

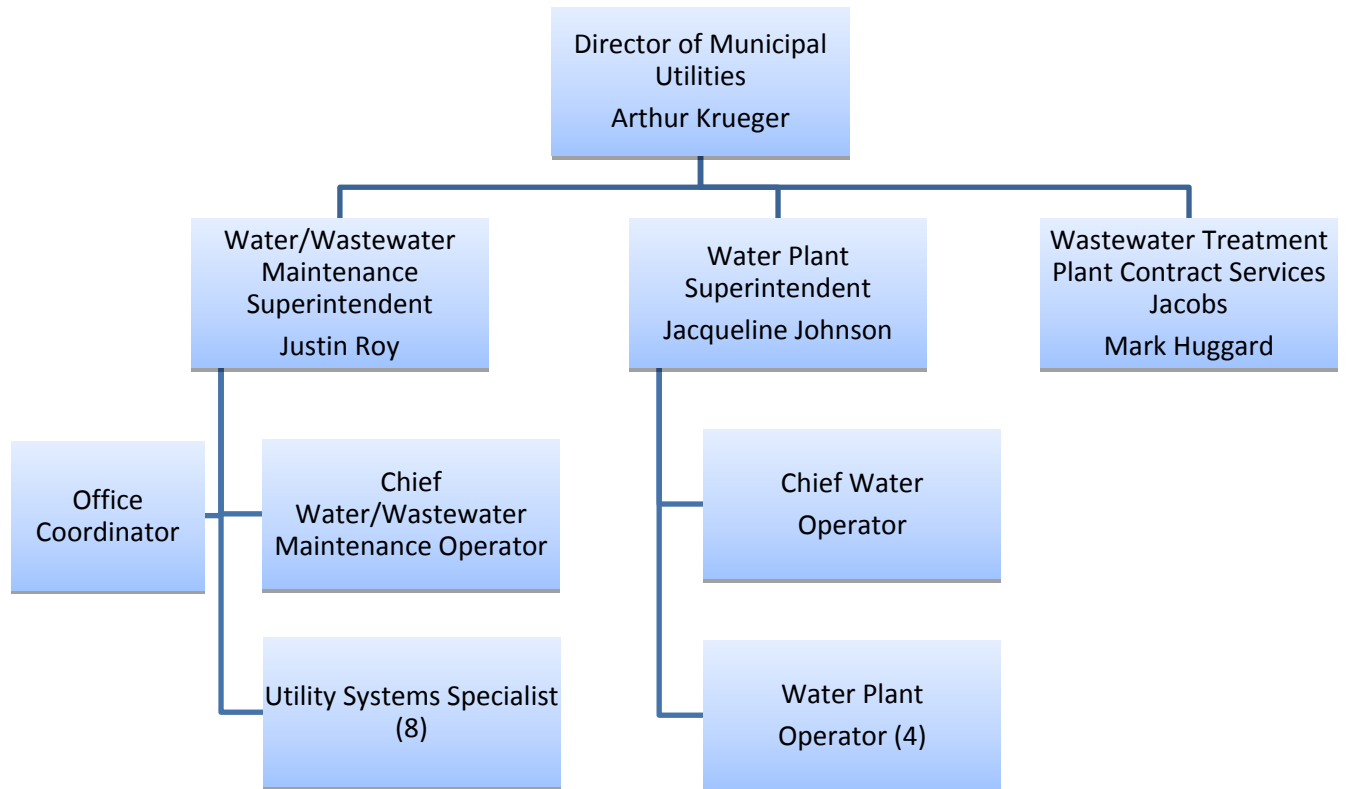
CITY OF TRAVERSE CITY
DEPARTMENT OF MUNICIPAL UTILITIES
2021
ANNUAL REPORT



TABLE OF CONTENTS

Organizational Chart	Page 3
Mission Statement	Page 4
Water/Sewer Maintenance Division	Page 5 - 8
Water Plant Division	Page 8 - 9

Department of Municipal Utilities Organizational Chart



**DEPARTMENT
OF
MUNICIPAL UTILITIES**

MISSION STATEMENT

*Preserve and enhance the safety, health, and quality of life for the people of
Traverse City through the effective management and maintenance of its
drinking water and wastewater infrastructure.*



Barlow 4 MG Water Reservoir Rehabilitation Project (Completed in 2020)



WATER/WASTEWATER MAINTENANCE DIVISION

Staffing:

Superintendent – Justin Roy

Chief Water/Sewer Operator – Brian McManus

Office Coordinator – Jennifer Nowak

7 - Utility Systems Specialists

1 - Utility Systems Apprentice

1 - Seasonal Laborer (summer)

Maintenance/Operational Responsibilities:

- 125 miles of pressurized water mains
- 90 miles of sanitary sewer mains
- 3,000 water system valves, 6" to 30" in diameter
- 1,000 fire hydrants
- 7,400 water meters
- 2,000 manholes

WATER/WASTEWATER MAINTENANCE DIVISION

Customer Service Activities:

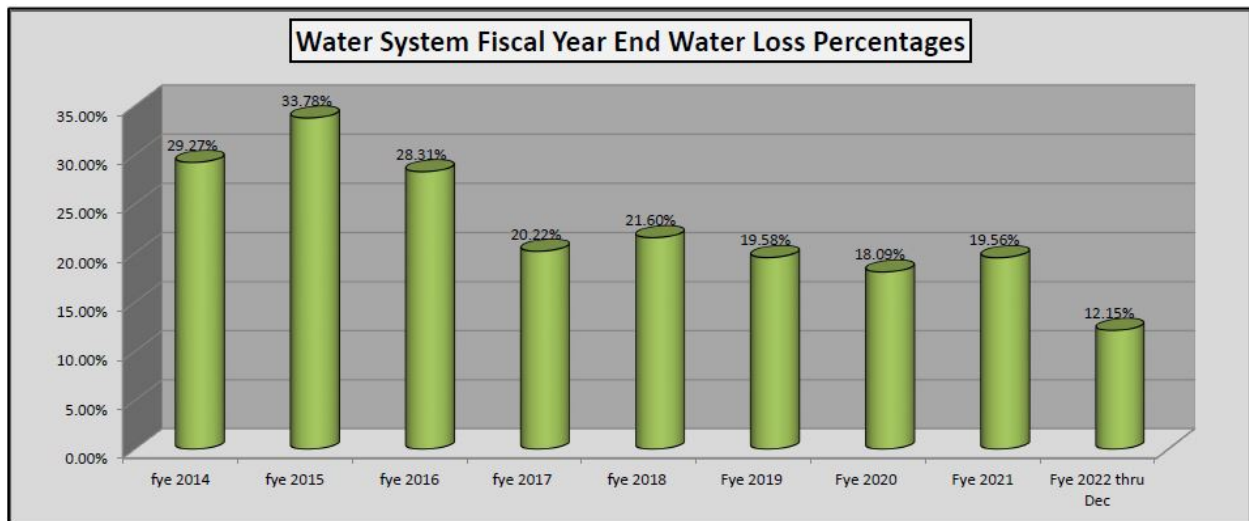
- 250+ new water meters installed as part of the ongoing Automated Metering Infrastructure (AMI) project.
- 3,500+ Miss Dig responses
- 500+ water service turn on/off requests
- 1000+ fire hydrants winterized
- 105 sewer calls; 26 City main related issues; 79 private property service line issues
- 10 miles of sanitary sewer cleaned
- 3 miles of sanitary sewer televised and inspected
- 39 water taps installed
- 100+ valves turned
- 400+ service calls (sampling, leaks, inspections, meter reads/re-reads, low-pressure complaints, new meter installs, etc.)
- 8 emergency water main break repairs



Water/Wastewater System Activities/Improvements:

- Completed Project Plan (5 years plan) for Clean Water State Revolving Fund (CWSRF) to align wastewater infrastructure improvement projects with EGLE's low-interest loan program for an estimated total of \$27,601,000.
- Awarded \$2,093,629 grant from Michigan Department of Health and Human Services (MDHHS) for source tracing of SARS-COV2 (COVID-19) in wastewater for a multi-year project ending in July 2023.
- Participated in EPA's Climate Resilience Evaluation Tool (CREAT) exercise to evaluate potential climate change effects on our wastewater collection system.

