Jacobs

Challenging today.
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Proposal for

Bissell Point WWTF Fine Screen, Concrete and Gate Improvements (12548)

Submitted to

Metropolitan St. Louis Sewer District

September 8, 2020

Jacobs

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September 8, 2020

Mr. Rich Unverferth
Director of Engineering
Metropolitan St. Louis Sewer District

Subject: Proposal for Bissell Point WWTF Fine Screen, Concrete and Gate Improvements (12548)

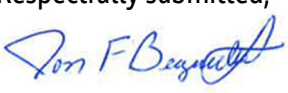
Dear Mr. Unverferth,

Upgrading the headworks at Bissell Point is critical to reducing high O&M costs associated with the comminutors and downstream pumping and treatment equipment. New screening facilities will also improve operation of the rehabilitated trickling filters and future fluidized bed incinerators. But retrofitting fine screens into an existing treatment plant is not a simple matter. Screenings loadings, hydraulics, screen type and size, and screenings transport and processing equipment must all be carefully designed and balanced with constructability and cost considerations in mind. Jacobs can help ease any concerns by bringing an experienced team with world-class technology and the ability to tackle any issues that arise. Our team provides MSD the most qualified and trusted partner for this project, specifically:

- **Leadership You Know and Trust –** The project will be managed under the proven leadership of Project Manager Jon Bergenthal. Dedicated to the District for decades, he knows your staff, knows your procedures, and knows your wastewater system, providing you a worry-free project delivery process with top notch legacy insight. His team is available immediately to begin working on this project.
- **Institutional Knowledge of Plant and Operations –** Our dedicated team brings familiarity with the Bissell Point WWTF. All of the team members were carefully selected based upon their past experience at the plant. In addition, our Operations & Maintenance experts will make certain that all aspects of the screen, concrete, and gate improvement project are carefully planned, including impacts on upstream and downstream processes and continuing operation of the treatment plant while the project is constructed.
- **Technology and Proven Recent Experience –** Jacobs offers the District a #1 ENR-ranked company in Water/Wastewater design with recent, relevant experience. We have completed over 50 headworks projects in the last 10 years, including retrofits as well as new projects of similar size as Bissell Point. Our Process Technologist Joel Rife, PE is highly regarded in the industry as a leading expert on screens/headworks. He is primary author of Chapter 11 (Screening and Grit Removal) of the current Water Environment Federation MOP No 8 "Design of Water Resource Recovery Facilities."

We've teamed with firms that have performed well for the District and have worked seamlessly with Jacobs. Donohue & Associates brings in-depth, recent knowledge of the facility, adding significant value to our team. David Mason + Associates brings a proven record of structural design and has a long history of success with MSD and Jacobs. EDCS continues the legacy of Gerry Ryan's design firm and history of working with MSD and Jacobs. We have been your strategic partner for many years. We have assembled a team skilled in your project requirements to maintain the same level of trust and confidence that you have come to rely on. We look forward to leading and mentoring these partners over the project's duration.

Respectfully submitted,



Jon Bergenthal, P.E.
Project Manager

Michael McCarty, P.E.
Vice President Missouri Operations

A Understanding of the Project and Technical Approach

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Fine screens will reduce high maintenance costs and poor performance associated with the comminutors.

We have identified several critical factors for your project to be a success.

We Understand the Project and the Facility

The Bissell Point Wastewater Treatment Facility provides secondary treatment to wastewater flows generated in the Bissell Point Service Area. The treatment facility also plays a prominent role in the District's Long-Term CSO Control Plan by treating significant quantities of wet weather flow generated in combined sewer areas. Peak flows of up to 350 MGD or more are handled by the existing treatment facilities during wet weather.

The current facility provides preliminary treatment (grit removal, comminution, and pre-aeration), primary settling, trickling filtration, secondary clarification, and seasonal disinfection of up to 250 MGD of flow. Up to another 100 MGD of flow receives preliminary treatment, primary settling, and disinfection prior to being blended with secondary-treated flow.

The existing comminutors date to the original 1970 primary treatment facilities. Although the comminutors have been rebuilt since, the equipment and technology are obsolete, repair costs are high, and performance is less than optimal. Macerated and untreated large debris pass from the comminutors where they end up in the plant sludge and skimmings or to some extent lodged in the trickling filter arms and media.

The purpose of the Bissell Point WWTF Fine Screen, Concrete, and Gate Improvements project is to replace the comminutors with fine screens to remove the solid and floatable materials from the wastewater flow, thereby reducing maintenance on downstream liquids and solids pumping and treatment equipment, and enhancing overall system performance. Along with the comminutor replacement, the project will also replace the existing sluice gates in the Gate Building and Pre-Aeration Tanks and provide gates for the new screens. The existing sluice gates are original equipment dating to 1970. Some of these gates were repaired in the mid-1990s under the Bissell Point Secondary Treatment Project (Contract BP-14), although those repairs were largely limited to gate stems and thrust nuts. Necessary concrete repairs at the gates are also included in the current project scope.

Screening System Performance and Design

The new fine screening facilities must provide a high level of solids removal to enhance the performance of all downstream liquids and solids treatment processes, and reduce maintenance on equipment associated with these processes. **A high degree of screening is particularly needed to protect the new equipment being installed in the upcoming incinerator replacement project.** When screening sewage from combined sewer and older collection systems with a large amount of inflow, it's very important to select screening system technologies that provide the best balance of sometimes conflicting goals of a high degree of screenings capture and the ability of the screen system to safely remove and process large debris without damaging the equipment. It is also critical to incorporate design features that allow the system to remove and process large shock loads of debris in order to prevent screen blinding and overloading of the screenings transport and processing equipment during these times of high loading.

Screening Facility Hydraulics

The most important design consideration for a screening facility is to accurately model the hydraulic conditions upstream, through the screens, and downstream of the screens. Downstream water levels determine screen capacity. Occassionally it is required to provide downstream water level control to allow the screen to process high flows without exceeding maximum acceptable velocities through the screens, while allowing the channel water levels to drop under normal/low flows to avoid excessive grit settling in front of the screens.

Another important consideration for a screening facility is automating the sluice gates upstream and downstream of the screens to allow taking screen channels on and off line quickly in response to the wide range of design flows for this project. Finally, the new screen facility must not result in hydraulic conditions that detrimentally impact upstream and downstream unit processes.

We performed the condition assessment and design of previous sluice gate and concrete repairs at the Gate Building and Pre-aeration Tanks as part of the Bissell Point Secondary Treatment project.

Sluice Gate Design

Sluice gates in headworks facilities are subjected to high concentration of hydrogen sulfide, resulting in condensation of sulfuric acid on the gates. We will review the comprehensive analysis of gate materials already performed by MSD and recommend the replacement gate design that provides the best balance between capital cost and long service life.

Constructability

The proposed screen, gate, and concrete improvements should be constructable such that all dry weather flows will continue to receive full treatment, and that wet weather flows can be maximized, while continuing to meet Missouri State Operating Permit requirements.

Odor/Corrosion Control System Design

Jon was PM for odor control studies at various MSD sites including Bissell Point that involved evaluating scenarios to control odors and phased-approach control plans. He also led the secondary treatment expansion that included addressing trickling filter odor and ventilation air.

The proper design of the foul air capture and treatment system is critical to the success of a new headworks facility, not only to provide a safe environment for the operators and prevent off-site odor, but just as importantly to prevent corrosion of the new screening and gate equipment. We have found that typically the most cost-effective odor control system is to provide tight-fitting screen channel covers and ventilating directly from the channels, thereby minimizing the quantity of foul air requiring treatment while providing sufficient concentrations of 'food' for biological odor control systems. Installing a fresh air intake on the screens and at the gates also provides additional insurance against screen and gate corrosion.

Technical Approach

Gate Replacement and Concrete Repairs

The sluice or slide gates that allow isolation of the two influent headers, the six grit tanks, and four pre-aeration tanks are to be replaced under this project. New gates to isolate the fine screens will also be provided. The purpose of replacement is to provide continued reliable service to plant operations.

Three issues need to be addressed as part of the Basis of Design Report:

- Materials of Construction
- Concrete Repairs
- Constructability and Construction Sequencing

Jacobs' experience is that the low-head gates proposed for this project will generally be less expensive when fabricated from stainless steel rather than cast with iron. The prelim's average costs for stainless steel gate pricing was heavily skewed by a single vendor's quote.

Materials of Construction

The gates can be constructed of either cast iron (grey, ductile, or Ni-Resist) or fabricated stainless steel. A Technical Memorandum was previously prepared by others for MSD addressing materials of construction for the gates. We will review the findings of that technical memorandum, focusing on material needs for the design seating and unseating heads, gate longevity, and corrosion resistance. Updated costs for the gates will be obtained and analyzed to establish valid and competitive pricing to use in comparison between different materials. We make our design recommendations based on the results of the analyses. Potential repairs to existing gate thimbles (erosion, corrosion) will also be addressed in the design.

Concrete Repairs

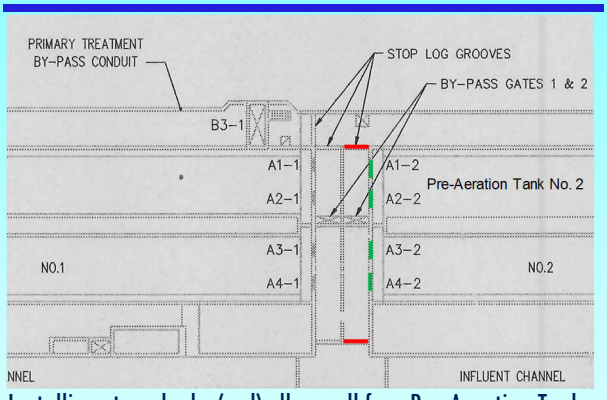
As part of the Basis of Design Report, our team will conduct a condition assessment of concrete conditions at each of the actuator pedestals. This assessment will serve as the basis for determining the extent or estimated quantities of the necessary repairs. Repair methods will be defined and applied to the estimated quantities to determine the preliminary cost of necessary repairs. Potential concrete repairs at gate thimbles will also be addressed in the design.

As principal author of the District's Long-Term CSO Control Plan, we understand completely the need to continue to maximize wet-weather flow treatment during construction of this project.

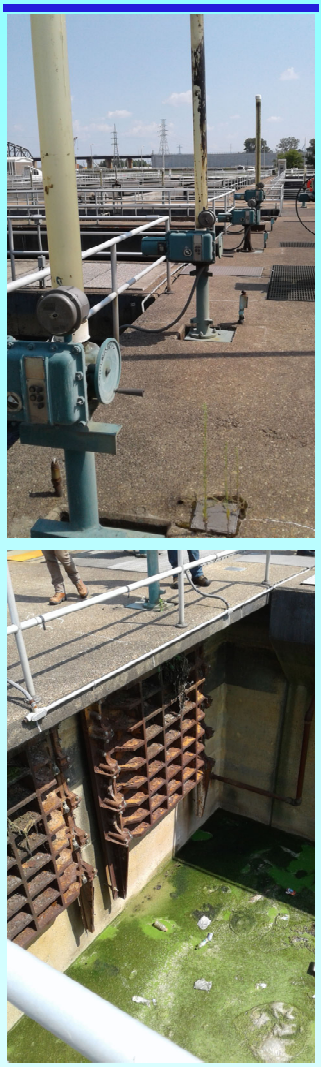
Constructability and Construction Sequencing

Maximizing flow through the treatment plant while at the same time replacing the gates is important. Plant shutdowns should be avoided and periods of reduced flow minimized. An initial review of the preliminary study drawings indicates that each of the grit tanks and pre-aeration tanks can be isolated, one unit at a time, using stop planks. The associated grit tank influent gate or pre-aeration tank influent and effluent gates can be replaced while the tank is isolated. New stop log planks and lifters may need to be provided by the Contractor if those furnished with the original construction – 50 years ago – no longer exist. Hydraulic and process loads with one unit out of service appear to be acceptable; we will verify during the initial design.

Replacing the influent gates on each of the two pump station headers will be more difficult. A single gate replacement could take several days, to as long as a week or more, depending primarily on the condition of the wall thimble and studs and any necessary repairs. An entire influent header will need to be shut down to replace its associated gate. The north header has three influent pumps tied to it and the south header has two pumps. Normally, two pumps should suffice to handle dry-weather flows. When the south header is down for gate replacement, the firm capacity of the north header (i.e., two pumps operating) appears to be sufficient to handle the range of normal dry weather flow. Inflows from high river stage or wet weather may not be able to be pumped, and these conditions should be avoided for gate replacement. More problematic is replacing the gate on the north header. The firm capacity of



Installing stop planks (red) allows all four Pre-Aeration Tank No. 2 gates (green) to be replaced. All flow is treated in Pre-Aeration Tanks 1, 3, and 4, or is bypassed to primary settling.



Pre-aeration tank gates are corroded and mainly inoperable.

the remaining header (i.e., one pump operating) is likely insufficient to handle the range of daily dry weather flows. Two pumps, as noted above, should suffice.

During the Basis of Design phase of the project, we will further develop concepts for allowing the influent gates to be replaced. Potential solutions may involve:

- Partially pumping down the pump station wet well and tunnel (as is now done before wet weather events), thereby providing some additional buffer.
- Limiting construction to certain seasons when high river or wet weather flows are less frequent.
- Limiting construction durations or establishing fall-back positions in case of pump failures.
- Obtaining permission for reduced capacity from MDNR.
- Combinations of the above, or others.

During design, we will investigate other concerns with the influent gate replacement including the need to remove part of the building roof in order to access the gates for removal.

Fine Screening

Our technical approach to the fine screening aspect of the project is founded on four major issues/obstacles that will affect schedule, cost, and ultimately, project success:

1. Evaluation of Anticipated Screenings Loadings and Characteristics.
2. Screening System Constructability, Maintenance of Plant Operations (MOPO), and Screen Building Location.
3. Screening System Design.
4. Screening System Operational and Maintenance (O&M) Considerations.

1. Evaluation of Anticipated Screenings Loadings and Characteristics

The Bissell Point Wastewater Treatment Facility is one of the largest facilities remaining in the U.S. that is not protected by raw sewage screens. Comminutors fell out of favor as an acceptable method of processing raw sewage many decades ago and we fully understand and appreciate how excited your O&M staff is to implement this project.

