

DATE: July 5, 2017

FILE: 5340-20

TO: Chair and Members
Comox Valley Sewage Commission

FROM: Russell Dyson
Chief Administrative Officer

RE: Comox Valley Water Pollution Control Center – Alternate Option for Phase 1 Upgrades

Purpose

To provide an alternate option to the already approved phase one upgrades at the Comox Valley Water Pollution Control Center (CVWPCC).

Policy Analysis

The Comox Valley Regional District (CVRD) operates a sewerage service primarily for the City of Courtenay and Town of Comox, established by Bylaw No. 2541, being the “Comox Valley Sewerage Service Establishment Bylaw No. 2541, 2003”.

At their November 15, 2016 meeting the Comox Valley Sewage Commission passed the following motion:

THAT the Comox Valley Regional District proceed with planning, engineering and construction of phase one of the Comox Valley Water Pollution Control Center (CVWPCC) upgrade option three identified within the CVWPCC Capacity Assessment completed by ISL Engineering and Land Services dated August 2016;

AND FINALLY THAT as part of the phase one upgrades for the CVWPCC, ultraviolet disinfection technology with a disinfection target of 200MPN/100mL be included within the scope of work for the detailed design.

Executive Summary

To better understand the capital upgrades and operational requirements required to service a growing population and changing regulations, a capacity assessment of the treatment plant and outfall was conducted in 2016 by ISL Engineering and Land Services (ISL) along with an ultraviolet (UV) disinfection feasibility study completed by AECOM.

Through ISL’s work a recommended option was developed that improved plant capacity along with improving effluent quality to comply with *Municipal Wastewater Regulations* (MWR). The recommended option included installation and replacement of the mechanical screen and grit removal system, construction of an offline equalization tank, a reclaimed water service and installation of UV disinfection equipment and a cloth media filter.

In November 2016, the Sewage Commission approved proceeding with planning, engineering and construction of the phase one upgrades as identified by ISL within their capacity assessment. Due to the significant capital costs of the recommended upgrades and the multi-year approach, the CVRD undertook an independent third party review of ISL’s findings prior to proceeding with the detailed

design. The purpose of the third party review was to review ISL's recommendation and identify efficiencies.

From this third party review an alternate option was suggested that replaces addition of a cloth media filter at this time with construction of a fourth clarifier. This option was reviewed in detail by ISL (memorandum attached as Appendix A) and was determined to significantly reduce the initial capital cost, while providing effluent quality that will still meet the anticipated MWR effluent quality requirements.

Table No.1 below compares capital and operating costs along with providing a net present value analysis for the original option (option three) and the proposed new option (option nine)

Table No.1: Comparison of Costs

| Description | Original Option (Option Three) | Proposed New Option (Option Nine) |
|---|--------------------------------|-----------------------------------|
| Phase 1 - 2017 Construction | \$15,489,000 | \$12,327,000 |
| Phase 2 - 2024 Construction | \$6,610,000 | \$6,610,000 |
| Phase 3 – Construction years vary | \$46,983,000 | \$44,520,000 |
| Total Capital Costs | \$69,082,000 | \$63,457,000 |
| Estimated Yearly Operating Costs | \$68,000 | \$50,000 |
| Net Present Value | \$53,637,000 | \$48,312,000 |

Both option three and option nine include the addition of an offline equalization process to reduce peak hourly flows during peak wet weather events. Option nine provides reduced capital costs and will meet all current regulations but will not provide tertiary treatment. Should total suspended solids (TSS) regulations be tightened in the future a cloth media filter could be added then.

Recommendation from the Chief Administrative Officer:

THAT the Comox Valley Regional District proceed with planning, engineering and construction of the phase one upgrades at the Comox Valley Water Pollution Control Center as per the alternate option (option nine) as identified within the Wastewater Treatment Option Memorandum completed by ISL Engineering and Land Services dated June 27, 2017.

Respectfully:

R. Dyson

Russell Dyson
Chief Administrative Officer

Background/Current Situation

The 2011 CVRD sanitary sewerage master plan and long term financial plan both identify the need for capital upgrades to the CVWPCC. The original facility was commissioned in 1984 and has undergone expansions in 1993 and 2008. As population and flows increase, upgrades are required for capacity increases to accommodate growth. Upgrades to alleviate capacity concerns will trigger the requirement for the CVWPCC to become registered under the MWR. These more stringent regulations require additional upgrades to improve effluent quality in order to be in compliance with the MWR.

To better understand the capital upgrades and operational requirements required to service a growing population and more stringent regulations, a capacity assessment of the treatment plant and outfall was conducted along with an UV disinfection feasibility study in 2016. The CVWPCC

capacity assessment, completed by ISL, provided a recommended phased upgrade approach that increases capacity and improves effluent quality. The UV feasibility study recommended UV disinfection targets and provided sizing and costing information.

The first phase of the recommended upgrades are required to alleviate current plant capacity constraints, as well as ensuring MWR redundancy and effluent quality requirements are achieved. MWR guidelines for effluent quality include TSS below 25mg/L and a disinfection step to ensure fecal coliform counts are below the limits at the edge of the initial dilution zone. The original preferred option by ISL included the addition of an equalization tank after the primary clarifiers to reduce peak hour flows, a cloth media filter, and installation of UV disinfection equipment. The installation of the cloth media filter would provide tertiary treatment for the plant and would optimize UV disinfection equipment, provide an opportunity for greater water reuse throughout the plant and provide a physical barrier to ensure the TSS consistently remains below 10mg/L.

Due to the significant capital costs of the recommended upgrades and the multi-year approach, the CVRD decided to complete an independent third party review of ISL's findings prior to proceeding with the detailed design. The purpose of the third party review being primarily to review ISL's recommendations and identify any alternative options that may provide cost efficiencies.

Through this process an alternate option was identified that includes an equalization tank but instead of a cloth media filter the option includes the construction of a fourth clarifier to improve performance during periods of higher flows.

The CVWPC currently operates in three distinct trains, each train is comprised of a primary clarifier, bioreactor and secondary clarifier. The typical depth of secondary clarifiers is four to five meters deep, however the two original clarifiers are shallow with a depth of 3.1meters. Deeper clarifiers help to ensure the sludge blanket is further away from the effluent weir and therefore solids escapement through the effluent is less likely. Both ISL and the third party reviewer identified the shallow clarifiers as a problem, but whereas ISL proposed a fabric filter to compensate, the third party reviewer has recommended an additional clarifier.

The proposed new option requires all the same upgrades as previously approved, but replaces the installation of the cloth media filter with a fourth clarifier. The new option will not provide tertiary treatment but will provide effluent that meets the anticipated MWR requirements of 25 mg/L of TSS. Should TSS requirements be tightened in the future the CVWPC will still have the ability to add a cloth media filter at such time.

CVRD management and operators have maximized use of effluent for plant processes but the CVWPC remains a large potable water consumer. The quality of water to be produced by the fabric filter would have allowed the plant to eliminate potable water use for plant processes, saving approximately \$35,000 per year. Option nine evaluated by ISL includes installation of an effluent reuse filtration package that would provide the CVWPC with enough treated water to displace use of potable water for plant processes.

Table No. 2 below highlights the costs of the two alternate phase one upgrade options at the CVWPC.

Table No. 2: Capital Cost Comparison of Options for CVWPCC Phase One Upgrades

| Project Description | Requirement | Original Option (Option Three) | Proposed New Option (Option Nine) |
|--|----------------------------|--------------------------------|-----------------------------------|
| Repair existing offshore pipe | Capacity/ Environmental | \$168,000 | \$168,000 |
| Mechanical screen/grit removal | Capacity | \$2,067,800 | \$2,067,800 |
| Construct offline equalization tank | Capacity | \$5,847,800 | \$5,847,800 |
| Install UV disinfection(MWR compliance) | Effluent Quality | \$3,115,000 | \$3,115,000 |
| Add cloth media filter | Effluent Quality | \$7,404,600 | - |
| Construct fourth clarifier | Effluent Quality | - | \$3,035,200 |
| Reclaimed water service | Capacity | \$375,000 | \$375,000 |
| Effluent reuse filtration package (optional) | Capacity/Reuse Quality | | \$1,208,200 |
| Total Phase 1 Capital Costs | | \$18,979,000 | \$15,817,000 |

As can be seen in Table No. 2, the capital costs for option nine are significantly less than the original proposed option three. Further upgrade phases will remain the same with the exception of reduced costs in phase three as no cloth media filter upgrades would be required. The original option three identified the potential for cost savings for the UV equipment with the installation of a cloth media filter, but these are likely to be modest operational cost savings rather than a reduction in capital costs.

A net present value analysis for the two options over a 50 year period was completed. Table No. 3 below details the capital, operating and NPV analysis for each option over a 50 year time period. The NPV analysis does not include operational costs for UV.

Table No. 3: Comparison of Costs

| Description | Original Option (Option Three) | Proposed New Option (Option Nine) |
|----------------------------------|--------------------------------|-----------------------------------|
| Total capital costs (all phases) | \$69,082,000 | \$63,457,000 |
| Estimated yearly operating costs | \$68,000 | \$50,000 |
| Net Present Value | \$53,637,000 | \$48,312,000 |

As identified by ISL both option three and option nine are viable and can be incorporated into the existing treatment plant. Option nine provides some distinct cost saving advantages, with both decreased capital and estimated yearly operating costs. Option nine will meet current MWR requirements for effluent quality however will not provide tertiary treatment and subsequently a physical barrier for the effluent to ensure that TSS will never exceed permit limits during peak flow events. Should TSS regulations become stricter in the future, a cloth media filter could still be added at a later date to comply with these changes.

Options

The Comox Valley Sewage Commission has the following options to consider:

1. Proceed with the alternate upgrade option as outlined in ISL's Wastewater Treatment Options Memorandum dated June 27, 2017.

2. Proceed with the previously approved upgrades to the CVWPCC as per option three as outlined within ISL’s CVWPCC capacity assessment report dated August 2016.
3. To not proceed with upgrades at this time.

Proceeding with option 1 will allow the CVWPCC to comply with the anticipated MWR effluent quality requirements at a significantly lower capital cost than that of the installation of a fabric filter. As such only option 1 above is recommended.

Financial Factors

An updated 10 year capital plan was approved by the Comox Valley Sewage Commission in November 2016 and included \$18,638,200 for the phase one capacity and effluent quality upgrades at the CVWPCC. Modifying the scope of the phase 1 upgrades will reduce the capital costs and associated borrowing requirements for this project.

Legal Factors

Upgrades to the CVWPCC will require registration under the MWR. The recommended improvements to the CVWPCC will ensure that the plant is compliant under the more stringent MWR requirements.

Regional Growth Strategy Implications

Upgrades to the CVWPCC will help ensure proper and effective treatment of wastewater for future generations whilst supporting a high quality of life through the protection and enhancement of community health and safety.

Disinfection of the effluent will add improved redundancy within the treatment process, compliance with regulations and increase local shellfish harvesting security by ensuring fecal coliform limits at the end of pipe are below guidelines.

Intergovernmental Factors

The Comox Valley Sewerage Service is governed by the Sewage Commission whose membership includes representation from the Town of Comox, the City of Courtenay and the Department of National Defence.

Interdepartmental Involvement

The Engineering Services Branch is leading this work.

Citizen/Public Relations

The CVWPCC is requiring significant upgrades in order to increase capacity and accommodate growth. The CVRD Engineering Services will be working closely with the communications department to keep the public up to date on the facility expansion.

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Attachments: Appendix A – “Wastewater Treatment Options Memorandum, completed by ISL Engineering and Land Service dated June 27, 2017”



To: **Comox Valley Regional District**
Attention: **Charlie Gore, Manager Capital Projects**
Cc: **Kris La Rose, P.Eng.**
Reference: **Wastewater Treatment Options**
From: **Ashraf Rayyan, P.Eng., PMP.**

Date: **June 27, 2017**

Project No.: **31548**

1.0 Introduction

1.1 Authorization

ISL Engineering and Land Services (ISL) was retained by the Comox Valley Regional District, "The District" to investigate the possibility of adding a fourth secondary clarifier to the Comox Valley Water Pollution Control Centre (CVWPCC). The scope of work was authorized by the District in response to ISL's proposal dated June 16, 2017.

1.2 Background

In August 2016, ISL completed "CVWPCC Capacity Assessment Study", which assessed existing treatment units. The study provided a clear path for upgrading the existing treatment process units up to 2066. The study developed several treatment options (8 options) and shortlisted (3 options) for further evaluation. The shortlisted options were evaluated in a more detail and ISL recommended Option 3 for implementation.

Option 3 requires the addition of an equalization process downstream of the primary clarifiers to reduce peak hourly flows during peak wet weather events, which will minimize the escaping of solids into the effluent. Incorporating the equalization tank will minimize the hydraulic shock load to the biological treatment. This option also includes the addition of cloth media disk filters as tertiary treatment (after the secondary clarifiers) to minimize the escaping of solids into the effluent during peak wet weather events. This option will not eliminate the need of a new bioreactor tank and clarifier, however, it will delay their construction to 2024. Process flow diagram and proposed conceptual plant layout for option 3 is included in Appendix B.

Option 3 may require adding polymer prior to the cloth media filter to enhance the filtration step. This option will provide a better effluent quality (TSS less than 10 mg/L) and a particle size less than 30 microns for optimum UV performance.

1.3 Scope of Work

Following additional discussion, the District directed ISL to investigate adding a fourth secondary clarifier to enhance the clarification process (Option 9), in lieu of constructing a cloth media filter for effluent polishing (Option 3). This memorandum addresses the viability, advantages and disadvantages of the option.



1.4 Existing Condition

The plant has three distinctive trains. Each train is comprised of a primary clarifier, bioreactor and secondary clarifier. Each bioreactor feeds its own secondary clarifier, and each train is provided with its return sludge pump. The ISL assessment report (2016) evaluated the existing biological treatment and found that the capacity of the existing bioreactors and secondary clarifiers are sufficient up to year 2019 and 2033 respectively.

Because the bioreactors and secondary clarifiers are normally constructed in tandem, ISL recommended that an additional bioreactor and secondary clarifier to be constructed by 2024 for Option 3 Phase 2 with full understanding that the plant may operate (from 2017 to 2023) on a higher mixed liquor suspended solids (MLSS) rate of 2500 mg/L which is higher than the target goal of 2300 mg/L and cloth media filter can provide an added protection for reducing TSS in the effluent. The plant can achieve MLSS 2500 mg/L when the Sludge Volume Index (SVI) is less than (150 mL/g). However, when the SVI is more than 250 mL/g, the plant reduces its MLSS to 2000 mg/l or less to minimize upsetting of the existing clarifiers. The existing bioreactors (2019) and secondary clarifiers (2033) are assessed based on a MLSS of 2000 mg/L.

In assessing the secondary clarifiers, the following were indicated in the ISL study:

- Based on the current flows, the plant can achieve an average monthly TSS of 25 mg/L (most of the time). It is anticipated that the influent flow will increased in the future, and the treatment capacity will need to be increased to handle future flows.
- Secondary clarifiers are typically designed based on overflow rates and solids loading rates, with the former being considered more important for operation and design purposes. Typical values for overflow rates and solids loading rates are available from different sources, these typical values are based on a clarifier depth of 4.0 to 5.5 m. The existing treatment facility has three clarifiers, two with a depth of 3.13 m each and one with a depth of 5.0 m. The clarifiers constructed in 1982 have a depth less than the typical depth of a secondary clarifier (4.0 - 5.5 m) as well as the depth of the clarifier constructed in 2008. A tank with a greater depth would be able to keep the sludge blanket further away from the effluent weir and better performance is normally achieved with such tanks.
- The plant has poor sludge settleability condition. Sludge settleability reflects the biological health of microorganisms within the bioreactor tanks but is only noticeable in the clarifier. Poor settling sludge causes the sludge blanket to rise to the surface, thus resulting in loss of solids in the effluent. The Sludge Volume Index (SVI) is commonly used for measuring sludge settleability. A review of the 2015 facility operating data indicates that the average operating SVI is 261 mL/g, which is high compared to a typical value of 150 mL/g or less.
- The SVI can be improved by adding polymers, without causing a significant increase in the waste sludge production. Polymers are usually added to the MLSS as it leaves the bioreactor basin or to the secondary clarifier center well. A polymer supply company should be consulted for selection of the polymer and its dosage. Jar testing should be performed to determine the type of polymer needed and its dosage. The facility should target an SVI of 100 mL/g or less.

2.0 Option 9

Option 9 requires addition of an equalization process after the primary clarifiers to reduce peak hourly flows during peak wet weather events, which will minimize escaping of solids into the effluent. This option also includes addition of a fourth secondary clarifier to minimize escaping of solids into the effluent. Process flow diagram and proposed conceptual plant layout for option 9 is included in Appendix B



In this option, the flow from one of the bioreactors (1 or 2) will be directed to the two shallow clarifiers (3.13 m depth). The new clarifier will serve either one of the existing bioreactors (1 or 2). This option will not eliminate the need of new bioreactor and clarifier (2024), however, it will delay their construction to 2024. This option will provide TSS less than 25 mg/L. This option includes a filtration package unit for effluent reuse.

2.1 Clarifier, splitter and piping

The new clarifier will be similar to the existing clarifier # 3 (5.0 m water depth). Table 1.1 summarizes the new clarifier dimensions.

Table 1.1 - Fourth Clarifier Dimensions

| Description | Units | Values |
|--------------------------------|----------------|--------|
| Number of secondary clarifiers | | 1 |
| Shape | | |
| Diameter | m | 23.1 |
| Water Depth | m | 5.00 |
| Area | m ² | 419 |

For this option, a small splitter box will be required to split the flow to the shallow clarifiers. Pipes modifications are required for the RAS/WAS pipes to accommodate the fourth clarifier, these modifications include yard piping and pipes within the congested pumps gallery.

2.2 Effluent Reuse

The MWR includes four categories of reclaimed water. Each category has specific quality and monitoring requirements, as prescribed in the respective tables and sections of MWR.

Indirect Potable Reuse: this category includes replenishment of a potable water source or potential potable water source, and any other application, including food crops and urban reuse, where a very high level of quality is warranted.

Greater Exposure Potential: this category includes agricultural crops, golf courses, cemeteries, residential lawns, greenhouses, silviculture operations, urban reuse and landscaping around parks, playgrounds, schools. Irrigation for frost protection and crop cooling is also permitted.

Moderate Exposure Potential: this category include may be selected when public contact is unlikely, the users are well aware of the risks posed by the use, and there will be no detrimental impact to the receiving environment from the use.

