1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

The South Platte Storage Study (SPSS) was initiated as a result of House Bill 16-1256 titled "South Platte Storage Study." It authorizes the Colorado Water Conservation Board, in collaboration with the State Engineer and the South Platte Basin and Metro Roundtables, to identify multi-purpose water storage options along the lower South Platte River to capture flows leaving Colorado in excess of the minimum legally required amounts. The study area for identifying storage options was the lower South Platte Basin between Greeley and the Nebraska State line. Water storage possibilities include new reservoirs, the enlargement/rehabilitation of existing reservoirs, and alternative storage mechanisms (e.g., underground storage).

The study tasks are summarized in **Figure 1-1**. Study methods and preliminary results were reviewed by and coordinated with members of the Colorado Water Conservation Board, Colorado Division of Water Resources, and South Platte Basin and Metro Roundtables through a series of three workshops and informal reviews. Members of these groups reviewed and commented on draft technical memoranda and the final project report.

The SPSS study was conducted by Stantec Consulting Services Inc., with support from Leonard Rice Engineers, Inc. Funding for the study was provided from the Colorado Water Conservation Board Water Supply Reserve Fund.

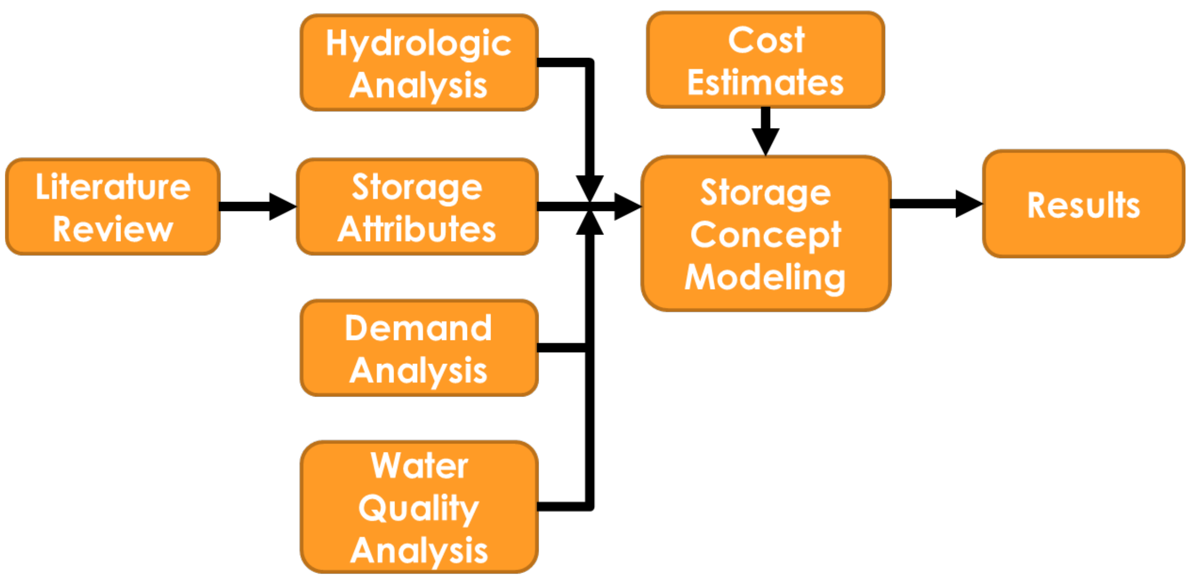

Figure 1-1 – South Platte Storage Study Approach

1.2 LITERATURE REVIEW

Past studies of storage options in the South Platte Basin were reviewed, and a database of storage options identified in these past studies was assembled. Storage options were categorized as new surface storage, existing surface storage enlargement, existing surface storage restoration, existing surface storage rehabilitation, gravel pit storage, and aquifer storage. After eliminating sites outside the SPSS study area and combining similar storage concepts, 73 surface storage options (excluding gravel pits) and 22 aquifer storage options were selected for evaluation.

1.3 LEGAL AND REGULATORY OVERVIEW

Federal, state and local regulations and permits that could affect the feasibility of storage options in the SPSS study area were reviewed and summarized. Key regulations and permits to consider during project development include: U.S. Army Corps of Engineers 404 permit, National Environmental Policy Act, Endangered Species Act, Platte River Recovery Implementation Program, South Platte River Compact, Colorado water rights administration, and local 1041 regulations.

1.4 HISTORICAL FLOW ANALYSIS

The historical flows at the Nebraska State line for the period 1996-2015 (water years) were analyzed to estimate the total amount of water leaving Colorado and the amount of water leaving Colorado in excess of the South Platte River Compact. Table 1-1 shows statistics for total water leaving Colorado and water delivered to Nebraska in excess of the Compact for this 20-year period.

Table 1-1. Historical Annual Flow for 1996-2015 at Nebraska State Line

Statistic	Physical Water Leaving Colorado (Julesburg Gage)	Water Delivered to Nebraska in Excess of the Compact (1)(2)
Annual Median (ac-ft/yr)	331,000	293,000
Annual Average (ac-ft/yr)	436,000	397,000
Minimum Year (ac-ft/yr)	29,000	10,000
Maximum Year (ac-ft/yr)	1,957,000	1,904,000
Total for 20-yr Period 1996-2015 (ac-ft)	8,728,000	7,939,000

(1) Storable flow Julesburg gage
(2) Future environmental flow obligations could reduce legally available water.

