City and Borough of Wrangell
Work Session - Borough Assembly Meeting
AGENDA

Monday, December 13, 2021
5:30 PM

Location: Borough Assembly Chambers

1. **CALL TO ORDER**
2. **ROLL CALL**
3. **PERSONS TO BE HEARD -** ***Section WMC 3.05.040 (C)*** *states that: The chair may call to order any person who is breaching the peace or being disorderly by speaking without recognition, engaging in booing or catcalls, speaking vulgarities, name calling, personal attacks, or engaging in other conduct which is determined by the chair to be disruptive of the meeting. Any person so disrupting a meeting of the assembly may be removed and barred from further attendance at the meeting unless permission to return or remain is granted by a majority vote of the assembly.*
4. **CONFLICT OF INTEREST**
5. **NEW BUSINESS**
    a. Discussion and Rehabilitation Options for the Public Safety Building
    b. Review of the Updated Preliminary Engineering Report and Discussion of Project Funding and Timeline for the Water Treatment Plant Improvements Project
6. **ADJOURNMENT**

CITY & BOROUGH OF WRANGELL, ALASKA
BOROUGH ASSEMBLY AGENDA STATEMENT

AGENDA ITEM TITLE:	DATE:	December 13, 2021
	Agenda Section	**5**

Review of the Updated Preliminary Engineering Report and Discussion of Project Funding and Timeline for the Water Treatment Plant Improvements Project

SUBMITTED BY:
Amber Al-Haddad, Capital Facilities Director

Reviews/Approvals/Recommendations	
☐	Commission, Board or Committee
Name(s)	
Name(s)	
☐	Attorney
☐	Insurance

FISCAL NOTE:		
Expenditure Required: None at this time		
FY 20: $	FY 21: $	FY22: $
Amount Budgeted:		
Account Number(s):		
Account Name(s):		
Unencumbered Balance(s) (prior to expenditure):		

ATTACHMENTS: Updated Preliminary Engineering Report developed by CRW Engineering Group

RECOMMENDATION MOTION:

None. Discussion only.

SUMMARY STATEMENT:

Status of the Water Treatment Plant Improvements Project

- With five years having passed since the original project budget was estimated, the funding agencies recommended that we reevaluate the 2017-developed cost estimate to ensure project funding is sufficient to meet today's projected market costs.

- Before requesting additional funds, an updated Preliminary Engineering Report (PER), was required to justify the additional funding request. The CBW contracted with CRW Engineering Group to provide value engineering services for the updated PER, including the preferred recommendations and their estimated cost of construction.

- Considerations undertaken in the Updated Preliminary Engineering Report (PER)

    - Perform a subsequent review all alternatives earlier evaluated, including that of our existing system to ensure it is not a responsible alternative to the other alternatives.
    - Revisit the backwash water and solids waste disposal method, which greatly affects our system classification and level of operator certification required by ADEC.
    - Revisit *all* treatment process aspects as they affect our system classification and level of operator certification required by ADEC.
    - Revisit the existing roughing filter building renovations, required for a variety of the alternatives, including DAF, to ensure that constructing a new building wouldn't be a more cost-effective option. Other considerations for this review:
        - Compare the costs of renting a temporary treatment system versus constructing a new treatment building. New considerations relate to this option could include significant upgrades to meet current building code,
        - A new building will eliminate the need for a temporary water treatment for a period of 9-12 months while the roughing filters are being renovated/expanded. This would allow the roughing filter to remain for future use, i.e. chemical storage, area to house a standby generator, etc. It has been suggested that rental fees for a temporary treatment system could run as high as $50,000/month, including delivery, set up and calibration, electrical and chemical costs, trouble shooting, and breakdown and shipping.
        - A new building will eliminate the need to reroute the water transmission lines between the water plant and the storage tanks, which was an oversight in the original PER and must be considered if expanding the roughing filter building.
    - Not identified in the PER cost estimates, but required through the project funding we have received, are the Buy America Act and the American Iron and Steel Act, which require us to use, to the greatest extent practicable, products produced in the USA.

- The Water Treatment Plant Improvements project is funded, nearly in whole, by federal funds from USDA / RD and EDA. Neither of the two federal agencies will reimburse for engineering design expenses if a construction contract is not awarded, possibly due to a lack of funding.

Grant Award Timelines

- Grants/Loan and Their Associated Timeline for Project Completion

  - Water Fund Contribution $119,000
  - USDA Loan $3,821,000 Received 9-2017 Terminates 9-2023
  - USDA Grant $3,161,000 Received 9-2017 Terminates 9-2023
  - EDA Grant $2,996,953 Received 9-2019 Terminates 9-2024

- Our 2017 projected cost was $9,051,000. From the total USDA grant funding approved in 2017, there is additional funding, in the amount of $1,046,953, which has not yet been de-obligated. The updated PER was completed in November 2021 and costs are projected in the amount of approximately $15,500,000. This equates to a shortfall in full project funding of approximately $5,403,000 ($5.4M).

- With EDA's funding set to expire in less than three years, they have indicated that at the time where we have two years remaining on the grant (this would be September 2022), if the project has not advanced to the design phase, they will consider implementing Termination for Convenience. EDA believes we have sufficient time, considering their grant terms, to seek the additional funding we need, before needing to execute an engineering design contract.

- Similar to EDA, with USDA's funding set to expire in less than two years, they have indicated that no further time extensions will be considered until we execute an engineering design contract.

- Administration reached out to our lobbyists, at both the federal and state level, to ask for assistance in obtaining a USDA/RD approval for another one-year time extension, to meet the timeline of that with EDA. Having this time extension would give the Borough time to seek the additional $5.4M needed for full project funding.

Additional Funding Opportunities

- With an updated PER that justifies the need for additional project funding and/or scope, EDA will consider granting additional funding. EDA suggested an additional $5.4M request to cover the entire shortfall is not a likely consideration.

- With an updated PER that justifies the need for additional project funding, USDA will not commit to additional loan or grant funds until after construction bids are received.

Recent discussions with USDA Rural Development indicate that their program regulations have changed since Wrangell secured our existing funding in 2017. To apply for new funding today, Wrangell's water rates would be required to be set to at least 1.5% of the Median Household Income (MHI) level to be eligible to submit a funding application. Wrangell is currently listed with a MHI of $50,389 and a residential user rate of $47.15. We would need to raise rates to $75.58 to be eligible to apply. Further, their program requires them to consider other credit programs first, such as their loan program or other loan programs, before considering grants. Additional loan debit would require further increases to the water rates.

USDA/RD does not anticipate receiving additional program funds from the Bipartisan Infrastructure Investment and Jobs Act (BIIJA) funding.

- Administration and Staff met with the DEC State Revolving Fund (SRF) program director for the State of Alaska to learn more about funding opportunities through their program. They have not yet received an indication of the level of funding nor the full guideline for administering the funding from the Bipartisan Infrastructure Investment and Jobs Act (BIIJA).