One of the biggest challenges associated with the project will be the lack of any historical screenings loading data. This is not an insurmountable issue. Because almost all screening projects involve screening upgrades that significantly increase screening capture, historical data is almost never used to size the screens and most importantly screenings processing equipment. Our approach to determine the design screenings loading criteria for this project starts with interviewing your operations staff about their experience with the existing comminutor system. While the system doesn't remove screenings, the operation and maintenance of the comminutors has been affected by screenings loadings and such factors as types of large debris that has avoided capture by the grit removal system and shock loading events that might have overloaded the comminutor system will provide valuable information.

We have designed numerous headworks projects including fine screens *(see Section 5)*. Many of these were enhancements to existing facilities that needed to remain operational during construction.

Screenings data from the Lemay Wastewater Treatment Plant will be evaluated and used while considering any significant differences between the collection systems serving both plants. **Our experience in obtaining screenings data over the years from similar plants will help us to recommend sufficiently conservative values for average and peak screenings loading criteria for the project**. In some cases, when peak screenings loadings are unknown, the processing equipment is sized for maximum screen carrying capacities.

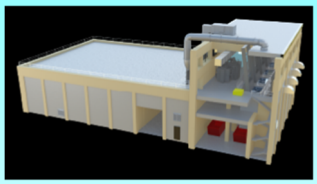
2. Screening System Constructability, Maintenance of Plant Operations (MOPO), and Screen Building Location

The constructability of the screening system is the most critical factor affecting two other issues that are crucial to project success: MOPO and Screen Building Location. **Our preliminary analyses indicate that it is possible to construct an effective screening facility in the existing comminutor channels**, but this will require several considerations:

- Significant additional investigations into the design of required structural modifications for the various screen designs that are determined to physically fit within the small footprint of the comminutor channels.
- Structural evaluations to determine feasibility of the modifications.
- Locating the screening transport and processing equipment without compromising access for O&M of the equipment.
- Locating and providing even loading of the screening receiving bins and implementing required code upgrades to the existing building.

Our preliminary conceptual layout of the facility is shown on the next page. This concept design uses the latest in robust screening technology, the **center-flow bar screen** (*discussed in more detail below*), which appears to be the best fit for the small footprint constraints of the retrofit option. Five duty screens sized for a peak flow of 70 MGD and one standby screen provide the required peak flow capacity of 350 MGD.

Our preliminary downstream hydraulics analysis indicates that the existing 54" x 54" comminutor effluent sluice gates would be abandoned, with the channel filled in to optimize hydraulics through the screen and new 72" x 72" automated sluice gates installed downstream of the screens. Temporary bulkheads would be placed outside the existing comminutor influent and effluent channels to allow for modification of each screen channel individually to accommodate anticipated peak flows through the facility during construction. For screenings bin access, a new canopy or building extension would be constructed to allow support of tipping troughs required for even screenings loading in the bins.

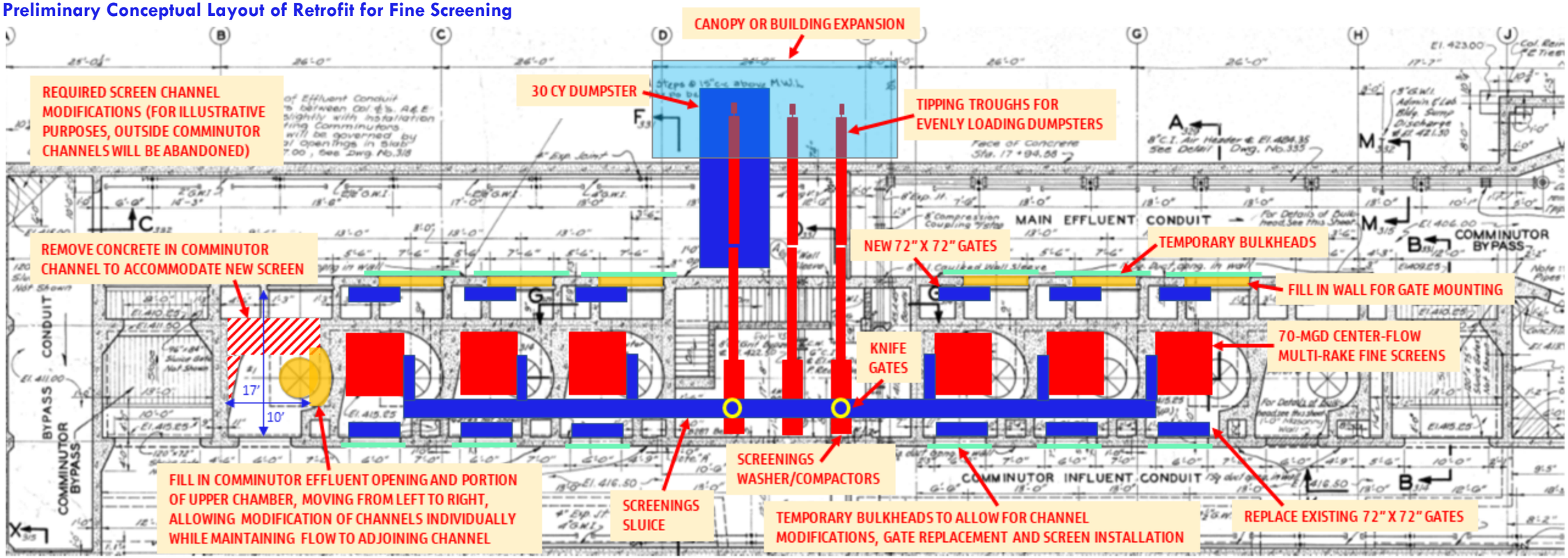


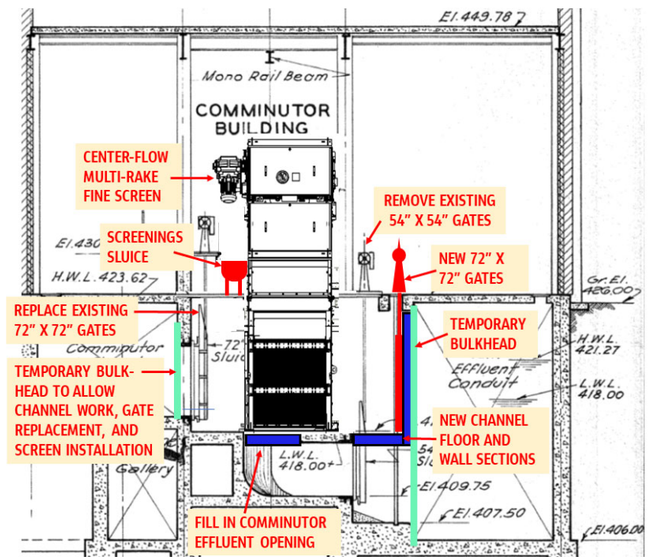
We created a 3D model (above) for the Trinity River Authority's Headworks Fine Screen Improvement, which Jacobs was recently awarded.

If our detailed analyses of the required structural modifications, constructability, and O&M considerations for the retrofit option reveal unacceptable factors, we will provide a new screening building design. The MSD prelim's basis of design does appear to be appropriate for the project and there will be far less issues associated with constructability and MOPO.

Design and construction of the large-diameter yard piping for incorporation of a new screen building into the existing hydraulic profile is probably the greatest challenge

Preliminary Conceptual Layout of Retrofit for Fine Screening





associated with the new screen building option. Another important consideration is construction of the piping, screen channels, building slab, and pile foundations without compromising the structural stability of the adjacent structures. As seen in our preliminary layout of a new screening facility on the next page, there is easily adequate space between the existing Comminutor Building and DEC/Lab to accommodate a new screening facility, though eliminating the access road between the buildings would be required. With the close proximity of the new screen facility to the lab and associated sensitive equipment, a robust odor control system would be particularly important if this location is selected for the new screen building.

3. Screening System Design

We are in full agreement with MSD's preliminary analysis that, while perforated screens can provide significantly greater screenings capture than bar screens, these screens are not appropriate for being able to withstand the large debris and shock loadings associated with the combined collection system tributary to the Bissell Point WWTF. **Bar spacing of the proposed multi-rake screens will be an important consideration in the design of the screens.** Typically, bar spacings of either ⅜" or ¼" are proposed for similar projects. Technically, bar screens with ⅜" bar spacing are classified as coarse screens, whereas bar screens with ¼" bar screens are classified as fine screens. An excellent example and lesson learned was realized at a similar large screening facility, the 440-MGD peak flow West Point WWTP (*see sidebar*).

At the West Point WWTP in Seattle, a 'hybrid' multi-rake bar screen facility was constructed, with ¼" screens treating normal dry weather flows and ⅜" screens treating wet weather flows. The ¼" screens have performed so well that a project is now underway to replace the ⅜" screens with ¼" screens to treat the wet weather flows.

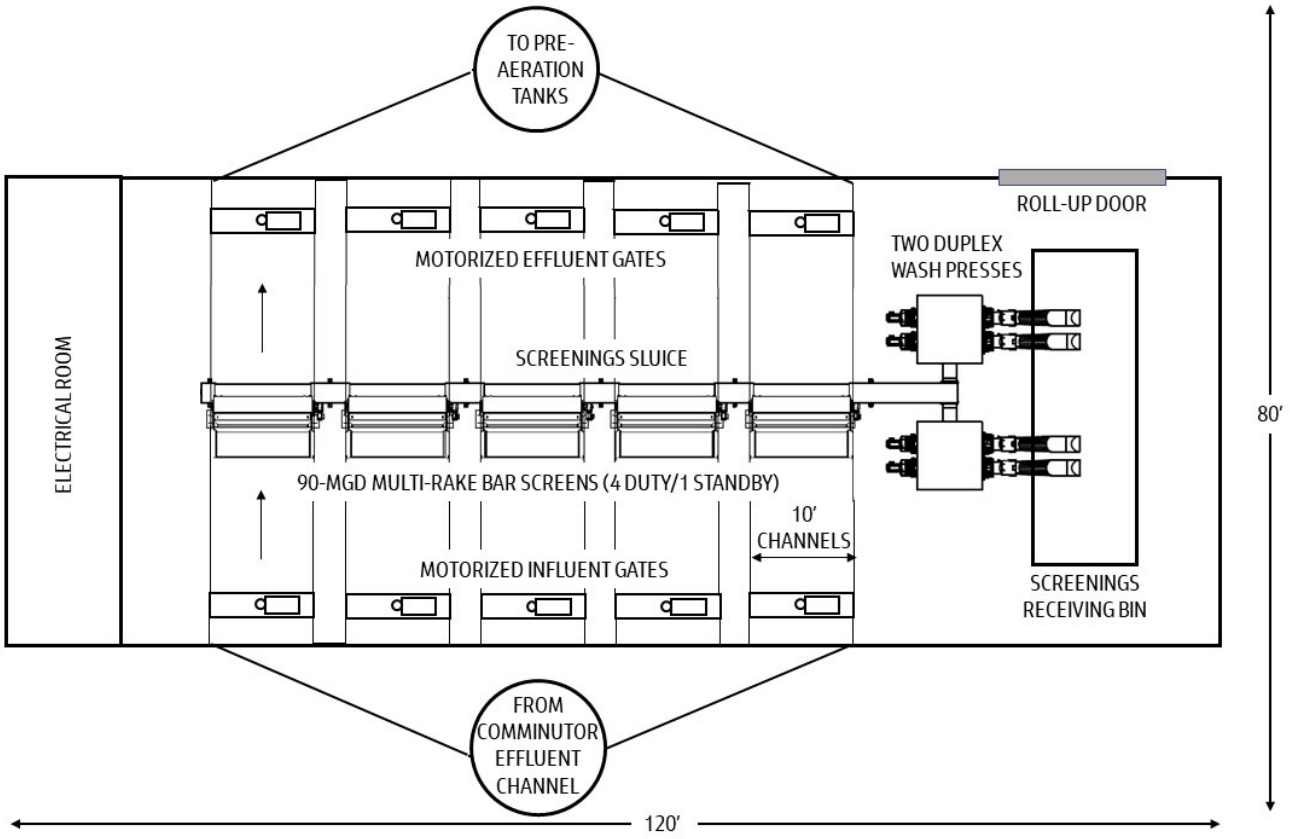
We introduced the latest in screening technology – the center-flow bar screen – in our Comminutor Building retrofit concept above. The greatest challenge associated with designing screens for optimum capture is the velocity through the bar openings, referred to as 'slot velocity'. With the wide range of flow encountered by all screen facilities and particularly the Bissell Point WWTF, it is always necessary to push against the upper limits of slot velocities, particularly when incorporating a standard 30 percent blinding factor in the hydraulics analysis of the screens. By orienting the bars parallel to the channel, the center-flow bar screen essentially doubles the submerged screen field area, dramatically reducing slot velocities and increasing screening capture. This technology combines two well-proven technologies: the **center-flow design**, that previously was only used on perforated screens, with the **multi-rake bar mechanisms**. It is offered by one of the most respected manufacturers in the field (Huber), who recently constructed a manufacturing facility in the United States. Because this technology meets both of your project's two important goals – **maximizing screening capture** with a screen capable of handing a **wide range of large debris** – we encourage MSD to consider employing this technology, particularly if the retrofit option appears feasible.