1.5 AVAILABLE WATER FOR STORAGE

A daily point flow model was used to compute the amount of water that would be physically and legally available for storage in a new SPSS storage project. Available water was computed for two hydrologic conditions: (1) historical conditions for the 1996-2015 period of record in the point flow model; and (2) future conditions using the same basic hydrology. Future hydrology was estimated by reducing the historical point flow model results by an allowance for Identified Projects and Processes (IPPs) in Colorado's Water Plan and an allowance for existing conditional exchange water rights that have not been executed to date. Statistics defining water available for storage at five locations in the SPSS study area are given in **Table 1-2**. Estimated future median annual available water is 20-30 percent less than median annual available water in the 20 years between 1996 and 2015. The median is a better statistic to describe typical conditions because there are a few high flow years that skew the average in the study period.

Table 1-2. Available Water for Selected Locations Based on Historical and Future Hydrology

Location	Median Annual Available Water (ac-ft)	Average Annual Available Water (ac-ft)	Available Water in Wet Year (ac-ft)	Available Water in Normal Year (ac-ft)	Available Water in Dry Year (ac-ft)
	All Years	All Years	1999	2010	2002
Historical Hydrology (1996-2015)					
South Platte River near Kersey	165,000	262,000	707,000	378,000	14,000
South Platte River near Weldona	179,000	281,000	731,000	411,000	18,000
South Platte River near Balzac	185,000	297,000	771,000	440,000	18,000
Lowline Ditch/Henderson Smith Ditch	200,000	314,000	799,000	476,000	33,000
South Platte River at Julesburg	289,000	397,000	951,000	627,000	79,000
Future Hydrology Based on IPP and Conditional Water Right Adjustments					
South Platte River near Kersey	116,000	214,000	580,000	275,000	6,000
South Platte River near Weldona	127,000	231,000	601,000	303,000	9,000
South Platte River near Balzac	144,000	246,000	641,000	326,000	9,000
Lowline Ditch/Henderson Smith Ditch	154,000	261,000	666,000	357,000	15,000
South Platte River at Julesburg	232,000	332,000	815,000	494,000	54,000

1.6 WATER DEMAND

Maximum potential water demands in the SPSS study area were estimated for use in the subsequent analysis to determine feasible sizes for conceptual SPSS storage projects. Agricultural and municipal & industrial (M&I) demands were estimated for four water districts and counties in the SPSS study area between Denver and Julesburg based on data from the Statewide Water Supply Initiative (SWSI 2010). Maximum demands on SPSS reservoirs were assumed to be equal to the future water supply gap or shortage (difference between demand and supply) for the lower South Platte Basin as reported in SWSI 2010. For purposes of the storage analysis, demands were aggregated at the five key locations on the South Platte River at which available water was estimated. **Figure 1-2** summarizes available supply and maximum potential demand values used for the SPSS analysis. Total median available supply is less than the total shortages in the upper part of the study area; for example, at the Denver gage the median available supply is 5,000 ac-ft compared to total M&I and agricultural water shortages of 106,000 ac-ft. In the lower part of the study area the median available water is greater than the total M&I and agricultural water shortages (232,000 ac-ft median available supply compared to 18,000 ac-ft shortages at the Julesburg gage).

