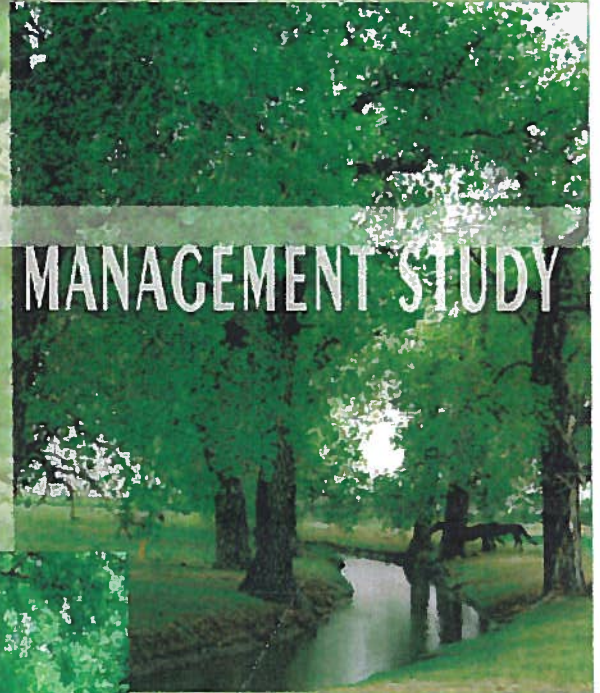


# HIGH LINE CANAL

HIGH LINE CANAL

FUTURE MANAGEMENT STUDY



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## ACKNOWLEDGEMENTS

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### High Line Canal Partners

Adams County	Denver Water
Arapaho County	Douglas County
Aurora Parks and Open Space	Greenwood Village
Cherry Hills Village	High Line Canal Preservation Association
Colorado Division of Wildlife	City of Littleton
Colorado State Parks	Highlands Ranch Metro Districts
Denver Parks and Recreation	South Suburban Parks and Recreation District
Urban Drainage and Flood Control District	

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PART 1: EXECUTIVE SUMMARY

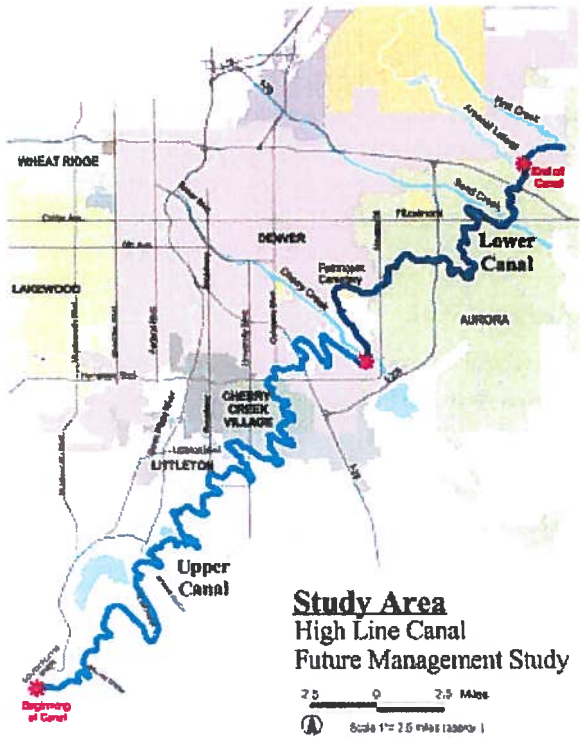


Figure 1 The study area included the entire length of the Canal from the headgate at the South Platte River to the Arsenal Lateral. An abandoned section of the canal from the Arsenal lateral east to First Creek was briefly studied to determine the feasibility of re-establishing water in this canal section.

Why the Study?

The High Line Canal Future Management Plan Study was undertaken to preserve a great open space and recreational resource--The High Line Canal (HLC). Change is coming to the Canal in 2010, when Denver Water, for purposes of water conservation, ceases to use the lower 22 miles of the 66-mile canal for water distribution (see Figure 1). Concerned agencies teamed together to form the High Line Canal Partners, a group that is committed to preserving the High Line Canal corridor as the important regional resource that it is. The Partners successfully received grant funding, mobilized their membership for matching contributions, and donated hours of their time to make this study a reality. This study is only the first of many steps to be taken to fully secure the future of the Canal.

Why change the Canal?

Built over a hundred years ago in 1879, the Canal was part of a grand scheme to irrigate the dry plains around Denver. Despite its unreliable water supply due to rather junior water rights, the Canal continues to deliver irrigation water, and currently has 67 water customers along its length. Of these water users:

- 62 customers are along the Upper Canal, between the South Platte River and Cherry Creek;
- 5 water users take water along the Lower Canal, between Cherry Creek and the Arsenal Lateral;
- The largest, the Rocky Mountain Arsenal National Wildlife Refuge ("The Arsenal"), has contracted with Denver Water to use reuse water instead of Highline Canal water for its irrigation water supply.



Historic photo of canal construction. Due to its relatively junior water right, the Canal never met the expectations of canal developers and farmers.

**The Canal and Water Conservation**

Denver Water, under a mandate from its board to implement water conservation measures since the 1990s, has scrutinized its own system for potential water savings. With the Arsenal going off of Canal water, attention turned to the High Line Canal for potential water savings. Approximately sixty percent of the water diverted into the Canal seeps into the ground or evaporates before reaching the customers at the end of the Canal. By removing the Rocky Mountain Arsenal and other users from the end of the Canal, water will be saved and stored in Denver Water’s reservoirs for use during droughts. The firm annual yield from these savings is about 2500 acre-feet, enough to supply the needs of about 5000 typical households for a year. Based on this potential savings, Denver Water decided that beginning in 2010, when the Arsenal switched over to its new supply—the High Line Canal would cease to deliver water below Cherry Creek through the Canal.

**The Canal as Regional Park**

Since the 1970’s five recreation management agencies have made agreements with Denver Water to provide and manage recreational facilities along the corridor. They are:

- City of Aurora Parks and Open Space Department;
- City of Denver Department of Parks and Recreation;
- South Suburban Parks and Recreation District;
- Highlands Ranch Metro Districts; and
- Douglas County.

These agencies oversee a network of over sixty miles of continuous trails connecting parks, neighborhoods and cities, making this a truly regional open space. While Denver Water continues to manage and operate the Canal for water delivery, the five managing agencies provide all maintenance and capital improvements for the recreational facilities along the corridor. Denver Water maintains ultimate authority over the corridor and maintains oversight of all operations to assure that the water delivery function is not impaired or impeded.

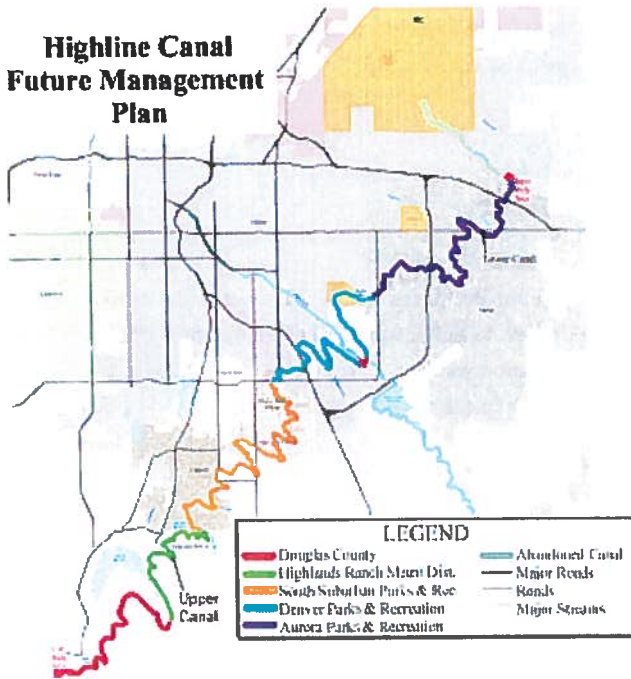


Figure 2 The Canal is managed by five different agencies, as shown in this plan.



The Canal corridor has become one of the most important open space and recreation facilities in the Denver metropolitan area.

### The High Line Canal Partners

Significant concerns were raised after Denver Water's announcement to stop using the Lower Canal. The fifteen agencies and citizens groups that formed the High Line Canal Partners decided to find a way to preserve this exceptional resource. The group successfully obtained a grant from Great Outdoors Colorado (GOCO) and has provided the matching funding to enable this study to become a reality. With the completion of this study, the Partners will continue to be the force that drives the implementation of the strategies and recommendations that will make the High Line Future Management Plan a reality.

#### HIGH LINE CANAL PARTNERS

- Adams County
- Arapaho County
- Aurora Parks and Open Space
- Cherry Hills Village
- Colorado Division of Wildlife
- Colorado State Parks
- Denver Parks and Recreation
- Urban Drainage and Flood Control District
- Denver Water
- Douglas County
- Greenwood Village
- High Line Canal Preservation Association
- City of Littleton
- Highlands Ranch Metro Districts
- South Suburban Parks and Recreation District

### The High Line Canal Future Management Study Goals

The overarching goal of the study is to identify strategies to preserve the Canal as a regional recreational resource. Other goals identified in the GOCO grant application study are:

- Provide a seamless transition from a water-carrying Canal to a recreational corridor from the perspective of the recreational user by maintaining the character of the canal and providing for an equivalent level of access, maintenance, safety, and amenities.
- Fully investigate all available options to provide the most effective and feasible method for water delivery from the headgate at Waterton Canyon to the Rocky Mountain Arsenal Lateral in a manner similar to the existing conditions in terms of support for vegetation and appearance.
- Fully investigate all available options to provide for the most effective method for ownership and management for the Canal.
- Provide a forum for all affected agencies and involved organizations to express their needs and desires for the Canal.
- Determine the most cost-effective options that minimize institutional impacts in selecting alternatives for implementation.
- Provide a mechanism to record agreement and seek formal adoption by all underlying jurisdictions and project partners.
- Provide for dissemination of public information throughout the project to assure canal users, neighbors and managers that their issues and concerns are being addressed.

The desired outcome of the study is to develop strategies to accomplish the management and water supply goals specified above with clearly articulated implementation steps to guide the process after the completion of the study process.



## Recommendations Summary

The study's recommendations propose a future Canal that:

- Is permanently dedicated to open space;
- Has multi-jurisdictional oversight but significant local control;
- Has sufficient water to maintain the trees, with opportunities for additional water through efficient use of existing water resources.

The recommendations are organized by the project goals of Management and Water Supply.

### Management Recommendations

In the context of the change proposed for the Lower Canal, the management sub-committee concerned itself with issues of:

- Ownership (for Lower Canal only);
- Management structure for the entire canal corridor; and
- Preservation of the Canal for recreation and open space.

The committee developed three alternatives for consideration. The alternatives' key differences lay mainly in the degree of centralized control vs. local control proposed by each. The following recommendations were developed from the preferred alternative, which combined a centralized oversight committee to insure regional continuity for the canal with local control of maintenance and operations decisions. These recommendations propose a two-part management structure, consisting of a deed restriction to oversee critical issues that should be established in perpetuity and an Intergovernmental Agreement (IGA) to provide more flexible oversight of important, but less critical, issues. Items not specified within the deed restriction or the IGA are to be the discretion of local jurisdictions.

**Recommendation 1.** Deed Restriction (Ownership). The Canal property in the Lower Canal reach (downstream of Cherry Creek) will be turned over to the underlying jurisdiction. This includes Denver, Aurora, and possibly Arapahoe County. The property transfer will require acceptance of a deed restriction that will impose the following limitations:

- Preservation of the property for recreation and natural resources;
- Preservation of existing public access to the Canal; and
- Adherence to the IGA (see below).

**Recommendation 2.** IGA (On-going management). Simultaneous with property transfer, all entities that have ownership, water management or recreation management responsibilities for the Canal will sign an IGA governing on-going use. The IGA will provide both a governance structure and guidelines for on-going use.

### **Governance Structure (IGA Board)**

Representatives from Denver Water and each of the recreation management agencies will make up an IGA Board to administer the agreement. Each member will have an equal vote. The board will have jurisdiction over the issues listed below. However, Denver Water will retain veto power over water conveyance and recreational issues affecting water conveyance in sections it owns; the City of Denver and City of Aurora, and possibly Arapahoe County will assume this authority in sections where they take ownership.

**PROPOSED IGA BOARD MEMBERS**

- City of Aurora
- City of Denver
- Denver Water
- Douglas County
- Highlands Ranch Metro Districts
- South Suburban Parks and Recreation
- Colorado State Parks (Ex officio member).
- Arapahoe County and Greenwood Village may become members depending on the status of management agreements for the canal.

**IGA purview (Operational guidelines).** The IGA board will oversee the following High Line Canal issues:

- Maintenance of a minimum trail width of eight feet;
- Preservation of the Canal corridor and historic trail designation;
- Coordination of responsibility for events crossing jurisdictional lines;
- Maintenance of multiple uses, including pedestrian activities, bicycling and equestrian use where appropriate;
- Adherence to minimum maintenance standards to preserve public health and safety;
- Prohibition of motorized vehicles along Canal, with the exceptions of patrol, maintenance, emergency service and accommodations for people with disabilities;
- Preservation of the Canal trail's continuity;
- Maintenance of public access to existing Canal crossings that are currently open to the public; and
- All road crossings will require approval of the IGA board.

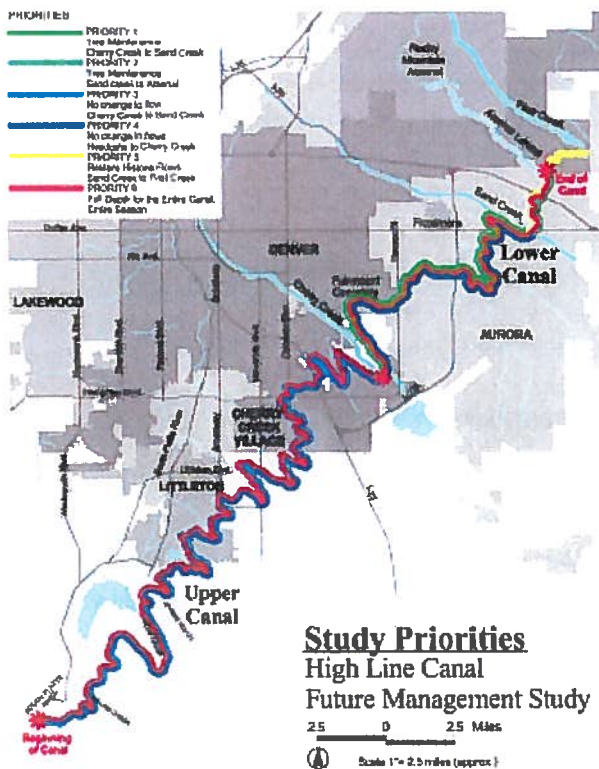


Figure 3 The plan shows the 6 priorities identified by the water supply sub-committee for the water supply component of the study.

Water Supply Recommendations

Anticipating a scarcity of replacement water for the Lower Canal, the Water Sub-Committee developed six prioritized water supply goals, or priorities. The two highest priorities sought sufficient water to sustain the existing trees—between Cherry Creek and Sand Creek (Priority 1), and between Sand Creek and the Arsenal Lateral (Priority 2). (These priorities were based upon preliminary findings in a study of tree water needs, identified by a separate study that Denver Water has been sponsoring for the last 5 years. The study has been lead by tree experts from Colorado State University, researching 5 locations along the High Line Canal). Priorities 3,4, and 5 called for finding water to maintain current flows at various locations along the Canal. Priority 6, the lowest ranked priority, called for a full canal for the entire irrigation season, a significant enhancement to the current Canal flows.

There were no easy answers for finding replacement water. Water supplies are expensive and difficult to find, with costs for the various priorities ranging from \$500,000 to \$225 million dollars. Only the highest ranked priorities were determined to be feasible. Most of the other priorities, at least as defined within this study, were deemed infeasible due to cost and/or availability of water, although partial attainment of several of these priorities remains a possibility. Following are the recommendations for water supply:

1. Accept the 4-week delivery of High Line Canal water offered by Denver Water, which will meet the irrigation needs of the trees from Cherry Creek to Sand Creek.
  - Water will be supplied at no cost to the Partners.
  - Flow will be 21 cubic feet/second (cfs) just below Cherry Creek - reduced from existing flow of 55 cfs.
  - Delivery schedule will be 2 weeks in the spring, 1 week in late summer, and 1 week in the fall if the HLC water right is in priority (i.e., water can legally be diverted into the Canal).
2. Change stormwater policy to allow historic stormwater inflows to continue discharging into the canal.
  - Stormwater can provide additional water to the trees.
  - Water quality of stormwater is improved by treatment/filtration in canal prior to discharge into drainageways .
  - Opportunities to manage existing tributary storm drainage currently flowing into the Canal need to be coordinated with regional drainage planning (by Urban Drainage and Flood Control District). New sources of storm drainage to be diverted into the Lower Canal that abide water rights statutes need to be investigated.
  - Any stormwater diverted into the Canal needs to be carefully metered to avoid overfilling the Canal and over topping, or causing canal damage. This limits the potential use of stormwater as a water supply.
3. Investigate selective lining of Canal along it's entire length, and other methods of reducing seepage. Use water saved by lining for Lower Canal water needs.
  - Lining may save approximately 2 acre-ft per 100 linear feet of lined canal.
  - Lining could be buried or applied in a manner that would not affect canal appearance.
  - Detailed field studies of canal lining need to be performed to determine methods and costs. Pursue possible research project with U.S. Bureau of Reclamation.
  - Lining upper reach could be a relatively low cost water supply for trees and aesthetics (per Priorities 1, 2 ,3, and 4) in lower reaches (water in Canal at Cherry Creek to continue north down canal).
  - Lining the lower reach will convey HLC water further down lower reaches.
4. Investigate the use of check dams to increase depth of water in Canal.
  - These low dams in the Canal will back up water behind them where water now flows freely, and could provide an appearance of a full canal with lower flows.
  - Detailed field studies need to be performed to verify feasibility, and to determine methods and costs.
  - This is a potential relatively low cost water supply alternative - increased depth without increased flow.
  - Potential problems of ponding, perceived mosquito problems, and silt deposition must be addressed prior to moving ahead with this recommendation.
5. Allow flow left in the Canal after servicing the Upper Canal ("tail water") to remain in the Canal downstream of Cherry Creek to provide water for the next reach of Canal. (It is Denver Water's intention, however, to minimize tail water to help achieve their efficiency goals for the Canal).
6. Investigate use of excess Aurora reuse water (early spring, late fall) as a drought protection supply to maintain trees in portions of the Lower Canal. (Re-use water to be last backup supply for Canal after stormwater.)



- State water laws prohibit diverting water into the Canal in dry years, and with sequential dry years it may be necessary to find emergency water supplies to maintain the health of the trees. Reuse water is a dependable supply in all types of hydrologic years, which can be pursued as an emergency supply if the High Line Canal water right and the stormwater sources are insufficient.
  - Aurora is planning a future plant on Sand Creek upstream of HLC that will greatly increase reuse water capacity.
  - Current treatment and delivery systems are available for delivery from Aurora's reuse water distribution system to HLC. Future distribution within the Canal corridor could include a sprinkler system.
7. Continue Colorado State University tree water needs study.
- Verify initial findings (requirement of four weeks of canal flow to maintain tree health).
  - Determine actual affects of watering 4 weeks per year.
  - Determine affects of different canal lining approaches on tree health.

### Implementation Summary

The recommendations laid out in this study are a significant first step toward achieving the goal of preserving the Canal. While challenges exist, each recommendation is very achievable. The first challenge, to continue the momentum generated by this study, has already been addressed by the High Line Canal Partners with a pledge from the Executive Committee to commit the staff and resources necessary to keep making progress towards achieving the recommendations that are identified in this report. The Executive Committee also agreed that:

- Denver Water staff will take the lead on organizing the High Line Canal Partners' efforts.
- Agreements between jurisdictions, as described below, will be drafted by staff from the signing agencies.

The following outlines the tasks to be performed to accomplish the study recommendations:

#### Management/Ownership Implementation tasks

1. An agreement between Arapahoe County and The City of Denver regarding future ownership of Lower Canal (below Cherry Creek) must be finalized to clarify ownership and maintenance responsibilities.
2. The deed restriction must be put in place, including:
  - Legal drafting of document;
  - Preliminary approval of deed restriction; and
  - Execution of property transfers to Denver, Aurora, and possibly Arapahoe County.
  - Approval /agreement by Denver Water.
3. The IGA must be developed and implemented, including:
  - Legal drafting of IGA;
  - Approval of IGA by policy makers; and
  - Members appointed to IGA board.

Water Supply Implementation Tasks

1. The City of Denver must designate an agency to take responsibility for operating and maintaining the water delivery component of the corridor.
2. Policy decisions regarding the application of a new water right as part of the replacement water supply need to be worked out between Denver Water and the Partners. Denver Water has indicated a preference to use the 1879 water right and make deliveries to the Lower Canal when a new water right would be in priority, rather than formally filing a new right with the State. In general, Denver Water is reluctant to dedicate the 1879 water right, or other river water for aesthetic uses in the Canal.
3. Canal lining and check dams need to be field-tested and designed. A plan identifying canal lining and check dam locations must be developed, and funding responsibilities need to be negotiated. If canal lining is a viable option, and water credits are allowed for the Lower Canal, a delivery agreement would need to be negotiated. Funding responsibilities for lining and check dams will also need to be determined.
4. Legal research and discussions with the State Engineer's Office must be conducted to evaluate the need to have a contract water user for the High Line Canal water below Cherry Creek, and beyond Sand Creek to accept deliveries of High Line Canal water diverted at the headgate.
5. Policy decisions regarding the flow of stormwater into the Canal need to be addressed at Denver Water and at Urban Drainage and Flood Control District to allow use of stormwater to irrigate trees and supplement canal flows while preserving the operational safety and integrity of the Canal.
6. Legal advice on stormwater that has historically entered the Canal should be sought to determine if the stormwater needs to be discharged at the next available stream crossing or if it can be carried in the Canal when the 1879 water right is in priority.
7. Legal advice on the use of tailwater from the Upper Canal at Cherry Creek should be sought to see if it can be delivered to a contract user in the Lower Canal.
8. A master plan for storm drainage outfalls into the Lower Canal needs to be completed. Investigate the feasibility of using reuse water from the City of Aurora as an emergency/drought water supply for maintaining the health of trees in portions of the Canal.

## PART 2: THE HIGH LINE CANAL TODAY / MANAGEMENT AND OPERATIONS

**Transformation of the Canal into a Multi-Use Corridor**

An appreciation of the evolution of the Canal over its history and an understanding of the current water delivery and recreation management provide a context for proposed changes in the corridor. Since its construction in 1879, the Canal has transformed from an agricultural ditch to the multi-use corridor that we so value today. Before 1968, recreational use of the Canal corridor was a violation of Denver Water policies. The recreational potential was evident to the cities and counties along the Canal, however, and in 1968 a commission including the City of Denver and other local governments began the planning effort that began to envision the High Line Canal as a large regional park. In 1970 both the South Suburban Parks and Recreation District and the City of Aurora entered into agreements with Denver Water for use of over 30 miles of the Canal for recreational purposes. In 1974, the City of Denver and Colorado State Parks followed suit and agreed to develop over 29 miles of trail.

**Current Status of Canal**Canal Water Delivery

Despite the development of the Canal into a regional open space, its current primary purpose is to convey water. All decisions regarding the management and operations of the Canal defer to this primary purpose. While the Lower Canal will likely be primarily devoted to recreation after the transfer of Canal property to the respective jurisdictions, the Upper Canal will remain a water delivery canal first and foremost, with recreational uses encouraged, but secondary to the water delivery purpose. An understanding of the water delivery function is important to both the future management scenarios and water supply plans for the Canal.



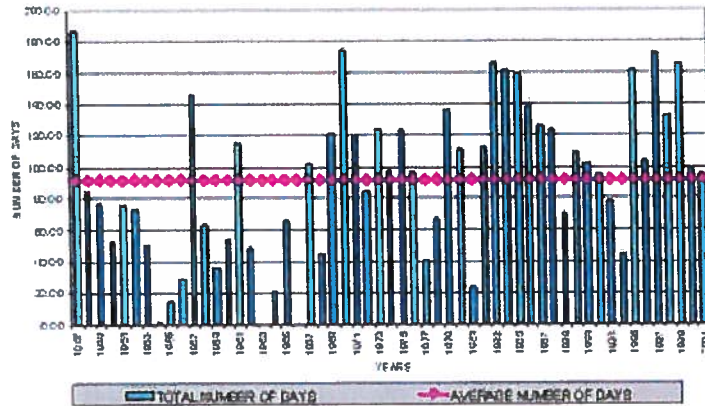
Most of the 66 mile long Canal corridor is owned by Denver Water. Denver Water has service agreements with its customers to provide irrigation water while the Canal's water right is in priority, and the Canal is flowing. Currently there are 67 water users along the entire Canal; 62 of these are along the Upper Canal, (southeast of Cherry Creek), and the remaining five are along the Lower Canal.

The Canal water right decree allows for a maximum of 600 cubic feet per second (cfs) of flow to be diverted into the Canal. Actual flow diverted into the Canal to service the water users has varied over the years from over 200 to 90 cfs. This is the flow that is diverted at the head-gate on the South Platte. As flows move down the Canal they grow considerably smaller due to user diversion, seepage and evaporation. On average, the flow in the Canal is approximately 2 feet deep. The average annual diversion into the High Line is 22,000 acre-feet. (An acre-foot is equal to 325,000 gallons, or 1 cubic foot per second flowing for 12 hours.)



As Figure 4 shows, in an average year the Canal flows water for 92 days a year. Of course reliability has been one of its challenges-the actual number of days of flow has varied from over 160 to 0. Denver Water diverts water into the Canal only when the Canal's water right is in priority-a determination made by the State Engineer's Office and completely out of Denver Water's control.

**Figure 4 HIGH LINE CANAL: NUMBER OF DAYS OF WATER FLOW BY YEAR 1947-2001**



Denver Water provides all staff and resources for the maintenance and operations of the Canal water operations. Over \$800,000 per year are devoted to canal operations and maintenance. The Canal operations are overseen by three ditch riders who monitor their segment everyday the Canal is in operation, and often when it is not. During the irrigation season they are on call 24 hours a day to take care of canal issues and emergencies (such as flooding dangers caused by sudden down-pours). Routine maintenance involves removing blockages to flow, such as tree limbs, shopping carts and vegetation. Denver Water's maintenance and operations responsibilities for water delivery include:

- Allocating and delivering the proper amounts of water to each customer's turnout along the Canal.
- Ensuring flow moves freely to user's turnouts and preventing course from meandering;
- Clearing the Canal of vegetation, trash and other obstructions;
- Maintaining vegetation (in cooperation with local entities) including tree trimming and removal on the side of the Canal opposite from the trail;
- Watering trees planted by Denver Water;
- Reviewing development and approval plans;
- Reviewing proposals for signs;
- Maintaining trash racks at culvert crossings;
- Managing easements;
- Establishing rules for use of the Canal; and
- Mowing and performing weed control of the Denver Water portion of the Canal.

The agencies and jurisdictions taking over the Lower Canal in the future will assume these responsibilities in addition to the recreational facility maintenance and operations that they currently

### Existing Recreation Management Framework

The five recreation management agencies that have lease agreements with Denver Water for the recreational use of the corridor oversee maintenance and operations of the trail and the associated recreational facilities along the corridor (parking lots, pedestrian bridges, trash receptacles, benches, etc.)

#### CURRENT AGENCIES WITH RECREATION LEASE AGREEMENTS

- City of Aurora
- City of Denver
- Douglas County
- Highlands Ranch Metro Districts
- South Suburban Parks and Recreation  
(South Suburban provides services for Littleton, Cherry Hills, Greenwood Village, Centennial, and Arapahoe County)

These agencies have 25-year leases with Denver Water to use and manage the corridor's park facilities. Each agency employs its own standards and procedures with general oversight by Denver Water. Policy issues and proposed modifications to the Canal (bridges, etc.) must be approved by Denver Water, and cannot impede the water delivery function.

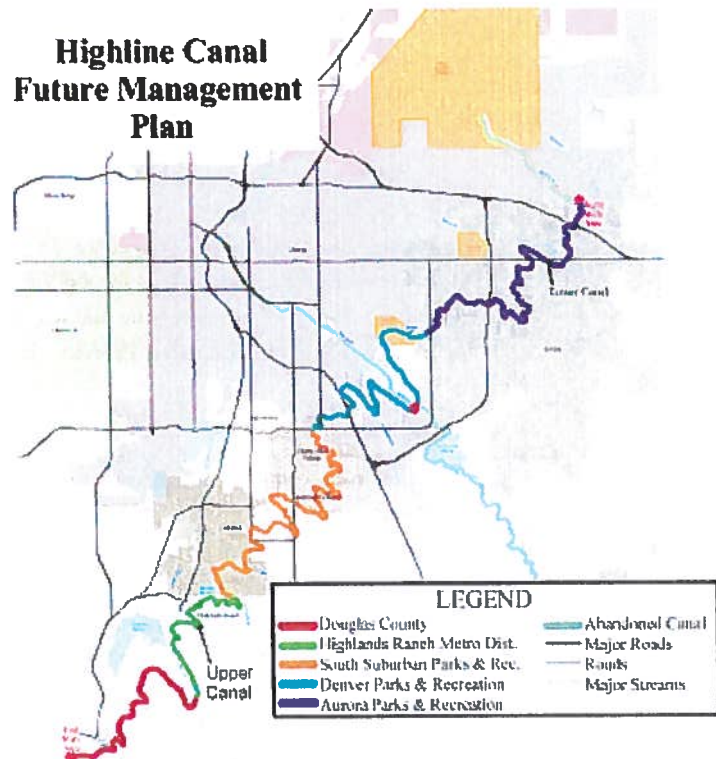


Figure 5 Five agencies manage the trail and recreational facilities along the Canal. These agencies hold a 25 year lease with Denver Water.

## PART 3: THE STUDY

### Project Team

The project team was an inclusive group of staff from the Partner agencies and consultant team. Due to the large number of agencies involved, the team was divided into a hierarchy of committees to guide the project process. Following is a description of the committees and their roles:

Coordinating Committee: Representatives from Denver Water and the five recreation management agencies defined the project scope, worked with the consultants to develop the project process, and enlisted the members for the technical sub-committees and the Executive Committee.

Technical Sub-Committees: Representatives of the Partner agencies worked with members of the consultant team on the Management Sub-Committee and the Water Supply Sub-Committee to research issues, develop alternatives, and propose recommendations to meet the project objectives. The technical sub-committees reported to the Executive Committee at key milestones.

Executive Committee: Key officials / decision-makers from each of the Partner agencies formed the Executive Committee. This committee met four times over the course of the project to monitor project process, and to weigh proposals and recommendations presented by the technical sub-committees. Final approval of the plan recommendations by the Executive Committee marked the beginning of the implementation stage of the project.

#### EXECUTIVE COMMITTEE MEMBERS

- Chair: Chips Barry/Denver Water
- Ron Benson/Douglas County
- Brad Buckner/Colorado State Parks
- Scott Hoover/Division. of Wildlife
- Cheryl Kuechenmeister/Greenwood Village
- Dave Lorenz/South Sub. Parks and Rec. Dist
- James Mejia/City of Denver Parks and Rec
- Ron Miller/City of Aurora
- Terry Nolan/Highlands Ranch Metro Districts
- Tina Scardina/Denver Parks and Rec.
- Scott Tucker/Urban Drainage & Flood Control
- Tom Waymire/High Line Canal Pres. Assoc.
- Jim Woods/City of Littleton

### Public Involvement

Press releases, a staffed information hot-line, a web site, and public meetings were used to engage the public in the project. Turnout for the first of two rounds of public meetings, held at the beginning of the study in January of 2001, was quite high, and confirmed the interest in preserving the Canal. Turnout for the second round of meetings held in May of 2002, in which the recommended management and water supply alternatives were presented, was lower, but still strong. The general message from these meetings was that the Canal is an extremely important resource to the communities it joins, and should be preserved as much as possible in its existing state. The public also voiced a strong desire to be kept informed about the status of the Canal, and the progress of efforts to find replacement water and establish the new ownership/management plan.



Public input into the process was also provided by the High Line Canal Preservation Association, an advocacy group for the High line Canal that is a member of the High line Canal Partners. This group was invited to all committee meetings, and was provided project materials and correspondence throughout the project.

### **GIS Mapping**

A detailed GIS inventory of the Canal was performed in association with this study. Trees, drainage structures, trail and other corridor elements were accurately located and used to create a GIS database. This database was used to create maps, and to aid analysis for this report. This resource will be extremely valuable for future management of the Canal. The GIS database is the property of Denver Water, and is available for review from the Denver Water GIS department .

## MANAGEMENT STUDY

### Management Study Process

The management study process was characterized by a high level of consensus among the participating agencies throughout the process. Very quickly the sub-committee was able to hone in on a general framework for management that met the goals of the participating agencies. Emphasis on the process was to create a plan of simple recommendations that would be easily adopted by the agencies involved. The management study stopped short of developing the detailed agreements and documents that will be required to finalized the proposed structure. These details are very important, and will be the focus of the implementation steps following this study.

The management sub-committee followed a methodology that analyzed the existing management system, identified the important issues of facility management, developed alternatives, and then refined the preferred alternative and developed recommendations for the management plan. The analysis employed questionnaires and interviews of Denver Water and the five recreation management agencies to evaluate the existing system and to identify potential issues with proposed management alternatives. The selection of the preferred alternative and the process of refining it into the proposed plan took place mostly through discussion in sub-committee meetings, and in presentations to the Executive Committee.

