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WaterSMART: Water and Energy Efficiency Grants for FY 2016

Biological Treatment for Removal of Selenium from Water Treatment Plant Concentrate

January 20, 2016

Applicant: Cottonwood Water and Sanitation District
Arapahoe County Water and Wastewater Authority
c/o Mulhern MRE, Inc.
2 Inverness Drive East, #200
Englewood, CO 80112
303-649-9857
303-414-0671 fax

General Managers: Patrick F. Mulhern, CWSD
pat@mulhernmre.com
Steve Witter, ACWWA
switter@arapahoewater.org

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EXECUTIVE SUMMARY

Date: January 20, 2016
Applicant: Cottonwood Water and Sanitation District, Parker, CO
Arapahoe County Water and Wastewater Authority, Centennial, CO
Serving Douglas, Arapahoe and Elbert Counties

Need: Biological Treatment to Remove Selenium from Water Treatment Plant Concentrate

The Cottonwood Water and Sanitation District ("Cottonwood") and the Arapahoe County Water and Wastewater Authority ("ACWWA") (together "the Applicants"), are public small water and wastewater providers to residents and businesses in Arapahoe, Douglas and Elbert Counties in Colorado. We are requesting a grant from the WaterSMART: Water and Energy Efficiency Grants for 2016 in the amount of $300,000 under Funding Group I. The proposed project meets the eligibility for this funding opportunity through the use of water conservation and efficient use and reuse of the applicants' water supplies. This project would construct a biological treatment system (biochemical reactor) to remove selenium from the concentrate discharge following reverse osmosis ("RO") treatment at our water treatment plant, the Joint Water Purification Plant ("JWPP").

During initial startup of the plant in 2010, discharges from the JWPP exceeded the aquatic protection limit for selenium in the discharge permit. As a result, the JWPP, a $30 million facility, was converted to a microfiltration process and has been very underutilized due to the marginal water quality due to high total dissolved solids in the treated water. It was subsequently determined that an additional treatment process would be required at the plant to remove selenium. Several studies over the last few years were unsuccessful in identifying a technology that is economically viable. Recently, a study by CH2M identified treatment through a Biochemical Reactor ("BCR") that could be constructed for $4 million. This remarkable technology has been shown to remove selenium to 1 to 3 ppb thereby allowing the plant to meet the stringent requirements of the discharge permit. This project proposes to construct a BCR for the removal of selenium. The Applicants will also make some internal modifications to provide a split flow treatment of RO and microfiltration with the flow then blended together for disinfection using an advanced oxidation process ("AOP"). These internal modifications will be at the Applicants expense separate from the grant request. The grant would be used to add the selenium treatment component.

In the past, the Applicants have relied heavily on non-tributary ground water ("NTGW") from the Denver Basin for water supply. In 2004, a regional study of NTGW for the Denver Basin entitled the "The South Metro Water Supply Study" was completed by water providers in this area. That study determined that the NTGW, a non-renewing resource, would not be an economically viable source of water to meet urban

demands for the area in the long term. The study recommended demand reduction, development of local renewable resources, full reuse of water sources, and importation of additional renewable water to replace use of the NTGW.
Cottonwood and ACWWA joined together to construct the JWPP to fully use and reuse the limited water supplies available on Cherry Creek. However, the project encountered high levels of ambient selenium in its source waters and was not able to meet the discharge limit for selenium without additional treatment to remove selenium.

This project would construct a BCR on property to be acquired behind the treatment plant. The proposed BCR uses biological and chemical processes to volatilize some forms of selenium and to bind additional forms in the sediments of the BCR. The BCR is an engineered facility that provides the ability to not only address the removal of selenium but to also remove other constituents of concern in the discharge. The ability to remove selenium to these extremely low levels which are protective of the environment is extraordinary.

High levels of naturally occurring selenium are a substantial problem in Colorado. Selenium exceedances have occurred in a number of locations related to RO treatment facilities that seek to provide a good quality, safe water supply for use and reuse of Colorado water sources. Naturally occurring levels of selenium also impact fish and invertebrates in many locations where streams are "listed" as not in compliance with selenium water quality standards. The inability to economically treat for selenium is a widespread issue in this State, and the furthering of this technology can have enormous benefits for water supply and reuse projects, existing and proposed.

The proposed project is construction and startup of this BCR. The estimated cost of the land is $200,000, the estimated cost of construction of the BCR is $3.8 million for a total project cost of $4 million. A pilot study for the biochemical reactor is in process to confirm design parameters used by CH2M in providing a conceptual design of the facility. At the same time, the Applicants are in the process of acquiring the land and permitting the project. Final design for the BCR is anticipated at the end of 2016 with construction and plant modifications to begin in early 2017.

The Applicants are requesting consideration for a Funding Group I grant of $300,000. The basis for the request is additional water supplies through reuse of water from Cherry Creek to reduce reliance on NTGW. The anticipated amount of reuse is 3,000 acre-feet.

In addition, the project is to further develop technology critical to ongoing use and reuse of water supplies in the arid west and specifically in Colorado where there are a number of water supply projects needing to address selenium issues. This technology also has the potential to remove selenium in areas where naturally occurring levels exceed the aquatic protection limit and threaten ecosystems. The Applicants believe that the advancement of this technology is a critical issue for full use and reuse of many water supply sources and is a matter of statewide interest.

BACKGROUND DATA

The map below, Figure 1, shows the geographic location of the project including the State of Colorado, Douglas and Arapahoe Counties and location in relation to the City of Denver, CO.

