# City of Molalla
# Wastewater Treatment Plant Upgrades
# Value Engineering Report
# December 10TH, 2021

UPDATED FEBURARY 11, 2022
WITH IMPLEMENTATION DATA


**Value Engineering Team**
Timothy Buckley, AIA, CVS, LEED AP BD+C, Team Facilitator
Matt Lersch, CCA, BECxP, CxA+BE, ITC, Cost Estimator / Construction Management
Nina Cousins, PE, Civil / Landscape
Kurt Merriman, PE, Geotechnical
Dick Hemmen, PE, SE, Structural
Doug Smith, PE, MBA, VMA, CCP, LEED AP, cSBA, Mechanical/Process Engineer
Ed Fernbach, PE, Wastewater Process Specialist
Dale Richwine, PE, Wastewater Operations Specialist
Sarah Partap, MBA, VMA, VE Project Manager
Cam Iseri, VE Project Coordinator

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# I. EXECUTIVE SUMMARY

## INTRODUCTION

This value engineering (VE) report is presented to City of Molalla and the design team to support decision making at the pre-design phase for the Wastewater Treatment Plant Upgrades project.

The goals for this study were to review the current design concepts and identify potential opportunities for design cost effectiveness and efficiency. The VE team sought to identify site development, planning, and building system alternatives that may offer first cost or life cycle cost benefits and/or improve project quality and reduce construction risks.

The following criteria were described by stakeholders as important project requirements:

- Construction Budget
- Meeting Environmental and Regulatory Standards and Requirements
- Impacts on Plant Maintenance and Operations
- Community Perception
- LEAN Principals
- Future Adaptability
- Schedule
- Adherence to the Master Plan

### Value Engineering Team and Process

The multidisciplinary team was led by a certified value management facilitator and included: geotechnical, civil, structural, waste water process engineering, wastewater operations, mechanical, cost estimating and construction management team members.

At the initial kickoff meeting, City of Molalla and the design team presented their project requirements and basis of planning and design. The VE study team worked together using the formal value methodology. The essential and secondary functions of the project components were identified along with their associated costs, design alternatives were generated, and the most viable alternatives were further developed.

### Substantiate Current Design and Project Requirements

In the process of comparing alternative concepts against the current design, the VE team noted the following planning/design components and owner project requirements that merit strong continued support:

- UV to eliminate chemicals
- Maximize use of ponds

- Flexible secondary process
- Aerobic digestion and dewatering
- Use of existing facility elements to the extent possible

**Value Engineering Proposals**

Key proposals include:
- Location alternatives for the SBR structure
- LEAN scope of phase 1 elements
- Hydraulic gradient
- System alternative considerations for filtration, equalization, treatment, digestion, and disinfection

Success of the formal VE process is not merely measured in terms of the value of cost reductions, but rather in the accepted implementation of all VE proposals and their contributions toward performance improvements in the project as a whole. Performance measures have been developed and standardized by the Cascadia Chapter of SAVE International. The following table summarizes the VE team's proposals relative to these performance measures:

| Performance Measures | Number of Proposals |
|---|---|
| Program | **10** |
| Aesthetics | **0** |
| Facility Preservation | **4** |
| Total Cost of Ownership / LCCA | **11** |
| Environmental Sustainability | **8** |
| Schedule | **8** |
| Constructability | **10** |
| Occupant Comfort, Safety & Performance | **3** |

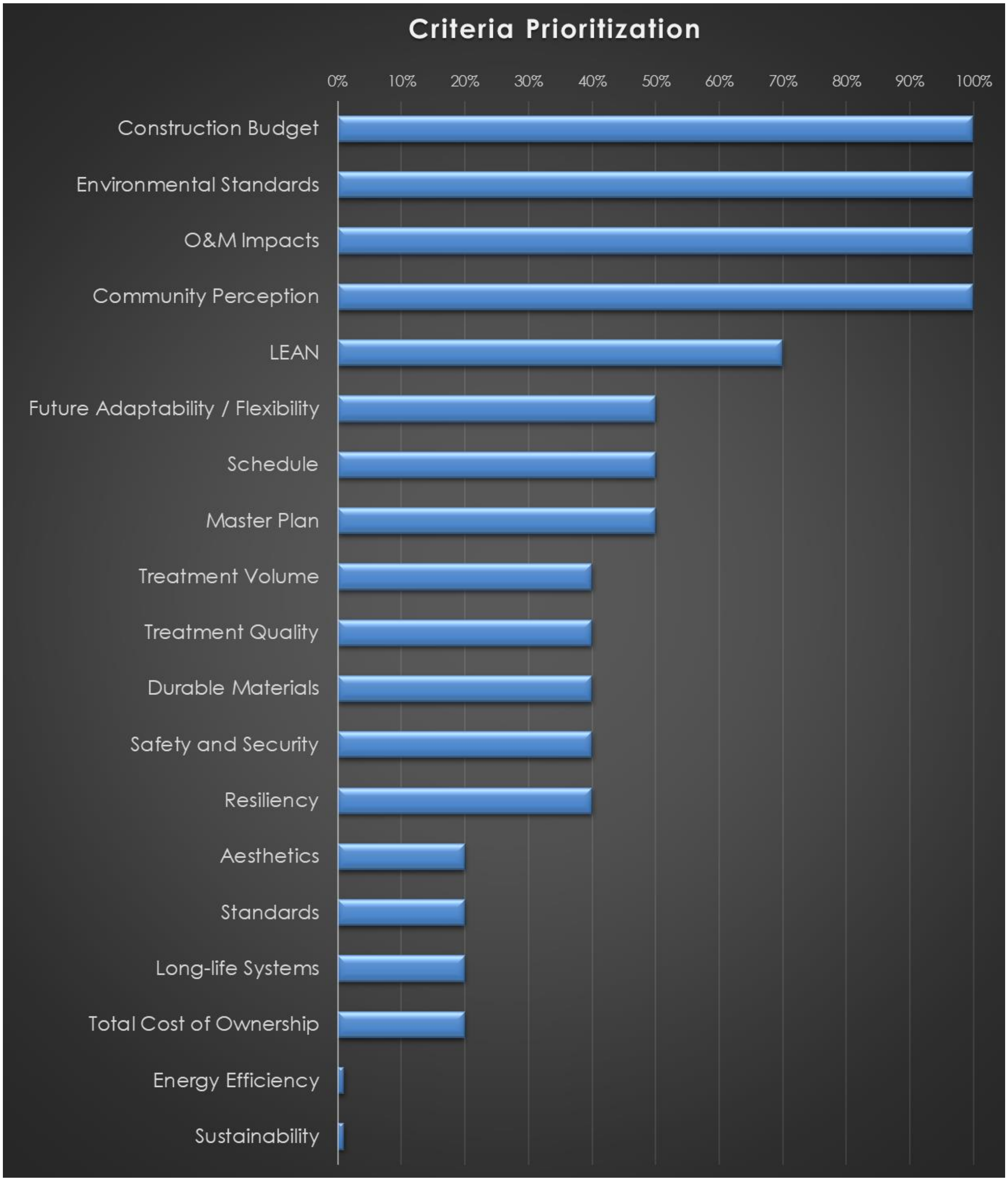
**Summary**

This project is well developed for the pre-design level. Process systems and reasons for accommodating future growth are well defined. However, the current design estimate exceeds the available budget, and cost reductions will be required. The schedule is also critical, as is defining permit requirements right now to avoid unexpected costs or delays if permit requirements are not fully identified moving into design.

A number of alternatives have been identified by the VE team to assist in cost and schedule reduction including site plan and location of elements, and other phase 1 scope elements that can be removed from the project at this time, and easily added in the future to meet future demand.

## Criteria Prioritization

At the VE kickoff meeting, City of Molalla stakeholders were led through a criteria prioritization exercise. This exercise identified criteria that are important to measure the success of the project and allows stakeholders to vote on which criteria are most important or of lower priority to them. The criteria prioritization graph on the following page shows how the various project criteria were weighted by the stakeholders. The VE team used this graph when evaluating and developing proposals to gauge the performance of proposals against project goals.


Criteria Prioritization
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Construction Budget
Environmental Standards
O&M Impacts
Community Perception
LEAN
Future Adaptability / Flexibility
Schedule
Master Plan
Treatment Volume
Treatment Quality
Durable Materials
Safety and Security
Resiliency
Aesthetics
Standards
Long-life Systems
Total Cost of Ownership
Energy Efficiency
Sustainability

# II. PROJECT DESCRIPTION

## PROJECT INFORMATION

| | | |
|---|---|---|
| Cost: | Upgrades | $26,590,000 |
| | Contingency | $ 3,988,500 |
| | **Total** | **$30,578,500** |
| Location: | 12424 Toliver Road<br>Molalla, OR 97038 | |
| Schedule: | Construction | 29 months (May 2023 – October 2025) |
| Delivery Method: | Design-Bid-Build | |
| Building Construction Type: | | Industrial Waste Water Treatment Plant |

**Description:**

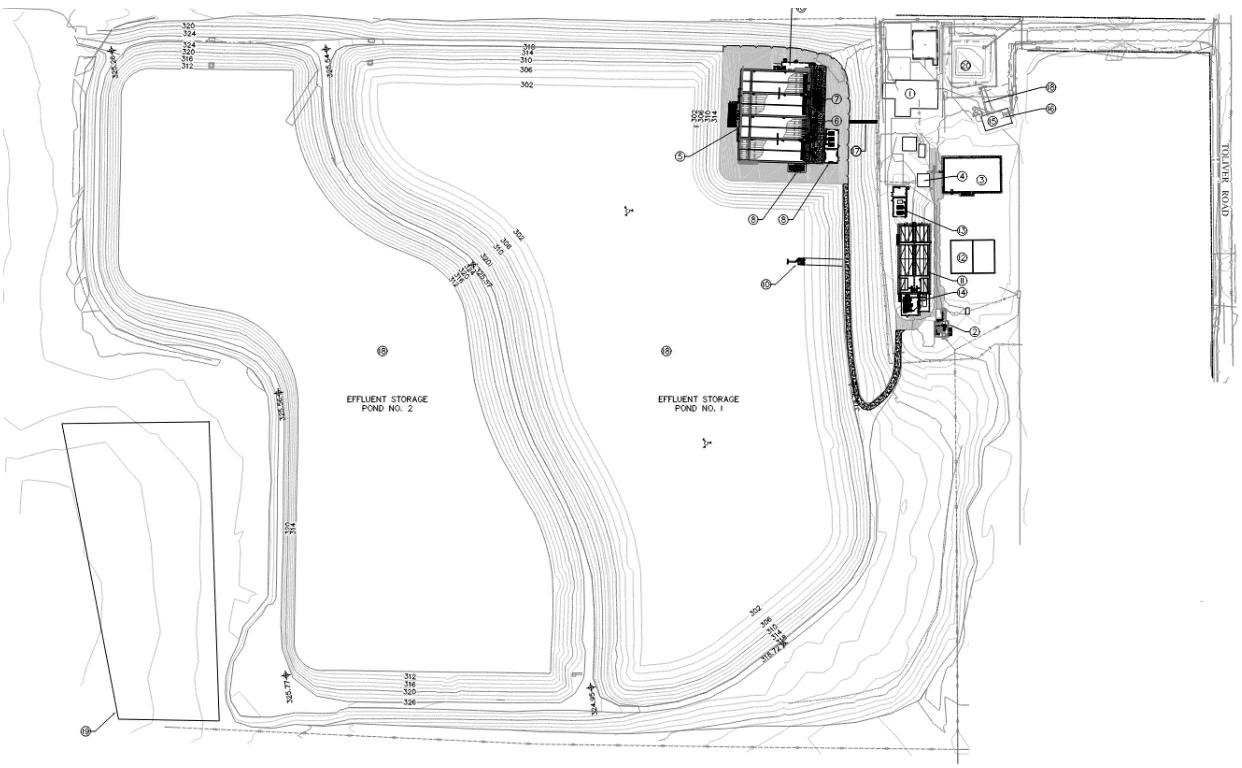
The City of Molalla's existing wastewater treatment plant is being upgraded to accommodate community growth, meet Agency (DEQ) NPDES permit requirements, and to improve function and performance of the entire system. Upgrades to the liquids treatment process includes flow equalization, grit removal, the construction of a new sequencing batch reactor (SBR) process, effluent filtration, and UV disinfection. The existing treatment ponds will be converted to effluent storage ponds for periods when discharge to the river or land application of treated effluent is not possible. New facilities for solids processing include aerobic digestion and dewatering with ultimate solids disposal at a landfill.

This design will provide for discharge of treated effluent to Molalla River during the wet weather season and land application of the treated effluent as a Class C water during the irrigation season. Effluent will be stored in the converted treatment ponds during the shoulder months of May, June, and October when treated effluent cannot be discharged to the river or land applied.

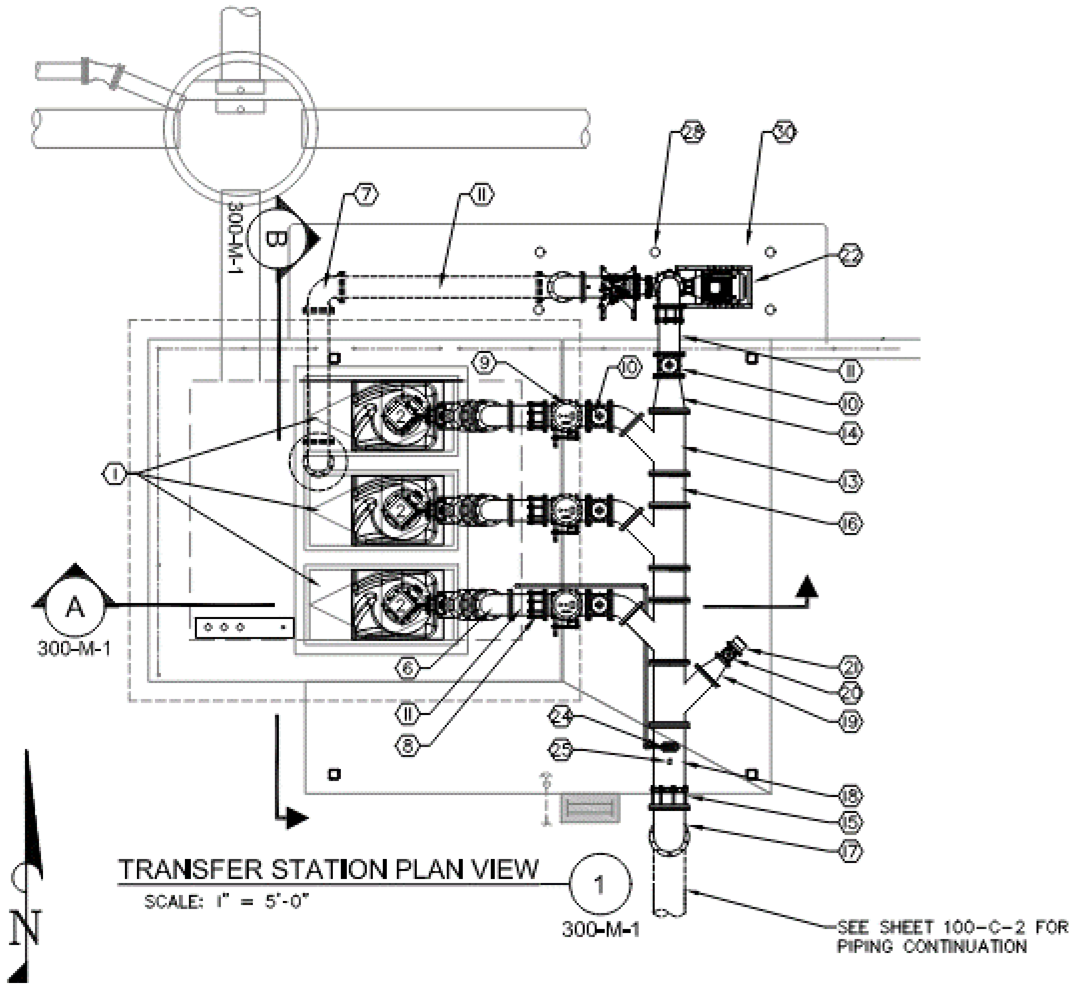
In addition to relining and outfall structure modifications, the plans also call for the location of the new sequencing batch reactor to be in an area of the current treatment pond 2, requiring the construction of a temporary cofferdam to allow construction and infill of a portion of the lagoon for the new structures, and then removal and repairs of the temporary cofferdam.

The design maintains the use of the current headworks, effluent pump station, and existing administration and laboratory facilities.