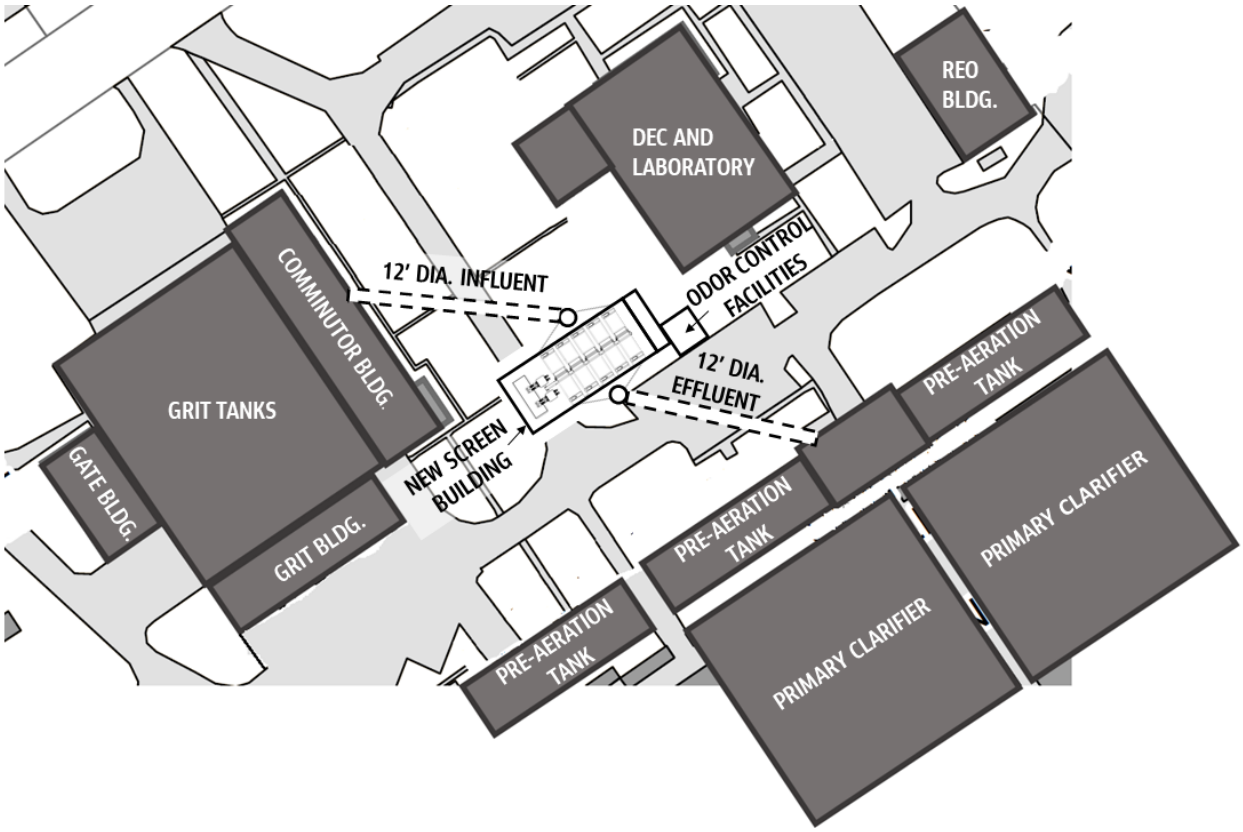
We routinely work with the screening vendor technologists, keeping abreast of advancements and improvements in screening equipment such as the new center-flow bar screen technology — the marriage of two well-proven technologies that appears an ideal option for the comminutor channel retrofit.

For collection and transportation of the screenings, the profession is quickly standardizing on the completely non-mechanical method using sluice troughs. Sluices offer many advantages, including simplicity of design and operation, and should be considered an extension of the washer-compactors that are also becoming standard as the profession implements fine screen technologies that result in increased capture of organic material along with the screenings. The water required to sluice the screenings gets the washing process started immediately; the key to successful operation of the sluice is to minimize the water used for moving the screenings to avoid hydraulically overloading the washer-compactors. If a large amount of debris

is captured by the screens, the sluice water simply builds up behind the screenings until enough head is provided to move the screens down the sluice trough.

Concepts for the New Screening Facility





Information Desired from the District

- Contract PA-17 Record Drawings
- Contract PA-19 Record Drawings
- Contract BP-14 Record Drawings
- Other Related Rehabilitation Contract Record Drawings
- CDG/David Mason Technical Memorandum on Gate Replacement
- Plant Hydraulic Profile
- Any Condition Assessment Reports, Technical Memoranda, and Staff Observations
- Existing Sluice Gate Shop Drawings for bolt patterns and to verify Influent Gate configuration (96-inch circular vs. square)

Agency and Regulatory Contacts/Permits Required

- A construction permit will be required by MDNR.
- Contact with EPA and MDNR may be needed if Consent Decree CSO Control Measures are impacted (e.g., peak wet weather flows treated).
- A building permit will be required from St. Louis City.

The number of screenings washer-compactors provided is among the most important design decisions associated with a large plant screen project, particularly one serving a combined/high I&I collection system and one where the magnitude of peak screenings loadings is relatively unknown. The washer-compactor is typically the "weak link in the chain" of a screening system and therefore we highly recommend multiple washer-compactors and at least one spare washer-compactor. Our preliminary layouts presented in this proposal are for two washer-compactors capable of processing peak screening loadings, with one spare.

Washer-compactor design can be provided either with or without washing tubs designed to nearly remove organic material completely from the screens. We will work with MSD and authorities at the preferred disposal site to determine required screenings quality and make the appropriate recommendations. **We have found modern wash tub design to be robust and low-maintenance and will always recommend use of the tubs when good screenings quality and odor minimization is required.** The length of the discharge tube on the washer-compactors is also an important design consideration. Maintaining a tube length of less than 10 feet is recommended to avoid excessive screenings drying in the tube.

Even loading of the screenings bins is the final challenge of good screen system design. In the retrofit option, orienting the bin to receive the screenings from the three proposed washer-compactors doesn't appear feasible while allowing truck access to the bin. Therefore we show 'tipping troughs' that are open-topped troughs receiving screenings from each washer-compactor, with sensors that signal when to rotate the trough and provide an even loading of the screenings into the bin. In the new screen building option, it will be possible to use a simpler motorized rail system that moves the dumpster as it loads, referred to as a 'dumpster-veyor'.

4. Screening System O&M Considerations

The Bissell Point WWTF does have an important advantage when considering the O&M of the new screening system, with grit removal provided ahead of the screens. Grit and heavy objects removed in the Detritor grit system will provide very valuable protection against damage of the screen and washer-compactor components and minimize the chances of getting large objects stuck in the screening sluice or whatever screenings transportation device is selected.

Floating debris and lighter grit that escape capture by the Detritors will present the greatest challenges to the new screening system. **Multi-rake bar screens have become the industry standard as a result of advancements in lower sprocket design that have essentially eliminated the possibility of failure of this key component.** With cleaning frequency based on water level differential, the multi-rake screens maximize capture while being able to quickly respond to shock loads of screenings.

As noted, we've found sluices to be a highly effective method of transporting screening requiring little O&M attention. We strongly advise a very conservatively designed washer-compactor system with fully redundant units because these are the components of a screening system that are most likely to fail, and when there's inadequate washer-compactor capacity, the entire system fails.

B.1 Project Manager and Project Team

Jacobs' achieved ENR's 2020 #1 Rankings:

- Top 100 Pure Designers
- Sewer & Waste

Project Manager Jon Bergenthal, PE will be your direct point of contact, working closely with MSD's Project Manager to make sure our team's overall direction, staffing, schedule, and QC procedures meet your expectations. Located in downtown St. Louis, he is available to meet with the project stakeholders on short notice. Jon has partnered with the District on your critical planning and improvement projects over the years as well providing invaluable insights and successes during the original negotiations on the Consent Decree and its subsequent modifications.

Jon is supported by a highly qualified team of professionals. **Design Manager Russ Dahmer, PE** has served as project manager, process lead, and design lead during his 32-year career, responsible for multi-office coordination of architecture, mechanical, electrical, I&C, structural, and process disciplines to produce bid documents. Russ brings extensive experience with the repair and retrofit of existing treatment plants and has worked closely with the manufacturers of the critical process equipment items.

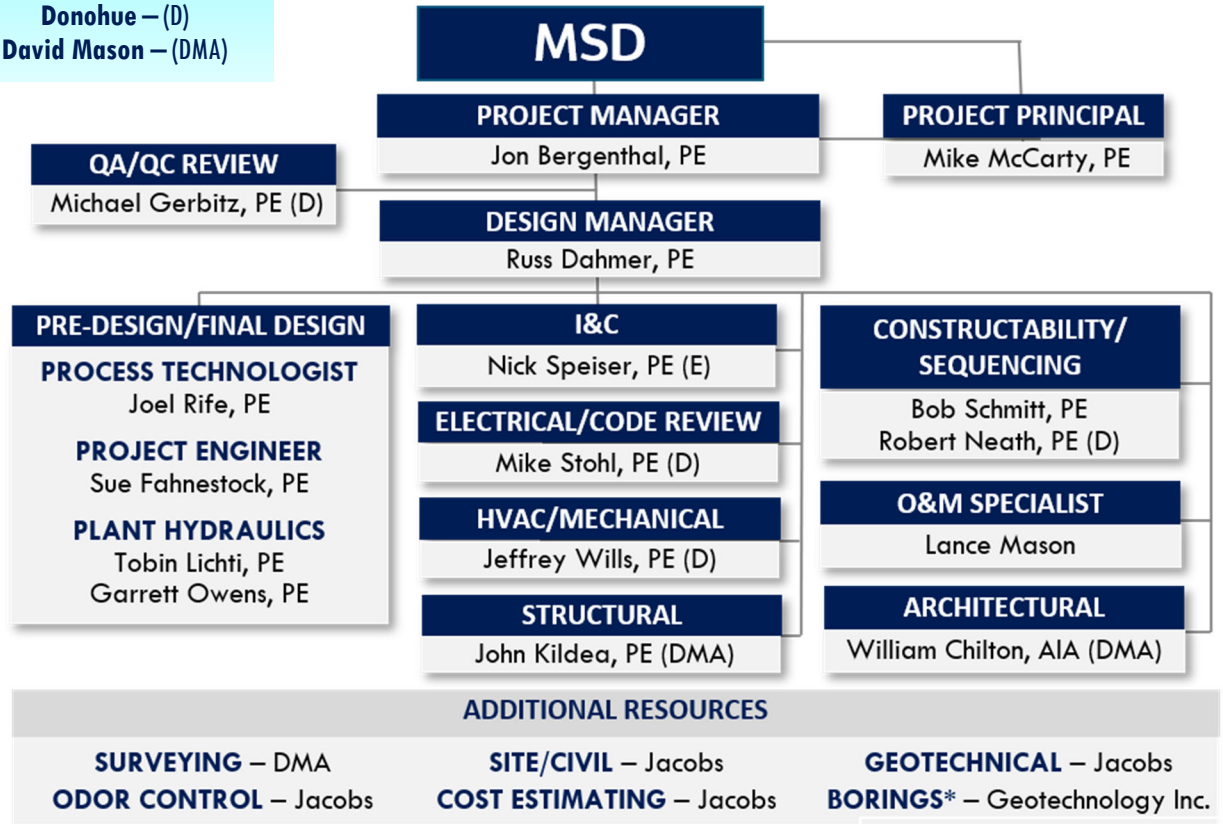
Screening Systems Technologist Joel Rife was the primary author of the Preliminary Treatment Chapter 11 of both the 5th and 6th Editions of the Water Environment Federation Manual of Practice No. 8, "Design of Water Resource Recovery Facilities," providing important updates to keep up with the rapidly evolving science and technologies associated with this important area of the plant.

Process Technologist Joel Rife, PE is regarded in the wastewater treatment industry as a leading expert on screen/headworks and grit removal applications. His 40 years of experience includes 85+ WWTP projects totaling $1B+ in construction cost. Joel was primary author of WEF's MOP 8 (*see sidebar*). He also led a WEF task force to address the issue of a lack of standardized tests to determine the amount of a grit in a flow stream. This culminated in the book, *Guidelines for Grit Sampling and Characterization*, for which he helped developed a wealth of information on current grit handling practices and recommendations for future improvements.

Resumes for core team members begin on the next page.

The Jacobs Team

EDCS – (E)
Donohue – (D)
David Mason – (DMA)



*if new building is required

Jon Bergenthal, P.E.
Project Manager

Jacobs

Education
ME, Environmental Engineering
BS, Environmental Engineering

Registration/Certification
PE: MO

Length of Service
Jacobs: 1976
Profession: 1976

Professional Affiliations
Water Environment Federation
Missouri Water Environment Association

Value to our MSD Team

- *Trusted Project Manager to MSD with four decades of keeping commitments, meeting schedules/budgets, responding promptly, and delivering superior value.*
- *Leads team with his extensive institutional knowledge of the Bissell Point WWTF.*

Relevant Projects

Bissell Point WWTF Trickling Filter Media Replacement, MSD – St. Louis, MO. Project Manager for the current project to rehabilitate 2.7 million cft of media.

Bissell Point Wastewater Treatment Plant Expansion, MSD – St. Louis, MO. Project Manager for designing the trickling filters, secondary treatment operating center, odor controls, sludge cake receiving/pumping, and CSO-related improvements expansion. Facility upgrades included a two-stage biological treatment process – a trickling filter/activated sludge combination – to treat high-strength wastewater, and six new trickling filters (each tilt-up concrete tank is 134-ft diameter with 32-ft media depth) employing slow-speed rotary distributors and plastic sheet media.

Odor Control Studies, MSD – Various Locations in St. Louis, MO. Project Manager for odor control studies at the Bissell Point, Lemay, Coldwater Creek, Missouri River, and Grand Glaize treatment plants.

Wastewater System Improvement Plan, MSD – St. Louis, MO. Project Manager for the Bissell Wastewater System Improvement Plan to reduce pollutant levels from CSOs and eliminating wet weather bypasses in the separated sewer system. Evaluated and analyzed existing collection system and alternatives to reach goals.

Lemay Treatment Plant, MSD – St. Louis, MO. Project Manager for design of two biofiltration systems to treat odorous air from the rising well, grit tanks, primary settling tanks, and sludge holding well. Both projects included several fast-track features to go from concept to start-up in 12 months.

LMRDP CSO Controls System Improvements, MSD – St. Louis, MO. Project Manager for the design of various remedial measures which will reduce overflow volumes from CSO outfalls to MSD's urban streams.

Water Pollution Control Facility Expansion – City of Jefferson, MO. Design Manager for planning and designing a treatment system employs a continuous feed, intermittent discharge mode of operation to effectively treat peaks over five times dry weather flows. The new headworks incorporates fine screening and grit removal. Also included design of the Walnut Street Pump Station that houses equipment over the wet well, including an enclosed septage receiving station, manually cleaned bar screen, and activated-carbon odor control system to scrub the exhaust.

Wastewater Treatment Plant Expansion Study – City of Washington, MO. Project Manager for the initial conceptual study and site selection analysis to upgrade and expand an obsolete trickling filter facility with a 4-mgd activated sludge treatment plant. Coordinated with various regulatory authorities (FEMA, MDNR).