  What we have learned from reading the BIIJA and receiving early news from Murkowski's office is that of the $23B in funds to the SRFs ($2.4B in FY22; $2.75B in FY23, etc.), nationwide, $180M is expected to be allocated to Alaska over five years. That amount will be split equally between the Cleaning Water SRF (wastewater projects) and the Drinking Water SRF (water projects), leaving $90,000,000 for drinking water projects over five years. Of that amount, the bill calls for 10% of the funding to be used for grants, negative interest loans, loan forgiveness and refinancing debt for disadvantaged communities.

  DEC's SRF Program Managers indicated that grants in their program are currently non-existent; however, we do understand that the BIIJA funding and guidelines broadens the States' discretionary authority to assist disadvantaged communities with grants, negative interest loans, forgiveness of principal, and loan forgiveness.

  A loan questionnaire to DEC's SRF Loan program is underway; however, the next loan questionnaire review is scheduled for March 2022.

- Administration and Staff reached out to our lobbyists, at both the federal and state level, to ask for assistance in seeking the additional $5.4 million needed to complete the project, and we continue to explore other funding through BIIJA opportunities and beyond.

  In addition, our Delegation Representatives will be arranging a meeting with the Denali Commission as another alternative to seek funding.

Considerations to Advance the Project

With USDA's suggestion of terminating the grant agreement if forward movement with an engineering design contract is not realized, there are few options to consider at this time if the project is to move forward.

- If the Borough decides to move forward with negotiations with DOWL engineering group and enter into a design contract, Administration and Staff have identified funds for consideration for this expense, as follows:

  1. $119,000 of water funds already committed to the project. These were funds scheduled to be the first funds used, and as such, they would have been spent on the design.
  2. $603,000 of the recently received ARPA funds, which were accepted by the Assembly in September 2021.
  3. $300,000+/- from either the Water Fund Reserve or the Sales Tax Fund, Health, Sanitation & Education Reserve, the balances of which we will share at the work session.
  4. Or consider the future funds expected from a recently-submitted grant application, in the amount of $1,815,949, to the Lost Revenue Relief Grant Program, under which investments to clean drinking water / infrastructure are eligible expenditures.

  By entering into a design contract, USDA says they will consider asking for another year extension, thereby changing our grant termination from September 2023 to September 2024, to match EDA's grant termination date. We would continue to seek the $5.4M shortfall in funding. If full funding to construct is not received, the Borough would *not* be reimbursed for the design fees by the either of the federal funding agencies, USDA and EDA since neither agency program allows for engineering design cost reimbursements for a project that does not results in an executed construction contract.

- As mentioned earlier, Administration reached out to our lobbyists to ask for assistance in obtaining a USDA/RD approval for another one-year time extension, to meet the timeline of that with EDA. We also met with our Delegation Representatives requesting assistance with the time extension request. We plan to submit a written letter to the Alaska State Director, asking for consideration under their authority to grant the extension.

  Having this time extension would give the Borough time to seek the additional $5.4M needed for full project funding without having to commit to a design contract without having full funding in place first. It is unknown is this grant extension request if possible and how long it could take to acquire.

Interim Water Treatment Measures

As interim measures to reduce our disinfection byproducts until a new plant is on-line, the Water Department recommends the following:

1. Purchase a closed-loop cooling system, expected to reduce clogging in the system, with a cost of $75,600. A budget amendment was provided for this purchase in October 2021. A sole source procurement was approved in November 2021.

2. Purchase new, larger capacity compressors, expected to provide the air needed to maximize ozone generation, with an estimated cost of approximately $150,000. A budget amendment would be necessary to move this forward.

3. Purchase a power conditioner or uninterruptable power supply to filter out electrical issues, with an estimated cost of approximately $160,000. A budget amendment would be necessary to move this forward.

4. If cooling issues persist, the department will revisit acquiring a new generator skeleton for generator #2, which is not working properly and regularly results in a fault condition (suggested by the manufacturer as a cooling issue which may be addressed after introducing the closed-loop cooling system), with an estimated cost of $50,000. A budget amendment would be necessary to move this forward.

   After installing a closed loop cooling system time would be needed to monitor and assess the effectiveness of the closed loop system solving some of our issues. If results are favorable, a new generator skeleton will not be necessary, whereas if it does not seem to solve our issues, the skeleton would be the next step in addressing cooling issues.

Other interim measures that could be considered would be replacing the sand media in the slow sand filters (a 2016 cost estimate was greater than $1,000,000) and/or replacing the existing roughing filter process with a new secondary treatment method (several options were explored between 2015-2017, with cost ranges then of approximately $250,000).

Memorandum

Date: November 11, 2021
To: Amber Al-Haddad
From: Jon Hermon, PE and Christi Meyn, PE – CRW Engineering Group, LLC
Project: 20901.00 Wrangell Water Treatment PER Update
Subject: DRAFT PER Update Memorandum

Introduction and Background

The City and Borough of Wrangell (CBW) has contracted CRW Engineering Group (CRW) to perform a technical analysis and update of the 2017 Water Treatment Plant Upgrades Preliminary Engineering Report (2017 PER).

The 2017 PER was developed by CRW in accordance with U.S. Dept. of Agriculture Rural Development (USDA-RD) program format and criteria. This report identified five water treatment system alternatives for increasing CBW's water treatment capacity and improve treated water quality. The preferred alternative featured dissolved air flotation (DAF) treatment followed by granular media filters, with backwash recycling. The new water treatment process was proposed to be constructed adjacent to the existing WTP, with the renovation and expansion of some facilities. Figure 1 shows the existing WTP site. An Environmental Report (ER) was also produced in this planning effort.

Since the PER was completed, CBW secured project funding through USDA-RD and the U.S. Economic Development Administration (EDA). CBW also solicited proposals from professional firms to conduct the design and construction administration of the new WTP based on the design concepts developed in the PER. During the course of these actions, concerns arose as to whether sufficient funding was programmed for the design and construction of the new plant. Concerns were based on the escalation of construction costs and community water consumption since 2017, the desire for increased treatment process redundancy, and the implementation of the Buy American and American Iron and Steel procurement stipulations imposed by the funding agencies. Based on the update to the 2017 PER, additional funding will be requested from USDA and EDA.

This planning effort provides an updated forecast for future population and water demand, proposed WTP site alternatives, backwash recycling feasibility, and includes an updated capital cost estimate. In addition, an updated environmental report (ER) accompanies this memorandum.

Future Water Demand Analysis

In 2017, CBW was projected to have a 20-year population growth rate of 0.8%, which was based on the average statewide growth rate at the time. [1] Unit water usage was estimated to be 250 gallons per capita per day (gpcd). These factors, along with a commercial usage that included seafood processors and local harbors and docks, resulted in a 20-year average daily demand of approximately 1.0 million gallons per day (MGD).

