

August 28, 2020

Colorado Department of Public Health and Environment
Attn: Bret Icenogle
Water Quality Control/Engineering Section
4300 Cherry Creek Drive South, B2
Denver, CO 80246-1530

RE: Pine Canyon Site Location and Trade Proposal Comments of the Town of Castle Rock

The Town of Castle Rock recommends that the Water Quality Control Division deny the site location application for the Pine Canyon Water Reclamation Facility and encourage the applicant to work with Castle Rock to obtain service through the Plum Creek Water Reclamation Authority. The application is inadequate, and the proposed project is inconsistent with the site location policies of the Colorado Water Quality Control Act, Water Quality Control Commission Regulation 22, and the implementing guidance developed by the Water Quality Control Division.

In order to approve the site location and design for a domestic wastewater treatment works, the Colorado Water Quality Control Act, C.R.S. § 25-8-702, requires the Division to:

- (a) Consider the local long-range comprehensive plan for the area as it affects water quality and any approved regional wastewater management plan for the area;
- (b) Determine that the plant on the proposed site will be managed to minimize the potential adverse impacts on water quality; and
- (c) Encourage the consolidation of wastewater treatment facilities whenever feasible.

The site application for the Pine Canyon Water Reclamation Facility should be denied because it does not show that the proposed plant will be managed to minimize the potential adverse impacts on water quality. The plant has serious potential adverse impacts on Castle Rock public water supply wells located immediately downstream of the proposed discharge. Furthermore, the applicant has not yet been formed as a District and has not demonstrated any ability to manage a wastewater treatment plant or to finance its construction, operation, and maintenance. The application lacks the minimum financial information necessary to demonstrate the ability to operate a wastewater plant.

The site location should also be denied because it would be feasible to provide wastewater service through consolidation with the Plum Creek Water Reclamation Authority facility. The proposed wastewater treatment plant would serve a new development located in the heart of Castle Rock. The existing PCWRA facility would efficiently serve the development. The application seriously underestimates the cost of the proposed treatment facility, and includes development costs that are irrelevant to the feasibility of consolidation of wastewater service. When the true, relevant costs are compared, consolidation with PCWRA is less expensive and therefore more feasible than the proposed wastewater treatment facility.

The applicant has not shown that the proposed wastewater treatment plant can be managed to minimize potential adverse impacts on water quality.

The designation of the legally responsible person and the legal description of the site location required by Reg. 22.5(1)(a) shows that the proposed facility cannot be properly constructed or managed.

Pine Canyon Water & Sanitation District (PCWSD) does not exist. The site application notes that the District has not been formed (Site app. Pg. 1). Therefore, the applicant is JRW Family Limited Partnership LLLP. The application does not identify the partners, does not provide other information about the legal structure of the partnership, and provides no information about the financial or management capability of the partnership to actually design, construct, operate, and maintain a domestic wastewater treatment works in a manner that does not place public health and the environment at risk.

The applicant must provide information that the applicant can generate funds, set rates, and earmark funds for acceptable waste treatment. (WQCD Reg. 22 Guidance, pg. 21). This information was not provided. It appears that the Family Partnership has no ability to generate funds, set rates, or earmark funds. It is relying entirely upon a water & sanitation district that does not exist and has not been formed.

The Division's Regulation 22 Guidance (pp. 22-23) also requires the applicant to provide information about the financial system associated with constructing, operating, and maintaining the proposed facilities. This requires evidence of enough resources available to meet these requirements. If the project will be financed independently, the applicant needs to provide written evidence from a financial institution that it has adequate capital to undertake the project. (Reg. 22 Guidance, pg. 22). If the entity will need a loan, it must submit a letter indicating the intent of a financial institution to make a loan for construction purposes. (*Id.*). None of this information was provided with the application. Lack of sufficient financial resources places public health and the environment at risk if there is not enough capital or revenue to properly construct, operate, and maintain the facilities.

The application form indicates that the applicant will not apply for a state or federal grant or loan to finance the project. Instead, the report notes (pg. 38) that the as-yet-unformed PCWSD will pursue bonds to pay for the facility, and also claims that the District may apply for grants or loans (pg. 5). There is no letter indicating that any financial institution will issue bonds, and the claimed sources of funding in the engineering report contradict the site location application.

The applicant must demonstrate the ability to finance the construction of the facility and must have sufficient reserve funds for operation and maintenance, and for anticipated expansions and improvements in treatment over at least a 20-year period. The applicant is required to provide a long-range financial plan and a projected 5-year budget and financial analysis. (Reg. 22 Guidance, pg. 23). None of this information was provided to demonstrate that there will be enough funding available to actually construct the project. The following factors required by the Regulation 22 Guidance were not adequately addressed in the application:

- Itemization of projected expenses and revenues. Costs are not itemized, and revenues are not projected. Because the area to be served does not have any development entitlements at this time, the applicant must provide a projection of the schedule for receiving wastewater impact fees and rates. This schedule must be compared to the capital and operating costs for the proposed facility to ensure that the facility can be completed and properly operated.
- Comparison of all anticipated wastewater revenues and planned expenditures for a 20-year period. The applicant provided no information to satisfy this requirement.
- Identification of reserve accounts for emergencies/replacement funding and operations and maintenance funds. The applicant did not identify any reserve accounts.
- Access to public and private financial capital. The applicant provided no information that it currently has access to capital. The applicant merely assumes that loans or bonds will be available upon formation of a special district without any existing residents or ratepayers.

- Revenues must be greater than costs. There is no demonstration that revenues will be greater than costs, particularly in the period immediately after construction of the facility leading up to build-out of the proposed development.
- Current outstanding debt and ability to borrow funds. No information about this was provided. However, because the proposed special district does not exist, it has no ability to borrow funds.
- Periodic financial audits. There is no information about a plan to provide for financial audits.
- Annual development and utilization of budget. The applicant provided no budget information at all.
- Rate structure based on customer, flow, and/or waste type. The applicant appears to assume a single rate structure, but fails to address the multiple proposed land uses shown in the application (Application Figure 2).
- Capital improvements plan. No plan was provided.

The application fails to account for the proximity of the proposed facility to public water supply intake structures as required by Section 22.5(1)(d). Relationship to and potential impact of proposed facility on any water supply intake. (22.5(1)(d)).

The proposed discharge point for the Pine Canyon facility would be located immediately upstream of public water supply wells for the Town of Castle Rock. Despite this fact, the application does not identify Castle Rock wells and drinking water intakes located downstream of proposed discharge point. There is no analysis of the potential impact of the proposed facility on these wells. The application does not provide adequate information to review this factor.

Furthermore, the proposed location is within the Town of Castle Rock's Watershed Protection District. Castle Rock Code Chapter 4.02 requires the applicant to apply for a watershed district permit from the Town before it can construct and operate a wastewater treatment facility. This application must address how the PCWSD can operate and maintain a domestic wastewater treatment facility immediately upstream of the Town's water supply wells without endangering public health.

The placement of a new wastewater treatment facility poses multiple risks to the drinking water supply of the town, including:

- Discharges of nitrate, arsenic, and other parameters of concern for human health that are commonly found in domestic wastewater effluent.
- Discharges containing technologically enhanced naturally occurring radioactive materials (TENORM). The applicant's proposed water supply is from Denver Basin wells. Filtrate from Denver Basin Groundwater is a source of TENORM. The applicant must indicate whether it will discharge residuals to its wastewater plant, and if not how it will handle the residuals.
- Other parameters of concern. The land use plan for Pine Canyon (Fig. 2) indicates multiple land uses including "mixed use" and "resort." Pine Canyon has not shown any institutional controls to prevent other pollutants from these sources from affecting the Town's water supply.
- Emergency plans, spill responses, supervisory control and data acquisition (SCADA), and staffing must all be adequate to prevent accidental contamination of the Town's water supply given the proximity to the Town's intake wells.

