

APWA Oregon Chapter
2016 Public Works Project of the Year

McMinnville Water Reclamation Facility Expansion Project



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Settled in 1843 and located in Oregon's Willamette Valley, the City of McMinnville has steadily grown around Linfield College, agriculture, wine, and tourism. In the 20 years since the original McMinnville Water Reclamation Facility (WRF) design and construction, McMinnville's population has grown by almost 50%. During this time, the WRF staff has complied with an extremely stringent permit limit for discharge into the Yamhill River despite approaching maximum wet weather and dry weather capacity. This has meant that while the WRF could still meet summer permit requirements as well as handle winter storm flows, there was no room for error and no ability to shut equipment down for service.

Project Description

The McMinnville Water Reclamation Facility (WRF), originally constructed in 1996, produces effluent that meets stringent ammonia and phosphorus standards before being discharged into the South Yamhill River. The original WRF encompassed screening, grit removal, two secondary treatment trains (Orbal aeration basins for nitrification and biological phosphorus removal), tertiary clarification, filtration, and U.V. treatment. Operating near dry weather capacity, the City wanted a third aeration basin for reliability/redundancy and a third secondary clarifier to increase wet weather treatment capacity.

CH2M provided design and services during construction (SDC) for the expansion in 2012. Evaluation of secondary alternatives resulted in selection of a third Orbal aeration basin as the preferred process. Design was completed in Spring 2014, with the construction completed in 2016 by McClure and Sons. Construction.

The new facilities include a 1.5 million gallon aeration basin, 120-foot diameter secondary clarifier, RAS/WAS pump station, a mixed liquor split box and a considerable amount of large diameter piping that ties the new facilities into the existing process, maximizing operational flexibility.

The project also includes site work and piping with associated electrical; instrumentation and control; heating, ventilation, and air conditioning; and building services. The facilities will increase dry weather nitrification capacity so that one Orbal can be taken offline for maintenance and increase wet weather capacity to 36 million gallons per day (mgd) with all trains online. The design will allow operation of any combination of aeration basin and secondary clarifiers for maximum operational flexibility.





42-inch diameter ductile iron pipe added to the existing Headworks to split flow to the new aeration basin.



Optimized aeration basin matching the size of the existing basins but with an additional 10-percent treatment capacity.

Headworks Modifications

While the headworks flow split structure was originally designed to serve only two treatment trains, novel modifications were made to split the flow to three trains, saving the cost of a completely new structure.

Aeration Basin 3

A new Aeration Basin was constructed to the east of the existing aeration basins. The basin is similar to the existing basins except the aeration system was optimized to provide increased treatment capacity compared the existing basins of the same size.

Secondary Clarifiers

The project included recoating of the two existing carbon steel clarifier mechanisms. The new secondary clarifier was constructed east of the existing secondary clarifiers. The tank is similar to the existing tanks except that the slab was designed to meet current seismic requirements. The new clarifier mechanism was constructed of stainless steel to prevent corrosion without requiring costly coatings.

Mixed Liquor Splitter Boxes

The addition of a third aeration basin and secondary clarifier required a new mixed liquor splitter box to convey the new aeration basin effluent to the new secondary clarifier, so a new Mixed Liquor Splitter Box 2 was constructed. Piping connecting the new and existing mixed liquor splitter boxes was provided to allow any combination of aeration basins and secondary clarifiers to operate. In addition to designing for current operational flexibility, the new mixed liquor splitter box was designed to accommodate a future fourth secondary treatment train.



New stainless steel clarifier mechanism saves costly coating projects in the future.



Return Sludge Pump Stations

The existing Return Sludge Pump Station 1 served as the primary support facility for much of the existing secondary treatment process, including electrical distribution and process control. The new pump station provides similar functionality for the new treatment train and has space for expansion or a fourth train. The project included process connections between two pump stations to allow the existing and new aeration basins and secondary clarifiers to be operated interchangeably. To minimize cost, some infrastructure in the existing pump station, such as compressed air and washdown water, was not duplicated in the new pump station. Instead, connections to the existing systems were provided.