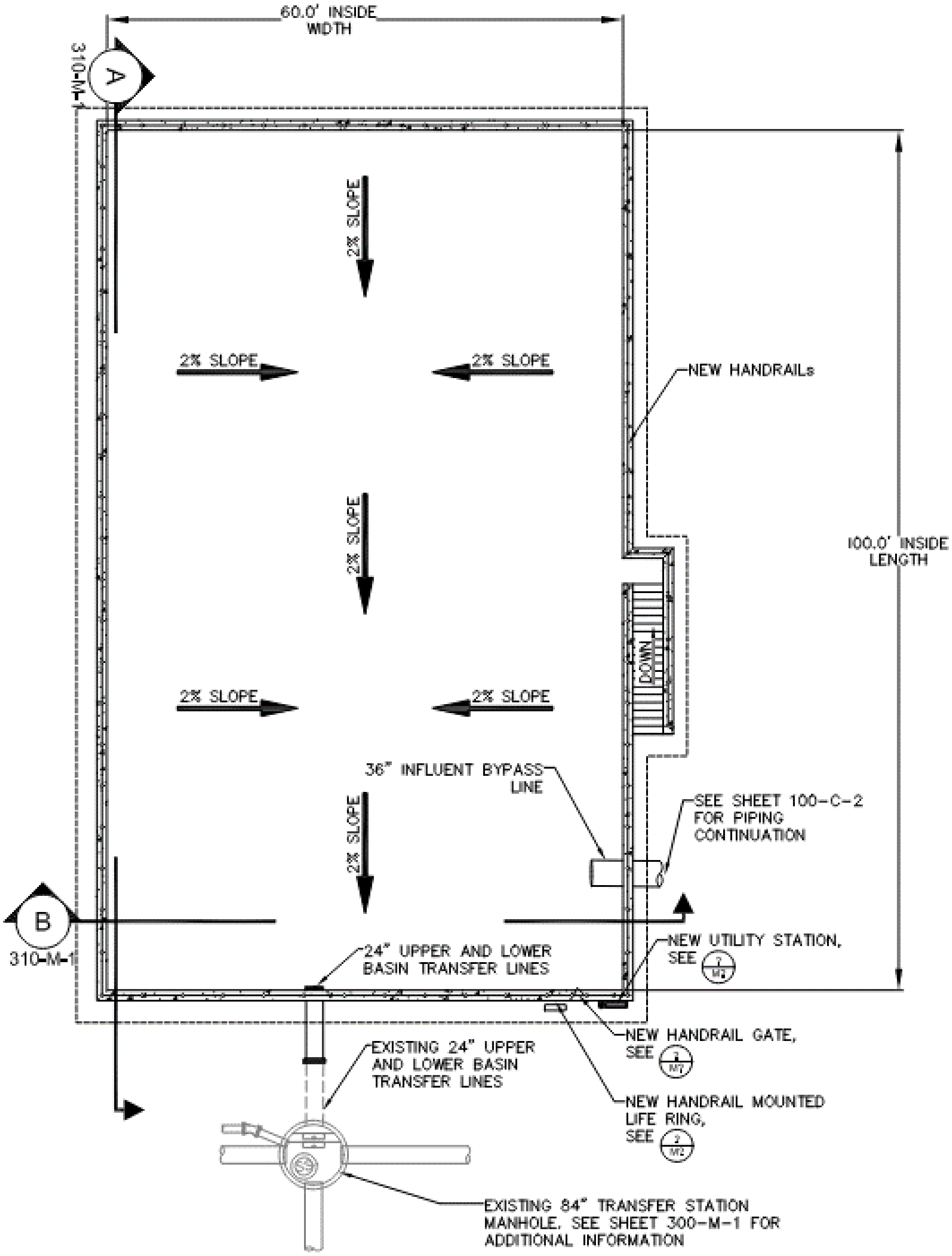
## SITE PLAN


EFFLUENT STORAGE
POND NO. 2
EFFLUENT STORAGE
POND NO. 1
TOLIVER ROAD

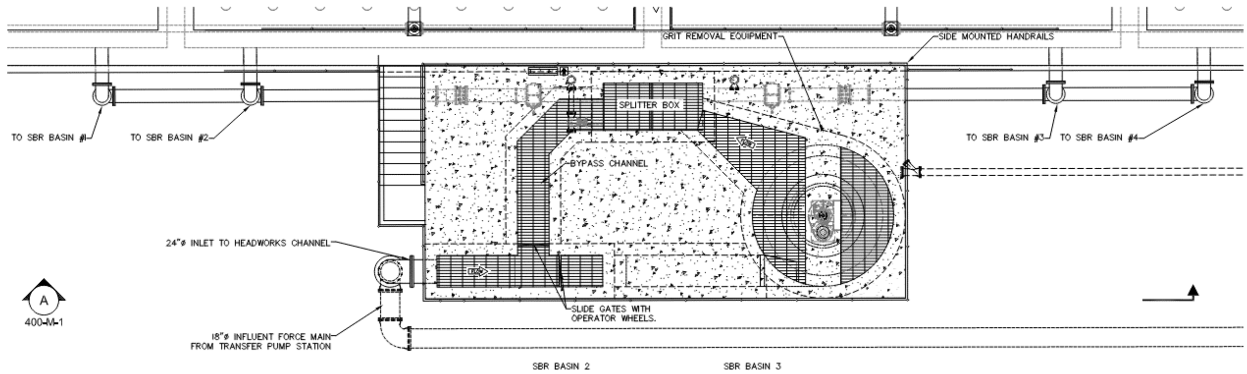
**Transfer Station Plan**



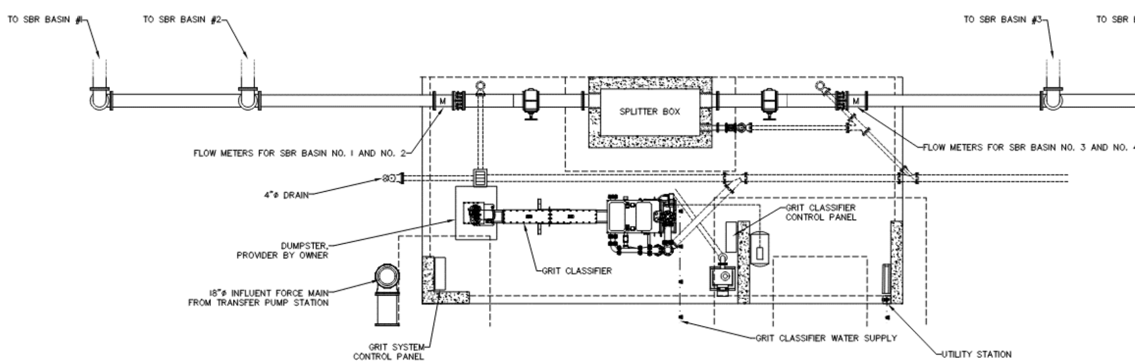
**Equalization Basin Plan**



## Grit Removal Plan

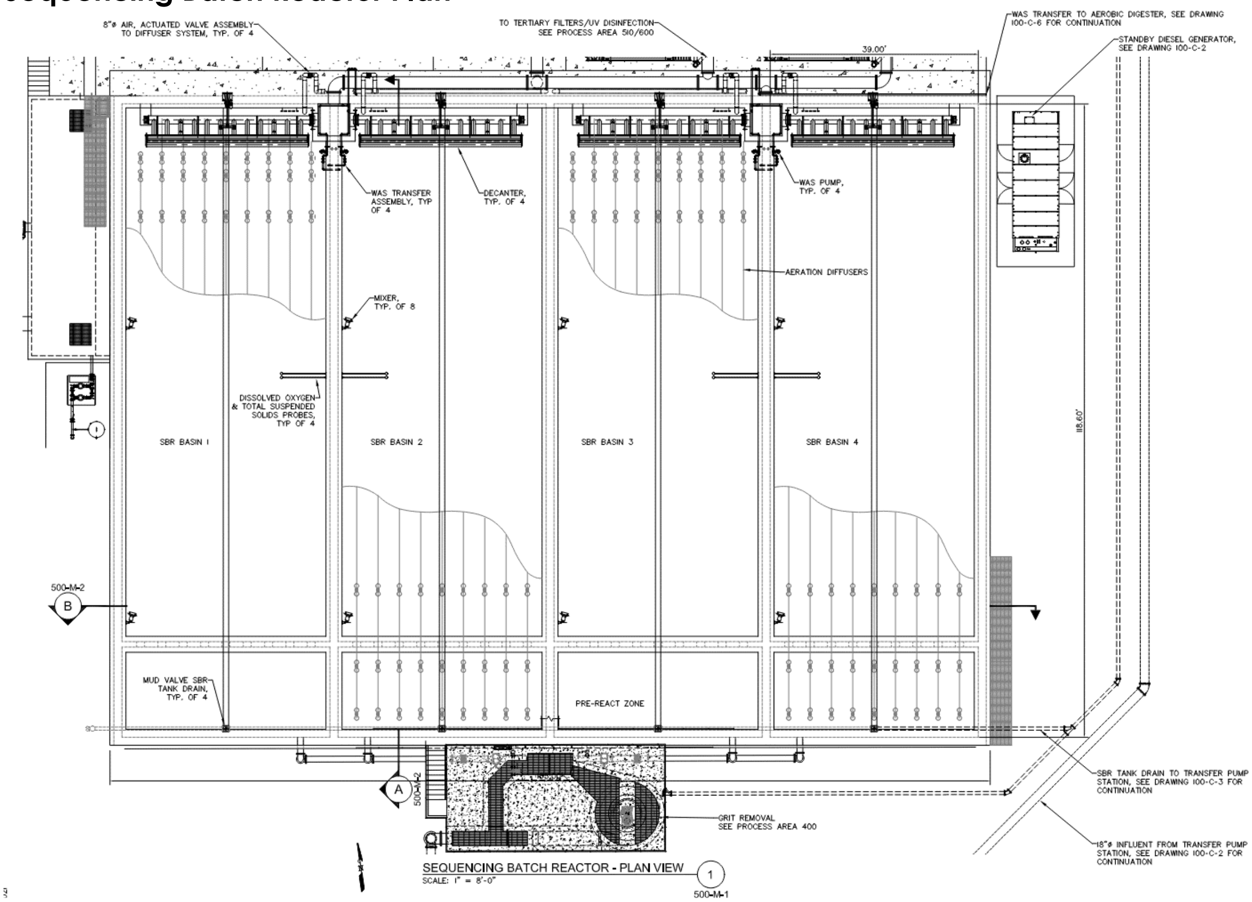



GRIT REMOVAL - UPPER PLAN VIEW
SCALE: 1" - 4'-0"
1
400-M-1

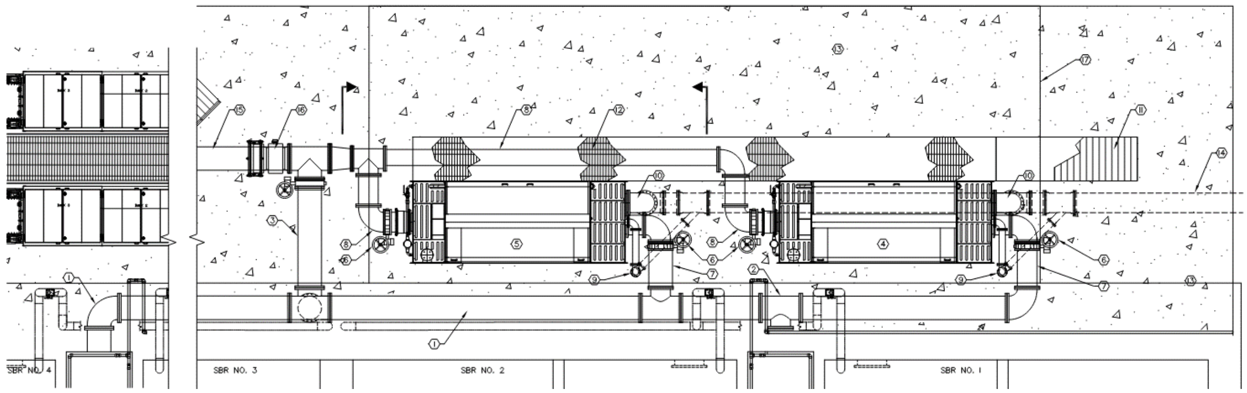



GRIT REMOVAL - LOWER PLAN VIEW
SCALE: 1" - 4'-0"
2
400-M-1

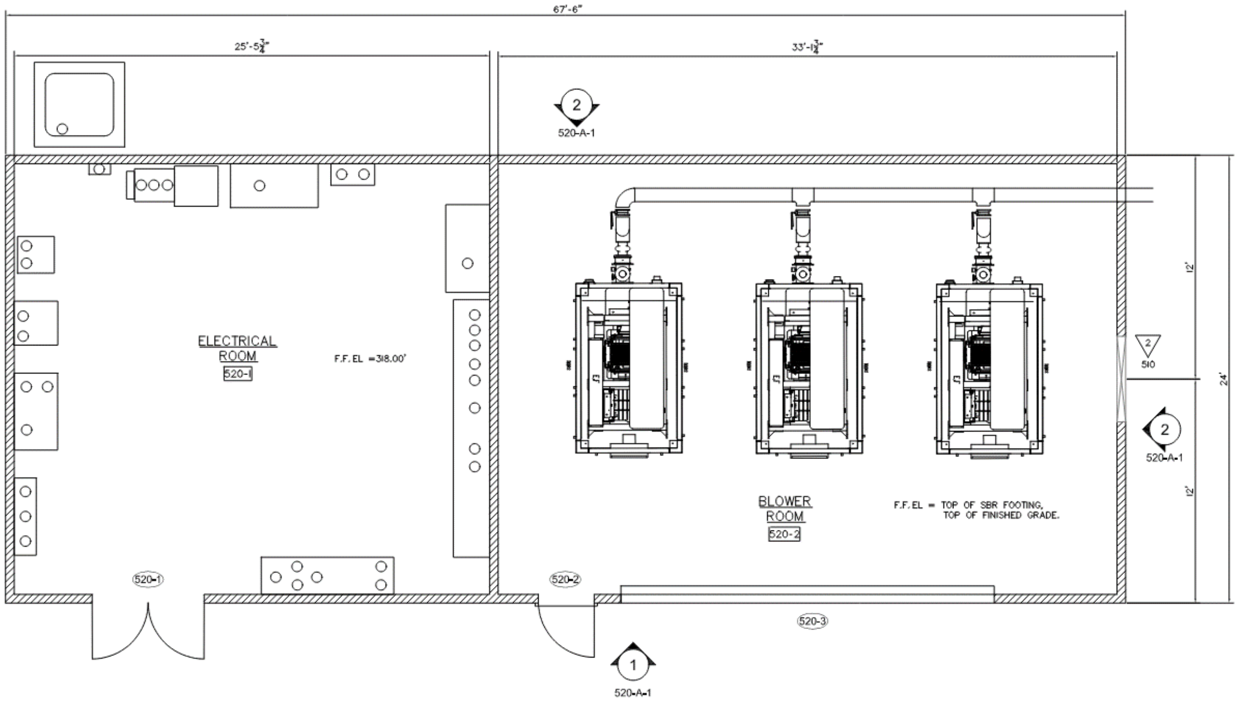
## Sequencing Batch Reactor Plan



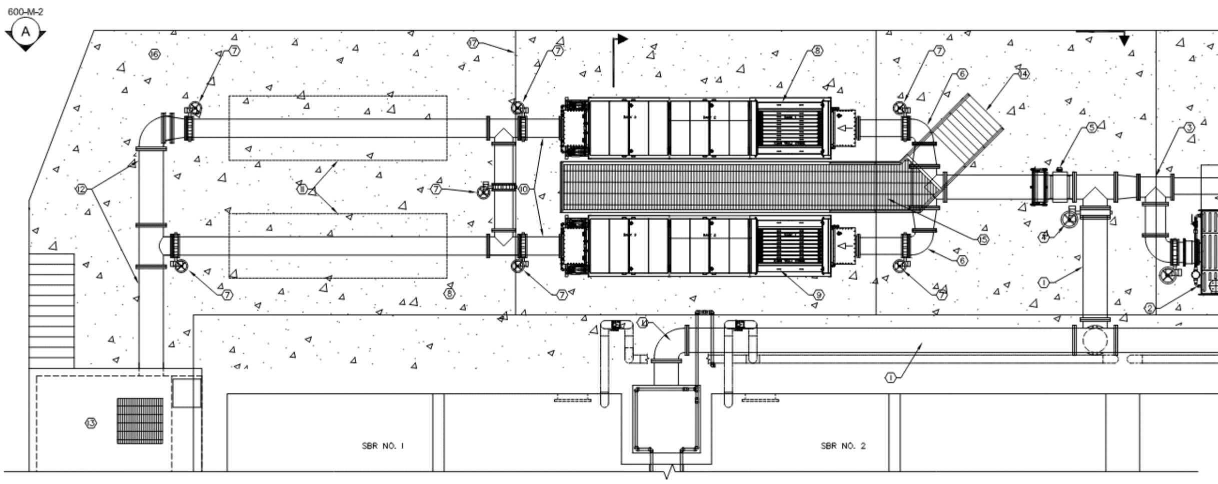
**Effluent Filters Plan**



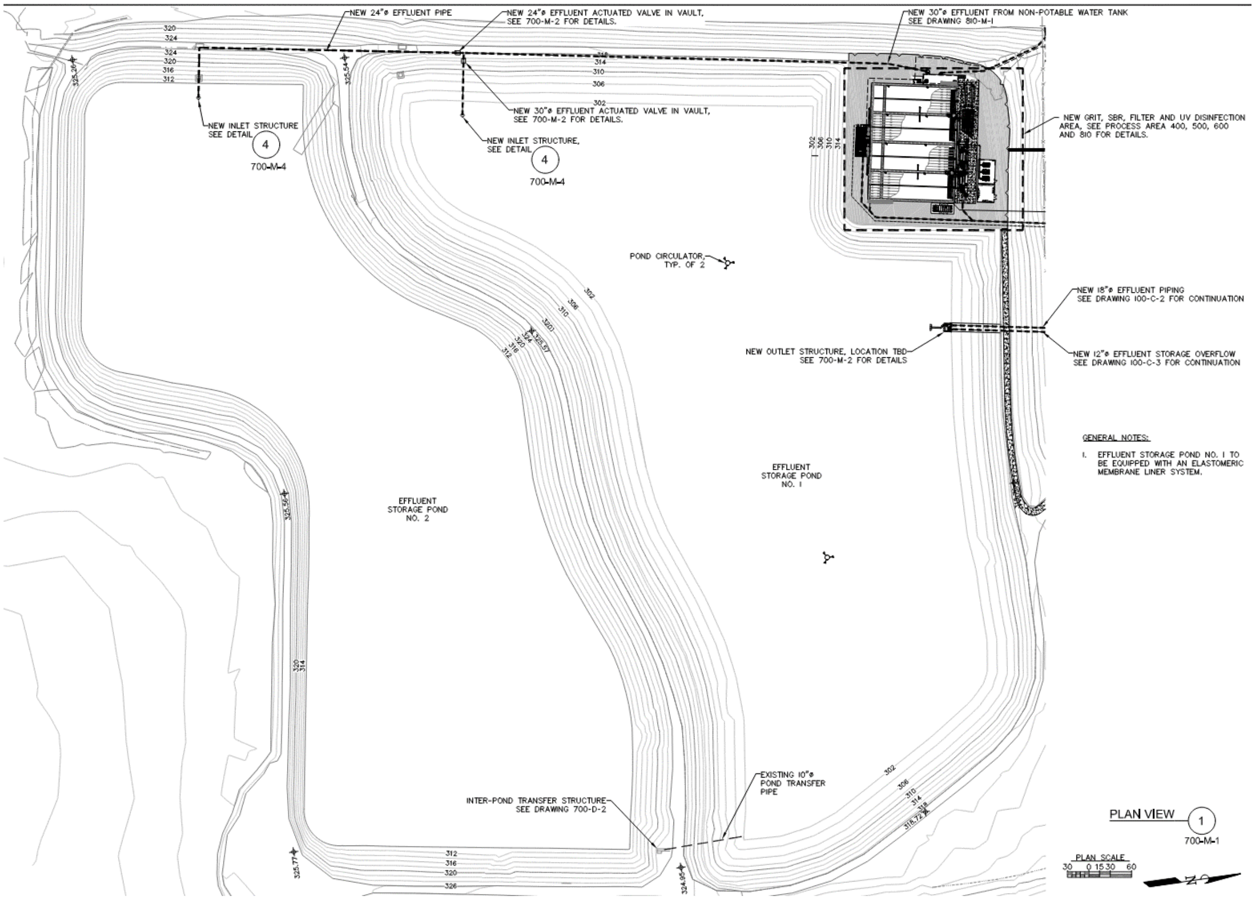
**Sequencing Batch Reactor Building Plan**



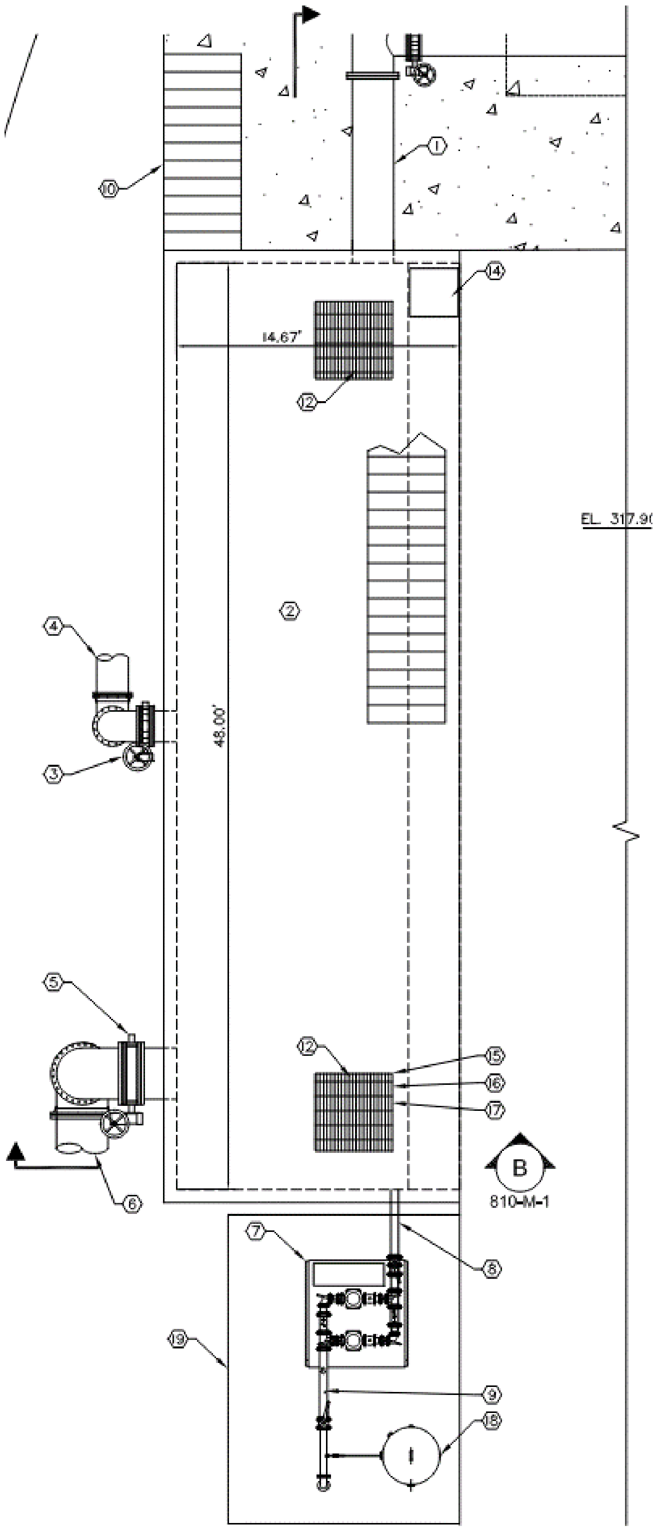
**UV Disinfection System Plan**



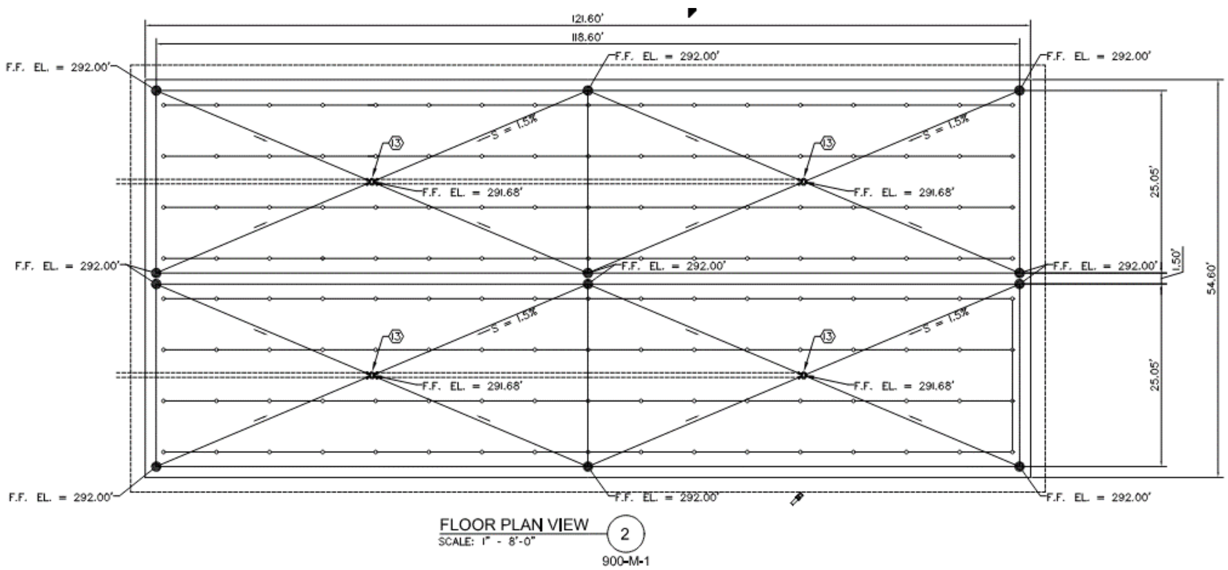
### Effluent Storage Plan



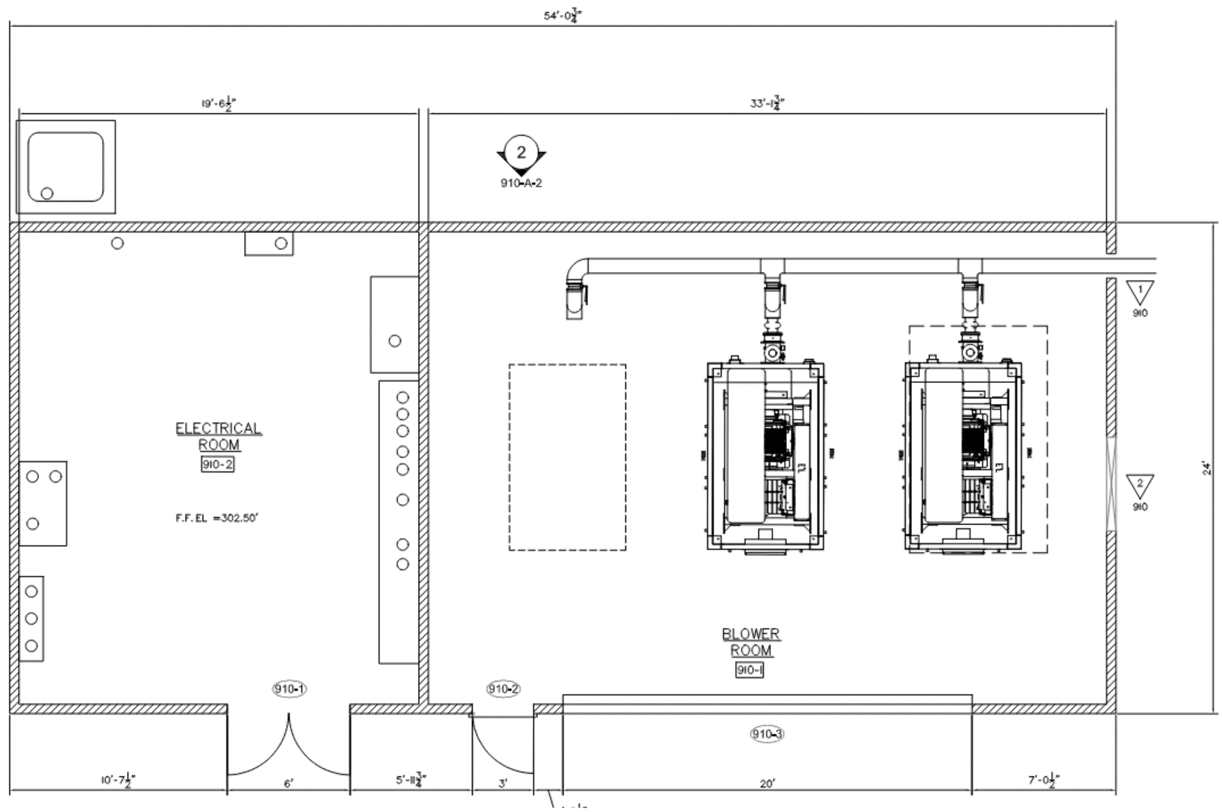
**Non-Potable Water System Plan**



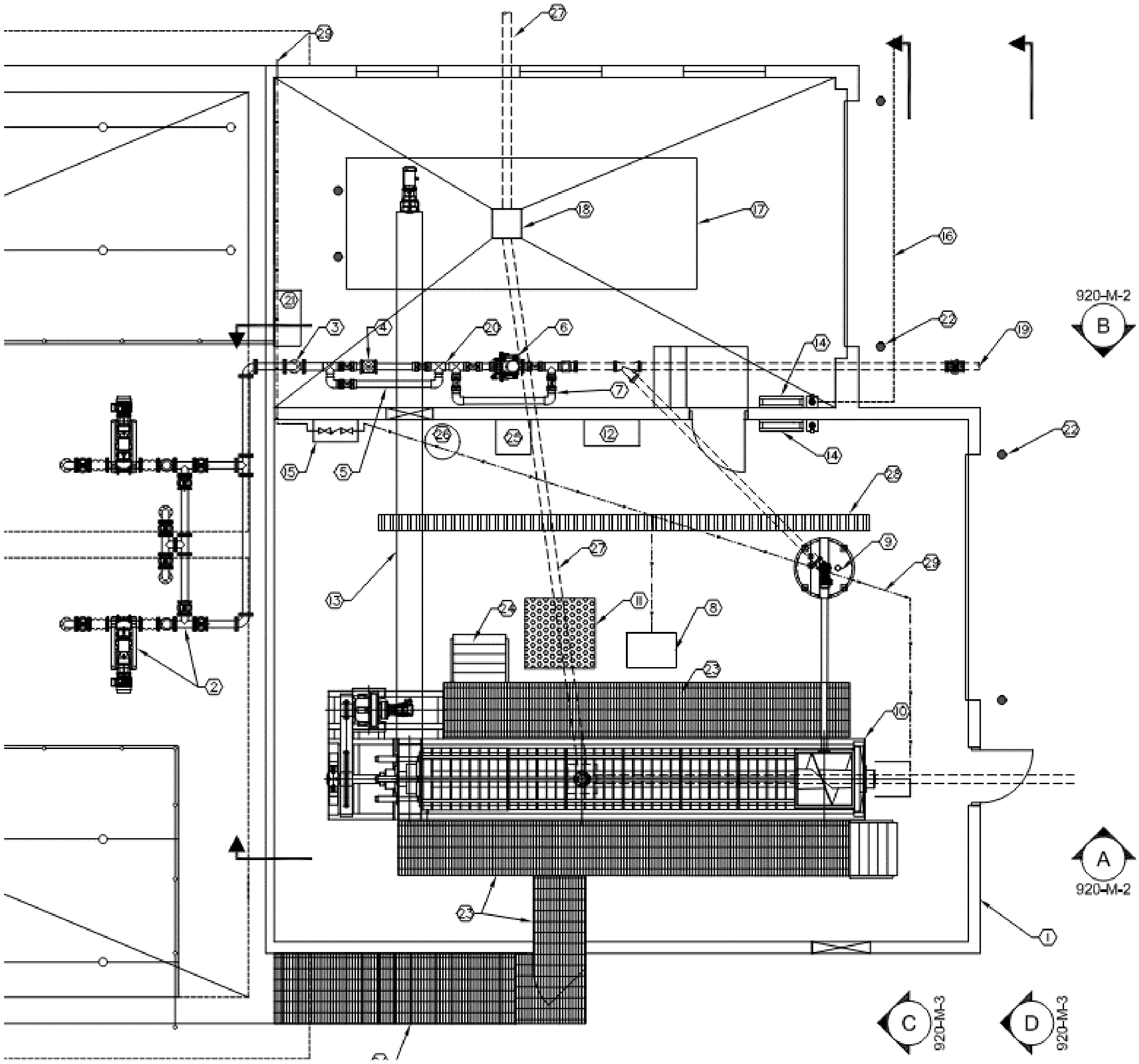
**Aerobic Digester Plan**



**Aerobic Digester Building Plan**



**Biosolids Dewatering Facility Plan**



# III. VALUE ENGINEERING PROPOSALS

The following section presents the developed VE proposals. Each proposal describes the current concept, then compares it to the VE concept. Order of magnitude cost estimates are included for each alternative, comparing the current design to the estimated VE concepts.

| No. | Name | Current Cost | VE Proposal Cost | Difference | Criteria Scored Ranking | Note | LCCA Difference $ |
|---|---|---|---|---|---|---|---|
| P-1 | Plant Location - West | 9,140,000 | 7,678,000 | 1,462,000 | 1 | | |
| P-2 | Plant Consolidation | 9,140,000 | 7,067,000 | 2,073,000 | 3 | NIC | |
| P-3 | Plant Location - East | 9,140,000 | 8,113,000 | 1,027,000 | 2 | NIC | |
| P-4 | Scope & Capacity | 12,528,000 | 6,553,000 | 5,975,000 | 2 | NIC | |
| H-1 | Hydraulic Gradient | 1,414,000 | 1,043,000 | 371,000 | 4 | LCCA | 1,520,000 |
| S-1 | Building Systems | 812,000 | 714,000 | 98,000 | 6 | | |
| WI-1 | Grit Separation | 1,134,000 | 878,000 | 256,000 | 5 | LCCA | 4,863,000 |
| WI-2 | Influent Equalization | 1,396,000 | 973,000 | 423,000 | 8 | LCCA | 5,202,000 |
| WT-1 | Aerobic Digestion | 3,016,000 | 1,688,000 | 1,328,000 | 7 | | |
| WE-1 | Effluent Filtration | 3,865,000 | 2,466,000 | 1,399,000 | 9 | | |
| WE-2 | UV Disinfection | 2,145,000 | 1,995,000 | 150,000 | 7 | | |
| | **Subtotal VE Proposals** | | | **5,487,000** | | | |

| | |
|---|---|
| LCCA | Life cycle cost impact |
| NIC | Indicates not included in total |

## REVISION PROPOSAL ITEMS

| No. | Description | ROM Cost | Notes |
|---|---|---|---|
| R1 | Interpretive signage, provide education (off site) for Community Ed and PR. | (10,000) | |
| R2 | Pump after screen and grit removal (sooner than equalization) and flow remaining by gravity. | 92,500 | NIC |
| R3 | Monitoring and/or extraction wells at pond perimeter in lieu of lining pond. Line pond in future if needed. | 1,541,115 | |
| R4 | Optimized process and downsized diesel generator. | 50,000 | |
| R5 | More native voltage process energy loads, with less power transformation. | 15,000 | |
| R6 | Aluminum ILO copper bus-work, feeders, and larger conductors. | 25,000 | |
| R7 | Skylights for improved daylighting under new roofs and canopies. | (15,000) | |
| R8 | More task and less general lighting. | 12,500 | |
| R9 | Increase fuel storage from 24 to 72 hours. | (31,250) | |
| | **SUBTOTAL REVISION PROPOSALS** | **1,587,365** | |
| | **GRAND TOTAL ALL PROPOSALS** | **7,074,365** | |

| | **PROPOSAL** | P-1 |
|---|---|---|
| **COMPONENT:** Plant Location - West | **AUTHOR** | NLC |

**CURRENT CONCEPT**

Construct the SBR in the northwest corner of Lagoon No. 2.

**VE CONCEPT**

Acquire adjacent property and construct SBR to the west.

**FUNCTIONS**

| Operate Efficiently | Circulate Vehicles | Level Site |
|---|---|---|

**ADVANTAGES**

- Eliminates cofferdam
- Improves vehicular circulation
- Consolidates plant systems
- Supports LEAN processes
- Allows for future expansion
- Simplifies phasing and construction
- Provides acreage for irrigation
- Maintains existing lagoon size

**DISADVANTAGES**

- Acquire property
- Cost of land acquisition
- Delay until land acquired

**DISCUSSION**

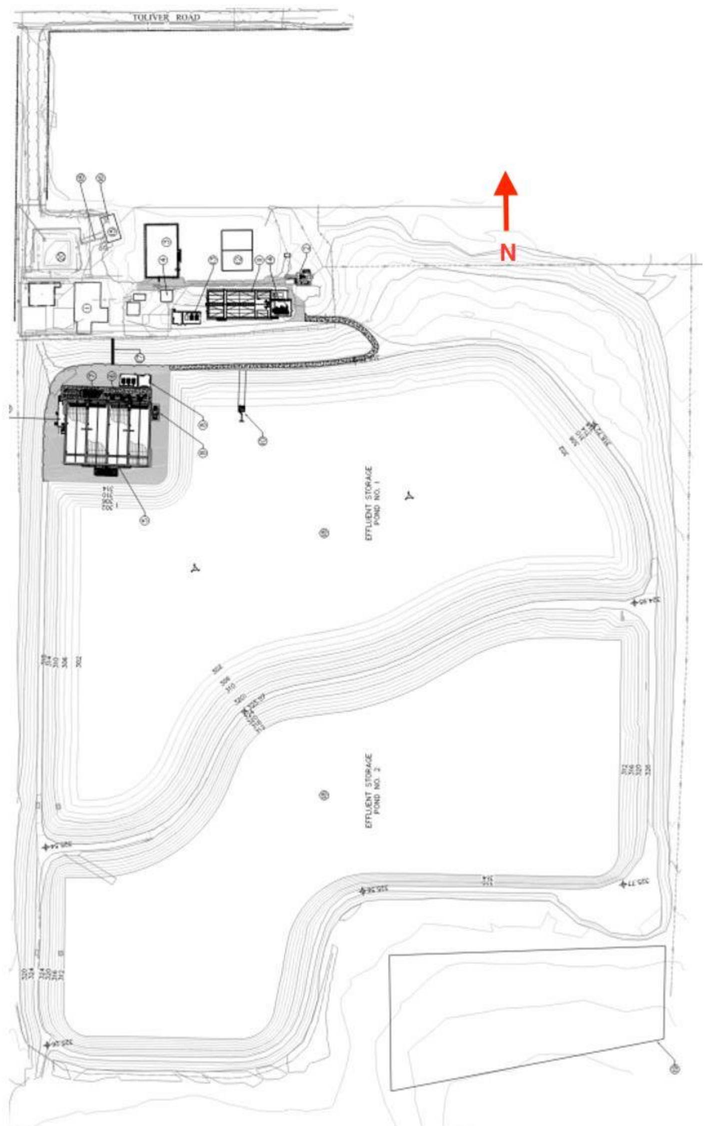
Constructing the SBR within the existing lagoon requires construction and removal of a temporary cofferdam/liner system and additional earthwork at a cost of approximately $2 million. Acquisition of a portion of the adjacent property to the west will reduce first cost of the SBR by eliminating the temporary cofferdam.

Placement of the SBR in the lagoon location does not solve existing plant process and vehicular circulation inefficiencies. Acquisition of the entire adjacent western parcel opens up many opportunities for life cycle cost savings including consolidation of plant systems and processes and improved vehicular circulation. In addition, it allows for future expansion and provides a large area for water storage/irrigation.

| | | |
|---|---|---|
| | **PROPOSAL** | P-1 |
| **COMPONENT:** Plant Location - West | **AUTHOR** | NLC |

The disadvantages of this option are tied to the delays and costs associated with land acquisition.