[1] Alaska Department of Workforce and Labor Development Population Projections

Based on CBW water production and consumption data from 2018 to 2021, per capita water use was calculated to be 216 gpcd. Similar to the 2017 PER methodology, this unit value was calculated by deducting actual measurements of commercial usage and WTP usage from the total water production of the treatment plant. The population dropped slightly from 2017 to 2021, and the community's 20-year growth rate is currently forecast to be slightly negative (-0.4% [1]). Nevertheless, for accommodating the possibility of future growth, the 2017 PER 20-year rate of +0.8% was used for this analysis to produce a conservative and comparable estimate. Commercial usage data from 2017 to 2021 was also studied, using the maximum monthly flow from each commercial user as a way to remove any COVID-19 related flow reductions that may lead to an underestimated water consumption for this sector. In addition, anticipated residential, transient, and commercial growth identified by CBW staff was assumed to be completed in 10 years, with the 0.8% growth rate applied to this user component in the following years. This approach resulted in an estimated 20-year average daily demand (ADD) of 1.3 MGD.

Table 1 summarizes the changes in water demand components.

Table 1: CBW Water Demand Updates

Year	Population Projection	Per Capita Water Use (gpcd)	Residential Water Use (gpd)	WTP Water Use (gpd)	Commercial Water Use (gpd)	ADD (gpd)	MDD (gpd)
2037	2,911	240	698,640	-	212,072	997,832	1,746,206
2041	2,720	216	587,751	60,000	667,182	1,291,961	2,260,933

A peaking factor of 1.75 was used to calculate the 2041 maximum day demand (MDD) of 2.26 MGD. The peaking factor was corroborated by comparing the average and maximum water consumption data measured by CBW.

Equipment Information

With exception to the disposal of process waste, no significant changes were made to the proposed treatment process from the 2017 PER. Dissolved air flotation (DAF) pretreatment with granular filtration continues to be the recommended treatment alternative. This alternative will include coagulation, mechanical flocculation, pH adjustment, and on-site hypochlorite generation and disinfection before retention in a new clearwell and the existing water storage tanks (WSTs). The disposal of process waste will be accomplished by discharging directly to CBW's wastewater treatment facility (WWTF) instead of being locally dewatered and recycling supernatant to the head of the water treatment process and transporting solids to the landfill. Figure 2 shows the proposed process schematic.

Two filtration options were solicited from filter manufacturers. One option contains two DAF units and two granular filter units, each sized to handle 100% of the 2014 MDD flow. This option provides complete redundancy. The second option contains three DAF units, each sized to handle 50% of the 2041 MDD flow, along with two granular filter units, both at 100% of the 2041 MDD flow. This option provides a backup DAF unit in the event of maintenance, and full filter redundancy. This option also allows the equipment to be sized closer to average flows, for increased efficiency.

Three DAF units and two granular filter units were used for sizing the new water treatment process, which would be housed within a new 5,700-SF building. Figure 3 shows one possible equipment layout. The existing slow sand filter building would be converted to a new serpentine clearwell, to provide disinfection contact time, and the existing ozone system is assumed to be taken offline. It is also

assumed that the roughing filter building would be demolished. CBW might elect to repurpose the roughing filter in the future. Similarly, the existing ozone system might be used in the future to potentially enhance the treatment process as suggested in the pilot study and in a recent follow-up study performed earlier this year. A budgetary allowance is assumed for demolishing this equipment if it's decided that the use of ozone will not be continued.

Due to the added treatment capacity and processes of mechanical flocculation, dissolved air flotation, and increased water storage, the required operator certification will increase from a Class II for the existing process to a Class III for the proposed process.

Backwash Disposal

The 2017 PER identified pre-treatment DAF and filter backwash waste recycling as the preferred alternative. This alternative included an above-ground clarifier with polymer injection and sludge disposal in the CBW landfill. However, the implementation of dewatering and backwash recycling would increase the required operator certification to a Class IV. CBW has expressed a preference to seek a lower operator certification requirement.

Table 2 summarizes the required operator certifications for continuing to use ozone and for the various backwash disposal scenarios discussed in the 2017 PER.

Table 2: Operator Certification Requirements

Scenario	Required Operator Certification
Existing Treatment Process	Class II
DAF + Granular Filtration + Ozone	Class III
DAF + Granular Filtration + Backwash Handling + Ozone	Class IV
DAF + Granular Filtration + Backwash Recycle (2017 PER Proposed Alternative)	Class IV
DAF + Granular Filtration + On-Site Backwash Handling	Class IV
DAF + Granular Filtration + No Backwash Handling	Class III

To avoid a Class IV operator certification, a 1,300-LF below-grade process waste line extension from the WTP is proposed as the backwash disposal option for this PER update. The line would run directly to the wastewater treatment plant (WWTP). Construction of the buried process waste line would require clearing and blasting along the proposed alignment.

At the plant's new design capacity of 2.26 MGD (1,600 gpm), the DAF pretreatment process is estimated to produce between 6,000 and 12,000 gallons per day of process waste. Granular media filter backwashing and filter-to-waste would produce an additional 30,000 gallons per day, assuming a portion of each filter is backwashed daily. The existing National Pollution Discharge Elimination System (NPDES) permit for the CBW WWTP allows for a daily maximum discharge of 3.6 MGD, with a monthly maximum average of 0.6 MGD. Based on a review of reported monthly WWTP discharges from 2020 through 2021, the average monthly discharge is 0.36 MGD and the average daily maximum discharge is 0.79 MGD. The highest monthly average flow recorded from 2020 to 2021 was 0.50 MGD, and the highest daily maximum flow was 1.88 MGD. Table 3 summarizes the WWTP discharge data. The additional estimated waste flows from the new water treatment process are not anticipated to cause the CBW NPDES permit

limits to be exceeded at the current wastewater discharge levels. However, monthly average discharge flows would be within 50,000 gpd of exceedance, and would eventually reach the discharge limit sooner, with future community growth or increased inflow and infiltration into the sewer collection system. The CBW wastewater system experiences high inflow and infiltration volumes into their sewer system during rainy months, which elevates the WWTP discharges. Sewer system upgrades would reduce inflow and infiltration and lower the monthly average discharge flows as a result.

Table 3: CBW WWTP Discharge Data

	Monthly Average Flow (MGD)	Daily Maximum Flow (MGD)
2020 – 2021 Average	0.36	0.79
2020 – 2021 Maximum	0.50	1.88
Proposed WTP Process Waste Flow	0.05	0.05
CBW NPDES Limit	0.60	3.60

DAF Solids and Backwash Sludge Handling Alternatives

Two alternatives were review for handling the DAF solids and backwash sludge.

Sludge Alternative 1

Alternative 1 consists of discharging the treatment waste directly to the new process waste line extension. Suspended solids would settle once discharged at the existing WWTP lagoon. Over time, solids would build within the lagoon and require dredging. This alternative would result in slight operations and maintenance (O&M) cost increases to account for increased frequency of lagoon dredging.