Site Work

Project site work included new access roads around the new facilities, yard piping, and site utilities. To maximize operational flexibility, yard piping was configured so that new and existing facilities can be used interchangeably. The site roads use a permeable paver system and bioswale system to minimize the impact of stormwater runoff from site roads.



New Return Sludge Pump Station serving the new third treatment train with space for a future fourth train.



One of multiple complicated pipeline tie-ins requiring close coordination between WRF staff and the construction team.



Extensive permeable paver and landscaping design by Greenworks minimizes stormwater runoff to the Yamhill River.





New motor control center and energy efficient variable frequency drives serving the new treatment process.



LED fixtures used for all interior and exterior lighting.

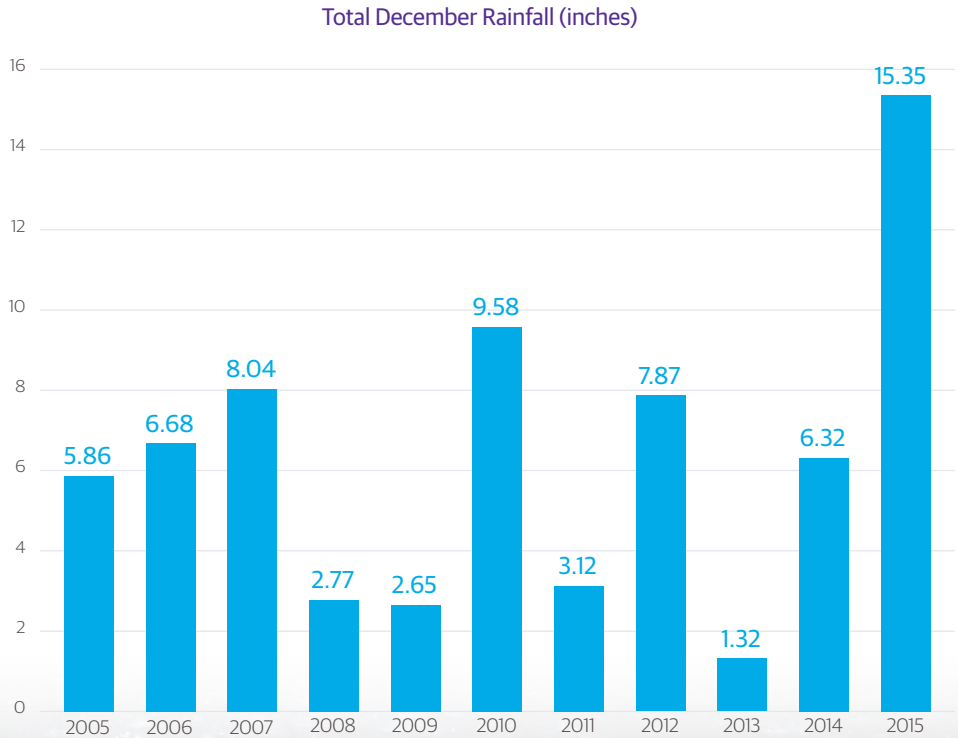
Electrical and Instrumentation and Control

The new treatment train is served by a new electrical room that includes a motor control center (MCC) containing motor starters and variable frequency drives for efficient operation of equipment. The MCC includes advanced metering and power monitoring capabilities so plant staff can accurately monitor energy usage. New interior and exterior lighting includes LED ballasts to reduce power requirements and minimize life cycle costs.

All new equipment is controlled automatically by the plant SCADA system via a PLC and fiber optic network. New control system software allows automatic operation with minimal plant staff intervention. Coupled with improvements to the aeration system design, the new control system increases WRF capacity to meet peak treatment requirements.

Completion Date Contained in Contract

The original contract substantial completion date was December 31, 2015. Like most wastewater treatment facilities in the northwest, the WRF experienced unprecedented rain events in December 2015. Flooding occurred throughout communities in the northwest, and some wastewater treatment facilities discharged untreated effluent. City of McMinnville staff, MSI, and CH2M worked together to ensure existing facilities stayed online without interruption. Tie-in's to existing structures and startup activities were put on hold and the new tankage was made available to contain excess flows, preventing untreated effluent from discharging into the Yamhill River. To accommodate this important effort, the team decided to delay substantial completion to February 26, 2016.