The applicant has not demonstrated the ability of the proposed treatment processes to meet applicable water quality planning targets. (22.5(1)(h))

As noted in the application, the applicant has requested preliminary effluent limitations (PELs) but has not yet received them for purposes of planning and design. Instead, the application provided preliminary Draft PELs

based on the general permit for domestic wastewater facilities under 1 million gallons per day (mgd). However, the preliminary draft PELs are inadequate because they do not account for the site-specific factors affecting a proposed new discharge to Plum Creek, the proposed location immediately upstream of Town of Castle Rock public water supply wells, or antidegradation requirements. At a minimum, the PELs for the facility should:

- Consider all limitations included in the PELs issued in 2018 for the PCWRA expansion.
- All of the available assimilative capacity in the stream for multiple parameters has already been allocated to PCWRA. Given the proximity of the proposed discharge to PCWRA, the proposed facility should not receive any allowance for dilution for parameters that were included in the PCWRA PELs without prior agreement from PCWRA.
- Include water quality-based effluent limitations for ammonia, chlorine, and any other limits included in the general permit for facilities <1.0 mgd
- Include additional human-health based parameters because of the proximity to Castle Rock wells.
- Consider the need to meet limitations for winter temperature for discharge to Plum Creek.
- Include antidegradation-based effluent limitations for all parameters of concern for the new facility. It is unclear whether the applicant has sufficient data to calculate the Baseline Water Quality at the proposed discharge location to determine the significant concentration threshold and Antidegradation-Based Average Concentration Limitations for the facility. However, at the very least the applicant should have included the antidegradation-based limitations in the general permit for domestic wastewater facilities in the preliminary PELs.

Finally, the proposed treatment plant would cause an unauthorized increase in phosphorus loads to Chatfield Reservoir. The applicant relies on a flawed proposal for a non-point to point source phosphorus trade to generate a phosphorus waste load allocation. The applicant claims that, by removing cattle from the property, phosphorus contributions to the reservoir will be decreased. However, the applicant has provided conclusions about the “typical” grazing that was accompanied by little evidence of the number of cattle that have been present on the property, how long ago they were present, or how many years within the last 20 had significant grazing activity. Furthermore, as detailed in the report of Vista Engineering, based on the little information presented it appears unlikely that historical ranching of the Pine Canyon parcel would have led to excess phosphorus and nitrogen reaching Plum Creek. The applicant simply assumed that all phosphorus from the cattle and horses would reach Plum Creek, failing to account for uptake by grass or other plants. The applicant also fails to consider the phosphorus that will be added by the proposed development, particularly since the development will occur outside the Town of Castle Rock permitted MS4 and therefore would not be subject to the same control measures. Instead, the applicant merely notes that they are considering best management practices to control water quality. Additional detail about the flaws in the proposed trade is provided in the attached Technical Memorandum from Vista Engineering (see Attachment B).

The application should be denied because consolidation with PCWRA is feasible (Section 22.5(1)(c)).

The application should be denied because it is feasible for the wastewater from the proposed development to be treated by PCWRA. The applicant’s consolidation analysis is flawed because it is based on a significant underestimate of the costs to build and operate a new wastewater treatment plant, and because the analysis considers irrelevant costs not related to wastewater treatment. In fact, the applicant has included costs for renewable water from the Town of Castle Rock in their analysis even though they are proposing to develop off of a non-renewable and unsustainable groundwater supply. Furthermore, the applicant’s claims that consolidation would injure their water rights and eliminate the opportunity for reclaimed water use are false.

The proposed Pine Canyon development is located in the middle of Castle Rock. PCWRA has included the Pine Canyon area in its facility plan and will soon complete an expansion of its capacity that will allow it to treat growth in and around Castle Rock, including the area where the Pine Canyon development is proposed. The map attached as Exhibit 1 shows the current service area in the PCWRA utility plan.

The applicant claims (engineering report pg. 23) that consolidation with PCWRA would impair PCWSD water rights because annexation to Castle Rock would require dedication of its water rights to Town. This is not impairment, it is use of the water rights to support urban-density development. The Regulation 22 Guidance, pg. 14, says that the Division may consider whether water rights issues prevent moving the effluent to another location for discharge. However, the applicant proposes to supply its development using non-tributary Denver Basin groundwater. Non-tributary groundwater does not have a required location for making return flows after use. Therefore, there would be no injury to the applicant's water rights from treatment at PCWRA.

The applicant also claims that it will lose an opportunity to conserve water through reclaimed water use. PCWRA is authorized to deliver Category 2 reclaimed water from its facility under NOA number COE004000. This category allows for unrestricted access landscape irrigation (Reg. 84.9). The applicant claims that it would use reclaimed water for residential area irrigation and indoor toilet flushing. However, the applicant provides no information about its plan to actually deliver reclaimed water for these uses, or for any other uses for which Category 2 reclaimed water could not be used under Regulation 84. Furthermore, the applicant has not investigated the ability of PCWRA to improve its reclaimed water system to allow it to obtain authorization to deliver Category 3 or Category 3 plus reclaimed water.

The applicant's economic analysis of the feasibility of consolidation is also flawed. First, the economic analysis improperly considers drinking water costs including renewable water supplies associated with annexation and development in the Town. However, the consolidation economic analysis considers the cost of consolidation with the regional wastewater treatment plant (WWTP) against the cost of constructing and operating a separate facility. (Reg. 22 Guidance, pg. 15). Therefore, the applicant's economic analysis considers irrelevant cost factors and cannot be used as the basis for site location approval. Even if the cost of drinking water service from the Town were relevant, the applicant's analysis ignores the fact that the applicant proposes to supply a large development using non-renewable Denver Basing groundwater that will eventually be exhausted as a supply, while the Town provides a renewable and sustainable drinking water supply.

The applicant significantly underestimates the capital and operational costs of its proposed facility, as explained in the Technical Memorandum of Vista Engineering, attached. The factors leading to the significant underestimate include:

- The proposed facility is under-sized by approximately 25%.
- The proposed design does not include necessary improvements to control odor and noise to prevent a nuisance for users of nearby open space and other nearby development.
- The proposed design does not address nutrient limitations that are expected to be implemented in approximately 2027.
- Operation and maintenance of the proposed facility will require significantly more staff than proposed in the site location application.

But even if the applicant's cost analysis were accurate, it shows that the cost of the proposed facility is significantly higher than the cost of treatment by PCWRA. The estimated wastewater capital costs for PCWSD are \$12 million, compared to a \$9 million wastewater impact fee for connection to PCWRA. (engineering report, pg. 38, App. F).

Finally, the applicant failed to analyze several economic factors necessary to determine the feasibility of consolidation. The Regulation 22 Guidance, pg. 15, requires consideration of the costs of land acquisition, debt retirement expenses, and operation and maintenance costs for a minimum period of twenty years. The applicant failed to include these costs or to estimate the costs of operation and maintenance for the required twenty-year duration. Furthermore, the guidance requires cost comparisons on the basis of cost per 1,000 gallons of wastewater treated, as well as the present net worth. Neither cost comparison was provided by the applicant.

Conclusion.

Castle Rock recommends denial of the site location application for the Pine Canyon Water Reclamation Facility. The application does not show that the proposed facility can be operated in a way that minimizes adverse impacts to water quality. Furthermore, treatment by the nearby Plum Creek Water Reclamation Authority facility would be feasible. The state's policy of encouraging consolidation wherever feasible, and the need to ensure that all domestic wastewater treatment facilities protect the environment, require the denial of the site location application. Castle Rock is open to discussing how the development can be served through the nearby Plum Creek Water Reclamation Authority from capacity owned by the Town and constructed to allow service to the development as part of annexation into the Town.

Sincerely,

Mark Marlowe

Digitally signed by Mark Marlowe
DN: cn=Mark Marlowe, o, ou=Castle Rock
Water, email=mymarlowe@cr.gov.com, c=US
Date: 2020.08.28 17:01:58 -06'00'