FIGURE 1

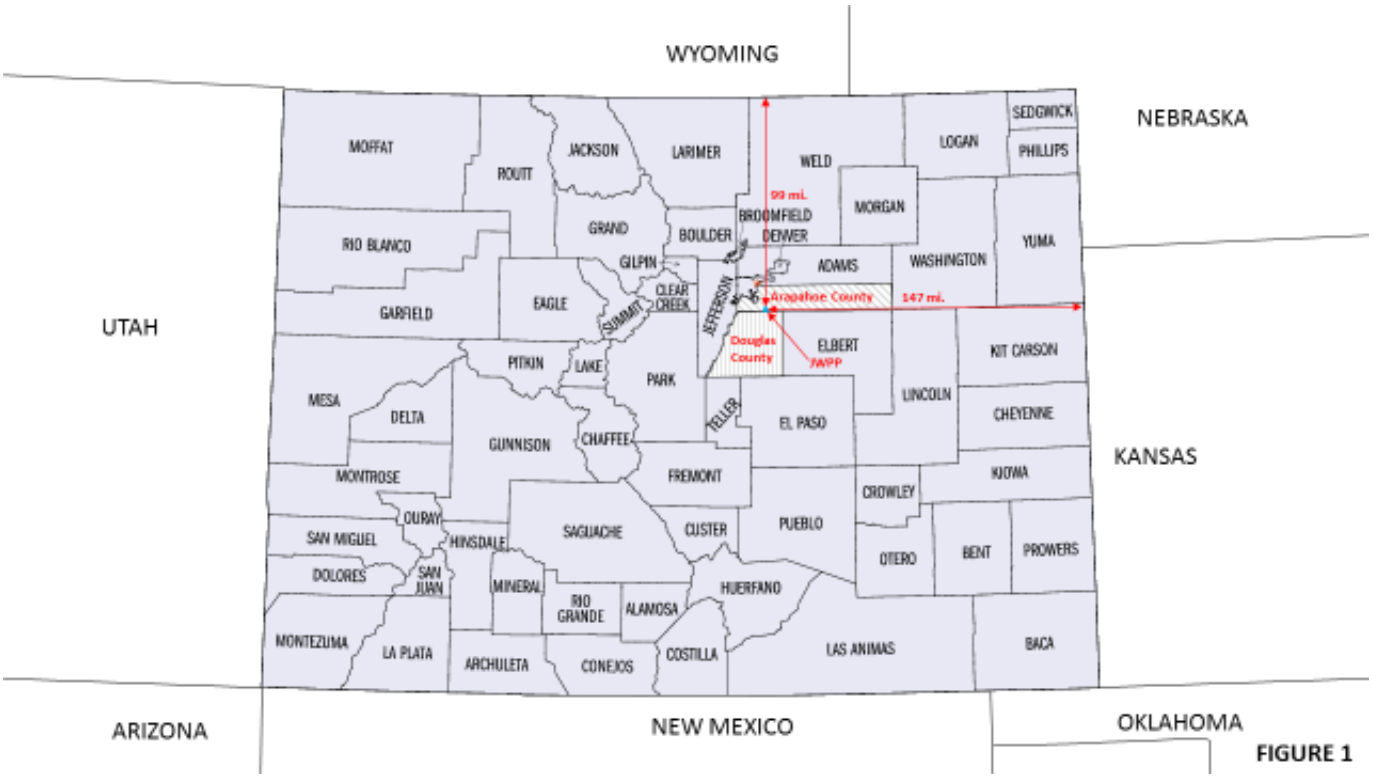
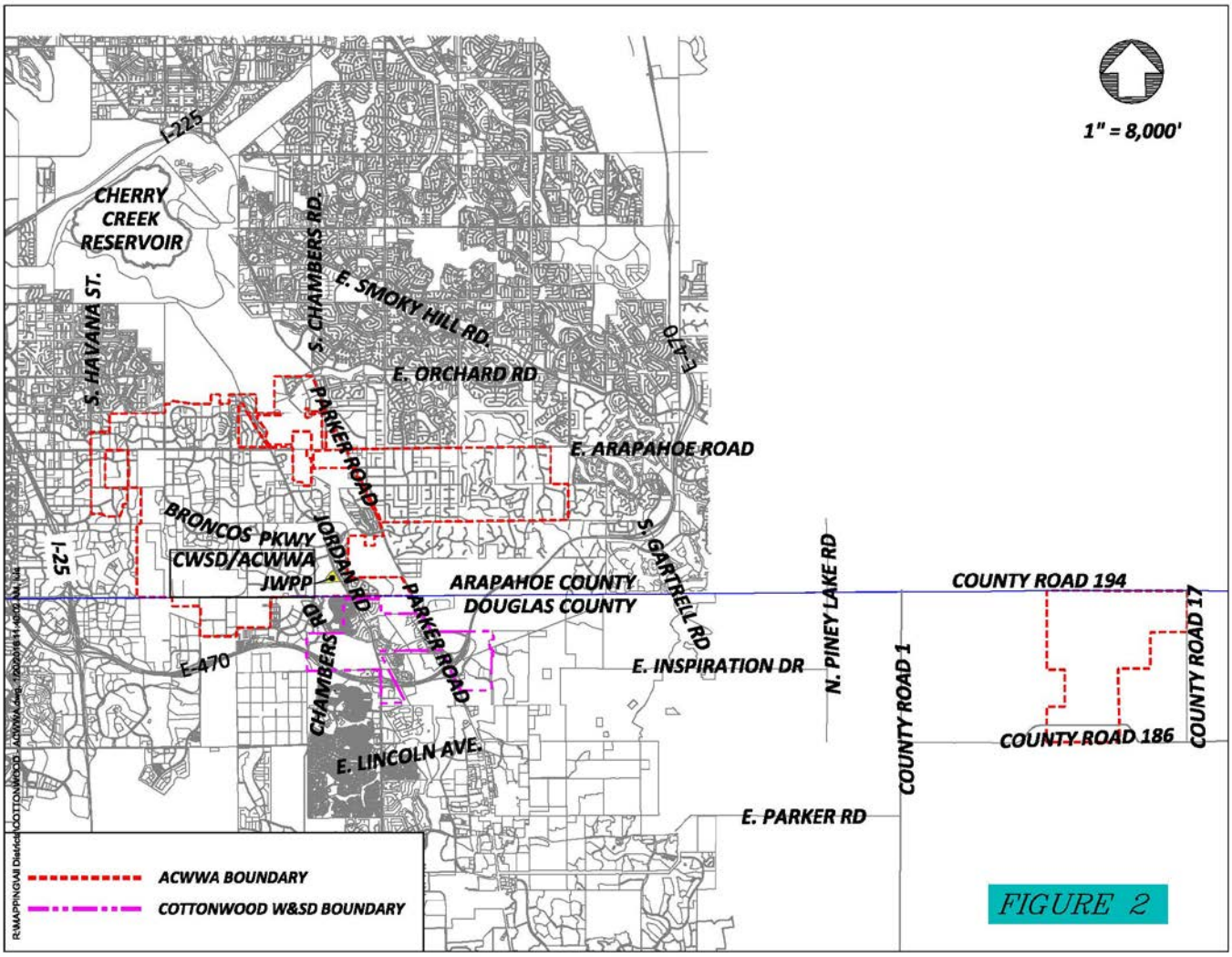


FIGURE 1

The Cottonwood Water and Sanitation District ("Cottonwood") was established under Title 32 of the Colorado State Statutes as a quasi-municipal corporation and political subdivision of the State of Colorado. The District was established in 1980 to provide the Cottonwood community in Parker, Colorado with water and wastewater services. The District contains approximately 1,300 acres and is comprised of residential, commercial, and open space located along the northern border of Douglas County on either side of Parker Road. Two-thirds of the district is within the Town of Parker and the remainder in unincorporated Douglas County. Cottonwood Water serves approximately 1535 single family homes, 1400 multi-family residences and about 70 commercial customers, including the Parker Adventist Hospital. The Cottonwood boundaries are shown in pink on Figure 2.

FIGURE 2



The Arapahoe County Water and Wastewater Authority ("ACWWA") provides the drinking water and wastewater services to the people living and working within its service area, a total of eight-square miles located mostly in the City of Centennial generally between Havana Street on the west, Himalaya on the east, Cherry Creek State Park on the north and the Arapahoe/Douglas County line on the south as shown in red on Figure 2. The area is comprised of about 3,500 residences and businesses primarily in Arapahoe County, with some additional customers located in northern Douglas County and Elbert County. While most of the customers are businesses, over the past few years ACWWA has realized more residential development of both multi-family and single-family homes.

The greatest challenge to water and wastewater providers' in the Denver South Metro Area is to provide adequate and safe water supply for their customers. Water supply in this area is very limited. The water available includes non-tributary ground water ("NTGW") from the Denver Basin Formation and alluvial water from Cherry Creek.

In 2004, the South Metro Water Supply Authority completed a study to evaluate NTGW as a water supply source (the Denver Basin Aquifers) and the ability to meet the long-term demands of the current and future

South Metro Area population. The conclusion of the study was that the NTGW would not be an economically viable water source for the future, and the measures should be taken to replace this as a supply. The study then recommended that water providers implement conservation, reuse of available supplies, develop all local renewable supplies, and pursue opportunities to import additional water.

Cottonwood and ACWWA have implemented successful water conservation programs, have worked to maximize reuse of both NTGW and Cherry Creek alluvial supplies and have constructed a water treatment plant, the "Joint Water Purification Plant" ("JWPP"), to fully use and reuse renewable water supplies on Cherry Creek. In addition, Cottonwood has invested in the WISE Project which imports return flows from Denver Water and Aurora Water, and ACWWA has invested in the ACWWA Flow project, both of which import water from the South Platte River north of Denver.

Cherry Creek has a large tributary of the South Platte River draining from south to north in the eastern plain. While the drainage basin is large, the stream is small, at most times flowing from 10 to 20cfs. About 12 miles south of Cherry Creek Reservoir, the stream reaches the beginning of urbanized areas and it's water is first used by the Pinery Water and Sanitation District who uses the water and returns treated wastewater effluent to the stream. It is then picked up by the Parker Water and Sanitation District who uses it and returns treated effluent to the stream. A third entity, the Stonegate Village Metropolitan District is located just downstream, uses NTGW as their water supply and also discharges treated effluent to the stream. Just below their discharge point, Cottonwood and ACWWA divert the water supply, which contains large percentages of treated effluent, to their wells.

In order to fully use and reuse water from Cherry Creek, Cottonwood and ACWWA jointly developed the JWPP which originally included reverse osmosis ("RO") treatment followed by an advanced oxidation process ("AOP") for disinfection. The RO treatment removes high levels of total dissolved solids ("TDS"), and both the RO and AOP treat for chemicals of emerging concern ("CECs") which are largely trace pharmaceuticals found in treated effluent.

Early on in operation of the JWPP, selenium concentrations in the concentrate from the plant exceeded the discharge permit for aquatic protection standards. This was largely due to naturally occurring levels of selenium in the source water which is the alluvial ground water in Cherry Creek. These naturally occurring levels diverted in the wells range from 3 ppb to 19 ppb and average about 12 ppb, well above the aquatic protection level established by EPA of 4.6 ppb. In order to resolve the exceedance of selenium, the JWPP was modified to change the primary treatment process from RO to microfiltration. The microfiltration process, while meeting drinking water standards, does not remove TDS and does not treat for CECs.

In order to use this water source, the Applicants invested heavily in the high technology treatment. As part of the treatment, the concentrate from the plant needed an additional treatment process, i.e., coagulation and microfiltration for treatment for phosphorous to allow discharges above Cherry Creek Reservoir. Now, largely due to naturally occurring selenium in the alluvial source water, the Applicants find that another treatment process is needed to remove selenium. After multiple studies, the Biological Treatment using a Biochemical Reactor ("BCR") has been identified as an economically viable solution. While it is economically viable, the cost of the BCR is identified at $4 million, on top of the cost of the existing $30 million facility.

Establishing RO treatment at the JWPP is critical to Cottonwood and ACWWA to fully utilize its renewable water supply on Cherry Creek, which is the third or fourth use of this supply in 12 miles of Cherry Creek. This includes full reuse of Cherry Creek water rights, NTGW, WISE return flow and ACWWA Flow returns. This plant is critical for Cottonwood and ACWWA to meet their water supply demands by fully reusing all of their available water sources. This will result in a reuse plan where the entities attain approximately 2 gallons of water use for every 1 gallon of water delivered from their sources, and will allow them to replace their use of non-renewing NTGW. Full reuse of all supplies by these entities also minimizes the volume of imported water required from other remote sources.