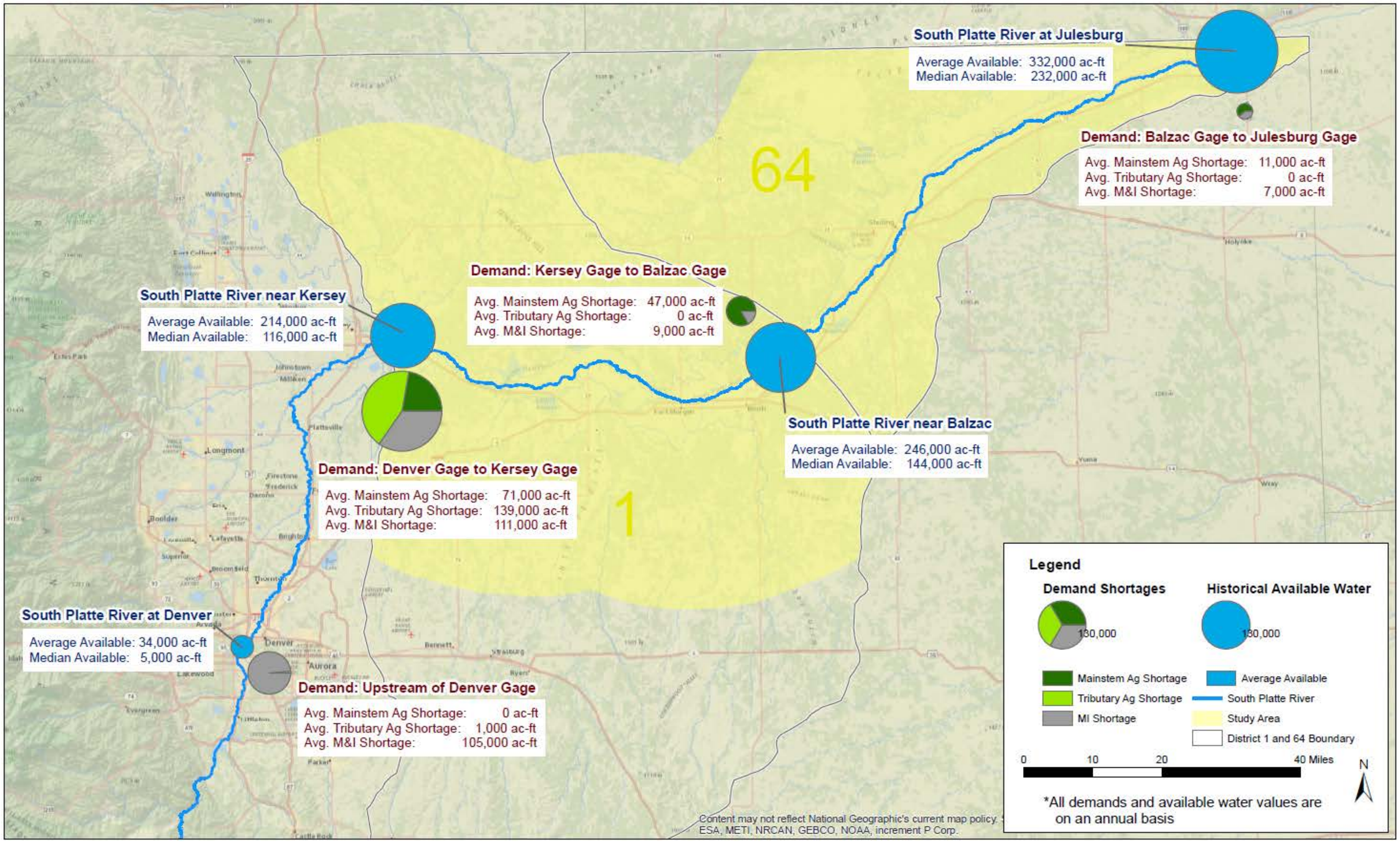

Figure 1-2. Summary of Available Water and Maximum Potential Demands at Key Locations in SPSS Study Area

1.7 WATER QUALITY

The quality of water available for a new storage project in the lower South Platte Basin could affect the feasibility of putting that water to beneficial use. Similarly, enlarging or rehabilitating existing reservoirs would only be feasible if water quality would be appropriate with treatment for the intended uses.

Existing water quality data for stream segments and reservoirs was reviewed and impaired water bodies based on the state's water quality assessment were identified. Water diverted for storage in the SPSS study area would be adequate quality for irrigation use, as these sources are currently widely used for agricultural purposes. However, if used directly as a drinking water supply, water from any new SPSS storage project would require a high level of treatment (e.g., reverse osmosis, ion exchange) to remove a number of problematic constituents including arsenic, selenium, sulfate, total dissolved solids, and uranium. In addition, water used for aquifer storage in managed groundwater basins would have to be treated prior to recharge to protect existing groundwater quality.

1.8 STORAGE OPTIONS

The SPSS evaluation process involved analyzing storage options (individual reservoir or aquifer storage facilities) and more comprehensive storage concepts or solutions. Storage concepts include individual storage options or combinations of storage options integrated with all other infrastructure required to have an operational storage project. Storage options were analyzed first, and the most promising options were incorporated into storage concepts. The overall storage evaluation process is summarized in Figure 1-3.

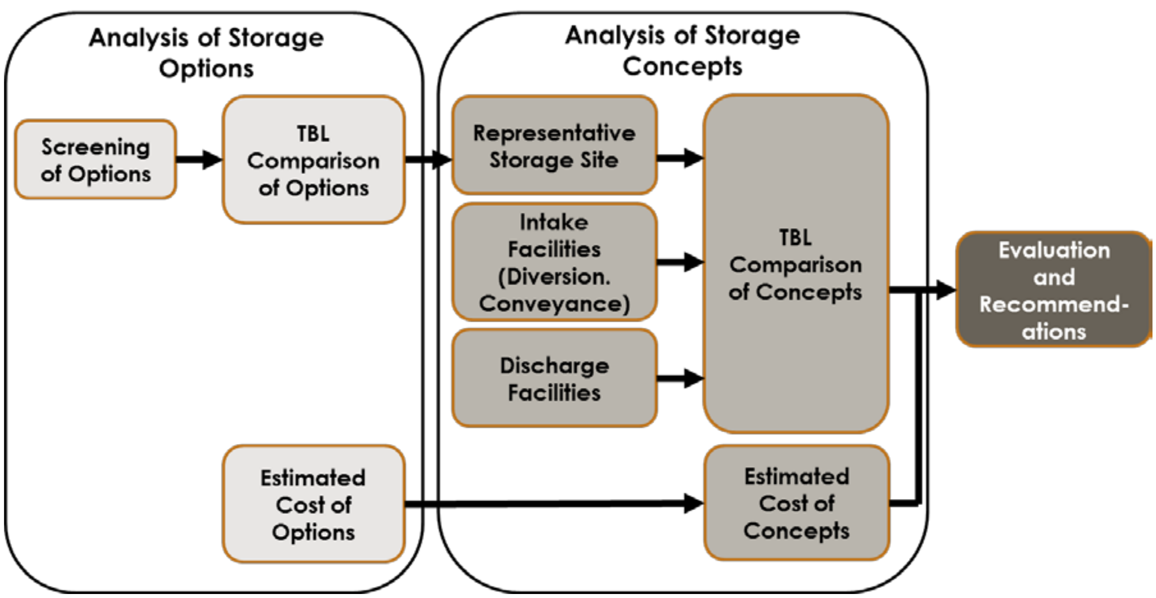

Figure 1-3. SPSS Storage Evaluation Process Overview

The long-list of possible storage sites in the SPSS study area was screened to identify those with the most potential for incorporating into SPSS storage concepts. Storage options not selected for use in creating storage concepts are not necessarily infeasible or inferior, depending on the particular application, and should be retained for consideration in any future studies. The storage site screening process is summarized in **Figure 1-4**. Surface and aquifer storage options remaining after the screening process are shown in **Figure 1-5**.