Lower Exposure Potential: this category is typically used in commercial or industrial applications where public access is restricted and where there will be no detrimental impact to the receiving environment from the use.



Table 2.1 summarizes the reclaimed water quality requirement for each category.

Table 2.1 – Municipal Effluent Quality Requirements (Table 13 – MWR)

| Parameters | Indirect Potable Reuse | Greater Exposure Potential | Moderate Exposure Potential | Lower Exposure Potential |
|--------------------------|--------------------------------|---|------------------------------------|--------------------------------------|
| pH | site specific | 6.5 to 9 | 6.5 to 9 | 6.5 to 9 |
| BOD5, TSS | BOD5 5 mg/L TSS < 5 mg/L | 10 mg/L | 25 mg/L | 45 mg/L |
| turbidity | maximum 1 NTU | average 2 NTU, maximum 5 NTU | n/a | n/a |
| fecal coliform (/100 mL) | median < 1 CFU or < 2.2 MPN | median < 1 CFU or < 2.2 MPN; maximum 14 CFU | median 100 CFU; maximum 400 CFU | median 200 CFU; maximum 1 000 CFU |

The plant staff intend to use the reclaimed water for plant irrigation, equipment and tanks washing. The Operators will be exposed to the reclaimed water. Both categories (greater exposure potential and moderate exposure potential can be applied for the treatment plant). If category “Moderate Exposure” is chosen, no treatment required other than chlorine disinfection. Adequate chlorine must be maintained and present at the point of use (minimum 0.5 mg/L).

If the category of “Greater Exposure Potential” is chosen, a filtration system complete with chlorine disinfection will be required. Using a modular unit of cloth media filter can achieve the required filtration step. The equipment is compact and can be installed indoor or outdoor of the UV building. Adequate chlorine must be maintained and present at the point of use (minimum 0.5 mg/L). For cost estimating purposes, ISL included the cost of the effluent filtration package. The package cost is based on the following;

- Installing the system indoor within the UV building
- Modular cloth filter system with a capacity of 1 MLD



2.3 Phasing

Table 2.2 provides the phasing for Option 9

Table 2.2: Options 9 Upgrades and Proposed Implementation Schedule

| Phases | Construction | Population | Average Flow | Option 9 |
|---------------------|--------------|------------|--------------|---|
| | Year | Capita | MLD | |
| Phase I (2017) | 2017 | Current | | <ul style="list-style-type: none"> • Replace existing 12 mm mechanical screen with 6 mm screen • Add grit removal tank c/w cyclones and classifiers units • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners • Injecting polymers prior existing clarifiers (provision to be confirmed by pilot testing) • Add fourth clarifier • Construct offline equalization tank • Repair of existing offshore pipe • Incorporate a UV disinfection • Add effluent reuse filtration package (Optional) |
| Phase II (2024) | 2024 | 50,109 | 21.1 | <ul style="list-style-type: none"> • Construct one aeration tank and clarifier |
| Phase III (Varies) | 2031 | 55,017 | 23.2 | <ul style="list-style-type: none"> • Replace all outfall sections (onshore/offshore) |
| | 2033 | 57,189 | 23.8 | <ul style="list-style-type: none"> • Construct two primary clarifiers • Construct new process building |
| | 2,034 | 57,266 | 20.0 | <ul style="list-style-type: none"> • Expand Equalization Tank |
| | 2,043 | 64,576 | 22.6 | <ul style="list-style-type: none"> • Upgrade effluent pumps |
| | 2045 | 66,786 | 28.0 | <ul style="list-style-type: none"> • Add mechanical screens to new process building • Add grit removal tank c/w cyclones and classifiers units |
| | 2056 | 76,169 | 0.0 | <ul style="list-style-type: none"> • Construct new thickener |
| | 2060 | 81,280 | 0.0 | <ul style="list-style-type: none"> • Install new centrifuge |
| Phase IV (Ultimate) | Beyond 2066 | | | <ul style="list-style-type: none"> • Construct One primary clarifier |
| | Beyond 2066 | | | <ul style="list-style-type: none"> • Construct one aeration tank and clarifier |



3.0 Financial Analysis

In order to fully evaluate Option 9 both capital and operational cost estimates were produced and have been summarized in Table 3.1, 3.2 and 3.3. The cost estimate shows also Option 3, recommended by ISL 2016 for comparison purposes.

A further detailed breakdown is provided in Appendix A of this report.

3.1 Capital Costs

The estimated capital costs within Table 3.1, 3.2 and 3.3 are considered to be at a conceptual level (Class D). A contingency of 40% is included in the cost estimates for engineering and construction contingencies. Furthermore no costs have been included within these estimates for the following:

- Land Procurement
- Taxes
- UV disinfection (included in AECOM report, 2016)
- Chlorine disinfection (included in AECOM report 2016)
- Non potable water pumping system (included in AECOM report, 2016)

All costs are represented in 2016 –Dollars

Table 3.1: Estimated Capital Cost Summary (2017)

| Phase 1 - 2017 Construction | | |
|--|---------------------|---------------------|
| Description | Option 3 | Option 9 |
| Mechanical Screen | \$452,000 | \$452,000 |
| Grit Removal | \$1,025,000 | \$1,025,000 |
| Offline Equalization Tank | \$4,177,000 | \$4,177,000 |
| Repair of existing outfall pipe | \$120,000 | \$120,000 |
| Media Cloth Filter | \$5,289,000 | |
| Fourth clarifier | | \$2,168,000 |
| Effluent reuse filtration package (Optional) | | \$863,000 |
| Capital Costs | \$11,063,000 | \$8,805,000 |
| Engineering and Contingencies (40%) | \$4,426,000 | \$3,522,000 |
| Total Capital Costs | \$15,489,000 | \$12,327,000 |

Table 3.2: Estimated Capital Cost Summary (2024)

| Phase 2 - 2024 Construction | | |
|--|--------------------|--------------------|
| Description | Option 3 | Option 9 |
| Biological Treatment | \$4,721,000 | \$4,721,000 |
| Capital Costs | \$4,721,000 | \$4,721,000 |
| Engineering and Contingencies (40%) | \$1,889,000 | \$1,889,000 |
| Total Capital Costs | \$6,610,000 | \$6,610,000 |

Table 3.3: Estimated Capital Cost Summary (2031 – 2063)



| Phase 3 - Construction Years (Varies) | | |
|---|---------------------|---------------------|
| Description | Option 3 | Option 9 |
| Replace Outfall Sections (Onshore/Offshore) - Year (2031) | \$13,949,000 | \$13,949,000 |
| Primary Clarifiers + Process Building - Year (2033) | \$7,651,000 | \$7,651,000 |
| Upgrade Media Cloth Filter - Year (2034) | \$1,759,000 | |
| Effluent Pumps - Year (2043) | \$1,780,000 | \$1,780,000 |
| Mechanical Screen - Year (2045) | \$892,000 | \$892,000 |
| Grit Removal - Year (2045) | \$1,013,000 | \$1,013,000 |
| Expand Chemical Treatment - Year (2045) | \$- | \$- |
| Thickener - Year (2056) | \$1,072,000 | \$1,072,000 |
| Centrifuge - Year (2060) | \$1,190,000 | \$1,190,000 |
| Aeration Tank and Clarifier - Year (2063) | \$4,253,000 | \$4,253,000 |
| Capital Costs | \$33,559,000 | \$31,800,000 |
| Engineering and Contingencies (40%) | \$13,424,000 | \$12,720,000 |
| Total Capital Costs | \$46,983,000 | \$44,520,000 |

3.2 Operating Costs

Detailed breakdown is included in Appendix A. The assumptions used for calculating the operating costs are as follows:

- Option 3 and 9: Operation of the equalization tank and equalization mixing will be intermittent, approximately 500 hrs. /year.
- Operation of Effluent Pumps will be intermittent, approximately 80 hrs. /year.
- For all options, operating costs for all equipment are not included in the operating costs, and we considered them equal for all options, with the exception of the following:
 - mixing and pumping power costs for the offline equalization tanks (Option 3 and 9)
 - cloth media disk filter and backwash pumps power costs and filter media replacement cost (Option 3)
 - Fourth clarifier power cost and repair/replacement costs (Option 9)
 - Effluent filtration package, power cost and repair/replacement costs (Option 9)
 - Effluent pumping (Option 3 and 9)
 - Heating and ventilation for UV/disk filter building (Option 3 and 9)
- Average yearly operating costs do not include the new UV system

For Options 3, the estimated extra solids production as a result of incorporating the cloth media filter into the process is 5.6 – 11.2 metric tons/year for years 2017 and 2062 respectively. ISL assumed that the cost of solids processed at the composting facility is equal to the selling revenue. Therefore, operating costs do not include any processing cost for the solids captured by the cloth media filter.



Average power are estimated based on the following.

- Pump and motor efficiencies 75%
- Mixing and Cloth media motors efficiency 90 %
- Clarifier motor efficiency 90%
- Effluent filtration package 75%
- Electrical power cost 0.1\$/kWh

For Options 3 and 9, upgrading of the existing effluent pumps by 2043 is required, the equalization tank will help to mitigate hourly variations in flowrates to obtain a nearly constant flowrate over the day. It is anticipated by 2043, the combined capacity of the equalization tank and the existing effluent pumps will be no more sufficient to normalize the maximum hourly flow to the maximum daily flow, or simply stated, the maximum daily flow will exceed the capacity of the existing effluent pumps.

Table 3.4 provides the estimated operating costs, all costs are represented in 2017-Dollars.

Table 3.4: Estimated Operating Costs

| Description | Option 3 | Option 9 |
|-------------------------------|----------|----------|
| Average Yearly Operating Cost | \$68,000 | \$50,000 |

Rounded to nearest 000

3.3 Net Present Value Analysis (NPV)

To provide a complete financial analysis, ISL undertook a 50 year Net Present Value analysis using the following basis

- A discount rate of 4%; and
- An inflation rate on the annual operating costs of 2% per year.

Table 3.5: Net Present Value Analysis of Options 1, 2 and 3

| Description | Option 3 | Option 9 |
|---|--------------|--------------|
| NPV - 50 yrs., 4% Discount Rate, 2% Inflation on Operating Costs per year | \$53,637,000 | \$48,312,000 |

Rounded to nearest 000

3.4 Financial Analysis Evaluation

Table 3.6 summarizes the capital costs, operating costs and the net present value analysis over 50 years for all options. Detailed cost estimates and breakdown are included in Appendix A. Total capital costs includes 40% engineering and construction contingencies.



Table 3.6: Capital and Operating Costs and NPV analysis

| Description | Option 3 | Option 9 |
|--|--------------|--------------|
| Phase 1 - 2017 Construction | \$15,489,000 | \$12,327,000 |
| Phase 2 - 2024 Construction | \$6,610,000 | \$6,610,000 |
| Phase 3 - (varies) | \$46,983,000 | \$44,520,000 |
| Total Capital Costs | \$69,082,000 | \$63,457,000 |
| Estimated yearly average operating costs | \$68,000 | \$50,000 |
| NPV | \$53,637,000 | \$48,312,000 |

Option 9 represents a lower capital and operational cost over 50 years compared with Option 3.

4.0 Advantages and Disadvantages

The advantages and disadvantages of Option 9 are summarized in Table 3.7. Option 3 is included for comparison purposes.

Table 3.7: Option 3 and 9 Advantages and Disadvantages

| Option # | Advantages | Disadvantages |
|-----------------|--|--|
| Option 3 | <ul style="list-style-type: none"> • The whole plant effluent flow will be less than 10 mg/L TSS on a consistent base • Provide a physical barrier for the whole effluent flow • Easier to construct • UV disinfection is more efficient and lower operating cost for the UV may be achieved. The saving cannot be determined at this time without pilot testing • Minimum disturbance to the current operation during construction • Less disturbance to electrical feed system during construction • Superior effluent quality will provide the CVRD with future proofing should the TSS regulations be tightened | <ul style="list-style-type: none"> • Higher capital and operating cost compared with Option 9 |
| Option 9 | <ul style="list-style-type: none"> • The portion of the effluent that will be used for effluent reuse will be less than 10 mg/L TSS on a consistent base | <ul style="list-style-type: none"> • Less efficient for UV disinfection compared with Option 3 • Does not provide a physical barrier for effluent • Difficult to construct due to flow splitting and more yard piping • More disturbance to the current operation during construction compared with Option 3. The Option require flow splitting to the shallow clarifiers in area congested with existing pipes. |

5.0 Recommendation



Both Options are viable options and can be incorporated in the existing treatment plant. Option 3 is more expensive approximately \$69M versus \$63.5M for Option 9. The difference in capital cost is approximately \$5.5M, with approximately \$3.1M by year 2017 and \$2.4 by year 2034. Also, the yearly operating costs for Option 9 is \$50.0 K which is less than Option 3 (\$68.0 K).

Yearly Operating costs for Options 3 and 9 are estimated at \$68.0 K and \$50.0K respectively. These operating costs do not include the electrical power cost for the new UV system. AECOM UV Disinfection Feasibility Study, 2016, estimated the electrical power cost at \$30.1K and \$43.0K for year-1 and year-25 respectively. These power costs are based on achieving 200 MPN/100 mL (fecal coliform counts) and without incorporating cloth media filters. As indicated in AECOM study, applying effluent filtration will reduce the required UV dose which will reduce the yearly operating costs for the UV system.

At the same time, UV systems require chemical cleaning to keep lamps clean during operation. Cloth media filters produce better effluent quality which reduces the frequency of chemical cleaning. The cost of chemical cleaning (labour and material) is not included in the estimated operating costs. These savings are not captured in the operating costs and are difficult to estimate without proper pilot testing. ISL believes that the difference in the operating costs for Options 3 and 9 (\$18.0 K) can be easily captured, as a result of incorporating the cloth media filters within the existing treatment plant which will provide more efficient operation of the UV disinfection process.

Based on the advancements of filtration technology, Option 3 provides some technical advantages over Option 9 which include better effluent quality and truly physical barrier for the effluent which assure that the plant will not exceed its TSS effluent limits and will provide the CVRD with future proofing should the TSS regulations be tightened. Option 3 provides a better effluent quality for UV disinfection. The option is easy to construct with a minimal disturbance to the current operation of the treatment plant.

Please do not hesitate to call if you require addition information.

Regards

Ashraf Rayyan, M.Eng., P.Eng., PMP
Manager, Water and Wastewater

Appendix A
Financial Analysis



| | | |
|--------------------|---|-------------|
| Title | CVWPCC WWTF Concept Design Cost Estimate for Option 9 - Phase I | |
| Date | 26-Jun-16 | |
| Description | | Year |
| | • Replace existing 12 mm mechanical screen with 6 mm screen | 2017 |
| | • Add grit removal tank c/w cyclones and classifiers units | 2017 |
| | • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners | 2017 |
| | • Injecting polymers prior cloth media filters (provision to be confirmed by pilot testing) | 2017 |
| | • Add fourth clarifier | 2017 |
| | • Construct offline equalization tank | 2017 |
| | • Repair of existing offshore pipe | 2017 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 1.0 Mechanical Screen | | | | | | | | \$ 452,000 |
| 1.1 General Requirements | | | | | | | | \$91,000 |
| 2.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 91,000 | |
| 1.2 Process Mechanical | | | | | | | | \$316,000 |
| 1.2.1 | Mechanical Screen c/w Washer and Compactor | L.S. | 1 | \$ 212,000 | \$ 212,000 | \$ 48,000 | \$ 260,000 | |
| 1.2.2 | Sluice Gates | unit | 1 | \$ 50,000 | \$ 50,000 | \$ 6,000 | \$ 56,000 | |
| 1.3 Electrical | | | | | | | | \$45,000 |
| 1.3.1 | Motor Controls | Motors | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 1.3.2 | Instruments and Control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 1.3.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 2.0 Grit Removal | | | | | | | | \$ 1,025,000 |
| 2.1 General Requirements | | | | | | | | \$205,000 |
| 2.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 205,000 | |
| 2.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$119,000 |
| 2.2.1 | Site Clearing/ Stripping and Stockpile (Area of chamber plus 10m, perimeter) | sq.m. | 225 | \$ 5 | \$ 1,125 | \$ - | \$ 1,125 | |
| 2.2.2 | Chamber Excavation and Backfilling | cu.m. | 1,170 | \$ 15 | \$ 17,550 | \$ - | \$ 17,550 | |
| 2.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 50 | \$ 2,000 | \$ 100,000 | \$ - | \$ 100,000 | |
| 2.3 Process Mechanical | | | | | | | | \$480,000 |
| 2.3.1 | Grit Removal Equipment | L.S. | 1 | \$ 300,000 | \$ 300,000 | \$ 48,000 | \$ 348,000 | |
| 2.3.2 | Sluice Gates | unit | 2 | \$ 50,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | |
| 2.3.3 | Connection to existing Odor System | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 2.3.4 | Weirs for splitter box | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 2.4 Structural | | | | | | | | \$146,000 |
| 2.4.1 | Concentrator and Channels Walls | cu.m. | 44 | \$ 1,500 | \$ 66,007 | \$ - | \$ 66,007 | |
| 2.4.2 | Bottom Slab for Concentrator and Channel | cu.m. | 22 | \$ 1,100 | \$ 24,241 | \$ - | \$ 24,241 | |
| 2.4.3 | Top Slab for Concentrator | cu.m. | 19 | \$ 1,500 | \$ 27,778 | \$ - | \$ 27,778 | |
| 2.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 2.4.5 | Handrail (Install Inc.) | li.m | 16 | \$ 150 | \$ 2,356 | \$ - | \$ 2,356 | |
| 2.4.6 | Access Road and Parking Pad | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 2.5 Electrical | | | | | | | | \$65,000 |
| 2.5.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 2.5.2 | Instruments and Control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 2.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 2.6 Decommissioning | | | | | | | | \$10,000 |
| 2.6.1 | Grit Removal Equipment | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |

| | | |
|--------------------|---|-------------|
| Title | CVWPCC WWTF Concept Design Cost Estimate for Option 9 - Phase I | |
| Date | 26-Jun-16 | |
| Description | | Year |
| | • Replace existing 12 mm mechanical screen with 6 mm screen | 2017 |
| | • Add grit removal tank c/w cyclones and classifiers units | 2017 |
| | • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners | 2017 |
| | • Injecting polymers prior cloth media filters (provision to be confirmed by pilot testing) | 2017 |
| | • Add fourth clarifier | 2017 |
| | • Construct offline equalization tank | 2017 |
| | • Repair of existing offshore pipe | 2017 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|-----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 3.0 Fourth Clarifier | | | | | | | | \$ 2,167,000 |
| 3.1 General Requirements | | | | | | | | \$434,000 |
| 3.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 434,000 | |
| 3.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - \$304,000 |
| 3.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 700 | \$ 5 | \$ 3,500 | \$ - | \$ 3,500 | |
| 3.2.2 | RAS and WAS piping | L.S. | | | \$ 200,000 | \$ - | \$ 200,000 | |
| 3.2.3 | Relocating utilities at Clarifier location | L.S. | | | \$ 100,000 | \$ - | \$ 100,000 | |
| 3.3 Process Mechanical | | | | | | | | \$998,000 |
| 3.3.1 | Clarifier Mechanism | L.S. | 1 | \$ 506,000 | \$ 506,000 | \$ 180,000 | \$ 686,000 | |
| 3.3.2 | Polymer injection system (provision) | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | |
| 3.3.3 | RAS/WAS Valves and Pipes | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | |
| 3.4 Structural | | | | | | | | \$392,000 |
| 3.4.1 | Clarifier Walls | cu.m. | 157 | \$ 1,500 | \$ 235,242 | \$ - | \$ 235,242 | |
| 3.4.2 | Bottom Slab for Clarifier Tank | cu.m. | 30 | \$ 1,100 | \$ 33,175 | \$ - | \$ 33,175 | |
| 3.4.3 | Access Stairs | cu.m. | 8 | \$ 1,500 | \$ 11,310 | \$ - | \$ 11,310 | |
| 3.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 3.4.5 | Handrail (Install Inc.) | li.m | 75 | \$ 150 | \$ 11,310 | \$ - | \$ 11,310 | |
| 3.4.6 | Splitter box provision | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 3.5 Electrical | | | | | | | | \$40,000 |
| 3.5.1 | Motor Controls | Motors | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 3.5.2 | Instruments and Controls | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 3.5.3 | Integration | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 4.0 Effluent Filtration Package | | | | | | | | \$ 863,000 |
| 4.1 General Requirements | | | | | | | | \$173,000 |
| 4.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 173,000 | |
| 4.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - \$50,000 |
| 4.2.1 | Pipes for cloth media filter to the headwork | L.S. | | | \$ 50,000 | \$ - | \$ 50,000 | |
| 4.3 Process Mechanical | | | | | | | | \$450,000 |
| 4.3.1 | Effluent filtration package | L.S. | 1 | \$ 250,000 | \$ 250,000 | \$ 80,000 | \$ 330,000 | |
| 4.3.2 | Effluent reuse valves and pipes | L.S. | 1 | \$ 120,000 | \$ 120,000 | \$ - | \$ 120,000 | |
| 4.4 Structural | | | | | | | | \$120,000 |
| 4.4.1 | Increase in the UV building to accommodate cloth media filter | L.S. | 1 | \$ 120,000 | \$ 120,000 | \$ - | \$ 120,000 | |
| 4.5 Electrical | | | | | | | | \$70,000 |
| 4.5.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 4.5.2 | Instruments and Controls | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 4.5.3 | Integration | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |

| | |
|---|--|
| Title | CVWPCC WWTF Concept Design Cost Estimate for Option 9 - Phase I |
| Date | 26-Jun-16 |
| Description | Year |
| • Replace existing 12 mm mechanical screen with 6 mm screen | 2017 |
| • Add grit removal tank c/w cyclones and classifiers units | 2017 |
| • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners | 2017 |
| • Injecting polymers prior cloth media filters (provision to be confirmed by pilot testing) | 2017 |
| • Add fourth clarifier | 2017 |
| • Construct offline equalization tank | 2017 |
| • Repair of existing offshore pipe | 2017 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) | |
|---|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | | |
| 5.0 Offline Equalization Tank | | | | | | | | \$ 4,177,000 | |
| 5.1 General Requirements | | | | | | | | \$836,000 | |
| 5.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 836,000 | | |
| 5.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - | \$322,000 |
| 5.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 3,025 | \$ 5 | \$ 15,125 | \$ - | \$ 15,125 | | |
| 5.2.2 | Tank Excavation and Backfilling | cu.m. | 15,125 | \$ 15 | \$ 226,875 | \$ - | \$ 226,875 | | |
| 5.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 40 | \$ 2,000 | \$ 80,000 | \$ - | \$ 80,000 | | |
| 5.3 Process Mechanical | | | | | | | | \$1,182,000 | |
| 5.3.1 | Equalization Pumps | unit | 2 | \$ 60,000 | \$ 120,000 | \$ 45,000 | \$ 165,000 | | |
| 5.3.2 | Gates | unit | 2 | \$ 50,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | | |
| 5.3.3 | Connection to existing Odor System | li.m. | 200 | \$ 1,000 | \$ 200,000 | \$ - | \$ 200,000 | | |
| 5.3.4 | Pumps Pipes and Valves | L.S. | 1 | \$ 180,000 | \$ 180,000 | \$ - | \$ 180,000 | | |
| 5.3.5 | Mixing mixers | unit | 8 | \$ 60,000 | \$ 480,000 | \$ 45,000 | \$ 525,000 | | |
| 5.4 Structural | | | | | | | | \$1,632,000 | |
| 5.4.1 | Tank Walls | cu.m. | 336 | \$ 1,500 | \$ 504,000 | \$ - | \$ 504,000 | | |
| 5.4.2 | Bottom Slab for Tank | cu.m. | 613 | \$ 1,100 | \$ 673,750 | \$ - | \$ 673,750 | | |
| 5.4.3 | Top Slab for Tank | cu.m. | 368 | \$ 1,100 | \$ 404,250 | \$ - | \$ 404,250 | | |
| 5.4.4 | Mis. Metals | L.S. | 1 | \$ 30,000 | \$ 30,000 | \$ - | \$ 30,000 | | |
| 5.4.5 | Access Road and Parking Pad | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | | |
| 5.5 Electrical | | | | | | | | \$205,000 | |
| 5.5.1 | Motor Controls | Motors | 8 | \$ 20,000 | \$ 160,000 | \$ - | \$ 160,000 | | |
| 5.5.2 | Instruments and control | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | | |
| 5.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | | |
| 6.0 Repair of existing outfall pipe | | | | | | | | \$ 120,000 | |
| 6.1 General Requirements | | | | | | | | \$0 | |
| 6.1.1 | Included in outfall sections costs | | | | | | \$ - | | |
| 6.2 Repair of existing outfall pipe | | | | | | | | \$120,000 | |
| 6.2.1 | Repair of existing outfall pipe | L.S. | 1 | \$ 120,000 | \$ 120,000 | \$ - | \$ 120,000 | | |
| Total Capital Cost | | | | | | | | \$8,805,000 | |

Title CVWPCC WWTF
 Concept Design Cost Estimate for Option 9 - Phase 2

Date 26-Jun-16

Description

- Construct one aeration tank and clarifier

Year
 2024

Additional Notes
 Installation included unless otherwise stated

Items not included
 Land procurement Costs
 Contingency Allowances
 Taxes
 UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labour / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) | |
|---|---|----------------------------|----------|-----------------|-------------|----------------------------------|---------------------------|----------------------|------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | | |
| 1.0 Aeration Tank & Clarifier | | | | | | | \$ | 4,720,000 | |
| 1.1 General Requirements | | | | | | | \$ | 944,000 | |
| 1.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 944,000 | | |
| 1.2 Site Civil, Access Road, and Landscaping | | | | | | | \$ | - | \$714,000 |
| 1.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 2,725 | \$ 5 | \$ 13,625 | \$ - | \$ 13,625 | | |
| 1.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ - | \$ 100,000 | | |
| 1.2.3 | Inter-connecting Pipes Below Grade Pipework (from primary splitter to aeration tank) | li.m. | 250 | \$ 1,500 | \$ 375,000 | \$ - | \$ 375,000 | | |
| 1.2.4 | RAS and WAS piping | li.m. | 50 | \$ 1,500 | \$ 75,000 | \$ - | \$ 75,000 | | |
| 1.2.5 | Air piping | li.m. | 100 | \$ 1,500 | \$ 150,000 | \$ - | \$ 150,000 | | |
| 1.3 Process Mechanical | | | | | | | | \$1,670,000 | |
| 1.3.1 | Fine bubble diffusers and air pipes | L.S. | 1 | \$ 280,000 | \$ 280,000 | \$ 180,000 | \$ 460,000 | | |
| 1.3.2 | Mixer | unit | 1 | \$ 60,000 | \$ 60,000 | \$ 12,000 | \$ 72,000 | | |
| 1.3.3 | Clarifier Mechanism | L.S. | 1 | \$ 506,000 | \$ 506,000 | \$ 180,000 | \$ 686,000 | | |
| 1.3.4 | RAS/WAS pumping | unit | 4 | \$ 60,000 | \$ 240,000 | \$ 12,000 | \$ 252,000 | | |
| 1.3.5 | RAS/WAS Valves and Pipes | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | | |
| 1.4 Structural | | | | | | | | \$1,161,000 | |
| 1.4.1 | Aeration Tank Walls | cu.m. | 313 | \$ 1,500 | \$ 468,750 | \$ - | \$ 468,750 | | |
| 1.4.2 | Bottom Slab for Aeration Tank | cu.m. | 260 | \$ 1,100 | \$ 286,000 | \$ - | \$ 286,000 | | |
| 1.4.3 | Access stairs | cu.m. | 26 | \$ 1,500 | \$ 39,000 | \$ - | \$ 39,000 | | |
| 1.4.4 | Handrail (Install Inc.) | li.m | 170 | \$ 150 | \$ 25,500 | \$ - | \$ 25,500 | | |
| 1.4.5 | Clarifier Walls | cu.m. | 157 | \$ 1,500 | \$ 235,242 | \$ - | \$ 235,242 | | |
| 1.4.6 | Bottom Slab for Clarifier Tank | cu.m. | 30 | \$ 1,100 | \$ 33,175 | \$ - | \$ 33,175 | | |
| 1.4.7 | Access Stairs | cu.m. | 8 | \$ 1,500 | \$ 11,310 | \$ - | \$ 11,310 | | |
| 1.4.8 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | | |
| 1.4.9 | Handrail (Install Inc.) | li.m | 75 | \$ 150 | \$ 11,310 | \$ - | \$ 11,310 | | |
| 1.5 Plumbing | | | | | | | | \$50,000 | |
| 1.5.1 | Plumbing | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | | |
| 1.6 Electrical | | | | | | | | \$182,000 | |
| 1.6.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | | |
| 1.6.2 | Instruments and Controls | L.S. | 1 | \$ 130,000 | \$ 130,000 | \$ - | \$ 130,000 | | |
| 1.6.3 | Integration | L.S. | 1 | \$ 12,000 | \$ 12,000 | \$ - | \$ 12,000 | | |
| Total Capital Cost | | | | | | | | \$4,721,000 | |

| | | | |
|--------------------|--|-------------|------|
| Title | 31548 CVWPCC WWTF Concept Design Cost Estimate for Option 9 - Phase 3 | Year | |
| Date | 26-Jun-16 | | |
| Description | | Year | |
| | • Replace all outfall sections (onshore/offshore) | | 2031 |
| | • Construct two primary clarifiers and process building | | 2033 |
| | • Upgrade cloth media filter | | 2034 |
| | • Upgrade effluent pumps | | 2043 |
| | • Add mechanical screens to new process building | | 2045 |
| | • Add grit removal tank c/w cyclones and classifiers units | | 2045 |
| | • Construct new thickener | | 2056 |
| | • Install new centrifuge | | 2060 |
| | • Construct one aeration tank and clarifier | | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|--|---|----------------------------|----------|-----------------|--------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 1.0 Replace Outfall Sections (Onshore/Offshore) - Year (2031) | | | | | | | | \$ 14,109,000 |
| 1.1 General Requirements | | | | | | | | \$0 |
| 1.1.1 | Included in outfall sections costs | | | | | | \$ - | |
| 1.2 Civil | | | | | | | | \$13,949,000 |
| 1.2.1 | 900 mm Tie-In and temporary works | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 1.2.2 | Onshore Section (2827.0 m Length) | L.S. | 1 | \$ 7,633,000 | \$ 7,633,000 | \$ - | \$ 7,633,000 | |
| 1.2.3 | Offshore section (2825.0 m Length) | L.S. | 1 | \$ 6,215,000 | \$ 6,215,000 | \$ - | \$ 6,215,000 | |
| 1.2.4 | Diffuser section (175.0 m Length) | L.S. | 1 | \$ 61,000 | \$ 61,000 | \$ - | \$ 61,000 | |
| 1.3 Mechanical and Electrical | | | | | | | | \$160,000 |
| 1.3.1 | Add fourth pump | L.S. | 1 | \$ 150,000 | \$ 150,000 | \$ - | \$ 150,000 | |
| 1.3.2 | Integration | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 2.0 Primary Clarifiers + Process Building - Year (2033) | | | | | | | | \$ 7,650,000 |
| 2.1 General Requirements | | | | | | | | \$1,530,000 |
| 2.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 1,530,000 | |
| 2.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$219,000 |
| 2.2.1 | Site Clearing/ Stripping and Stockpile (Area of building and tank plus 10m, perimeter) | sq.m. | 3,687 | \$ 5 | \$ 18,435 | \$ - | \$ 18,435 | |
| 2.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | |
| 2.3 Process Mechanical | | | | | | | | \$2,568,000 |
| 2.3.1 | Primary Clarifier Mechanism | L.S. | 2 | \$ 360,000 | \$ 720,000 | \$ 180,000 | \$ 900,000 | |
| 2.3.2 | Air Blowers | L.S. | 5 | \$ 150,000 | \$ 750,000 | \$ 180,000 | \$ 930,000 | |
| 2.3.3 | WAS pumping | unit | 2 | \$ 60,000 | \$ 120,000 | \$ 12,000 | \$ 132,000 | |
| 2.3.4 | WAS Valves and Pipes | L.S. | 1 | \$ 150,000 | \$ 150,000 | \$ - | \$ 150,000 | |
| 2.3.5 | Air Valves and Pipes | L.S. | 1 | \$ 250,000 | \$ 250,000 | \$ - | \$ 250,000 | |
| 2.3.6 | Sluice Gates | unit | 4 | \$ 50,000 | \$ 200,000 | \$ 6,000 | \$ 206,000 | |
| 2.4 Structural | | | | | | | | \$2,402,000 |
| 2.4.1 | Primary Tank Walls | cu.m. | 150 | \$ 1,500 | \$ 225,000 | \$ - | \$ 225,000 | |
| 2.4.2 | Bottom Slab for Primary Tank | cu.m. | 160 | \$ 1,100 | \$ 176,000 | \$ - | \$ 176,000 | |
| 2.4.3 | Access stairs | cu.m. | 16 | \$ 1,500 | \$ 24,000 | \$ - | \$ 24,000 | |
| 2.4.4 | Process Building | cu.m. | 250 | \$ 1,500 | \$ 375,000 | \$ - | \$ 375,000 | |
| 2.4.5 | Bottom Slab for Process Building | cu.m. | 216 | \$ 1,100 | \$ 237,600 | \$ - | \$ 237,600 | |
| 2.4.6 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 150,000 | \$ 150,000 | \$ - | \$ 150,000 | |
| 2.4.7 | Handrail (Install Inc.) | li.m | 170 | \$ 150 | \$ 25,500 | \$ - | \$ 25,500 | |
| 2.4.8 | Superstructure + Architectural (Process Building, 6 m tall, steel frame with masonry infill) | sq.m. | 540 | \$ 2,200 | \$ 1,188,000 | \$ - | \$ 1,188,000 | |
| 2.5 Plumbing & HVAC | | | | | | | | \$800,000 |
| 2.5.1 | Plumbing | L.S. | 1 | \$ 300,000 | \$ 300,000 | \$ - | \$ 300,000 | |
| 2.5.2 | HVAC | L.S. | 1 | \$ 500,000 | \$ 500,000 | \$ - | \$ 500,000 | |
| 2.6 Electrical | | | | | | | | \$132,000 |
| 2.6.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 2.6.2 | Instruments and Controls | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 2.6.3 | Integration | L.S. | 1 | \$ 12,000 | \$ 12,000 | \$ - | \$ 12,000 | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 9 - Phase 3