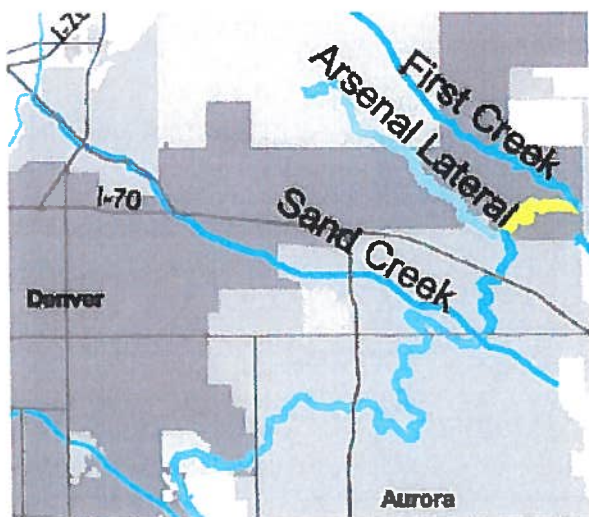


Figure 6. The section of the Canal between the Arsenal lateral and First Creek that has been lost to development of a golf course is an example of the potential problems of local control with no regional oversight.

### Range of Management Alternatives

The pivotal issue for the Canal management alternatives was centralized vs. local control. All other decisions regarding how the Canal is managed hinged on how and by whom Canal management decisions are made. The management sub-committee developed three alternatives (refer to Appendix A1), with two alternatives representing each side of the centralized control/local control continuum, and a third that combines elements of each. The combined option was selected for refinement into the proposed plan. The group found that the flexibility of local control and the relative permanence of an intergovernmental agreement with oversight over the regionally significant aspects of the corridor were elements that should be included in the plan. Following is a discussion of local control and centralized control, and their potential impacts on the corridor.

Arguments Supporting Centralized Control

- The Canal is a regional amenity whose value to the region depends on its continuity, and that a single, centralized agency should be responsible for making decisions regarding its future.
- A centralized agency would replicate Denver Water's control over the years. Without this regional presence, who will ensure that the new owners will not abandon the Canal, or other-wise negatively impact its regional value?
- An agency overseeing the entire Canal could provide the vision to make the Canal an even better amenity for the region.
- Water will continue to be delivered down the Canal to keep the trees healthy. A centralized agency would ensure that the Canal functions properly for water delivery so that downstream agencies are not negatively impacted by the negligence of upstream owners.

Arguments Supporting Local Control

- The existing system based on locally managed operations and maintenance of the Canal is very successful. Citizens know whom to call about problems and are able to deal with these issues on a local level. It is also efficient, taking advantage of existing maintenance departments whose staff and administrators are ideally suited to carry out the Canal maintenance responsibilities.
- Another layer of bureaucracy would stifle the effectiveness of Canal operations
- Colorado State Parks, the only existing agency considered acceptable to take on a centralized management role, is not interested. The creation of an entirely new agency whose sole purpose is to manage the Canal would likely be inefficient
- There would be a redundancy of agencies in the Upper Canal, where Denver Water would still own the Canal and oversee management of the corridor
- Developing a funding mechanism for a centralized agency would be complicated and politically very difficult to achieve
- Local control allows the local agency to tailor the improvements and maintenance to local preferences and standards.

**Management Recommendations**

The following recommendations were developed from the preferred alternative, which combined a centralized oversight committee to insure regional continuity for the Canal with local control of maintenance and operations decisions. These recommendations propose a two-part management structure, consisting of a deed restriction to oversee critical issues that should be established in perpetuity and an Intergovernmental Agreement (IGA) to provide more flexible oversight of important, but less critical, issues. Items not specified by the deed restriction or IGA are left to the discretion of the local jurisdictions.

Recommendation 1. Deed Restriction (Ownership). The Canal property in the Lower Canal reach (downstream of Cherry Creek) will be turned over to the underlying jurisdiction. This includes Denver, Aurora, and possibly Arapahoe County. The property transfer will require acceptance of a deed restriction that will impose the following limitations:

- Preservation of the property for recreation and natural resources;
- Preservation of existing public access to the Canal; and
- Adherence to the IGA (see below).

The limitations comprising the deed restriction are permanent. No mechanism for modifications is proposed.

Although no property transfer will occur in the Upper Canal, several of the Partners seek to have Denver Water commit to the same conditions of preservation and adherence to the IGA (with veto power regarding water delivery issues). Denver Water is strongly committed to the principles of the deed restriction, and will work with the Partners to develop an instrument that formalizes the commitment.

Recommendation 2. IGA (On-Going Management). Simultaneous with property transfer, all entities that have ownership, water management or recreation management responsibilities for the Canal will sign an IGA governing on-going use. The IGA will provide both a governance structure and guidelines for on-going use.

**Governance structure (IGA Board).** Representatives from Denver Water and each of the recreation management agencies will make up an IGA Board to administer the agreement. Each member will have an equal vote. The board will have jurisdiction over the issues listed below. However, Denver Water will retain veto power over water conveyance and recreational issues affecting water conveyance in sections it owns; the City of Denver and City of Aurora, and possibly Arapahoe County will assume this authority in sections where they take ownership. Colorado State Parks will participate as an ex officio (non-voting) member due to the importance of the trail connection through Chatfield State Park to the High Line Canal corridor.

#### PROPOSED IGA BOARD MEMBERS

- City of Aurora
- City of Denver
- Denver Water
- Douglas County
- Highlands Ranch Metro Districts
- South Suburban Parks and Recreation
- Colorado State Parks (ex officio member)
- Arapahoe County and Greenwood Village may become members depending on the status of management agreements for the canal.

**IGA purview (Operational guidelines).** The IGA board will oversee the following High Line Canal issues:

- Maintenance of a minimum trail width of eight feet;
- Preservation of the Canal corridor and historic trail designation;
- Coordination of responsibility for events crossing jurisdictional lines;
- Maintenance of multiple uses, including pedestrian activities and bicycling;
- Adherence to minimum maintenance standards to preserve public health and safety;
- Prohibition of motorized vehicles along Canal, with the exceptions of patrol, maintenance, emergency service and accommodations for people with disabilities;
- Preservation of the Canal trail's continuity;
- Maintenance of public access to existing Canal crossings that are currently open to the public; and
- All road crossings will require approval of the IGA board.

**IGA Amendments/Changes:** The intent of the IGA is to accommodate change if needed, but to make the process for change controlled and somewhat difficult. The IGA board may change the conditions above, or add new conditions by voting to amend the agreement. The specific policies for a successful vote (majority, two thirds majority, unanimity, etc.) have not been determined and will need to be formalized as part of the IGA document.

**IGA Board Meetings/Communication with Non-Member Partner Agencies:** The IGA board will meet once a year. In addition to the board members, the non-member High Line Canal Partner agencies will be invited. The meeting will also be open to the public. For purposes of coordination and agency cooperation, the non-member Partner agencies will be informed of IGA business, and will be apprised of important decisions or proposals regarding the Canal.



## WATER SUPPLY STUDY

### Water Supply Study Overview

With the decision to not use the Lower Canal for water delivery, the impacts to the water supply vary from no irrigation water at all in the Lower Canal to reduced levels of flow in the Upper Canal due to the reduced flow requirements to service a shorter canal length. The High Line Canal Partners outlined objectives to address these proposed impacts, and also sought to address historic complaints that the water supply in the Canal was not reliable enough. As part of the search for additional water supply, the Partners added an objective of enhancing the flows in the Canal and creating a reliable, season-long flow. The objectives that were identified guided the endeavor to find water for the Canal to:

- Maintain a population of deciduous shade trees directly adjacent to the channel of the canal. (Cottonwood trees were chosen as a representative species for this objective due to their prevalence along the Canal, and their relatively high water requirements.)
- Maintain flow of water in the Lower Canal for aesthetic purposes.
- Enhance the frequency and depth of flow in the entire Canal for aesthetic purposes.

These objectives propose a range of replacement water options from maintenance / sustenance of the trees to enhancement of the existing flows throughout the Canal. With the likelihood that replacement water would be difficult to find, the Partners developed water supply priorities to guide and focus the study process on the most critical aspects of the objectives.

The goals of the Water Supply study are to identify potential, feasible water supplies for the objectives above. This study is a brief investigation that outlines opportunities that can be pursued in the future. This is the beginning of a long process of water supply development that will require much more detailed analysis, and possibly permitting, water rights acquisitions, water court activities, and design, not to mention construction and implementation. The study seeks to highlight the most promising water supply options, and to educate the Partners about the realities of the availability and costs for additional water in the current water supply environment of the Denver metropolitan area.

### Water Supply Study Process

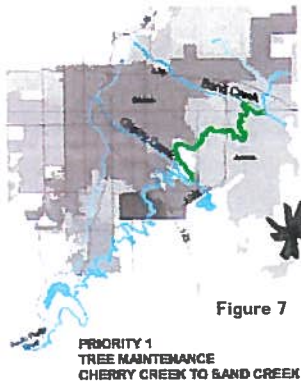
The process for the Water Supply Study followed the following steps/tasks:

1. Set Water Supply Priorities
2. Characterize the Historic Canal Flows
3. Quantify Water Needs For Each Priority
4. Brainstorm Potential Water Supplies
5. Evaluate Costs and Availability
6. Develop Recommendations for each Priority

These steps are summarized in the following sections. Work products developed for the study are provided in Appendix B.

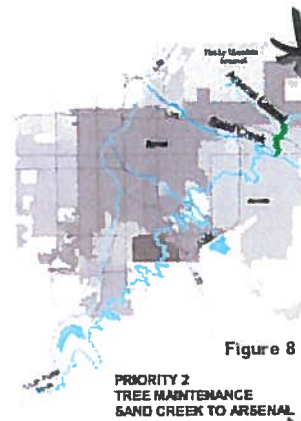
**Set Water Supply Priorities**

This task was largely performed by staff representatives of the High Line Canal Partners prior to the start of the project. In the initial water sub-committee meeting the priorities were re-evaluated, modified, and re-prioritized to reflect the desires of the entire committee.



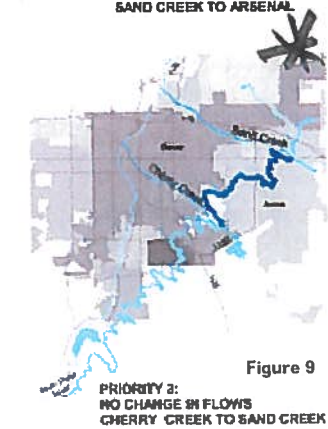
*Priority 1: Provide water for the trees from Cherry Creek to Sand Creek.*

This priority would supply water to maintain the health of the trees in this reach. The geographic limits of the reach were determined to include the most developed segment of the Lower Canal, where there is extensive existing tree growth and continuous recreational trail development. (Figure 7)



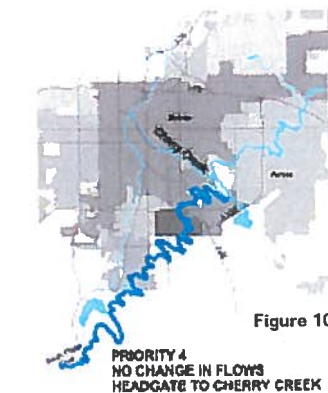
*Priority 2: Provide water to maintain the health of the trees from Sand Creek to the Arsenal Lateral.*

Similar to Priority 1, this would provide water to maintain the health of the trees. The geographic limits of this reach are from Sand Creek to the Arsenal Lateral—a section of canal that currently does not have a public access trail. (Figure 8)



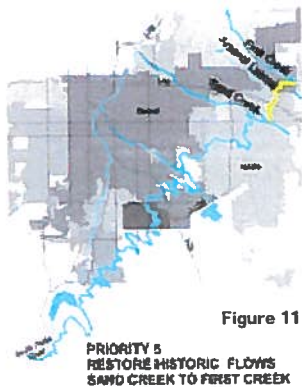
*Priority 3: Provide water to maintain the existing flows in the canal from Cherry Creek to Sand Creek.*

This priority would replicate existing flows from Cherry Creek to Sand Creek. (Figure 9)



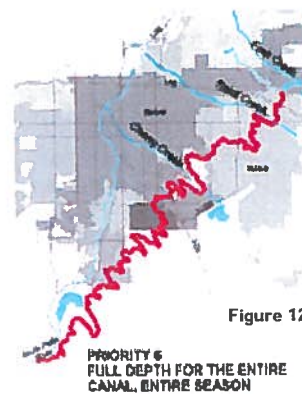
*Priority 4: Provide water to maintain the existing flows from the South Platte headgate to Cherry Creek.*

Once the Lower Canal stops functioning for water delivery, flows in the Upper Canal will be an average of 6" lower due to the decreased amount of diverted water at the headgate. (Actual depth changes will vary depending on location along the Canal from 5.5 inches lower at the headgate to 8 inches lower just above Cherry Creek.) The water provided for this priority would supplement the projected flows in this reach to current levels. (Figure 10)



***Priority 5: Provide water to restore historic flows from Sand Creek to First Creek.***

Only part of the Canal reach identified in this priority remains the property of Denver Water. The segment between the Arsenal Lateral and First Creek has been turned over to the City of Denver and therefore is not under Denver Water control. Although the Canal has been removed in this area to facilitate development of a golf course, efforts are being made to re-establish a canal and trail in this area. This priority would provide water to achieve historic flow levels and frequency in this reach. (Figure 11)



***Priority 6: Provide water to provide full depth flows in the Canal for the entire irrigation season.***

This priority greatly prolongs the number of days of flow in the Canal per season, and assumes a full canal throughout the irrigation season. (Figure 12)

Characterize the Historic Canal Flows

This task pertains primarily to Priorities 3, 4, 5, and 6 that refer to historic and existing flows as a baseline for their respective water supply objectives. To characterize the historic flows in a format that would serve as a base for identifying the water needs for these priorities, four products were produced:

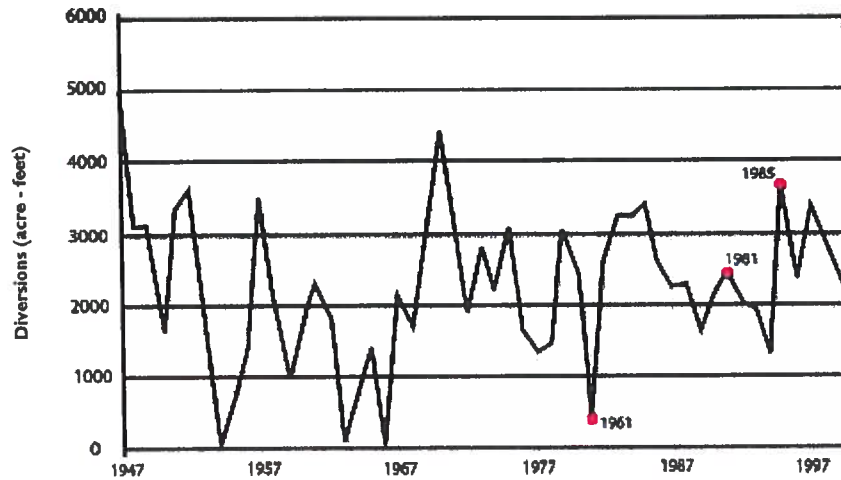
1. Selection of representative dry, average, and wet hydrologic years to use in water supply evaluations and presentations.
2. Selection of four study sites along the canal to use in water supply evaluations and presentations.
3. Development of flows throughout the irrigation season for the selected dry, average, and wet hydrologic years at the four study sites along the canal.
4. Development of schematic cross section graphs for selected dry, average, and wet hydrologic years at the four study sites showing the number of days with no water, water levels up to 1 foot deep, 1 to 2 feet deep, etc.

Following are representative findings from this task that provide a general overview of the historical flows. Refer to Appendix B1 for the unabridged task documentation.

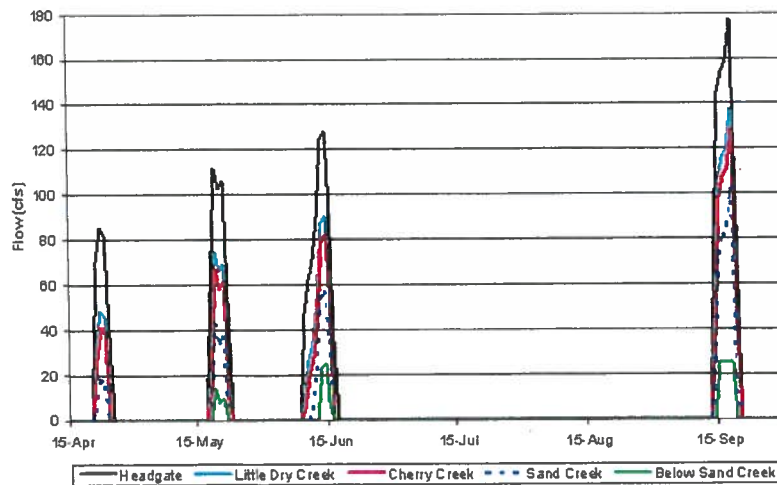
The representative wet, average, and dry years selected by the team are 1995, 1991, and 1961, respectively. Figure 13 provides perspective on historic trends, and also illustrates the relative wetness of the last 20 years in terms of canal flow.

The quantities of flow for each type of year at the headgate, and four study sites are summarized below in Figures 14, 15 and 16:

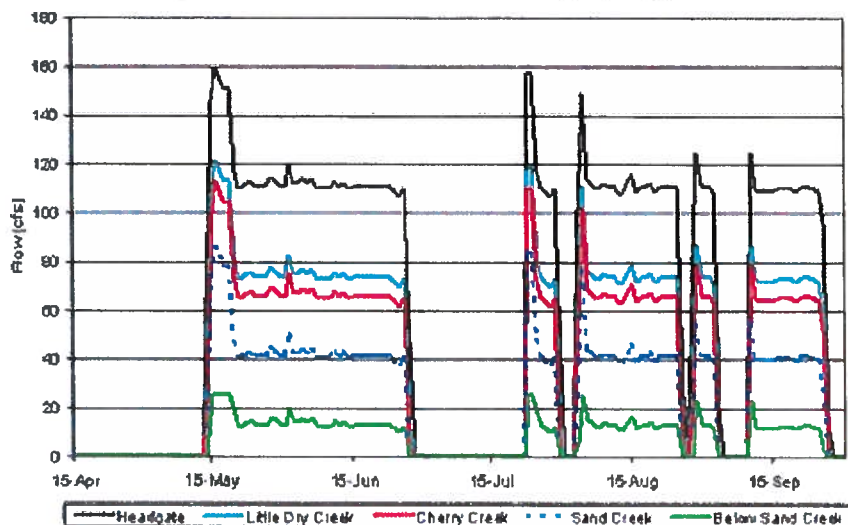
**FIGURE 13  
AVERAGE ANNUAL HEADGATE**



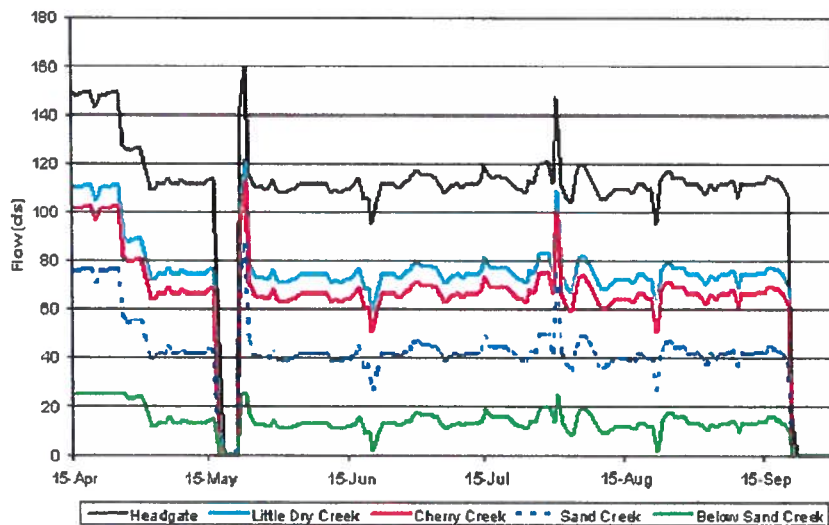
**Figure 14  
Irrigation Season Flows at Study Sites - Representative Dry Year, 1981**



**Figure 15**  
**Irrigation Season Flows at Study Sites - Average Year, 1991**



**Figure 16**  
**Irrigation Season Flows at Study Sites - Representative Wet Year, 1995**

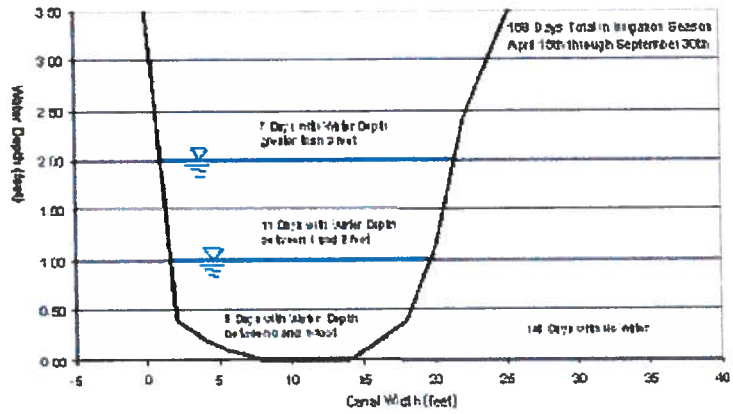


Figures 17, 18, and 19 show schematic cross section graphs of historic water depths for the average year the High Line Canal at East Harvard Avenue bridge (just up the Canal from Cherry Creek). These figures are the basis for development of the target flows for Priorities 3,4,5 and 6, as summarized in the following Water Supply Study task-Quantify Water Needs.

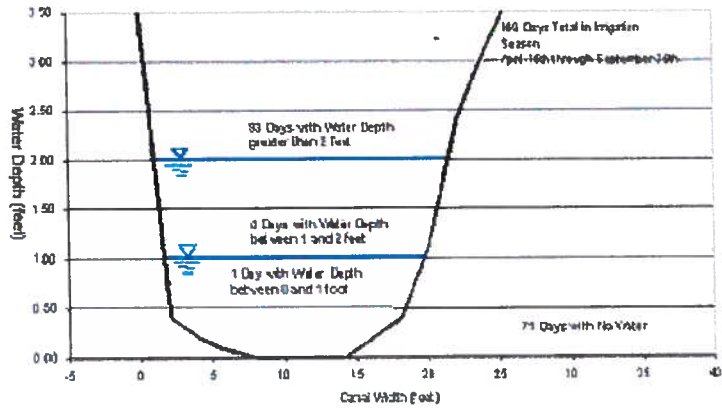
Priorities 1 and 2 have water supply goals based on providing sufficient water to maintain the health of the trees-a goal that is not based on historic flows. The water needs for these priorities will be based on information from a separate, parallel study on the water needs of cottonwood trees along the channel, which is being performed for Denver Water by tree experts from Colorado State University.



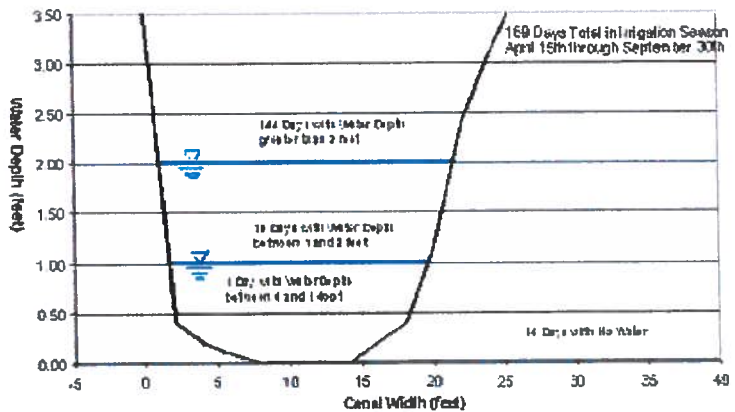
**Figure 17**  
**Dry Year Days at Selected Depths At East Harvard Avenue Bridge**



**Figure 18**  
**Average Year Days at Selected Depths - East Harvard Avenue Bridge**



**Figure 19**  
**Wet Year Days at Selected Depths - East Harvard Avenue Bridge**



Quantify Water Needs

This task addresses the quantification of the actual flows needed to meet the needs of the priorities established at the beginning of the study, and characterized in the previous task. The findings for this task are summarized in Table 1 below, and compared in Figure 20.

Table 1

**TARGET FLOW RATES AT STUDY CROSS SECTIONS**

Priority No. 1 - Tree Maintenance - Cherry Cr to Sand Cr  
Cross Section: South of Cherry Cr at E. Harvard Bridge

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow(cfs)	69	55	68	21
Avg Depth (ft)	2	2	2	1
Avg No. Days	155	21	98	28
Volume (af)	21300	2300	13200	1200

Priority No. 2 - Tree Maintenance - Sand Cr to Arsenal Lateral  
Cross Section: North of Sand Cr at Colfax and Tower Rd

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow(cfs)	21	20	20	7
Avg Depth (ft)	1	1	1	0
Avg No. Days	164	13	95	28
Volume (af)	6400	500	3600	400

Priority No. 3 - Aesthetics - Cherry Cr to Sand Cr  
Cross Section: South of Cherry Cr at E. Harvard Bridge

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow(cfs)	69	55	68	55
Avg Depth (ft)	2	2	2	2
Avg No. Days	155	21	98	98
Volume (af)	21300	2300	13200	10800

Priority No. 4 - Aesthetics - Headgate to Cherry Cr  
Cross Section: At Little Dry Creek

	Representative Historical Data			Current Flows	Est. Future Flows	Target Flows
	Wet	Dry	Average			
Avg Flow(cfs)	77	60	75	61	37	29
Avg Depth (ft)	2	2	2	2	2	0
Avg No. Days	155	22	99	99	0	99
Volume (af)	23900	2800	14700	12000	7300	4700

Target flow is the amount of water in addition to estimated future deliveries needed to replicate current flows.

Priority No. 5 - Reliable Flow - Sand Cr to First Creek  
Cross Section: North of Sand Cr at Colfax and Tower Rd

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow(cfs)	21	20	20	17
Avg Depth (ft)	1	1	1	1
Avg No. Days	164	13	95	95
Volume (af)	6400	500	3600	3100

Priority No. 6 - Normal Depth for Entire Canal, Entire Season  
Cross Section: Near Headgate at Rampart Range Rd

	Representative Historical Data			Desired Flows	Est. Future Flows	Target Flows
	Wet	Dry	Average			
Avg Flow(cfs)	113	94	109	90	69	32-90
Avg Depth (ft)	2	2	2	2	1.05	-
Avg No. Days	167	23	102	109	102	-
Volume (af)	35300	4300	22100	30200	11800	19400

As mentioned, Priorities 1 and 2 are based on a goal of maintaining the health of the cottonwood trees in each respective reach. Denver Water has been sponsoring a study with Colorado State University researchers for the last 5 years to attempt to quantify the tree's needs. By controlling the amount of water that the trees receive and studying the effects exhibited by the trees, the study has developed the following conclusions regarding the trees' water needs:

- Trees began to show stress after 8 to 10 weeks of drought conditions
- Springtime moisture is probably the most critical for the trees due to the growth activity that occurs during this season.
- The trees should be watered a minimum of three times throughout the growing season, including the following waterings:
  - Spring (Highest Priority): Recharge the soil moisture along the Canal after the prolonged period of no supplemental irrigation. It is estimated that two weeks flow is required to achieve a satisfactory soil moisture recharge.
  - August (Second Priority): Recharge soil moisture. One week of flow is estimated to be sufficient.
  - September (Third Priority): Final irrigation / soil recharge to carry the trees into winter. One week of flow is estimated to be sufficient.

Priorities 3 through 6 refer to historic flow rates as their baseline, which have therefore been estimated from the historical flow data and adjusted to reflect current normal diversion rates. Historically, the average diversion rate was over 200 cubic feet/second(cfs). These flows have gradually decreased over the years as the agricultural uses along the Canal have given way to urban development which is less dependent on the Canal's water. Today's average diversion rate is about 90 cfs. Target flow rates, considering Denver Water's more efficient operation of the Canal, are based on 82 percent of the average year flows in 1991. Target flows for replicating current flows in terms of frequency and depth of water are based on the representative average year flows of 1991. The process for estimating the flows required for each priority are briefly described below.

***Priority No. 1*** - (Water for the trees from Cherry Creek to Sand Creek.)

The quantity of water needed is based on the water needs of the cottonwoods as determined in the CSU tree study. To meet the watering recommendations, the following flows are estimated:

1. Spring Time: Two weeks of flow as estimated by the tree expert requirements
2. August: One week of flow.
3. September: A final week of canal flow to recharge the soil moisture could help prepare trees for winter dormancy.

The total days of flow needed in the Canal according to the CSU study total 28 days. It has been determined that the flow rate required to adequately wet the soil is 21 cubic feet per second (based on historic ditch losses in this reach of 20cfs). The total volume of water required to meet this priority is 1200 acre-feet of water.

***Priority No. 2*** - (Water to maintain the health of the trees from Sand Creek to the Arsenal Lateral.)

The same approach described for Priority 1 was applied to defining the target flows for Priority 2. A flow of 7 cfs is required in this section of the Canal (based on historic ditch losses in this reach of

6cfs) to recharge the soil moisture. The proposed schedule and duration of flow is identical to that proposed in priority 1: 28 days spread out over spring, summer and fall. The total volume of water required is 400 acre-feet.

**Priority No. 3** - (Water to maintain current flow levels in the canal from Cherry Creek to Sand Creek.)

The quantity of water needed for this priority is based on the historic flow research done previously in this study for the average year, which is represented by 1991. Priority 3 requires a total volume of 10,800 acre-feet of water.

**Priority No. 4** - (Water to replicate the current flows in the Canal from the Headgate to Cherry Creek.)

After water deliveries to the Lower Canal are stopped, Denver Water estimates future diversions at the South Platte headgate to average about 66 percent of diversions prior to the change. The replacement water required to re-establish the current water flow elevations in this reach requires 4700 acre-feet of water.

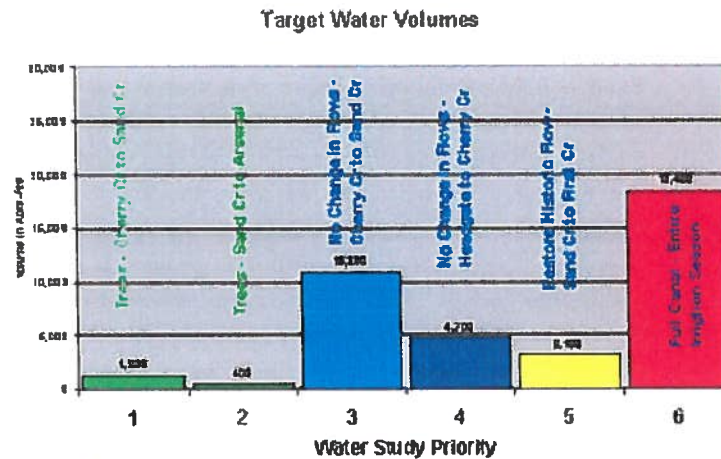


Figure 20 Graph shows water requirements for each priority in acre-feet

**Priority No. 5** - (Water to restore historic flows from Sand Creek to First Creek).

The quantity of water needed for this priority is based on 82 percent of the historic flows to the Arsenal as previously described above for the average year, which is represented by 1991. However instead of delivering the water to the Arsenal the water would be delivered down the High Line Canal to First Creek. Priority 5 requires a total volume of 3,100 acre-feet of water.

*Priority No. 6 - (Water to provide full depth flows in the canal for the entire irrigation season.)*

Water needs for this priority were calculated using the current normal diversion rate of 90 cfs, and assumed a continuous flow at this flow rate for 169 days. The total volume of water required to meet this priority is 18,400 acre-feet.

#### Brainstorming Potential Water Supplies

This task involved brainstorming a comprehensive list of potential water supplies and concepts to meet the goals set out in the six water supply priorities. The cooperation of water resource staff from the key High Line Partner agencies was a critical component of this task. Much of the required information required the participation of water resource personnel who could assess each agency's policies on water use and distribution. The committee met with representatives from Denver Water, Denver Public Works/Wastewater, Urban Drainage and Flood Control District, Arapahoe County, and the City of Aurora Department of Utilities and Department of Water Resources.

Every type of potential water supply that could be identified by the committee was evaluated. These included:

- Direct flow: Water that can be physically diverted from the region's rivers and streams.
- Storage: Water that is stored in a reservoir until needed
- Reusable Lawn Irrigation Return Flows (LIRFs): Municipalities deliver various types of water to their customers. Certain types of water such as imported water from the Arkansas River to the South Platte River basin, can be used and reused to extinction. Through accounting methods municipalities can quantify the amount of lawn irrigation return flows that are reusable. These reusable lawn irrigation return flows are a potential water source for diversion or augmentation.
- Reuse Water: Treated wastewater that is reused for non-potable purposes
- Groundwater: Water that is pumped from both shallow and deep wells.
- Stormwater: Rain water and snow melt that flows from urbanized areas into stormwater drainage systems. This type of water is often similar to direct flow water in terms of water rights issues.

In addition to water supplies, other options for achieving the goals of the priorities were investigated. These focused on modifications to the Canal which would either save water losses which could then be used for Lower Canal flow, or alterations to the flow to create an appearance of a full channel. Refer to Appendix B3 for a more detailed description of the water supply options.

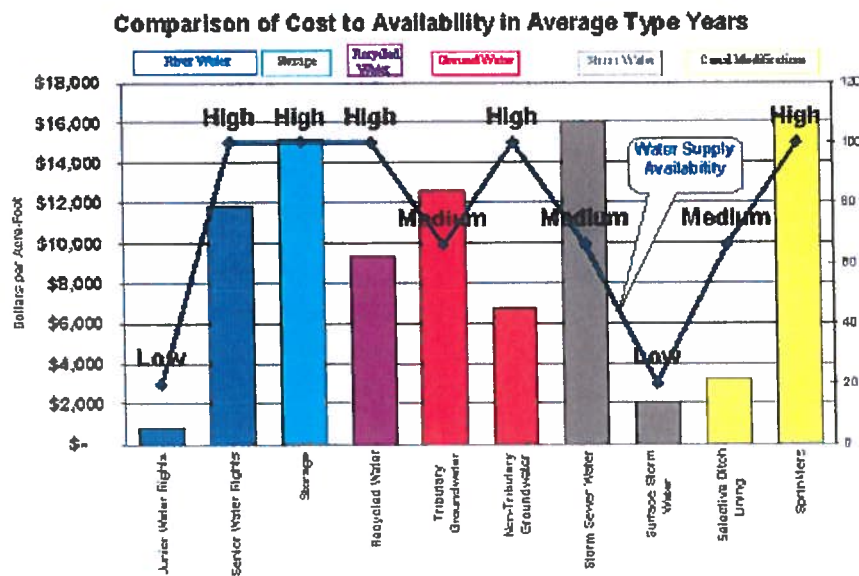


Evaluating Costs & Availability of Potential Water Sources

As expected, the preliminary evaluation of the water supply types identified in the brainstorming session eliminated most of the potential sources, either due to cost or lack of reliability. Figure 21 summarizes the most important finding of the water supply brainstorming and evaluation. In a phrase, you get what you pay for. Water supplies that are inexpensive are less reliable than more costly options. Water supplies that can be relied upon most every year cost a high premium and are difficult to find. Following is a brief synopsis of the opportunities and constraints associated with the different water supply options that were evaluated.