Construction Schedule, Management, and Control Techniques

The project was completed using the conventional design-bid-build approach with MSI as the contractor and CH2M as the designer providing resident observation services. While the approach was conventional, the team was not. The City and CH2M were able to engage some of the original 1996 project staff. CH2M's resident observer, quality manager and original treatment plant staff brought critical insights and lessons learned to the design and construction process, greatly contributing to project success.

Before construction activities began, the City, MSI, and CH2M chartered a Partnering Team. The partnering approach allowed for the Owner's, Contractor's, and Engineer's management staff to meet on regular basis, outside of weekly construction meetings, to discuss project goals, progress, and concerns. The McMinnville WRF Partnering Team developed the following mission statement: "The McMinnville WRF Expansion Project will be constructed safely, by an innovative hardworking team who will use coordination and proactive communication to produce a well-functioning, high-quality, superior-value facility for the City of McMinnville."

The Partnership was critical to the team's successful cooperation during the severe storms of December 2015 mentioned above.

To fund this project, the City's Master Plan allocated approximately \$3.9M for professional services and \$11.7M for construction, resulting in a total expected project cost of \$15.6M. Actual costs were \$2.3M for professional services and \$10.9M for construction for a total cost of \$13.2M, a savings of \$2.4M. Additionally, over \$400,000 in deferred maintenance was included in the project, resulting in a savings of approximately \$2.8M that can be used for future projects. Excellent coordination between the City, MSI, and CH2M resulted in a total change order rate of 1.6%, well-below the industry average. From start to finish, the project has proven to be a financial success for the community.

Safety Performance

Zero lost-time injuries occurred during the construction project. In addition to executing their safety programs, the City of McMinnville, MSI, and CH2M each have a safety culture built into their organizations. Each weekly project meeting began with a discussion of site safety. This was an opportunity for the team to voice any concerns in an open manner, so that the group could find solutions before there were problems.



The McMinnville WRF Expansion project will be constructed safely, by an innovative hardworking team who will use coordination and proactive communication to produce a well-functioning, high-quality, superior-value facility for the City of McMinnville.





New stainless steel scum beach for new secondary clarifier.



Oxidation ditch aeration basin with three zones.

Community Need

In the 20 years after the original WRF construction, McMinnville's population grew by almost 50%. During this time, City staff meticulously operated the existing WRF to comply with an extremely stringent permit limit for discharge into the Yamhill River. However, the WRF was approaching maximum wet weather and dry weather capacity. This meant that while the WRF could still meet summer permit requirements as well as handle winter storm flows, there was no room for error and no ability to shut equipment down for service.

As part of the design process, the City worked with CH2M to evaluate process alternatives that would increase treatment capacity, improve reliability and redundancy, and minimize cost. Adding another similar treatment train to match the existing was selected as the most viable option, as it not only provided the needed additional capacity but also installed equipment that operations was already intimately familiar with via two decades of experience with the original treatment trains. This also provided an opportunity to optimize the new treatment train based on extensive operator experience. Improvements to the new train include:

- 10-percent increased dry weather treatment capacity through the new aeration basin, compared to each existing basin of the same footprint.
- Designing the new clarification mechanism to be stainless steel, eliminating costly recoating projects in the future.

Sustainable Practices

The WRF Expansion project is testament to the fact that a community can make practical financial decisions while at the same time taking steps to protect the environment for future generations.

The project was funded without the need for loans or bond measures, proof that proper financial planning, rate studies, and engineering analysis can result in a reliable long-term investment.



New Grit Drying Station to dry out grit before hauling, minimizing cost.