- Awarded contract for engineering design services for the West Side Sanitary Sewer Pipe Lining Project for approximately 6,500 linear feet of sanitary sewer to reduce Infiltration & Inflow (I&I) in most critical areas of the sewer collection system.
- Replaced 1,100 feet of 8-inch water main and 508 feet of sanitary sewer main with the Cedar Street Reconstruction Project (Kids Creek Culvert Crossing) between Sixth Street and W Front Street to eliminate a significant source of I&I from entering the City sanitary sewer system along Kids Creek.
- Participated in MDOTs design process for US-31 Reconstruction Project (Garfield Ave. to Division St) to upgrade water, sanitary sewer, and storm sewer utilities.
- Awarded engineering design services to re-route the 24-inch sanitary sewer in the 100 block E Front Street alley away from the river wall and stabilize the sewer, alley, and river wall in the 200 block along the Boardman River between Cass and Park Streets.
- Cleaned and televised the 24-inch sanitary sewer from Union Street to the Front Street Lift Station. A 15-foot long fatberg was discovered and removed which was impeding the pipe flow area by one-third. Two sandbags were also removed from the sewer main that was impeding available pipe flow area.
- Continued to monitor sanitary sewer flows tributary to the West Trunkline Sanitary Sewer with 4 sewer flow meters to collect/monitor continuous dry and wet weather flow data that will be used to complete a future Sanitary Sewer Evaluation Study (SSES).
- Constructed temporary containment area around Sanitary Sewer Overflow (SSO) low point west of Union Street (behind Record-Eagle) to contain SSOs and keep raw sewage from entering the river.
- Continued enforcement of Cross-Connection Control program to improve water system safety. Completed 700 residential/commercial inspections (by contractor) that included illicit sanitary sewer connection inspections and enforcement to remove illicit connections to reduce I&I from sanitary sewers.
- Unaccounted-for water (water loss) is defined as the percent difference between the total volume of water produced at the Water Treatment Plant vs. the billed water to all customers and is displayed in the chart below on an annual basis:



The fiscal year ending (fye) 2021 was skewed higher due to the timing of billing. City customer billings for June 2021 were much lower than actual as several larger accounts were not billed until July 2021. If the July 1 and July 6th billings, which would have been included in the June usage were added to June, the water loss percentage would have decreased from 19.56% as shown above to 16.75%. Therefore, the actual water loss continues to trend downward since fye 2015 as we continue to replace old inaccurate meters with new AMI meters in our system. An acceptable goal for water systems is to have water loss in the 10% to 15% range.



WATER TREATMENT PLANT DIVISION

Staffing:

Superintendent – Jacqueline Johnson

Chief Water Operator – Vern Coblentz

4 - Water Treatment Operators (Rotate through Maintenance)

Maintenance/Operation Responsibilities:

- 20 million gallons per day (MGD) rated Water Treatment Plant (5 high service pumps, numerous valves/meters, etc.)
- 19.7 MGD firm capacity; 16.7 MGD operational capacity at Low Service pump station intake system (4 pumps, 2 traveling screens, intake crib, etc.)
- 2 flocculation basins
- 5 sand & anthracite gravity filters
- 3 chemical feed systems (ferric sulfate, chlorine, and fluoride)
- Plant compressed air system (operates valves, bubbler systems, etc.)
- 1 backwash pump to clean filters via backwashing process
- 2 lagoons for settling solids out of filter backwash water; recycled water discharges to East Bay (NPDES permit)

- 750 kW diesel generator in plant
- 275 kW diesel generator in the Wayne Hill Booster Station
- 20 kW natural gas generator at Barlow Tanks site
- 4 water storage reservoirs (4 million gallons (MG) & 2 MG at Barlow Site; 1.3 MG at Wayne Hill & 1.5 MG treated water storage reservoir at the plant)
- 2 booster pump stations
- 7 pressure reducing valve vaults

Customer Service Activities:

- Produced 1.9 billion gallons of safe, clean drinking water for the City and portions of Garfield, Elmwood, and Peninsula Townships.
- The Water Treatment Plant's State certified microbiology lab tested over 1700 water samples for bacteria to keep the City and nearby water supplies safe.
- Completed microcystin (algal bloom) testing at the Water Treatment Plant and the results were non-detect.
- Completed quarterly Per- and Polyfluoroalkyl Substances (PFAS) testing. The results for one compound, PFOA was 2 parts per trillion (ppt) compared to the maximum contaminant level of 8 ppt. All other PFAS were non-detect.
- Completed replacement of 6 private galvanized water service lines with the Cedar Street Reconstruction Project (Kids Creek Culvert Crossing) toward compliance with EGLE's Lead and Copper Rule (LCR).

Water Treatment Plant (WTP) & Water System Improvements:

- Continued with Phase 2 of the Filters 1, 2 & 3 and Floc Tank Repairs Project at the Water Treatment Plant, replacing the filter media, valves, and piping on Filters #2 and #3 and recoating the East Floc Tank and Filters #2 and #3.
- Performed a cyber security audit of the WTP SCADA (operator control) system.
- Installed mixer into Wayne Hill Reservoir to improve water quality.
- Completed Water System Reliability Study in February 2021.
- Completed Project Plan (5 years plan) for Drinking Water State Revolving Fund (DWSRF) to align water infrastructure improvement projects with EGLE's low-interest loan program for an estimated total of \$14,927,000.
- Completed EPA required Risk and Resilience Assessment and Emergency Response Plan for the City's water system to comply with America's Water Infrastructure Act of 2018 (AIWA) which evaluates risks to the water system from malevolent acts and natural hazards.
- Performed ARC Flash (Electrical) Study at the Water Treatment Plant, Low Service, and Wayne Hill Booster Station.

End of Report



Operations Management and Facilities Services
2020–2021 Annual Report

Traverse City, Michigan

Jacobs

Challenging today.
Reinventing tomorrow.

Contents

Letter from project management	1
Our team	2
Access to regional and nationwide support resources.....	4
Serving and protecting the City for 31 years	5
Overview of services provided to the City	7
Key 2020 - 2021 highlights	8
Protecting Traverse City with superior permit management and regulatory compliance	10
Helping the City weather the storm – emergency and contingency response	11
Maintenance/Asset management.....	12
The Proactive Maintenance Advantage.....	13
Safety.....	14
COVID-19 response and prevention.....	14
Sustainability – together aiming higher for a more sustainable future	15
Community involvement.....	16
Financial overview.....	17
Looking forward.....	18

Exhibits

Exhibit 1 Our experienced and knowledgeable team	2
Exhibit 2 Major milestones and accomplishments	5
Exhibit 3 Services Jacobs provides to the City.....	7
Exhibit 4 2020-2021 highlights	8
Exhibit 5 Total gallons of wastewater treated annually, billion gallons	10
Exhibit 6 Hydraulic capacity compared to actual flow rates, mgd.....	10
Exhibit 7 Organic loading capacity compared to actual organic loadings, pounds/day	11
Exhibit 8 Maintenance work order summary	12
Exhibit 9 Jacobs' maintenance activities compared to industry standard.....	12
Exhibit 10 Contract year 31 reconciliation summary	17

Appendix A

Letter from project management

For the last 31 years, Jacobs has proudly operated and maintained (O&M) the Traverse City Regional Wastewater Treatment Plant (TCRWWTP). Our partnership has resulted in an efficient, reliable and compliant facility. Together we continue to look for ways to optimize operations, increase sustainable practices and reduce the financial demands of the facility.

In the 2020-2021 contract year, we successfully completed the following projects:

- Capital improvement upgrade to digester 3.
 - The upgrade to digester 3 includes the replacement of the mixing system with the latest in digester mixing technology. It allows our plant to provide improved process performance, provides energy savings and lowers maintenance costs. In addition, the interior and exterior surfaces of the digester were coated and new access hatches, stairs and gas collection system were installed.
- Successfully mitigated compliance risks during heavy rain events
 - Most notably, was the historic rain event which began on October 22, 2020 and ended on October 23, 2020. The Grand Traverse area received almost four inches of rain during this time dramatically increasing the forward flow demand at the treatment facility.
- The ultraviolet (UV) project.
 - In May 2021, our team raised the elevation of the UV module controls. This helps prevent flooding during times of increased flow demand. Additionally, this solution enables the UV modules to stay in place and protects the equipment allowing us to continue using the UV disinfection during wet weather events.

On behalf of our entire team, we thank you for your support. We are excited to continue our partnership and are dedicated to providing the best operational, technical and cost-effective solutions to the Traverse City community as a whole.

Regards,



Elizabeth Hart
Project Manager



Mark Huggard
Assistant Project Manager

Our team

knowledgeable, dedicated professionals. We strive to bring a unique and holistic approach to all challenges faced in the course of our workdays. We succeed at doing so because we have a robust training procedure and thoroughly written training/guidance materials. In addition, we have the support and expertise of the entire Jacobs organization. Exhibit 1. Highlights our local team and frequently worked with Jacobs' experts.