**CURRENT CONCEPT**

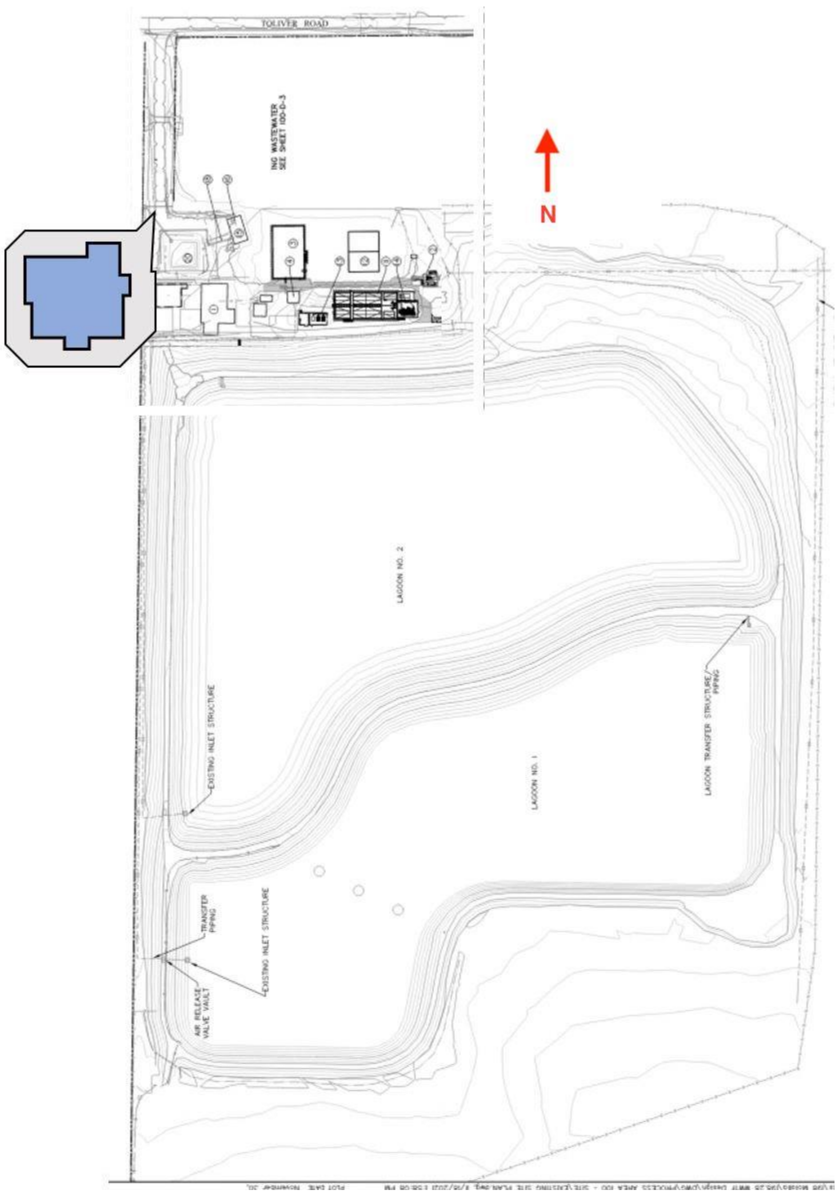


| | PROPOSAL | P-1 |
|---|---|---|
| COMPONENT: Plant Location - West | AUTHOR | NLC |

**EXISTING SITE PHOTO**

| | | |
|---|---|---|
| | **PROPOSAL** | P-1 |
| **COMPONENT:** Plant Location - West | **AUTHOR** | NLC |

**VE CONCEPT**



City of Molalla

Wastewater Treatment Plant Upgrades

VALUE ENGINEERING STUDY

**COST ESTIMATE FORM**

**P-1**

COMPONENT: Plant Location - West

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Temporary Berm Install/Liner/Removal | 1 | LS | 975,000 | 975,000 | Temporary Berm Install/Liner/Removal | | | 975,000 | |
| Dewatering (SBR Site) | 1 | LS | 25,000 | 25,000 | Dewatering (SBR Site) | | | 25,000 | |
| SBR Site Fill | 1 | LS | 750,000 | 750,000 | SBR Site Fill | | | 750,000 | |
| | | | | | Land Purchase | 1 | LS | 600,000 | 600,000 |
| Const. Facilities & Temporary Controls | 1 | LS | 445,000 | 445,000 | Const. Facilities & Temporary Controls | 1 | LS | 333,750 | 333,750 |
| Concrete (Walls) | 1 | LS | 1,260,000 | 1,260,000 | Concrete (Walls) | 1 | LS | 1,260,000 | 1,260,000 |
| Concrete (Slab) | 1 | LS | 192,000 | 192,000 | Concrete (Slab) | 1 | LS | 192,000 | 192,000 |
| SBR Equipment | 1 | LS | 3,438,000 | 3,438,000 | SBR Equipment | 1 | LS | 3,438,000 | 3,438,000 |
| Controls, SCADA, Instrumentation | 1 | LS | 110,000 | 110,000 | Controls, SCADA, Instrumentation | 1 | LS | 110,000 | 110,000 |
| Electrical | 1 | LS | 120,000 | 120,000 | Electrical | 1 | LS | 120,000 | 120,000 |
| Handrails | 1 | LS | 162,000 | 162,000 | Handrails | 1 | LS | 162,000 | 162,000 |
| Manway Access Ports | 1 | LS | 40,000 | 40,000 | Manway Access Ports | 1 | LS | 40,000 | 40,000 |
| Lighting | 1 | LS | 55,000 | 55,000 | Lighting | 1 | LS | 55,000 | 55,000 |
| Mechanical | 1 | LS | 100,000 | 100,000 | Mechanical | 1 | LS | 100,000 | 100,000 |
| Air Piping | 1 | LS | 85,000 | 85,000 | Air Piping | 1 | LS | 85,000 | 85,000 |
| Coatings | 1 | LS | 50,000 | 50,000 | Coatings | 1 | LS | 50,000 | 50,000 |
| Portable Hoists | 1 | LS | 32,000 | 32,000 | Portable Hoists | 1 | LS | 32,000 | 32,000 |
| Utility Stations | 1 | LS | 4,000 | 4,000 | Utility Stations | 1 | LS | 4,000 | 4,000 |
| Stairs | 1 | LS | 20,000 | 20,000 | Stairs | 1 | LS | 20,000 | 20,000 |
| Startup, Testing | 1 | LS | 25,000 | 25,000 | Startup, Testing | 1 | LS | 25,000 | 25,000 |
| | | | | | | | | | |
| Subtotal | | | | 7,888,000 | Subtotal | | | | 6,626,750 |
| General Contractor Markup | 15.871 | % | | 1,251,904 | General Contractor Markup | 15.871 | % | | 1,051,731 |
| Total to nearest $1000 | | | | 9,140,000 | Total to nearest $1000 | | | | 7,678,000 |
| | | | | | | | | | |
| | | | | | Difference | | | | 1,462,000 |

MENG Analysis

Proposal

P-1

| | **PROPOSAL** | P-2 |
|---|---|---|
| **COMPONENT:** Plant Consolidation | **AUTHOR** | NLC |

**CURRENT CONCEPT**

Construct the SBR in the northwest corner of Lagoon No. 2.

**VE CONCEPT**

Demolish existing plant Office/Treatment Building and construct SBR in its place. Provide new office and lab.

**FUNCTIONS**

| | | |
|---|---|---|
| Operate Efficiently | Improve Hydraulics | Level Site |

**ADVANTAGES**

- Eliminates cofferdam
- Consolidates plant footprint and piping
- Optimizes plant systems and processes
- Supports LEAN processes
- Improves vehicular circulation
- Improves plant hydraulics
- Maintains existing lagoon size

**DISADVANTAGES**

- Temporary office and lab needed
- Requires phased construction
- Requires more building demolition
- Requires additional wet well volume

**DISCUSSION**

Constructing the SBR within the existing lagoon requires construction and removal of a temporary cofferdam/liner system and additional earthwork at a cost of approximately $2 million. Demolition of the existing plant Office/Treatment Building and construction of the SBR in its place will reduce first cost by eliminating the temporary cofferdam.

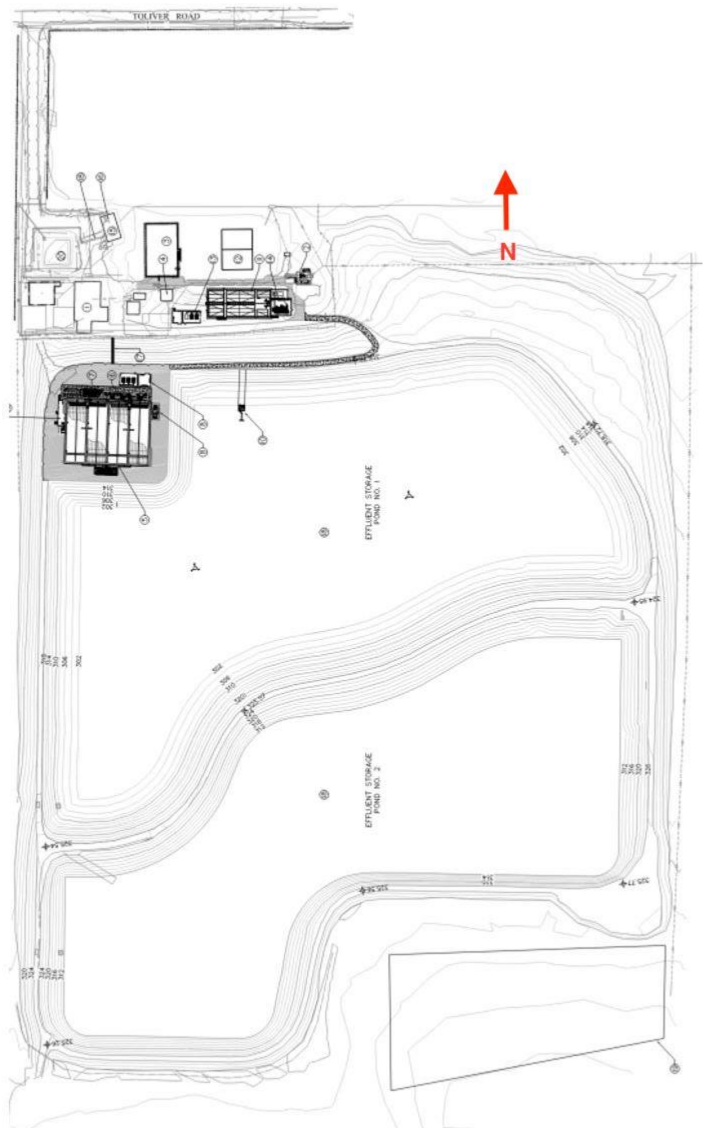
| | **PROPOSAL** | P-2 |
|---|---|---|
| **COMPONENT:** Plant Consolidation | **AUTHOR** | NLC |

Placement of the SBR in the lagoon location does not solve existing plant process and vehicular circulation inefficiencies. Construction of the SBR in the existing plant Office/Treatment Building location allows for consolidation of plant footprint and piping, which will optimize plant systems and processes while maintaining the existing lagoon size. This location allows for improved plant hydraulics.

Disadvantages of this option are that it requires more complex construction phasing and additional building demolition. It also requires a temporary solution for the existing administration and laboratory functions.

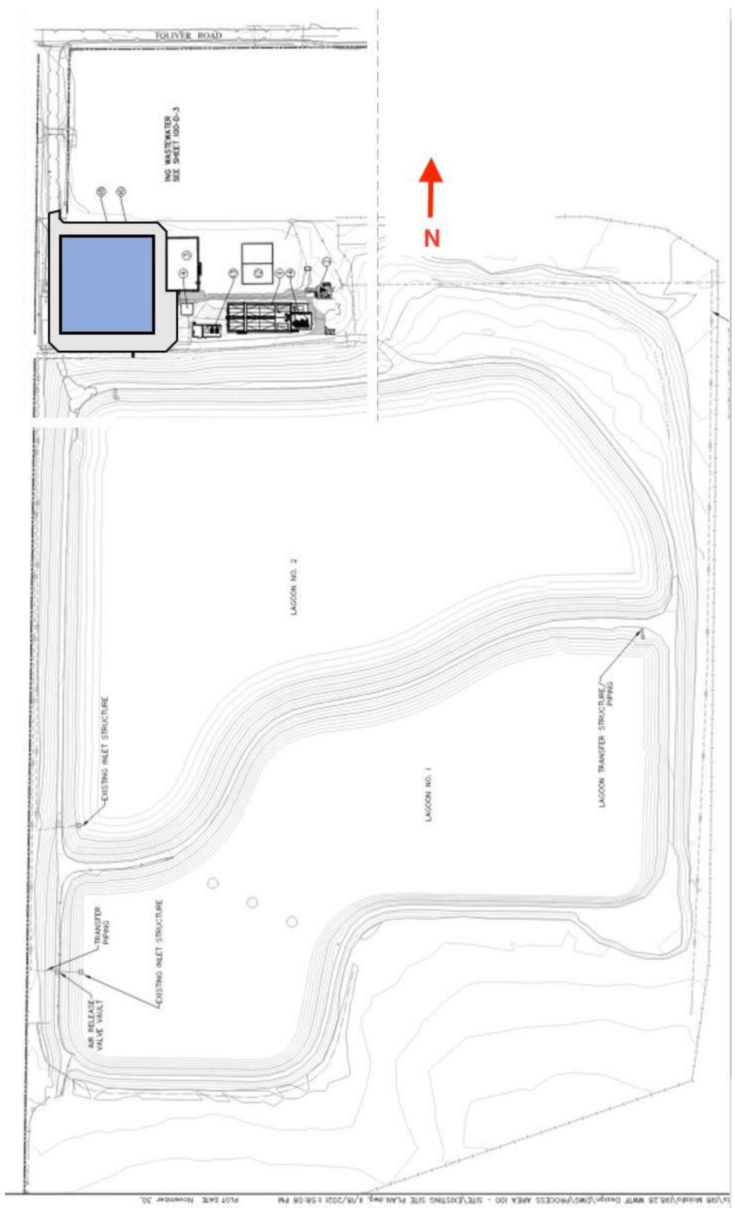
| | **PROPOSAL** | P-2 |
|---|---|---|
| **COMPONENT:** Plant Consolidation | **AUTHOR** | NLC |

**CURRENT CONCEPT**



| | **PROPOSAL** | P-2 |
|---|---|---|
| **COMPONENT:** Plant Consolidation | **AUTHOR** | NLC |

**VE CONCEPT**



City of Molalla
Wastewater Treatment Plant Upgrades

VALUE ENGINEERING STUDY

**COST ESTIMATE FORM**

COMPONENT: Plant Consolidation

**P-2**

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Temporary Berm Install/Liner/Removal | 1 | LS | 975,000 | 975,000 | Temporary Berm Install/Liner/Removal | | | 975,000 | |
| Dewatering (SBR Site) | 1 | LS | 25,000 | 25,000 | Dewatering (SBR Site) | | | 25,000 | |
| SBR Site Fill | 1 | LS | 750,000 | 750,000 | SBR Site Fill | | | 750,000 | |
| | | | | | Demolition of Admin Bldg/Portable | 4,800 | SF | 15 | 72,000 |
| Const. Facilities & Temporary Controls | 1 | LS | 445,000 | 445,000 | Const. Facilities & Temporary Controls | 1 | LS | 333,750 | 333,750 |
| Concrete (Walls) | 1 | LS | 1,260,000 | 1,260,000 | Concrete (Walls) | 1 | LS | 1,260,000 | 1,260,000 |
| Concrete (Slab) | 1 | LS | 192,000 | 192,000 | Concrete (Slab) | 1 | LS | 192,000 | 192,000 |
| SBR Equipment | 1 | LS | 3,438,000 | 3,438,000 | SBR Equipment | 1 | LS | 3,438,000 | 3,438,000 |
| Controls, SCADA, Instrumentation | 1 | LS | 110,000 | 110,000 | Controls, SCADA, Instrumentation | 1 | LS | 110,000 | 110,000 |
| Electrical | 1 | LS | 120,000 | 120,000 | Electrical | 1 | LS | 120,000 | 120,000 |
| Handrails | 1 | LS | 162,000 | 162,000 | Handrails | 1 | LS | 162,000 | 162,000 |
| Manway Access Ports | 1 | LS | 40,000 | 40,000 | Manway Access Ports | 1 | LS | 40,000 | 40,000 |
| Lighting | 1 | LS | 55,000 | 55,000 | Lighting | 1 | LS | 55,000 | 55,000 |
| Mechanical | 1 | LS | 100,000 | 100,000 | Mechanical | 1 | LS | 100,000 | 100,000 |
| Air Piping | 1 | LS | 85,000 | 85,000 | Air Piping | 1 | LS | 85,000 | 85,000 |
| Coatings | 1 | LS | 50,000 | 50,000 | Coatings | 1 | LS | 50,000 | 50,000 |
| Portable Hoists | 1 | LS | 32,000 | 32,000 | Portable Hoists | 1 | LS | 32,000 | 32,000 |
| Utility Stations | 1 | LS | 4,000 | 4,000 | Utility Stations | 1 | LS | 4,000 | 4,000 |
| Stairs | 1 | LS | 20,000 | 20,000 | Stairs | 1 | LS | 20,000 | 20,000 |
| Startup, Testing | 1 | LS | 25,000 | 25,000 | Startup, Testing | 1 | LS | 25,000 | 25,000 |
| | | | | | | | | | |
| Subtotal | | | | 7,888,000 | Subtotal | | | | 6,098,750 |
| General Contractor Markup | 15.871 | % | | 1,251,904 | General Contractor Markup | 15.871 | % | | 967,933 |
| Total to nearest $1000 | | | | 9,140,000 | Total to nearest $1000 | | | | 7,067,000 |
| | | | | | | | | | |
| | | | | | Difference | | | | 2,073,000 |

MENG Analysis

Proposal

**P-2**

| | **PROPOSAL** | P-3 |
|---|---|---|
| **COMPONENT:** Plant Location - East | **AUTHOR** | KDM |

**CURRENT CONCEPT**

SBR is located in the existing pond. Requires a temporary cofferdam, pond bottom clean-out, structural backfill, and a new permanent lined pond slope to support SBR building.

**VE CONCEPT**

Relocate the SBR to undeveloped part of the city property just to the east of the plant.

| **FUNCTIONS** | | |
|---|---|---|
| Support Structure | Streamline Operations | Ease Access |

**ADVANTAGES**

- No temporary cofferdam
- No imported fill
- Puts SBR at plant outflow location
- Allows gravity flow if SBR grade is maintained
- Improves access
- Maintains pond volumes

**DISADVANTAGES**

- Old fills may require stone column or pile foundation support of SBR
- Requires pumping if SBR grade is lowered
- New fills may be required over old fills to establish SBR grade

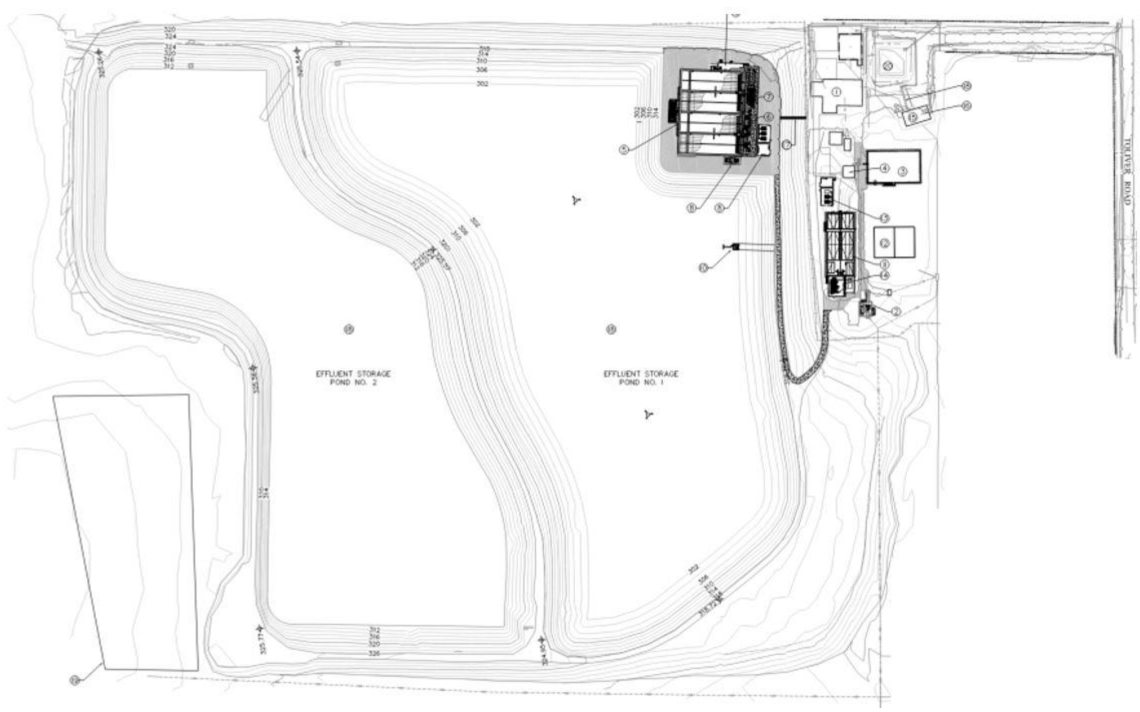
**DISCUSSION**

The current SBR location is in the northeast corner of existing pond No. 1. The corner of the pond would be sealed off with a temporary cofferdam, drained, and cleaned to expose native soils. Imported structural fill would be placed to fill the corner of the pond up to the same grade at the pond berm tops. The cofferdam would be removed to expose the new lined pond berm slope. The SBR would be constructed on the new structural fill pad.

| | | |
|---|---|---|
| | **PROPOSAL** | P-3 |
| **COMPONENT:** Plant Location - East | **AUTHOR** | KDM |

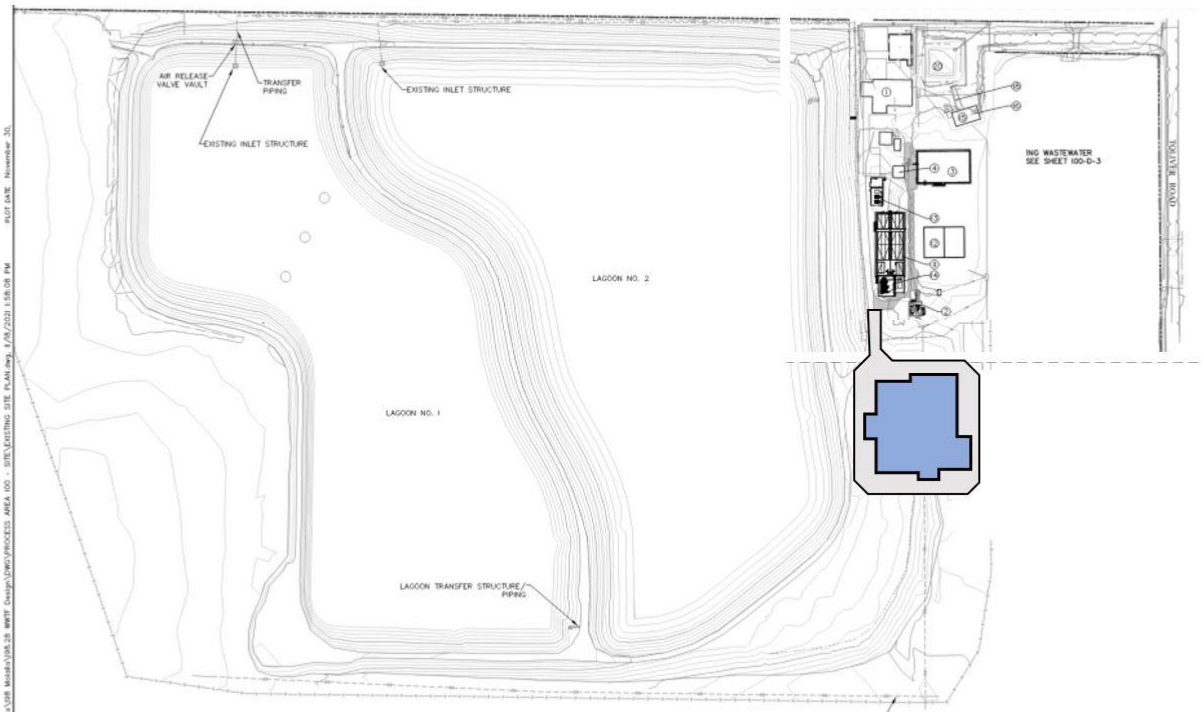
The SBR would be relocated to the land east of the plant. The location is in-line with the plant outflow, streamlining the treatment process. The current grade is underlain by loose/soft fills derived from the excavation of Ponds 1 and 2. The old fills are up to 20 deep. The fills deepen the farther east you move away from the plant. The old fills are settlement prone. If the old fills cannot be economically removed and replaced below the SBR, the SBR can be supported on stone columns or drilled foundation piles to mitigate the settlement risk. Depending on the design grade of the SBR, new fills may be required to raise existing grades above the old fills east of the plant. Stone columns or drilled foundation piles are still required to support the SBR if new fills are placed above old fills to raise site grades.