Sludge Alternative 2

Alternative 2 consists of sludge handling for the new water treatment process. On-site sludge handling was included with all of the backwash waste alternatives in the 2017 PER, and consists of piping the backwash waste to a settling tank before discharging to the process waste line extension. The tank would be insulated and located near the WTP. Polymer would be injected into the backwash waste water to improve settling of solids in the clarifier tank. Primary dewatering of the settled solids would occur with a centrifuge system and secondary dewatering would occur over the course of one to two months through evaporation and gravity drain in outside covered containers. The dewatered sludge would be transported by ocean freight to a landfill facility in eastern Washington (used by CBW for all municipal refuse disposal). This alternative will result in increased capital costs and increased O&M costs for on-site chemical addition and dewatering operations. As displayed in Table 2, on-site sludge handling would raise the required operator certification to Class IV. For this reason, on-site backwash handling is not considered further.

WTP Site Alternatives

Three site locations were evaluated for placement of the new water treatment process. All sites are located within the general vicinity of the existing WTP. The general process flow will not vary

significantly from the 2017 PER. The process flow would bypass the existing roughing filter downstream of the control building and be directed to the new DAF and filter facility. Filtered water would be routed through the new clearwell before tying into the existing process piping that supplies the existing WSTs.

The new process building is sized to accommodate DAF, filter and ancillary equipment and would occupy a footprint of approximately 5,700 SF. This size was based on the larger of two concept DAF/filter configurations provided by DAF manufacturers to help estimate the scope of this project. The building would also house chemical dosing equipment and process piping, as well as mechanical and electrical equipment.

Site A

Site A is located at the existing WTP. The new process building would be constructed on top of the existing sand filter building, as shown in Figure 4. This site location would not require any significant earthwork, but would require use of the existing concrete structure as a foundation for a new floor structure. Modification of the existing roof structure would be required to allow construction of the new process building floor while keeping the existing slow sand filters in operation. With this option, the building floor would span two equally-sized bays of the existing filter structure and the full breadth of the structure. For cost estimate purposes, the floor is assumed to be a composite concrete and corrugated steel deck supported by steel beams. A visual review of the concrete indicates it to be in decent condition for supporting a new building, but a non-destructive structural evaluation of the concrete should be conducted early in the design process to confirm that the concrete interior is in sound condition. An assumed budgetary amount is included with the design fee for this alternative. Some crack sealing and concrete patching will be needed in isolated areas. This site would require the least amount of new yard piping, impose the least site impact, and facilitate relatively efficient water conveyance between the DAF/filter process and the disinfection process.

However, this alternative presents a significant amount of risk associated with supplying water to the community during construction, as the existing WTP would have a reduced filter capacity while the roof modification is being completed. Each of the two spanned filter bays would need to be separately taken offline to allow the roof modifications. During this time frame, the City would be temporarily relying on only three filters, when four filters are needed during periods of high water consumption. Providing a temporary, supplemental, final filtering process for helping meet high water demands would likely be cost prohibitive and is not considered in this update. Further, the new facility would be founded on an existing concrete structure that is over 20 years old. While concrete structures are generally very durable and provide relatively long usable lives, the condition of the existing concrete is not known with certainty. The possibility exists that significant portions of the concrete filter structure would need to be rehabilitated to be made usable as a basement for the new process building.

Site B

Site B is located south of the existing WTP, cut into the hillside as shown in Figure 5. The proposed WTP would require approximately 4,705 cubic yards (CY) of excavation and 1,800 CY of fill. Since it is anticipated that the excavation will consist of bedrock blasting, excavation side slopes are assumed to be 0.75H:1V for cost estimating purposes. Fill side slopes are assumed to be 1.5H:1V, with the material consisting of crushed rock. Imported fill material will be needed to construct a pad for the new process building. This site will require additional clearing and grubbing of forested area.

This alternative presents a relatively moderate amount of risk associated with bedrock blasting to make room for the new process building. This blasting work would be in close proximity to the

existing water treatment plant. While this excavation approach commonly occurs near existing structures in Southeast Alaska (where bedrock is prevalent), the possibility exists that the existing facility could incur some damage as a result of nearby blasting.

Site C

Site C is located west of the existing WTP, across the Wood St Extension Road as shown in Figure 6. The location would be positioned to avoid conflicts with an existing septic system disposal area located south of the proposed site. The new process building would require approximately 14,720 CY of fill, with side slopes of 1.5H:1V, and about 320 CY of excavation. This site requires the longest runs of yard piping. This site will require additional clearing and grubbing of forested area.

Capital Cost Estimate

Capital cost estimates were developed for each site using applicable line items from the 2017 PER and applying 2% inflation per year to the unit costs. Updated budgetary pricing for the DAF pretreatment and granular filter package was obtained, and quantities such as fill and excavation were updated to reflect the conditions of each site. Line items were added as needed, such as additional yard piping and process waste piping extending to the WWTP. Design, construction, and administration percentages were not changed from the 2017 PER.

Table 4 lists capital cost estimates for each site. Detailed capital cost estimates are included in Attachment 2.

Table 4: Capital Cost Estimates

	Site A	Site B	Site C
Construction	$ 12,668,000	$12,787,000	$12,786,000
Design (9%)*	$ 1,216,000	$1,151,000	$1,151,000
Construction Admin (9%)	$ 1,141,000	$1,151,000	$1,151,000
Project Admin (2%)	254,000	$256,000	$256,000
Total	**$15,279,000**	**$15,345,000**	**$15,344,000**

* Site A design fee value shown includes a non-destructive concrete structural inspection

O&M Cost Estimate

An updated O&M cost estimate was developed using applicable line items from the 2017 PER and apply 2% inflation per year to costs such as chemicals. Table 5 lists the annual O&M cost for DAF pretreatment with granular filtration and backwash disposal to the WWTP. A detailed O&M cost estimate is included in Attachment 2.

Table 5: Annual O&M Cost

DAF Filtration	
Power	$39,674
Labor	$31,625
Chemicals/Backwash Supply Water	$311,787
Equipment/Material Replacement	$8,878
Building	$11,200
Backwash Disposal	
Labor	$3,250
Equipment	$600
TOTAL	**$407,015**

Net Present Value Cost

A net present value (NPV) cost was determined by using the 2021 OMB 20-year real discount rate of 3.00% to determine a uniform series present worth (USPW) factor, which is applied to the annual O&M cost. The USPW is added to the capital cost to determine the NPV cost. A detailed NPV cost is included in Attachment 2.

Table 6: NPV Cost

	Site A	Site B	Site C
Capital Cost	$15,279,000	$15,345,000	$15,344,000
Annual O&M Cost	$407,015	$407,015	$407,015
NPV	**$21,344,356**	**$21,400,356**	**$21,399,356**

Preferred Alternative

Preliminary Project Design

The preferred alternative is Site C, which has the second-lowest NPV cost and is within 0.3% of the lowest NPV cost (Site A). While the Site A option is estimated with a slightly lower cost and would impose less impacts to the site, it would involve the most complicated construction approach and the most risk with the structural modifications to the existing facility. The Site B option is estimated with nearly the same cost as the Site C option, but would impose relatively greater construction risk due to the need for substantial bedrock blasting.