Exhibit 1

Our experienced and knowledgeable team

Name	Position	Education/Certification/Licenses
Kevin Dahl	Manager of Projects	Degrees: BS Civil Engineering and MS Environmental Engineering Certifications: New England Water Environment Association Class IV Wastewater Collection Systems Operator, Certified Maintenance Reliability Technician (CMRT), Certified Reliability Leader, Connecticut Class IV Wastewater Treatment Operator and Rhode Island Class IV Wastewater Treatment Operator
Elizabeth Hart	Project Manager	Degree: BS Water Science Certifications: Wastewater A, L1 and L2, Water F4, Stormwater Certified and CMRT
Mark Huggard	Assistant Project Manager	Degree: Associates Degree in Water Environmental Technologies Certifications: Wastewater A, L1 and L2, Water F4 and S4 and CMRT
Andrew Waldron	Maintenance Supervisor	Certifications: CMRT, Certified Reliability Leader and Water Resource Recovery Technician (WRRT) Certification
Justin Straub	Operations Supervisor	Degree: BS Biology/Conservation and Natural Resource Use
Andrew Peterson	Lead Operator	Degree: Associates Degree in Water Treatment Technologies Certification: Wastewater B
Josh Lycka	Operator/Industrial Pretreatment Program (IPP) Coordinator	Degree: BS Natural Resource Management Certifications: Wastewater D and CMRT
Luke Bonser	Operator-in-Training	Degree: Associate of Arts Spring Arbor University-
Jacob Wanserski	Operator-In-Training	Degrees: Associates in Environmental Engineering and Water and Wastewater Technology and BS in Water Resources Certification: Wastewater Certification-Subclass A1
Dalton Brown	Operator-In-Training	Certification: U.S. Army Reserves – certificates of water treatment training
Rick Shaw	Operator in Training	Certification: CMRT
Zack Niec	Operator	Degree: BS Environmental Science
Alex Arnold	Laboratory Analyst	Degree: BS Physics/Mathematics/Computer Science
Shane Wyatt	Mechanic	Certification: CMRT
Kerry Gensler	Mechanic	Certification: CMRT
Raymond Kite	Mechanic	Degree: Associates Degree Business Management and Automotive/Diesel Technology and Engineering
Casey Park	Utility Worker	None

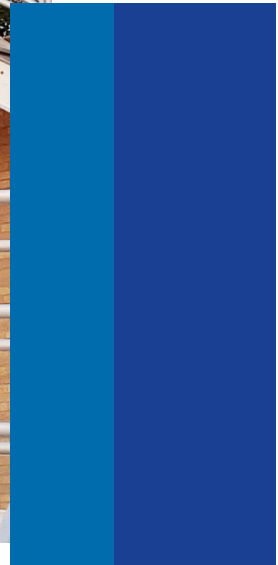


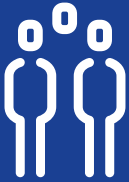
Exhibit 1 (continued)

Our experienced and knowledgeable team

Name	Position	Education/Certification/Licenses
Support staff		
Maria Lenzi	Administrative Specialist	None
Shelly Campbell	Business Manager	Degree: Masters in Accounting
Duyen Tran	Sustainability and Operations- Envision Professional (ENV SP)	Degree: BS Chemistry Certification: Arizona Wastewater Class IV
Jim Fischer	Jacobs Engineer	Professional Engineer
Allen Gelderloos	Jacobs Engineer	Professional Engineer
Jeff Heroux	Compliance and Reporting Manager	Certification: Massachusetts Wastewater 7
Rebekka Maier	Compliance and IPP Coordinator	Degree: BS Environmental Engineering Certification: Idaho Wastewater Treatment Class 1
Ryan Vedrode	Compliance and Laboratory Coordinator	Degree: BS in Chemistry Certification: Michigan Wastewater A
Josue Escobar	Supervisory Control and Data Acquisition (SCADA) -Systems Configuration Specialist	Degree: Engineering Technology, Navy Electrician "A" School
Harry Sellers	Maintenance Specialist	Certifications: CMRT and Certified Reliability Leader
JD Verbrugge	Regional Safety Coordinator	Degrees: BA in Criminal Justice, BS in Zoology, MS in Environmental Studies

Access to regional and nationwide support resources

Jacobs operates more than 200 facilities and treats 1.1 billion gallons of water and wastewater daily. Our integrated resources allow us to support you in a variety of ways. When you hired Jacobs, you hired a vast and expansive knowledgebase. We are your partner and an extension of the City.



The Deep Bench Advantage

2020-2021: 1,575 hours of regional and national support from Jacobs experts at no additional cost.

ENGINEERING

- Clinch Park lift station – provided conditional estimate of pump capacity.
- Primary header – offered support for addressing the failing primary influent pipes.
- Headworks and primary treatment options study review – provided review comments on first and second drafts of study report by Hubbell, Roth & Clark.
- UV system – performed capacity evaluation which included near term and long term solutions. Worked with EGLE to help understand the issues and related solutions. Assisted in the execution and completion of the near term solution.

TECHNICAL

- SCADA programming – Jacobs SCADA programmers have modified the SCADA programming, often upon request; saving time and reducing costs and compliance vulnerability.
- Added Cyber X to our SCADA system – the most widely-deployed industrial cybersecurity platform for continuous, non-invasive risk assessment and machine to machine (M2M) anomaly detection. Its purpose-built platform enables organizations to detect and respond faster to cyber security risks.

COMPLIANCE

- Industrial pretreatment program (IPP) administration – assisted with permit writing, monitoring and evaluation of industrial users (IUs), meeting new per- and polyfluoroalkyl substances (PFAS) regulations and conducting Sewer Use Survey.
- Review and consult on regulatory reporting.
- Development of spill response plans, sample tracking tools and sampling plans.
- Conduct regular training on a variety of compliance subjects.

OPERATIONAL

- Business risk review – ensuring seamless project operations with effective use of internal review process.
- Transferred data to HACH Wims – a program that uses intelligent alerts and modeling tools to help resolve and prevent operational issues.











MAINTENANCE

- Assist with use and management of our Computerized Maintenance Management System (CMMS).
- Assist with condition assessments.
- Assist with larger projects.
- Support all maintenance activities as needed to reduce downtime and expense.

Serving and protecting the City for 31 years

Since 1990, the City and Jacobs have been steadfast in our focus of improving our approach to the operations and maintenance of the TCRWWTP. We are dedicated to providing quality service to this beautiful area and its citizens. Exhibit 2 highlights the major milestones and accomplishments our partnership has afforded the community.




Exhibit 2
Major milestones and accomplishments

Year	Accomplishment	Impact	
1980	Sara Lee begins discharging to WWTP, which begins experiencing compliance issues. State of Michigan initiates enforcement.	FINANCIAL (regulatory compliance) – could lead to permit violations resulting in fines.	
1990s	Traverse City selects Jacobs for regional WWTP operation; contract includes administration of IPP; IPP discharge permit issued to Sara Lee and other industrial users; Sara Lee completed pretreatment facility to meet requires of discharge permit; received second place for U.S. Environmental Protection Agency (U.S. EPA) IPP Excellence Award.	FINANCIAL (regulatory compliance) – reduced likelihood of permit violations and related fines; reinforced regulator confidence in the City's approach to compliance.	
	Completed the \$1.5 million WWTP upgrade to increase biochemical nutrient removal.	FINANCIAL (regulatory compliance) – ensured compliance with regulatory permit; reinforced regulator confidence in the City's approach to compliance.	
Early 2000s	\$31 million plant upgrade including newest, largest membrane bioreactor (MBR) in North America (upgrade designed by Jacobs); received the American Council of Engineering Companies (ACEC) Engineering Excellence Award; received the ACEC and Society of Professional Engineers Eminent Conceptor Award for Engineering; Received the U.S. EPA Region 5 Best Operated and Maintained Facility Award; received the Michigan Water Environment Association (MWEA) Health and Safety Award.	AIMING HIGHER (financial/regulatory and safety compliance) – upgrade designed within current footprint of facility (public did not want plant to expand into Hull Park) while ensuring compliance with a more stringent discharge permit. Avoiding fines related to noncompliance. This stellar safety record translates into peace of mind for the City's leadership and cost avoidance including but not limited to, risk-based insurance premiums and costs related to accidents or injuries.	
2012	After a competitive bidding process, signed new 5-year agreement with the City to operate and maintain WWTP and lift stations and administer the IPP.	PARTNERSHIP – continuity of a proven partnership resulting in excellence in the areas of safety, compliance, operations and engineering.	
2014	Facilitated the replacement of the first train of original membranes, refurbished screw compressors adding new inline air dryers and extended a screw compressor line to the membrane building. Applied for and received the National Pollutant Discharge Elimination System (NPDES) permit renewal effective August 2015.	PARTNERSHIP (proactive maintenance) – ensuring compliance and continuity of operations, avoiding expenses repair costs associate with equipment failure. Compliance-regulatory deliverable.	
2015	Oversaw upgrades including the sieve drum concentrator controls, the replacement of digester 4's recirculation pump and improved the dissolved oxygen (DO) control loop and replaced necessary physical components of the aeration basin. Replaced three trains of membrane cassettes.	FINANCIAL (proactive maintenance) – ensuring compliance and continuity of operations, avoiding expenses repair costs associate with equipment failure.	
2016	Signed new 5-year agreement with the City to operate and maintain WWTP and lift stations, and administer the IPP.	PARTNERSHIP – continuity of a proven partnership resulting in excellence in the areas of safety, compliance, operations and engineering.	
2017	Oversaw replacement of screw pump 1 and trough reconditioning; upgrade of TBA lift station; replacement of the 5th train of membranes; and cleaning and condition assessment of digester 3.	FINANCIAL (proactive maintenance) – ensuring compliance and continuity of operations, avoiding expenses repair costs associate with equipment failure.	
2018	Replaced the sixth train of membranes; upgraded one programmable logic controller (PLC) at the WWTP and the PLC at Front Street lift station and replaced the piston pump in the west biosolids storage building with two progressive cavity pumps; Devised new method of replacing carbon in odor control canisters reducing the cost by roughly \$15,000.	FINANCIAL (proactive maintenance) – ensuring compliance and continuity of operations, avoiding expenses repair costs associate with equipment failure.	

