Fort Collins WSDMP Update
Additional Supplies and Facilities

Community Working Group
Meeting #4
June 22, 2011
Overview

- Existing water demands and supply system
- Future water demands
- Alternatives for meeting future needs
- Halligan permitting process
- Environmental considerations
Fort Collins Water Needs

• Present Demands
  – Currently deliver about 26,000 AF/yr treated and 4,000 AF/yr of raw water
  – Demand levels declined from 230 gpcd in early 1990s to 200 gpcd before 2002
  – Lower use in recent years
    • Average of ~153 gpcd since 2003
Existing Treated Water Supplies and Facilities

- Direct flow rights
- Converted agricultural rights
- Colorado-Big Thompson (CBT) project
  - North Poudre Irrigation Comp. (multiple use)
- Michigan Ditch and Joe Wright Reservoir
  - Mostly reusable source of water (needed for fully consumable demands)
  - Allocated to Reuse Plan
Reusable supplies used by City

Reusable Water
(City Supplies And WSSC Credits)

City Water System

6,000-8,000 AF
Reusable effluent delivered to PRPA

Reusable Water (City Supplies And WSSC Credits)

City Water System

PRPA/Rawhide

6,000-8,000 AF

4,200 AF
PRPA provides Windy Gap water to City, which is used at ABI and City

- Windy Gap (PRPA) to ABI: 4,200 AF
- Reusable Water (City Supplies And WSSC Credits) to City Water System: 6,000-8,000 AF
- City Water System to PRPA/Rawhide: 4,200 AF
ABI effluent applied to farm fields,
City effluent provided to PRPA

Windy Gap (PRPA) 4,200 AF

Reusuable Water (City Supplies And WSSC Credits) 6,000-8,000 AF

City Water System

ABI

Land Application 4,200 AF

PRPA/ Rawhide
City has obligation to WSSC, Fort Collins nets 2,310 acre-feet/year

Windy Gap (PRPA) ➔ 4,200 AF ➔ ABI

Reusable Water (City Supplies And WSSC Credits) ➔ 6,000-8,000 AF ➔ City Water System

City Water System ➔ 4,200 AF ➔ Land Application

City Water System ➔ 1,890 AF ➔ WSSC

Land Application ➔ PRPA/Rawhide

PRPA/Rawhide ➔ WSSC
# Current and Projected Average Annual Yield of Water Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Conversion Factor (Ac-ft/Sh)</th>
<th>Average Annual Yield (Ac-ft/Yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poudre River Direct Flow</td>
<td></td>
<td>11,300</td>
</tr>
<tr>
<td>Joe Wright-Michigan Ditch</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Reuse Plan (PRPA)</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>NCWCD (CBT)</td>
<td>0.76</td>
<td>4,600</td>
</tr>
<tr>
<td>N. Poudre Irrigation Co.</td>
<td>5.57</td>
<td>0</td>
</tr>
<tr>
<td>Arthur Irrigation Co.</td>
<td>3.44</td>
<td>0</td>
</tr>
<tr>
<td>Larimer County Canal No. 2</td>
<td>42.69</td>
<td>200</td>
</tr>
<tr>
<td>New Mercer Ditch Co.</td>
<td>30.23</td>
<td>300</td>
</tr>
<tr>
<td>Pleasant Valley &amp; Lake</td>
<td>39.74</td>
<td>200</td>
</tr>
<tr>
<td>Warren Lake Reservoir Co.</td>
<td>10.00</td>
<td>0</td>
</tr>
<tr>
<td>Water Supply &amp; Storage Co.</td>
<td>84.00</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>16,600</td>
</tr>
</tbody>
</table>

**Notes:**
1. Yields are the approximate average annual yields of the water rights and do not reflect weather variations and other physical and legal constraints in the system.
Average Annual Yield vs. Usable Yield

- Average annual yield of City’s water rights portfolio ~74,000 ac-ft/year
  - Treatable average annual yield ~55,000 ac-ft
  - Firm yield (1-in-50 drought) ~31,000 ac-ft/year

- These annual average yields are limited by:
  - Significant annual variation due to weather
  - Legal constraints such as unconverted rights, ditch losses (~20%), volumetric limitations, return flow obligations
  - Demands below yield of water rights are unusable
Water Supplies and Demands for Fort Collins Utilities

130% of Average Poudre River Flows (1986)

Direct flow rights in excess of demands.

