alternative 2	Diversions from the Poudre River at the Poudre Valley Canal and New Cache Canal headgate SPWCP diversion on the South Platte River
New Reservoirs	Cactus Hill at 120,000 AF	Glade at 170,000 AF Galeton at 45,624 AF		Cactus Hill at 190,000 AF Galeton at 45,624 AF	Same as Alternative 3
Road Relocation	Weld County Roads (WCRs) 15, 19, and 90 affected by Cactus Hill Reservoir; WCR 15 would be realigned about 1 mile east	7-mile portion of U.S. 287		WCR 15, 19 and 90 affected by Cactus Hill Reservoir; WCR 15 would be realigned about 1 mile east	Same as Alternative 3
Winter Flow Augmentation	None, not feasible with Cactus Hill Reservoir	A pool of 3,600 AF would be designated from the existing storage in Glade Reservoir for release to the Poudre River at a rate up to 10 cfs from November 1 through April 30, and from September 1-September 30		None, not feasible with Cactus Hill Reservoir	None, not feasible with Cactus Hill Reservoir

[†]Flows in the 1.48-mile river reach between the Poudre Valley Canal and the Hansen Supply Canal would be greater (average of 8,200 AFY) than the No Reclamation Action Option and due to exchanges with C-BT, there would be an average reduction of 7,700 AFY in releases to the Poudre River at the Hansen Supply Canal.

Alternative 3 is similar to the District's Preferred Alternative except that water diverted from the Poudre River would be stored in the proposed Cactus Hill Reservoir instead of the proposed Glade Reservoir. Key components of Alternative 3 are:

- Diversion from the Poudre River at the Poudre Valley Canal for the District's Grey Mountain water right, SPWCP exchanges with the Larimer-Weld Canal and New Cache Canal, and reservoir exchanges with Terry Lake, Big Windsor Reservoir, and Timnath Reservoir
- Storage of water in a new 190,000 AF Cactus Hill Reservoir
- Construction of the SPWCP
- Construction of new pumping stations and water pipelines
- Realignment of three, two-lane Weld County roads totaling 10.3 miles
- Realignment of 6.8 miles of a 230–kV Platte River Power Authority transmission line

Alternative 4 is a new alternative developed for the SDEIS in response to comments on the DEIS requesting that alternatives be considered that would divert water from the Poudre River farther downstream than the Poudre Valley Canal, with storage of the water in a plains reservoir. Relative to the other action alternatives, Alternative 4 would allow more water to remain in the Poudre River between the Poudre Valley Canal and the New Cache Canal before it was diverted for exchanges. As modeled for SDEIS analyses, direct flow exchange water from Larimer-Weld Canal would be diverted or reexchanged at or near the Poudre Valley Canal as it would be in Alternatives 2 and 3. New Cache Canal direct flow exchange water would continue to flow downstream in the Poudre River channel about 23 miles to its current diversion location at the New Cache Canal headgate east of Fort Collins and I-25. This water would then be taken through a turnout from the New Cache Canal and routed by pump station and pipeline to storage in Cactus Hill Reservoir. The use of the New Cache Canal would be similar to the No Action Alternative (Alternative 1). Key components of Alternative 4 are:

- Diversion from the Poudre River at the Poudre Valley Canal for the District's Grey Mountain water right supply, SPWCP exchanges with the Larimer-Weld Canal, and reservoir exchanges with Terry Lake, Big Windsor Reservoir, and Timnath Reservoir.
- Diversion from the Poudre River at the New Cache Canal for the New Cache exchange water from the SPWCP
- Storage of water diverted from the Poudre River in a new 190,000 AF Cactus Hill Reservoir
- Construction of the SPWCP infrastructure which includes the new 45,624 AF Galeton Reservoir
- Construction of new pumping stations and water pipelines
- Realignment of three, two-lane Weld County roads totaling 10.3 miles
- Realignment of 6.8 miles of a 230-kV Platte River Power Authority transmission line

S.6 AFFECTED ENVIRONMENT (CHAPTER 3)

The affected environment associated with the action and No Action Alternatives consists of flow-based resources potentially affected by diversions or storage of water and land-based resources adjacent to proposed or realigned infrastructure, such as new reservoirs, new pipelines and realigned roads or transmission lines. Flow-based resources are rivers from which water would be diverted, such as the Poudre River and the South Platte River, canals that would be used in the operation of one or more of the alternatives, such as Larimer-Weld Canal, New Cache Canal and Home Supply Ditch, and reservoirs that would be used in the operation of one or more of the alternatives, such as Carter Lake and Horsetooth, Flatiron, Terry Lake, Big Windsor, and Timnath Reservoirs. Flow-based resources also include the aquatic life, wetlands and riparian resources associated with these surface water resources, the morphology and sediment transport of the Poudre River and the South Platte River, and alluvial ground water adjacent to surface water resources and proposed reservoir sites.

The primary water supply source for the No Action Alternative would consist of 45,200 AFY of permanently transferred historical consumptive use associated with agricultural water rights within the Poudre River and Big Thompson River Basins (estimated to equal 64,200 acres of fallowed agricultural land). Historical return flows associated with these agricultural water rights would remain at the headgates for maintenance of ditch losses and return flows. It is assumed that historical diversion locations and amounts would be maintained for water right transfers within the Big Thompson Basin and thus no streamflow impacts are predicted as a direct result of these transfers.

In response to comments on the DEIS requesting additional information about Poudre River resources, the mainstem was divided into six representative segments (Table S-4, Figure S-1) to collect baseline data on aquatic resources, ground water, water quality, stream morphology, and wetland and riparian vegetation. Segment selection was determined based on discussions between the Corps, USGS, and NISP third-party contractors. Within each segment, study sites considered representative of the aquatic biological resources, riparian vegetation, wetlands, and river geomorphology were selected for intensive data collection, and these are referred to as the Poudre River study sites throughout this document. Although the 2013 flood on the mainstem may have altered some of the aquatic and vegetation communities and land forms within the representative segments, the Poudre River study sites remain a representative sample of the conditions along the river developed in response to cycles of flooding and other forces that alter the river and the riparian environment.

Figure S-1. NISP Alternatives Study Area.

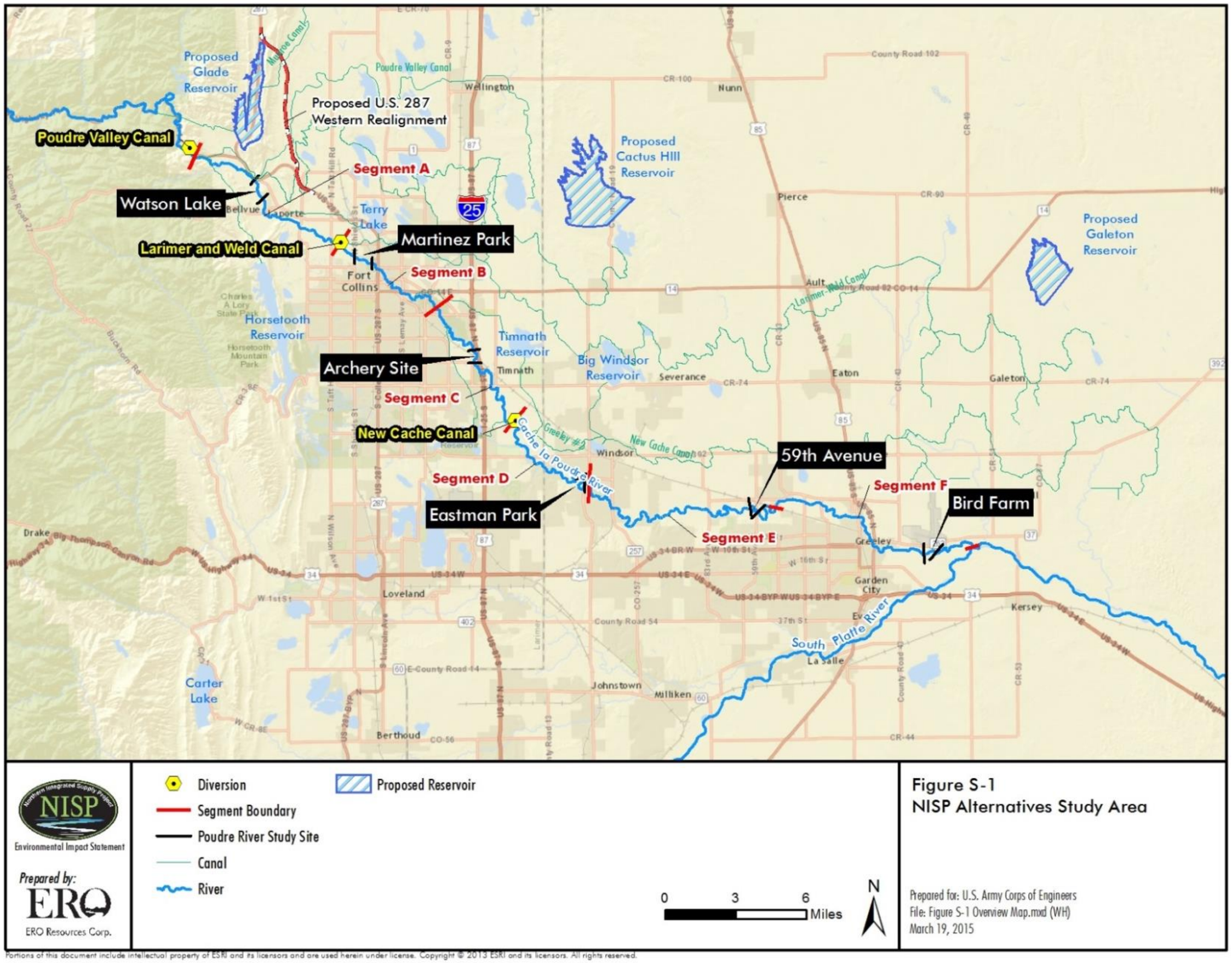


Table S-4. Poudre River study segments.

Segment	Reach	Representative Poudre River Study Site
A	From the mouth of Poudre Canyon to the Larimer-Weld Canal	Watson Lake
B	Larimer-Weld Canal to Spring Creek in Fort Collins	Martinez Park
C	Spring Creek to the New Cache Canal Diversion; this segment continues through Fort Collins and crosses under I-25	Archery Site
D	New Cache Canal to County Road 17, near of the Town of Windsor; this segment runs through the Town of Timnath	Eastman Park
E	County Road 17 to the 59th Ave. Railroad Bridge upstream of Greeley; this segment contains the Town of Windsor	59th Avenue
F	The 59th Avenue Railroad Bridge upstream of Greeley to the South Platte River; this segment is adjacent to and downstream of the City of Greeley	Bird Farm

S.6.1 Surface Water Hydrology, Surface Water Quality and Stream Morphology

S.6.1.1 Poudre River

The Poudre River study area for the flow-related resources is from the canyon mouth (approximate downstream limit of the Poudre Canyon where the river transitions from the confinement of the canyon to an unconfined alluvial channel) to the confluence with the South Platte River (Figure S-1). The study area largely coincides with the Cache la Poudre River National Heritage Area and is downstream of the Wild and Scenic River designated reaches. National Heritage Areas are designated by Congress as places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape.

In the upper Poudre River watershed, the majority of the river flow is from snowmelt, with additional input from overland storm runoff during summer and some ground water inflow. Average annual peak flows (related to seasonal snow melt and not rain events) are highest at the canyon mouth (2,552 cfs at Canyon Gage), lowest at the Boxelder Gage (1,571 cfs) downstream of Fort Collins, and then increase slightly in the lower reaches of the river (1,856 cfs at Greeley Gage) primarily due to return flows and ground water discharge. Natural flows are augmented by nine transbasin diversions that deliver water into the upper Poudre River.

The Poudre River has 21 major diversions at multiple locations primarily for municipal water supply and agricultural use. These diversions occasionally result in dry-up points along the river that occur during winter and summer. At least 12 dry-up points were identified between the Greeley Filters Pipeline intake and the Ogilvy Ditch headgate based on discussions with Water Commissioners and reviews of historical data, although several are reported to occur only in the driest of years, such as 2002. The river is recharged downstream of the dry-up points by surface water discharges and/or by ground water inflows. Water is returned to the river through a variety of point and nonpoint discharges.

Historically, pollution has been present in the Poudre River for at least 50 years. Primary sources of anthropogenic input to the Poudre River that affect water quality are wastewater treatment plant discharges, stormwater drains and runoff from urban areas, and return flow from irrigated agriculture. Tributary inflows to the Poudre River downstream of the canyon are minimal except during storm events. Seven permitted wastewater treatment plants currently discharge to the Poudre River in the study area. Poudre River water quality was generally the poorest between Boxelder Creek and Greeley.

Temperature in the Poudre River generally increases from upstream to downstream as cooler mountain waters and snowmelt reach the plains and is warmed by greater solar radiation. Temperatures are also affected by changes in flow rates from diversions, and contributions from waste water treatment plants (WWTP) outfalls, tributaries, and ground water return flows. During higher flows, total metals, total organic carbon, and turbidity concentrations tend to be higher than during lower flows. During lower flows, total dissolved solids, sulfate, chlorophyll *a*, nutrient concentrations, and river temperature tend to be higher than during higher flows. Elevated total metal concentrations were generally associated with elevated turbidity, but at some downstream locations were also due to elevated dissolved metal concentrations as a result of ground water discharge to the river from local bedrock formations. Some of the natural contaminants to the river, such as selenium, are exacerbated by human activities, such as runoff from agricultural fields.