Serving and protecting the City for 31 years

Exhibit 2 (continued)

Major milestones and accomplishments

Year	Accomplishment	Impact	
2019	Jacobs Operator received the MWEA Operator of the Year Award; received the MWEA Large Facility Safety Award; replaced first membrane bioreactor scour air blower; Jacobs funded the installation of flow meters for the biosolids unloading bays to more accurately measure hauled volumes and thus reduce costs related to biosolids land application.	AIMING HIGHER (safety and operational excellence) – this stellar safety record translates into peace of mind for the City's leadership and cost avoidance including but not limited to, risk-based insurance premiums and costs related to accidents or injuries.	
2020	Replaced the seventh train of membranes; City and Jacobs reduced the cost of this project by working together and implement a new way to store the membranes before install; We completed the pump replacement project at the Riverine lift station.	FINANCIAL (proactive maintenance) – ensuring compliance and continuity of operations, avoiding expenses repair costs associate with equipment failure.	
2021	Completion of the UV project per Administrative Consent Order (ACO) requirements, completion of the digester 3 rehabilitation and the replacement of the eighth and original membrane train cassettes.	PARTNERSHIP – continuity of a proven partnership resulting in excellence in the areas of safety, compliance, operations and engineering.	



Membrane replacement – train 8 newly coated.



Membrane replacement.

Overview of services provided to the City

Jacobs operates and maintains the City owned TCRWWTP and contributing lift stations, administers the IPP, and maintains eight autosamplers positioned at each of the Townships for the purpose of tracking their individual biochemical oxygen demand (BOD) loadings to the facility. Our scope is further detailed in Exhibit 3.




Exhibit 3 Services Jacobs provides to the City

Item	Description	Performance exhibit (see Appendix)
Scope: meet requirements of state regulator stipulated in the facility's discharge permit		
Administer the City's IPP	Advise City of changes to Federal pretreatment standards – evaluate new sewer users/prepare permits; monitor existing significant industrial users (SIUs) for compliance with permit/prepare notice of violations; investigate interferences in collection system; prepare required regulatory reports.	Appendix A, Exhibit A-1 is a summary of SIU inspections and outcomes in the last year.
Operate facility so effluent quality meets the requirements of the discharge permit	Monitor effluent quality and report results to start on a monthly basis.	Appendix A, Exhibits A-2 – A-9 compare the facility's effluent quality to permit limits.
Develop and follow the facility's state regulated Asset Management Plan (AMP)	Submit annual report to regulator – monitor the equipment at the facility and 9 lift stations and make recommendations to City for projects to address identified equipment deficiencies.	Please refer to the "Key 2020-2021 highlights" section of the report for completed projects.
Develop and follow the facility's state regulator approved Residual Management Program (RMP) – program details procedures for proper land application of biosolids	Submit annual report to regulator – facilitate the disposal of biosolids generated at the facility in accordance with approved plan.	NA
Scope: provide and document maintenance for the project		
Routine preventive maintenance (PM) and repair	Provide routine PM and repair of the equipment and buildings, consistent with accepted maintenance practices, best management practices and manufacturer specifications and PM recommendations.	Exhibit 8 contains a maintenance work order summary, and Exhibit A-11 contains an overview of Jacobs 2020-2021 repair expenses.
Establish predictive maintenance (PdM) techniques and programs to ensure reliability of equipment and facilities	We utilize predictive maintenance techniques to help determine the condition of in-service equipment in order to estimate when maintenance should be performed. This optimizes the efforts of our work force, and reduces the occurrences of emergency and corrective maintenance (CM).	Exhibit 8.
Scope: quantify BOD loadings to the facility		
Sampler maintenance	Maintain a system of eight automatic flow proportioned composite samplers located where wastewater from townships enters multi-user part of the collection system.	Appendix A, Exhibit A-11.
Sampling and analysis	Sample and perform BOD tests three times per week from these locations to quantify BOD loadings received at the plant from the townships of Garfield, East Bay, Acme, Elmwood, Peninsula and from the City of Traverse City.	Appendix A, Exhibit A-11.




Key 2020 - 2021 highlights

We are always looking for opportunities to improve our performance by reducing compliance vulnerabilities, operational costs and the facility's carbon footprint; all while achieving operational excellence, acquiring and maintaining a highly qualified staff and demonstrating a high standard of safety. An overview of our performance highlights is located in Exhibit 4.

Exhibit 4
2020-2021 highlights

Enhancement	Value	Impact	
UV system interim upgrade	In 2017, Jacobs engineering performed a study that identified the existing capacity limitations of the UV system, which had historically led to periodic flooding of and subsequent damage to the UV equipment. The same study identified near-term and long-term solutions to these capacity limitations. Working with Environment, Great Lakes and Energy (EGLE), Jacobs and the City obtained approval, via an administrative consent order, to address the capacity issues with the proposed near-term solution by May 15, 2021. The ACO was issued by EGLE, approved by the City commission on June 17, 2020, and fully executed on July 2, 2020. This allowed for a longer period of time to prepare for the much more expensive upgrade of the UV system that is also required as part of the ACO. Included in the near-term solutions, is the raising of the elevation of the UV module controls which would prevent them from flooding during periods of increased flow demand. This means we will not have to pull the modules and bypass UV disinfection completely should a wet weather event like the one described above occur in the future. The near-term modifications project was completed on May 11, 2021.	COMPLIANCE PARTNERSHIP (FINANCIAL)	
Upgrade of digester 3 (CIP #948)	In 2016, Digester 3 was removed from service following the discovery of gas leaks at various points around the structure. The digester was removed from service, cleaned and a full inspection was performed. Using the results of the inspection and based on the digesters age, built in the 1960's it was determined an upgrade was required to maintain system reliability. The upgrade included reconditioning and repairs to the inside and outside portions of the structure, installation of a linear mixer the latest technology in digester mixing and updated SCADA system monitoring. The addition of the linear mixing technology reduces maintenance cost, increases treatment efficiency reducing biosolids volumes hauled and reduces electrical usage.	COMPLIANCE FINANCIAL	
Utilization of coconut shell carbon media for odor control system	We replaced the activated carbon in the facilities Phoenix odor control system. We were able to find activated carbon made from coconut shells. With our modification to the cannisters making them reusable, and this year, finding activated carbon made from coconut shells, this process is largely sustainable. In addition, we were able to further reduce the cost of the project from just over \$5,000 to \$2,914.44. Prior practice was to purchase new cannisters equipped with new activated carbon, the cost of this project was nearly \$20,000.	FINANCIAL SUSTAINABILITY	



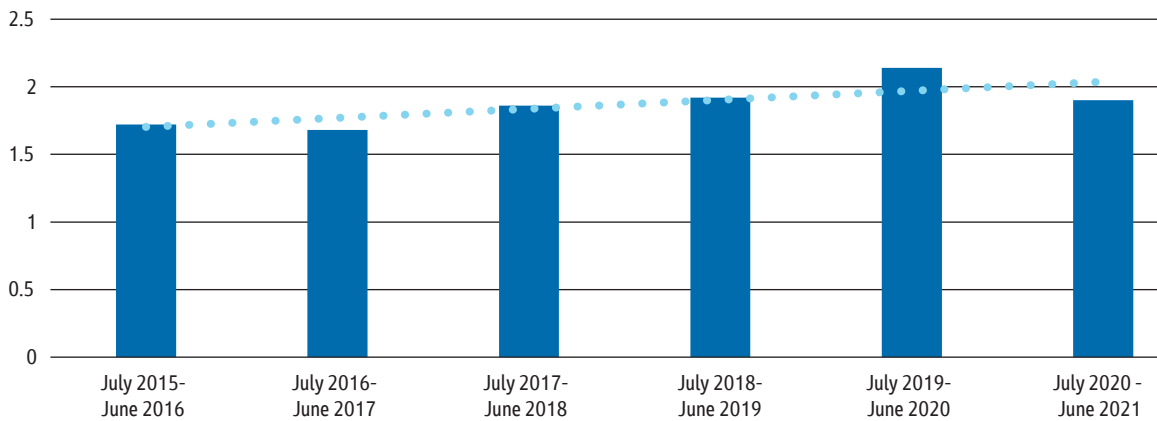
Enhancement	Value	Impact
Front Street passive bypass isolation gate installation and auxiliary pump piping	<p>With the water tables at record high levels and an increase in intensive wet weather events, we had a need to add auxiliary pump redundancy at the Front Street lift station. Auxiliary pumping was installed it was determined that in order to improve the reliability of the auxiliary pumping system a more permanent piping configuration was needed. Permanent auxiliary pump suction and discharge piping was installed this addition helped improve equipment reliability, therefore reducing the risk of sewer system backups. A gate valve was also installed at the stations passive bypass pipe to eliminate the possibility of the station receiving backflow from high river levels.</p>	COMPLIANCE (FINANCIAL) 
Completed first membrane replacement project	<p>With City approval the replacement of the first train of membrane cassettes took place in 2014. Knowing the burden of cost these replacements brought to the City it was determined the replacements should be staggered throughout the subsequent years. The replacement of the last original (2004) membrane train cassette was completed in September 2021. The second round of membrane replacements has already been identified in the City's Capital Improvement Plan (CIP).</p>	COMPLIANCE (FINANCIAL) 
Completed the membrane gate replacement project	<p>In July 2020 we completed the replacement of the last four of 16 failing aluminum membrane inlet/outlet gates. The replacement gates were of stainless-steel material ensuring equipment longevity and membrane process reliability for years to come.</p>	COMPLIANCE (FINANCIAL) 
Administration building generator cooling system replacement	<p>The failing cooling system on the administration building generator was replaced. In the event of a power outage, the TCRWWTP administration building generator supplies power to very critical equipment. Without a properly functioning cooling system, the generator would overheat and become inoperable.</p>	COMPLIANCE (FINANCIAL)

Protecting Traverse City with superior permit management and regulatory compliance

More than 1.9 billion gallons of wastewater were treated at the TCRWWTP in 2020-2021. During this time, the facility produced a high-quality effluent that met, and for many parameters, exceeded permit requirements. A detailed summary of TCRWWTP's effluent compared to permit requirements is provided in Appendix A. Exhibit 5 is a graphical depiction of the total flows treated at the facility each year for the past five years. From 2016 to 2021, there has been an 11 percent increase in the volume of flow treated at the facility and a 10 percent decrease in this year compared to last year.