Site C consists of locating the new process building west of the Wood St Extension Road. The existing slow sand filters would be converted into a new serpentine clearwell. The site will require 14,720 CY of fill and 320 CY of excavation in addition to site clearing and grubbing. The 170-LF raw water line extension would tie into the existing piping downstream of the control building and route

to the new WTP. The 220-LF filtered water line extension would route from the new process building and tie into the existing piping between the roughing filters and the new clearwell. The existing site piping would be used to route the treated water back through the control building and into the WSTs.

The proposed DAF filtration plant will be designed to treat a 2041 MDD of 2.26 MGD. Three DAF units, each capable of 50% of the 2041 MDD flow, would be located upstream of two granular filtration units, each capable of 100% of the 2041 MDD flow. Coagulant injection would occur upstream of the filtration process, followed by pH adjustment and disinfection downstream of the filtration and prior to storage in the existing WTPs.

DAF solids and backwash waste will be routed directly to the process waste line, without on-site dewatering. This approach will require a 1,300 LF below-grade process waste line extension from the proposed WTP to the existing WWTF.

Project Schedule

The project schedule will be driven by the availability of design and construction funding. It is anticipated that the project design can be completed over the course of ten months, and the construction completed over the course of 12 months.

Total Project Cost Estimate

The total cost estimate for the proposed alternative is presented in Table 4, Site A.

Conclusions and Recommendations

Based on this evaluation, the DAF treatment process is recommended as shown and described in this PER update. The Site C option is designated as the “preferred” alternative for the project site. Piped below-grade disposal directly to the existing WWTF is the recommended alternative for backwash waste. The improvements associated with these alternatives will allow CBW to continue to meet the consumption and water quality needs of the community.

Attachments

Attachment 1 – Figures

Attachment 2 – Cost Estimates

Attachment 3 – Product Data

END

Conceptual Capital Cost Estimate
Summary

	Site A	Site B	Site C	On-Site Backwash Handling
Construction	$ 12,668,000	$ 12,787,000	$ 12,786,000	$ 632,000
Design (9%*)	$ 1,216,000	$ 1,151,000	$ 1,151,000	$ 42,000
Construction Admin (9%)	$ 1,141,000	$ 1,151,000	$ 1,151,000	$ 42,000
Project Admin (2%)	$ 254,000	$ 256,000	$ 256,000	$ 10,000
Subtotal	**$ 15,279,000**	**$ 15,345,000**	**$ 15,344,000**	**$ 726,000**

* Site A Design fee includes a non-invasive concrete structural inspection

Alternative Method of Calculating the Life Cycle Analysis (new RD Bulletin)

NPV = C + USPW(O&M) - SPPW(S)

NPV	Net Present Value
C	Capital Cost
USPW	Uniform series present worth
O&M	Annual O&M Costs
SPPW	Single payment present worth of the salvage value

Uniform Series Present Worth for O&M	**$\frac{(1+i)^n-1}{i(1+i)^n}$**	
Yearly O&M		USPW
Design Life of System	20	
Interest Rate (30 years)	3	14.9
	0.03	

On-Site Backwash Handling

	Site A	Site B	Site C
Capital Cost	$16,005,000	$16,071,000	$16,070,000
Annual O&M Cost	$457,479	$457,479	$457,479
NPV	$22,811,130	$22,877,130	$22,876,130

No On-Site Backwash Handling

	Site A	Site B	Site C
Capital Cost	$15,279,000	$15,345,000	$15,344,000
Annual O&M Cost	$407,015	$407,015	$407,015
NPV	$21,334,356	$21,400,356	$21,399,356

Conceptual Capital Cost Estimate
Site A

SITE A

Project Duration **48 weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST (2017)	UNIT COST (2021)	TOTAL COST
General						
Meals and lodging		2688	day	$60	$65	$174,720
Superintendent		48	weeks	$7,200	$7,794	$374,112
Project Manager	8 hrs/week	48	weeks	$800	$866	$41,568
Expeditor	40 hrs/week	48	weeks	$2,800	$3,031	$145,488
Roundtrip Air Fare		32	each	$1,000	$1,083	$34,656
Allowance for Misc Air Freight		1	ls	$75,000	$81,183	$81,183
Equipment Mobilization		1	ls	$50,000	$54,122	$54,122
Meetings/Coordination						
Project Meetings		96	hours	$100	$109	$10,464
Project Schedule		12	months	$200	$217	$2,604
Shop Drawings		192	hours	$100	$109	$20,928
Equipment						
Pickup (2 each)	Rental/Ownership Cost	48	weeks	$300	$325	$15,600
Flatbed Truck	Rental/Ownership Cost	48	weeks	$500	$542	$26,016
Other						
Project Office	Office + equipment	12	months	$750	$812	$9,744
Safety Equipment		1	ls	$5,000	$5,413	$5,413
Temporary Power	Generators for Tools	12	months	$500	$542	$6,504
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$32,473	$32,473
Fuel, oil and gas for equipment		12	months	$1,500	$1,624	$19,488
Housing						
Housing		12	months	$10,000	$10,825	$129,900
Utilities		12	months	$1,500	$1,624	$19,488
Insurance						
Certified Payroll Fee		1	ls	$5,000	$5,413	$5,413
Water Treatment Plant Modifications						
Site Grading and Drainage		1	LS	$25,000	$27,061	$27,061
Demolish Roughing Filter Bldg		1	LS		$15,000	$15,000
Demolish Ozone Generation System		1	LS	$10,000	$10,825	$10,825
DAF Treatment System		1	LS		$3,500,000	$3,500,000
DAF Building		5740	SF		$325	$1,865,500
DAF Building Concrete Repair		1	LS		$40,000	$40,000
Floor Structure for New WTP		1	LS		$350,000	$350,000
Modify Existing Filter Roof		1	LS		$100,000	$100,000
Yard Piping		40	LF		$200	$8,000
Streaming Current Detector		1	ea	$25,000	$27,061	$27,061
Conversion of Filters to Clearwells		4	ea		$100,000	$400,000
Connection to Existing WTP Piping		1	LS	$50,000	$54,122	$54,122
Process Piping and Instrumentation		1	LS	$350,000	$378,852	$378,852
Chemical Feed Systems		1	LS	$35,000	$37,886	$37,886
Replace Onsite Chlorine Generation System		1	LS	$115,000	$124,480	$124,480
Caustic Feed System Improvements		1	ea	$30,000	$32,473	$32,473
10 hp Transfer Pumps to Treatment System		2	ea	$12,000	$12,990	$25,980
60 hp Booster Pumps		2	ea	$20,000	$21,649	$43,298
Control Panels		1	LS	$150,000	$162,365	$162,365
Remodel Part of Control Bldg for Chemical Storage		400	SF	$50	$55	$22,000