Mark Marlowe
Director of Castle Rock Water

Exhibits

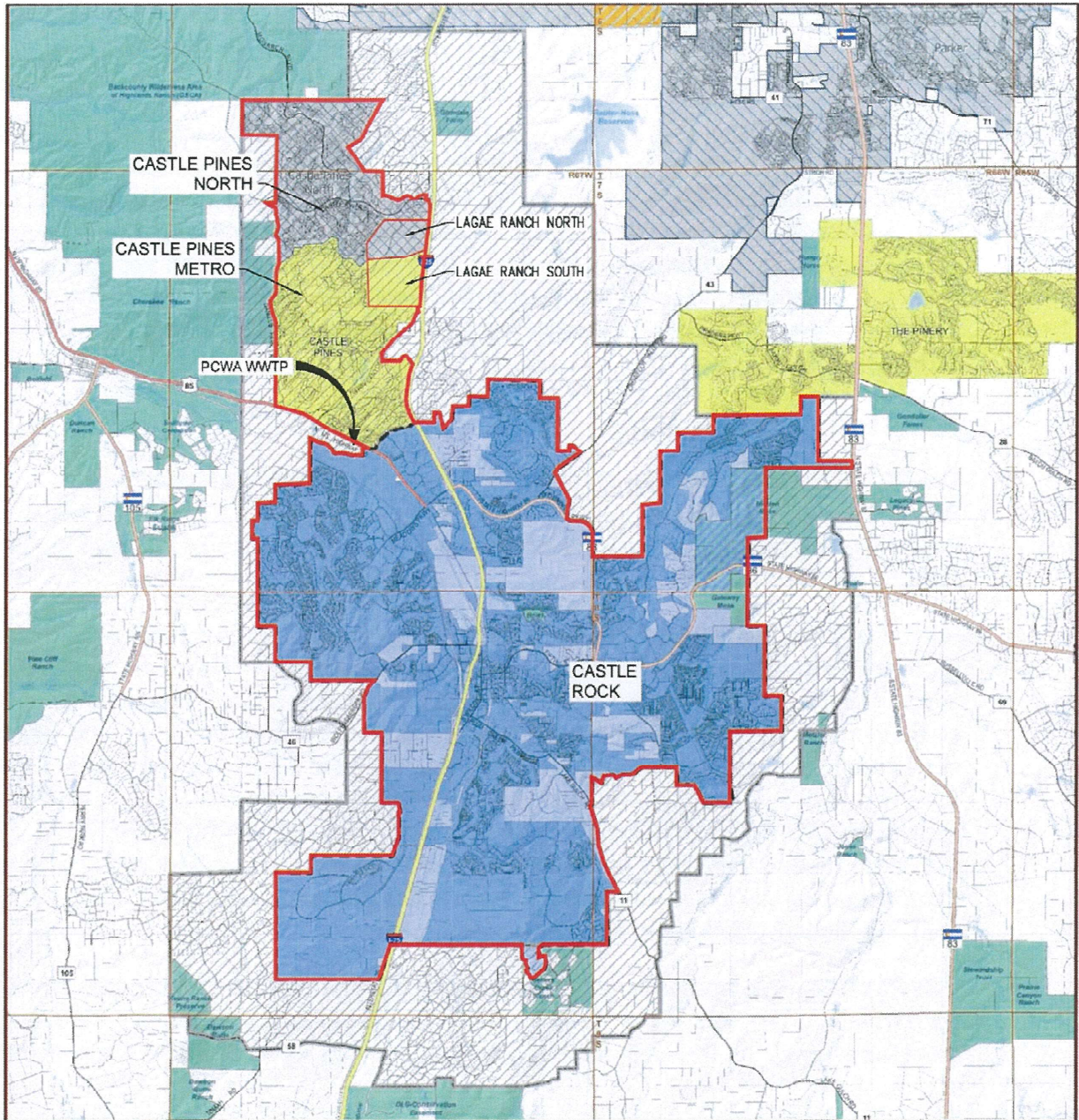
Exhibit 1: Map of PCWRA Service Area

Attachments

Attachment A: Denial Recommendation

Attachment B: Technical Memorandum from Vista Engineering

cc: Jason Gray, Mayor of Castle Rock
David Corliss, Town Manager of Castle Rock
Doug DeBord, County Manager of Douglas County
Terence Quin, Director of Community Development of Douglas County
Curt Weitkunat, Planning Manager, Douglas County
Matt Jakubowski, Principal Planner, Douglas County
Diane Kielty, Authority Manager of the Chatfield Watershed Authority
Mary Kay Provaznik, Chair of the Technical Advisory Committee for Chatfield Watershed Authority
Brian Hlavacek, Director of Environmental Health, Tri-County Health Department
Kelly Weidenbach, Director of Planning and Information Management, Tri-County Health Department
Ernestine Trujillo, Aqua Engineering



- | | |
|---|--------------------|
| Municipal Planning Area (Incorporated) | Townships |
| Municipal Planning Area (Unincorporated) | Sections |
| Castle Rock Municipal Planning Area Boundary | Lakes |
| Community Separation Buffer | Intermittent Lakes |
| Municipal Planning Area Inclusive of County PUA | Streams |
| Separated Urban Area (SUA) | Interstate |
| Other Incorporated Areas | US Highways |
| Parcels | State Highways |
| Open Space | Major Roads |
| Open Space within Incorporated Area | Local Roads |
| PCWA SERVICE AREA | |

Exhibit 1

PCWRA SERVICE AREA

FIGURE 1.1

PLUM CREEK RECLAMATION AUTHORITY
UTILITY PLAN UPDATE AND PRELIMINARY ENGINEERING SERVICES





Water Quality Contr Engineering Section

4300 Cherry Creek Drive South, B2
Denver, Colorado 80246-1530
CDPHE.WQEngReview@state.co.us
303-692-6298

Colorado Department
of Public Health
and Environment

Applicant Certification and Review Agencies Recommendation Section 22.4 of Regulation 22: New Domestic Wastewater Treatment Facility

A. Project and System Information	
System Name	Pine Canyon Water and Sanitation District
Project Title	Pine Canyon Water Reclamation Facility
County	Douglas

1. Applicant Certification

I certify that I am familiar with the requirement of *Regulation 22 - Site Location and Design Approval Regulations for Domestic Wastewater Treatment Works*, and have posted the site in accordance with the Regulations. An engineering report, as described by the regulations, has been prepared and is enclosed.

Applicant Legal Representative (e.g., Public Works Director)	Date	Typed Name	Signature
Property Owner		Jim Walker	

The system legal representative is the legally responsible agent and decision-making authority (e.g. mayor, president of a board, public works director, owner). The Consulting Engineer is not the legal representative and cannot sign this form.

2. Recommendation of Review Agencies

As required in Section 22.4(2), the application and the engineering report must be submitted to all appropriate local governments, 208 planning agencies and State agencies for review and comment prior to submittal to the Division. By signing below, the entity or agency: 1) acknowledges receipt of the proposed site location application, 2) has reviewed the proposed site location application and may elect to provide comments, and 3) has provided a recommendation concerning the application to the Division. The recommendation should be based on the factors outlined in Section 22.4(2); for example, on the consistency of the proposed site location application with the local comprehensive plan(s) as they relate to water quality and any adopted water quality management plans(s). *Please note: Review agencies are encouraged to provide project comments; however, if a review agency does not recommend approval then the agency must attached a letter describing the reason for their decision or comment on the next page.*

Signature of Management Agency, if different from other entities listed below				
Role	Date	Typed Name / Agency	Signature	
		N/A		
			Recommend Approval?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Signature of County, if proposed facility is located in unincorporated areas of a county				
Role	Date	Typed Name / Agency	Signature	
		Douglas County		
			Recommend Approval?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Signature of City or Town, if site is located within three miles of the City/Town boundary (if multiple, attach additional sheets as needed)				
Role	Date	Typed Name / Agency	Signature	
Director of Castle Rock Water	8/28/2020	Town of Castle Rock	Mark Marlowe <small>Digitally signed by Mark Marlowe DN: cn=Mark Marlowe, o=Castle Rock Water, email=mmarlowe@crgov.com, c=US Date: 2020.08.28 17:02:27 -0600</small>	
			Recommend Approval?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Signature of Local Health Authority				
Role	Date	Typed Name / Agency	Signature	
		Tri County Health		
			Recommend Approval?	Yes <input type="checkbox"/> No <input type="checkbox"/>

REVIEW

OF

SITE APPLICATION ENGINEERING REPORT

PINE CANYON

WATER & SANITATION DISTRICT

Pine Canyon Water Reclamation Facility

Dated July 2020

FOR

TOWN OF CASTLE ROCK



AUGUST 26, 2020

By

VISTA ENGINEERING LLC
21220 SCOTT RD
CALHAN, CO 80808-9240

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EXECUTIVE SUMMARY

PRELIMINARY EFFLUENT LIMITS

Preliminary effluent limits were received from CDPHE – WQCD Permits Section. Discharge was proposed to be to East Plum Creek, stream segment COSPUS10A and reclaimed water PELs for Regulation 84 Category 3. The PELs were based on information provided by Pine Canyon. The information omitted the fact that the proposed DWWTW outfall was just upstream of the Town of Castle Rock surface-water-influenced groundwater wells. It is recommended this site application report be rejected, new PELs be developed, and a revised site application report be submitted should this project move forward.