Reductions in streamflow have been greatest in the vicinity of Fort Collins; changes in the Poudre River channel associated with reductions in streamflow have been greater downstream of I-25. River morphology from the canyon mouth to around I-25 is flood-dominated. At most cross sections upstream of I-25, bankfull discharge rarely occurs. River morphology downstream of I-25 tends to be deposition-dominated. Channel size and capacity are reduced in the downstream direction except for the Greeley Channelized Reach, which has an artificially high hydraulic depth and high bankfull discharge. Downstream of I-25, the river channel has contracted to as little as 15 feet wide at some riffles. It takes substantially less flow to flood the lower reaches of the Poudre River (except for the Greeley Channelized Reach) as was observed during recent high flows in 2011, 2013, and 2014.

The Poudre River upstream of I-25 appears to be sediment supply-limited and downstream of I-25 appears to be sediment transport-limited. A transport-limited system is more sensitive to changes in hydrology because its behavior is controlled by the hydraulics of the system rather than by sediment supply. This has led to channel narrowing downstream of I-25, and in some sections the riffle-pool complexes of the river are changing with the filling of pools with sediment.

Coarser cobble and gravel river substrate is more common upstream of I-25 and a substrate of silt and sand is more common downstream of I-25. Sands and gravels that have moved through the upstream reaches are in greater supply relative to the more limited transport capacity of the river. No continuous armor layer is present downstream of I-25.

S.6.1.2 South Platte River

The lower South Platte River study area extends from the South Platte River-Poudre River confluence downstream to the Kersey Gage. Peak runoff occurs primarily in May through early July. Total annual flow volumes vary considerably from year-to-year due to variability in snowpack, and precipitation events. Streamflow in the lower South Platte Basin during the spring and early summer is reliant on snowmelt runoff from headwaters watersheds, and during the remainder of the year is reliant on return flows from upstream use of native water and C-BT water. Occasional heavy precipitation events in the watershed results in associated peak flows from spring through early fall.

The South Platte River serves as the principal source of water for eastern Colorado and is diverted extensively for agricultural use. In general, water quality is poor at the Kersey Gage as a result of upstream discharges and diversions.

Within the South Platte River Basin primary sources of anthropogenic water pollutants are urban stormwater, wastewater treatment plan discharges, and runoff or subsurface flows from agricultural fields. Agricultural runoff to the Poudre and South Platte Rivers is a combination of nonpoint source discharges from fields and discharges from ditches and pipelines. Another source of pollution is water that percolates into ground water from farm fields and then flows into the streams. Agriculture contributes nutrients, suspended sediments, pesticides, and other pollutants to South Platte River Basin streams. Marine shale deposits along the Front Range are a natural source of salts to the South Platte River (e.g., sulfate, sodium, calcium, and selenium).

Stream morphology of the South Platte River is described in Section 3.4.1 of the DEIS. More detailed information can be found in the South Platte River Stream Morphology Report (ERO 2008a).

S.6.2 Aquatic Resources

Coldwater fishes (species that require cold temperatures throughout the year) still present in the Poudre River study area are the nonnative brown trout, rainbow trout, and mountain whitefish. The native greenback cutthroat trout is also a coldwater fish but no longer is present in the study area. The remaining species in the study area have varying preferences for water temperatures but are considered warmwater species based on their tolerance for seasonally warmer water temperatures in the summer. A few native species, such as longnose dace, longnose sucker, and white sucker, are considered warmwater species but have wide temperature tolerances and are commonly found with trout in coldwater sections of streams and rivers as well as in warmwater sections.

The loss of several native species over the last century indicates that some environmental thresholds have already been crossed. The native greenback cutthroat trout, a federal and state threatened species, has long ago been replaced by nonnative brown and rainbow trout in the coldwater sections of the Poudre River. Hornyhead chub, quillback, and northern redbelly dace have not been collected from the Poudre River since 1914. This could be a result of early flow manipulation, channelization, changes in water quality, or some combination of these factors.

Native fishes and nonnative game fishes in the mainstem are affected by channelization and fragmentation. These channel modifications may be partially responsible for the extirpation of some native species from the system.

Nonnative fish are much less prevalent in the South Platte River than they are in the lower sections of the Poudre River. The relatively small number of nonnative species may be partially attributable to the fluctuating flow conditions on the South Platte River, which may discourage species that are not adapted to this flow regime. In 2002, native sand shiners, fathead minnows, and bigmouth shiners were most common. In 2004, these three species were still abundant, but nonnative mosquitofish were also present in large numbers.

S.6.3 Soils

Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable climate and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Many of the soils irrigated for agriculture in the NISP study areas are Prime Farmland soils.

S.6.4 Wetlands, Riparian Resources, and Other Waters

Wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (33 CFR 328.3(b)). Other waters include surface water features such as streams, ditches, and ponds. Wetlands and other waters that meet the definition of "waters of the United States", currently the subject of proposed federal rulemaking, are under the jurisdiction of the Corps under Section 404 of the Clean Water Act (CWA). Riparian areas are a transitional habitat between terrestrial and aquatic ecosystems found immediately adjacent to rivers, streams, and sometimes lakes. Riparian areas differ from wetlands in that they are generally linear, more terrestrial, are often dependent on a natural disturbance regime, and do not include the instream environment.

Types of wetlands that occur in the study areas include: palustrine persistent emergent (PEM) wetlands dominated by grasses, sedges, and rushes; and palustrine scrub-shrub wetlands (PSS) dominated by willows and other shrubs. Some wetlands contain more than one type of wetland; in those cases, the dominant wetland type was used. Some wetlands may include scattered deciduous trees such as cottonwood and willow.

Wetland functional assessments were based on hydrogeomorphic (HGM) classes using the FACWet Method. HGM classes are riverine (associated with a stream channel, floodplain, or terrace), lacustrine fringe (topographic depression with permanent water greater than 2 meters deep), depressional (topographic depression without permanent water greater than 2 meters deep), and slope (located on a topographic slope with ground water as primary water source).

Using the FACWet method, a composite functional capacity index score ranging from 1.0 (reference standard) to below 0.60 (nonfunctioning) are derived for each wetland or group of wetlands.

S.6.4.1 Proposed Reservoir Sites

S.6.4.1.1 Glade Reservoir

Within the Glade Reservoir study area, including the U.S. 287 realignment study area, all of the wetlands were classified as PEM or PSS. Hydrogeomorphic types include depressional and riverine wetlands. The FACWet composite functional capacity index score ranged from 0.69 (functioning impaired) to 0.93 (reference standard). The composite functional capacity index scores of wetlands in the U.S. 287 realignment study area ranged from 0.76 (functioning) to 0.94 (reference standard). Of the 22 wetlands in the Glade Reservoir site and the U.S. 287 realignment study area, five wetlands had composite functional capacity index scores ranked as the reference standard with scores of 0.93 or 0.94. Six wetlands ranked as highly functioning with four wetlands with a score of 0.80, one with a score of 0.85, and one with a score of 0.89. Ten wetlands ranked as functioning with four wetlands with a score of 0.71 and six wetlands with a score of 0.79. One wetland ranked as functioning impaired with a score of 0.69. Mesic mixed shrublands and mesic native shrublands occur along creeks in the study area. The mesic mixed woodlands are dominated by cottonwoods and other trees and shrubs

S.6.4.1.2 Galeton Reservoir

Nine wetlands in the Galeton Reservoir study area were classified as PEM. HGM types included depressional and riverine wetlands. The wetlands all had a FACWet composite functional capacity index score of 0.82 (functioning).

S.6.4.1.3 Cactus Hill Reservoir

Within the Cactus Hill Reservoir study area, three wetlands classified as PEM occur. The only HGM type observed was depressional. FACWet composite functional capacity index scores were 0.67 and 0.69 (functioning impaired) and 0.70 (functioning) for the three wetlands.

S.6.4.2 Poudre River

The Poudre River corridor from the mouth of the canyon to the confluence with the South Platte River has diverse wetland, riparian, and upland communities interspersed throughout the floodplain. Cottonwood woodlands occur as narrow bands along the banks or as large stands with a grassy understory. Upstream of Fort Collins, narrowleaf cottonwoods are the dominant species of the woodlands and plains cottonwood are dominant through Fort Collins to the confluence with the South Platte River. Peachleaf willow, crack willow, box elder, and green ash are commonly found in the cottonwood woodlands. Sandbar willow, the most common riparian shrubland, most often occurs on sandbars along the banks. Reed canarygrass forms dense stands along the banks, often forming an understory in the sandbar willow stands. Typically, reed canarygrass and sandbar willow are wetlands with a fairly wide range of ground water depths that provide supportive wetland hydrology. Wetlands dominated by sedges and

mesic grasses occur along the river's edge, along the banks of tributaries and ditches, and throughout the floodplain in areas with shallow ground water. Upland grasslands interspersed between the stands of cottonwood are often dominated by smooth brome.

Within the Poudre River study sites, wetlands were classified as PEM and PSS. HGM types included depressional wetlands throughout the floodplain and riverine wetlands along the banks. FACWet composite functional capacity index scores for depressional wetlands ranked as functioning, but scores were lower at the four upstream Poudre River study sites (0.72 for 3.4 acres of wetlands at Watson Lake, 0.70 for 5.0 acres of wetlands at Martinez Park, 0.72 for 3.9 acres of wetlands at Archery Site, and 0.73 for 0.2 acres of wetlands at Eastman Park) and higher for the downstream sites (0.76 for 2.5 acres of wetlands at 59th Avenue and 0.77 for 8.5 acres of wetlands at Bird Farm). Riverine wetlands at Watson Lake (3.3 acres), Eastman Park (4.1 acres), and 59th Avenue (1.9 acres) had a composite functional capacity index score of 0.70. Martinez Park riverine wetlands (3.7 acres) had a score of 0.71 and Bird Farm riverine wetlands (4.3 acres) had a score of 0.73. The 2.8 acres of wetlands at Archery Site were functioning impaired with a score of 0.69. Sites that scored lower were typically within municipal areas or had more disturbances to the wetlands and surrounding area.

Past disturbances such as gravel mining, channelization, levee construction, development, and changes in hydrology have impacted the extent of the riparian corridor. The combination of flood flows that are no longer effective in establishing new stands of plains cottonwood, extensive stands of smooth brome and reed canarygrass that compete with cottonwood seedlings and nonnative woody vegetation that is establishing at rates equal to or greater than plains cottonwood, establish a trajectory for a future Poudre River riparian corridor that will likely be very different from the past and current riparian corridor. As the stands of plains cottonwoods mature and die, they will not likely be readily replaced at current densities and distribution, and the woody vegetation that replaces the plains cottonwoods will likely be a mix of cottonwoods and nonnative woody vegetation (e.g., green ash).

S.6.4.3 South Platte River

Herbaceous wetlands dominated by cattails, sedges, rushes, and grasses occur throughout the South Platte River floodplain below the confluence with the Poudre River to the Kersey Gage. On the south side of the South Platte River, some herbaceous wetlands are associated with an abandoned side channel that has areas of open water. Smaller areas of herbaceous wetlands border the north banks of the South Platte River or are associated with a tributary. Bare sand bars likely become colonized by sandbar willow periodically. Functional assessments were not conducted for South Platte River wetlands.

The riparian associations are similar to those on the Poudre River with plains cottonwood associations dominating the floodplain. Upland grasslands are interspersed between the stands of cottonwood. Other species likely associated with the cottonwood include peachleaf willow, crack willow, and green ash with a high cover of smooth brome in the understory.

S.6.5 Wildlife

Mule deer winter range is found in many of the study areas; severe winter range is found in a narrow band along the Front Range. Mule deer winter concentration areas occur in the westernmost study areas, such as the Glade and Cactus Hill Reservoir sites. White-tailed deer winter range is found between Fort Collins and the Glade Reservoir site, surrounding the Cactus Hill Reservoir site, and along the Poudre River. Pronghorn severe winter range is located at the Glade and Galeton Reservoir sites, with winter range found at the Cactus Hill and Galeton Reservoir sites. Elk winter range is found in the foothills in the western portion of the Glade Reservoir site. Elk severe winter range and elk winter concentration areas occur in the northwestern portion of the Glade Reservoir site and coincide with a portion of the western arm of proposed Glade Reservoir.

S.6.6 Hazardous Materials

The proposed Glade forebay would be located near the Atlas "E" Missile Site 13. A trichloroethene release occurred from operations at the facility. The Corps, Omaha District, Environmental Remediation Branch investigated the contaminated ground water plume from 1999 to 2004 to define the vertical and horizontal extent of the plume. In response to comments on the DEIS, additional monitoring was performed for the SDEIS. By the end of 2009, only one well had trichloroethene concentrations above the Colorado ground water standard. The plume is smaller than it was when originally investigated in 1999 and no detectable trichloroethene currently is within the footprint of the proposed forebay. As the contaminant mass continues to naturally attenuate, the plume will continue to decrease in size.

S.7 DIRECT AND INDIRECT EFFECTS (EIS CHAPTER 4)

Many of the effects associated with the alternatives are predicted to be similar. Differences in facilities, source water supply, diversion amounts, diversion locations and other characteristics would result in some differences in predicted effects that can be used to differentiate the alternatives as discussed below. This summary focuses on the effects that can be used to differentiate the alternatives; therefore not all sections of the SDEIS are summarized. All of the direct and indirect effects for the alternatives are summarized at the end of Chapter 4. Some flow-related resources are on a trajectory that is predicted to continue with or without implementation of any of the NISP alternatives. The NISP alternatives may accelerate or reinforce the trajectory in a similar manner or to a similar degree. For flow-based resources, the No Action Alternative was not evaluated by comparison to 2010 current conditions hydrology. Based on uncertainty regarding the Participants' response and timing of actions if the NISP permit is denied and uncertainty of the availability of future water supplies, the Corps determined that the No Action Alternative would be evaluated based on a comparison to 2050 Future Conditions hydrology, as described in Sections 1.8 and 4.1.2. With Future Conditions as a baseline, the maximum anticipated effect is disclosed, which will inform the decision-maker and the public of what may happen if the Corps denied the permit. In the following discussion,

Alternative 2 refers to both the Reclamation Action Option and No Reclamation Action Option unless otherwise noted.