Russ Dahmer, PE
Design Manager

Jacobs

Education
BS, Civil Engineering
BS, Geology

Registration
PE: MO

Length of Service
Jacobs: 1990
Profession: 1988

Value to our MSD Team

- *Numerous projects that integrated systems with existing facilities in limited space.*

Relevant Projects

Wastewater Treatment Plant Expansion – City of Washington, MO. Process Lead for plans and specifications for a new WWTP. Responsibilities included the development of P&IDs, demolition drawings, specifications, coordination with I&C, and interdisciplinary checks and coordination. This facility included influent pumping, fine screening, grit removal, vertical loop reactors, and secondary clarification. The plant incorporated the 'cannibal' system of sludge treatment built into the old primary and secondary basins and utilized the existing aerobic digestion basins – greatly reducing the installation cost. The cannibal system was integrated with the existing sludge handling and dewatering facility, further reducing costs.

River Intake Rehabilitation, Water Treatment System, Confidential Client – Hannibal, MO. Process Design Lead to evaluate rehabilitation of an existing Mississippi River intake that must remove solids larger than 25 micron. Recommended a passive bar rack with an automated rake followed by a passive screen with fine openings (tubular, wedge wire well screen) with an airburst cleaning system to protect the pumps. Also recommended parallel vertical turbine pumps to provide the needed flow variability, using existing floor openings and minimizing modifications to existing concrete. For solids removal, evaluated six different technologies; ultimately selected hydrocyclones and automatic screens to meet the requirements.

Municipal Water Plant Expansion, Columbia Water and Light – Columbia, MO. Design Manager for design, bid, and construction phases of an 8-mgd expansion. Responsible for process and mechanical design including equipment sizing and procurement specifications. Developed system control philosophy, coordination of other disciplines (electrical, I&C, civil, structural), and production of bid documents. Included replacement of existing valve actuators, rehabilitation of piping, HVAC, site improvements, and a complete upgrade of filter control panels with a fully automated PLC-based system.

Boiler Makeup Water Treatment System, Amoco Oil – Texas City, TX. Design Manager for design-build involving site work, foundations, and a new building. Responsibilities included process and mechanical design, engineering support of on-site CM, final pre-commissioning inspections, and start-up supervision.

Condensate Treatment System, Confidential Client – Gulf Coast. Process Design to upgrade system with four separate treatment trains. Overcame extremely tight site conditions and interfaced new equipment with existing pipe runs to provide needed redundancy while increasing system reliability.

Elm Point WTP Improvements – St. Charles, MO. Process Lead to evaluate and design improvements to cost-effectively upgrade the 40-year-old equipment while maintaining service and reducing operating costs. Recommended replacing the solids contact reactor mechanism with a new, similar unit to minimize disruption to the plant related to the age and maintenance requirements of the existing units.

Joel Rife, PE, BCEE
Process Technologist

Jacobs

Education
MS, Environmental Health Engineering
BS, Civil Engineering

Registration
PE: NM
Board Certified Environmental Engineer, American Academy of Environmental Engineers

Length of Service
Jacobs: 2016
Profession: 1979

Professional Affiliations
Water Environment Federation

Value to our MSD Team

- *Extensive experience with 25 headworks/screen projects valued at over $400M.*

Relevant Projects

Headworks Upgrades, San Jose/Santa Clara WWTP – San Jose, CA. Developed preliminary design and served as senior technical consultant for final design on the design-build of a new headworks and to upgrade the existing wet weather headworks at a 400-mgd peak flow plant. New 240 to 280-mgd headworks consists of multi-rake bar screens, sluice, washer-compactors, and HeadCell grit removal.

Screening System Evaluation, Trinity River Authority CRWS – Dallas, TX. Senior Technical Consultant to replace a failed fine screening system at a 500-mgd peak flow plant. Included recommendations for a 2-stage (coarse/fine) screening system.

Influent Screening Improvement, King County West Point WWTP – Seattle, WA. Senior Process Engineer for a 440-mgd peak flow project involving retrofit of an existing single rake screen facility with a new fine screen facility using multi-rake screens. Required analysis of multiple screen options and screenings handling alternatives including sluicing, dry conveyance, screening sump/pump arrangements, and methods of incorporating grinding in the screenings handling processes to reduce the volume of the annual large leaf loading happening every fall.

Screen Replacement, Belmont WWTP – Indianapolis, IN. Senior Process Engineer to replace existing climber screens with multiple rake screens at 220-mgd peak flow plant.

Reclamation Rehabilitation and Asset Management Plant, Phase 1, Water Utility Authority – Albuquerque, NM. Lead Process Engineer for design of new headworks facility at an 80-mgd nitrogen removal WWTP. Included innovative first-stage removal of 6-mm grit ahead of screening, new multi-rake screening facility with sluice and screenings washing/dewatering, grit removal for 100-micron grit removal.

Tahoe-Truckee Sanitation Agency – Truckee, CA. Process Engineer to replace screening process. Starting from conceptual in-house design based on step screens, final design was two 15-mgd multi-rake screens, sluice, and washer-compactors.

NW Langley WWTP – Metro Vancouver, BC. Senior Technical Consultant to the design team for a new screen and grit removal system at a 66-mgd peak flow plant. Preliminary design based on the use of three 12-ft-diameter, 12-tray HeadCells.

Turkey Creek WWTP Headworks Modifications – Knoxville, TN. Senior Technical Consultant at a 44-mgd peak flow headworks improvements project consisting of two 6-mm opening perforated plate fine screens and HeadCell grit removal system.

Gowanus Canal CSO Headworks Modifications – New York City, NY. Technical Review for EPA of design by another consultant of a 323-mgd headhouse to limit discharge of screenable materials. Consists of four coarse screens and a CSO storage tank.

Robert Hite WWTP Headworks Upgrades – Denver, CO. Guided equipment selection and design of a design-build project involving new single rake bar screens and sluice.

Sue Fahnestock, PE
Project Engineer

Jacobs

Education
MS, Civil Engineering
BS, Civil Engineering

Registration
PE: MO

Length of Service
Jacobs: 1989
Profession: 1985

Value to our MSD Team

- *Served as Bissell Point startup coordinator on the Secondary Treatment Expansion.*

Relevant Projects

Bissell Point WWTF Trickling Filter Media Replacement, MSD – St. Louis, MO. Project Engineer for design of improvements to trickling filters, including replacement of media, rotary distributors, and filter liner system.

Bissell Point Wastewater Treatment Plant Expansion, MSD – St. Louis, MO. Start-up Coordinator for MSD's $270-million wastewater treatment plant expansion. Responsibilities included on-site coordination of start-up activities with plant personnel, joint venture design and construction personnel, manufacturers and contractors; tracking submittals, testing, issues and training prior to start-up; and aiding in resolution of issues that arose during start-up.

Equipment Specifications for Bissell Point WWTP, MSD – St. Louis, MO. Project Engineer for equipment specifications for trickling filter media, rotary distributors, and ventilation scrubber system for the plant expansion.

Long Term CSO Control Plan, MSD – St. Louis, MO. Project Engineer to address 200+ wet weather overflow locations from the combined sewer systems in the Lemay and Bissell Point service areas. Project responsibilities included water quality impact assessment, selection of water quality goals, evaluation of CSO control alternatives, and development of the long term control plan.

Missouri River Wastewater Treatment Plant Restoration, MSD – St. Louis, MO. Project Engineer for flood restoration including facility assessment for developing recommendations for repair/replacement of plant equipment, assisting with the planning and scheduling of equipment restoration needed for initial operation, and developing a plan and schedule for complete operation of the treatment facility.

Missouri River Wastewater Treatment Plant, MSD – St. Louis, MO. Project Engineer with duties including construction submittal review and start-up training for a new 28-mgd wastewater treatment plant.

LMRDP CSO Tunnel, MSD – St. Louis, MO. Project Engineer for evaluating emergency overflow alternatives for the large-diameter CSO Tunnel. Responsibilities include coordinating transient surge modeling and use of results to develop tunnel operation risk elements and analyze mitigation measures to reduce risk of damaging hydraulic surge pressures, backups into the combined sewer systems and flooding of downstream facilities. In addition, acted as Project Engineer for developing the CSO Post-Construction Monitoring Program plan to guide MSD in demonstrating achievement of Performance Criteria for each CSO Control Measure throughout the District and assessing and documenting impact of receiving water quality that resulted from implementation of the CSO Control Measures.

Wet Weather Flow Evaluation – Omaha, NE. Task Manager for analysis of flows to the two wastewater treatment facilities. Technology evaluated included several storage and parallel primary treatment (via screens and filters) options.

Tobin Lichti, PE
Plant Hydraulics

Jacobs

Education
MS, Environmental Engineering
BS, Chemical Engineering

Registration
PE: MO

Length of Service
Jacobs: 2005
Profession: 2002

Value to our MSD Team

- *Long history working with MSD data for its planning and improvement projects.*

Relevant Projects

Bissell Point WWTF Trickling Filter Media Replacement, MSD – St. Louis, MO. Project Engineer for condition assessment of a major trickling filter facility, including filter media, liners, and ventilation system. Prepared assessment reports and project specifications and oversaw preparation of the construction cost estimate.

LMRDP Foulwater Interceptor Sewer Improvement Preliminary Study, MSD – St. Louis, MO. Project Engineer for preparation of preliminary engineering study report to evaluate options to resolve the leakage of River Des Peres base flow and wet weather flow, as well as Mississippi River backwater, into the foulwater interceptor sewers which run under the River Des Peres channel. Large amounts of I/I entering the system are causing issues within the sewer system and at the wastewater treatment plant. Evaluation includes rehabilitation and/or replacement of the sewers and considers both capital costs and operational flexibility/redundancy.

Watershed Facility Planning, MSD – St. Louis, MO. Watershed Engineer as part a multi-year project in planning sewage system CIP. Assessed watershed issues by analyzing flow meter data, customer complaints, and I/I investigations. Developed appropriate projects and solutions utilizing SSES and hydraulic modeling information as Watershed Engineer for the Coldwater Creek Watershed.

Tri CSO Study, MSD – St. Louis, MO. Project Engineer using existing maps, as-built drawings, and field investigation data to create a system inventory for the purpose of building a computer model to analyze the combined sewer system and make recommendations for improvements and determine additional field investigations.

Wastewater Treatment Plant Expansion Preliminary Engineering Report – City of Moberly, MO. Project Manager for PER to evaluate improvements to the City's WWTP and collection system that are necessary for the plant to become a regional treatment facility. Includes development of flows and loads from surrounding communities and development of scopes and cost estimates for two different phases of improvements.

Water Distribution System Hydraulic Model – City of Moberly, MO. Project Manager updating the City's hydraulic model. Included updating the model geometry to reflect improvements the City has made, recalibrate the model based on updated flow tests performed by the City, and propose system improvements.

Wastewater Treatment Evaluation, Industrial Park Sewer Association Corporation – Cape Girardeau, MO. Project Engineer for preparing an engineering study report to address future needs for the Cape Girardeau Industrial Park Lagoon and Airport Lagoon, which faced ongoing operational issues and upcoming environmental regulations. The engineering study reviewed design and operational characteristics, identified current and future challenges, and developed alternative solutions.

Combined Sewer System Basin Study – Kansas City, MO. Project Engineer for building a computer model to analyze the system and recommend improvements.

Garrett Owens, PE

Jacobs

Dynamic "Digital Twin" Simulation Modeling

Education
BS, Mechanical Engineering

Registration
PE: FL, TX

Length of Service
Jacobs: 2005
Profession: 2005

Professional Affiliations
American Water Works Association

Value to our MSD Team

- *Leads development of simulation models for process dynamics, operations, controls, and design of systems through digital twin simulation.*

Relevant Projects

West Point WWTP Hydraulic Performance Analysis & Optimization – Seattle, WA. Generated a Replica™ digital twin model of wastewater treatment plant facilities to assist in developing optimized control strategies to reduce the risk of non-permitted bypass during peak flow events. The model was linked to the client's distributed control system for functional acceptance testing before start-up of three facilities.

James River WWTP, Hampton Roads Sanitation District – Newport News, VA. Developed a Replica model of WWTP facilities to create a prioritized list of CIP projects that reduce the risk of raw water overflow during peak flow events. It analyzed alternatives and determined low-cost improvements to eliminate overflow.

Missouri River WWTP – City of Omaha, NE. Project Engineer developing a Replica model of plant facilities to assist in the development of optimized control strategies that reduce the risk of non-permitted bypass during peak flow events. The model was also used to track water quality components throughout the system and to analyze different methods of treatment to reduce E. coli in the effluent.

William Chilton, AIA, LEED

DMA

Architectural

Education
B. Architecture

Registration
RA: MO

Length of Service
Profession: 1988

Professional Affiliations
American Institute of Architects (AIA)
International Code Council
Historic Preservation Commission Member (University City, MO)

Value to our MSD Team

- *Extensive experience with MSD projects providing construction documents, cost estimating, and construction contract administration along with code analysis.*

Relevant Projects

Bissell Point WWTP Disinfection Facilities – St. Louis, MO. Construction administration for the project including shop drawings and construction submittal review, addressing RFIs, completing proposals for additional work, processing change orders, and completing as-built drawings.

Meramec River WWTF, Phase II Expansion – St. Louis, MO. Project Architect for addition to the Administration Building and a new Blower Building.

Lemay WWTP Concrete Rehabilitation – St. Louis, MO. Assessed deteriorated concrete across the entire site, completed documentation, completed concrete product investigations and recommendations, compiled the findings, assessments, cost estimate, and recommendations into a report and construction drawings.

Lemay WWTP Pump Station #3 – St. Louis, MO. Responsibilities included all the architectural design including the building code analysis. Also completed all the architectural CAD drawings and specification writing.

Nick Speiser, PE
I&C Engineer

EDCS

Education
MS, Electrical Engineering
BS, Electrical Engineering

Registration
PE: MO

Length of Service
EDCS: 2020
Profession: 2008

Value to our MSD Team

- *MSD experience with assessing and replacing electrical and controls at headworks.*

Relevant Projects

Fenton WWTF Fine Screen Replacement, MSD – St. Louis, MO. Electrical and controls engineering design to replace the headworks fine screen after it was damaged in a flood. Included assessing which portions of the existing system could be re-used and designing the replacement system. Performed on-site assessment to verify existing conditions. Final design included replacing the fine screen control panel, motors, local control station, emergency stop pushbuttons, and spray water solenoid valve. Hazardous gas detection and alarming was added to meet NFPA 820 requirements.