**CURRENT CONCEPT**



| | **PROPOSAL** | P-3 |
|---|---|---|
| **COMPONENT:** Plant Location - East | **AUTHOR** | KDM |

**VE CONCEPT**



**COST ESTIMATE FORM**

COMPONENT: Plant Location - East

**P-3**

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Temporary Berm Install/Liner/Removal | 1 | LS | 975,000 | 975,000 | Temporary Berm Install/Liner/Removal | | | 975,000 | |
| Dewatering (SBR Site) | 1 | LS | 25,000 | 25,000 | Dewatering (SBR Site) | | | 25,000 | |
| SBR Site Fill | 1 | LS | 750,000 | 750,000 | SBR Site Fill | 1 | LS | 750,000 | 750,000 |
| | | | | | Stone columns foundations | 1 | LS | 225,000 | 225,000 |
| Const. Facilities & Temporary Controls | 1 | LS | 445,000 | 445,000 | Const. Facilities & Temporary Controls | 1 | LS | 333,750 | 333,750 |
| Concrete (Walls) | 1 | LS | 1,260,000 | 1,260,000 | Concrete (Walls) | 1 | LS | 1,260,000 | 1,260,000 |
| Concrete (Slab) | 1 | LS | 192,000 | 192,000 | Concrete (Slab) | 1 | LS | 192,000 | 192,000 |
| SBR Equipment | 1 | LS | 3,438,000 | 3,438,000 | SBR Equipment | 1 | LS | 3,438,000 | 3,438,000 |
| Controls, SCADA, Instrumentation | 1 | LS | 110,000 | 110,000 | Controls, SCADA, Instrumentation | 1 | LS | 110,000 | 110,000 |
| Electrical | 1 | LS | 120,000 | 120,000 | Electrical | 1 | LS | 120,000 | 120,000 |
| Handrails | 1 | LS | 162,000 | 162,000 | Handrails | 1 | LS | 162,000 | 162,000 |
| Manway Access Ports | 1 | LS | 40,000 | 40,000 | Manway Access Ports | 1 | LS | 40,000 | 40,000 |
| Lighting | 1 | LS | 55,000 | 55,000 | Lighting | 1 | LS | 55,000 | 55,000 |
| Mechanical | 1 | LS | 100,000 | 100,000 | Mechanical | 1 | LS | 100,000 | 100,000 |
| Air Piping | 1 | LS | 85,000 | 85,000 | Air Piping | 1 | LS | 85,000 | 85,000 |
| Coatings | 1 | LS | 50,000 | 50,000 | Coatings | 1 | LS | 50,000 | 50,000 |
| Portable Hoists | 1 | LS | 32,000 | 32,000 | Portable Hoists | 1 | LS | 32,000 | 32,000 |
| Utility Stations | 1 | LS | 4,000 | 4,000 | Utility Stations | 1 | LS | 4,000 | 4,000 |
| Stairs | 1 | LS | 20,000 | 20,000 | Stairs | 1 | LS | 20,000 | 20,000 |
| Startup, Testing | 1 | LS | 25,000 | 25,000 | Startup, Testing | 1 | LS | 25,000 | 25,000 |
| Subtotal | | | | 7,888,000 | Subtotal | | | | 7,001,750 |
| General Contractor Markup | 15.871 | % | | 1,251,904 | General Contractor Markup | 15.871 | % | | 1,111,248 |
| Total to nearest $1000 | | | | 9,140,000 | Total to nearest $1000 | | | | 8,113,000 |
| | | | | | | | | | |
| | | | | | Difference | | | | 1,027,000 |

MENG Analysis

Proposal **P-3**

| | **PROPOSAL** | P-4 |
|---|---|---|
| **COMPONENT:** Scope & Capacity | **AUTHOR** | DCS |

**CURRENT CONCEPT**

Phase 1 includes significant work in support of Phase 2 including:

1) Full-size influent equalization tank
2) Full capacity transfer pumps
3) Two future need SBR cells and larger building
4) Future need Biosolids Class A
5) Future second aerobic digester building and blower space
6) Electrical service and generator capacity for Phase 2 loads
7) Space for future Phase 2 effluent pump

**VE CONCEPT**

Reduce project scope and plant capacity to meet current Phase 1 needs only including:

1) Half-size influent equalization tank
2) Half capacity transfer pumps
3) Only two SBR cells and smaller building
4) Biosolids Class B
5) Building and blower space for just one aerobic digester
6) Electrical service and generator for Phase 1 loads
7) Effluent pump configuration for Phase 1 only

| **FUNCTIONS** | | |
|---|---|---|
| Embrace LEAN | Conserve Funds | Ready Future |

| **ADVANTAGES** | **DISADVANTAGES** |
|---|---|
| • Reduces cost to meet budget<br>• Supports LEAN principal<br>• Preserves flexibility<br>• Lower O&M cost | • Potentially less future-ready |

| | **PROPOSAL** | P-4 |
|---|---|---|
| **COMPONENT:** Scope & Capacity | **AUTHOR** | DCS |

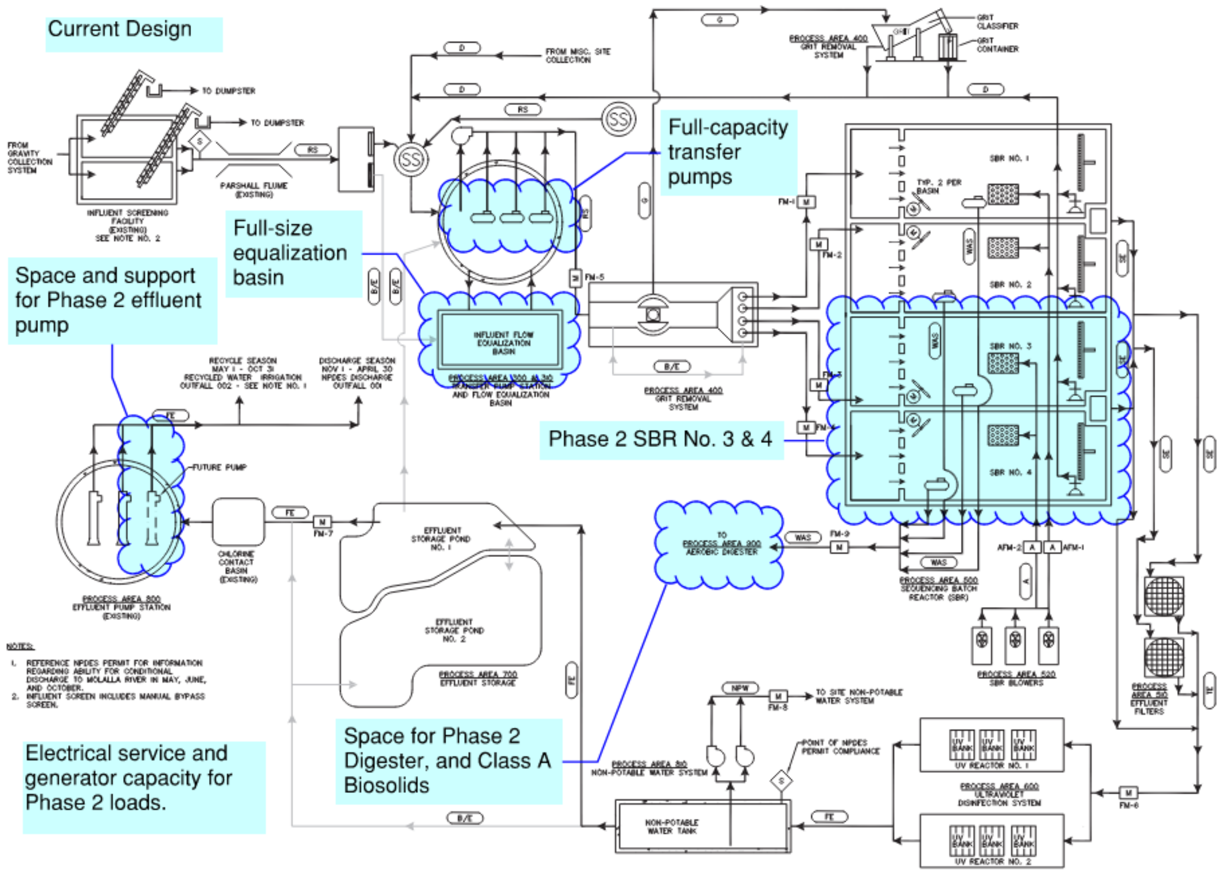
**DISCUSSION**

The current design assumes the City will grow per 30-year projection, which is subject to change; actual growth could be significantly more or less than projected, changing the design criteria for Phase 2 of the project.

Waste stream characteristics, regulatory environment, climate, I&I reduction, and especially technology may change before Phase 2.

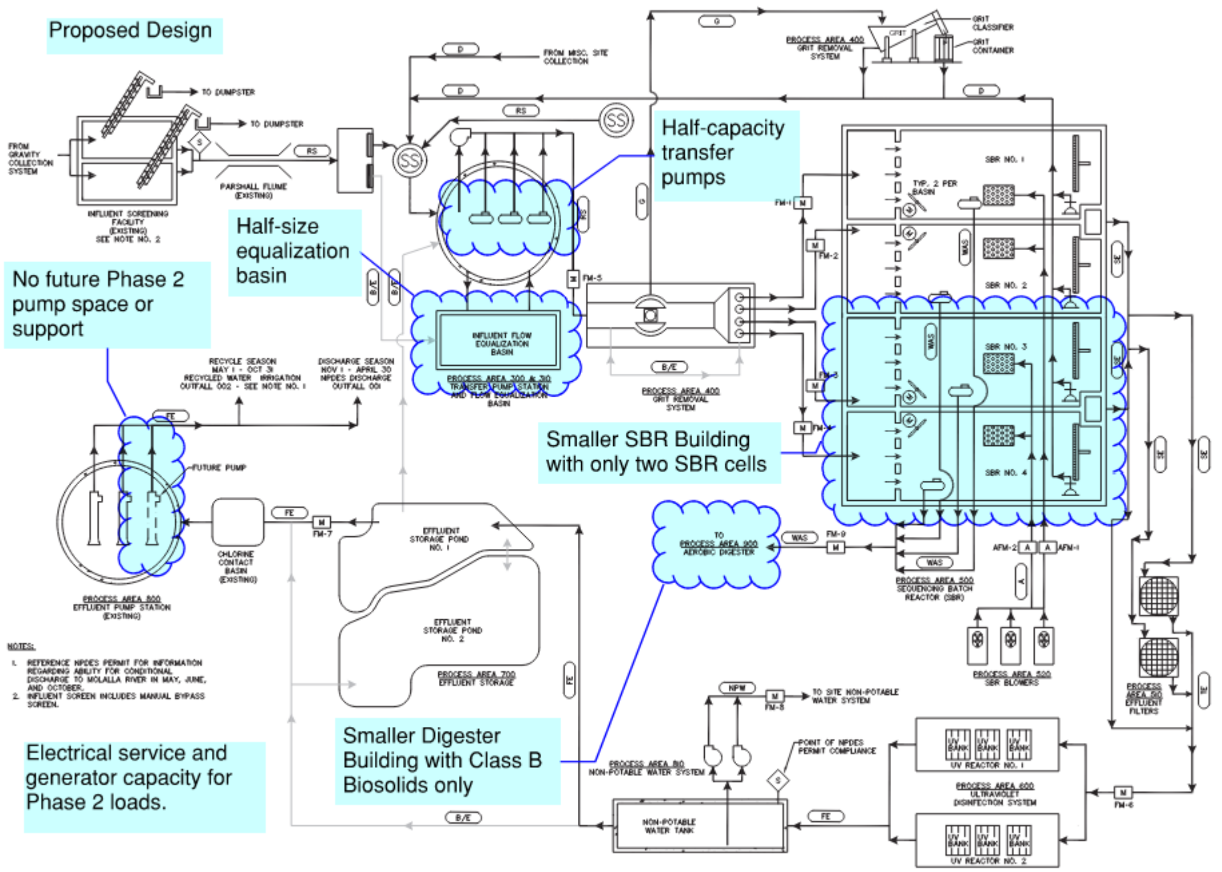
This proposal suggests following LEAN principals to only design and build for Phase 1, with only minimal provisions for Phase 2.

**CURRENT CONCEPT**



| | **PROPOSAL** | P-4 |
|---|---|---|
| **COMPONENT:** Scope & Capacity | **AUTHOR** | DCS |

## VE CONCEPT



**COST ESTIMATE FORM**

**P-4**

COMPONENT: Scope & Capacity

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Influent equalization basin - full-size | 1 | EA | 1,204,000 | 1,204,000 | Influent equalization basin - half-size | 1 | EA | 722,400 | 722,400 |
| Transfer pump station - full-capacity | 1 | EA | 910,000 | 910,000 | Transfer pump station - half capacity | 1 | EA | 546,000 | 546,000 |
| SBR facility cell and support | 4 | EA | 1,966,500 | 7,866,000 | SBR facility cell and support | 2 | EA | 1,966,500 | 3,933,000 |
| Digester building for two digesters | 1,216 | SF | 325 | 395,200 | Digester building for one digester | 730 | SF | 325 | 237,120 |
| Future Class A biosolids readiness | 1 | EA | 50,000 | 50,000 | Class B biosolids only (no cost) | | | | |
| Electrical for Phase 1 & 2 | 1 | LS | 362,000 | 362,000 | Electrical for Phase 1 only | 1 | LS | 217,200 | 217,200 |
| Rough-in for Phase 2 effluent pump | 1 | EA | 25,000 | 25,000 | No rough-in for future effluent pump | | | | |
| Subtotal | | | | 10,812,200 | Subtotal | | | | 5,655,720 |
| General Contractor Markup | 15.871 | % | | 1,716,004 | General Contractor Markup | 15.871 | % | | 897,619 |
| Total to nearest $1000 | | | | 12,528,000 | Total to nearest $1000 | | | | 6,553,000 |
| | | | | | Difference | | | | 5,975,000 |

MENG Analysis

Proposal

**P-4**

| | **PROPOSAL** | H-1 |
|---|---|---|
| **COMPONENT:** Hydraulic Gradient | **AUTHOR** | EF |

**CURRENT CONCEPT**

The hydraulic arrangement of the unit processes and the hydraulic grade line put the equalization deep in the ground and the rest of the treatment two plus stories above grade. In addition, the peak flow of 12 MGD cannot get to the existing headworks – flooding results in the interceptors.

**VE CONCEPT**

The hydraulic gradient is optimized, and processes are shuffled around to lower the elevation of most of the structures. Equalization is moved to after grit removal and excess headloss around the treatment processes is removed.

| **FUNCTIONS** | | |
|---|---|---|
| Convey Fluid | System Capacity | Equalize Flows |

**ADVANTAGES**

- Improve operations
- Enhance treatment
- Improve SBR performance
- Treat side streams
- Reduce excavation and fill

**DISADVANTAGES**

- Increased pumping

**DISCUSSION**

The existing plant profile is set by the headworks and the effluent pump station. Proposed equalization is the lowest point in the plant. When equalization is used, the transfer pump station wet well must be brought to a very low level to empty the tank. The profile also shows as much as 30 feet of head being wasted across the site from the headworks to the effluent including a 20-foot drop between the UV and the effluent pumps. Some of that head is used to get into the lagoons. However, when the logons are removed from the main process stream, the plant profile can be lowered and

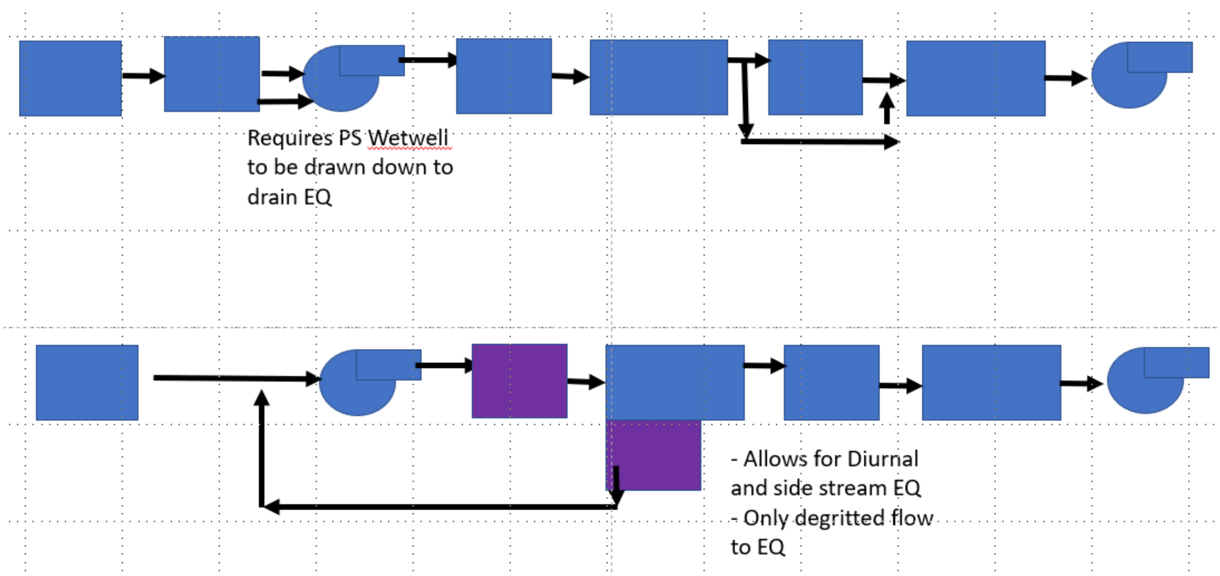
| | **PROPOSAL** | H-1 |
|---|---|---|
| **COMPONENT:** Hydraulic Gradient | **AUTHOR** | EF |

optimized. Additional pumping is needed to use the lagoons but that increase in energy use is offset by:

- Raising the transfer pump station wet well operating level
- Using the Headcell effluent weir as an active component in the EQ and distribution to the SBRs
- Recovering head burned on the effluent end of the SBRs
- Allowing the headworks flume not to be flooded

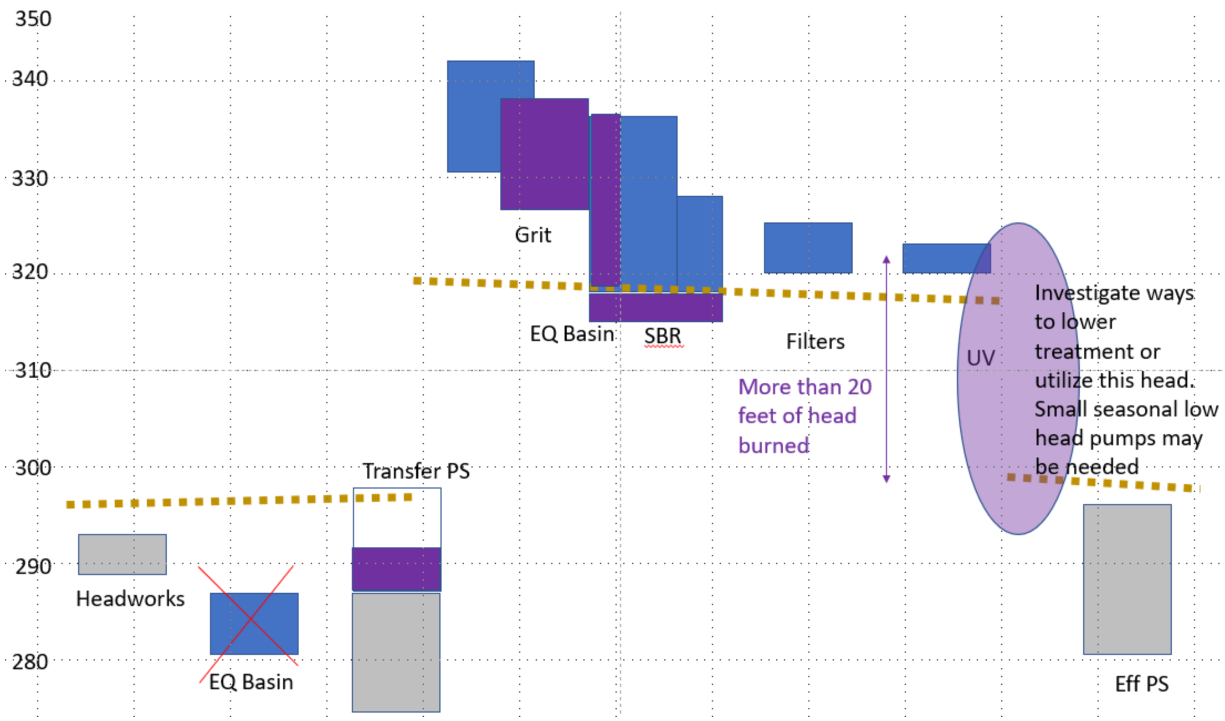
**CURRENT CONCEPT (BLUE)** **VE CONCEPT (PURPLE)**

**Flow Diagram**



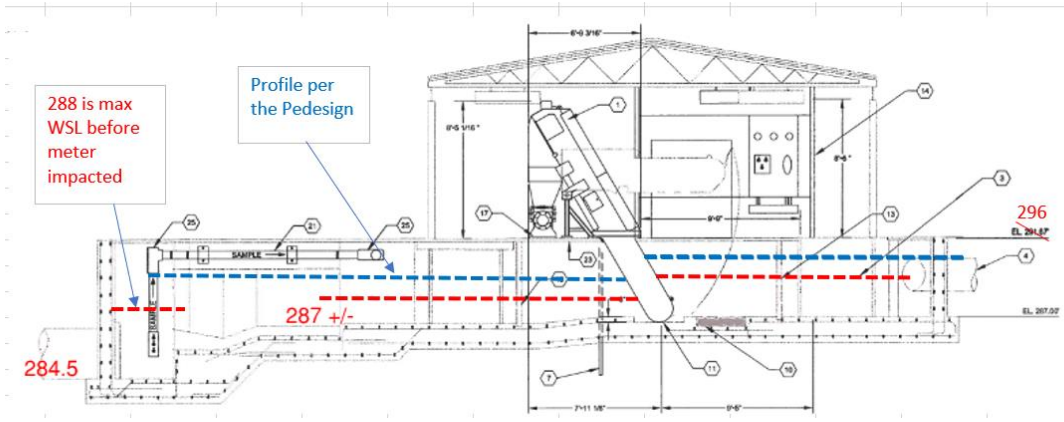
| | **PROPOSAL** | H-1 |
|---|---|---|
| **COMPONENT:** Hydraulic Gradient | **AUTHOR** | EF |

## Simplified Hydraulic Profile




## Headworks Hydraulics

See Technical report T-2 Headworks Capacity



| PROPOSAL | H-1 |
|---|---|
| AUTHOR | EF |

**COMPONENT:** Hydraulic Gradient

## COMPONENT LIFE CYCLE COST ANALYSIS (LCCA)

| | | |
|---|---|---|
| Client: | City of Molalla | H-1 |
| Project: | Wastewater Treatment Plant Upgrades | proposal # |
| Date: | 10-Dec-21 | |
| By: | DCS | |
| COMPONENT | Hydraulic Gradient | |
| COMPONENT # | H-1 | |
| Escalation rate | 0.03 | |
| Discount rate | 0.04 | |
| Study Period | 50 Yrs. | |

Notes: Transfer pumps assumed at 100-hp each; assume approximately 1.5 pumps are running continuously or 113-kW. This proposal reduces system head by 5 ft, assumed to reduce the pump head by 25%, hence saving 28 kW, or at $0.10/kW-hr power cost; $2.80/hr; hence annually $2.80/hr x 24 hr/day x 365 day/yr = $24.5K/yr. Annual maintenance assumed 1% of first cost, major maintenance 10% every 10-years, and salvage value of 10%.

Instructions: Enter escalation, discount, and study period above.
Enter annual costs, replacement costs (and appropriate replacement year), and salvage value.
Enter these costs in the shaded cells using today's (current) dollars. For annual costs, escalation rates will be automatically entered,
but can be individually overwritten below for differential escalation.
All costs will automatically be escalated and discounted.

| ALTERNATIVE A : Current | | | | ALTERNATIVE B: Proposed | | | | DIFFERENCE |
|---|---|---|---|---|---|---|---|---|
| **INITIAL COSTS** | | | INITIAL COST | | | | PROPOSED COST | DIFFERENCE |
| | | | 1,414,000 | | | | $ 1,043,000 | $ 371,000 |
| **O & M ANNUAL COSTS** | | | | | | | | |
| STAFFING OPERATIONS | | | | | | | | |
| STAFFING MAINTENANCE | | | | | | | | |
| SUPPLIES OPERATIONS | | | | | | | | |
| SUPPLIES MAINTENANCE | | | | | | | | |
| Subcomponents | Cost in current $ | Esc. | Pres. Worth $ | Subcomponents | Cost in current $ | Esc. | Pres. Worth $ | |
| Maintenance cost | 14,140 | 0.03 | $ 570,807 | Maintenance cost | 10,430 | 0.03 | $ 421,041 | $ 149,766 |
| Energy cost | 456,000 | 0.03 | $ 18,407,929 | Energy cost | 431,500 | 0.03 | $ 17,418,907 | $ 989,023 |
| | | 0.03 | $ - | | | 0.03 | $ - | $ - |
| SUBT. O & M OVER LIFE CYCL | $ 470,140 | | $ 18,978,736 | | 441,930 | | $ 17,839,948 | $ 1,138,789 |
| **MAJOR REHAB REPLACEMENT COSTS** | | | | | | | | |
| Subcomponents | Cost in current $ | Yr. | Pres. Worth $ | Subcomponents | Cost in current $ | Yr. | Pres. Worth $ | |
| | | | $ - | | | | $ - | $ - |
| Maintenance rehab | 141,400 | 10 | $ 129,618 | Maintenance rehab | 104,300 | 10 | $ 95,610 | $ 34,009 |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| SUBT. REPLACEMENT | | | $ 130,000 | | | | $ 96,000 | $ 34,000 |
| TOT. O & M & REPL. (Pres. Worth) | | | 19,109,000 | | | | 17,936,000 | 1,173,000 |
| TOT. INITIAL, O&M, & REPL. (Pres. Worth) | | | 20,523,000 | | | | 18,979,000 | 1,544,000 |
| | Cost in current $ | | | | Cost in current $ | | | |
| SALVAGE VALUE | 141,400 | 50 | $ 92,000 | | 104,300 | 50 | $ 68,000 | $ 24,000 |
| TOT. INITIAL, O&M, REPL. MINUS SALVAGE | | | 20,431,000 | | | | 18,911,000 | 1,520,000 |

**COST ESTIMATE FORM**

**H-1**

COMPONENT: Hydraulic Gradient

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Submersible Pumps (3), Centrifugal (1) | 1 | LS | 400,000 | 400,000 | Submersible Pumps (3), Centrifugal (1) | 1 | LS | 300,000 | 300,000 |
| Controls | 1 | LS | 150,000 | 150,000 | Controls | 1 | LS | 100,000 | 100,000 |
| Grit Structure | 1 | LS | 170,000 | 170,000 | Grit Structure | 1 | LS | 100,000 | 100,000 |
| SBR Foundation | 1 | LS | 500,000 | 500,000 | SBR Foundation | 1 | LS | 400,000 | 400,000 |
| Subtotal | | | | 1,220,000 | Subtotal | | | | 900,000 |
| General Contractor Markup | 15.871 | % | | 193,626 | General Contractor Markup | 15.871 | % | | 142,839 |
| Total to nearest $1000 | | | | 1,414,000 | Total to nearest $1000 | | | | 1,043,000 |
| | | | | | Difference | | | | 371,000 |

MENG Analysis

Proposal **H-1**

| | **PROPOSAL** | S-1 |
|---|---|---|
| **COMPONENT:** Building Systems | **AUTHOR** | DH |

**CURRENT CONCEPT**

Construction of hydraulic structures and associated buildings use field construction intensive methods such as cast-in-place concrete and stick framed wood construction for auxiliary buildings and equipment enclosures.

**VE CONCEPT**

Construct auxiliary buildings and enclosures, and components of hydraulic structures where feasible using precast elements such as pre-engineered metal buildings, panelized light gauge steel construction, or precast concrete elements.

| **FUNCTIONS** | | |
|---|---|---|
| Protect Equipment | Exclude Weather | Define Process |

**ADVANTAGES**

- Reduced construction schedule
- Reduced construction cost
- More durable and deterioration resistant materials than wood

**DISADVANTAGES**

- Increased detailing
- Shipping of components

**DISCUSSION**

Auxiliary buildings supporting process structures and enclosing equipment are planned to be constructed using conventional wood construction with metal roofing and composite siding. These buildings include the SBR/Blower Building, UV Disinfectant Canopy, Aerobic Digester Building, and Biosolids Dewatering Building. Although conventional timber construction is relatively cost effective, it is field labor intensive, with resultant schedule impacts. In addition, timber construction is more susceptible to deterioration and moisture-sensitive than other types of construction.

| | **PROPOSAL** | S-1 |
|---|---|---|
| **COMPONENT:** Building Systems | **AUTHOR** | DH |

The use of pre-engineered metal buildings (PEMB) for these facilities will provide metal construction that will be more resistant to moisture and resultant deterioration. PEMB construction also provides long clear spans and open space. Interior durability can be provided by wainscotting, and insulation can be done cost effectively. In addition, the cost of the a PEMB is typically less than wood construction, and as most of the components are fabricated in the factory, erection and field construction time is typically shorter than for conventional framed wood construction.

Alternately, framed cold formed steel stud construction could be used in lieu of wood construction to alleviate potential deterioration problem with framed wood construction.

The use of cast-in-place concrete has similar issues with field construction and forming. Although precast components can be used in hydraulic structures, connections and waterproofing are obstacles to the use of precast. An exception would be structures like the Effluent Outlet Structure, which could be cast-in-place but would more efficiently constructed of precast concrete sections with integral waterproofed jointing or field-applied waterproofing.

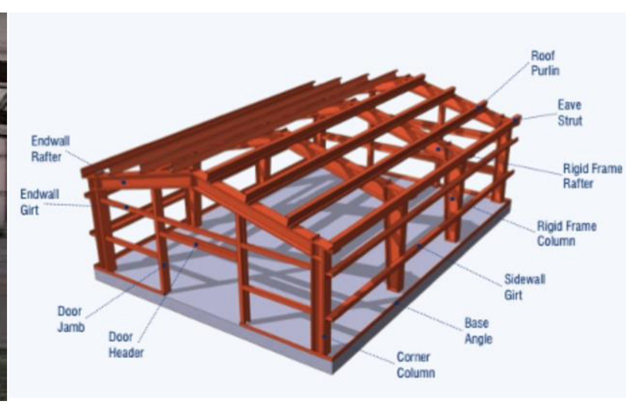
**CURRENT CONCEPT**

Conventional Wood Construction

| | **PROPOSAL** | S-1 |
|---|---|---|
| **COMPONENT:** Building Systems | **AUTHOR** | DH |

Cast In Place Concrete Forming

**VE CONCEPT**




Pre-engineered Metal Buildings

| | | |
|---|---|---|
| | **PROPOSAL** | S-1 |
| **COMPONENT:** Building Systems | **AUTHOR** | DH |

Precast Concrete Vault

City of Molalla

Wastewater Treatment Plant Upgrades

VALUE ENGINEERING STUDY

**COST ESTIMATE FORM**

COMPONENT: Buidling Systems

**S-1**

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| SBR/Blower Building Structure (Wood) | 1 | LS | 120,000 | 120,000 | SBR/Blower Building Structure (PEMB) | 1 | LS | 108,000 | 108,000 |
| UV Disinfectant Canopy (Wood) | 1 | LS | 216,000 | 216,000 | UV Disinfectant Canopy (PEMB) | 1 | LS | 194,000 | 194,000 |
| Digester Building (Wood) | 1 | LS | 100,000 | 100,000 | Digester Building (PEMB) | 1 | LS | 90,000 | 90,000 |
| Biosolids Dewatering Building (Wood) | 1 | LS | 126,000 | 126,000 | Biosolids Dewatering Building (PEMB) | 1 | LS | 113,000 | 113,000 |
| Effluent Outlet Structure (Concrete) | 1 | LS | 139,000 | 139,000 | Effluent Outlet Structure (Precast) | 1 | LS | 111,000 | 111,000 |
| Subtotal | | | | 701,000 | Subtotal | | | | 616,000 |
| General Contractor Markup | 15.871 | % | | 111,256 | General Contractor Markup | 15.871 | % | | 97,765 |
| Total to nearest $1000 | | | | 812,000 | Total to nearest $1000 | | | | 714,000 |
| | | | | | | | | | |
| | | | | | Difference | | | | 98,000 |

MENG Analysis

Proposal **S-1**

| | **PROPOSAL** | WI-1 |
|---|---|---|
| **COMPONENT:** Grit Separation | **AUTHOR** | EF |

**CURRENT CONCEPT**

Design is around the proprietary vortex grit removal process called Pista Grit supplied by Smith & Loveless. The tank is designed for peak flow of 8.8 MGD and is in the process flow train after equalization. The complex construction is all above grade and has a full bypass.