*Direct flow:* This surface water, such as water from the South Platte, or Cherry Creek, is already over-appropriated, which means that there is not enough water to satisfy all water rights holders. Reliable direct flow water is difficult to obtain and is extremely expensive. This source was largely rejected as a feasible water supply source, except for some limited water supply (in the early spring and late fall) that could be obtained with a new water right, and a potential arrangement with Denver Water to use some of the 1879 High Line Canal water right water.

Figure 21



- *Storage:* Storage space in reservoirs is very limited. Denver Water and the City of Aurora committed to providing some storage space when their reservoirs were not full (i.e. in dry years). However, the water to be stored still must be obtained through direct flow, ground water, etc.
- *Lawn Irrigation Return Flows (LIRFs):* Usually a portion of the lawn irrigation water which seeps into storm drains and streams often belongs to the water provider which originally provided the water to the properties doing the irrigating. This water must be adjudicated, or quantified by a water court before it can be used. Denver Water is in the process of quantifying its LIRF's for a water rights application, however the source for a majority of Denver Water's LIRF's is imported westslope water. Denver Water's original decrees, agreements, etc for the west slope water reportedly would not be allowed for contemplated uses in this study. The City of Aurora Water Utilities Department has not quantified its LIRF's, which are not included in this study.

- *Reuse Water:* Reuse water is expensive. It also has a more limited distribution system than a typical potable water system, so the locations where it could be introduced into the Canal are limited. The potentially unregulated dumping of the treated reuse water into streams, which is not currently allowed under Colorado Department of Health and Environment regulations should be a concern. However, the City of Aurora has offered the use of reuse water from their system in off-peak seasons (early spring and late fall) as a final backup system to supplement flows in the Canal. The committee considers this a good back-up water supply if all other water sources are insufficient.
- *Groundwater:* Groundwater pumped from shallow wells is very similar to diverted water from rivers or streams. It is expensive because for it to be a dependable supply, other water (decreed augmentation water) needs to be acquired to replace the depletions caused to the stream as a result of pumping the shallow groundwater and consuming a portion of it through evaporation and evapo-transpiration. Groundwater from deep wells (~ 1,000 feet) is in general owned by the overlying land owner or entity that provides water to the overlying land owners. This water source, potentially available from the City of Denver, is fairly expensive in terms of drilling wells and pumping costs. It is also a non-renewable water source. Aurora has reserved this source as an emergency water supply for drought periods and excluded it as a potential water supply for the canal.
- *Stormwater:* Stormwater is subject to the same regulation by Colorado state water rights statutes as direct flow water. In the eyes of the State Water Commissioner it is one in the same. In addition, stormwater in this region is unreliable, and when it does come, often tends to come all at once. Any stormwater that could be diverted into the Canal would need to be carefully metered to avoid overfilling the Canal and causing overtopping or Canal damage. These issues limit the potential use of stormwater as a water supply. However, in certain areas where historic drainage patterns have flowed into the Canal and where the possibility exists to release it into the canal slowly, such as at Expo Park in Aurora, stormwater is an excellent resource that will improve any water supply plan.

Over the years both Denver Water and the Urban Drainage and Flood Control District (UDFCD) have worked to prevent the flow of storm drainage into the Canal. The Canal traverses 16 stream basins in this study area, in most cases either flowing under in a siphon, or over in a crossover structure. There are small local stormwater drains and local tributary drainage that currently flow into the canal, but these flows are relatively small and do not provide a reliable water supply source. The focus of this assessment of stormwater as a water supply source for the Canal has been on large diameter storm sewer pipelines in the vicinity of the Canal. The study has looked primarily at opportunities to divert stormwater into the Lower Canal, where the main need for new water supply is needed.

*Stormwater Issues:*

- In a drought year when water supply is most needed for the Canal, there will be limited stormwater runoff.
- The use of stormwater has water rights implications similar to the use of junior direct flow water rights. Augmentation water will be required to use the stormwater except in periods of high stream runoff when there is not a call by downstream senior water rights. The exceptions to this are the locations where stormwater has historically flowed into the canal. If these flows into the Canal are maintained or re-established, it is likely that no augmentation requirements will be required by the State if the water is returned to the river system at the next available stream crossing.
- To divert stormwater into the Canal in a carefully metered manner, a detention pond is needed adjacent to the canal to capture a meaningful quantity of the stormwater and hold it until it is released into the Canal. In many urbanized areas there is no space for new detention ponds proximate to the Canal.
- In addition to stormwater runoff, the storm sewer systems intercept and convey base flows of groundwater and lawn irrigation return flows. Intercepting these base flows and diverting them into the Canal would appear to be a viable water supply alternative. However, municipalities along the Canal are concerned about redirecting these base flows to benefit the Canal at the expense of downstream drainageway ecosystems that rely on these flows for their sustenance. However, base flows increase with urban development, and if base flows were to increase in any of the basins crossing the Canal, these increased flows could be diverted without impacting the downstream ecosystems. Diverted base flows would need to comply with State water law.
- Developing stormwater as a water supply can be expensive. With the cost of augmentation water, construction costs, and operation and maintenance costs the estimated cost for average year water supply is \$16,000 per acre foot, which is quite high relative to other water supply costs (see Figure 21). However, this cost can be much lower if augmentation is not required, and if only minor construction is required to divert water into the canal.

*Stormwater Opportunities*

- Policy changes within Denver Water and UDFCD could preserve the tributary stormwater that currently drains into the Canal.
- New construction of detention ponds and drainage improvements near the canal can be designed to flow into the Canal at a controlled rate.
- Canal flows and stormwater diversions into the Canal can be monitored and controlled electronically, reducing the likelihood of canal damage or overtopping.
- The most promising potential stormwater source locations included:
  - Expo Park (east of Alameda and Havana in Aurora): Historic tributary drainage into the Canal from Westerly Creek requires a new connection between the Expo Park pond and the Canal to allow excess stormwater flows (not base flows) to flow into the Canal.
  - Four Square Mile Area (Parker Road at Mexico Ave. and Parker Road at Jewell Ave. outfalls in Arapahoe County): Both of these historic tributary drainages are currently being modified by the Urban Drainage and Flood Control District to bypass the Canal. Each project can be modified to redirect flows, or partial flows into the Canal if

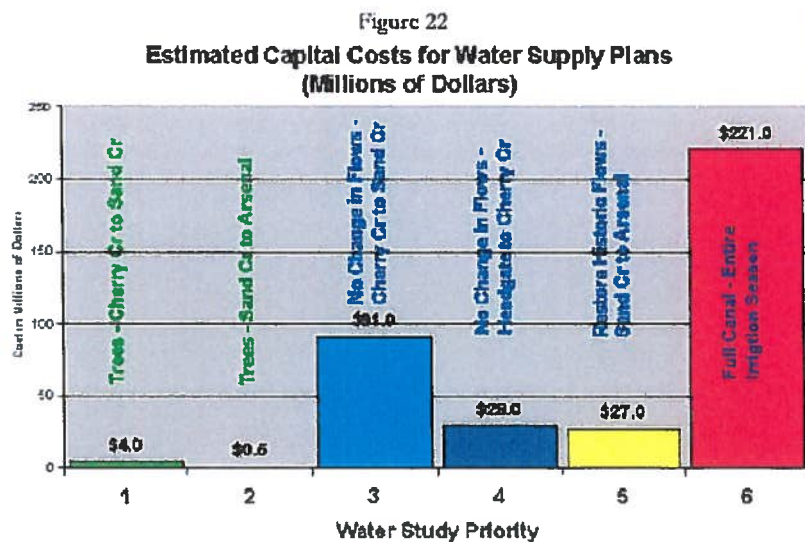
Denver Water and Urban Drainage can agree on a revised policy for stormwater in the Canal. Water from these outfalls could provide water for the Lower Canal reach down-canal of Cherry Creek.

- Majestic Industrial Park at I-70 and Tower Road in Aurora: Detention pond up-gradient of the Canal could be furnished with a controlled release outlet into the Canal to provide water for the Lower Canal reach down-canal of Sand Creek.

The most promising source of replacement water for the water supply priorities is actually a canal modification technique—specifically, selective Canal lining. Instead of "finding" new water, the concept is to conserve water that is currently lost due to seepage in the Canal, and apply it to meet the water supply priorities. The concept of a selective Canal lining is new. While the objective for lining the Canal is to reduce seepage of ditch water into the soil, there is a second and equally important priority to keep the trees alive. An overly efficient liner would prevent canal water from irrigating the trees; the selective liner will allow some seepage to keep the trees watered. Further study will be necessary to develop a design for the liner that works for this application. The amount of selective canal lining required has been estimated by evaluating the water savings generated per unit length of canal lining. Whenever the lined canal section is in operation, those savings are in effect. This concept needs to be field tested to verify actual savings.

Figure 22 shows an estimate of the cost of water for each priority. Priorities 1 and 2, based upon quantities of water to maintain/irrigate the trees, are apparently feasible, ranging in the millions of dollars. Priorities 3, 4 and 5, based upon restoring or maintaining historic flows in various reaches of the Canal, cost from 27 million dollars to over 90 million dollars. These priorities appear to be outside the range of feasibility, at least in their current state. And finally, Priority 6, based on a full canal for the entire irrigation season, is not at all feasible, with projected costs at over 220 million dollars. In addition, it is very questionable whether the amount of water needed to meet priorities 3-6 could be acquired on the open market even if the funding could be arranged.

In light of these costs, detailed recommendations for water supply were only made for Priorities 1 and 2. Using the water supply strategies outlined for these two priorities there are opportunities to provide some incremental increases in water for Priorities 3, 4 and 5. The water supply needed for these priorities is shown in terms of the amount above and beyond the water supply plans identified for Priorities 1 and 2.





During the course of this study, Denver Water committed to providing a portion of the water required for Priority 1 out of its 1879 High Line Canal water right. By the end of the study, Denver Water increased its commitment to provide all the water needed for this priority, assuming that the 1879 water right is in priority and the Canal is flowing water. This greatly simplified the water supply plan for Priority 1.

**Water Supply Recommendations:**

(The following recommendations are summarized in the Recommendations Summary of the Executive Summary).

Recommended Water Supply Plan-Priority One: Water for the trees from Cherry Creek to Sand Creek.

The water needs for this priority are represented by the red line in Figure 23 below. The committee originally developed a water supply plan for this priority that assumed a contribution from Denver Water of two weeks of flow in the spring from the High Line Canal 1879 water right when Denver Water's storage reservoirs were spilling or projected to spill. The remainder of the needed water was to be provided by a new water right, City of Aurora stormwater contributions (including from Expo Park), and selective canal lining, as indicated in Figure 23. The actual canal lining was to occur in the Upper Canal, with the water savings used to provide flows for the Lower Canal. Original cost estimates for developing this water supply plan ranged from \$1.25 million to \$4 million. The wide range was due to a variability in potential costs for the canal lining. With Denver Water's increased commitment of High Line Canal water for this priority, the water supply plan recommendation becomes more simplified, and much less costly. Denver Water's contribution of 4 weeks of flow in the Lower Canal completely covers the water needs for this priority. Denver Water's commitment is to deliver the water when the 1879 water right is in priority, and no longer carries the condition that Denver Water's reservoirs be full or projected to fill. This increases the probability of flow in the Canal to about 9 out of 10 years.

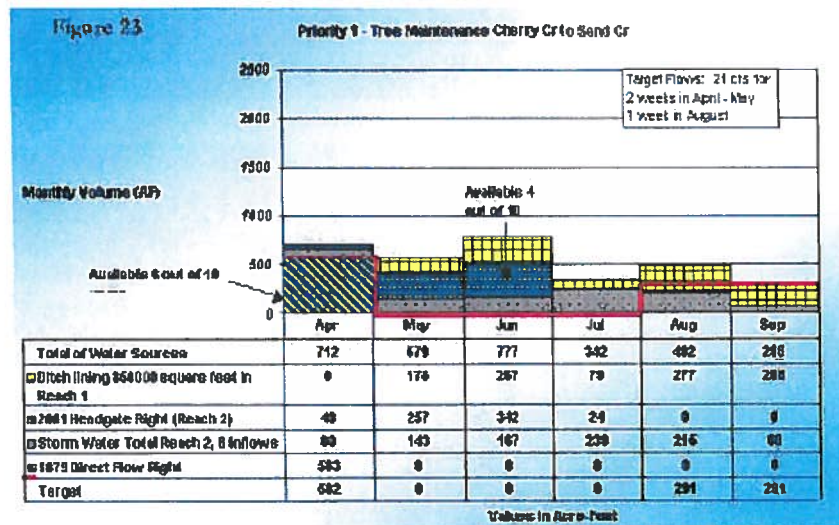
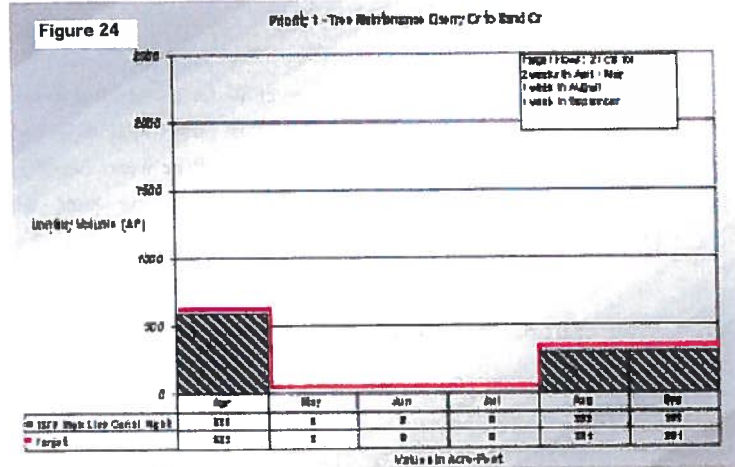


Figure 23. The water supply plan developed during the study prior to Denver Water's increased commitment of HLC water.



The water committee also recommends that the feasibility of the following backup water supplies be pursued:

- Stormwater that has historically been carried in the Canal;
- Tailwater from the upper reach to the lower reach; research legal ability to secure the right to continue to divert this water and determine how much, if any, will be available; and
- Excess reuse water from Aurora's reuse water system.

**Original Water Sources, Priority 1  
(Trees - Cherry Creek to Sand Creek)**

- High Line Canal Water (2 weeks in Spring)
- Tributary Storm Water
- New 2002 Headgate Water Right
- Selective Canal Lining
- \$4,000,000
- Backup Supply - Aurora Excess Reuse Water

**Revised Solution to Priority 1  
(Trees - Cherry Creek to Sand Creek)**

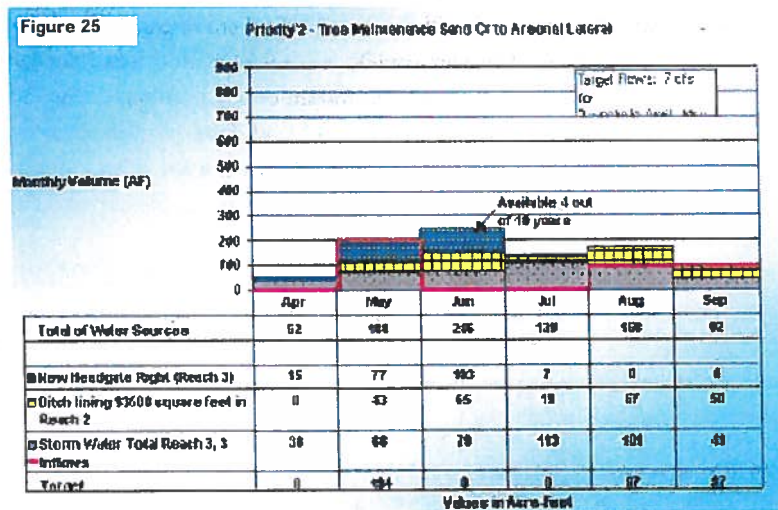
- Denver Water will provide High Line Canal Water
  - 2 weeks in Spring
  - 1 week in late Summer
  - 1 week in Fall
  - Cost = \$0
- Backup Supply - Aurora Excess Reuse Water
  - Aurora section only
  - Cost = undetermined (generally expensive)

Recommended Water Supply Plan-Priority Two: Water to maintain the health of the trees from Sand Creek to the Arsenal Lateral.

The water needs for this priority are represented by Figure 25 below. The water supply plan relies upon:

- Tributary stormwater (stormwater already flowing into the Canal);
- Selective canal lining in the Upper Canal, resulting in water credits that are to be delivered by Denver Water to the Lower Canal. Given the variability of the other water supplies, and to minimize lining costs and to maximize efficient delivery of the water beyond Sand Creek, the water credits generated should be delivered at the same time Denver Water is delivering 1879 High Line Canal water to the Lower Canal.
- Water from a new water right, or the following alternative which would provide the identical quantity of water for the Lower Canal: Pursue an agreement with Denver Water to deliver water under its 1879 water right anytime a new water right would be in priority. This type of arrangement can provide water during periods of low demand from the South Platte River in about 4 out of 10 years.

The estimated cost for this plan is \$500,000.



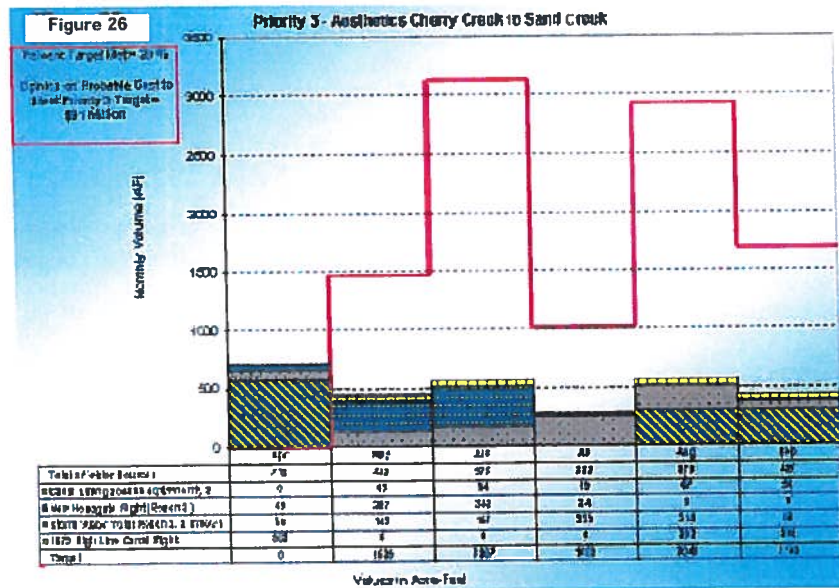
### Recommended Water Sources, Priority 2 (Trees - Sand Creek to Arsenal Lateral)

- Continue to divert storm water
  - Selective Canal lining
  - New 2002 Headgate Water Right
  - \$500,000
- 
- Backup Supply: Sprinkler System with Reuse Water

The water committee recommends a backup water supply system be pursued in the event the primary water supply is determined to be insufficient. Two options have been identified:

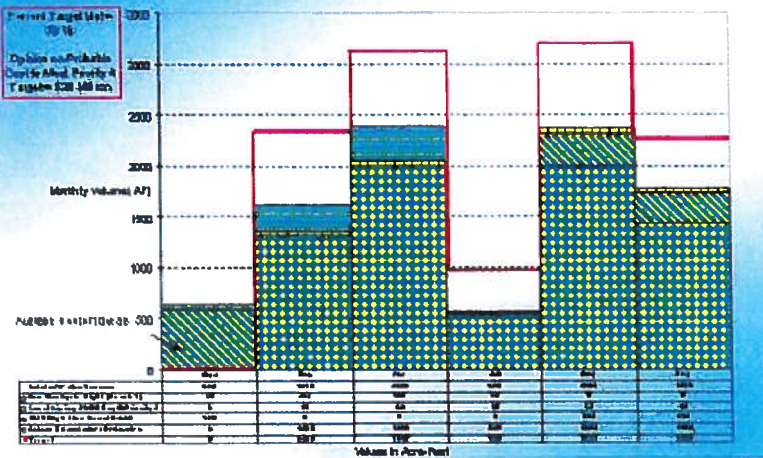
- Increase the amount of canal lining—an option that can be pursued if additional water is needed during average type years;
- Install and use an irrigation system using non-potable water—an option that could be used if additional water is needed during average-type years, and/or in drought years.

Figures 26, 27, 28, and 29 illustrate the water requirement for Priorities 3,4,5, and 6, respectively, in context with the water supplies identified for Priorities 1 and 2. While no specific water supply recommendations have been identified for these priorities due to cost and availability of water, partial attainment of these priorities may be achieved through the use of canal lining, check dams, and stormwater, if these prove to be feasible sources. These supply options have the potential to contribute significantly to the water flow objectives for Priorities 3 and 4.

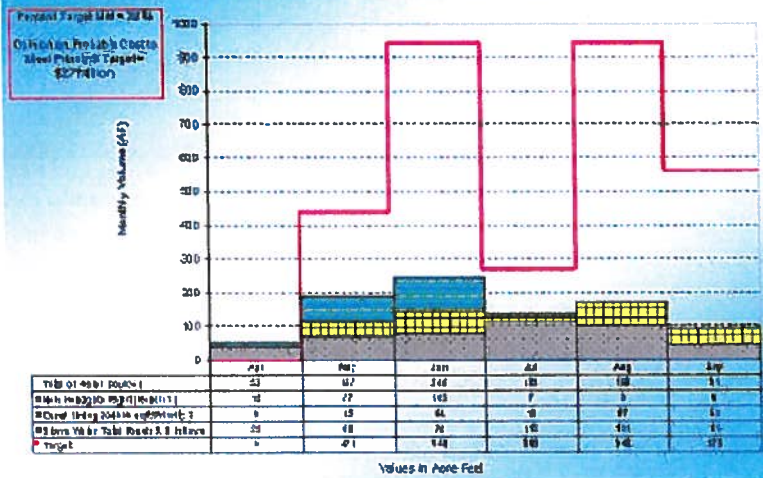




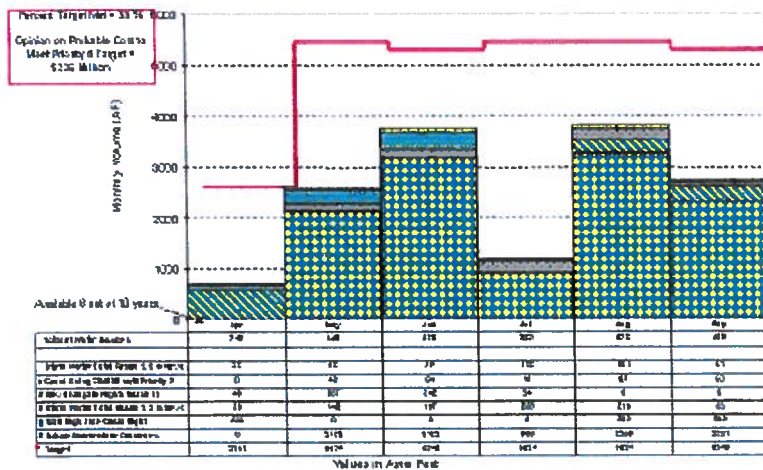
**Figure 27** Priority 4 - Available Headgate to Cherry Creek



**Figure 28** Priority 5 - Reliable Flow Sand Creek to First Creek



**Figure 29** Priority 6 - Normal Depth for Entire Canal, Entire Season



## Next Steps / Implementation

Following are items that need to be accomplished to implement the recommendations of this study.

### 1. Establish an administrative and management structure to implement recommendations.

The following structure was agreed upon by the Executive Committee to ensure that the efforts to preserve the High Line Canal are continued.

- The existing Executive Committee will be retained to review the progress of the implementation efforts.
- Denver Water staff will take the lead in coordinating the efforts of the High Line Canal Partners.
- Development of the deed restrictions for the transfer of the Lower Canal property to the local jurisdictions will be performed by representatives of the agencies seeking property ownership: Denver, Aurora, and Arapahoe County, with Denver Water.
- Drafting and acceptance of the Intergovernmental Agreement (IGA) will be led by the current recreational lease holders. Other Partner agencies will be apprised of the progress of this group, and may attend meetings if desired.

### 2. Finalize and formalize ownership and management responsibilities.

- An agreement between Arapahoe County and Denver regarding future ownership and management of the Canal below Cherry Creek must be finalized;
- The deed restriction must be put in place, including:
  - Legal drafting of document;
  - Preliminary approval of deed restriction; and
  - Execution of property transfers to Denver, Aurora, and possibly Arapahoe County, with Denver Water.
- The Intergovernmental agreement (IGA) must be developed and implemented, including:
  - Legal drafting of the IGA document;
  - Approval of the IGA by policy makers; and
  - Appointment of members to IGA board.

### 3. Research, Define and Pursue Water Supply Options.

#### *Administrative/Policy Tasks:*

- The City of Denver must designate an agency to take responsibility for operating and maintaining the water delivery component of the Lower Canal in the City of Denver.
- Policy decisions regarding the application for a new water right need to be worked out between Denver Water and the Partners. Denver Water has indicated a preference to use the the 1879 water right and make deliveries to the Lower Canal when a new water right would be in priority.
- An operating agreement for water operations for the Lower Canal ownership entities must be drafted and approved by each agency.



*Canal Modifications*

- Canal lining and check dams need to be field-tested and designed. A plan identifying canal lining locations must be developed, and funding responsibilities negotiated.
- If canal lining is a viable option, an operational agreement needs to be worked out for water credits derived from canal lining to either allow slug deliveries or constant delivery of water.

*Drainage Planning and Water Resources Study & Design*

- Policy decisions regarding the flow of stormwater into the Canal need to be addressed at Denver Water and at Urban Drainage and Flood Control District to take advantage of stormwater as a supplemental water source.
- A master plan for storm drainage outfalls into the Lower Canal needs to be completed.
- Pursue the feasibility of using reuse water from City of Aurora as an emergency drought supply for maintaining the health of trees in the portions of the canal. Verify with Colorado Department of Health and the Environment whether reuse water can be released into canals/drainageways.
- Aurora's Expo Park stormwater overflow from new detention pond to the Canal needs to be reconnected to allow excess storm flows to return to the Canal, as they have historically.

*Water Rights Clarifications*

- Conduct legal research and discuss with the State Engineer's Office the need to have a contract water user for the High Line Canal water beyond Cherry Creek, and beyond Sand Creek to accept deliveries of High Line Canal water diverted at the headgate.
- Seek legal advice on stormwater that has historically entered the canal to determine if it needs to be discharged at the next available stream crossing or can be carried in the Canal when the 1879 water right is in priority.
- Seek legal advice on the use of tailwater from the upper canal at Cherry Creek to see if it can be delivered to a contract user in the Lower Canal.

# Appendix

## **APPENDIX A1 MANAGEMENT OPTIONS**

### **MEMORANDUM**

To: High Line Canal Management and Executive Committees

From: BBC Research & Consulting

Re: Management Options and Issues for High Line Canal Management

Date: March 20, 2001

At the High Line Canal Management Committee meeting of February 7<sup>th</sup>, a number of options were raised and discussed regarding institutions or management entities that might oversee the Canal's maintenance and operation when Denver Water (DW) relinquishes its authority downstream of Cherry Creek. The current allocation of tasks between DW and the local management agencies is presented in the table that is attached as Appendix A.

The February discussions focused on the pros and cons of various management strategies and on an identification of management responsibilities. As the meeting progressed, discussion focused on three possible alternatives, distinguished largely by the degree of local control. These are set forth below.

It should be noted that significant changes in the status quo are assumed to be applicable for only the Denver and Aurora portions of the Canal downstream from Cherry Creek. DW has indicated its intention to continue both its current water management and administrative roles upstream of Cherry Creek and to divest itself of those responsibilities downstream. As a result, the only change that we can foresee upstream of Cherry Creek is the potential reduction of the water flow through this section. While it is also possible that some regional organization could take over recreation management responsibilities from local jurisdictions and recreation districts both upstream and downstream of Cherry Creek, this scenario is viewed as unlikely.

#### **Option 1. Municipal Ownership and Management**

Under this option, tasks that are now the responsibility of DW would be relegated to the jurisdictions that currently manage recreation along portion of the canal downstream of Cherry Creek (Denver and Aurora). Ownership of the canal would also pass to these municipalities, with deed restrictions in place in order to ensure continuation of the current state of the canal. The subject municipalities would be responsible for functions currently performed by Denver Water including water management and acquisition, ditch management and regulatory oversight (i.e. reviewing requests for development of recreational or other facilities along the canal).

This option would not attempt to replace the regional role currently filled by DW. On the contrary, it would devolve all responsibilities to the municipalities and would allow them to manage and regulate the canal with greater flexibility. However, the freedom of municipalities would be limited by deed restrictions put in place at the time ownership was transferred. Details of deed restrictions were not discussed.

## Appendix A-1 Management Options

### Option 2. Municipal Ownership, Integrated Management and Oversight

Under this scenario, ownership would again pass to the local jurisdictions, with deed restrictions in place. However, additional restrictions would be provided by interlocking inter-governmental agreements between the five entities that currently manage the canal. These would provide guidelines for administrative and regulatory control of the canal. Additionally, an advisory board made up of representatives from each jurisdiction and perhaps other interested parties could be set up to resolve conflicts, review performance and provide either binding or non-binding oversight.

While the municipalities would own the canal under this scenario, their management and regulatory actions would be limited by three factors: deed restrictions, inter-governmental agreements and a regional advisory group. The presence of intergovernmental agreements would give all municipalities some regional control over the character of the canal. The advisory group, while potentially nonbinding, could provide a centralized voice in favor of or against certain management or regulatory initiatives.

In any of these options, easements could be held by a third party participant, offering an additional source of preservation insurance.

### Option 3. Regional Ownership; Municipal Management

This scenario attempts to replace DW with some other third party. In this scenario, ownership, or primary administrative oversight, of the canal downstream of Cherry Creek would pass to an interested third party. This would limit canal ownership to two parties (DW and this third party), and would ensure that regulatory decisions (i.e. decisions regarding recreational and other development) would consider the regional nature of the canal. Local jurisdictions would continue to manage the recreational aspect of the canal. Responsibilities for water acquisition and management and ditch maintenance could fall to either the local entities or the central organization.

This scenario would ensure a degree of regional consistency along the length of the canal, but would remove some of the management and regulatory authority of municipalities. While municipalities might manage both the recreation and the water aspects of the canal, by not owning the canal and not having the final authority on canal operations, they would not have full control over regulatory and management decisions.

### Responsibilities

Exhibit 1 presents the various options and the division of responsibilities under each option.

**Exhibit 1.  
High Line Canal Management Options and Responsibilities**

Options	Ownership	Administration/ Regulatory Oversight	Water Management/ Acquisition	Ditch Maintenance
Municipal Ownership and Management	Local	Local	Local	Local
Municipal Ownership, Integrated Management and Oversight	Local	Inter-Governmental, some regional advisory role	Local	Local
Regional Ownership; Municipal Management	Centralized	Centralized	Local or Centralized	Local or Centralized

Source: BBC Research & Consulting

## Appendix A-1 Management Options

### Issues

There are a number of issues that are raised by the alternatives outlined above, including the following.

- Are the impacted municipal governments prepared to perform the functions currently fulfilled by DW? In maintaining the conveyance of water and the grounds alongside the canal, DW currently has an 18 to 24 person staff, which is on-call 24 hours a day. As seen in Appendix A on the following page, they have a broad portfolio of responsibilities.

Do the municipalities have the expertise, funding and desire to take on all of these responsibilities?

- Does the possibility exist for the municipalities to contract with DW for some services? Would this be desirable for either party? Is there specialized expertise at DW that would be difficult to replace in the impacted municipal governments? Would DW consider maintaining some canal maintenance functions if properly compensated?
- What are the implications of a municipality's failure to perform DW's current responsibilities adequately? What will happen if the conveyance of water is impeded, if storm water enters the system or if management standards deteriorate? How will these or other non-performance scenarios impact the municipalities or downstream users?
- What are the implications of any of the options presented above on the upstream jurisdictions? Will they be impacted by this change? If so, in what ways?

These issues should be among those considered in evaluating management and funding scenarios for the downstream portion of the Canal. A decision about the balance between regional and local control should involve assessing not only the degree of regional character that should be maintained on the Canal, but the ability of different organizations to perform necessary maintenance functions and the consequences of non-performance.

## Appendix A-1 Management Options

### Appendix A

#### Current Division of High Line Management Responsibilities

<b>Denver Water Board</b>	<b>Municipalities and Recreation Districts</b>
Ownership	Fire Suppression (local fire departments)
Watering trees planted by the Board (for 3-4 years)	Maintenance of all recreation amenities
Herbicide treatment for weed control	Maintenance of sanitary facilities
Vegetation maintenance (cooperatively with local entity)	Mowing
Removal of vegetation from Canal's cross section and flow line	Watering trees planted by the local entity
Tree removal, safety tree trimming on the side of the Canal opposite from the trail	Insect and disease monitoring and control for new trees planted by local entity
Approval of location and number of signs	Vegetation Maintenance (cooperatively with DW)
Approval of any development and improvement plans, such as license agreements or easement agreements for permanent installations (i.e. bridges)	Provision and maintenance of benches, rest areas and picnic areas
Maintaining easements	Trail maintenance
Establishing rules for use of the canal	Trash maintenance
Clearing the ditches of trash, vegetation and other obstructions	Posting information and regulatory signs
Ensuring flow moves freely to headgate users	Safety tree trimming trailside and at intersections
Mowing and weed control of DW portion of canal	Enforcement of rules, regulations and local ordinances
Any other work that needs to be done for water conveyance	Grading of maintenance roadways
Maintaining canal course (preventing meandering)	Application of herbicides (if approved by DW) around obstructions (i.e. signs, fence lines, etc.)