Exhibit 5

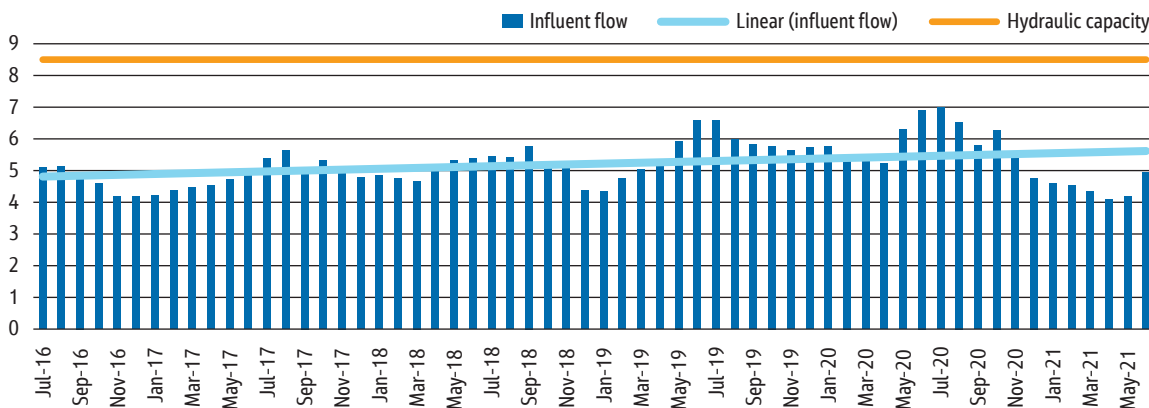
Total gallons of wastewater treated annually, billion gallons



Facilities are designed with a certain hydraulic (flow) and organic (BOD) loading capacity. The monthly average flow loading capacity of the TCRWWTP is 8.5 million gallons per day (mgd). Exhibit 6 compares the facility's flow capacity with monthly average influent rates for the past five years. The average influent flow rate for July 2016 through June 2021 amounts to roughly 61 percent of the plant's capacity. Average influent flow rates in 2019-2020 and 2020-2021 represent 68 percent and 61 percent of the plant's flow capacity respectively. During this five year period, the highest monthly average flow rates were experienced in June and July of 2020. When compared to plant flow capacity, the average influent flow for these months ranged from 81 percent-82 percent of the plant capacity. **Since July 2016, average influent flow rates were at 61 percent of the facility's hydraulic capacity.** The Michigan Department of EGLE requires that when a facility is within 80 percent of its design capacity for a sustained period of time, a plan be devised to either add capacity to a facility or reduce loadings.

Exhibit 6

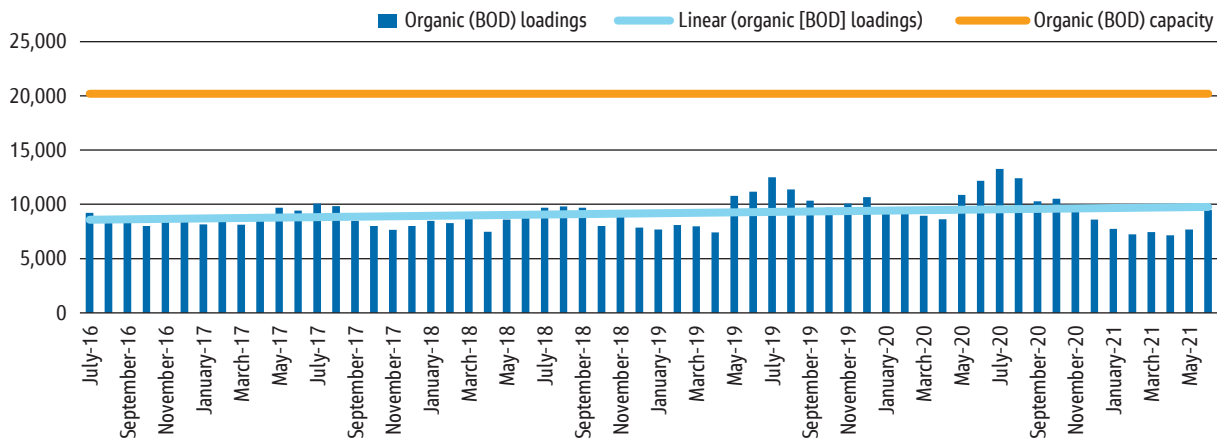
Hydraulic capacity compared to actual flow rates, mgd



The organic loading of pollutants is the measure of the presence of BOD in the waste stream entering the treatment facility in pounds per day (lbs./day) and represents the strength of the wastewater. The BOD loading capacity for the TCRWWTP is 20,200 lbs./day. Exhibit 7 compares the facility's designed organic loading capacity with actual influent loadings. On average, over the past five years, influent BOD loadings amounted to 45 percent of the facility's capacity. **In 2020-2021, the average influent organic loadings amounted to 46 percent of the facility's organic loading capacity equating to a five percent decrease from 2019-2020's average loading capacity of 51 percent.**

Exhibit 7

Organic loading capacity compared to actual organic loadings, pounds/day



Helping the City weather the storm – emergency and contingency response

We experienced a historic rain event on October 22, 2020 continuing into the following day. With the watershed already saturated, the storm resulted in increased infiltration and inflow to the collection system amount to an **influent flow at the facility of 12.3 mgd on October 23. The facility is designed to handle 8.5 mgd.** Our Emergency Response Plan and preparedness ensured 100 percent permit compliance during this operational challenge.



Membrane system before the storm.



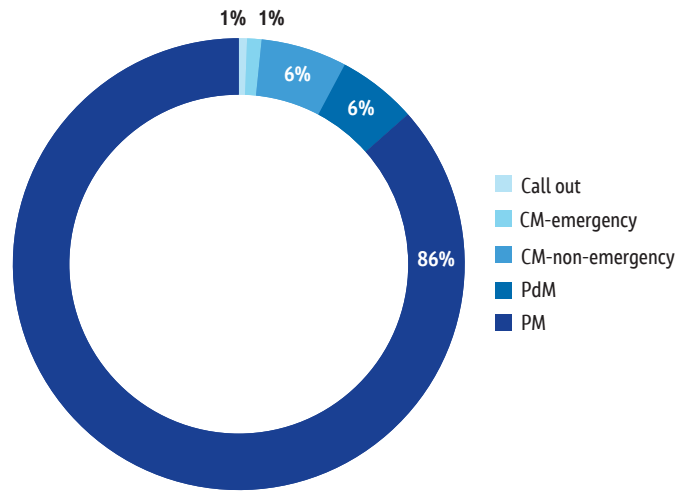
Membrane system flooding during storm.

Maintenance/Asset management

Jacobs skilled and dedicated team, both on-site and throughout Jacobs' O&M group, is comprised of several reliability-centered maintenance certified technicians, as well as Certified Reliability Leaders. Jacobs' CMMS, the corner stone of our equipment management strategy, is designed to sustain a high level of equipment performance and reliability while extending the lifecycle of the assets (equipment). This equipment tracking tool includes an asset registry, provides maintenance and repair scheduling and tracking, allows for inventory control and retains the history of the equipment's condition. All of which, decrease compliance vulnerabilities by enhancing our ability to plan necessary purchases, maximize equipment performance and minimize equipment downtime.

In 2020-2021, our team completed 3,393 work orders, 3,615 actual hours. With 92 percent of the maintenance activities being predictive or preventative in nature, while eight percent were corrective. **Jacobs 92/8 PM/CM ratio well exceeds the industry standard 80/20 ratio as shown in Exhibit 8.**

Exhibit 8
Maintenance work order summary



As shown in Exhibit 9, **we have consistently exceeded the industry standard** for the past five years.