**VE CONCEPT**

Use stacked tray vortex grit removal.

| **FUNCTIONS** | | |
|---|---|---|
| Remove Grit | Reduce Maintenance | Add Treatment |

**ADVANTAGES**

- Improve operations
- Reduce equipment wear
- Treat all flows, no bypass
- Captures and washes fine grit
- Used as flow splitter to MBR
- Guarantee performance (with site grit characterization)

**DISADVANTAGES**

- One supplier with experience

**DISCUSSION**

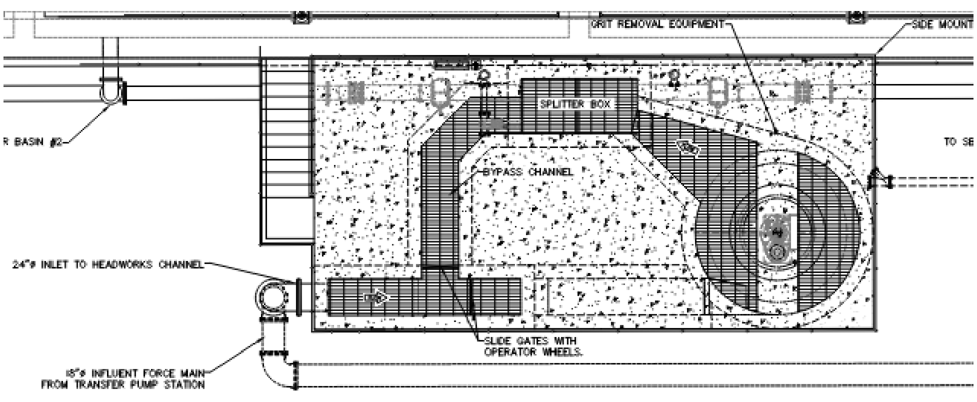
Pista has proven to be an expansive and ineffective method for grit removal. Numerous studies have shown the vortex approach is sensitive to flow changes, doesn't capture fine grit and is unreliable. Stacked tray vortex grit removal (Headcell) is proposed instead. Full scale testing has shown that the approach backed by simple sedimentation concepts can be designed to get targeted fine grit.

| | **PROPOSAL** | WI-1 |
|---|---|---|
| **COMPONENT:** Grit Separation | **AUTHOR** | EF |

The system is shorter and fits well downstream of the transfer station and before equalization. The Headcell is proposed to get 104 micron grit at normal flows and 200 micron grit at the full 12 MGD peak flow.

**CURRENT CONCEPT**

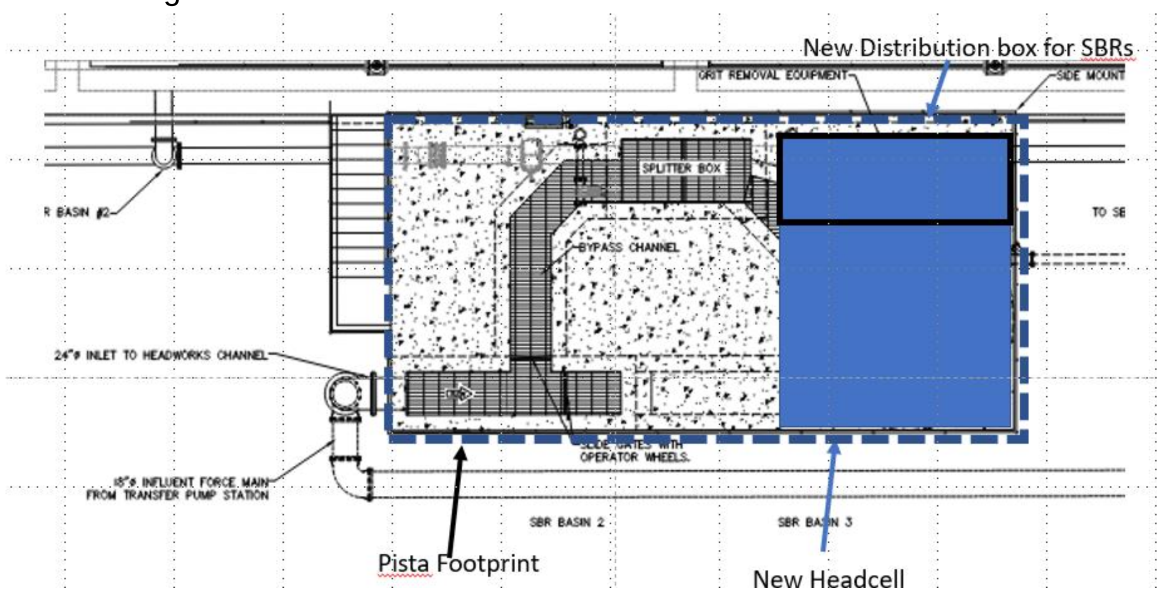
The current plan and profile are as follows (for 8 MGD)

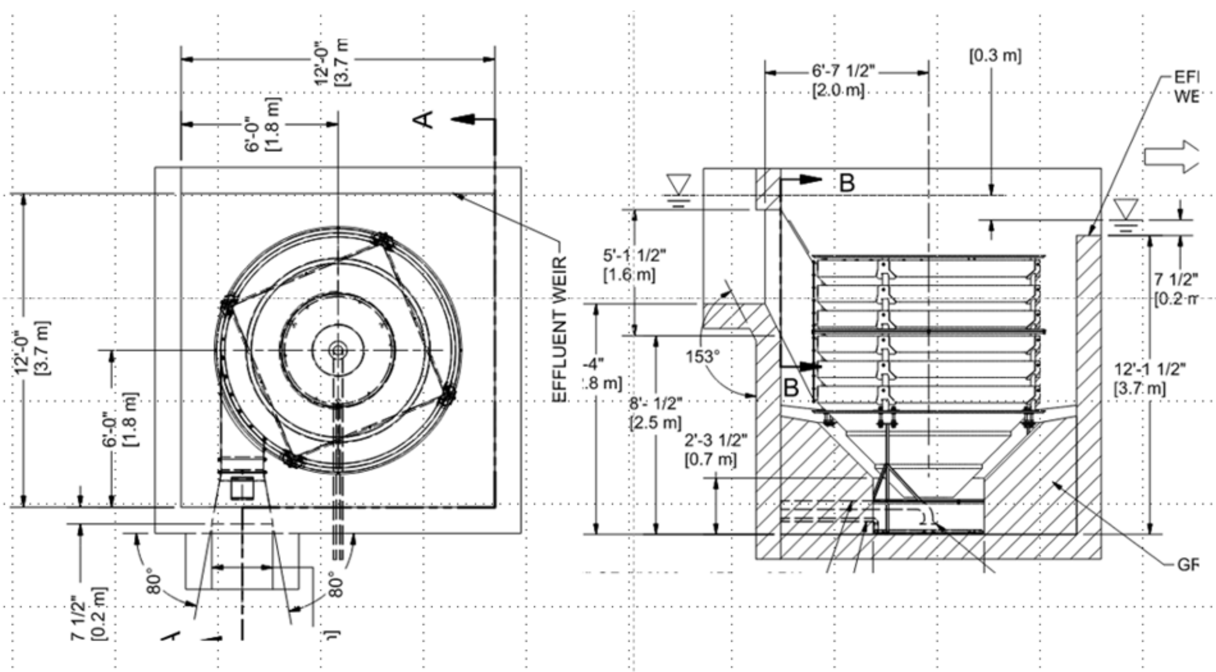


| | | |
|---|---|---|
| | **PROPOSAL** | WI-1 |
| **COMPONENT:** Grit Separation | **AUTHOR** | EF |

**VE CONCEPT**

A single 9 tray, 12’ diameter Headcell looks as follows (12 MGD) when laid over the current design.



| | PROPOSAL | WI-1 |
|---|---|---|
| **COMPONENT:** Grit Separation | **AUTHOR** | EF |

## COMPONENT LIFE CYCLE COST ANALYSIS (LCCA)

**WI-1** (proposal #)

| | |
|---|---|
| Client: | City of Molalla |
| Project | Wastewater Treatment Plant Upgrades |
| Date: | 10-Dec-21 |
| By: | DCS |
| COMPONENT | Grit Separation |
| COMPONENT # | WI-1 |
| Escalation rate | 0.03 |
| Discount rate | 0.04 |
| Study Period | 50 Yrs. |

Notes: Improved grit removal is assumed to reduce downstream equipment annual maintenance cost from 2% to 1% of capital cost. Similarly, major maintenance every 10 years is assumed reduced from 15% to 10% of capital cost. Salvage value is assumed at 10% in both current and proposed cases. The capital costs are for the process equipment ($10M for current design).

Instructions: Enter escalation, discount, and study period above.
Enter annual costs, replacement costs (and appropriate replacement year), and salvage value.
Enter these costs in the shaded cells using today's (current) dollars. For annual costs, escalation rates will be automatically entered,
but can be individually overwritten below for differential escalation.
All costs will automatically be escalated and discounted.

ALTERNATIVE A : **Current** — ALTERNATIVE B: **Proposed** — DIFFERENCE

### INITIAL COSTS

| | INITIAL COST | INITIAL COST | DIFFERENCE |
|---|---|---|---|
| | 10,000,000 | $ 9,744,000 | $ 256,000 |

### O & M ANNUAL COSTS

STAFFING OPERATIONS
STAFFING MAINTENANCE
SUPPLIES OPERATIONS
SUPPLIES MAINTENANCE

| Subcomponents | Cost in current $ | Esc. | Pres. Worth $ | Subcomponents | Cost in current $ | Esc. | Pres. Worth $ | Difference |
|---|---|---|---|---|---|---|---|---|
| Annual maintenance cost | 200,000 | 0.03 | $ 8,073,653 | Annual maintenance cost | 97,440 | 0.03 | $ 3,933,484 | $ 4,140,169 |
| | | 0.03 | $ - | | | 0.03 | $ - | $ - |
| | | 0.03 | $ - | | | 0.03 | $ - | $ - |
| SUBT. O & M OVER LIFE CYCL | $ 200,000 | | $ 8,073,653 | | 97,440 | | $ 3,933,484 | $ 4,140,169 |

### MAJOR REHAB REPLACEMENT COSTS

| Subcomponents | Cost in current $ | Yr. | Pres. Worth $ | Subcomponents | Cost in current $ | Yr. | Pres. Worth $ | Difference |
|---|---|---|---|---|---|---|---|---|
| | | | $ - | | | | $ - | $ - |
| Maintenance rehab | 1,500,000 | 10 | $ 1,375,017 | Maintenance rehab | 974,400 | 10 | $ 893,211 | $ 481,806 |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| SUBT. REPLACEMENT | | | $ 1,375,000 | | | | $ 893,000 | $ 482,000 |

| | Current | Proposed | Difference |
|---|---|---|---|
| TOT. O & M & REPL. (Pres. Worth) | 9,449,000 | 4,826,000 | 4,623,000 |
| TOT. INITIAL, O&M, & REPL. (Pres. Worth) | 19,449,000 | 14,570,000 | 4,879,000 |

| | Cost in current $ | Yr. | Pres. Worth $ | Cost in current $ | Yr. | Pres. Worth $ | Difference |
|---|---|---|---|---|---|---|---|
| SALVAGE VALUE | 1,000,000 | 50 | $ 647,000 | 974,400 | 50 | $ 631,000 | $ 16,000 |
| **TOT. INITIAL, O&M, REPL. MINUS SALVAGE** | | | **18,802,000** | | | **13,939,000** | **4,863,000** |

**COST ESTIMATE FORM**

**WI-1**

COMPONENT: Grit Separation

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Const. Facilities & Temporary Controls | 1 | LS | 105,000 | 105,000 | Const. Facilities & Temporary Controls | 1 | LS | 75,000 | 75,000 |
| Vortex Grit Removal Equipment | 1 | LS | 375,000 | 375,000 | Headcell | 1 | LS | 400,000 | 400,000 |
| Grit Classifier Equipment | 1 | LS | 80,000 | 80,000 | Included in Headcell | 1 | LS | | |
| Concrete (Pist Grit Structure) | 1 | LS | 48,000 | 48,000 | Not needed | 1 | LS | | |
| Concrete (Structure/Flow Channels) | 1 | LS | 120,000 | 120,000 | Concrete (Structure/Flow Channels) | 1 | LS | 100,000 | 100,000 |
| 4" Diameter Grit Piping and Valves | 1 | LS | 7,500 | 7,500 | 4" Diameter Grit Piping and Valves | 1 | LS | 8,000 | 8,000 |
| Utility Station | 1 | LS | 1,000 | 1,000 | Utility Station | 1 | LS | 1,000 | 1,000 |
| Aluminum Grating | 1 | LS | 5,000 | 5,000 | Aluminum Grating | 1 | LS | 5,000 | 5,000 |
| 12" Diameter Magnetic Flow Meter (SBR | 1 | LS | 40,000 | 40,000 | Duplicate of transfer meter | 1 | LS | 15,000 | 15,000 |
| Slide Gates | 1 | LS | 30,000 | 30,000 | Slide Gates | 1 | LS | 15,000 | 15,000 |
| Mechanical | 1 | LS | 50,000 | 50,000 | Mechanical | 1 | LS | 50,000 | 50,000 |
| Electrical | 1 | LS | 50,000 | 50,000 | Electrical | 1 | LS | 35,000 | 35,000 |
| Lighting | 1 | LS | 8,000 | 8,000 | Lighting | 1 | LS | 8,000 | 8,000 |
| Instrumentation, Controls, & SCADA | 1 | LS | 30,000 | 30,000 | Instrumentation, Controls, & SCADA | 1 | LS | 30,000 | 30,000 |
| Stairs | 1 | LS | 10,000 | 10,000 | Stairs | 1 | LS | 10,000 | 10,000 |
| Handrails | 1 | LS | 5,625 | 5,630 | Handrails | 1 | LS | 6,000 | 6,000 |
| Coatings | 1 | LS | 13,500 | 13,500 | Coatings | 1 | LS | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Subtotal | | | | 978,630 | Subtotal | | | | 758,000 |
| General Contractor Markup | 15.871 | % | | 155,318 | General Contractor Markup | 15.871 | % | | 120,302 |
| Total to nearest $1000 | | | | 1,134,000 | Total to nearest $1000 | | | | 878,000 |
| | | | | | | | | | |
| | | | | | Difference | | | | 256,000 |

MENG Analysis

Proposal **WI-1**

| | **PROPOSAL** | WI-2 |
|---|---|---|
| **COMPONENT:** Influent Equalization | **AUTHOR** | EF |

**CURRENT CONCEPT**

Influent equalization is between the headworks and the transfer station. As a result, the tank is the deepest structure in the project and cannot drain back to the headworks by gravity. The equalization tank is before grit removal and will become a catch basin for significant amounts of debris when used. Use of the equalization tank is projected to be just a few times per year on peak storm flows only.

**VE CONCEPT**

Relocate the equalization tank to occur after transfer pumping and grit removal, bringing the tank up out of the groundwater, and improve flow by draining by gravity back to the transfer station.

| **FUNCTIONS** | | |
|---|---|---|
| Simplify Operations | Equalize Flows | Equalize Loads |

**ADVANTAGES**

- Improve operations
- Reduce treatment O&M
- Reduce treatment energy use
- Simplify constructability

**DISADVANTAGES**

- Larger transfer station
- Increase pumping energy
- Adds treatment control complexity

**DISCUSSION**

The current plan is to only use flow equalization during large wet weather events. Flows from the headworks over 9 MGD up to 12 MGD would be routed to an inground 1-million-gallon tank.

| | PROPOSAL | WI-2 |
|---|---|---|
| **COMPONENT:** Influent Equalization | **AUTHOR** | EF |

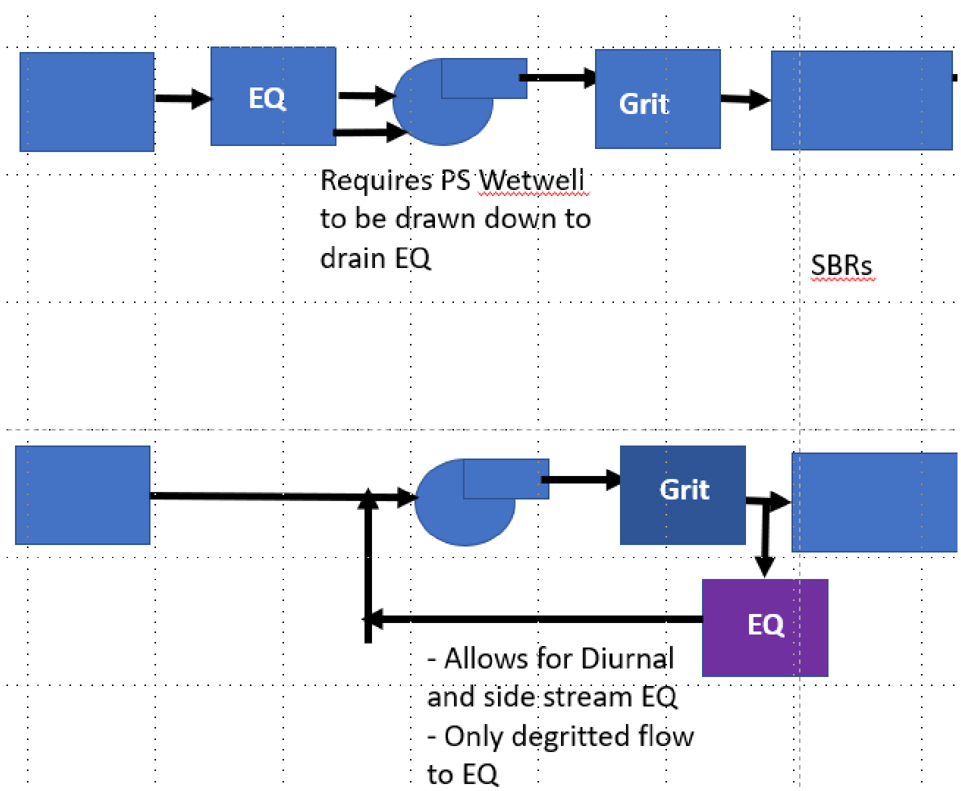
**CURRENT CONCEPT**

The proposed tank is behind the headworks screens but before grit removal. The tank is drained by pumping the transfer pump wet well 10 feet lower than its normal operating range. While the EQ basin is being drained, the incoming flow will need to be lifted 10 feet higher than normal. The basin is not configured to equalize small storms and diurnal peaking. The basin cannot be used to equalize recycle streams such as digester decanting, filter backwash, and screw press filtrate. Grit will accumulate in the basin when used.

**VE CONCEPT**

The proposed moves the EQ to after grit removal. The full 12 MGD peak flow would get grit removal and then 3 MGD would be split off to EQ. The EQ basin could also be used for smoothing diurnal peaks and side stream equalization reducing the design loads on the SBR.

Current and VE concept flow diagrams are shown on the following figure.



| | | **PROPOSAL** | WI-2 |
|---|---|---|---|
| **COMPONENT:** Influent Equalization | | **AUTHOR** | EF |

## COMPONENT LIFE CYCLE COST ANALYSIS (LCCA)

| | | |
|---|---|---|
| Client: | City of Molalla | WI-2 |
| Project: | Wastewater Treatment Plant Upgrades | proposal # |
| Date: | 10-Dec-21 | |
| By: | DCS | |
| COMPONENT | Influent Equalization | |
| COMPONENT # | WI-2 | |
| Escalation rate | 0.03 | |
| Discount rate | 0.04 | |
| Study Period | 50 Yrs. | |

Notes: Assume SBR and digester blower power reduction of 30%; plus lower downstream energy use by UV, mixers, and other process equipment, assumed netting 25% energy use savings throughout. Per pre-design, total plant Phase 2 peak load is 3,000 kW; assume Phase 1 continuous average load is 500 kW, with electric rate of $0.10/kW-hr; hence $50/hr x 24 hr/day x 265 day/yr = $456K/yr.

Instructions: Enter escalation, discount, and study period above.
Enter annual costs, replacement costs (and appropriate replacement year), and salvage value.
Enter these costs in the shaded cells using today's (current) dollars. For annual costs, escalation rates will be automatically entered,
but can be individually overwritten below for differential escalation.
All costs will automatically be escalated and discounted.

| ALTERNATIVE A : | Current | | | ALTERNATIVE B: | Proposed | | | DIFFERENCE |
|---|---|---|---|---|---|---|---|---|
| **INITIAL COSTS** | | | INITIAL COST | | | | PROPOSED COST | DIFFERENCE |
| | | | 1,396,000 | | | | $ 973,000 | $ 423,000 |
| **O & M ANNUAL COSTS** | | | | | | | | |
| STAFFING OPERATIONS | | | | | | | | |
| STAFFING MAINTENANCE | | | | | | | | |
| SUPPLIES OPERATIONS | | | | | | | | |
| SUPPLIES MAINTENANCE | | | | | | | | |
| Subcomponents | Cost in current $ | Esc. | Pres. Worth $ | Subcomponents | Cost in current $ | Esc. | Pres. Worth $ | |
| Maintenance cost | 13,960 | 0.03 | $ 563,541 | | 9,730 | 0.03 | $ 392,783 | $ 170,758 |
| Energy cost | 456,000 | 0.03 | $ 18,407,929 | Energy cost | 342,000 | 0.03 | $ 13,805,947 | $ 4,601,982 |
| | | 0.03 | $ - | | | 0.03 | $ - | $ - |
| SUBT. O & M OVER LIFE CYCL | $ 469,960 | | $ 18,971,470 | | 351,730 | | $ 14,198,730 | $ 4,772,740 |
| **MAJOR REHAB REPLACEMENT COSTS** | | | | | | | | |
| Subcomponents | Cost in current $ | Yr. | Pres. Worth $ | Subcomponents | Cost in current $ | Yr. | Pres. Worth $ | |
| | | | $ - | | | | $ - | $ - |
| Maintenance rehab | 139,600 | 25 | $ 112,312 | Maintenance rehab | 97,300 | 25 | $ 78,281 | $ 34,032 |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| | | | $ - | | | | $ - | $ - |
| SUBT. REPLACEMENT | | | $ 112,000 | | | | $ 78,000 | $ 34,000 |
| TOT. O & M & REPL. (Pres. Worth) | | | 19,083,000 | | | | 14,277,000 | 4,806,000 |
| TOT. INITIAL, O&M, & REPL. (Pres. Worth) | | | 20,479,000 | | | | 15,250,000 | 5,229,000 |
| | Cost in current $ | | | | Cost in current $ | | | |
| SALVAGE VALUE | 139,600 | 50 | $ 90,000 | | 97,300 | 50 | $ 63,000 | $ 27,000 |
| **TOT. INITIAL, O&M, REPL. MINUS SALVAGE** | | | **20,389,000** | | | | **15,187,000** | **5,202,000** |

**COST ESTIMATE FORM**

**WI-2**

COMPONENT: Influent Equalization

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Construction Facilities & Temporary Co | 1 | LS | 129,000 | 129,000 | Construction Facilities & Temporary Co | 1 | LS | 60,000 | 60,000 |
| Gravel Under Structure | 1 | LS | 33,000 | 33,000 | Gravel Under Structure | 1 | LS | 33,000 | 33,000 |
| Concrete (Slab) | 1 | LS | 660,000 | 660,000 | Concrete (Slab) | 1 | LS | 300,000 | 300,000 |
| Concrete (Walls) | 1 | LS | 180,000 | 180,000 | Concrete (Walls) | 1 | LS | 250,000 | 250,000 |
| Piping, Valves | 1 | LS | 10,000 | 10,000 | Piping, Valves | 1 | LS | 10,000 | 10,000 |
| Handrails | 1 | LS | 12,000 | 12,000 | Handrails | 1 | LS | 6,000 | 6,000 |
| Utility Station | 1 | LS | 1,000 | 1,000 | Utility Station | 1 | LS | 1,000 | 1,000 |
| Backfill | 1 | LS | 179,400 | 179,400 | Backfill | 1 | LS | 80,000 | 80,000 |
| | | | | | Flushing and return control system | 1 | LS | 100,000 | 100,000 |
| Note that instrumentation and controls are missing from both approaches | | | | | | | | | |
| Subtotal | | | | 1,204,400 | Subtotal | | | | 840,000 |
| General Contractor Markup | 15.871 | % | | 191,150 | General Contractor Markup | 15.871 | % | | 133,316 |
| Total to nearest $1000 | | | | 1,396,000 | Total to nearest $1000 | | | | 973,000 |
| | | | | | Difference | | | | 423,000 |

MENG Analysis

Proposal **WI-2**

| | **PROPOSAL** | WT-1 |
|---|---|---|
| **COMPONENT:** Aerobic Digestion | **AUTHOR** | RDR |

**CURRENT CONCEPT**

The current design is to construct two 400,000-gallon aerobic digesters. The digesters are to provide stabilization of the biomass to meet EPA 503 Class B standards. The stabilized solids are then dewatered with a screw press and hauled to a local landfill for ultimate disposal.

**VE CONCEPT**

This VE concept is to not stabilize the biomass to Class B standards but to make the tankage smaller to 30 days holding time and then dewater the biomass for hauling and ultimate disposal at the local landfill.

| **FUNCTIONS** | | |
|---|---|---|
| Hold Biomass | Aerate Biomass | Minimize Volume |

**ADVANTAGES**

- Lower cost for tanks and associated equipment
- Opportunity for phasing tankage as plant loads increase
- Class B biosolids opportunity not lost as additional tankage can be added in the future

**DISADVANTAGES**

- Opportunity for Class B land application program initially lost
- Must add tankage in future if Class B is determined necessary

**DISCUSSION**

The aerobic digester design capacity is shown on Table 3.11.4.1 and is described in section 3.11.3 Design Criteria. Key elements of this design criteria are the SRT of 60 days. This is obtained in the proposed volume due to periodic decanting of the digesters. Changing this design criteria to 30 days (4 weeks) to operate as a holding tank will allow for adequate storage for screw press maintenance. 38% volatile solids reduction will not be achieved, but this is not necessary for landfilling.

| | | **PROPOSAL** | WT-1 |
|---|---|---|---|
| **COMPONENT:** Aerobic Digestion | | **AUTHOR** | RDR |

**TABLE 3.11.4.1**
**AEROBIC DIGESTER DESIGN DATA**

| Item | Data |
|---|---|
| Type | Aerobic Digester |
| Number of Basins (Phase I) | 2 |
| Number of Basins (Phases I + II) | 3 |
| SRT (Days) | 60 |
| Total Volume Phase I (Gal) | 800,000 |
| Total Volume Phases I + II (Gal) | 1,200,000 |
| Basin Dimensions | |
| Basin Length (ft) | 118.6 |
| Basin Width (ft) | 25.05 |
| TWL (ft) | 18 |

## 3.11.3 Design Criteria

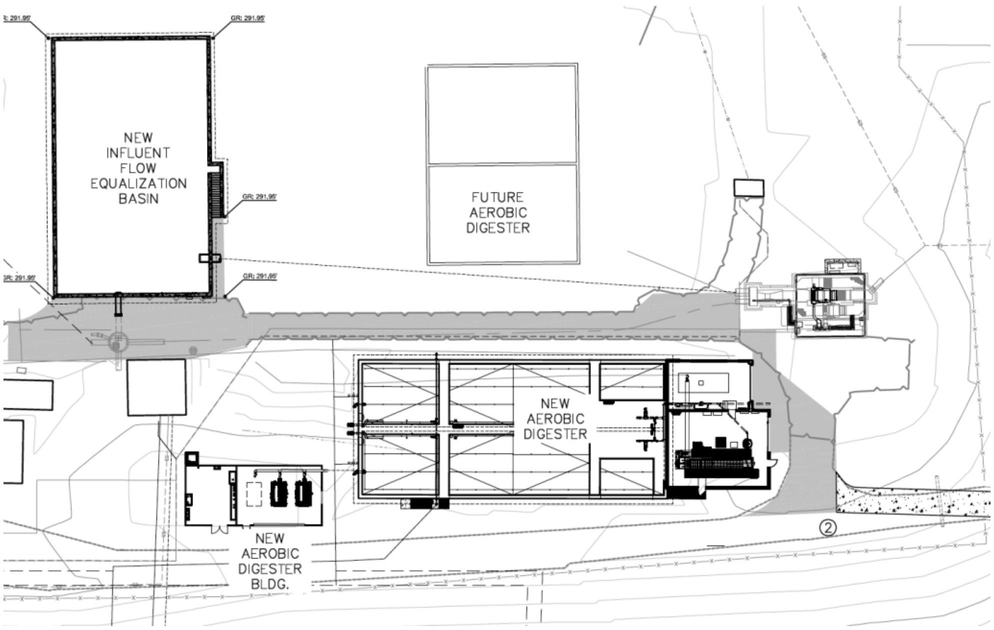
The design criteria for the Aerobic Digester and ancillary systems is listed below.