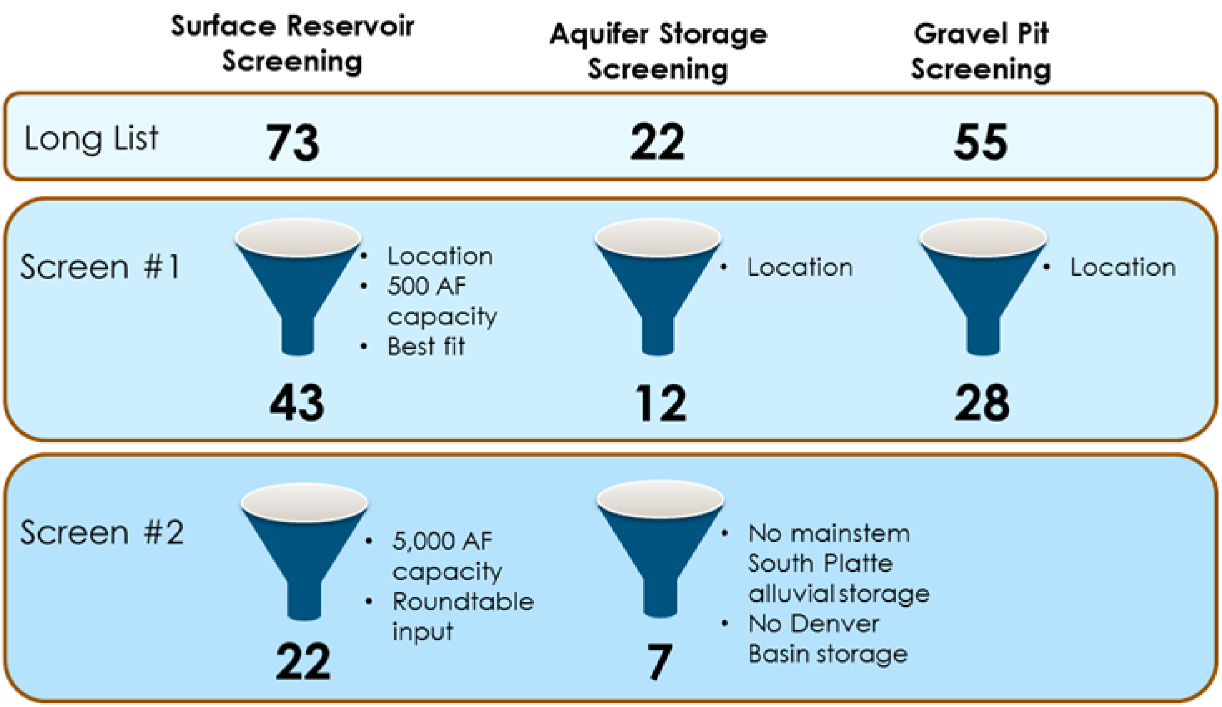

Figure 1-4. Summary of Storage Site Screening Process

Storage options were evaluated for 25 technical, environmental and social criteria based on available information on the sites and experience of the project team. Using this triple bottom line (TBL) type of evaluation process usually involves weighting categories of criteria in different ways to explore different value systems of stakeholder groups. For this study three criteria weighting scenarios were tested: equal weights, higher weighted technical criteria, and higher weighted environmental criteria. Most storage options ranked similarly regardless of the weighting scenario. **Table 1-3** lists the average of the scores under the three weighting scenarios. Because storage categories have different characteristics in terms of how they would be developed and operated, it is appropriate to compare sites within categories but not necessarily between categories.

Current cost estimates for surface storage options were developed based primarily on past studies supplemented by additional work by the consultant team. Costs were expressed in 2017 dollars and include permitting, design, land acquisition, and construction, with an accuracy of -50% to +100%. Results are summarized in **Table 1-3**. Costs were not estimated for certain storage options that were not included in storage concepts described later in this report.

Aquifer storage concepts were assumed to be supplemental supply projects that would either work in conjunction with a surface reservoir or be smaller stand-alone projects. To standardize the comparative analysis they were assumed to have infiltration basins with 5,000 ac-ft/month (82 cfs) capacity for recharge and extraction wellfields with 4,000 ac-ft/month (65 cfs) capacity for recovery.