The CTP hydrologic modeling was used to predict the flow changes associated with the NISP alternatives on the flow-related resources. The following terms are used to describe the hydrologic model runs when discussing predicted effects for the flow-related resources:

- Current Conditions (2010 flows = Run 1)
- Current Conditions Effects (2010 flows with NISP alternatives = Run Series 3)
- Future Conditions Effects (2050 flows with RFFAs + NISP alternatives = Run Series 4)
- Cumulative Effects (2050 flows with RFFAs + HSWSPs Proposed Actions + NISP alternatives = Run Series 5)
- Alternative 1 Effects (2050 flows with RFFAs + No Action Alternative = Run 9a)

S.7.1 Surface Water

Most of the flow-reducing changes associated with each of the proposed NISP action alternatives would be concentrated in the reach from the Poudre Valley Canal headgate to the New Cache Canal headgate, a distance of about 23 miles, including the segment of the Poudre River traversing Fort Collins. In this reach, modeled changes in streamflow are attributable to use of the Grey Mountain right in combination with one or more of the SPWCP direct flow and reservoir exchanges. Downstream of New Cache Canal on the Poudre River, modeled changes in streamflow are limited to diversions under the Grey Mountain right, which are predicted to have very little effect on daily median flows outside of April through June due to the junior (1980) priority of the water right.

In all alternatives, most diversion from the Poudre River would occur in May and June (Figure S-2 and Figure S-3). In the Reclamation Action Option of Alternative 2, 82% of average annual Poudre River diversions would occur during the months of May and June; 74% of the average annual Poudre River diversions would occur during the same 2 months under the No Reclamation Action Option of Alternative 2. The percentage of average annual diversions during May and June would be 72% under Alternatives 3 and 4.

Figure S-2. Effects on Current Conditions Median Daily Flow at Canyon Gage, IY 1980-2005.

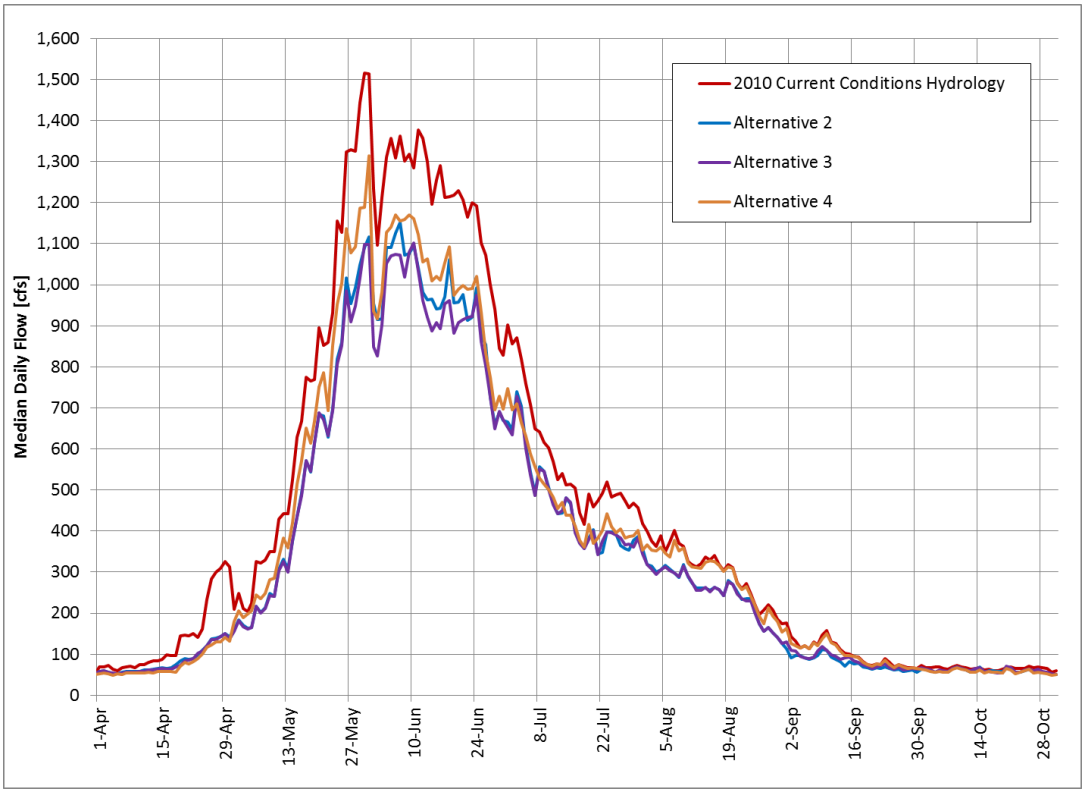
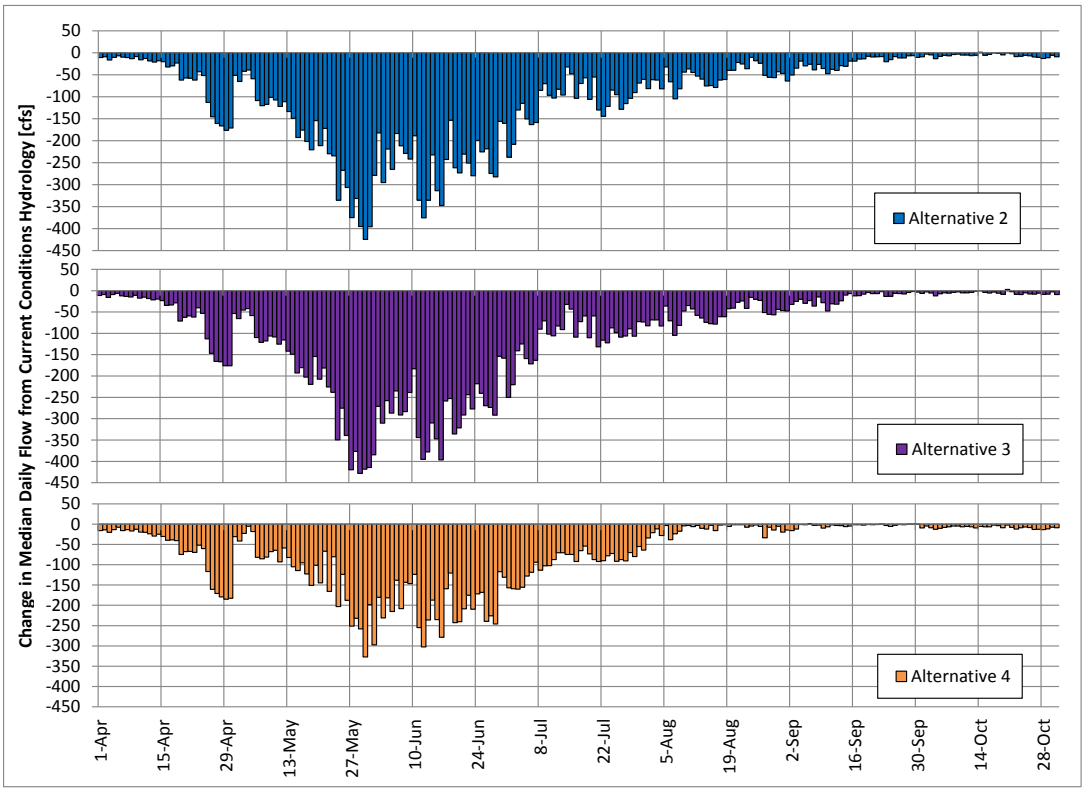


Figure S-3. Change in Median Daily Flow from Current Conditions at Canyon Gage, IY 1980-2005.



Alternative 2 Reclamation Action Option would require total average annual diversions of 63,500 AFY, 35,100 AFY of which would be from the Poudre River and the rest from the South Platte River. The No Reclamation Action Option would require physical diversions of 8,200 AFY more from the Poudre River than the Reclamation Action Option (Table S-5), but due to proposed operational changes to C-BT Project facilities associated with the Reclamation Action Option, net streamflow changes below the Hansen Supply Canal for the Reclamation Action Option would be nearly identical to the No Reclamation Action Option. This issue is discussed in more detail in Section 4.2.3.4.1 of Chapter 4. Compared to Glade Reservoir in Alternative 2, Cactus Hill Reservoir in Alternatives 3 and 4 would be larger, wider and shallower. In addition, the plains location of Cactus Hill Reservoir would require delivery of water through nearly 30 miles of the Poudre Valley Canal. Compared to Alternative 2, the resulting combination of increased evaporation and transit losses would require more water to be diverted to Cactus Hill Reservoir from the Poudre River in order to meet the Participants' water supply needs. Total average annual diversions would be 79,200 AFY in Alternative 3 (49,200 AFY from the Poudre River) and 80,800 AFY (48,800 AFY from the Poudre River) in Alternative 4 (Table S-5). The increased diversions would result in larger changes in modeled streamflows at the evaluated locations on the Poudre River and South Platte River.

Table S-5. Average annual diversion amounts under Current Conditions Effects by alternative.

River Location Canal	Alternative 1 (AFY)	Alternative 2		Alternative 3 (AFY)	Alternative 4 (AFY)
		Reclamation Action Option (AFY)	No Reclamation Action Option (AFY)		
Poudre River (see footnote)		**35,100**[†]	**43,300**	**49,200**	**48,800**
Location					
Poudre Valley Canal		35,100[†]	43,300	49,200	37,800
Larimer-Weld Canal	**Not evaluated**	0	0	0	0
New Cache Canal		0	0	0	11,000
South Platte River		**28,400**	**28,400**	**30,000**	**32,000**
Big Thompson River		**0**	**0**	**0**	**0**

[†]Flows in the 1.48-mile river reach between the Poudre Valley Canal and the Hansen Supply Canal would be greater (average of 8,200 AFY) than the No Reclamation Action Option due to exchanges with C-BT and the associated bypass of divertible flows by NISP. The combination of bypassed diversions, releases from Glade Reservoir, and reduced releases from the Hansen Supply Canal would be such that the streamflow effects of the Reclamation Action Option below the Hansen Supply Canal would be nearly identical to the No Reclamation Action Option, i.e., the net effect of both Alternative 2 options downstream of the Hansen Supply Canal would be a streamflow reduction of 43,300 AFY.

Alternative 4 would divert SPWCP exchange water from the New Cache Canal at the historical point of diversion (the New Cache headgate, located east of I-25) rather than diverting this water upstream at the Poudre Valley Canal headgate, as would be done under Alternatives 2 and 3. The resultant effect on streamflows would be less dewatering of the reach from the Hansen Supply Canal to the New Cache headgate (about 22 miles, including through Fort Collins) relative to Alternatives 2 and 3 (Figure S-4 and Figure S-5). From the Poudre Valley Canal headgate to the Larimer-Weld Canal headgate, there would still be reductions in flow associated with Grey Mountain diversions and the SPWCP exchanges with Larimer-Weld Canal, Terry Lake, and Big Windsor. Below the Larimer-Weld Canal headgate, streamflows would be

reduced due to Grey Mountain diversions and the SPWCP exchange with Timnath Reservoir. Downstream of the New Cache Canal headgate, the only differences between Alternatives 3 and 4 would be associated with the comparative amounts of Grey Mountain diversions. At the Kersey Gage, model results for Alternatives 3 and 4 show similar combined volumes of Grey Mountain diversions on the Poudre River and SPWCP diversions from the South Platte River.

The modeled changes to median daily flows at the Kersey Gage are similar for all action alternatives, reflecting both the Grey Mountain and South Platte River diversions that are similar in frequency and magnitude. Alternative 2 flows would be greater than the other alternatives in some months (December-February, June), consistent with Alternative 2 modeling showing the lowest average diversions (both Grey Mountain on the Poudre River and SPWCP water rights on the South Platte River).

For all action alternatives, Grey Mountain diversions from the Poudre River generally would be limited to the peak runoff months (May-June of wet years). The occurrence of modeled flow changes at the Kersey Gage illustrates that in-priority diversions from the South Platte River for storage in Galeton Reservoir could happen in any month, including through the winter. The relative changes in flow at the Kersey Gage would be much less than on the Poudre River as a percentage of the 2010 current conditions hydrology flows because the magnitude of flow on the South Platte River is much greater than on the tributary Poudre River.

Both the Reclamation Action Option and the No Reclamation Action Option for Alternative 2 would include a winter flow augmentation program. A pool of 3,600 AF would be designated in Glade Reservoir each year for release to the Poudre River during historical low flow periods between November 1 and April 30, and from September 1 to September 30 (if any of the designated 3,600 AF were available at the end of April). Winter flow in the Poudre River is typically low (Figure S-6). The flow augmentation program would minimize some indirect project effects and improve winter and September streamflows through Fort Collins by providing a flow of 10 cfs below the Larimer-Weld Canal headgate (upstream of Martinez Park) (Figure S-7). The reach affected by flow augmentation would extend from upstream of the Larimer County Canal headgate near Laporte to the Timnath Inlet Canal headgate located on the east side of Fort Collins, a distance of about 12 river miles. The release and recapture of the augmentation flows is allowed by the District's water rights decrees proposed to be used for NISP. The exact method to return the water to Glade Reservoir will be determined between the SDEIS and the FEIS, but possible options include water exchanges. Curtailment of streamflow augmentation releases may be required under extreme drought conditions when reservoir levels are low.

Figure S-4. Effects on Current Conditions Median Daily Flow at Lincoln Street Gage, IY 1980-2005.