**Aerobic Digester**

- Provide adequate tank volume to allow sixty days SRT for the projected sludge loading for the year 2035 (Phase I).
- Minimum 38 percent vector attraction reduction.
- Provide an overflow between basins.
- Provide the ability to sequentially fill digester tanks or fill each digester tank directly from WAS pumps.
- Provide adequate air distribution to accomplish mixing and aerobic digestion to produce a stabilized biosolids within the design residence time.
- Provide the ability to decant supernatant after settling from any digester basin. Target solids concentration within digesters of 1.4 to 2 percent.
- Provide a staff gauge for each basin.
- Have the ability to transfer sludge to any of the digester basins, Biosolids Dewatering Facility, or tanker truck loading.
- Provide Dissolved Oxygen / Oxidation Reduction Potential (DO/ORP) probe for process optimization and control.

| | **PROPOSAL** | WT-1 |
|---|---|---|
| **COMPONENT:** Aerobic Digestion | **AUTHOR** | RDR |

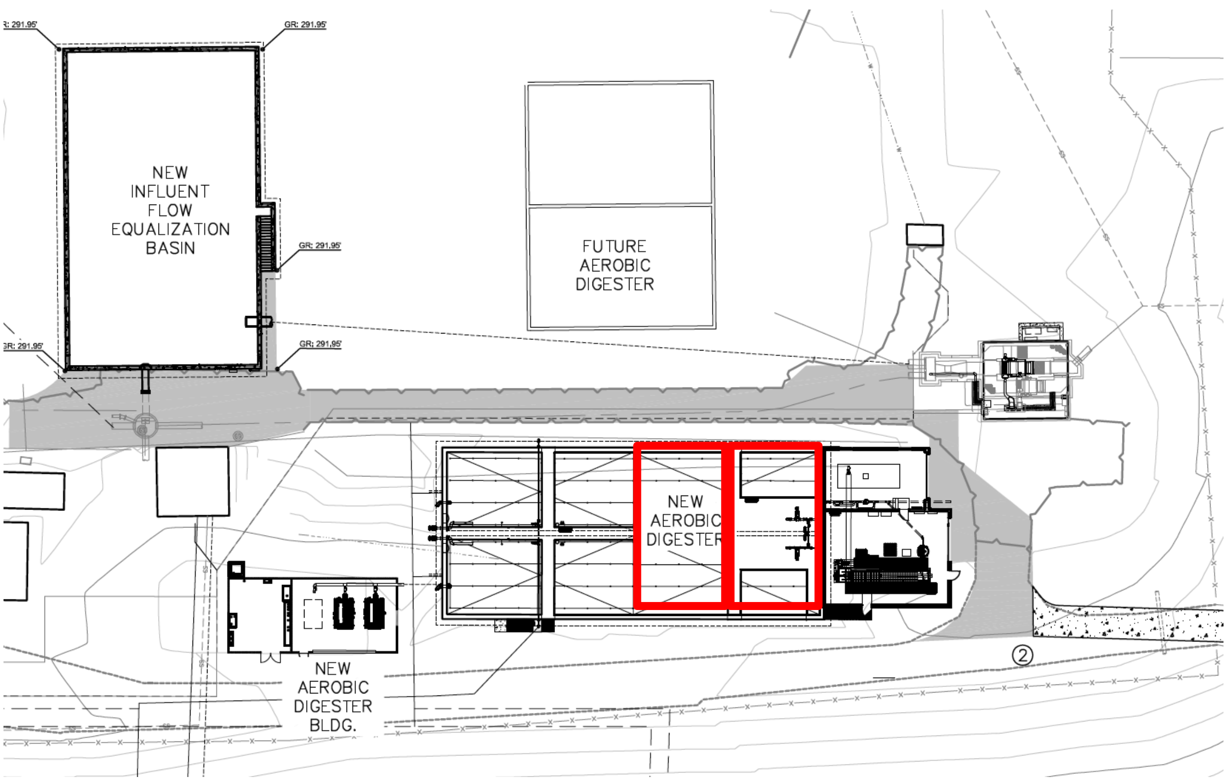
**CURRENT CONCEPT**



| | **PROPOSAL** | WT-1 |
|---|---|---|
| **COMPONENT:** Aerobic Digestion | **AUTHOR** | RDR |

**VE CONCEPT**

The VE concept is to only construct 50% of the aerobic digester volume reducing the SRT in the aerobic digesters from 60 days to 30 days. The SBR tankage will then be reduced from two 400,000-gallon tanks to two 200,000-gallon tanks. Each tank will still have its own decant capability. With this concept, dewatered can only be hauled to the landfill for disposal. No application on local farmland will be allowed.



City of Molalla

Wastewater Treatment Plant Upgrades

VALUE ENGINEERING STUDY

**COST ESTIMATE FORM**

COMPONENT: Aerobic Digestion

**WT-1**

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Const. Facilities & Temporary Controls | 1 | LS | 266,000 | 266,000 | Const. Facilities & Temporary Controls | 1 | LS | 266,000 | 133,000 |
| Demolition and Site Preparation | 1 | LS | 177,000 | 177,000 | Demolition and Site Preparation | 1 | LS | 177,000 | 88,500 |
| Excavation | 1 | LS | 141,750 | 141,750 | Excavation | 1 | LS | 141,750 | 70,880 |
| Gravel Under Structure | 1 | LS | 10,450 | 10,450 | Gravel Under Structure | 1 | LS | 10,450 | 5,230 |
| Concrete (Walls) | 1 | LS | 240,000 | 240,000 | Concrete (Walls) | 1 | LS | 240,000 | 120,000 |
| Concrete (Slab) | 1 | LS | 660,000 | 660,000 | Concrete (Slab) | 1 | LS | 660,000 | 330,000 |
| Concrete (Walkways) | 1 | LS | 72,000 | 72,000 | Concrete (Walkways) | 1 | LS | 72,000 | 36,000 |
| Blowers, Diffusers, and Controls | 1 | LS | 875,000 | 875,000 | Blowers, Diffusers, and Controls | 1 | LS | 875,000 | 437,500 |
| Decanters | 2 | EA | 30,000 | 60,000 | Decanters | 2 | EA | 30,000 | 60,000 |
| 4" Diameter Magnetic Flow Meter (WAS | 1 | LS | 4,000 | 4,000 | 4" Diameter Magnetic Flow Meter (WAS | 1 | LS | 4,000 | 4,000 |
| Instrumentation | 1 | LS | 20,000 | 20,000 | Instrumentation | 1 | LS | 20,000 | 20,000 |
| Electrical | | | 55,000 | | Electrical | 1 | LS | 55,000 | 55,000 |
| Lighting | | | 25,000 | | Lighting | 1 | LS | 25,000 | 25,000 |
| Utility Stations | | | 4,000 | | Utility Stations | 1 | LS | 4,000 | 4,000 |
| Coatings | 1 | LS | 10,000 | 10,000 | Coatings | 1 | LS | 10,000 | 10,000 |
| Handrail | 1 | LS | 18,750 | 18,750 | Handrail | 1 | LS | 18,750 | 9,380 |
| Portable Hoist | 1 | LS | 8,000 | 8,000 | Portable Hoist | 1 | LS | 8,000 | 8,000 |
| Manway Access Ports | 1 | LS | 20,000 | 20,000 | Manway Access Ports | 1 | LS | 20,000 | 20,000 |
| Stairs | 1 | LS | 20,000 | 20,000 | Stairs | 1 | LS | 20,000 | 20,000 |
| | | | | | | | | | |
| Subtotal | | | | 2,602,950 | Subtotal | | | | 1,456,490 |
| General Contractor Markup | 15.871 | % | | 413,114 | General Contractor Markup | 15.871 | % | | 231,160 |
| Total to nearest $1000 | | | | 3,016,000 | Total to nearest $1000 | | | | 1,688,000 |
| | | | | | | | | | |
| | | | | | Difference | | | | 1,328,000 |

MENG Analysis

Proposal

**WT-1**

| | **PROPOSAL** | WE-1 |
|---|---|---|
| **COMPONENT:** Effluent Filtration | **AUTHOR** | DCS |

**CURRENT CONCEPT**

Effluent filtration to Class A for:

1) Future Class A effluent
2) For proprietary downstream UV treatment

**VE CONCEPT**

Reduce effluent filtration:

Alternate A) Reduce filtration from Class A to Class C
Alternate B) Eliminate filtration with use of non-proprietary downstream UV treatment

**FUNCTIONS**

| | | |
|---|---|---|
| Remove Particulate | Comply Regulation | Protect Downstream |

**ADVANTAGES**

- Lower first cost
- Lower life cycle cost
- Smaller footprint

**DISADVANTAGES**

- Increased effluent particulate

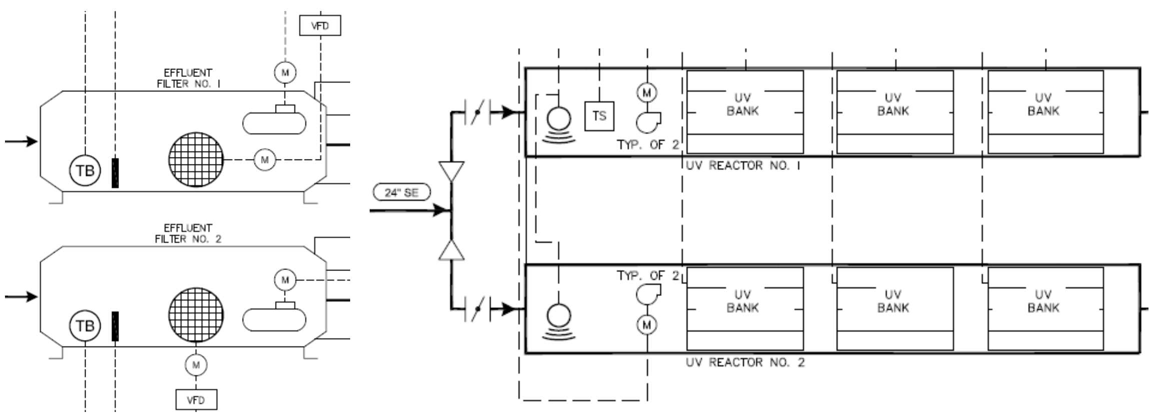
**DISCUSSION**

Reportedly, the effluent filtration is provided to: 1) Support future Class A reclaim water, and especially in Phase 1, 2) Allow use of highly proprietary UV treatment equipment.

This proposal suggests two alternates to reduce the cost, complexity, and operations and maintenance cost of the filtration unit process by: A) Relaxing the degree of filtration from effluent Class A to Class C, as Class A is not required by the permit, or B) Eliminate filtration entirely and use non-proprietary downstream UV treatment equipment.

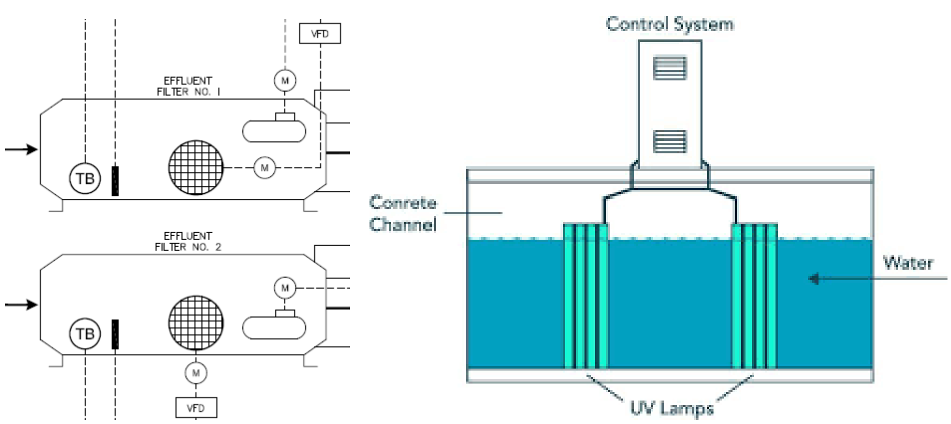
| | PROPOSAL | WE-1 |
|---|---|---|
| **COMPONENT:** Effluent Filtration | **AUTHOR** | DCS |

## CURRENT CONCEPT




Class A effluent filters (left) feeding proprietary UV treatment (right).

## VE CONCEPT




Class C effluent filters (left) feeding non-proprietary UV treatment (right) under Alt A, or no UV at all under Alt B.

**COST ESTIMATE FORM**

**WE-1**

COMPONENT: Effluent Filtration

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| Effluent filters and support, Class A | 1 | LS | 1,485,000 | 1,485,000 | No filter | | | | |
| Proprietary UV treatment | 1 | LS | 1,851,000 | 1,851,000 | Conventional UV treatment | 1 | LS | 2,128,650 | 2,128,650 |
| Subtotal | | | | 3,336,000 | Subtotal | | | | 2,128,650 |
| General Contractor Markup | 15.871 | % | | 529,457 | General Contractor Markup | 15.871 | % | | 337,838 |
| Total to nearest $1000 | | | | 3,865,000 | Total to nearest $1000 | | | | 2,466,000 |
| | | | | | Difference | | | | 1,399,000 |

MENG Analysis

Proposal **WE-1**

| | PROPOSAL | WE-2 |
|---|---|---|
| **COMPONENT:** UV Disinfection | **AUTHOR** | DCS |

**CURRENT CONCEPT**

UV disinfection to Class C standard, with provision for future upgrade to Class A.

**VE CONCEPT**

UV disinfection to Class C only, with no provisions for future upgrade.

| FUNCTIONS | | |
|---|---|---|
| Disinfect Effluent | Occupy Space | Ready Future |

**ADVANTAGES**

- Lower first cost

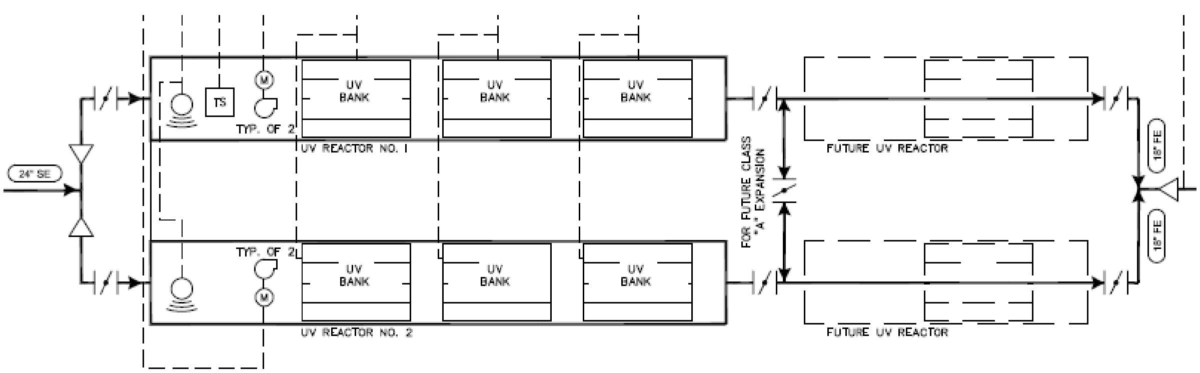
**DISADVANTAGES**

- Potentially less future-ready

**DISCUSSION**

The need for future Class A reclaim water production is unclear and the project is overbudget. This proposal suggests eliminating Phase 1 provisions for the future upgrade to Class A treatment to reduce project cost and complexity.

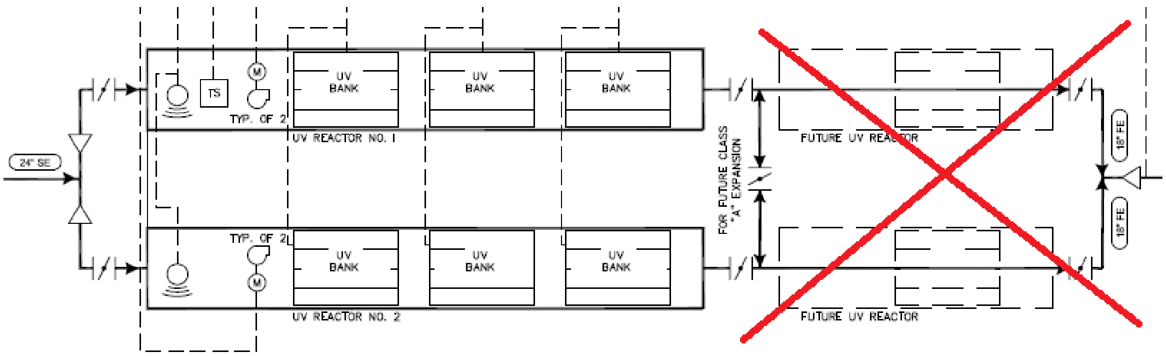
**CURRENT CONCEPT**




UV disinfection to Class C with provision for future disinfection to Class A.

| | | |
|---|---|---|
| | **PROPOSAL** | WE-2 |
| **COMPONENT:** UV Disinfection | **AUTHOR** | DCS |

**VE CONCEPT**




UV disinfection to Class C without current provision for future upgrade.

**COST ESTIMATE FORM** **WE-2**

COMPONENT: UV Disinfection

| CURRENT DESIGN | | | | | VE PROPOSAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** | **ITEM** | **QTY** | **UNIT** | **UNIT COST** | **TOTAL COST** |
| UV disinfection; with Class A provision | 1 | LS | 1,851,000 | 1,851,000 | UV disinfection; Class C only | 1 | LS | 1,721,430 | 1,721,430 |
| Subtotal | | | | 1,851,000 | Subtotal | | | | 1,721,430 |
| General Contractor Markup | 15.871 | % | | 293,772 | General Contractor Markup | 15.871 | % | | 273,208 |
| Total to nearest $1000 | | | | 2,145,000 | Total to nearest $1000 | | | | 1,995,000 |
| | | | | | Difference | | | | 150,000 |

MENG Analysis

Proposal **WE-2**

# IV. TECHNICAL REPORTS

| No. | Name |
|---|---|
| T1 | Permitting |
| T2 | Headworks Capacity |
| T3 | Treatment Process |

| TECHNICAL REPORT | PROPOSAL | T-1 |
|---|---|---|
| **COMPONENT:** Permitting | **AUTHOR** | RDR |

**CURRENT CONCEPT**

The City has submitted a request to the Oregon Department of Environmental Quality (DEQ) for a modification to their NPDES permit. The existing design is based on these permit modifications being accepted by DEQ. The significant permit modifications that have been corrected are:

1. Have 10/10 (BOD/TSS) limit changed to the Willamette River Basin wet weather standard of 30/30.
2. Obtain a wet weather mass load increase based on the new plant wet weather design flows at the 30/30 wet weather standard.
3. Have the discharge point of compliance changed from the end of the effluent pipeline, currently at the river, to the end of the plant's treatment train following UV disinfection and prior to the effluent pump station.
4. Obtain the ability to discharge to the Mollala River during the dry weather months of May, June, and October if the river flows are greater than 350-cfs and the river water temperature is less than 18°C even though there is no current temperature allocation for Molalla in the Molalla River Temperature TMDL.
5. Allow for discharge of treated water from the effluent storage ponds (existing treatment lagoons) through the outfall during the wet weather season without additional treatment or disinfection. The current design is based on the discharge of stored water not be sampled or accounted for in the discharge loads.

**CONSIDERATIONS**

Changes in the any of the five permit modification assumptions made in the current concept will require a change in the design of the treatment plant and may significantly increase the cost of treatment. Considerations on how the City should proceed along with the impacts to the design if the above permit modifications are not granted are discussed in the following sections.

1. **Continue to use attorney to correct existing pervious 10/10 permitting error**
   It is recommended that the City continue to use an environmental attorney to lead the efforts in coordinating the permit modifications. Though a significant project cost, a legal firm has a necessary set of skills not provided by City staff

| TECHNICAL REPORT | PROPOSAL | T-1 |
|---|---|---|
| COMPONENT: Permitting | AUTHOR | RDR |

or engineering firms that will be required to get the required permit changes. For instance, the issue of the 10/10 standard vs. the 30/30 standard is a legal issue. The change in this limit will fall under the anti-backsliding rule where the limits cannot be made less strict. In this case, not changing the limit when the outfall was moved from Bear Creek to the Molalla River was clearly an error in judgement of permit writer and City staff. This change should have been done. The Clean Water Act allows a change in standards under the anti-backsliding rule, if an error was made. This level of permit negotiation is best done by an environmental attorney. With the significant project cost impacts of not getting the requested permit modifications, the attorney fees will be of high value to the project.

2. **Have 10/10 (BOD/TSS) limit changed to the Willamette River Basin wet weather standard of 30/30**

   This single permit modification request will have the most significant impact on project costs. The SBR treatment process followed by effluent filters can meet the 10/10 concentration limit. The impact is not based on concentration, but on the mass load that can be discharged. The mass load that can be discharged, by Oregon Administrative Rule, is calculated using the concentration limit at the design wet weather flow. Using the 30/30 standard, the wet weather average monthly effluent load that the current design is based on is 1126-lbs./day, average weekly is 1689-lbs./day and the daily maximum is 2252-lbs./day. The peak day flow is 6.62-mgd. Under the designed permit scenario, to meet the daily maximum mass load, the plant must discharge a BOD and TSS concentration of 41-mg/L.

   If the 30/30 limit is not obtained and a 10/10 limit is maintained, then the effluent mass loads will be based on the 10/10 limit. With the new design flows and the mass load limit base on the 10/10 standard, the new wet weather average monthly effluent load will be 375-lbs./day, average weekly will be 562-lbs./day and the daily maximum will be 750-lbs./day. This means that at the design peak week flow of 6.4-mgd, the effluent concentration for BOD and TSS will need to be less than 10.5-mg/L and the concentration will need to be less than 10-mg/L. This will require filtration of all flow during the winter months requiring the filters to be sized to take the peak 2043 flow of 12.07-mgd. The current filter design has two filters with a capacity of 4.5-mgd each. This is a hydraulic-based

| TECHNICAL REPORT | PROPOSAL | T-1 |
|---|---|---|
| COMPONENT: Permitting | AUTHOR | RDR |

design, so redundancy requirements will require an additional unit, with a total of 4 units required. This will increase the cost of the facility by at least $1.5M.

3. **Obtain a wet weather mass load increase based on the new plant wet weather design flows at the 30/30 wet weather standard**
   The OAR's allow for DEQ to increase the wet weather mass load when the design flow is increased. The only issue that can affect this is if there is not adequate assimilative capacity in the river during the wet weather season. The City has had a consultant do water quality modeling of the river showing that there is adequate assimilative capacity in the river. Therefore, this should not be a problem, as long as the change from the 10/10 to the 30/30 standard is obtained.

4. **Have the discharge point of compliance changed from the end of the effluent pipeline, currently at the river, to the end of the plant's treatment train following UV disinfection and prior to the effluent pump station.**
   The current treatment system has a sample station located at the end of the 5-mile effluent pipeline to sample the plant effluent prior to being discharged into the Molalla River. This takes a considerable amount of staff time to travel to the station to pick up their samples. The new design is based on sampling the treated effluent at a sample station located at the treatment plant, taking samples between the UV disinfection process and the effluent pump station. This will provide significant savings in plant operations.

   The basis of this permit modification is that if the effluent standards are met at the designated point of compliance, plant sample station, and there is not significant impact to the effluent quality prior to discharge, then this is acceptable. There should be no issue with this change for DEQ not to allow it. If DEQ does not allow this change, then the current impact to operations will continue.

5. **Obtain the ability to discharge to the Molalla River during the dry weather months of May, June, and October if the river flows are greater than 350-cfs and the river water temperature is less than 18°C even though there is no current temperature allocation for Molalla in the Molalla River Temperature TMDL.**

| **TECHNICAL REPORT** | **PROPOSAL** | T-1 |
|---|---|---|
| **COMPONENT:** Permitting | **AUTHOR** | RDR |

The City of Molalla did not receive a temperature allocation in the Molalla River Temperature TMDL. This was because they were not permitted to discharge from the lagoon treatment system during the dry weather months and there was no representation during the TMDL process to get the City an allocation for a future treatment system. DEQ will not reopen the TMDL to give the City an allocation.

The permit modification request was made for DEQ to allow discharge to the river on a "conditional basis." This means that the discharge would be allowed during the shoulder months, May, June, and October, if the river had a flow greater than 350-cfs and the river water temperature was less than 18°C. The basis for this request is that the TMDL is based on a standard with the minimum river flow and temperature. If the river flow is greater than 350-cfs and the temperature greater than 18°C, the conditions that the TMDL are based do not apply. This is a reasonable request but needs to be approached by the attorneys through the legal perspective.

If the discharge on a "conditional basis" is not granted, then the City has two options:

- Option 1: Effluent Load Trade with Sanders Wood Products – Sanders Wood Products operates a sawmill that uses water for cooling and some other uses. This water is discharged to a wetland that discharges to a creek that eventually discharges to the Molalla River downstream of the City. Sanders Wood Products received a temperature waste load allocation in the TMDL. Based on the TMDL, this is only needed in the fall if there is a wet fall period. This allows the possibility to trade this allocation with them for use in the months of May and June.
- Option 2: Store Effluent During the Months of May, June, and October – This option requires storage during the months of May, June, and October. The question is, how much storage is required and if the modified ponds will have adequate storage. This will also require the need to lower the pond levels during the summer months by increasing the flow to the irrigation site. The issue here is if there is adequate acreage of application site available to accommodate the additional volumes of stored effluent. The treated effluent stored during the month

| TECHNICAL REPORT | PROPOSAL | T-1 |
| --- | --- | --- |
| **COMPONENT:** Permitting | **AUTHOR** | RDR |

of October can be discharged to the plant effluent following November 1, but there is an issue with how this will be accounted for in the permit.

6. **Allow for discharge of treated water from the effluent storage ponds (existing treatment lagoons) through the outfall during the wet weather season without additional treatment or disinfection**
The current design has assumed that the treated water in the storage ponds can be discharged to the river through the effluent pump station and outfall without additional treatment (i.e., running through the treatment plant or filtration and disinfection). I was referred by the designer to the Neskowin WWTP that stores effluent for discharge during the wet season. In this case, their effluent design flow was increased beyond their influent flow for this period to account for the additional load being discharged. If this same logic is followed by DEQ with the permit modification, then:
    a) The effluent maximum month design flow will need to be increased to obtain an additional wet weather load allocation.
    b) The pond effluent will need to be blended with the treated effluent and testing for BOD and TSS performed to calculate and report the actual discharge load to the river.
    c) There is a question on the need to disinfect the pond effluent. If the total discharge, pond plus plant, must meet the effluent disinfection requirements, then the UV system capacity will need to be increased to compensate for this additional flow, or a pond effluent management strategy will need to be developed to discharge it through filtration and UV disinfection when the wet weather flows are lower and the combined discharge can be done without overloading the existing process units and be discharged within the waste allocation for BOD and TSS.

| **TECHNICAL REPORT** | **PROPOSAL** | T-2 |
|---|---|---|
| **COMPONENT:** Headworks Capacity | **AUTHOR** | EF |

**CURRENT CONCEPT**

The hydraulic profile in the predesign documents shows a flooded Parshall flume as well as a surcharged influent sewer.

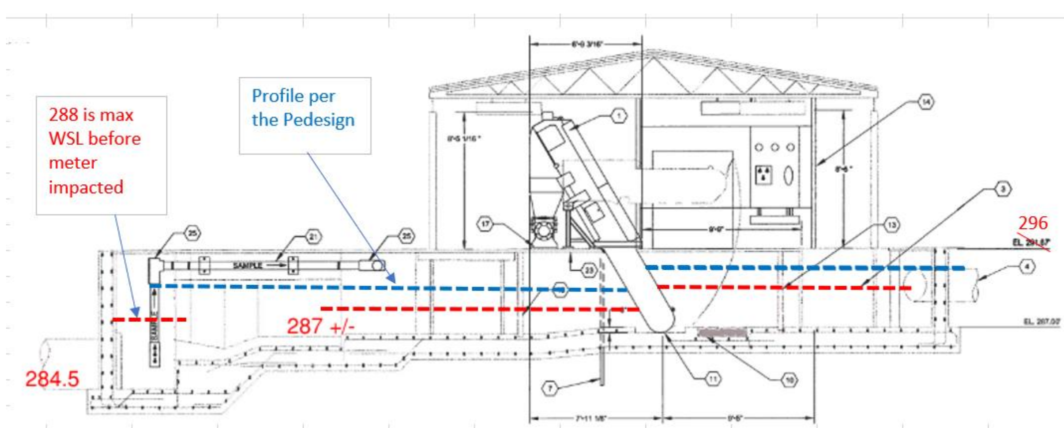
**CONSIDERATIONS**

The hydraulic profile in the predesign documents shows a flooded Parshall flume as well as a surcharged influent sewer. It is unclear how this could occur, but pumping immediately after the headworks could eliminate this situation.