Flow (cfs)

Date

13

Direct Flow Rights  Water from Storage  2008 Actual Demands
Water Supplies and Demands for Fort Collins Utilities

30% of Average Poudre River Flows (2002)

Significant variation in water right yields.

Some excess even in dry year.

- Direct Flow Rights
- Water from Storage
- 2008 Actual Demands
Future Water Demands

- Utilities must plan for the future
- Depends largely on population and commercial/industrial growth
- Water Utility has limited growth potential due to surrounding water districts
Future Water Demands

• Future population growth defined by City Planning Department
  – State demographer growth projections to 2035 distributed throughout City using zoning, density, growth trends and other parameters
  – They do expect an increase in density (more multi-family developments), but do not expect a significant difference between now and 2035

• Although the Utilities can effect how customers use water, growth patterns and density are defined by the Planning Department
Population Based Demands

• Anticipated population served by Utility is ~165,100 by 2050
  – 2010 population served ~129,900
  – Projections use 2010 census data
• Population based water supply needs
  – Uses 162 GPCD and 3% treatment loss
  – Existing need ~24,300 ac-ft/year
  – Future need ~30,900 ac-ft/year
City of Fort Collins - Water Utility
Historic and Projected Population

Population

Year

Historic
Projected
Large Contractual Use (LCU)

- Current LCU (Anheuser-Busch)
  - ~4,000 ac-ft/year (including some raw water obligations)
  - Anheuser-Busch use has declined ~25% in recent years
  - Requires reusable water source
- Future estimated LCU
  - ~8,500 ac-ft/year
  - Anheuser-Busch and other potential customers
  - Mix of reusable and single-use water sources
**Future Water Supply Needs**

- Total project need of ~39,700 ac-ft/year
  - Population of ~165,100 at 162 GPCD
  - LCU of ~8,500
  - 3% delivery and treatment loss
- Using 38,600 ac-ft/year in Halligan Reservoir permitting process
  - Permitting process not complete and values may be adjusted
What is the impact of no additional facilities and supplies?

- The City will still do well in most years if demands increase with no additional supplies and facilities.
- Shortages will occur during more severe droughts.
  - More so for droughts greater than 1-in-50 year.
- Cannot meet safety factor (15% of demands in storage).
- Modeled 1-in-50 and 1-in-100 drought hydrology with future demands and no additional facilities and supplies.
What is the impact of no additional facilities and supplies?

• 1-in-50 drought contains the following:
  – 6 year long drought
  – 50% CBT quota in last year

• Model results show the following:
  – Shortages in 3\textsuperscript{rd} and 6\textsuperscript{th} years of drought
  – Maximum shortage in last year of \~1,200 \text{ac-ft}
    (~3\% of annual demand)
  – Joe Wright Reservoir very low through most years of drought (could not fully meet Reuse Plan in 2 years)
What is the impact of no additional facilities and supplies?

- 1-in-100 drought contains the following:
  - 8 year long drought
  - 40% CBT quota in 7th year

- Model results show the following:
  - Shortages in 5 years out of 8 year drought
  - Maximum shortage in 7th year of ~5,600 ac-ft (~15% of annual demand)
  - Joe Wright Reservoir very low through most years of drought (could not fully meet Reuse Plan in 5 years out of 8 year drought)
What is the impact of no additional facilities and supplies?

• Potential impacts to customers may include:
  – 1-in-50 drought: lawn watering restrictions, ban on certain uses, potential rate adjustments, potential stress and loss of existing landscapes
  – 1-in-100 drought: much more restrictive on all uses, definite rate adjustments, higher losses of existing landscapes
  – Response levels could be more severe, since water providers need to prepare for continuing drought (never know what the next year brings)
Fort Collins Water Supply System
Strengths and Weaknesses

- **Strengths:** Senior water rights provide good base flows, converted agricultural rights yield well in most years, CBT system provides stored water that helps meet winter demands (when river yields are low)
- **Weaknesses:** High reliance on CBT quota (and policies of Northern District), no effective way to use surplus water rights, no place to store conserved water
  - Need to focus on diversification of supplies
Questions?
Alternatives for Meeting Future City Needs

