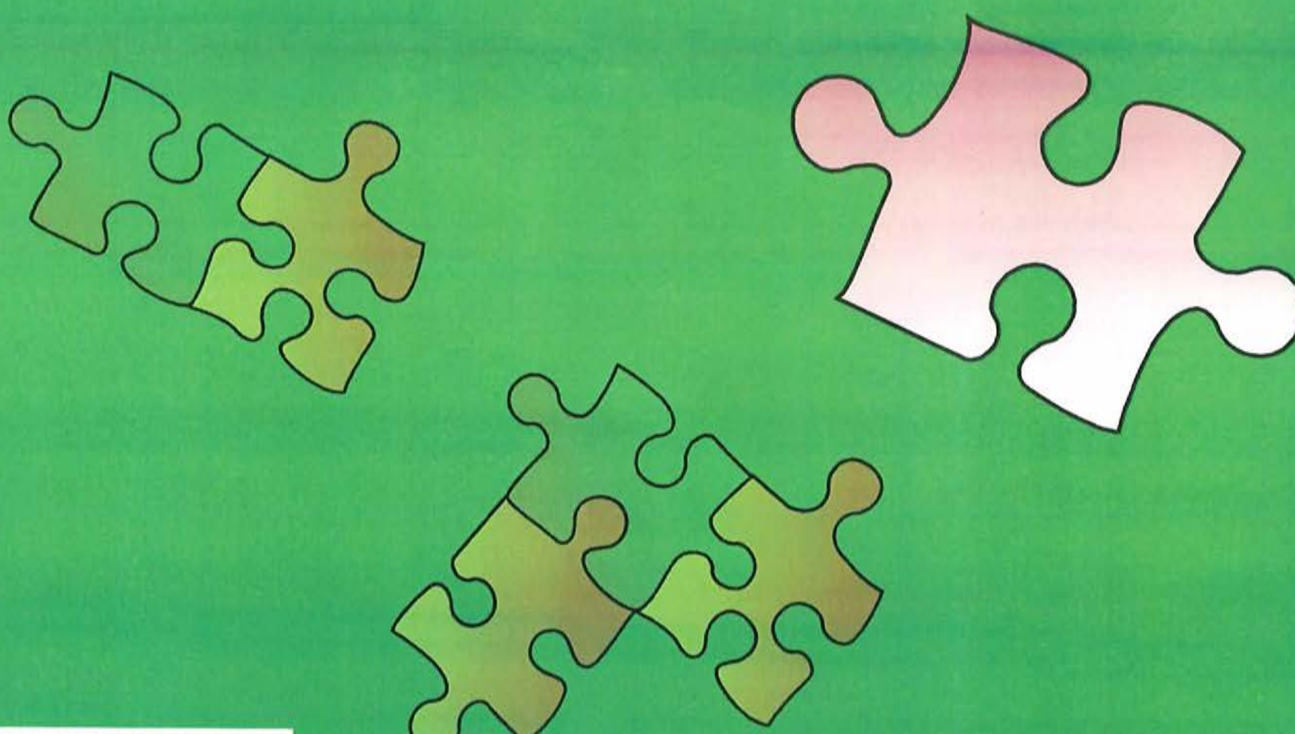
Wastewater Alternatives Evaluation

Clear Creek Countywide Wastewater Utility Plan



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CLEAR CREEK COUNTY WASTEWATER STUDY GROUP

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CHAPTER 1
EXECUTIVE SUMMARY

The State of Colorado, including Clear Creek County, has experienced a significant amount of growth in the last ten years. It is expected that Clear Creek County will undergo significant growth and changes in the next 30 years. Along with this growth and change, will come more stringent water quality regulations, which will affect the treatment techniques and methods of management at a regional scale. In response to a need for long term planning, the Clear Creek Wastewater Study Group in cooperation with Clear Creek County contracted with Richard P. Arber Associates to prepare a Countywide Wastewater Utility Plan with two distinct components. The first component is the preparation of ten separate Wastewater Utility Plans as required by the Denver Regional Council of Governments (DRCOG) for all the permitted wastewater dischargers in the Upper Clear Creek Watershed. The second component is this *Wastewater Alternatives Evaluation* report, which outlines the following subjects.

- Decentralized wastewater treatment.
- Treatment regionalization.
- Biosolids handling regionalization.
- Septage receiving.
- Regional operations.

DECENTRALIZED WASTEWATER TREATMENT

The majority of growth in Clear Creek County is in unincorporated areas, and it is predicted that this trend will continue. This growth has traditionally been served by decentralized wastewater treatment systems; mainly conventional systems. In unincorporated areas, the extension of existing infrastructure is often cost prohibitive, especially for single family large lots. In Clear Creek County, decentralized wastewater treatment is commonly the selected sustainable solution.

There have been many advances in decentralized wastewater treatment recently, resulting in small systems capable of advanced treatment comparable to that of centralized systems. These advanced treatment systems are needed in areas where the receiving soil capacity is reduced or where the County prescriptive requirements can not be met. Advanced treatment systems may also be necessary in areas that are known to be environmentally sensitive. Chapter 3 provides a detailed overview of the various treatment systems available.

Management is critical to the future success of decentralized wastewater treatment systems. The various levels of management are outlined in detail in Chapter 3. Clear Creek County should consider a combination of Management Alternative 2 and 3. Conventional systems would be managed under Alternative 2, and advanced systems would be managed under Alternative 3 with a Responsible Management Entity (RME). The RME could be a Countywide entity that is either publicly or privately operated. Most likely, the entity would be an extension of the County (County Health Department). Staffing and financing would need to be addressed, and an analysis of an appropriate rate structure to fund staffing and resources would be required to ensure economic sustainability.

For new construction, inclusion into the management system would be required prior to a certificate of occupancy. A designation of conventional or advanced treatment system would also be documented at this time so as to identify the appropriate maintenance rates. Existing systems would be added to the management system at the point of sale.

Utilizing the County as the RME for both management alternatives would make the system more streamlined and efficient. The fees or rate structure would vary between the two alternatives; with Alternative 2 being less expensive and Alternative 3 having the higher rate.

The RME would operate within a geographical District encompassing Clear Creek County (not including any areas which currently have an RME such as Saddleback Metropolitan District).

A review of the Clear Creek County Individual Sewage Disposal System (ISDS) Regulations was done. The regulations are founded on prescriptive code; however, it is suggested that effluent limits be incorporated when appropriate. This combination of prescriptive code and effluent limitations would be better tailored to address advanced treatment systems.

In addition, it is suggested that the ISDS Regulations be amended to provide more structure to make the decision between conventional or advanced treatment. A first step in implementing this would be to identify the most environmentally sensitive areas in the County, which would require advanced treatment. The criteria for whether or not an area is environmentally sensitive could include the following items:

- Known groundwater contamination due to existing systems.
- Existing high density of decentralized wastewater treatment systems.
- Potential for increased density of decentralized wastewater treatment systems.

TREATMENT REGIONALIZATION

In response to growth and change in the watershed, improvements to centralized and some decentralized wastewater treatment facilities will be required. One alternative to individual improvements is treatment regionalization. Treatment regionalization can be cost effective and in some cases the most sustainable solution.

The alternatives for treatment regionalization were initially screened based on nominal capital costs and geographic feasibility. The remaining alternatives were then further evaluated using budgeting capital costs and comparative matrices.

Under certain conditions, treatment regionalization is considered viable for the following entities:

- Easter Seals regionalizing with the Central Clear Creek Sanitation District (CCCSD).

- Silver Valley Ranch regionalizing with the Town of Georgetown/Silver Plume.
- Arapaho Mobile Home Park Area regionalizing with the Town of Empire.
- Empire Junction regionalizing with the Town of Empire.

Capital investments from development along potential sewer routes, particularly for Easter Seals, Silver Valley Ranch and Arapaho Mobile Home Park Area, would be necessary to make these alternatives viable. Easter Seals is actively working with the County and CCCSD to see if a regionalization agreement can be made. Regionalization for Empire Junction should be determined when development is initiated and more information known.

One of the key elements of the Countywide Wastewater Utility Plan Project is the evaluation of regionalized treatment. The current CCCSD Wastewater Treatment Facility (WWTF) site has been the focus for regionalization in the Upper Clear Creek Watershed. The CCCSD site is centrally located downstream of the Town of Georgetown/Silver Plume, Town of Empire, Easter Seals, Shadows Ranch, and Empire Junction. Regionalization costs could be reduced with a collaborative effort from all entities. The regionalization project capital costs total about $16 million for the plant and infrastructure. The cooperative effort does make treatment regionalization more economically feasible; however, regionalization capital costs are still estimated to be more than double the costs for improving existing facilities at Georgetown and Empire.

REGIONAL BIOSOLIDS HANDLING

All ten major treatment facilities in the watershed produce biosolids and currently dispose these solids utilizing contract haulers. Depending on the hauler, the biosolids are taken out of the County and ultimately disposed at landfills, land applied or composted for beneficial use. Hauling costs can be expensive and will only increase in the future. Most of the treatment facilities haul solids with a high water content (typically around 98% water and 2% solids), and therefore are essentially paying to haul water. The production of a cake type solid (typically in the range of 20% to 25% solids) greatly reduces water content and consequently hauling costs. Biosolids cake is commonly produced utilizing a centrifuge or belt press. This equipment is expensive; however, a single unit regionally located for use by all entities could be of economic benefit, and would be a stepping stone to increased sustainability in the County.

It was determined that the ideal site for a regional facility is the CCCSD due to its central location within the County, available treatment capacity, sufficient power, useable area for construction and close proximity to I-70 for efficient truck access. The regional facility would consist of an aerated storage basin, dewatering equipment and roll-off storage. Contract hauling would be utilized to dispose of the stored sludge.

A separate thirty year life cycle economic evaluation for each of the four major generators in the County (Georgetown, Empire, Idaho Springs and the CCCSD) was prepared to compare the current mode of operation to a regional biosolids handling facility. These evaluations were based on cost sharing between the entities. At an initial investment of approximately $1.8 million (shared amongst the entities), the construction of a regional biosolids handling facility is moderately higher than the current mode of operation. Construction of the facility could be favorable for Georgetown, Empire and the CCCSD depending on the variability of actual operation and maintenance (O&M) and construction costs. However, participation in a regional facility is not favorable for Idaho Springs.

The regional biosolids facility becomes economically viable for all four entities, including Idaho Springs, if the initial capital investment is reduced to approximately $1.0 million. The cost reduction could be accomplished with alternate design layouts or supplemental funding such as grants. Other alternatives, such as the purchase of a mobile dewatering unit could also be considered. The rough purchase price for all of the required equipment for a mobile dewatering unit is about $800,000.

A goal of Clear Creek County is to continue to increase the watershed sustainability. The production of a biosolids cake from the treatment entities is one step towards increased sustainability. The next step would be the composting of the cake product within the County boundary for redistribution and beneficial use back to the residents. The Clear Creek County Recycling Center is an appropriate location for future composting activities. The Recycling Center is located south of Idaho Springs along Soda Creek Road. The facility was at one time a composting site; however, it was shut down due to some quality control issues. The center currently accepts yard waste and has sufficient available land for the creation of composting windrows. In looking to the future, the County should consider the recycling center as a viable composting area.

REGIONAL SEPTAGE RECEIVING

The majority of past growth and predicted future growth in Clear Creek County will occur outside the municipal boundaries. This will result in a large number of decentralized facilities. Septic tanks for these facilities must be pumped on a regular basis for maintenance. The resulting septage must be managed, and the current practice of hauling septage to the Denver Metropolitan area is not a sustainable practice. As such, consideration should be made toward construction of a septage receiving station in Clear Creek County.

The two optimum sites for a regional septage receiving station in Clear Creek County are within the CCCSD and the City of Idaho Springs due to the available capacity at each of the WWTF and ease of truck access. There is one septage receiving station in the County located in Idaho Springs; however, due to collection system capacity issues and past abuse, it is only available to receive septage on the weekends.

Septage receiving stations have various levels of sophistication. More sophisticated systems have advantages such as reducing the potential for shock loading and increasing the ease of billing haulers. A simple septage receiving station has the advantage of being less expensive.

Approximate budget capital costs for a simple septage receiving station are between $200,000 and $400,000, and between $400,000 and $800,000 for a more sophisticated system. These costs could be lower if the septage receiving station was planned and constructed at the same time as a regional biosolids handling facility. Cost savings could be realized through common wall construction, shared power and multi purpose truck access ports. As such, planning for a regional septage receiving station should coincide with planning for a regional biosolids handling facility.

REGIONAL OPERATIONS

A final regionalization concept is wastewater operations. In our coordination effort with the stakeholders and wastewater service providers of the Upper Clear Creek Watershed, there was a common willingness to consolidate or regionalize operations in some form so as to increase efficiency and reduce costs. Regionalized operations can take on numerous forms and were simplified into the following four graduated levels.

- Level 1 – Continue Current Practices.
- Level 2 – Information Sharing.
- Level 3 – Information and Resource Sharing.
- Level 4 – Consolidated Operations.

Wastewater operations assistance is needed in Clear Creek County. Improvements will be slow in development, but strides in information sharing are already occurring. The wastewater service entities should start by continuing the practice of organized Wastewater Study Group meetings. With the many commitments of normal work tasks, it seems that quarterly meeting are reasonable. The meetings have minimal cost and time impacts and would provide a forum to share ideas and forward the regionalized concept of assisting each other. Forums can be held with the Colorado Water and Wastewater Network and the Wastewater Mentoring Program to review interest in participation. The entities can establish an email or internet interaction medium for communications on problems, assistance, regulation updates, notification on seminars and conferences, chemical deliveries, sludge hauling and other operation aspects. Full consolidated operations will require formal agreements and may be difficult to implement politically. However, with the establishment of normal interaction, the appropriate level of regionalized operations will evolve.

CHAPTER 2
INTRODUCTION

The Clear Creek Watershed is expected to undergo significant growth and changes in the next 30 years. This growth along with the continuingly more stringent water quality regulations will affect the needed improvements and management techniques of wastewater handling facilities in the region. In response to a need for long term planning, the Clear Creek Wastewater Study Group in cooperation with Clear Creek County contracted with Richard P. Arber Associates to prepare a Countywide Wastewater Utility Plan. Details of the project, the coordination effort, and pertinent watershed information are provided in this chapter.

PROJECT

The Countywide Wastewater Utility Plan consists of two distinct components: 1.) The preparation of Wastewater Utility Plans, and 2.) The preparation of a *Wastewater Alternatives Evaluation* for the entire region. The Denver Regional Council of Governments (DRCOG) requires all Towns/Cities/Districts operating State permitted wastewater treatment facilities to prepare or update Wastewater Utility Plans (WUP) every 5 years. In the Upper Clear Creek Watershed, there are ten (10) entities with State permitted wastewater handling facilities. They are as follows:

- Colorado Department of Transportation (CDOT) Eisenhower Tunnel.
- Clear Creek Ski Corporation.
- Town of Georgetown.
- Town of Empire.
- Henderson Mine.
- Central Clear Creek Sanitation District (CCCSD).
- St. Mary's Glacier Water and Sanitation District.
- Shwayder Camp.

- City of Idaho Springs.
- Clear Creek High School.

Ten separate WUPs were prepared for each of the entities list above. These have been submitted to the entities, the County and DRCOG as separate documents.

The second part to the project is the preparation of this *Wastewater Alternatives Evaluation* report. This report focuses on the entire watershed. Within the report are evaluations of the following.

- Decentralized wastewater treatment.
- Centralized wastewater treatment regionalization alternatives.
- Regional biosolids handling alternatives.
- Regional septage handling alternatives.
- Operations regionalization alternatives.

The general evaluation concepts for the watershed are identified on the planning map found in Appendix A.

COORDINATION

There are many entities interested in the water quality of Clear Creek and the direction of wastewater handling practices in the watershed. In preparing this report and the WUPs, Richard P. Arber Associates has coordinated with the following entities.

- Clear Creek Economic Development Corporation (CCEDC).
- Clear Creek County.
- City of Idaho Springs.
- Town of Empire.

- Town of Georgetown.
- Town of Silver Plume.
- Henderson Mine and Mill.
- Climax Mine.
- City of Westminster.
- City of Northglenn.
- City of Arvada.
- City of Golden.
- Upper Clear Creek Watershed Association (UCCWA).
- Coors Brewing Company.
- Central Clear Creek Sanitation District (CCCSD).
- Clear Creek Ski Corporation.
- St. Mary's Glacier Water and Sanitation District.
- Jefferson County.
- City of Black Hawk.
- Clear Creek Watershed Foundation.
- Colorado Department of Transportation (CDOT).
- Denver Regional Council of Governments (DRCOG).
- Colorado Department of Public Health and Environment (CDPHE).
- Easter Seals Rocky Mountain Village.

In addition to contacting and meeting with these entities, Richard P. Arber Associates attended the Clear Creek Watershed Forum in March of 2007 and Study Group Meetings with the stakeholders.

CLEAR CREEK WATERSHED

The Clear Creek watershed is an important source for water supplies in the Denver Region. Most of the water results from the runoff of snowfall in the high country along the Continental Divide.

Clear Creek is a water supply for several large cities along the Front Range, including Thornton, Westminster and Northglenn through storage at Standley Lake. As a result, downstream cities are interested in maintaining high water quality standards in the Upper Clear Creek Watershed.

The Upper Clear Creek watershed covers an area of about 416 square miles in Gilpin, Clear Creek, and Jefferson Counties. The headwaters occur along the east side of the continental divide, where elevations reach over 14,000 feet in the Front Range of Colorado. From there, numerous streams coalesce into Clear Creek. Clear Creek flows generally east for about 40 miles to Golden, where it becomes part of the South Platte Urban Watershed at an elevation of 5,700 feet.

Most of the watershed geology is composed of variably fractured crystalline basement rocks and thin soils. This geology leads to fracture-flow groundwater systems which are susceptible to pollution in the event of a septic system failure. Water quality can be compromised due to large surface flows in narrow canyons that can lead to flooding and issues such as sediment loading. The strongly mineralized geologic characteristics lead to numerous and dispersed mining activities over the last 150 years. The resulting placer mining and waste piles exposed large amounts of bedrock and waste material to the environment causing acidification and mobilization of heavy metals into surface water.

A. Clear Creek/Standley Lake Watershed Agreement

Standley Lake is a reservoir located in Jefferson County that is supplied primarily with water from Clear Creek. In cooperation with the Farmers Reservoir and Irrigation Company (FRICO), the reservoir supplies water to the Standley Lake Cities (SLC), Northglenn, Thornton, and Westminster. The SLC requested a Rulemaking Hearing to establish water quality standards and control regulations for Standley Lake. Twenty three entities developed and agreed to the Clear Creek/Standley Lake Watershed Agreement (Agreement), which was adopted in December 1993.

The entities involved are government agencies and private corporations having land use, water supply, and/or wastewater treatment responsibilities within the Clear Creek Basin.

It was agreed upon to develop a narrative standard for Segment 2, Big Dry Creek, Standley Lake in lieu of a numeric standard. The parties involved agreed to testing, monitoring and implementation of best management practices on a voluntary basis. The narrative standard reads as follows:

"The trophic status of Standley Lake shall be maintained as mesotrophic as measured by a combination of common indicator parameters such as total phosphorus, chlorophyll "a", Secchi depth and dissolved oxygen. Implementation of this narrative standard shall only be by Best Management Practices and controls implemented on a voluntary basis."

According to the Agreement, should the narrative standard not be met for Standley Lake, numeric standards or effluent limitations for phosphorus and/or nitrogen in the Upper Clear Creek Basin may be implemented. These wastewater effluent limitations would include a 1.0 mg/L limit for total phosphorus.

B. Stream Standards

The stream standards for the Upper Clear Creek Basin are defined in the state regulation, Classifications and Numeric Standards South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin (Regulation No. 38). This regulation was first adopted April 6, 1981 and was last amended on August 14, 2006 with an effective date of September 30, 2006. The following classifications for stream segments within the Upper Clear Creek Basin are summarized below:

- Cold Water Aquatic Life Class 1.
- Class 1a Recreation.

- Agriculture.
- Domestic Water Supply.

The classification Cold Water Aquatic Life Class 1 is considered impaired for stream segment COSPCL02 due to copper, lead and zinc according to the Colorado 2006 303(d) list. The majority of the heavy metal loading throughout the Clear Creek drainage basin is due to natural geologic conditions and mining activity. There are ongoing CERCLA cleanup activities within the watershed.

C. Water Rights

Water rights can be a major factor in the implementation of a wastewater alternative. In evaluating alternatives for the ten major treatment entities of Upper Clear Creek, a peripheral review of water rights was performed with the entity, essentially highlighting the magnitude of required returned flows to Clear Creek. This review is reflected in the individual decision matrices detailed in this report. Actual implementation of a preferred option for centralized or decentralized facilities will require a thorough review of all water right impacts.

D. Sustainability

The stakeholders of the Upper Clear Creek Drainage Basin have a goal to continue to increase watershed sustainability. There are essentially three components to the sustainable concept; environment, economics and society. Ultimately, the implementation of a preferred wastewater alternative must enhance these components and hence the quality of the watershed.

CHAPTER 3
DECENTRALIZED WASTEWATER TREATMENT

Decentralized wastewater treatment is commonly defined as individual or cluster onsite systems varying in complexity from simple septic tanks followed by absorption fields to elaborate advanced treatment facilities. Decentralized facilities are an integral part of wastewater management in Clear Creek County. In this chapter, decentralized technologies are summarized, management structure alternatives are described, and suggested regulatory amendments are presented.

DECENTRALIZED TREATMENT TECHNOLOGIES

Clear Creek County has a diverse mixture of development within city boundaries and unincorporated areas. Growth within city/town boundaries is normally served by the existing centralized wastewater treatment facilities. In unincorporated areas, the extension of existing infrastructure is often cost prohibitive, especially for single family large lots. In Clear Creek County, decentralized wastewater treatment is commonly the selected sustainable solution.

Clear Creek County developed a County Master Plan in February 2004. The purpose of the Plan was to provide a policy document for development in unincorporated areas within Clear Creek County. According to the Clear Creek County Master Plan, between the years 1990 and 2002, 85% of the growth in the County occurred in unincorporated areas. As of 2002, 62% of residents in the County lived in unincorporated areas. Figure 3-1 was taken from the Clear Creek County Master Plan, and DROG planning boundaries were overlaid to show population density from 2002 in relation to the municipal planning boundaries. As shown in Figure 3-1, the far eastern part of the County shows a high density of development in unincorporated areas. It is clear that decentralized wastewater treatment strategies will be necessary for the future sustainability of the County.

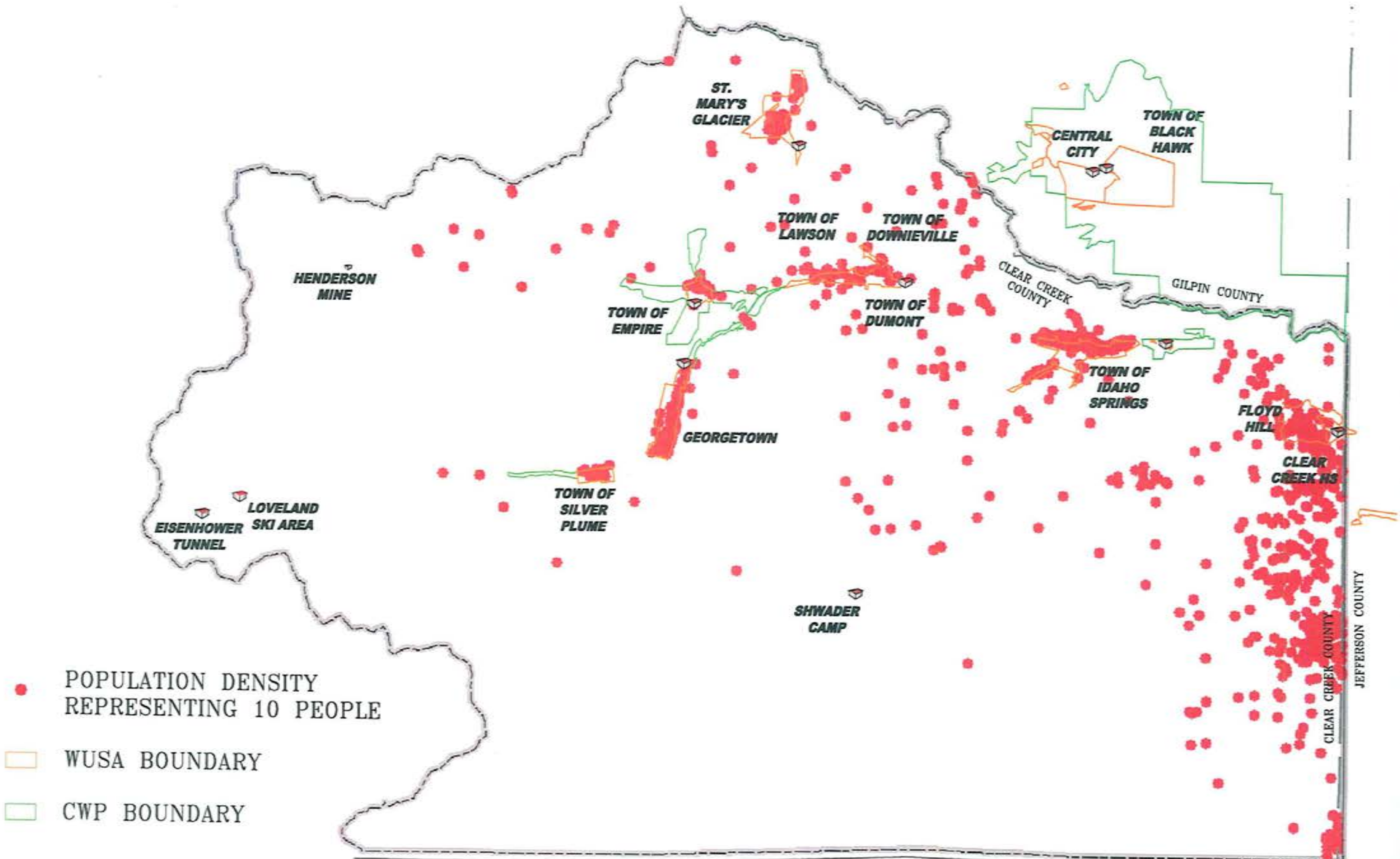

FIGURE 3-1

COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
CLEAR CREEK COUNTY POPULATION DENSITY AND PLANNING BOUNDARIES (2002)

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SYSTEMS OVERVIEW

Centralized wastewater treatment relies on the conveyance of wastewater from the point of generation to a centrally located facility for treatment and discharge to either surface or ground water. The conveyance is normally achieved via gravity sewers and lift stations. Decentralized wastewater treatment units are commonly located at the source of generation, or, in the case of clustered systems, wastewater is conveyed a short distance to a small cluster facility designed to treat flows from several homes and/or businesses.

Decentralized wastewater treatment systems have historically consisted of an anaerobic treatment unit (septic tank) and a soil treatment unit (absorption field). Recently, technology has emerged to take decentralized treatment to a new level. Small treatment units, which have the capability of treating effluent to secondary and tertiary treatment standards, are now available for individual homes and businesses, as well as clusters of homes and businesses. These systems have many different configurations and will be discussed in detail in this chapter. Typically, a decentralized treatment strategy that treats to a higher standard prior to discharge to an absorption field is called "advanced treatment." Systems consisting of septic tanks and absorption fields are called "conventional treatment" systems. The various typical configurations of decentralized systems are described below. Typical treatment performances and costs for both conventional and advanced treatment systems as well as a list of some proprietary manufacturers of advanced treatment systems are found in Appendix B.

A. Conventional System

The conventional system consists of a septic tank and an absorption field. The septic tank is the primary treatment unit where solids are settled out and grease floats to the top. Effluent from the septic tank is taken from the "clear zone", which either flows by gravity or is pumped to the absorption field. The absorption field, when designed properly and suitable soil is available, provides further treatment. Figure 3-2 is a schematic of a typical conventional decentralized wastewater treatment system.

B. Suspended Growth Aerobic Treatment

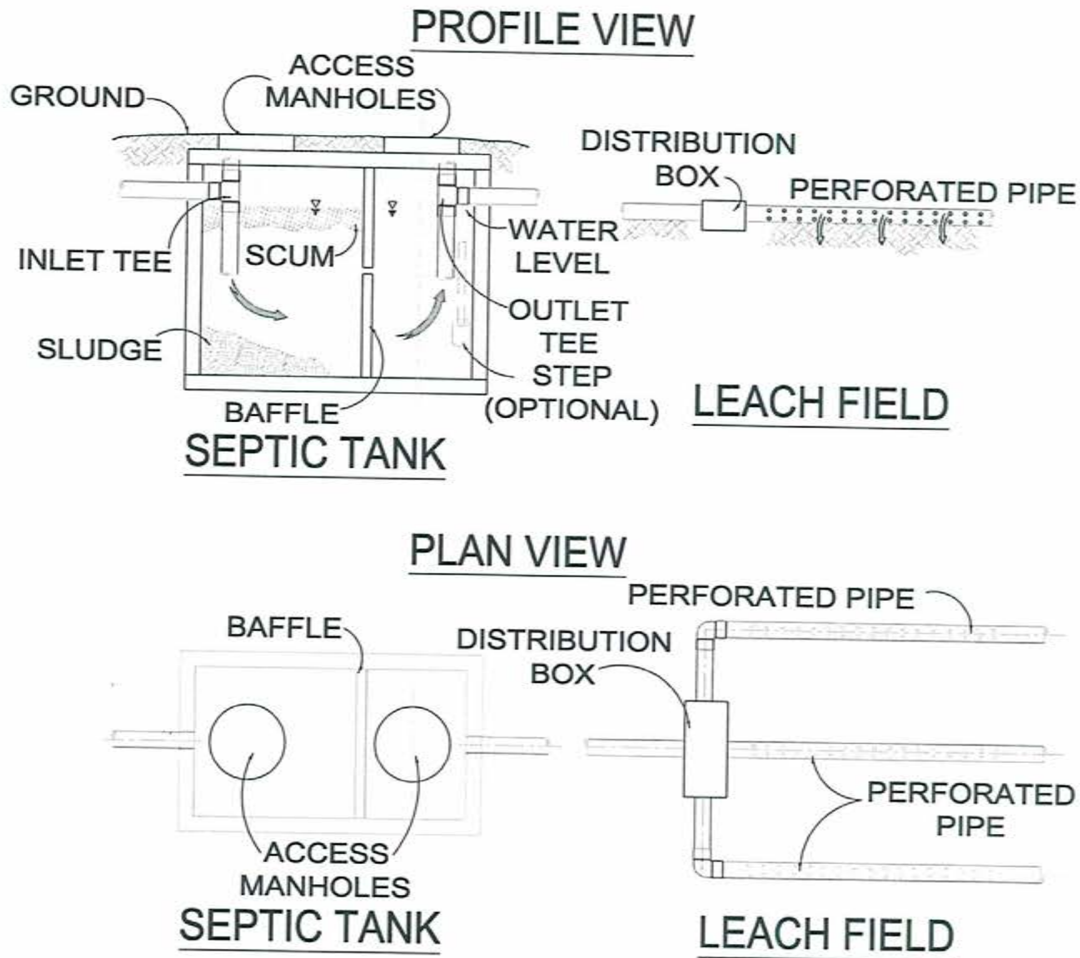
Suspended growth aerobic treatment systems rely on suspended biological growth for treatment. An aeration system is employed to increase the dissolved oxygen level in the wastewater and keep biomass suspended and mixed within the aeration tank. Suspended biological growth will break down the organics in the water. A separate clarifying tank follows the aeration tank and allows the biomass to settle. The settled biomass (activated sludge) can then be returned to the aeration tank. The system will build up excess biomass, which should be wasted periodically. Variations in sludge return and effluent recycle make the system flexible and provide opportunity for nitrogen removal. Figure 3-3 is a schematic of a typical suspended growth aerobic treatment system.