Exhibit 9
Jacobs' maintenance activities compared to industry standard

Year	Planned work order percentage
2020-2021	92 percent
2019-2020	93 percent
2018-2019	94 percent
2017-2018	95 percent
2016-2017	93 percent
Industry standard	80 percent



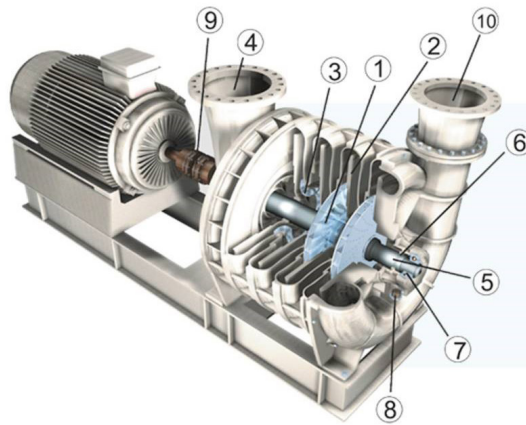
The Proactive Maintenance Advantage

During a routine blower inspection, our mechanic noticed milky oil in the site glass of aeration blower 1. The milky oil was an early sign of seal failure.

Catching the seal failure early allowed for the blower to be rebuilt rather than replaced, reducing the cost of this project by roughly \$14,000.



Blower 1 seal fail.



- 1: Impeller
- 2: Intermediate Section
- 3: Baffle
- 4: Inlet Flange
- 5: Shaft
- 6: Shaft Sealing
- 7: Ball Bearing
- 8: Oil-/Grease-Lubrication
- 9: Coupling
- 10: Outlet Flange



Blower 1 diagram.

We reconfigured the Hull Park control panel. The reconfiguration simplified the controls, increasing the reliability of the lift station and decreasing vulnerabilities. **Jacobs performed the reconfiguration saving the City \$1,500.**



Hull Park control panel reconfiguration.

Safety

Jacobs' focus on safety and worker well-being—known as BeyondZero™—empowers our employees to create and sustain a positive, safe and healthy work environment by fostering a culture in which associates look out for one another at all times. Our Jacobs developed site-specific work safety control plan defines our team's safety responsibilities which include the development of Activity Hazard Analysis (AHA's) for routine and non-routine tasks. We reference these AHA's in our daily pre-task plans (PTP) which are created and reviewed by all associates at our morning safety meetings. The PTP helps the team define hazards present that day and spells out the personal protective equipment (PPE) needed to guard against or eliminate those hazards. We are proud to report the result of the above-described effort is: **more than 480 days, or 11,520 hours, since our team has experienced an Occupational Safety and Health Administration (OSHA)-recordable incident.**



BeyondZero is about keeping our people safe. That means not getting injured, not allowing others to be injured and not allowing unsafe practices, behaviors or conditions to exist. It's about creating a culture of caring by actively engaging and involving employees and influencing their beliefs and behaviors.



COVID-19 response and prevention

Through the last year, we had zero workplace related COVID exposures or cases at the facility. The COVID-19 pandemic added to the challenge of maintaining a safe work environment. To better control the risk of staff exposure, ensure continuity of operations and maintain access to vital supplies and services; we established a Continuity of Operations plan early in the year. Among other things, the plan included scheduling modifications designed to maintain physical distancing and minimize contact between team members. We also screened everyone, checking temperatures and symptoms before starting work shifts, and we conducted safety briefings and meetings via conference calls to avoid larger gatherings.

Sustainability – together aiming higher for a more sustainable future

A leader in sustainable approaches, Jacobs is constantly looking for opportunities to help Traverse City become more sustainable. Key efforts implemented by Jacobs at TCRWWTP include:

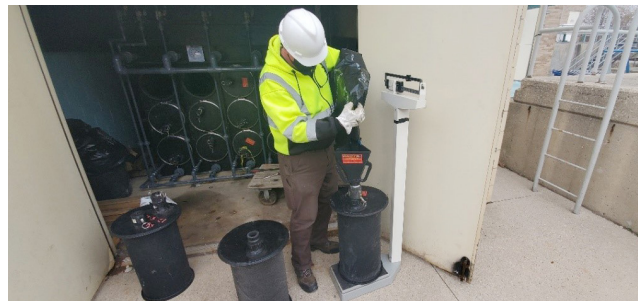
- Permeate (plant effluent) reuse in different process areas **reducing City water usage by roughly 37 million gallons in 2020–2021**. An increase of roughly 10 million gallons compared to 2019-2020.
- **The upgrade of Digester 3's mixing system saved an estimated 2,234 kWhs** equating to approximately \$1,172 in the first seven months of operation.
- Methane gas, a byproduct of the sludge stabilization that takes place in the anaerobic digesters, is used to heat the digesters, as well as the administration building. This reduces the use of natural gas at the facility.
 - We also perform preventive maintenance on the natural gas and methane systems verifying there are no leaks and all the related equipment is working.
 - The thermostats in auxiliary buildings are set at temperatures that will prevent freezing and damage to the equipment but minimize gas consumption.
- The biosolids, the nutrient rich solids byproduct of wastewater treatment that has been stabilized in the digesters, are reused in the fertilization of farm fields helping to grow crops not meant for human consumption and in accordance with regulatory requirements.
- Replaced the carbon within our carbon odor cannisters with material made from coconut shells. In conjunction with the modifications we previously made to the cannisters, making them reusable versus replacing the full cannister as designed, makes the process largely sustainable and reduces ongoing maintenance costs.
- Recycled:
 - Used oil
 - 131 pounds of UV ballasts.
 - 30 gallons of paint.
 - 210 IV and florescent bulbs.



Digester 3 rehabilitation – exterior.



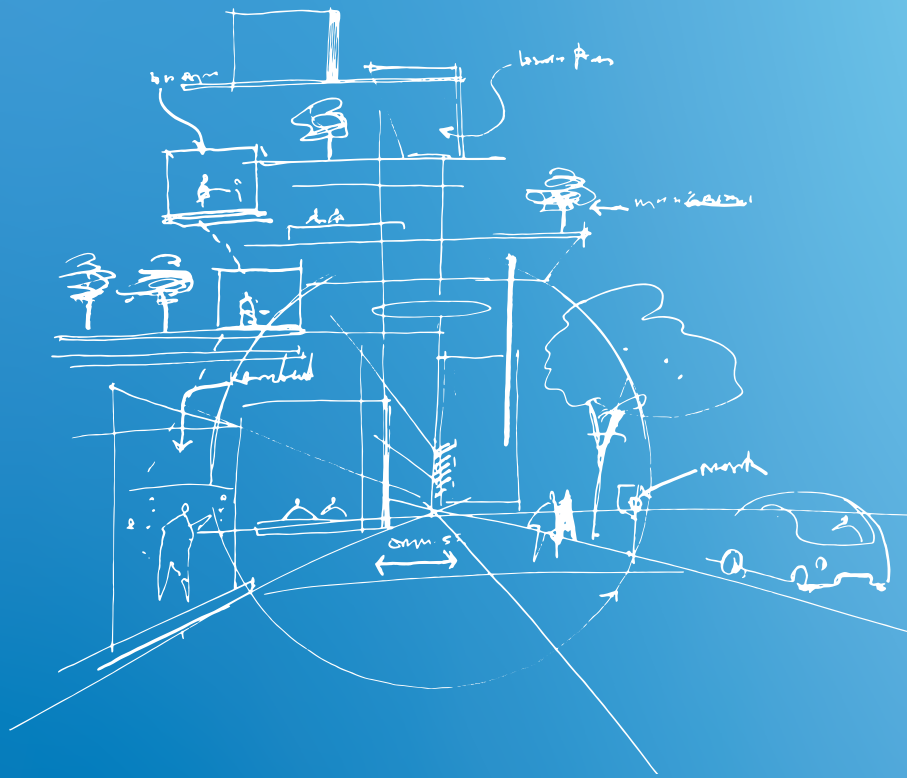
Digester 3 rehabilitation – interior.



Odor control canisters – activated carbon replacement.



Recycling.



Community involvement

Our team takes great pride in being involved members of our community. Unfortunately, in 2020-2021, many of our typical public/community service events were cancelled or postponed. We look forward to the day when we can all safely gather and participate in a more engaged way.

In the meantime, we were able to financially contribute to the following non-profits.

- \$1,000 Inland Seas and Grand Traverse Watershed
- \$1,500 Traverse Area Community Sailing (TACS)

Financial overview

Jacobs is dedicated to providing quality service in the most fiscally responsible manner possible. We appreciate that the City has many financial demands and strive to minimize the expense of operating and maintaining the wastewater treatment plant. Exhibit 10 is a summary of our yearend operational and maintenance expense totals.

Exhibit 10

Contract year 31 reconciliation summary

Traverse City CY31 (2020-2021)	CY31 annual budget	Yearend actuals	Yearend balance
Ferric chloride (Phosphorus removal to meet permit-Increased flow, led to a need to increase ferric chloride and thus increased amount spent on this line item.)	\$117,369.00	\$146,741.21	(\$29,372.21)
Electricity (Increased flow, led to an increase in electrical consumption, and thus increased the amount spent on this line item.)	\$461,004.00	\$502,725.02	(\$41,721.02)
Repairs (This line item only includes materials used for repairs that were not performed as an out of scope. Out-of-scope repairs are, per our contract, repairs that amount to \$9,000 or greater.)	\$125,000.00	\$275,814.29	(\$150,814.29)
Total	\$703,373.00	\$925,280.52	(\$221,907.52)



Looking forward

As we look to the next year, our team is thrilled about working side by side with the City in the implementation of the capital improvement plan for the TCRWWTP and related lift stations. Projects currently scheduled for the coming fiscal year include:

- Upgrading the administration building heating, ventilation and air conditioning system (HVAC)
- Painting the facilities cranes, hoists and ferric chloride tank
- Engineering studies at the Front Street, Birchwood, Bay Street, Woodmere and Riverine lift stations
- Replacement of the primary header
- Refurbishing the third membrane system scour air blower
- Upgrading boiler controls and adding methane gas metering
- Engineering study related to the upgrade of the UV system
- Replacement of township auto samplers

Important to note is that the second membrane replacement project, CIP #1044, is scheduled to commence in the 2025-2026 fiscal year.