Lemay WWTP Secondary Improvements, MSD – St. Louis, MO. Electrical and controls design to increase secondary treatment capacity from 210 mgd. Conducted site surveys of existing equipment for modification and reuse and relocation. It became apparent that debris in the plant was impacting secondary treatment; therefore, new screenings buildings were installed at the Wet Weather Screening Building and the Headworks Screening Building. The two screenings buildings are located in different areas of the plant and required new power feeds from the existing plant power distribution, provisions for generator connections, and electrical equipment rated for the Class I Division 2 area classifications. A new odor control system and HVAC system to reduce area classifications and new bar screen climber control panels and washer compactor control panels were required at each facility. The new facilities also have new PLC control panels which are networked together and integrated into the existing plant Invensys system. Other areas of work were instrumentation improvements for the replacement of magnetic flow meters at the aeration basins and secondary clarifiers. New suspended solids meters were installed to improve solids balancing through the system. These meters are connected into the plant SCADA system using wireless I/O.

LMRDP CSO Controls System Improvements: Lemay No. 3 Pump Station, MSD – St. Louis, MO. The new L3PS was designed to accept flow from the JB Tunnel and pump to Lemay WWTP as a replacement of the existing pump station. Control and monitoring of the entire Jefferson Barracks Tunnel system is consolidated at the L3PS as it is the network connection point of all the intake structures and level sensors in the system. The project included design of controls for the new pumps, valves, and flow monitoring. The pump station design included fiber optic switches and patch panels along with a radio access point to accept communications from all tunnel structures as well as transmit information to the Lemay WWTP. The L3PS pumps have local pump control panels which house pump protection modules to protect the pumps and motors. The pump station has bar screens to trap the large debris; the bar screens have automatic bar screen climbers to remove debris build up. Wet well level is measured with pressure sensors installed on pilot pipe in order to measure in the tight spaces around the screens and provide a tunnel level measurement. The pump station design also included flow meters, gates, valves, an HVAC system, and fire alarm and security systems to be remotely monitored.

Mike Stohl, PE
Electrical

Donohue

Education
BS, Electrical Engineering

Registration/Certification
PE: MO
2-Hour OSHA, 2017 Confined Space Entry

Length of Service
Profession: 2006

Professional Affiliations
Consulting Electrical Engineers (CEE) — Illinois Division
Illinois Water Environment Association
Electrical, Power, Energy and Controls Committee

Awards
2019 ACEC Missouri Engineering Excellence Honor Award, Project Manager/Design Lead: Lemay Pump Station Electrical System Transformation, Metropolitan St. Louis Sewer District

Value to our MSD Team

- *Extensive work with Ameren on MSD projects including workshops and compliance with the Ameren CDE-10 standards.*

Relevant Projects

Bissell Point WWTF Main Substation Switchgear Replacement, MSD – St. Louis, MO. Lead Design Engineer to replace equipment and conductors in the original main switchgear equipment enclosure, replace resistance grounding, and replace MCCs in the Primary Building tunnel. Challenges include: tie into an existing third bus and add a tiebreaker such that metering is configured for bus monitoring (cold sequence), develop detailed construction sequencing to maintain two of three electric sources at all times, and locate new building in a space confined substation.

Lemay Pump Station 1 and 2 Improvements, MSD – St. Louis, MO. Lead Design Engineer to evaluate 4160V metal clad switchgear. Determined that replacement with arc resistant switchgear was most logical for the 350-mgd facility. Challenges including maintaining operations during construction and limited floor space.

Coldwater Creek Final Clarifier Replacement, MSD – St. Louis, MO. Lead Electrical Engineer for design modifications to the Final Clarifier System to replace four rectangular clarifiers with one large circular clarifier. Electrical design included modifications to the existing RAS Pump Station for the addition of the new final clarifier, modifications to an existing 480V MCC, new 480V panelboard, and a VFD.

Wastewater Collection System Upgrade – Willmar, MN. Electrical Engineer as Donohue program manager for design of $70 million of improvements including new 5-mgd treatment facility, six miles of gravity interceptor, two raw wastewater pump stations, and several miles of raw wastewater force main. The new treatment facility includes fine screening, screenings washing/compacting, and grit removal. Electrical design consisted of a 12.47kV electric service, 12.47kV main switchgear, two 1,500kW diesel standby generators, two 12.47kV distribution loops around the facility, two 12.47kV to 480V step-down padmount transformers, 480V power panels, and site lighting. Construction related services including answering contractor questions, shop drawing reviews, and periodic site visits.

East Side Wastewater Treatment Plant – Joliet, IL. Lead Electrical Engineer for new 50-mgd influent pump station with screening equipment to replace existing aged equipment. Electrical design included modifications for the existing 4.16kV switch-gear, 4.16kV feeder across the site, 4.16kV-480V padmount transformer and MCC with dual, draw-out interlocked main circuit breakers for connection to a portable generator connection cabinet, two 250-hp VFDs and harmonic filters and two 135-hp VFDS and HFs for the dry pit submersible pumps with one of the larger drives provided with a 3-contactor bypass utilizing a reduced voltage solid state starters. Design included providing power to additional loads via a new 480V motor control, two 5-hp VFDs, panelboards, grounding, lightning protection and lighting. Also, power distribution and explosion-proof devices for Class 1, Division 1 and 2, Group D hazardous locations as required by NFPA 72 and 820 for presence of gasses.

Jeffrey Wills, PE
Mechanical

Donohue

Education
BS, Mechanical Engineering

Registration/Certification
PE: IL
2-Hour OSHA, 2017 Confined Space Entry

Length of Service
Profession: 1994

Awards
2019 ACEC Missouri Engineering Excellence Honor Award, Lead Mechanical Engineer: Lemay Pump Station Electrical System Transformation, Metropolitan St. Louis Sewer District

Value to our MSD Team

- *Donohue's Practice Leader for Energy Recovery and Mechanical Systems.*

Relevant Projects

Bissell Point WWTF Redundant Sludge Acceptance, MSD – St. Louis, MO. Mechanical QC Reviewer for new redundant sludge (cake) acceptance station. Included demolition of: existing polymer storage tanks and associated piping, cast-in-place reinforced concrete wall, pavement, mechanical equipment, piping, duct banks, electrical, generator, and I&C wiring. New facilities included CIP concrete structure, sludge hopper and hatch, hydraulic power unit, biosolids pump, twin screw feeder, push floor dischargers, hoist, sump pump, buried and exposed interior piping, valves, MCC, electrical facilities and wiring, I&C equipment, HVAC equipment, and site work.

Preliminary Treatment Facility Modifications – Green Bay, WI. Designed HVAC and plumbing systems for modifications to the existing preliminary treatment facility. Assisted lead process engineer with design and layout of multiple screw conveyors for transportation of cleaned and dried screenings.

Water Pollution Control Facility HVAC Improvements – Cedar Rapids, IA. Lead Mechanical Engineer for design of an HVAC upgrade to replace existing aged equipment in multiple buildings. Project focused on NFPA 820 compliant and corrosion resistant solutions to provide a long-lasting, reliable HVAC system. Modifications to both the HVAC units and ductwork focused on improved air flow and overall efficiency.

John Kildea, PE
Structural

DMA

Education
BS, Civil Engineering

Registration/Certification
PE: MO
OSHA Confined Space Entry

Length of Service
Profession: 1997

Professional Affiliations
Structural Engineering Institute

Value to our MSD Team

- *DMA's Director of Structural Engineering with extensive MSD assessments of concrete structures and rehabilitation design and plan preparation.*

Relevant Projects

Bissell Point WWTF Trickling Filter Media Replacement, MSD – St. Louis, MO. Structural Principal for visual structural condition assessment for six existing trickling filters. For each major TF component, a summary of rehabilitation needs based on condition observations was developed.

Mill Creek Tunnel Phase III, MSD – St. Louis, MO. Project Manager for structural engineering services encompassing design of tunnel reinforcement and access structures for a 100+year-old arched brick sewer below downtown St. Louis. Survey services included establishing horizontal and vertical control, full descent tunnel topography survey, preparation of surface site topography for design of new manhole structures, and preparation of a property line strip map and new easement documents.

Missouri River & Coldwater Creek WWTFs Expansion Study, MSD – St. Louis, MO. Performed structural consulting, condition assessments, and feasibility studies, including evaluating possible reconfigurations of existing structures.

Bob Schmitt, PE

Jacobs

Constructability/Sequencing

Education
BS, Mechanical Engineering

Registration
PE: MO

Length of Service
Jacobs: 1991
Profession: 1989

Professional Affiliations
Engineer's Club of St. Louis
Missouri Water Environment Association

Value to our MSD Team

- *Experience with Lemay screenings – similar to what is proposed at Bissell Point.*

Relevant Projects

Lemay WWTP, MSD – St. Louis, MO. QA/QC inspector for Secondary Improvements associated with providing new screenings facilities and various plant upgrades. Responsibilities included on-site inspection and coordination of the new systems.

Bissell Point WWTF, MSD – St. Louis, MO. Assistant Resident Engineer for construction management, field inspection, and start-up of the multi-hearth sludge incinerator modifications. Responsibilities included the upgrading of various process systems including new sludge pumps, incinerator exhaust scrubbers, induced draft fans, high energy exhaust gas afterburners, and service water pumping station.

Bissell Point WWTF, MSD – St. Louis, MO. QA/QC inspector for installation of electrical and instrumentation systems associated with the disinfection construction project. Includes chemical disinfection for both dry and wet-weather flows and a specialized VFD system and controls for the medium voltage effluent pump station. Reviewed shop drawings and coordinated the electrical and instrumentation systems.

Lemay and Bissell Point WWTFs, MSD – St. Louis, MO. QA/QC inspector for Incinerator Scrubber Upgrades at the facilities associated with the replacement of the existing impingement tray and single venturi scrubbers to comply with new emission guidelines per 40 CFR Part 60 Subpart MMMM regulations. Responsibilities included on-site inspection and provided loop drawings for integrating the new systems.

Robert Neath, PE

Donohue

Constructability/Sequencing

Education
MS, Sanitary/Environmental Engineering
BS, Civil Engineering

Registration
PE: MO

Length of Service
Profession: 1992

Professional Affiliations
Engineer's Club of St. Louis

Value to our MSD Team

- *Extensive on-site MSD experience includes concrete preservation, electrical, I&C, HVAC, washer/compactor, screen repairs, and influent channel grit removal.*

Relevant Projects

Bissell Point WWTF Redundant Sludge Acceptance, MSD – St. Louis, MO. Design Manager for new redundant sludge (cake) acceptance station.

Lemay and Bissell Point WWTF Disinfection Upgrades, MSD – St. Louis, MO. Provided CM services including: process design reviews, biddability/constructability reviews at milestone events, cost estimate reviews, bid phase support, and construction administration/inspection from project award through final acceptance.

Lemay and Bissell Point WWTF Incinerator Scrubber Upgrades, MSD – St. Louis, MO. Provided CM services including: process design reviews; biddability/constructability reviews at milestone events, cost estimate reviews, bid phase support, regulatory compliance submittals, and construction administration/inspection from project award through emissions compliance testing and final acceptance.

Lance Mason
O&M Specialist

Jacobs

Education
MS, Biology
BS, Biology

Registration
Grade Four Wastewater Treatment Operator: AZ

Length of Service
Profession: 1994

Value to our MSD Team

- *Works with staff nationwide to optimize and/or troubleshoot processes to achieve highest level of efficiency while maintaining regulatory compliance for water quality.*

Relevant Projects

Plant Commissioning, Missouri River WWTP – Omaha, NE. Operations Specialist for upgrading the headworks process to treat 150 mgd including four 6-mm screens, each with 45-mgd capacity and six grit removal units each with 300-gpm capacity. The processes also upgraded associated screenings and grit handling equipment. Coordinated initial equipment and various performance testing that required documentation and communication with contractor, consultants, and client Ops personnel.

Process Optimization, Little Miami WWTP, MSDGC – Cincinnati, OH. Performed a process evaluation to optimize the process control program. After hosting numerous workshops with staff, a change to the process control program improved consistency of water quality and verified resizing the aeration blowers for significant cost savings

Plant Commissioning, Seminole Tribe WWTP – Immokalee, FL. Operations Specialist for full replacement of a WWTP with a new BNR facility including new drum screening and vortex grit removal. Provided a plant commissioning plan and operator training.

Michael Gerbitz, P.E.
QA/QC Review

Donohue

Education
MS, Civil Engineering
BS, Aerospace Engineering and Mechanics

Registration
PE: MI, WI, MN

Length of Service
Profession: 1990

Professional Affiliations
Water Environment Federation
Central States Water Environment
NACWA

Value to our MSD Team

- *30-year career focused primarily on headworks and screening improvements.*

Relevant Projects

Headworks Modifications, NEW Water – Green Bay, WI. Lead Process Engineer for design of headworks fine screening, screenings washing/compacting, screenings conveyance, grit dewatering, and grit conveyance equipment at the 40-mgd/160-mgd peak WWTP. The headworks includes four escalator-style fine screens with 1/4-inch openings. Existing channels were modified to accommodate two screens per channel.

Preliminary Treatment Improvements, Western Lake Superior Sanitary District – Duluth, MN. Designed preliminary treatment improvements at the 40-mgd/155-mgd peak facility. The project addressed condition- and performance-related deficiencies with screening and grit removal. Improvements included screen influent channel modifications, three 1/4-inch opening bar screens, screenings washing/compacting, screening bypass channel, grit removal basin and grit slurry pumping enhancements, grit dewatering/washing equipment, and material handling and HVAC enhancements.

WWTP Upgrades – Rantoul, IL. QC Review for process design and project management involving installation of two new fine screens to replace existing comminutors, new jet mixing equipment of the anaerobic digester, and SCADA system upgrades.

Pump Station Upgrade – Gary, IN. Process Engineer for final design including new mechanically cleaned screening equipment, pumping equipment, metering equipment, hoisting equipment, piping, valving, sluice gates, and slide gates.

Proposed Subconsultants

We will meet the minimum 25% utilization from our collective subconsultant team members shown in Table B-1.

We selected our subconsultants based on their specialized expertise and hands-on experience with the District's standards and schedule expectations, in addition to the success we've enjoyed working with these firms and their skilled personnel.

Figure B-1. Anticipated Tasks for Subconsultants

Firm	Role	M/WBE	% of Use
EDCS	Instrumentation and Controls	WBE	3-7%
Donohue	Electrical; QA/QC Review	–	10-15%
DMA	Structural; Architectural; Surveying	MBE	15-25%

EDCS (as IDCS) updated and amended Instrumentation and Controls Design Criteria for MSD that describes standard components and control philosophy for pump stations and treatment facility control.