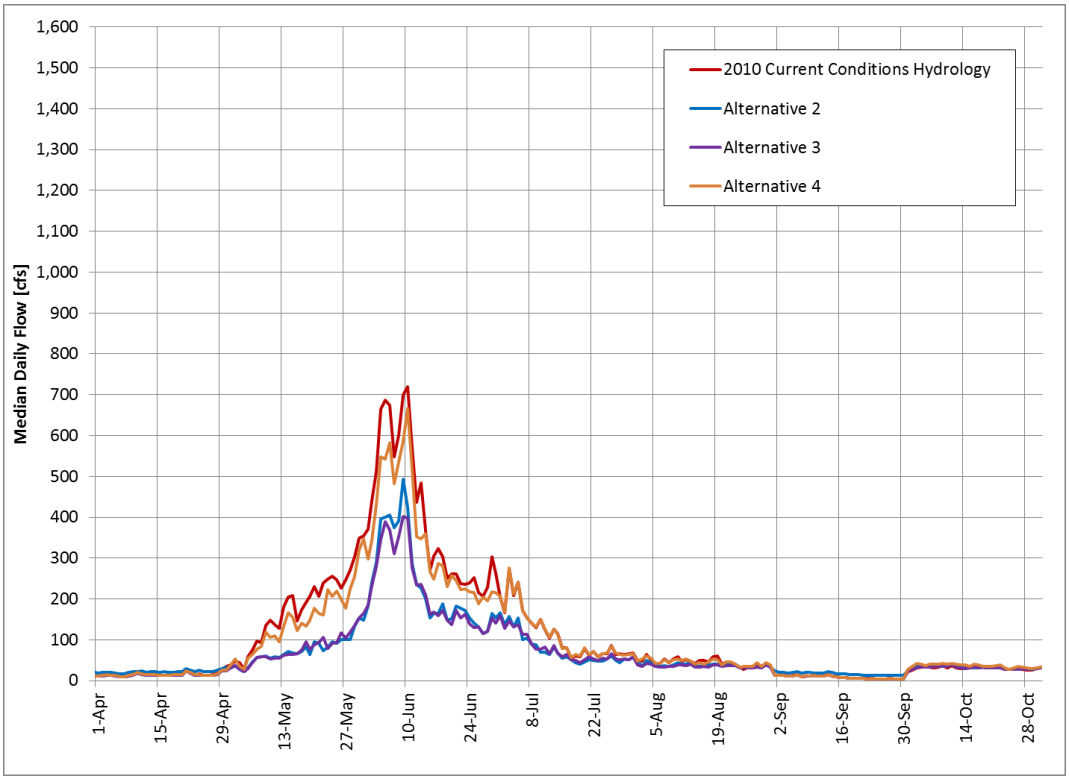


Figure S-5. Change in Median Daily Flow from Current Conditions at Lincoln Street Gage, IY 1980-2005.

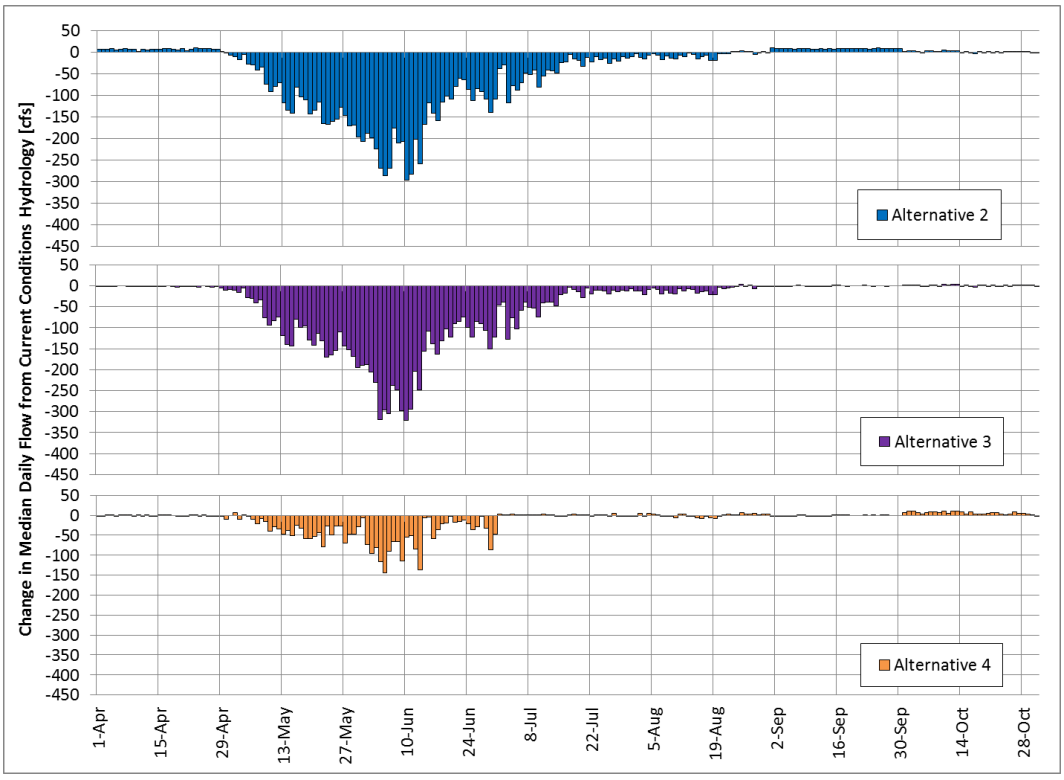


Figure S-6. Median Daily Flow at Lincoln Street Gage during Alternative 2 Flow Augmentation Periods, IY 1980-2005.

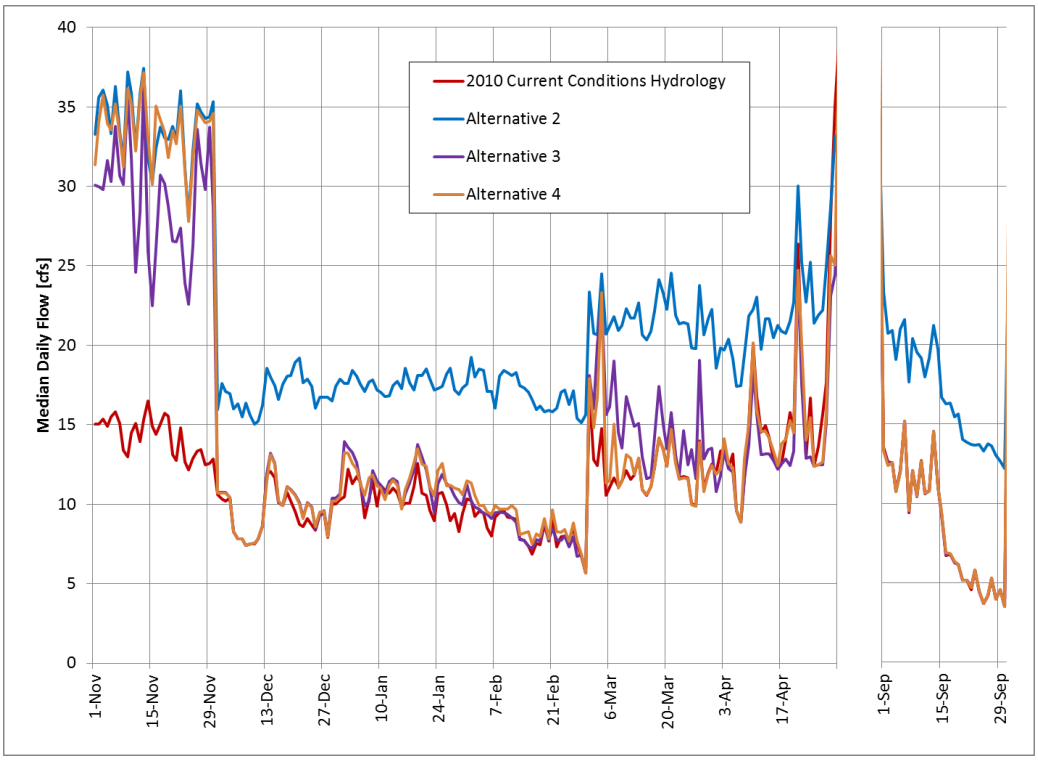
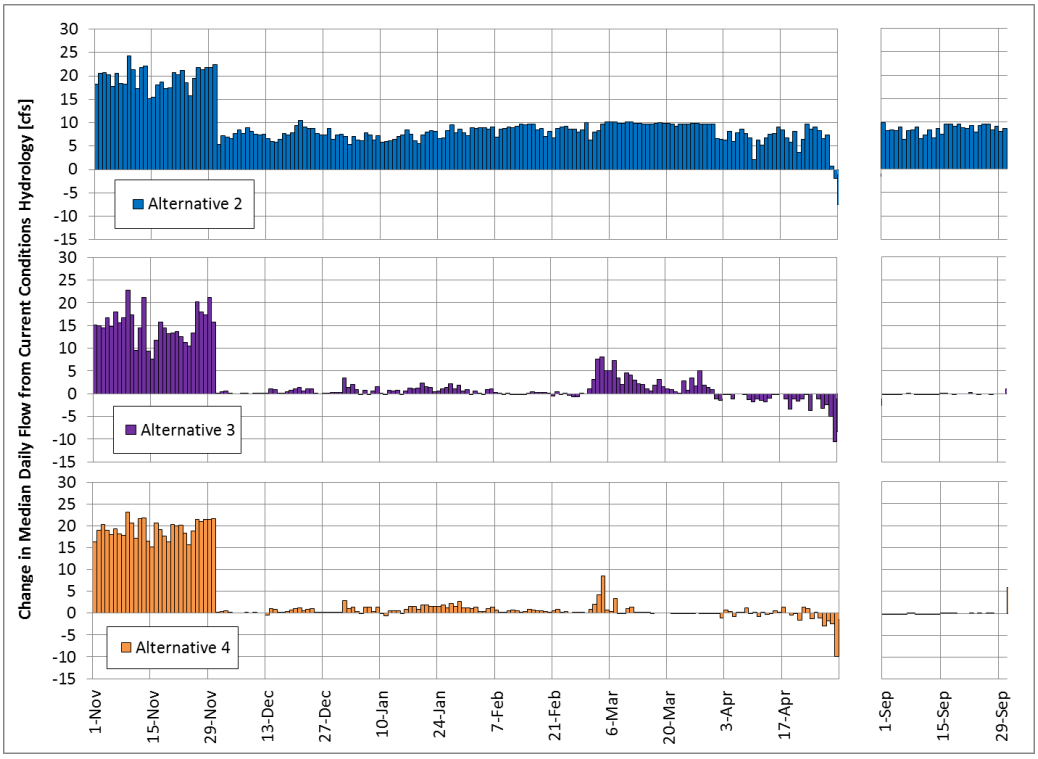


Figure S-7. Change in Median Daily Flow at Lincoln Street Gage during Alternative 2 Flow Augmentation Periods, IY 1980-2005.



S.7.2 Surface Water Quality

The results presented in the SDEIS reflect the first of two phases of water quality analysis. The first phase includes a qualitative assessment of likely changes in water quality for multiple locations under each of the alternatives. The intent of the first phase of analysis was to determine which water quality constituents and locations are most likely to be affected by hydrologic changes. Results of this first phase of analysis will then be used to determine which parameters can be quantitatively modeled at those locations most likely to be sensitive to hydrologic changes. Phase II water quality modeling will be conducted for the FEIS in coordination with the WQCD and the EPA using WQCD protocols to satisfy 401 certification requirements. Results of Phase II water quality modeling will be presented in the FEIS.

Among the action alternatives, the effects on water quality when compared to current conditions hydrology are similar. However, there are relative differences in water quality impact based on the volume, timing, and location of diversions. Generally, Alternative 2 would have fewer anticipated impacts because overall diversions would be less than Alternatives 3 and 4, and the augmentation releases from Glade Reservoir would have a beneficial effect in some months. The potential for the alternatives to result in increased instances of water quality standards being exceeded is summarized in Table S-6; only medium to high potential are shown. Other constituents would have a low potential for standard exceedance. A medium rating indicates that current water quality is approaching the standard and changes in flow associated with the alternative could result in standard exceedances. Parameters with a high rating are likely to continue exceeding the standard and the alternative could contribute to a greater magnitude and/or frequency of standard exceedance. The 404(b)(1) Guidelines at 40 CFR 230.10(b) specify that no discharge of dredged or fill material may be permitted if it will cause or contribute to violations of any applicable State water quality standard. Therefore, in order for the proposed Project to be permitted, the District must propose measures to avoid causes or contributions specifically attributable to the Project that would result in standard violations. The disclosure of potential effects to water quality is based on the evaluation of effects without consideration of the avoidance measures proposed by the District (Appendix F).

Table S-6. Potential for exceedance of water quality standards.

Parameter	Alternative 2	Alternative 3	Alternative 4
Poudre River above Lincoln Street in Fort Collins (Segment 10)			
Copper	Medium	Medium	Medium
Dissolved Manganese	Medium	Medium	Medium
Poudre River from Lincoln Street to below Boxelder Creek (Segment 11)			
Total Phosphorus	Medium	Medium	Medium
Selenium	High*	High	High
Poudre River from below Boxelder Creek the South Platte River (Segment 12)			
Total Recoverable Iron	High*	High*	High*
Ammonia	High*	High*	High*
Total Phosphorus	High*	High*	High*
Selenium	High*	High*	High*
Segment 1b of the South Platte River			
Total Recoverable Iron	High*	High*	High*
Dissolved Manganese	Medium	Medium	Medium
Ammonia	Medium	Medium	Medium
Total Phosphorus	High*	High*	High*
Sulfate	High*	High*	High*

*Water Quality Standard already being exceeded under current conditions.

The only parameters with "high" potential for exceeding water quality standards under any of the alternatives are those parameters that are already exceeding standards in Segment 11 of the Poudre River (from Shields Street in Fort Collins to a point immediately above the confluence with Boxelder Creek), Segment 12 of the Poudre River (from a point immediately above the confluence with Boxelder Creek to the confluence with the South Platte River), and Segment 1b of the South Platte River (from the Poudre River confluence to the Kersey Gage and downstream about 24 miles to the Weld/Morgan County line).

