

## Headworks Screening



### Project Purpose:

The purpose of this project is to replace the influent screens and screenings handling equipment.

### Project History and Status:

Constructed as part of the Plant's Tenth Addition, the Headworks Facility continues to experience numerous operational and maintenance issues. These include the hydraulics of the existing influent flow meters that requires the water level in the screening channels to be artificially raised. This prevents the influent band screens from operating intermittently as screenings accumulate; instead, at least one screen must operate continuously and at higher channel levels. This increases the wear and tear on the equipment and reduces the screening system's hydraulic capacity.

This project was included in the 2016 Liquid Processing Facilities Plan.

### Alternatives:

The following alternatives were evaluated in detail in the 2016 Liquid Processing Facilities Plan:

#### Alternative S0—Maintain the Existing System (Null Alternative)

In this alternative, the existing band screens and screenings handling equipment would be maintained. Replacement of the existing equipment, including the screens, Maci pumps, Lisep, Lipactor, macerator grit pump, and grit snail, and installation of a fourth band screen and Lisep and Lipactor is assumed in year 10 given the age and condition of the equipment and the need to accommodate the projected maximum flow.

Alternative S1—Install Screens and Wash Press for Sluiced Screenings

In this alternative the existing band screens and sluicing trough would be maintained. The trough would discharge into new channels in which two screens, likely 1/8-inch perforated plate screens to provide the maximum capture of the screened material, would be installed. These screens, which would only be required to handle the volume of sluicing water, would discharge to two screenings wash presses. The washed screenings would discharge directly to the haul-off waste container.

Given the space restrictions and the size of the equipment, specifically the wash presses, it does not appear that there is available space for installation of two screens and wash presses in the Maci pit area. It may be possible, however, to extend the trough to the north and construct concrete channels at floor level under the mezzanine in which the screens could be installed. The wash presses would be installed on top of the channels under the mezzanine and discharge directly into the haul-off waste container. Given District staff comments about the inadequacy of the existing trench drains to handle flows from the grit classifiers, it would be necessary to cut new trench drains into the floor to convey the screened sluicing water back into the screening channels.

Alternative S2—Install New Band Screens and Dedicated Wash Presses

In this alternative new band screens would be installed with dedicated wash presses at each screen. It is necessary to replace the existing screens to use dedicated wash presses because the discharge elevation of the existing screenings is too low to permit installation of a wash press. The wash presses would be positioned on the west side of the screens and would discharge onto a belt conveyor, which would transport the screenings to the haul-off waste container. The ability of the conveyor to reach the container without major modifications to the mezzanine would need to be verified during detailed design.

This alternative would eliminate use of the screenings trough and associated sluicing water, the Maci pumps, the macerator grit pumps, the secondary grit tank, the Lisep and Lipactor, and the grit snail. This alternative also includes costs for installation of a fourth band screen and wash press in year 10 to accommodate the projected maximum flow.

Alternative S3—Install Step Screens and Dedicated Wash Presses

In this alternative new step screens would be installed with dedicated wash presses serving each screen. Significant channel modifications would be required to allow proper flow to the screens and for proper installation of the new screens in the area currently occupied by the existing center-flow band screens. The wash presses would be positioned on the east side of the screens and would discharge onto a belt conveyor located on the west side of the screens. The conveyor would transport the screenings to the haul-off waste container. The isolation slide gates upstream of the screens would also need to be replaced because of the channel modifications.

This alternative would eliminate use of the screenings trough, the Maci pumps, the macerator grit pumps, the secondary grit tank, the Lisep and Lipactor, and the grit snail. The capacity of the step screens allows the projected maximum flow of 180 mgd to be achieved without installation of a fourth screen.

Alternative S4—Install Travelling Rake Screens and Dedicated Wash Presses

This alternative is the same as Alternative S3, except that travelling rake screens would be installed instead of step screens. Travelling rake screens have the advantage of being more robust than step screens and are constructed to sustain impacts from large objects. This alternative would eliminate use of the screenings trough, the Maci pumps, the macerator grit pumps, the secondary grit tank, the Lisep and Lipactor, and the grit snail.

Alternative S5—Install Perforated Plate Screens and Dedicated Wash Presses

This alternative is the same as Alternative S3 except that perforated plate screens would be installed instead of step screens. This alternative would eliminate use of the screenings trough, the Maci pumps, the macerator grit pumps, the secondary grit tank, the Lisep and Lipactor, and the grit snail. This alternative also includes the installation of a fourth screen and wash press in year 10 to accommodate the projected maximum flow.

Alternative S6—Install Moving Media Screens and Dedicated Wash Presses

This alternative is the same as Alternative S3, except that moving media screens would be installed instead of step screens. This alternative would eliminate use of the screenings trough, the Maci pumps, the macerator grit pumps, the secondary grit tank, the Lisep and Lipactor, and the grit snail. This alternative also includes the installation of a fourth screen in year 10 to accommodate the projected maximum flow.