Electrical Design & Control Systems, LLC is a woman-owned small business headquartered in St. Louis. EDCS provides electrical and instrumentation and controls design and construction engineering services for a wide variety of clients, specializing in the wastewater industry. In addition to their work with Jacobs on the LMRDP CSO Controls System Improvements, EDCS has participated on MSD projects for the Bissell Point WWTF, including: Chemical Disinfection Improvements (E/I&C); Maline Creek Storage Tunnel (E/I&C); Maline Creek Storage Tunnel Pump Station (I&C); and Chemically Enhanced Primary Treatment (E/I&C).

Our team's Bob Schmitt has worked with Donohue on several projects including at Bissell Point and the Lemay PS 1 & 2 Improvements.

Donohue & Associates, Inc. brings extensive electrical and controls systems experience with a team of electrical engineers who have served MSD very well on projects such as: Bissell Point WWTF Main Substation Switchgear and MCC Replacement, Bissell Point WWTF Redundant Sludge Acceptance System, and Coldwater Creek WWTF Final Clarifiers Replacement. Donohue has a successful history of collaborating and coordinating with Ameren, as well as attaining compliance with their standards. Since forming in 1997, Donohue has grown to over 120 employees across 11 Midwest offices. Nationally, Donohue is ranked No. 17 by *ENR* in the Wastewater Treatment Plants category. Their staff includes process, electrical, HVAC/plumbing, and civil engineers as well as certified treatment plant operators, construction specialists, and LEED professionals.

DMA uses LiDAR technology to capture precise locations and conflicts within complex environments such as inside existing pump stations and/or treatment plants with intricate piping systems.

David Mason + Associates brings a proven record of structural design and success with MSD and Jacobs. Headquartered in St. Louis, DMA is a Minority-Owned Business Enterprise (MBE) specializing in engineering, surveying, and architecture, providing a full range of planning, design, management, and inspection services. DMA has a total staff of more than 170, including civil engineers, structural engineers, surveyors, and electrical engineers. They have provided services in water/wastewater for over 25 years, serving MSD on several projects, such as the pump station replacement and structural modifications at Bissell Point, the Harlem-Baden Watersheds, and work at Coldwater Creek, Fenton, Grand Glaize, Lemay, Lower Meramec, and Missouri River wastewater treatment facilities. For the ongoing Bissell Point WWTF Trickling Filter Media Replacement Project, DMA conducted condition assessments of the filters and prepared contract documents for structural repairs.

B.2 Project Management Procedures

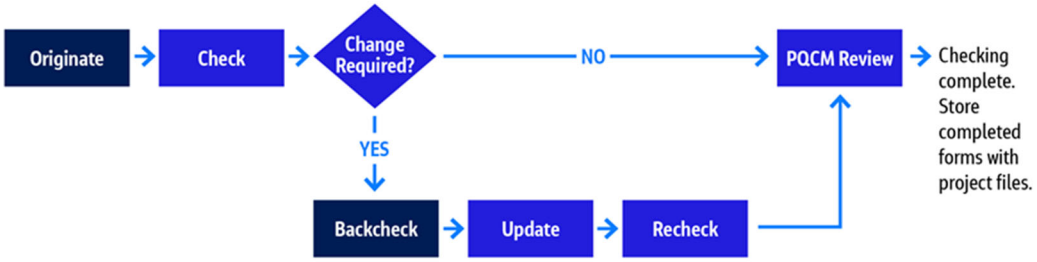
We have heard from MSD's project managers that they appreciate our client survey process and the ability to reach out to Jacobs' management if they ever felt that their issues or expectations were not being met — few (if any) other consultants do this and provide you this level of commitment.

Partnering with the District over several decades, we have successfully implemented our Project Management Procedures on some of your most important projects. We will tailor these procedures to deliver the Bissell Point improvements on time and within budget.

Project Management Tools include:	
Responsibilities Assignment Matrix	JacobsValue+ and JacobsSustainability+
Reviews (including Concept, Deliverable, Operability, Constructability, Technical)	Communications Plan (including Client Expectation/Satisfaction Surveys, Interactive Planning, Progress Meetings)
Schedule Management	Cost Control Management

B.3 Quality Control Measures

Our formal QA/QC Program stresses efficient production of quality documents through continuous attention to client requirements, clear communication of these requirements to the project team, and applying appropriate production methods.



A rigorous 5-step QC checking process verifies that every deliverable (including from our subconsultants) is viewed by a second set of experienced eyes.

This is complimented with a review and gate process (these are performed by independent gatekeepers who are sufficiently qualified to review an overall deliverable package along with QC documentation to determine alignment with client expectations) that takes a holistic view of the deliverables package as whole with respect to the QC process, client requirements and expectations, and the project execution plan.

We conduct internal quality audits to verify and improve the execution of each project.

ISO 9001

Jacobs has a rigorous governance system that complies with the requirements of ISO 9001:2015 – an international standard dedicated to Quality Management Systems (QMS). It outlines a framework for improving quality and a vocabulary of understanding for any organization looking to provide products and services that consistently meet the requirements and expectations of customers and other relevant interested parties in the most efficient manner possible. The QMS is the aggregate of all the processes, resources, assets, and cultural values that support the goal of organizational efficiency and customer satisfaction.

C Personnel Availability and Work Load

Jacobs' St. Louis office includes **over 25 personnel** who have worked directly on projects for MSD, plus additional staff whose projects involved design coordination with MSD's infrastructure or standards.

Availability of Key Personnel

The workload for our team members and their availability to serve on your project are shown in Figure C-1. We are basing the percentages on an estimated Notice to Proceed (NTP) of February 2021. As demonstrated to MSD for many years, we assign appropriate manpower as needed to meet your goals.

In addition to the local St. Louis staff (shown in Figure C-2), we can also draw upon Jacobs' worldwide expertise (55,000 employees) for additional insights or alternative perspectives should the need arise.

Figure C-1. Current Workload and Availability of Key Personnel for Your Project

Key Staff (Project Role)	Current Commitments at NTP	Commitment to MSD Project
Jon Bergenthal (Project Manager) [1]	15%	85%
Russ Dahmer (Design Manager) [1]	10%	90%
Joel Rife (Process Technologist) [2]	65%	35%
Tobin Lichti (Hydraulics) [1]	20%	80%
Garrett Owens (Modeling) [3]	50%	50%
Sue Fahnestock (Project Engineer) [1]	40%	60%
Nick Speiser (I&C) [1]	40%	60%
Mike Stohl (Electrical) [4]	20%	80%
Jeffrey Wills (Mechanical) [4]	40%	60%
John Kildea (Structural) [1]	60%	40%
William Chilton (Architectural) [1]	60%	40%
Bob Schmitt (Constructability) [1]	70%	30%
Robert Neath (Constructability) [1]	20%	80%

Work Location: [1] St. Louis, MO [2] Albuquerque, NM [3] San Antonio, TX [4] Sheboygan, WI

Number of People Available in Office and Fields of Expertise

With multi-disciplined resources, we can readily draw on experts from any skill set to assist with the assignment. Figure C-2 summarizes each of our team member firms' personnel in disciplines that are relevant to your project.

Figure C-2. Personnel by Relevant Discipline

Discipline	Jacobs	EDCS	Don.	DMA
Architect/Landscape Arch.	19			2
Constr. Mgmt./Inspection	3			
Cost Estimator	3			
Civil Engineer	23	1	1	18
Civil Technician/CADD	7			
Environmental/Sanitary Eng.	17		2	
Geologist/Geotechnical	7			
H/H/Modeling/Design	4			
M/E/P Engineer	24	2		8

Discipline	Jacobs	EDCS	Don	DMA
Control System/I&C	1			
Simulation/Visualization	1			
Planner	3			
Project Controls/Sched.	6			
Project Manager	27		1	
Quality Assurance	1			
Safety	1			
Structural Engineer	24			17
Survey				18

Figure C-3 provides the team's current and continuing work locations.

We have local management's support and the technical resources to successfully execute your project. If the expertise on a particular topic is located outside the St. Louis office, we engage that expertise on short notice, either virtually (e.g., MS Teams) or through in-person meetings as needed. Recent evidence of our successful delivery of multiple concurrent pre-design reports and final design packages was under the LMRDP program. Jacobs and our subconsultants delivered on time and on budget.

Figure C-3. Location of Consultants' Project Team Members

Location Categories	Jacobs	EDCS	Donohue	DMA	Total
Work in STL City/County	280	3	1	123	407
Relocate to STL City/County	0	0	0	0	0
Office Outside of STL City/County	2	0	3	0	5
Total	**282**	**3**	**4**	**123**	**412**

Staff/Teaming Assignments

Project Manager Jon Bergenthal leads the overall project management, technical direction, and delivery of the project. He will make project task assignments, provide coordination with subconsultants, and manage schedule and budget. Project Principal Mike McCarty provides corporate support and the commitment of resources.

Design Basis Report

The Design Basis Report will result in several critical and inter-related project decisions such as the type and design criteria for the new screens and whether the existing building/channels can be reused. To support this decision making, the **design basis phase has many different tasks, including:**

Assess the condition of the existing facilities	Establish screenings loadings
Evaluate screen type and manufacturer	Select screening system design criteria
Lay out equipment to provide for access/O&M	Evaluate the feasibility of modifying the existing comminutor building and channels
Assess hydraulics for optimal screen performance and up/downstream impact	Analyze sluice gate materials and costs and needed concrete repairs
Evaluate the cost of new versus modified facilities and gate replacements	Assess constructability of planned improvements and impact on operations

As each pre-design task is initiated, we assign a Lead Engineer to manage the effort and coordinate work assigned within our team. The Lead Engineer draws support from our team's technical leadership positions – process, structural, mechanical, construction, etc., as well as our specialized engineering discipline pool. Support services may include surveying, geotechnical, and professional cost estimators.

Final Design

We provide services and resources to manage final design efforts, including analyses and calculations, drawings, technical specifications, front end documents based on 2013 EJCDC standards, and opinions of probable construction cost. We take responsibility for planning, directing, organizing, monitoring, and controlling all aspects of each work phase. Our demonstrated design experience on large-scale projects provides proven expertise and best practices that we can successfully apply to your project. We diligently track personnel assignment workloads and insert staff with specialized expertise to meet our goals for schedule, budget control, and quality assurance. By doing so, we produce a project that meets your performance expectations.

Bid Phase
We assign a single individual to receive and respond to bidders' questions, thereby making certain that we give consistent responses.

Construction Phase
Our team supports the project during construction, including attending monthly project meetings, reviewing submittals, preparing O&M manuals, and assisting with training and start-up.

D Project Design Schedule

COORDINATION SCHEDULE WITH THE DISTRICT

Date: Sept. 8, 2020

PROJECT NAME: **Bissell Point WWTF Fine Screen, Concrete and Gate Improvements**

PROJECT NUMBER: 12548

CONSULTANT: Jacobs Engineering Group Inc.

CONTRACT STAGE		INDIVIDUAL CALENDAR DAYS	ACCUMULATED CALENDAR DAYS
Final Design			
A.	Preliminary Conference	5	5
B.	Basis of Design Report	98	103
C.	MSD Review (Includes Meeting)	21	124
D.	Plans and Specs (30%)	84	208
E.	MSD Review (Includes Meeting)	21	229
F.	Plans and Specs (60%)	84	313
G.	MSD Review (Includes Meeting)	28	341
H.	Plans and Specs (95%)	91	432
I.	MSD Review (Includes Meeting)	28	460
J.	Design Completion (100%)	21	481
	TOTAL CALENDAR DAYS		481

Note: Intermediate submittals may be required if all comments are not addressed.

E Related Project Experience and Past Performance of Project Team

Our team has a long, committed relationship with MSD and first-hand experience with your overall system and the specifics of the Bissell Point WWTF. This will be critical in properly renewing the plant assets addressed in the proposed project in a cost-effective and non-disruptive manner.

Jacobs at Bissell Point

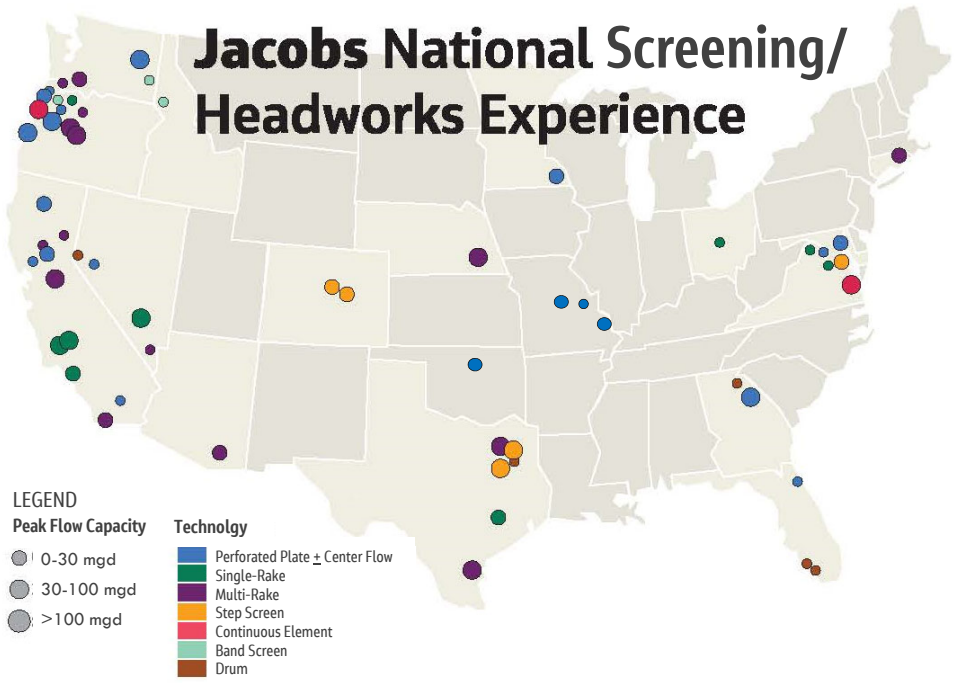
As a member of a JV, Jacobs provided planning, design, construction management, and startup services for an advanced secondary treatment system. We managed six major subconsultants and directed fifteen construction packages We provided management of construction contracts and contractors, change orders, field inspection services, and preparation of record drawings. The plant, which remained in operation during construction of all improvements, was designed, constructed, and started up on-time and within budget. Bissell Point's new facilities performed to specifications as soon as they were brought on line.