C. Sequencing Batch Reactor

A sequencing batch reactor (SBR) utilizes a single tank for aeration and clarification. Septic effluent flows into the tank until it reaches a set level. At this point, the tank is closed off to influent flow. The tank is aerated inducing a suspended growth type aerobic treatment system. The air is then turned off and sludge is allowed to settle. Clarified effluent is then decanted for discharge. The sludge is retained and pumped out regularly. Generally, two parallel SBR systems are put in place. A second system allows diversion of flow during reaction in the parallel system. Figure 3-4 is a schematic of a typical sequencing batch reactor.

D. Membrane Treatment Systems

Membrane treatment systems operate much like suspended growth aerobic treatment systems. Instead of having a separate clarifying tank, solids are separated from the effluent using



PROCESS DESCRIPTION:

- SOLIDS SETTLE AND FLOAT OUT IN FIRST CHAMBER OF SEPTIC TANK
- FLOW IS DISTRIBUTED EVENLY THROUGHOUT LEACH FIELD VIA PERFORATED PIPE.
- OPTIONAL SEPTIC TANK EFFLUENT PUMP (STEP)

FIGURE 3-2
COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
CONVENTIONAL TREATMENT SYSTEM

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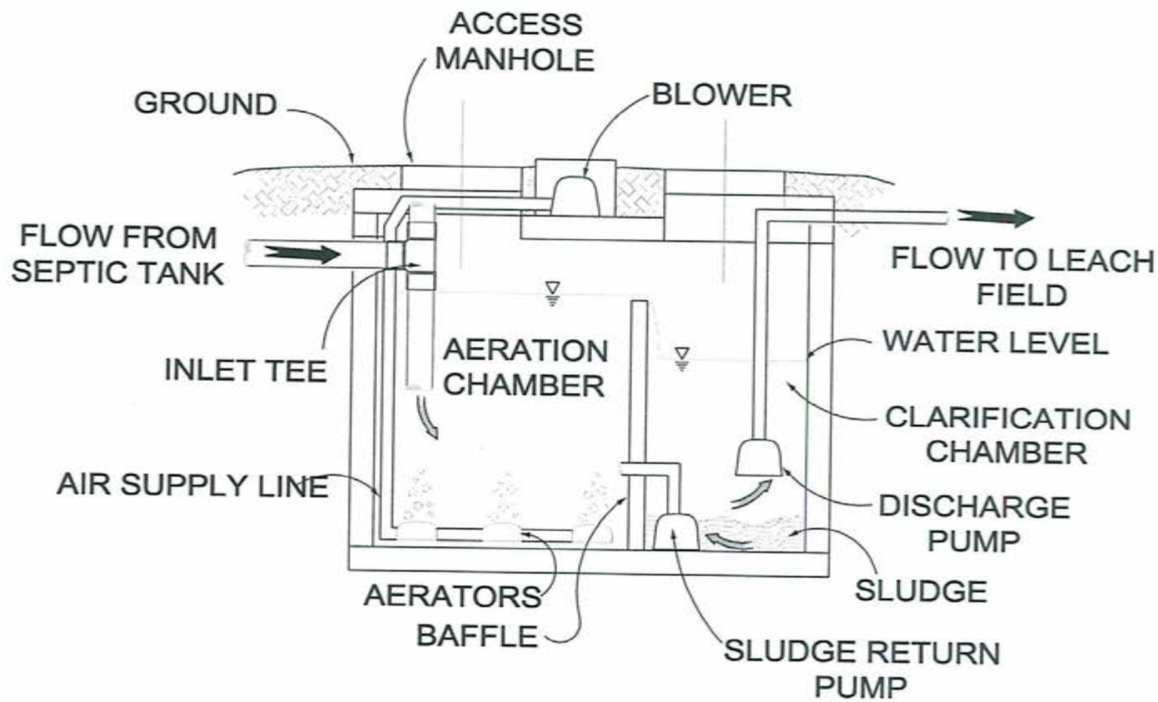

PROCESS DESCRIPTION:

- FLOW FROM SEPTIC TANK IS AEROBICALLY TREATED.
- ONCE WATER LEVEL IN CLARIFICATION CHAMBER REACHES A CERTAIN HEIGHT, DOSING PUMP PRESSURIZES LEACH FIELD.

FIGURE 3–3

COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
SUSPENDED GROWTH AEROBIC TREATMENT SYSTEM

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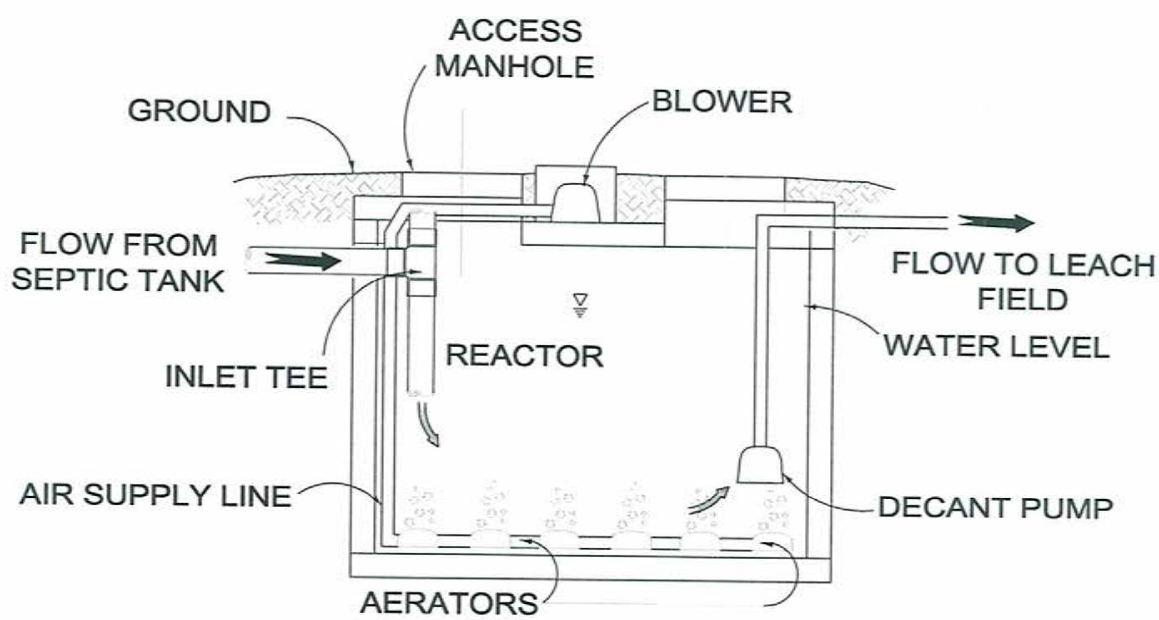

PROCESS DESCRIPTION:

- FLOW FROM SEPTIC TANK FILLS REACTOR.
- AERATORS TURN ON AND AEROBICALLY TREAT WATER
- AERATORS TURN OFF AND REACTOR DECANTS.
- TRANSFER PUMP SENDS WATER TO CLARIFICATION CHAMBER.
- ONCE WATER LEVEL IN CLARIFICATION CHAMBER REACHES A CERTAIN HEIGHT, DOSING PUMP PRESSURIZES LEACH FIELD.

FIGURE 3–4
COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
SEQUENCING BATCH REACTOR

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membranes. Effluent is passed through the membrane by a pressure differential. Variations in sludge return and effluent recycle make the system flexible and provide opportunity for nitrogen removal. Figure 3-5 is a schematic of a typical membrane treatment system.

E. Fixed Film Aerobic Treatment – Intermittent Media Filter

Fixed film aerobic treatment is similar to suspended growth but the biomass is attached to media. This media can be rock, wood, plastic, textile or anything else that can support biogrowth.

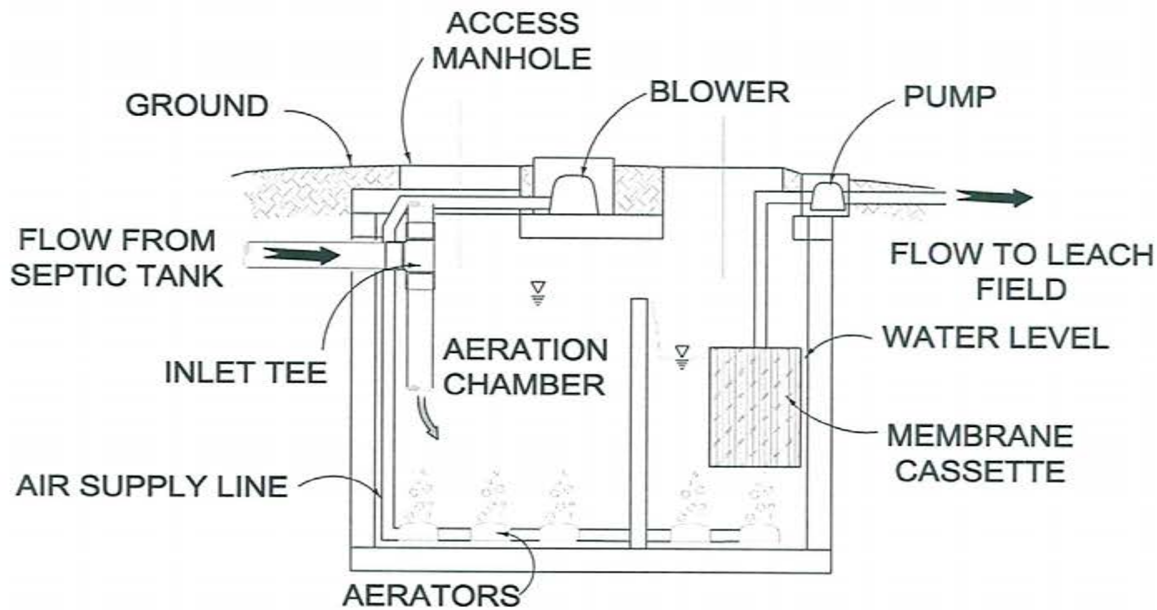
One type of fixed film system is an intermittent media filter. Wastewater is pumped intermittently from the septic tank onto a bed of media where it trickles through. Flow from the bed of media then goes to the absorption field for additional treatment and discharge. Biomass grows on the media and the wastewater is treated as it flows through. Oxygen is introduced to the biomass through natural surface oxygen transfer and separate aeration is not required. Figure 3-6 is a schematic of a typical intermittent media filter.

F. Fixed Film Aerobic Treatment – Recirculating Media Filter

Another type of fixed film system is a recirculating media filter. The media is similar to an intermittent media filter. Wastewater is pumped intermittently from the septic tank to the media bed where it trickles through. A portion of the flow is diverted to the absorption field, and a portion of the flow is diverted back to the septic tank. This mode of operation provides more passes through the treatment media for enhanced treatment as well as potential for nitrogen removal. Figure 3-7 is a schematic of a typical recirculating media filter.

G. Integrated Fixed Film Activated Sludge

Integrated fixed-film activated sludge (IFAS) is another option that combines attached and suspended growth processes. IFAS uses the suspended growth aeration tank and adds lightweight



PROCESS DESCRIPTION:

- FLOW FROM SEPTIC TANK IS AEROBICALLY TREATED.
- ONCE WATER LEVEL REACHES CERTAIN HEIGHT, EFFLUENT IS PUMPED THROUGH MEMBRANE TO FILTER AND SENT TO LEACH FIELD.

FIGURE 3–5
COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
MEMBRANE TREATMENT SYSTEM

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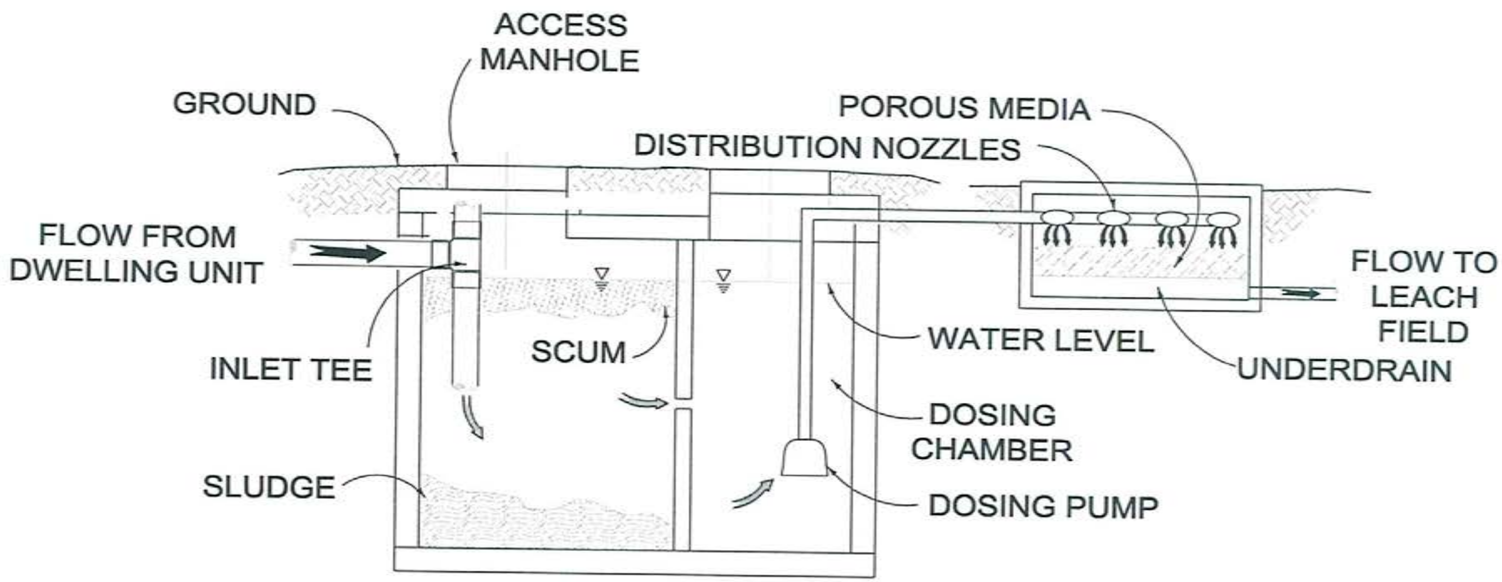

PROCESS DESCRIPTION:

- DOSING PUMP INTERMITTENTLY PRESSURIZES DISTRIBUTION MANIFOLD.
- WATER IS AEROBICALLY TREATED IN PORUS MEDIA.
- UNDERDRAIN COLLECTS EFFLUENT, WHICH FLOWS TO LEACH FIELD.

FIGURE 3-6
COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
INTERMITTENT MEDIA FILTER

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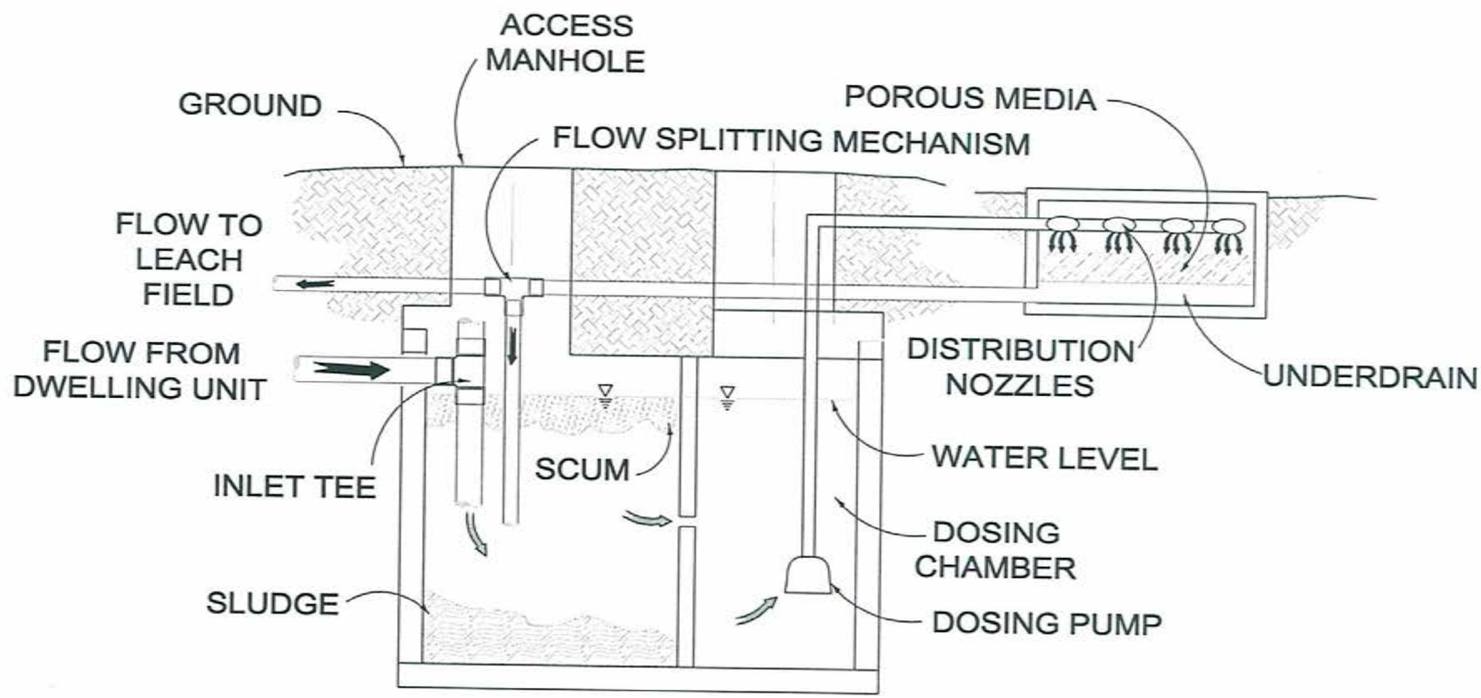

PROCESS DESCRIPTION:

- DOSING PUMP INTERMITTANTLY PRESSURIZES DISTRIBUTION MANIFOLD.
- WATER IS AEROBICALLY TREATED IN POROUS MEDIA
- UNDERDRAIN COLLECTS EFFLUENT.
- A PORTION OF THE FLOW RETURNS TO THE SEPTIC TANK, AND A PORTION FLOWS TO THE LEACH FIELD.

FIGURE 3–7
COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
RECIRCULATING MEDIA FILTER

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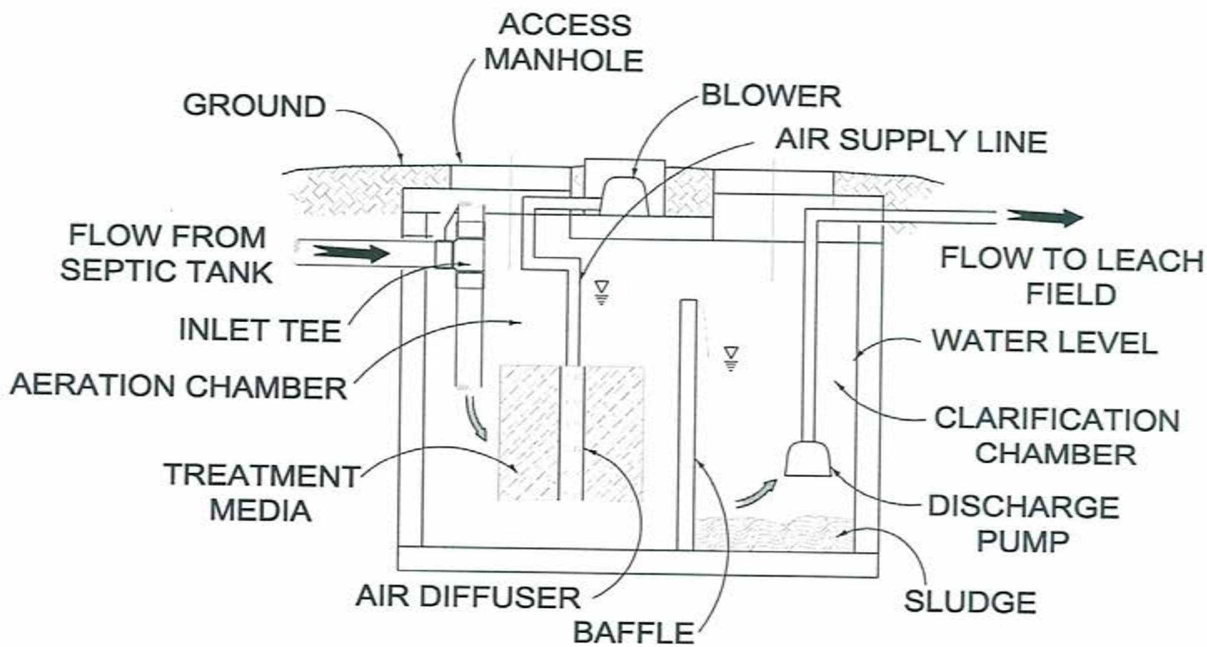
plastic media. Biomass is both attached to the media and suspended in the tank. The suspended media may allow for a smaller aeration tank and clarifier compared to a purely suspended growth system. Figure 3-8 is a schematic of a typical integrated fixed film activated sludge treatment system.

H. Lagoons

Both facultative and aerated lagoons are commonly used for wastewater treatment in the United States. Facultative lagoons rely on natural surface aeration and oxygen transfer from algae as opposed to aerated lagoons that enhance aeration with mechanical equipment. Both systems typically achieve 75 to 95 percent five day biochemical oxygen demand (BOD_5) removal. Facultative lagoons tend to generate a large amount of algae, resulting in poor total suspended solids (TSS) removal depending on the season. Aerated lagoons reduce TSS more consistently to about 20 to 60 mg/L. Facultative lagoons are generally capable of 2 to 3 log removal of fecal coliform, while aerated lagoons can achieve 1 to 2 log removal. Nutrient removal is possible in both systems but is very dependant on temperature. Lagoon systems are not recommended for Clear Creek County due to the extreme temperature variations, large footprint and potential for human contact. Figure 3-9 is a schematic of a typical lagoon system.

I. Constructed Wetlands

Constructed wetlands use plants and settling for the removal of BOD_5 and TSS. Usually, constructed wetlands are installed following the septic tank in a conventional system. Constructed wetlands are capable of reducing BOD_5 and TSS to 20 to 30 mg/L and can be designed for nitrogen removal. Fecal coliform reduction of 2 to 3 logs is achievable from constructed wetlands treatment systems. Figure 3-10 is a schematic of a typical constructed wetlands system.



PROCESS DESCRIPTION:

- FLOW FROM SEPTIC TANK IS AEROBICALLY TREATED ON FIXED FILM MEDIA.
- ONCE WATER LEVEL IN CLARIFICATION CHAMBER REACHES A CERTAIN HEIGHT, DOSING PUMP PRESSURIZES LEACH FIELD.

FIGURE 3–8
COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
INTEGRATED FIXED FILM ACTIVATED SLUDGE TREATMENT SYSTEM

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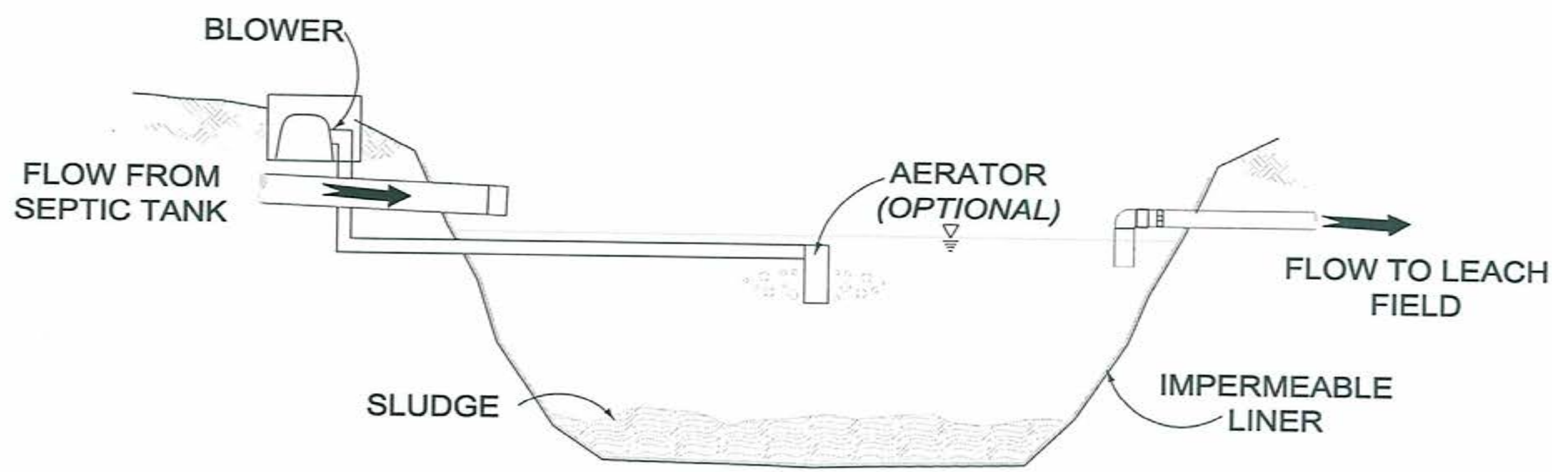

PROCESS DESCRIPTION:

- FLOW FROM THE SEPTIC TANK IS AEROBICALLY TREATED IN AN OPEN SURFACE LAGOON.
- GRAVITY FLOW TO THE LEACH FIELD.

FIGURE 3-9
COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
LAGOON TREATMENT SYSTEM

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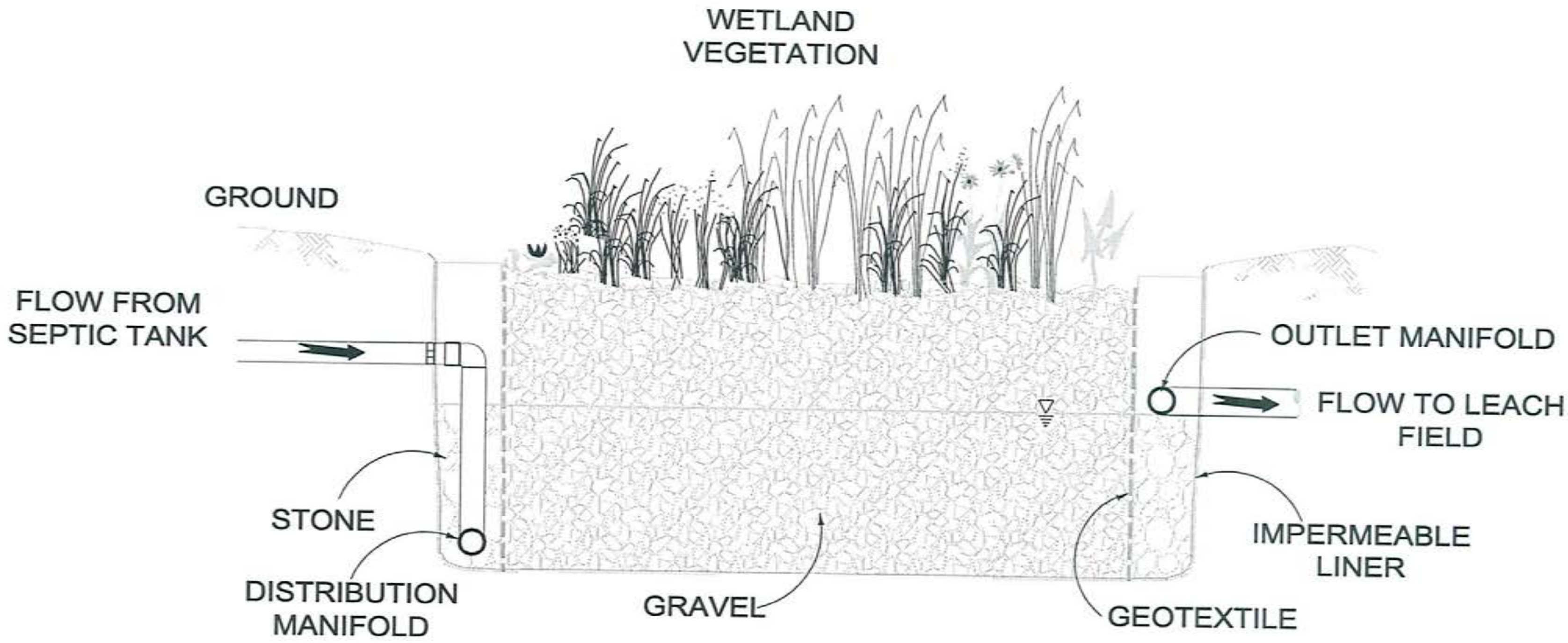

PROCESS DESCRIPTION:

- FLOW FROM THE SEPTIC TANK GOES INTO GRAVEL TREATMENT AREA.
- WETLAND VEGETATION TREATS WASTEWATER.
- FLOW IS VIA GRAVITY TO THE LEACH FIELD.