STRINGENT DISCHARGE LIMITS INCLUDING NUTRIENT REMOVAL

The small plant proposed for Pine Canyon would have similar discharge limits required for the large regional facility, Plum Creek Water Reclamation Authority's (PCWRA) DWWTW, including total inorganic nitrogen, total phosphorus, and arsenic. Plum Creek's facility used biological treatment to reduce nutrients prior to chemical treatment. The Pine Canyon DWWTW proposes removing all the phosphorus through chemical precipitation. The chemical phosphorus removal process generates chemical sludge at a yield between 1 lb sludge/lb BOD removed to 1.25 lb sludge/lb BOD removed. The proposed design plans for biological sludge removal, but the report does not discuss chemical sludge removal.

Regulation 31 is expected to result in lower nutrient limits for phosphorus, nitrogen, ammonia, and selenium in the near future. Limits are expected in 2027. Additional treatment processes could include ultraviolet advanced oxidation process (UV AOP), granular activated carbon (GAC), chemical coagulation, or electrocoagulation. Costs for the capital improvements to include an advanced process are not included in the OPC.

HIGH PER-CAPITA COSTS

The Pine Canyon District has not been formed. Section 8.1.2 of the site application report stated the district will pursue bonds or other financing available to Colorado Special Districts to pay for the DWWTW. The district would have the power to tax and/or assess fees for services, and to issue municipal bonds to pay for water and wastewater infrastructure. As a special district, Pine Canyon would have legal authority to establish and collect property tax on the properties within its boundaries to redeem the bonds. The district could use other revenues available to retire the debt. An example would be user fees. The Colorado Department of Local Affairs (DOLA) recommends prospective property owners looking to purchase homes within a special district consider the potential future tax liability.

OPERATION & MAINTENANCE (ANNUAL) COSTS

Section 8.1.1 of the site application report lists annual operating and maintenance (O&M) cost of \$780,000, based on sequencing batch reactors (SBRs). Annual O&M costs for a MBR include costs for membrane replacement, and power costs for membrane air scour to prevent fouling.

Annual O&M costs for a MBR of corresponding treatment capacity is estimated to be \$1,322,034 for the 1st year. Annual O&M costs are expected to increase at an inflation rate of 4%.

SERVICE AREA

The Pine Canyon service area will be sited on a 540-acre parcel, located in Sections 34-36, Township 7 S, Range 67 W, of the 6th Principal Meridian. The parcel has been broken off from the original 1,800-acre Scott Ranch, and is currently unincorporated Douglas County. The parcel is surrounded by the Castle Rock community.

DESIGN CONSIDERATIONS

Section 3.1.3 of the site application report stated that the proposed DWWTW design capacity would be 0.405 MGD. Evaluating the proposed loading using the Town of Castle Rock design criteria increases the design capacity to 0.4732 MGD. The hydraulic capacity is approximately 25% undersized, and does not include capacity for slip-stream processes. A 0.500 MGD facility is recommended. Processes omitted from the design include biological phosphorus removal, dissolved organic nitrogen removal, diluted waste activated sludge holding tank/basin (DWAS), and thickened wastewater activated sludge holding tank/basin (TWAS). The facility is proposed to have exterior process basins and stand-by generator. The facility should be enclosed in buildings to control noise and odors, and provide architectural enhancements to make the buildings blend with surrounding development.

COSTS

The Opinion of Potential Costs (OPCs) for 0.405 MGD with exterior process basins, and the 0.500 MGD facility enclosed in a building are provided in the following table:

Table 1 OPC

DESIGN CAPACITY	0.405 MGD	0.500 MGD
Total 2020 Dollars	\$11,539,627	\$14,770,108
Total 2021 Dollars (4% inflation)	\$12,001,212	\$15,360,913

PROPOSED DWWTW LOCATION

Section 6.1.7 of the site application states “the facility is located on a segregated site and is not immediately adjacent to residences.” The proposed location is in the future Walter J. Scott Riparian Park. The site application report states, “the design will consider both odor control and facility architecture/aesthetics”. It should be noted the facility will likely require these components, although no costs are included in the OPC. Sewer plant smells wafting across the open space would not be acceptable.

WASTE LOAD ALLOCATION

The proposal is to remove the livestock from the parcel, and the lack of manure would remove 1,528 lb of phosphorus per year from the watershed. The land had been well managed since the formation of the Scott Ranch in 1909. The land was not overgrazed. It was likely the phosphorus deposited on the parcel had helped maintain the healthy pasture land. The site application report does not provide data that indicates phosphorus in excess of the soil's uptake rate had been applied to the pasture. Therefore, the non-point source phosphorus contribution does not appear to be available for a waste allocation trade.

INTRODUCTION

This report provides a review of the Pine Canyon Water & Sanitation District Pine Canyon Water Reclamation Facility Site Application, prepared by Aqua Engineering, dated July 2020. This review was completed by Vista Engineering LLC, on behalf of Castle Rock Water. The site application was reviewed based on design criteria from Colorado Department of Public Health & Environment (CDPHE) “Design Criteria for Domestic Wastewater Treatment Works”, dated Sept 2012, and Town of Castle Rock “Wastewater Collection Design, 2018 Criteria Manual”. The abbreviation used for a domestic wastewater treatment works, also referred to as a water reclamation facility, will be DWWTW.

DEFINITIONS

The following discussion provides definitions for wastewater treatment facilities to provide a context of terms used in the Site Application Report and CDPHE design criteria. The site application refers to a water reclamation facility. **Water reclamation** is defined as a process by which wastewater from homes and businesses is cleaned using biological and chemical treatment so that water can be returned to the environment safely to augment the natural systems from which it came. **Wastewater treatment** is defined as a process used to convert wastewater into an effluent (outflowing of water to a receiving body of water) that can be returned to the water cycle with minimal impact on the environment or directly reused. CDPHE wastewater treatment works design criteria uses the term “domestic wastewater treatment works” (DWWTW). All of these terms refer to sewer treatment.

PRELIMINARY EFFLUENT LIMITS

Preliminary effluent limits were received from CDPHE – WQCD Permits Section. Discharge is proposed to be to East Plum Creek, stream segment COSPUS10A and reclaimed water PELs for Regulation 84 Category 3. Section 4.1 of the site application report lists a Preliminary Effluent Limits Summary. The PELs are based on information provided by Pine Canyon to CDPHE. The information provided to CDPHE omitted the fact that the proposed DWWTW outfall is proposed just upstream of the Town of Castle Rock surface-water-influenced groundwater wells.

Item #9 of the Regulation 22 Application Form stated, “AQUA contacted CDPHE to inquire on the location of the nearest water supply (WS) intake, and was advised that this information was not publicly available, due to homeland security. Thus, we defer to the CDPHE-WQCD and the review agencies who are receiving this site application for this information.” The Town of Castle Rock has surface-influenced groundwater wells just downstream of the proposed outfall. It is recommended this site application report be rejected, new PELs be developed, and a revised site application report be submitted should this project move forward.

CHALLENGES OF A SMALL WASTEWATER PLANT

Operation of a small-community DWWTW is a difficult undertaking. Problems are related to stringent discharge requirements, high per-capita costs, limited finances, and limited operation and maintenance budgets.¹ These problems will likely be experienced at the Pine Canyon development. Another problem with the proposed formation of a special district is the method and effort to educate potential home owners that might purchase lots. Pine Canyon is a unique community surrounded by Castle Rock. The homes within Pine Canyon would likely be similar to the homes in the surrounding developments – size, construction quality, lot size. The difference would be how water and wastewater services are offered. Pine Canyon is proposing to form a special district, construct wastewater collection infrastructure within the community, then construct and operate its own treatment plant (DWWTW). The site application report appears to have underestimated the required DWWTW capacity, its associated construction costs, and proposes to offer part-time staff for operation and maintenance. Home owners in the Pine Canyon development could have wastewater service that costs more than their Castle Rock neighbors.

STRINGENT DISCHARGE LIMITS INCLUDING NUTRIENT REMOVAL

Chemical Precipitation Phosphorus Removal

The small plant proposed for Pine Canyon would have similar discharge limits required for Plum Creek Water Reclamation Authority's (PCWRA) DWWTW, including total inorganic nitrogen, total phosphorus, and arsenic. The Pine Canyon DWWTW proposes an advanced biological treatment, dual-train, four-stage process with pre-anoxic basin, aeration basin, post-anoxic basin, and membrane bioreactor (MBR) basin. The Pine Canyon treatment train would be designed to remove nitrogen through primarily biological processes (although chemical addition including methanol and alkalinity is required to meet the stringent limits), but the report did not discuss biological phosphorus removal. Rather than operate the DWWTW to remove as much phosphorus as possible through biological nutrient removal, then removing the remaining phosphorus by adding ferric chloride to the MBR basin, the site application report proposes to remove all the phosphorus through chemical precipitation. The chemical phosphorus removal process generates chemical sludge at a yield between 1 lb sludge/lb BOD removed to 1.25 lb sludge/lb BOD removed.