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## APPENDIX A2 PRELIMINARY FRAMEWORK

memorandum

To: Highline Canal Management Committee  
From: BBC Research & Consulting  
Re: Recommendation from April 12 meeting  
Date: April 30, 2001

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At the April 12<sup>th</sup> meeting, we discussed a range of potential future management structures for the High Line Canal. These included municipal management and ownership, municipal ownership with intergovernmental agreements and regional ownership with either regional or municipal ownership. This memo outlines the recommendation that emerged from the meeting, the differences between conservation easements and deed restrictions and the outstanding issues that remain. These issues should be addressed in our May 3<sup>rd</sup> meeting.

### Recommended Management Structure

The recommended structure that emerged from the April 12<sup>th</sup> discussion anticipates municipal ownership of the Canal downstream of Cherry Creek and consists of three tiers:

- Deed restrictions or conservation easements that limit the activities of owner municipalities in regards to critical, regional functions;
- An inter-governmental agreement (IGA) that provides more flexible governance of important regional issues that are not critical enough to include in a deed restriction; and
- Municipal management and control over non-regional or less critical issues.

The recommended structure provides for tight control over a small number of critical issues that have a regional character, more flexible control over less critical issues that also have a regional nature and purely local control over non-regional issues. The proposed framework is illustrated in Exhibit I below.

## Appendix A-2 Preliminary Framework

### Exhibit 1. Recommended Management Structure

Source:  
BBC Research & Consulting

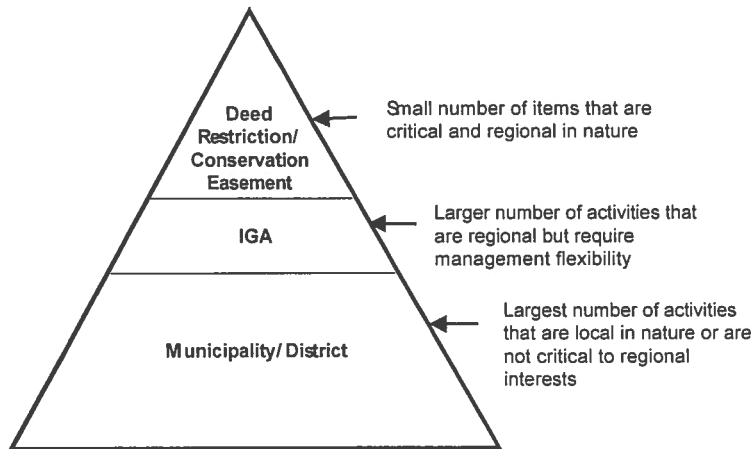


Exhibit 2 below outlines the responsibilities that were identified for inclusion in the deed restriction/conservation easement and intergovernmental agreement tiers. All activities not specifically identified in one of these tiers are designated as under municipal (or recreation district) control.

### Exhibit 2. Allocation of Responsibilities Among Management Tiers

Source:  
BBC Research & Consulting

Deed Restriction/Conservation Easement	Inter-Governmental Agreement
Preservation of the property for recreation and natural resources	Restriction to non-motorized uses
Maintenance of easements	Maintenance of water flow (water coordination)
Public access	Minimum trail width
High Line Canal name	Fee issues
Adherence to the IGA	Maintenance of the historic alignment
Continuity (i.e. control of vehicle bridge crossings, impediments, utilities, etc.)	Coordination of inter-jurisdictional events
	Maintenance of multi-use character
	Leash restrictions
	Minimum maintenance standards (tree care, health/safety of users)
	Pedestrian Crossings
	Wildlife Values

## Appendix A-2 Preliminary Framework

### Deed Restriction/Conservation Easement

In considering the framework outlined above, some of the discussion at the April 12<sup>th</sup> meeting revolved around whether a deed restriction or conservation easement was the optimal tool for the most restrictive level of management. Brief descriptions of each mechanism are provided below.

**Deed restriction.** A deed restriction is a clause in a deed limiting the future use of a property. They are often used in homeowner's associations to formalize certain covenants (i.e. architectural review, signage, etc.). The advantage of a deed restriction is that it would not introduce an outside organization into the process of preserving the Canal. However, enforcement of deed restrictions is unclear, particularly in a case when no overarching organization (i.e. a homeowner's association) is present.

**Conservation easement.** Conservation easements are agreements with public or non-profit organizations that place limits on land use to help preserve property. Typically a landowner will donate an easement to an eligible organization, forgoing development rights or agreeing to other restrictions on a property. The primary advantage of a conservation easement is that the recipient of the easement takes on the responsibility of enforcement. However, an easement introduces another organization into the process, which may or may not be desirable.<sup>1</sup>

### Outstanding Issues

While the general framework outlined above was agreed upon, a number of issues that could impact its implementation remain. These issues need to be discussed, if not fully resolved, prior to the Executive Committee meeting in early May. Outstanding issues include the following:

**IGA structure.** The goal of the IGA management tier is to provide regional oversight of operational issues that require some management flexibility. While IGAs provide a level of flexibility, it could be difficult to enact changes if modifications have to be approved by the governing bodies of all institutions. Potential modifications to the IGA structure could include:

- Appointing a governing board through the IGA that would have the ability to ratify changes. If this approach was chosen, board composition should be discussed.
  
- Designating certain operation practices that can be changed by approval of the administrators of each jurisdiction and others that require consideration of the governing board.
  
- Involving only direct management organizations, ownership jurisdictions or some other subset in the IGA.

**Deed restriction/conservation easement.** Both deed restrictions and conservation easements were discussed in the April 12<sup>th</sup> meeting as potential mechanisms for the most restrictive portion of the tier. The May 3<sup>rd</sup> meeting should review which of these mechanisms is preferable.

**Participation of Denver Water.** The question of whether Denver Water will participate in the deed restrictions/conservation easements and/or IGA was only briefly discussed in our last meeting. As holder of the deeds upstream of Cherry Creek, will Denver Water make itself subject to the same restrictions as municipalities downstream? Will Denver Water participate in the IGA or

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<sup>1</sup> The other reason conservation easements are often used is that donors receive tax benefits from the monetary value of forgoing potential future land uses on their property. In this case, tax benefits are obviously not an issue.

## **Appendix A-2 Preliminary Framework**

maintain its current role as provider of administrative oversight for the upstream portion of the Canal?

Maintenance of water flow. Finally, a significant item that was tabled at the last meeting was responsibility for maintaining the water flow in the Canal. It was suggested that this will be linked to the provision of water. Is this the ideal solution or should others be explored?

# APPENDIX B1 CHARACTERIZATION OF HISTORIC / EXISTING FLOWS

## High Line Canal Task 2 Memorandum

**To:** Paul Thomas  
**From:** Erin Wilson and Greg Roush, Leonard Rice Consulting Water Engineers  
**Subject:** Task 2 – Characterize Historic/Existing Flow Regime in the High Line Canal  
**Date:** February 27, 2001

### Introduction

This memorandum describes the approach and results to Task 2 - Characterize Historic/Existing Flow Regime in the High Line Canal. The objective of this task was to:

*Develop a data base that can be used to explain the historic and existing High Line Canal flow regime to stakeholders and that the subcommittee can use as a base to evaluate priorities 3 and 4.*

- Priority 3 is water supply to replicate the current flows regime (frequency and depth) in the canal for aesthetic purposes - Cherry Creek to Sand Creek.
- Priority 4 is water supply to replicate the current flows regime (frequency and depth) in the canal for aesthetic purposes - Headgate to Cherry Creek.
- Priority 5 (newly proposed at last Water Committee Meeting) is reliable water supply from Sand Creek to First Creek
- The results of Task 2 will also help evaluate old Priority 5, now Priority 6, water supply to a normal depth of flow for the entire canal for the irrigation season.

Four main products were developed under this Task as follows:

1. Selection of representative dry, average, and wet hydrologic years to use in supply evaluations and presentations.
2. Selection of four study sites along the canal to use in supply evaluations and presentations.
3. Development of time-series flows throughout the irrigation season for the selected dry, average, and wet hydrologic years at the four study sites along the canal.
4. Development of schematic cross section graphs for selected dry, average, and wet hydrologic years at the four study sites showing the number of days with no water, water levels up to 1-foot deep, 1 to 2 feet deep, etc.

## Appendix B-1 Characterization of Flows

### Data Collection

The following information was provided by Denver Water to help develop an understanding of historical diversions, deliveries, and losses in the High Line Canal.

High Line Canal Seepage Investigation Summary Memorandum. Included with this memorandum, in paper copy, was the following information used to develop seepage estimates for the period 1997 through 2000:

- Average annual diversion rate and volumes
- Average days of diversion (1879 Water Right Only) and diversion schedule
- Irrigation use between Platte Canyon Reservoir and Cherry Creek
- Irrigation use between Cherry Creek and Rocky Mountain Arsenal
- Fairmount Cemetery use
- Rocky Mountain Arsenal use
- Seepage loss and seepage loss per mile for 16 segments along the canal
- Average annual flow and associated water depth for 16 segments along the canal
- Total tailwater and spills discharged at spill points

In addition, a spreadsheet of daily irrigation season flows for 1997 through 2000 at the gage at East Harvard Bridge, used in support of the seepage analysis, was provided (HLC@HRV97-2000.xls).

Daily Diversion Spreadsheet (HLC1879\_Only.xls). The spreadsheet contains High Line Canal daily river headgate diversions, for the 1879 water right only, for the period 1947 through 2000. Supporting tables and graphs, developed using the spreadsheet, were also received.

Current Annual Usage, by Canal Headgate. This table, provided in paper copy, shows a current breakdown of water delivered at each headgate along the canal.

Canal Channel Cross Sections. Canal channel cross sections were provided, in paper copy, for the following staff gage locations on the canal:

- Rampart Range Road
- Roxborough Road
- Fremont Avenue Bridge
- Little Dry Creek Siphon
- East Belleview Avenue Bridge
- South Colorado Blvd. At 3-Pond Park
- South Dahlia Street Bridge
- East Harvard Avenue Bridge
- Leetsdale and East Mississippi Avenue
- South Valencia Street
- East 2nd Avenue near Peoria Street
- East 6th Avenue and Chambers Road

Canal Staff Gage Rating Tables. Staff gage rating tables were provided, in paper copy, for the locations where cross sections were provided, listed above.

In addition, monthly streamflows at the Bear Creek at Morrison gage were downloaded from the State of Colorado's CDSS Web Page, for the available period of 1947 through 1999.

### Approach and Results

The following approach was followed to meet the objectives of Task 2.

#### Selection of Dry, Average and Wet Hydrologic Years

1. Annual canal headgate diversions under the 1879 water right, from 1947 through 2000, were determined by summing daily diversions for each year in the spreadsheet provided by Denver Water. **Figure 1** shows average annual headgate diversions for the period.
2. Annual diversions were ranked (sorted) from lowest to greatest and graphed. The lowest 25 percent of flows were estimated to represent dry years, the middle 50 percent of flows were estimated to represent average years, and the highest 25 percent of flows were estimated to represent wet years.



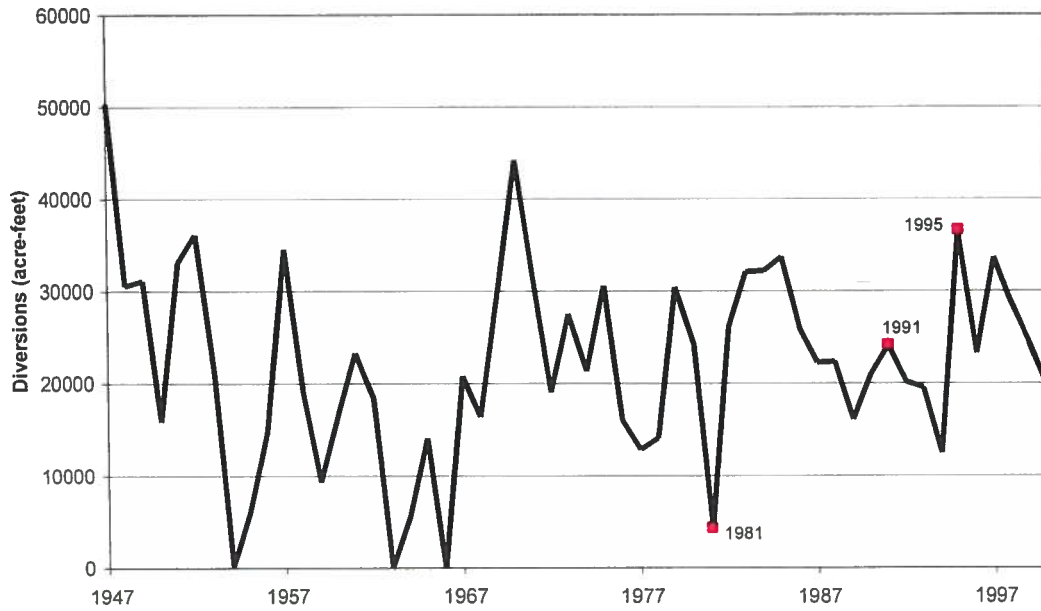
## Appendix B-1 Characterization of Flows

3. Recent years were chosen from dry, average, and wet years to use as representative years for subsequent analyses. Based on information for Denver Water staff, it is believed that shares in the canal have been relatively consistent in the last 20 years, therefore, 1981 was chosen to represent current dry conditions, 1991 was chosen to represent current average conditions, and 1995 was chosen to represent current wet conditions. **Figure 2** shows the ranked diversions with the representative years highlighted.
4. Two additional checks were made to provide confidence in the selection of years. The number of days with diversions was determined for the years 1947 through 2000 using the *countif* excel function with the spreadsheet data provided by Denver Water. The annual number of days were ranked (sorted) from least to most and graphed. **Figure 3** shows that the selected years (highlighted) also represent dry, average, and wet years based on total number of days with diversions.

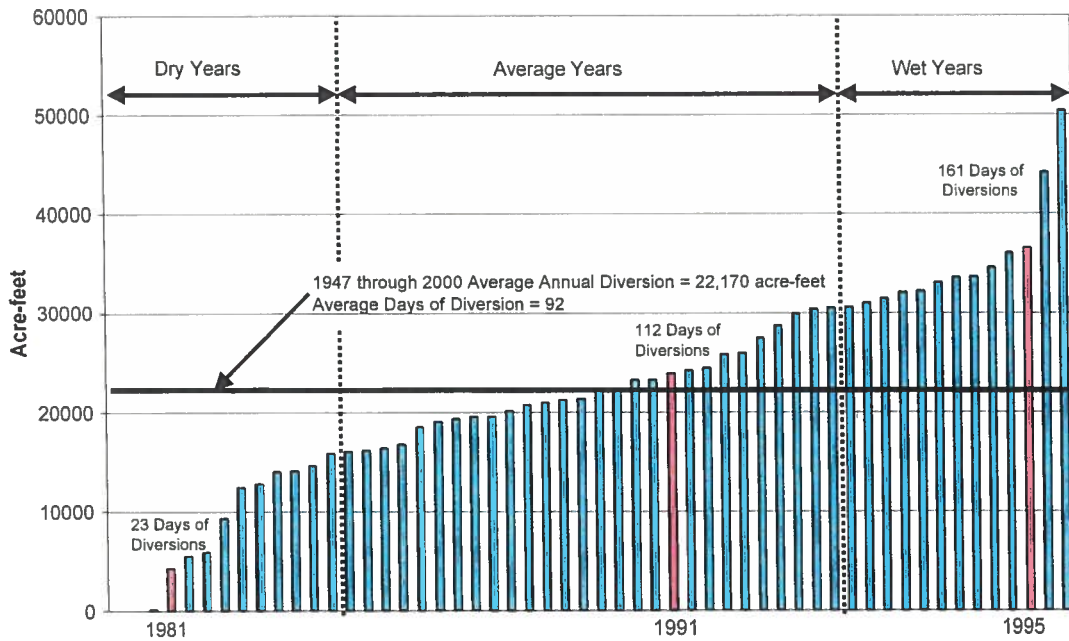
Annual diversions from a nearby gage in the South Platte River Basin, Bear Creek at Morrison, were ranked from lowest to greatest for the period 1947 through 2000 and graphed. This gage was chosen because upstream effects of storage and diversions are minimal; therefore the gage is a fair representation of South Platte basin hydrology. **Figure 4** shows that the selected years (highlighted) also represent dry, average, and wet hydrologic years based on basin hydrology.

Appendix B-1 Characterization of Flows

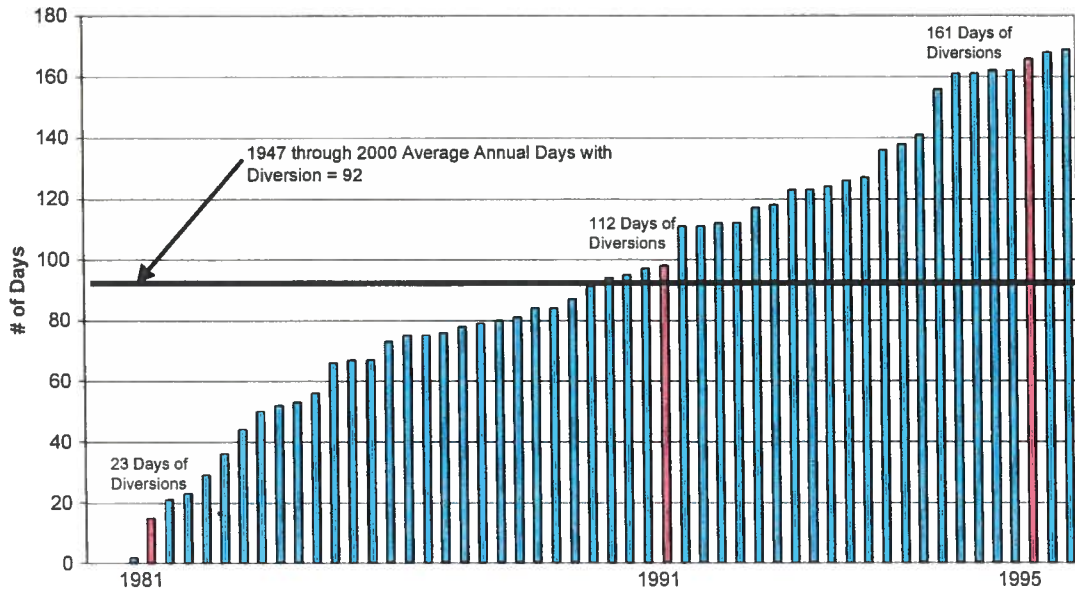
**Figure 1**  
Average Annual Headgate Diversions (1947-2000)



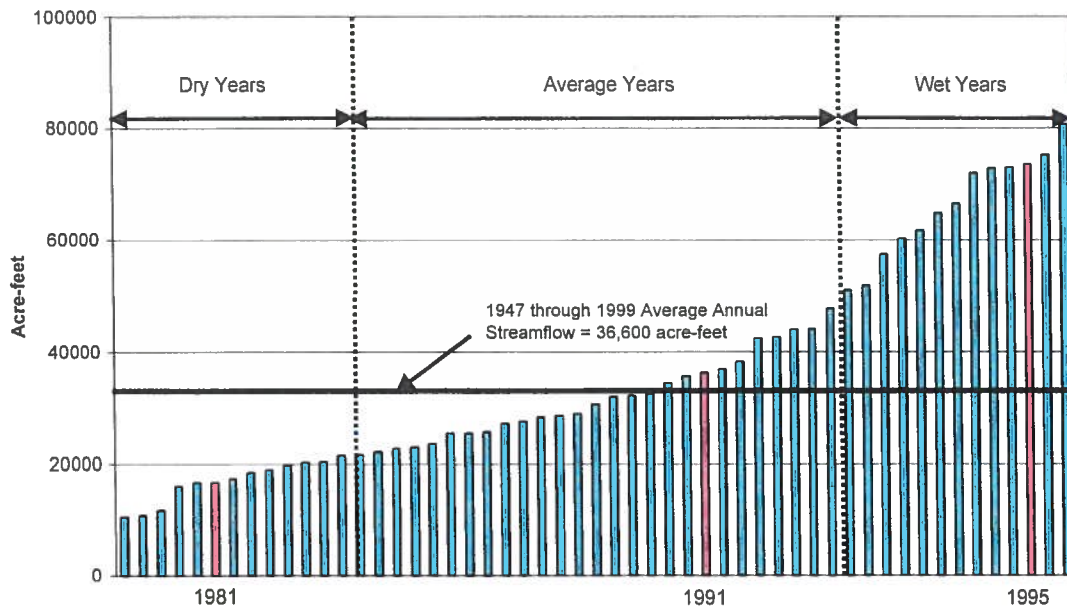
**Figure 2**  
Ranked Annual Headgate Diversions (1947 through 2000)



**Figure 3**  
**Ranked Annual Days with Diversions (1947 through 2000)**



**Figure 4**  
**Bear River at Morrison Ranked Annual Flow (1947 through 1999)**



## Appendix B-1 Characterization of Flows

### Selection of Canal Study Sites

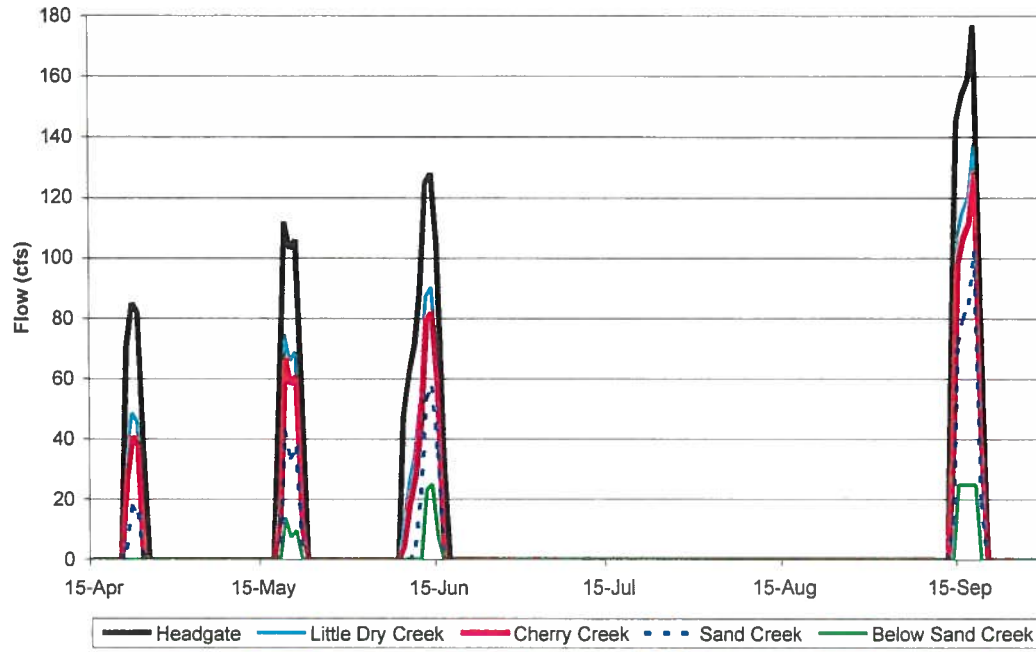
1. Study segments along the canal were selected to represent the major sections of flow regime in the canal:
  - River headgate to Little Dry Creek
  - Little Dry Creek to Cherry Creek
  - Cherry Creek to Sand Creek
  - Sand Creek to the Rocky Mountain Arsenal
2. Final study sites were selected where cross sections and rating curves were available as follows:
  - Little Dry Creek Siphon (upstream of Little Dry Creek)
  - East Harvard Avenue Bridge (upstream of Cherry Creek)
  - East 6th Avenue and Chambers Road (upstream of Sand Creek)
  - Colfax and Tower Road (downstream of Sand Creek)

The information required to determine dry, average, and wet year flow regimes was available at the four locations selected.

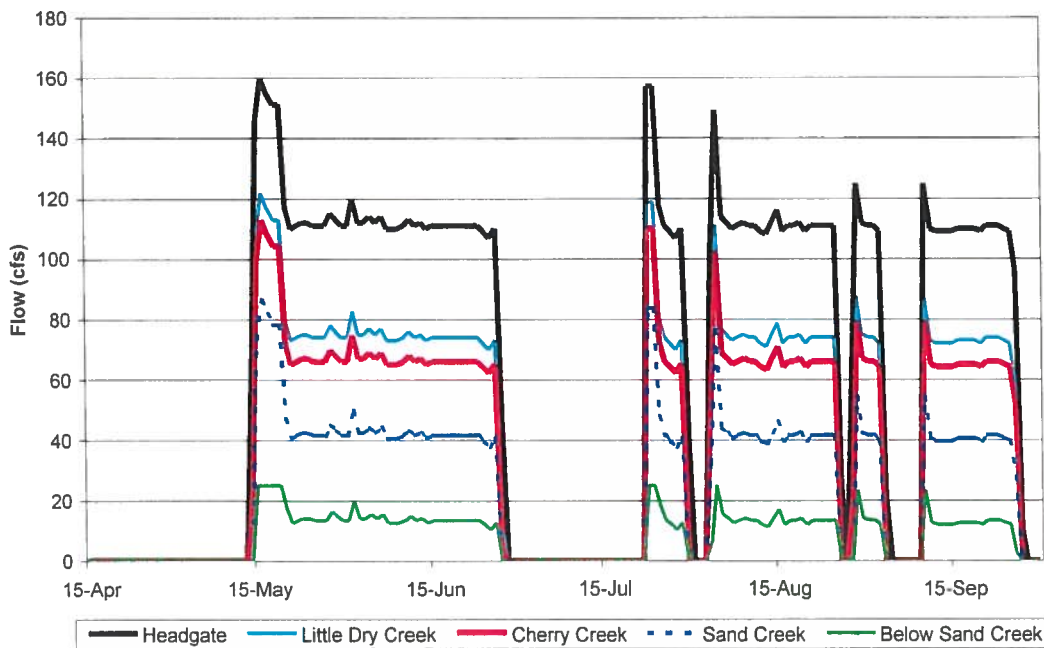
### Development of Flows at Study Sites

1. By enhancing the spreadsheet provided by Denver Water, representative dry, average, and wet year flows were estimated at each of the study sites based on river headgate diversions as follows:  
**Study Site Flow = River Headgate Diversion - Seepage - Use - Spill**  
where:  
**River Headgate Diversion** is daily diversion provided by Denver Water;  
**Seepage** is calculated based on the seepage per mile estimates provided by Denver Water;  
**Use** (irrigation use) is calculated based on the use by segment, as a percentage of river headgate diversions for the period 1997 through 2000, provided by Denver Water;  
**Spill** is calculated based on tailwater and spill estimates, as a percentage of river headgate diversions for the period 1997 through 2000, provided by Denver Water. Note that in the flow analysis, all spills are removed from the canal at Sand Creek.
  2. The flow at the Rocky Mountain Arsenal cannot exceed the lateral capacity of 25 cfs. Therefore, a check was made when the Colfax and Tower Road study site flow was calculated to assure that flow plus seepage between the site and the Rocky Mountain Arsenal did not exceed 25 cfs.
- Figure 5** shows the representative dry year flow during the irrigation season (April 15 through September 30) at the four study site locations and at the river headgate.
- Figures 6 and 7** show the representative average and wet year flows.

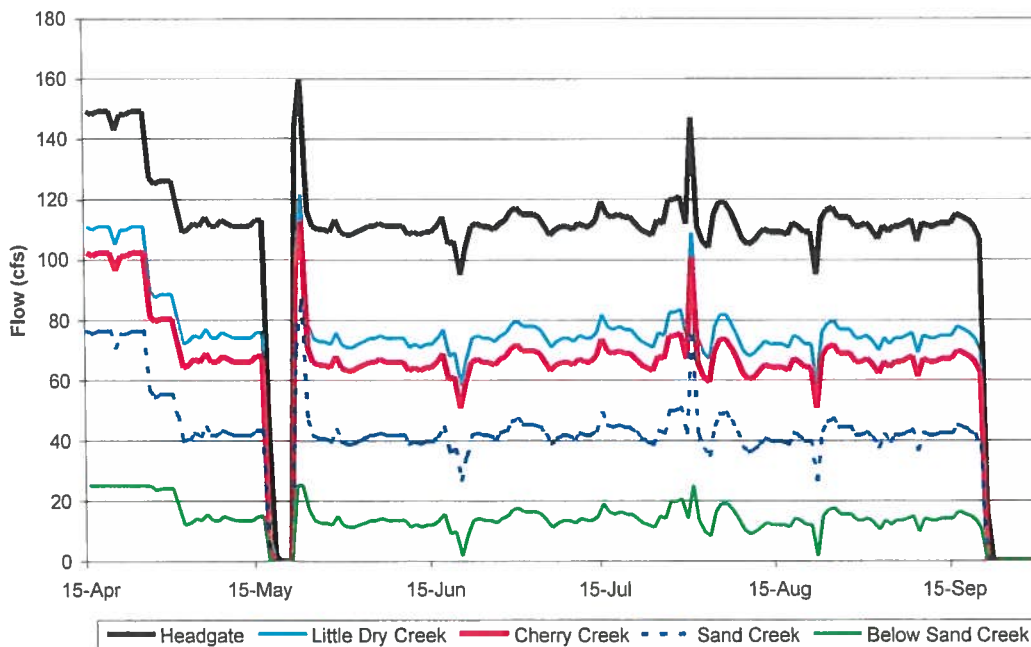
Figure 5  
Irrigation Season Flows at Study Sites - Representative Dry Year, 1981



**Figure 6**  
Irrigation Season Flows at Study Sites- Average Year, 1991



**Figure 7**  
Irrigation Season Flows at Study Sites - Representative Wet Year, 1995



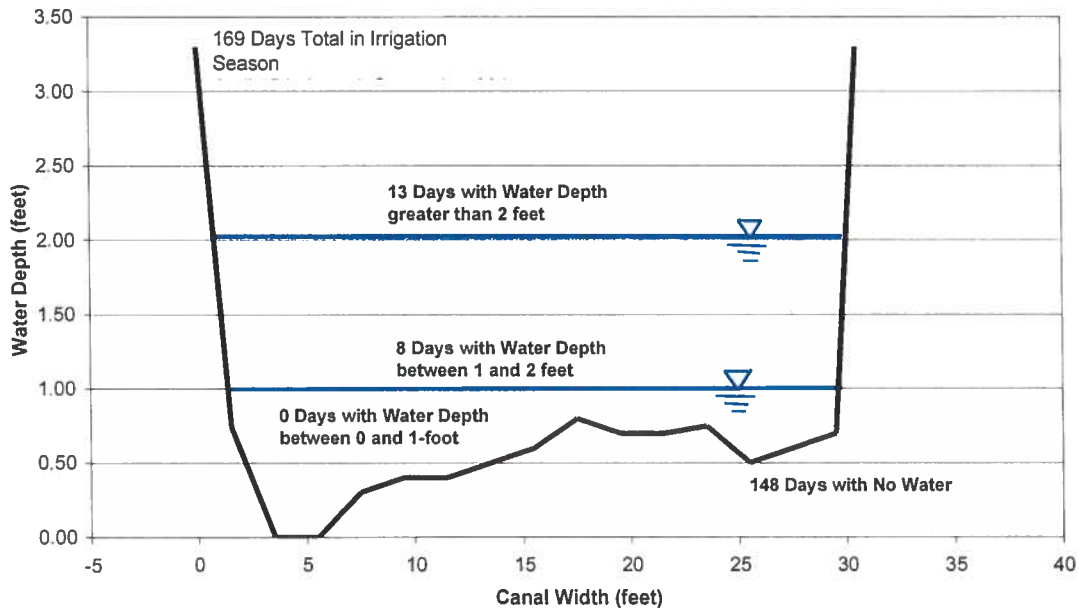


## Appendix B-1 Characterization of Flows

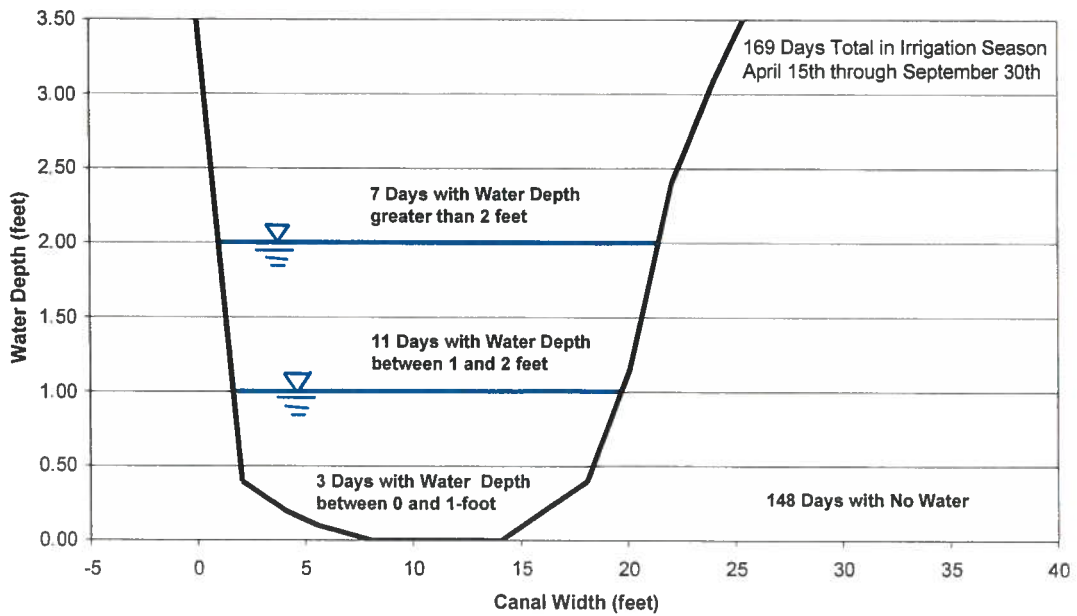
### Development of Schematic Cross Sections

1. Canal channel cross sections at the four study sites, provided by Denver Water, were digitized in excel (width versus depth). Staff gage rating curves at the four study sites were also digitized (flow versus depth).
2. The table of rating curves was cross-referenced to the dry, average, and wet year flows at each study site using the excel *vlookup* function. This command assigned depths to correspond with the flow for each day.
3. For each study site and representative year, the *countif* excel function was used to determine the number of days at the site with no flow, flow less than 1-foot, and flow between 1 and 2 feet, and flow greater than 2 feet.
4. The number of days corresponding to flow categories were included on the plotted channel cross sections at each study site for the representative dry year, as shown in **Figures 8 through 11**; the representative average year, as shown in **Figures 12 through 15**; and the representative wet year, as shown in **Figures 16 through 19**.