FIGURE 3−10
COUNTYWIDE WASTEWATER UTILITY PLAN−WASTEWATER ALTERNATIVES REPORT
CONSTRUCTED WETLANDS TREATMENT SYSTEM

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NUTRIENT REMOVAL CAPABILITY OF DECENTRALIZED SYSTEMS

Effluent limits for all dischargers in the Upper Clear Creek Watershed will continue to get more stringent. In particular, nutrient reduction, specifically nitrogen and phosphorus, will become more prevalent for decentralized and centralized facilities. A large portion of the Upper Clear Creek residents are served with decentralized facilities and therefore nutrient removal performance will become more important as we look forward to the future.

A. Nitrogen

Total nitrogen reduction can be simplified into two processes; 1) Nitrification, which converts ammonia to nitrate, and 2) Denitrification, which converts nitrate to nitrogen gas. Conventional decentralized systems, in the presence of adequate receiving soils, are effective for removal of ammonia; however, denitrification is generally not effective. A variety of advanced treatment systems are specifically designed for the removal of total nitrogen. See Appendix B for treatment performance and costs of decentralized wastewater treatment technologies.

B. Phosphorus

The removal of phosphorus is achieved through chemical precipitation, biological uptake or absorption. The most effective method for phosphorus removal with decentralized systems is soil absorption. In general, finer grained soils have higher sorption capacities for phosphorus, and unsaturated flow conditions are ideal to allow optimum contact of effluent with soil particles. In areas with bedrock near the ground surface oversized absorption fields with shallow trenches are ideal. Systems using dosing systems for intermittent effluent application can also increase the potential for unsaturated flow, thereby enhancing removal. See Appendix B for treatment performance and costs of decentralized wastewater treatment technologies.

DECENTRALIZED TREATMENT MANAGEMENT ALTERNATIVES

Historically, nationwide, management of decentralized treatment systems has been neglected. This has led to numerous issues, such as hydraulic failure (effluent ponding above ground or backing up into the residence or business) and groundwater contamination. Decentralized systems, if properly managed and maintained, are capable of producing high quality effluent. The United States Environmental Protection Agency (EPA) published the *Guidelines for Management of Onsite and Decentralized Wastewater Treatment Systems* in 2003, which provided a list of management alternatives for decentralized systems. Using these guidelines, the following four management alternatives have been developed for Clear Creek County.

A. Management Alternative 1 – No Management

Most decentralized wastewater treatment systems are currently operated without any formal management system. The homeowner owns and operates the wastewater system under this management alternative. Management success relies on homeowner education from mailers and/or pamphlets informing residents of the key elements involved in regular maintenance. It may also be advisable to require a septic system inspection at the time of any transfer of ownership.

Generally, advanced systems require more regular skilled maintenance than a conventional septic system. Without some form of management, it is likely that the maintenance requirements of an advanced system will become a burden on the homeowner or result in poor effluent quality. This management alternative is not recommended for advanced treatment systems.

B. Management Alternative 2 – Passive Management

The homeowner owns and operates the system under this style of management, while the management entity (most likely the County) provides assistance and maintenance reminders. At this level of management, the management entity would keep a maintenance schedule and send reminders to individual homeowners. The homeowners may be required to submit proof of maintenance. As with Management Alternative 1, it is also advisable to include requirement of inspections at the point of sale. The cost of a passive management system is generally minimal and could be funded with annual fees, property taxes, or other forms of financing.

Passive management is not recommended for advanced treatment systems because the responsibility for maintenance remains upon the homeowner. The maintenance of an advanced system will likely become a burden to the homeowner and result in poor effluent quality.

C. Management Alternative 3 – Responsible Management Entity (RME) O&M

In this alternative, a responsible management entity (RME) may take the responsibility for operation and maintenance (O&M) of all decentralized wastewater treatment systems in a particular area. An RME may be a public or private entity that charges fees to homeowners in exchange for regular maintenance. The RME could be a district, branch of the County Health Department, or other entity. An RME may perform its own inspections and maintenance or enter into a contract with a third party. Advanced treatment systems with effluent limits would be sampled by the RME, and the results would be sent to the County documenting compliance or noncompliance. The homeowner maintains ownership of the system, and responsibility for repair and/or replacement of system components. An RME would not supersede the authority of the County and must operate within the local regulations.

D. Management Alternative 4 – Responsible Management Entity (RME) Ownership

Under this style of management, an RME would own and operate the decentralized wastewater treatment systems in a particular area. An RME may be a public or private entity that charges fees to homeowners in exchange for regular maintenance. The RME could also be a branch of the County Health Department. The RME would be responsible for all maintenance including the costs for repair and replacement. No risk lies with the homeowner in this scenario because the ownership of the system lies with the RME. An RME would not supersede the authority of the County and must operate within the local regulations.

FUTURE COUNTY MANAGEMENT

Clear Creek County should consider a combination of Management Alternative 2 and 3. Conventional systems would be managed under Alternative 2, and advanced systems would be managed under Alternative 3 with an RME. The RME could be a Countywide entity that is either publicly or privately operated. Most likely, the entity would be an extension of the County (County Health Department). Staffing and financing would need to be addressed, and an analysis of an appropriate rate structure to fund staffing and resources would be required to ensure economic sustainability.

Utilizing the County as the RME for both management alternatives would make the system more streamlined and efficient. The fees or rate structure would vary between the two alternatives; with Alternative 2 being less expensive and Alternative 3 having the higher rate.

For new construction, inclusion into the management system would be required prior to a certificate of occupancy. A designation of conventional or advanced treatment system would also be documented at the time of construction so as to identify the appropriate maintenance rates. Existing systems would be added to the management system at the point of sale.

The RME would operate within a geographical District encompassing Clear Creek County (not including any areas which currently have an RME such as the Saddleback Metropolitan District).

EXEMPLARY MODELS

There are examples of well organized decentralized wastewater treatment management in Clear Creek County. One such example is the Saddleback Metropolitan District. The Saddleback

Metropolitan District was formed to be the RME for a development in eastern Clear Creek County. This development encompasses 535 acres of which 200 acres are designated as open space. Each house in the District is required to have its own advanced treatment system which is required to meet State of Colorado surface water discharge standards. The District has entered into a contract with a supplier of advanced treatment systems which must be NSF Standard 40 Certified (see Appendix C). The initial cost of the treatment system must be paid by the lot owner, and a service charge is paid each month, which covers testing, maintenance, repair, and replacement. A one time development fee is charged to each new house in the District, which goes toward water rights augmentation, and a one time capital reserve fee is charged in order to build a capital reserve fund for the District. The District operates much like a community on centralized wastewater treatment.

Another example of a progressive decentralized facilities model within Clear Creek County is Shadows Ranch, which is an event center near Georgetown. Currently, the facility is served by a conventional system; however, there are plans for expansion. The wastewater flows from the facility will be treated using constructed wetlands in the future. Installation of the wetlands is being done as an environmental stewardship opportunity and not due to mandates by Clear Creek County. An RME will be established, similar to that for the Saddleback Metropolitan District. There is also potential for collaboration with the Colorado School of Mines Rocky Mountain Small Flows Program, which is the leading research program for decentralized wastewater treatment in the area.

REGULATORY OVERVIEW/COMMENTS

Decentralized wastewater facilities are usually regulated at the County level. For systems with design flows of 2,000 gpd or greater, a Colorado Discharge Permit is required, and for systems under 2,000 gpd, a County permit is required. Policy 6, which was promulgated by the Water Quality Control Division (WQCD), provides a decision framework for local regulators to determine when a State permit is required and when a County permit is required. Prior to Policy

6, a single property owner could split large wastewater flows into multiple systems, which were all individually under 2,000 gpd. By doing so, the property owner avoids a site application and State permit. Policy 6 provides a decision framework to avoid unmanaged arrays of septic tanks, which could lead to environmental degradation.

A. General Regulatory Comments

Septic tanks installed in Clear Creek County must be watertight. This is called out as a "General Design Feature" in Section V.A.7; however, an additional step should be taken to require field verification as part of the inspection process. This could be accomplished via a hydrostatic water test or a certification document from the tank manufacturer. Septic tanks are an important part of the overall system, providing primary treatment and storage of solids. Leaking septic tanks could lead to contaminated groundwater.

A requirement in Section V.A.8. states that system components be accessible for inspection and maintenance. Some of these components are often buried due to aesthetics as well as safety concerns. If components are buried, there should be some type of marker on site to locate the components. Maintenance and inspections are critical for the proper operation of any wastewater system. Any measure taken to increase the ease of access thereby increases the likelihood that proper inspection and maintenance occurs.

Section V.L. outlines the requirements for parallel distribution systems. These are systems for which a diversion mechanism switches the flow of effluent between two absorption fields. Each of the absorption fields should have an area large enough to accept fifty percent of the design flow, and the diversion mechanism is to be turned annually. The diversion mechanism is a mechanical device that is turned by a person, and it is unrealistic to assume that it will be turned annually unless there is a mandatory maintenance requirement. In order to prevent failure caused by overloading one absorption field, these designs should be prohibited unless a maintenance schedule is enforced.

Section V.O. calls out the requirements for pre-treatment systems and requires that "The Registered Professional Engineer shall supply the adequate documentation to substantiate compliance with required effluent standards. When, in the opinion of the Health Official, the Department does not have sufficient information for evaluation of an application, the Health Official may require additional tests, including effluent sampling not to exceed five years." The pre-treatment system was designed and installed due to unsuitable soils or sensitive environmental conditions. Verification of the system's ability to perform as designed is important; therefore, required routine sampling throughout the life of the system should be considered.

Section V.P. provides the design requirements for constructed wetlands. Constructed wetlands are an appropriate alternative to mechanical systems in some cases; however, these systems do require maintenance. Depending on design, constructed wetlands can have pump systems, flow control structures and effluent filters. Additionally, the vegetation should be monitored and maintained, as it is part of the treatment process. Just as with mechanical systems, constructed wetlands are a pre-treatment process designed to treat wastewater to a high quality prior to discharge to an absorption field. As such, they should be regulated in a consistent manner with other pre-treatment units.

B. Regulatory Recommendations

The Clear Creek County Individual Sewage Disposal System (ISDS) Regulations provide prescriptive codes that are to be met in order for a system to be permitted. These codes consist of requirements such as set back distances, burial depths, pipe sizes and absorption field sizing criteria based on percolation tests. The prescriptive codes work under the assumption that suitable soil is available for treatment. In areas where suitable soil is not available, or where sensitive environmental conditions call for advanced treatment, regulations imposing effluent limits for contaminants of concern, in addition to the prescriptive codes, may be appropriate.

Regulations containing effluent limits address the quality of effluent leaving a treatment system prior to discharge to an absorption field.

If an advanced treatment system is installed, it was done so due to conditions calling for a higher quality effluent than septic tank effluent. Therefore, it is important that the system be monitored and maintained so as to meet these higher standards. If monitoring and maintenance is not done, the system that was originally designed to allow for development in a challenging or environmentally sensitive area could potentially result in a hydraulic failure or degradation of water quality. The frequency of monitoring that would be required for decentralized systems would vary based on size. For systems serving individual homes, the frequency of monitoring required would be less than for a cluster system serving multiple homes operating under a State Discharge Permit. Additional flexibility with respect to exceedances of effluent limits should be considered for systems serving individual homes.

It is recommended that additional framework as to when a given site will require conventional treatment or advanced treatment be built into the regulations. These locations requiring advanced treatment would be designated based upon the following types of criteria.

- Known groundwater contamination.
- High density of existing dischargers utilizing decentralized wastewater treatment systems.
- Areas of predicted future high density of decentralized wastewater treatment systems.

With above criteria combined with the existing regulations, the County will be better equipped to make decisions concerning the requirement of conventional or advanced treatment systems.

CHAPTER 4

WASTEWATER FLOW PROJECTIONS/TREATMENT FACILITY SUMMARIES

Wastewater flow and biosolids projections are integral to the evaluation of wastewater alternatives in Clear Creek County. The wastewater flow projection methodology and results, along with summaries on the impact to centralized facilities are presented in this chapter.

GROWTH PROJECTIONS

The base information used for projection of growth was provided by a report called the *Study Group Background Report*, which was prepared by DRCOG on November 10, 2005. The projections in this report were modified by the Clear Creek Planning Department based upon local knowledge. The projections are given for the years 2005, 2015 and 2030, and they are divided into the categories of "population", "employment" and "visitors." A thirty year planning period is used for this study; therefore, extrapolation to the year 2038 was necessary. It was assumed that growth would continue past 2030 at the established rate from 2015 to 2030. Table 4-1 summarizes the growth projections for each entity within the Study Area. The background data for these projections is found in Appendix D.

Table 4-1 – Growth Projections for Entities Within Study Area

Year		Clear Creek High School	CCCSD [(1)]	Town of Empire	Town of Georgetown/ Silver Plume	City of Idaho Springs/CCSD [(2)]	St. Mary's Water & Sanitation District
2005	Population	600	414	355	1,291	1,889	705
	Employment	50	150	46	343	732	1
	Visitors [(3)]	20	650	160	1,500	2,500	15
2015	Population	1,076	496	397	1,729	1,947	996
	Employment	90	338	89	1,059	1,007	10
	Visitors [(3)]	800	1,013	249	2,337	3,895	250
2030	Population	1,684	535	424	2,098	1,994	1,443
	Employment	100	479	94	1,177	1,074	20
	Visitors [(3)]	1,500	1,578	388	3,641	6,068	300
2038 [(4)]	Population	2,138	557	439	2,326	2,020	1,758
	Employment	106	577	97	1,245	1,112	29
	Visitors [(3)]	2,097	1,999	492	4,612	7,687	331

(1) CCCSD = Central Clear Creek Sanitation District.
(2) CCSD = Chicago Creek Sanitation District.
(3) Represents the average daily number of visitors present on any given day.
(4) Extrapolated figures based on projected growth rate.

WASTEWATER FLOW PROJECTIONS

Wastewater flow projections for each entity in the Study Area were calculated based on the growth projections. The individual terms in the growth projections (population, employment, visitors) were multiplied by "flow factors", which have units of gallons per capita per day (gpc/d) in order to calculate an average annual wastewater flow. The following raw flow factors were used:

- Population Raw Flow Factor: 77 gpc/d.
- Employment Raw Flow Factor: 45 gpc/d.
- Visitors Raw Flow Factor: 11 gpc/d.

These numbers are based on values provided by DRCOG and reflect raw wastewater flow with no contribution from infiltration and inflow (I/I). The base raw flow factors were adjusted to accommodate the unique population, business community, visitors and I/I conditions of each entity. The flow factor for Clear Creek High School is based on industry values used for schools. These adjusted flow factors are presented in Table 4-2 below.

Table 4-2 – Flow Factors For Clear Creek Entities

Entity	Flow Factor	Value (gpc/d)
Clear Creek High School	school population	13 [1]
Central Clear Creek Sanitation District	population	85
	employment	50
	visitors	12
Town of Empire	population	107
	employment	62
	visitors	15
Town of Georgetown	population	183
	employment	107
	visitors	26
City of Idaho Springs	population	99
	employment	58
	visitors	14
St. Mary's Water and Sanitation District	population	176
	employment	103
	visitors	25

(1) Represents gallons per day per student/staff.

Applying these factors to the growth projections gives an average annual wastewater flow. It is necessary to develop peaking factors to project peak month flow in each entity. The peaking factors are based on actual 2005 flow records for each entity (except Empire, which are based on 2006).

Most entities have progressive I/I programs, and so it was assumed that there would be a linear reduction of I/I down to half of the current estimated I/I value. This was done for each entity except for St. Mary's Glacier Water and Sanitation District because the facility is designed for handling high I/I.

The flow projections for Clear Creek High School were handled differently from the other entities within the Study Area. The growth projections are based on a DRCOG model. For this area, the model projects growth encompassing the high school plus the surrounding area. The surrounding area includes Floyd Hill, Beaver Brook and possibly part of the Saddleback Metropolitan District. These areas are currently served by decentralized facilities, and it is anticipated that this practice will continue into the future. The ultimate build out enrollment and staffing for the high school was obtained through communication with the school. The build out enrollment in conjunction with the "school population" flow factor presented in Table 4-2 above was used to project flow.

Table 4-3 summarizes the annual average flows, peak month flows and the percent of the hydraulic capacity of the existing wastewater treatment facility for each entity within the Study Area. The background data for these projections is found in Appendix E.

Table 4-3 – Flow Projections for Entities Within the Wastewater Study Area

Agency	Year	Annual Average (mgd)	Peak Month (mgd)	Percent of Capacity (%)
Clear Creek High School (0.024 mgd capacity)	2005	0.0011	0.0020	8%
	2038	0.0085	0.015	63%
Central Clear Creek Sanitation District (0.10 mgd capacity)	2005	0.042	0.047	47%
	2015	0.071	0.078	78%
	2030	0.088	0.097	97%
	2038	0.10	0.11	110%
Town of Empire (0.06 mgd capacity)	2005	0.043	0.052	86%
	2015	0.050	0.059	99%
	2030	0.051	0.061	102%
	2038	0.052	0.062	104%
Town of Georgetown (0.58 mgd capacity)	2005	0.31	0.50	86%
	2015	0.45	0.72	124%
	2030	0.47	0.76	130%
	2038	0.48	0.77	133%
City of Idaho Springs (0.60 mgd capacity)	2005	0.27	0.37	62%
	2015	0.30	0.41	69%
	2030	0.32	0.44	74%
	2038	0.33	0.46	77%
St. Mary's Water and Sanitation District (0.60 mgd capacity)	2005	0.12	0.25	42%
	2015	0.18	0.37	61%
	2030	0.26	0.53	88%
	2038	0.32	0.64	107%

TREATMENT FACILITY DESCRIPTIONS

The following is a summary of each facility in the Study Area. The term equivalent residential unit (EQR) is often used to evaluate the available hydraulic capacity of a facility or the projected flow from an anticipated development. For the purpose of this project, one EQR is equivalent to 300 gallons per day of wastewater flow. This value can be related to the peak month flow, which is the design criteria commonly used for hydraulic capacity. This is a conservative figure used for planning purposes.

A. Clear Creek High School

The Clear Creek High School wastewater treatment facility (WWTF) is a membrane bioreactor (MBR) plant, which came on-line February 1, 2004. The current process consists of equalization followed by the MBR and ultraviolet disinfection. The WWTF has a permitted hydraulic capacity of 0.024 mgd. The capacity of the WWTF can be easily doubled to 0.048 mgd. The ultimate build out flow of the high school is only 66% percent of the existing capacity. The reserve hydraulic capacity at build out at the Clear Creek High School WWTF is about 0.009 mgd with no expansion. By doubling the WWTF capacity, the reserve hydraulic capacity is about 0.033 mgd. This is equivalent to approximately 110 EQR, which could be used by surrounding commercial and residential development.

The Clear Creek High School WWTF was originally planned to be part of the Beaver Brook Sanitation District along with a nearby development. Plans for the development ceased, and the school district became the owner of the WWTF. The WWTF can serve only the high school unless ownership is transferred to a district or other governing body.

B. Central Clear Creek Sanitation District

The CCCSD provides wastewater treatment for the communities of Dumont, Downieville and Lawson. The existing wastewater treatment plant was placed online in January 1976. The original plant was a sequencing batch reactor. The plant was modified in 1992 to a conventional activated sludge facility with a hydraulic capacity of 0.10 mgd. The existing facility likely can be re-rated to 0.12 mgd. If re-rated, the facility would be able to treat the District's ultimate flows; however, the facility is master planned to easily double its capacity (0.20 mgd to 0.24 mgd) if necessary. Improvements to the facility in response to more stringent effluent limits may be required.

C. Town of Empire

The collection system and the original treatment plant for Empire were constructed in 1973. The original plant was an extended aeration system with a hydraulic capacity of 0.06 mgd. In 1996, aerobic digestion and phosphorus removal facilities were added. The improved flow scheme now includes extended aeration with clarification followed by tertiary treatment to remove phosphorus. The tertiary treatment consists of chemical addition, flocculation and clarification.

The current facilities may be adequate to meet ultimate flow projections. This depends on actual growth in the area, whether or not the service area expands, and continued I/I maintenance on the collection system. The Empire WWTF has the potential to easily double its capacity to 0.12 mgd; however, a replacement digester and phosphorus removal system would be required. Improvements to the facility in response to more stringent effluent limits may be required.

D. Town of Georgetown

The Georgetown WWTF serves the communities of Georgetown and Silver Plume. The facility has been in operation for about 40 years. The original plant was a 0.25 mgd package plant that did not consistently meet discharge permit requirements. The plant was modified in 1985 by improving the secondary treatment process and adding an external clarifier. This increased the plant hydraulic capacity to 0.58 mgd. The plant was modified again in 2005 with no change in the hydraulic capacity. The improvements included a new headworks facility and a new chlorination/dechlorination facility.

Based on the current projections, expansion of the existing facility within the next several years is anticipated. Currently, I/I is a significant issue, and the Town has incorporated an I/I reduction program. Georgetown continues to reduce I/I and will likely gain capacity as a result. There has been preliminary planning done to increase the hydraulic capacity to 0.72 mgd, which will be adequate to treat ultimate flows. Improvements to the facility in response to more stringent effluent limits may be required.

E. City of Idaho Springs

The Idaho Springs WWTF serves the City of Idaho Springs and the Chicago Creek Sanitation District (CCSD). The original plant was constructed in the 1980's as a dual basin sequencing batch reactor (SBR) with ultraviolet (UV) disinfection. The disinfection process was converted to chlorination/dechlorination in the early 1990's. A generator was installed in the late 1990's to provide backup power if necessary. The current plant has a permitted hydraulic capacity of 0.60 million gallons per day (mgd).

Based on current growth projections, the facility is adequate to treat ultimate wastewater flows. Improvements to the facility in response to more stringent effluent limits may be required.

F. St. Mary's Glacier Water and Sanitation District

The St. Mary's WWTF is an activated sludge facility, which was constructed in 2001. It replaced an aerated lagoon system. The WWTF is designed to handle large variations in hydraulic loads due to high I/I contribution in the spring. From mid-August through mid-May, the facility operates in extended aeration mode, and during high snow melt, the facility operates in contact stabilization mode.

Based on current projections, the existing facility may be able to treat the District's ultimate flows. This is dependant on actual growth in the area. There have been discussions concerning the construction of a winter ski resort, which would add substantial flow. Improvements to the facility in response to more stringent effluent limits may be required.

CHAPTER 5

TREATMENT REGIONALIZATION

In response to growth and change in the Clear Creek Watershed, improvements to centralized and some decentralized wastewater treatment facilities will be required. One alternative to individual improvements is treatment regionalization. Treatment regionalization can be cost effective and in some cases the most sustainable solution. In this chapter, wastewater treatment regionalization alternatives within the watershed are evaluated. Each alternative was preliminarily screened based on geographical and nominal cost feasibility. After screening, the viable alternatives were evaluated on the basis of cost and comparative matrices.

BASIS OF COSTS

The capital costs of each alternative were estimated with unit costs developed specifically for Clear Creek County. The unit costs are based on similar sized projects in similar regions. Table 5-1 summarizes the capital unit costs used for comparing alternatives.

Table 5-1 – Capital Cost Basis

Item	Description	Cost	Units
Sewer Line	8″ Outside Asphalt	$100	Linear Foot
	8″ Inside Asphalt	$130	Linear Foot
	10″ Outside Asphalt	$130	Linear Foot
	10″ Inside Asphalt	$150	Linear Foot
	12″ Outside Asphalt	$150	Linear Foot
	12″ Inside Asphalt	$170	Linear Foot
Force Main	3″ Inside Asphalt	$60	Linear Foot
	4″ Outside Asphalt	$60	Linear Foot
	6″ Outside Asphalt	$70	Linear Foot
	6″ Inside Asphalt	$90	Linear Foot
Mechanical Plant	Less Than 0.1 mgd	$10	Per Gallon/Day
	0.1 mgd to 1.0 mgd	$9	Per Gallon/Day
Decentralized Facility	Advanced Treatment	$35	Per Gallon/Day
Lift Station	0.01 mgd to 0.1 mgd	$5	Per Gallon/Day
	Less Than 0.01 mgd	$7	Per Gallon/Day

* All costs given in 2007 dollars.

The capital costs for some of the alternatives are also based on tap fees where inclusion into an existing district or town is being considered. Tap fees for each entity are calculated on an equivalent residential unit (EQR) basis. One EQR is estimated at an equivalent of 300 gpd.

Depending on the magnitude of the capital cost difference, operational and maintenance (O&M) costs or a life cycle analysis was also employed. Life cycle analyses were conducted over a 30-year life cycle. In general, a capital cost difference exceeding $1.0 million did not warrant further life cycle analysis.

The life cycle analysis includes capital cost plus the net present value of ongoing O&M costs. The planning period used for the analysis is thirty years at a discount rate of 4.875% (Natural Resources Conservation Service – 2007). Table 5-2 outlines the O&M unit costs used for comparing alternatives.

Table 5-2 – O&M Cost Basis

Item	Description	Cost	Units
Centralized Facility	User Fees (annual)	Varies by Entity	Per EQR
Decentralized Facility	Inspection (annual) (1)	$130	Per EQR
	Maintenance Contract (annual) (2)	$95	Per EQR
	Sampling (annual) (3)	$240	Per EQR
	Tank Pumping (every five years) (4)	$350	Per EQR

(1) Based on one inspection annually checking sludge/scum levels as well as major components.
(2) Based on two visits annually by a third party service provider to conduct routine maintenance.
(3) Based on field sample collection as well as lab analysis two times annually.
(4) Approximate rate based on a 1,500 gallon septic tank.

Costs for centralized facilities are based on user costs for customers within the wastewater service areas. The costs for decentralized facilities are based on literature values on user costs from districts that manage decentralized wastewater treatment systems. The background data for all life cycle evaluations is found in Appendix F.

SCREENED ENTITIES

As described previously, there are ten entities in the Clear Creek Watershed with State permitted treatment facilities. Of these ten, the following six were screened from further evaluation based on geographical, economical and political infeasibility:

- Clear Creek High School.
- Shwayder Camp.
- St. Mary's Glacier Water and Sanitation District.
- Henderson Mine.
- CDOT Eisenhower Tunnel.
- Clear Creek Ski Corporation.

Shwayder Camp, St. Mary's Glacier, Henderson Mine and Clear Creek High School are so isolated geographically that the cost of regionalization is infeasible.

It should be noted that some stakeholders have indicated that there may be interest in increasing the water quality of Fall River. St. Mary's Glacier WWTF discharges to Silver Creek, which is tributary to Fall River. Idaho Springs could serve St. Mary's Glacier by extending a gravity sewer about 8 miles at a cost exceeding $7.0 million, not including tap fees or plant expansion costs.

Eisenhower Tunnel and Clear Creek Ski Corporation are in close proximity, making regionalization more feasible. Regionalization between these two entities has been evaluated previously and was not pursued due to the political concerns of having agreements between a state government, CDOT, and a private entity, Clear Creek Ski Corporation.

VIABLE ENTITIES

Of the ten Major wastewater treatment facilities, three are considered viable alternatives for regionalization. In addition, five current and proposed decentralized sites are also considered viable candidates for regionalization. Viability was based solely on geographic and cost feasibility. The following entities were evaluated. See Appendix A base mapping for general proximity and details of the comparison.

- Town of Georgetown.
- Town of Empire.
- City of Idaho Springs.
- Easter Seals Rocky Mountain Village.
- Empire Junction.
- Arapaho Mobile Home Park Area.
- Shadows Ranch.
- Silver Valley Ranch.

Budgetary capital costs and in some cases life cycle O&M costs were used to compare alternatives. Decision matrices were developed for each entity with criteria based on past experience and input from the project stakeholders. Each entity is given a rank for a specific alternative, and each criteria is given a weighing factor. The rank is multiplied by the weighting factor to give a score. The highest score indicates preference toward a specific alternative. The following details the evaluation of the eight viable entities.

A. Town of Georgetown

The Georgetown WWTF is about 85% loaded and in some disrepair. Recent work has improved the headworks and disinfection facilities, but major upgrades to the main aerobic processes are needed. The Town has two viable treatment alternatives.

- Alternative 1 – Regionalize with the CCCSD.
- Alternative 2 – Improve/expand the current facility.

The construction costs for Alternative 2 have been estimated by the Town's consulting engineer in their report detailing the expansion for a 0.72 mgd facility (*Wastewater Treatment Plant Improvements Utility Compliance Plan, 2003*). This upgrade has been estimated at $2.0 - $3.0 million. A figure of $4.0 million was used as a conservative estimate, including tertiary treatment units, for comparative purposes.

The CCCSD WWTF is master planned for expansion to a 0.20 mgd facility. If Georgetown were to regionalize with CCCSD, an approximate 1.0 mgd facility would need to be constructed. In addition, about 5.5 miles of sewer would need to be installed interconnecting the facilities. Table 5-3 outlines the estimated capital costs for each alternative.

Table 5-3 – Budgeting Capital Costs for Georgetown Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the CCCSD	12" Sewer Line Along Alvarado Road	19,000 ft	$3,230,000
	12" New CCCSD Infrastructure	10,000 ft	$1,700,000
	New Mechanical Plant at CCCSD site	1.0 million gallons	$9,000,000
			Total = $13,930,000
Alternative 2 – Improve/Expand the Current Facility	Facility Expansion/Improvement	0.58 mgd to 0.72 mgd (1)	**Total = $4,000,000**

(1) Expansion size proposed by the Town's consulting engineer.

Table 5-4 summarizes the comparative matrix of the two alternatives, and the alternatives are depicted on Figure 5-1.