Community Working Group
Meeting #4
June 22, 2011
Meeting Future Needs

- Will be able to meet some future needs with conversion of existing water rights
- Raw Water Requirements (RWR)
  - Developers must hand over water rights or cash in lieu of water rights
  - Currently have ~$23 million in Water Rights Reserve Fund
Alternatives for Meeting Future Needs

- Changing planning criteria
- Factors to consider in alternatives analysis
- Acquiring additional supplies
  - Water sharing and/or leasing from others
- Developing additional storage
  - Halligan Reservoir enlargement
Planning Criteria and Purpose

- Discussed in past 2 meetings (Non-drought use and severe drought planning)

<table>
<thead>
<tr>
<th>Key Planning Criteria</th>
<th>General Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water demand planning level (GPCD, etc.)</td>
<td>Determines future water demand projections (defines need)</td>
</tr>
<tr>
<td>Drought reliability level (i.e., 1-in-50 drought)</td>
<td>Determines the quantity of water rights and facilities needed to provide a firm supply for meeting future demands</td>
</tr>
<tr>
<td>Safety factor (i.e., storage reserve equal to 15% annual demand)</td>
<td>Provides short-term supplies in the event of unforeseen system outages, destructive natural events, or other emergencies</td>
</tr>
<tr>
<td>Water Supply Shortage Response Plan</td>
<td>Provides plan for dealing with projected water supply shortages or emergency situations</td>
</tr>
</tbody>
</table>
Changing water demand planning level

• Many CWG members thought having a planning level GPCD separate from the conservation goal seemed reasonable

• CWG members wants to know community’s preference for different landscapes and increased conservation
  – Planning a customer survey

• CWG members wanted to know what impacts additional conservation would have on existing landscapes in Fort Collins
## Potential reductions to estimated irrigation application depths

<table>
<thead>
<tr>
<th>Period</th>
<th>Average GPCD</th>
<th>Single Family Use (gallons/year)</th>
<th>Estimated Irrigation Application (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Indoor</td>
</tr>
<tr>
<td>1998-2001</td>
<td>198</td>
<td>163,936</td>
<td>74,695</td>
</tr>
<tr>
<td>2004-2010</td>
<td>153</td>
<td>103,349</td>
<td>58,154</td>
</tr>
<tr>
<td>Future</td>
<td>140</td>
<td>94,778</td>
<td>54,726</td>
</tr>
<tr>
<td>Future</td>
<td>120</td>
<td>81,238</td>
<td>49,310</td>
</tr>
<tr>
<td>Future</td>
<td>100</td>
<td>67,699</td>
<td>43,894</td>
</tr>
</tbody>
</table>

### Notes:

1. Irrigation application calculations use a lot size of 8,500 square feet times a 65% pervious area factor (or 5,525 square feet of irrigable area).
2. Future scenarios assume that GPCD reductions will be equal among all customer categories and that the single family reduction will be 60% outdoor and 40% indoor.
3. Annual indoor water use is based on average winter use.
Changing reliability criteria or safety factor

• Many of CWG members thought current planning levels seemed reasonable
  – Some thought more reliability is needed
• Key CWG observations included:
  – It’s hard to consider each component separately
  – More information is needed on cost and environmental impacts
Considerations for Supply Alternatives

June 22, 2011
Scope of Presentation

- Focus on supply-side alternatives
- Discuss major considerations but general in nature
- Many good ideas from CWG regarding alternatives. Some are primarily demand management-related:
  - more water conservation
  - changing Fort Collins’ drought policy and/or safety factor
  - using lawns as dry year supply
  - reducing/halting growth, etc.
- Not in this presentation except to the degree they are an intrinsic part of a supply-side alternative
Feasibility Threshold Considerations

- Effective Supply
- Synergistic with Fort Collins’ Water Rights
- Willing Parties and Agreements
- Water Rights
- Facility Requirements
- Source Water Quality
- Environmental Impacts
- Monetary Cost
Effective Supply

- Deliverable to Fort Collins’ water treatment plant
  - from Fort Collins pipeline
  - from Munroe Canal (irrigation season only)
  - from Horsetooth Reservoir