The Bissell Point WWTF originally went on line in December 1970 as a primary treatment facility providing grit removal, comminution, preaeration, primary settling, sludge dewatering by vacuum filters, sludge incineration, and ash dewatering in two 1871-vintage settling basins. Our Secondary Treatment Project began in 1984 and was completed in the mid-1990s, meeting the terms of a Consent Decree (CD) to add secondary treatment to the treatment plant and an Overflow Regulation System at the CSO Outfalls. Our upgrade helped improve plant operating efficiency through innovative technologies, met CD construction deadlines, and employed a phased construction and startup program to correlate with the District's funding over a 7-year construction period. An example of our innovation was providing an additional 100-mgd wet weather flow capacity added at minimal cost (approx. $10 million) through modifications to an existing junction structure, upgrades to existing grit removal facilities, and modifications to the process control strategy. We designed sludge handling systems that included 12 three-meter gravity belt thickeners handling secondary sludge and 15 two-meter belt presses that dewater the combined sludge as well as upgrades to conveying equipment and incinerator improvements.

Continuing renewal or replacement of assets at the plant is required to maintain the ability of the District to meet its goals for providing wastewater treatment. The Bissell Point WWTF Fine Screens Concrete and Gate Improvements project replaces the existing comminutors with fine screens and rehabilitates associated concrete channels and control gates. This project will improve the reliability of headworks solids removal needed for future sludge incineration improvements and also benefit O&M of downstream wastewater treatment processes.

Project Manager Jon Bergenthal's team is finishing up the Trickling Filter Media Replacement at Bissell Point, and several of our team members bring additional experience at the facility including the Redundant Sludge Acceptance System, Main Substation Switchgear and MCC Replacement, and the Sludge Incinerator Modification projects. Combining Jacobs' extensive experience with headworks improvements nationwide (*see next page*), our legacy knowledge of your overall collection system, Consent Decree requirements, and the operating capabilities of Bissell Point, we are able to evaluate industry-best practices and alternatives and deliver design elements that are efficient and constructible while maintaining the treatment capacity of the facility throughout construction.

Headworks projects are all unique – there may be no other area of a wastewater treatment plant that is more misunderstood. Our experience at facilities across the country has enabled us to solve myriad challenges such as a variety of control strategies and sequencing for headworks and screening facilities, the balance of



screenings capture rate vs. increased head loss associated with screenings accumulation (matted condition), an existing structure that does not allow screen pivoting, or the management of temporary screenings conveyance and processing throughout construction.

Table A-1 shows some of the larger headworks we have designed. Over the past 10 years, we have completed 50+ WWTP headworks. Beginning on the next page are a few project descriptions.

Table A-1. Sampling of Screening Projects at Larger Facilities

Project Name	Location	Peak Flow Capacity (mgd)	Screen Size (mm)	Screen Type
Albany Wastewater System Improvements	Albany, NY	69	6	Perforated Plate
South Austin Train C	Austin, TX	75	10	Single-rake
Rowlett Creek RWWTP Peak Flow	Plano, TX	120	6	Step
Alexandria Renew Enterprises WRF	Alexandria, VA	120	6	Continuous Element
F. Wayne Hill Water Resources Center	Gwinnett, GA	150	6	Center Flow Band
Missouri River WWTP	Omaha, NE	150	6	Multi-rake
Spokane Riverside Park WRF	Spokane WA	150	6	Perforated Plate
Willow Lake WPCP	Salem, OR	155	9.5	Multi-rake
Wilson Creek Expansion and Advanced Treatment Improvements	Allen, TX	172	10	Single-rake
Columbia Blvd. WWTP Screenhouse and Dry Weather Clarifier	Portland, OR	180	6	Perforated Plate
Columbia Blvd. WWTP Headworks	Portland, OR	180	6	Perforated Plate
Wilson Creek RWWTP Advanced Treatment and Headworks Improvements	Allen, TX	224	6	Step
Durham AWTF	Durham, OR	195	9.5	Multi-rake
SJSCWRP Headworks Upgrades	San Jose, CA	260	TBD	Multi-rake
Central Plant	Clark, NV	260	12.7	Single-rake
Rock Creek AWTF	Hillsboro, OR	300	6	Continuous Element
Orange County Plant No. 1	Orange, CA	320	15.875	Single-rake
Orange County Plant No. 2	Orange, CA	340	15.875	Single-rake

Wilson Creek Regional WWTP
Advanced Treatment and Headworks Improvements

Jacobs

Allen, Texas

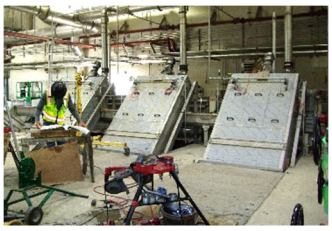
Client/Owner
North Texas Municipal WaterDistrict (NTMWD)

Cost
$44.9M

Firm's Portion
100% (as prime)

Project On Schedule
Completion expected 2020

Responsibilities/Role
Design, SCADA Integration, Startup Support, Commissioning, Operator Training



HIGHLIGHTS: Installation of Fine Screens, Installation of Sluice and New Washer/Compactor Equipment, Installation of Screens into an Existing Structure, Addresses Ragging Issues

The plant has an existing peak 2-hour flow capacity of 172 mgd. With several projects under construction, when finished it will increase peak capacity to 224 mgd. As part of this project, one of the tasks is to increase the headworks peak 2-hour flow capacity to 224 mgd. To accomplish this, a new headworks facility with three step screens was constructed parallel to the existing headworks facility.

Project Approach

The existing headworks facility had four telescoping rake screens that were plagued with mechanical failures such as overheating of the hydraulic system, cable breakages, and bearing issues which resulted in binding of the screens. This new project added three new step screens at the existing headworks facility with the forth channel converted to a by-pass with a manually cleaned bar screen. The six new step screens (three in the existing headworks and three in the new headworks) are Huber SSL 5900 (6mm) step screens with Huber conveyors and washer/compactors.

Rowlett Creek Regional Wastewater Treatment Plant
Peak Flow Management Improvements

Jacobs

Rowlett, Texas

Client/Owner
North Texas Municipal Water District (NTMWD)

Cost
$48.1M

Firm's Portion
100% (as prime)

Project On Schedule
Completion expected 2020

Responsibilities/Role
Design, SCADA Integration, Startup Support, Commissioning, Operator Training

HIGHLIGHTS: Installation of Fine Screens, Installation of Sluice and New Washer/Compactor Equipment, Installation of Screens into an Existing Structure, Addresses Ragging Issues

The plant has an existing peak 2-hour flow capacity of 60 mgd with phased expansions performed to expand the capacity to 120 mgd. As part of this project, one task is to increase 2-hour peak flow capacity of the headworks to 120 mgd.

Project Approach

The existing headworks is a two-channel facility with no room for expansion. The Owner recently had two new Huber step screens installed at the existing headworks which will be relocated to the new headworks facility. The new headworks facility consists of five channels, with two channels for the existing step screens, a new step screen for Phase 1, a channel for a future step screen, and an overflow channel with a manually cleaned bar screen. The existing step screens are Huber 6mm with conveyors, washer/compactors, the new step screens are Westech 6mm with new conveyor, washer/compactors.

Columbia Boulevard Wastewater Treatment Plant Expansion and Screenhouse Facility Improvements

Jacobs

Portland, Oregon

Client/Owner
Bureau of Environmental Services

Cost
$16.9M

Firm's Portion
100% (as prime)

Project Schedule
Construction 2014 (within schedule)

Responsibilities/Role
Design, SCADA Integration, Startup Support, Commissioning, Operator Training

As part of their $1.3 billion CSO program, the City of Portland constructed deep tunnels to capture CSO flows and deliver them to the facility. To accommodate this increased flow, we designed the retrofit of the original Screenhouse Facility to provide preliminary treatment for wet weather flows in excess of the existing headworks' capacity.

Perforated screen was used at many facilities in Europe, but was relatively new in the U.S., particularly wider than 7 feet. To ensure experienced manufacturers and quality screens, the City visited facilities with perforated screens and prequalified manufacturers. The new equipment was selected by working closely with BES staff, and the resulting facility has proven to be easy to operate and maintain.

HIGHLIGHTS: Installation of Fine Screens, Installation of Sluice and New Washer/Compactor Equipment, Installation of Screens into an Existing Structure, Addresses Ragging Issues

The Screenhouse Project was designed to expand screening capacity at CBWTP from 300 mgd to 450 mgd but has been able to treat flows in excess of the design criteria. As part of a design-build project, this project involved an extensive retrofit of the original (1940s) screenhouse, which was abandoned after construction of a newer Headworks facility in the 1990s.

Project Approach

We proposed and designed perforated screens in the screenhouse. The new equipment consists of 1/4-inch perforated screens, sluicing conveyor, and washer/compactor. The screening system provided a higher removal rate. The enclosed sluicing conveyor captured odor and screening material and the screening washer/compactor minimized water content, resulting in reduced screening hauling and disposal costs.

The CBWTP had climber bar screens in their newer headworks at 5/8-inch spacing, which allow significant debris and solids to pass through, particularly long stringy debris, pencils, wood sticks, and needles, etc. This caused significant problems for downstream processes. Furthermore, the climber bar screens often have problems with upstream rock build up and debris wedged between bars. The screening system at the headworks has washers and belt conveyors, which do not adequately clean or contain screenings. These problems have resulted in expensive repairs, extensive cleanups, and interruptions to the unit process.

With this experience in mind, the City opted for perforated screens in the Screenhouse. The new equipment consists of 1/4-inch perforated screens, sluicing conveyor, and washer/compactor. The screening system provides for a higher removal rate; the enclosed sluicing conveyor captures odor and screening material; and the screening washer/compactor minimizes water content, resulting in reduced screening hauling and disposal costs.

The Screenhouse Project included development of an operational strategy to operate the screenhouse and headworks in tandem to manage both dry flows and peak wet weather flows from the City's CSO tunnels. The existing headworks allows significant amounts of debris to pass through to downstream process. The new screenhouse, with finer 1/4-inch perforated screens, is utilized for re-screening flow that goes through the headworks.

With re-screening and the ability to treat more than the designed capacity, the result is more floatables and debris captured, and hence, less contaminants discharged to the river and fewer issues with equipment downstream, as well as discharge permits.

Design was completed within the contracted price with no change orders.

New Water Reclamation Facility

Jacobs

Enid, Oklahoma

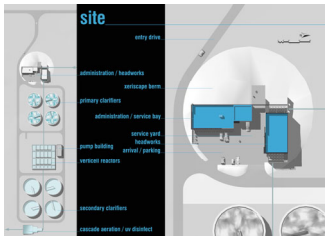
Client/Owner
City of Enid (Engineering Dept.)

Cost
$38.5M

Firm's Portion
100% (as prime)

Project Schedule
Completed 2012 (within schedule)

Responsibilities/Role
Preliminary and Final Design, Bid Phase Services, Engineering During Construction, Full-Time Construction Observation, Record Drawings, O&M Manuals, Start-Up Assistance



HIGHLIGHTS: New Fine Screening Facilities to Replace and Upgrade Aging Facilities

Originally built in 1954, Enid's water pollution control plant had reached its design capacity and most of the facilities and equipment were beyond their useful lives. We designed a new 12-mgd Water Reclamation Facility that would handle anticipated increases in residential and industrial flows while incorporating the existing sludge processing facilities (aerobic digesters and belt filter presses) into the new design.

Project Approach

The new facility includes influent pumping, fine screening, primary clarification, and an activated sludge system with nitrification to meet effluent limits. Secondary treatment is provided by VertiCel® aeration basins (a modified suspended growth activated sludge system with vertical loop reactors and fine bubble aeration tanks) and final clarifiers. The VertiCel BNR process combines mechanical and coarse bubble aeration in anoxic tanks and fine bubble diffused aeration in aerobic tanks. Process control technology utilizes control algorithms and PLC-based I&C

Fine screening facilities include two Parkson Aqua Guard continuous rotating belt, 1/4-inch effective screen opening spacing, full-channel-width inclined screens. Each screen is mounted in a 4.5-ft-wide, 7.5-ft-deep channel, angled 75° from horizontal, and is capable of passing 22.5 mgd of wastewater. Each fine screen's channel has a motor-actuated slide gate at the entrance and a manual-operated operated slide gate at the exit or downstream end. A manual bar screen, located in a separate channel, provides screening when the mechanical screens' capacity is exceeded or requires maintenance. The screenings lifted out of the wastewater stream are deposited into a Parkson Hycor Helican shaftless screw-type conveyor. The screenings conveyor has a capacity of 53-cf per hour of wet screenings. Screenings from the conveyor are deposited into a Parkson Aqua Washpress Screenings Compactor where they are mixed with water, washed to remove organic material, compressed to remove free water, and conveyed and deposited into a dumpster.

San Jose-Santa Clara Regional WW Facility Headworks Design-Build

Jacobs

San Jose, California

Client/Owner
City of San Jose & Santa Clara

Cost
$123.5M

Firm's Portion
10% (as design prime)

Project Schedule
Construction start 2019 (within schedule)

Responsibilities/Role
Design, SCADA Integration, CM, Startup Support, Commissioning, Operator Training

HIGHLIGHTS: Installation of Screens, Installation of Sluice and New Washer/ Compactor Equipment, Installation of Screens into New Structures

Project includes construction of a new Headwork No. 3 for this 400 MGD peak flow plant, including 3 multi-rake screens rated for 105 MGD each, screening sluice, 2 duty/2 standby washer-compactors, raw sewage pumps, and 6 conical tray grit removal basins.

Project Approach

Jacobs was awarded this design-build on the basis of an "indicative design" for the new Headworks 3 adjacent to existing Headworks 2 to replace the 30-year-old Headworks 1. We found that the new headworks on a more open site of the plant would not only save construction cost but allow for flushing large interceptors.