There are discrepancies in various documents showing the influent trunk sewer size to be 18, 21, and 24 inches.

With any of these sizes, the sewer will likely be surcharged upstream at Hwy 213 and 12 MGD will not get to the headworks.

The capacity of the influent sewer appears to be approximately 9 MGD, the current peak flow. The headworks profile is depicted below.



| TECHNICAL REPORT | PROPOSAL | T-3 |
|---|---|---|
| **COMPONENT:** Treatment Process | **AUTHOR** | RDR |

**CURRENT CONCEPT**

The current design is based on a flow-through SBR provided by Sanitaire and now a couple other vendors. Sanitaire has the most experience with this SBR treatment alternative.

**CONSIDERATIONS**

Over the past few years, vendors have gained experience in flow-through SBRs as well as two new flow-through SBR process alternatives that have entered the market. Consideration should be given in bidding this system as a performance specification to provide the opportunity for these new SBR process alternatives to be evaluated to determine if significant cost savings can be achieved. These process alternatives are AquaNereda by AquaAerobics. AquaAerobics is a U.S. supplier of process equipment including conventional SBR systems. The advantage of the AquaNereda process is smaller SBR basins. The process utilizes the growth of a granular biomass that settles faster than conventional biomass, allowing for the smaller SBR basins.

Though a new process concept, there are a number of successful operations in Europe and a number of facilities are now in operation in the United States. The closest facility to Molalla is Whitefish, MT. The Whitefish WWTP has similar design flows and loads with an average dry weather flow of 1.59-mgd and a peak flow of 6.02-mgd. The process was selected over the Sanitaire flow-through SBR for which the system was designed due to a 20% savings in PV cost.

In summary, using an evaluated bid for the SBR equipment may produce significant savings in the SBR process. In this case, this could be as much as $1.8M.

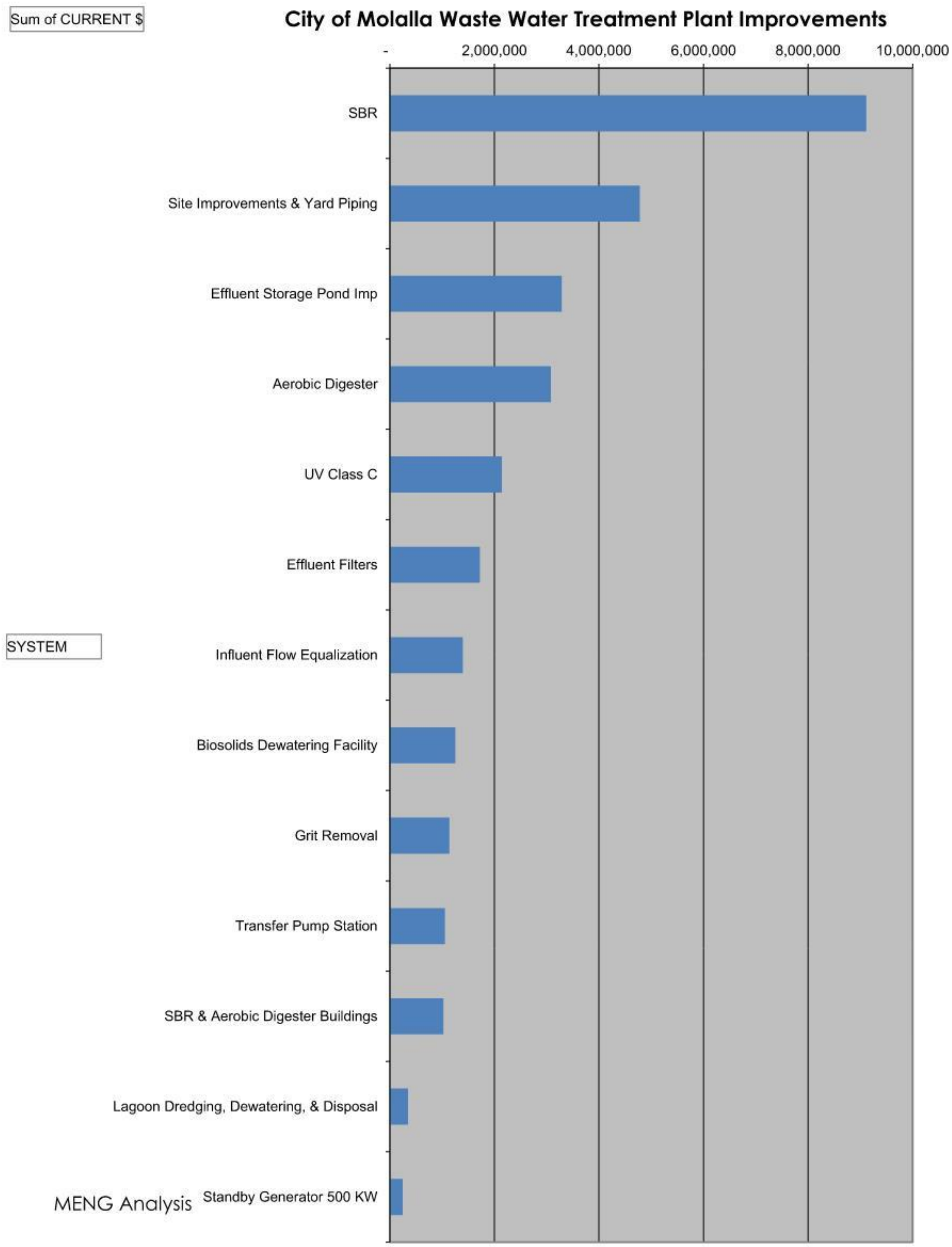
# V. VALUE ENGINEERING

## COST ANALYSIS

The VE team was not tasked to complete a detailed cost estimate review but as the various systems were explored, the team did review and analyze certain cost categories and developed a cost model based upon the design team's cost estimates. The tool is useful for understanding and allocation of cost resources on the project.

The cost model graph on the following page shows the cost estimate values broken down and grouped into function-based system costs. This tool assists in evaluating where the largest percentage of the project's resources are being allocated towards different building functions.

For this project, the SBR building is a significant cost driver for the project, followed by site improvements and yard piping, and pond improvements (relining and other improvements).


Sum of CURRENT $
City of Molalla Waste Water Treatment Plant Improvements
-
2,000,000
4,000,000
6,000,000
8,000,000
10,000,000
SBR
Site Improvements & Yard Piping
Effluent Storage Pond Imp
Aerobic Digester
UV Class C
Effluent Filters
SYSTEM
Influent Flow Equalization
Biosolids Dewatering Facility
Grit Removal
Transfer Pump Station
SBR & Aerobic Digester Buildings
Lagoon Dredging, Dewatering, & Disposal
MENG Analysis
Standby Generator 500 KW

## RISK ANALYSIS

While risk management should be conducted throughout the life cycle of a project, risk analysis integrated into the review study utilizes the skills and experience of the independent subject matter expert design professionals on the VE team. The process is used in identifying, evaluating, and prioritizing potential project risks to assist the owner and design team with risk management plan activities.

During the Evaluation Phase of the VE workshop, the team identified potential risks for the project quality, scope, cost, and schedule based on the current status of documents provided for the study. The team then conducted qualitative risk analysis with the nominal group technique collectively assessing risk probability, resultant potential cost, and project schedule impacts for each risk item on a scale of 1 to 5 (with 5 being high probability or impact). To prioritize the risk register, these impact scores are entered into a simple weighting formula:

Risk Priority = (Probability x Cost Impact) + (Probability x Schedule Impact)

The resultant weighted scores are then sorted and graphed. The project risk priority graph appears on the following page.

The intent of the risk analysis exercise is to identify major risk elements unique to each project for the benefit of the owner and design team and identify potential mitigation strategies where risk exposure can be controlled or reduced. The owner should collaborate with the design team to mitigate these risks.

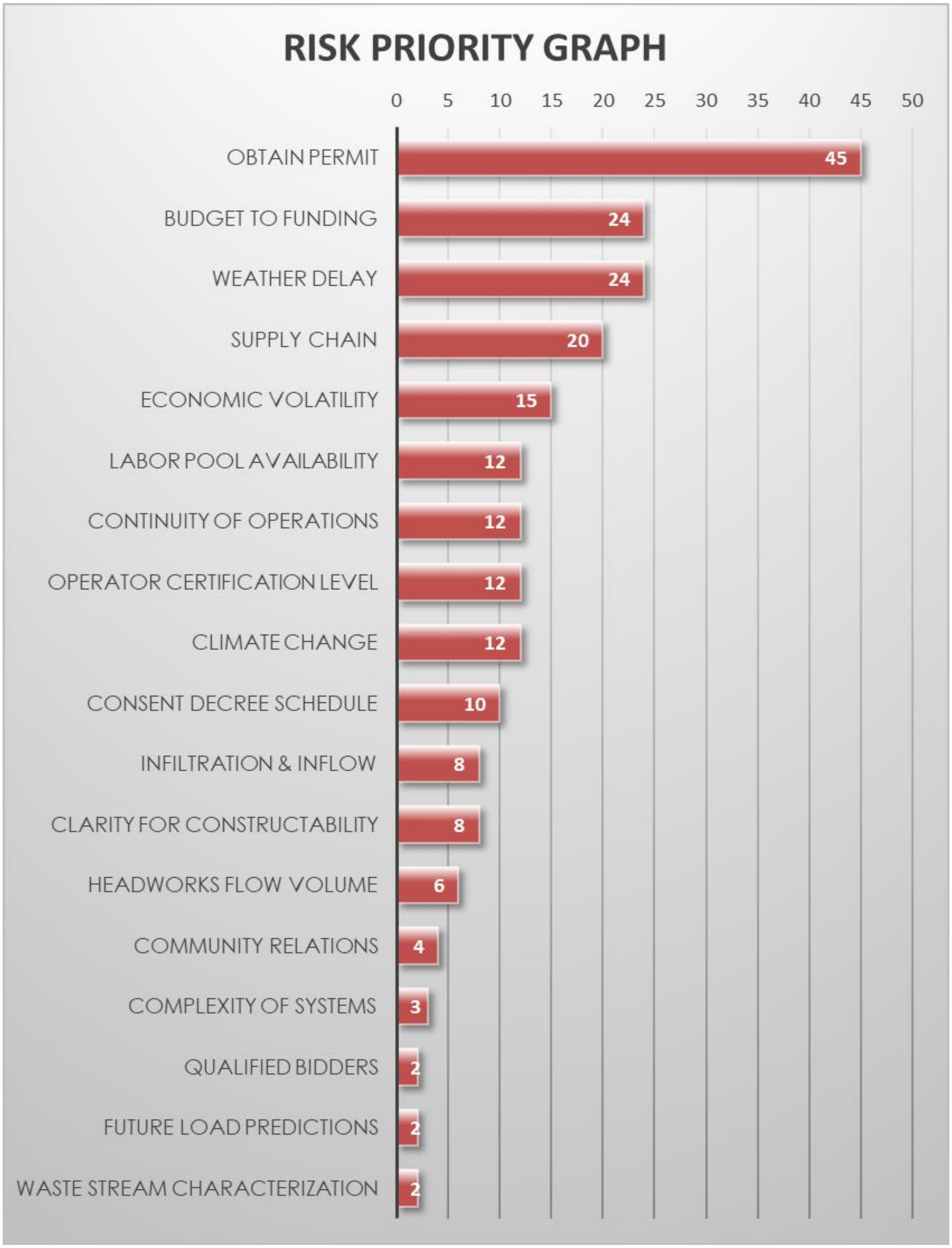
The majority of the risks that were identified by the team are largely external risk factor categories.

With uncertainty about DEQ requirements for the permit, any additional requirements or conditions for the permit could have significant cost, schedule, and operations implications. To mitigate this risk element, please see technical report T-1.

The second highest risk factor relates to the differential of the current estimate to the budget (currently overbudget). Design modifications should be incorporated to get the project back within the budget.

Other external risks include potential for weather delay (if the schedule for work in the ponds slips into the wet season), global and local supply chain issues, economic volatility (rapid inflation on the costs of materials and equipment), and even potential labor market impacts as the impacts of the pandemic continue to impact the marketplace.

Strategies for mitigation should be developed taking early action to reduce risk impact potential for all of the potential risks.


RISK PRIORITY GRAPH
0
5
10
15
20
25
30
35
40
45
50
OBTAIN PERMIT
45
BUDGET TO FUNDING
24
WEATHER DELAY
24
SUPPLY CHAIN
20
ECONOMIC VOLATILITY
15
LABOR POOL AVAILABILITY
12
CONTINUITY OF OPERATIONS
12
OPERATOR CERTIFICATION LEVEL
12
CLIMATE CHANGE
12
CONSENT DECREE SCHEDULE
10
INFILTRATION & INFLOW
8
CLARITY FOR CONSTRUCTABILITY
8
HEADWORKS FLOW VOLUME
6
COMMUNITY RELATIONS
4
COMPLEXITY OF SYSTEMS
3
QUALIFIED BIDDERS
2
FUTURE LOAD PREDICTIONS
2
WASTE STREAM CHARACTERIZATION
2

## FUNCTION ANALYSIS

The process of Functional Analysis is unique to Value Engineering compared to other quality and cost control systems. The process frames the project's core needs, identifies the greatest opportunities for value improvement, and helps the team focus on what really matters. Additionally, the way the human brain works begins to set the stage for optimizing the Creativity Phase by triggering divergent thought processes to help generate even more ideas. You will see functions identified from this workshop in each proposal, and on the creativity alternative sheets in the appendix of this report.

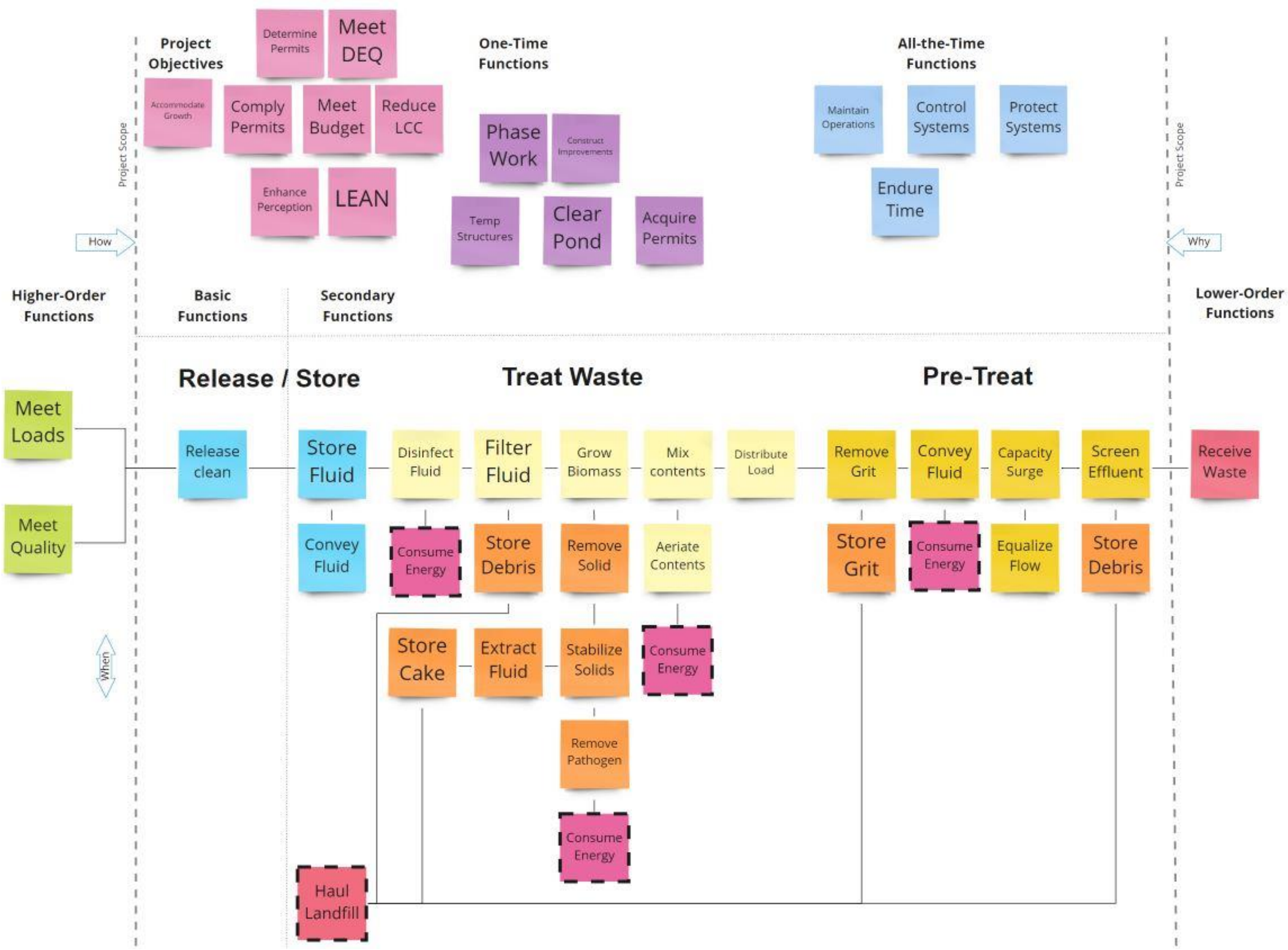
### Random Function Identification Technique

The team ran a quick synergistic brainstorm exercise to evaluate and generate unique functions pertaining to the project. These functions were then prioritized based on resource and risk intensity. Results of these highest resource intense or critical functions can be seen on the creativity sheets in the appendix of this report.

### Function Analysis System Technique (FAST) Diagram

The Function Analysis System Technique (FAST) diagram is another tool used during the function analysis phase of the study to assist the team in understanding the project's unique requirements, and logic path relationships between certain functions critical to the project. The process is helpful for the team: reframing the mind to look past the current design concept to generate alternative ideas and solutions addressing these functional requirements that are unique to the project, rather than the current design. A sample of the FAST diagram created by the team during the study pertaining to the Waste Water Treatment Plant elements is on the following page.

**WWTP FAST Diagram**



# VI. VE METHODOLOGY

Value engineering provides an independent, impartial project review by a team assembled specifically for this study. Value engineering itself is an organized creative process, which examines the proposed project and identifies alternatives to optimize cost and performance and assures compliance with project requirements. Through a structured system of investigation, idea generation, and analysis, the independent multidisciplinary team is able to consider and identify alternatives for site design, budget, schedule, and construction methods concurrently in a concentrated study.

After the initial presentation by City of Molalla and the design team, the VE team analyzed the budget and defined the basic functions of each project component. The VE team looked for ways to eliminate or modify design elements that add either first cost or life cycle cost without contributing to its required function. Specific proposals and reports were prepared and analyzed by the group for conformance to the project and VE study goals, prior to final prioritization.

Prioritization and brainstorming activities were conducted in group sessions alternating with additional small group and individual study sessions. All members supported an open-minded attitude to new suggestions, and all alternatives were considered valid until rejected by the entire team. Although the earlier sections of this report only elaborate or include the preferred alternatives, the appendix of this report includes all of the brainstorming notes from the workshop.

# VII. APPENDIX

## VALUE ENGINEERING TEAM

**Timothy Buckley, AIA, CVS, LEED AP BD+C**
**Team Facilitator**
**MENG Analysis**
2001 Western Avenue, Suite 200
Seattle, WA 98121
(206) 838-9797 Office
(360) 608-2009 Cell
timothy@menganalysis.com

**Matt Lersch, CCA, BECxP, CxA+BE, ITC**
**Cost Estimator**
**MENG Analysis**
2001 Western Avenue, Suite 200
Seattle, WA 98121
(206) 838-9797 Office
(425) 614-8149 Cell
matt@menganalysis.com

**Nina Cousins, PE**
**Civil**
**Coastal Solutions, LLC**
11027 Manitou Beach Dr. NE
Bainbridge Island, WA 98110
(206) 406-2493 Office
nina@coastalsolns.com

**Kurt Merriman, PE**
**Geotechnical**
**Associated Earth Sciences, Inc.**
911 5th Ave., Suite 100
Kirkland, WA 98033
(425) 827-7701 Office
(425) 766-7065 Cell
kmerriman@aesgeo.com

**Dick Hemmen, PE, SE**
**Structural Engineer**
**Hemmen Engineering**
4368 SW Cloverdale Street
Seattle, WA 98136
(206) 999-5828 Cell
RLHemmen@yahoo.com

**Doug Smith, PE, MBA, VMA, CCP, LEED AP, cSBA**
**Mechanical/Process**
**MENG Analysis**
2001 Western Avenue, Suite 200
Seattle, WA 98121
(206) 838-9797 Office
(425) 246-0949 Cell
doug@menganalysis.com

**Ed Fernbach, PE**
**Wastewater Process**
**CDMSmith**
620 SW 5th Ave., Suite 1115
Portland, OR 97204
(925) 296-8029 Office
(206) 979-4007 Cell
fernbachej@cdmsmith.com

**Dale Richwine, PE**
**Wastewater Operations**
**Richwine Environmental, Inc.**
15941 S Agnes Ave.
Oregon City, OR 97045
(503) 858-5153 Office
daler@richenv.com

**Sarah Partap, MBA, VMA**
**Project Manager**
**MENG Analysis**
2001 Western Avenue, Suite 200
Seattle, WA 98121
(206) 838-9797 Office
(206) 451-3462 Cell
sarah@menganalysis.com

**Cam Iseri**
**Project Technology**
**MENG Analysis**
2001 Western Avenue, Suite 200
Seattle, WA 98121
(206) 838-9797 Office
(208) 707-2696 Cell
cam@menganalysis.com

## OWNER AND DESIGN TEAM

**Andy Peters**
**Owner**
**City of Molalla**
315 Kennel Ave.
Molalla, OR 97038
(503) 759-0220
apeters@cityofmolalla.com

**Dan Huff**
**Owner**
**City of Molalla**
315 Kennel Ave.
Molalla, OR 97038
(503) 759-0220
dhuff@cityofmolalla.com

**Mac Corthell**
**Owner**
**City of Molalla**
315 Kennel Ave.
Molalla, OR 97038
(503) 759-0220
mcorthell@cityofmolalla.com

**Steve Major**
**The Dyer Partnership Engineers & Planners, Inc.**
1330 Teakwood Ave
Coos Bay, OR 97420
(541) 269-0732
smajor@dyerpart.com

**Aaron Speakman**
**The Dyer Partnership Engineers & Planners, Inc.**
1330 Teakwood Ave
Coos Bay, OR 97420
(541) 269-0732
aspeakman@dyerpart.com

**Tyler Molatore**
**The Dyer Partnership Engineers & Planners, Inc.**
759 W Central Ave
Sutherlin, OR 97479
(541) 459-4619
tmolatore@dyerpart.com

**Ryan Quigley, PE**
**Civil**
**The Dyer Partnership Engineers & Planners, Inc.**
1165 South Park Street
Lebanon, OR 97355
(541) 405-4520
rquigley@dyerpart.com

**Greg Scherer**
**Structural**
**VLMK Consulting Engineers**
(971) 254-8282
gregs@vlmk.com

**Bill Nickels**
**Geotechnical**
**Foundation Engineering, Inc.**
820 NW Cornell Avenue
Corvallis, OR 97330
(541) 757-7645
wln@foundationengr.com

**Jim Maitland**
**Geotechnical**
**Foundation Engineering, Inc.**
820 NW Cornell Avenue
Corvallis, OR 97330
(541) 757-7645
jkm@foundationengr.com

**Greg Scholtz**
**Mechanical / Electrical**
**R&W Engineering, Inc.**
9615 SW Allen Blvd #107
Beaverton, OR 97005
(503) 292-6000
gscholtz@rweng.com

**Jon van Staveren**
**Environmental**
**Pacific Habitat Services, Inc.**
(800) 871-9333
jvs@pacifichabitat.com

## KICKOFF MEETING SIGN-IN SHEET

| Name | Company | Project Role | Phone / E-mail |
|---|---|---|---|
| Steve Major | Dyer Partnership | Design Team - President | (541) 269-0732<br>smajor@dyerpart.com |
| Dick Hemmen | Hemmen Engineering | VE Team - Structural | (206) 999-5828<br>rlhemmen@yahoo.com |
| Ed Fernbach | CDMSmith | VE Team | (925) 296-8029<br>fernbachej@cdmsmith.com |
| Andy Peters | City of Molalla | Public Works Division Manager | (503) 793-0507<br>apeters@cityofmolalla.com |
| Dale Richwine | Richwine Environmental, Inc. | VE Team | (503) 858-5153<br>daler@richenv.com |
| Doug Smith | MENG Analysis | VE Team - Mechanical/Process | (206) 838-9797<br>doug@menganalysis.com |
| Kurt Merriman | Associated Earth Sciences, Inc. | VE Team - Geotechnical | (425) 766-7065<br>kmerriman@aesgeo.com |
| Matt Lersch | MENG Analysis | VE Team - Cost / CM | (206) 838-9797<br>matt@menganalysis.com |
| Dan Huff | City of Molalla | City Manager | dhuff@cityofmolalla.com |
| Nina Cousins | Coastal Solutions | VE Team - Civil | (206) 406-2493<br>nina@coastalsolns.com |
| Ryan Quigley | Dyer Partnership | Design Team | (541) 405-4520<br>rquigley@dyerpart.com |
| Tyler Molatore | Dyer Partnership | Design Team | (541) 459-4619<br>tmolatore@dyerpart.com |
| Timothy Buckley | MENG Analysis | VE Team - Facilitator | (206) 838-9797<br>timothy@menganalysis.com |
| Cam Iseri | MENG Analysis | VE Team - Coordinator | (206) 838-9797<br>cam@menganalysis.com |
| Sarah Partap | MENG Analysis | VE Team - Project Manager | (206) 838-9797<br>sarah@menganalysis.com |
| Aaron Speakman | Dyer Partnership | Design Team | (541) 269-0732 |

## VE IMPLEMENTATION FORM

The VE Implementation form is used to track the acceptance of the value engineering proposals.