- Deliverable during critical portions of droughts
  - to be effective, must deliver water at times when Fort Collins’ existing supplies are inadequate to meet projected demands without violating safety factor
  - reduced stream flow affects potential yield and exchange potential

- Reusable water
  - Fort Collins’ existing sharing agreements require reusable water
Willing Parties and Agreements

- Applicable to sharing agreements
- Must meet the needs of all parties
- Contractual agreements are required
- To be a useful as a municipal supply, must be a permanent arrangement
- May require land use agreements/limitations
- May be subject to irrigation/ditch company bylaws/operating rules
Synergistic With Fort Collins’ Rights

- Some of Fort Collins’ water rights, in order to be fully utilized, will require additional storage to meet return flow requirements.

- These water rights are already counted in the City’s existing yield.
Water Rights

- A water right may only be used according to the terms of its decree.

- Else must change rights in Water Court (not a small issue)
  - Limited to the amount of quantifiable lawful historical use
  - Prevent injury to other water rights
  - Maintain historical return flows
  - Likely reduced yield in the case of upstream change (smaller physical supply, can’t harm intervening rights)

- NCWCD policies and restrictions may affect changes
  - CBT water has been intermingled with base supply, but cannot be changed

- These requirements apply to any long-term interruptible supply or rotational fallowing arrangements.
  - Even short-term arrangements must meet the tests of a change

- Subject to irrigation/ditch company bylaws/operating rules
Facility Requirements

- Diversion, storage and release facilities
- Land and ROW acquisitions
- Construction in an urbanizing setting
- Construction within or close to riparian ecosystems
- Municipal versus irrigation levels of facility condition and reliability
Source Water Quality

- Source water quality is affected by upstream human activities and natural processes.

- Lower elevation → more human activity → reduced source water quality → increased treated water supply costs.

- Water quality of lower elevation reservoirs more strongly affected by nutrient loading and increased temperatures (higher trophic status).
Environmental Impacts

- **Construction-related**
  - reservoirs: inundation (new on-stream storage)
  - pipelines: riparian and other impacts, access
  - gravel pits: riparian impacts

- **Operation-related**
  - stream flow depletions
  - flood attenuation and disruption of sediment supply (new on-stream storage)
  - dry-up of irrigated lands
  - increased energy consumption for alternatives involving pumping or treatment of lower water quality supplies
Monetary Cost

- Facilities permitting, construction and mitigation costs
- Ongoing O&M costs, including energy costs
- Land acquisition and ROW costs
- Water rights acquisition costs
  - Average yield vs. dry year yield
  - Single use vs. reusable water
  - Source water quality
  - Flexibility of delivery locations via facilities or exchange
- CBT water as an example: Current price $\approx$ $8,000/unit (down from $12,000/unit in 2002). At 50% dry year quota, $\approx$ $16,000/AF$ for single use ‘movable’ water.
Water Supply from Agriculture

(Interruptible supply, rotational fallow, dry year lease, purchase/dry-up, purchase/lease back, conservation and transfer of consumptive use)

▪ The “downstream” problem
  ▪ Most irrigation supply and irrigation reservoirs are downstream
  ▪ Most remaining senior rights divert downstream, are partially supplied by return flows (limited ‘net’ yield)
  ▪ Upstream changes will likely have reduced yield and/or junior priorities
  ▪ Downstream supplies would require a pipeline or would deplete the river during low flow periods
  ▪ Water quality issues associated with downstream supplies

▪ The dry year yield problem
  ▪ As with other water rights, the yields of irrigation rights are lower during dry years
Water Supply from Agriculture

- **Water Rights Issues**
  - Changes of water rights would be required
  - Contractual and water rights change problems increase geometrically with the number of shareholders involved.
  - Historical return flows must be maintained year round
  - Maintaining winter return flows would require additional storage

- **Operational Issues for Sharing Arrangements**
  - Defined thresholds and notice requirements for sharing
  - Payment schedules
  - Flexibility = complexity
  - Permanent conservation easements on participating lands.
  - Permanent operation of involved ditch delivery systems
  - Essentially a long-term partnership between city and farmers.
Water Supply from Agriculture