Biological Phosphorus Removal Prior to Chemical Precipitation

As a comparison, the existing regional Plum Creek Water Reclamation Authority plant has optimized nutrient removal through its biological processes, reducing the amount of chemicals and associated chemical sludge required to meet discharge limits. Plum Creek has demonstrated their anaerobic selector basins remove BOD, and maintain a population of phosphorus-accumulating organisms (PAOs). The phosphorus is removed in the sludge. Reducing nutrient concentrations in the biological processes reduces the amount of chemical required to meet

¹ Tchobanoglous, G., Burton, F.L.: *Wastewater Eng 3th Ed.*, Metcalf & Eddy, New York, 1991.

nutrient limits, and reduces the volume of chemical sludge generated per mass of nutrient removed.

Future Lower Nutrient Limits

Regulation 31 is expected to result in lower nutrient limits for phosphorus, nitrogen, ammonia, and selenium in the near future. Limits are expected in 2027. Section 4.1.2 of the site application report states the total nitrogen (TN) concentration would be lower than most economically viable treatment technologies are capable of achieving. The site application report notes that the proposed DWWTW could soon require additional processes, including a dissolved organic nitrogen (DON) treatment process. Section 5.2.2 of the site application report stated sampling for DON would be conducted after the facility was operational to determine a preferred DON-removal process. Treatment processes could include ultraviolet advanced oxidation process (UV AOP), granular activated carbon (GAC), chemical coagulation, or electrocoagulation. Costs for the capital improvements, that could be required by 2027, are not included in the OPC.

HIGH PER-CAPITA COSTS

The Pine Canyon District has not been formed. Section 8.1.2 of the site application report states the district will pursue bonds or other financing available to Colorado Special Districts to pay for the DWWTW. The discussion does not address how the complete infrastructure for the community would be financed and ultimately purchased. The report's Table 17 lists the DWWTW cost at \$12,004,000. The report's Table 18 lists the impact fees at \$17,665,086, and notes that the number includes bond interest. It is unclear what amount would be budgeted for the wastewater collection system, or how it would be purchased. Section 8.1.2 states, "the revenue projections demonstrate that PCWSD has the financial capacity to construct, operate and manage the facility. The cash flow projection demonstrates that PCWSD will be able to meet its increased debt obligation, have a debt service reserve of at least 1.10, pay the projected utility costs, and maintain all other aspects of operation of the PCWRF, through implementation of the projected user rates and impact fees, and successful acquisition of bonds or other capital funding." The discussion seems to be short on detail, other than the indication of financing the project with new debt.

Pine Canyon would be a Title 32, Article 1 special district, and would have various financial powers. The district would have the power to tax and/or assess fees for services, and to issue municipal bonds to pay for water and wastewater infrastructure. Issuing bonds is a method of borrowing money, which places the district in legal indebtedness. The debt can generally only be issued as the result of an election. But, a newly formed district can hold an election with its early customers (who can be associated with the district's forming members). The bonds would be sold to investors who must be repaid over time with interest. Terms including interest rate and repayment period on these bonds vary but is often 20 years. The investors' money is used by the district to pay for infrastructure including water treatment plants and lines, sewer treatment plants and lines, and reuse irrigation holding ponds, pump stations, and re-use lines.

The special district has legal authority to establish and collect property tax on the properties within its boundaries to redeem the bonds. The district could use other revenues available to

retire the debt. An example would be user fees. The Colorado Department of Local Affairs (DOLA) recommends prospective property owners looking to purchase homes within a special district consider the following to determine future tax liability:²

- How much outstanding general obligation debt does the district have?
- Are the principal and interest payments on the general obligation bonds insured?
- Are the bonds rated, if so, what is the rating?
- If the bonds are Limited Tax Obligations, what is the mill levy cap associated with the bonds?
- Does the developer hold the bonds, or, have they been issued to the public?
- What is the amount of the yearly debt service payment?
- What revenue is being used to pay the debt service?
- What is the ratio of debt outstanding to the assessed valuation of the district?

Colorado legislature has passed a number of laws requiring certain disclosures to buyers of residential property, so that they would be aware that they are buying property that might be within a special district that can levy taxes and may have outstanding debt.

OPERATION & MAINTENANCE (ANNUAL) COSTS

Section 8.1.1 of the site application report lists annual operating and maintenance (O&M) cost of \$780,000. Although the site application report uses an inflation factor of 4% for the capital cost estimate, no inflation factor is applied to O&M costs. The report does not address price increases over time, staff payroll increases, contingency for unexpected equipment failure, and other factors that would drive increases in operating costs. The example DWWTWs listed for reference served small communities that are located in relatively rural areas. Town of Bennett, Spring Valley Ranch Metropolitan District, and Town of Johnstown are not located within the service district of a large regional DWWTW, and were forced to try to operate a stand-alone plant. The site application report does not provide a discussion about the success these DWWTWs are having to prevent gradual decline due to deferred maintenance that would require significant capital improvements.

Additionally, the referenced facilities utilize sequencing batch reactors (SBRs). These facilities have smaller annual O&M costs due to lower electrical costs and longer service life of process equipment. SBRs include concrete basins, ductile iron pipe (DIP), stainless steel decanters, blowers, and pumps. The basins, building, and majority of the equipment have a typical design life of 20 years. The SBR process has a return rate of 1Q (one x the design flow). The aeration requirement is limited to the oxygen required for biological treatment and aerobic digestion. Equipment with shorter, 5 to 10-year, design life might be chemical feed pumps and aeration fine bubble diffusers. SBRs do not have the O&M cost of membrane replacement.

MBR facilities have return flows at 3 to 4 times the influent flow rate. The pumps and associated power costs are more than a SBR with a 1Q return flow rate. MLSS is pumped

² “Special Districts: A Brief Review for Prospective Homeowners”, Colorado Department of Local Affairs (DOLA), June 2019.

through the 0.04 μm membranes for filtration. Blowers supply oxygen to the aerobic biological treatment and supply compressed air to the backwash and back pulse for fouling control. Membranes require replacement every 5 to 10 years. Section 6.1 of the site application report states the selected treatment process would be a membrane bioreactor (MBR) facility, with a design MLSS concentration of 8,000 mg/L. Research has shown MBRs operate at lower MLSS concentrations, typically 6,500 mg/L, provide better nitrogen removal and longer membrane life. Dependent on manufacturer's recommendations, membranes can be operated at 12,000 mg/L to 16,000 mg/L, but with a corresponding shortening of membrane life. MBRs without waste activated sludge (WAS) holding tanks, operated by part-time contract operators, are often operated at higher-than-design MLSS concentrations. This review estimates the membrane replacement would occur every 5 years, due to heavy MLSS loading on the membranes and ferric chloride fed to the MBR tank for phosphorus removal.

The following figure provides an estimate of the O&M costs by category³. Chemicals for membrane cleaning is estimated at 6%. The labor, estimated at 13% of the annual O&M cost, is for a full-time staff. Combined power costs were estimated to be 34% of the annual O&M budget. Power costs for running pumps, barscreens, HVAC, and lighting are estimated to be 9% of the annual budget. Blower power costs for process air are estimated to be 12% of the annual O&M budget. Blower power costs for membrane scour were estimated to be 13% of the annual O&M budget. Annual costs for membrane replacement are estimated to be 28% of the annual O&M budget. Repair and replacement maintenance costs are estimated to be 19% of the annual O&M costs. Chemicals for membrane cleaning is estimated to be 6%. Chemical addition for nutrient removal would increase the chemical fraction of the annual O&M costs.

³ DeCarolis, Adham, et al., "Cost trends of MBR Systems for Municipal Wastewater Treatment", WEFTECH '07, San Diego, CA.