TECHNICAL PROJECT DESCRIPTION

This project is to add a new treatment process to remove selenium in RO concentrate generated from the JWPP. In order to allow for discharge of the concentrate from RO to the natural stream, this BCR will remove selenium and other undesirable constituents to levels required through the State's discharge permit system. This reactor could be constructed on about 6 acres of vacant land behind the JWPP.

The BCR is proposed based upon a study of natural treatment alternatives by CH2M ("Biological Treatment of Selenium in Concentrate", Technical Memorandum dated November 12, 2015.) The following is an excerpt from this study regarding natural treatment systems. While both BCRs and wetland treatment are discussed, the recommended alternative is a BCR given large land requirements and less treatment flexibility if wetlands were utilized.

> "Natural treatment systems are constructed or modified ecosystems that use natural biological, physical and chemical processes to improve water quality. They encompass the general category of engineered wetlands, both constructed and natural, but also include biochemical reactors that may operate passively, or may be intensified through the addition of commercial carbon and nutrient feeds to enhance biological treatment. Both active and passive biological treatment technologies have been shown to provide effective treatment of concentration ranges of selenium (CH2M HILL, 2010).
>
> Typically more land-intensive than active treatment systems, passive biological systems can be less expensive to operate and manage because of lower or negligible energy or chemical inputs (Ziemkiewicz et al., 2003). In passive treatment systems designed to treat selenium, a naturally occurring element with significant ecotoxicological properties, oxidized forms of the element (i.e., selenite, selenate) can be reduced to selenite, elemental selenium, and selenides through microbial reduction, followed by sequestration in soil and sediments (Gusek et al. 2009). Labile organic carbon released from the substrate serves as an electron donor (i.e., an energy source for the microbes providing the treatment). Common electron acceptors (e.g., dissolved oxygen (DO) and nitrate) are removed first or concurrently.
>
> Engineered wetlands designed for selenium removal have spanned the size range of pilot systems on the order of 100 feet square or less, up to full-scale marshes covering 90 acres or more (CH2M HILL, 2012). In these systems, water moves slowly through a vegetated shallow marsh, coming in contact with decomposing vegetation and anaerobic (low oxygen) sediments. Studies of wetlands treating selenium have indicated that the oxidized forms (i.e., selenate, selenite) are rarely found in wetland sediment. Instead, selenide, elemental selenium and organic selenium are more typically found, indicating that selenium has been transformed biologically. Because constructed wetlands attract birds, and selenium intake through food chain bioaccumulation can lead to physical abnormalities, the use of open water wetlands for selenium treatment is often limited to treat concentrations in the range of 15 μg/L or less.
>
> More commonly, passive treatment systems designed for selenium reduction consist of a vertical or horizontal subsurface flow of water through a reducing organic substrate. This achieves microbial and chemical reduction of selenium naturally, with shorter hydraulic residence times and smaller areas than constructed wetlands. Termed biochemical reactors (BCRs), these passive systems have been employed previously for treatment of a variety of mine-impacted waters (e.g., ITRC, 2008) and in a variety of forms. The organic substrate utilized has been composed of wood chips, saw dust,

mushroom compost, horse manure, field hay, yard wastes, and limestone granules in varying proportions.

The geochemistry of BCRs relies on a staged approach for trace metal removal. Sulfate-reducing BCRs precipitate trace metals with biogenic sulfide (i.e., natural chemical reduction of selenate to elemental selenium), while selenate-reducing BCRs remove selenium as elemental precipitates (CH2M HILL, 2010). Because selenium compounds are more readily reduced than sulfur compounds and reduced sulfur compounds can act as a chemical reductant, any sulfides precipitated in the BCR (e.g., acid volatile sulfides) provide additional reducing capacity within the substrate. As additional selenium-bearing water passes through this substrate, there is not only the benefit of biological reduction, but also the potential for chemical reduction.

Other removal processes occurring in passive treatment systems include volatilization and adsorption. Volatilization of selenium through bacterial, fungal, or algal-mediated methylation of selenium has been shown to be a significant loss of selenium in wetlands through the conversion to organic forms such as dimethyl selenide (Hanson et al., 1998; Lin et al., 2003). Physical adsorption of selenate to iron, aluminum, or manganese oxyhydroxides present within soil or sediments and to organic matter, readily occurs in passive treatment systems (Kadlec and Wallace, 2009).

Because the BCR is comprised of organic media, secondary parameters (e.g., biochemical oxygen demand [BOD], color, sulfide, and reduced nitrogen) are generated that require treatment before discharge. Across different projects, post-BCR treatment has varied widely, including aerated and non-aerated ponds, surface flow constructed wetlands, and subsurface flow gravel beds, singly or in combinations. Frequently described as aerobic polishing cells, these treatment units function by trapping particulate organic particles, increasing the DO content of the BCR effluent, as well as oxidizing chemical oxygen demand (COD) or BOD present.

Recent advances in passive biological treatment of selenium have come through the implementation by mining companies and the US Bureau of Reclamation (Reclamation) of treatability pilot studies, full-scale systems, and additional projects discovered through professional contacts and continued review of the literature (Bays et al. 2012). Pilot studies have indicated consistently that total selenium can be reduced to <5 μg/L, even to method detection limits. These projects have demonstrated that passive treatment can be a practical, cost effective, and technologically appropriate way to manage selenium low influent soluble selenium concentrations (<50 μg/L), even in cold weather locations such as Canada. Similar cost-effective solutions are expected for selenium removal in other regions where siting and sizing constraints can be met." (CH2M, "Biological Treatment of Selenium in Concentrate", technical memorandum dated November 12, 2015)

The proposed layout of the BCR proposed for this project is shown on Figure 3, and the process drawing is shown in Figure 4. Data from previous pilot studies and installations indicate that selenium can be reduced to concentrations between 1 and 3 ppb which is below the aquatic protection level of 4.6 ppb.