All action alternatives would have the potential to cause further exceedances of temperature standards in some locations and some years. Due to increased diversions at the Poudre Valley Canal, adverse effects on stream temperature are possible in sensitive reaches of Segment 10 (from the Monroe Canal/North Poudre Supply Canal diversion to Shields Street in Fort Collins) and Segment 11, potentially including key months of July and August. Generally, the anticipated adverse effects on stream temperature for Alternative 2 are expected to be less than those for Alternative 3 and greater than those for Alternative 4. The streamflow augmentation program included in Alternative 2 would increase flow rates in parts of Segments 10 and 11 (from 0.37 miles upstream of the Larimer County Canal to the Timnath Inlet headgate) to values greater than those in current conditions, providing a net temperature benefit in this reach in March and September.

Alternative 2 diversions at the Poudre Valley Canal could exacerbate occasionally observed dissolved oxygen issues in July and August in Segment 11. Augmentation flows under

Alternative 2 would likely provide a dissolved oxygen benefit during times of low flow from November through April and in September. Planned aeration of releases from Glade Reservoir under Alternative 2 should also help maintain dissolved oxygen concentrations within standards. Effects of Alternative 3 on dissolved oxygen would generally be similar to, but greater than those identified for Alternative 2, due to greater flow diversions at the Poudre Valley Canal and the lack of streamflow augmentation. Any adverse effects would be primarily in Segment 11. Adverse effects from Alternative 4 on dissolved oxygen in Segment 11 would generally be less than those identified for Alternative 2 and Alternative 3 because less water would be diverted at the Poudre Valley Canal.

Glade Reservoir would be constructed only in Alternative 2 and is anticipated to have water quality similar to Horsetooth Reservoir, although total organic carbon concentrations may be greater. Periods of low dissolved oxygen near the bottom are likely in the summer. Metal concentrations are likely to be within standards. Fish consumption advisories are likely because of mercury in fish tissues. In Alternative 2, with the Reclamation Action Option, minor effects on Horsetooth Reservoir water quality are anticipated, with no exceedances of water quality standards expected.

Galeton Reservoir would be constructed in all action alternatives. Nutrient and chlorophyll *a* concentrations are likely to exceed interim value standards. Specific conductance, pH, and selenium concentrations are likely to be high. Low dissolved oxygen concentrations near the bottom are expected in the summer. Water quality in Galeton Reservoir would be somewhat similar to the water quality found in Riverside and Jackson Reservoirs.

Cactus Hill Reservoir would be constructed in the No Action Alternative (120,000 AF) and Alternatives 3 and 4 (190,000 AF). Water quality in Cactus Hill would be lower than Glade Reservoir, but better than Galeton Reservoir. Water quality would be slightly lower under Alternative 4 because a portion of the water would come from the diversion on the Poudre River at the New Cache Canal headgate, which has lower water quality than diversions at the upstream Poudre Valley Canal.

S.7.3 Stream Morphology and Sediment Transport

The effects of the action alternatives on channel morphology and sediment transport are predicted to be similar and may result in minor detectable changes in the Poudre River mainstem reaches upstream of I-25; downstream of I-25 predicted effects may result in moderate detectable changes due to the accumulation of sediments (Table S-7). The existing trajectory of channel morphology and sediment transport is predicted to continue. All action alternatives would reduce flows in the mainstem of the Poudre River and are predicted to contribute to the existing trend of channel contraction, loss of channel complexity, and increased flooding downstream of I-25. The differences in the alternatives would result in some minor differences among the alternatives in predicted effects on channel morphology and sediment transport (Table S-7). The No Action Alternative is addressed in Section S.8.2. All of the action alternatives would reduce the duration of flows above 1,000 cfs, reduce the 2% high flow, flushing of fines, and duration of bed material movements (Table S-7) which would affect channel morphology. In general,

Alternative 3 would have the greatest predicted reductions. Reductions in these parameters would be similar for Alternatives 2 and 4 depending upon the river reach, with Alternative 4 having less effect in the Fort Collins reach. For all of the action alternatives, channel contraction is predicted to occur downstream of I-25 as an extension of the processes already underway by deposition on bars, islands, riffles, and channel margins. It is likely that the acceleration of channel contraction would lead to an increased frequency of flooding downstream of 1-25.

Table S-7. Comparison of action alternatives effects on channel morphology and sediment transport for the Poudre River mainstem under Current Conditions Effects.

Potential Effect	Current Conditions	Current Conditions Effects		
		Alternative 2	Alternative 3	Alternative 4
Duration of Flows at or above 1,000 cfs (% reduction)	—	30-35	30-40	20-25
2% High Flow (% reduction)	—	10-30	15-37	12-30
Flushing of Fines				
Laporte Reach				
No. of events	15	10	11	11
Duration (total days)	132	94	82	88
Fort Collins Reach				
No. of events	23	16	18	20
Duration (total days)	325	222	205	231
Timnath, Windsor, Greeley Upstream, Greeley Channelized, and Greeley Reaches				
No. of events	18	19	16	17
Duration (total days)	292	218	197	217
Duration of Bed Material Movement (% reduction)	—	21; up to 40 in some locations	26; up to 40 in some locations	24; up to 40 in some locations

S.7.4 Ground Water

S.7.4.1 Reservoir Sites

S.7.4.1.1 Glade Reservoir

Ground water level data collected during 2008 and 2009 indicated that water levels vary by as much as 10 feet between seasons. Water levels reach their lowest level by late spring and then begin rising through the summer, remaining high through much of the winter. Although there are large variations within ground water levels in the area throughout the year, the residual trichloroethene mass near the source area appears to no longer affect downgradient areas, which is where the Glade forebay would be located. The 2008/2009 sampling results indicate that the trichloroethene plume has retracted and currently no detectable trichloroethene is within the footprint of the proposed Glade Reservoir forebay. As the contaminant mass continues to naturally attenuate, the plume will continue to decrease in size.

S.7.4.1.2 Galeton Reservoir

Oil and gas well sites within the reservoir site have had reported spill incidents. The incidents are closed and no additional remedial activities are required. If the Galeton Reservoir site were permitted by the Corps, a detailed analysis of oil and gas facilities would be conducted prior to construction. No other known hazardous sites were identified within or adjacent to the proposed Galeton Reservoir study area. No selenium or salinity impacts are predicted to occur to the ground water underlying Galeton Reservoir and no impacts are predicted to occur to the South Platte River from ground water at the Galeton Reservoir site.

S.7.4.2 Poudre River

Changes in Poudre River flow and stage in all alternatives would affect alluvial ground water levels adjacent to the river. The difference between the alternatives in ground water level reductions associated with predicted maximum river stage reductions would be small. For the four river segments that were analyzed (A, B, C, and F shown in Figure S-1), the predicted reductions in maximum river stage would range from about 1.8 feet to 3.0 feet. The effect of reductions in maximum river stage on ground water levels would be greatest adjacent to the river and decrease with increasing distance from the river. The predicted declines in ground water levels are for a maximum-case situation that may occur typically once in 26 years, as predicted by the CTP hydrologic modeling. More frequently, the predicted reductions in river stage range from 0 to 1 foot, and less frequently, reductions range between 1 and 2 feet, depending on location and alternative. With predicted stage reductions of 1 to 2 feet, ground water level reductions in the alluvium in the vicinity of the river would be less than what is predicted for the maximum-case situation and would not likely be discernible by alluvial well owners, given the range of natural variability in water levels.

S.7.5 Soils

The permanent effects on Prime Farmland would be greatest for the No Action Alternative because irrigation would be removed from 64,200 acres of irrigated land. While the total acreage cannot be determined because the exact location of the dry up is not known, it is likely that more than 9,447 acres of Prime Farmland (or 1% of the total acres of Prime Farmland in Larimer and Weld Counties) would be lost, which would be considered a moderate impact. The loss could be substantially higher. The level of permanent impacts to Prime Farmlands for all action alternatives would be minor, considering the impacts would be less than 1% of all Prime Farmland in Larimer and Weld Counties. Alternatives 3 and 4 would have greater permanent effects on Prime Farmland than Alternative 2 because of the higher number of acres impacted by the Cactus Hill Reservoir compared to Glade Reservoir. The permanent effects on Prime Farmland for conveyance systems would be slightly more for the No Action Alternative. There would be no permanent effects on Prime Farmland due to flow changes in the Poudre and South Platte Rivers in all alternatives.

S.7.6 Wetlands, Riparian Resources and Other Waters

The No Action Alternative would have substantially more estimated permanent wetland effects (251 acres) than the other alternatives because an estimated 219 acres of wetlands would be permanently dewatered due to the transfer of agricultural water rights from 64,200 acres of irrigated lands to provide water to the NISP Participants. Alternative 2 is predicted to have the least amount of permanent wetland effects (44 acres of permanently filled wetlands within the study areas). Alternatives 3 and 4 are estimated to have 81 acres of permanent wetland effects (34 acres of permanently filled wetlands within the study areas and 47 acres of wetlands downslope of the Poudre Valley Canal permanently affected by a loss of hydrologic support). Changes in ground water levels along the Poudre River in Alternatives 2 and 3 also may adversely affect 9 acres of wetlands along the river. Alternative 2 also would have the least amount of permanent effects on other waters (12 acres). Alternatives 3 and 4 would permanently fill 92 acres of other waters, mostly as a result of lining the Poudre Valley Canal (Table S-8). The disclosure of potential effects to wetlands, riparian resources and other waters is based on the evaluation of effects without consideration of the mitigation measures proposed by the District (Appendix F).

The plains cottonwood woodlands along the Poudre River are on a trajectory of decline. Nonnative woody vegetation (e.g., green ash, Russian olive, and Siberian elm) are predicted to increase as a result of the current trajectory. In some years, a decrease in river stage of 0.5 to 1.0 foot during the growing season is predicted in all action alternatives. Declines in river stage would be greater and more frequent in Alternative 3 than the other alternatives. In Alternatives 2 and 3, an estimated 9 acres of herbaceous wetlands are potentially sensitive to declines in the ground water table within 100 feet of the riverbanks (Table S-8). The effect is predicted to occur in Segment B in Alternative 2 and in Segments C and D in Alternative 3; river segments are shown on Figure S-1). In all alternatives, reed canarygrass is predicted to continue to colonize areas of the formerly active channel downstream of I-25. All alternatives are predicted to further reduce inundation of wetlands and riparian areas immediately adjacent to the Poudre River. Changes in flows associated with all alternatives are predicted to accelerate and/or reinforce the well-established trajectory.

Table S-8. Summary of unmitigated direct and indirect effects on wetlands and other waters.

Variable	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Permanently filled wetlands (acres)	32	44	34	34
Wetlands with permanently altered hydrologic support (acres)	219	0	47	47
Permanently filled other waters (acres)	6	12	92	92
Wetlands potentially sensitive to changes in wetland species due to permanent seasonal declines in ground water levels along Poudre River (acres)	Not analyzed under Current Conditions	9	9	0
Total	**257**	**65**	**182**	**173**

Note: The disclosure of potential effects to wetlands and other waters is based on the evaluation of effects without consideration of the mitigation measures proposed by the District (Appendix F).

S.7.7 Wildlife

The differentiating effects to wildlife are primarily associated with the size and location of proposed reservoirs. Table S-9 compares the estimated effects on winter ranges, winter concentration areas and severe winter ranges for deer, pronghorn and elk. These habitat components are typically the most critical or limiting for these species. The disclosure of potential effects on wildlife habitat is based on the evaluation of effects without consideration of the mitigation measures proposed by the District (Appendix F).

Table S-9. Estimated permanent effects on wildlife habitat.

Wildlife Species	Alternative 1	Alternative 2 Proposed Action		Alternative 3	Alternative 4
		Reclamation Action Option	No Reclamation Action Option		
Mule Deer					
Winter Range (acres)	2,602	3,789	3,789	5,687	5,688
Severe Winter Range (acres)	0	228	128	45	45
Winter Concentration Areas (acres)	1,635	70	70	2,332	2,332
White-Tailed Deer					
Winter Range (acres)	2,602	416	416	3,929	3,929
Pronghorn					
Winter Range (acres)	220	2,256	2,256	2,317	2,317
Severe Winter Range (acres)	0	2,254	2,254	1,927	1,927
Elk					
Overall Range (acres)	0	2,043	2,043	46	46
Winter Range (acres)	0	186	196	10	10
Severe Winter Range (acres)	0	2	2	0	0
Winter concentration area (acres)	0	124	124	0	0

Generally the No Action Alternative would have the least effect on habitat for these species because it would have the least area affected by reservoir construction with a single 120,000 AF Cactus Hill Reservoir. Alternatives 3 and 4 would have the greatest effect on deer habitats, except for mule deer severe winter range, which would be most affected by Alternative 2. Alternative 2 would have substantially greater effects on elk habitat compared to the other alternatives because the Glade Reservoir site is partially located within areas of elk habitat.

S.7.8 Special Status Species

Alternative 2 is predicted to result in a loss of 53 acres of Preble's meadow jumping mouse (Preble's) habitat associated with the construction of Glade Reservoir. Preble's is federally listed as a threatened species. None of the other alternatives are predicted to cause a permanent loss of Preble's habitat, although they may cause minor temporary effects.

In Alternative 2, a portion of U.S. 287 would need to be relocated to accommodate Glade Reservoir. The relocation of U.S. 287 is predicted to cause 29 acres of loss and 45 acres of

temporary disturbance to Bell's twinpod habitat. Bell's twinpod is a plant listed by the Colorado Natural Heritage Program as imperiled due to its rarity. The No Action Alternative would have no effects and Alternatives 3 and 4 are predicted to cause 1 acre of Bell's twinpod habitat loss due to the lining of the Poudre Valley Canal.