Permeable paver system



Return Sludge Pumping Station



Bioswale



Drainage outlet for permeable paver system



Translucent wall panels

Besides strictly adhering to stringent treatment requirements, the City went the extra mile and implemented optional sustainable practices wherever possible, as a benefit to the community and environment. These elective project components include:

- Extensive permeable paver system to prevent rainfall runoff that would otherwise occur with an impervious surface, such as concrete or asphalt.
- Bioswale to collect and convey stormwater runoff, rather than a hard-piped system, minimizing impact to the surrounding environment.
- Water efficient landscaping with irrigation provided by disinfected treatment plant effluent.
- Variable frequency drives (VFDs) and premium efficiency motors on major process equipment to optimize performance and minimize energy use.
- LED lighting for all new interior and exterior fixtures to minimize energy use.
- Translucent wall panels that provide natural lighting while maintaining security.
- Low VOC coatings to protect staff health in interior spaces.

Environmental Considerations

Erosion control best practices were used during construction to minimize the impact of construction activities on the surrounding environment, particularly the Yamhill River.

During the dry, hot summer construction periods, MSI implemented dust control measures to minimize the impact of construction activity on local air quality.

Although the heavy rains in December 2015 caused problems throughout communities in the Northwest, the project team worked together to minimize the impact of these storms on McMinnville and surrounding environment. More complicated process connections and sequencing activities were deferred so as to not risk disruption of the treatment process.

Extensive permeable paver system and landscaping





Community Relations

The WRF property is located primarily in an industrial area in northeast McMinnville but is adjacent to some neighborhoods. City staff maintained close contact with the WRF neighbors to ensure all concerns were addressed.

To celebrate the project completion, a ribbon-cutting ceremony was held that included the City Council and WRF staff.

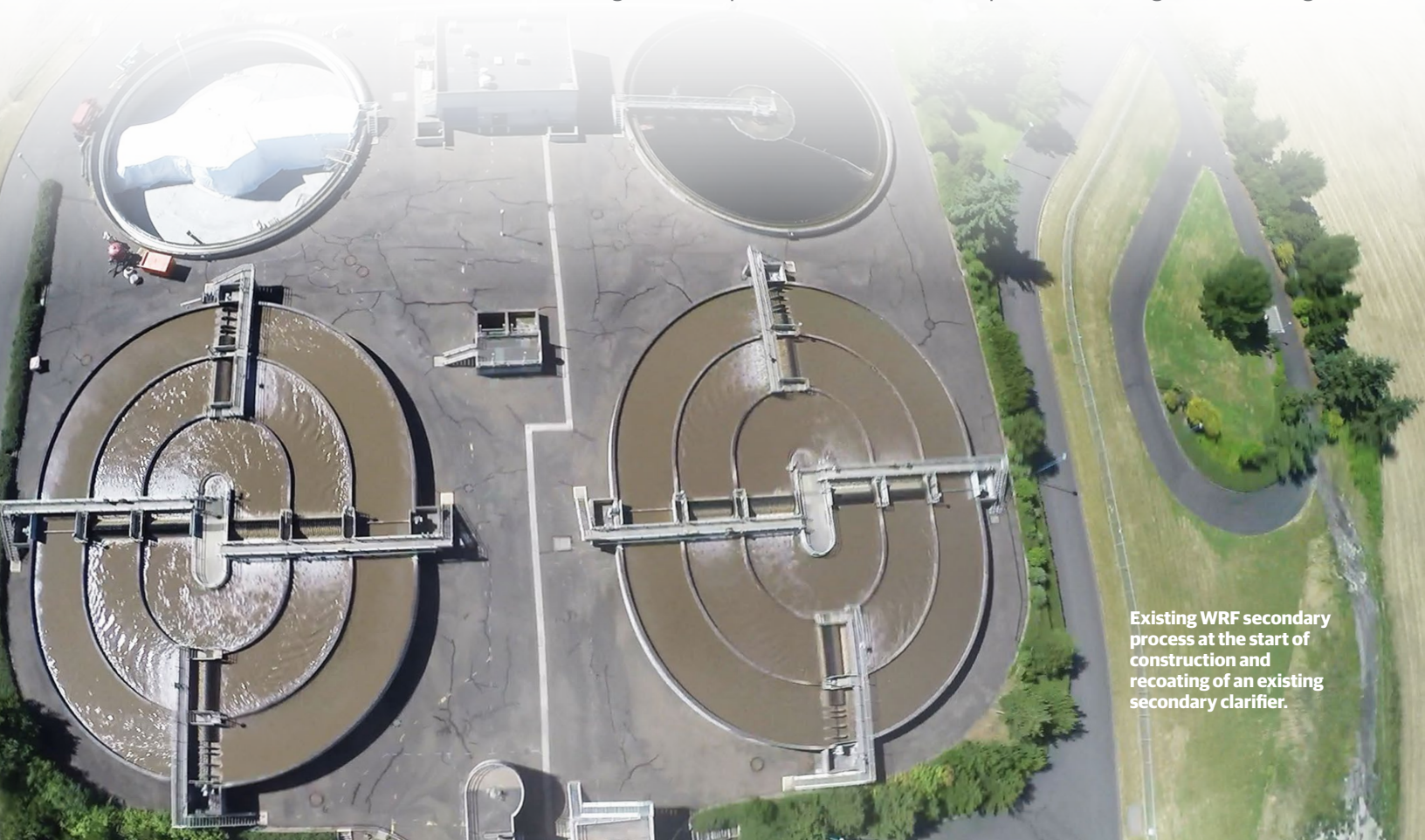
Unusual Accomplishments under Adverse Conditions