FIGURE 3

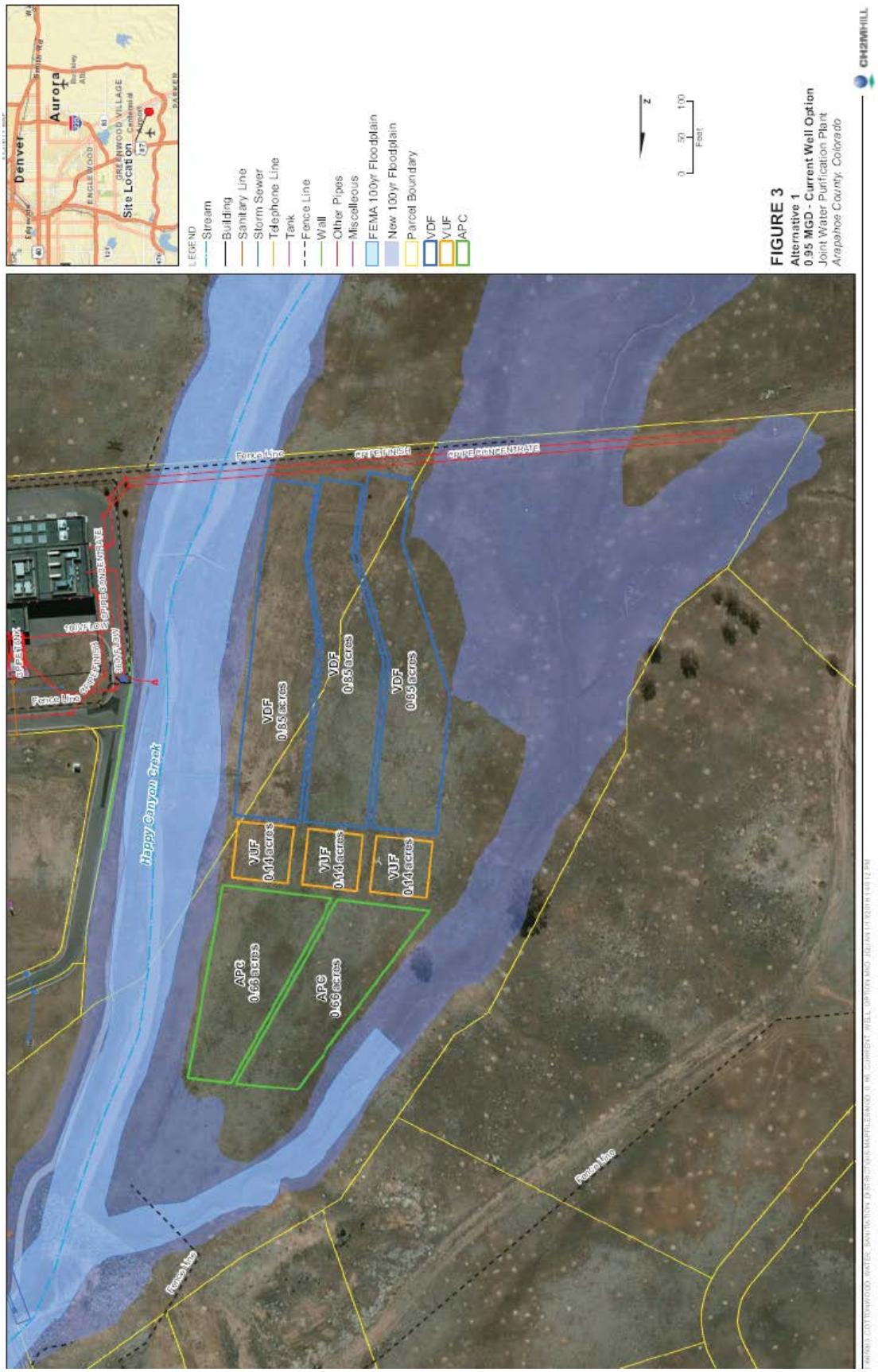

Denver
Aurora
Site Location
GREENWOOD VILLAGE
ENGLEWOOD
LEGEND
Stream
Building
Sanitary Line
Storm Sewer
Telephone Line
Tank
Fence Line
Wall
Other Pipes
Miscellaneous
FEMA 100yr Floodplain
New 100yr Floodplain
Parcel Boundary
VDF
VUF
APC
N
0
50
100
Feet
FIGURE 3
Alternative 1
0.95 MGD - Current Well Option
Joint Water Purification Plant
Arapahoe County, Colorado
CH2MHILL
Happy Canyon Creek
Fence Line
CPE FINISH
CPE CONCENTRATE
VDF
0.85 acres
VUF
0.14 acres
APC
0.66 acres

FIGURE 4

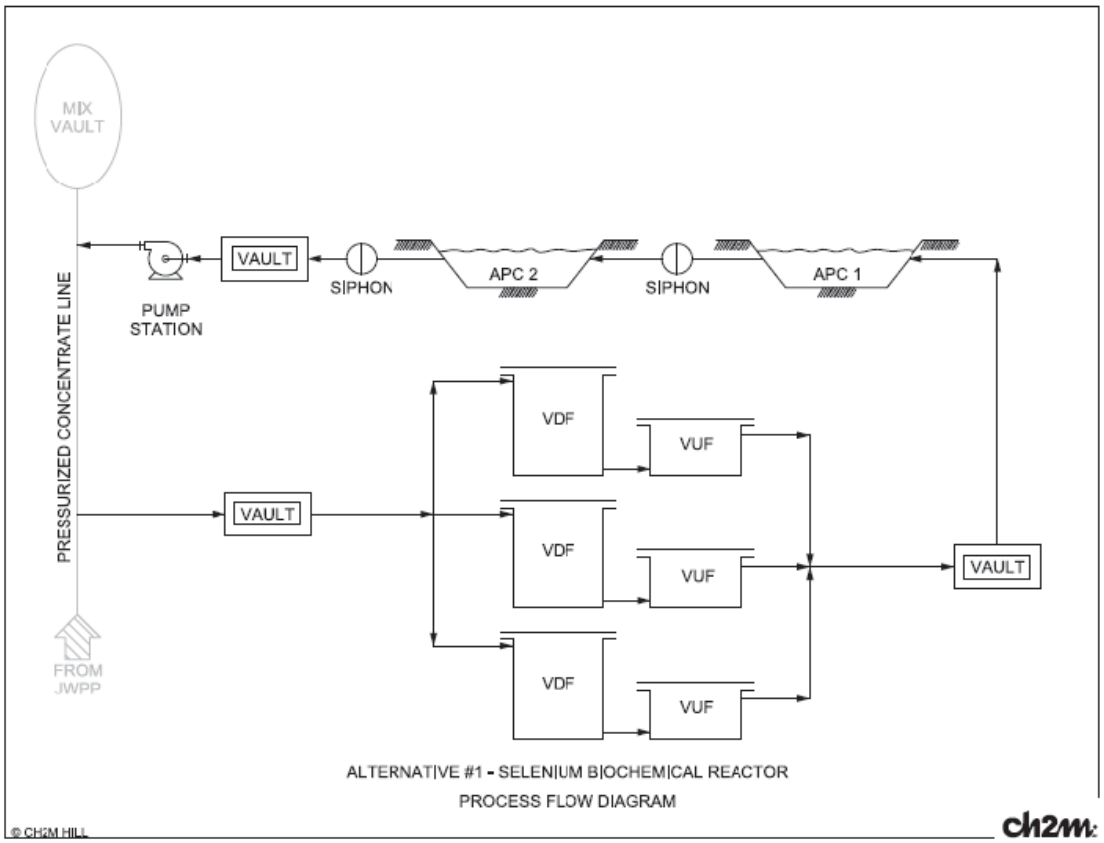


Figure 4

Alternative 1 Selenium Biochemical Reactor Process Flow Diagram

Cottonwood and ACWWA propose to purchase additional land adjacent to the JWPP and construct this BCR to reduce the selenium in the concentrate discharge from the JWPP. This will allow full use of the RO treatment process which is now proposed to treat one-half of the flow with the other half treated using microfiltration. The flow will then be blended and disinfected using the AOP. This reconfiguration will produce a high quality treated water with reduced total dissolved solids, hardness, and contaminants of emerging concern. Any modifications within the plant will be completed as a separate project by the Applicants. The plant capacity will be 6 MGD resulting in the treatment of approximately 3,000 acre-feet of alluvial water and return flows that are not currently being utilized.

The cost for construction of the BCR is estimated at a total of $4 million per the attached study by CH2M and as provided in the budget section to follow. Cottonwood and ACWWA have retained CH2M to complete a pilot study of the proposed facility. The pilot study will confirm selenium removal efficiencies and will establish final design parameters for the BCR. This pilot study is underway with operation of the pilot unit expected to begin by February 1, with study completion in May, 2016.

For ACWWA, this project will provide for reuse of an estimated 1,900 acre-feet of water from the ACWWA Flow importation project. For Cottonwood, this will allow for use and reuse of Cherry Creek and WISE return flows amounting to an estimated 1,100 acre-feet.

EVALUATION CRITERIA

V.A.1 Evaluation Criterion A: Water Conservation (28 points)

*Up to **28 points** may be awarded for a proposal that will conserve water and improve efficiency. Points will be allocated to give consideration to projects that are expected to result in significant water savings.*

This project will specifically construct a BCR for the biological removal of selenium. This technology will be used to support water conservation by allowing reuse of water supply from the JWPP, the water plant owned by the Applicants. The technology proposed in this project, however, has widespread application for water supply in Colorado and elsewhere in the arid west where water supply is scarce and where naturally occurring levels of selenium often exceed standards for protection of ecosystems.

With scarce water supply, water providers desire to reuse water supplies wherever their water rights decrees will allow. Often, because of unintended reuse occurring in short distances on low flow streams by multiple water providers, the water supply has high TDS and Chemicals of Emerging Concern ("CECs", i.e. trace pharmaceuticals and other chemicals not removed in the wastewater treatment process). The best treatment to provide for a high quality, safe water supply is RO. However, RO results in the concentration of constituents in the RO concentrate, and with high levels of selenium to begin, selenium needs to be removed to meet discharge standards. Until now, there has not been an economically reasonable means of removing selenium to the very low discharge limits required through regulations. Hence, this BCR is an opportunity to advance this technology for use by the Applicants and many others pursuing reuse of water supplies in the West.

Specifically, for the Applicants, this project is a water conservation project through reuse of their water sources on Cherry Creek. Cottonwood and ACWWA are located in the upper reaches of Cherry Creek, a tributary of the South Platte River. In the upper portions of Cherry Creek, an eastern slope stream, the amount of natural flow is very limited. As a consequence, in addition to this limited resource, these entities needed another source of supply which has been the non-tributary groundwater ("NTGW") of the Denver Basin Aquifers. After relying on NTGW heavily as this area developed, the South Metro Water Supply Study was completed in 2004. This study found that the NTGW was not an economically viable water supply for the long term, and recommended that use of this supply be reduced and replaced through a series of measures. This included 1) demand reduction or water conservation, 2) full reuse of both NTGW and renewable water sources, 3) full development of local renewable water sources, and 4) import of additional renewable water supply.

Even prior to the completion of that study, these entities were working to reduce reliance on NTGW. Both initiated water conservation programs in the early 2000's. The primary factor in water conservation has been tiered water rates that greatly penalize those who exceed a base need for water supply. As use exceeds the base need, the water rate doubles and then triples. Use of low flow water fixtures and irrigation efficiency systems are encouraged through rebates related to purchase of these items. Peak water use from prior to initiation of the water conservation program has been reduced approximately by 15%.