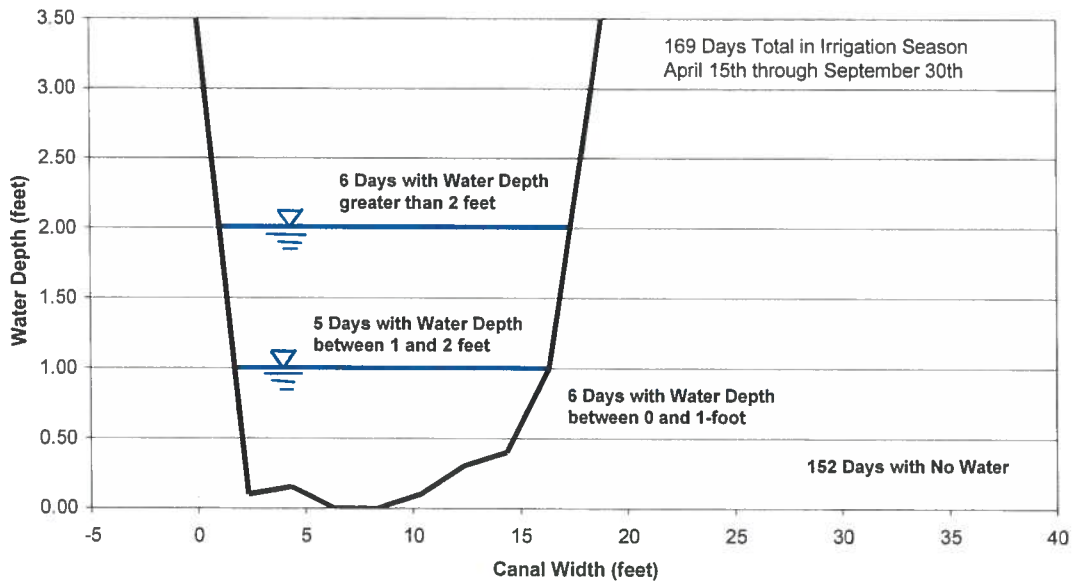
**Figure 8**  
**Dry Year Days at Selected Depths - Little Dry Creek Siphon**



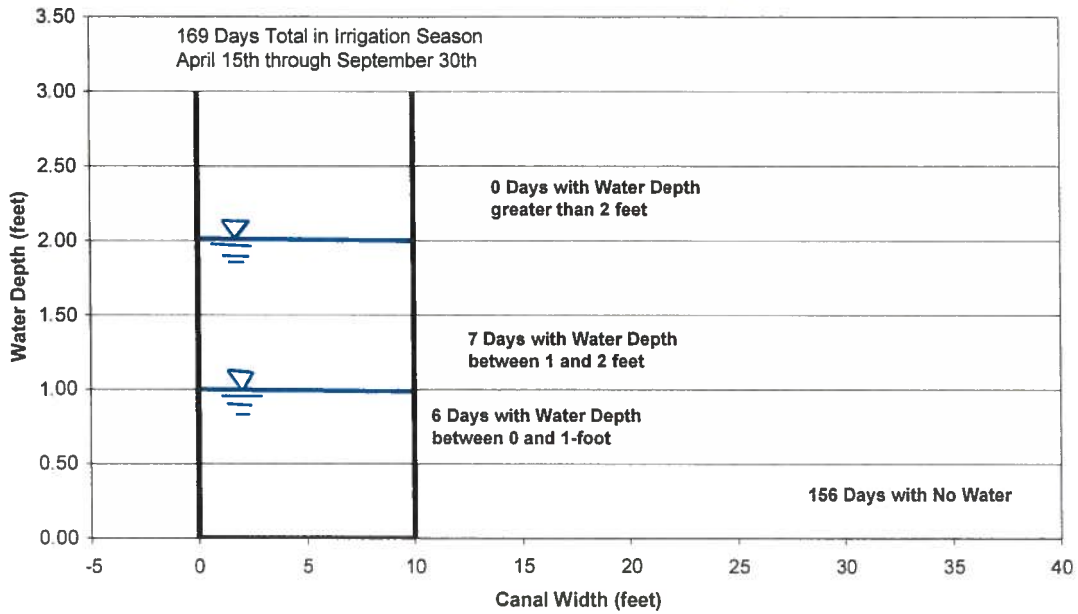
**Figure 9**  
**Dry Year Days at Selected Depths At East Harvard Avenue Bridge**



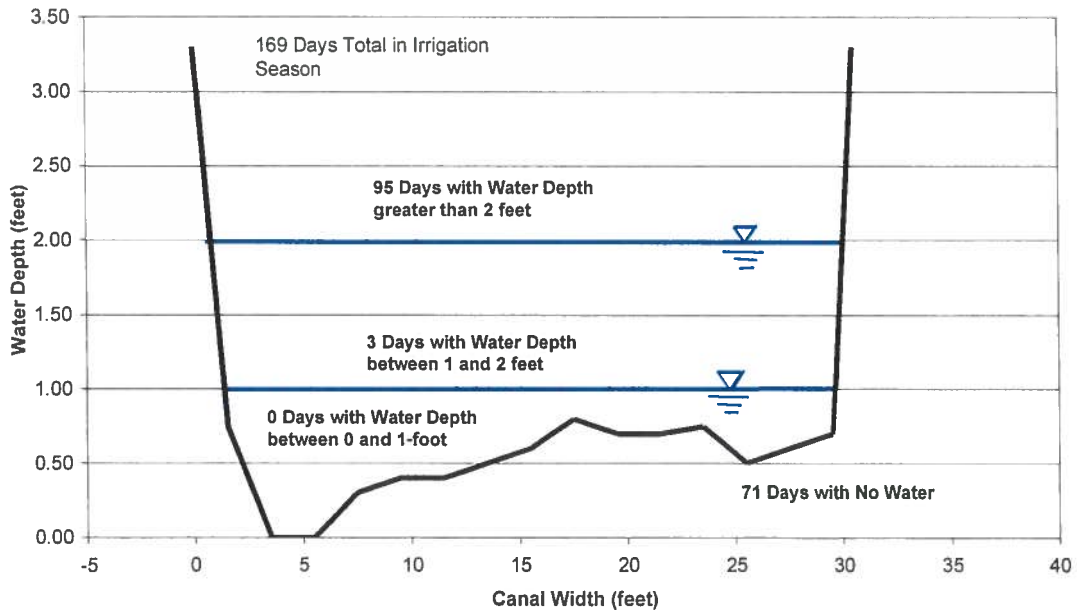
**Figure 10**  
**Dry Year Days at Selected Depths - East 6th Avenue & Chambers Road**



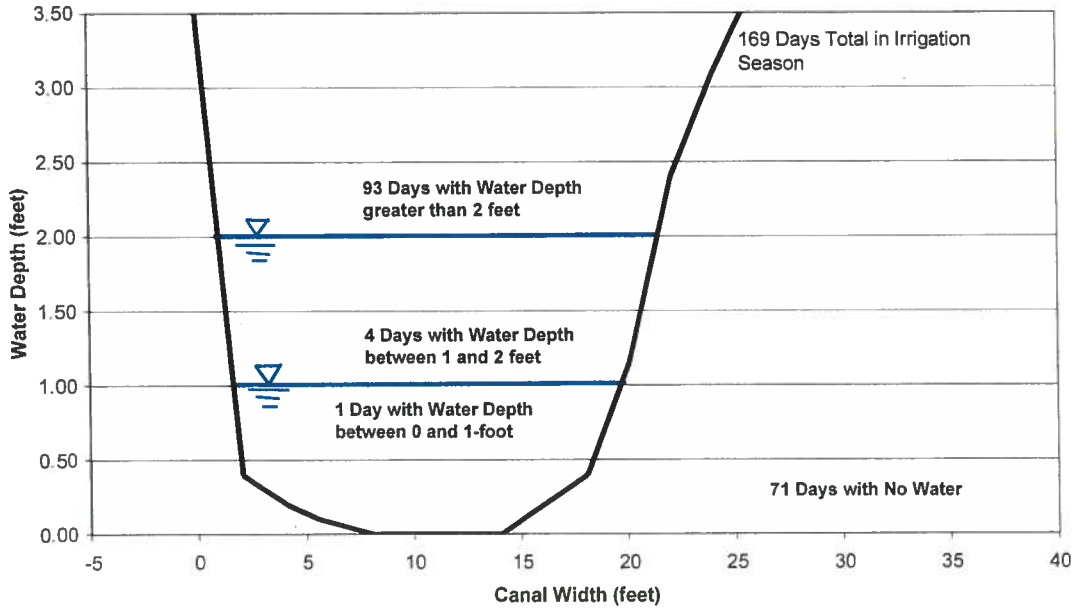
**Figure 11**  
**Dry Year Days at Selected Depths - Colfax and Tower Road**



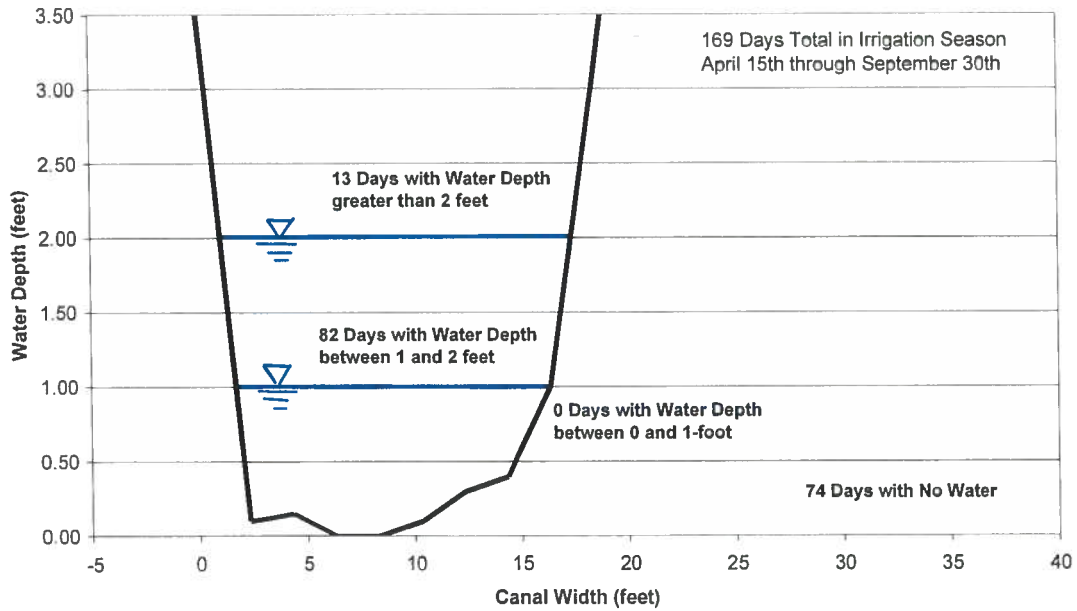
**Figure 12**  
**Average Year Days at Selected Depths - Little Dry Creek Siphon**



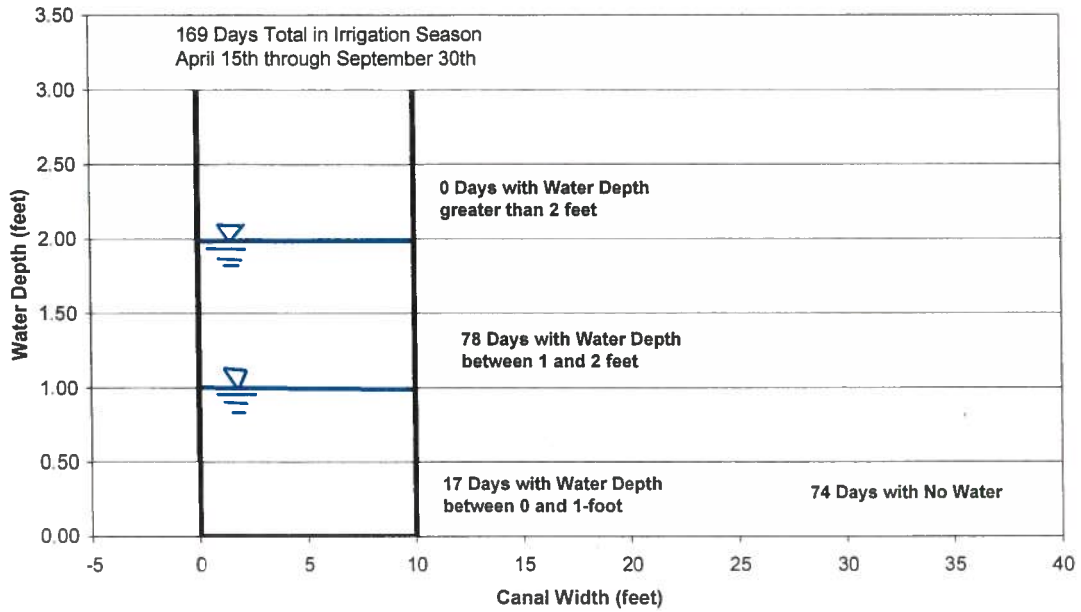
**Figure 13**  
Average Year Days at Selected Depths - East Harvard Avenue Bridge



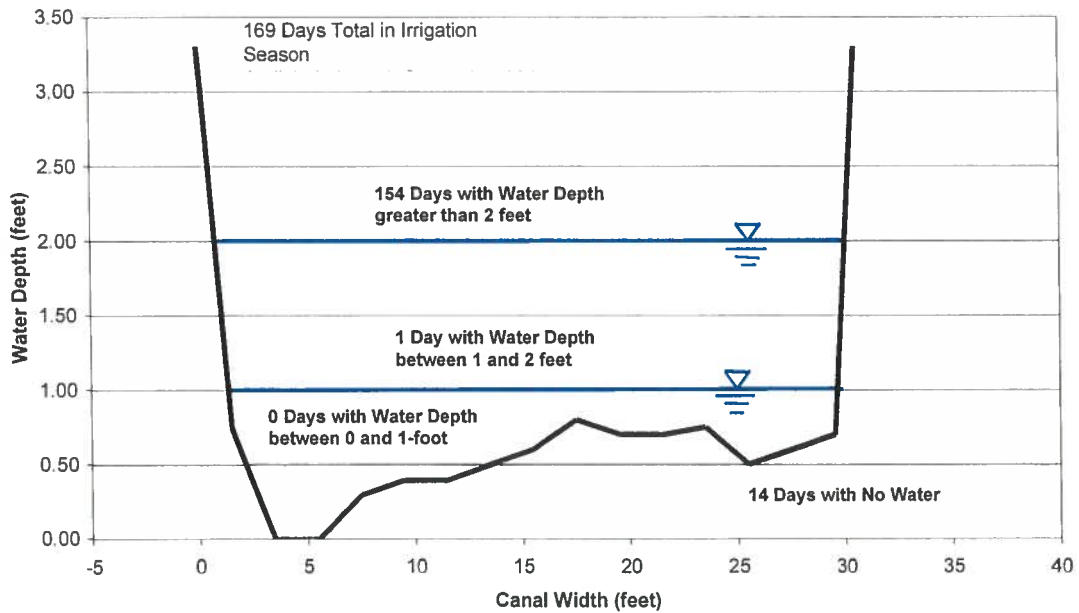
**Figure 14**  
Average Year Days at Selected Depths - East 6th Avenue & Chambers



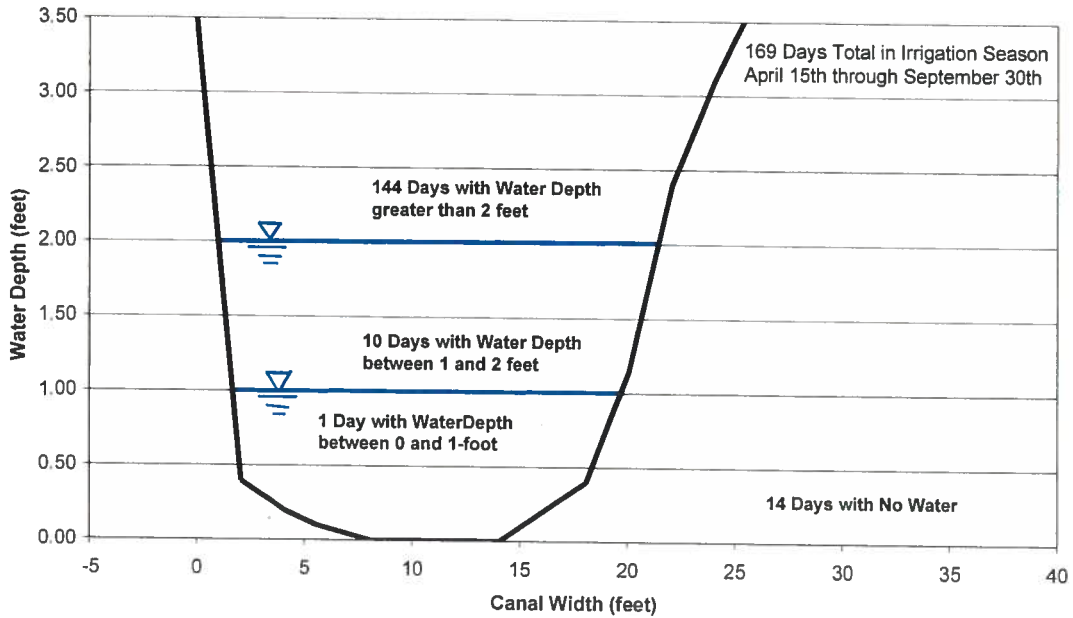
**Figure 15**  
Average Year Days at Selected Depths - Colfax and Tower Road



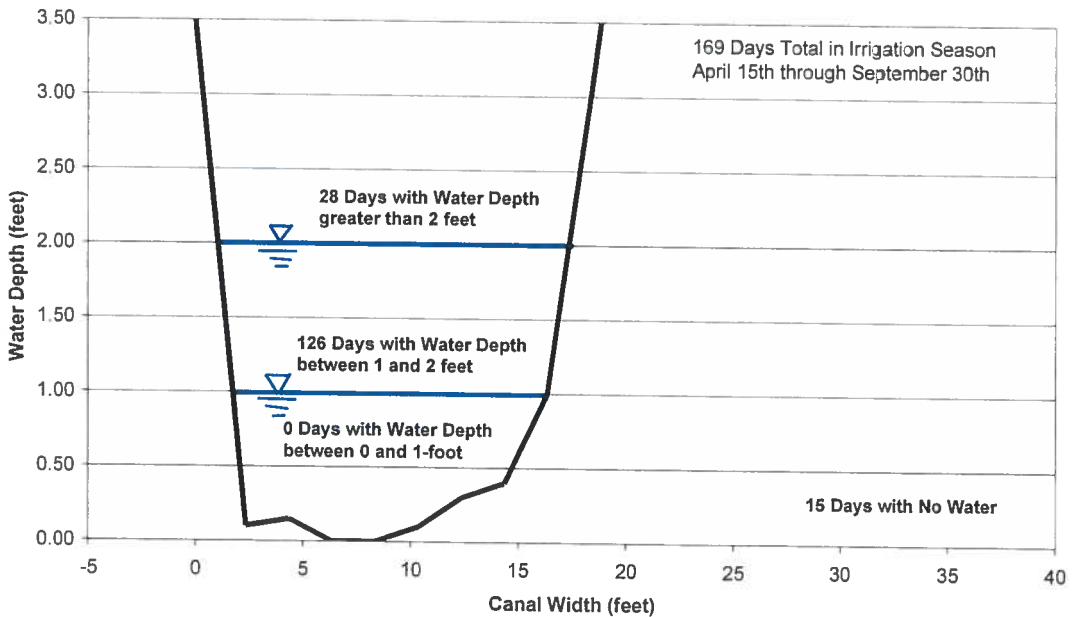
**Figure 16**  
Wet Year Days at Selected Depths - Little Dry Creek Siphon



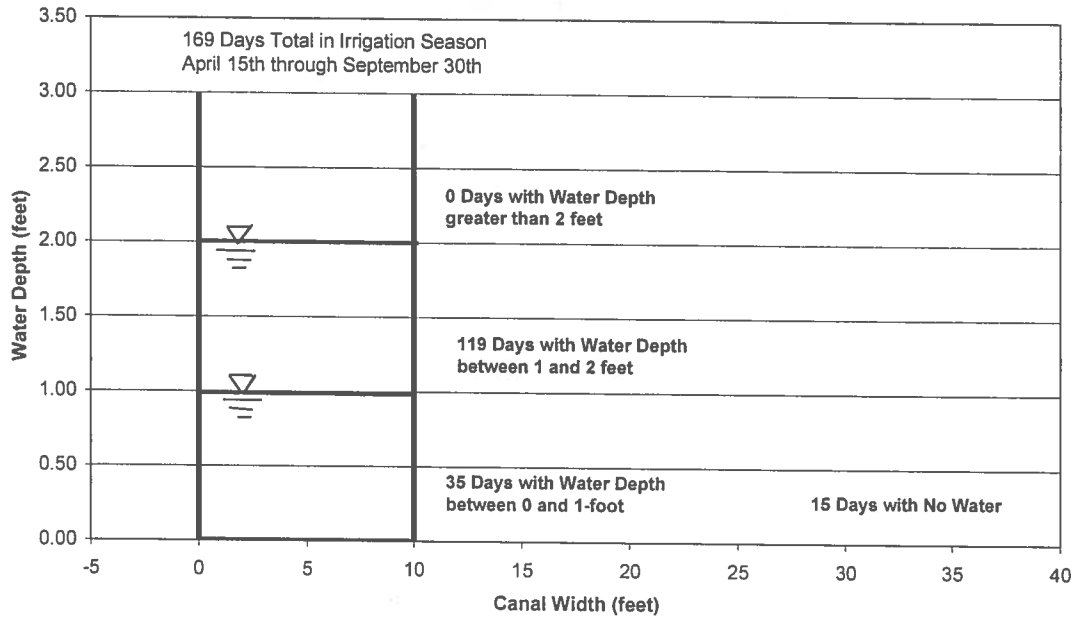
**Figure 17**  
**Wet Year Days at Selected Depths - East Harvard Avenue Bridge**



**Figure 18**  
**Wet Year Days at Selected Depths - East 6th Avenue & Chambers**



**Figure 19**  
**Wet Year Days at Selected Depths - Colfax and Tower Road**



## APPENDIX B2 QUANTIFICATION OF FLOWS FOR PRIORITIES

### High Line Canal Task 3 Memorandum

**To:** Paul Thomas  
**From:** Greg Roush, Erin Wilson, Leonard Rice Consulting Water Engineers, Inc.  
**Subject:** Task 3 – Quantify Target Flow Rates for Identified Priorities  
**Date:** May 4, 2001

#### **Introduction**

This memorandum describes the approach and results to Task 3 – Quantify the flow regimes required to meet the six priorities identified for the study. The objective of this task was to:

*Develop target flow rates and durations at four selected study sites along the canal for the six priorities listed below.*

1. Water to maintain the deciduous tree population within the lower canal property – Cherry Creek to Sand Creek.
2. Water to maintain the deciduous tree population within the lower canal property – Sand Creek to Arsenal Lateral.
3. Water to replicate the current flows regime (frequency and depth) in canal for aesthetic purposes – Cherry Creek to Sand Creek.
4. Water to replicate the current flows regime (frequency and depth) in canal for aesthetic purposes – Headgate to Cherry Creek.
5. A reliable water supply from Sand Creek to First Creek. This priority was added to original scope of work as a result of the first Water Committee meeting.
6. Water to supply a normal depth of flow for the entire canal for the entire irrigation season for aesthetic purposes.

Three main products were developed under this Task as follows:

1. Time-series graphs showing selected target flows throughout the irrigation season and representative average hydrologic year flows at the study sites along the canal.



## Appendix B-2 Quantification of Flows for Priorities

2. Schematic cross section graphs showing target levels for water depths and representative average hydrologic year water depths at the study sites.
3. Table comparing the statistics of the target flow regimes (flow rate, frequency, and depths) to the representative wet, dry and average year flow regimes.

### Data Collection

High Line Canal Tree Water Demands - Denver Water held a meeting with staff from Colorado State University on March 26, 2001 to discuss preliminary results of an on going study to determine the quantity, duration and frequency of water required to maintain trees along the canal. The following information was provided:

- Copy of handouts from the March 26, meeting.
- Water Usage of Cottonwoods, Progress Report for 2000 Submitted to Denver Water Department, February 15, 2001 by W.R. Jacobi et. al. Colorado State University.
- A letter from Denver Water with recommended minimum watering requirements in average type years to maintain existing trees.

Meeting with Water Subcommittee – Information regarding target flows was obtained at the first two water subcommittee meetings from study participant representatives. Major items of discussion and direction provided by the subcommittee were the following:

- Target flows to sustain existing trees would represent the minimum flow requirements for identifying water supplies in this study.
- Target flows for replicating current flow regime, in terms of frequency and depth of water, would be based on the representative average year flows of 1991. The 1991 flows are to be adjusted down by 82% to reflect current average headgate deliveries of 90 cfs versus the average headgate deliveries in 1991 of 110 cfs.

### Approach and Results

The following approach was followed in estimating target flows for each of the study priorities.

Priority No. 1 - Water to maintain the deciduous tree population within the lower canal property – Cherry Creek to Sand Creek.

Target levels to meet the water needs of Cottonwoods and other trees along the canal are based on interpretation of preliminary results developed in the CSU study. The trees along the lower canal may need to be watered three times between spring and early fall:

1. Spring Time: Recharge the soil moisture along the lower canal. It is estimated at this time it takes about seven days of flow in the canal to recharge the soil moisture. Watering in the spring is the highest priority.
2. August: Recharge the soil moisture along the canal. This is the second priority.

## Appendix B-2 Quantification of Flows for Priorities

3. September: Recharge of soil moisture could help prepare trees for winter dormancy. This is the third priority.

The desired target flow of 21 cfs in the canal near Cherry Creek is the estimated seepage loss from Cherry Creek to Sand Creek plus 1 cfs to maintain sufficient water depth at the end of the canal reach to have seepage for soil moisture recharge. The duration of target flows will be two weeks in the early spring (April-June), one week in August and one week in September. The selected target flow is shown along with the representative average year (1991) flow in Figures 1 and 2. Target flow statistics (average flow rate, water depth, number of days of diversion, and total volume) are compared with historic wet, dry and average years in Table 1.

Priority No. 2 - Water to maintain the deciduous tree population within the lower canal property – Sand Creek to Arsenal Lateral.

The same approach as described for Priority 1 was applied to defining the target flows for Priority 2. The desired target flow of 7 cfs in the canal near Cherry Creek is the estimated seepage loss from Sand Creek to the Arsenal Lateral plus 1 cfs to maintain sufficient water depth at the end of the canal reach to have seepage for soil moisture recharge. The duration of target flows will be two weeks in the early spring (April-June), one week in August and one week in September. The selected target flow is shown along with the representative average year (1991) flow in Figures 3 and 4. Target flow statistics (average flow rate, water depth, number of days of diversion, and total volume) are compared with historic wet, dry and average years in Table 1.

Priority No. 3 - Water to replicate the current flow regime (frequency and depth) in canal for aesthetic purposes – Cherry Creek to Sand Creek.

In Task 2 the flow regime (frequency and depth) in the canal was characterized for wet, dry and average type years. The water subcommittee made the decision to establish target flows for this priority based on current average year conditions. The representative average year selected in Task 2 was 1991. In 1991 the normal headgate diversion was about 110 cfs. The current normal headgate diversion of about 90 cfs, is a result of more efficient operations.

Target flows for this priority are based on historic flows of the representative average year conditions adjusted down to reflect current flow regime. The adjustment factor applied is the ratio of 90 cfs divided by 110 cfs or about 82%. The selected target flow (~55 cfs, for ~98 days) shown along with the representative average year (1991) in Figures 5 and 6. Target flow statistics (average flow rate, water depth, number of days of diversion, and total volume) are compared with historic wet, dry and average years in Table 1.

It should be noted that the target flows mentioned above are the estimated flows needed to replicate current frequency and depth of water in the canal, based on the canal dimensions that exist today. The same aesthetic value (frequency and depth) may be achieved with less water along with canal modifications such as narrowing of the canal, or installing check dams to create a bank full look. Thus, the water depth shown in Figure 6 may be the primary target to which water supply alternatives will be evaluated.

## Appendix B-2 Quantification of Flows for Priorities

Priority No. 4 - Water to replicate the current flows regime (frequency and depth) in canal for aesthetic purposes – Headgate to Cherry Creek.

A similar approach as described for Priority 3 was applied to defining the target flow regime for Priority 4. The difference is Denver Water will be continuing to provide water to users in the upper reach. The frequency of flow in this reach is not expected to change but the amount and depth of flow will be reduced once deliveries are discontinued to current contract users downstream of Cherry Creek.

Denver Water estimates future headgate diversions to average about 60 cfs compared to 90 cfs currently. The difference of 30 cfs is the target flow at the headgate.

At the representative cross section for this canal reach, Little Dry Creek cross section, the target flow (24 cfs) is the difference between estimated current average flows (61 cfs) and estimated future canal flows (37 cfs) for delivery to contract users between Little Dry Creek and Cherry Creek. The selected target flow (~ 24 cfs, for ~99 days) is shown along with the representative average year (1991) in Figures 7 and 8. As discussed above the 1991 flows have been reduced to reflect current normal headgate diversions (~82% of 1991 headgate diversions). Target flow statistics (average flow rate, water depth, number of days of diversion, and total volume) are compared with historic wet, dry and average years in Table 1.

Priority No. 5 - A reliable water supply from Sand Creek to First Creek.

A similar approach as described for Priority 3 was applied to defining the target flows for Priority 5. However, instead of delivering the water to the Arsenal Lateral the water would remain in the canal and be conveyed to First Creek. Currently no water is carried in the canal from the Arsenal Lateral to First Creek. The selected target flow (~17 cfs, for ~95 days) is shown along with the representative average year (1991) in Figures 9 and 10. Target flow statistics (average flow rate, water depth, number of days of diversion, and total volume) are compared with historic wet, dry and average years in Table 1.

Priority No. 6 - Water to supply a normal depth of flow for the entire canal for the entire irrigation season for aesthetic purposes.

The current normal diversion rate, when in priority, is about 90 cfs. The selected target flow (~90 cfs, for ~169 days) is shown along with the representative wet, dry and average years in Figure 11. Target flow statistics (average flow rate, water depth, number of days of diversion, and total volume) are compared with historic wet, dry and average years in Table 1.

Appendix B-2 Quantification of Flows for Priorities

**TABLE 1  
TARGET FLOW RATES AT STUDY CROSS SECTIONS**

**Priority No. 1 - Tree Maintenance - Cherry Cr to Sand Cr**  
**Cross Section: South of Cherry Cr at E. Harvard Bridge**

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow (cfs)	69	55	68	21
Avg Depth (ft)	2.2	1.9	2.1	1.1
Avg No. Days	155	21	98	28
Volume (af)	21,300	2,300	13,200	1,200

**Priority No. 2 - Tree Maintenance - Sand Cr to Arsenal Lateral**  
**Cross Section: North of Sand Cr at Colfax and Tower Rd.**

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow (cfs)	21	20	20	7
Avg Depth (ft)	1.1	1.1	1.1	0.4
Avg No. Days	154	13	95	28
Volume (af)	6400	500	3800	400

**Priority No. 3 - Aesthetics - Cherry Cr to Sand Cr**  
**Cross Section: South of Cherry Cr at E. Harvard Bridge**

	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow (cfs)	69	55	68	55
Avg Depth (ft)	2.2	1.9	2.1	1.9
Avg No. Days	155	21	98	98
Volume (af)	21,300	2,300	13,200	10,800

**Priority No. 4 - Aesthetics - Headgate to Cherry Cr**  
**Cross Section: At Little Dry Creek**

	Representative Historical Data			Current Flows	Est. Future Flows	Target Flows
	Wet	Dry	Average			
Avg Flow (cfs)	77	60	75	61	37	24
Avg Depth (ft)	2.4	2.1	2.3	2.2	1.9	0.3
Avg No. Days	155	22	99	99	0	99
Volume (af)	23,800	2,600	14,700	12,000	7,300	4,700

Target flow is the amount of water in addition to estimated future deliveries needed to replicate current flows.