Alternative S7—Install Chopper Pumps and Wash Presses

This alternative involves the use of chopper pumps instead of the Maci pumps. Chopper pumps may be less susceptible to wear and plugging than Maci pumps. Three wash presses would be installed in the mezzanine in place of the existing secondary grit tanks, Lisep equipment, and Lipactors. Each wash press would discharge to the belt conveyor over the haul-off waste container.

This alternative would retain use of the existing band screens, the screenings trough, the Maci pit, macerator grit pumps, and grit snail until this equipment is replaced in 10 years. New band screens (four) and grit pumps would be installed in 10 years, similar to Alternative S2.

**Key Risks and Issues**

The key social, environmental, and other nonmonetary considerations of each alternative are summarized in Table 1.

**Table 1 - Influent Screening and Screenings Handling Alternative Nonmonetary Considerations Summary**

Alternative	Benefits	Limitations
S0—Maintain the Existing System (Null Alternative)	<ul style="list-style-type: none"> <li>▪ Continues use of equipment with remaining useful life (screens, Liseps, Lipactors, Maci pumps, macerator grit pump)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Still has water requirement for sluicing of the screenings.</li> <li>▪ Continues using equipment that has been problematic and requires frequent attention and maintenance (Liseps, Lipactors, Maci pumps, macerator grit pump, and grit snail).</li> </ul>
S1—Install Screens and Wash Press for Sluiced Screenings	<ul style="list-style-type: none"> <li>▪ Provides improved and simpler screenings handling process with fewer pieces of equipment.</li> <li>▪ Significantly reduces maintenance required for screenings handling.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> <li>▪ Eliminates the grit snail and associated maintenance.</li> <li>▪ If one of the two sluicing screens or washpresses is out of service, that does not require any of the main channel screens to be taken out of service.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Still has water requirement for sluicing of the screenings to the new screens.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> <li>▪ May create cramped space with channels and equipment under the mezzanine.</li> <li>▪ Requires a fourth screen to provide 180 mgd.</li> </ul>
S2—Install New Band Screens and Dedicated Wash Presses	<ul style="list-style-type: none"> <li>▪ Provides improved and less complicated screenings handling process with fewer pieces of equipment.</li> <li>▪ Reduces maintenance required for screenings handling equipment.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> <li>▪ Eliminates water requirement for sluicing of the screenings to the Maci pit.</li> <li>▪ Least intrusive construction of the screenings alternatives. No changes to screenings channels required.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Conveyor across length of building.</li> <li>▪ Will require fourth screen for 180 mgd.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> <li>▪ Access to slide gates is limited.</li> </ul>
S3—Install Step Screens and Dedicated Wash Presses	<ul style="list-style-type: none"> <li>▪ Provides improved and simpler screenings handling process with fewer pieces of equipment.</li> <li>▪ Reduces maintenance required for screenings handling.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> <li>▪ Eliminates water requirement for sluicing of the screenings to the Maci pit.</li> <li>▪ Fourth screen not required for 180 mgd.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Constructability concerns. Significant removal of concrete from channels required to install different style screen.</li> <li>▪ Step screens are more susceptible to damage from larger objects.</li> <li>▪ Conveyor across length of building.</li> <li>▪ Substantial channel modifications required.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> <li>▪ Access to slide gates is limited.</li> <li>▪ Screenings capture is unlikely to be as good as band screens.</li> </ul>
S4—Install Travelling Rake Screens and Dedicated Wash Presses	<ul style="list-style-type: none"> <li>▪ Provides improved and simpler screenings handling process with fewer pieces of equipment.</li> <li>▪ Reduces maintenance required for screenings handling.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> <li>▪ Eliminates water requirement for sluicing of the screenings to the Maci pit.</li> <li>▪ Screens are sturdy and better able to handle large objects without damage.</li> <li>▪ Fourth screen not required for 180 mgd.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Conveyor across length of building.</li> <li>▪ Substantial channel modifications required.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> <li>▪ Screenings capture is unlikely to be as good as band screens</li> </ul>
S5—Install Perforated Plate Screens and Dedicated Wash Presses	<ul style="list-style-type: none"> <li>▪ Provides improved and less complicated screenings handling process with fewer pieces of equipment.</li> <li>▪ Improved screenings capture over Alternatives S3 and S4.</li> <li>▪ Reduces maintenance required for screenings handling.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> <li>▪ Eliminates water requirement for sluicing of the screenings to the Maci pit.</li> <li>▪ Provides opportunity to design screens for existing hydraulic conditions.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Screenings discharge requires a brush, which is a maintenance item.</li> <li>▪ Conveyor across length of building.</li> <li>▪ Substantial channel modifications required.</li> <li>▪ Will require fourth screen for 180 mgd.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> </ul>
S6—Install Moving Media Screens and Dedicated Wash Presses	<ul style="list-style-type: none"> <li>▪ Provides improved and simpler screenings handling process with fewer pieces of equipment.</li> <li>▪ Improved screenings capture over Alternatives S3 and S4.</li> <li>▪ Reduces maintenance required for screenings handling.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> <li>▪ Eliminates water requirement for sluicing of the screenings to the Maci pit.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Screenings discharge requires a brush, which is a maintenance item.</li> <li>▪ Conveyor across length of building.</li> <li>▪ Substantial channel modifications required.</li> <li>▪ Requires a fourth screen to provide 180 mgd of capacity.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> </ul>
S7—Install Chopper Pumps and Wash Presses	<ul style="list-style-type: none"> <li>▪ Replaces Maci pumps with pumps better suited to pumping screenings.</li> <li>▪ Reduced maintenance of screenings handling equipment.</li> <li>▪ Wash presses are less susceptible to plugging with heavy grease loads.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Proposed solution is not substantially different than the existing system, and may not improve maintenance requirements.</li> <li>▪ Alternative does not address issues associated with existing screens.</li> <li>▪ Alternative does not address issues associated with screenings trough.</li> <li>▪ Operation of grit snail is still required.</li> <li>▪ Water use is still high.</li> <li>▪ Replaces equipment that has remaining useful life (Lisep, Lipactors, Maci pumps, and macerator grit pumps).</li> </ul>