S.7.9 Aquatic Biological Resources

Relative to the other alternatives, Alternative 3 would divert the most water from the Poudre River in Segment B (Fort Collins reach) and is predicted to have a moderate adverse effect on adult trout. The other alternatives are predicted to have negligible to minor adverse effects on Poudre River fish. In Segment B, Alternative 2 would have a moderate beneficial effect on aquatic biological resources due to augmented flows in winter, early spring, and in September. All other alternatives are predicted to have minor adverse effects on changes in species composition of macroinvertebrates in the Poudre River.

S.7.10 Recreation

Reduction in Poudre River flow is predicted to adversely affect boating on Segment B of the Poudre River through Fort Collins in all alternatives. Under Current Condition Effects, Alternatives 2 and 3 are predicted to reduce the average number of boating days (based on a target flow of greater than 150 cfs) from 54 days to 35 and 36 days respectively during May through August. Alternative 4, which would allow more flow to pass through the Fort Collins reach before being diverted at the New Cache Canal, is predicted to reduce the average number of boating days from 54 days to 50 days during May through August.

Alternative 3 is predicted to have a moderate adverse effect on adult trout in Segment B of the Poudre River through Fort Collins, which in turn would have a moderate to major adverse effect on anglers fishing for trout through Fort Collins. The other alternatives are predicted to have no to minor effects on fishing in the Poudre River. In Alternative 2, Glade Reservoir would be managed for public recreation, to include a managed fishery, and would provide a major benefit to the region as a public recreational resource, with fishing, boating, camping, hiking, horseback riding, and biking potential recreation opportunities provided.

S.7.11 Cultural, Historical and Paleontological Resources

The No Action Alternative is predicted to have no direct effects on cultural, historical, and paleontological resources. As described below, Alternative 2 would have the greatest adverse effect on cultural resources. Effects to cultural and historic resources resulting from Alternative 2 would potentially be greater under the No Reclamation Action Option than the Reclamation Action Option due to an increase in pipeline construction with the No Reclamation Action Option. The effects on cultural resources from Alternatives 3 and 4 would be similar under both alternatives.

In Alternative 2, 2 known and an estimated 35 National Register of Historic Places eligible sites would be affected by the construction of Glade Reservoir or by inundation. The realignment of U.S. 287 in Alternative 2 would affect seven known and seven unrecorded cultural resource sites. Of the known sites, one is eligible for listing on the National Register of Historic Places, three are not eligible, and three have been not assessed. No cultural resources have been identified at the proposed Cactus Hill Reservoir site (Alternatives 1, 3, and 4). Fifteen known cultural resources are associated with the proposed Galton Reservoir, a component of Alternatives 2, 3, and 4. Of these 15 sites, 13 have not had an official determination and may be eligible for listing in the National Register of Historic Places. The other two are not eligible.

There are no predicted effects to paleontological resources for Alternatives 1, 3, and 4. The realignment of U.S. 287 under Alternative 2 would affect known fossil-bearing geologic units primarily associated with the road cut through the hog back. Additionally, the construction of Glade Dam may also affect fossil-bearing geologic units.

S.7.12 Socioeconomic Resources

The No Action Alternative would have moderate to major effects on water rates and affordability for most Participants. The other alternatives would have minor to moderate effects on water rates and affordability for most Participants. Alternative 2 and Alternative 3 would have major effects on the nonuse values associated with the Poudre River for Fort Collins residents.

Construction of reservoirs associated with all of the alternatives would adversely affect residences. The two residences adversely affected by the construction of Glade Reservoir under Alternative 2 are owned by the District. In the No Action Alternative, the smaller Cactus Hill Reservoir would inundate two residences and six residences would be within 500 feet of the reservoir. In Alternatives 3 and 4, Cactus Hill Reservoir would inundate six residences and ten residences would be within 500 feet of the reservoir. There would be a moderate to major adverse effect under Alternative 2 to a gas station and campground at Ted's Place associated with the realignment of U.S. 287.

Alternative 2 would provide a major regional recreation benefit due to the development of Glade Reservoir. Glade Reservoir levels should support a viable recreation facility with respect to seasonal water levels, but Glade's recreation value may diminish toward the end of prolonged dry periods. Annual visitation of 338,600 visitor days is estimated based on a projected average Glade Reservoir surface area during the recreation season of 1,240 acres. It would likely take a number of years to reach this estimated visitation due to the time needed to develop the facilities. The annual value of recreation at Glade Reservoir, at full development, would be an estimated $13.2 million.

Reductions in flows in Segment B of the Poudre River associated with Alternatives 2 and 3 are predicted to result in average flows in May and June below 100 to 150 cfs, which is the approximate flow range needed to sustain recreational boating in this segment. Boating visitation is projected to be reduced by two-thirds, resulting in a projected annual decrease in recreation value of $241,000.

The No Action Alternative would transfer agricultural water rights from 64,200 acres of irrigated lands to provide a water supply to the Participants. Because dryland farming or revegetation are less economically productive, less labor and input intensive, and produce less revenue than irrigated farming, such changes in land use would have an impact on the region's economy. The annual total effect on economic output in the study area is estimated at $87 million, with a projected loss of 738 agriculture-related jobs. With appropriate changes in land management these lands could still be used for agricultural production (e.g., dry land crops and grazing) which could reduce some of these estimated economic and fiscal effects, but agricultural production would be substantially reduced without irrigation. The other alternatives are predicted to have minor effects on agriculture, including exchanges to canals that could increase the salinity of irrigation water and have a minor effect on the production of crops most sensitive to increased salinity.

S.7.13 Hazardous Materials

Alternatives 1, 3, and 4 are not predicted to affect known hazardous sites. For Alternative 2, the proposed Glade Reservoir forebay is located near a known trichloroethene plume. Currently no detectable trichloroethene occurs within the footprint of the proposed forebay and the trichloroethene plume is contracting. Soil containing trichloroethene is not expected within the footprint of the proposed forebay.

S.7.14 Energy Use and Greenhouse Gases

All of the alternatives would involve pumping to convey water. The pumping would require electrical energy and would generate greenhouse gases such as carbon dioxide. The No Action Alternative would have the least predicted annual carbon dioxide emissions and Alternative 4 would have the greatest predicted annual carbon dioxide emissions (Table S-10).

Table S-10. Estimated annual electrical energy use and carbon dioxide emissions during operations.

Variable	Alternative 1	Alternative 2		Alternative 3	Alternative 4
		Reclamation Action Option	No Reclamation Action Option		
Kilowatt Hours Used	34,828,300	48,135,987	61,302,050	59,074,504	64,445,426
Carbon Dioxide Emissions (Tons)	27,087	37,259	47,677	45,944	50,122

S.8 CUMULATIVE EFFECTS (EIS CHAPTER 5)

A cumulative effect is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and RFFAs regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). Past actions have resulted in cumulative effects, which continue to influence the present

environmental conditions, which in turn are predicted to be affected by the NISP alternatives and RFFAs. Section 5.1 of this SDEIS discusses past and ongoing actions and the flow-related and land-based RFFAs considered in assessing cumulative effects, including the flow-based RFFAs included in the CTP modeling for cumulative effects. This summary focuses on the cumulative effects that can be used to differentiate the alternatives. All of the cumulative effects for the alternatives are presented in Chapter 5.

Each resource section in Chapter 5 includes a discussion of how climate change may affect the respective resource. In addition to the analysis of predicted changes to the hydrology of the Poudre River with climate change, other future factors associated with climate change (e.g., increases in temperature, increases in the number and duration of droughts and increases in evaporation and transpiration) are identified that could affect each resource.

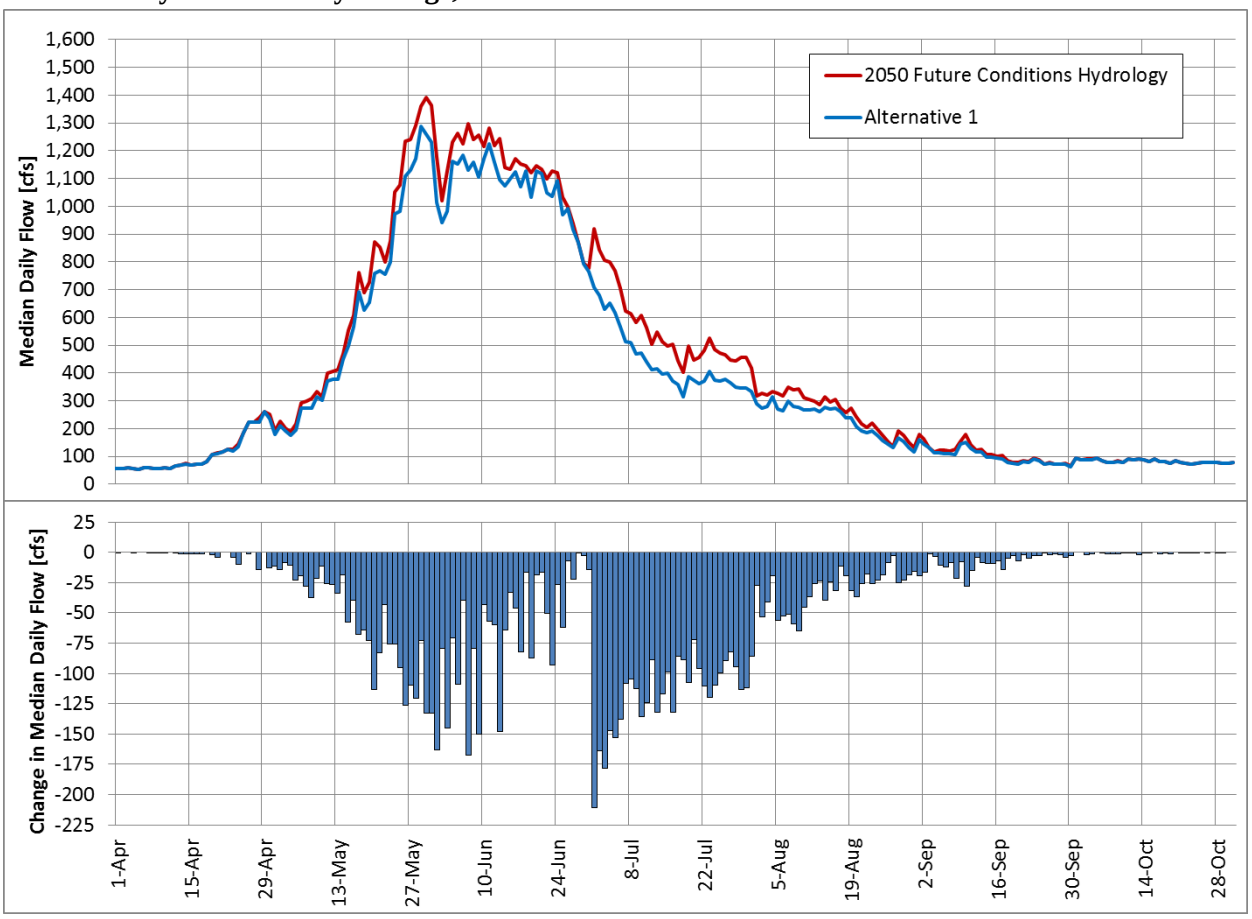
S.8.1 Surface Water

The RFFAs, along with 2050 municipal and agricultural water demands, define the Future Conditions hydrology (CTP Run 2). The Future Conditions hydrology with each of the action alternatives (NISP Run 4 series) is used for comparison to determine cumulative effects for the alternatives (NISP Run 5 series). The Run 5 series of the CTP hydrologic modeling was used to predict the cumulative effects of NISP and the HSWSPs on flows when combined with RFFAs.

The No Action Alternative would require the least diversions from the Poudre River upstream of the New Cache Canal headgate (Table S-11). Nearly all effects to Poudre River flows associated with the No Action Alternative would occur in the nearly 23-mile reach of the Poudre River mainstem between the Poudre Valley Canal headgate and the New Cache Canal headgate between May and September. The greatest effect of the No Action Alternative would be in July, when the diversions would be the greatest and Poudre River flow is less than in May and June (Figure S-8).

The differences in average annual diversions of Alternatives 2, 3, and 4 between Current Conditions Effects and Future Conditions Effects or Cumulative Effects would be small (Table S-11). Average annual diversions from the Poudre River decrease in the future scenarios in all alternatives except the No Reclamation Action Option of Alternative 2. Under Future Conditions scenarios, the junior Grey Mountain right would be in priority somewhat less than with Current Conditions. As a result, the full NISP demand would be met by a rebalancing of sources, drawing more on the SPWCP exchanges from the Larimer-Weld and New Cache irrigation systems. This, in turn, would result in small increases in diversions from the South Platte River.

Figure S-8. Alternative 1 (No Action Alternative) Median Daily Flow and Modeled Change in Median Daily Flow at Canyon Gage, IY 1980-2005.



Reasonably foreseeable future actions, primarily HSWSP, would generally increase Poudre River diversions. At the Canyon Gage, the incremental cumulative effect would be 0 to 100 cfs greater than compared to Future Conditions Effects during May and July and 0 to 25 cfs less compared to Future Conditions Effects during April and September. The incremental cumulative effect varies from beneficial to adverse during June and August. The difference in the incremental cumulative effect between the alternatives is negligible (Figure S-9 and Figure S-10). The incremental cumulative effect at the Lincoln Street Gage would have a similar pattern as that of the Canyon Gage, but the magnitude of the incremental effect would be less. At the Greeley Gage, the incremental cumulative effect would generally be beneficial, with flow increases of 0 to 25 cfs compared to Future Conditions Effects. The incremental cumulative effect at the Kersey Gage would be similar to the Canyon Gage.

Table S-11. Average annual diversion amounts by alternative.