Jacobs and the City have worked together for more than three decades to create a mutually beneficial partnership.

Together, with the utilization of institutional knowledge and cohesive communication, we have successfully reduced operational vulnerabilities, exceeded performance expectations and worked through countless challenges. We enthusiastically embrace the opportunities the coming years will bring to further demonstrate the advantages of our effective collaboration.

Appendix A

Exhibit A-1**2020-2021 IPP, significant industrial user (SIU) and categorical industrial user (CIU) inspections and highlights**

Date	Discharger
2/20/2020	AlcoTec Wire
7/17/2020	Munson Support Services
7/20/2020	CRM Inc.
9/3/2020	CRM Inc.
9/9/2020	Munson Medical Center
9/14/2020	Sara Lee Frozen Bakery LLC
10/7/2020	Munson Support Services
11/6/2020	Munson Medical Center
11/24/2020	Sara Lee Frozen Bakery LLC
11/24/2020	AlcoTec Wire
12/14/2020	Great Lakes Stainless
2/23/2021	Munson Support Services
3/24/2021	Sara Lee Frozen Bakery LLC
3/25/2021	Great Lakes Stainless
3/31/2021	Munson Support Services
5/21/2021	Great Lakes Stainless
7/27/2021	Sara Lee Frozen Bakery LLC
7/27/2021	CRM Inc.

Highlights

Industrial user survey	In October of 2020, we began collecting industrial user data through the periodic Industrial User Survey. This mailing goes out to all commercial water users to identify if any new or existing industries require further oversight by the Control Authority. Current survey responses have resulted in the identification of two industries needing to modify their waste stream disposal practices to comply with the Sewer Use Ordinance.
Additions to IU list	Eight additions to the industrial user list were made based on preliminary results from the IU survey in February 2021. The list identifies facilities that pose a minimal risk to the publicly owned treatment works (POTW) and may require oversight, such as spill plans, inspections, or sampling. Industries on this list are also billed an annual fee for IPP cost recovery.
SIU base	In April 2021, one of four discharging SIU's (Munson Support Services [MSS]) ceased all operations and was removed from the SIU list. The facility's permit was revoked due to their compliance history. Traverse City now oversees three discharging SIUs and two zero-discharge CIUs.
State IPP network	Traverse City joined the state IPP network, which holds monthly conference calls and sends regulatory updates via a Listserv. Being a part of this network provides us additional resources and the opportunity to network with IPP coordinators and regulatory staff throughout the state.
Brownfield groundwater dewatering	The IPP oversaw three construction dewatering projects from 2020-2021. This included permitting, performing inspections and site testing. Discharge from Brownfield sites are tested weekly to ensure compliance with local regulations.

Exhibit A-2

Plant performance compared to permit requirements

Parameter description	Effluent permit limit	Plant effluent quality	Importance
Carbonaceous biochemical oxygen demand (CBOD) – the measure of the amount of pollutants present in plant effluent.	85% removal/monthly average concentration of 25 milligrams per liter (mg/L).	>99% removal/maximum monthly average concentration <2.0 mg/L (refer to Appendix A, Exhibits A-3 and A-4).	When BOD concentrations in the effluent are high, it can lead to decreased dissolved oxygen (DO) in the receiving stream adversely affecting the health of the fish and other aquatic organisms.
Total suspended solids (TSS) – the measure of material suspended in a known volume of water that is trappable in a filter.	85% removal/monthly average concentration of 30 mg/L.	>98% removal/maximum monthly average concentration <1.0 mg/L (refer to Appendix A, Exhibits A-3 and A-4).	High TSS concentration in the effluent discharged to the receiving stream can block sunlight, decreasing the growth of vegetation in water ways and can even kill the vegetation. This vegetation produces the dissolved oxygen needed to support life in a body of water. Reduced vegetation would impact the health and growth of other organisms, such as fish. In addition, the decrease in water clarity caused by TSS can affect the ability of fish to see and catch food. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease and prevent egg and larval development.
Total phosphorus (TP) – the measure of organic and inorganic phosphorus compounds in water.	Monthly average concentration of .5 mg/L.	Maximum monthly average concentration 0.5 mg/L (refer to Appendix A, Exhibit A-5) Note: The addition of ferric chloride is used to remove total phosphorus from the wastewater. To reduce the expense of purchasing ferric chloride, we monitor the concentration of total phosphorus in the plant effluent closely and only add ferric chloride as needed to meet the permit requirement.	Phosphorus is an essential element for plant life, but when there is too much of it in water, it can cause eutrophication. Eutrophication is when a body of water becomes over enriched with nutrients. It often leads to algae blooms that disrupt the normal ecosystem functioning of a body of water. The algae blooms consume available oxygen and reduce sunlight in marine environments, resulting in the death of many aquatic organisms including fish.

Parameter description	Effluent permit limit	Plant effluent quality	Importance
Ammonia nitrogen (NH ₃ -N) – the measure of the amount of ammonia, a toxic pollutant often found in landfill leachate and in waste products, such as sewage, liquid manure and other liquid organic waste products.	Monthly average concentration of 11 mg/L. Limit is effective May–September of each year.	Maximum monthly average concentration <1 mg/L (refer to Appendix A, Exhibit A-5).	NH ₃ -N in excess of recommended limits is toxic to humans and other organisms.
DO – the measure of the amount of oxygen in water.	DO concentration limit (September 1–May 31) 4 mg/L/DO concentration limit (June 1 – August 31) 6 mg/L.	Plant effluent minimum dissolved oxygen concentration 7.2 mg/L (refer to Appendix A, Exhibit A-6).	Low DO primarily results from excessive algae growth caused by phosphorus. This can result in insufficient amounts of dissolved oxygen available for fish and other aquatic life. Die-off and decomposition of submerged plants also contributes to low dissolved oxygen.
pH – the measure of how acidic/basic water is.	Minimum pH limit 6.0 standard units (s.u.)/Maximum pH limit 9.0 s.u.	Minimum pH value 6.7 s.u./maximum pH Value 7.4 s.u. (refer to Appendix A, Exhibit A-7).	Extremes in pH can make waterways inhospitable to life. Acidic water also speeds the leaching of heavy metals harmful to fish.
Fecal coliform – fecal coliform by themselves are usually not pathogenic; they are indicator organisms, which means they may indicate the presence of other pathogenic bacteria.	Plant effluent fecal coliform monthly geomean limit 200 counts/100 milliliters (mls).	Plant effluent fecal coliform maximum monthly geomean <1 counts/100mls (refer to Appendix A, Exhibit A-8).	The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals.
Silver (Ag) – amongst other uses, is a byproduct of traditional photography found in photo fixer.	Monthly average concentration limits were 5.3 micrograms per liter (ug/L). Silver sampling requirements were reduced to annually per the new NPDES permit, issued November 2020.	Plant effluent maximum concentration was <0.2 ug/L (refer to Appendix A, Exhibit A-9).	Ag in excess of recommended limits is toxic to aquatic organisms.
Copper (Cu) – amongst other uses, is a byproduct of metal and electrical manufacturing.	Monthly average concentration limit 70 ug/L. Copper monitoring limits were added to the new NPDES permit, issued November 2020.	Plant effluent maximum concentration was 36 ug/L (refer to Appendix A, Exhibit A-10).	Cu in excess of recommended limits is toxic to aquatic organisms.

Exhibit A-3

2020-2021 TCRWWTP percent removals versus NPDES permit requirement

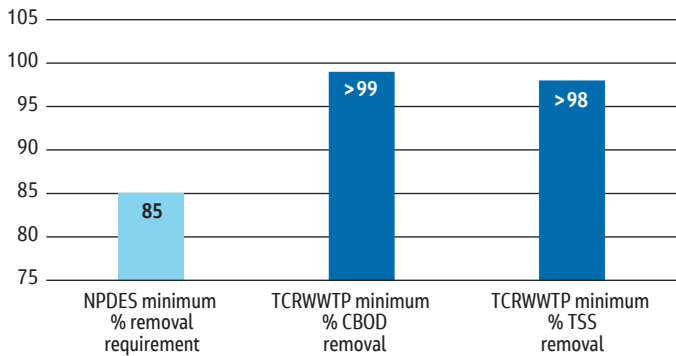
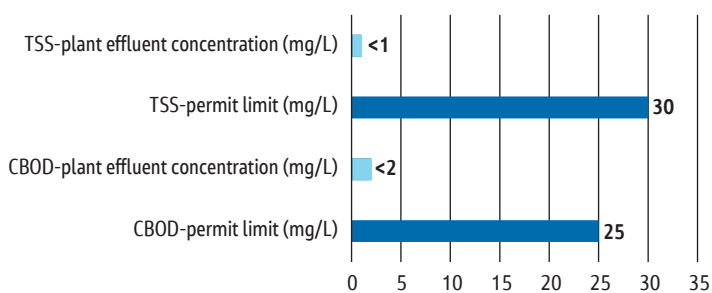


Exhibit A-4

2020-2021 plant effluent maximum monthly average CBOD and TSS concentrations versus NPDES permit monthly average concentration requirements



TP is primarily removed from the waste stream with the use of ferric chloride. Ferric chloride feed rates are flow paced to help ensure permit compliance while conserving chemical and reducing costs.