**Priority No. 5 - Reliable Flow - Sand Cr to First Creek**  
**Cross Section: North of Sand Cr at Colfax and Tower Rd.**

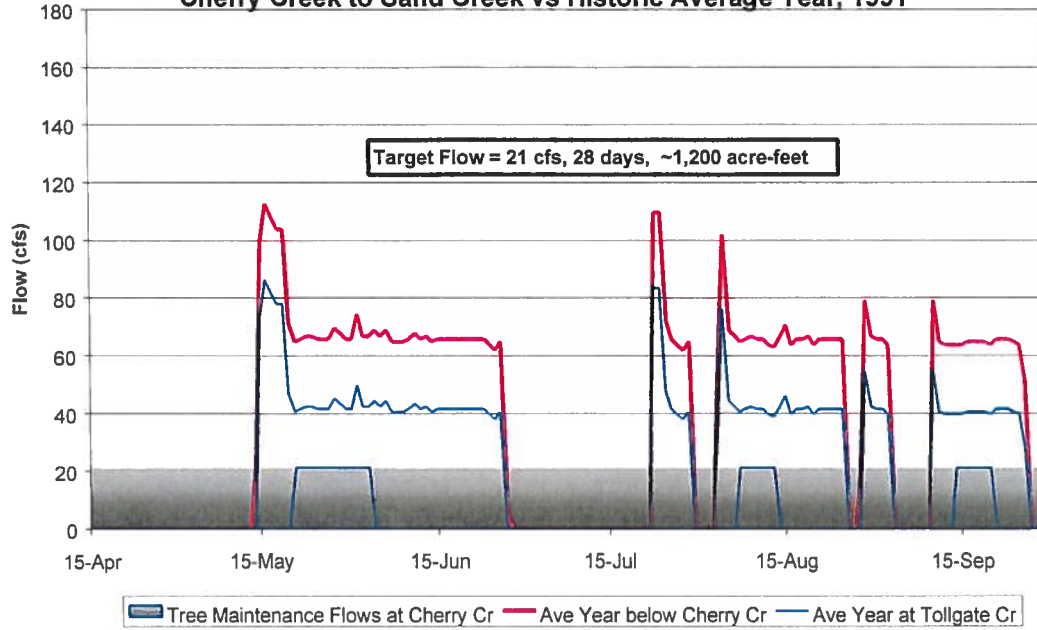
	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow (cfs)	21	20	20	17
Avg Depth (ft)	1.1	1.1	1.1	0.9
Avg No. Days	154	13	95	95
Volume (af)	6,400	500	3,800	3,100

**Priority No. 6 - Normal Depth for Entire Canal, Entire Season**  
**Cross Section: Near Headgate at Rampart Range Rd.**

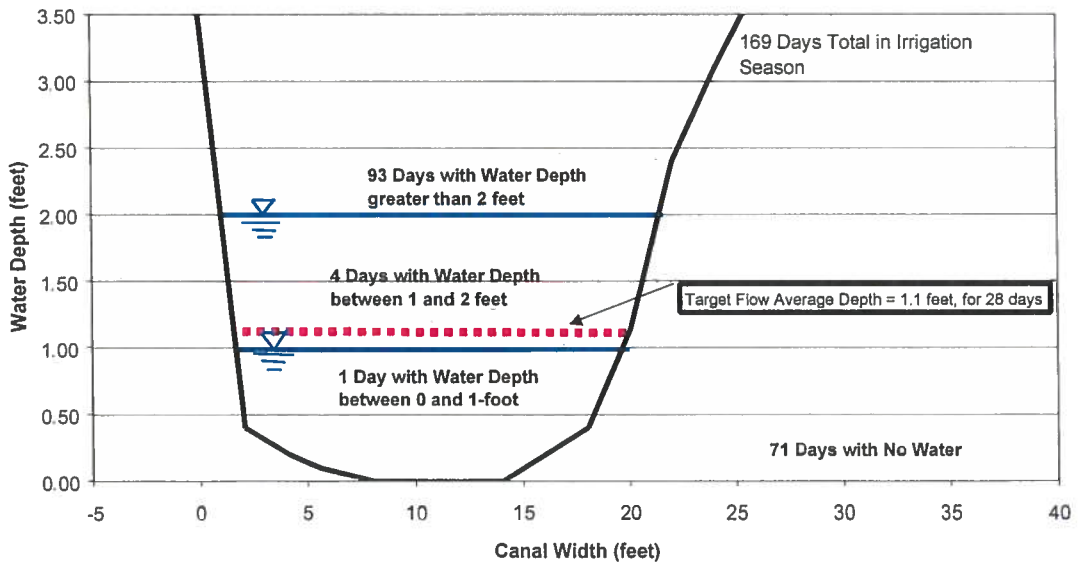
	Representative Historical Data			Target Flows
	Wet	Dry	Average	
Avg Flow (cfs)	113	94	109	90
Avg Depth (ft)	1.9	1.6	1.8	1.5
Avg No. Days	157	23	102	169
Volume (af)	35,300	4,300	22,100	30,200

Appendix B-2 Quantification of Flows for Priorities

**Figure 1**  
**Water Supply Priority 1 - Tree Maintenance Flows from**  
**Cherry Creek to Sand Creek vs Historic Average Year, 1991**

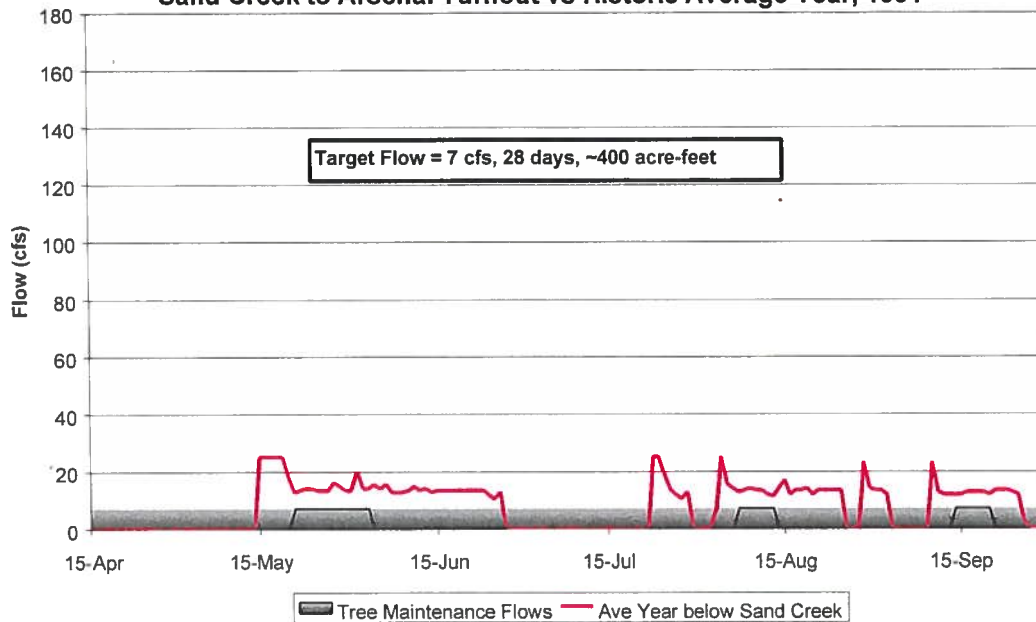


**Figure 2**  
**Average Year Days at Selected Depths - East Harvard Avenue Bridge**  
**and Target Flow Depth for Priority 1- Tree Maintenance Cherry Cr to Sand Cr**

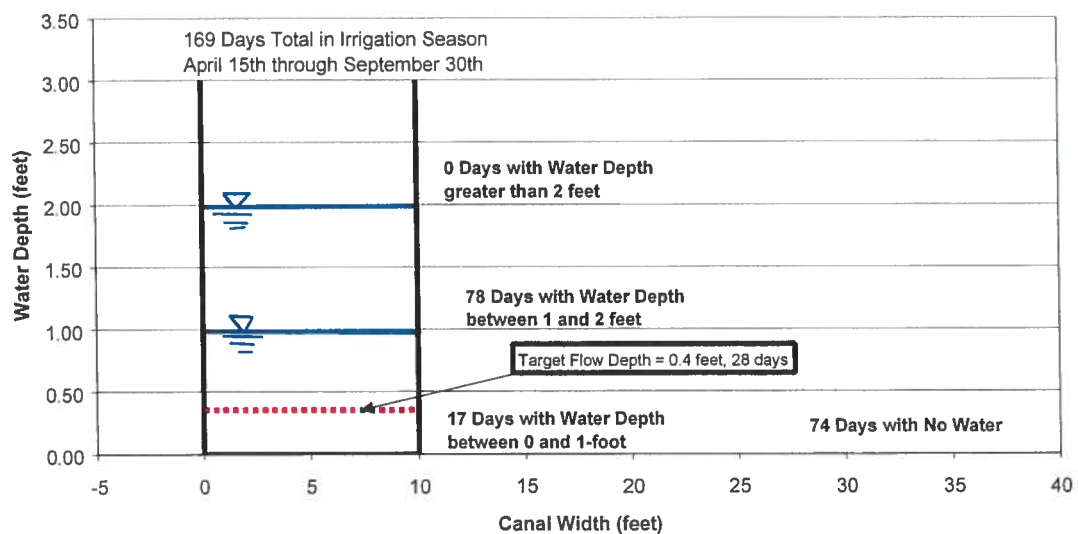


Appendix B-2 Quantification of Flows for Priorities

**Figure 3**  
**Water Supply Priority 2 - Tree Maintenance Flows from Sand Creek to Arsenal Turnout vs Historic Average Year, 1991**

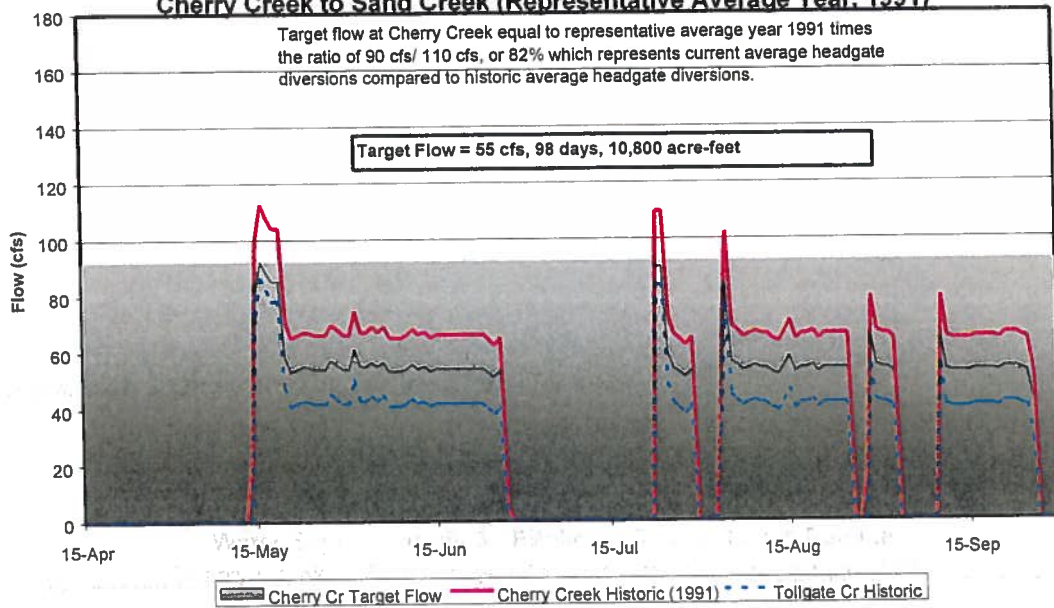


**Figure 4**  
**Average Year Days at Selected Depths - Colfax and Tower Road and Target Flow Depth for Priority 2, Tree Maintenance from Sand Cr to Arsenal Lateral**

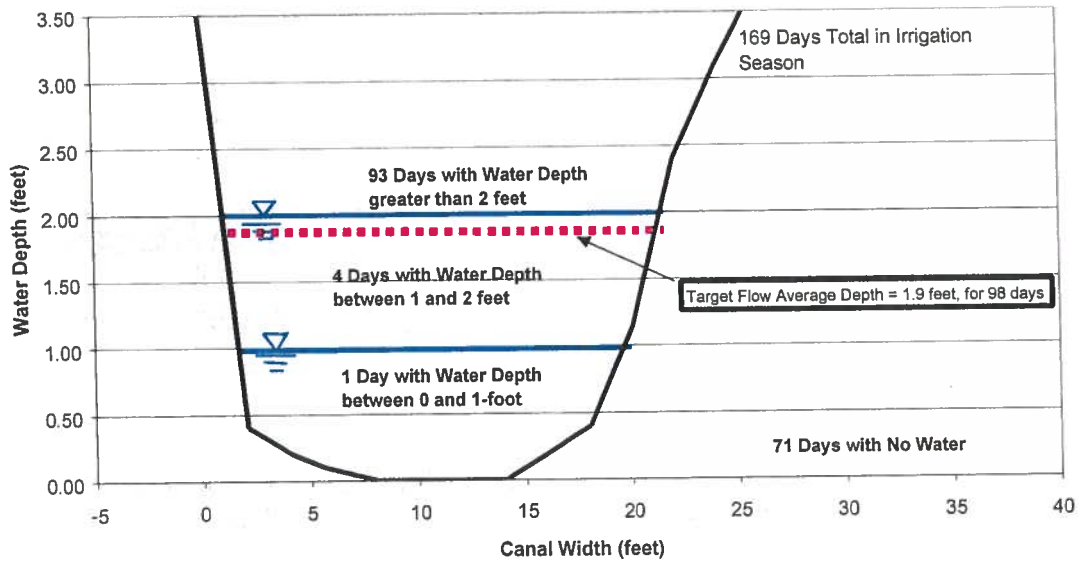


Appendix B-2 Quantification of Flows for Priorities

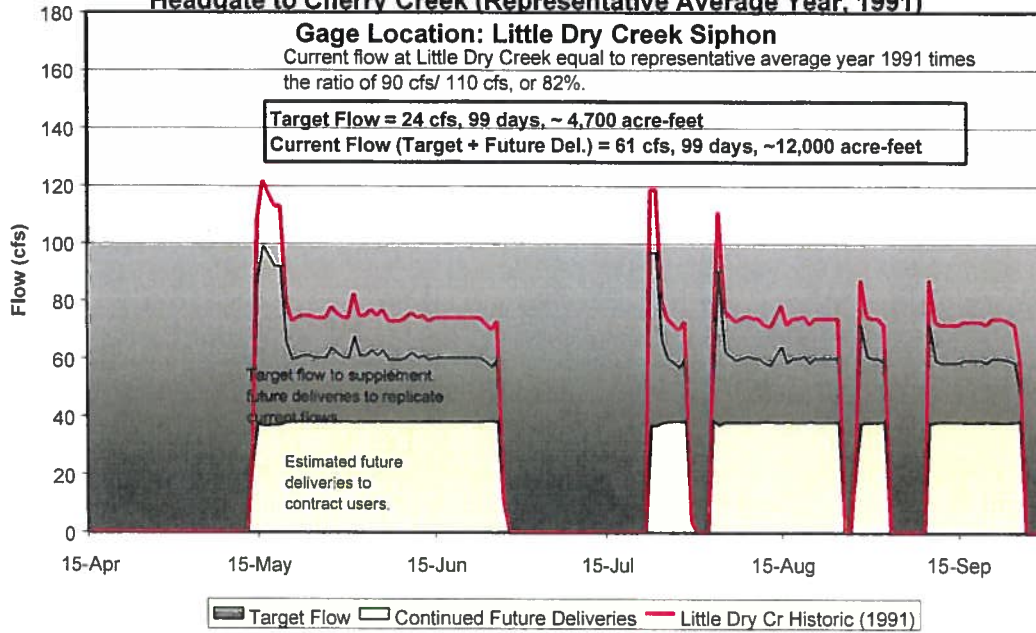
**Figure 5**  
**Water Supply Priority 3 - Replicate Current Flows Regime**  
**Cherry Creek to Sand Creek (Representative Average Year, 1991)**



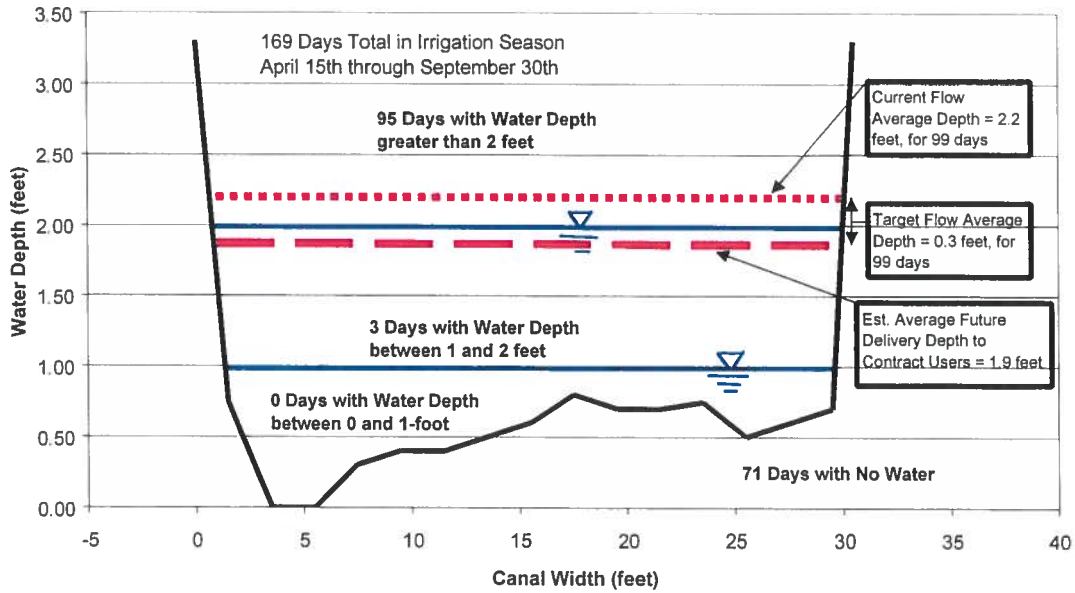
**Figure 6**  
**Average Year Days at Selected Depths - East Harvard Avenue Bridge**  
**and Target Flow Depth for Priority 3- Aesthetics Cherry Cr to Sand Cr**



**Figure 7**  
**Water Supply Priority 4 - Replicate Current Flows Regime**  
**Headgate to Cherry Creek (Representative Average Year, 1991)**



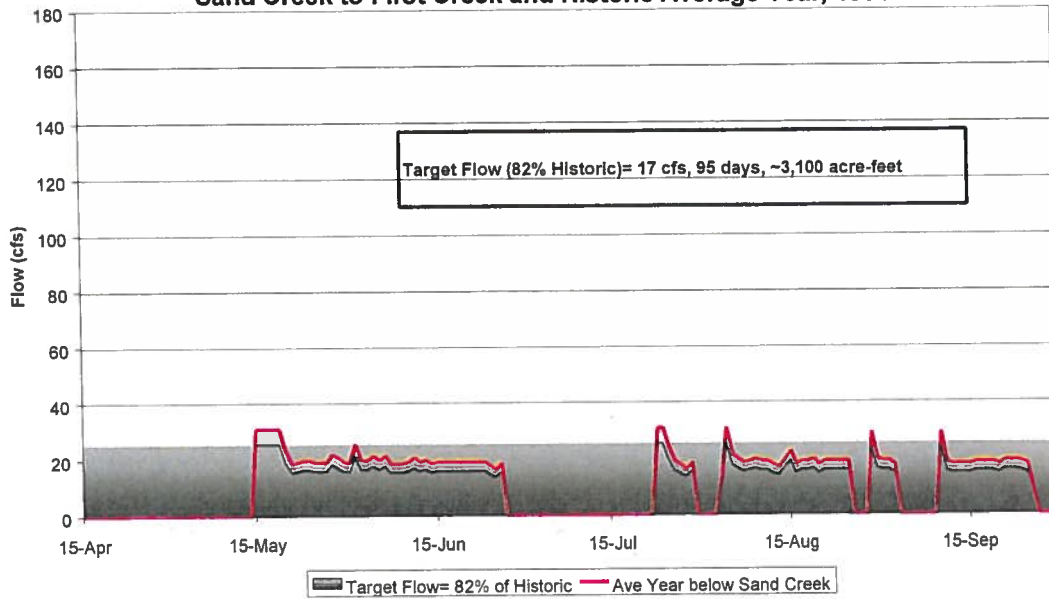
**Figure 8**  
**Average Year Days at Selected Depths - Little Dry Creek Siphon**  
**and Target Flow Depth for Priority 4- Aesthetics Headgate to Cherry Cr**



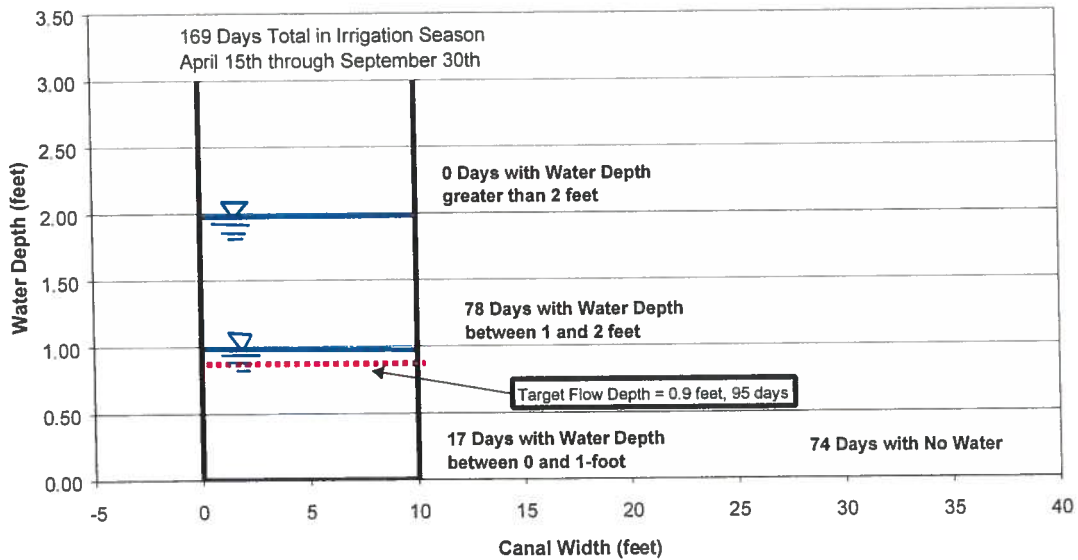


Appendix B-2 Quantification of Flows for Priorities

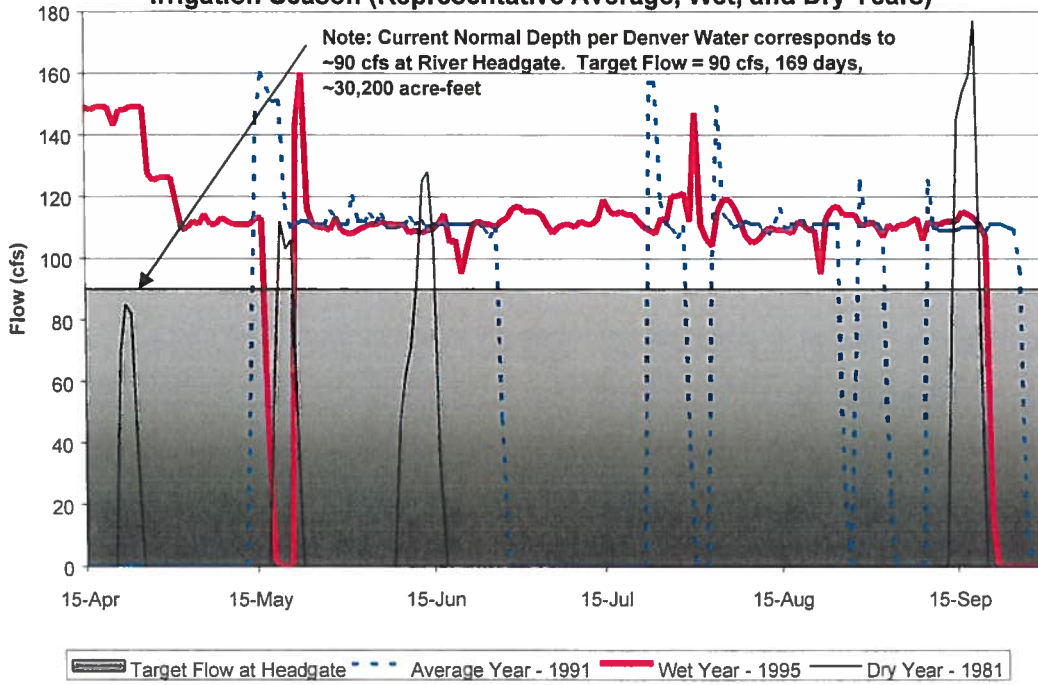
**Figure 9**  
**Water Supply Priority 5 - Reliable Water Supply from Sand Creek to First Creek and Historic Average Year, 1991**



**Figure 10**  
**Average Year Days at Selected Depths - Colfax and Tower Road and Target Flows for Priority 5, Reliable Flow from Sand Cr to Arsenal Lateral**



**Figure 11**  
**Water Supply Priority 6 - Normal Depth for Entire Canal, Entire Irrigation Season (Representative Average, Wet, and Dry Years)**



## APPENDIX B3 POTENTIAL WATER SUPPLY SOURCES

### High Line Canal Task 4 Memorandum

**To:** Paul Thomas  
**From:** Greg Roush and Erin Wilson, Leonard Rice Consulting Water Engineers  
**Subject:** Task 4 – Quantify Target Flow Rates for Identified Priorities  
**Date:** May 24, 2001

#### Introduction

This memorandum describes the approach and results to Task 4 – Identify Sources of Water. The purpose of this task is to; a) develop a list of water sources and potential structural enhancements to meet the Task 3 target flows, and b) develop guidelines for collection of data on each water supply or structural enhancement element.

Two main products were developed under this Task as follows:

1. A list of potential water supply elements with brief, one paragraph, summaries of potential supply element.
2. Guidelines to follow in the collection and summary of data needed to characterize each water supply element and to allow reasonable comparison of various water supply elements in Task 7.

#### Approach and Results

Potential Water Supply Elements - Leonard Rice Engineers and Wright Water Engineers developed a list of typical water supply sources and canal modification concepts. These sources and concepts were first discussed at two meetings with several of the participating agencies, then a third meeting was held with the water subcommittee to finalize the list as follows.

- Meeting held at Aurora on April 4<sup>th</sup> with Aurora and Denver Water staff.
- Meeting held at Wenk Associates on April 25<sup>th</sup> with City of Denver, Urban Drainage and Flood Control District, and Arapahoe County to identify storm water opportunities primarily from the South Platte headgate to the Cherry Creek area.
- Water Subcommittee brainstorming meeting held at Denver Water on May 2<sup>nd</sup>.

## Appendix B-3 Potential Water Supplies

Leonard Rice Engineers and Wright Water Engineers also developed guidelines for collection of data related to the water supply elements based on past experience. These guidelines were presented and discussed with the water subcommittee on May 17, 2001.

Table 1 summarizes the potential water supply concepts to meet the identified water supply targets in this study which have been categorized into the following types:

- Direct flow
- Storage
- Consumable Lawn Grass Return Flows
- Consumable Effluent
- Groundwater
- Storm Water
- Canal Modifications

The objective was to compile a comprehensive list of potential water supplies and concepts to meet tree maintenance needs and provide water for aesthetic purposes in terms of water depth and flow in the canal. In this task no judgments have been made regarding the feasibility of the listed water supply concepts and canal modifications.

Data Collection Guidelines - Readily available data needs to be collected for the water supply elements identified in Table 1 to allow an evaluation to determine the most promising options that meet the study objectives. A representative project for each of the water supply concepts is to be identified. As stated in the scope of work, information will first be obtained from the consultants' experience, libraries, and past job files. Next subcommittee members will be asked to collect information from their organizations. Any remaining information will be estimated based on consultants' professional judgment.

The data to be collected has been categorized to address four main issues of quantity, quality, cost, and permitting/litigation. For each main issue there are several subissues as identified in Table 2. The data collected will be summarized into an Excel spreadsheet, similar to that shown in Figure 1, to allow sorting and comparison of water supply alternatives by the water subcommittee.

**Appendix B-3 Potential Water Supplies**

Table 1  
List of Potential Water Supply Elements

<b>TYPE</b>	<b>BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT</b>
Direct Flow	<b>New Headgate Water Right</b> – A new 2001 priority water right could be filed at the headgate of the High Line Canal for the decreed purposes of recreation, aesthetics and tree maintenance. This right may have a yield sufficient to meet study target flows in wet years, or wet periods in average and dry hydrologic years.
Direct Flow	<b>New Water Rights at Tributary Crossings</b> - New water rights could be filed on perennial tributaries that cross the canal. During times a 2001 water right is in priority the water could be diverted by gravity or pumped into the canal to meet study target flows. The decreed junior rights could also serve as diversion points for other water sources in an exchange or augmentation plan.
Direct Flow	<p><b>Continued Use of 1879 Right at Headgate</b> – Denver Water plans to continue deliveries of water to share holders from the headgate to Cherry Creek, however the flow rate will be less than current flow rates. It may be sufficient to meet the needs of the trees and provide much of the aesthetic value of flowing water in this upper reach of the canal. Denver Water has also offered to provide additional water to the lower canal under the following conditions to help meet spring time needs of trees and to small user needs on the canal section between Cherry Creek and Sand Creek:</p> <ul style="list-style-type: none"> <li>• Deliveries will only be made when Denver Water’s storage reservoirs are full or projected to fill.</li> <li>• At this time based on tree research to date, it is estimated the delivery will be about 2 weeks in the spring during April through June. Further tree research may modify this.</li> <li>• The amount delivered beyond Cherry Creek shall be the contract users entitlement, plus a sufficient amount to cover seepage losses and provide sufficient head at the lateral headgate to make the delivery.</li> </ul> <p>Providing water to the remaining lower canal small users is the may satisfy the estimated tree water requirements in the spring when the above conditions are satisfied. This however, is not a dependable supply in many years.</p>
Direct Flow	<b>1879 Rights on Tributaries</b> – It may be that the High Line Canal already has an 1879 right to water in tributaries crossing the High Line Canal. In a previous water court case for a different ditch in the metropolitan area the water court ruled that the water historically intercepted by the canal was part of the original water right appropriation. The partnering agencies may want to acquire these rights if they can get a legal opinion that water historically intercepted was and is still a part of the High Line Canal 1879 water right.

**Appendix B-3 Potential Water Supplies**

TYPE	BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT
Direct Flow	<b>Purchase Water Rights</b> – Municipalities have already purchased most of the upstream senior water rights. It may be that less senior irrigation rights upstream would be available for purchase and transfer in a water court proceeding to be diverted at the headgate of the High Line Canal and then carried to the point of need along the canal.
Direct Flow	<b>Lease Direct Flow Water Rights</b> – The water right portfolio of municipalities and other water users with South Platte water rights may have excess water available in average to wet years that could be leased for delivery to meet study target flows.
Direct Flow	<b>Lease Transbasin Water Rights</b> – Several municipalities import water into the upper South Platte basin. It may be that currently these water rights are not being fully exercised and would be available for lease and import by the participating agencies. In some cases, water right decrees may prevent this type of lease.
Storage	<b>New Storage</b> – Participating agencies may be able to develop new storage in the South Platte basin in conjunction with the Southern Metro Study participants, a group looking to develop off channel storage along the South Platte River to meet water demands in Douglas County.
Storage	<b>Leasing</b> – Lease storage water from upstream entities with rights, for example in Cheesman, Spinney, Tarryall, Eleven Mile, Antero Reservoirs, Wellington Lake.
Storage	<b>Purchase</b> – Acquire Burlington-Wellington shares from FRICO which entitles share holders to a portion of the water stored in Wellington Lake. Then change the point of diversion and divert directly to the High Line Canal, or use the historic consumptive use in an augmentation plan.
Consumable Lawn Grass Return Flows	<b>Direct use</b> – Consumable lawn grass return flows that are returning to the tributaries above the High Line Canal crossings of the tributaries could be purchased, used, or leased and diverted directly into the canal. Potential sources of consumable lawn grass return flows are Denver Water, Aurora, Englewood, and Centennial Water and Sanitation District.
Consumable Lawn Grass Return Flows	<b>Divert by Exchange/Augmentation Plan</b> – Consumable lawn grass return flows that are returning to the tributaries and South Platte below the High Line Canal crossings of the tributaries could be diverted through an exchange and/or augmentation plan. In an exchange the consumable lawn grass return flows would be left in the stream and a like amount would be diverted from the tributaries crossed. In an augmentation plan the consumable lawn grass return flows would be used to offset stream depletions of a junior water right (diversions less return flows). Again the potential sources of consumable lawn grass returns are Denver Water, Aurora, Centennial Water and Sanitation

**Appendix B-3 Potential Water Supplies**

<b>TYPE</b>	<b>BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT</b>
	District, and possibly other entities that have lawn grass return flows quantified.
Consumable Effluent	<p><b>Purchase, Lease, or Use</b> of consumable effluent could provide a water supply to the High Line Canal in several ways including:</p> <p style="padding-left: 40px;"><b>Pump</b> the water from reuse treatment plants, Diverting it by <b>exchange</b>, using perennial tributary water as the source Including it in an <b>augmentation plan</b> to cover out-of-priority depletions from diversion of perennial stream water, and <b>Store and Release</b> in/from downstream gravel pit reservoirs to cover stream depletions caused by diverting slugs of storm water.</p> <p>Potential sources of consumable effluent include: Aurora current and future reuse plants, Metropolitan Waste Water Plant (Denver, others) BiCities waste water treatment plant (Denver, Englewood, others)</p>
Tributary Groundwater	<b>Pump Alluvial Groundwater</b> at creek crossings into the High Line Canal. This is an alternative to a junior direct flow right, which may provide a more dependable <u>physical</u> supply in dry years. The State will require the well(s) be included in an augmentation plan. Potential sources with a significant alluvial aquifer include Plum Creek, Cherry Creek and Sand Creek.
Non-Tributary Groundwater	<b>Pump Nontributary Groundwater</b> located in the Upper and Lower Arapahoe aquifers, and the Laramie Fox-Hills aquifer could be pumped directly into the canal as a water supply, or used in an augmentation plan. The nontributary groundwater can be obtained from a pre-Senate Bill 213 well owner, or from a landowner who has adjudicated the right, per Senate Bill 5, to use the unappropriated groundwater beneath the owners land. The well could be located along the canal so long as it is within the landowner's property used to adjudicate the nontributary groundwater.
Stormwater	<b>Divert Stormwater</b> from a tributary basin(s) via diversion structures or pumps into the canal and discharge it back to a South Platte tributary that is located above the calling right on the South Platte River. This option may need to be combined with an augmentation source to make up stream depletions, and a SCADA system to evaluate available canal capacity and not cause overtopping and flooding problems further down the canal.
Stormwater	<b>Maintain Existing Stormwater</b> pipe discharges into the canal. This is especially true for the canal reach below Cherry Creek. Excess ditch



**Appendix B-3 Potential Water Supplies**

<b>TYPE</b>	<b>BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT</b>
	capacity from the headgate to Cherry Creek created from eliminating deliveries to the Arsenal needs to be evaluated but could also be used to carry existing storm water flows. This alternative may save resources planned for under piping that could be applied to acquiring additional water for the canal.
Canal Modifications	<b>Ditch Lining</b> – A clay liner or buried plastic liner (to maintain the aesthetics of an unlined ditch) could be installed along the canal to reduce seepage losses and allow the carriage of limited water sources further down the ditch. Selective lining (bottom only, bottom and one side, etc.) could be done to allow watering of trees.
Canal Modifications	<b>Create a low flow channel</b> – Modify the cross section of the canal to create a low flow channel that would provide the aesthetics of flowing water with less water available. The low flow channel would meander in the bottom of the main canal to provide a water source to the side with the majority of trees. The reduced wetted perimeter created by the low flow channel will also reduce seepage losses and allow limited water sources to be carried further down the canal.
Canal Modifications	<b>Construct Small Check Dams</b> – By constructing small check dams in the canal it would create the appearance of a bank full canal with less water available. The check dams could be constructed to allow water to flow through at a reduced rate during low flow conditions, and be constructed low enough to allow overflow during high flow conditions.
Canal Modifications	<b>Sprinkler System</b> – To assure the survival of certain trees, or isolated groups of trees, it may be appropriate to extend existing water distribution lines and install sprinkler systems.
Canal Modifications	<b>Water Quality Structures</b> – The canal could be used as a storm water improvement structure, a BMP (best management practice), as part of its compliance to the new stormwater regulations. This option is not a supply of water but it may 1) provide resident time for tree watering, and 2) provide a revenue source to offset purchase or lease of water to meet the study objectives.