- Implications to Agriculture
  - Some dry-up involved, even if rotational or periodic
  - In the case of municipal/agricultural water sharing agreements:
    - Permanent preservation of involved agricultural lands
      (fundamentally a land use decision with major cost/legal/equity considerations)
    - Permanent operation of involved ditch delivery systems
    - Permanent irrigation use of water rights being shared
Water Supply and Storage Company (WSSC)

- Trans-basin diversions of about 34,000 AF/year average (half of WSSC’s total supply)
- Partially regulated by Long Draw Reservoir (10,600 AF) and Chambers Lake (8,800 AF)
- Long Draw Reservoir currently cannot release water during winter
- Currently irrigates about 40,000 acres, mostly east of Fort Collins
- Thornton and other municipal providers own ≈ 60% of WSSC
  - Competition for remaining shares of this highly desirable reusable trans-basin source
- Some of WSSC’s supplies already committed to Fort Collins/WCCS/Platte River Power Authority exchange
- WSSC supplies interrelated with many other entities’ supplies
North Poudre Irrigation Company (NPIC)

- Halligan Reservoir (≈ 6,400 AF)
- North Poudre Canal (≈ 30,000 AF average yield)
- Munroe Canal (≈ 30,000 AF average yield, but no dry year yield exclusive of CBT or other exchanges)
- More than 70% owned by municipal providers: Fort Collins, Tri-Districts, Ault, Nunn, Eaton, Windsor, Severance)
- A “split system”: Much of NPIC’s lands supplied by the North Poudre Canal cannot be served by the Munroe Canal without new pumping facilities and changes of water rights
- Difficulties in changing native supply portion of NPIC shares. - Fort Collins weighing the advantages and disadvantages of leaving the native supply in the NPIC system
Upstream Agricultural Supplies

- Larimer and Weld Irrigation Company
  - Wilson Canal/Worster Reservoir (3,800 AF)
  - Now controlled by one of the Tri-Districts
  - Larimer & Weld also has “downstream” rights/supplies that may be feasible to transfer up to Fort Collins’ diversions
Downstream Agricultural Supplies

- Lots of physical supply, but...
- Would require an upstream transfer (exchange) or a physical delivery system
- Upstream exchange potential is very limited below Larimer & Weld Canal, particularly during drought periods
- Source water supply comes partially from municipal effluent and irrigation return flows (water quality problems if physically delivered)
Groundwater Use

- The regional groundwater supply is alluvial in nature
  - interconnected with surface streams, time lags

- Two modes of development:
  - augmentation plan (pump and use water from aquifer, replace delayed depletions to avoid injury): complex water rights, must replace up to 100% of pumping
  - build a physically isolated GW reservoir: large land area, difficult to fill and get water out

- Would involve structural components

- A downstream supply: would require upstream transfer (very limited) or a physical delivery system

- Upstream transfers would deplete stream flows during drought periods

- Water quality affected by overlying land uses
Recycling/Reuse

- Requires a legally reusable supply
- Fort Collins’ reusable supplies are already committed
- Additional reusable supply would have to be firmed up (by additional storage)
- Existing end uses that could be easily served are very limited.
Gravel Pit Storage

- A downstream supply
- Useful for meeting some return flow requirements
- Riparian impacts
- Requires an engineered system but do-able
- Susceptible to extreme floods
Conclusions

- There are several supply-side alternatives that could work for Fort Collins; all have trade-offs.
- Water sharing with agriculture has promise but would involve significant land use decisions and may be more expensive than other alternatives.
- Acquiring more irrigation rights can help meet Fort Collins’ needs but the effectiveness of this option would be limited without additional storage.
- Some additional storage will be needed in order to Fort Collins to fully utilize portions of its existing water rights portfolio.
- Enlargement of existing storage has some advantages over construction of new storage.
Alternatives for Fort Collins

- The current policy gives some flexibility in the types of alternatives are used to increase our long-term water supply reliability
- As part of meeting future demands, the Utility will continue to weigh the benefits and costs associated with different alternatives
  - Continue to acquire some additional water rights
  - Must have some storage to manage converted agricultural rights (gravel pit storage)
  - Having discussions with agricultural interests to increase supplies during drought years
  - Currently pursuing Halligan Reservoir
Halligan Reservoir Permitting