MBR O&M

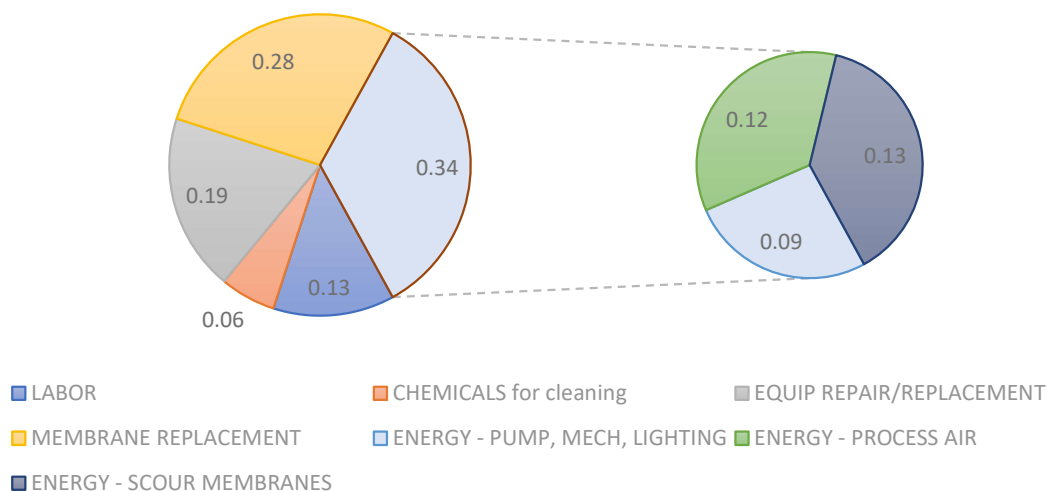


Figure 1 Percentage of Annual Operation & Maintenance Costs for MBR

Annual O&M costs for a MBR include costs for membrane replacement, and power costs for membrane air scour to prevent fouling. The annual O&M cost of \$780,000 for a SBR would have a corresponding annual O&M cost of \$1,322,034 for a MBR.

STAFFING

Section 7.2.1 of the site application report states the planned operation time would be 20 hours/wk for 1 person. It is unclear how 1 person for an average of 4 hours/day for 5 days/week will complete: 1 hour process control/day, 7 days/week; conduct discharge permit monitoring including sampling and transporting samples to a certified lab; operate the screw press to dewater biosolids (sludge) and transport thickened solids to a permitted land application site; and conduct maintenance on membrane cartridges, pumps, blowers, chemical feed equipment, chemical storage tanks, and, lastly, respond to alarms and deal with failure conditions.

New England Interstate Water Pollution Control Commission has developed a spreadsheet for estimating staffing at publicly and privately owned wastewater treatment plants. Staffing for a nutrient removal activated sludge MBR is estimated at 3.39 full-time equivalents. The following table lists labor estimates from the spreadsheet:

Table 2 Staffing Estimate

WORK	ANNUAL HOURS
Basic & Advanced Operations and Processes	1952
Maintenance	608
Laboratory Operations	2002
Biosolids/Sludge Handling	160
Yardwork	370
Estimated Operation & Maintenance Hours	5,092
Estimated Operation & Maintenance Staff	3.39 FTEs

SERVICE AREA

The design loading to a DWWTW is determined by defining the service area, considering historical data, engineering flow and loading assumptions (e.g., organic, solids, nutrient), area population, land use, unique customers (industrial, retail, restaurants), and population and employment projections and/or land use projections as noted in the Service Area Definition of the Regulation 22 Guidance Document §22.4(1)(b)(i). Potential changes in land use, flow and concentration trends are required to be considered in the development of hydraulic and loading forecasts. Treatment processes are typically designed for maximum month conditions. Maximum Month Flow (MMF) and Maximum Month Load (MML) represent the highest 30-day average flow or load expected to be received at the DWWTW.

The Pine Canyon parcel is surrounded by the Castle Rock community.

The Pine Canyon service area will be sited on a 540-acre parcel, located in Sections 34-36, Township 7 S, Range 67 W, of the 6th Principal Meridian. The parcel has been broken off from the original 1,800-acre Scott Ranch, and is currently unincorporated Douglas County. The parcel is surrounded by the Castle Rock community. Figure 2 shows the approximate parcel as the screened area. The parcel is divided into two portions by Interstate 25 and surrounded by Castle Rock's residential communities. Pine Canyon's east portion is surrounded by the Woodlands Metzler Ranch community to the North, the Terrain community to the East of Founders Parkway, the Woodlands subdivision to the South, and I-25 to the West. The West portion is bordered by offices and industrial development to the North and South, I-25 to the East, and adjacent to a golf-course and Red Hawk community to the West.

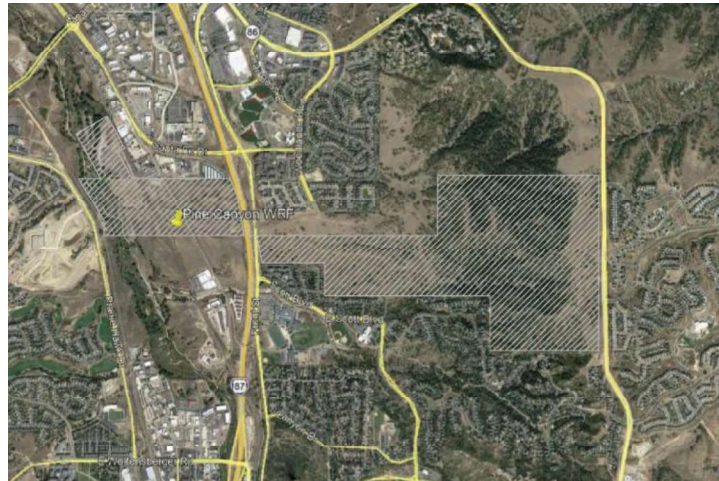


Figure 2 Castle Rock Community Surrounding Pine Canyon

DESIGN FLOWS

The site application report proposes austere, conservation-based, indoor use only, average daily wastewater flows for residential SFEs. Outdoor irrigation is proposed through reuse.

SITE APPLICATION REPORT'S MMADF

The approach assumes 50 gpd/person, and estimates average household size to be 3 residents per single family equivalent (SFE) for both single family and multi-family housing units.

The household count was derived from the United States Census Bureau. The site application report establishes the annual average daily flow to be 150 gpd/SFE. This value is adjusted by a peaking factor of 1.2 to establish the maximum month average daily flow (MMADF) to be 180 gpd/SFE. The site application report outlines their approach and provides references for the data, as listed in the following table:

Table 3 Site Application Estimated Average Daily Wastewater Flow

DOCUMENT	INDOOR WATER USE gpd/SFE	OUTDOOR WATER USE gpd/SFE
Denver Water Efficiency Plan		
Water Research Foundations "Residential End Uses of Water, Version 2	138 gpd/SFE	
Colorado Water Plan	60 gpd/person (180 gpd/SFE)	
EPA Water Sense New Home Specification Ver 1.0	110 gpd/SFE	
Site Application	150 gpd/SFE	

DAILY FLUCTUATIONS & PEAKING FACTORS

Annual average flow does not account for daily fluctuations. Using annual average flow typically under-sizes a treatment facility. CDPHE requires that treatment facilities be sized for maximum month average daily flows. Peaking factors have been established by compiling flow data for peak hour, peak day, and average day, and developing peaking factors. The following table lists typical fluctuations in water use in community systems⁴:

Table 4 Peaking Factors

	Percentage of Average for Year	
	Range	Typical
Daily average in maximum month	1.10% - 1.40%	1.20%
Daily average in maximum week	1.20% - 1.70%	1.40%
Maximum day	1.60% - 2.20%	1.80%
Maximum hour	2.25% - 3.20%	2.70%

TOWN OF CASTLE ROCK'S DESIGN CRITERIA FOR MMADF ESTIMATE

This review used design criteria from the Town of Castle Rock's "Wastewater Collection Design, 2018 Criteria Manual". SFEs are listed in the following table:

Table 5 Wastewater Flowrates from Residential Sources

SOURCE	Typical ADF/UNIT	TYPICAL SFEs/unit
Single Family Residential & Duplexes	200 gpd/dwelling unit (DU)	1/DU
Multi-family Residential	130 gpd/DU	0.65/DU
Retail/Offices	0.1 gpd/ft ²	0.0005/ft ²
Hotels/Motels	75 gpd/room	0.375/room
Restaurants	1.5 gpd/ft ²	0.0075/ft ²
Industrial/Other Commercial	600 gpd/acre	3.0/acre
School, Middle (25 ac, 850 students)	8,500 gpd/school	42.50/school

⁴ Tchobanoglous, G. and Schroeder, E.D.: *Water Quality*, Addison-Wesley, Reading, MA 1985.