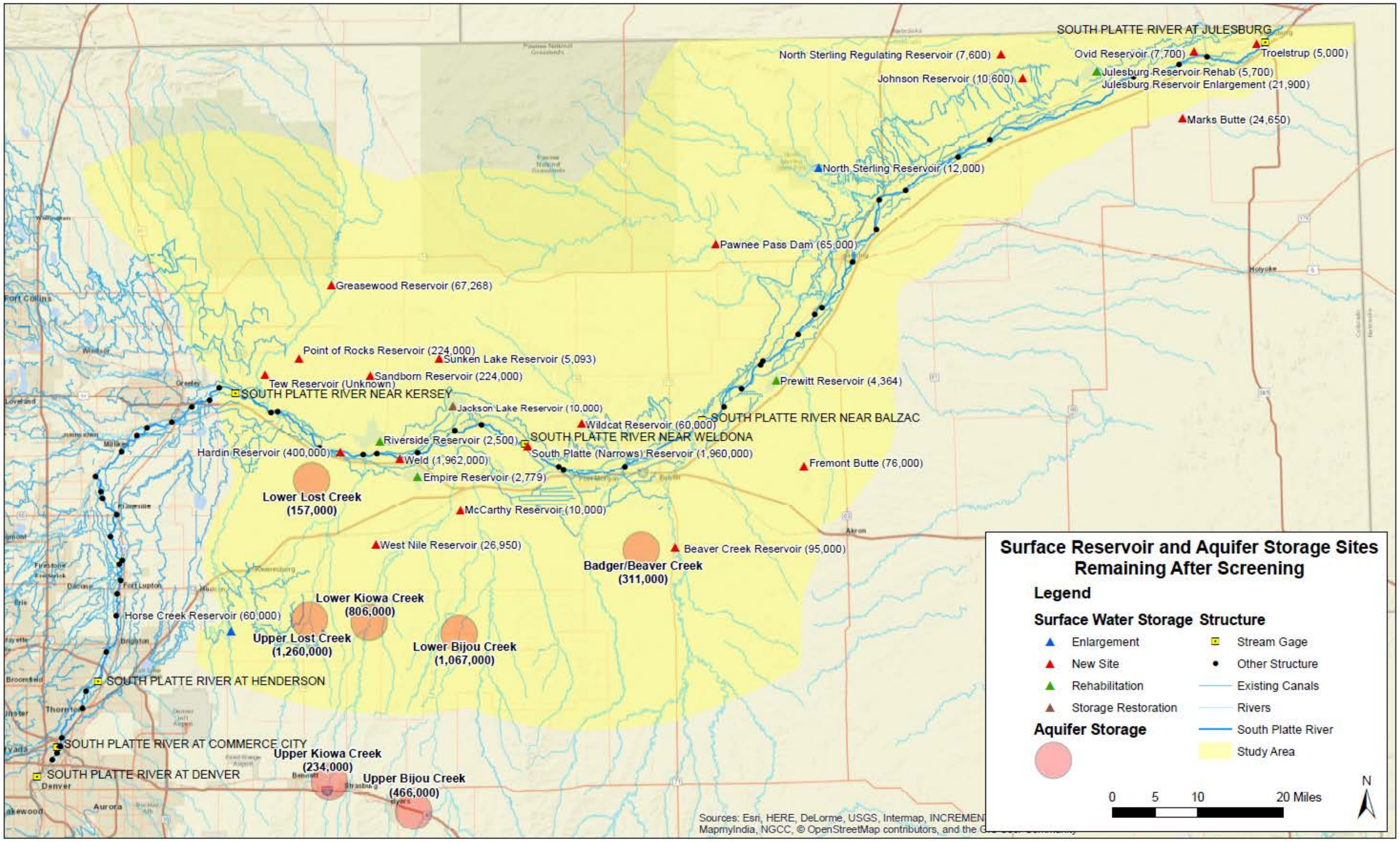

Figure 1-5. Surface Reservoir and Aquifer Storage Sites Remaining After Screening

Table 1-3. Storage Option Costs and Scores

Storage Type/Name	Storage Capacity (ac-ft)	Estimated 2017 Cost ($ million)	Unit Cost ($/ac-ft)	Average of Scores for 3 Weighting Scenarios (1)
New Site - Mainstem				
South Platte (Narrows) Reservoir	1,960,000	$145	$74	11.2
Hardin Reservoir	400,000	-	-	8.7
New Site – Off Chann				
Sandborn Reservoir	224,000	$131	$580	11.0
West Nile Reservoir	26,950	$59	$2,100	8.5
McCarthy Reservoir	10,000	$27	$2,500	9.3
Wildcat Reservoir	60,000	$79	$1,300	14.3
Pawnee Pass Dam	75,000	$254	$3,400	10.7
Fremont Butte Reservoir	76,000	$74	$980	11.2
North Sterling Regulating Reservoir	7,600	$38	$5,000	11.7
Johnson Reservoir	10,600	$24	$2,300	11.7
Ovid Reservoir	7,700	$24	$3,100	10.8
Troelstrup Reservoir	5,000	$19	$3,700	10.8
Beaver Creek Reservoir	95,000	$66	$690	13.2
Point of Rocks Reservoir	224,000	-	-	13.5
Sunken Lake Reservoir	5,100	-	-	10.2
Greasewood Reservoir	67,300	-	-	9.8
Enlargement				
North Sterling Reservoir Enlargement	12,000	$22	$1,800	11.7
Julesburg Reservoir Enlargement	21,900	$44	$2,000	13.7
Rehabilitation				
Empire Reservoir Rehab	2,779	$14	$5,000	16.0
Prewitt Reservoir Rehab	4,364	$5.5	$1,300	14.3
Julesburg Reservoir Rehab	5,700	$31	$5,400	17.8
Jackson Lake Reservoir Rehab	10,000	$37	$3,700	15.2
Riverside Reservoir Rehab	2,500	$13	$5,200	16.0