Date 26-Jun-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes

Installation included unless otherwise stated

Items not included

- Land procurement Costs
- Contingency Allowances
- Taxes
- UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|--------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 3.0 Media Cloth Filter (2034) | | | | | | | | \$ 1,759,000 |
| 3.1 General Requirements | | | | | | | | \$352,000 |
| 3.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 352,000 | |
| 3.2 Process Mechanical | | | | | | | | \$1,322,000 |
| 3.2.1 | Modification to Polymer Injection System | unit | 1 | \$ 30,000 | \$ 30,000 | \$ 12,000 | \$ 42,000 | |
| 3.2.2 | Cloth media filter equipment | unit | 1 | \$ 1,050,000 | \$ 1,050,000 | \$ 180,000 | \$ 1,230,000 | |
| 3.2.3 | Pipes and Valves | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 3.3 Electrical | | | | | | | | \$85,000 |
| 3.3.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 3.3.2 | Instruments and Control | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 3.3.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 4.0 Effluent Pumps - Year (2043) | | | | | | | | \$ 1,780,000 |
| 4.1 General Requirements | | | | | | | | \$0 |
| 4.1.1 | Included in effluent pumps item costs | | | | | | \$ - | |
| 4.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$50,000 |
| 4.2.1 | Interconnecting pipes within CVWPCC | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 4.3 Process Mechanical | | | | | | | | \$1,200,000 |
| 4.3.1 | Replace existing pumps | L.S. | 1 | \$ 600,000 | \$ 600,000 | \$ - | \$ 600,000 | |
| 4.3.2 | Valves and pipes (within the vault) | L.S. | 1 | \$ 600,000 | \$ 600,000 | \$ - | \$ 600,000 | |
| 4.4 Structural | | | | | | | | \$80,000 |
| 4.4.1 | New outfall chamber | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 4.5 Electrical | | | | | | | | \$450,000 |
| 4.5.1 | Electrical | L.S. | 1 | \$ 370,000 | \$ 370,000 | \$ - | \$ 370,000 | |
| 4.5.2 | Instruments and control | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 5.0 Mechanical Screen - Year (2045) | | | | | | | | \$ 892,000 |
| 5.1 General Requirements | | | | | | | | \$179,000 |
| 5.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 179,000 | |
| 5.2 Process Mechanical | | | | | | | | \$648,000 |
| 5.2.1 | Mechanical Screen c/w Washer and Compactor | L.S. | 2 | \$ 300,000 | \$ 600,000 | \$ 48,000 | \$ 648,000 | |
| 5.3 Electrical | | | | | | | | \$65,000 |
| 5.3.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 5.3.2 | Instruments and control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 5.3.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |

| | | |
|--------------------|--|-------------|
| Title | 31548 CVWPCC WWTF Concept Design Cost Estimate for Option 9 - Phase 3 | Year |
| Date | 26-Jun-16 | |
| Description | | |
| | • Replace all outfall sections (onshore/offshore) | 2031 |
| | • Construct two primary clarifiers and process building | 2033 |
| | • Upgrade cloth media filter | 2034 |
| | • Upgrade effluent pumps | 2043 |
| | • Add mechanical screens to new process building | 2045 |
| | • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| | • Construct new thickener | 2056 |
| | • Install new centrifuge | 2060 |
| | • Construct one aeration tank and clarifier | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) | |
|---|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | | |
| 6.0 Grit Removal - Year (2045) | | | | | | | | \$ 1,013,000 | |
| 6.1 General Requirements | | | | | | | | \$203,000 | |
| 6.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 203,000 | | |
| 6.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - | \$119,000 |
| 6.2.1 | Site Clearing/ Stripping and Stockpile (Area of chamber plus 10m, perimeter) | sq.m. | 225 | \$ 5 | \$ 1,125 | \$ - | \$ 1,125 | | |
| 6.2.2 | Chamber Excavation and Backfilling | cu.m. | 1,170 | \$ 15 | \$ 17,550 | \$ - | \$ 17,550 | | |
| 6.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 50 | \$ 2,000 | \$ 100,000 | \$ - | \$ 100,000 | | |
| 6.3 Process Mechanical | | | | | | | | \$480,000 | |
| 6.3.1 | Grit Removal Equipment | L.S. | 1 | \$ 300,000 | \$ 300,000 | \$ 48,000 | \$ 348,000 | | |
| 6.3.2 | Sluice Gates | unit | 2 | \$ 50,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | | |
| 6.3.3 | Connection to existing Odor System | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | | |
| 6.3.4 | Weirs for splitter box | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | | |
| 6.4 Structural | | | | | | | | \$146,000 | |
| 6.4.1 | Concentrator and Channels Walls | cu.m. | 44 | \$ 1,500 | \$ 66,007 | \$ - | \$ 66,007 | | |
| 6.4.2 | Bottom Slab for Concentrator and Channel | cu.m. | 22 | \$ 1,100 | \$ 24,241 | \$ - | \$ 24,241 | | |
| 6.4.3 | Top Slab for Concentrator | cu.m. | 19 | \$ 1,500 | \$ 27,778 | \$ - | \$ 27,778 | | |
| 6.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | | |
| 6.4.5 | Handrail (Install Inc.) | li.m | 16 | \$ 150 | \$ 2,356 | \$ - | \$ 2,356 | | |
| 6.4.6 | Access Road and Parking Pad | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | | |
| 6.5 Electrical | | | | | | | | \$65,000 | |
| 6.5.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | | |
| 6.5.2 | Instruments and control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | | |
| 6.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | | |
| 7.0 Thickener - Year (2056) | | | | | | | | \$ 1,072,000 | |
| 7.1 General Requirements | | | | | | | | \$215,000 | |
| 7.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 215,000 | | |
| 7.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - | \$144,000 |
| 7.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 800 | \$ 5 | \$ 4,000 | \$ - | \$ 4,000 | | |
| 7.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | | |
| 7.2.3 | Inter-connecting Pipes Below Grade Pipework | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ - | \$ 100,000 | | |
| 7.3 Process Mechanical | | | | | | | | \$480,000 | |
| 7.3.1 | Thickener Mechanism | L.S. | 1 | \$ 250,000 | \$ 250,000 | \$ 180,000 | \$ 430,000 | | |
| 7.3.2 | Connection to existing Odor System | L.S. | 1 | \$ 50,000 | \$ 50,000 | | \$ 50,000 | | |
| 7.4 Structural | | | | | | | | \$198,000 | |
| 7.4.1 | Thickener Tank Walls | cu.m. | 32 | \$ 1,500 | \$ 48,000 | \$ - | \$ 48,000 | | |
| 7.4.2 | Bottom Slab for Thickener Tank | cu.m. | 63 | \$ 1,100 | \$ 69,300 | \$ - | \$ 69,300 | | |
| 7.4.3 | Thickener cover | L.S. | 1 | \$ 30,000 | \$ 30,000 | \$ - | \$ 30,000 | | |
| 7.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 9 - Phase 3

Date 26-Jun-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes

Installation included unless otherwise stated

Items not included

Land procurement Costs

Contingency Allowances

Taxes

UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|--|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 7.5 Electrical | | | | | | | | \$35,000 |
| 7.5.1 | Motor Controls | Motors | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 7.5.2 | Instruments and Controls | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 7.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 8.0 Centrifuge - Year (2060) | | | | | | | | \$ 1,190,000 |
| 8.1 General Requirements | | | | | | | | \$238,000 |
| 8.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 238,000 | |
| 8.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$57,000 |
| 8.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 1,225 | \$ 5 | \$ 6,125 | \$ - | \$ 6,125 | |
| 8.2.2 | Inter-connecting Pipes Below Grade Pipework | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 8.3 Process Mechanical | | | | | | | | \$530,000 |
| 8.3.1 | Centrifuge | L.S. | 1 | \$ 350,000 | \$ 350,000 | \$ 180,000 | \$ 530,000 | |
| 8.4 Structural | | | | | | | | \$330,000 |
| 8.4.1 | Centrifuge base based on extending existing structure | cu.m. | 60 | \$ 1,500 | \$ 90,000 | \$ - | \$ 90,000 | |
| 8.4.2 | Superstructure + Architectural (Chemical Room, 6 m tall, steel frame with masonry infill) | sq.m. | 100 | \$ 2,200 | \$ 220,000 | \$ - | \$ 220,000 | |
| 8.4.3 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 8.5 Electrical | | | | | | | | \$35,000 |
| 8.5.1 | Motor Controls | Motors | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 8.5.2 | Instruments and Controls | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 8.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 9.0 Aeration Tank and Clarifier - Year (2063) | | | | | | | | \$ 4,252,000 |
| 9.1 General Requirements | | | | | | | | \$851,000 |
| 9.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 851,000 | |
| 9.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$339,000 |
| 9.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 2,725 | \$ 5 | \$ 13,625 | \$ - | \$ 13,625 | |
| 9.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ - | \$ 100,000 | |
| 9.2.3 | RAS and WAS piping | L.S. | 1 | \$ 75,000 | \$ 75,000 | \$ - | \$ 75,000 | |
| 9.2.4 | Air piping | li.m. | 100 | \$ 1,500 | \$ 150,000 | \$ - | \$ 150,000 | |
| 9.3 Process Mechanical | | | | | | | | \$1,670,000 |
| 9.3.1 | Fine bubble diffusers and air pipes | L.S. | 1 | \$ 280,000 | \$ 280,000 | \$ 180,000 | \$ 460,000 | |
| 9.3.2 | Mixer | unit | 1 | \$ 60,000 | \$ 60,000 | \$ 12,000 | \$ 72,000 | |
| 9.3.3 | Clarifier Mechanism | L.S. | 1 | \$ 506,000 | \$ 506,000 | \$ 180,000 | \$ 686,000 | |
| 9.3.4 | RAS/WAS pumping | unit | 4 | \$ 60,000 | \$ 240,000 | \$ 12,000 | \$ 252,000 | |
| 9.3.5 | RAS/WAS Valves and Pipes | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 9 - Phase 3

Date 26-Jun-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---------------------------|--|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 9.4 Structural | | | | | | | | \$1,161,000 |
| 9.4.1 | Aeration Tank Walls | cu.m. | 313 | \$ 1,500 | \$ 468,750 | \$ - | \$ 468,750 | |
| 9.4.2 | Bottom Slab for Aeration Tank | cu.m. | 260 | \$ 1,100 | \$ 286,000 | \$ - | \$ 286,000 | |
| 9.4.3 | Access stairs | cu.m. | 26 | \$ 1,500 | \$ 39,000 | \$ - | \$ 39,000 | |
| 9.4.4 | Handrail (Install Inc.) | li.m | 170 | \$ 150 | \$ 25,500 | \$ - | \$ 25,500 | |
| 9.4.5 | Clarifier Walls | cu.m. | 157 | \$ 1,500 | \$ 235,242 | \$ - | \$ 235,242 | |
| 9.4.6 | Bottom Slab for Clarifier Tank | cu.m. | 30 | \$ 1,100 | \$ 33,175 | \$ - | \$ 33,175 | |
| 9.4.7 | Access Stairs | cu.m. | 8 | \$ 1,500 | \$ 11,310 | \$ - | \$ 11,310 | |
| 9.4.8 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 9.4.9 | Handrail (Install Inc.) | li.m | 75 | \$ 150 | \$ 11,310 | \$ - | \$ 11,310 | |
| 9.5 Plumbing | | | | | | | | \$50,000 |
| 9.5.1 | Plumbing | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 9.6 Electrical | | | | | | | | \$182,000 |
| 9.6.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 9.6.2 | Instruments and Controls | L.S. | 1 | \$ 130,000 | \$ 130,000 | \$ - | \$ 130,000 | |
| 9.6.3 | Integration | L.S. | 1 | \$ 12,000 | \$ 12,000 | \$ - | \$ 12,000 | |
| Total Capital Cost | | | | | | | | \$33,718,000 |

| | | |
|--------------------|---|------|
| Title | CVWPCC WWTF Concept Design Cost Estimate for Option 3 - Phase I | |
| Date | 3-Aug-16 | |
| Description | | Year |
| | • Replace existing 12 mm mechanical screen with 6 mm screen | 2017 |
| | • Add grit removal tank c/w cyclones and classifiers units | 2017 |
| | • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners | 2017 |
| | • Injecting polymers prior cloth media filters (provision to be confirmed by pilot testing) | 2017 |
| | • Add cloth media filter | 2017 |
| | • Construct offline equalization tank | 2017 |
| | • Repair of existing offshore pipe | 2017 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 1.0 Mechanical Screen | | | | | | | | \$ 452,000 |
| 1.1 General Requirements | | | | | | | | \$91,000 |
| 2.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 91,000 | |
| 1.2 Process Mechanical | | | | | | | | \$316,000 |
| 1.2.1 | Mechanical Screen c/w Washer and Compactor | L.S. | 1 | \$ 212,000 | \$ 212,000 | \$ 48,000 | \$ 260,000 | |
| 1.2.2 | Sluice Gates | unit | 1 | \$ 50,000 | \$ 50,000 | \$ 6,000 | \$ 56,000 | |
| 1.3 Electrical | | | | | | | | \$45,000 |
| 1.3.1 | Motor Controls | Motors | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 1.3.2 | Instruments and Control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 1.3.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 2.0 Grit Removal | | | | | | | | \$ 1,025,000 |
| 2.1 General Requirements | | | | | | | | \$205,000 |
| 2.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 205,000 | |
| 2.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$119,000 |
| 2.2.1 | Site Clearing/ Stripping and Stockpile (Area of chamber plus 10m, perimeter) | sq.m. | 225 | \$ 5 | \$ 1,125 | \$ - | \$ 1,125 | |
| 2.2.2 | Chamber Excavation and Backfilling | cu.m. | 1,170 | \$ 15 | \$ 17,550 | \$ - | \$ 17,550 | |
| 2.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 50 | \$ 2,000 | \$ 100,000 | \$ - | \$ 100,000 | |
| 2.3 Process Mechanical | | | | | | | | \$480,000 |
| 2.3.1 | Grit Removal Equipment | L.S. | 1 | \$ 300,000 | \$ 300,000 | \$ 48,000 | \$ 348,000 | |
| 2.3.2 | Sluice Gates | unit | 2 | \$ 50,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | |
| 2.3.3 | Connection to existing Odor System | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 2.3.4 | Weirs for splitter box | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 2.4 Structural | | | | | | | | \$146,000 |
| 2.4.1 | Concentrator and Channels Walls | cu.m. | 44 | \$ 1,500 | \$ 66,007 | \$ - | \$ 66,007 | |
| 2.4.2 | Bottom Slab for Concentrator and Channel | cu.m. | 22 | \$ 1,100 | \$ 24,241 | \$ - | \$ 24,241 | |
| 2.4.3 | Top Slab for Concentrator | cu.m. | 19 | \$ 1,500 | \$ 27,778 | \$ - | \$ 27,778 | |
| 2.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 2.4.5 | Handrail (Install Inc.) | li.m | 16 | \$ 150 | \$ 2,356 | \$ - | \$ 2,356 | |
| 2.4.6 | Access Road and Parking Pad | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 2.5 Electrical | | | | | | | | \$65,000 |
| 2.5.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 2.5.2 | Instruments and Control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 2.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 2.6 Decommissioning | | | | | | | | \$10,000 |
| 2.6.1 | Grit Removal Equipment | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |

| | | |
|--------------------|---|-------------|
| Title | CVWPCC WWTF Concept Design Cost Estimate for Option 3 - Phase I | |
| Date | 3-Aug-16 | |
| Description | | Year |
| | • Replace existing 12 mm mechanical screen with 6 mm screen | 2017 |
| | • Add grit removal tank c/w cyclones and classifiers units | 2017 |
| | • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners | 2017 |
| | • Injecting polymers prior cloth media filters (provision to be confirmed by pilot testing) | 2017 |
| | • Add cloth media filter | 2017 |
| | • Construct offline equalization tank | 2017 |
| | • Repair of existing offshore pipe | 2017 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|--------------|---------------------------------|---------------------------|-----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 3.0 Media Cloth Filter | | | | | | | | \$ 5,289,000 |
| 3.1 General Requirements | | | | | | | | \$1,058,000 |
| 3.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 1,058,000 | |
| 3.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - \$208,000 |
| 3.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 2,100 | \$ 5 | \$ 10,500 | \$ - | \$ 10,500 | |
| 3.2.2 | Tank Excavation and Backfilling | cu.m. | 2,500 | \$ 15 | \$ 37,500 | \$ - | \$ 37,500 | |
| 3.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 80 | \$ 2,000 | \$ 160,000 | \$ - | \$ 160,000 | |
| 3.3 Process Mechanical | | | | | | | | \$2,729,000 |
| 3.3.1 | Polymer Injection System | unit | 1 | \$ 100,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | |
| 3.3.2 | Cloth media filter equipment | unit | 1 | \$ 1,575,000 | \$ 1,575,000 | \$ 180,000 | \$ 1,755,000 | |
| 3.3.3 | Sluice Gates | unit | 12 | \$ 50,000 | \$ 600,000 | \$ 12,000 | \$ 612,000 | |
| 3.3.4 | Pipes and Valves | L.S. | 1 | \$ 250,000 | \$ 250,000 | \$ - | \$ 250,000 | |
| 3.4 Structural | | | | | | | | \$1,189,000 |
| 3.4.1 | Tank Walls | cu.m. | 352 | \$ 1,500 | \$ 528,000 | \$ - | \$ 528,000 | |
| 3.4.2 | Bottom Slab for Tank | cu.m. | 120 | \$ 1,100 | \$ 132,000 | \$ - | \$ 132,000 | |
| 3.4.3 | Top Slab for Tank | cu.m. | 90 | \$ 1,100 | \$ 99,000 | \$ - | \$ 99,000 | |
| 3.4.4 | Mis. Metals | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 3.4.5 | Access Road and Parking Pad | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 3.4.6 | Superstructure + Architectural (Equipment Room, 4 m tall, steel frame with masonry infill) | sq.m. | 150 | \$ 2,200 | \$ 330,000 | \$ - | \$ 330,000 | |
| 3.5 Electrical | | | | | | | | \$105,000 |
| 3.5.1 | Motor Controls | Motors | 3 | \$ 20,000 | \$ 60,000 | \$ - | \$ 60,000 | |
| 3.5.2 | Instruments and Control | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 3.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 4.0 Offline Equalization Tank | | | | | | | | \$ 4,177,000 |
| 4.1 General Requirements | | | | | | | | \$836,000 |
| 4.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 836,000 | |
| 4.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$ - \$322,000 |
| 3.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 3,025 | \$ 5 | \$ 15,125 | \$ - | \$ 15,125 | |
| 3.2.2 | Tank Excavation and Backfilling | cu.m. | 15,125 | \$ 15 | \$ 226,875 | \$ - | \$ 226,875 | |
| 3.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 40 | \$ 2,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 4.3 Process Mechanical | | | | | | | | \$1,182,000 |
| 3.2.1 | Equalization Pumps | unit | 2 | \$ 60,000 | \$ 120,000 | \$ 45,000 | \$ 165,000 | |
| 3.2.2 | Gates | unit | 2 | \$ 50,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | |
| 3.2.3 | Connection to existing Odor System | li.m. | 200 | \$ 1,000 | \$ 200,000 | \$ - | \$ 200,000 | |
| 3.2.4 | Pumps Pipes and Valves | L.S. | 1 | \$ 180,000 | \$ 180,000 | \$ - | \$ 180,000 | |
| 3.2.5 | Mixing mixers | unit | 8 | \$ 60,000 | \$ 480,000 | \$ 45,000 | \$ 525,000 | |

| | | |
|--------------------|---|-------------|
| Title | CVWPCC WWTF Concept Design Cost Estimate for Option 3 - Phase I | |
| Date | 3-Aug-16 | |
| Description | | Year |
| | • Replace existing 12 mm mechanical screen with 6 mm screen | 2017 |
| | • Add grit removal tank c/w cyclones and classifiers units | 2017 |
| | • Decommissioning of existing primary sludge cyclones and classifiers and send the primary sludge directly to the sludge thickeners | 2017 |
| | • Injecting polymers prior cloth media filters (provision to be confirmed by pilot testing) | 2017 |
| | • Add cloth media filter | 2017 |
| | • Construct offline equalization tank | 2017 |
| | • Repair of existing offshore pipe | 2017 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---------------------------|--|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 4.4 | Structural | | | | | | | \$1,632,000 |
| 3.4.1 | Tank Walls | cu.m. | 336 | \$ 1,500 | \$ 504,000 | \$ - | \$ 504,000 | |
| 3.4.2 | Bottom Slab for Tank | cu.m. | 613 | \$ 1,100 | \$ 673,750 | \$ - | \$ 673,750 | |
| 3.4.3 | Top Slab for Tank | cu.m. | 368 | \$ 1,100 | \$ 404,250 | \$ - | \$ 404,250 | |
| 3.4.4 | Mis. Metals | L.S. | 1 | \$ 30,000 | \$ 30,000 | \$ - | \$ 30,000 | |
| 3.4.5 | Access Road and Parking Pad | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 4.5 | Electrical | | | | | | | \$205,000 |
| 3.5.1 | Motor Controls | Motors | 8 | \$ 20,000 | \$ 160,000 | \$ - | \$ 160,000 | |
| 3.5.2 | Instruments and control | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 3.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 5.0 | Repair of existing outfall pipe | | | | | | | \$ 120,000 |
| 5.1 | General Requirements | | | | | | | \$0 |
| 4.1.1 | Included in outfall sections costs | | | | | | \$ - | |
| 5.2 | Repair of existing outfall pipe | | | | | | | \$120,000 |
| 4.2.1 | Repair of existing outfall pipe | L.S. | 1 | \$ 120,000 | \$ 120,000 | \$ - | \$ 120,000 | |
| Total Capital Cost | | | | | | | | \$11,063,000 |