Table 5-4 – Wastewater Treatment Comparative Matrix – Town of Georgetown

Criteria	Weighting Factor (1)	Alternative 1 – Regionalize With the CCCSD		Alternative 2 – Improve/Expand the Current Facility	
		Rank (2)	Score (3)	Rank (2)	Score (3)
Capital Costs	10	6	60	9	90
Operation & Maintenance Costs	9	8	72	7	63
Institutional/Administrative Impacts	8	7	56	9	72
Ability to Meet Future Effluent Limits	9	9	81	8	72
Improved Water Quality	9	9	81	8	72
Ability to Serve Future Development	8	8	64	7	56
Central Clear Creek Sanitation District Infrastructure Impacts	8	6	48	10	80
Environmental Impacts	7	7	49	7	49
Water Rights Impacts	7	8	56	10	70
Public Health Impacts	8	7	56	7	56
Ease of Project Implementation	7	7	49	10	70
Total Score		**672**		**750**	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

As indicated by the budgetary capital costs and the comparative matrix, regionalization is undesirable for the Town of Georgetown. The significant distance between the Georgetown WWTF and the CCCSD WWTF, and the extremely high infrastructure costs of regionalization make the alternative of improving the current facility most feasible.

B. Town of Empire

The Town of Empire WWTF is about 85% loaded. In recent years, growth has been limited, but the growth potential is high. Most likely within the next five years, an expansion to the facility will be required. There are two viable options for the Town of Empire.

- Regionalize with the CCCSD.
- Expand the existing facility when needed.

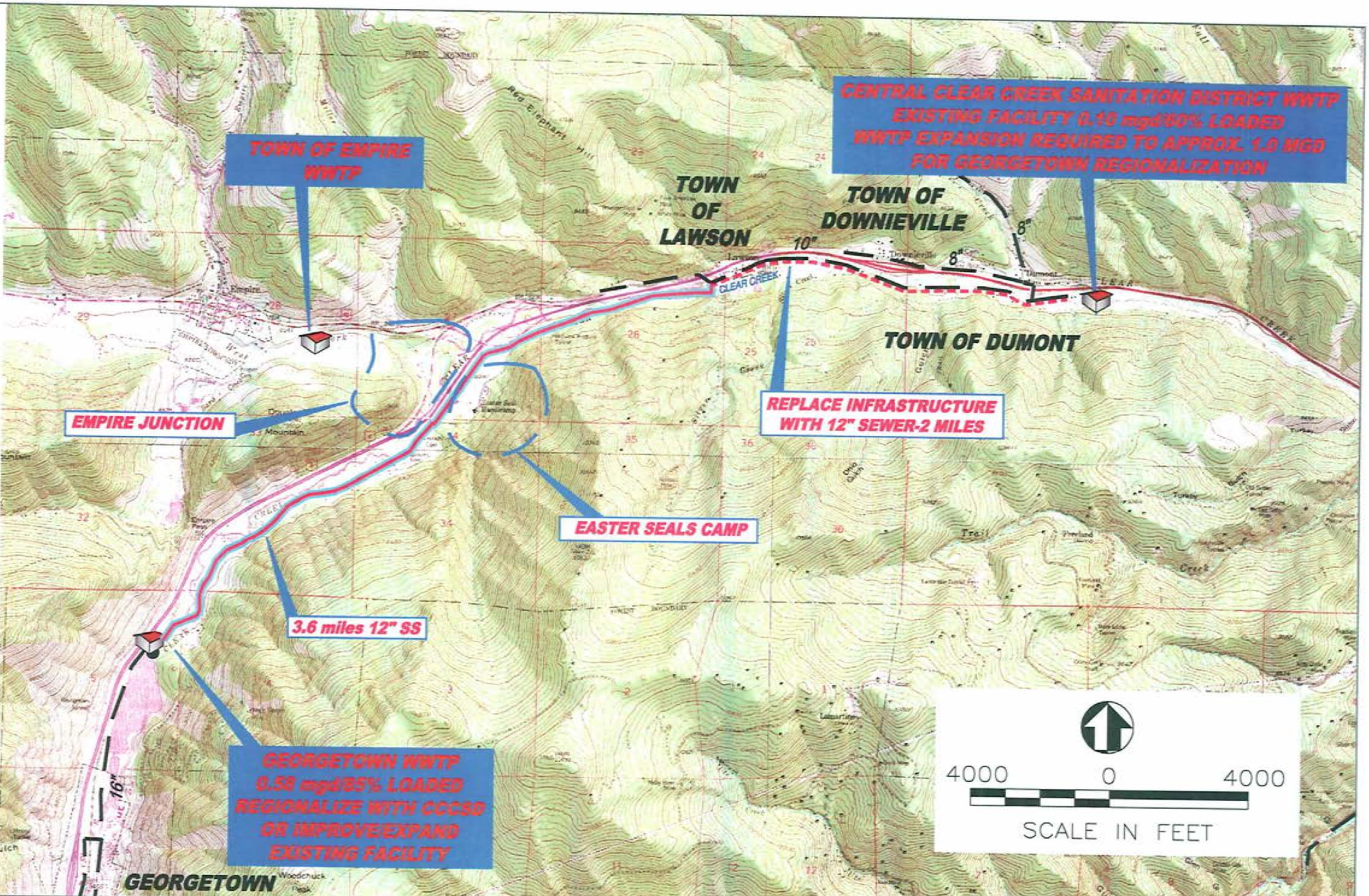

FIGURE 5-1

COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
TOWN OF GEORGETOWN WASTEWATER TREATMENT ALTERNATIVES

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The existing facility can be easily doubled in capacity to 0.12 mgd. The existing digester and phosphorus removal clarifier can be converted to an extended aeration treatment train; however, a new sludge digester and tertiary treatment would be required as replacements.

The CCCSD WWTF is master planned for expansion to a 0.20 mgd facility. If Empire were to regionalize with CCCSD, the combined flow is in the capacity range of the facility. About 1.5 miles of 10″ sanitary sewer would need to be installed along the frontage road. Table 5-5 outlines the budgeting capital costs associated with each alternative.

Table 5-5 – Budgeting Capital Costs for Empire Wastewater Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the CCCSD	10″ Sewer Line Along Frontage Rd.	8,000 ft	$1,200,000
	WWTF Expansion to 0.20 mgd	0.10 mgd addition	$900,000
			Total = $2,100,000
Alternative 2 – Expand the Existing Facility When Needed	Double Empire WWTF Capacity – 0.06 mgd to 0.12 mgd	Addition of 0.06 mgd	**Total = $800,000** (1)

(1) Cost higher due to added complexity of phosphorus removal unit process.

Table 5-6 shows the comparative matrix of the two alternatives, and a map showing both alternatives is presented on Figure 5-2.

Table 5-6 – Wastewater Treatment Comparative Matrix – Town of Empire

Criteria	Weighting Factor (1)	Alternative 1 – Regionalize With the CCCSD		Alternative 2 – Expand the Existing Facility When Needed	
		Rank (2)	Score (3)	Rank (2)	Score (3)
Capital Costs	10	8	80	10	100
Operation & Maintenance Costs	9	9	81	8	72
Institutional/Administrative Impacts	8	7	56	9	72
Ability to Meet Future Effluent Limits	9	9	81	8	72
Improved Water Quality	9	9	81	8	72
Ability to Serve Future Development	8	9	72	8	64
Central Clear Creek Sanitation District Infrastructure Impacts	8	8	64	9	72
Environmental Impacts	8	7	56	9	72
Water Rights Impacts	9	7	63	9	81
Public Health Impacts	8	8	64	8	64
Ease of Project Implementation	8	7	56	9	72
Total Score		**754**		**813**	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

The cost of regionalization is more than $1.0 million higher than expanding the existing facility. As indicated by the score of the comparative matrix and the substantial cost difference, Alternative 2, expansion of the existing facility, is the favorable option for the Town of Empire.

C. City of Idaho Springs

The City of Idaho Springs WWTF has adequate capacity to treat ultimate wastewater flows. Future treatment improvements will be limited to the enhancement of treatment quality. Gravity sewer extensions can accommodate most of the proposed development. However, the City did annex the Hidden Valley area, which is down gradient, past the Twin Tunnels. It is estimated that the Hidden Valley Area could total about 200 EQR, or 60,000 gpd. There are essentially two alternatives for serving the Hidden Valley Area.

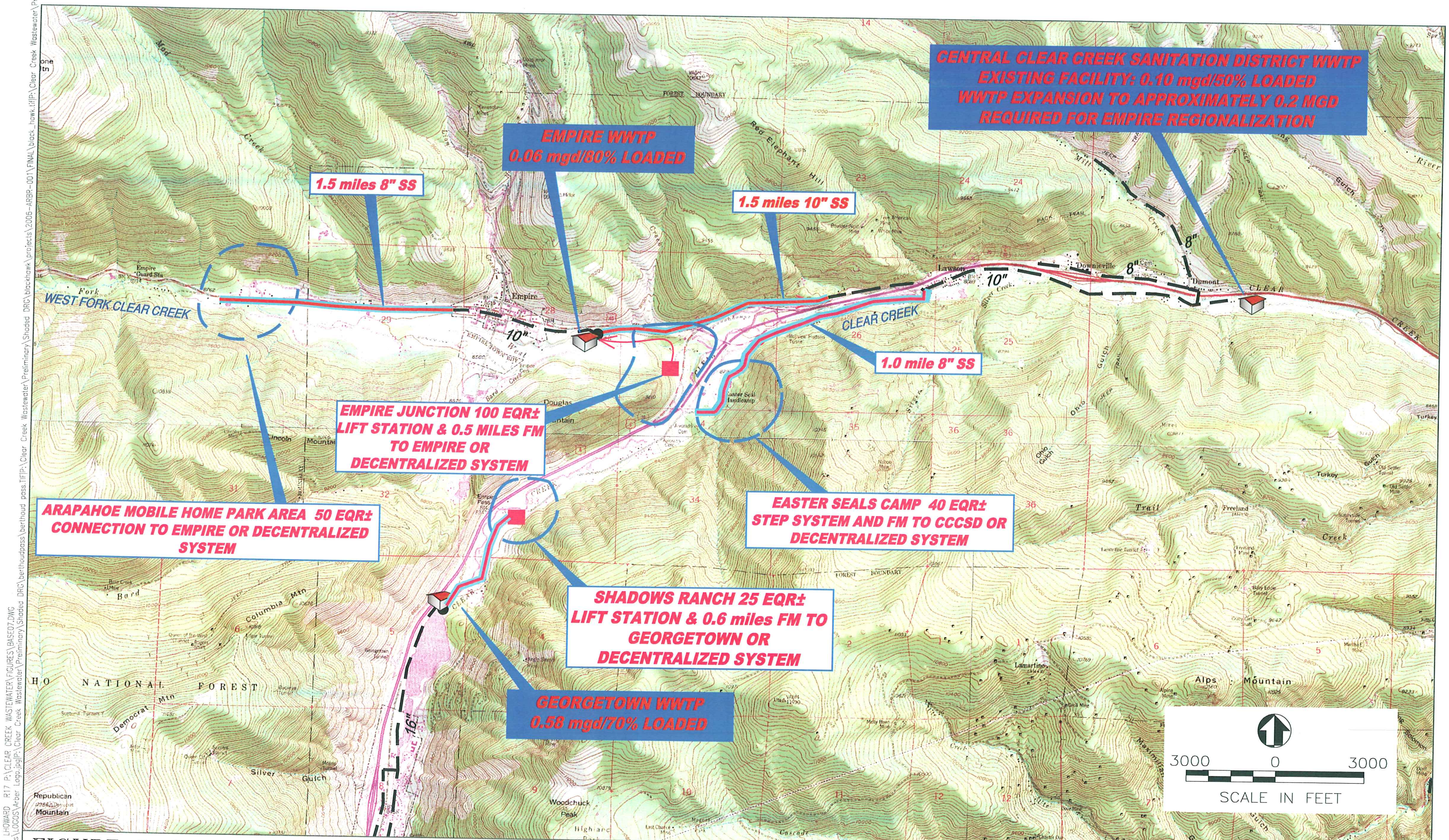

FIGURE 5-2

COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
CENTRAL CLEAR CREEK AREA WASTEWATER TREATMENT ALTERNATIVES

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- Alternative 1 – Lift station and force main to WWTF.
- Alternative 2 – New WWTF downstream at the Hidden Valley Area.

In Alternative 1, the lift station would be constructed at Hidden Valley, and the force main would be aligned in the frontage road with a discharge at the Idaho Springs WWTF. The lift station would be sized to accommodate the potential development down gradient of the WWTF.

Alternative 2 would essentially move the current treatment operation down to the Hidden Valley Area. The new facility would be sized for the ultimate flows of the City and total about 0.7 mgd. Table 5-7 outlines the budgeting capital costs associated with both alternatives.

Table 5-7 – Budgeting Capital Costs for Idaho Springs Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Lift Station and Force Main to WWTF	Lift Station	60,000 gpd	$300,000
	6″ Force Main Along Frontage Road	6,000 ft	$540,000
			Total = $840,000
Alternative 2 – New WWTF at the Hidden Valley Area	New Mechanical Plant	0.7 mgd	$6,300,000
	12″ Sewer Line Along Frontage Road	6,000 ft	$1,020,000
			Total = $7,320,000

Because of the large cost difference between alternatives, a comparative matrix was not prepared. As shown, the cost of a new facility is over eight times greater that the lift station alternative. Other costs, such as decommissioning, have not been included, making the cost difference even greater. The Hidden Valley Area is best served with a lift station and force main. The lift station alternative is shown on the map presented on Figure 5-3.

D. Easter Seals Rocky Mountain Village

The Rocky Mountain Village Easter Seals Camp is served with five conventional decentralized wastewater systems. According to CDPHE's interpretation of Policy 6: (Multiple Individual Sewage Disposal Systems) the horizontal influence zones of the systems overlap, resulting in wastewater flows exceeding 2,000 gpd. CDPHE permitting is required for all facilities exceeding 2,000 gpd; and therefore, a permitted facility will be needed for service. The estimated maximum flow for the system is about 12,000 gpd. The Camp has been given a compliance schedule to implement the needed improvements. Easter Seals has essentially the following two options:

- Regionalize with the CCCSD.
- Decentralized facility.

The existing systems are separated; therefore, infrastructure improvements bringing the flows together would be necessary for both alternatives.

For regionalization with the CCCSD, about one mile of 8″ sanitary sewer would also be required along Alvarado Road. The CCCSD tap fees are $7,500 per EQR. Table 5-8 outlines the estimated capital costs associated with both alternatives.

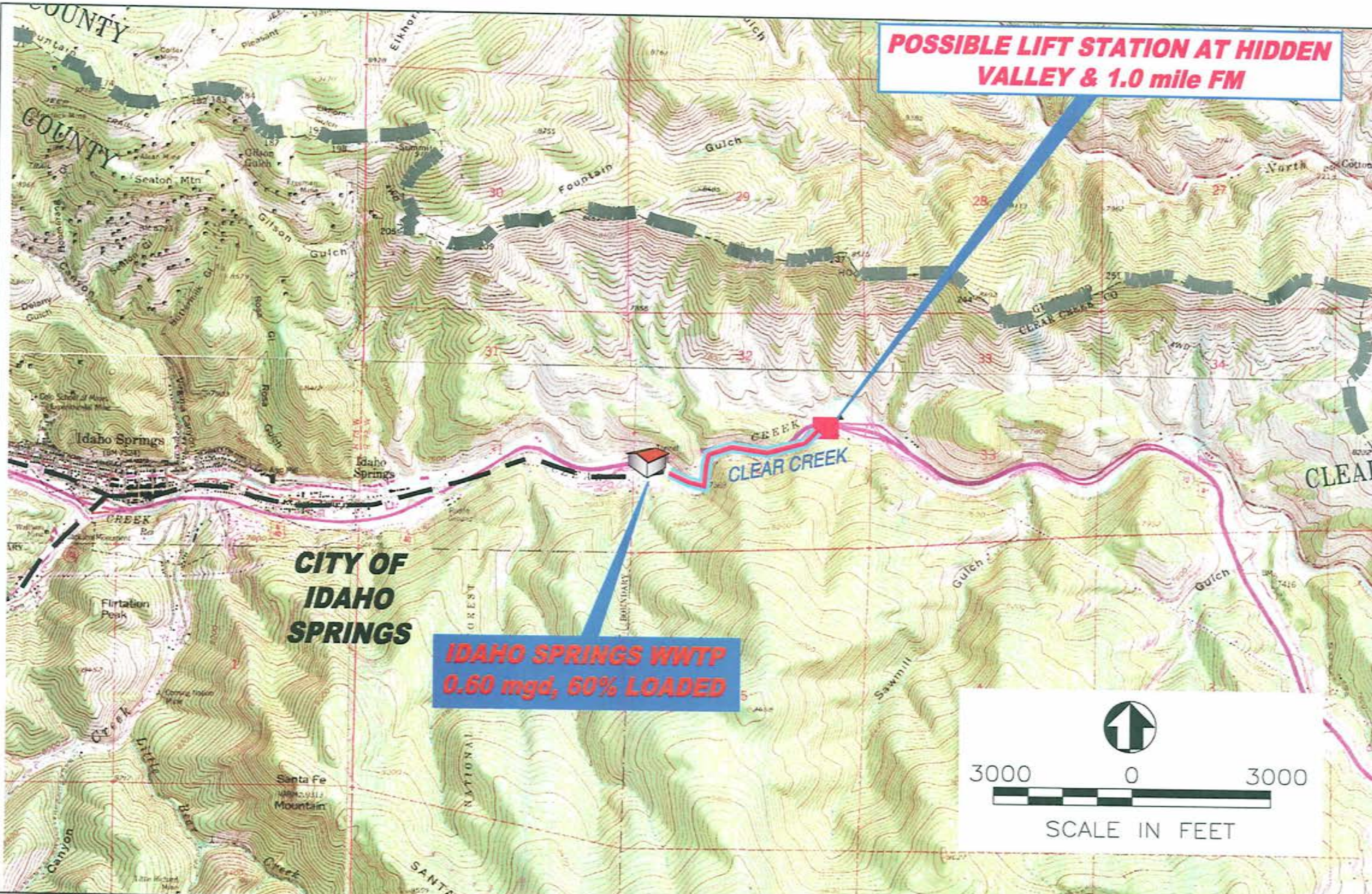

FIGURE 5-3

CLEAR CREEK COUNTY WASTEWATER PROJECT
CITY OF IDAHO SPRINGS WASTEWATER TREATMENT ALTERNATIVES

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Table 5-8 – Budgeting Capital Costs for Easter Seals Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the CCCSD	8″ Sewer Line Along Alvarado Road	5,000 ft	$1,100,000 [(1)]
	Conveyance on Easter Seals Property	N/A	$250,000 [(2)]
	Tap Fees	40 EQR	$300,000
			Total = $1,650,000
Alternative 2 – Decentralized Facility	Decentralized Facility	12,000 gpd	$420,000
	Bring Flows Together	N/A	$200,000 [(3)]
			Total = $620,000

(1) Based on preliminary analysis prepared for Easter Seals.
(2) Miscellaneous piping to bring five separate systems together plus conveyance to edge of property.
(3) Miscellaneous piping to bring five separate systems together.

The construction costs in Table 5-8 are divided into those on Easter Seals property and those along Alvarado Road for the purpose of a more detailed analysis. Clear Creek County has property ownership and vested land interest along Alvarado Road and has indicated a desire to assist with funding the sewer extension. The County and Easter Seals are currently reviewing funding options for the sewer along Alvarado Road. A life cycle analysis was prepared both including and excluding the sewer along Alvarado Road with the assumption that Easter Seals would be responsible for the sewer on the camp property only. The results are outlined in Table 5-9. User fees for the CCCSD are $375 per EQR.

Table 5-9 – Life Cycle Costs for Easter Seals Wastewater Treatment Alternatives

Regionalize with the CCCSD	
Capital Costs	$1,650,000
Capital Cost (without Alvarado Road) [(1)]	$550,000
Present Value – O&M – 30 years	$249,000
Total =	**$1,899,000**
Total (without Alvarado) =	**$799,000**
Decentralized Facility	
Capital Costs	$620,000
Present Value – O&M – 30 years	$350,000
Total =	**$970,000**

(1) Alvarado Road sewer potentially funded by Clear Creek County.

Table 5-10 summarizes the comparative matrix for Easter Seals. The alternatives are depicted on Figure 5-2.

Table 5-10 – Wastewater Treatment Comparative Matrix – Easter Seals

Criteria	Weighting Factor (1)	Alternative 1 – Regionalize With the CCCSD		Alternative 2 – Decentralized Facility	
		Rank (2)	Score (3)	Rank (2)	Score (3)
Capital Costs	10	9	90	8	80
Operation & Maintenance Costs	9	9	81	7	63
Institutional/Administrative Impacts	8	7	56	8	64
Management of Discharge Water Quality	9	9	81	7	63
Ability to Serve Future Development	7	9	63	7	49
CCCSD Infrastructure Impacts	8	7	56	9	72
Environmental Impacts	8	8	64	7	56
Water Rights Impacts	7	7	49	7	49
Public Health Impacts	8	8	64	7	56
Ease of Project Implementation	8	8	64	8	64
Total Score		**668**		**616**	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

The comparative matrix is a reflection of ongoing talks between Clear Creek County, the CCCSD and Easter Seals as well as the ability of the County to finance the portion of the sewer along Alvarado Road. Preliminary discussions between the three entities have indicated a desire for cooperation with the goal of regionalization. Easter Seals has indicated desire to regionalize with the CCCSD if financially feasible.

E. Empire Junction

Currently, Empire Junction consists of several mobile homes. This area is served by multiple conventional decentralized wastewater treatment systems which are old and in need of replacement. The development potential in this area is high and could include a hotel, restaurant and possibly a museum. The *Clear Creek Master Plan 2030* has identified the area as "mixed use", which could result in the area being rezoned for more commercial/retail and residential development. Additionally, CDOT may be planning to move the truck weigh station in Dumont to Empire Junction, which could have an effect on the manner in which the area is developed. The future wastewater flow has been estimated at about 100 EQR, or about 30,000 gpd. There are two alternatives for serving Empire Junction.

- Regionalize with the Town of Empire.
- Decentralized facility (cluster system).

The Town of Empire tap fees are $5,000 per EQR. Expansion of the facility would be required. As indicated previously, the facility can be easily doubled to 0.12 mgd. In order to regionalize with the Town of Empire, a lift station along with about 0.5 miles of force main would be needed. Table 5-11 outlines the estimated capital costs associated with both alternatives.

Table 5-11 – Budgeting Capital Costs for Empire Junction Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the Town of Empire	Lift Station	30,000 gpd	$150,000
	4" Force Main	2,000 ft	$120,000
	Tap Fees	100 EQR	$500,000
			Total = $770,000
Alternative 2 – Decentralized Facility	Decentralized Facility	30,000 gpd	**Total = $1,050,000**

The costs of the alternatives are similar; therefore, a life cycle evaluation was also prepared. The Town of Empire annual user fees are $300 per EQR. Table 5-12 outlines the results from the life cycle evaluation, and Table 5-13 summarizes the comparative matrix. The alternatives are shown on Figure 5-2.

Table 5-12 – Life Cycle Costs for Empire Junction Wastewater Treatment Alternatives

Regionalize with the Town of Empire	
Capital Costs	$770,000
Present Value – O&M – 30 years	$498,000
Total =	**$1,268,000**
Decentralized Facility	
Capital Costs	$1,050,000
Present Value – O&M – 30 years	$875,000
Total =	**$1,925,000**

Table 5-13 – Wastewater Treatment Comparative Matrix – Empire Junction

Criteria	Weighting Factor (1)	Alternative 1 – Regionalize with the Town of Empire		Alternative 2 – Decentralized Facility	
		Rank (2)	Score (3)	Rank (2)	Score (3)
Capital Costs	10	10	100	9	90
Operation & Maintenance Costs	9	9	81	8	72
Institutional/Administrative Impacts	8	7	56	8	64
Management of Discharge Water Quality	9	9	81	8	72
Empire Infrastructure Impacts	8	7	56	8	64
Ability to Serve Future Development	7	9	63	7	49
Environmental Impacts	8	7	56	8	64
Water Rights Impacts	7	7	49	7	49
Public Health Impacts	8	8	64	7	56
Ease of Project Implementation	8	7	56	8	64
Total Score		662		644	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

Based on the comparative matrix and cost estimates, regionalizing with the Town of Empire is the most desirable alternative. It is recommended that at the time of development, when more is known about land uses, a more detailed analysis be completed so as to verify this conclusion.

F. Arapaho Mobile Home Park Area

Arapaho Mobile Home Park Area is located about 1.5 miles west of Empire and consists of several residences, the Arapaho Mobile Home Park, the Rock Meadow Trailer Park and a restaurant. Currently, this area is served by conventional decentralized wastewater treatment systems. There is also a package plant serving some of the units in the area which discharges to absorption fields. The size of the area is estimated at about 50 EQR, or 15,000 gpd. There are two alternatives for serving the Arapaho Mobile Home Park Area.

- Regionalize with the Town of Empire.
- Decentralized facility (cluster system).

Regionalizing with the Town of Empire would require construction of about 1.5 miles of 8″ sanitary sewer. Tap fees for the Town of Empire are $5,000 per EQR, and annual user fees are $300/EQR. Table 5-14 outlines the estimated capital costs and Table 5-15 summarizes the life cycle evaluation.

Table 5-14 – Budgeting Capital Costs for Arapaho Mobile Home Park Area Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the Town of Empire	8″ Sewer Line	8,000 ft	$800,000
	Tap Fees	50 EQR	$250,000
			Total = $1,050,000
Alternative 2 – Decentralized Facility	Decentralized Facility	15,000 gpd	$525,000
	Interconnection Between Systems	N/A	$200,000 [1]
			Total = $725,000

[1] Infrastructure to interconnect systems would be required as each system is currently individually plumbed.

Table 5-15 – Life Cycle Costs for Arapaho Mobile Home Park Area Wastewater Treatment Alternatives

Regionalize with the Town of Empire	
Capital Costs	$1,050,000
Present Value – O&M – 30 years	$249,000
Total =	**$1,299,000**
Decentralized Facility	
Capital Costs	$725,000
Present Value – O&M – 30 years	$438,000
Total =	**$1,163,000**

Table 5-16 summarizes the comparative matrix. The alternatives are depicted on Figure 5-2.

Table 5-16 – Wastewater Treatment Alternative Comparative Matrix Arapaho Mobile Home Park Area

Criteria	Weighting Factor [(1)]	Alternative 1 – Regionalize with the Town of Empire		Alternative 2 – Decentralized Facility	
		Rank [(2)]	Score [(3)]	Rank [(2)]	Score [(3)]
Capital Costs	10	8	80	10	100
Operation & Maintenance Costs	9	9	81	8	72
Institutional/Administrative Impacts	8	7	56	8	64
Management of Discharge Water Quality	9	8	72	7	63
Empire Infrastructure Impacts	8	7	56	8	64
Ability to Serve Future Development	7	9	63	7	49
Environmental Impacts	8	7	56	8	64
Water Rights Impacts	7	7	49	7	49
Public Health Impacts	8	9	72	7	56
Ease of Project Implementation	8	7	56	9	72
Total Score		**641**		**653**	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

As indicated by the comparative matrix and life cycle cost analysis, the alternatives are similar. The higher capital costs for regionalization could be offset with additional development interest along the proposed sewer route adjacent to Highway 40.

G. Shadows Ranch

Shadows Ranch is located about 0.6 miles to the north east of the Georgetown WWTF, situated between Interstate 70 and Alvarado Road. The Ranch is an event type facility serving weddings and other gatherings. The facility is currently served by a conventional decentralized wastewater treatment system. The Ranch is in the process of improving the system with the addition of wetlands advanced treatment. In addition, there is potential for portions of the Ranch to be dedicated to decentralized treatment research in cooperation with the Colorado School of Mines Rocky Mountain Onsite and Small Flows Program. The size of Shadows Ranch is estimated at about 25 EQR, or 7,500 gpd. There are two alternatives for serving the area.

- Regionalize with the Town of Georgetown.
- Continue decentralized wastewater treatment.

It should be noted that Shadows Ranch is proceeding with improvements to their existing facilities adding wetlands tertiary treatment.

Regionalizing with the Town of Georgetown would require a lift station and about 0.5 miles of 3" force main along Alvarado Road. Tap fees for the Town of Georgetown WWTF are $8,000 per EQR for properties outside Town limits. Table 5-17 outlines the estimated capital costs associated with each alternative.

Table 5-17 – Budgeting Capital Costs for Shadows Ranch Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the Town of Georgetown	Lift Station	7,500 gpd	$100,000 (1)
	3" Force Main Along Alvarado Road	3,000 ft	$180,000
	Tap Fees	25 EQR	$200,000
			Total = $480,000
Alternative 2 – Continue Decentralized Wastewater Treatment	Wetlands Upgrade	7,500 gpd	**Total = $200,000** (2)

(1) Cost adjusted according to knowledge of similar sized lift stations.
(2) Cost lower for wetlands compared to other advanced treatment systems.

The cost of maintaining the current decentralized treatment practice is less than half of regionalization. However, because of the small magnitude of the costs, a life cycle evaluation was also completed. Shadows Ranch has plans to construct and operate constructed wetlands for advanced treatment, which would have lower maintenance costs than a typical advanced treatment system. Therefore, the annual maintenance costs were assumed to be $200 per EQR. Table 5-18 outlines the results of the life cycle evaluation.

Table 5-18 – Life Cycle Costs for Shadows Ranch Wastewater Treatment Alternatives

Regionalize with the Town of Georgetown	
Capital Costs	$480,000
Present Value – O&M – 30 years	$145,000
Total =	**$625,000**
Continue Decentralized Wastewater Treatment	
Capital Costs	$200,000
Present Value – O&M – 30 years	$202,000
Total =	**$402,000**

The life cycle evaluation shows that utilizing the decentralized facilities is the most desirable alternative. Table 5-19 summarizes the comparative matrix. Figure 5-2 shows a map with the two alternatives.