**Economic Analysis**

The present worth analysis completed for the Liquid Processing Facilities Plan is presented below.

	<b>Null Alternative</b>	<b>Screen Sluiced Screenings</b>	<b>New Band Screens, Wash Presses</b>	<b>New Step Screens, Wash Presses</b>	<b>New Trav. Rake Screens, Wash Presses</b>	<b>New Perf. Plate Screens, Wash Presses</b>	<b>New Moving Media Screens, Wash Presses</b>	<b>Chopper Pumps, Wash Presses</b>
	<b>S0</b>	<b>S1</b>	<b>S2</b>	<b>S3</b>	<b>S4</b>	<b>S5</b>	<b>S6</b>	<b>S7</b>
Total Opinion of Current Capital Cost	---	\$1,677,000	\$4,145,000	\$3,390,000	\$3,849,000	\$3,590,000	\$3,869,000	\$1,304,000
Total Opinion of Future Capital Cost	\$5,564,000	\$4,224,000	\$1,713,000	---	---	\$1,415,000	\$1,169,000	\$4,673,000
Annual O&M	\$120,000	\$96,000	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000	\$104,000
Present Worth								
O&M	\$1,578,000	\$1,262,000	\$907,000	\$907,000	\$907,000	\$907,000	\$907,000	\$1,368,000
Future Costs	\$3,626,000	\$2,753,000	\$1,116,000	---	---	\$473,000	\$762,000	\$3,045,000
Salvage	(\$1,182,000)	(\$897,000)	(\$363,000)	---	---	(\$153,000)	(\$248,000)	(\$992,000)
<b>Total Opinion of Present Worth</b>	<b>\$4,022,000</b>	<b>\$4,795,000</b>	<b>\$5,805,000</b>	<b>\$4,297,000</b>	<b>\$4,756,000</b>	<b>\$ 4,817,000</b>	<b>\$5,290,000</b>	<b>\$4,725,000</b>

**Project Recommendation**

It is recommended that Alternatives S3 and S1 be considered in more detailed evaluation. The 20-year present worth cost of Alternative S3 is within around 4% of the null (do-nothing) alternative, which is considered equal at this planning level. The null alternative does not resolve any of the operational or maintenance issues related to influent screening. Alternative S1 is within 10% of Alternative S3. This alternative would continue to use the most efficient screening equipment (band screens) yet simplifies the screenings handling equipment and processes.

For purposes of capital improvements planning it is assumed that Alternative S3 will be implemented.

**Project Schedule:**

	Start Date	Completion Date
Planning	2016	2017
Design	2021	2021
Construction	2022	2023

**Financial Summary (2019\$):**

<b>Total Project Cost</b>	
District Staff & Engineering	\$600,000
Contractor	\$3,020,000
<b>Total</b>	<b>\$3,620,000</b>

**Fiscal Allocation (2019\$):**

	2020	2021	2022	2023
District staff	\$10,000	\$50,000	\$60,000	\$60,000
Consultant	\$0	\$260,000	\$80,000	\$80,000
Construction	\$0	\$0	\$1,510,000	\$1,510,000
<b>Total</b>	<b>\$10,000</b>	<b>\$310,000</b>	<b>\$1,650,000</b>	<b>\$1,650,000</b>

**Fiscal Allocation (actual \$):**

	2020	2021	2022	2023
District staff	\$10,000	\$50,000	\$70,000	\$70,000
Consultant	\$0	\$280,000	\$90,000	\$90,000
Construction	\$0	\$0	\$1,640,000	\$1,690,000
<b>Total</b>	<b>\$10,000</b>	<b>\$330,000</b>	<b>\$1,800,000</b>	<b>\$1,850,000</b>