Title CVWPCC WWTF
 Concept Design Cost Estimate for Option 3 - Phase 2

Date 3-Aug-16

Description

- Construct one aeration tank and clarifier

Year
 2024

Additional Notes
 Installation included unless otherwise stated

Items not included
 Land procurement Costs
 Contingency Allowances
 Taxes
 UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labour / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) | |
|---|---|----------------------------|----------|-----------------|-------------|----------------------------------|---------------------------|----------------------|------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | | |
| 1.0 Aeration Tank & Clarifier | | | | | | | \$ | 4,720,000 | |
| 1.1 General Requirements | | | | | | | | \$944,000 | |
| 1.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 944,000 | | |
| 1.2 Site Civil, Access Road, and Landscaping | | | | | | | \$ | - | \$714,000 |
| 1.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 2,725 | \$ 5 | \$ 13,625 | \$ - | \$ 13,625 | | |
| 1.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ - | \$ 100,000 | | |
| 1.2.3 | Inter-connecting Pipes Below Grade Pipework (from primary splitter to aeration tank) | li.m. | 250 | \$ 1,500 | \$ 375,000 | \$ - | \$ 375,000 | | |
| 1.2.4 | RAS and WAS piping | li.m. | 50 | \$ 1,500 | \$ 75,000 | \$ - | \$ 75,000 | | |
| 1.2.5 | Air piping | li.m. | 100 | \$ 1,500 | \$ 150,000 | \$ - | \$ 150,000 | | |
| 1.3 Process Mechanical | | | | | | | | \$1,670,000 | |
| 1.3.1 | Fine bubble diffusers and air pipes | L.S. | 1 | \$ 280,000 | \$ 280,000 | \$ 180,000 | \$ 460,000 | | |
| 1.3.2 | Mixer | unit | 1 | \$ 60,000 | \$ 60,000 | \$ 12,000 | \$ 72,000 | | |
| 1.3.3 | Clarifier Mechanism | L.S. | 1 | \$ 506,000 | \$ 506,000 | \$ 180,000 | \$ 686,000 | | |
| 1.3.4 | RAS/WAS pumping | unit | 4 | \$ 60,000 | \$ 240,000 | \$ 12,000 | \$ 252,000 | | |
| 1.3.5 | RAS/WAS Valves and Pipes | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | | |
| 1.4 Structural | | | | | | | | \$1,161,000 | |
| 1.4.1 | Aeration Tank Walls | cu.m. | 313 | \$ 1,500 | \$ 468,750 | \$ - | \$ 468,750 | | |
| 1.4.2 | Bottom Slab for Aeration Tank | cu.m. | 260 | \$ 1,100 | \$ 286,000 | \$ - | \$ 286,000 | | |
| 1.4.3 | Access stairs | cu.m. | 26 | \$ 1,500 | \$ 39,000 | \$ - | \$ 39,000 | | |
| 1.4.4 | Handrail (Install Inc.) | li.m | 170 | \$ 150 | \$ 25,500 | \$ - | \$ 25,500 | | |
| 1.4.5 | Clarifier Walls | cu.m. | 157 | \$ 1,500 | \$ 235,242 | \$ - | \$ 235,242 | | |
| 1.4.6 | Bottom Slab for Clarifier Tank | cu.m. | 30 | \$ 1,100 | \$ 33,175 | \$ - | \$ 33,175 | | |
| 1.4.7 | Access Stairs | cu.m. | 8 | \$ 1,500 | \$ 11,310 | \$ - | \$ 11,310 | | |
| 1.4.8 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | | |
| 1.4.9 | Handrail (Install Inc.) | li.m | 75 | \$ 150 | \$ 11,310 | \$ - | \$ 11,310 | | |
| 1.5 Plumbing | | | | | | | | \$50,000 | |
| 1.5.1 | Plumbing | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | | |
| 1.6 Electrical | | | | | | | | \$182,000 | |
| 1.6.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | | |
| 1.6.2 | Instruments and Controls | L.S. | 1 | \$ 130,000 | \$ 130,000 | \$ - | \$ 130,000 | | |
| 1.6.3 | Integration | L.S. | 1 | \$ 12,000 | \$ 12,000 | \$ - | \$ 12,000 | | |
| Total Capital Cost | | | | | | | | \$4,721,000 | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 3 - Phase 3

Date 3-Aug-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|--|---|----------------------------|----------|-----------------|--------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 1.0 Replace Outfall Sections (Onshore/Offshore) - Year (2031) | | | | | | | | \$ 14,109,000 |
| 1.1 General Requirements | | | | | | | | \$0 |
| 1.1.1 | Included in outfall sections costs | | | | | | \$ - | |
| 1.2 Civil | | | | | | | | \$13,949,000 |
| 1.2.1 | 900 mm Tie-In and temporary works | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 1.2.2 | Onshore Section (2827.0 m Length) | L.S. | 1 | \$ 7,633,000 | \$ 7,633,000 | \$ - | \$ 7,633,000 | |
| 1.2.3 | Offshore section (2825.0 m Length) | L.S. | 1 | \$ 6,215,000 | \$ 6,215,000 | \$ - | \$ 6,215,000 | |
| 1.2.4 | Diffuser section (175.0 m Length) | L.S. | 1 | \$ 61,000 | \$ 61,000 | \$ - | \$ 61,000 | |
| 1.3 Mechanical and Electrical | | | | | | | | \$160,000 |
| 1.3.1 | Add fourth pump | L.S. | 1 | \$ 150,000 | \$ 150,000 | \$ - | \$ 150,000 | |
| 1.3.2 | Integration | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 2.0 Primary Clarifiers + Process Building - Year (2033) | | | | | | | | \$ 7,650,000 |
| 2.1 General Requirements | | | | | | | | \$1,530,000 |
| 2.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 1,530,000 | |
| 2.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$219,000 |
| 2.2.1 | Site Clearing/ Stripping and Stockpile (Area of building and tank plus 10m, perimeter) | sq.m. | 3,687 | \$ 5 | \$ 18,435 | \$ - | \$ 18,435 | |
| 2.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | |
| 2.3 Process Mechanical | | | | | | | | \$2,568,000 |
| 2.3.1 | Primary Clarifier Mechanism | L.S. | 2 | \$ 360,000 | \$ 720,000 | \$ 180,000 | \$ 900,000 | |
| 2.3.2 | Air Blowers | L.S. | 5 | \$ 150,000 | \$ 750,000 | \$ 180,000 | \$ 930,000 | |
| 2.3.3 | WAS pumping | unit | 2 | \$ 60,000 | \$ 120,000 | \$ 12,000 | \$ 132,000 | |
| 2.3.4 | WAS Valves and Pipes | L.S. | 1 | \$ 150,000 | \$ 150,000 | \$ - | \$ 150,000 | |
| 2.3.5 | Air Valves and Pipes | L.S. | 1 | \$ 250,000 | \$ 250,000 | \$ - | \$ 250,000 | |
| 2.3.6 | Sluice Gates | unit | 4 | \$ 50,000 | \$ 200,000 | \$ 6,000 | \$ 206,000 | |
| 2.4 Structural | | | | | | | | \$2,402,000 |
| 2.4.1 | Primary Tank Walls | cu.m. | 150 | \$ 1,500 | \$ 225,000 | \$ - | \$ 225,000 | |
| 2.4.2 | Bottom Slab for Primary Tank | cu.m. | 160 | \$ 1,100 | \$ 176,000 | \$ - | \$ 176,000 | |
| 2.4.3 | Access stairs | cu.m. | 16 | \$ 1,500 | \$ 24,000 | \$ - | \$ 24,000 | |
| 2.4.4 | Process Building | cu.m. | 250 | \$ 1,500 | \$ 375,000 | \$ - | \$ 375,000 | |
| 2.4.5 | Bottom Slab for Process Building | cu.m. | 216 | \$ 1,100 | \$ 237,600 | \$ - | \$ 237,600 | |
| 2.4.6 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 150,000 | \$ 150,000 | \$ - | \$ 150,000 | |
| 2.4.7 | Handrail (Install Inc.) | li.m | 170 | \$ 150 | \$ 25,500 | \$ - | \$ 25,500 | |
| 2.4.8 | Superstructure + Architectural (Process Building, 6 m tall, steel frame with masonry infill) | sq.m. | 540 | \$ 2,200 | \$ 1,188,000 | \$ - | \$ 1,188,000 | |
| 2.5 Plumbing & HVAC | | | | | | | | \$800,000 |
| 2.5.1 | Plumbing | L.S. | 1 | \$ 300,000 | \$ 300,000 | \$ - | \$ 300,000 | |
| 2.5.2 | HVAC | L.S. | 1 | \$ 500,000 | \$ 500,000 | \$ - | \$ 500,000 | |
| 2.6 Electrical | | | | | | | | \$132,000 |
| 2.6.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 2.6.2 | Instruments and Controls | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 2.6.3 | Integration | L.S. | 1 | \$ 12,000 | \$ 12,000 | \$ - | \$ 12,000 | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 3 - Phase 3

Date 3-Aug-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|--------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 3.0 Media Cloth Filter (2034) | | | | | | | | \$ 1,759,000 |
| 3.1 General Requirements | | | | | | | | \$352,000 |
| 3.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 352,000 | |
| 3.2 Process Mechanical | | | | | | | | \$1,322,000 |
| 3.2.1 | Modification to Polymer Injection System | unit | 1 | \$ 30,000 | \$ 30,000 | \$ 12,000 | \$ 42,000 | |
| 3.2.2 | Cloth media filter equipment | unit | 1 | \$ 1,050,000 | \$ 1,050,000 | \$ 180,000 | \$ 1,230,000 | |
| 3.2.3 | Pipes and Valves | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 3.3 Electrical | | | | | | | | \$85,000 |
| 3.3.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 3.3.2 | Instruments and Control | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 3.3.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 4.0 Effluent Pumps - Year (2043) | | | | | | | | \$ 1,780,000 |
| 4.1 General Requirements | | | | | | | | \$0 |
| 5.1.1 | Included in effluent pumps item costs | | | | | | \$ - | |
| 4.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$50,000 |
| 5.2.1 | Interconnecting pipes within CVWPCC | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 4.3 Process Mechanical | | | | | | | | \$1,200,000 |
| 5.3.1 | Replace existing pumps | L.S. | 1 | \$ 600,000 | \$ 600,000 | \$ - | \$ 600,000 | |
| 5.3.2 | Valves and pipes (within the vault) | L.S. | 1 | \$ 600,000 | \$ 600,000 | \$ - | \$ 600,000 | |
| 4.4 Structural | | | | | | | | \$80,000 |
| 5.4.1 | New outfall chamber | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 4.5 Electrical | | | | | | | | \$450,000 |
| 5.5.1 | Electrical | L.S. | 1 | \$ 370,000 | \$ 370,000 | \$ - | \$ 370,000 | |
| 5.5.2 | Instruments and control | L.S. | 1 | \$ 80,000 | \$ 80,000 | \$ - | \$ 80,000 | |
| 5.0 Mechanical Screen - Year (2045) | | | | | | | | \$ 892,000 |
| 5.1 General Requirements | | | | | | | | \$179,000 |
| 5.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 179,000 | |
| 5.2 Process Mechanical | | | | | | | | \$648,000 |
| 5.2.1 | Mechanical Screen c/w Washer and Compactor | L.S. | 2 | \$ 300,000 | \$ 600,000 | \$ 48,000 | \$ 648,000 | |
| 5.3 Electrical | | | | | | | | \$65,000 |
| 5.3.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 5.3.2 | Instruments and control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 5.3.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 6.0 Grit Removal - Year (2045) | | | | | | | | \$ 1,013,000 |
| 6.1 General Requirements | | | | | | | | \$203,000 |
| 6.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 203,000 | |
| 6.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$119,000 |
| 6.2.1 | Site Clearing/ Stripping and Stockpile (Area of chamber plus 10m, perimeter) | sq.m. | 225 | \$ 5 | \$ 1,125 | \$ - | \$ 1,125 | |
| 6.2.2 | Chamber Excavation and Backfilling | cu.m. | 1,170 | \$ 15 | \$ 17,550 | \$ - | \$ 17,550 | |
| 6.2.3 | Inter-connecting Pipe Below Grade Pipework | li.m. | 50 | \$ 2,000 | \$ 100,000 | \$ - | \$ 100,000 | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 3 - Phase 3

Date 3-Aug-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|---|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 6.3 Process Mechanical | | | | | | | | \$480,000 |
| 6.3.1 | Grit Removal Equipment | L.S. | 1 | \$ 300,000 | \$ 300,000 | \$ 48,000 | \$ 348,000 | |
| 6.3.2 | Sluice Gates | unit | 2 | \$ 50,000 | \$ 100,000 | \$ 12,000 | \$ 112,000 | |
| 6.3.3 | Connection to existing Odor System | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 6.3.4 | Weirs for splitter box | L.S. | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 6.4 Structural | | | | | | | | \$146,000 |
| 6.4.1 | Concentrator and Channels Walls | cu.m. | 44 | \$ 1,500 | \$ 66,007 | \$ - | \$ 66,007 | |
| 6.4.2 | Bottom Slab for Concentrator and Channel | cu.m. | 22 | \$ 1,100 | \$ 24,241 | \$ - | \$ 24,241 | |
| 6.4.3 | Top Slab for Concentrator | cu.m. | 19 | \$ 1,500 | \$ 27,778 | \$ - | \$ 27,778 | |
| 6.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 6.4.5 | Handrail (Install Inc.) | li.m | 16 | \$ 150 | \$ 2,356 | \$ - | \$ 2,356 | |
| 6.4.6 | Access Road and Parking Pad | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 6.5 Electrical | | | | | | | | \$65,000 |
| 6.5.1 | Motor Controls | Motors | 2 | \$ 20,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 6.5.2 | Instruments and control | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 6.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 7.0 Thickener - Year (2056) | | | | | | | | \$ 1,072,000 |
| 7.1 General Requirements | | | | | | | | \$215,000 |
| 7.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 215,000 | |
| 7.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$144,000 |
| 7.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 800 | \$ 5 | \$ 4,000 | \$ - | \$ 4,000 | |
| 7.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 40,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 7.2.3 | Inter-connecting Pipes Below Grade Pipework | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ - | \$ 100,000 | |
| 7.3 Process Mechanical | | | | | | | | \$480,000 |
| 7.3.1 | Thickener Mechanism | L.S. | 1 | \$ 250,000 | \$ 250,000 | \$ 180,000 | \$ 430,000 | |
| 7.3.2 | Connection to existing Odor System | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 7.4 Structural | | | | | | | | \$198,000 |
| 7.4.1 | Thickener Tank Walls | cu.m. | 32 | \$ 1,500 | \$ 48,000 | \$ - | \$ 48,000 | |
| 7.4.2 | Bottom Slab for Thickener Tank | cu.m. | 63 | \$ 1,100 | \$ 69,300 | \$ - | \$ 69,300 | |
| 7.4.3 | Thickener cover | L.S. | 1 | \$ 30,000 | \$ 30,000 | \$ - | \$ 30,000 | |
| 7.4.4 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 7.5 Electrical | | | | | | | | \$35,000 |
| 7.5.1 | Motor Controls | Motors | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 7.5.2 | Instruments and Controls | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 7.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 8.0 Centrifuge - Year (2060) | | | | | | | | \$ 1,190,000 |
| 8.1 General Requirements | | | | | | | | \$238,000 |
| 8.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 238,000 | |
| 8.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$57,000 |
| 8.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 1,225 | \$ 5 | \$ 6,125 | \$ - | \$ 6,125 | |
| 8.2.2 | Inter-connecting Pipes Below Grade Pipework | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |

Title 31548 CVWPCC WWTF
Concept Design Cost Estimate for Option 3 - Phase 3

Date 3-Aug-16

| Description | Year |
|--|------|
| • Replace all outfall sections (onshore/offshore) | 2031 |
| • Construct two primary clarifiers and process building | 2033 |
| • Upgrade cloth media filter | 2034 |
| • Upgrade effluent pumps | 2043 |
| • Add mechanical screens to new process building | 2045 |
| • Add grit removal tank c/w cyclones and classifiers units | 2045 |
| • Construct new thickener | 2056 |
| • Install new centrifuge | 2060 |
| • Construct one aeration tank and clarifier | 2063 |

Additional Notes
Installation included unless otherwise stated
Items not included
Land procurement Costs
Contingency Allowances
Taxes
UV disinfection