CTP Flow Condition River Location Canal	Alternative 1 (AFY)	Alternative 2		Alternative 3 (AFY)	Alternative 4 (AFY)
		Reclamation Action Option (AFY)	No Reclamation Action Option (AFY)		
Current Conditions Effects					
Poudre River (see footnote)		**35,100**†	**43,300**	**49,200**	**48,800**
Location					
Poudre Valley Canal	**Not evaluated**	35,100†	43,300	49,200	37,800
Larimer-Weld Canal		0	0	0	0
New Cache Canal		0	0	0	11,000
South Platte River		**28,400**	**28,400**	**30,000**	**32,000**
Big Thompson River		**0**	**0**	**0**	**0**
Future Conditions Effects					
Poudre River	**35,900**	**34,400**	**43,300**	**48,900**	**48,000**
Location					
Poudre Valley Canal	17,900	34,400	43,300	48,900	35,700
Larimer-Weld Canal	5,000	0	0	0	0
New Cache Canal	13,000	0	0	0	12,300
South Platte River	**0**	**29,800**	**29,800**	**30,600**	**32,200**
Big Thompson River	**4,000**	**0**	**0**	**0**	**0**
Cumulative Effects					
Poudre River		**34,000**	**43,600**	**48,900**	**47,800**
Location					
Poudre Valley Canal	**Not evaluated**	34,000	43,600	48,900	35,200
Larimer-Weld Canal		0	0	0	0
New Cache Canal		0	0	0	12,600
South Platte River		**30,500**	**30,500**	**31,700**	**32,500**
Big Thompson River		**0**	**0**	**0**	**0**

†Flows in the 1.48-mile river reach between the Poudre Valley Canal and the Hansen Supply Canal would be greater (average of 8,200 AFY) than the No Reclamation Action Option due to exchanges with C-BT and the associated bypass of divertible flows by NISP. The combination of bypassed diversions, releases from Glade Reservoir, and reduced releases from the Hansen Supply Canal would be such that the streamflow effects of the Reclamation Action Option below the Hansen Supply Canal would be nearly identical to the No Reclamation Action Option, i.e., the net effect of both Alternative 2 options downstream of the Hansen Supply Canal would be a streamflow reduction of 43,300 AFY.

Figure S-9. Cumulative Effects Median Daily Flow at Canyon Gage, IY 1980-2005.

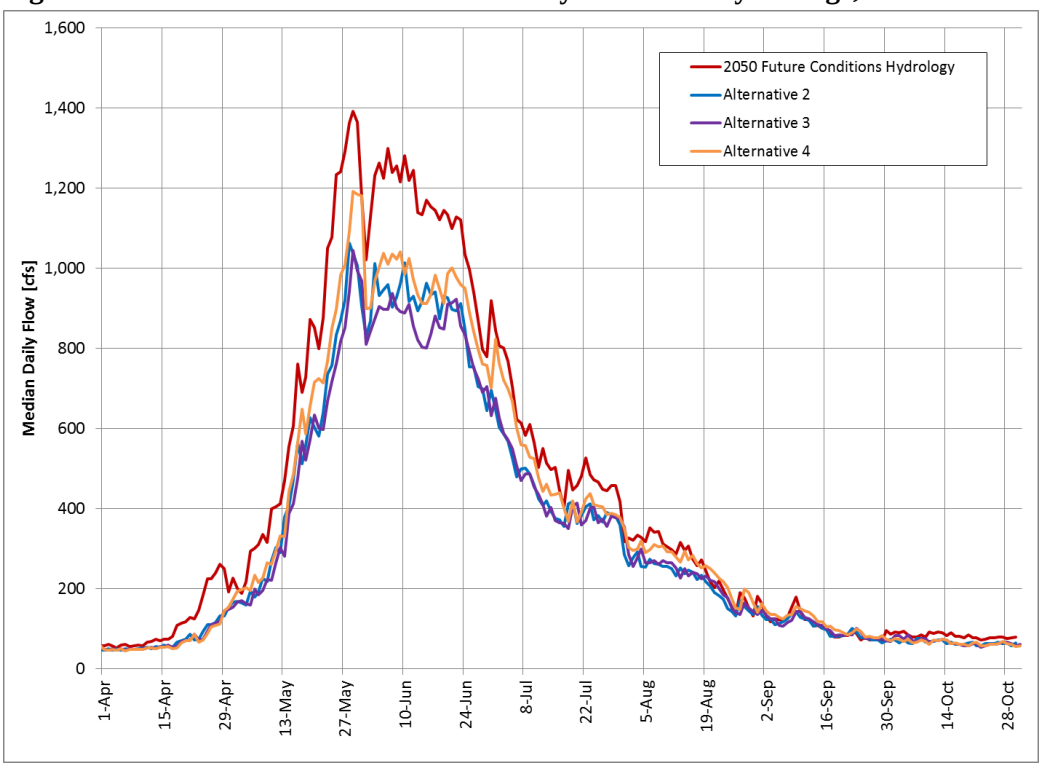
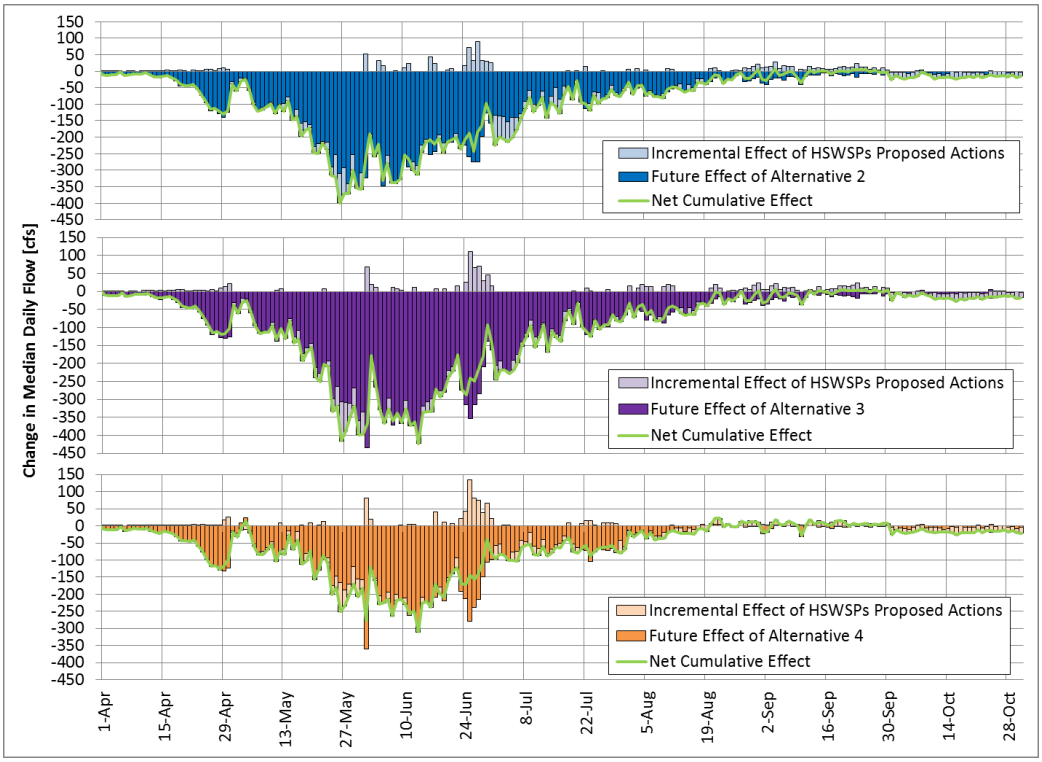


Figure S-10. Future Conditions and Cumulative Effects Change in Median Daily Flows at Canyon Gage, IY 1980-2005.



S.8.2 Surface Water Quality

The difference between the diversions under Future Conditions and Cumulative Effects in all alternatives is small. The cumulative reduction in flows from May to August at the Canyon Gage would increase with the addition of the reasonably foreseeable actions. Metal and nutrient concentrations and the potential for standard exceedances in the Poudre and South Platte Rivers would be similar as to those predicted to occur under Current Conditions Effects under all the alternatives (Table S-6). Total phosphorus would have a medium potential for exceedance of standards in the Poudre River. Selenium, which currently exceeds standards in Segments 11 and 12 of the Poudre River, would continue to have a high potential for standard exceedance. In Segment 1b of the South Platte River, the potential for continued exceedance of the total recoverable iron, total phosphorus, and total sulfate standards would be high. The potential for exceedance of the dissolved manganese and ammonia standard would be medium on the South Platte River.

The frequency and magnitude of temperature excursions upstream of the Hansen Supply Canal on the Poudre River in July and August is likely to increase with further decreases in flow. In Alternative 2, during September and the winter months flows in the lower Segment 10 reach would increase slightly from augmentation releases from Glade Reservoir. These releases would have a beneficial effect on water quality parameters compared to Current Conditions hydrology. Lower flows under all the alternatives could increase temperature standard exceedances upstream of Boxelder Creek in Segment 12 of the Poudre River, particularly in July and August. With Cumulative Effects hydrology, some increase in Poudre River temperature in Segment 12 is possible depending on changes in ground water inflow and WWTP discharges. The potential for exceedance of temperature standards in the South Platte River would be low under all the alternatives.

The 404(b)(1) Guidelines at 40 CFR 230.10(b) specify that no discharge of dredged or fill material may be permitted if it will cause or contribute to violations of any applicable State water quality standard. Therefore, in order for the proposed Project to be permitted, the District must propose measures to avoid causes or contributions specifically attributable to the Project that would result in standard violations. The disclosure of potential effects to water quality is based on the evaluation of effects without consideration of the avoidance measures proposed by the District (Appendix F).

Alternatives 1, 3, and 4 would have no effect on Horsetooth Reservoir water quality under Cumulative Effects hydrology. Alternative 2 would have negligible effects on Horsetooth Reservoir under the Reclamation Action Option and no effect with the No Reclamation Action Option.

S.8.3 Stream Morphology and Sediment Transport

The trajectory of channel morphology and sediment transport is predicted to amplify under Future Conditions Effects and Cumulative Effects as the result of ongoing channel contraction, fining of surficial material, and loss of channel complexity. These predicted changes in river

condition are a fluvial response to historical and contemporary physical and hydrologic changes to the river, floodplain, and watershed. Under Future Conditions Effects and Cumulative Effects, all alternatives would reduce flows in the mainstem of the Poudre River and are predicted to contribute to the existing trend of channel contraction, loss of channel complexity, and increased flooding downstream of I-25. The differences in the alternatives previously described (Table S-7) would result in some minor differences among the alternatives in predicted Cumulative Effects on channel morphology and sediment transport (Table S-12). In general, the No Action Alternative would have the least effect and Alternative 3 would have the greatest predicted effect.

Based on the current trajectory, there is predicted to be a propensity toward channel contraction throughout the system, but this is predicted to mainly occur downstream of I-25 where there would be material of the relevant size fraction available for deposition and vegetation within the formerly active channel is predicted to trap sediment which feeds the cycle of channel contraction that in turn provides additional substrate for the establishment of additional vegetation to trap more sediment. It is likely that the acceleration of channel contraction would lead to an increased frequency of flooding downstream of I-25. The complexity of in-channel morphologic features is currently low in the reaches downstream of I-25 as the result of sand deposition smothering the bed and reducing the magnitude and frequency of pool and riffle sequences. Further channel contraction under Future Conditions Effects and Cumulative Effects is predicted to exacerbate this condition.

The incremental impact of the Cumulative Effects (Run 5 series) on morphology and sediment transport is similar to the impact of Future Conditions Effects (Run 4 series) except that the introduction of the HSWSPs (Run 5 series) consistently increases the impacts beyond the impacts of the Future Conditions Effects by about 10% to 15%.

Implementation of any of the alternatives with Future Conditions Effects and/or Cumulative Effects is not predicted to affect the morphology of the South Platte River downstream of the confluence with the Poudre River. No new studies or analysis were done for the SDEIS for the South Platte River. Section 4.4.1 of the DEIS concluded that channel-forming flows (1.5-year peak flows of 3,858 cfs) would occur or be exceeded about 3% of the time. Under the action alternatives, flows of this magnitude would occur less than 1% of the time.

Table S-12. River morphology and sediment transport cumulative effects in the Poudre River mainstem.

Potential Effect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Reduction in 2% Probability Discharge (Flood Flows)	0% to 5%	6% to 11%	4% to 11%	3% to 12%
Fining of Surficial Material	Slight decreases in the number of flushing events at a few representative sections.	No decreases in the number of flushing events at about half of the representative sections. At about half of the representative sections, the number of flushing events would decrease by 1% to 50%.	No decreases in the number of flushing events at about two to thirds of the representative sections. At about one to third of the representative sections, the number of flushing events would decrease by 1% to 50%.	No decreases in the number of flushing events at about half of the representative sections. At about half of the representative sections, the number of flushing events would decrease by 2% to 50%.
Movement of Bed Material	Slight to no decreases in the number of events that move bed material.	At about one to third of the representative sections, the number of events that move bed material would decrease by 3% to 35%.	At about one to third of the representative sections, the number of events that move bed material would decrease by 1% to 50%.	At about one to third of the representative sections, the number of events that move bed material would decrease by 12% to 100%.

S.8.4 Ground Water

S.8.4.1 Reservoir Sites

The Future Conditions Effects at the Glade and Galeton reservoir sites would be the same as the Current Conditions Effects. Reasonably foreseeable future actions would not cumulatively affect ground water conditions at the Glade Reservoir or Galeton Reservoir sites.

S.8.4.2 Poudre River

For the four river segments that were analyzed (A, B, C, and F shown in Figure S-1), the predicted reductions in maximum river stage would range from about 0.4 foot to 1.0 foot with Future Conditions Effects in the No Action Alternative. The difference between the predicted maximum ground water level reductions associated with the No Action Alternative and the action alternatives, particularly in the near-bank areas, would likely be observable.