Table 5-19 – Wastewater Treatment Comparative Matrix – Shadows Ranch

Criteria	Weighting Factor (1)	Alternative 1 – Regionalize with the Town of Georgetown		Alternative 2 – Continue Decentralized Facilities	
		Rank (2)	Score (3)	Rank (2)	Score (3)
Capital Costs	10	8	80	9	90
Operation & Maintenance Costs	9	9	81	8	72
Institutional/Administrative Impacts	8	7	56	9	72
Management of Discharge Water Quality	9	8	72	8	72
Ability to Serve Future Development	7	9	63	8	56
Georgetown Infrastructure Impacts	8	8	64	9	72
Environmental Impacts	8	7	56	8	64
Water Rights Impacts	7	7	49	8	56
Public Health Impacts	8	7	56	7	56
Ease of Project Implementation	8	7	56	9	72
Total Score		633		682	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

As indicated by the lower costs and the comparative matrix, the continued use of decentralized facilities is warranted. Shadows Ranch has been an exemplary model of quality design and operations, and this evaluation indicated that this practice should continue.

H. Silver Valley Ranch

Silver Valley Ranch is located about two miles west of Silver Plume along Interstate 70. The potential development area encompasses about fifty acres and is estimated at about 25 EQR, or 7,500 gpd. There are two options for serving the area.

- Regionalize with Georgetown/Silver Plume.
- Decentralized facility.

Regionalizing with the Town of Georgetown would require about two miles of 8″ sanitary sewer along the Interstate 70 frontage road. The Town of Georgetown tap fees are $8,000 per EQR for properties outside Town limits. Table 5-20 outlines the estimated capital costs associated with both alternatives.

Table 5-20 – Budgeting Capital Costs for Silver Valley Ranch Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with Georgetown/Silver Plume	8″ Sewer Line Along Frontage Road	11,000 ft	$1,430,000
	Tap Fees [1]	25 EQR	$200,000
			Total = $1,630,000
Alternative 2 – Decentralized Facility	Decentralized Facility	7,500 gallons	**Total = $263,000**

[1] Actual tap fee price including a Silver Plume fee for connection to the infrastructure (would need to be negotiated).

The cost of regionalization is more than six times the cost of a decentralized facility. Table 5-21 summarizes the comparative matrix. Figure 5-4 shows a map with the two alternatives.

Table 5-21 – Wastewater Treatment Alternative Comparative Matrix – Silver Valley Ranch

Criteria	Weighting Factor (1)	Alternative 1 – Regionalize With Georgetown/Silver Plume		Alternative 2 – Decentralized Facility	
		Rank (2)	Score (3)	Rank (2)	Score (3)
Capital Costs	10	6	60	10	100
Operation & Maintenance Costs	9	8	72	9	81
Institutional/Administrative Impacts	8	7	56	7	56
Management of Discharge Water Quality	9	8	72	7	63
Impact to Silver Plume Water Supply	10	9	90	6	60
Georgetown/Silver Plume Infrastructure Impacts	7	10	70	8	56
Ability to Serve Future Development	8	9	72	8	64
Environmental Impacts	8	8	64	9	72
Water Rights Impacts	7	7	49	8	56
Public Health Impacts	8	7	56	7	56
Ease of Project Implementation	8	7	56	8	64
Total Score		717		728	

(1) Weighting Factor, on a scale of 10 (most important) through 1 (least important).
(2) Rank, on a scale of 10 (best) through 1 (worst).
(3) Score = Weighting Factor X Rank.

Based on costs and the comparative matrix, the use of decentralized wastewater treatment is the more desirable alternative at Silver Valley Ranch. The largest factor is the cost of regionalization. The only circumstance that would make regionalization viable is substantial growth along the sewer route between Silver Valley Ranch and Silver Plume. If decentralized treatment is utilized at Silver Valley Ranch, consideration should be made to protect the Silver Plume water supply intake from being impacted by wastewater effluent, which is located downstream of Silver Valley Ranch.

UPPER CLEAR CREEK REGIONAL FACILITY

One of the key elements of the Countywide Wastewater Utility Plan Project is the evaluation of regionalized treatment. As detailed in this chapter, the current CCCSD WWTF site has been the focus for regionalization in the Upper Clear Creek Watershed. The CCCSD site is centrally located downstream of the Town of Georgetown/Silver Plume, Town of Empire, Easter Seals, Shadows Ranch, and Empire Junction. Except for Georgetown and Shadows Ranch, these entities are in close proximity (1.0 to 1.5 miles) of the CCCSD sewer system. An interconnecting sewer for Georgetown would extend over 3 miles. As depicted in this chapter, regionalization costs are high especially for the Town of Georgetown; however, costs can be reduced with a cooperative effort from all entities. The capital costs of a combined regionalization effort are summarized in Table 5-22. The following has been assumed:

- CCCSD would contribute land for a new mechanical plant and would not pay capital costs for construction.
- Based on combined flow, the new mechanical plant capacity is estimated at 1.2 mgd.
- Utilize $8/gallon for plant costs for a total of $9,600,000.
- Clear Creek County contributes to the project at an estimate of 40 EQR. The County has control of land along Alvarado Road from Easter Seals to CCCSD.

Table 5-22 – Upper Clear Creek Regional Facility Costs

Entity	Ultimate Projected EQR	Treatment Facility Cost	Infrastructure Cost	Total Cost
Georgetown/Silver Plume	2,567	$8,300,000	$3,600,000 (1)	$11,900,000
Empire	207	$700,000	$1,200,000 (2)	$1,900,000
Shadows Ranch	25	$80,000	$100,000 (3)	$180,000
Easter Seals	40	$120,000	$250,000 (3)	$370,000
Empire Junction	100	$300,000	$200,000 (4)	$500,000
Clear Creek County	40	$100,000	$1,100,000 (5)	$1,200,000
Total	**2,979**	**$9,600,000 (6)**	**$6,450,000**	**$16,050,000**

(1) 12″ sewer from Georgetown to Easter Seals and new 12″ sewer within CCCSD.
(2) 10″ sewer from the Empire to the CCCSD collection system.
(3) Onsite costs to connect to trunk sewer from Georgetown (no contribution to interceptor sewer).
(4) Lift station and force main to trunk sewer from Empire.
(5) 12″ sewer from Easter Seals to the CCCSD collection system.
(6) During the study, an alternative treatment process was presented claiming a lower treatment facility cost of $4.0 to $5.0 million. The details of the process are outlined in Appendix J.

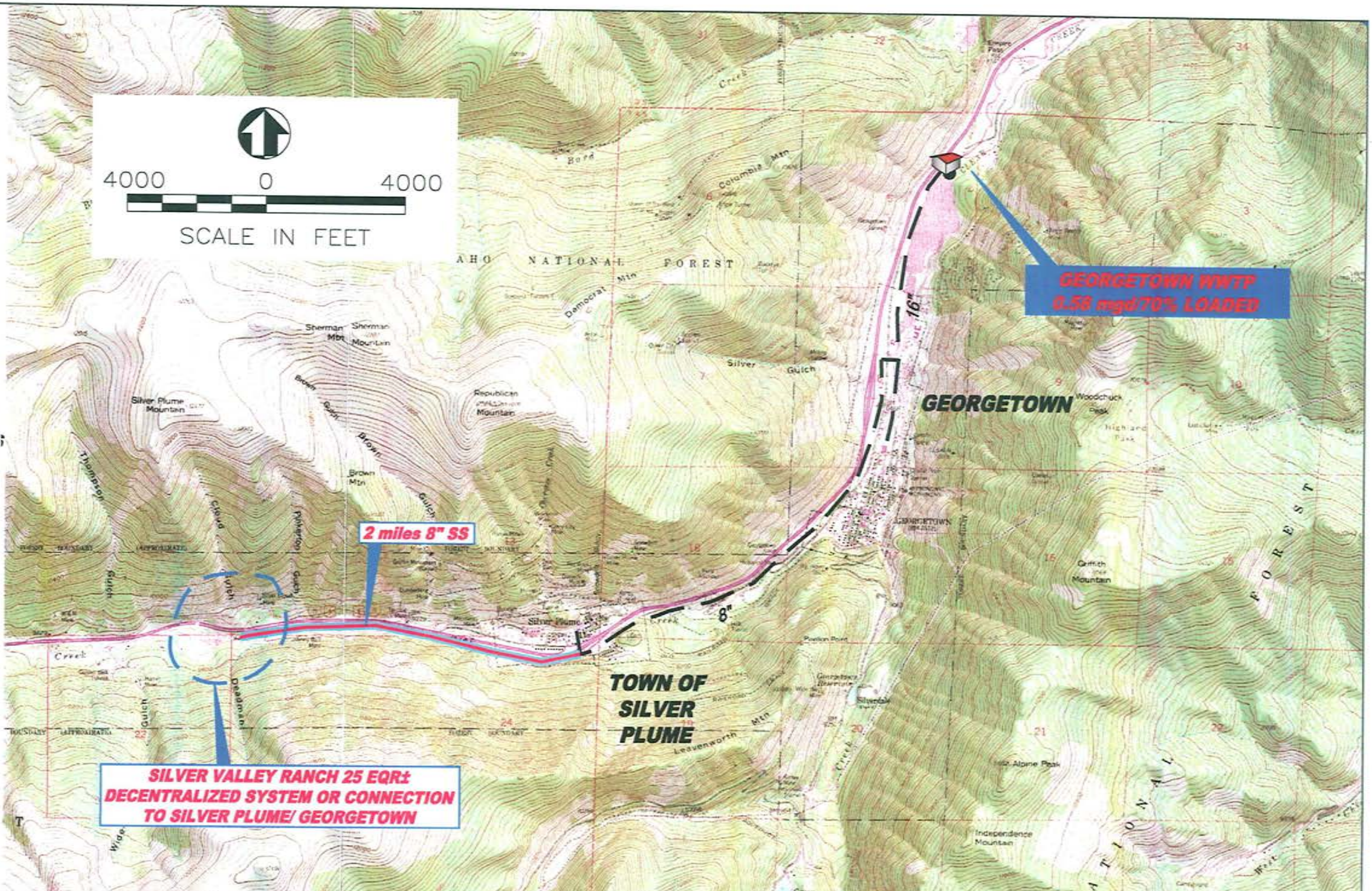

FIGURE 5-4
COUNTYWIDE WASTEWATER UTILITY PLAN-WASTEWATER ALTERNATIVES REPORT
SILVER VALLEY RANCH WASTEWATER TREATMENT ALTERNATIVES

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As shown, the regionalization project capital costs total about $16 million for the plant and infrastructure. Total regionalization costs for the Town of Georgetown and Town of Empire are reduced by about 15% to 10% respectively as a result of the cooperative effort and there are cost reductions for the other smaller entities. Because of their relative size, the Town of Georgetown and Empire would drive a cooperative regionalization effort. The cooperative effort does make treatment regionalization more economically feasible; however, regionalization capital costs are still estimated to be more than double the costs for improving existing facilities at Georgetown and Empire. The recommendations indicated in this chapter for all entities are unchanged based on the analysis of a cooperative regionalization effort.

CHAPTER 6

REGIONAL BIOSOLIDS HANDLING

Biosolids are a natural byproduct of the domestic wastewater treatment process. All ten Major treatment facilities in the watershed produce biosolids and currently dispose these solids utilizing contract haulers. Depending on the hauler, the biosolids are taken out of the County and ultimately disposed at landfills, land applied or composted for beneficial use. Hauling costs can be expensive and will only increase in the future. Most of the treatment facilities haul solids with a high water content (typically around 98% water and 2% solids), and therefore are essentially paying to haul water. The production of a cake type solid (typically in the range of 20% to 25% solids) greatly reduces water content and consequently hauling costs. Biosolids cake is commonly produced utilizing a centrifuge or belt press. This equipment is expensive; however, a single unit regionally located for use by all entities could be of economic benefit, and would be a stepping stone to increased sustainability in the County. A regional biosolids handling facility is evaluated in this chapter.

REGIONAL SITE

The production of a biosolids cake has a byproduct called centrate or filtrate. This byproduct is a waste stream with high organic content that must be discharged back to a treatment facility. The regional biosolids handling site must have the following characteristics:

1. Proximity to a sewer or treatment facility for disposal of centrate/filtrate.
2. Truck access for sludge drop off and cake hauling.
3. Sufficient power supply.
4. Surplus treatment capacity to handle the centrate/filtrate byproduct.
5. Available land.

There are only four major treatment entities which could serve as a site for a regional biosolids handling facility; Georgetown, Empire, Central Clear Creek and Idaho Springs. Poor access and site limitations eliminate Georgetown and Empire. Idaho Springs has surplus capacity, but limited space. The CCCSD Wastewater Treatment Facility is a feasible site. The CCCSD site is centrally located within the County, there is available treatment capacity, sufficient power, attainable land for construction and close proximity to I-70 for efficient truck access. The regional biosolids handling facility pre-design, cost estimate and evaluation was based on the CCCSD site.

FACILITY PRE-DESIGN

A summary of relevant biosolids regulations, design criteria and the pre-design of the biosolids handling facility are presented in this section.

A. Biosolids Regulations

The State of Colorado Biosolids Regulation incorporates the federal requirements contained in Standards for the Use and Disposal of Sewage Sludge (40 CFR 503) and the sludge classification and management requirements of the State of Colorado Domestic Sewage Sludge Disposal Regulation (5 CCR 1003-7).

Key requirements of the Biosolids Regulation include: (1) metals content criteria, (2) pathogen destruction criteria and (3) vector attraction reduction criteria.

Biosolids that are land-applied for beneficial use must not exceed the numeric criteria for "Ceiling Limit" metals concentration as shown in Table 6-1. If "Pollutant Limit" concentrations are exceeded, then cumulative pollutant loadings at the land application site must be monitored. Typically, when ceiling limits are exceeded, higher rates will be charged by hauling companies.

Table 6-1 – Maximum Metals Concentrations

Metal	Pollutant Limit (mg/kg dry weight)	Ceiling Limit (mg/kg dry weight)
Arsenic	41	75
Cadmium	39	85
Copper	1,500	4,300
Lead	300	840
Mercury	17	57
Molybdenum	-	75
Nickel	420	420
Selenium	100	100
Zinc	2,800	7,500

Pathogen-destruction criteria for land application of biosolids include two sludge production classifications: Class A and Class B. Class A sludge is required in public contact areas, while Class B is required for agricultural land application or for use on disturbed land reclamation. The Class B requirement can be met with testing verification or by use of a specific solids treatment process. Testing verification requires the geometric mean of the density of fecal coliforms for seven individual samples of biosolids to be below 2,000,000 colony-forming units per dry gram of total solids. Specific acceptable treatment processes include aerobic digestion, air drying, anaerobic digestion, composting and lime stabilization. Most of the treatment facilities in the watershed employ the aerobic digestion method and produce Class B sludge. For the purposes of this evaluation, we have assumed that each treatment facility will produce Class B sludge.

B. Biosolids Projections

Biosolids generation projections are necessary for both the sizing of a facility as well as preparation of a life cycle cost analysis. Wastewater flow (minus I/I contributions) is proportional to the generation of biosolids. Biosolids reports from the year 2005 were used to calculate the ratio of real dry mass of biosolids to calculated raw wastewater flow in 2005. This ratio was used to project the mass of biosolids generated into the future. In order to calculate the volume of biosolids generated, it was estimated that each facility would continue to produce biosolids at the present average percent solids. The background data for these calculations is found in Appendix G.

The biosolids projections prepared for the project include the entities of Georgetown, Empire, the CCCSD and Idaho Springs. These are the major biosolids generators in the County, and their projections determine the size of a possible regional facility, as well as the economic feasibility. Adding other entities to a regional operation would only increase the economic feasibility and future sustainability of the County. Table 4-4 summarizes the biosolids projections for the major generators.

Table 4-4 – Biosolids Projections for Major Generators

Entity	2005 (gallons/yr)	2015 (gallons/yr)	2030 (gallons/yr)	2038 (gallons/yr)
Town of Georgetown (3.2% solids) (1)	234,000	368,000	454,000	509,000
City of Idaho Springs (1.8% solids) (1)	345,000	398,000	449,000	485,000
CCCSD (2% solids) (2)	96,000	135,000	168,000	190,000
Town of Empire (2% solids) (2)	68,000	81,000	89,000	95,000
Total	**743,000**	**982,000**	**1,160,000**	**1,279,000**

(1) Actual 2005 average.
(2) Assumed value.

C. Design Criteria

The design criteria and assumptions used to size the facility are presented in this section. The first assumption was that the metals limits would be met. Currently, the biosolids produced at the Georgetown WWTF have elevated zinc concentrations. It is assumed that blending of the biosolids at a regional facility would reduce the zinc concentration below the ceiling limit. Some simple blending calculations were prepared to justify this assumption, which are found in Appendix H.

According to the facility pre-design concept, further digestion or treatment of the biosolids would not be required at the regional facility. The facility design would include temporary aerated storage, cake production equipment and truck loading and unloading facilities.

The new facility would function as follows: Class B sludge from each treatment entity would be hauled to the regional site and unloaded into the temporary aerated storage tank. Sludge in the tank would be pumped to the dewatering unit where cake would be produced and dropped into a roll-off container for storage. The roll-off container would then be hauled off site for cake disposal or composting.

The dewatering unit would most likely be a belt filter press or a centrifuge. For the purpose of this analysis, the haul costs are based on Parker Ag prices. In Clear Creek County, Parker Ag hauls cake biosolids to the Climax Mine site. Climax Mine has an active composting facility and uses the compost to remediate mine tailings.

According to the biosolids projections, at the 30-year planning horizon, the estimated annual volumetric production of biosolids for the major generators is about 1,279,000 gallons per year. This equates to about 107,000 gallons per month.

The facility pre-design was based on one month of storage, allowing for emergencies. A sketch of a possible regional biosolids handling facility is provided in Figure 6-1. The corresponding preliminary site plan at the CCCSD site is shown in Figure 6-2. The budgetary construction costs estimated for this facility total approximately $2.0 million. Details of the estimate are presented in Appendix I.

LIFE CYCLE COST EVALUATION

To review the feasibility of constructing this regional facility, a life cycle cost evaluation using present worth analysis was prepared for each of the major generators, consisting of Georgetown, Empire, CCCSD and Idaho Springs. Present worth analysis is used to determine the total cost of multiple alternatives over a chosen time period. The analysis calculates the capital cost plus the net present value of ongoing O&M costs. The present value calculation allows future costs to be compared to one another regardless of when they occur during the life of the alternative.

The following two alternatives were compared.

- Alternative 1 - Maintain current mode of operation (contract hauling).
- Alternative 2 – Participate in a regional biosolids handling facility.

The operating costs for Alternative 1 are represented by the cost per unit volume of biosolids hauled by a contract hauler (labor costs are not included). The costs used to evaluate Alternative 2 are the initial capital cost of the facility, O&M, the cost per unit volume of biosolids hauled to the regional facility from each entity and the cost per unit mass of cake biosolids hauled for disposal. The capital and O&M costs were divided among the major generators on the basis of the fraction of the total volume of biosolids each currently contributes. These fractions are based on the current biosolids production estimates and are as follow:

- Town of Georgetown: 34%.
- Town of Empire: 10%.
- CCCSD: 6%.
- City of Idaho Springs: 50%.

The capital cost is based on construction costs plus contingency, general conditions, overhead, engineering, legal and administrative costs. Also included is the purchase of a hauling truck to convey biosolids from each entity to the regional facility. It was assumed that CCCSD's portion of the investment would be reduced based on donated land value and tap fees for handling the filtrate and centrate. This is reflected in the percentages above.

The regional facility operation and maintenance costs consist of power and chemical usage. It was assumed that the labor costs would be shared among all of the entities involved in the operation, and there would be no net increase in labor hours for current staff.

The capital, O&M, and hauling costs used for the life cycle cost evaluation are summarized in Table 6-2. The planning period used for the analysis is thirty years at a discount rate of 4.875%, provided by the Natural Resources Conservation Service for water resources projects in the year 2007.

Table 6-2 – Life Cycle Evaluation Costs

Alternative	Capital Investment	Operation and Maintenance Cost	Hauling Cost
Alternative 1 – Maintain Current Mode of Operation	N/A	N/A	$0.08/gallon $0.13/gallon (Georgetown) [1]
Alternative 2 – Regional Biosolids Handling Facility	$1,831,000	$20,000/year	From WWTF to Regional Facility: $0.0015/gallon Contract Hauling – Biosolids Cake: $44/ton

[1] The Town of Georgetown pays a zinc surcharge for not meeting the land application standards.

The Town of Georgetown exceeds the ceiling limit for zinc in their biosolids. As such, the Georgetown evaluation includes a zinc surcharge for hauling.

The CCCSD does not currently haul biosolids. The treated solids are dried on site and used for fertilization on surrounding landscaping. As such, the life cycle cost analysis for CCCSD does not include hauling costs until the year 2010 when hauling may be required.

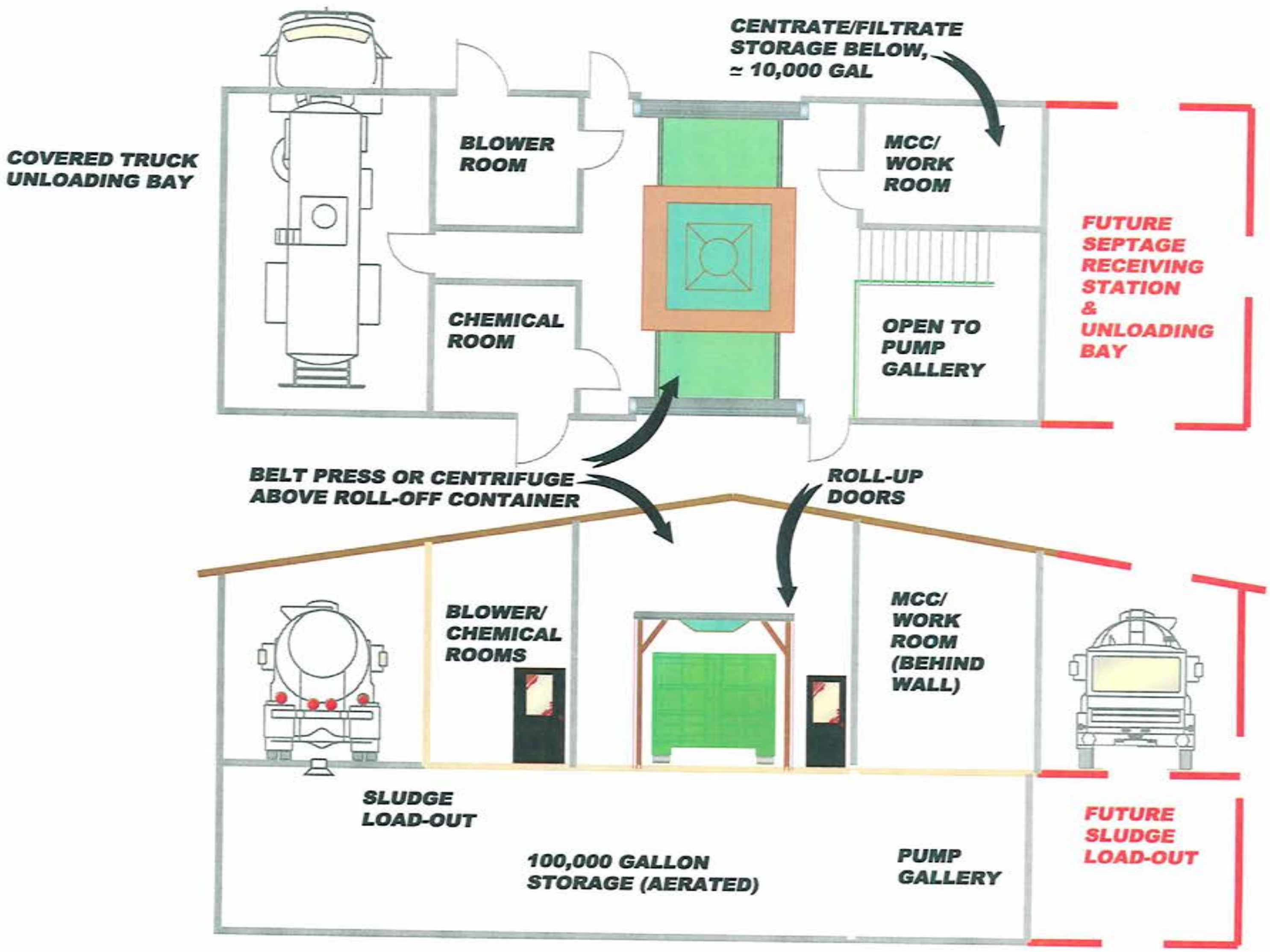

FIGURE 6–1
COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
REGIONAL BIOSOLIDS HANDLING FACILITY EXAMPLE

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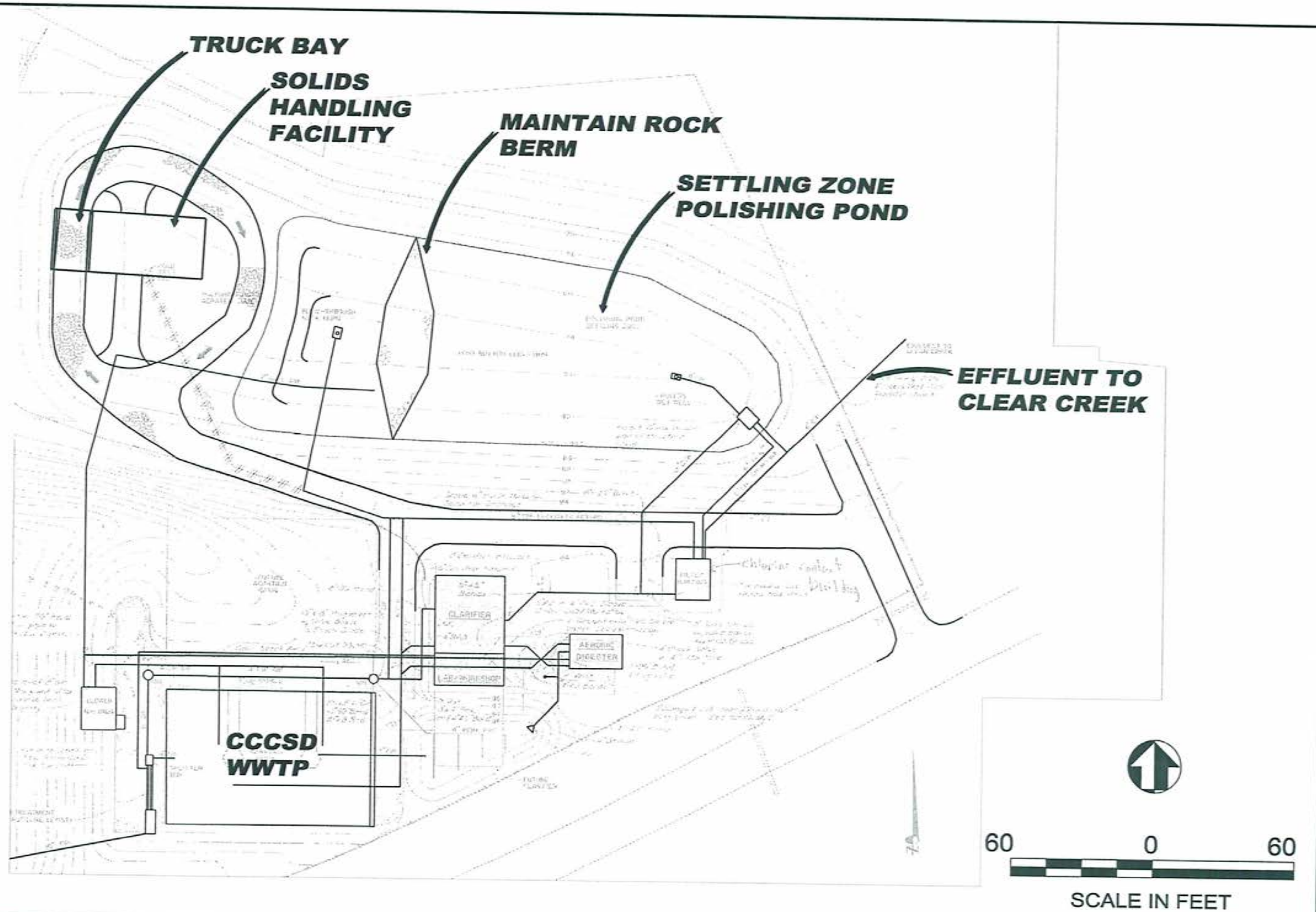

FIGURE 6-2

COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
REGIONAL BIOSOLIDS EXAMPLE SITE PLAN

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The thirty year life cycle cost analysis for each entity, comparing the present value for the two alternatives is presented in Table 6-3. The background data for all of the life cycle cost evaluations is found in Appendix I.

Table 6-3 – Present Value Life Cycle Cost Evaluation

Entity	Alternative 1 – Maintain Current Mode of Operation (30-Year Present Value)	Alternative 2 – Regional Biosolids Handling Facility (30-Year Present Value)
Town of Georgetown	$826,000	$822,000
City of Idaho Springs	$523,000	$1,129,000
Town of Empire	$107,000	$221,000
Central Clear Creek Sanitation District	$169,000	$212,000

As shown in the summary table, at an initial investment of approximately $2.0 million, the construction of a regional biosolids handling facility is favorable for Georgetown and could be favorable for Empire and the CCCSD depending on the variability of actual O&M and construction costs. However, participation in a regional facility is not favorable for Idaho Springs.

Based on further cost analysis, a regional biosolids handling facility becomes economically viable for all four entities, including Idaho Springs, if the initial capital investment is reduced to approximately $1.0 million. The cost reduction could be accomplished with alternate design layouts or supplemental funding such as grants.

OTHER ALTERNATIVES

There are other alternatives available for producing a biosolids cake at a reduced investment. Some contract haulers, such as Parker Ag, provide mobile belt press units for the production of cake at individual treatment facilities. Georgetown and Idaho Springs utilized the mobile belt press this year (2007). Their costs for hauling were reduced; however, if the unit is not used carefully, the operation can disrupt the treatment process.

Purchasing a mobile unit to be used by all the entities within Clear Creek County could avoid disruption of the treatment processes. Each WWTF is unique and is staffed with operators with knowledge specific to that facility. Placing the responsibility of the mobile unit in the hands of the operators could limit the potential for system upsets.

A purchased unit would require a trailer and truck for hauling to each treatment facility. The rough costs for the equipment, trailer and truck is $800,000. A dedicated storage area for the equipment, possibly at the CCCSD site, would be needed.