Capital Cost Estimate

| Item | Description | Material or Equipment Cost | | | | Labor / Installation Costs (\$) | Total Line Item Cost (\$) | Total Item Cost (\$) |
|--|---|----------------------------|----------|-----------------|-------------|---------------------------------|---------------------------|----------------------|
| | | Unit | Quantity | Unit Price (\$) | Amount (\$) | | | |
| 8.3 Process Mechanical | | | | | | | | \$530,000 |
| 8.3.1 | Centrifuge | L.S. | 1 | \$ 350,000 | \$ 350,000 | \$ 180,000 | \$ 530,000 | |
| 8.4 Structural | | | | | | | | \$330,000 |
| 8.4.1 | Centrifuge base based on extending existing structure | cu.m. | 60 | \$ 1,500 | \$ 90,000 | \$ - | \$ 90,000 | |
| 8.4.2 | Superstructure + Architectural (Chemical Room, 6 m tall, steel frame with masonry infill) | sq.m. | 100 | \$ 2,200 | \$ 220,000 | \$ - | \$ 220,000 | |
| 8.4.3 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 8.5 Electrical | | | | | | | | \$35,000 |
| 8.5.1 | Motor Controls | Motors | 1 | \$ 10,000 | \$ 10,000 | \$ - | \$ 10,000 | |
| 8.5.2 | Instruments and Controls | L.S. | 1 | \$ 20,000 | \$ 20,000 | \$ - | \$ 20,000 | |
| 8.5.3 | Integration | L.S. | 1 | \$ 5,000 | \$ 5,000 | \$ - | \$ 5,000 | |
| 9.0 Aeration Tank and Clarifier - Year (2063) | | | | | | | | \$ 4,252,000 |
| 9.1 General Requirements | | | | | | | | \$851,000 |
| 9.1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | | | | | \$ 851,000 | |
| 9.2 Site Civil, Access Road, and Landscaping | | | | | | | | \$339,000 |
| 9.2.1 | Site Clearing/ Stripping and Stockpile (Area of tank plus 10m, perimeter) | sq.m. | 2,725 | \$ 5 | \$ 13,625 | \$ - | \$ 13,625 | |
| 9.2.2 | Access Road and Parking Pad | L.S. | 1 | \$ 100,000 | \$ 100,000 | \$ - | \$ 100,000 | |
| 9.2.3 | RAS and WAS piping | L.S. | 1 | \$ 75,000 | \$ 75,000 | \$ - | \$ 75,000 | |
| 9.2.4 | Air piping | li.m. | 100 | \$ 1,500 | \$ 150,000 | \$ - | \$ 150,000 | |
| 9.3 Process Mechanical | | | | | | | | \$1,670,000 |
| 9.3.1 | Fine bubble diffusers and air pipes | L.S. | 1 | \$ 280,000 | \$ 280,000 | \$ 180,000 | \$ 460,000 | |
| 9.3.2 | Mixer | unit | 1 | \$ 60,000 | \$ 60,000 | \$ 12,000 | \$ 72,000 | |
| 9.3.3 | Clarifier Mechanism | L.S. | 1 | \$ 506,000 | \$ 506,000 | \$ 180,000 | \$ 686,000 | |
| 9.3.4 | RAS/WAS pumping | unit | 4 | \$ 60,000 | \$ 240,000 | \$ 12,000 | \$ 252,000 | |
| 9.3.5 | RAS/WAS Valves and Pipes | L.S. | 1 | \$ 200,000 | \$ 200,000 | \$ - | \$ 200,000 | |
| 9.4 Structural | | | | | | | | \$1,161,000 |
| 9.4.1 | Aeration Tank Walls | cu.m. | 313 | \$ 1,500 | \$ 468,750 | \$ - | \$ 468,750 | |
| 9.4.2 | Bottom Slab for Aeration Tank | cu.m. | 260 | \$ 1,100 | \$ 286,000 | \$ - | \$ 286,000 | |
| 9.4.3 | Access stairs | cu.m. | 26 | \$ 1,500 | \$ 39,000 | \$ - | \$ 39,000 | |
| 9.4.4 | Handrail (Install Inc.) | li.m. | 170 | \$ 150 | \$ 25,500 | \$ - | \$ 25,500 | |
| 9.4.5 | Clarifier Walls | cu.m. | 157 | \$ 1,500 | \$ 235,242 | \$ - | \$ 235,242 | |
| 9.4.6 | Bottom Slab for Clarifier Tank | cu.m. | 30 | \$ 1,100 | \$ 33,175 | \$ - | \$ 33,175 | |
| 9.4.7 | Access Stairs | cu.m. | 8 | \$ 1,500 | \$ 11,310 | \$ - | \$ 11,310 | |
| 9.4.8 | Concrete Walkways / Access Ramp / Road | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 9.4.9 | Handrail (Install Inc.) | li.m. | 75 | \$ 150 | \$ 11,310 | \$ - | \$ 11,310 | |
| 9.5 Plumbing | | | | | | | | \$50,000 |
| 9.5.1 | Plumbing | L.S. | 1 | \$ 50,000 | \$ 50,000 | \$ - | \$ 50,000 | |
| 9.6 Electrical | | | | | | | | \$182,000 |
| 9.6.1 | Motor Controls | Motors | 4 | \$ 10,000 | \$ 40,000 | \$ - | \$ 40,000 | |
| 9.6.2 | Instruments and Controls | L.S. | 1 | \$ 130,000 | \$ 130,000 | \$ - | \$ 130,000 | |
| 9.6.3 | Integration | L.S. | 1 | \$ 12,000 | \$ 12,000 | \$ - | \$ 12,000 | |
| Total Capital Cost | | | | | | | | \$33,718,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 1 - 2017 Construction | | | |
|-----------------------------|---|---------------------|---------------------|
| Item | Description | Option 3 | Option 9 |
| 1.0 | Mechanical Screen | \$ 452,000 | \$ 452,000 |
| 1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 91,000 | \$ 91,000 |
| 1.2 | Mechanical Screen c/w Washer and Compactor | \$ 260,000 | \$ 260,000 |
| 1.3 | Sluice Gates | \$ 56,000 | \$ 56,000 |
| 1.4 | Electrical | \$ 45,000 | \$ 45,000 |
| 2.0 | Grit Removal | \$ 1,025,000 | \$ 1,025,000 |
| 2.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 205,000 | \$ 205,000 |
| 2.2 | Site Civil, Access Road, and Landscaping | \$ 119,000 | \$ 119,000 |
| 2.3 | Grit Removal Equipment | \$ 348,000 | \$ 348,000 |
| 2.4 | Sluice Gates | \$ 112,000 | \$ 112,000 |
| 2.5 | Connection to existing Odor System | \$ 10,000 | \$ 10,000 |
| 2.6 | Weirs for splitter box | \$ 10,000 | \$ 10,000 |
| 2.7 | Structural | \$ 146,000 | \$ 146,000 |
| 2.8 | Electrical | \$ 65,000 | \$ 65,000 |
| 2.9 | Decommissioning | \$ 10,000 | \$ 10,000 |
| 3.0 | Offline Equalization Tank | \$ 4,177,000 | \$ 4,177,000 |
| 3.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 836,000 | \$ 836,000 |
| 3.2 | Site Civil, Access Road, and Landscaping | \$ 322,000 | \$ 322,000 |
| 3.3 | Equalization Pumps | \$ 165,000 | \$ 165,000 |
| 3.4 | Gates | \$ 112,000 | \$ 112,000 |
| 3.5 | Connection to existing Odor System | \$ 200,000 | \$ 200,000 |
| 3.6 | Pumps Pipes and Valves | \$ 180,000 | \$ 180,000 |
| 3.7 | Mixing mixers | \$ 525,000 | \$ 525,000 |
| 3.8 | Structural | \$ 1,632,000 | \$ 1,632,000 |
| 3.9 | Electrical | \$ 205,000 | \$ 205,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 1 - 2017 Construction | | | |
|-----------------------------|---|----------|----------|
| Item | Description | Option 3 | Option 9 |
| 4.0 | Chemical Treatment | \$ - | \$ - |
| 4.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | |
| 4.2 | Site Civil, Access Road, and Landscaping | | |
| 4.3 | Soda Ash Super Bag System | | |
| 4.4 | Polymer Injection System | | |
| 4.5 | Pipes and Valves | | |
| 4.6 | Structural | | |
| 4.7 | HVAC / Plumbing System | | |
| 4.8 | Electrical | | |
| 5.0 | Aeration Tank & Clarifier | \$ - | \$ - |
| 5.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | |
| 5.2 | Site Civil, Access Road, and Landscaping | | |
| 5.3 | Fine bubble diffusers and air pipes | | |
| 5.4 | Mixer | | |
| 5.5 | Clarifier Mechanism | | |
| 5.6 | RAS/WAS pumping | | |
| 5.7 | RAS/WAS Valves and Pipes | | |
| 5.8 | Structural | | |
| 5.9 | Plumbing | | |
| 5.10 | Electrical | | |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 1 - 2017 Construction | | | |
|-----------------------------|---|--------------|--------------|
| Item | Description | Option 3 | Option 9 |
| 6.0 | Repair of existing outfall pipe | \$ 120,000 | \$ 120,000 |
| 6.1 | General requirements included in the repairs costs | \$ - | \$ - |
| 6.2 | Repair of existing outfall pipe | \$ 120,000 | \$ 120,000 |
| 7.0 | Media Cloth Filter | \$ 5,289,000 | \$ - |
| 7.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 1,058,000 | \$ - |
| 7.2 | Site Civil, Access Road, and Landscaping | \$ 208,000 | \$ - |
| 7.3 | Polymer Injection System | \$ 112,000 | \$ - |
| 7.4 | Cloth media filter equipment | \$ 1,755,000 | \$ - |
| 7.5 | Sluice Gates | \$ 612,000 | \$ - |
| 7.6 | Pipes and Valves | \$ 250,000 | \$ - |
| 7.7 | Structural | \$ 1,189,000 | \$ - |
| 7.8 | Electrical | \$ 105,000 | \$ - |
| 8.0 | Fourth Clarifier | \$ - | \$ 2,168,000 |
| 8.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | \$ 434,000 |
| 8.2 | Site Civil, Access Road, and Landscaping | | \$ 304,000 |
| 8.3 | Clarifier Mechanism | | \$ 686,000 |
| 8.4 | Polymer injection system (provision) | | \$ 112,000 |
| 8.5 | RAS/WAS Valves and Pipes | | \$ 200,000 |
| 8.6 | Structural | | \$ 392,000 |
| 8.7 | Electrical | | \$ 40,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 1 - 2017 Construction | | | |
|-----------------------------|---|---------------|---------------|
| Item | Description | Option 3 | Option 9 |
| 8.0 | Effluent Reuse Package | \$ - | \$ 863,000 |
| 8.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | \$ 173,000 |
| 8.2 | Pipes for cloth media filter to the headwork | | \$ 50,000 |
| 8.3 | Effluent filtration package | | \$ 330,000 |
| 8.4 | Effluent reuse valves and pipes | | \$ 120,000 |
| 8.6 | Increase in the UV building to accommodate cloth media filter | | \$ 120,000 |
| 8.7 | Electrical | | \$ 70,000 |
| 9.0 | Upgrade Effluent Pumps | \$ - | \$ - |
| 9.1 | General requirements included in effluent pumps item costs | | |
| 9.2 | Upgrade of existing effluent pumps and new outfall chamber | \$ - | \$ - |
| | Capital Costs | \$ 11,063,000 | \$ 8,805,000 |
| | Engineering and Contingencies (40%) | \$ 4,426,000 | \$ 3,522,000 |
| | Total Capital Costs | \$ 15,489,000 | \$ 12,327,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 2 - 2024 Construction | | | |
|-----------------------------|---|------------------------|------------------------|
| Item | Description | Option 3 | Option 9 |
| 1.0 | Aeration Tank & Clarifier | \$ 4,721,000 | \$ 4,721,000 |
| 1.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 944,000 | \$ 944,000 |
| 1.2 | Site Civil, Access Road, and Landscaping | \$ 714,000 | \$ 714,000 |
| 1.3 | Fine bubble diffusers and air pipes | \$ 460,000 | \$ 460,000 |
| 1.4 | Mixer | \$ 72,000 | \$ 72,000 |
| 1.5 | Clarifier Mechanism | \$ 686,000 | \$ 686,000 |
| 1.6 | RAS/WAS pumping | \$ 252,000 | \$ 252,000 |
| 1.7 | RAS/WAS Valves and Pipes | \$ 200,000 | \$ 200,000 |
| 1.8 | Structural | \$ 1,161,000 | \$ 1,161,000 |
| 1.9 | Plumbing | \$ 50,000 | \$ 50,000 |
| 1.10 | Electrical | \$ 182,000 | \$ 182,000 |
| | Capital Costs | \$ 4,721,000.00 | \$ 4,721,000.00 |
| | Engineering and Contingencies (40%) | \$ 1,889,000 | \$ 1,889,000 |
| | Total Capital Costs | \$ 6,610,000 | \$ 6,610,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 3 - Varies | | | |
|------------------|---|-------------------------|-------------------------|
| Item | Description | Option 3 | Option 3 |
| 1.0 | Replace Outfall Sections (Onshore/Offshore) - Year (2031) | \$ 13,949,000 | \$ 13,949,000 |
| 1.1 | General requirements (included in the Outfall items costs) | \$ - | \$ - |
| 1.2 | 900 mm Tie-In and temporary works | \$ 40,000 | \$ 40,000 |
| 1.3 | Onshore Section (2827.0 m Length) | \$ 7,633,000 | \$ 7,633,000 |
| 1.4 | Offshore section (2825.0 m Length) | \$ 6,215,000 | \$ 6,215,000 |
| 1.5 | Diffuser section (175.0 m Length) | \$ 61,000 | \$ 61,000 |
| 1.6 | Add fourth pump | \$ - | \$ - |
| | Capital Costs | \$ 13,949,000.00 | \$ 13,949,000.00 |
| | Engineering and Contingencies (40%) | \$ 5,580,000 | \$ 5,580,000 |
| | Total Capital Costs | \$ 19,529,000 | \$ 19,529,000 |
| 2.0 | Primary Clarifiers + Process Building - Year (2033) | \$ 7,651,000 | \$ 7,651,000 |
| 2.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 1,530,000 | \$ 1,530,000 |
| 2.2 | Site Civil, Access Road, and Landscaping | \$ 219,000 | \$ 219,000 |
| 2.3 | Primary Clarifier Mechanism | \$ 900,000 | \$ 900,000 |
| 2.4 | Air Blowers | \$ 930,000 | \$ 930,000 |
| 2.5 | WAS pumping | \$ 132,000 | \$ 132,000 |
| 2.6 | WAS Valves and Pipes | \$ 150,000 | \$ 150,000 |
| 2.7 | Air Valves and Pipes | \$ 250,000 | \$ 250,000 |
| 2.8 | Sluice Gates | \$ 206,000 | \$ 206,000 |
| 2.9 | Structural | \$ 2,402,000 | \$ 2,402,000 |
| 2.10 | Plumbing & HVAC | \$ 800,000 | \$ 800,000 |
| 2.12 | Electrical | \$ 132,000 | \$ 132,000 |
| | Capital Costs | \$ 7,651,000.00 | \$ 7,651,000.00 |
| | Engineering and Contingencies (40%) | \$ 3,061,000 | \$ 3,061,000 |
| | Total Capital Costs | \$ 10,712,000 | \$ 10,712,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 3 - Varies | | | |
|------------------|---|------------------------|------------------------|
| Item | Description | Option 3 | Option 3 |
| 4.0 | Upgrade Media Cloth Filter - Year (2034) | \$ 1,759,000 | \$ - |
| 4.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 352,000 | \$ - |
| 4.2 | Modification to Polymer Injection System | \$ 42,000 | \$ - |
| 4.3 | Cloth media filter equipment | \$ 1,230,000 | \$ - |
| 4.4 | Pipes and Valves | \$ 50,000 | \$ - |
| 4.5 | Electrical | \$ 85,000 | \$ - |
| | Capital Costs | \$ 1,759,000.00 | \$ - |
| | Engineering and Contingencies (40%) | \$ 704,000 | \$ - |
| | Total Capital Costs | \$ 2,463,000 | \$ - |
| 5.0 | Effluent Pumps - Year (2043) | \$ 1,780,000 | \$ 1,780,000 |
| 5.1 | General requirements (included in the Effluent Pumps items costs) | \$ - | \$ - |
| 5.2 | Site Civil, Access Road, and Landscaping | \$ 50,000 | \$ 50,000 |
| 5.3 | Replace existing pumps | \$ 600,000 | \$ 600,000 |
| 5.4 | Valves and pipes (within the vault) | \$ 600,000 | \$ 600,000 |
| 5.5 | Structural | \$ 80,000 | \$ 80,000 |
| 5.6 | Electrical | \$ 450,000 | \$ 450,000 |
| | Capital Costs | \$ 1,780,000.00 | \$ 1,780,000.00 |
| | Engineering and Contingencies (40%) | \$ 712,000 | \$ 712,000 |
| | Total Capital Costs | \$ 2,492,000 | \$ 2,492,000 |
| 6.0 | Mechanical Screen - Year (2045) | \$ 892,000 | \$ 892,000 |
| 6.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 179,000 | \$ 179,000 |
| 6.2 | Mechanical Screen c/w Washer and Compactor | \$ 648,000 | \$ 648,000 |
| 6.3 | Electrical | \$ 65,000 | \$ 65,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 3 - Varies | | | |
|------------------|---|------------------------|------------------------|
| Item | Description | Option 3 | Option 3 |
| 7.0 | Grit Removal - Year (2045) | \$ 1,013,000 | \$ 1,013,000 |
| 7.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 203,000 | \$ 203,000 |
| 7.2 | Site Civil, Access Road, and Landscaping | \$ 119,000 | \$ 119,000 |
| 7.3 | Grit Removal Equipment | \$ 348,000 | \$ 348,000 |
| 7.4 | Sluice Gates | \$ 112,000 | \$ 112,000 |
| 7.5 | Connection to existing Odor System | \$ 10,000 | \$ 10,000 |
| 7.6 | Weirs for splitter box | \$ 10,000 | \$ 10,000 |
| 7.7 | Structural | \$ 146,000 | \$ 146,000 |
| 7.8 | Electrical | \$ 65,000 | \$ 65,000 |
| 8.0 | Expand Chemical Treatment - Year (2045) | | |
| 8.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | | |
| 8.2 | Civil | | |
| 8.3 | Add soda ash injection pump | | |
| 8.4 | Add polymer Injection pump | | |
| 8.5 | Pipes and Valves | | |
| 8.6 | Electrical | | |
| | Capital Costs | \$ 1,905,000.00 | \$ 1,905,000.00 |
| | Engineering and Contingencies (40%) | \$ 762,000 | \$ 762,000 |
| | Total Capital Costs | \$ 2,667,000 | \$ 2,667,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 3 - Varies | | | |
|------------------|---|------------------------|------------------------|
| Item | Description | Option 3 | Option 3 |
| 9.0 | Thickener - Year (2056) | \$ 1,072,000 | \$ 1,072,000 |
| 9.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 215,000 | \$ 215,000 |
| 9.2 | Site Civil, Access Road, and Landscaping | \$ 144,000 | \$ 144,000 |
| 9.3 | Thickener Mechanism | \$ 430,000 | \$ 430,000 |
| 9.4 | Connection to existing Odor System | \$ 50,000 | \$ 50,000 |
| 9.5 | Structural | \$ 198,000 | \$ 198,000 |
| 9.6 | Electrical | \$ 35,000 | \$ 35,000 |
| | Capital Costs | \$ 1,072,000.00 | \$ 1,072,000.00 |
| | Engineering and Contingencies (40%) | \$ 429,000 | \$ 429,000 |
| | Total Capital Costs | \$ 1,501,000 | \$ 1,501,000 |
| 10.0 | Centrifuge - Year (2060) | \$ 1,190,000 | \$ 1,190,000 |
| 10.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 238,000 | \$ 238,000 |
| 10.2 | Site Civil, Access Road, and Landscaping | \$ 57,000 | \$ 57,000 |
| 10.3 | Centrifuge | \$ 530,000 | \$ 530,000 |
| 10.4 | Structural | \$ 330,000 | \$ 330,000 |
| 10.5 | Electrical | \$ 35,000 | \$ 35,000 |
| | Capital Costs | \$ 1,190,000.00 | \$ 1,190,000.00 |
| | Engineering and Contingencies (40%) | \$ 476,000 | \$ 476,000 |
| | Total Capital Costs | \$ 1,666,000 | \$ 1,666,000 |