In the action alternatives, the predicted reductions in maximum river stage would range from about 1.4 feet to 3.4 feet for the action alternatives with Future Conditions Effects and 2.0 feet to 3.2 feet with Cumulative Effects. The difference between the action alternatives in ground water level reductions associated with predicted maximum river stage reductions would be small.

S.8.5 Wetlands, Riparian Resources, and Other Waters

The NISP alternatives are predicted to affect river stage, ground water levels, and inundation (Section S.7.6). The current trend leading to shifts in woody riparian species composition along the mainstem is expected to continue and to be affected by the NISP alternatives. The combined effects of the RFFAs, NISP alternatives, and the HSWSPs (cumulative effects) are predicted to further reinforce and/or accelerate the previously described trajectory of wetland and riparian resources along the mainstem.

The degree to which impacts on wetland and riparian resources along the mainstem of the Poudre River increase with Cumulative Effects can be seen in how predicted effects increase from Current Conditions Effects hydrology to Cumulative Effects. This is particularly evident when comparing the predicted effects of stage changes on shallowly rooted near-bank herbaceous wetland vegetation (within 100 feet of the riverbanks). Alternative 3 is predicted to have the greatest effect on river stage. Under Current Conditions Effects hydrology, the greatest predicted indirect effect would be to an estimated 9 acres of vegetation classes that are potentially sensitive to declines in the ground water table within Segment B. Under Future Conditions hydrology, the greatest predicted effect would be to an estimated 60 acres of vegetation classes that are potentially sensitive to declines in the ground water table within Segments B, C, and D (Table S-13). Under Cumulative Effects, the greatest predicted effect would be to an estimated 148 acres of vegetation classes that are potentially sensitive to declines in the ground water table within Segments B, C, D, and E. This progression of predicted effects shows how effects are predicted to become more widespread along the mainstem with Future Conditions Effects and Cumulative Effects.

Generally, the No Action Alternative with Future Conditions Effects would have the least predicted flow-related indirect effect on wetland and riparian resources, and Alternative 3 would have the greatest predicted indirect effect on wetland and riparian resources along the mainstem. Alternative 3 with Cumulative Effects consistently would have the greatest number of weeks and percentage of the period of record with a decline in ground water levels of 0.5 foot or greater. For river Segments A, B, and C, Alternative 4 consistently would have the fewest number of weeks and percentage of the period of record with a decline in ground water levels of 0.5 foot or greater among the action alternatives.

Table S-13. Summary of flow-related indirect cumulative effects on Poudre River wetland and riparian resources.

Variable and Modeled Hydrologic Condition	Alternative 1	Alternative 2 (Both Reclamation Options)	Alternative 3	Alternative 4
Predicted Change in River Stage	Minor predicted changes in river stage	Decrease river stage by 0.5 to 1.0 foot during the growing season	Declines in river stage would be greater and more frequent than the other alternatives	Decrease river stage by 0.5 to 1.0 foot during the growing season
Segments (Figure S-1) with Predicted Weekly Average Stage Declines that Exceed Impact Threshold†				
Future Conditions Effects	None	Segment B	Segment B, C, and D	Segment D
Cumulative Effects	None	Segment B, C, and D	Segment B, C, D and E	Segment B and D
Alluvial Ground Water Levels	Predicted changes in ground water levels would be within or very close to the observed range	Infrequent short-lived declines below the observed maximum ground water depths during the growing season in Segments C, D, E, and F; negligible effects on Segments A and B	Declines similar to and slightly more frequent than under Alternative 2	Similar to Alternatives 2 and 3, except fewer declines in ground water levels are predicted in Segments A and B due to shifting some diversions to downstream of Fort Collins.
Acres of Wetland Vegetation Classes Potentially Sensitive to Changes in Wetland Species Due to Declines in the Ground Water Table				
Current Conditions Effects	0	9	9	0
Future Conditions Effects	0	9	60	21
Cumulative Effects	0	60	148	30

†Impact threshold used in the SDEIS is a decline in river stage of 0.5 foot or greater in herbaceous wetlands within 100 feet of the river for more than 10% of the period of record.

Note: The disclosure of potential effects to wetlands, riparian resources and other waters is based on the evaluation of effects without consideration of the mitigation measures proposed by the District (Appendix F).

S.8.6 Wildlife

In the No Action Alternative, the combined effects of human population growth, commercial and residential development, transportation improvements and water storage and delivery, including the loss or degradation of 2,280 acres of grassland habitat due to the construction of a 120,000 AF Cactus Hill Reservoir would result in the loss or degradation of habitat, mortality from ground-disturbing activities and increased traffic, and creation or expansion of movement barriers. The No Action Alternative would not affect elk habitat and no cumulative effect would occur on elk.

Construction and/or expansion of Chimney Hollow, Halligan and Seaman Reservoirs (RFFAs) would all occur within elk and mule deer winter range and winter concentration areas. Because

different populations of big game occur in the plains grasslands (Cactus Hill and Galeton Reservoirs) compared to the Foothills grasslands (Chimney Hollow and Seaman Reservoirs), the No Action Alternative and RFFAs would not affect the same populations. On a regional scale, cumulative effects would be negligible for big game species because less than 1% of habitat available within each Game Management Unit established by CPW would be affected and the No Action Alternative and RFFAs would not likely have a noticeable effect on big game populations or sex ratios at a regional scale. On a local scale, cumulative effects would be major for mule deer because effects on winter concentration areas would be greater than 20% and moderate for pronghorn and white-tailed deer because the moderate direct effect at Cactus Hill and the loss of habitat associated with the RFFAs would not result in the loss of more than 20% of the local habitat.

The No Action Alternative would contribute to cumulative losses of migratory bird, reptile and amphibian and other wildlife habitat. Some of these cumulative effects would be offset by the construction and expansion of the Cactus Hill Reservoir that would provide new open water habitat for waterfowl as well as foraging habitat for fish-eating birds such as osprey. Drying of irrigated lands would likely contribute to cumulative losses of wetland, irrigated meadow and grassland habitats. Dry up could include reestablishing native vegetation in some areas that would provide habitat for grassland-associated wildlife.

Cumulative effect of the action alternatives would be similar. On a regional scale, cumulative effects in all action alternatives would be negligible for big game species because these projects would not likely have a noticeable effect on big game populations or sex ratios at a regional scale. In Alternative 2, cumulative effects on a local scale would be minor for white-tailed deer and major for mule deer, pronghorn, and elk, particularly to local and resident herds in the Seaman to Glade/realigned U.S. 287 area because greater than 20% of the local habitat would be lost and more fragmented. In Alternatives 3 and 4, cumulative effects on a local scale would be major for mule deer, white-tailed deer, and pronghorn because the alternatives would cumulatively result in the loss of greater than 20% winter range, winter concentration area, and severe winter range.

S.8.7 Aquatic Biological Resources

For almost all of the individual metrics of fish habitat availability (weighted usable area), values gradually increased from Current Conditions through Future Conditions to Future Conditions Effects. The incremental change between Future Conditions Effects and Cumulative Effects is mostly negligible in all alternatives. The effects summary focuses on Segment A, B and C of the mainstem (shown on Figure S-1) because the predicted effects in these segments distinguish the alternatives, and the two recreationally important fish species, brown and rainbow trout, occur in these segments.

The No Action Alternative would have negligible to minor impacts to aquatic resource components in the mainstem. In the South Platte River, the changes in flow would be relatively small and there would be negligible impacts. The No Action Alternative would have little effect on the adult life stage of brown and rainbow trout in Segments A and B, but in Segment C, the

lower runoff flows would reduce average habitat for these species in the spring and early summer and would have a minor adverse impact on trout in Segment C. There would be a gradual loss of average habitat availability for brown and rainbow trout with the reductions in spring runoff flows from Current Conditions through Future Conditions Effects, which results in decreases in average weighted usable area of 11% to 19%. These two species do not maintain resident, reproducing populations in Segment C, but seasonally use the habitat in the segment when temperatures are suitable. The increased temperatures with the No Action Alternative could further limit the time when temperatures are suitable for trout. The lowered spring flows would reduce habitat availability and the seasonal use by these recreationally important species in Segment C.

Alternative 2 with Cumulative Effects would have minor adverse cumulative impacts to most aquatic resource components in the mainstem. In the South Platte River, the changes in flow would be relatively small and there would be a negligible cumulative impact. In Segment B of the mainstem there would be a moderate beneficial cumulative impact with augmented low flows. In Segment B, the effect of Alternative 2 would be an overall moderate beneficial cumulative impact. The augmented winter flows would more than double minimum flows in most years. The occurrence of extreme low flows would be approximately 9% less and the frequency of extreme flow fluctuations would be reduced by nearly half. Habitat availability for almost all species of fish would benefit from the augmented flows during the winter, early spring, and other low flow times of the year in sections upstream of the Timnath Reservoir Inlet. Minimum weighted usable area values would increase substantially for every species and most average weighted usable area values would increase as well. Some species, such as longnose dace and rainbow trout juveniles and fry, would also benefit from the reduced spring flows. Abundance of fish likely would increase and some species that now maintain low population levels may account for a higher proportion of the community. These changes indicate there would be a moderate beneficial impact to the fish community. However, increases in summer temperatures could dampen the benefit to trout. Alternative 2 would have a moderate adverse cumulative impact on trout in Segment C. In Segment C, brown and rainbow trout do not maintain resident reproducing populations, but seasonally use the habitat when temperatures are suitable. The increased temperatures with Alternative 2 Cumulative Effects could further limit the time when temperatures are suitable for trout. The lowered spring flows would reduce habitat availability and the seasonal use by these recreationally important species. There likely would not be a change in the overall species composition of the fish community with Alternative 2, but the community relative abundance may shift to one more dominated by small-bodied warmwater species with fewer trout.

Alternative 3 Cumulative Effects would have minor adverse effects to most aquatic biological resource components in the mainstem and would be similar to the effects predicted for Alternative 2 in all segments except for Segment B of the mainstem. In Segment B there would be an overall moderate adverse cumulative impact. For most fish species and life stages other than for adult trout, many weighted usable area metrics would not change by more than 10% for Alternative 3 Current Conditions Effects, Future Conditions Effects and Cumulative Effects. For adult brown and rainbow trout, lower spring flows would reduce weighted usable area values

from Current Conditions through Future Conditions. For the increment between Alternative 3 Future Conditions Effects to Alternative 3 Cumulative Effects, the further reduction in spring flows reduces weighted usable area values for almost all species and life stages. For most species and life stages, this would result in a negligible reduction in habitat availability for Cumulative Effects, but for adult trout, the reductions would be greater. In the South Platte River, the changes in flow would be relatively small and there would be a negligible cumulative impact.

Alternative 4 Cumulative Effects would be negligible to minor adverse to most aquatic resource components in the mainstem. Changes in fish habitat availability would mostly be negligible while there would be minor adverse impacts with changes in macroinvertebrate and periphyton species composition. In Segments A and B, most species and life stages would have negligible changes in weighted usable area metrics for Alternative 4 Current Conditions Effects, Future Conditions Effects and Cumulative Effects. The few species with more substantial changes would have only a small incremental change between Alternative 4 Future Conditions Effects and Cumulative Effects. In Segments A, B, and C, macroinvertebrate community abundance may benefit slightly from lower spring flows and the community may sustain a higher proportion of species that prefer moderate to slow current velocity. Species composition may change to species more suited to the altered flow regime, which would be a minor adverse cumulative impact. Similarly, there may be a minor increase in in abundance of periphyton and aquatic plants and minor adverse cumulative impact due to changes in periphyton species composition and increases in filamentous green algae. In the South Platte River, the changes in flow would be relatively small and there would be a negligible impact.

S.8.8 Recreation

A cumulative reduction in Poudre River flow is predicted to adversely affect boating on Segment B of the Poudre River through Fort Collins in all alternatives. The Future Conditions Effects and Cumulative Effects are summarized in Table S-14.

Table S-14. Predicted boating days in the Poudre River at the Lincoln Street Gage.

Modeled Hydrologic Condition	Alternative 1	Alternative 2 (Both Reclamation Options)	Alternative 3	Alternative 4
Current Conditions	54	54	54	54
Current Condition Effects	Not analyzed	35	36	50
Future Conditions	54	54	54	54
Future Condition Effects	50	35	32	53
Cumulative Effects	Not analyzed	33	31	52

S.9 MITIGATION

The mitigation plan in the SDEIS is the draft conceptual mitigation plan proposed by the District (Appendix F). The draft Conceptual Mitigation Plan (Appendix F) outlines the proposed

avoidance, minimization and compensatory mitigation measures for key environmental resources, including water quality, stream morphology, fish and other aquatic life, wetlands, riparian vegetation, and terrestrial wildlife. Between the SDEIS and FEIS, the conceptual mitigation plan will be refined and a more comprehensive proposed mitigation plan will be included in the FEIS. The Corps will describe the final mitigation requirements in its Record of Decision and may incorporate mitigation required by the Colorado Wildlife Commission and the WQCD.

The District will submit to the Corps a proposed final Mitigation Plan that will include components of:

- A mitigation plan for fish and wildlife resources approved by the Colorado Wildlife Commission
- Water quality mitigation measures that may be required by the WQCD as part of a water quality certification
- Reasonable and prudent measures and terms and conditions of the Biological Opinion of the USFWS addressing ESA compliance
- Mitigation identified by the USFWS in its Fish and Wildlife Coordination Act Report
- Mitigation that addresses specifically identifiable environmental effects determined to be significant, as required by Corps regulation (33 CFR 320.4(r)(2)), as well as mitigation for impacts to aquatic resources, as required by Corps regulations (33 CFR 332).