The entities then looked to reuse of their water supplies and return flows from Cherry Creek. Cherry Creek is extraordinary in that Cottonwood and ACWWA are the fourth entity with a legal right to use this limited water supply in a 12 mile reach of this stream. That is, upstream entities that use water from Cherry Creek have the right to use and reuse their water supply prior to it reaching the wells of Cottonwood and ACWWA. As a consequence, there are 3 upstream wastewater treatment plants that return treated effluent to Cherry Creek above their wells. While the water is highly treated, return flows from these plants leaves the water high in Total Dissolved Solids ("TDS") and high in trace pharmaceuticals and other chemicals called "Chemicals of Emerging Concern" or "CECs".

In order for Cottonwood and ACWWA to obtain a high quality water and have confidence in safely reusing the supply, these entities built a water treatment plant, the Joint Water Purification Plant ("JWPP") with high technology treatment processes. The water was treated using reverse osmosis ("RO") and was disinfected with an advanced oxidation process ("AOP") which includes the addition of hydrogen peroxide to oxidize the water prior to treatment with infrared light. The RO process reduces TDS to an acceptable level, removes even the smallest viruses and removes CECs. The AOP process disinfects the water and breaks down many CEC compounds to their basic elements. This high level of treatment was considered appropriate and safe for use and reuse of this supply. The water is reused by both of these entities by virtue of their augmentation plans which have been approved in water court. This reuse allows these entities to achieve approximately 2 gallons of use for every gallon of water originally pumped, a very effective reuse program. This allows both of these entities to greatly reduce their reliance on non-renewing NTGW.

In addition, both of these entities have invested in water importation projects to bring additional renewable water into this area from the lower South Platte River. ACWWA's project is termed "ACWWA Flow" and imports water rights obtained from the lower South Platte River north of Denver. Cottonwood has participated in the "WISE" Project, a cooperative project with Aurora Water and Denver Water. This project recaptures reusable water of these entities that has already been used and reused by Aurora and Denver customers through return flows that are captured in the South Platte River north of Denver. In both cases, this imported water is reusable and can be used and reused by ACWWA and Cottonwood with proper treatment.

The JWPP was completed in 2010. Shortly after start-up, it was determined that the discharge from the plant exceeded the concentration limit for selenium which is based upon an aquatic protection standard. This occurred largely because of high, naturally occurring levels of selenium in the water source. When Cottonwood and ACWWA were notified of the exceedance, they quickly eliminated the discharge and converted the plant process to microfiltration. While this level of treatment meets drinking water standards, it does not treat for high TDS nor does it treat or remove CECs. As a consequence, water quality has suffered dramatically and use of the plant is very limited. ACWWA greatly reduced its volume of use and blends the flow with other sources. Cottonwood does not take water from the plant because of quality issues.

At this point, these entities recognized that an additional treatment process was required beyond those provided at the JWPP. Since then, a number of studies have been completed of technologies to remove selenium. Until recently, no economically viable technology was identified. Recently, however, a study completed by CH2M identified biologic treatment that could reduce selenium to concentrations between 1

and 3 parts per billion ("ppb"). This would allow the entities to reduce selenium concentrations to below the allowable limit of 4.6 ppb which would allow for reinstatement of the treatment plant which would allow for safe use and reuse of these supplies.

Subcriterion No. A.1: Quantifiable Water Savings

*Up to **24 points** may be allocated based on the quantifiable water savings expected as a result of the project.*

Describe the amount of water saved. *For projects that conserve water, please state the estimated amount of water expected to be conserved (in acre-feet per year) as a direct result of this project. Please provide sufficient detail supporting how the estimate was determined, including all supporting calculations. Please be sure to consider the questions associated with your project type (listed below) when determining the estimated water savings, along with the necessary support needed for a full review of your proposal (please note, the following is **not** an exclusive list of eligible project types. If your proposed project does not align with any of the projects listed below, please be sure to provide support for the estimated project benefits, including all supporting calculations and assumptions made).*

In addition, all applicants should be sure to address the following:

- *What is the applicant's average annual acre-feet of water supply?*

Currently, Cottonwood delivers 855 acre-feet, and ACWWA delivers 4,100 acre-feet of water annually to its customers.

- *Where is the water that will be conserved currently going (e.g., back to the stream, spilled at the end of the ditch, seeping into the ground, etc.)?*

The water currently being used to meet these demands is largely from NTGW pumping. Therefore, by conserving these supplies, the NTGW will not be pumped, but will remain in storage in the aquifers.

- *Where will the conserved water go?*

The water that will be saved through this project will remain in storage and will be available to these entities for use during drought. As is the case with all naturally recharged water systems, each year the amount of water available changes with weather conditions. This presents a great challenge to water providers in how to meet demands during drought. Often this is done by placing water into storage to meet the drought. In this case, this water supply is maintained in the aquifer without lost yield due to evaporation, and is available through pumping during drought. This is a very effective use of the NTGW, a non-renewing resource.

Please include a specific quantifiable water savings estimate; do not include a range of potential water savings.

Today, this treatment plant delivers approximately 800 acre-feet annually to ACWWA customers and none to Cottonwood customers. With construction of a BCR to enable full use of the plant, the plant will have capacity of 6 MGD. This results in an average annual treatment of an estimated 3,000 acre-feet of water, 1,900 acre-feet by ACWWA and 1,100 acre-feet by Cottonwood. Hence, this will result in some 2,200 acre-feet of water use not currently available to these entities.

Please address the following questions according to the type of project you propose for funding.

(8) ***Small-scale Water Recycling and Water Reuse:*** *Small-scale projects that reclaim and reuse wastewaters or naturally impaired groundwater and surface water to offset existing uses. Applicants proposing small-scale water recycling and reuse projects should address the following:*

(a) How have current uses been determined? Please provide all relevant calculations, assumptions, and supporting data.

Cottonwood and ACWWA have always recognized that water reuse is critical to their ability to serve their customers. Therefore, from the beginning of their planning, they have developed augmentation plans decreed in water court to provide the ability to reuse their water supply. Through these augmentation plans, they have estimated that they will achieve approximately 2 gallons of water use for every gallon of reusable water pumped from their decreed sources.

Since use and reuse of water supply from Cherry Creek is currently very limited due to water quality, establishment of the plant by virtue of providing a BCR that will remove selenium is critical. Without the ability to utilize water from Cherry Creek, the water providers are currently heavily pumping NTGW. As a result, there is a significant drop each year in water levels in the aquifers, and a corresponding drop in water production rates in the wells.

(b) Explain in detail how the proposed project will result directly in offsetting current uses, including how the water be delivered to customers.

The water provided through this reuse will be pumping from Cherry Creek, treated at the JWPP, and will be delivered directly into the delivery pipelines for each of these entities. As this occurs, corresponding NTGW pumping will drop by a like amount.

V.A.2 Evaluation Criterion B: Energy – Water Nexus (16 points)

Up to ***16 points*** *may be awarded based upon the extent to which the project increases the use of renewable energy or otherwise results in increased energy efficiency.*

While this project does not produce renewable energy for other purposes, the project does produce most of the energy required for the treatment and removal of selenium. That is, the microbial treatment is self-sustaining and heat is provided to prevent freezing or dormancy during cold weather periods. Other active means of removing selenium can be energy intensive.

The project proposed is the construction of a BCR for the treatment of selenium in the concentrate from the JWPP. Natural treatment systems are constructed ecosystems that use natural biological, physical and chemical processes to improve water quality. This system will be an engineered biochemical reactor that operates passively except for the addition of commercial carbon and nutrient feeds to enhance biological treatment. This passive system has been shown to provide effective treatment of concentration ranges experienced here.

Typically more land-intensive than active treatment systems, passive biological systems are generally less expensive to operate and manage because of the negligible energy required. In this passive treatment system designed to treat selenium, a naturally occurring element with significant ecotoxicological properties, oxidizes forms of the element (i.e., selenate, selenite) reducing it to selenite, elemental selenium,

and selenides through microbial reduction, followed by sequestration in soil and sediments (Gusek et al. 2009). Labile organic carbon released from the substrate serves as an electron donor (i.e., an energy source for the microbes providing the treatment). In addition, heat is generated through the treatment process thereby allowing for operation year round without dormancy.

Therefore, the treatment system is natural and the only energy required for operation of the BCR is related to small, low head pumps that move the treated water between cells and back into the delivery system for discharge.

Describe any other benefits of the renewable energy project.

- *Expected environmental benefits of the renewable energy system.*

The proposed BCR will remove selenium from waters tributary to Cherry Creek and Cherry Creek Reservoir. The JWPP does not add any selenium to water discharged into Cherry Creek. The selenium is naturally occurring in the source water and is concentrated through the RO process. By removing selenium through the bioreactor, selenium loading to Cherry Creek tributaries and the reservoir will be reduced to the benefit of fish and other invertebrates in this environment. The level of selenium in the stream and the reservoir is of concern because of the level of naturally occurring selenium from the local geology.

V.A.3 Evaluation Criterion C: Benefits to Endangered Species (12 points)

This project does not have known benefits to endangered species. However, as described in the previous section, the BCR will remove selenium and hence reduce selenium loading in an area where high naturally occurring selenium can adversely impact the natural ecosystems associated with Cherry Creek Tributaries and Cherry Creek Reservoir.