Project Name / Number
31548 CVWPCC WWTF

Title
Concept Design Cost Estimate

Date
26-Jun-16

| Phase 3 - Varies | | | |
|------------------|---|------------------------|------------------------|
| Item | Description | Option 3 | Option 3 |
| 11.0 | Aertation Tank and Clarifier - Year (2063) | \$ 4,253,000 | \$ 4,253,000 |
| 11.1 | General requirement includes (overhead, indirect cost, contractor profit, mobilization and demobilization and temporary work at 25% of project value) | \$ 851,000 | \$ 851,000 |
| 11.2 | Site Civil, Access Road, and Landscaping | \$ 339,000 | \$ 339,000 |
| 11.3 | Fine bubble diffusers and air pipes | \$ 460,000 | \$ 460,000 |
| 11.4 | Mixer | \$ 72,000 | \$ 72,000 |
| 11.5 | Clarifier Mechanism | \$ 686,000 | \$ 686,000 |
| 11.6 | RAS/WAS pumping | \$ 252,000 | \$ 252,000 |
| 11.7 | RAS/WAS Valves and Pipes | \$ 200,000 | \$ 200,000 |
| 11.8 | Structural | \$ 1,161,000 | \$ 1,161,000 |
| 11.9 | Plumbing | \$ 50,000 | \$ 50,000 |
| 11.10 | Electrical | \$ 182,000 | \$ 182,000 |
| | Capital Costs | \$ 4,253,000.00 | \$ 4,253,000.00 |
| | Engineering and Contingencies (40%) | \$ 1,702,000 | \$ 1,702,000 |
| | Total Capital Costs | \$ 5,955,000 | \$ 5,955,000 |

| | | |
|------------------------------------|-------------------|-----|
| Equalization Tank Operating Hours | hrs/year | 500 |
| Effluent Pumps Operating Hours | hrs/year | 80 |
| kWh cost | \$/kWh | 0.1 |
| Yearly Heating & Ventilation Cost | \$/m ² | 13 |
| Repair and Annual Replacement Cost | | 2% |
| Soda Ash Cost | \$/kg | 1 |

| Description | Units | Equalization Mixing | Equalization Tank pumps | Cloth Media Filter | Backwash pumps | Fourth Clarifier pumps | Effluent pumps | Effluent filtration package | Heating & Ventilation | | pH Adjusting |
|---|--|---------------------|-------------------------|--------------------|----------------|------------------------|----------------|-----------------------------|-----------------------|-----------------|--------------|
| | | | | | | | | | Chemical Building | Filter Building | |
| Rated power/unit | hp | 5 | 60 | 1.5 | 15 | 3 | 150 | 5 | | | |
| Flow/unit | m ³ /hr | | 1000 | | 200 | 42 | 1523 | | | | |
| Head | m | | 5 | | 8 | | 19.1 | | | | |
| Efficiency | | 90% | 75% | 90% | 75% | 90% | 75% | 75% | | | |
| Power consumed per unit | kWh | 4.1 | 18.2 | 1.2 | 5.8 | 2.5 | 105.7 | 5.0 | | | |
| Building area | m ² | | | | | | | | 100 | 150 | |
| Operation | hrs/year | 500 | 500 | 8760 | 730 | 8760 | 80 | 2000 | 8760 | 8760 | |
| Annual Power | kWh/year | 2,072 | 9,083 | 10,892 | 4,244 | 21,783 | 8,455 | 9,947 | | | |
| Annual Power Cost/Unit \$ | \$ | 207 | 908 | 1089 | 424 | 2178 | 846 | 995 | 1300 | 1950 | |
| Design average flow (2043) | MLD | | | | | | | | | | 22 |
| Estimated required alkalinity | mg/L as CaCO ₃ | | | | | | | | | | 50.0 |
| Alkalinity gain | mg/L per mg/L of Na ₂ CO ₃ | | | | | | | | | | 0.9 |
| Sodium hypochlorite system | | | | | | | | | | | |
| Concentration | | | | | | | | | | | 100% |
| Dose | mg/L | | | | | | | | | | 55.6 |
| Consumption | liter/year | | | | | | | | | | 446,147 |
| Annual Chemical Cost | \$ | | | | | | | | | | 446,147 |
| Mechanical capital cost | \$ | 525,000 | 165,000 | | 50,000 | 800,000 | 600,000 | | | | |
| Number of units | | 6 | 2 | 3 | 2 | 1 | 3 | 1 | | | |
| Repairs and annual filter replacement cost (2% of mechanical cost)/unit | \$ | 1,750 | 1,650 | 7,900 | 500 | 16,000 | 4,000 | 2,500 | | | |

Cloth media disk filter cost includes \$6510/filter/year unit, calculated based on replacing the filter media every 20 years

| Option 3 Operating Cost | | | | | | | | | | | | | | | | | | | |
|-------------------------|--------------|---------------------|------------|-------------|-------------------------|------------|-------------|--------------------|------------|-------------|----------------|------------|-------------|----------------|------------|-------------|-----------------|-------------------------------------|------------|
| Year | Average Flow | Equalization Mixing | | | Equalization Tank pumps | | | Cloth Media Filter | | | Backwash pumps | | | Effluent pumps | | | HVAC | Repairs and annual replacement cost | Total Cost |
| | | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Filter Building | | |
| 2018 | 15.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2019 | 16.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2020 | 16.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2021 | 16.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2022 | 17.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2023 | 17.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2024 | 17.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2025 | 17.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2026 | 18.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2027 | 18.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2028 | 18.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2029 | 18.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2030 | 19.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2031 | 19.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2032 | 19.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2033 | 19.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2034 | 20.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 3 | 2 | 2,178 | 2 | 1 | 424 | | | | 1950 | 42,000 | 49,119 |
| 2035 | 20.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2036 | 20.6 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2037 | 20.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2038 | 21.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2039 | 21.4 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2040 | 21.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2041 | 22.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2042 | 22.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2043 | 22.6 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | | | | 1950 | 58,300 | 68,021 |
| 2044 | 22.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2045 | 23.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2046 | 23.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2047 | 23.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2048 | 24.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2049 | 24.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2050 | 24.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2051 | 25.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2052 | 25.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2053 | 25.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2054 | 26.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2055 | 26.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2056 | 26.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2057 | 27.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2058 | 27.6 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2059 | 28.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2060 | 28.4 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2061 | 28.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2062 | 29.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2063 | 29.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2064 | 29.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2065 | 30.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |
| 2066 | 30.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 5 | 4 | 4,357 | 3 | 2 | 849 | 3 | 2 | 1,691 | 1950 | 70,300 | 81,713 |

Average Annual Cost (Rounded 000) 68,000

| Option 3 Operating Cost | | | | | | | | | | | | | | | | | | | |
|-------------------------|--------------|---------------------|------------|-------------|-------------------------|------------|-------------|--------------------|------------|-------------|-----------------------------|------------|-------------|----------------|------------|-------------|-----------------|-------------------------------------|------------|
| Year | Average Flow | Equalization Mixing | | | Equalization Tank pumps | | | Cloth Media Filter | | | Backwash pumps | | | Effluent pumps | | | HVAC | Repairs and annual replacement cost | Total Cost |
| | | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Filter Building | | |
| Option 9 Operating Cost | | | | | | | | | | | | | | | | | | | |
| Year | Average Flow | Equalization Mixing | | | Equalization Tank pumps | | | Fourth Clarifier | | | Effluent Filtration package | | | Effluent Pumps | | | HVAC | Repairs and annual replacement cost | Total Cost |
| | | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Total units | Duty units | Yearly Cost | Filter Building | | |
| 2018 | 15.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2019 | 16.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2020 | 16.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2021 | 16.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2022 | 17.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2023 | 17.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2024 | 17.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2025 | 17.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2026 | 18.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2027 | 18.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2028 | 18.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2029 | 18.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2030 | 19.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2031 | 19.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2032 | 19.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2033 | 19.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2034 | 20.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2035 | 20.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2036 | 20.6 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2037 | 20.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2038 | 21.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2039 | 21.4 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2040 | 21.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2041 | 22.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2042 | 22.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2043 | 22.6 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | | | | 1950 | 35,800 | 43,489 |
| 2044 | 22.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2045 | 23.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2046 | 23.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2047 | 23.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2048 | 24.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2049 | 24.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2050 | 24.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2051 | 25.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2052 | 25.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2053 | 25.8 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2054 | 26.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2055 | 26.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2056 | 26.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2057 | 27.2 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2058 | 27.6 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2059 | 28.0 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2060 | 28.4 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2061 | 28.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2062 | 29.1 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2063 | 29.5 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2064 | 29.9 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2065 | 30.3 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |
| 2066 | 30.7 | 8 | 8 | 1,658 | 2 | 1 | 908 | 1 | 1 | 2,178 | 1 | 1 | 995 | 3 | 2 | 1,691 | 1950 | 47,800 | 57,180 |