Standby Generator		1	LS	$150,000	$162,365	$162,365
Fuel System		1	LS	$24,000	$25,979	$25,979
Sewer Service Extension						
Clearing and Grubbing		1	Acre	$40,000	$43,298	$43,298
Excavation (non-bedrock)		1450	CY	$30	$33	$47,850
Bedrock Blasting and Removal		1450	CY	$40	$44	$63,800
Rock Removal		1450	CY	$20	$22	$31,900
Backfill and Bedding		1450	CY	$35	$38	$55,100
Sanitary Sewer Pipe		1,300	LF	$80	$87	$113,100
Sanitary Sewer Manholes/Cleanouts		4	EA	$7,500	$8,119	$32,476
Connection to Wastewater Treatment Plant		1	LS	$5,000	$5,413	$5,413
Seeding		1	ACRE	$15,000	$16,237	$16,237
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$54,122	$54,122
Project Closeout						
Punchlist Items		1	ls	$25,000	$27,061	$27,061
Asbuilts of System		1	ls	$15,000	$16,237	$16,237
Site Cleanup		1	ls	$25,000	$27,061	$27,061
Demobilization		1	ls	$50,000	$54,122	$54,122

	Subtotal	$9,211,000
General Contractor Overhead and Profit	15.0%	$1,382,000
General Contractor Bond & Insurance	3.0%	$277,000
Estimating Contingency	15.0%	$1,382,000
Inflation	3.5%	$323,000
Buy American Iron and Steel	1.0%	$93,000
	Construction Subtotal	$12,668,000
Design	9.0%	$1,141,000
Structural Inspection of Clearwell Concrete (non-destructive)		$75,000
Construction Administration	9.0%	$1,141,000
City Administration	2.0%	$254,000
Estimated Total Cost (Site A)		**$15,279,000**

Conceptual Capital Cost Estimate
Site B

SITE B

Project Duration **48 weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST (2017)	UNIT COST (2021)	TOTAL COST
General						
Meals and lodging		2688	day	$60	$65	$174,720
Superintendent		48	weeks	$7,200	$7,794	$374,112
Project Manager	8 hrs/week	48	weeks	$800	$866	$41,568
Expeditor	40 hrs/week	48	weeks	$2,800	$3,031	$145,488
Roundtrip Air Fare		32	each	$1,000	$1,083	$34,656
Allowance for Misc Air Freight		1	ls	$75,000	$81,183	$81,183
Equipment Mobilization		1	ls	$50,000	$54,122	$54,122
Meetings/Coordination						
Project Meetings		96	hours	$100	$109	$10,464
Project Schedule		12	months	$200	$217	$2,604
Shop Drawings		192	hours	$100	$109	$20,928
Equipment						
Pickup (2 each)	Rental/Ownership Cost	48	weeks	$300	$325	$15,600
Flatbed Truck	Rental/Ownership Cost	48	weeks	$500	$542	$26,016
Other						
Project Office	Office + equipment	12	months	$750	$812	$9,744
Safety Equipment		1	ls	$5,000	$5,413	$5,413
Temporary Power	Generators for Tools	12	months	$500	$542	$6,504
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$32,473	$32,473
Fuel, oil and gas for equipment		12	months	$1,500	$1,624	$19,488
Housing						
Housing		12	months	$10,000	$10,825	$129,900
Utilities		12	months	$1,500	$1,624	$19,488
Insurance						
Certified Payroll Fee		1	ls	$5,000	$5,413	$5,413
Water Treatment Plant Modifications						
Site Clearing and Grubbing		1	LS		$6,000	$6,000
Bedrock Blasting and Removal		5055	CY	$80	$87	$439,785
Site Fill		1800	CY		$30	$54,000
Site Grading and Drainage		1	LS	$25,000	$27,061	$27,061
Demolish Roughing Filter Bldg		1	LS		$15,000	$15,000
Demolish Ozone Generation System		1	LS	$10,000	$10,825	$10,825
DAF Treatment System		1	LS		$3,500,000	$3,500,000
DAF Building		5740	SF		$325	$1,865,500
DAF Building Concrete Repair		1	LS		$40,000	$40,000
Yard Piping		230	LF		$200	$46,000
Streaming Current Detector		1	ea	$25,000	$27,061	$27,061
Conversion of Filters to Clearwells		4	ea		$100,000	$400,000
Connection to Existing WTP Piping		1	LS	$50,000	$54,122	$54,122
Process Piping and Instrumentation		1	LS	$350,000	$378,852	$378,852
Chemical Feed Systems		1	LS	$35,000	$37,886	$37,886
Replace Onsite Chlorine Generation System		1	LS	$115,000	$124,480	$124,480
Caustic Feed System Improvements		1	ea	$30,000	$32,473	$32,473
10 hp Transfer Pumps to Treatment System		2	ea	$12,000	$12,990	$25,980
60 hp Booster Pumps		2	ea	$20,000	$21,649	$43,298
Control Panels		1	LS	$150,000	$162,365	$162,365

Conceptual Capital Cost Estimate
Site B

Remodel Part of Control Bldg for Chemical Storage		400	SF	$50	$55	$22,000
Standby Generator		1	LS	$150,000	$162,365	$162,365
Fuel System		1	LS	$24,000	$25,979	$25,979
Sewer Service Extension						
Clearing and Grubbing		1	Acre	$40,000	$43,298	$43,298
Excavation (non-bedrock)		1450	CY	$30	$33	$47,850
Bedrock Blasting and Removal		1450	CY	$40	$44	$63,800
Rock Removal		1450	CY	$20	$22	$31,900
Backfill and Bedding		1450	CY	$35	$38	$55,100
Sanitary Sewer Pipe		1,300	LF	$80	$87	$113,100
Sanitary Sewer Manholes/Cleanouts		4	EA	$7,500	$8,119	$32,476
Connection to Wastewater Treatment Plant		1	LS	$5,000	$5,413	$5,413
Seeding		1	ACRE	$15,000	$16,237	$16,237
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$54,122	$54,122
Project Closeout						
Punchlist Items		1	ls	$25,000	$27,061	$27,061
Asbuilts of System		1	ls	$15,000	$16,237	$16,237
Site Cleanup		1	ls	$25,000	$27,061	$27,061
Demobilization		1	ls	$50,000	$54,122	$54,122

	Subtotal	$9,299,000
General Contractor Overhead and Profit	15.0%	$1,395,000
General Contractor Bond & Insurance	3.0%	$279,000
Estimating Contingency	15.0%	$1,395,000
Inflation	3.5%	$326,000
Buy American Iron and Steel	1.0%	$93,000
	Construction Subtotal	$12,787,000
Design	9.0%	$1,151,000
Construction Administration	9.0%	$1,151,000
City Administration	2.0%	$256,000
Estimated Total Cost (Site B)		**$15,345,000**