V.A.4 Evaluation Criterion D: Benefits to Water Marketing (12 points)

N/A

V.A.5 Evaluation Criterion E: Other Contributions to Water Supply Sustainability (14 points)

Subcriterion E.3: Other Water Supply Sustainability Benefits

Up to 14 points may be awarded for projects that include other benefits to water supply sustainability.

- *Will the project make water available to alleviate water supply shortages resulting from drought?*
    - *Explain in detail the existing or recent drought conditions in the project area. Describe the impacts that are occurring ow or are expected to occur as a result of drought conditions?*

      Water supply from renewable sources such as Cherry Creek are highly variable each year, and are subject to variable weather and precipitation conditions that directly relate to water yield. Water rights of these entities on Cherry Creek are subject to the prior appropriation system in Colorado for the South Platte River Basin. The table below entitled "Annual Flows, Cherry Creek near Parker, Colorado" shows the average annual flow on Cherry

Creek from 1992 to 2015. This shows the large variability in flow that needs to be managed each year by the Cottonwood and ACWWA. Flows range from 39% of average to 205% of average over this time period. In 4 of the last 24 years, flows in Cherry Creek have been less than 60% of average and in 2014, were 39% of average. This table does not tell the whole story in that years following drought also commonly result in low flow availability as senior agricultural rights downstream on the South Platte commonly call out all junior rights which are a majority of the Applicant's supply. Less than 25% of the water rights of Cottonwood and ACWWA on Cherry Creek are senior water rights with appropriation dates expected to be in priority in droughts. While water conservation measures are planned to reduce demands in drought years by at least 20%, water yields off of Cherry Creek can readily drop by 70% to 80%.

Annual Flows
Cherry Creek Near Parker, CO
(USGS No. 393109104464500)

Year	Annual Flow (af/y)	% of Average
1992	6,957	86%
1993	5,241	65%
1994	3,457	43%
1995	7,151	89%
1996	3,973	49%
1997	4,306	54%
1998	12,810	159%
1999	16,511	205%
2000	8,888	110%
2001	7,132	89%
2002	4,622	57%
2003	7,332	91%
2004	7,251	90%
2005	8,591	107%
2006	5,356	67%
2007	16,418	204%
2008	10,966	136%
2009	13,521	168%
2010	12,230	152%
2011	6,885	86%
2012	5,841	73%
2013	5,342	66%
2014	3,132	39%
2015	9,145	114%
Average	8,044	100%
Maximum	16,511	205%
Minimum	3,132	39%

Source: USGS National Water Information System (http://waterdata.usgs.gov/).
Notes: Annual flows are calendar year totals. Data from 11/12/2015 - 12/31/2015 are provisional.

- *Describe the severity and duration of drought conditions in the project area.*

Severe drought conditions have occurred with relatively high frequency over the last 65 years. The most severe drought in recent history was the drought of 2002 through 2005 on the South Platte River. This drought resulted in new administration of water rights in the basin that has served to reduce the time that water rights are in-priority and significantly

reduced the yields off the South Platte River from 2003 through 2012. This has led all water providers in the basin to search out other options for meeting drought.

- *Describe how the water source that is the focus of this project (river, aquifer or other source of supply) is impacted by droughts.*

  The water source that is the subject of this plan is upper Cherry Creek above Cherry Creek Reservoir. Upper Cherry Creek is over-appropriated by 5 water providers that have competing water rights in a distance of 12 miles from Franktown to the Reservoir. Cherry Creek is the primary source of renewable water supply for these entities both for first use and reuse of their water supply.

  Cherry Creek frequently goes dry in several reaches of this 12 mile stretch, and a majority of entities' water rights are not in priority at least during the summer months if not all year round during drought. During these times, these entities rely more heavily on use of NTGW from the Denver Formation. However, ongoing use of the NTGW has resulted in severe declines in the aquifer water levels which then corresponds with dropping production rates. While entities have been able to meet drought demands through pumping of the aquifers, models predict that it will not be economically viable to drill sufficient wells to meet demands in the future if current demands on the aquifer continue.

- *Provide a detailed explanation of how the proposed WaterSMART Grant project will improve the reliability of water supplies during times of drought.*

  By implementing this project to allow for full use and reuse of water supplies from upper Cherry Creek, Cottonwood and ACWWA will be able to reduce pumping from the Denver Basin Aquifers in a like amount. This will reduce pumping substantially and may result in stabilization of aquifer levels and production rates. Full use of this plant together with the importation of renewable water supply that is currently underway has the potential to reduce NTGW pumping to less than 20% of the Applicants' average annual water supply. In addition, these entities are considering Aquifer Storage and Recovery ("ASR") of imported supplies. The combination of these measures will largely preserve NTGW for use to meet demands during drought.

  In addition to the specific benefit to these entities, furthering this technology to remove selenium in an economically viable manner is critical to reuse of water supply throughout the State. In a recent meeting with the CDPHE, they expressed great interest in this technology as a means of solving selenium issues in water supply and environmental applications in many locations in the State.

- *Does the project promote and encourage collaboration among parties?*

  Full use of the scarce water resources in Colorado is an important need. Often to use and reuse water on the Front Range, there are challenges to treatment that relate to high TDS and Chemicals of Emerging Concern ("CECs") related to upstream discharges of treated wastewater effluent. Both

high TDS and CECs are best treated with reverse osmosis ("RO"). RO, however, concentrates constituents that are filtered out of the drinking water and these constituents, most notably selenium, prevent discharges of the concentrate back to the stream. The ability to biologically and chemically remove selenium and other similar constituents through natural systems that are economically viable to construct and have low annual operating costs is a critical technology necessary to maximize use of our water resources.

In addition, selenium as a naturally occurring metal is a concern for the environment of Colorado where background levels often exceed aquatic protection limits, and threaten ecosystems. Therefore, development of natural treatment system technology has the potential to provide significant benefit environmentally as well.

Finally, selenium discharges are an ongoing challenge to the mining industry in Colorado. Furthering technology in this area will also have the potential to allow continued mining or mine clean-up while protecting the environment.

In this case, these applicants are trying to develop their water rights and reuse capability on Cherry Creek just above Cherry Creek Reservoir, an important ecosystem in the middle of an urban development area. This project will provide the ability for the water provider to develop and use its resources while at the same time protecting and providing benefits to the ecosystem by reducing selenium loading and by potentially removing other constituents of concern.

This project has developed interest and support through the Colorado Department of Public Health and Environment ("CDPHE"), the Metro Roundtable of the Colorado Water Conservation Board ("CWCB"), the Cherry Creek Basin Water Quality Authority ("CCBWQA"), Colorado Parks and Wildlife (Operators of Cherry Creek Reservoir), the South Metro Water Supply Authority, the Arapahoe County Commissioners, the Douglas County Commissioners, the City of Centennial, and the Town of Parker. The natural treatment system technology proposed with regard to selenium is a matter of statewide interest through the CDPHE due to many problems with selenium throughout the state.

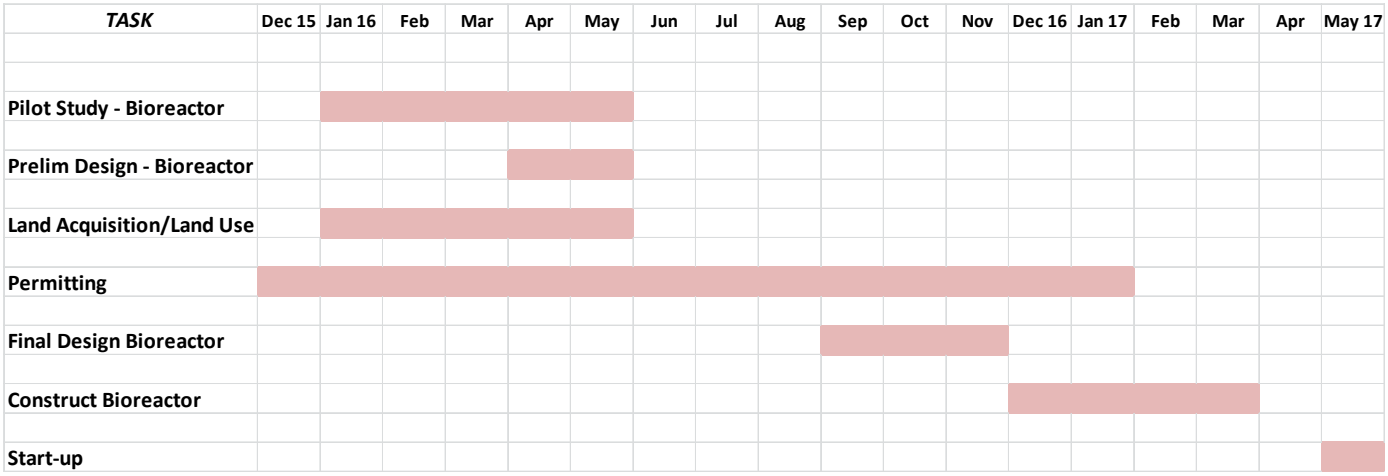
V.A.6 Evaluation Criterion F: Implementation and Results (10 points)

Subcriterion F.1: Project Planning

Both the Cottonwood Water and Sanitation District and the Arapahoe County Water and Wastewater Authority have completed water conservation plans that have been approved by the Colorado Water Conservation Board.