Construction at existing wastewater treatment plants usually has one unique challenge – the flow to the plant cannot be turned off. Showers run, dishes are washed, and toilets are flushed all day, every day of the year. Shutdowns are avoided whenever possible.

While construction of the standalone Train 3 facilities was straight-forward, tie-ins to the existing facilities were not. In order to provide complete interchangeability between new and existing basins, multiple large diameter pipelines, including a 48-inch, and large electrical ductbanks had to be routed through the existing site without interruption to the treatment process. This resulted in increased design and construction sequencing complexity. Process tie-ins were carefully planned and the construction sequence was developed during the design stage to ensure that the project was buildable.

When a plant shutdown is unavoidable, very careful planning is required to ensure the plant shuts down and starts up smoothly. In the case of the WRF Expansion Project, two of these shutdowns were required and they were executed flawlessly.

The best teams remain flexible and understand that the best plan is one that can nimbly adapt to changing circumstances when needed. Record rainfall in December 2015 meant the team needed to modify the plan to complete the project without disrupting the existing treatment process at a time when the process faced its greatest challenge.



Existing WRF secondary process at the start of construction and recoating of an existing secondary clarifier.

Additional Considerations

Sometimes we view the most impressive public works projects as those that use the latest technologies or create the most publicity. Often overlooked are the projects and staff that work tirelessly to achieve similar results by optimizing or modifying existing infrastructure at cost savings to the public. These projects tend to have an experienced team with a commitment to the best, not most glamorous, solutions.

Such was the case with the McMinnville WTP Expansion project. When the City worked with CH2M to evaluate treatment process options in early 2013, the team considered a variety of technologies, including the latest, most advanced treatment schemes. The selected process was a highly optimized version of the existing technology, a process well-known by City staff based on 20 years of proven operating experience. While the existing aeration basin and secondary clarifier might look identical to the casual observer, City staff know that the aeration basin can actually treat approximately 10% more waste than the existing trains and while the secondary clarifier will perform the same as existing, the stainless steel will not require costly recoating projects in the future. These decisions couple the best interest of the rate payers with protection of the environment.

For the City and CH2M teams, the start of construction did not mean that the project was "thrown over the fence" to MSI. The three groups worked collaboratively throughout construction to develop an approach based on the team's collective experience and in-depth knowledge of the treatment plant.

The experience and dedication of the team influenced the approach to the storms of December 2015. Despite the looming contract deadline, the team worked together to identify that plant operation and effluent quality were paramount. With this understanding, the team remained flexible and successfully negotiated a contract change that allowed final construction activities to occur once plant flows stabilized. That the project was delivered successfully and without incident, despite having such a significant weather event during the construction phase deserves recognition. The publicity that was not generated and the headlines that were not written are testament to the project's success!

The City of McMinnville, MSI, and CH2M team is proud to have successfully delivered a project of exceptional value and quality to the community it serves and is confident the project will have a lasting impact on the growing McMinnville community for years to come.



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