Conceptual Capital Cost Estimate
Site C

SITE C

Project Duration **48 weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST (2017)	UNIT COST (2021)	TOTAL COST
General						
Meals and lodging		2688	day	$60	$65	$174,720
Superintendent		48	weeks	$7,200	$7,794	$374,112
Project Manager	8 hrs/week	48	weeks	$800	$866	$41,568
Expeditor	40 hrs/week	48	weeks	$2,800	$3,031	$145,488
Roundtrip Air Fare		32	each	$1,000	$1,083	$34,656
Allowance for Misc Air Freight		1	ls	$75,000	$81,183	$81,183
Equipment Mobilization		1	ls	$50,000	$54,122	$54,122
Meetings/Coordination						
Project Meetings		96	hours	$100	$109	$10,464
Project Schedule		12	months	$200	$217	$2,604
Shop Drawings		192	hours	$100	$109	$20,928
Equipment						
Pickup (2 each)	Rental/Ownership Cost	48	weeks	$300	$325	$15,600
Flatbed Truck	Rental/Ownership Cost	48	weeks	$500	$542	$26,016
Other						
Project Office	Office + equipment	12	months	$750	$812	$9,744
Safety Equipment		1	ls	$5,000	$5,413	$5,413
Temporary Power	Generators for Tools	12	months	$500	$542	$6,504
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$32,473	$32,473
Fuel, oil and gas for equipment		12	months	$1,500	$1,624	$19,488
Housing						
Housing		12	months	$10,000	$10,825	$129,900
Utilities		12	months	$1,500	$1,624	$19,488
Insurance						
Certified Payroll Fee		1	ls	$5,000	$5,413	$5,413
Water Treatment Plant Modifications						
Site Clearing and Grubbing		1	LS		$25,000	$25,000
Site Fill		14720	CY		$30	$441,600
Site Grading and Drainage		1	LS	$25,000	$27,061	$27,061
Demolish Roughing Filter Bldg		1	LS		$15,000	$15,000
Demolish Ozone Generation System		1	LS	$10,000	$10,825	$10,825
DAF Treatment System		1	LS		$3,500,000	$3,500,000
DAF Building		5740	SF		$325	$1,865,500
DAF Building Concrete Repair		1	LS		$40,000	$40,000
Yard Piping		390	LF		$200	$78,000
Streaming Current Detector		1	ea	$25,000	$27,061	$27,061
Conversion of Filters to Clearwells		4	ea	$100,000	$100,000	$400,000
Connection to Existing WTP Piping		1	LS	$50,000	$54,122	$54,122
Process Piping and Instrumentation		1	LS	$350,000	$378,852	$378,852
Chemical Feed Systems		1	LS	$35,000	$37,886	$37,886
Replace Onsite Chlorine Generation System		1	LS	$115,000	$124,480	$124,480
Caustic Feed System Improvements		1	ea	$30,000	$32,473	$32,473
10 hp Transfer Pumps to Treatment System		2	ea	$12,000	$12,990	$25,980
60 hp Booster Pumps		2	ea	$20,000	$21,649	$43,298
Control Panels		1	LS	$150,000	$162,365	$162,365
Remodel Part of Control Bldg for Chemical Storage		400	SF	$50	$55	$22,000

Standby Generator		1	LS	$150,000	$162,365	$162,365
Fuel System		1	LS	$24,000	$25,979	$25,979
Sewer Service Extension						
Clearing and Grubbing		1	Acre	$40,000	$43,298	$43,298
Excavation (non-bedrock)		1450	CY	$30	$33	$47,850
Bedrock Blasting and Removal		1450	CY	$40	$44	$63,800
Rock Removal		1450	CY	$20	$22	$31,900
Backfill and Bedding		1450	CY	$35	$38	$55,100
Sanitary Sewer Pipe		1,300	LF	$80	$87	$113,100
Sanitary Sewer Manholes/Cleanouts		4	EA	$7,500	$8,119	$32,476
Connection to Wastewater Treatment Plant		1	LS	$5,000	$5,413	$5,413
Seeding		1	ACRE	$15,000	$16,237	$16,237
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$54,122	$54,122
Project Closeout						
Punchlist Items		1	ls	$25,000	$27,061	$27,061
Asbuilts of System		1	ls	$15,000	$16,237	$16,237
Site Cleanup		1	ls	$25,000	$27,061	$27,061
Demobilization		1	ls	$50,000	$54,122	$54,122
				Subtotal		$9,298,000

General Contractor Overhead and Profit	15.0%		$1,395,000
General Contractor Bond & Insurance	3.0%		$279,000
Estimating Contingency	15.0%		$1,395,000
Inflation	3.5%		$326,000
Buy American Iron and Steel	1.0%		$93,000
		Construction Subtotal	$12,786,000
Design	9.0%		$1,151,000
Construction Administration	9.0%		$1,151,000
City Administration	2.0%		$256,000
Estimated Total Cost (Site C)			**$15,344,000**

Conceptual Capital Cost Estimate
On-Site Backwash Handling

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST (2017)	UNIT COST (2021)	TOTAL COST
Clarifier Tank						
30,000-gal Backwash Water Storage Tank		30,000	gal	$2.50	$2.71	$81,182
30,000-gal Tank Insulation Package		30,000	gal	$0.50	$0.54	$16,236
Tank Add Heat System		1	ls	$10,000	$10,824	$10,824
Connection Piping to WTP		150	LF	$120	$130	$19,484
Fill for Tank Base		100	CY	$30	$32	$3,247
Sludge Dewatering and Disposal Equipment						
Sludge Dewatering System		1	ea	$275,000	$297,669	$297,668.84
Containers for Secondary Sludge Dewatering		1	ls	$30,000	$32,473	$32,472.96

		Subtotal	$461,000
General Contractor Overhead and Profit	15.0%		$70,000
General Contractor Bond & Insurance	3.0%		$14,000
Estimating Contingency	15.0%		$70,000
Inflation	3.5%		$17,000
		Construction Subtotal	$632,000
Design	9.0%		$42,000
Construction Administration	9.0%		$42,000
City Administration	2.0%		$10,000
Estimated Total Cost			**$726,000**

O&M Cost Estimate Summary

DAF Treatment/Filtration			
Power		$	39,674
Labor		$	31,625
Chemicals/Backwash supply water		$	311,787
Equipment/Material Replacement		$	8,878
Building		$	11,200
	SUBTOTAL	$	403,165
Backwash Disposal Alternatives			
On-Site Settling/Dewatering			
Power		$	2,780
Labor		$	3,250
Chemicals		$	15,556
Equipment/Material Replacement		$	2,728
Sludge Disposal		$	30,000
	SUBTOTAL	$	54,314
No Settling/Detwatering			
Labor		$	3,250
Equipment/Material Replacement		$	600
	SUBTOTAL	$	3,850

Total Annual O&M - On-site backwash handling	$	457,479
Total Annual O&M - No backwash handling	$	407,015

Water Treatment Plant DAF Costs (monthly/yearly)

Daily Water Consumption	1,300,000	**gpd**
Monthly Water Consumption	39,000,000	**gal/month**
Yearly Water Consumption	474,500,000	**gal/year**