Storage Type/Name	Storage Capacity (ac-ft)	Estimated 2017 Cost ($ million)	Unit Cost ($/ac-ft)	Average of Scores for 3 Weighting Scenarios (1)
Aquifer Storage				
Lower Lost Creek Basin	157,000	$39	N/A(2)	19.2
Upper Lost Creek Basin	1,260,000	$39	N/A(2)	16.7
Lower Bijou Creek Basin	1,067,000	$39	N/A(2)	17.5
Upper Bijou Creek Basin	466,000	$39	N/A(2)	13.5
Lower Kiowa Creek Basin	806,000	$39	N/A(2)	16.0
Upper Kiowa Creek Basin	234,000	$39	N/A(2)	13.5
Badger/Beaver Creek Basin	311,000	$39	N/A(2)	15.8

(1) Range of possible scores is 0 – 34.
(2) Not applicable. Cost is a function of recharge and extraction hydraulic capacities, not storage capacity.

1.9 STORAGE CONCEPTS

Storage concepts were organized based on the reach of the lower South Platte River in which a storage project would be located, the reach from which water would be diverted, and whether storage would be achieved in a surface reservoir or groundwater basin. Storage concepts consisted of a specific storage option, an approach to capture water from the South Platte River, and an approach to deliver water to meet demands. While hundreds of possible storage concepts could be envisioned in the lower South Platte Basin, eight representative storage concepts were selected to investigate the range of practical storage projects in the region.

Each storage concept was simulated using a MODSIM water resources model developed for this project. To simplify the analysis and focus on differences due to storage options, surface storage concepts had the following consistent features:

- A representative storage option at the maximum physical capacity.
- New dedicated 800 cfs (520 mgd) river diversion with 10,000 ac-ft gravel pit for regulating storage. Although existing irrigation canals could be used to assist in filling some storage options, a detailed analysis of this opportunity was outside the SPSS scope.
- 400 cfs (260 mgd) bi-directional conveyance from intake to storage.
- Release back to river in the bi-directional pipeline to meet downstream demands or exchange to Kersey demand location.
- 150 cfs (100 mgd) conveyance to the Brighton area to meet demands in the Denver metro area.

ASR concepts were limited to a combined inflow rate of 82 cfs (54 mgd) based on the assumed recharge capacity and an outflow rate of 65 cfs (43 mgd) based on the assumed recovery wellfield capacity. All storage concepts were simulated to release water from storage to meet demands as follows.

- First, release to the South Platter River to meet downstream demands.
- Second, exchange to Kersey to meet northern Front Range demands.
- Third, pump to Brighton to meet Denver metro area demands.

No attempt was made in this study to optimize infrastructure or operational assumptions for any of the concepts. The new MODSIM model was used to estimate the firm yield for the eight selected storage concepts. Table 1-4 provides a short description of each storage concept, and the annual firm yield (yield that can be delivered every year) with and without a pipeline to Brighton. This pipeline is an expensive component of any solution so firm yield with and without this component was computed.

Table 1-4. Storage Concept Annual Yield for Maximum Capacity of Representative Storage Sites

Storage Concept	Representative Storage Site(s)	Diversion Reach	Limiting Capacity	Annual Firm Yield with Pipeline to Brighton (ac-ft/yr)	Annual Firm Yield without Pipeline to Brighton (ac-ft/yr)
Surface Reservoir Concepts					
Mainstem Storage	South Platte (Narrows)	Greeley-Weldona	1,960,000 ac-ft	62,000	47,000
Upper Basin Storage	Sandborn	Greeley-Weldona	224,000 ac-ft	22,000	20,000
Mid Basin Storage North	Wildcat	Weldona-Balzac	60,000 ac-ft	9,000	7,000
Mid Basin Storage South	Beaver Creek	Weldona-Balzac	95,000 ac-ft	11,000	8,000
Lower Basin Storage	Julesburg, Ovid, Troelstrup	Balzac-Julesburg	40,300 ac-ft	24,000	24,000
Existing Reservoir Improvements	Riverside, Jackson, Prewitt, Julesburg, North Sterling	Greeley-Weldona Weldona-Balzac Balzac-Julesburg	56,464 ac-ft	17,000	15,000
Aquifer Storage Concepts					
Groundwater Basin Storage West – Recharge Limited	Lower Lost Creek Aquifer	Greeley-Weldona	5,000 ac-ft/month recharge	8,400	8,400
Groundwater Basin Storage East – Recharge Limited	Beaver/Badger Aquifer	Weldona-Balzac	5,000 ac-ft/month recharge	8,000	8,000

Similar to the evaluation of storage options, storage concepts were evaluated for 20 TBL criteria based largely on the criteria listed in HB16-1256, and total costs for all components included in the concepts. Table 1-5 summarizes storage concept costs and TBL scores. Cost estimates include the following assumptions:

- No water treatment costs are included for water delivered to the Brighton or Kersey demand nodes for M&I use.
- Additional infrastructure needed to convey water from Brighton or Kersey to ultimate project beneficiaries is not included.
- All concepts only make use of new diversion structures and intakes. Any potential for use of existing irrigation canals is not considered.
- All concepts include an expensive pipeline and pumping system to Brighton in order to maximize the yield and allow for an even comparison of storage options. Eliminating the pipeline reduces firm yield by 0 to 15,000 ac-ft/yr, and reduces total storage concept cost by $280M - $780M.