Average Annual Cost (Rounded 000) 50,000

Net Present Value Calculation

NPV Basis

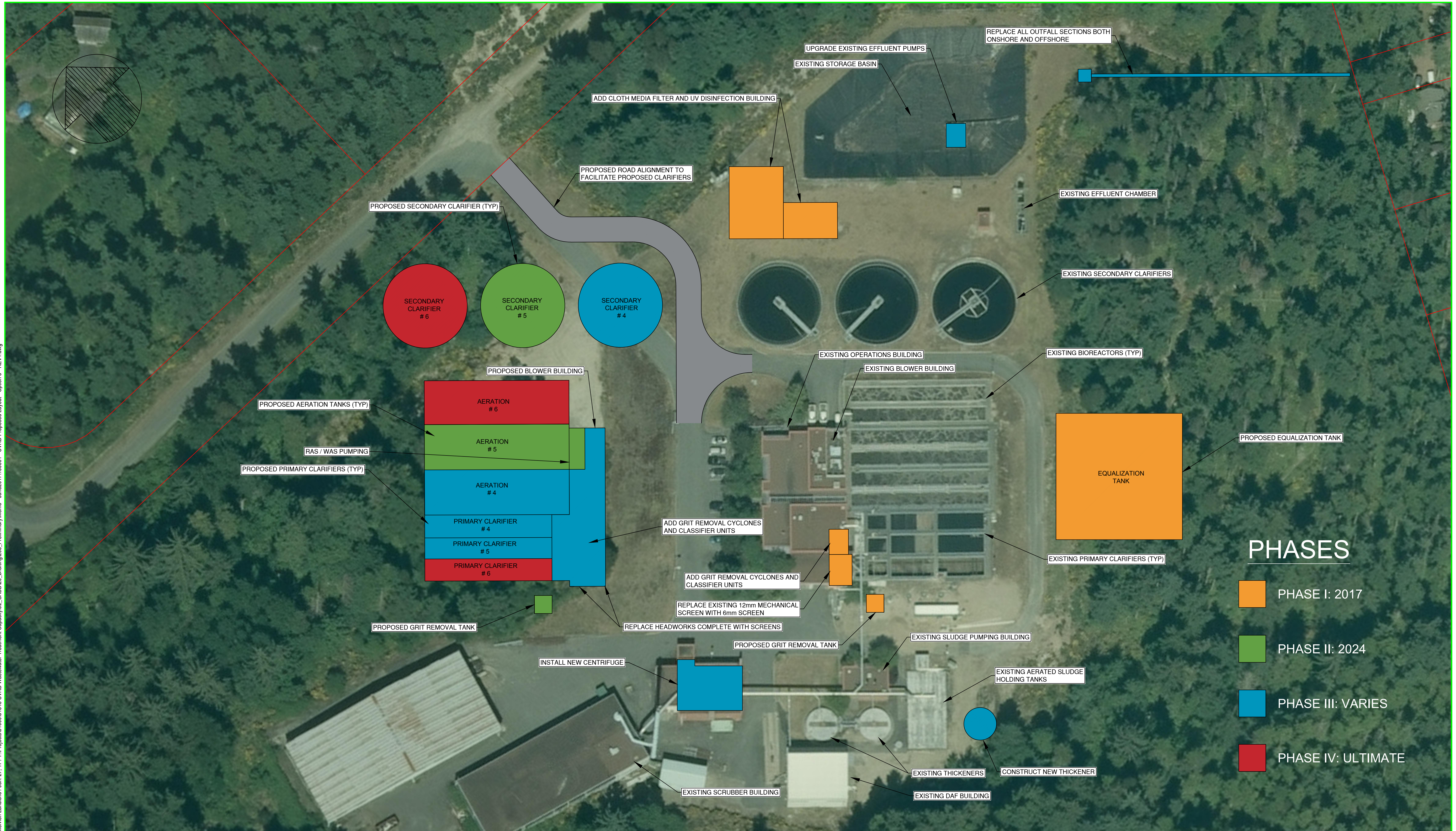
Discount rate = 0.04
 Inflation = 2%

| Project Year | Option 3 | | | | Option 9 | | | | Inflation Factor 2% | |
|--------------|--------------|---------------|------------|---------------|---------------|---------------|------------|---------------|---------------------|------|
| | Capital Cost | O&M Cost | Total Cost | Inflated Cost | Capital Cost | O&M Cost | Total Cost | Inflated Cost | | |
| 2017 | 1 | \$ 15,489,000 | | \$ 15,489,000 | \$ 15,798,780 | \$ 12,327,000 | | \$ 12,327,000 | \$ 12,573,540 | 1.02 |
| 2018 | 2 | | \$ 49,119 | \$ 49,119 | \$ 51,103 | | \$ 43,489 | \$ 43,489 | \$ 45,246 | 1.04 |
| 2019 | 3 | | \$ 49,119 | \$ 49,119 | \$ 52,125 | | \$ 43,489 | \$ 43,489 | \$ 46,151 | 1.06 |
| 2020 | 4 | | \$ 49,119 | \$ 49,119 | \$ 53,168 | | \$ 43,489 | \$ 43,489 | \$ 47,074 | 1.08 |
| 2021 | 5 | | \$ 49,119 | \$ 49,119 | \$ 54,231 | | \$ 43,489 | \$ 43,489 | \$ 48,015 | 1.10 |
| 2022 | 6 | | \$ 49,119 | \$ 49,119 | \$ 55,316 | | \$ 43,489 | \$ 43,489 | \$ 48,976 | 1.13 |
| 2023 | 7 | | \$ 49,119 | \$ 49,119 | \$ 56,422 | | \$ 43,489 | \$ 43,489 | \$ 49,955 | 1.15 |
| 2024 | 8 | \$ 6,610,000 | \$ 49,119 | \$ 6,659,119 | \$ 7,802,219 | \$ 6,610,000 | \$ 43,489 | \$ 6,653,489 | \$ 7,795,623 | 1.17 |
| 2025 | 9 | | \$ 49,119 | \$ 49,119 | \$ 58,702 | | \$ 43,489 | \$ 43,489 | \$ 51,973 | 1.20 |
| 2026 | 10 | | \$ 49,119 | \$ 49,119 | \$ 59,876 | | \$ 43,489 | \$ 43,489 | \$ 53,013 | 1.22 |
| 2027 | 11 | | \$ 49,119 | \$ 49,119 | \$ 61,073 | | \$ 43,489 | \$ 43,489 | \$ 54,073 | 1.24 |
| 2028 | 12 | | \$ 49,119 | \$ 49,119 | \$ 62,295 | | \$ 43,489 | \$ 43,489 | \$ 55,155 | 1.27 |
| 2029 | 13 | | \$ 49,119 | \$ 49,119 | \$ 63,540 | | \$ 43,489 | \$ 43,489 | \$ 56,258 | 1.29 |
| 2030 | 14 | | \$ 49,119 | \$ 49,119 | \$ 64,811 | | \$ 43,489 | \$ 43,489 | \$ 57,383 | 1.32 |
| 2031 | 15 | \$ 19,529,000 | \$ 49,119 | \$ 19,578,119 | \$ 26,349,570 | \$ 19,529,000 | \$ 43,489 | \$ 19,572,489 | \$ 26,341,993 | 1.35 |
| 2032 | 16 | | \$ 49,119 | \$ 49,119 | \$ 67,430 | | \$ 43,489 | \$ 43,489 | \$ 59,701 | 1.37 |
| 2033 | 17 | \$ 10,712,000 | \$ 49,119 | \$ 10,761,119 | \$ 15,068,164 | \$ 10,712,000 | \$ 43,489 | \$ 10,755,489 | \$ 15,060,281 | 1.40 |
| 2034 | 18 | \$ 2,463,000 | \$ 49,119 | \$ 2,512,119 | \$ 3,587,924 | \$ - | \$ 43,489 | \$ 43,489 | \$ 62,113 | 1.43 |
| 2035 | 19 | | \$ 68,021 | \$ 68,021 | \$ 99,094 | | \$ 43,489 | \$ 43,489 | \$ 63,355 | 1.46 |
| 2036 | 20 | | \$ 68,021 | \$ 68,021 | \$ 101,076 | | \$ 43,489 | \$ 43,489 | \$ 64,623 | 1.49 |
| 2037 | 21 | | \$ 68,021 | \$ 68,021 | \$ 103,098 | | \$ 43,489 | \$ 43,489 | \$ 65,915 | 1.52 |
| 2038 | 22 | | \$ 68,021 | \$ 68,021 | \$ 105,160 | | \$ 43,489 | \$ 43,489 | \$ 67,233 | 1.55 |
| 2039 | 23 | | \$ 68,021 | \$ 68,021 | \$ 107,263 | | \$ 43,489 | \$ 43,489 | \$ 68,578 | 1.58 |
| 2040 | 24 | | \$ 68,021 | \$ 68,021 | \$ 109,408 | | \$ 43,489 | \$ 43,489 | \$ 69,949 | 1.61 |
| 2041 | 25 | | \$ 68,021 | \$ 68,021 | \$ 111,596 | | \$ 43,489 | \$ 43,489 | \$ 71,348 | 1.64 |
| 2042 | 26 | | \$ 68,021 | \$ 68,021 | \$ 113,828 | | \$ 43,489 | \$ 43,489 | \$ 72,775 | 1.67 |
| 2043 | 27 | \$ 2,492,000 | \$ 68,021 | \$ 2,560,021 | \$ 4,369,666 | \$ 2,492,000 | \$ 43,489 | \$ 2,535,489 | \$ 4,327,792 | 1.71 |
| 2044 | 28 | | \$ 81,713 | \$ 81,713 | \$ 142,264 | | \$ 57,180 | \$ 57,180 | \$ 99,552 | 1.74 |
| 2045 | 29 | \$ 2,667,000 | \$ 81,713 | \$ 2,748,713 | \$ 4,881,287 | \$ 2,667,000 | \$ 57,180 | \$ 2,724,180 | \$ 4,837,721 | 1.78 |
| 2046 | 30 | | \$ 81,713 | \$ 81,713 | \$ 148,011 | | \$ 57,180 | \$ 57,180 | \$ 103,574 | 1.81 |
| 2047 | 31 | | \$ 81,713 | \$ 81,713 | \$ 150,971 | | \$ 57,180 | \$ 57,180 | \$ 105,645 | 1.85 |
| 2048 | 32 | | \$ 81,713 | \$ 81,713 | \$ 153,991 | | \$ 57,180 | \$ 57,180 | \$ 107,758 | 1.88 |
| 2049 | 33 | | \$ 81,713 | \$ 81,713 | \$ 157,070 | | \$ 57,180 | \$ 57,180 | \$ 109,913 | 1.92 |
| 2050 | 34 | | \$ 81,713 | \$ 81,713 | \$ 160,212 | | \$ 57,180 | \$ 57,180 | \$ 112,112 | 1.96 |
| 2051 | 35 | | \$ 81,713 | \$ 81,713 | \$ 163,416 | | \$ 57,180 | \$ 57,180 | \$ 114,354 | 2.00 |
| 2052 | 36 | | \$ 81,713 | \$ 81,713 | \$ 166,684 | | \$ 57,180 | \$ 57,180 | \$ 116,641 | 2.04 |
| 2053 | 37 | | \$ 81,713 | \$ 81,713 | \$ 170,018 | | \$ 57,180 | \$ 57,180 | \$ 118,974 | 2.08 |
| 2054 | 38 | | \$ 81,713 | \$ 81,713 | \$ 173,418 | | \$ 57,180 | \$ 57,180 | \$ 121,353 | 2.12 |
| 2055 | 39 | | \$ 81,713 | \$ 81,713 | \$ 176,887 | | \$ 57,180 | \$ 57,180 | \$ 123,780 | 2.16 |
| 2056 | 40 | \$ 1,501,000 | \$ 81,713 | \$ 1,582,713 | \$ 3,494,692 | \$ 1,501,000 | \$ 57,180 | \$ 1,558,180 | \$ 3,440,524 | 2.21 |
| 2057 | 41 | | \$ 81,713 | \$ 81,713 | \$ 184,033 | | \$ 57,180 | \$ 57,180 | \$ 128,781 | 2.25 |
| 2058 | 42 | | \$ 81,713 | \$ 81,713 | \$ 187,714 | | \$ 57,180 | \$ 57,180 | \$ 131,357 | 2.30 |
| 2059 | 43 | | \$ 81,713 | \$ 81,713 | \$ 191,468 | | \$ 57,180 | \$ 57,180 | \$ 133,984 | 2.34 |
| 2060 | 44 | \$ 1,666,000 | \$ 81,713 | \$ 1,747,713 | \$ 4,177,126 | \$ 1,666,000 | \$ 57,180 | \$ 1,723,180 | \$ 4,118,492 | 2.39 |
| 2061 | 45 | | \$ 81,713 | \$ 81,713 | \$ 199,203 | | \$ 57,180 | \$ 57,180 | \$ 139,397 | 2.44 |
| 2062 | 46 | | \$ 81,713 | \$ 81,713 | \$ 203,187 | | \$ 57,180 | \$ 57,180 | \$ 142,185 | 2.49 |
| 2063 | 47 | \$ 5,955,000 | \$ 81,713 | \$ 6,036,713 | \$ 15,311,177 | \$ 5,955,000 | \$ 57,180 | \$ 6,012,180 | \$ 15,248,954 | 2.54 |
| 2064 | 48 | | \$ 81,713 | \$ 81,713 | \$ 211,396 | | \$ 57,180 | \$ 57,180 | \$ 147,929 | 2.59 |
| 2065 | 49 | | \$ 81,713 | \$ 81,713 | \$ 215,624 | | \$ 57,180 | \$ 57,180 | \$ 150,888 | 2.64 |
| 2066 | 50 | | \$ 81,713 | \$ 81,713 | \$ 219,937 | | \$ 57,180 | \$ 57,180 | \$ 153,905 | 2.69 |
| | | \$ 69,084,000 | \$ 67,890 | NPV | \$ 53,636,504 | \$ 63,459,000 | \$ 49,916 | NPV | \$ 48,311,441 | |

Appendix B
Drawings

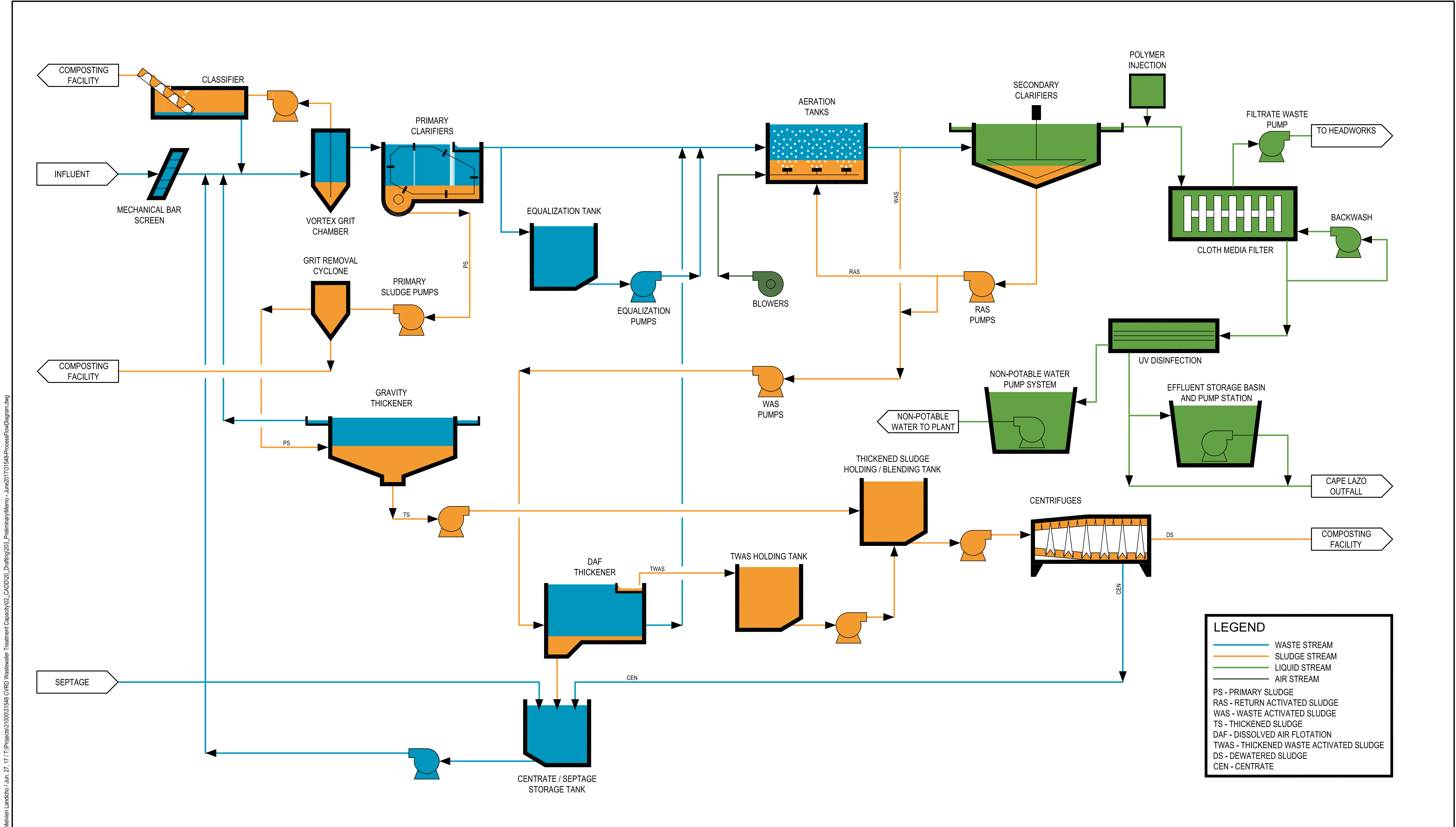


Melvin Landicho / Jun. 27, 17 / T:\Projects\31000\31548 CVRD Wastewater Treatment Capacity\02_CADD\00_Drawing\03_Preliminary\Memo - June2017\160901 - CVRD Proposed Layout - Option 3 - REV1.dwg



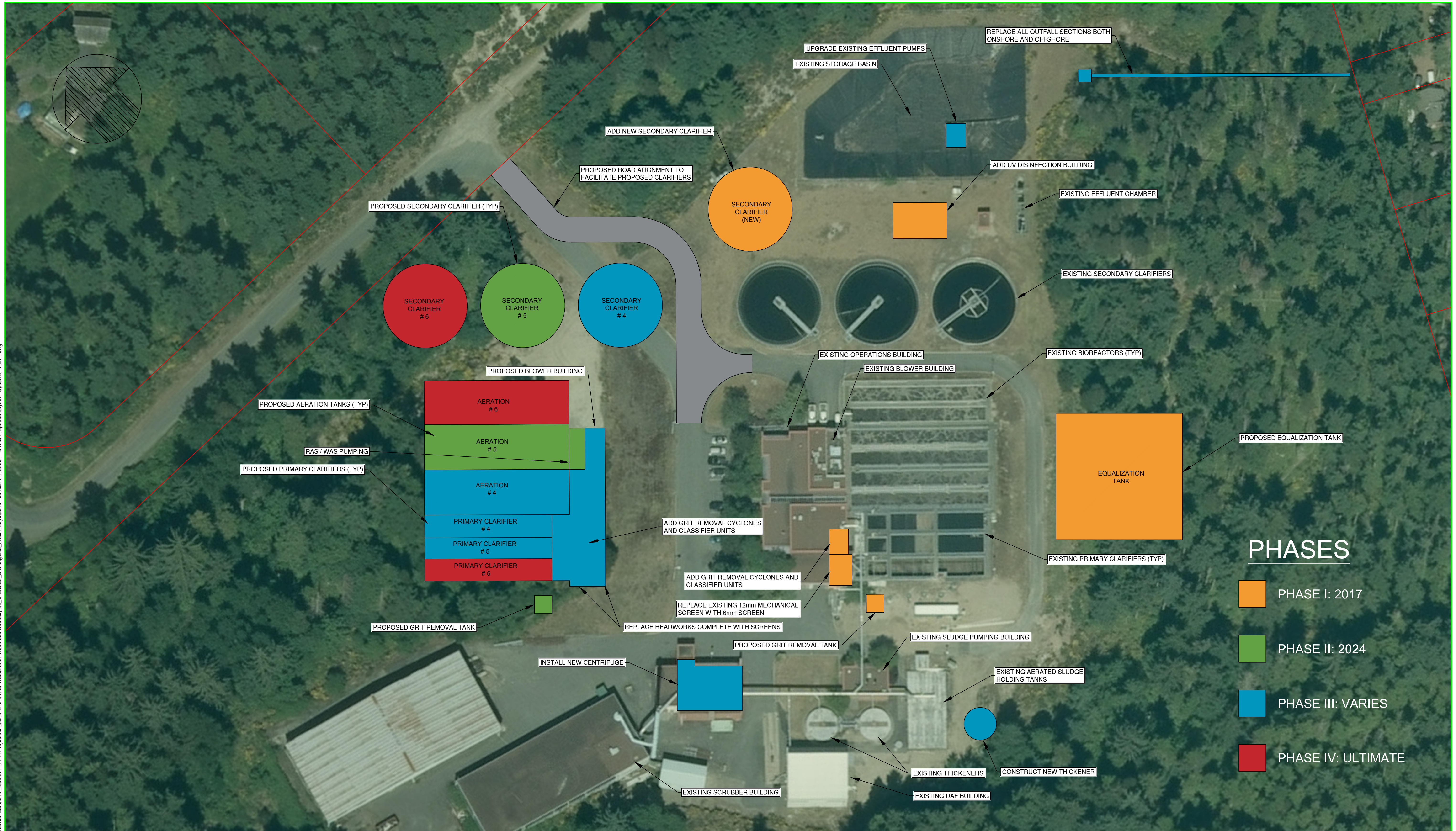
COMOX WWTP
 COMOX VALLEY WATER POLLUTION CONTROL CENTER
 PROPOSED PLANT LAYOUT (OPTION 3)

Figure B.1



Mehlen Landtbo / Jun. 27, 17 / T:\Projects\31000\31548 CVRD Wastewater Treatment Capacity\02_CADD\02_Drafting\03_Preliminary\Memo - June2017\31548-ProcessFlowDiagram.dwg

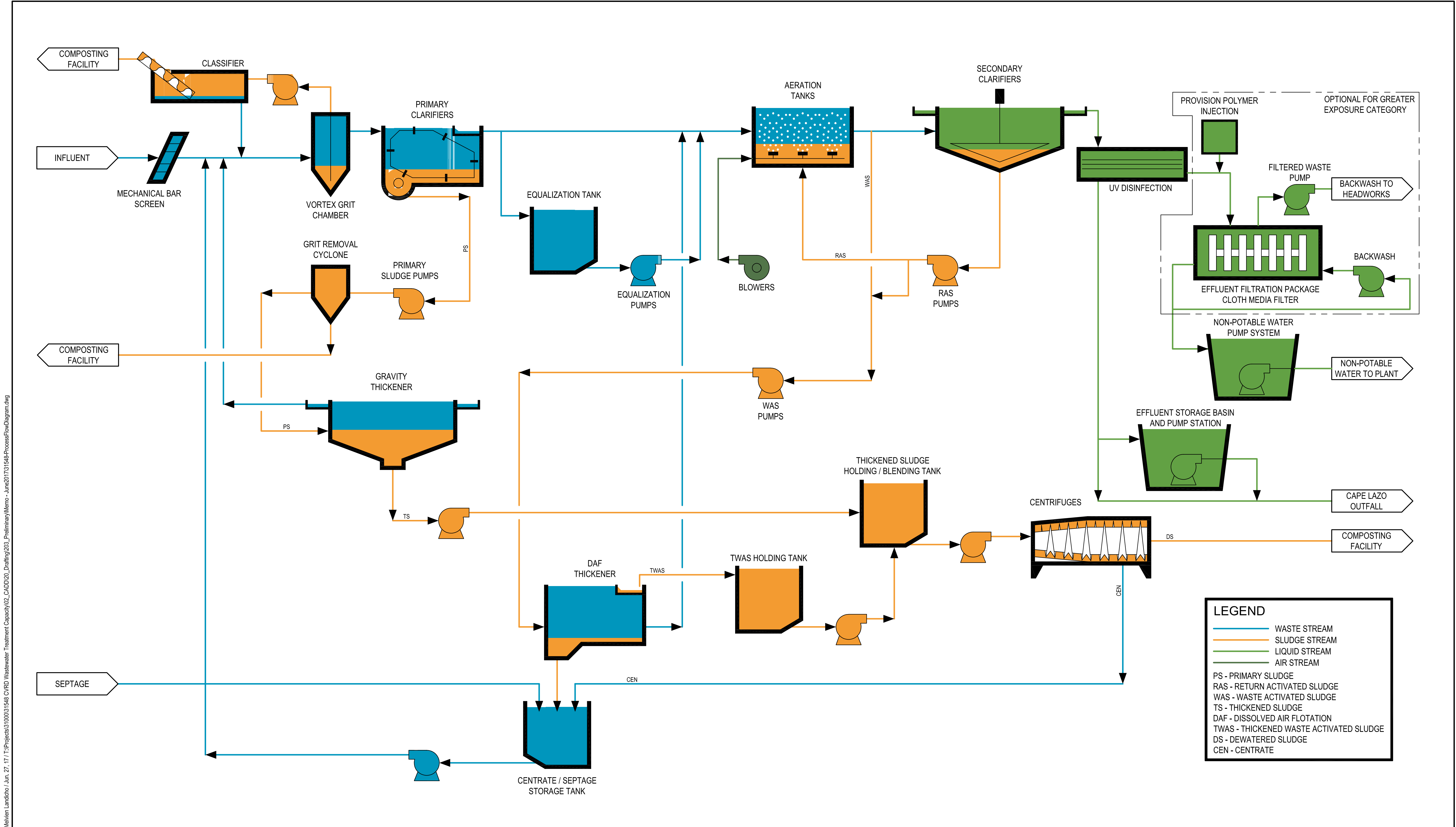
Melvin Landicho / Jun. 27, 17 / T:\Projects\31000\31548 CVRD Wastewater Treatment Capacity\02_CADD\00_Drawing\03_Preliminary\Memo - June2017\160901 - CVRD Proposed Layout - Option 9 - REV1.dwg



COMOX WWTP

COMOX VALLEY WATER POLLUTION CONTROL CENTER PROPOSED PLANT LAYOUT (OPTION 9)

Figure B.3



Mehlen Landabo / Jun. 27, 17 / T:\Projects\31000\31548 CVRD Wastewater Treatment Capacity\02_CADD\20_Drafting\203_Preliminary\Memo - June2017\31548-ProcessFlowDiagram.dwg