**Appendix B-3 Potential Water Supplies**

**Table 2  
Guidelines for Data Collection**

<b>ISSUE</b>	<b>Subissue</b>	<b>Data To Be Collected</b>
<b>YIELD</b>	Amount	Avg Year Normal Flow Rate ____ cfs (April-Sept Monthly hydrograph)
		Avg Year Volume ____ af
	Dependability	Dry Year Normal Flow Rate ____ cfs (April-Sept Monthly hydrograph)
		Dry Year Volume ____ af
		Will est. supply increase/decrease/remain same over time?
	Permanence	Is the supply renewable or finite?
		Is the supply available for purchase or lease?
	Location	Which canal reaches can be served? Headgate to Cherry Cr Cherry Cr to Sand Cr Sand Cr to First Cr All reaches Cherry Cr to First Cr
Where is the original location of the water source?		
Timing	What is the projected year of availability?	
<b>WATER QUALITY</b>	Perception	What would be the publics' perception of this water source good, neutral or bad?
	Project Needs	Will the water quality cause problems in the ditch (sediment, chemicals harmful to vegetation and animals, cause algae blooms, odor)? Will diversion of this source be of a benefit to the environment?
<b>COST</b>	Capital	Estimated capital costs for water acquisition, mitigation, and facilities for delivery?
	Annual	Estimated annual costs for pumping, treating and leasing?
	Total	Cost basis for comparison will be present worth value per af of average year yield. Discount rate of 6%?
<b>PERMITTING AND LITIGATION</b>	Federal	Is a 404 Permit required ?
		Will 404 permit likely trigger a ESA consultation regarding downstream depletions, or review of on-site species?
		Will an EIS or EA be required to develop this supply?
	State/Local	Is a County 1041 permit required?
		Is a CDPS permit required?
		Will the project need 401 WQ certification?
	Water Court	To develop this supply will new water rights need to be filed?
		Will this source require a decreed augmentation supply?
Will this source require a decreed exchange?		
	Will this source require well permits?	

## **APPENDIX B4 TARGET FLOW RATES FOR PRIORITIES**

### **High Line Canal Task 4 Memorandum**

**To:** Paul Thomas  
**From:** Greg Roush and Erin Wilson, Leonard Rice Consulting Water Engineers  
**Subject:** Task 4 – Quantify Target Flow Rates for Identified Priorities  
**Date:** May 24, 2001

#### **Introduction**

This memorandum describes the approach and results to Task 4 – Identify Sources of Water. The purpose of this task is to; a) develop a list of water sources and potential structural enhancements to meet the Task 3 target flows, and b) develop guidelines for collection of data on each water supply or structural enhancement element.

Two main products were developed under this Task as follows:

1. A list of potential water supply elements with brief, one paragraph, summaries of potential supply element.
2. Guidelines to follow in the collection and summary of data needed to characterize each water supply element and to allow reasonable comparison of various water supply elements in Task 7.

#### **Approach and Results**

Potential Water Supply Elements - Leonard Rice Engineers and Wright Water Engineers developed a list of typical water supply sources and canal modification concepts. These sources and concepts were first discussed at two meetings with several of the participating agencies, then a third meeting was held with the water subcommittee to finalize the list as follows.

- Meeting held at Aurora on April 4<sup>th</sup> with Aurora and Denver Water staff.
- Meeting held at Wenk Associates on April 25<sup>th</sup> with City of Denver, Urban Drainage and Flood Control District, and Arapahoe County to identify storm water opportunities primarily from the South Platte headgate to the Cherry Creek area.
- Water Subcommittee brainstorming meeting held at Denver Water on May 2<sup>nd</sup>.

## Appendix B-4 Target Flow Rates

Leonard Rice Engineers and Wright Water Engineers also developed guidelines for collection of data related to the water supply elements based on past experience. These guidelines were presented and discussed with the water subcommittee on May 17, 2001.

Table 1 summarizes the potential water supply concepts to meet the identified water supply targets in this study which have been categorized into the following types:

- Direct flow
- Storage
- Consumable Lawn Grass Return Flows
- Consumable Effluent
- Groundwater
- Storm Water
- Canal Modifications

The objective was to compile a comprehensive list of potential water supplies and concepts to meet tree maintenance needs and provide water for aesthetic purposes in terms of water depth and flow in the canal. In this task no judgments have been made regarding the feasibility of the listed water supply concepts and canal modifications.

Data Collection Guidelines - Readily available data needs to be collected for the water supply elements identified in Table 1 to allow an evaluation to determine the most promising options that meet the study objectives. A representative project for each of the water supply concepts is to be identified. As stated in the scope of work, information will first be obtained from the consultants' experience, libraries, and past job files. Next subcommittee members will be asked to collect information from their organizations. Any remaining information will be estimated based on consultants' professional judgment.

The data to be collected has been categorized to address four main issues of quantity, quality, cost, and permitting/litigation. For each main issue there are several subissues as identified in Table 2. The data collected will be summarized into an Excel spreadsheet, similar to that shown in Figure 1, to allow sorting and comparison of water supply alternatives by the water subcommittee.

**Appendix B-4 Target Flow Rates**

Table 1  
List of Potential Water Supply Elements

TYPE	BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT
Direct Flow	<p><b>New Headgate Water Right</b> – A new 2001 priority water right could be filed at the headgate of the High Line Canal for the decreed purposes of recreation, aesthetics and tree maintenance. This right may have a yield sufficient to meet study target flows in wet years, or wet periods in average and dry hydrologic years.</p>
Direct Flow	<p><b>New Water Rights at Tributary Crossings</b> - New water rights could be filed on perennial tributaries that cross the canal. During times a 2001 water right is in priority the water could be diverted by gravity or pumped into the canal to meet study target flows. The decreed junior rights could also serve as diversion points for other water sources in an exchange or augmentation plan.</p>
Direct Flow	<p><b>Continued Use of 1879 Right at Headgate</b> – Denver Water plans to continue deliveries of water to share holders from the headgate to Cherry Creek, however the flow rate will be less than current flow rates. It may be sufficient to meet the needs of the trees and provide much of the aesthetic value of flowing water in this upper reach of the canal. Denver Water has also offered to provide additional water to the lower canal under the following conditions to help meet spring time needs of trees and to small user needs on the canal section between Cherry Creek and Sand Creek:</p> <ul style="list-style-type: none"> <li>• Deliveries will only be made when Denver Water’s storage reservoirs are full or projected to fill.</li> <li>• At this time based on tree research to date, it is estimated the delivery will be about 2 weeks in the spring during April through June. Further tree research may modify this.</li> <li>• The amount delivered beyond Cherry Creek shall be the contract users entitlement, plus a sufficient amount to cover seepage losses and provide sufficient head at the lateral headgate to make the delivery. Providing water to the remaining lower canal small users is the may satisfy the estimated tree water requirements in the spring when the above conditions are satisfied. This however, is not a dependable supply in many years.</li> </ul>
Direct Flow	<p><b>1879 Rights on Tributaries</b> – It may be that the High Line Canal already has an 1879 right to water in tributaries crossing the High Line Canal. In a previous water court case for a different ditch in the metropolitan area the water court ruled that the water historically intercepted by the canal was part of the original water right appropriation. The partnering agencies may want to acquire these rights if they can get a legal opinion that water historically intercepted was and is still a part of the High Line Canal 1879 water right.</p>

**Appendix B-4 Target Flow Rates**

TYPE	BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT
Direct Flow	<b>Purchase Water Rights</b> – Municipalities have already purchased most of the upstream senior water rights. It may be that less senior irrigation rights upstream would be available for purchase and transfer in a water court proceeding to be diverted at the headgate of the High Line Canal and then carried to the point of need along the canal.
Direct Flow	<b>Lease Direct Flow Water Rights</b> – The water right portfolio of municipalities and other water users with South Platte water rights may have excess water available in average to wet years that could be leased for delivery to meet study target flows.
Direct Flow	<b>Lease Transbasin Water Rights</b> – Several municipalities import water into the upper South Platte basin. It may be that currently these water rights are not being fully exercised and would be available for lease and import by the participating agencies. In some cases, water right decrees may prevent this type of lease.
Storage	<b>New Storage</b> – Participating agencies may be able to develop new storage in the South Platte basin in conjunction with the Southern Metro Study participants, a group looking to develop off channel storage along the South Platte River to meet water demands in Douglas County.
Storage	<b>Leasing</b> – Lease storage water from upstream entities with rights, for example in Cheesman, Spinney, Tarryall, Eleven Mile, Antero Reservoirs, Wellington Lake.
Storage	<b>Purchase</b> – Acquire Burlington-Wellington shares from FRICO which entitles share holders to a portion of the water stored in Wellington Lake. Then change the point of diversion and divert directly to the High Line Canal, or use the historic consumptive use in an augmentation plan.
Consumable Lawn Grass Return Flows	<b>Direct use</b> – Consumable lawn grass return flows that are returning to the tributaries above the High Line Canal crossings of the tributaries could be purchased, used, or leased and diverted directly into the canal. Potential sources of consumable lawn grass return flows are Denver Water, Aurora, Englewood, and Centennial Water and Sanitation District.

**Appendix B-4 Target Flow Rates**

<b>TYPE</b>	<b>BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT</b>
Consumable Lawn Grass Return Flows	<p><b>Divert by Exchange/Augmentation Plan</b> – Consumable lawn grass return flows that are returning to the tributaries and South Platte below the High Line Canal crossings of the tributaries could be diverted through an exchange and/or augmentation plan. In an exchange the consumable lawn grass return flows would be left in the stream and a like amount would be diverted from the tributaries crossed. In an augmentation plan the consumable lawn grass return flows would be used to offset stream depletions of a junior water right (diversions less return flows). Again the potential sources of consumable lawn grass returns are Denver Water, Aurora, Centennial Water and Sanitation District, and possibly other entities that have lawn grass return flows quantified.</p>
Consumable Effluent	<p><b>Purchase, Lease, or Use</b> of consumable effluent could provide a water supply to the High Line Canal in several ways including:</p> <ol style="list-style-type: none"> <li>5. <b>Pump</b> the water from reuse treatment plants,</li> <li>6. Diverting it by <b>exchange</b>, using perennial tributary water as the source</li> <li>7. Including it in an <b>augmentation plan</b> to cover out-of-priority depletions from diversion of perennial stream water, and</li> <li>8. <b>Store and Release</b> in/from downstream gravel pit reservoirs to cover stream depletions caused by diverting slugs of storm water.</li> </ol> <p>Potential sources of consumable effluent include:</p> <ol style="list-style-type: none"> <li>4. Aurora current and future reuse plants,</li> <li>5. Metropolitan Waste Water Plant (Denver, others)</li> <li>6. BiCities waste water treatment plant (Denver, Englewood, others)</li> </ol>
Tributary Groundwater	<p><b>Pump Alluvial Groundwater</b> at creek crossings into the High Line Canal. This is an alternative to a junior direct flow right, which may provide a more dependable <u>physical</u> supply in dry years. The State will require the well(s) be included in an augmentation plan. Potential sources with a significant alluvial aquifer include Plum Creek, Cherry Creek and Sand Creek.</p>
Non-Tributary Groundwater	<p><b>Pump Nontributary Groundwater</b> located in the Upper and Lower Arapahoe aquifers, and the Laramie Fox-Hills aquifer could be pumped directly into the canal as a water supply, or used in an augmentation plan. The nontributary groundwater can be obtained from a pre-Senate Bill 213 well owner, or from a landowner who has adjudicated the right, per Senate Bill 5, to use the unappropriated groundwater beneath the owners land. The well could be located along the canal so long as it is within the landowner’s property used to adjudicate the nontributary groundwater.</p>



**Appendix B-4 Target Flow Rates**

TYPE	BRIEF DESCRIPTION OF WATER SUPPLY ELEMENT
Stormwater	<b>Divert Stormwater</b> from a tributary basin(s) via diversion structures or pumps into the canal and discharge it back to a South Platte tributary that is located above the calling right on the South Platte River. This option may need to be combined with an augmentation source to make up stream depletions, and a SCADA system to evaluate available canal capacity and not cause overtopping and flooding problems further down the canal.
Stormwater	<b>Maintain Existing Stormwater</b> pipe discharges into the canal. This is especially true for the canal reach below Cherry Creek. Excess ditch capacity from the headgate to Cherry Creek created from eliminating deliveries to the Arsenal needs to be evaluated but could also be used to carry existing storm water flows. This alternative may save resources planned for under piping that could be applied to acquiring additional water for the canal.
Canal Modifications	<b>Ditch Lining</b> – A clay liner or buried plastic liner (to maintain the aesthetics of an unlined ditch) could be installed along the canal to reduce seepage losses and allow the carriage of limited water sources further down the ditch. Selective lining (bottom only, bottom and one side, etc.) could be done to allow watering of trees.
Canal Modifications	<b>Create a low flow channel</b> – Modify the cross section of the canal to create a low flow channel that would provide the aesthetics of flowing water with less water available. The low flow channel would meander in the bottom of the main canal to provide a water source to the side with the majority of trees. The reduced wetted perimeter created by the low flow channel will also reduce seepage losses and allow limited water sources to be carried further down the canal.
Canal Modifications	<b>Construct Small Check Dams</b> – By constructing small check dams in the canal it would create the appearance of a bank full canal with less water available. The check dams could be constructed to allow water to flow through at a reduced rate during low flow conditions, and be constructed low enough to allow overflow during high flow conditions.
Canal Modifications	<b>Sprinkler System</b> – To assure the survival of certain trees, or isolated groups of trees, it may be appropriate to extend existing water distribution lines and install sprinkler systems.
Canal Modifications	<b>Water Quality Structures</b> – The canal could be used as a storm water improvement structure, a BMP (best management practice), as part of its compliance to the new stormwater regulations. This option is not a supply of water but it may 1) provide resident time for tree watering, and 2) provide a revenue source to offset purchase or lease of water to meet the study objectives.

**Appendix B-4 Target Flow Rates**

Table 2  
Guidelines for Data Collection

ISSUE	Subissue	Data To Be Collected
<b>YIELD</b>	Amount	Avg Year Normal Flow Rate ____ cfs (April-Sept Monthly hydrograph)
		Avg Year Volume _____ af
	Dependability	Dry Year Normal Flow Rate ____ cfs (April-Sept Monthly hydrograph)
		Dry Year Volume _____ af
		Will est. supply increase/decrease/remain same over time?
	Permanence	Is the supply renewable or finite?
		Is the supply available for purchase or lease?
	Location	Which canal reaches can be served? 6. Headgate to Cherry Cr 7. Cherry Cr to Sand Cr 8. Sand Cr to First Cr 9. All reaches 10. Cherry Cr to First Cr
Where is the original location of the water source?		
Timing		What is the projected year of availability?
<b>WATER QUALITY</b>	Perception	What would be the publics' perception of this water source good, neutral or bad?
	Project Needs	Will the water quality cause problems in the ditch (sediment, chemicals harmful to vegetation and animals, cause algae blooms, odor)? Will diversion of this source be of a benefit to the environment?
<b>COST</b>	Capital	Estimated capital costs for water acquisition, mitigation, and facilities for delivery?
	Annual	Estimated annual costs for pumping, treating and leasing?
	Total	Cost basis for comparison will be present worth value per af of average year yield. Discount rate of 6%?
<b>PERMITTING AND LITIGATION</b>	Federal	Is a 404 Permit required ?
		Will 404 permit likely trigger a ESA consultation regarding downstream depletions, or review of on-site species?
		Will an EIS or EA be required to develop this supply?
	State/Local	Is a County 1041 permit required?
		Is a CDPS permit required?
		Will the project need 401 WQ certification?
	Water Court	To develop this supply will new water rights need to be filed?
		Will this source require a decreed augmentation supply?
Will this source require a decreed exchange?		
Will this source require well permits?		

## APPENDIX B5

### RANKING CRITERIA FOR WATER SUPPLY SOURCES

#### High Line Canal Task 6 Memorandum

**To:** Paul Thomas  
**From:** Greg Roush, Leonard Rice Consulting Water Engineers  
**Subject:** Task 6 – Develop Criteria for Fatal Flaw Screening and Ranking of Alternative Water Sources  
**Date:** June 29, 2001

#### Introduction

This memorandum describes the approach and results to Task 6 – Develop Criteria for Fatal Flaw Screening and Ranking of Alternative Water Sources. The purpose of this task is to develop criteria for fatal flaw screening for use in Task 7 and a ranking method to evaluate and compare potential water sources in Task 8. The number of potential sources may be substantial and it is necessary to eliminate those that are not appropriate, or select a representative project of a group of similar projects so the study can be performed efficiently.

The main products developed under this Task are as follows:

1. A list of fatal flaw screening criteria to exclude certain water sources from further consideration.
2. A methodology to rank water sources to identify the more preferred water sources to acquire and develop for meeting the water supply priorities.

#### *Approach and Results*

Fatal Flaw Criteria - Leonard Rice Engineers and Wright Water Engineers drafted a list of fatal flaw criteria that was presented and discussed with the water subcommittee on May 17, 2001. Based on the discussion the only fatal flaw criteria to be applied in Task 7 are:

- Availability – Is the identified water source available for appropriation, purchase, use or lease?
- Canal Overtopping – Can the identified water source be controlled for delivery into the canal so that overtopping does not occur?

Other fatal flaw criteria suggested included minimum flow rates, volumes, water quality, reliability, and development costs. In general, the water subcommittee did not want to eliminate projects based on these other suggested fatal flaw criteria. The subcommittee felt it was becoming apparent that a combination of several sources will be needed and it was premature to eliminate any potential sources that could be included in a plan of multiple water sources.

Ranking Criteria - The second part of this task was to develop a set of guidelines to use in ranking of water resource projects for identifying the most feasible sources. The concept of assigning weighting factors to various main issues (quantity, quality, cost, and permitting/litigation) and subissues was discussed. It was the consensus of the group that this type of ranking would lead to a false ranking of the alternative water supply elements. In other words, a project could score very high in 3 of the 4 main issues (good water quality, low cost to develop, and essentially no permitting), with the remaining low score in the fourth issue being the result of a nearly fatal flaw concept (ex. available flow rate = 1 cfs in 1 out of 10 years). Instead it was agreed that:

1. All representative water supply projects identified would be incorporated into the spreadsheet format suggested in Task 4,
2. The spreadsheet would have the capability to sort on any selected issue or subissue for review by the subcommittee,
3. Based on a qualitative analysis (not quantitative analysis), the water subcommittee will identify the most promising sources, and those that are not very promising, with the others lying somewhere in between,
4. The subcommittee will then take the most promising sources and combine them to formulate a recommended plan for each of the water supply priorities identified for the study.

The water subcommittee then discussed preferences for use in the qualitative analysis of the water supplies as summarized below.

#### Issue: Yield

- The preference is a supply that is available on demand (ex. storage or groundwater) versus diversion of stormwater which is more difficult to manage.
  - Renewable supplies are preferred to finite supplies.
  - Prefer to own the supply versus leasing the supply.
  - Prefer a supply with its origin close to the High Line Canal versus one that needs to be conveyed a long distance (directly or by exchange).
  - Prefer supplies that can be developed prior to the year 2012.

#### Issue: Water Quality

- Water quality of the source should not be harmful to vegetation, or animal life,
- However, it doesn't necessarily need to be a good quality, and opportunities for use as a water quality improvement facility may be preferred.

Issue: Cost

- Water supplies with high capital costs are preferred to water supplies with high annual costs. This is based on the way participating agencies receive funding. It was reported easier to get upfront financial support to develop a project than to get yearly financing for a project with high annual costs.

Issue: Permitting/Litigation

- Projects with least amount of permitting and litigation are preferred.

## APPENDIX B6 STORMWATER RESEARCH SUMMARY

**Table 4  
Summary of Stormwater Potential Supply Locations**

Stormwater	Amount Average cfs	Avg Year Yield, AF												Reach	Source Origin	Timing	Water Quality Percep- tion 1,2,3	WQ Concerns	Env Benefits				
		AF	Apr	May	Jun	Jul	Aug	Sep	1,2,3,4,5	2	1	16	1										
1. Expo Park Historic Storm Flows	30-90	117	10	18	21	30	30	27	11	6	6	11	10	10	16	1	2	Flows from Storm Sewer - Unplug	On Line Date Avail	1	Y	Y	
2. Mexico/Parker Historic Storm	10 - 20	13	1	2	2	3	3	3	1	1	1	1	1	1	2	0	2	Storm Sewer	Avail	1	Y	Y	
3. Parker Jewell Project	15-30	18	2	3	3	4	4	4	2	1	1	1	1	1	2	0	2	Flows from Storm	Const. 2002	2	Y	Y	
4. Havana 42" Storm Sewer	15-30	18	2	3	3	4	4	4	2	1	1	1	1	1	2	0	2	Flows from Storm	Avail	2	Y	Y	
5. Dayton Street 60" Storm Sewer	20-70	54	6	9	9	12	12	6	3	3	3	3	3	6	0	2	2	Flows from Storm	Avail	2	N	Y	
6. Potomac 36" - 42" Storm Sewer	10 - 20	18	2	3	3	4	4	4	2	1	1	1	1	2	0	2	2	Flows from Storm	Avail	2	Y	Y	
7. Goldsmith Gulch	10 - 20	13	1	2	2	3	3	3	1	1	1	1	1	2	0	1	1	Flows from Storm	Avail	2	Y	Y	
8. Cherry Crest Outfall (Bellview & University)	10 - 20	13	1	2	2	3	3	3	1	1	1	1	1	2	0	1	1	Flows from Storm	Const. 2002	2	Y	Y	
<b>Total</b>		<b>264</b>	<b>25</b>	<b>42</b>	<b>45</b>	<b>63</b>	<b>60</b>	<b>26</b>	<b>15</b>	<b>15</b>	<b>20</b>	<b>20</b>	<b>19</b>	<b>34</b>	<b>1</b>								

**APPENDIX C  
PUBLIC MEETING COMMENTS**

# **HIGH LINE CANAL PARTNERS**

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**High Line Canal Neighbors Comments**

*January 2001 Public Meetings*

Interest in the canal and its future has been considerable. Over 350 users of the canal trail attended three public meetings, sponsored by the fifteen High Line Canal Partners, in January 2001. The meetings were held in Aurora, Denver and Littleton.

The meetings provided opportunity for neighbors to 1) learn about the study on how to preserve the canal and 2) to inform the partners about their concerns and suggestions for the future of the canal.

Neighbors and users of the canal were asked to submit comments, concerns and suggestions on cards provided to attendees. Comments include suggestions for additional water, suggestions for jurisdictional management of the canal and how recreation could be funded, the value of the canal to its users, and general comments about the overall project. The comments are shown below, categorized by subject and showing the city in which the person lives. Additional comments from phone calls and correspondence are also included.

Suggestions, such as those provided for water sources and recreation management, will be addressed in the study. Answers will be provided at the completion of the study. Questions and comments directed to Denver Water will be responded to in a separate document.

Summary points of users of the canal trail:

- The canal and trail are extremely important to users and neighbors who are concerned how changes may adversely affect its future. The trail is highly used for many activities including walking, running, bird watching, cycling and horseback riding. There is a tremendous sense of community among users.
- Water in the canal for vegetation, wildlife and aesthetics is very important. People do not want the amount of water reduced.
- Retaining the continuity of the entire trail in the metro area is important. There appeared to be a willingness to pay for costs associated with maintaining the canal.
- Some people question the need of Denver Water to make any changes to operations of the canal.

## **WATER FOR THE CANAL:**

*These suggestions refer to ideas on other sources of water for the canal or for ways to save canal water.*

If you must dry up water in the “lower” canal, please do not channelize it or concrete it over (for ex, Denver’s recent Goldsmith Gulch project – helpful and useful but too “concret-y.” (Denver)

Where water cut off at end of trail – all trees dead. How can you say you will cut off water but that trees will still be there? *What about partial lining of canal bottom to reduce loss? Are you planning to stop water at upper canal later? Our canal is unique in the whole country – is there no way to save it as a historical site. Seems a shame to let such a precious unique*

## Appendix C Public Meeting Comments

commodity go. Denver is practically a desert – *how can there be enough runoff to fill canal*. Like the one guy in the meeting said – city can spend billions on stadium – *why can't we use some public money to maintain canal?* (Unknown)

I would like to see replanting of trees along the canal to provide additional shade and replace some of the older, dying cottonwoods. I maintain our community garden at the intersection of Oswego St. and 2<sup>nd</sup> Ave in Aurora and the addition of shade trees would also protect the perennial garden there, which we planted a few years ago with a mini-grant from Aurora. (Aurora)

Why in the upper part of the canal, do you not allow any more storm water? Use this water to supplement the lower canal and control it at Cherry Creek. Why not take in as much storm water where ever you can in both parts? Do not dump excess water into Cherry or Sand Creeks. (Denver)

Source for water: Can water be diverted from the South Platte River to the High Line canal, dumping the water at either Cherry Creek or Sand Creek – which returns to South Platte River. (Denver)

If the lower part of the canal goes dry, it would be very damaging to property values. If the lower part of the canal goes dry it would be very damaging to all wildlife. We simply have to find a way to continue water flow on the lower canal also! (Denver)

The second largest water customer on the lower canal – Fairmount Cemetery – could be accommodated as well as the residential areas by extending the flow to Sand Creek. The ultimate and final flow will still be to the Platte. But so much will have been preserved. (Denver)

Can some of the 67 historical users of canal water be bought out or persuaded to relinquish their rights? (Denver)

Create a segment of the canal where water would flow all summer – the area that is created would be where appropriate zoning could allow commercial development adjacent to the canal – i.e. – restaurants, cafes, etc. This area could be in where a fee could be charged to the commercial usage – a special district – they would be responsible for obtaining, acquiring the additional water – just an idea. (Denver)

I am concerned that use of treated water could be harmful to vegetation and wildlife.

Good meeting. I believe a major priority should be to maintain the flow in the upper canal near its present levels. Reducing the flow by 25 – 35% will in the end reduce its overall benefits by the same percentage. (Littleton)

The phantom alternative sources of water should be determined before any decision to shut off the Waterton water. Cut down the cottonwood trees. They use too much water. (Aurora)

Leave canal alone unless you repair the leaching of water, the beauty, the wildlife and the trails. We at Kirkeguard Acres need the drainage for roads and fields. (Aurora)

It seems to be a waste of water not to be able to use floodwater from Expo Park as a source of water for the High Line Canal. Before the changes at Expo, floodwater dumped right into the canal. (Aurora)

Why pump surplus water into Cherry Creek? Continue to allow “surplus” water to flow past Cherry Creek through the Aurora section of the canal.

Please do not concrete the canal. It was done in an area between Sable and Chambers and it really destroyed the natural beauty of the canal. (Aurora)

Take the water that is dumped into Cherry Creek and keep it flowing down the canal. (Aurora)

How about planning alternative trees to the cottonwoods, like conifers, oak, hawthorns, hackberry? (Denver)

Could the canal be partially lined to reduce leakage, but not cut off water to the trees? (Denver)



## Appendix C Public Meeting Comments

I especially value the canal for the flora and fauna environment that exists – a bit of “country” in the city. I hope that the water will continue to flow to keep this current environment. Although your study chooses to “ignore” the wildlife, most of that visit the canal daily and live on the canal, love the wildlife. So, if you change the water flowing in the canal, it should not be lethal to the wildlife that lives there. Keep water quality good – concerned at water storm sewers. (Denver)

Would like to see new cottonwood growth to replace old growth cottonwoods. (Aurora)

Divert creeks and minor drainages into canal – needs to be engineered so on over flows during heavy rains. West Slope water can be used to extinction – reuse water from treatment plants could/should be piped into canal. City and districts should purchase use of water for the canal during “wet” years when Denver has no use for it. (Aurora)

Concern of quality of any drainage or recycled water – possible pollution. (Denver)

Wetlands could be a solution to cleaning up storm drainage as well as adding wildlife habitat. This has been used successfully in other areas in Colorado. (Littleton)

Could sections of the canal be lined with clay or some other impervious substance to reduce or eliminate seepage? (Denver)

If seepage is a significant problem, then line part or all of it. Question: How much of the estimated water loss is due to seepage? (Littleton)

Water historically used from agriculture from the canal should not be diverted to domestic, household use. Use it for watering parks or other outdoor uses to keep the water for wildlife and plant use. (Denver)

How do you prevent water loss through leakage/seepage in a simple, economical manner, with extensive inner lining of the canal surface? (Littleton)

Bringing up variable nature of flow through time is patronizing. We all know the flow is variable – but that doesn’t mean the flow is less valuable to us. The water is the life blood of the canal. Many wetlands formed along canal. If water levels change very much, will dry up wetlands. I know there is federal protection of wetlands – but doesn’t the Denver Water have to abide by federal wetland laws? How does reduction in flow affect rural customers? Even though I don’t farm or have cattle, - it is very important to me that other people do. Our city is congested enough and I value the farms that are there. (Unknown)

Need to use and reuse surface and wastewater (Unknown)

Who is studying impact on habitat, wildlife. Won’t the substitute water evaporate as fast as Denver Water Board water – what is the gain? (Unknown)

I don’t think the use of recycled water unless de-scented would be a good solution to the water problems. (Aurora)

The priority should be to let the canal stay in existence, whether the water flow needs to be diminished or not. People could still walk it, we walk it now when there’s no water flowing. (Littleton)

My concern is where we are going to get enough water for the canal in the lower end to have an amount that is worthwhile. Can the city of Aurora buy some of the water from the higher end of the canal? I am reminded that we are trying to save water and that the canal is not an efficient way to furnish water. Then why don’t you just shut down all the water in the canal, rather than just the lower part of the canal. It almost sounds like the people in the higher end have already put their foot down and said they want the water. Since there are fewer users on the lower end, we will just cut your water off.

## Appendix C Public Meeting Comments

### RECREATION MANAGEMENT:

#### The following comments refer to management of the recreational trail

Water Department: We paid a premium to be property owners on the canal – have you considered that we would pay (perhaps with many others) to pay additional fees to maintain our asset? And keep our canal as it is TODAY!! (Littleton)

What about making the High Line Canal a state park? Wouldn't the cost of preservation go down? And also water? (Littleton)

Have you considered using the Mayor's South Platte River Commission as a model for deciding how to administer the canal? (Denver)

Keeping the "entire" canal intact and open for all recreational purposes. (Denver)

I would like to see one entity manage recreation for the entire length of the canal. (Denver)

The canal is unique – is there no way to save it as an historic site?

Why are you not concerned about the wildlife along the canal? Would like to see this designated as our "historical landmark." (Denver)

Denver Water must be commended for their desire to maintain the canal yet with necessary change for their customer. I would recommend a "blanket" – "overall" agency responsible for the maintenance and recreational needs of the canal. Horse use of the canal must still be protected – especially the upper canal near Chatfield. (Lakewood)

I would even pay extra in taxes to keep the water.