• Currently working through the NEPA permitting process with the U. S. Army Corps of Engineers
  – Teaming with Greeley and NPIC on permitting (Halligan Seaman Water Management Project)
  – Process includes extensive alternatives analysis (viability, environmental impacts, costs, etc.)
  – Charged with finding the Least Environmentally Damaging Practicable Alternative (LEDPA)
    • May not be enlarging Halligan Reservoir
Halligan Reservoir Permitting

- Initially requested 12,000 ac-ft of capacity for Utility
  - Used 185 gpcd and shared North Fork exchange potential with Tri-Districts
- Using approximately 162 gpcd to size Utilities portion
- Adjustments will reduce capacity needed by Utility
  - Modeling still not complete for determining size required by Utility
  - Preliminary results indicate 6,000-7,000 ac-ft at Halligan for Utility
Halligan Reservoir Permitting

• Corps of Engineers initially considers alternatives that only meet water supply needs
• Once LEDPA is determined and the environmental impacts of that alternative are defined, then mitigation of the impacts are considered
  – For example, if Halligan is the LEDPA the storage capacity could be increased to meet certain flow improvements
• Shared Vision Planning experiment identified ways of improving flow conditions between the reservoirs
  – Will continue to engage stakeholders
Monetary Considerations

- Need to look at cost to increase the City’s firm yield through the drought period (1-in-50 year)
  - Most rights need to be modeled to identify the cost per ac-ft of increased firm yield
- Firm yield for CBT unit is 0.5 ac-ft per unit
  - Cost per ac-ft of additional firm yield ~$16,000
  - Slightly lower cost for CBT portion of NPIC share
- Halligan Reservoir at 6,500 ac-ft for Fort Collins will cost ~$22 million
  - Cost per ac-ft of additional firm yield ~$3,000
Fort Collins Utilities
Price per Acre-Foot of **Additional** Firm Yield

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT</td>
<td>$18,000</td>
</tr>
<tr>
<td>NPIC</td>
<td>$14,000</td>
</tr>
<tr>
<td>Halligan Res.</td>
<td>$2,000</td>
</tr>
</tbody>
</table>
### Modeling Analysis of Planning Criteria Costs

<table>
<thead>
<tr>
<th>Reliability Criterion</th>
<th>Halligan Size (AF)</th>
<th>Cost (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-in-50</td>
<td>6,300</td>
<td>$21.7</td>
</tr>
<tr>
<td>1-in-100</td>
<td>11,800</td>
<td>$30.7</td>
</tr>
</tbody>
</table>

**Notes:**
1) Assumes maintaining safety factor of 15% of annual demand in storage.
2) Cost varies with size per Halligan Reservoir estimates.
## Modeling Analysis of Planning Criteria Costs

<table>
<thead>
<tr>
<th>Safety Factor %</th>
<th>Safety Factor (AF)</th>
<th>Required Storage (AF)</th>
<th>Cost (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0</td>
<td>0</td>
<td>$0.0</td>
</tr>
<tr>
<td>5%</td>
<td>1,930</td>
<td>930</td>
<td>$4.1</td>
</tr>
<tr>
<td>10%</td>
<td>3,860</td>
<td>2,860</td>
<td>$10.3</td>
</tr>
<tr>
<td>15%</td>
<td>5,790</td>
<td>4,790</td>
<td>$15.8</td>
</tr>
<tr>
<td>20%</td>
<td>7,720</td>
<td>6,720</td>
<td>$18.8</td>
</tr>
<tr>
<td>25%</td>
<td>9,650</td>
<td>8,650</td>
<td>$22.5</td>
</tr>
<tr>
<td>30%</td>
<td>11,580</td>
<td>10,580</td>
<td>$26.5</td>
</tr>
</tbody>
</table>

Notes:
1) Minimum safety factor of 1,000 acre-feet must be provided at Joe Wright Reservoir in order to meet certain obligations.
2) Safety factor amount assumes 2050 annual demand of 38,600 acre-feet.
3) Cost varies with size per Halligan Reservoir estimates.
Environmental Considerations

- Fort Collins water use reduces flows in the Poudre River and other watersheds (Colorado and Michigan River basins)
- Poudre River relative impacts greater in the winter than summer from Fort Collins’ use
- Poudre River flows are reduced mostly by local irrigation diversions
2008 Daily Poudre River Gaged Flow at Canyon Mouth and Fort Collins Poudre River Diversions (7-Day Average)
Conceptual Flow Diagram of the Cache La Poudre River in June