Subcriterion F.2: Readiness to Proceed

Cottonwood and ACWWA have been working for years to re-establish appropriate treatment through the JWPP. The following is a project schedule that anticipates constructing the BCR over next winter with the intent of having re-established the treatment plant by June, 2017. This is important for these entities because of substantial growth that is finally happening in this area after many years of very slow growth following the recession. These entities have been looking for solutions to selenium removal and have planned the funding to allow for implementation of the project in this time period.



Currently, CH2M is under contract to complete a pilot study of the BCR at the JWPP. Pilot testing will occur for 90 days. The results of the pilot test will establish design parameters for final design of the BCR. The applicants have met with the CDPHE regarding permitting requirements and are working on obtaining the necessary discharge permit. The entities are also in the process of acquiring the land and obtaining land use permits. All indications are that this can result in a project construction during the winter of 2016/17.

Cottonwood and ACWWA are pursuing grant opportunities through this WaterSMART grant and through the Colorado Water Conservation Board. These grants are very important to the customers of these entities as the cost of providing high quality, safe water supply in this area is an enormous financial burden. However, even if the grants are not received, these entities have the ability to fund or finance the costs of this project.

Subcriterion F.3: Performance Measures

Performance measures for this project will include:

1. BCR Operation – It is necessary to construct the BCR and establish operation to reduce the selenium concentration in the treated outflow to below the aquatic protection standard of 4.6 ppb. Other parameters may also require treatment once the revised discharge permit is established.

2. JWPP Operation – The primary objective of the project is to restore use of the JWPP to allow for annual treatment of no less than 3,000 acre-feet of water supply and reuse supply. This will be an increase in current annual treatment by 2,200 acre-feet. The treatment of that volume of additional water will be the key performance measure for the project. This treatment will relate directly to a decrease in the use of NTGW.

Subcriterion F.4: Reasonableness of Costs

The cost of this project is estimated at $4.0 million to construct a BCR to remove selenium from the concentrate discharge from the water treatment plant ("JWPP"). This would enable the applicants to use reverse osmosis at the JWPP, which is the treatment required to provide a good quality, safe water supply. This treatment plant is currently treating approximately 800 acre-feet per year. This change would allow the plant to be operated up to 6 MGD with an estimated annual usage of 3,000 acre-feet. Therefore, this improvement will directly relate to a net water supply addition of 2,200 acre-feet. This project would be a very cost effective way to achieve this amount of water supply delivery through reuse of water sources on Cherry Creek. But in addition to the water delivered, the project has these additional benefits;

1. This project will enable these entities to utilize some 2,200 acre-feet of additional renewable water from Cherry Creek thereby replacing this volume of NTGW use and reuse. By effectively using and reusing this water, the water supply gap in the South Platte/Metro Basin of Colorado is greatly reduced and there is less pressure on the import of water from remote locations.

2. The project provides for appropriate treatment for a safe, high quality water supply given that these entities are the fourth user of these supplies in a 12 mile stretch of Cherry Creek.

3. The project will remove selenium currently in water tributary to Cherry Creek thereby reducing the loading to Cherry Creek tributaries and Cherry Creek Reservoir. Selenium levels in the reservoir are a concern for fish in general and specifically the Walleye Fishery. Hence this project would be a benefit to the Cherry Creek State Park Recreational Area and would benefit the Walleye Fishery.

4. This project would serve to further technology to remove selenium in a cost effective manner which could benefit selenium compliance issues statewide. This would further water

providers' ability to reuse the scarce water supply in Colorado and other arid western states.

5. This project has very low energy and operational costs associated with using natural biological and chemical reactions to remove naturally occurring pollutants. Hence, most of the energy required for the project is developed through the project.

V.A.7 Evaluation Criterion G: Additional Non-Federal Funding (10 points)

The funding plan for this project is as follows:

The cost of constructing the BCR is substantial at $4.0 million. This includes bioreactor construction at $3.8 million, and land acquisition at $0.2 million.

The project would be funded as follows:

•	Cottonwood	$2,175,000	(54.4%)*
•	ACWWA	$1,500,000	(37.5%)*
•	Metro Roundtable	$ 25,000	(0.6%)
•	WaterSMART Grant	$ 300,000	(7.5%)
	TOTAL:	**$4.0 million**	**(100.0%)**

*Cottonwood and ACWWA are pursuing an additional grant opportunity for up to $475,000 for this project. The success of this application will not be known until April of this year. Therefore, if successful, the Applicants' share of these costs could drop from 91.9% to 80%.

V.A.8 Evaluation Criterion H: Connection to Reclamation Project Activities (4 points)

N/A

IV.D. 5 Performance Measures

As discussed under “Performance Measures” under Evaluation Criteria in the previous section, the goal of this project is to provide for selenium treatment that will allow for operation of a water treatment plant that allows reuse of a large amount of water supply on Cherry Creek. The objective, then, is to produce 3,000 acre-feet of reuse water each year, exceeding what can reasonably be done with the existing microfiltration plant by some 2,200 acre-feet per year.

Records exist today based on metered water throughput at the plant of the average annual water use at the plant since it was converted to a microfiltration process. Once the BCR is constructed and established, the new plant throughput can be measured through meters at the plant to verify an incremental increase in water use by 2,200 acre-feet. Similarly, there are records of NTGW pumping for each year. The reduction in the amount of NTGW pumping can be readily measured.

A secondary performance measure is the selenium concentration at the outflow from the BCR. This must meet the aquatic protection standard of 4.6 ppb which will be measured per the requirements of the CDPHE Discharge Permit for the plant. The permit will have sampling requirements where a licensed laboratory completes an analysis of selenium concentration and reports the results to the applicants who report the results to the CDPHE.

WaterSMART: Water and Energy Efficiency Grants for FY 2016
Biological Treatment for Removal of Selenium from Water Treatment Plant Concentrate

ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

The Applicants intend to construct the BCR on land located directly behind the JWPP as shown in Figure 5 below. Currently, there is approximately 6.23 acres of land out of the 100-year floodplain in this area located between two creeks, Happy Canyon Creek and Green Acres Tributary, both tributaries of Cherry Creek as shown on the attached map. The applicants own 1.53 of these acres. The remaining land is in private ownership, and the land has been platted as a drainage tract. The Applicants are in the process of obtaining the land, and are currently negotiating the cost with the landowner. The Applicants have the ability to acquire the land through condemnation, if necessary, but believe that possibility is very unlikely.

An environmental and cultural resources study will be completed on the site of the proposed BCR. This will be done as part of the due diligence related to purchase of the property, and as part of the land use approvals required through Arapahoe County. The Preble's Jumping Mouse has been identified in the upper Cherry Creek Basin, and there have been cultural resources findings as well. The project will also require a COE 404 permit for a crossing of Happy Canyon Creek to access the site for construction and maintenance. The applicants plan to retain an Environmental Consultant to evaluate the area, the ability to use the site, and mitigation that may be necessary.