Table 1-5. Summary of Storage Concept Costs for Maximum Representative Storage Sites

Storage Concept (Representative Sites)	Storage Capacity (ac-ft)	Storage Cost ($M)	Intake System Cost ($M) (Diversion, Gravel Pits, Pipes, Pump)	Delivery System Cost ($M) (Pipe to Brighton, Kersey Gravel Pits)	Total Storage Concept Cost ($M)	Total Unit Cost ($/AFY Firm Yield)	TBL Score (Range: 0-20)
Surface Reservoir Concepts							
Mainstem Dam (Narrows)	1,960,000	$145	$0	$380	$525	$8,500	11.5
Upper Basin Storage (Sandborn)	224,000	$131	$168	$322	$621	$28,000	12
Mid Basin Storage North (Wildcat)	60,000	$79	$141	$433	$652	$72,000	11
Mid Basin Storage South (Beaver)	95,000	$66	$407	$437	910	$83,000	11
Existing Reservoirs (Riverside, Jackson, Prewitt, Julesburg, North Sterling)	40,300	$121	$221	$322	$662	$39,000	10
Lower Basin Storage (Julesburg, Ovid, Troelstrup)	56,464	$118	$92	$826	$1,037	$43,000	8
Aquifer Storage Concepts							
Groundwater Storage West (Lost Creek) – Recharge Limited	157,000	$39	$238	$158	$435	$52,000	12
Groundwater Storage East (Badger/Beaver) – Recharge Limited	311,000	$39	$160	$270	$469	$59,000	10.5

1.10 CONCLUSIONS AND RECOMMENDATIONS

1.10.1. Conclusions

1.10.1.1 Available Water, Demand and Water Quality

The following conclusions relate to available water in the SPSS study area.

1. A large supply of water is available for beneficial use in the lower South Platte Basin. Between 1996 and 2015, an annual median of approximately 293,000 ac-ft/yr of water was delivered to Nebraska in excess of the South Platte Compact. Excess available water varied between 10,000 ac-ft/yr and 1,904,000 ac-ft/yr over this period.
2. Under future conditions, average annual water available for diversion to a new storage project would vary from approximately 214,000 ac-ft/yr at Kersey to 332,000 ac-ft/yr at Julesburg. Median annual available water would vary from approximately 116,000 ac-ft/yr at Kersey to 232,000 ac-ft/yr at Julesburg, highlighting the influence of a few high runoff years on streamflow statistics in the South Platte Basin.
3. Annual streamflows in the study area are characterized by a few very high flow years. A large mainstem dam or several off-stream dams with large diversion structures would be required to capture a large portion of the available streamflow.
4. Available water at Kersey is much less than at Julesburg due to return flows in the lower basin. A large lower basin reservoir(s) would be required as part of a storage scheme to capture a large portion of available flow upstream of the state line.
5. Because the vast majority of storage options are located off the main South Platte River channel, physically available water is constrained by the diversion capacity and the capacity of conveyance facilities from the river to the storage reservoir. Large diversion and conveyance structures would be needed to capture and convey water from the river to off-channel storage. At the Balzac gage near the middle of the SPSS study area, a diversion capacity of 550 cfs would be needed to capture 85 percent of the available water.
6. Future water shortages in the lower South Platte Basin based on the water supply gap estimated in SWSI 2010 are significant, and exceed the estimated available water in the future. Annual municipal and agricultural demands that could potentially be served by water from a SPSS storage project total over 502,000 ac-ft/yr for the Denver Metro Area, the Northern Front Range Region, and the lower South Platte basin below Greeley.
7. Water quality throughout the SPSS study area is adequate for agricultural use but would require advanced water treatment for direct municipal use.

1.10.1.2 Storage Options and Concepts

Conclusions related to the SPSS analysis of storage opportunities in the lower South Platte Basin are summarized as follows.

1. Many off-channel storage options are feasible and can be combined in a wide variety of water supply concepts.
2. Firm yields of 9,000 ac-ft/yr to 62,000 ac-ft/yr were estimated for the representative storage concepts analyzed for this study.
3. Capital costs for storage concepts range from $7,400 to $78,200/ac-ft/yr, exclusive of treatment costs, with a pipeline to Brighton. Without the pipeline to Brighton the concept costs range from $3,300 to $47,000/ac-ft/yr exclusive of treatment costs. The upper end of this range greatly exceeds the cost of recent water development projects in Colorado.
4. Not surprisingly, a large mainstem reservoir has the best performance in terms of putting the state's water to beneficial use. However, permitting obstacles may be insurmountable.
5. Aquifer storage projects are more limited by recharge and recovery rates rather than storage volume. Typical aquifer storage projects are designed as supplemental supply sources, not as projects to recharge large volumes of water diverted during peak spring snowmelt periods. This results in lower firm yield, and does not attempt maximize use of potential storage capacity as occurs with surface reservoirs. However, a related benefit is that aquifer storage projects are relatively low cost and can be scaled up over time (not constructed all at once). These unique characteristics make aquifer storage projects difficult to compare to surface water storage projects.
6. Storage options lower in the basin tend to be more efficient (better storage:yield ratio) because there is more water available. However they are further from the main demand centers.
7. Combinations of storage options working conjunctively can provide significantly more benefit than individual options. A combination of upper basin and lower basin storage concepts rivals the large mainstem dam option for firm yield benefits. However, there will be reduction in efficiency as the number of projects goes up, and even with multiple storage project a large amount of available water would leave Colorado.
8. No feasible storage concepts or reasonable combinations of concepts are capable of putting all the available flow in the lower South Platte River to beneficial use. This is shown in **Table 1-6**. Therefore as a general principle, more storage will always be "better" in this region in terms of maximizing available supply for basin water users.