MMADF BASED ON USE

The Pine Canyon development is divided into 20 planning areas (PA). Single family density is proposed to be 1.7 dwelling units (DU)/acre to 4.2 DU/acre. Multi-family density is proposed to be 14.2 DU/acre. Mixed use density is proposed to be 15.8 DU/acre to 20.4 DU/acre. A school is proposed for the 12.7-acre PA-14. A high-quality, destination Spa Resort is proposed for the 21.4-acre PA-6. Dwelling Units and commercial development square footage are listed on Figure 2 of the site application report.

Residential Water Usage

Figure 2 of the site application report lists the following DUs: 800 single-family DUs, 225 multi-family DUs, and 600 multi-family DUs associated with mixed use development. Section 3.1.1 of the site application report lists residential SFEs at 1,800 DU. The report estimates residential MMDAF to be 324,000 gpd.

Using Town of Castle Rock design criteria, the unit flow would be 200 gpd/SFE. Residential flows are estimated to be 360,000 gpd.

Commercial/Business Water Usage

Section 3.1.2.2 of the site application report states commercial and business space would consist of offices and retail stores. The site application report estimates 550,000 ft² of office space at 60 gpd/1,000 ft². The site application report estimates 50,000 ft² of retail space at 20 gpd/1,000 ft². Combined commercial space flows are estimated to be 31,000 gpd.

Using Town of Castle Rock design criteria, the estimated flows from the 50,000 ft² of retail space would be 5,000 gpd, when estimated by 0.1 gpd/ft². The estimated flows from the 11.4 acres of commercial space would be 6,840 gpd, when estimated by 600 gpd/acre. Combined commercial space flows are estimated to be 11,840 gpd.

The site application report does not include food service business in any of the non-residential uses. That would be different than surrounding commercial development. Food service is included in the revised flow estimate at 5,000 ft², at the Town of Castle Rock flow estimate of 1.5 gpd/ft², for 7,500 gpd.

Hotel Water Usage

Section 3.1.2.3 states a 220-room hotel is planned. The estimated flow from the hotel is 60 gpd/room, or 13,200 gpd.

Using the Town of Castle Rock design criteria, the flow estimate is as 75 gpd/room x 220 rooms, or 16,500 gpd. There was no discussion about restaurants associated with the hotel or resort, so actual flows could be higher.

School Water Usage

Section 3.1.2.4 estimates an 800-person school, and a unit flow of 25 gpd/person. The estimated school flow is 20,000 gpd.

Using the Town of Castle Rock design criteria, school flows are estimated at 10 gpd/student, or 8,000 gpd.

Infiltration & Inflow (I&I)

Section 3.1.4 of the site application report states the infiltration and inflow (I&I) is not expected to have a significant impact on the expected flows to the DWWTW due to specified construction practices requiring waterproofing and leak testing. Inflow occurs in new collection systems. Service stub-out's temporary plugs can leak. Collection main end plugs can leak. Service lines are not leak tested during installation. Although I&I might not be significant, it will be measurable. I&I will be included in the flow estimate as recommended in the Town of Castle Rock design criteria, and is included in the following table.

REVISED MAX MONTH AVERAGE FLOW

This review calculates design average daily flows by using the Town of Castle Rock design criteria. The average flow will be adjusted to max month average flow by a factor of 1.2. This factor is used in Section 3.1.2.1 of the site application report and Table 2 of this review. Infiltration & inflow (I&I) will be estimated as 10% of the average daily flow.

Table 6 Pine Canyon DWWTW Design Flow

DEVELOPMENT AREAS	USE	DWELLING UNITS (DU)	FLOW (gpd)
PA-1	Single Family	75	15,000
PA-2	Single Family	50	10,000
PA-3	Single Family	95	19,000
PA-4	Single Family	90	18,000
PA-6	Hotel/Resort	225 rooms	16,500
PA-8	Single Family	105	21,000
PA-9	Single Family	135	27,000
PA-10	Single Family	35	7,000
PA-11	Single Family	40	8,000
PA-12	Single Family	90	18,000
PA-13	Single Family	85	17,000
PA-14	School	800 students	8,000
PA-16	Multi-family	225	29,250
PA-17	Mixed Use	200	26,000
PA-18	Mixed Use	400	52,000
PA-19	Business/Light Industrial	11.4 acres	6,840
TOTAL			363,990 gpd
Max Month Average Daily Flow (x1.2)			0.4368
I&I			0.0364
Design Flow			0.4732

Section 3.1.3 of the site application report stated that the proposed DWWTW design capacity would be 0.405 MGD. Evaluating the proposed loading using the Town of Castle Rock design

criteria increases the design capacity to 0.4732 MGD. It is recommended additional capacity be included in the design for slipstream return flows. As an example, activated sludge will be wasted from the process and held in a waste basin. The sludge will be approximately 98% water. The sludge will be dewatered using a rotary screw sludge thickener. The thickened sludge will be conveyed to a sludge truck. Process water will be returned to the treatment basins. The membrane cartridges require cleaning with large volumes of water and cleaning chemicals, including citric acid. The “dirty water” from the cleaning process will be returned to the process basins. At a minimum, it is recommended the DWWTW be sized for 0.500 MGD (an increase of approximately 25%).

MBR FACILITY SIZING & COST

Section 6.1.2 of the site application report proposes a 4-stage activated sludge with membrane clarification treatment system. The activated sludge basins would include a pre-anoxic reactor, aeration reactor, post-anoxic reactor, and final membrane reactor. The membrane reactor provides clarification and filtration, eliminating the need for a secondary clarifier and tertiary filter. This treatment approach on other projects has produced effluent meeting the PELs proposed in this site application report.

UNIT PROCESSES SIZING

This review recommends the MBR’s design capacity be increased to 0.500 MGD. The following table lists Preliminary design criteria from Section 5.5 of the Suez “Proposal for the Pine Canyon WWTF” and proposed sizing for the larger, 0.500 MGD MBR:

Table 7 MBR Preliminary Design Criteria

PARAMETER	Site Application	This Review
Flow (MMF)	0.405 MGD	0.500
Pre-anoxic Tank (working volume)	81,000 gal	100,248
Aerobic Tank (working volume)	216,000 gal	267,327
Post-anoxic Tank (working volume)	54,000 gal	66,832
Membrane Tank (working volume excluding membranes)	351,000 gal	433,333
Design MLSS in bioreactor	8,000 mg/L	6,500 – 8,000 mg/L
Water Depth (minimum)		
	Pre-anoxic	19 ft
	Aerobic	18 ft
	Post-anoxic	17 ft
Actual Oxygen Requirement (AOR)	2,288 lb O ₂ /day	2,825 lb O ₂ /day
Sludge Wasting Rate	15,500 gpd	19,136 gpd

COSTS

The costs provided in Section 5.3.3 of the site application report would increase for the larger MBR, and buildings to enclose the facility. The following discussion outlines differences between the costs from the site application report and the recommended facility. The larger building would be approximately twice the size of the proposed operations building, and have a corresponding increased cost for thermal & moisture protection, doors & windows, finishes, mechanical and electrical. The proposed building would be approximately 136 ft². The Suez equipment associated with the membranes is designed for 30% extra capacity. Therefore, the

OPC for the 0.500 MGD facility does not increase the membrane equipment cost estimate. The following table lists the OPC with data from Section 5.3.3 of the site application report, and revised costs associated with the larger 0.500 MGD facility:

Table 8 OPC

DIVISION	0.405 MGD FACILITY	0.500 MGD FACILITY
DIV 1 General Conditions	\$852,000	\$1,265,500
DIV 2 Site Work	\$663,000	\$800,000
DIV 3 Concrete	\$1,094,000	\$1,531,600
DIV 4 Masonry	\$51,000	\$102,000
DIV 5 Metals	\$82,000	\$462,400
DIV 6 Wood & Plastic	\$138,000	\$276,000
DIV 7 Thermal & Moisture Protection	\$20,000	\$40,000
DIV 8 Doors & Windows	\$40,000	\$80,000
DIV 9 Finishes	\$89,100	\$178,200
DIV 11 Equipment	\$2,525,000	\$2,525,000
DIV 13 Special Construction	\$342,000	\$342,000
DIV 14 Hoist & Cranes	\$20,000	\$50,000
DIV 15 Mechanical & Process Piping	\$385,000	\$385,000
DIV 16 Electrical & Controls	\$1,365,000	\$1,774,500
Subtotal A	\$7,666,100	\$9,812,200
Contractor's Overhead & Profit (10%)	\$766,610	\$981,220
Bonds & Insurance (2%)	\$153,322	\$196,244
Subtotal B	\$8,586,032	\$10,989,664
Contingency (20%)	\$1,717,206	\$2,197,933
Subtotal C	\$10,303,238	\$13,187,597
Engineering & Permitting (12%)	\$1,236,389	\$1,582,512
Total 2020 Dollars	\$11,539,627	\$14,770,108
Total 2021 Dollars (4% inflation)	\$12,001,212	\$15,360,913

IRRIGATION

Section 4.1.6 of the site application report notes, “irrigation water would be applied per the Notice of Authorization (NOA) and Land Application Management Plan (LAMP) approved by CDPHE. The water application rate, and corresponding nitrogen and phosphorus effluent loading would be limited by the agronomic rates of the irrigated vegetation species.” Rather than provide a discussion of the proposed vegetation species and associated agronomic rates that would apply to the Pine Canyon development, the site application report references “Colorado’s Water Plan (CWP)” for a general discussion on reuse water projects throughout the state.