User Data:

Design Flow	1.3	MGD
Design Flow	902.7777778	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.7	days
Annual Water Production	474,500,000	gallons
Daily Plant Operation	24	hr/day

Operational Costs:

Electricity Service Charge	$13.50	/mo
Electricity	$0.115	/kwh
Burdened labor rate for an Operator	$65	/hr

Description	Number	Phase	Voltage	kW	Total Connected load kW	Total kWh	Run Time per day Hours
Control Panel							
Rapid mixer	1	3	460	1.5	1.5	36	24
Flocculators	4	3	460	0.56	2.24	53.76	24
Air Compressor	1	1	120	3.73	3.73	14.92	4
Instrumentation etc	1	1	240	1	1	24	24
				Sub Total (kW)	8.47		
Backwash pump	1	3	460	29.8	29.8	7.945872	0.26664
Sludge pump	n/a						
Airscour blower	1	3	460	11.2	11.2	1.344	0.12
Mixers							
Soda Ash mixer	1	1	110	0.56	0.37	0.37	1
Polymer mixer	1	1	110	0.25	0.25	0.25	1
				Sub Total (kW)	0.62		
Clearwell Booster Pumps	1	3	460	44.742	44.742	807.8416667	18.05555556
Dosing Pumps							
Chemical dosing pumps	4	1	110	0.03	0.12	2.88	24
				Sub Total (kW)	0.12		

Total load for 1.8 MGD plant (KWH) 949

Power Cost: $0.1145 per kwh

Daily Power Cost $108.70

Daily Production 1,300,000 gallons
Power cost per 1000 gallons $ 0.084

Yearly Power Cost	$39,674.10

Chemical Cost
Estimated Chemical Dosages:

		Typical Dosages (ppm)	
Polymer	- PAX XL-19	35	
Soda Ash (Sodium Carbonate)		5.0	(typ. 50% of alum)
Sodium Hypochlorite		4	

Flowrate in usgpm 902.78 (not used)
Plant Run Hours 24
Total Galls per Day 1,300,000

Total Pounds of Chemicals Used Per Day				
	#/day	#/month	$/#	Cost/day
Polymer:	379.57	11576.95187	$ 1.08	$ 410.86
Soda Ash:	54.22	1653.850267	$ 0.32	$ 18
Sodium Hypochlorite	43.38	1323.080214	$ 2.44	$ 106
			total	$ 534

Chemical cost /1000 gall. = 0.411
Yearly chemical cost $ 194,954

Total Operating Cost
Power $ 0.084
Chemicals $ 0.41
$ 0.49 per 1000 gal

Chemical cost of soda ash $ 38,562

Backwash Volume
DAF pretreatment waste 6000 gpd 6-12k per AWC and Suez
Filter backwash waste 30000 gpd

backwash frequency 0.25 days
backwash volume per year 52,560,000 gallons
cost of water 0.0022 $/gallon
cost of backwash per year $ 116,834 $/year

Capital Equipment Replacement	Cost	Expected Equipment Life	Annual Cost
Chemical Systems	$10,830	7 yr	$2,177
Backwash Pump	$8,660	10 yr	$1,411
Air Scour Blower	$10,830	10 yr	$1,764
Booster Pumps	$21,650	10 yr	$3,527

Inflation 5 %

Operator Labor
labor Requirement:
average hours/day of operation for chemical preperation, monitoring and adjustment 1 hrs
average hours/day for minor maintenance of treatment equipment 0.333 hrs
labor rate per hour $65
labor cost/day for operation of treament equipment $65
labor cost/year for operation of treament equipment cost per 365 days $23,725
labor cost/day for minor maintenance of treatment equipment $22
labor cost/year for minor maintenance of treatment equipment 365 days $7,900

Total Yearly Labor $ 31,625.43

Estimated Annual Water Treatment O&M Cost

Yearly Power Cost	$	39,674
Yearly chemical cost	$	194,954
cost of backwash per year	$	116,834
Capital Equipment Replacement:	$	8,878
Operator Labor	$	31,625

Total Yearly Treatment Operating Cost $391,965
(Bldg O&M Cost is Calculated Separately)

O&M Cost Estimate
Building

NEW WTP BUILDING

System Data:

Total Building Area	8,000 ft^2
(New Treatment Bldg + Control Building)	

Operational Costs:

Burdened labor rate for an Operator	$65 /hr
Labor - Operation and maintenance of building	2 hr/wk
Misc Materials and Supplies	$550 /yr
Floor Resurfacing	$330 /yr
Electricity	$0.11 /kwh

Capital Costs:	Cost	Expected Equipment Life	Annual Cost
Unit Heaters (5 total)	$5,000	15 yr	$700
Inflation	5 %		

Electrical Demand:

Equipment	Power	Usage (hr/day)	Yearly Demand (kwh)	Annual Cost
Building Unit Heater	7,500 watts	9	18,478	$2,116
Building Lights	0.4 watts/ft2	6	7,008	$802
Misc. Building Power	1,750 kwh/yr		1,750	$200

Estimated Annual Building O & M Cost

Labor		$6,800
Materials (Routine O&M and repairs)		$550
Electricity		$3,120
Equipment Replacement Cost		$700
	Total	$11,200

O&M Cost Estimate
On-Site Backwash Handling

Operational Costs:			
Burdened labor rate for an Operator		$65	/hr
Equipment Operating Cost		$60	/hr
Backwash Clarifier Tank Cleaning		40	hr/year
Inspection and cleaning sewer collection system			
Labor - Operator		10	hr/year
Sludge Dewatering & Disposal			
Sludge Centrifuge Power Cost	$	2,780	/yr
Sludge Chemical Cost	$	15,556	/yr
Sludge Disposal	$	30,000	/yr
Inspection and cleaning sewer collection system			
Labor - Operator		10	hr/year

Capital Equipment Replacement:	Cost	Expected Equipment Life	Annual Cost
Sludge Centrifuge Parts	$3,860	2 yr	$2,128

Estimated Annual Operation & Maintenance Cost

Power		
Sludge Centrifuge	$	2,780
Operator Labor		
Sewer Collection System		$650
Tank Cleaning		$2,600
Equipment		
Sewer Collection System		$600
Sludge Centrifuge Parts		$2,128
Sludge Chemicals		$15,556
Disposal		$30,000
Total		**$54,314**

O&M Cost Estimate
Backwash Disposal - no on-site handling

Operational Costs:

Burdened labor rate for an Operator	$65	/hr
Equipment Operating Cost	$60	/hr
Lagoon Dredging	40	hr/year
Inspection and cleaning sewer collection system		
Labor - Operator	10	hr/year
Inspection and cleaning sewer collection system		
Labor - Operator	10	hr/year

Estimated Annual Operation & Maintenance Cost

Operator Labor	
Sewer Collection System	$650
Tank Cleaning	$2,600
Equipment	
Sewer Collection System	$600
Total	**$3,850**