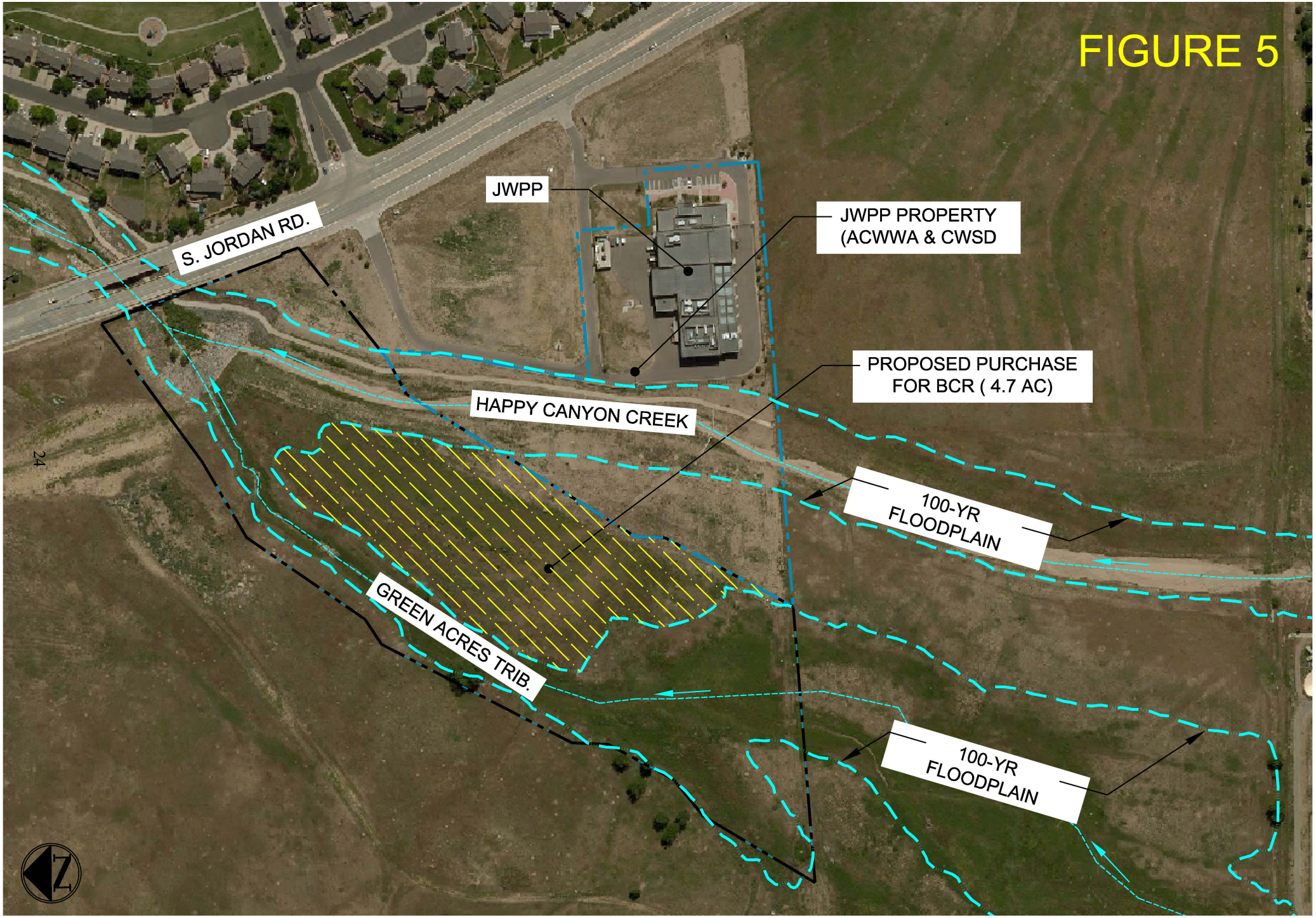


FIGURE 5
JWPP
JWPP PROPERTY
(ACWWA & CWSD
S. JORDAN RD.
PROPOSED PURCHASE
FOR BCR (4.7 AC)
HAPPY CANYON CREEK
100-YR
FLOODPLAIN
GREEN ACRES TRIB.
100-YR
FLOODPLAIN
24

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REQUIRED PERMITS OR APPROVALS

The applicants have identified the following permits/approvals necessary to complete the project.

1. **Land Use Permit –** A land use permit will be required from unincorporated Arapahoe County for construction of a natural treatment system. The District will submit an application for a Location and Extent permit from the County. Plans will need to be submitted detailing the facility, the necessary access, a drainage plan and erosion control facilities. This permit requires a public hearing before the Arapahoe County Planning Commission.

2. **Grading and Erosion Control Permit –** A Grading and Erosion Control Permit (GESC) will be required through the Southeast Metropolitan Stormwater Authority ("SEMSWA"). This will show grading before, during and after construction of the facility. Erosion control measures will be required throughout the course of the project to prevent soil and construction materials from reaching the drainageway. The area will then need to be revegetated to SEMSWA requirements.

3. **COE 404 Permit/Biological Assessment under Section 7 of the Endangered Species Act –** An access road will need to cross Happy Canyon Creek to reach the facility. This road will cross a sandy channel bottom of Happy Canyon Creek and is proposed as a compacted riprap section across the channel bottom and onto the site. Access to the site is needed very infrequently after construction.

   A biological assessment and cultural resources evaluation will need to be prepared with approvals and mitigation as required to meet permitting requirements.

4. **Discharge Permit –** The applicants will need to obtain a discharge permit from the Colorado Department of Public Health and Environment ("CDPHE"). The applicants are currently in the process of requesting Preliminary Effluent Limits (PELS). The PELS will assist in design of the BCR to meet those limits.

WaterSMART: Water and Energy Efficiency Grants for FY 2016
Biological Treatment for Removal of Selenium from Water Treatment Plant Concentrate

LETTERS OF PROJECT SUPPORT

The applicants have requested letters of support from the following entities:

1. The Cherry Creek Basin Water Quality Authority
2. Colorado Parks and Wildlife
3. The South Metro Water Supply Authority
4. The Southeast Metro Stormwater Authority
5. Arapahoe County Commissioners
6. Douglas County Commissioners (attached)
7. City of Centennial
8. Town of Parker

Letters are attached for those who have responded. Others will be forwarded as soon as they are received.

January 12, 2016

Bureau of Reclamation
Financial Assistance Management Branch
Attn: Ms. Janeen Koza
Mail Code: 84-27852
PO Box 25007
Denver, CO 80225

Re: Cottonwood Water and Sanitation District Biological Treatment of Selenium in Concentrate (reinstatement of the JWPP)

Dear Ms. Koza:

Douglas County is submitting this letter in support of the application to the Bureau of Reclamation for the WaterSMART Grant for "Biological Treatment of Selenium in Concentrate" as proposed by the Cottonwood Water and Sanitation District ("Cottonwood") and the Arapahoe County Water and Wastewater Authority ("ACWWA"). These applicants intend to use these funds to construct a biological treatment system to reduce the selenium concentrations in the concentrate discharge from the reverse osmosis ("RO") process at their Joint Water Purification Plant ("JWPP").

Development in Douglas County and its urban areas has been substantial over the past 30 years, and has been largely reliant on use of Denver Basin non-tributary ground water ("NTGW") over that time period. Douglas County has been working with water providers to find other water resources to reduce the burden on the NTGW through conservation, reuse and development of local renewable water supplies. These entities have invested heavily in the JWPP to develop and reuse their local resources but have been frustrated by difficulties in dealing with selenium in the discharge from RO. This project is an ideal solution that uses natural treatment processes to remove the selenium and meet the standard for aquatic protection, and provides environmental benefits to Cherry Creek Reservoir as well.

Water supply is a very important issue in Douglas County where renewable water supplies are scarce. This project would enable these entities to provide a high quality, safe water supply for their customers and would allow them to recapture the value of an important investment.

We believe that a grant from the Bureau of Reclamation can be an important contribution to making this a viable solution.

Thank you for your consideration.

Sincerely,

BOARD OF DOUGLAS COUNTY COMMISSIONERS

David A. Weaver, Chair

WaterSMART: Water and Energy Efficiency Grants for FY 2016
Biological Treatment for Removal of Selenium from Water Treatment Plant Concentrate

OFFICIAL RESOLUTIONS

Since this is a joint facility, this application is presented jointly by the Applicants, the Cottonwood Water and Sanitation District ("Cottonwood") and the Arapahoe County Water and Wastewater Authority ("ACWWA"). ACWWA's resolution was made at a Board Meeting on January 13, 2016. Cottonwood's Board will consider the resolution at their Board Meeting on January 21 and will be sent once executed.

RESOLUTION NO. 2016-1

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE ARAPAHOE COUNTYER WATER AND WASTEWATER AUTHORITY IN SUPPORT OF THE APPLICATION FOR THE WATERSMART: WATER AND ENERGY EFFICIENCY GRANS FOR TY2016 FOR THE BIOLOGICAL TREATMENT OF SELENIUM IN CONCENTRATE (REINSTATEMENT OF THE JWPP)

RECITALS

WHEREAS, the Arapahoe County Water and Wastewater Authority ("ACWWA") is a political subdivision and public corporation of the State of Colorado that was organized and is operating pursuant to C.R.S. Section 29-1-204.2; and

WHEREAS, ACWWA and the Cottonwood Water and Sanitation District ("Cottonwood") have cooperated and contracted with each other to construct and operate the Joint Water Purification Plant ("JWPP"); and

WHEREAS, ACWWA and Cottonwood desire to apply for and obtain a Water SMART grant ("Grant") to assist with construction of a biologic treatment system for removal of selenium in the concentrate of the JWPP as set forth in the application for the Grant; and

WHEREAS, ACWWA is governed by a Board of Directors ("Board") that, being fully informed, has taken official action to support the application.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Arapahoe County Water and Wastewater Authority that:

1. ACWWA has the legal authority to enter into the Grant agreement. Board President Doyle Tinkey is authorized to execute documents on behalf of ACWWA.

2. ACWWA's Board of Directors, and General Manager Steve Witter, have reviewed and support the application.

3. ACWWA has funding in its capital improvements plan ("CIP") budget in 2016 and projected CIP budget in 2017 sufficient for ACWWA's portion of the funding of the project as described in the application.

4. The applicant will work with the Bureau of Reclamation to meet established deadlines for entering into a cooperative agreement.

ARAPAHOE COUNTY WATER AND WASTEWATER AUTHORITY, a political subdivision and public corporation of the State of Colorado

By: _____
Doyle Tinkey, President

By: _____
Steve Witter, General Manager