I am very much in favor of spending Denver and environs tax dollars to preserve this amenity as a "linear park." If we can afford ski areas, STADIUMS (!!) and golf courses, we can afford to preserve the canal. (Denver)

I think the days of using the canal as a water source to paid users is over. Its just not economical or effective. Now we need to emphasize the recreational and environmental benefits of the canal. I feel these 2 areas deserve funding – just as parks and rec areas are financed. (Aurora)

I'm cautiously optimistic as to the approach being taken to this issue. I certainly hope the recreational aspects of the canal will be preserved and in particular that there will continue to be trails including dirt trails where they presently exist. I love these not-cement trails for walking and running and much more. (Aurora)

I would like the High Line Canal to remain a part of the communities it traverses – so as Aurora remains so should the canal. I came to Denver in August 1951 and have treasured the canal as a definite asset from aesthetic approach as a user. (Denver)

How much can the High Line Preservation Association (private citizens) help out with maintenance of the canal? (Denver)

Why can't the Denver Water Board refer to the citizens of Denver the question for charter amendment: "The city of Denver will preserve the High Line Canal." Why go through this torturous process for the \$ concerns of the Water Board if the citizens of Denver want to preserve this resource? (Unknown)

## Appendix C Public Meeting Comments

As president of Sunlite Homeowners Assn., our members value the canal for its present and future recreational use. We have a great opportunity to create a master plan for the development and use that serves well all our communities. This plan should include vacant land and access corridors nearby and adjacent to the canal. It should be concerned with best uses of these parcels and access corridors for wildlife and horticultural (natural) preservation, irrigation of trees, water and drainage reuse, and the other values cited in the meeting. Development of recreation and parks with funding sources (including lottery revenue) should receive consideration. Let's do the job right, and create a collective commission for planning and development with park and recreation departments of the municipalities as managements. (Aurora)

I want to make sure the High Line does not become a major bikeway as called for in Kevin Flynn's column in the Rocky Mtn News on Jan 8, 2001. The bicycle master plan was being discussed tonight (01/18/01) at the Central library. He states that Denver has 3 major freeways for bikes – Platte River, Cherry Creek and High Line! The High Line needs to stay the way it is now (as far as bikes are concerned). A walker w/ a stroller should not be fighting with "bike commuters." (Denver)

The canal could be turned into a park. We would like the trees preserved for their beauty and contribution to clean air. The canal is a conservation center for birds and animals. We feel that water could be conserved by individuals using it more wisely and by other means than lessening the flow to the canal. Rainwater and other alternative sources could be diverted to the canal. No portion of the canal should be sold to developers. (Denver)

Consider using volunteers (people who's property abut the canal) to help with maintance – i.e. water newly planted trees, mow, plant flower gardens and maintain. I have doing this for 20 years. (Unknown)

Since the canal is a R.O.W. through properties, who will get ownership. The liability issues w/ falling limbs/trees will be an issue!! Maintenance of inside the canal if water is irregular or periodic, weeds grow 3 to 4' high. Mowing etc. will be needed. (Aurora)

An analysis of the financial picture – how much does the individual property owner pay for the canal? To whom does this money go? How much will it cost to change the canal? (Unknown)

Should be owned and maintained by Aurora Parks and Rec. It is a great asset to Aurora. How about using state lottery funds? (Unknown)

Would like to see canal kept under park and rec, funded equally by city and state lottery funds. (Aurora)

Financially perhaps some lotto money could help as well) (Denver)

Why not have Parks and Rec. take over Aurora's part of taking care of the High Line Canal? (Aurora)

It would seem that perhaps a small mill levy along a corridor for the length of the canal would raise enough funds for maintenance as well as a water source. Plus add a cost to other users, i.e. clubs, etc. (Aurora)

I would support linking up the gaps in the trail so that the entire 71 miles are easily accessible and continuous. Obviously, that will cost money and I feel that acquiring the land needed will be recreation dollars well spent. (Denver)

Maintain rural ambiance. We need fewer groomed ball fields, fewer cement and asphalt covered trails and more open natural spaces. See Bob Pyle's "Thunder Tree." This is a multi use trail. Hard surfaces increase bicycle speed and danger to other users. Equestrians cannot use hard surface trails. (Denver)

Establish user fees (i.e., donations or optional tax form donation) to support the cost of keeping water in the canal. (Denver)

Need an umbrella group to bring the whole canal jurisdiction together, will give continuity. (Denver)

I believe that the High Line Canal is the most important park and recreation area in the city. That is uniquely accessible to tens of thousands of residents, reminiscent of the park beltway in Cleveland, Ohio. If anything, I would like to see the park like aspect enhanced and expanded. Why can't our tax dollars for parks (or the lottery income) be used for this? (Denver)

## Appendix C Public Meeting Comments

The canal should be given LANDMARK status and protected forever for all the values identified tonight – we love it. (Denver)

A financial analysis of the recreational benefits of the canal should be done to show the great extent of these benefits to agencies looking at management. A similar study was conducted last year on Cherry Creek Reservoir.

### GENERAL COMMENTS:

I would like the overall decision making process regarding the future of the canal to be made clear – consultants' studies to determine options are great – However how, when and by whom will decisions be made? (Englewood)

My concern is that money is the only issue of the group conducting this. We can not put enough importance of nature and all its benefits. I have been to many cities (San Diego, LA, Seattle, Cleveland, Phoenix, Sioux Falls, etc.) with trails that were beautiful and well kept. The city of Aurora has to protect this very important asset. We cannot allow this to vary from present. (Aurora)

Please do not: fill canal with sand as was rumored. Use your identifying where large cottonwoods are so you can cut them down. (Unknown)

Would like more involvement in planting and maintaining the beauty of vegetation and trees along the canal both for aesthetics and for those who walk, bike or run along the canal. Additional recreational facilities would also increase value – benches, etc. Love the trees – shade, oxygen, etc. Promote wildlife, birds, etc. (Denver)

If the flow water is stopped real estate values will be affected. What will be done to regain that lost value? (Denver)

When will the water be cut off – in 10 years or sooner? (Unknown)

There needs to be a 5 year public relations program put in place and financed by someone – city, county, etc. – to educate the population of the values of the High Line now and in the future. 10, 20 years, and build more support for the High Line issue now and in the future. (Denver)

I was dismayed to see that the map handed out at the meeting, while providing quite a bit of detail about the municipalities along the Upper or western canal, made it look as if Aurora is some kind of a waste land. Other than I-224, no major roads are drawn in, nor are the golf courses and parks in the vicinity of the Lower or Eastern Canal. While I am aware that the Upper segment has more users, I cannot help but view this as a value judgment of the importance of the two segments. (Aurora)

### GROWTH RELATED ISSUES:

Why should Denver Water be concerned about the High Line Canal “using” water – so it can be “saved” for more housing developments???. Keep the water for the canal – and its flora and fauna!!! (Denver)

I am very concerned about “lost” water and how this water could be used for 4,000 homes. This implies that some time in the future, a study will look at the “lost” water in the upper part of the canal and how many homes could be served with that water. Please give us some assurance this is not the beginning of the end of the canal! (Littleton)

Policy change for the Water Board: Less water for constructing new homes, etc. and more water for the canal. It is an insignificant amount compared to the total amount managed by DWB – a full canal vs. unlimited growth. (Denver)

I question the sincerity of the intent to save water in the canal currently lost through seepage and evaporation. Pardon my cynicism, but I suspect the “saved” water will be available for more water taps so that the land development scoundrels can continue to subdivide the Front Range metro area into the Los Angeles of the 21<sup>st</sup> century. (Denver)

## Appendix C Public Meeting Comments

I'm a frequent user of the canal right of way. I am not particularly concerned that the canal is leaky and that the water loss could supply 6,000 homes. The fact is that the canal, leaks and all provides greenery and recreation for tens of thousands of people. Seems like a very good tradeoff. The amount of water in the canal is important. I hope that the volume is not reduced below its historic average. The water, besides maintaining vegetation, provides an important aesthetic. The public has a right to expect the canal to be maintained with its historic flows. Think of it as kind of a public easement – by use. (Denver)

### RECREATION IMPROVEMENTS/QUESTIONS:

*The following suggestions were received for improvements to the recreation trail. These requests are outside the scope of the Partners study but the suggestions are being forwarded to the recreation managers of the trail.*

I use the canal almost daily for walking and bike riding (in season). I appreciate its beauty and stress reducing capabilities. Could an underpass be constructed under Broadway near Ridge Road or Arapahoe Road for safety reasons? (Littleton)

Where each road or street crosses the trail there should be markers to slow traffic or to make drivers aware that there could be walkers, joggers, bikers and people with strollers to be encountered. (Denver)

It would great to complete the recreation trail bridge over Plum Creek to be able to get to Waterton Canyon. It would be a lot safer if the recreation trail could slope down into the canal bottom (when there was not water in the canal) to cross busy streets (like Mineral, County Line, etc) then slope back up to the trail on the other side of the street. (Littleton)

Is the area north of Alameda and Chambers of the trail to be repaved? Is the Sand Creek trail to be paved as I sink with my bike in the sand. Few bikers are found there? (Aurora)

The canal trail should NOT be paved or graveled or asphalted – it should be natural, a dirt trail.

Debris removal should be more frequent. In the 3.5 mile stretch from Broadway and Ridge Rd. east in a loop to Broadway and ½ block South of Arapahoe Rd, there is a king size mattress, 2 pieces of a bicycle, a stereo component, box fan and other miscellany and they've been there for months – even after the Denver Water truck drove through checking trees.

Are there any special plans for the Bible Park and Eisenhower park areas? Bible Park path along the canal (dirt path or road) is busy all year around. Since I have lived next to the park (35 years) I would like the area to have limited vehicle access. (Denver)

I am concerned that the canal path retain its rural setting and NOT be completely paved. Walking on pavement is more difficult on the body especially for seniors. Please retain dirt paths between Quebec/Leetsdale and Iliff. (Denver)

The new underpass at University Blvd. is terrific. I would like to see more underpasses/overpasses at busy street intersections. How can these be funded? As it is, the trail is a bunch of segments separated by major streets like Broadway that are annoying and dangerous to cross. (Denver)

Need to suggest dog walkers keep dogs on leash. Dogs have a tendency to scare the wildlife. (Unknown)

Keep the dirt trails!! Add porta-potties. (Englewood)

I value the tranquility of the trail as a great place to jog. Thus, it's really irritating when that tranquility is disturbed by a damned cop car (e.g. Cherry Hills Village) patrolling. If the police want to patrol the canal, they are more than welcome to do so by bicycle or on horseback. Police cars should only be on the trail for genuine emergencies—not as a shortcut or to answer a petty complaint by some rich resident. I also find the Denver Water trucks annoying especially on the weekends. I understand that they sometimes need to be there for maintenance. However, if they need to check diversion gates, etc., they also can use a bike or a horse. (Denver)

**Appendix C Public Meeting Comments**

Want to ensure the High Line Canal recreation use includes in its plans equestrian use. Inclusive of safe access, footing, scenic, etc. Denver Parks does not allow horses, and I don't want to see that happen anywhere along the High Line Canal. Would like to see better crossing (safe ones) such as under and over passes for equestrians as well. Thank you. (Littleton)

Improve on-grade crossings! I'd like to see tunnels perhaps at Yale and Monaco where it is hard to cross the street. (Unknown)

Is Bible Park going to be altered? i.e. more parking lots?, baseball diamonds?, any surprises in store? (Denver)

**BENEFITS:**

During the public meetings, participants were asked "what they value about the canal". The chart below shows the results of this question. Others in the audience added their responses to this question on the cards. Their responses are listed below.

**Summary of High Line Canal Public Meetings  
January 2001**

*What Do YOU Value About Highline Canal?*

	<u>Value</u>	<b>Aurora Meeting</b>	<b>Denver Meeting</b>	<b>Arap. County Mtg.</b>	<b>Total</b>
1	Open Space (Oasis, Continuity, etc)	3	7	3	13
2	Trees (Shade, Canopy, Air Qual.)	4	6	3	13
3	Trails (Connections, Walking, Biking)	3	6	3	12
4	Wildlife / Habitat	1	2	4	7
5	Property Values	1	1	1	3
	Historical Value / Legacy	1	3	1	5
7	Sense of Community / Social Place	3	1	5	9
8	Water	2	3	1	6
9	Horseback Riding	1	1	2	4
10	Irrigation water for Agriculture	1		1	2
11	Recreation	1	1	1	3
12	Drainage		3		3
13	Other (Safety, Beauty, Tranquility, Public Relations for DW, Water Conservation, Link between public and DW, Education)	2	5	3	10

## Appendix C Public Meeting Comments

Comments, continued.....

I value the High Line Canal so highly, that proximity to the canal was my first priority in choosing a location for buying my first home. The surface is excellent for running and riding and the sense of community of people meeting on the canal is essential for the social aspects of holding neighborhoods together. *Could the raw GIS coordinate information be made available including accurate data and distances along the canal path?* The canal serves as a wildlife corridor. (Littleton)

I bike on the High Line 5-6 days a week and go from my home. I don't need to load my bike on the car and drive several miles. It's like being in the country right in the middle of the big city, the views of the Mts., wildlife, trees plus the friendly people you see each day. (Littleton)

Willing to work to ensure that access to the High Line Canal continues as is or improves. A wonderful recreational resource. (Aurora)

The canal is a beautiful place I can easily access from my townhouse for exercise with my dog and a soaking in the beauty, nature, wildlife, connection with neighbors, peacefulness. An essential part of my day/life would be missing without the canal. We all need to connect with nature for tranquility and spirituality. Hard on wildlife to have water flow/cut-off/flow/cut-off etc. (Unknown)

We think it's very important to maintain the same height of the water and as many days of flow as possible because the trees already have so many stressors to deal with in Denver's climate and air pollution. The trees and the flowing water (how we wish it could flow 365 days/year!) are what make the whole recreation trail such an incredible and unique resource. *Let all of us help pay for the High Line's water!* Every drop is worth every penny it costs!! We value the beauty of the whole canal ecosystem. (Littleton)

I am a daily user of the High Line Canal for recreation (cardiovascular) use. I treasure my daily walks on the canal and am very interested in preserving the wildlife and vegetation. In addition, I am involved in the Highlands Ranch Metro District. I am a Director. (Highlands Ranch)

A resident on the canal for over 20 years (two homes on the canal). A committed runner. I have trained for many races – including marathons – accumulating thousands of miles. I love the canal. My family (including our pets) loves the canal. Let's all make the canal an even better environment. (Littleton)

The joy of a garden – our well would not provide enough water to grow a garden. (Littleton) Canal water customer.

Looking at it from my yard – running and biking along it. Watching the wildlife live. The water and the canal are a bit of serenity in the city offering peacefulness in a stressed world. (Unknown)

Water in the canal is never wasted. It keeps trees and bushes alive, keeps animals and birds in the area. It makes the canal more beautiful and more natural. Canal is not canal if there is no water in it. Running water in the canal makes the canal more beautiful. *So please keep the canal running all the time, even at a lower volume.* (Littleton)

I think the High Line Canal has great value for the following reasons: 1. Great recreation area for bicycle, hiking and horseback riding. 2. Essential for wildlife corridor and habitat. 3. A piece of our Colorado history. 4. Necessary for plant and tree survival. Many times my husband, my neighbor and I have gone bicycling along the canal and it always feels great to cool off in the shade of the big cottonwoods. We have several species of birds and animals along the canal, too. Please save this wonderful place for future generations. (Aurora)

I like the “park” that the High Line Canal has become. Like other parks, it supports vegetation, animal life, recreation, tranquility, etc. This park needs water. (Denver)

I like the safe path the High Line canal provides throughout the city. (Denver)

The High Line is a unique multi-dimensional resource to the Denver metro area and needs to be adequately valued. Its preservation is crucial to maintaining quality of life in this region. (Englewood)

## Appendix C Public Meeting Comments

The Canal offers: Enjoyable, non-polluting and safe off-street transportation for us and our families and children. Trees provide shade that substantially lower water consumption for irrigation of lawns along the canal. And much, much more! (Greenwood Village)

Good running – less traffic – good surface (Unknown)

Concern: to ensure enough water in the canal not only for the trees, but for the native species of shrubs, bushes, grasses, wild flowers, etc. And to continue to attract local and migrating waterfowl and songbirds! (Englewood)

The High Line Canal is the crown jewel of the Queen city. Let's protect it. (Denver)

Nearby safe, quiet and "wild" place to walk with my dog on a leash. Denver parks (e.g. Washington park) are being taken over by organized sports and large groups of loose dogs with their owners. Urban hiking spot for those who are unable to hike/walk in more difficult settings. (Denver)

I believe that the High Line Canal is the most important park and recreation area in the city. That is uniquely accessible to tens of thousands of residents, reminiscent of the park beltway in Cleveland, Ohio. If anything, I would like to see the park like aspect enhanced and expanded. Why can't our tax dollars for parks (or the lottery income) be used for this? (Denver)

This was a very informative meeting. My concern is that the upkeep of the trail continues if another management group is in charge. Will the city of Denver oversee to ensure it is done right? (Denver)

The generally level trail provides a venue for people of all ages. Tots learn to cycle along it, safe from traffic. Runners/joggers plod the path w/o worry about surface irregularities. For the elderly strollers of Windsor gardens and other senior communities, the trail allows them their only opportunity for safe outdoor exercise and the restorative effect of the riparian environment. (Littleton)

Initially purchased a home in 1993 on canal at So. Windemere in Littleton. Primary requirement was a house bordering the canal. In 2000, we specifically searched for a ranch style home (due to our medical problems) ON THE CANAL. We found one at So. Yosemite St. That is how important living on the canal is to us! We enjoy watching the water flow, animals that habitate (fox, not skunk), and the parade of people, horses, dogs, etc. that go by our window. Some resolution must be made to keep water in the entire canal. (Denver)

I enjoy walking along the canal and value the almost rural setting – the trees, wildlife and the flow of the canal's water. (Denver)

I love to do BIRDWATCHING when I walk the canal. I appreciate the efforts of Denver Water toward water conservation and lessons in xeriscaping. The classes you offer in the summer are terrific. Your high Line Canal map/booklet is very useful. I feel that Denver Water will continue to guard and manage our precious High Line Canal. It really is a tremendous resource for a city the size of Denver (Denver)

The canal is an ecosystem; altering one portion of the canal will affect other portions. (i.e., wildlife, flora, etc.) (Denver)

Preservation of the wildlife habitat is essential. (Littleton)

I value the wildlife, trees, wild flowers and the water. My grandchildren love walking with me observing the wonderful environment. I find people very friendly on the canal. On the street many of these same people seem to be afraid to even look at you. (Denver)

As a regular user for the past 20 years, I was surprised that no one mentioned during the Jan. 23 meeting the importance of the canal as a view shed. While many of the long distance views available have been compromised by housing developments (west of Windsor Gardens and west of Expo Park, for example), portions of the canal offer high-up, expansive views of Denver and the mountains that you can't get anywhere else. Consider the section that runs through Bible Park, or the one adjoining Kent Denver, for instance. The "High Line" aspect of the green space can't be underestimated. (Denver)



## Appendix C Public Meeting Comments

I value the canal because it's as close to living in the country as I can get while still living in the city. (Denver)

Please keep some water flowing the canal from spring until fall. When there's adequate water flowing in the spring, animals are attracted. When the flow stops in mid summer, animals are stranded and die. I'm tired of seeing dead beavers, muskrat, and raccoons in the dry canal bed. Mid summer is too late for them to find a new home. I'm tired of seeing black crowned night herons picking around in the muck for food in mid summer. Please keep some water flowing continuously. We need to take care of the animals that are left. They're sacred. (Denver)

Numerous species of birds use the canal's riparian environment. Moreover, many require the fairly consistent presence of flowing water, not just vegetation. (Littleton)

Trees very important -- shades our yard. Wild life -- ducks -- fox -- beaver -- raccoon -- also nice! Helps to cool us -- the southerly wind over the water. To walk -- jog -- and visit with friends. (Denver)

The canal is a sanctuary from the hullabaloo of urban life. I can take my grandson for peaceful walks and share nature as it exists in more rural parts of Colorado. A continued supply of water is needed to preserve the current unique atmosphere. It is "our" canal, "our" open space, provides a sense of community. (Denver)

Do whatever it takes to keep adequate water flow for wildlife and trees/natural landscape in High Line Canal. (Aurora)

It was rumored that Bible Park was to be altered. Please preserve the canal and the small parks along it. It is a small reminder of God in a smoggy, asphalt existence (Denver)

Trees provide shade, coolness, and a wind break and also purifies the air along the 70 miles of the canal. (Denver)

My 1-year-old grandson is fascinated by the leaves, trees, flowers, birds, and animals. It brings me pleasure to introduce him to these basic delights. (Denver)

Part of my treatment for cardiac problems is a walk 5 times a week. I find the canal a soothing, idyllic alternative to the hustle and bustle of a city. (Denver)

I enjoy the flowers, tree, shrubs and wildlife. In spring the lilacs and dogwoods provide a great treat for the nose. (Denver)

People walking and jogging on the canal form a bond as they enjoy the peace. Where else can you greet all the people you meet and exchange smiles? (Denver)

I enjoy the canal for its peace, tranquility and the diverse wildlife it provides a home for. It is so wonderful to have such a great oasis in an overcrowded city. (Denver)

I want to emphasize the canal's importance as a place for everyone to enjoy nature that includes the flora and the fauna: they need water! (Aurora)

Primary concern is for wildlife spec. as a wetland area for fowl. All the animals need the trees, water, and habitat. (Denver)

Trees (Denver)

What I value most about the H.L. Canal: The ability to run on unsurfaced, tree-lined path without the threat, noise and pollution from traffic. While the High Line Canal is enjoyable to me for recreation, it's home for the wildlife. (Denver)

I use the canal as a biking trail. I have ridden the whole canal at one time or another. This is a safe way to bike! Closing it will end my biking! I do 2000 miles per year. (Aurora)

The vast diversity of wildlife that I have seen will disappear when water flow stops. Foxes, pelicans, ducks, geese, and even carp which seem to come from somewhere when the water flows (Aurora)

## Appendix C Public Meeting Comments

I am representing "Bicycle Aurora." The canal is a valuable link in the off-street trail system throughout the entire metro area. (Aurora)

The canal provides vital habitat for many species of wildlife. Some of which are rare and would cease to exist with the resources provided by the canal i.e. Water, trees, shrubs. These provide shelter, food, transportation for that wildlife. (Aurora)

Not only does the canal provide recreation, it is a transportation corridor. I and many others use it to traverse the city/metro. (Aurora)

The trees along our lower canal are priceless assets to an area that is relatively arid and unattractive. The canal becomes more of a treasure as it leaves Cherry Hills, etc., and travels north. (Denver)

I recently purchased my home because of the canal. I also paid a premium for my home because of the canal. I firmly believe that my property value will drop significantly if the canal is allowed to dry up. (*Will this lower canal, in a less affluent area than the upper canal, receive the same attention? Are we being "cast off" because we're less powerful politically? Do we need the clout of the Water Board to survive?*) My neighbors and I did not receive notification of this meeting. We live in High Line Estates and back up to the canal. (Denver)

Absolutely love the canal, the oasis in the city, the TREES and the attendant wildlife. Sense of community, chance to meet neighbors, beauty of Denver. My dogs love it (Unknown)

My concern is the water, and needed water to continue to have the High Line Canal be very similar to present. Concern for wildlife, trees etc. on the highland canal. The value of the place to go to enjoy the atmosphere and nature. (Aurora)

I would hope people could become more involved in helping to preserve all the wonderful facets of the canal – Have been walking the High Line Canal for 35 years and enjoy the serenity of the area and the wildlife. (Denver)

Recreation – We've walked the canal for 20 years. It is never the same without water in it. Without water there is a tendency for it to become a dumping area. KEEP THE WATER FLOWING! (Denver)

The canal provides my family recreational opportunities – a place to walk my dog – jog for fitness – get away from city streets and cars and auto noise. Go a short distance or long. A place to daydream without interruption. It is invaluable. (Aurora)

The trail has potential to be more beautiful with added native plantings. We would like to plant trees on the H C bank behind our new housing development. Cottonwoods are wonderful. They need younger trees too. (Aurora)

Would like to see tree and landscaping work done along canal and open areas. (Aurora)

Wildlife and water (Aurora)

I walk the canal often and enjoy the water but even without water it is good – but when water is not flowing there is always trash – grocery carts, other materials – I would like to see some way to stop the trash. (Aurora)

Water and foliage is a nice change from the urban landscape. It is a wonderful place to run without having to deal with traffic. The water makes it a beautiful place to walk. Water makes it a nice place to walk dogs (because it is so green and lush). (Unknown)

The canal (when water is flowing) serves as a buffer (security) for our neighborhood. There is a large apartment complex across the canal that we seem to get foot traffic from when the canal is dry. We are also seeing more and more trash thrown into the canal from that same complex particularly when dry. (Aurora)

I use the canal exclusively; I walk it at least 3 times daily. I value the natural environment including the water and resultant vegetation and wildlife. (Denver)

## Appendix C Public Meeting Comments

Please don't abandon the canal and its varied and tremendous value – Give us some alternatives for its preservation – Perhaps people need to become more involved. (Denver)

Being on the canal improves property values. Value – the huge old cottonwoods growing along the canal. (Denver)

Having walked the entire length of the canal, I have a very strong interest in its future. The High Line is a true gem in the midst of our ever-growing area. (Aurora)

The water is very important for beauty and aesthetic value in addition to wildlife and vegetation. Unique resource for all to enjoy! (Denver)

Save the cottonwoods! Save the wildlife corridor! (Unknown)

How can we replace a 100 year old resource?  
(Denver)

### MEETINGS AND COMMUNICATION:

I would prefer a meeting where everyone could hear the questions (Aurora)

The conduct of the meeting seemed designed to cut off public discussion. You only allowed people to discuss values, and to ask questions. You should also allow the public time to express their thoughts and comments publicly. (Denver)

WWW.Denverwater.org is the wrong URL for information relating to this effort. Past remarks by representatives of Denver Water indicate that they are indifferent (at best) to the value of this HUGE civic amenity. One cannot assume that information on THEIR web site would be unbiased. (Greenwood Village)

Meeting format: Parts 1 and 2 fine, part 3 too short and part 4 just plain lousy (sorry) You cut off dialog that might have been meaningful for everyone. Sure it made it easier for you, as you didn't have to take the heat, but you also didn't get the opportunity to see "the light" – Set rules, then let people have a meaningful dialog. (Denver)

We need more basic information on why Denver Water and its partners are even considering this move. Many of us have read information in the newspaper and other media that appears to be very biased. A clear presentation, with supporting documentation showing projections for additional water needs would be very helpful to you cause, I believe. Good presentation. (Littleton)

Please communicate thru something other than web site that is discriminatory. (Denver)

I think it would have been more informative to have stayed in the large meetings and heard from a panel of experts instead of attending the small groups. (Aurora)

Well-organized and informative presentation. (Lakewood)

Good meeting. Glad that canal will still have water upstream. (Littleton)

### To Denver Water – Conservation Suggestions:

Some members of the audience stated their belief that Denver Water customers do not conserve enough water and that conservation savings could be used for new growth in Denver Water's existing service instead of canal water. Their specific suggestions for more conservation are listed below.

To Denver Water, to conserve water! Require all sprinklers to install a rain stat that will automatically shut off the sprinkler system after a measurable rain storm. (Unknown)

## Appendix C Public Meeting Comments

Parks and Rec. replant with native grasses rather than “Kentucky” blue grass. Example: buffalo grass only needs to be watered and mowed 3 x 4/1 thru 10/30. (Denver)

The Water Board needs to enforce 3-day a week watering of lawn. So much goes down the gutters. Some of my neighbors water 7 days a week for hours! So much is wasted on lawns. (Denver)

Please look at retraining Denver Water users to conserve water – incentives to Xeriscape, to retrain ourselves to use less water. Give people cash back for Xeriscaping  
Water conservation – How many times have we seen park sprinklers going in the middle or after a substantial rainfall?  
(Unknown)

Denver Water could provide free or low-cost residential and commercial water conservation evaluations (i.e., leaking sprinkler valves, over-watering of lawns, xeriscaping, commercial waste of water, etc.) (Denver)

Why is Denver Water watering parks (e.g. Rosamund and Bible Parks) with high arching sprinklers midday in the summer that’s poor water conservation and sends a bad message to the public. Sometimes the grassy areas are so boggy – even in the hot, dry summer! Let’s see more space in our parks converted to “natural areas” for wildlife, less over-watered turf and more native grasses and vegetation and Xeriscape!! (Denver)

February 9, 2001

**Appendix C Public Meeting Comments**

**Summary of High Line Canal Public meetings (First Round)**

*What Do **YOU** Value About Highline Canal?*

	<b>Value</b>	<b>Aurora Meeting</b>	<b>Denver Meeting</b>	<b>Arap. Cty Mtg.</b>	<b>Total</b>
1	Open Space (Oasis, Continuity, etc)	3	7	3	13
2	Trees (Shade, Canopy, Air Qual.)	4	6	3	13
3	Trails (Connections, Walking, Biking)	3	6	3	12
4	Wildlife / Habitat	1	2	4	7
5	Property Values	1	1	1	3
	Historical Value / Legacy	1	3	1	5
7	Sense of Community / Social Place	3	1	5	9
8	Water	2	3	1	6
9	Horseback Riding	1	1	2	4
10	Irrigation water for Agriculture	1		1	2
11	Recreation	1	1	1	3
12	Drainage		3		3
13	Other (Safety, Beauty, Tranquility, Public Relations for DW, Water Conservation, Link between public and DW, Education)	2	5	3	10

**COMMENTS FROM  
HIGH LINE CANAL PUBLIC MEETING  
APRIL 23, 2002  
LITTLETON**

About 40 people attended.

- Concerned that the High Line Canal proposed Recreation Management Plan, bullet four, mentions pedestrian and bicycling, but does not mention equestrian. As I mentioned 1 year ago, I want to ensure all IGA's include equestrian use in all aspects of its plan. Separate trails may be necessary for equestrian and bicycling as horses and bikes don't mix. Plus there are many bicycle trails around, but not as many equestrian use opportunities on a nature trail. If necessary, I would prefer ensuring equestrian use over bicycling use. Thank you for considering all of our input.
- I'm leaving this meeting much more encouraged than when I came in. Lived in Denver metro area since 1959. There was a time the DWB would probably have done whatever it wanted to with this issue -- this is a much better approach!
- Can the HLC Trail qualify to be designated a National Historic Trail? As it is now? After the discussed modifications?
- How saline can the water be at lower end? Where is last delivery on upper canal?
- Thanks for this evening! It was informative.

Questions Asked:

- *Won't check dams increase mosquito populations?*
- *Will Denver Water work with neighbors near possible check dam sites so they have input?*
- *Did you look at groundwater as a source?*
- *Concern for Denver Water later taking the 62 customers in the Upper Canal off the high line.*
- *Why not run flows via the canal to Cherry Creek and then down Cherry Creek to the South Platte.*
- *Can we get lottery funding for recreation costs?*
- *Applaud partnership of agencies working on solutions.*
- *Are there areas where seepage is worse?*
- *What are the statutory and regulatory requirements if any?*
- *How will this processes agreements be institutionalized so that 10 years from now they still hold?*
- *Concerned check dams would be dangerous for kids. How would liability be handled- would the neighbor property owner be liable in any way?*

**COMMENTS FROM  
HIGH LINE CANAL PUBLIC MEETING  
APRIL 25, 2002  
AURORA**

About 60 people attended.

- I am excited to see the direction of this project. I had not seen anything on the progress of studies or rationale of cutting off the water. I am glad to see all the studies and discussion. I use the High Line Canal for biking, and am excited to see the direction of this.
- I am very pleased the Aurora portion (particularly between Peoria and Ursula) of the trail is available for older pedestrians such as myself who need a dirt surface due to arthritis issues. That portion just east of Lyn Knoll Elementary School is the best area I've seen anywhere along the canal.
- Put a section on the website where people can submit comments and ideas.

Questions Asked:

- *What are all the tags on the trees for?*
- *Is there groundwater available along Sand Creek?*
- *Will you have to find a customer along the canal to deliver water for the four weeks?*
- *Are you going to dump the water into Cherry Creek or could that water go further downstream as far as it could?*
- *Is anyone looking at the impacts to the ducks and other wildlife along the canal?*
- *What will happen to the wildlife?*

**COMMENTS FROM  
HIGH LINE CANAL PUBLIC MEETING  
MAY 7, 2002  
DENVER**

About 50 people attended this meeting in Denver.

- I realize that it is not reasonable to always have water in the canal, especially with Colorado water laws as they are. It is nicer to have water in the canal from a picturesque standpoint but that's not always possible. I appreciate the level of concern about the canal displayed by these studies. It is very important to maintain the trees but the need of local wildlife to have access to water must also be considered. Thank you for holding these meetings. Please continue keeping the public informed.
- I am concerned that lining and damming the canal will result in a loss of wildlife -- both flora and fauna.
- Very informative presentation and to the point -- much appreciated! Thanks for the website to obtain additional info.
- Thank you for all of your efforts to preserve this extremely valuable community resource. Could standardized street crossing markings be provided at all crossings, e.g., fluorescent yellow/white paint?
- No curb (or "handicap" curbs) @ all access points for bicycles.
- Use of CO "Lottery" proceeds to re-pave path or replace with concrete, and install underpasses @ busy intersections.
- I am surprised you have not calculated the recreation value of the proposed changes. Denver has grown enough! I grew up in this town. We came here in 1946 from Dillon, CO. Denver is a monster. Keep the Canal. Stop the growth. Give recreation and wildlife a chance. I don't think your plan will stand up to real economic analysis.
- How does Arapahoe County figure into this? Please put equestrian use in writing in the goals.
- The canal is directly behind my property. I have a concern with check dams, etc., and the stagnant water breeding mosquitos. I also understand the need for customers to draw water from the canal and resulting need for check dams. Personally, I would rather look at a sandy canal bottom than stagnant mosquito infested water.

Questions Asked:

- *Is the seepage worse at certain locations on the canal where soils are more sandy?*
- *Does Denver Water have plans to cut-off the upper canal in future years?*
- *Is there a connection between growth in the metro area and the need to make these changes to the canal?*
- *What does Denver look like with full development?*
- *If Denver does not grow, do you still need to abandon the High Line Canal?*
- *I don't understand how you can say you're not abandoning the canal if you are cutting water off at Cherry Creek. How are you going to preserve the look of the canal at Green Valley Ranch? It seems like you are just tossing the ball to the Denver Parks Department. How can Denver Water say its going to make the lower canal available as a recreation amenity? If there is no water in it, that's why it's a recreation amenity. Your goals should be to conserve the canal in its present state.*
- *Are you looking for state lottery monies?*
- *Are Denver and Aurora willing to take over the lower portions?*
- *Who's going to pay the cost of half a million dollars in Priority 2?*
- *Have you been considering or studying the wildlife needs to have access in the water in the canal?*
- *Do you know the dollar amount of the recreational value of the canal? The answer is, it's priceless.*



## Appendix C Public Meeting Comments

- *If by making changes to the canal Denver Water saves 2,500 acre feet of water, how much does it cost to buy that amount and save that water for the canal?*
- *There is stagnant water in the canal at this time. It's very smelly water from Dahlia to Holly.*
- *Is there any chance that the water that is being saved by taking four customers off the canal, of selling that water to the neighbors along the upper portion of the canal for them to use for lawn irrigation? This way the water stays in the canal.*
- *How much do customers of the canal pay?*
- *What is the new 2002 headgate water?*
- *Can the water in Goldsmith Gulch be used?*
- *Will the water taper to nothing at Cherry Creek?*