Notes:
1. Map has been simplified for clarity of presentation.
2. Stream flow scale is different than shown on maps for June and August.
3. Diversion and inflow locations are approximate.
4. Inflows not explicitly labeled are due to groundwater discharge, diffuse inflows, and diversion and inflow measurement errors.
5. Diversion, delivery, and streamflow values are calculated from average monthly flow data from CDSS for 2008.
Future Impacts

• Additional diversions for future use will further reduce flows in the Poudre River
  – No additional flow reductions anticipated in other river basins since Fort Collins use of those basins will not increase

• Most flow reduction will occur from moving converted agricultural water rights to our pipelines or to storage
  – Original diversion locations of these rights are above downtown Fort Collins
Conceptual Flow Diagram of the Cache La Poudre River in August

Notes:
1. Map has been simplified for clarity of presentation.
2. Stream flow scale is different than shown on maps for June and August.
3. Diversion and inflow locations are approximate.
4. Inflows not explicitly labeled are due to groundwater discharge, diffuse inflows, and diversion and inflow measurement errors.
5. Diversion, delivery and streamflow values are calculated from average monthly flow data from CDSS for 2008.
6. Stream flows at ungauged locations estimated by mass-balance.

Legend:
- Tributary Inflow
- Ag Inflow
- Municipality
- Fort Collins
- Mun Inflow
- Timnath
- Mun Diversion
- Wellington

Flowline Symbology Scale

City of WELLINGTON

Notes:
1. Map has been simplified for clarity of presentation.
2. Stream flow scale is different than shown on maps for June and August.
3. Diversion and inflow locations are approximate.
4. Inflows not explicitly labeled are due to groundwater discharge, diffuse inflows, and diversion and inflow measurement errors.
5. Diversion, delivery and streamflow values are calculated from average monthly flow data from CDSS for 2008.
6. Stream flows at ungauged locations estimated by mass-balance.

Legend:
- Tributary Inflow
- Ag Inflow
- Municipality
- Fort Collins
- Mun Inflow
- Timnath
- Mun Diversion
- Wellington

Flowline Symbology Scale

City of WELLINGTON

Notes:
1. Map has been simplified for clarity of presentation.
2. Stream flow scale is different than shown on maps for June and August.
3. Diversion and inflow locations are approximate.
4. Inflows not explicitly labeled are due to groundwater discharge, diffuse inflows, and diversion and inflow measurement errors.
5. Diversion, delivery and streamflow values are calculated from average monthly flow data from CDSS for 2008.
6. Stream flows at ungauged locations estimated by mass-balance.

Legend:
- Tributary Inflow
- Ag Inflow
- Municipality
- Fort Collins
- Mun Inflow
- Timnath
- Mun Diversion
- Wellington

Flowline Symbology Scale

City of WELLINGTON

Notes:
1. Map has been simplified for clarity of presentation.
2. Stream flow scale is different than shown on maps for June and August.
3. Diversion and inflow locations are approximate.
4. Inflows not explicitly labeled are due to groundwater discharge, diffuse inflows, and diversion and inflow measurement errors.
5. Diversion, delivery and streamflow values are calculated from average monthly flow data from CDSS for 2008.
6. Stream flows at ungauged locations estimated by mass-balance.

Legend:
- Tributary Inflow
- Ag Inflow
- Municipality
- Fort Collins
- Mun Inflow
- Timnath
- Mun Diversion
- Wellington

Flowline Symbology Scale
Additional Facilities and Supplies
Triple Bottom Line Considerations

• Social: How do our actions affect others?
  – Provide a reliable water supply to our customers
  – Consider our community’s desire for healthy ecosystems and attractive landscapes
  – Benefits of maintaining viable agriculture in the region
Addtional Facilities and Supplies

Triple Bottom Line Considerations

- Environmental: How do our actions affect the environment?
  - Minimize impacts to our natural environment
  - Consider impacts to the urban and agricultural environment
Additional Facilities and Supplies
Triple Bottom Line Considerations

• Economic: What economic benefits/costs will our actions have?
  – Consider the cost to our customers and others
  – Consider the local and regional economic impacts
Questions?