New Water Reclamation Facility

Cape Girardeau, Missouri

Jacobs

Client/Owner
City of Cape Girardeau Public Works

Cost
$62M

Firm's Portion
100% (as prime)

Project Schedule
Completed 2019 (within schedule)

Responsibilities/Role
Phase I: Antidegradation Review Report, Facility Plan, SRF Funding Assistance, Negotiation Assistance, Rate Analysis

Phase II: Design, Bid, & Construction Phase Services

HIGHLIGHTS: New Fine Screening Facilities to Replace and Upgrade Aging Facilities

For more than a decade, we have provided professional services enabling the City of Cape Girardeau to efficiently upgrade its wastewater conveyance and treatment facilities. When the City was faced with an unreasonable compliance schedule, we assisted them in negotiations with MDNR. We devised a workable schedule for upgrading the treatment plant, an affordable penalty, and a reasonable supplemental environmental project that would benefit the community. All compliance milestones have been met.

Project Approach

We provided regulatory compliance assistance, facility planning, antidegradation review, user rate study, SRF funding application assistance, design, bid phase, and construction phase services for a new, larger Wastewater Treatment Facility at a new location. A new site was necessary due to a geologic emergency – the development of over 24 sinkholes near the existing plant.

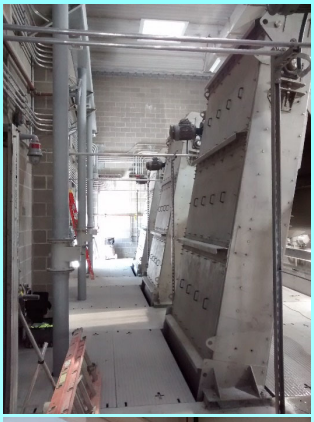
We evaluated two new sites, and a variety of treatment process alternatives to meet projected population growth and future effluent limits including nutrient control. The new facilities consist of a 60-inch trunk sewer, influent pumping station, headworks with mechanical fine screens and grit removal equipment, modified Sequencing Batch Reactor (SBR) activated sludge process, and ultraviolet disinfection. The SBR is designed to provide nitrification, and with the future addition of mixers and adjustment of controls, can be upgraded to remove nutrients. The SBR process includes a unique peak flow treatment mode that saved the City more than $1 million in capital construction costs. The belt dryer for biosolids processing is a state-of-the-art system that includes two waste activated sludge holding basins, centrifuge dewatering, cake storage, a belt dryer, biosolids storage silo, and truck loading bay. The system can produce a Class A Exceptional Quality (EQ) pelletized reusable biosolids fertilizer product.

The fine screening facilities include two Parkson Aqua Guard, 1/4-inch effective screen opening, full-channel-width inclined screens, capable of passing 25 mgd flow each. Each fine screen's channel has a motor-actuated slide gate at the entrance and a manual-operated operated slide gate at the exit. A manual 3/4-inch opening bar screen, located in a separate channel, provides 50-mgd screening capacity when the mechanical screens' capacity is exceeded or they require maintenance. The screenings lifted out of the wastewater stream are deposited into two Parkson Aqua Washpress Screenings Compactors where they are washed to remove organic material, compressed to remove free water, and deposited into dumpsters.

Instrumentation and Controls

EDCS

Various MSD Projects



Improvements at Lemay (above) and Fenton (below).

Lemay WWTP Secondary Improvements

Construction Cost: $14.7M; **Electrical/I&C Services Portion:** $191,300

- New Wet Weather Screening Building and new Headworks Screening Building.
- New power feeds from existing plant power, generator connections, Class I Div 2 rating.
- New odor control system and HVAC systems to reduce area classifications.
- New bar screen climber control panels and washer compactor control panels.
- New PLC control panels; networked and integrated into existing plant Invensys.
- Instrumentation for replacement of flow meters at aeration basins and secondary clarifiers.
- New suspended solids meters; connected into plant SCADA system using wireless I/O.

Fenton WWTF Fine Screen Replacement

Construction Cost: $400,000; **I&C Services Portion:** $20,542

- Replace the headworks fine screen at the Fenton WWTF after flood damage.
- On-site assessment of existing system for possibility of re-use.
- Replace fine screen control panel, motors, local control station, emergency stop pushbuttons, and spray water solenoid valve.
- Hazardous gas detection and alarming was added to meet NFPA 820 requirements.

LMRDP CSO Controls System Improvements: Lemay No. 3 Pump Station

Opinion of Probable Construction Cost: $30,124,600; **Electrical/I&C Services Portion:** $84,100

- New pump station to accept flow from Jefferson Barracks Tunnel, pump to the Lemay WWTP.
- Lemay No. 3 PS to be network connection point of all the intake structures and level sensors in the Jefferson Barracks Tunnel system (control and monitoring of Tunnel consolidated at L3 PS).
- Design of controls for the new pumps, valves, and flow monitoring.
- Fiber Optic switches, patch panels, radio access point to accept communications from all of the tunnel structures & transmit information to the Lemay WWTP.
- Pumps have local pump control panels with pump protection modules.
- Bar screens with automatic bar screen climbers to remove debris build up.
- Wet well level measured by pressure sensors installed on pilot pipe provide a tunnel level.
- New flow meters, gates, valves, HVAC system, fire alarm, and security systems (remotely monitored).

Bissell Point WWTF Redundant Sludge Acceptance System

Donohue

St. Louis, Missouri

Cost
$3.3M (fee: $504,000)

Project Schedule
Substantial completion 2020

Responsibilities/Role
Planning, Design, Bidding, Construction Support

Donohue is leading the redundant sludge acceptance system project at the Bissell Point WWTF. The redundant sludge cake receiving facility will receive sludge cake hauled in from other District treatment facilities for incineration. Donohue's efforts include identifying and evaluating alternatives for the sludge cake receiving facility, preliminary and final design, bidding support, and construction-related services.

The existing sludge acceptance system allows a truck to dump cake solids into a below-grade receiving well with a live hopper bottom with augers that drop the cake into screw conveyors. The screw conveyors discharge into a piston pump, which pumps the cake to the belt filter press discharge conveyors prior to going into the incinerator receiving bins. This project adds a redundant system for the existing sludge acceptance system. The new system includes a below-grade receiving system, cake storage, conveyance, and pumping. The facility is located so as not to interrupt the necessary continual operation of the existing unloading facility.

Project highlights include:

- Cake storage, conveyance, and pumping.
- Storage volume and pumping evaluation.
- Right sizing cake pipe, pressure, pump rate, and pump horsepower.
- New power and control panels.
- New electrical duct banks to existing substation.

Bissell Point WWTF Substation Switchgear and MCC Replacement

Donohue

St. Louis, Missouri

Cost
$9.125M; (fee: $789,000)

Project Schedule
Ongoing

Responsibilities/Role
Planning, Design, Bidding, Construction Support

Donohue evaluated Allis Chalmers and G.E. 4,160V metal clad switchgear and determined that replacement and consolidation of multiple switchgear buildings with arc resistant switchgear was most logical.

This included replacement of one dozen low voltage motor control centers (MCC) consisting of over 70 vertical sections. The MCC replacements improved reliability for the preliminary treatment portion of the plant. Care was taken to replace one MCC at a time to limit equipment downtimes. Feeders and conductors were replaced in kind to prevent splice points.

The WWTF was mostly constructed prior to the introduction of NFPA 820 and contains multiple tunnels interconnecting the various process spaces. The preliminary treatment portion of the plant contains communitors, isolation gates, and open wastewater channels. Plant staff elected to separate the Comminutor Building from the tunnel, replace the electrical within the Comminutor Building for NFPA 820 compliance, and add seal-off fittings to conduits.

Challenges include keeping the stations operational throughout construction and replacing equipment in kind due to limited available floor space. A phasing plan limits downtimes and periods of reduced capacity at the influent pump station.

Lemay Pump Station 1 and 2 Improvements

Donohue

St. Louis, Missouri

Cost
$3.7M (fee: $636,000)

Project Schedule
Completed

Responsibilities/Role
Medium Voltage: transformers/ unit substation; switchgear; and site distribution; Construction Sequencing

Donohue performed design related to the evaluation of G.E Magneblast 4,160V metal clad switchgear. The evaluation determined that replacement with arc resistant switchgear was most logical for the 350-mgd facility. Workshops were held with Ameren to design the interfaces within the outdoor substation including the addition of low resistance grounding system to limit the available fault current.

Switchgear was designed to be housed in a sheltered aisle weatherproof enclosure with split bus, and to be arc resistant with exhaust plenums out of the enclosure. The project included replacement of variable frequency drives with air cooled drives designed with integral PLCs to control the start and stop sequences of the pumps and associated discharge ball valves as well as an exhaust ductwork system that allows the VFD exhaust to be vented out of the pump station during summer months and retained for space heating in the winter months.

Special project challenges included keeping the stations operational throughout construction and replacing equipment in kind due to limited available floor space. A step-by-step phasing plan was created to limit downtimes and periods of reduced capacity at the pump station.

Structural Projects for MSD

David Mason + Associates

Various Locations

Bisell Point WWFT Trickling Filter Media Replacement

Cost: $31M; **Fee:** $134,644

DMA performed a visual structural condition assessment for each trickling filter in November 2019. For each major TF component, a summary of rehabilitation needs based on condition observations was developed.

Bissell Point Structural Modifications

Fee: $29,640

DMA provided structural engineering and construction administration services for this project that consisted of upgrading the existing belt filter presses to larger and more efficient units located within a solids handling building. Design included supplemental structural members to increase the vertical capacity of the supporting floor for these larger and heavier process units. Specially designed base isolators were utilized for the new, heavier belt filter presses to maintain existing seismic forces being applied to the building support structure.

Coldwater Creek Sanitary Relief Sections B, C, & D – Site A

Cost: $14M; **Fee:** $121,171

DMA performed structural engineering for the main diversion structure, the 180-ft-diameter storage tank, influent and recycling pump station, and several junction chambers. These services included design of the elements and construction administration services. DMA was responsible for the final design and preparation of construction plans and specifications for the following main components to provide a fully functional flow equalization facility at Tank Site A: Diversion Structure, Influent Pump Station, Storage Tank, Odor Control System, Electrical Supply and Backup Power, Site Work, and Control System for the Flow Equalization System. This was a prototype project, the first time that MSD utilized aboveground compensatory, inline, wet weather storage. This design also had to account for the continuing use of the main trunk line while construction was occurring.

ENGINEERING PROFESSIONAL SERVICES DIVERSITY MULTIPLIER CALCULATION SHEET

Starting multiplier- **1.000**

Vendor Diversity (only one category allowed)
Is prime firm a WBE or Asian-American MBE? If yes, enter 0.100- 0

Is prime firm an MBE other than Asian or Hispanic-American? If yes enter 0.100- 0

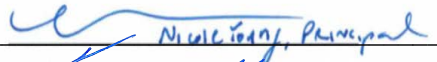
PRIME CONTRACTOR VENDOR MULTIPLIER SUB-TOTAL (1.000 to 1.100) 1.000
ENTER THIS VALUE ON LINE 1 OF LAST SHEET

Workforce Diversity- Prime Consultant (Minority Women may count as either Women or Minorities at the proposer's discretion, but not both). Count all full time personnel working in your office for this calculation regardless of job duties. Full time personnel shall have worked for the company for the past three months and during that period averaged 30 hours of work per week. COUNT FULL-TIME PERSONNEL ONLY!

a. Total Local Office Workforce- 280
b. Women in Local Office Workforce- 90
c. Minorities in Local Office Workforce- 14
d. "b" divided by "a" (drop all decimals/fractions)- 32 %
e. "c" divided by "a" (drop all decimals/fractions)- 5 %
f. If "d" is 32% or greater, ENTER 0.025 ON LINES 2 AND 3 OF LAST SHEET
g. If "d" is 16% or greater, ENTER 0.025 ON LINE 3 OF LAST SHEET UNLESS THERE IS ALREADY A VALUE ENTERED
h. If "e" is 18% or greater, ENTER 0.025 ON LINES 4 AND 5 OF LAST SHEET
i. If "e" is 9% or greater, ENTER 0.025 ON LINE 5 OF LAST SHEET UNLESS THERE IS ALREADY A VALUE ENTERED

Sub-consultant workforce scoring: Use only if a minimum of 25% of work is sub-contracted. Minority Women may count as either Women or Minorities at the proposer's discretion, but not both). Count all full time personnel working in your office for this calculation regardless of job duties. Full time personnel shall have worked for the company for the past three months and during that period averaged 30 hours of work per week. COUNT FULL-TIME PERSONNEL ONLY!

Names of sub-consultants **performing at least 25% of total contract** included in calculation (add more lines if needed)

Name of Sub-Consultant(s)	Authorized Signature of Sub-Consultant
EDCS	
David Mason + Associates	
Donohue and Associates	

j. Combined Total Local Office Workforce of all listed sub-consultants- 132
k. Women in Combined Total Local Office Workforce- 22
l. Minorities in Combined Total Local Office Workforce- 34
m. "k" divided by "j" (drop all decimals/fractions)- 17 %
n. "l" divided by "j" (drop all decimals/fractions)- 26 %
o. If "m" is 32% or greater, ENTER 0.025 ON LINES 2 AND 3 OF LAST SHEET UNLESS A VALUE IS ALREADY ENTERED
p. If "m" is 16% or greater, ENTER 0.025 ON LINE 3 OF LAST SHEET UNLESS THERE IS ALREADY A VALUE ENTERED
q. If "n" is 18% or greater, ENTER 0.025 ON LINES 4 AND 5 OF LAST SHEET UNLESS A VALUE IS ALREADY ENTERED
r. If "n" is 9% or greater, ENTER 0.025 ON LINE 5 OF LAST SHEET UNLESS THERE IS ALREADY A VALUE ENTERED

FINAL MULTIPLIER TABULATION

1.	PRIME CONTRACTOR VENDOR MULTIPLIER	1.000
2.	WOMAN WORKFORCE 32% OR GREATER	0.025
3.	WOMAN WORKFORCE 16% OR GREATER	0.025
4.	MINORITY WORKFORCE 18% 0R GREATER	0.025
5.	MINORITY WORKFORCE 9% OR GREATER	0.025
6.	**FINAL MULTIPLIER (TOTAL OF 1 THRU 5) (1.000 thru 1.200)**	1.100

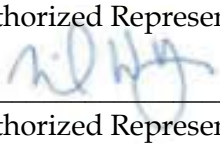
The undersigned certifies on behalf of the entity submitting this Report that the above information is true and accurate as of the date set forth below:

Jacobs Engineering Group Inc. — Prime Firm Name

September 8, 2020 — Date

Michael McCarty — Authorized Representative Name

Vice President Missouri Operations — Representative Title



Authorized Representative Signature