Section 5.1.1 notes reuse water might be used for toilet flushing in the residential homes.

This review would like to see a discussion on the flow/day of effluent that is proposed for reuse water in Pine Canyon. Would the reuse water have higher nutrient concentrations than allowed to be discharged into East Plum Creek? Section 5.1.1 notes reuse water might be used for toilet flushing in the residential homes. This review would like more details on plumbing system, monitoring, and customer education that would be provided for such a reuse.

PROPOSED WWTP LOCATION

The proposed site of the DWWTW is West of Interstate 25, adjacent to the Rio Grande railroad track. The plant site is proposed to be 2 acres located in the future Walter J. Scott Riparian Park. Open-space trails pass by the plant. The plant would be approximately 1700 feet from the edge of the Red Hawk community. It is recommended the plant be fully enclosed in buildings of architectural design to disguise the true purpose of the facility. The plant examples shown in the site application report, Wolf Creek, Utah and Richmond, Utah, are metal buildings designed to look like barns.

This architecture would not blend with the surrounding communities. Figure 3 of the site application report shows exterior concrete basins for anoxic and aeration processes, and a standby generator installed adjacent to the operations building. Noise, odor, and aerosols could provide public nuisance complaints. The membrane bioreactor (MBR) (clarifier-type basin) and sludge dewatering equipment are proposed to be located in a building. Placing the stand-by generator outside would provide unacceptable noise, as the generator would be run each week and would run continuously in event of power failure. The barbed-wire-topped-chain-link fence would have an impoundment yard look, and be unacceptable for the open-space park location. The plant did not include a dilute waste activated sludge tank (DWAS) and a thickened waste activated sludge tank (TWAS). If the proposed operational approach is to waste sludge from the membrane reactor, directly to the screw dewatering equipment, into a sludge truck, the volume of sludge truck traffic through the open space would likely be unacceptable.

Section 6.1.7 of the site application states “the facility is located on a segregated site and is not immediately adjacent to residences.” The site application report states, “the design will consider both odor control and facility architecture/aesthetics”. It should be noted the facility will likely require these components, although no costs are included in the OPC. Sewer plant smells wafting across the open space would not be acceptable.

Beautiful parks, well-planned trails and abundant open space are a few of the things that make Castle Rock a great place to call home. The Parks, Open Space and Trails Division makes it a priority that residents be able to explore the great outdoors right from their own backyard.

WASTE LOAD ALLOCATION

The site application report includes the “Trade Application Engineering Report” prepared by Aqua Engineering for the Chatfield Watershed Authority. The report includes a section on waste load allocation, including trading the non-point loading of phosphorus from cattle and horses to the point loading from the DWWTW outfall into East Plum Creek.

The following excerpt is from the site application report’s drainage report: “East Plum Creek is located along the West side of the Pine Canyon property. Two minor drainageways convey stormwater flows through the parcel. Walker Tributary #1 conveys stormwater flows from the

east portion underneath I-25, Liggett Road, and the Union Pacific Railroad, to discharge into East Plum Creek. Walker Tributary #2 conveys stormwater flows from the East parcel to the southern edge of the site where stormwater is conveyed through The Woodlands filing #9 and Scott II filing #3 existing developments. There are no other major drainageways, existing irrigation ditches, or canals located on the site.” It appears these two minor drainageways are dry except during significant storm events. The site application report does not include stream and soil sampling along the drainageways to better quantify the amount of phosphorus making its way off the pasture and into the waterways or East Plum Creek.



Figure 3 Mule Grazing on Walker Property

GRAZING PRACTICES

The Pine Canyon parcel is divided into 2 portions: approximately 424 acres in the eastern portion and approximately 116 acres in the western portion. The East parcel includes acres of tree-covered hills, providing shade and shelter for grazing cattle. The West parcel is open prairie grass, with little shelter for cattle. No information is provided on cross fencing and rotational grazing practices. Section 3.2 of the “Trade Application Engineering Report” stated 65 cows, 40 calves, and 7 horses are typically grazed on the property for 6 months per year. The grazing density is approximately 4.8 acres per animal.

Section 1.1 of the “Trade Application Engineering Report” quotes a Journal of Animal Science article that “watersheds with concentrated livestock populations have been shown to discharge as much as 5 to 10 times more nutrients than watersheds in cropland or forestry.” That section also quoted R.K. Hubbard, about the potential of pathogens traveling from grazing land to surface water bodies. This lead-off in the phosphorus trade application report seems to provide extraneous information, as the ranch property has been carefully managed to control grazing pressure to prevent forage damage. Concentrated livestock feeding (feed lots) is not currently practiced on the property. The report does not make a correlation between pathogen monitoring and phosphorus monitoring.

PROPOSED PHOSPHORUS LOADING

Section 3.3 of the “Trade Application Engineering Report” proposes phosphorus loading of 1,528 lb/yr, based on the wet weight of manure being carried into East Plum Creek. That phosphorus loading might occur if the livestock were kept in a small pen that straddled East Plum Creek. The livestock are allowed to free-graze. The preferred grazing area would be the wooded hills located on the East portion of the parcel. East Plum Creek is a year-round running creek, but located along the West edge of the West portion of the parcel.

GRAZING BENEFITS FOR WATER QUALITY

R.K. Hubbard, “Water Quality and the Grazing Animal”⁵ stated grazing animals and pasture production can affect water quality both positively and negatively. When livestock are produced on pasture and the land is not overgrazed, the likelihood of nutrient contamination of water may be much

The Pine Canyon parcel has been carefully managed since 1909. The grazing has helped improve the pasture grass (forage).

lower than that of heavily fertilized conventionally produced crops. When land has a thick cover of perennial forages, there is little runoff and therefore less chance for fertilizers to be washed away. Most forage crops, especially perennial grasses, form dense root systems that effectively serve as filters to remove contaminants before they can seep into the groundwater. Organic components of manure and urine from grazing animals can build soil organic matter reserves, resulting in soils having increased water-holding capacity, increased water-infiltration rates, and improved structural stability. These changes can decrease soil loss by wind and water erosion. Manures stimulate the growth of beneficial soil microbial populations, increase microbial activity within the soil, and increase the population of beneficial mesofauna, such as earthworms. A study by Chichester et al (1979)⁶ showed that concentrations of phosphorus were not increased by summer grazing of pasture in Ohio. Forage systems protect the soil surface from erosion, and when animal waste inputs are low to moderate, both surface and ground water quality under grazed areas may be better than that under cropper areas.

LACK OF ARGUMENT TO SUPPORT PHOSPHORUS LOADING TRADE

The Pine Canyon parcel has been carefully managed since 1909. The land has not been overgrazed during the summer months, and animals were removed during the winter months. The grazing has helped improve the pasture grass (forage). The animals have contributed nutrients, including nitrogen and phosphorus, at a level that has provided a benefit to pasture improvement. The site application report does not provide data that indicates phosphorus in excess of the soil’s uptake rate had been applied to the pasture. Therefore, the non-point source phosphorus contribution does not appear to be available for a waste allocation trade.

⁵ R.K. Hubbard, “Water Quality and the Grazing Animal”, *American Society of Animal Science*, 2004.

⁶ Chichester, F.W., R.W. Van Keuren, and J.L. McGuinness, “Hydrology and chemical quality of flow from small pastured watersheds: II. Chemical quality.” *Journal of Environmental Quality*, 8:167-171.