The capital costs, although lower than for a regional facility, would most likely need to be offset. The offset costs could be accomplished by loans or grants. Another alternative would be to enter into a public-private partnership with a company specializing in biosolids treatment.

POSSIBLE REGIONAL COMPOSTING FACILITY

A goal of Clear Creek County is to continue to increase the watershed sustainability. The production of a biosolids cake from the treatment entities is one step towards increased sustainability. The next step would be the composting of the cake product within the County boundary for redistribution and beneficial use back to the residents. The Clear Creek County Recycling Center is an appropriate location for future composting activities. The Recycling Center is located south of Idaho Springs along Soda Creek Road. The facility was at one time a composting site; however, it was shut down due to some quality control issues. The center currently accepts yard waste and has sufficient available land for the creation of composting windrows. In looking to the future, the County should consider the recycling center as a viable composting area.

CHAPTER 7
REGIONAL SEPTAGE RECEIVING

There is one septage receiving station in the Clear Creek County Study Area. The City of Idaho Springs operates a simplified receiving station only on weekends, primarily utilized by recreation vehicles. The station use is limited because of sewer capacity issues and control of illegal dumping. As indicated in this study, the County has a substantial population residing in unincorporated areas utilizing decentralized septic systems. These numerous septic tanks are pumped periodically for maintenance and the contract haulers are often trucking the waste to the Denver Metropolitan Area for disposal. In an effort to increase the County sustainability, reduce hauling costs and decrease the risk of illegal dumping, planning for a regional septage receiving station should be started.

VIABLE LOCATIONS

The regional septage receiving station location needs to have the following attributes:

1. Proximity to a sewer for discharge.
2. Available capacity at the down stream plant.
3. Efficient vehicle access.
4. Available power supply.

Of the four major wastewater service providers, only Idaho Springs and CCCSD embody all four attributes. The current capacity of the Georgetown facility is limited. The Empire treatment facility capacity is also limited and there is poor vehicle access. The Idaho Springs Treatment Facility is only 60% loaded and is the largest in the region. CCCSD is the selected area for evaluating a regional biosolids handling facility. There may be cost savings in incorporating a septage receiving station with the biosolids facility. Idaho Springs and CCCSD are considered to be the optimum locations for a receiving station.

DESIGN CONCEPTS

There are essentially two approaches for a septage receiving station; simple and sophisticated. A simple septage receiving station would consist of an unloading area with a hose bib, quick connect hose and manually cleaned coarse screen with discharge to the collection system. A more sophisticated station would include a limited access unloading area (possibly card or key pad entry) quick connect hose with flow measurement, mechanical screening, flow equalization, a pump system for controlled flow to the sewer and odor control. Example process schematics for both approaches are shown in Figure 7-1.

The simplified system is obviously the least expensive; however, the more sophisticated system has many advantages. Limiting access with key cards or key codes would be beneficial, reducing abuse of the system and limiting illegal dumping. In addition, users can be tracked electronically for monitoring. Flow measurement would be an advantage in keeping records of flow quantities for use in billing. Adequate equalization storage would also be important for emergencies and limiting shock loads. Finally, odor control would be appropriate. Septage is high in organic content and typically in an anaerobic state; making the odors potentially offensive to the surrounding community.

The cost range for a septage receiving station varies as a function of the complexity of the system. The estimated capital cost for a simple septage receiving station would be between $200,000 and $400,000. A more sophisticated system would range between $400,000 and $800,000. There is potential for some cost savings by including the septage receiving station with the potential regional biosolids handling facility. There would be efficiencies in common wall construction, shared power and multipurpose truck access ports.

IMPLEMENTATION

Planning for a regional septage receiving station should be initiated and should coincide with the regional biosolids handling facility. As indicated earlier, combining the two systems could save capital costs (see Figure 6-1 showing the possible combined systems). Funding for the facility is of course of great importance; therefore, the first step in the planning process should be the completion of a feasibility study where the site is identified, a predesign of the facility is prepared and the construction costs are more accurately estimated. With better cost information, funding and cost sharing mechanisms can be explored.

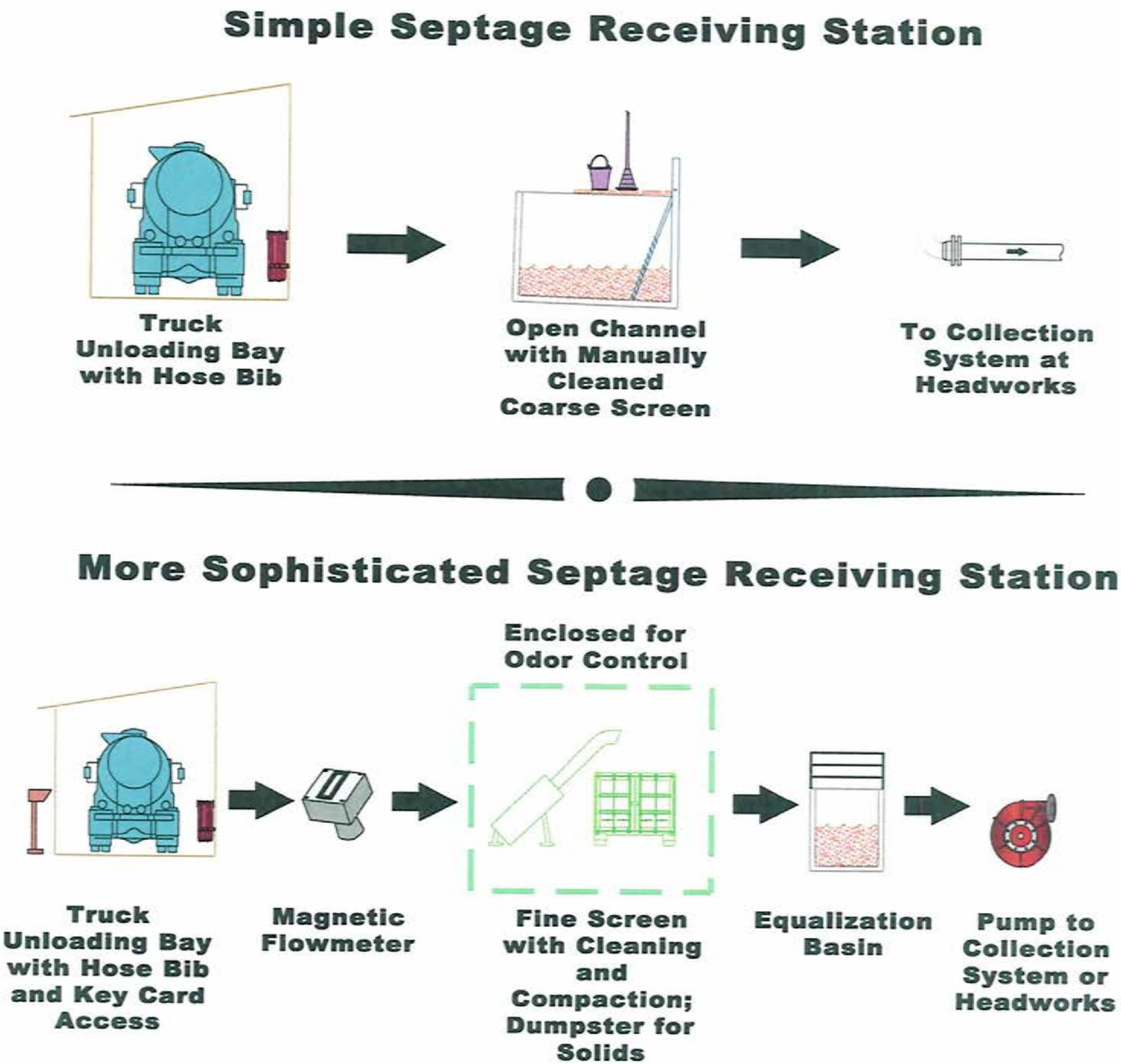

FIGURE 7-1
COUNTYWIDE WASTEWATER UTILITY PLAN–WASTEWATER ALTERNATIVES REPORT
SEPTAGE RECEIVING STATION EXAMPLE SCHEMATICS

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CHAPTER 8
OPERATIONS

A final regionalization concept is operation of wastewater collection and treatment systems. In our coordination effort with the stakeholders and wastewater service providers of the Clear Creek Watershed, there was a common willingness to consolidate or regionalize operations in some form so as to increase efficiency and reduce costs. Regionalized operations can take on numerous forms; however the regionalization concepts were simplified into the following four graduated levels.

- Level 1 – Continue Current Practices.
- Level 2 – Information Sharing.
- Level 3 – Information and Resource Sharing.
- Level 4 – Consolidated Operations.

LEVEL 1 – CONTINUE CURRENT PRACTICE

Each of the ten wastewater service providers manage and operate their own wastewater treatment facilities and corresponding collection systems. The Town of Empire, Henderson Mine, Clear Creek Ski Corporation, Shwayder Camp, Central Clear Creek Sanitation District, St. Mary's Glacier Water and Sanitation District and Clear Creek High School all utilize contract operations for system management. The Town of Georgetown and the City of Idaho Springs employ full time staff for wastewater operations, collection management and system administration; and the Colorado Department of Transportation operates the Eisenhower Tunnel facility. This current mode of operation has been impacted by the Countywide Wastewater Utility Plan Project. Due to coordination meetings and interaction, entities are now communicating more and conducting some limited sharing of ideas and resources.

LEVEL 2 – INFORMATION SHARING

In this project, the wastewater service providers are gathered together to discuss the overall wastewater improvement concepts for the entire watershed. These meetings have been a good forum for interaction and sharing of information. This practice should continue and will be a benefit to all ten wastewater providers in the Clear Creek Watershed. Normal quarterly meeting and email/internet interaction (help lines) can be established. The Coors Brewing Company has already made strides in this type of information sharing concept. They have established the Colorado Water and Wastewater Treatment Network. Members of the network are offered training opportunities, educational seminars and a simple internet forum to communicate. Another interactive sharing model is the Water and Wastewater Mentoring Program sponsored by the Colorado Water and Wastewater Utility Council (CWWUC). This program was created to assist water and wastewater service providers with limited resources. The program has been implemented statewide and gives the providers access to seminars, educational opportunities and regulation updates. It also provides a forum to interact with other entities to receive advice and assistance.

LEVEL 3 – INFORMATION AND RESOURCE SHARING

At this level of operations, the Level 2 information sharing would be implemented in conjunction with resources sharing. The sharing of resources can reduce costs and streamline operations for each entity. The shared resources could include equipment such as sewer vacuum trucks, closed circuit television inspection systems, and emergency bypass sewage pumps. In addition, common services such as chemical delivery and sludge hauling can be coordinated to save costs by receiving bulk rates. This added level of resource sharing would require a more formal agreement between entities to establish a funding and administration mechanism.

LEVEL 4 – CONSOLIDATED OPERATIONS

Consolidated operations is the most extreme level of regionalization. At this level, all wastewater systems, except the CDOT Eisenhower Tunnel facility, would be operated and administered by a single entity. The entity could be established as a special district or other government body, or all the systems could be managed by a single contract operator established under an intergovernmental agreement between the service providers. This mode of operation would provide a more cohesive approach enhancing system control. Area wide, staff resources for operations and administration would be reduced and the inter-sharing of resources would save operations costs. In addition, with an established consolidated operator, there would be opportunities to expand services to include the management of decentralized systems, specifically clustered advanced treatment facilities.

IMPLEMENTATION

Wastewater operations assistance is needed in Clear Creek County. Improvements will be slow in development, but strides in information sharing are already occurring. The wastewater service entities should start by continuing the practice of organized Wastewater Study Group meetings. With the many commitments of normal work tasks, it seems that quarterly meeting are reasonable. The meetings have minimal cost and time impacts and would provide a forum to share ideas and forward the regionalized concept of assisting each other. Forums can be held with the Colorado Water and Wastewater Network and the Colorado Water and Wastewater Mentoring Program to review interest in participation. The entities can establish an email or internet interaction medium for communications on problems, assistance, regulation updates, notification on seminars and conferences, chemical deliveries, sludge hauling and other operation aspects. Full consolidated operations will require formal agreements and may be difficult to implement politically. However, with the establishment of normal interaction, the appropriate level of regionalized operations will evolve.

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Appendix A

Wastewater Treatment and Biosolids Handling Alternatives

Appendix B

ISDS/Cluster Systems Treatment Performance and Cost & Proprietary Manufacturers

ISDS/Cluster Systems Treatment Manufacturers

Manufacturer / Distributor	Model Name / Number	Technology Employed	Website	Phone Number
ETV Certification				
Aquapoint, Inc.	Bioclere Model 16/12	Fixed Film Process	www.aquapoint.com	508-998-7577
BioConcpts	ReCip	Constructed Wetlands	www.bioconceptsinc.com	252-249-1376
Bio-Microbics	RetroFAST 0.375	Fixed Film Process	www.biomicrobics.com	800-753-3278
F.R. Mahoney & Associates, Inc.	Amphidrome Single Family System	Sequencing Batch Reactor / Recirculating Filter	www.frmahony.com	781-982-9300
Septitech, Inc.	Septitech Model 400	Fixed Film Process	www.septitech.com	207-657-5252
Waterloo Biofilter Systems, Inc.	Waterloo Biofilter 4-Bedroom	Fixed Film Process	www.waterloo-biofilter.com	519- 856-0757
NSF 40 Class 1 Certification				
Manufacturer / Distributor	**Model Name / Number**	**Technology Employed**	**Website**	**Phone Number**
Advanced Septic Treatment Systems	TRD-1000 Series	Sequencing Batch Reactor	www.advancedsepticsystems.com	360-856-2142
Aquapoint, Inc.	Bioclere Model 16/12	Fixed Film Process	www.aquapoint.com	508-998-7577
Aquarobic International	Mini-Plant Series	Sequencing Batch Reactor	www.aquarobicinternational.com	800-927-8304
Bio-Microbics, Inc.	MicroFAST Series	Fixed Film Process	www.biomicrobics.com	800-753-3278
Bord NaMona Environmental Products	Puraflo Series	Recirculating / Intermittent Filter	www.bnm-us.com	336-547-9338
Clearstream Wastewater Systems, Inc.	Clearstream Systems	Continuous-Flow Suspended Growth System	www.clearstreamsystems.com	409-755-1500
Consolidated Treatment Systems, Inc.	Multi-Flo Series Nayadic Series	Continuous-Flow Suspended Growth System and Filtration Continuous-Flow Suspended Growth System	www.consolidatedtreatment.com	937-746-2727
Delta Environmental Products, Inc.	Whitewater DF Series Whitewater UC Series	Continuous-Flow Suspended Growth System Continuous-Flow Suspended Growth System	www.deltaenvironmental.com	225-665-1666
Hoot Aerobic Systems, Inc.	Hoot Series LA-Hoot Series	Continuous-Flow Suspended Growth System Continuous-Flow Suspended Growth System	www.hootsystems.com	337-474-2804
Hydro-Action Industries	AP Series	Continuous-Flow Suspended Growth System	www.hydro-action.com	574-936-6022
JET, Inc.	BAT series	Fixed Film Process	www.jetincorp.com	440-461-2000
MicroSeptec	ES Series SM Series	Combination Fixed Film / Suspended Growth Process Combination Fixed Film / Suspended Growth Process	www.microseptec.com	949-297-4590
Mid-Atlantic Aeration Wastewater Treatment Systems, LLC	MAA Series	Continuous-Flow Suspended Growth System	www.mid-atlanticaeration.com	888-472-7976
Norweco, Inc.	Singulair Series	Continuous-Flow Suspended Growth System	www.norweco.com	419-668-4471
Orenco Systems Inc.	AdvanTex Series	Recirculating / Intermittent Filter	www.orenco.com	800-348-9843
Premier Tech 2000 ITEÉ	Ecoflo Biofilters	Fixed Film Process	www.premiertech.com	418-867-8883
Zabel Environmental Technology	SCAT Series	Fixed Film Process	www.zabelzone.com	800-221-5742
Other				
Huber Technology	MembraneClearBox	Membrane Bioreactor	www.membraneclearbox.de/english	+49-8462-201-0

ISDS/Cluster Systems Treatment Performance and Cost

Treatment Performance and Cost (based on typical three bedroom residence)

Technology	BOD (removal) [a]	TSS (removal) [a]	Fecal Coliform (removal) [a]	Total N (removal) [a, b]	Total P (removal) [a, b]	Capital Cost [c]	O&M Cost [c]
Conventional							
septic tank	up to 55%	up to 55%	1 – 3 log	negligible	negligible		
leach field [d]	potentially ≥ 90%	potentially ≥ 90%	3 – 4 log	10 – 20%	0 – 95% [e]	$9,000 - $15,000 [f]	$100 - $400
* All advanced treatment systems require a septic and leach field.							
Advanced Treatment – Aerobic							
continous-flow suspended growth	up to 95%	up to 95%	1 – 2 log	up to 60%	up to 20%	$6,000 - $10,000	$200 - $400
fixed film	up to 95%	up to 95%	1 – 2 log	up to 60%	up to 20%	$6,000 - $10,000	$100 - $300
sequencing batch reactor [g]	up to 95%	up to 95%	1 – 2 log	up to 60%	up to 20%	$9,000 - $13,000	$100 - $300
membrane bioreactor	up to 95%	up to 95%	3 – 4 log	up to 60%	up to 20%	$15,000 - $19,000	$200 - $400
Advanced Treatment – Filters							
intermittent media filter	up to 95%	up to 95%	2 – 4 log	20 – 30%	up to 30% [h]	$8,000 - $11,000	$100 - $300
recirculating media filter	up to 95%	up to 95%	2 – 3 log	up to 70% [i]	up to 30% [h]	$9,000 - $12,000	$100 - $300
Advanced Treatment – Aquatic							
aerobic lagoon	up to 95%	up to 90%	2 – 3 log	up to 60%	up to 50%	$15,000 - $30,000	$250 - $350
facultative lagoon	up to 95%	0 – 90% [j]	1 – 2 log	up to 60%	up to 50%	$15,000 - $30,000	$250 - $350
constructed wetland	up to 95%	up to 90%	2 – 3 log	potentially ≥ 60% [k]	up to 50%	$12,000 - $24,000	$100 - $200

a) Values are general. Removals will vary between manufacturers and designs. All values are based on proper design, installation, and maintenance.
b) The values for nitrogen and phosphorus removal will vary greatly based on system configuration, design, and raw wastewater characteristics.
c) The costs for advanced treatment systems are in addition to costs for the conventional system. These costs are based on systems designed for removal of BOD, TSS, and fecal coliform only. Additional costs of between $3,000 and $5,000 can be expected for systems designed to remove nitrogen.
d) Treatment performance of leach field is highly variable depending on soil type, structure, and chemistry.
e) Phosphorus removal in leach field varies based on design of absorption field and phosphorus sorption capacity of soil.
f) The costs for septic tank and leach field are combined.
g) Sequencing batch reactors are usually installed in parallel and/or include a separate holding tank.
h) Some phosphorus removal is achieved by sorption onto treatment media.
i) Removal of nitrogen in recirculating sand filters provided by recycling flow for denitrification.
j) TSS values vary greatly for facultative lagoons based on seasonal algae growth.
k) Nitrogen removal for constructed wetlands can be significant based on plant uptake rate.

ISDS/Cluster Systems Treatment Performance and Cost

Sources:

Richard P. Arber Associates. *Individual Sewage Disposal Systems Project*. March 2006

Siegrist, Robert L.; Tyler, Jerry E.; Jenssen, Petter D. *Design and Performance of Onsite Wastewater Soil Absorption Systems.* May 2000.

United States Environmental Protection Agency. *Onsite Wastewater Treatment Systems Manual (EPA/625/R-00/008).* February 2002.

Appendix C

Decentralized Wastewater Treatment System Certifications

Decentralized Wastewater Treatment System Certification Standards

National Sanitation Foundation Standard

Parameter	Concentration (mg/L)	
BOD_5	7-day average	< 40
	30-day average	< 45
TSS	7-day average	< 25
	30-day average	< 30

Environmental Protection Agency Environmental Technology Verification

Parameter	Sample Type	Sample Location *	
		Raw Influent	Treated Effluent
BOD5	24 Hour Composite	X	
cBOD5	24 Hour Composite		X
Suspended Solids	24 Hour Composite	X	X
pH	Grab	X	X
Temperature (deg C)	Grab	X	X
Alkalinity (as CaCO3)	24 Hour Composite	X	X
Dissolved Oxygen	Grab		X
TKN (as N)	24 Hour Composite	X	X
Ammonia-N (as N)	24 Hour Composite	X	X
Nitrite-N (as N)	24 Hour Composite		X
Nitrate-N (as N)	24 Hour Composite		X
Phosphorous, Total (as P)	24 Hour Composite	X	X
Orthophosphate (as P)	24 Hour Composite		X

* Note: Fields marked with "X" indicate a parameter that is tested for.

Appendix D

Background Data for Growth Projections

Growth Projections for the Town of Georgetown/Silver Plume

	Population	Employment	Visitors
2005	1291	343	1500
2015	1729	1059	2337
2016	1751	1066	2407
2017	1774	1074	2479
2018	1797	1082	2554
2019	1821	1089	2630
2020	1844	1097	2709
2021	1868	1105	2791
2022	1892	1113	2874
2023	1917	1120	2960
2024	1942	1128	3049
2025	1967	1136	3141
2026	1993	1144	3235
2027	2018	1152	3332
2028	2045	1161	3432
2029	2071	1169	3535
2030	2098	1177	3641
2031	2125	1185	3750
2032	2153	1194	3863
2033	2181	1202	3979
2034	2209	1211	4098
2035	2238	1219	4221
2036	2267	1228	4348
2037	2296	1236	4478
2038	2326	1245	4612

% population growth 2015 - 2030 = 1.30
% employment growth 2015 - 2030 = 0.71
% visitor growth 2015 - 2030 = 3.00

interpolated values: 2016 - 2029
extrapolated values: 2031 - 2038

Growth Projections for the City of Idaho Springs

	Population	Employment	Visitors
2005	1889	732	2500
2015	1947	1007	3895
2016	1950	1011	4012
2017	1953	1016	4132
2018	1956	1020	4256
2019	1959	1024	4384
2020	1963	1029	4515
2021	1966	1033	4651
2022	1969	1038	4790
2023	1972	1042	4934
2024	1975	1047	5082
2025	1978	1051	5234
2026	1981	1056	5391
2027	1985	1060	5553
2028	1988	1065	5720
2029	1991	1069	5891
2030	1994	1074	6068
2031	1997	1079	6250
2032	2000	1083	6438
2033	2004	1088	6631
2034	2007	1093	6830
2035	2010	1097	7034
2036	2013	1102	7245
2037	2016	1107	7463
2038	2020	1112	7687

% population growth 2015 - 2038 = 0.16
% employment growth 2015 - 2038 = 0.43
% visitor growth 2015 - 2038 = 3.00

interpolated values: 2016 - 2029
extrapolated values: 2031 - 2038

Growth Projections for the CCCSD

	Population	Employment	Visitors
2005	414	150	650
2015	496	338	1013
2016	499	346	1043
2017	501	354	1075
2018	504	362	1107
2019	506	371	1140
2020	509	380	1174
2021	511	389	1210
2022	514	398	1246
2023	516	407	1283
2024	519	417	1322
2025	522	426	1361
2026	524	436	1402
2027	527	447	1444
2028	530	457	1487
2029	532	468	1532
2030	535	479	1578
2031	538	490	1625
2032	540	502	1674
2033	543	514	1724
2034	546	526	1776
2035	549	538	1829
2036	551	551	1884
2037	554	564	1941
2038	557	577	1999

% population growth 2015 - 2038 = 0.51
% employment growth 2015 - 2038 = 2.35
% visitor growth 2015 - 2038 = 3.00

interpolated values: 2016 - 2029
extrapolated values: 2031 - 2038

Growth Projections for the Town of Empire

	Population	Employment	Visitors
2005	355	46	160
2015	397	89	249
2016	399	89	256
2017	400	90	264
2018	402	90	272
2019	404	90	280
2020	406	91	289
2021	408	91	297
2022	409	91	306
2023	411	92	315
2024	413	92	325
2025	415	92	335
2026	417	93	345
2027	418	93	355
2028	420	93	366
2029	422	94	377
2030	424	94	388
2031	426	94	400
2032	428	95	412
2033	430	95	424
2034	432	95	437
2035	433	96	450
2036	435	96	463
2037	437	96	477
2038	439	97	492

% population growth 2015 - 2038 = 0.44
% employment growth 2015 - 2038 = 0.37
% visitor growth 2015 - 2038 = 3.00

interpolated values: 2016 - 2029
extrapolated values: 2031 - 2038

Growth Projections for the St. Mary's Glacier Water & Sanitation District

	Population	Employment	Visitors
2005	705	1	15
2015	996	10	250
2016	1021	10	253
2017	1046	11	256
2018	1073	11	259
2019	1099	12	262
2020	1127	13	266
2021	1155	13	269
2022	1184	14	272
2023	1214	14	276
2024	1244	15	279
2025	1275	16	282
2026	1307	17	286
2027	1340	17	289
2028	1373	18	293
2029	1408	19	296
2030	1443	20	300
2031	1479	21	304
2032	1516	22	307
2033	1554	23	311
2034	1593	24	315
2035	1633	25	319
2036	1674	26	323
2037	1716	28	327
2038	1758	29	331

% population growth 2015 - 2038 = 2.50
% employment growth 2015 - 2038 = 4.73
% visitor growth 2015 - 2038 = 1.22

interpolated values: 2016 - 2029
extrapolated values: 2031 - 2038

Growth Projections for Clear Creek High School

	Population	Employment	Visitors
2005	600	50	20
2015	1076	90	800
2016	1109	91	834
2017	1142	91	870
2018	1177	92	907
2019	1213	93	946
2020	1249	93	986
2021	1287	94	1029
2022	1326	95	1073
2023	1366	95	1119
2024	1408	96	1167
2025	1450	97	1216
2026	1494	97	1269
2027	1540	98	1323
2028	1586	99	1379
2029	1634	99	1438
2030	1684	100	1500
2031	1735	101	1564
2032	1788	102	1631
2033	1842	102	1701
2034	1898	103	1774
2035	1955	104	1850
2036	2014	104	1929
2037	2075	105	2011
2038	2138	106	2097

% population growth 2015 - 2038 = 3.03
% employment growth 2015 - 2038 = 0.70
% visitor growth 2015 - 2038 = 4.28

interpolated values: 2016 - 2029
extrapolated values: 2031 - 2038

Appendix E

Background Data for Flow Projections

2005 data	Average flow (mgd)
January	0.25
February	0.25
March	0.26
April	0.26
May	0.31
June	0.51
July	0.46
August	0.38
September	0.27
October	0.29
November	0.24
December	0.27

max month =	0.51
average annual =	0.31
peaking factor =	1.6

Wastewater Flow Projections for the Town of Georgetown/Silver Plume

population	183	**gpcd**
employment	107	**gpcd**
visitor	26	**gpcd**

	Population	Employment	Visitors	average annual flow (mgd)	peak month flow (mgd)	% of capacity
2005	1,291	343	1,500	0.31	0.50	86%
2015	1,729	1,059	2,337	0.45	0.72	124%
2030	2,098	1,177	3,641	0.47	0.76	130%
2038	2,326	1,245	4,612	0.48	0.77	133%

Linear I/I reduction

2005 I/I (%) =	138
2015 I/I (%) =	117
2030 I/I (%) =	86
2038 I/I (%) =	69

2005 data	Average flow (mgd)
January	0.27
February	0.31
March	0.24
April	0.24
May	0.29
June	0.38
July	0.36
August	0.28
September	0.24
October	0.17
November	0.18
December	0.22

max month =	0.38
average annual =	0.27
peaking factor =	1.4

Wastewater Flow Projections for the City of Idaho Springs

population	99	gpcd
employment	58	gpcd
visitor	14	gpcd

	Population	Employment	Visitors	average annual flow (mgd)	peak month flow (mgd)	% of capacity
2005	1,889	732	2,500	0.27	0.37	62%
2015	1,947	1,007	3,895	0.30	0.41	69%
2030	1,994	1,074	6,068	0.32	0.44	74%
2038	2,020	1,112	7,687	0.33	0.46	77%

Linear I/I reduction

2005 I/I (%) =	29
2015 I/I (%) =	24
2030 I/I (%) =	18
2038 I/I (%) =	14

2005 data	Average flow (mgd)
January	0.035
February	0.035
March	0.038
April	0.041
May	0.043
June	0.048
July	0.045
August	0.045
September	0.045
October	0.048
November	0.043
December	0.042

max month =	0.048
average annual =	0.042
peaking factor =	1.1

Wastewater Flow Projections for the CCCSD

population	85	gpcd
employment	50	gpcd
visitor	12	gpcd

	Population	Employment	Visitors	average annual flow (mgd)	peak month flow (mgd)	% of capacity
2005	414	150	650	0.042	0.047	47%
2015	496	338	1,013	0.071	0.078	78%
2030	535	479	1,578	0.088	0.097	97%
2038	557	577	1,999	0.10	0.11	110%

2006 data	Average flow (mgd)
January	0.047
February	0.044
March	0.041
April	0.041
May	0.050
June	0.053
July	0.054
August	0.052
September	0.042
October	0.034
November	0.031
December	0.036

max month =	0.054
average annual =	0.044
peaking factor =	1.2

Wastewater Flow Projections for the Town of Empire

population	107	gpcd
employment	62	gpcd
visitor	15	gpcd

	Population	Employment	Visitors	average annual flow (mgd)	peak month flow (mgd)	% of capacity
2005	355	46	160	0.043	0.052	86%
2015	397	89	249	0.050	0.059	99%
2030	424	94	388	0.051	0.061	102%
2038	439	97	492	0.052	0.062	104%

Linear I/I reduction

2005 I/I (%) =	39
2015 I/I (%) =	33
2030 I/I (%) =	24
2038 I/I (%) =	19

Wastewater Flow Projections for the St. Mary's Glacier Water & Sanitation District

2005 data	Average flow (mgd)
January	0.078
February	0.082
March	0.088
April	0.097
May	0.20
June	0.25
July	0.16
August	0.12
September	0.11
October	0.12
November	0.10
December	0.092

max month =	0.25
average annual =	0.12
peaking factor =	2.0

population	176	gpcd
employment	103	gpcd
visitor	25	gpcd

	Population	Employment	Visitors	average annual flow (mgd)	peak month flow (mgd)	% of capacity
2005	705	1	15	0.12	0.25	42%
2015	996	10	250	0.18	0.37	61%
2030	1,443	20	300	0.26	0.53	88%
2038	1,758	29	331	0.32	0.64	107%

Wastewater Flow Projections for Clear Creek High School

2005 data	Average flow (mgd)
January	0.0010
February	0.0010
March	0.0010
April	0.0010
May	0.002
June	0.001
July	0.001
August	0.001
September	0.001
October	0.001
November	0.001
December	0.0010

max month =	0.0020
average annual =	0.0011
peaking factor =	1.8

school flow factor 13 gpcd

	Staff + Students	average annual flow (mgd)	peak month flow (mgd)	% of capacity
2005	500	0.0011	0.0020	8%
2038	650	0.0085	0.015	63%

Appendix F

Treatment Regionalization Life Cycle Cost Evaluations

Richard P. Arber Associates, Inc.

Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client: Clear Creek County	Project No: CLRCRK01
Project: **Regionalization Life Cycle Analysis Empire Junction**	By: DRW / Ckd:
	Date: / Date:

Alternatives for Empire Junction
1. Decentralized wastewater treatment
2. Regionalize with the Town of Empire

COSTS FOR DECENTRALIZED SYSTEM(S)

Operation	Cost
Construction Costs	$ 1,050,000
Annual Inspection Cost	$ 130
Annual Sampling	$ 95
Annual Maintenance Contract	$ 240
Septic Tank Pumping (every 5 years)	$ 350

* Annual costs and pumping costs for advanced treatment per single family dwelling.

COSTS FOR REGIONALIZATION WITH EMPIRE

Operation	Cost
Construction Costs	$ 270,000
Tap Fees	$ 500,000
Annual User Fees	$ 300

* User fees per single family dwelling.

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	Decentralized System(s)				Regionalization with Empire		
	Capital Cost	O&M	Pumping	PV	Capital Cost	User Fees	PV
2008	$ 1,050,000	$ 46,500		$ 1,096,500	$ 770,000	$ 30,000	$ 800,000
2009		$ 46,500		$ 44,338		$ 30,000	$ 28,605
2010		$ 46,500		$ 42,277		$ 30,000	$ 27,276
2011		$ 46,500		$ 40,312		$ 30,000	$ 26,008
2012		$ 46,500	$ 35,000	$ 67,370		$ 30,000	$ 24,799
2013		$ 46,500		$ 36,652		$ 30,000	$ 23,646
2014		$ 46,500		$ 34,948		$ 30,000	$ 22,547
2015		$ 46,500		$ 33,323		$ 30,000	$ 21,499
2016		$ 46,500		$ 31,774		$ 30,000	$ 20,500
2017		$ 46,500	$ 35,000	$ 53,102		$ 30,000	$ 19,547
2018		$ 46,500		$ 28,889		$ 30,000	$ 18,638
2019		$ 46,500		$ 27,546		$ 30,000	$ 17,772
2020		$ 46,500		$ 26,266		$ 30,000	$ 16,946
2021		$ 46,500		$ 25,045		$ 30,000	$ 16,158
2022		$ 46,500	$ 35,000	$ 41,855		$ 30,000	$ 15,407
2023		$ 46,500		$ 22,771		$ 30,000	$ 14,691
2024		$ 46,500		$ 21,712		$ 30,000	$ 14,008
2025		$ 46,500		$ 20,703		$ 30,000	$ 13,357
2026		$ 46,500		$ 19,740		$ 30,000	$ 12,736
2027		$ 46,500	$ 35,000	$ 32,991		$ 30,000	$ 12,144
2028		$ 46,500		$ 17,948		$ 30,000	$ 11,579
2029		$ 46,500		$ 17,114		$ 30,000	$ 11,041
2030		$ 46,500		$ 16,318		$ 30,000	$ 10,528
2031		$ 46,500		$ 15,560		$ 30,000	$ 10,038
2032		$ 46,500	$ 35,000	$ 26,003		$ 30,000	$ 9,572
2033		$ 46,500		$ 14,147		$ 30,000	$ 9,127
2034		$ 46,500		$ 13,489		$ 30,000	$ 8,703
2035		$ 46,500		$ 12,862		$ 30,000	$ 8,298
2036		$ 46,500		$ 12,264		$ 30,000	$ 7,912
2037		$ 46,500	$ 35,000	$ 20,496		$ 30,000	$ 7,545
2038		$ 46,500		$ 11,150		$ 30,000	$ 7,194
TOTAL LIFE CYCLE COST				**$ 1,925,466**			**$ 1,267,818**

Richard P. Arber Associates, Inc.
Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client:	Clear Creek County
Project:	**Regionalization Life Cycle Analysis** **Arapaho Mobile Home Park Area**

Project No: CLRCRK01	
By: DRW	Ckd:
Date:	Date:

Alternatives for Empire Junction
1. Decentralized wastewater treatment
2. Regionalize with the Town of Empire

COSTS FOR DECENTRALIZED SYSTEM(S)

Operation	Cost
Construction Costs	$ 725,000
Annual Inspection Cost	$ 130
Annual Sampling	$ 95
Annual Maintenance Contract	$ 240
Septic Tank Pumping (every 5 years)	$ 350

* Annual costs and pumping costs for advanced treatment per single family dwelling.

COSTS FOR REGIONALIZATION WITH EMPIRE

Operation	Cost
Construction Costs	$ 800,000
Tap Fees	$ 250,000
Annual User Fees	$ 300

* User fees per single family dwelling.

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	Decentralized System(s)				Regionalization with Empire		
	Capital Cost	O&M	Pumping	PV	Capital Cost	User Fees	PV
2008	$ 725,000	$ 23,250		$ 748,250	$ 1,050,000	$ 15,000	$ 1,065,000
2009		$ 23,250		$ 22,169		$ 15,000	$ 14,303
2010		$ 23,250		$ 21,139		$ 15,000	$ 13,638
2011		$ 23,250		$ 20,156		$ 15,000	$ 13,004
2012		$ 23,250	$ 17,500	$ 33,685		$ 15,000	$ 12,399
2013		$ 23,250		$ 18,326		$ 15,000	$ 11,823
2014		$ 23,250		$ 17,474		$ 15,000	$ 11,274
2015		$ 23,250		$ 16,662		$ 15,000	$ 10,749
2016		$ 23,250		$ 15,887		$ 15,000	$ 10,250
2017		$ 23,250	$ 17,500	$ 26,551		$ 15,000	$ 9,773
2018		$ 23,250		$ 14,445		$ 15,000	$ 9,319
2019		$ 23,250		$ 13,773		$ 15,000	$ 8,886
2020		$ 23,250		$ 13,133		$ 15,000	$ 8,473
2021		$ 23,250		$ 12,522		$ 15,000	$ 8,079
2022		$ 23,250	$ 17,500	$ 20,928		$ 15,000	$ 7,703
2023		$ 23,250		$ 11,385		$ 15,000	$ 7,345
2024		$ 23,250		$ 10,856		$ 15,000	$ 7,004
2025		$ 23,250		$ 10,351		$ 15,000	$ 6,678
2026		$ 23,250		$ 9,870		$ 15,000	$ 6,368
2027		$ 23,250	$ 17,500	$ 16,495		$ 15,000	$ 6,072
2028		$ 23,250		$ 8,974		$ 15,000	$ 5,790
2029		$ 23,250		$ 8,557		$ 15,000	$ 5,521
2030		$ 23,250		$ 8,159		$ 15,000	$ 5,264
2031		$ 23,250		$ 7,780		$ 15,000	$ 5,019
2032		$ 23,250	$ 17,500	$ 13,002		$ 15,000	$ 4,786
2033		$ 23,250		$ 7,073		$ 15,000	$ 4,563
2034		$ 23,250		$ 6,745		$ 15,000	$ 4,351
2035		$ 23,250		$ 6,431		$ 15,000	$ 4,149
2036		$ 23,250		$ 6,132		$ 15,000	$ 3,956
2037		$ 23,250	$ 17,500	$ 10,248		$ 15,000	$ 3,772
2038		$ 23,250		$ 5,575		$ 15,000	$ 3,597
TOTAL LIFE CYCLE COST				**$ 1,162,733**			**$ 1,298,909**

Richard P. Arber Associates, Inc.
Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client:
Clear Creek County

Project:
Regionalization Life Cycle Analysis
Shadows Ranch

Project No: CLRCRK01	
By: DRW	Ckd:
Date:	Date:

Alternatives for Empire Junction
1. Continue decentralized wastewater treatment
2. Regionalize with the Town of Georgetown

COSTS FOR DECENTRALIZED SYSTEM(S)

Operation	Cost	
Construction Costs	$	200,000
Annual Inspection Cost	$	130
Annual Sampling	$	95
Annual Maintenance Contract	$	200
Septic Tank Pumping (every 5 years)	$	350

* Annual costs and pumping costs for advanced treatment per single family dwelling.
* Maintenance for constructed wetlands lower than for other advanced treatment systems.

COSTS FOR REGIONALIZATION WITH GEORGETOWN

Operation	Cost	
Construction Costs	$	280,000
Tap Fees	$	200,000
Annual User Fees	$	350

* User fees per single family dwelling.

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	Decentralized System(s)				Regionalization with Georgetown		
	Capital Cost	O&M	Pumping	PV	Capital Cost	User Fees	PV
2008	$ 200,000	$ 10,625		$ 210,625	$ 480,000	$ 8,750	$ 488,750
2009		$ 10,625		$ 10,131		$ 8,750	$ 8,343
2010		$ 10,625		$ 9,660		$ 8,750	$ 7,955
2011		$ 10,625		$ 9,211		$ 8,750	$ 7,586
2012		$ 10,625	$ 8,750	$ 16,016		$ 8,750	$ 7,233
2013		$ 10,625		$ 8,375		$ 8,750	$ 6,897
2014		$ 10,625		$ 7,985		$ 8,750	$ 6,576
2015		$ 10,625		$ 7,614		$ 8,750	$ 6,271
2016		$ 10,625		$ 7,260		$ 8,750	$ 5,979
2017		$ 10,625	$ 8,750	$ 12,624		$ 8,750	$ 5,701
2018		$ 10,625		$ 6,601		$ 8,750	$ 5,436
2019		$ 10,625		$ 6,294		$ 8,750	$ 5,183
2020		$ 10,625		$ 6,002		$ 8,750	$ 4,942
2021		$ 10,625		$ 5,723		$ 8,750	$ 4,713
2022		$ 10,625	$ 8,750	$ 9,950		$ 8,750	$ 4,494
2023		$ 10,625		$ 5,203		$ 8,750	$ 4,285
2024		$ 10,625		$ 4,961		$ 8,750	$ 4,086
2025		$ 10,625		$ 4,730		$ 8,750	$ 3,896
2026		$ 10,625		$ 4,511		$ 8,750	$ 3,715
2027		$ 10,625	$ 8,750	$ 7,843		$ 8,750	$ 3,542
2028		$ 10,625		$ 4,101		$ 8,750	$ 3,377
2029		$ 10,625		$ 3,910		$ 8,750	$ 3,220
2030		$ 10,625		$ 3,729		$ 8,750	$ 3,071
2031		$ 10,625		$ 3,555		$ 8,750	$ 2,928
2032		$ 10,625	$ 8,750	$ 6,182		$ 8,750	$ 2,792
2033		$ 10,625		$ 3,232		$ 8,750	$ 2,662
2034		$ 10,625		$ 3,082		$ 8,750	$ 2,538
2035		$ 10,625		$ 2,939		$ 8,750	$ 2,420
2036		$ 10,625		$ 2,802		$ 8,750	$ 2,308
2037		$ 10,625	$ 8,750	$ 4,873		$ 8,750	$ 2,200
2038		$ 10,625		$ 2,548		$ 8,750	$ 2,098
TOTAL LIFE CYCLE COST				**$ 402,273**			**$ 625,197**

Richard P. Arber Associates, Inc.

Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client:	Clear Creek County
Project:	Regionalization Life Cycle Analysis Easter Seals

Project No: CLRCRK01	
By: DRW	Ckd:
Date:	Date:

Alternatives for Empire Junction
1. Decentralized wastewater treatment
2. Regionalize with the CCCSD

COSTS FOR DECENTRALIZED SYSTEM(S)

Operation	Cost
Construction Costs	$ 620,000
Annual Inspection Cost	$ 130
Annual Sampling	$ 95
Annual Maintenance Contract	$ 240
Septic Tank Pumping (every 5 years)	$ 350

* Annual costs and pumping costs for advanced treatment per single family dwelling.

COSTS FOR REGIONALIZATION WITH CCCSD

Operation	Cost
Construction Costs	$ 250,000
Tap Fees	$ 300,000
Annual User Fees	$ 375

* User fees per single family dwelling.

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	Decentralized System(s)				Regionalization with the CCCSD		
	Capital Cost	O&M	Pumping	PV	Capital Cost	User Fees	PV
2008	$ 620,000	$ 18,600		$ 638,600	$ 550,000	$ 15,000	$ 565,000
2009		$ 18,600		$ 17,735		$ 15,000	$ 14,303
2010		$ 18,600		$ 16,911		$ 15,000	$ 13,638
2011		$ 18,600		$ 16,125		$ 15,000	$ 13,004
2012		$ 18,600	$ 14,000	$ 26,948		$ 15,000	$ 12,399
2013		$ 18,600		$ 14,661		$ 15,000	$ 11,823
2014		$ 18,600		$ 13,979		$ 15,000	$ 11,274
2015		$ 18,600		$ 13,329		$ 15,000	$ 10,749
2016		$ 18,600		$ 12,710		$ 15,000	$ 10,250
2017		$ 18,600	$ 14,000	$ 21,241		$ 15,000	$ 9,773
2018		$ 18,600		$ 11,556		$ 15,000	$ 9,319
2019		$ 18,600		$ 11,018		$ 15,000	$ 8,886
2020		$ 18,600		$ 10,506		$ 15,000	$ 8,473
2021		$ 18,600		$ 10,018		$ 15,000	$ 8,079
2022		$ 18,600	$ 14,000	$ 16,742		$ 15,000	$ 7,703
2023		$ 18,600		$ 9,108		$ 15,000	$ 7,345
2024		$ 18,600		$ 8,685		$ 15,000	$ 7,004
2025		$ 18,600		$ 8,281		$ 15,000	$ 6,678
2026		$ 18,600		$ 7,896		$ 15,000	$ 6,368
2027		$ 18,600	$ 14,000	$ 13,196		$ 15,000	$ 6,072
2028		$ 18,600		$ 7,179		$ 15,000	$ 5,790
2029		$ 18,600		$ 6,845		$ 15,000	$ 5,521
2030		$ 18,600		$ 6,527		$ 15,000	$ 5,264
2031		$ 18,600		$ 6,224		$ 15,000	$ 5,019
2032		$ 18,600	$ 14,000	$ 10,401		$ 15,000	$ 4,786
2033		$ 18,600		$ 5,659		$ 15,000	$ 4,563
2034		$ 18,600		$ 5,396		$ 15,000	$ 4,351
2035		$ 18,600		$ 5,145		$ 15,000	$ 4,149
2036		$ 18,600		$ 4,906		$ 15,000	$ 3,956
2037		$ 18,600	$ 14,000	$ 8,198		$ 15,000	$ 3,772
2038		$ 18,600		$ 4,460		$ 15,000	$ 3,597
TOTAL LIFE CYCLE COST				$ 970,187			$ 798,909

Appendix G

Background Data for Biosolids Projections

Biosolids Generation Projections for the Town of Georgetown/Silver Plume

Year 2005		
total raw flow	47.94	million gal
total volume biosolids	234,000	gal
% solids	3.2	
total dry mass biosolids	31.27	tons
dry mass biosolids/volume raw flow	0.652	tons/million gal

raw flow factors		
population	77	gpcd
employment	45	gpcd
visitors	11	gpcd

	population	employment	visitors	raw flow (mgd)	dry mass biosolids (tons/yr)	total volume biosolids (gal/yr)
2005	1,291	343	1,500	0.131	31.27	234,000
2015	1,729	1,059	2,337	0.206	49.17	367,893
2030	2,098	1,177	3,641	0.255	60.61	453,530
2038	2,326	1,245	4,612	0.286	68.07	509,314

Biosolids Generation Projections for the City of Idaho Springs

Year 2005

total raw flow	75.15	million gal
total volume biosolids	344,500	gal
% solids	1.848	
total dry mass biosolids	26.59	tons
dry mass biosolids/volume raw flow	0.354	tons/million gal

raw flow factors		
population	77	gpcd
employment	45	gpcd
visitors	11	gpcd

	population	employment	visitors	raw flow (mgd)	dry mass biosolids (tons/yr)	total volume biosolids (gal/yr)
2005	1,889	732	2,500	0.206	26.59	344,500
2015	1,947	1,007	3,895	0.238	30.75	398,354
2030	1,994	1,074	6,068	0.269	34.69	449,448
2038	2,020	1,112	7,687	0.290	37.46	485,354

Note: The biosolids data for Idaho Springs is from 2006.

Biosolids Generation Projections for the CCCSD

Year 2005

total raw flow	16.71	million gal
total volume biosolids	96,000	gal
% solids	2	
total dry mass biosolids	8.02	tons
dry mass biosolids/volume raw flow	0.480	tons/million gal

raw flow factors

population	77	gpcd
employment	45	gpcd
visitors	11	gpcd

	population	employment	visitors	raw flow (mgd)	dry mass biosolids (tons/yr)	total volume biosolids (gal/yr)
2005	414	150	650	0.046	8.02	96,000
2015	496	338	1,013	0.065	11.31	135,356
2030	535	479	1,578	0.080	14.03	167,993
2038	557	577	1,999	0.091	15.91	190,496

Note: The total volume biosolids is an estimation made by the CCCSD. They do not currently haul biosolids.

Biosolids Generation Projections for the Town of Empire

Year 2005		
total raw flow	11.38	million gal
total volume biosolids	67,600	gal
% solids	2	
total dry mass biosolids	5.65	tons
dry mass biosolids/volume raw flow	0.496	tons/million gal

raw flow factors	
population	77 gpcd
employment	45 gpcd
visitors	11 gpcd

	population	employment	visitors	raw flow (mgd)	dry mass biosolids (tons/yr)	total volume biosolids (gal/yr)
2005	355	46	160	0.0312	5.65	67,600
2015	397	89	249	0.0373	6.76	80,936
2030	424	94	388	0.0411	7.45	89,250
2038	439	97	492	0.0436	7.90	94,521

Note: The % solids value is an assumption.

Appendix H

Biosolids Metals Blending Calculations

Total Blended Metals Concentrations

Entity	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Zinc (mg/kg)	
Georgetown	3.6	40	300	91	0.53	7.6	7.2	6.1	7700	Conservative value.
Idaho Springs	2.7	6.71	457.5	44.6	0.25	7.7	13.7	1.1	894.6	
CCCSD	1.5	1.95	327.4	29.5	0.2	6.7	11.4	1.5	534.1	
Empire									480	

Year	Georgetown biosolids (lb/yr)	Idaho Springs (lb/yr)	dry wt CCCSD biosolids (lb/yr)	dry wt Empire biosolids (lb/yr)	total dry wt biosolids (lb/yr)	% Contribution	Springs %	CCCSD % contribution	Empire % contribution
2005	62,547	53,178	16,038	11,293	143,055	44	37	11	8
2015	98,336	61,491	22,612	13,521	195,960	50	31	12	7
2030	121,226	69,378	28,065	14,910	233,578	52	30	12	6
2038	136,137	74,920	31,824	15,791	258,672	53	29	12	6

Year	Blended Arsenic (mg/kg)	Blended Cadmium (mg/kg)	Blended Copper (mg/kg)	Blended Lead (mg/kg)	Blended Mercury (mg/kg)	Blended Molybdenum (mg/kg)	Blended Nickel (mg/kg)	Blended Selenium (mg/kg)	Blended Zinc (mg/kg)
2005									
2015	3	20	338	60	0	7	10	3	3,759
2030	3	22	332	63	0	7	9	4	4,206
2038	3	23	331	64	0	7	9	4	4,326
	3	23	331	64	0	7	9	4	4,407

Pollutant Concentration Limits

Pollutant	mg/kg
Arsenic	41
Cadmium	39
Copper	1,500
Lead	300
Mercury	17
Molybdenum	
Nickel	420
Selenium	100
Zinc	2,800

Ceiling Concentration Limits

Pollutant	mg/kg
Arsenic	75
Cadmium	85
Copper	4,300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7,500

Appendix I

Regional Biosolids Handling Facility Life Cycle Cost Evaluation

Regional Biosolids Handling Facility Capital Costs
OPINION OF PROBABLE
PROJECT COST

Client: CLEAR CREEK COUNTY	
Project: Regional Biosolids Handling	

Project No: CLRCRK01	
By: RJA	Ckd:
Date: 4-18-07	Date: 4-18-07

DESCRIPTION	QTY.	UNIT MEAS.	MATER.	LABOR	UNIT COST	TOTAL COST
Structure						
Earthwork	5,000	CY			$25	$125,000
Concrete	250	CY			$600	$150,000
CMU Walls	3,200	SF			$20	$64,000
Roof	1,900	SF			$40	$76,000
Doors	9	EA			$1,000	$9,000
Windows	3	EA			$1,000	$3,000
Roll Up Doors	2	EA			$4,000	$8,000
Equipment/Other						
Power/Service	1	LS			$100,000	$100,000
Control	1	LS			$30,000	$30,000
Misc. Piping	1	LS			$40,000	$40,000
Blowers	2	EA			$20,000	$40,000
Diffusers	1	LS			$20,000	$20,000
Chemical Pumping System	1	LS			$15,000	$15,000
Pumps	3	EA			$15,000	$45,000
Centrifuge or Beltpress	1	LS			$300,000	$300,000
Mis Metals	1	LS			$20,000	$20,000
Hauling Truck	1	LS			$40,000	$40,000
PROJECT SUBTOTAL						**$1,085,000**
Contingency	25%					$271,250
General Conditions and Overhead	10%					$108,500
CONSTRUCTION TOTAL						**$1,464,750**
Engineering, Legal, and Administrative	25%					$366,188
Centrate/Filtrate CCCSD Tap Fee (10 EQR)	LS					$75,000
CCCSD Land (1 acre)	LS					$40,000
PROJECT TOTAL						**$1,945,938**
PROJECT TOTAL (NO TAP OR LAND FEES)						**$1,830,938**

Regional Biosolids Handling Facility Capital Costs
OPINION OF PROBABLE PROJECT COST

Client:	CLEAR CREEK COUNTY
Project:	Regional Biosolids Handling

Project No: CLRCRK01	
By: RJA	Ckd:
Date: 4-18-07	Date: 4-18-07

DESCRIPTION	QTY.	UNIT MEAS.	MATER.	LABOR	UNIT COST	TOTAL COST
Structure						
Earthwork	5,000	CY			$25	$125,000
Concrete	250	CY			$600	$150,000
CMU Walls	3,200	SF			$20	$64,000
Roof	1,900	SF			$40	$76,000
Doors	9	EA			$1,000	$9,000
Windows	3	EA			$1,000	$3,000
Roll Up Doors	2	EA			$4,000	$8,000
Equipment/Other						
Power/Service	1	LS			$100,000	$100,000
Control	1	LS			$30,000	$30,000
Misc. Piping	1	LS			$40,000	$40,000
Blowers	2	EA			$20,000	$40,000
Diffusers	1	LS			$20,000	$20,000
Chemical Pumping System	1	LS			$15,000	$15,000
Pumps	3	EA			$15,000	$45,000
Centrifuge or Beltpress	1	LS			$300,000	$300,000
Mis Metals	1	LS			$20,000	$20,000
Hauling Truck	1	LS			$40,000	$40,000
PROJECT SUBTOTAL						**$1,085,000**
Contingency	25%					$271,250
General Conditions and Overhead	10%					$108,500
CONSTRUCTION TOTAL						**$1,464,750**
Engineering, Legal, and Administrative	25%					$366,188
Centrate/Filtrate CCCSD Tap Fee (10 EQR)	LS					$75,000
CCCSD Land (1 acre)	LS					$40,000
PROJECT TOTAL						**$1,945,938**
PROJECT TOTAL (NO TAP OR LAND FEES)						**$1,830,938**

Richard P. Arber Associates, Inc.
Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client: Clear Creek County	
Project: **Regional Biosolids Handling Georgetown**	

Project No: CLRCRK01	
By: DRW	Ckd: RJA
Date:	Date:

Alternative for Biosolids Handling
1. Maintain Current Operation
2. Construct Regional Biosolids Handling Facility

COSTS FOR CURRENT OPERATION

Operation	Cost
Hauling @ 2% ($/gallon)	$ 0.13

COSTS FOR REGIONAL BIOSOLIDS HANDLING FACILITY

Operation	Cost
Hauling WWTF to Facility ($/gallon)	$ 0.0015
Hauling Facility to Climax ($/ton)	$ 44
Operation & Maintenance ($/yr)	$ 6,415
Capital Cost	$ 618,984

Notes: Facility assumed to have 50 year life.
Contribution portion - 34%

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	Current Operation		Regional Facility			
	Hauling Cost	PV	Capital	Hauling	O&M	PV
2008	$ 35,042	$ 35,042	$ 618,984	$ 7,304	$ 6,415	$ 632,702
2009	$ 36,607	$ 34,905		$ 7,525	$ 6,415	$ 13,292
2010	$ 38,276	$ 34,800		$ 7,760	$ 6,415	$ 12,887
2011	$ 40,059	$ 34,728		$ 8,008	$ 6,415	$ 12,503
2012	$ 41,966	$ 34,690		$ 8,271	$ 6,415	$ 12,140
2013	$ 44,010	$ 34,689		$ 8,551	$ 6,415	$ 11,796
2014	$ 46,203	$ 34,725		$ 8,849	$ 6,415	$ 11,471
2015	$ 48,562	$ 34,801		$ 9,166	$ 6,415	$ 11,165
2016	$ 49,229	$ 33,639		$ 9,268	$ 6,415	$ 10,716
2017	$ 49,907	$ 32,517		$ 9,371	$ 6,415	$ 10,286
2018	$ 50,597	$ 31,434		$ 9,477	$ 6,415	$ 9,873
2019	$ 51,298	$ 30,389		$ 9,585	$ 6,415	$ 9,478
2020	$ 52,012	$ 29,379		$ 9,695	$ 6,415	$ 9,100
2021	$ 52,738	$ 28,404		$ 9,807	$ 6,415	$ 8,737
2022	$ 53,476	$ 27,463		$ 9,921	$ 6,415	$ 8,389
2023	$ 54,227	$ 26,554		$ 10,038	$ 6,415	$ 8,056
2024	$ 54,991	$ 25,677		$ 10,156	$ 6,415	$ 7,737
2025	$ 55,768	$ 24,829		$ 10,277	$ 6,415	$ 7,432
2026	$ 56,560	$ 24,011		$ 10,400	$ 6,415	$ 7,138
2027	$ 57,364	$ 23,221		$ 10,526	$ 6,415	$ 6,857
2028	$ 58,184	$ 22,458		$ 10,654	$ 6,415	$ 6,588
2029	$ 59,017	$ 21,720		$ 10,785	$ 6,415	$ 6,330
2030	$ 59,866	$ 21,009		$ 10,919	$ 6,415	$ 6,083
2031	$ 60,730	$ 20,321		$ 11,055	$ 6,415	$ 5,846
2032	$ 61,609	$ 19,657		$ 11,194	$ 6,415	$ 5,618
2033	$ 62,504	$ 19,016		$ 11,335	$ 6,415	$ 5,400
2034	$ 63,415	$ 18,396		$ 11,480	$ 6,415	$ 5,191
2035	$ 64,343	$ 17,797		$ 11,627	$ 6,415	$ 4,990
2036	$ 65,288	$ 17,219		$ 11,778	$ 6,415	$ 4,798
2037	$ 66,250	$ 16,661		$ 11,932	$ 6,415	$ 4,614
2038	$ 67,229	$ 16,121		$ 12,089	$ 6,415	$ 4,437
Salvage Value			$ (247,593)			$ (59,372)
TOTAL LIFE CYCLE COST		**$ 826,274**				**$ 822,280**

Richard P. Arber Associates, Inc.
Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client: Clear Creek County	
Project: **Regional Biosolids Handling Idaho Springs**	

Project No: CLRCRK01	
By: DRW	Ckd: RJA
Date:	Date:

Alternative for Biosolids Handling
1. Maintain Current Operation
2. Construct Regional Biosolids Handling Facility

COSTS FOR CURRENT OPERATION

Operation	**Cost**
Hauling @ 2% ($/gallon)	$ 0.08

COSTS FOR REGIONAL BIOSOLIDS HANDLING FACILITY

Operation	**Cost**
Hauling WWTF to Facility ($/gallon)	$ 0.0015
Hauling Facility to Henderson ($/ton)	$ 44
Operation & Maintenance ($/yr)	$ 9,444
Capital Cost	$ 911,281

Notes: Facility assumed to have fifty year life.
Contribution portion - 50%

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	**Current Operation**		**Regional Facility**			
	Hauling Cost	PV	Capital	Hauling	O&M	PV
2008	$ 27,628	$ 27,628	$ 911,281	$ 6,960	$ 9,444	$ 927,685
2009	$ 28,020	$ 26,717		$ 7,171	$ 9,444	$ 15,843
2010	$ 28,425	$ 25,844		$ 7,395	$ 9,444	$ 15,309
2011	$ 28,845	$ 25,006		$ 7,631	$ 9,444	$ 14,803
2012	$ 29,279	$ 24,203		$ 7,882	$ 9,444	$ 14,322
2013	$ 29,728	$ 23,431		$ 8,149	$ 9,444	$ 13,867
2014	$ 30,192	$ 22,691		$ 8,432	$ 9,444	$ 13,435
2015	$ 30,673	$ 21,981		$ 8,734	$ 9,444	$ 13,027
2016	$ 30,895	$ 21,111		$ 8,832	$ 9,444	$ 12,488
2017	$ 31,121	$ 20,277		$ 8,931	$ 9,444	$ 11,972
2018	$ 31,353	$ 19,479		$ 9,031	$ 9,444	$ 11,478
2019	$ 31,590	$ 18,714		$ 9,134	$ 9,444	$ 11,005
2020	$ 31,833	$ 17,981		$ 9,239	$ 9,444	$ 10,553
2021	$ 32,082	$ 17,279		$ 9,346	$ 9,444	$ 10,120
2022	$ 32,336	$ 16,607		$ 9,454	$ 9,444	$ 9,705
2023	$ 32,597	$ 15,962		$ 9,565	$ 9,444	$ 9,309
2024	$ 32,864	$ 15,345		$ 9,678	$ 9,444	$ 8,929
2025	$ 33,137	$ 14,753		$ 9,794	$ 9,444	$ 8,565
2026	$ 33,417	$ 14,186		$ 9,911	$ 9,444	$ 8,217
2027	$ 33,704	$ 13,643		$ 10,031	$ 9,444	$ 7,883
2028	$ 33,998	$ 13,122		$ 10,153	$ 9,444	$ 7,564
2029	$ 34,299	$ 12,623		$ 10,278	$ 9,444	$ 7,258
2030	$ 34,608	$ 12,145		$ 10,405	$ 9,444	$ 6,965
2031	$ 34,924	$ 11,686		$ 10,535	$ 9,444	$ 6,685
2032	$ 35,248	$ 11,246		$ 10,667	$ 9,444	$ 6,417
2033	$ 35,580	$ 10,825		$ 10,802	$ 9,444	$ 6,159
2034	$ 35,921	$ 10,420		$ 10,940	$ 9,444	$ 5,913
2035	$ 36,270	$ 10,032		$ 11,080	$ 9,444	$ 5,677
2036	$ 36,628	$ 9,661		$ 11,224	$ 9,444	$ 5,451
2037	$ 36,996	$ 9,304		$ 11,370	$ 9,444	$ 5,234
2038	$ 37,372	$ 8,962		$ 11,520	$ 9,444	$ 5,027
Salvage Value			$ (364,513)			$ (87,408)
TOTAL LIFE CYCLE COST		**$ 522,865**				**$ 1,129,456**

Richard P. Arber Associates, Inc.

Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client:	Clear Creek County
Project:	**Regional Biosolids Handling** **Empire**

Project No: CLRCRK01	
By: DRW	Ckd: RJA
Date:	Date:

Alternative for Biosolids Handling
1. Maintain Current Operation
2. Construct Regional Biosolids Handling Facility

COSTS FOR CURRENT OPERATION

Operation	**Cost**
Hauling @ 2% ($/gallon)	$ 0.08

COSTS FOR REGIONAL BIOSOLIDS HANDLING FACILITY

Operation	**Cost**
Hauling WWTF to Facility ($/gallon)	$ 0.0015
Hauling Facility to Henderson ($/ton)	$ 44
Operation & Maintenance ($/yr)	$ 1,853
Capital Cost	$ 178,817

Notes: Facility assumed to have fifty year life.
Contribution portion - 10%

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	**Current Operation**		**Regional Facility**			
	Hauling Cost	PV	Capital	Hauling	O&M	PV
2008	$ 5,621	$ 5,621	$ 178,817	$ 1,355	$ 1,853	$ 182,026
2009	$ 5,720	$ 5,454		$ 1,397	$ 1,853	$ 3,099
2010	$ 5,823	$ 5,294		$ 1,440	$ 1,853	$ 2,994
2011	$ 5,929	$ 5,140		$ 1,486	$ 1,853	$ 2,895
2012	$ 6,040	$ 4,992		$ 1,535	$ 1,853	$ 2,801
2013	$ 6,153	$ 4,850		$ 1,587	$ 1,853	$ 2,711
2014	$ 6,272	$ 4,713		$ 1,642	$ 1,853	$ 2,627
2015	$ 6,394	$ 4,582		$ 1,701	$ 1,853	$ 2,547
2016	$ 6,434	$ 4,396		$ 1,720	$ 1,853	$ 2,442
2017	$ 6,474	$ 4,218		$ 1,739	$ 1,853	$ 2,341
2018	$ 6,514	$ 4,047		$ 1,759	$ 1,853	$ 2,244
2019	$ 6,556	$ 3,884		$ 1,779	$ 1,853	$ 2,152
2020	$ 6,597	$ 3,727		$ 1,799	$ 1,853	$ 2,063
2021	$ 6,640	$ 3,576		$ 1,820	$ 1,853	$ 1,978
2022	$ 6,683	$ 3,432		$ 1,841	$ 1,853	$ 1,897
2023	$ 6,727	$ 3,294		$ 1,863	$ 1,853	$ 1,820
2024	$ 6,771	$ 3,161		$ 1,885	$ 1,853	$ 1,745
2025	$ 6,816	$ 3,035		$ 1,907	$ 1,853	$ 1,674
2026	$ 6,861	$ 2,913		$ 1,930	$ 1,853	$ 1,606
2027	$ 6,908	$ 2,796		$ 1,954	$ 1,853	$ 1,541
2028	$ 6,955	$ 2,684		$ 1,977	$ 1,853	$ 1,478
2029	$ 7,002	$ 2,577		$ 2,002	$ 1,853	$ 1,419
2030	$ 7,051	$ 2,474		$ 2,026	$ 1,853	$ 1,361
2031	$ 7,100	$ 2,376		$ 2,052	$ 1,853	$ 1,307
2032	$ 7,150	$ 2,281		$ 2,077	$ 1,853	$ 1,254
2033	$ 7,201	$ 2,191		$ 2,104	$ 1,853	$ 1,204
2034	$ 7,252	$ 2,104		$ 2,131	$ 1,853	$ 1,156
2035	$ 7,305	$ 2,020		$ 2,158	$ 1,853	$ 1,109
2036	$ 7,358	$ 1,941		$ 2,186	$ 1,853	$ 1,065
2037	$ 7,412	$ 1,864		$ 2,214	$ 1,853	$ 1,023
2038	$ 7,467	$ 1,791		$ 2,243	$ 1,853	$ 982
Salvage Value			$ (71,527)			$ (17,152)
TOTAL LIFE CYCLE COST		**$ 107,429**				**$ 221,409**

Richard P. Arber Associates, Inc.
Consulting Engineering and Project Management

LIFE CYCLE COST ANALYSIS

Client:
Clear Creek County

Project:
Regional Biosolids Handling
CCCSD

Project No: CLRCRK01	
By: DRW	Ckd: RJA
Date:	Date:

Alternative for Biosolids Handling
1. Maintain Current Operation
2. Construct Regional Biosolids Handling Facility

COSTS FOR CURRENT OPERATION

Operation	Cost
Hauling @ 2% ($/gallon)	$ 0.08

COSTS FOR REGIONAL BIOSOLIDS HANDLING FACILITY

Operation	Cost
Hauling WWTF to Facility ($/gallon)	$ 0.0015
Hauling Facility to Henderson ($/ton)	$ 44
Operation & Maintenance ($/yr)	$ 2,632
Capital Cost	$ 121,855

Notes: Facility assumed to have fifty year life.
Contribution portion - 6%

PRESENT WORTH COST COMPARISON OF ALTERNATIVES (30 year @ 4.875% - discount rate for water resources projects)

YEAR	Current Operation		Regional Facility			
	Hauling Cost	PV	Capital	Hauling	O&M	PV
2008		$ -	$ 121,855	$ 2,732	$ 2,632	$ 127,218
2009		$ -		$ 2,815	$ 2,632	$ 5,193
2010	$ 8,938	$ 8,126		$ 2,902	$ 2,632	$ 5,031
2011	$ 9,253	$ 8,021		$ 2,995	$ 2,632	$ 4,878
2012	$ 9,584	$ 7,923		$ 3,094	$ 2,632	$ 4,733
2013	$ 9,934	$ 7,830		$ 3,198	$ 2,632	$ 4,595
2014	$ 10,303	$ 7,743		$ 3,310	$ 2,632	$ 4,465
2015	$ 10,693	$ 7,663		$ 3,428	$ 2,632	$ 4,343
2016	$ 10,840	$ 7,407		$ 3,466	$ 2,632	$ 4,167
2017	$ 10,990	$ 7,160		$ 3,505	$ 2,632	$ 3,998
2018	$ 11,143	$ 6,923		$ 3,545	$ 2,632	$ 3,837
2019	$ 11,299	$ 6,694		$ 3,585	$ 2,632	$ 3,683
2020	$ 11,459	$ 6,473		$ 3,626	$ 2,632	$ 3,535
2021	$ 11,623	$ 6,260		$ 3,668	$ 2,632	$ 3,393
2022	$ 11,790	$ 6,055		$ 3,711	$ 2,632	$ 3,257
2023	$ 11,961	$ 5,857		$ 3,754	$ 2,632	$ 3,127
2024	$ 12,136	$ 5,667		$ 3,799	$ 2,632	$ 3,002
2025	$ 12,315	$ 5,483		$ 3,844	$ 2,632	$ 2,883
2026	$ 12,497	$ 5,305		$ 3,890	$ 2,632	$ 2,769
2027	$ 12,684	$ 5,135		$ 3,937	$ 2,632	$ 2,659
2028	$ 12,876	$ 4,970		$ 3,985	$ 2,632	$ 2,554
2029	$ 13,071	$ 4,811		$ 4,034	$ 2,632	$ 2,453
2030	$ 13,271	$ 4,657		$ 4,084	$ 2,632	$ 2,357
2031	$ 13,476	$ 4,509		$ 4,135	$ 2,632	$ 2,264
2032	$ 13,686	$ 4,367		$ 4,187	$ 2,632	$ 2,175
2033	$ 13,900	$ 4,229		$ 4,240	$ 2,632	$ 2,090
2034	$ 14,119	$ 4,096		$ 4,294	$ 2,632	$ 2,009
2035	$ 14,344	$ 3,968		$ 4,349	$ 2,632	$ 1,931
2036	$ 14,573	$ 3,844		$ 4,405	$ 2,632	$ 1,856
2037	$ 14,809	$ 3,724		$ 4,463	$ 2,632	$ 1,784
2038	$ 15,049	$ 3,609		$ 4,521	$ 2,632	$ 1,715
Salvage Value			$ (48,742)			$ (11,688)
TOTAL LIFE CYCLE COST		**$ 168,507**				**$ 212,268**

Appendix J

Alternative Treatment Process

Efficiency = Sustainability

Clear Creek Watershed
Wastewater Study Group

ALTERNATIVE # 3

Georgetown/Upper Clear Creek
Regional Wastewater Treatment Facility

Alternative #3

Upper Clear Creek Regional Treatment Facility

- Highlight existing Alternatives
  - 1) Regional expansion at CCCSD (Arber)
  - 2) Expand at existing site near Georgetown Lake (Arber)
- Over-view of CCC wastewater demand
  - Recent development experience (2030 plan)
  - Current development condition (CCC GIS)
  - Likely future development patterns, implications (Arber)
- Alternative #3 Regional Treatment Facility:
  - ,what, where, who, why (WWS)
  - Details of VERTREAT, NORAM, advantages
  - Cost details, facility comparisons, (P.E./PhD, Noram)
  - Cost of existing system, financing, (WWS)
  - Cost of financing, costs of infiltration & implications (WWS)

Wastewater "regionalization"

- **Infrastructure consolidation**
  - Pump/vacuum station
  - Sewer main extension
  - Satellite or pretreatment facilities
- **Management consolidation**
  - RME for decentralized wastewater systems
  - 'pool' services such as billing and secretarial

BOTH satisfy CRS consolidation guidance requirements.

The common goal is highest level of SERVICE with best overall *efficiency*

Table 5-3 – Budgeting Capital Costs for Georgetown Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
			$4 Million
Alternative 2 – Improve/Expand the Current Facility	Facility Expansion/Improvement	0.58 mgd to 0.72 mgd [1]	Total = $4,000,000

[1] Expansion size proposed by HDR

What IF?

- An alternative proposal met the sewage demand of Silver Plume and Georgetown with Nutrient removal, but cost the ratepayers no more (and possibly ONE MILLION DOLLARS LESS) than the projected $3 to $4M to expand the plant in-place.
- This option provided capacity to treat septage generated by every future onsite residence in the basin for $217,000 more than the $4M alternative.

Table 5-3 – Budgeting Capital Costs for Georgetown Wastewater Treatment Alternatives

Alternative	Item	Units	Cost
Alternative 1 – Regionalize with the CCCSD	12" Sewer Line Along Alvarado Road	19,000 ft	$3,230,000
	12" New CCCSD Infrastructure	10,000 ft	$1,700,000
	New Mechanical Plant at CCCSD site	1.0 million gallons	$9,000,000
			Total = $13,930,000

$13,930,000.00

What IF the regional treatment alternative could serve developments from Silver Plume to Empire Junction for $8,723,000.00 LESS than above projected cost?

Scope/Scale of Existing Project

1st -- Watershed Scale,
past-present-future

2nd -- Specific Implications:
Georgetown/Empire Junction regional treatment scenario

Recent historical residential growth

from County 2030 Plan

- The 1990 Census showed a population of 7,619 which increased to 9,553 in 2002, for a total gain of 1,934 persons. = 25% increase in population.
- "Growth has occurred primarily in unincorporated Clear Creek County. Of the 600 building permits issued from 1990 to 2000 almost 90% of new construction occurred in the unincorporated portions of the county."

Current Conditions
'state of the watershed'
data provided by CCC GIS

- Approximately 53% of existing improvements in CCC are located in unincorporated areas.
- Approximately 60-65% of **existing** residences in CCC are served by on-site systems
  (reported in 60-75% in CORE study)
- In all probability, over +90% conventional/dated

Future municipal development
data per CCC GIS 2/23/07* and Arber report**

Facility	% unoccupied*	05 pop**	residents @ buildout
St. Marys	79.40%	705	600
Cent. Clear Crk	30.95%	414	128
Silver Plume	22.54%	combined	
Georgetown	23.40%	1,291	302
Empire	25.15%	89	22
Idaho Springs	16.85%	1,889	319

Total 1,371 new residents

Future unincorporated development

per CCC 2030 Plan

• Existing inventory in approved subdivisions	1,200-1,700
• future lot capacity on non-ag lands	3,000-4,100
• Future converting Agricultural lands	1,600-2,240
	3,100-8,040

- Maximum potential future ADDITIONAL residential population of 13,340 – 18,492 humans living in unincorporated areas of CCC @ +/- 2.4 ppl/residence
- Compare with: 1,371 future **municipal** residents = 7.4%- 10.2% future residential population in CCC.

In all probability, municipal systems for top 6 towns will likely serve less than 10% of future residential population growth in Clear Creek County through BUILD-OUT.

Conclusions

- using the 2002 population of 9,553 residents, **CCC is currently somewhere around 34.2% to 40% of maximum possible build-out potential.**
- unless development patterns change DRASTICALLY (i.e. diverging from existing character), at the MOST, only +/-**10% of future residential growth will occur in existing sanitation service areas.**
- According to the residential unit projections in the County 2030 Plan, well over 92% of ALL ***possible*** future residential growth will occur outside existing sewer service areas, or **in unincorporated rural areas of the County.**

Georgetown WWTP

- Current avg daily flow = 310,000 gpd
- Gtown: 508 residential 71 commercial accounts
- Splume: res. pop.134
  - @ 2.3/household = 58 residential EQR
  - est 10 commercialEQR

Total = 566 residential 81 commercial accts

1 EQR assumed = 300gal/EQR

Monthly sewer bill = $36/month/EQR

Estimated gross income $24,458/month

Annual gross revenue is only $293,496.00

Wastewater funding conundrum

- 508 res accts @ 2.5 people= 1270 people
- Even with additional 60 EQR from S.P

  annual gross revenue is <$300,000.

Georgetown annual budget alone is $365,302. Current fee structure operating at a financial loss, or at best "just treading water" with costs.

At $36/mo, it will take well over 10-15 years to pay back $3Million projected expansion.

Monthly fees will be forced to increase significantly, i.e. 75% to 100% or more.

Georgetown WWTP

Annual est costs from Splume $40,000

- Electricity contribution est @ $2,200

- Annual O&M Budget $340,302 /579 acct
  - Electricity for wwtp $18,000
  - **Annual infiltration** **$25,000**

total $365,000 /year

Georgetown WWTP Infiltration

- Georgetown Flow Factor: 183 g/p/day
- DRCOG est. base flow = 77 g/p/day
- DRCOG infiltration (10%)= 85 g/p/day
- EPA "excessive" I&I= flows over 120g/p/day
- **106 gal/day extraneous flows**
- **58% of daily flow** (almost 2 out of 3 gallons reaching the plant are I&I)
- ***Combined, top 5 WWTP's in CCC treat over 350 acre feet of infiltration volume per year.***

The REAL price of infiltration

- Annual budget of 365,302 in Georgetown
- 58% of volume reaching plant is I&I

"a spoonful of sewage in a vat of wine is a vat of sewage"

nearly $200,000 spent to treat I&I yearly

$10,440 spent on Electricity alone.

Energy cost for treating I&I = 41% of I&I Budget

I&I treatment costs = 800% more than budget to fix the I&I problem annually.

"... facilities have progressive efforts to reduce I&I...."

- Assume net reduction of extraneous flows nonetheless is 50% by 2038 106/2 = 53gal/day
- 77 g/p/d + 53 g/day extraneous flows = **130/day**
- 10 gal/day ***above*** EXCESSIVE (120g/p/d) by current EPA definition.

CONCLUSION: Current direction of wastewater management in Gtown/Splume for the next 30 years is to simply ***engineer*** for I&I rates surpassing current EPA definition of "excessive extraneous flows" **by at least 8%.**

Noram VERTREAT advantages

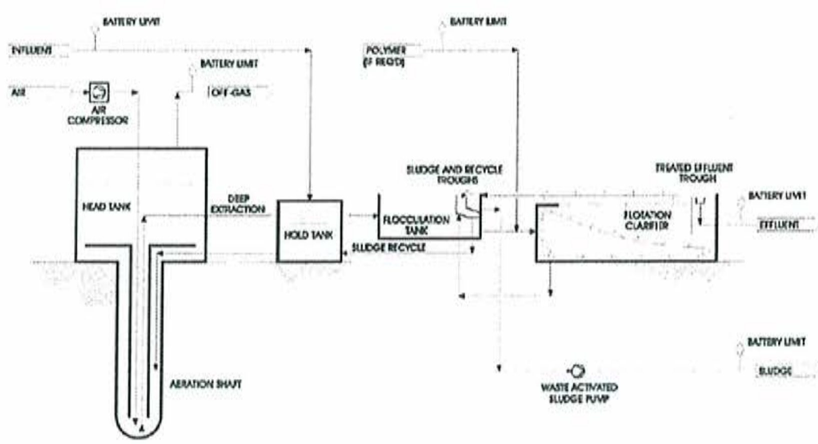
- 60% lower energy requirement
- 75% - 90% smaller 'footprint'
- Can be fully enclosed in structure
- 100% Odor and Noise control
- Cold Climate/Wind advantages

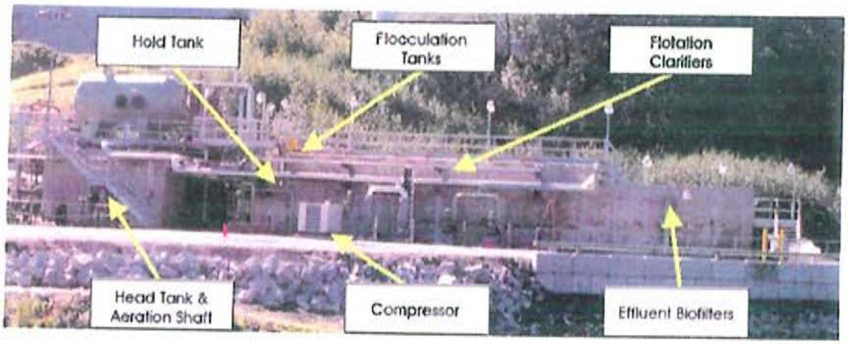
Cons:

Involves 350' shaft, 5' wide,
Groundwater/temperature concerns

What is VERTREAT

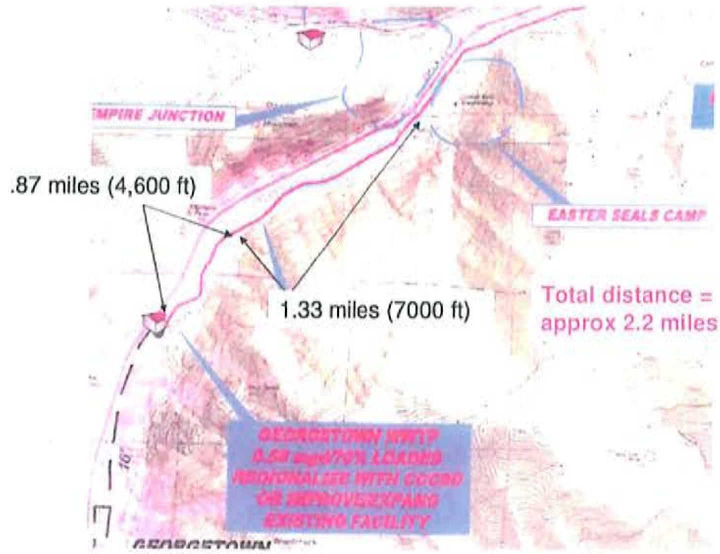
CONCEPTUAL PLANT FLOWSHEET





Where is the new site?

Proximity to Empire Junction



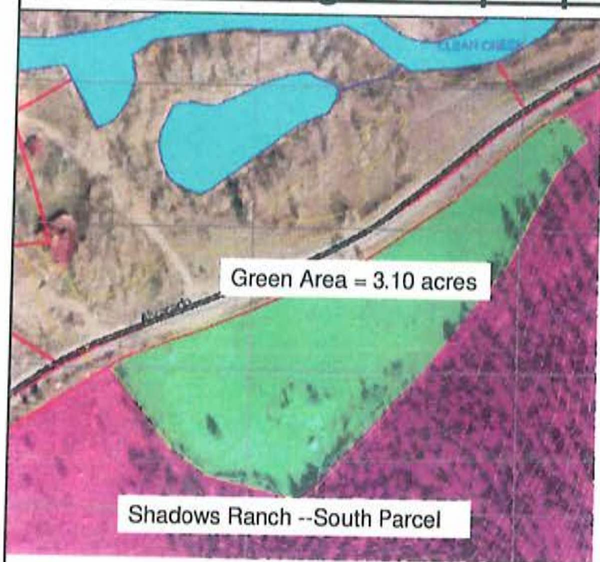
Limitations of existing site

- Very limited space
  - No elbow room!
- Sloping surface
- Proximity to:
  - Lake/River/Wetlands
  - Alvarado Road
  - I-70
  - Georgetown Dam

  Public Visibility, etc.

  Poor truck/hauler access

Advantages of proposed site



- Elbow Room
- Solid granite
- Flat Site
  - Near power
  - Existing road
- Away from:
  - Creek/wetland
  - I-70
  - groundwater

VERTREAT Cost projection #1

Alternative 3

-- Item	Units	Cost
12" Sewer Line Along Alvarado Road	4,600'	$782,000
New VERTREAT plant at Whitaker property	**up to 1 mgd**	$3.435M

- Option 1 Total cost $4,217,000.00
- INCLUDES Treatment Capacity for County-wide Septage processing.

VERTREAT Cost projection #2

Alternative 3

-- Item	Units	Cost
12" Sewer Line along Alvarado Road	4,600'	$782,000
New VERTREAT plant at Whitaker property	**1 mgd**	$3.435M
6" force main up Alvarado rd	7,000'	$490,000
Lift Station	100,000	$500,000

Option 2 Total cost $5,207,000.00

Every attempt made to reduce cost:

Use existing improved headworks at existing site (recent work not in vain)

Sludge Centrifuge Dewatering equipment costs included in proposal from WW

Salvage/transfer existing equipment and laboratory (if any).

Salvage/re-use equipment from recent Chlorination/Dechlorination work?

Exclusions from Noram Contract

The balance of the treatment plant engineering and equipment supply, including, but not limited to:

- Site preparation and permitting
- MCC & I/O Panel
- Sludge dewatering
- Influent screening & degritting
- Control Room, Laboratory Facility
- Sludge digestion
- Sludge handling and disposal
- Effluent disinfection

NORAM Bio Systems Inc. October 17, 2007

VERTREAT™ DESIGN CRITERIA

Plant Location: Clear Creek Regional Wastewater Facility, CO
Application: Municipal Wastewater Treatment Plant

Influent Specifications

Parameter	Unit of Measure	Basis for Design
Average Flow	MGD	1.575
Peak Factor	PF	3
Peak Hourly Flow	MGD	4.725
Average BOD_5*	mg/L	150
Average TSS*	mg/L	150
Average Total Nitrogen	mg/L	20
Average Total Phosphorus	mg/L	4
Temperature	°C	10 - 20

* – estimated based on BOD of 110 mg/L in the domestic sewage, and a BOD of 1100 mg/L in the septage (representing 75,000 gpd of the total flow).

Effluent Specifications

Parameter	Unit of Measure	Basis for Design
Average BOD	mg/L	20
Average TSS	mg/L	20

VERTREAT™ EQUIPMENT SPECIFICATION

Plant Location: Clear Creek Regional Wastewater Facility, CO
Application: Municipal Wastewater Treatment Plant

Design Features

Number of Bioreactors	1
Shaft Depth	350 ft
Shaft Diameter	5 ft
Number of Head Tanks	1
Width	10 ft
Length	20 ft
Height	18 ft
Number of Sludge Pumps	2
Maximum flow rate per pump	3.5 gpm
Average power draw per pump	0.5 HP
Number of Flotation Clarifiers	2
Width	20 ft
Length	80 ft
Height	13 ft
Number of Compressors	2
Maximum flow per compressor	150 scfm
Installed power per compressor	44 HP
Average power draw	41 HP

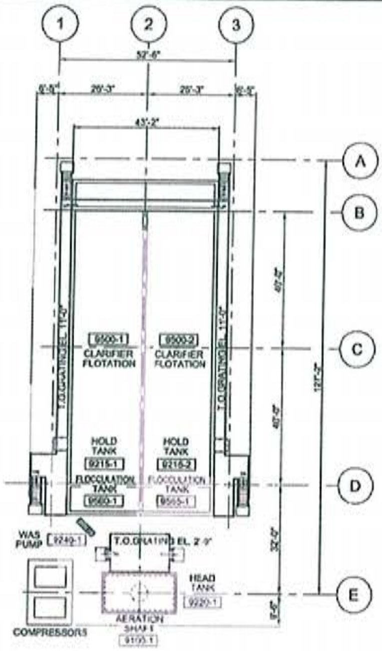
Motor List and Size

Name	Number	Total Installed Power (HP)	Average Power Draw (HP)	Power Draw of Conventional System (HP)
Compressors	2	88	41	82
Waste Sludge Pumps	2	1	1	1
Recycle Sludge Pumps	0	0	0	30
Clarifier Skimmers	2	2	2	2
Clarifier Collectors	2	2	2	2
Total:	8	93	46	117

- The VERTREAT™ system operates at 39% of the power draw of a conventional activated sludge system in this application.
- The total energy savings are 621,960 kWhr / yr, representing an annual cost savings of $54,110 / yr at a nominal power cost of $0.087 / kWhr.

Piping Requirements

Pipe Size (inch, standard gauge pipe)	Line Count	Approximate Total Length (ft)
2	3	1200
3	2	40
4	4	120
6	1	50
8	3	180
10	1	400
12	7	800
14	3	20
16	1	50
30	1, downcomer	310



Building footprint <15,000 sq ft

(75' x 170')

Entire facility is completely enclosed under roof, including space for offices.

Architectural Packages for exterior appearance.

Complete odor control

Noise free operation

GOOD NEIGHBOR!

Architecture Appropriate to regional setting!

Virtually unlimited options for exterior details

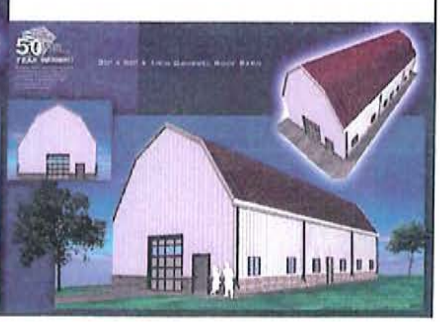


Figure 4 - Installed VERTREAT™ Bioreactors

Figure 5 - Bioreactor Piping inside Head Tank

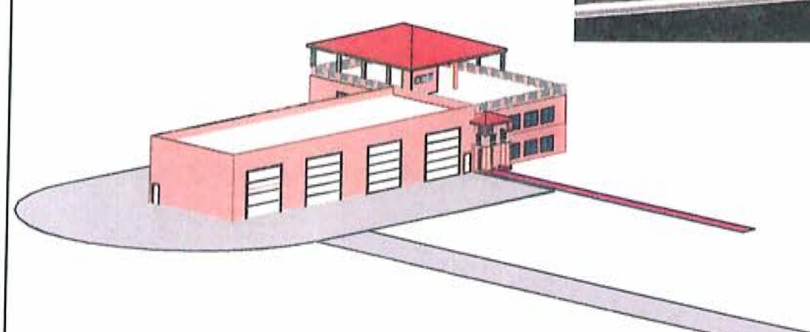
Figure 8 - Twin Flotation Clarifiers

Figure 9 - 4% Float Thickened Sludge

Future Septage Receiving

Future Expandability for regional sludge management facility.

verTAD system for Class A biosolids



VERTREAT SUMMARY

- LOWER FIRST COST, W/ NUTRIENTS
- 60% LOWER ENERGY COST (CO_2)
- LONGER LIFE CYCLE (shaft +125 YRS)
- CAPACITY TO HANDLE ALL SEPTAGE GENERATED FROM FUTURE GROWTH UNDER RENEWABLE PERMITS
- OPTIONAL EXPANDABILITY FOR VERTAD SYSTEM/CLASS A BIOSOLIDS

Whole Water

SYSTEMS, LLC

John Grove, Principal Biologist

F. Patrick Fitzgerald, P.E. Principal Engineer

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