We request a copy of the completed VE implementation form be returned to MENG Analysis once complete, for incorporation into the final report. Receipt of the completed implementation form helps us track and analyze data from our studies in order to improve future value engineering services.

| CLIENT: | City of Molalla | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: | Wastewater Treatment Plant Upgrades | | | | | | |
| DATE: | December 10, 2021 | | | | | | |
| Prop. # | COMPONENTS AND SYSTEMS | PROJECTED COST REVISION (Rough Order of Magnitude) | ACCEPT | REJECT | MODIFY | ACCEPTED VALUE OF PROPOSAL | COMMENTS / DISCUSSION |
| P-1 | Plant Location - West | 1,462,000 | | | X | $ 500,000.00 | The City is pursuing the acquisition of property to the west of the existing facility and evaluating the feasibility of its use for the construction of the new SBR. The savings is expected to be less than the $1,462,000 presented in the VE Report, as there appears to be costs associated with the development of the additional property that were excluded from the VE cost estimate. |
| P-2 | Plant Consolidation | 2,073,000 | | X | | | This recommendation will eliminate existing facilities that are critical to achieving the requirements of the NPDES permit and Mutual Agreement and Order ("MAO") and therefore cannot be eliminated from the treatment process at any time. |
| P-3 | Plant Location - East | 1,027,000 | | X | | | The northeast area of the WWTP is less favorable than the area the City is pursuing to the west. The construction of new treatment process facilities in the northeast area of the WWTP site will require additional geotechnical considerations, wetland mitigation, existing sewer line re-alignment, and an effluent pump station. |
| P-4 | Scope & Capacity | 5,975,000 | | X | | | To meet current design parameters, provide operational flexibility, and accommodate future growth, it is recommended that the system components be constructed per the current design and not reduced in size. Reducing the capacity of the transfer pump station and SBR, for example, would not provide capacity for existing conditions (flows and loads). |
| H-1 | Hydraulic Gradient | 371,000 | | X | | | This proposed alternative would require increasing the transfer pump station and grit removal system capacity from 8.8 mgd to 12.07 mgd, a 37 percent increase in size. Diurnal flow equalization, as recommended, would also require re-pumping of equalized flows from the transfer pump station to the SBR, thereby increasing life-cycle costs. |
| S-1 | Building Systems | 98,000 | X | | | $ 98,000.00 | Building systems will be evaluated further during design. Cost, long lead times and expandability of pre-engineered metal buildings will need to be considered. |
| WI-1 | Grit Separation | 256,000 | | X | | | The design team has had good experience with Pista Grit system in Western Oregon and recommends using the proposed system as the basis of design. Headcell and Pista Grit systems have similar capital costs and grit removal efficiencies, however; the Pista Grit has a lower long term operational cost and uses less process water during operation. |
| WI-2 | Influent Equalization | 423,000 | | X | | | Given the existing location of the aeration basin, as well as the complexities regarding locating the equalization basin after grit removal, it is recommended that the City maintains the current design. |
| WT-1 | Aerobic Digestion | 1,328,000 | | X | | | The current volume of aerobic digestion provides the City with much needed operational flexibility. It also positions the City to target Class B biosolids. |
| WE-1 | Effluent Filtration | 1,399,000 | | X | | | UV system manufacturers will not guarantee compliance with Class C total coliform standards without effluent filtration. If effluent filtration is eliminated from the design, the UV dose would increase from 60 mJ/cm2 to 100 mJ/cm2. This results in almost doubling the size of the UV system, and increasing capital costs and life-cycle costs. |

| CLIENT: | City of Molalla | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: | Wastewater Treatment Plant Upgrades | | | | | | |
| DATE: | December 10, 2021 | | | | | | |
| Prop. # | COMPONENTS AND SYSTEMS | PROJECTED COST REVISION (Rough Order of Magnitude) | ACCEPT | REJECT | MODIFY | ACCEPTED VALUE OF PROPOSAL | COMMENTS / DISCUSSION |
| WE-2 | UV Disinfection | 150,000 | | X | | | The current design only adds three additional butterfly valves to the piping configuration. In the context of the entire project, this does not represent a large increase in capital costs. The proposed cost deduct of $150,000 appears over estimated. |
| R1 | Interpretive signage, provide education (off site) for Community Ed and PR. | (10,000) | X | | | $ (10,000.00) | The City will evaluate opportunities for community education and public relations during design. |
| R2 | Pump after screen and grit removal (sooner than equalization) and flow remaining by gravity. | 92,750 | | X | | | Reference response to WI-1 and WI-2. |
| R3 | Monitoring and/or extraction wells at pond perimeter in lieu of lining pond. Line pond in future if needed. | 1,541,115 | | | X | | The City has opted to line effluent storage pond No. 1 as part of the upgrades. However, if monitoring wells are required by DEQ then the primary purpose of lining the lagoons no longer stands, and the City may consider this adea accepted with modifications. |
| R4 | Optimized process and downsized diesel generator. | 50,000 | | X | | | The generator size can be evaluated further during design. Sizing will be based on minimum process equipment that is necessary for proper treatment. |
| R5 | More native voltage process energy loads, with less power transformation. | 15,000 | | X | | | Electrical design standard is to use 480 V, 3 ph. for all motors 3/4 hp and larger. Smaller motors, receptacles, lights and process equipment must be provided 120 V, 1 ph. based on equipment requirements. |
| R6 | Aluminum ILO copper bus-work, feeders, and larger conductors. | 25,000 | | X | | | R&W Engineering does not recommend using aluminum conductors for industrial or municipal facilities. Copper conductors have better electrical stability over a longer time period. |
| R7 | Skylights for improved daylighting under new roofs and canopies. | (15,000) | X | | | $ (15,000.00) | Lighting and opportunities for skylights will be evaluated during design. |
| R8 | More task and less general lighting. | 12,500 | X | | | $ 12,500.00 | Lighting within all facilities will be evaluated during design. General and task lighting is evaluated for best operator safety and work performance. |
| R9 | Increase fuel storage from 24 to 72 hours. | (31,250) | | X | | | Fuel storage will be evaluated during design, however; due to the size requirements for 72 hours of fuel storage, this may not be feasible. |
| | GRAND TOTAL ALL PROPOSALS | | | | | $ 585,500.00 | |

The owner has reviewed each of the Value Analysis proposals and recommends the responses contained herein.

by: Andy Peters

title: Public Works Division Mng

date: Feb 11, 2022

GENERAL COMMENTS REGARDING THIS VALUE ANALYSIS STUDY:

Although only a few recommendations can be formally accepted, each brought up new issues for the Team to consider and will undoubtably lead to a better final product - a plant that will serve the basin for many years to come. -Andy

## CREATIVITY ALTERNATIVES SHEETS

The creativity alternatives sheets are a record of options discussed during the workshop. They are included here to illustrate the range of options considered during the study for key project elements.

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Civil

**FUNCTIONS:**

| | 2-word: Active Verb / Measurable Noun | | | Active Verb / Measurable Noun | |
|---|---|---|---|---|---|
| 1 | Remove | Material | 5 | Convey | Fluids |
| 2 | Import | Material | 6 | Store | Fluids |
| 3 | Level | Site | 7 | Support | Vehicles |
| 4 | Retain | Fluids | 8 | Manage | Erosion |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Earthwork | $ 2.0M | Concrete Stairs | $17k |
| Sewer Piping | $1.1M | Potable Water System | $9k |
| Site Demolition | $319k | | |
| Non-Potable Water Systems | $266k | | |
| Asphalt Pavements | $170k | | |
| Erosion Control | $29k | | |
| Stormwater System | $23k | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| P-1 | 1 | Acquire land and construct new SBR to the west, instead of in the existing lagoon. |
| | 2 | Construct SBR on elevated platform in lagoon location. |
| See Geo | 3 | Construct SBR to the northeast, instead of in the existing lagoon. |
| | 4 | Construct SBR to the south, instead of in the existing lagoon. |
| | 5 | Construct the SBR within the lagoon using a permanent cofferdam solution. |
| | 6 | Use gravel instead of asphalt. |
| | 7 | Use tanks instead of lagoons. |
| | 8 | Use bladders instead of lagoons. |
| | 9 | Use gravity systems instead of pumps. |
| | 10 | Salvage more of the existing systems. |
| | 11 | Replace temporary cofferdam with permanent solution (more expensive and challenging). |
| | 12 | Don't use a cofferdam. |
| | 13 | Increase Pond No. 2 to the south. |
| P-2 | 14 | Consolidation of plant (place entire plant at admin building site with lab, maintenance). |
| P-1 & P-2 | 15 | Construct SBR and solids handling on single site to minimize piping and distances between processes. |
| P-1 & P-2 | 16 | Improve vehicular circulation (LEAN). |
| | 17 | New plant entrance to the south. |
| | 18 | More below grade piping to simplify vehicular circulation. |
| | 19 | Injection overflow into ground in lieu of lagoons. |
| | 20 | Evaporate the overflow in lieu of lagoons. |
| | 21 | Find additional recycled water uses to minimize storage. |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Geotechnical

**FUNCTIONS:**

| # | 2-word: Active Verb | Measurable Noun | # | Active Verb | Measurable Noun |
|---|---|---|---|---|---|
| 1 | Control | Fluids | 5 | Continue | Operation |
| 2 | Remove | Materials | 6 | Improve | Operation |
| 3 | Support | Excavation | 7 | Streamline | Operation |
| 4 | Place | Materials | 8 | Support | Facilities |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Dewatering | | | |
| Excavation shoring | | | |
| Structural fill | | | |
| Foundations | | | |
| Slabs / flatwork | | | |
| Paving | | | |
| | | | |

| # leave blank | votes | | | ALTERNATE PROPOSALS |
|---|---|---|---|---|
| | | | 1 | Use permanent sheet form cofferdam and use as foundation |
| P-3 | | | 2 | Soil improvements ILO of excavation (stone columns) |
| | | | 3 | Add dewatering well for groundwater during construction |
| | | | 4 | Sheet piles can control ground water and pond water |
| | | | 5 | Sheet piles will support excavation and reduce import costs |
| | | | 6 | Sheet piles streamline the SBR platform construction operation |
| | | | 7 | Soil cement treatment can solidify some of the remnant pond bottom soils to reduce excavation |
| | | | 8 | Soil cement treatment can be used to reuse suitable excavated site soils ILO imported |
| | | | 9 | Dewatering wells will control ground water in advance of excavation |
| | | | 10 | Dewatering wells will support site excavation |
| | | | 11 | Dewatering wells allowed streamlined operation |
| P-3 | | | 12 | Stone columns at east site (for alternative SBR building) |
| P-3 | | | 13 | Auger pile columns at east site (for alternative SBR building) |
| P-3 | | | 14 | Over ex at east site (for alternative SBR building) |
| P-3 | | | 15 | East site (for alternative SBR building), improve soil and add fill for new grades |
| | | | 16 | Amend soils from pond and use as structural fill |
| | | | 17 | Ecology block and membrane for temp cofferdam |
| | | | 18 | Underground tunnels between process buildings |
| H-1 | | | 19 | Lower SBR grade and pump out |
| | | | 20 | Is it better to add pumping stations to avoid issues, or can pumping be reduced with revised grades |
| | | | 21 | Verify pond liner has longevity, especially when exposed to UV (cover with geoweb and soil) |
| | | | 22 | Utilidors |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Planning

2-word: Active Verb / Measurable Noun | Active Verb / Measurable Noun

**FUNCTIONS:**

| | | | | | |
|---|---|---|---|---|---|
| 1 | | | 5 | | |
| 2 | | | 6 | | |
| 3 | | | 7 | | |
| 4 | | | 8 | | |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Maintain Operations | 30 months | | |
| DEQ Permit (propose, acquire, meet requirements) | ? | | |
| Phase Work / Logistics / Temporary Systems | Critical path | | |
| | | | |
| Locate / Construct new SBR Facility | | | |
| Modify Existing Systems | | | |
| Demolish Existing Systems | | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| | | 1 | Where is 1955 treatment plant? Does site exist? Can it be re-commissioned to take processing load? |
| | | 2 | Build second plant on adjacent property (smaller) and build redundancy with existing plant |
| T-1 | | 3 | Complete permitting before design |
| | | 4 | Realign discharge back to Bear Creek |
| | | 5 | Construction in lagoon is very expensive, including cofferdam |
| | | 6 | Explore use of north city property (tree zone adjacent to creek) |
| | | 7 | Optimize SBR elevations (change pumping if necessary) |
| | | 8 | No building in the lagoon |
| | | 9 | Current SBR location impacts pond outlet |
| P-1 | | 10 | Acquire adjacent property, build new at adjacent property (simplify sequencing and construction costs). |
| P-1 | | 11 | Buy entire farm property, build SBR and plant farm with materials to increase use of irrigation discharge. |
| P-4 | | 12 | Build 2/3 of current need (only 1 MGD (vs 1.5), extra tankage for equalization, pre-plan space for future expansion) - address nitrogen or phosphorus mitigation |
| | | 13 | Community-wide wastewater reduction efforts |
| | | 14 | Community water-source heat pump |
| R1 | | 15 | Interpretive signage, provide education (off site) for Community Ed and PR |
| | | 16 | Convert ponds to more green / wetland |
| P-2 | | 17 | Demo admin building and construct SBR in with location with admin |
| P-1 | | 18 | All new SBR and solids handling construction in new adjacent (acquired) property (retain existing op during construction) |
| | | 19 | Switch to anerobic digesters and capture gas for energy generation |
| | | 20 | Haul solids to other agency for processing (ILO on site) |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Planning

**FUNCTIONS:**

| | 2-word: Active Verb / Measurable Noun | | | Active Verb / Measurable Noun | |
|---|---|---|---|---|---|
| 1 | | | 5 | | |
| 2 | | | 6 | | |
| 3 | | | 7 | | |
| 4 | | | 8 | | |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Maintain Operations | 30 months | | |
| DEQ Permit (propose, acquire, meet requirements) | ? | | |
| Phase Work / Logistics / Temporary Systems | Critical path | | |
| | | | |
| Locate / Construct new SBR Facility | | | |
| Modify Existing Systems | | | |
| Demolish Existing Systems | | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| | | 21 | Minimize pumps |
| | | 22 | Pump to neighboring municipality |
| | | 23 | Construct the SBR on a barge (eliminate outlet structure rework, temp cofferdam work, excavation, and backfill etc.). Float into optimal location for connection. |
| | | 24 | Local subcontractor outreach |
| | | 25 | Build second plant at other location (support by development impact fees) |
| | | 26 | Confirm staffing requirements for future plant (possibly 1 added staff FTE) |
| | | 27 | City website explaining how fantastic the facility is and how clean the results are |
| | | 28 | |
| | | 29 | |
| | | 30 | |
| | | 31 | |
| | | 32 | |
| | | 33 | |
| | | 34 | |
| | | 35 | |
| | | 36 | |
| | | 37 | |
| | | 38 | |
| | | 39 | |
| | | 40 | |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Permitting

**FUNCTIONS:** (2-word: Active Verb / Measurable Noun)

| # | Active Verb | Measurable Noun | # | Active Verb | Measurable Noun |
|---|---|---|---|---|---|
| 1 | Update | Permit | 5 | Store | Fluid |
| 2 | Negotiate | DEQ | 6 | | |
| 3 | Redefine | Storage | 7 | | |
| 4 | Trade | Load | 8 | | |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Wet Weather Concentration to Basin Standards | | | |
| Wet Weather Increase in Mass Load | | | |
| Allow May, June, & Oct Discharge with Conditions | | | |
| Change Point of Compliance to Treatment Plant | | | |
| Allow Discharge of Lagoon Stored Effluent w/o sampling | | | |
| | | | |
| | | | |

| # leave blank | votes | | | ALTERNATE PROPOSALS |
|---|---|---|---|---|
| T-1 | | | 1 | Complete permitting before design |
| | | | 2 | Convert ponds to more green / wetland (DEQ should allow if called overflow from wetland (not storage)) |
| | | | 3 | Convert ponds to a water garden concept (i.e. Albany) |
| T-1 | | | 4 | Continue to use attorney to correct existing previous 10/10 vs 30/30 ppm error in permit |
| T-1 | | | 5 | Trade temperature load with mill site |
| T-1 | | | 6 | Add filters to filter peak wet weather flows if permit is not modified |
| | | | 7 | Obtain additional site for reclaimed water application |
| T-1 | | | 8 | Renegotiate permit to allow summer discharge if cooling added. |
| | | | 9 | Re-permit for Bear Creek discharge |
| T-1 | | | 10 | Compliance point confirmation |
| T-1 | | | 11 | Confirm construction schedule completion allowance |
| | | | 12 | |
| | | | 13 | |
| | | | 14 | |
| | | | 15 | |
| | | | 16 | |
| | | | 17 | |
| | | | 18 | |
| | | | 19 | |
| | | | 20 | |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Structural

**FUNCTIONS:**

| | 2-word: Active Verb / Measurable Noun | | | Active Verb / Measurable Noun | |
|---|---|---|---|---|---|
| 1 | Support | Structures | 5 | Define | Process |
| 2 | Disperse | Loads | 6 | Assure | Operations |
| 3 | Retain | Fluids | 7 | Protect | Occupants |
| 4 | Protect | Equipment | 8 | Resist | Seismic |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Concrete Foundations and Slabs | $2.6M | | |
| Concrete Hydraulic Structures | $1.9M | | |
| Concrete and Type V Building Structures | $990K | | |
| Gravel Base | $40K | | |
| Metal Grating and Stairs | $50K | | |
| | | | |
| | | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| | | 1 | SBR pier or auger pile foundations |
| | | 2 | Raised platform ILO traditional structure |
| | | 3 | SBR foundation on concrete piers with spandeck at lagoon |
| | | 4 | Construct one large pre-engineered building to house multiple systems and operations |
| S-1 | | 5 | Use pre-engineered metal buildings in lieu of Type V construction |
| P-2 option | | 6 | Consolidate new buildings and processes into one larger pre-engineered metal building |
| | | 7 | Use sheet pile coffer dam that would become support for the foundation of the SBR |
| | | 8 | Precast equalization basin walls |
| | | 9 | Lined earth structure equalization basin |
| | | 10 | Move headworks to acquired property next to SBR |
| S-1 | | 11 | Precast concrete planks for SBR walks and interior walls |
| S-1 | | 12 | Precast outlet structure |
| S-1 | | 13 | Panelized cold form steel framed building |
| | | 14 | New wastewater treatment plant versus redoing existing |
| see P-3 | | 15 | Move SBR to east of digesters/dewatering, found on stone columns or improved fill |
| | | 16 | Ecology block with fabric cover ILO canopy for weather protection |
| | | 17 | Modular prefabricated (reinforced fiberglass or steel ) SBR tanks |
| | | 18 | Verify equipment and pipes are seismically anchored, and resilient to level 3 (consider 4?) |
| | | 19 | Seismic evaluation of existing elements to remain, upgrade where needed |
| S-1 | | 20 | Use precast, modular, or panelized building systems |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Pre-Process

**FUNCTIONS:**

| | 2-word: Active Verb / Measurable Noun | | | Active Verb / Measurable Noun | |
|---|---|---|---|---|---|
| 1 | Prevent | Overflows | 5 | Remove | Grit |
| 2 | Equalize | Flows | 6 | Remove | Trash |
| 3 | Protect | Equipment | 7 | Distribute | Flows |
| 4 | Measure | Flows | 8 | Protect | Environment |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Screening Facility | $0 | | |
| Parshall Flume | $0 | | |
| Flow Equalization Basin | $1.2M | | |
| Transfer Station | $910K | | |
| Grit Removal | $979K | | |
| Flow Splitting | $100K | | |
| | | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| R2 | | 1 | Pump after screen and grit removal (sooner than equalization) and flow remaining by gravity. |
| T-2 | | 2 | Clarify concerns with headworks hydrology, (relocate further up interceptor and combine with expanded influent sewer) coordinated with downstream systems. |
| T-2 | | 3 | Move grit removal to headworks to eliminate grit deposits in flow equalization |
| T-2 | | 4 | Construct new influent Trunk Sewer CIP Project C1 to get PIF to plant (estimated $600,000 in 2016) from 2000 Master Plan. |
| WI-2 | | 5 | Do not build EQ basin, use money to upgrade influent trunk sewer and use 4th SBR for flow equalization (in Phase I) construct EQ basin in Phase II. |
| | | 6 | Put flow that hydraulic profile was based on the drawing - Clarify in design |
| | | 7 | Build smaller SBR process and use Pond 1 for treatment and blend two effluents to the filters, pond 2 for storage |
| WI-1 | | 8 | Use stack tray ILO Vortex grit separator |
| | | 9 | Washer compactor to reduce volume of screenings |
| | | 10 | Convey all waste to single dump storage and pickup location |
| | | 11 | Co-locate grit collection and headworks screen for single dump storage and pickup location |
| | | 12 | Use vertical turbine pumps ILO submersible pumps at transfer station. |
| T-2 | | 13 | Adjust transfer pump station to eliminate flow metering |
| | | 14 | Use mag meter downstream of transfer pumps to measure influent flow |
| | | 15 | Build all new headworks for improved flow management and hydraulics |
| | | 16 | Lower operating level of transfer pump station to eliminate surcharging of the headworks |
| | | 17 | |
| | | 18 | |
| | | 19 | |
| | | 20 | |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Treatment

**FUNCTIONS:**

2-word: Active Verb / Measurable Noun | Active Verb / Measurable Noun

| | Verb | Noun | | Verb | Noun |
|---|---|---|---|---|---|
| 1 | Treating | Liquid | 5 | Load | Transport |
| 2 | Retain | Bacteria | 6 | Aerate | Bacteria |
| 3 | Stabilize | Solids | 7 | Store | Solids |
| 4 | Reduce | Volume | 8 | Convey | Solids |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| **SBR** | | Dewatering | $2.7M |
| Tankage | $4M | Wasting System / Pumps | $100K |
| Blowers and Aerators | $300K | | |
| Decanters | $200K | | |
| Mixers | $100k | | |
| | | | |
| Aerobic Digestion | $3.3M | | |

| # leave blank | votes | | | ALTERNATE PROPOSALS |
|---|---|---|---|---|
| | | | 1 | Alternatives to SBR - Activated Sludge (reactors and clarifiers ILO single tank) |
| | | | 2 | Alternatives to SBR - BioMAG (magnetic material added to biomass, then reclaimed) reduced footprint, less volume, quicker processing |
| | | | 3 | Alternatives to SBR - Membrane Bioreactor (MBR) super clean effluent, eliminates filters, reduced O&M cost, but more equalization required in advance. |
| | | | 4 | Optimize SBR profile and elevations (adjust to reduce excavation and pumping) |
| | | | 5 | Pump before equalization (deepest structure), move to be part of SBR structure, use unused SBR tank |
| | | | 6 | New headworks coordinated with needs for equalization and SBR and filtration (raise surcharged influent sewer). |
| | | | 7 | Evaluate the need for equalization (balance equalization and SBR and processes) if only justified two times per year. |
| T-3 | | | 8 | Performance Spec Option Alternative to SBR - Granular activated sludge (AQUANERDA), smaller tanks. |
| T-3 | | | 9 | Alternative to SBR - Don't remove cofferdam, use remaining volume as flow equalization basin |
| T-3 | | | 10 | Conventional SBR ILO of flow through SBR (possible square tank geometry) |
| | | | 11 | Modular SBR - 4 prefab at 1M gal. ea |
| | | | 12 | Thermal treatment ILO SBR |
| | | | 13 | Incinerate |
| | | | 14 | Use Dissolved Air Flotation (DAF) with polymer Plus Filters (like Stockton) |
| | | | 15 | Live stabilization of solids (Redmond, Newport examples) |
| | | | 16 | Develop land application for biosolids on local farmland |
| | | | 17 | Use a portion of lagoon for sludge and decant overflow |
| | | | 18 | Convert lagoon 1 to SBR |
| | | | 19 | Only install only 2 SBR cells for phase 1 load, and construct other 2 in next phase |
| | | | 20 | Optimize aeration to reduce blower horsepower and associated loads |
| WT-1 | | | 21 | Reduce size of aerobic digester (tanks) and not produce class B and dispose in landfill (upgrade to class B in future when needed) |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Post Process

**FUNCTIONS:**

| | 2-word: Active Verb / Measurable Noun | | | Active Verb / Measurable Noun | |
|---|---|---|---|---|---|
| 1 | Store | Fluid | 5 | Remove | Solids |
| 2 | Reduce | Leakage | 6 | Recycle | Water |
| 3 | Destroy | Pathogen | 7 | Pump | Fluids |
| 4 | Consume | Energy | 8 | Improve | Safety |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Ponds (No. 1 $139K outlet; No. 2 lining $1.5M) | $2.8M | Two ponds; one aerated | |
| UV Class C ($1.2M UV; $216K canopy) | $1.9M | Two banks of 3 modules, plus 1 future mod ea | |
| Effluent filters ($875K filters; $249K canopy) | $1.5M | Two filters; each motorized | |
| Lagoon Dredging | $300K | Dredging always underway? | |
| Non-potable Water tank | $100K | One tank and two pumps | |
| Effluent pumping | $0K | Two pumps (existing), one future | |
| | | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| | | 1 | More UV capacity. |
| | | 2 | Pump sooner than equalization. |
| | | 3 | New headworks, coordinated with new downstream systems to optimize entire hydraulic gradient and eliminate or reduce pumps, energy use, etc. |
| P-4 | | 4 | Install Phase 1 work only; no work on Phase 2 and beyond capacity. |
| | | 5 | Tanks in lieu of ponds. |
| | | 6 | Public amenity associated with the ponds. |
| | | 7 | Increased plant discharge flow capacity and smaller ponds. |
| | | 8 | Increased reclaim water use throughout the City and surrounding community. |
| | | 9 | Injection wells in lieu of discharge to river or farm. |
| | | 10 | Revert to discharge to adjacent creek, while maintaining lower 10/10 limits. |
| | | 11 | Amended soil in lieu of pond liner. |
| R3 | | 12 | Monitoring and/or extraction wells at pond perimeter in lieu of lining pond. Line pond in future if needed. |
| | | 13 | On-grade bladder storage ILO ponds. |
| | | 14 | Stone or concrete armored pond walls over liner. |
| | | 15 | Storm water vault technology for clean effluent storage ILO open ponds. |
| | | 16 | Injection wells ILO discharge to river or farm. |
| | | 17 | High-temperature pathogen destruction in lieu of UV. |
| | | 18 | Chemical pathogen destruction in lieu of UV. |
| | | 19 | Micro-filtration to remove pathogens in combination UV. |
| | | 20 | Solar UV pathogen destruction during conducive weather. |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** Post Process

**FUNCTIONS:**

| | 2-word: Active Verb / Measurable Noun | | | Active Verb / Measurable Noun | |
|---|---|---|---|---|---|
| 1 | Store | Fluid | 5 | Remove | Solids |
| 2 | Reduce | Leakage | 6 | Recycle | Water |
| 3 | Destroy | Pathogen | 7 | Pump | Fluids |
| 4 | Consume | Energy | 8 | Improve | Safety |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Ponds (No. 1 $139K outlet; No. 2 lining $1.5M) | $2.8M | Two ponds; one aerated | |
| UV Class C ($1.2M UV; $216K canopy) | $1.9M | Two banks of 3 modules, plus 1 future mod ea | |
| Effluent filters ($875K filters; $249K canopy) | $1.5M | Two filters; each motorized | |
| Lagoon Dredging | $300K | Dredging always underway? | |
| Non-potable Water tank | $100K | One tank and two pumps | |
| Effluent pumping | $0K | Two pumps (existing), one future | |
| | | | |

| # leave blank | votes | | ALTERNATE PROPOSALS |
|---|---|---|---|
| | | 21 | High-efficiency, variable capacity pumps ILO standard. |
| | | 22 | Centrifugal filtration. |
| | | 23 | Electrostatic filtration. |
| | | 24 | Ponds as emergency back-up equalization. |
| WE-1 | | 25 | Class C filtration ILO Class A (permit only required Class C). Eliminate filtration, and investigate UV technology (Trojan) that can deliver class C with out pre-filtration. |
| | | 26 | Provide dewatering for filter backwash ILO return to influent chamber. |
| WE-2 | | 27 | Class C only UV capability (eliminate the future UV module space and piping for Class A). |
| | | 28 | Pond spray cooling system (reduce temperature for discharge to river). |
| | | 29 | Pond ground loop cooling system. |
| | | 30 | PV array at ponds, no water storage. |
| | | 31 | Eliminate filtration for class C water. |
| with P-1 | | 32 | Farmland acquisition, use for reuse and reduce pump cost, and biosolid land application. |
| | | 33 | |
| | | 34 | |
| | | 35 | |
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| | | 39 | |
| | | 40 | |

**CLIENT:** City of Molalla
**PROJECT:** Wastewater Treatment Plant Upgrades
**COMPONENT:** MEP

**FUNCTIONS:** (2-word: Active Verb / Measurable Noun)

| | Active Verb | Measurable Noun | | Active Verb | Measurable Noun |
|---|---|---|---|---|---|
| 1 | Generate | Power | 5 | Control | Systems |
| 2 | Transform | Power | 6 | Condition | Space |
| 3 | Distribute | Power | 7 | Communicate | Staff |
| 4 | Illuminate | Surfaces | 8 | Alarm | Emergencies |

| CURRENT CONCEPT | $ ROM | | $ ROM |
|---|---|---|---|
| Generator, 500 kW | $212K | New generator, in addition to 750 kW existing | |
| | | Electrical includes all-new SBR Bldg service | |
| Site Electrical and Buildings | $174K | may be low | |
| Lighting | $100K | | |
| Interface controls (SCADA) | $500K | Estimate seems low across the board | |
| SBR & Digester Bldg HVAC (2 @ $5K each) | $125K | $10K in estimate seems low | |
| Low voltage systems | $25K | | |

| # leave blank | votes | | | ALTERNATE PROPOSALS |
|---|---|---|---|---|
| | | | 1 | Process gas ILO diesel for generator fuel. |
| R4 | | | 2 | Optimized process and downsized diesel generator. |
| | | | 3 | Photovoltaic (PV) power generation and battery storage ILO diesel generator. |
| R5 | | | 4 | More native voltage process energy loads, with less power transformation. |
| see P-2 | | | 5 | Consolidated plant and process equipment to reduce electrical distribution cost. |
| | | | 6 | High-efficiency LED lighting with automatic lighting controls throughout. |
| | | | 7 | Energy efficient equipment and systems and downsized electrical service. |
| | | | 8 | Generic process controllers and software ILO proprietary SCADA system. |
| | | | 9 | One new larger (1-MW+) generator ILO two smaller (one 750 kW (E) and 500 kW (N)). |
| R6 | | | 10 | Aluminum ILO copper bus-work, feeders, and larger conductors. |
| R7 | | | 11 | Skylights for improved daylighting under new roofs and canopies. |
| R8 | | | 12 | More task and less general lighting. |
| | | | 13 | All new SCADA throughout ILO extending existing aged system. |
| with P-4 | | | 14 | Downsize electrical service to near-term load (eliminate 40% spare capacity). |
| | | | 15 | Open process ILO covered and/or inside buildings - all-weather equipment. |
| | | | 16 | Modular/pre-fab ILO stick-built canopies, buildings, and large process equipment. |
| | | | 17 | Fish in ponds for algae control. |
| | | | 18 | Downstream chlorination to reduce effluent pipe slime. |
| | | | 19 | Premium ILO code-minimum efficiency energy using systems. |
| | | | 20 | Micro-hydro energy recovery. |
| | | | 21 | Primary metered service. |
| R9 | | | 22 | Increase fuel storage from 24 to 72 hours. |