Table 1-6. Water Leaving the State under Future Hydrology for Simulated Storage Concepts

Storage Concept	Median Annual Water Leaving State (ac-ft)	Percentage of Available Water Contributing to Beneficial Use (1)
No Storage	249,000	-
Mainstem Storage	150,000	51%
Upper Basin Storage	210,000	19%
Mid Basin Storage North	196,000	21%
Mid Basin Storage South	192,000	22%
Lower Basin Storage	78,000	44%
Existing Reservoir Improvements	100,000	50%
Groundwater Basin Storage West	213,000(2)	18%
Groundwater Basin Storage East	196,000(2)	21%

(1) Includes evaporation losses and other losses which would not be beneficial uses
(2) Assumes maximum size to capture peak spring runoff. Actual projects would be smaller and leave more water at the state line.

9. Because nearly all concepts require off-channel storage and diversion from the South Platte River, intake capacity constraints can be important and there are benefits to having multiple off-channel storage projects to minimize the effects of these constraints.
10. Enlargements and rehabilitations of existing reservoirs tend to score higher than new reservoirs in the multi-criteria ranking process.
11. Triple bottom line scores for the storage sites analyzed in this study were fairly similar at this level of analysis without specific information on how the sites would be used in a water supply strategy; thus the triple bottom line scoring process should not be used to eliminate options at this time.
12. Any of the storage concepts could be candidates for further study in the future under the right circumstances. However, concepts with more storage higher in the basin generally offer a greater potential for benefits and could be more attractive to a broader variety of potential participants.
13. Multiple large storage projects, including one low in the basin, would be required to capture a substantial amount of the available water above the state line.
14. Even a combination of conjunctively operated storage projects would not be capable of addressing the majority of the combined overall M&I and agricultural water supply gaps in the South Platte Basin.

1.10.2. Recommendations

The SPSS team developed the following recommendations for future work.

1. Better estimates of future hydrology should be developed to refine the anticipated available water under future basin operations. Completion of the South Platte Decision Support System would facilitate further hydrologic and operational studies.
2. Exchanges will be important to making storage work cost effectively for many applications. A more robust method of estimating future exchange potential may be needed to refine this important aspect of the analysis.
3. Site-specific and owner-specific analyses will be needed when particular project opportunities are identified in the future. The work in the SPSS is a starting point for more specific alternative investigations, but substantial additional analysis will be required to test the feasibility of specific storage options based on points of diversion, intake systems, and methods of operating to meet demands.
4. Aquifer storage and recovery projects will require site specific aquifer characterization and pilot testing. Pilot testing and preliminary design can begin at a relatively low cost due to the scalability of ASR systems.
5. Using existing irrigation canals to fill storage sites could significantly reduce infrastructure costs for some concepts. Partnerships with irrigation companies and available canal capacities should be investigated further.
6. Cooperative storage projects with multiple users, multiple components and multiple purposes would have the best chance of success. The state, Roundtables and water users should continue to explore opportunities for cooperative multi-use storage projects in the lower South Platte Basin.
7. Gravel pit storage opportunities were not considered in detail in this study. Gravel pits have been used extensively for storage along the South Platte River upstream of Greeley. An investigation of gravel pit storage opportunities downstream of Greeley may be warranted.
8. Use of water from SPSS storage projects directly for M&I use would require advanced water treatment. Recharge into aquifer storage would also require treatment. Additional investigation is required into the feasibility of available advanced treatment processes on water quality from the study area, particularly in the further downstream reaches of the South Platte River.
9. Investigation is warranted into how storage could support future implementation of alternative transfer method (ATM) projects per recommendations in the South Platte Basin Implementation Plan. Most or even all ATM project would need storage to increase yield and project efficiency. Investigation is needed into how new storage projects could be utilized in combination with ATMs to efficiently store and deliver available water as well as water provided from ATM projects. This combination could potentially make both new storage and ATM projects more feasible and help meet the water supply gaps in the basin.
10. Future storage projects would have an impact on Colorado’s water obligation to the PRRIP. Membership in SPWAP in addition to coordination with the State of

Colorado and SPWAP would be necessary to comply with all PRRIP mitigation requirements for new South Platte water storage projects. Further investigation into SPWRAP effects of new storage projects is recommended.

11. This study did not simulate conjunctive operation of a large surface storage project with an ASR project. Benefits of conjunctive use should be investigated.
12. This study did not evaluate potential supplies or storage opportunities upstream of Kersey on the South Platte River or Poudre River. Extending the water availability study and the investigation of potential storage options upstream of Kersey on the South Platte River and Cache la Poudre River should be considered.