Exhibit A-5

2020-2021 plant effluent maximum monthly average nutrient concentrations versus NPDES permit monthly average concentration requirements

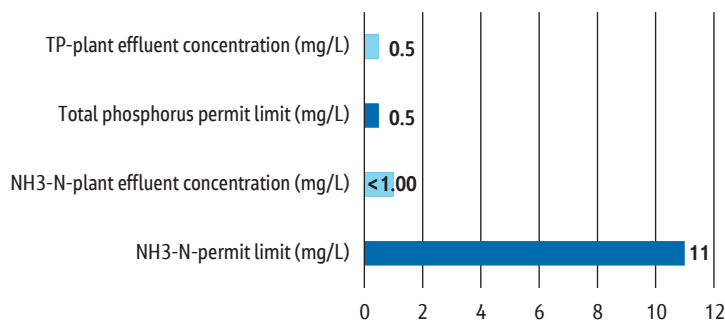


Exhibit A-6

2020-2021 plant effluent minimum DO concentration versus NPDES permit requirement

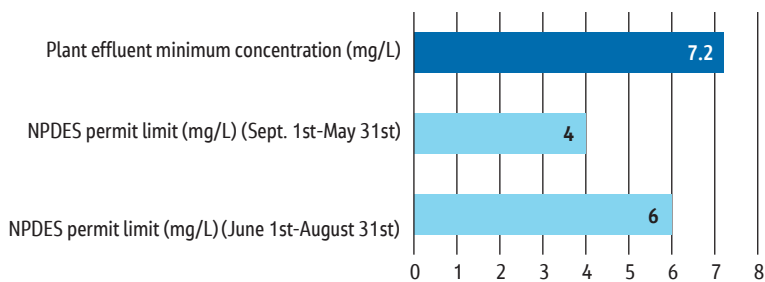


Exhibit A-7

2020-2021 plant effluent maximum and minimum pH values versus NPDES permit limits

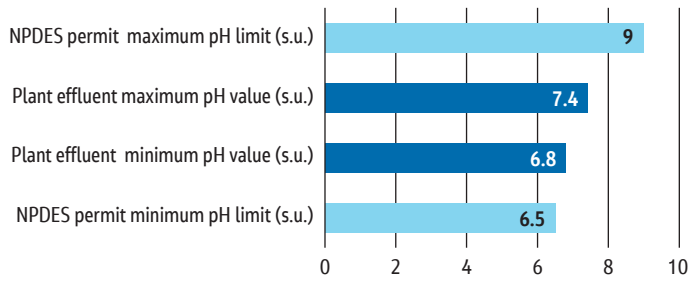


Exhibit A-8

2020-2021 plant effluent maximum fecal coliform geomean versus NPDES permit effluent requirement (counts/100mls)

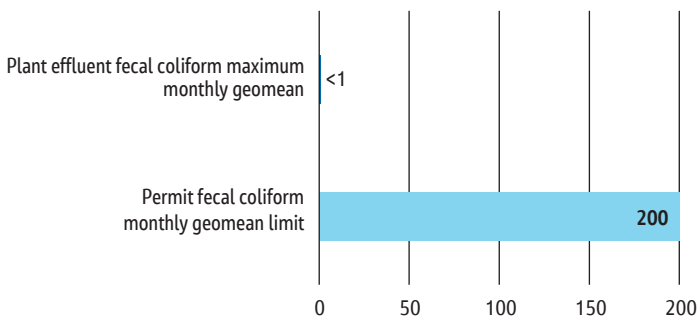


Exhibit A-9

2020-2021 plant effluent maximum silver concentration versus NPDES permit silver concentration requirement (ug/L)

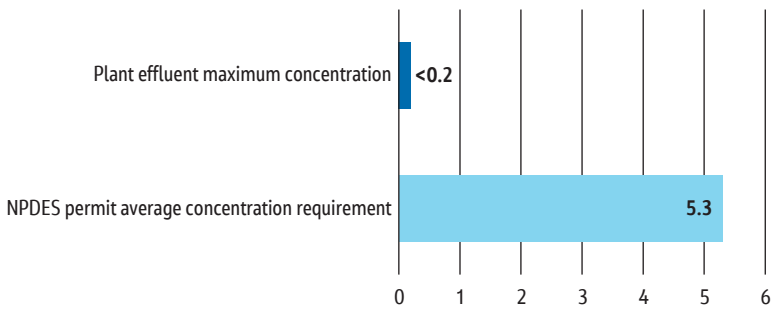


Exhibit A-10

Jacobs TCRWWTP repair expenses summary

Repair	Expense
Total of all repair expenses (purchased by Jacobs or City)	\$581,261
Jacobs repair expenses 2020-2021	
Total of all repair expenses paid by Jacobs	\$275,814
Jacobs' repairs budget FY 2020-2021 (included in annual contract)	\$125,000
Jacobs' repairs budget balance FY 2020-2021	(\$150,814)
Repair expenses paid for by City	
Digester #5 recirculation pumps – replacement rotating assembly, received	\$20,663
TCRWWTP and lift stations – Phase Loss Study, complete	\$14,050
Front Street lift station – spare rotating assembly with reverse rotation impeller, received	\$31,280
Spare pump assembly for the gravity belt concentrator's (GBC's) discharge pump, received	\$36,918
Aeration basin – repair of two flygt mixers, received repaired mixers	\$11,940
Alarming/callout upgrades at 7 of the City-owned lift stations	\$32,330
Membrane train drain pump spare rotating assembly	\$35,569
Switch gear repairs	\$67,765
Replacement cooling system for Administration building generator	\$20,767
Rehabilitation of the east biosolids building sump station	\$19,910
WWTP and lift station – Arc Flash and Coordination Study	\$15,900
Total	\$307,092
Repair expenses paid for by Jacobs	
GBC discharge pump drive shaft	\$5,119
Blower #2 motor repair	\$1,349
Hull Park replacement and spare pumps	\$3,339
Replacement vacuum pump	\$6,391
Spare vacuum pump	\$6,391
Spare turbidity meter parts	\$1,656
Isolation valves for Birchwood lift station	\$6,680
Replacement gear box for GBC discharge pump	\$1,880
Rebuild of GBC discharge pump shaft assembly	\$2,562
Spare adjustable speed drive – for backpulse and permeate pumps	\$5,026
Replacement parts for organic return pump – west grit chamber	\$5,916
Replaced biosolids storage tank #2's yard valve	\$1,083
Emergency response to power outage	\$1,780
Programming added to shut off primary pumping if sieve drum concentrator hopper is high level	\$1,525
Aeration basin mixer repair	\$7,980
Aeration basin mixer repair	\$7,980
Permeate effluent structure extension	\$3,876
Connection for bypass pump	\$3,191
Coast Guard lift station replacement pump	\$8,434
Autoanalyzer maintenance/repair service agreement	\$4,510
Front Street lift station electrical repair	\$1,300
Aeration basin flygt mixer repair	\$2,995
Addition of surge protection at Front Street and Bay Street lift stations	\$3,000
Front Street lift station variable frequency drive (VFD) troubleshooting	\$1,122
Biannual boiler servicing	\$3,021
Repair parts for influent automatic screening	\$5,802
Purchase, install and programming of new human machine interface (HMIs) for US filter polymer units	\$4,500
Front Street lift station soft start upgrade	\$8,200

Repair	Expense
Front Street lift station rain gauge alarming system purchase and install	\$5,796
Tarps to cover membrane trains to prevent freezing	\$1,239
New BOD incubator	\$4,269
Gate repairs	\$1,080
Coast Guard replacement pump	\$8,434
Replacement shafts for the primary clarifier drives	\$1,950
Repair of VFD for the influent automatic screen	\$1,826
Coolant flushing and refill for the Administration building generator	\$1,260
Front Street lift station – pump soft start replacement	\$2,200
New SCADA system firewall	\$1,572
Birchwood lift station – generator status alarm added	\$1,135
Replacement valves for the membrane vacuum system	\$1,542
Screw compressor – replacement oil cooler	\$1,103
Luminescent dissolved oxygen (LDO) replacement caps	\$1,072
Relocation of influent autosampler	\$1,273
East loadout basement cleanup resulting from sump failure	\$1,922
Sieve drum concentrator – replacement gearbox and motor assembly	\$4,642
Membrane train level transmitter	\$2,732
Replacement carbon for odor control canisters	\$2,935
Digester 5 transfer pump – spare parts	\$4,380
Digester 3 linear mixer – spare parts	\$6,266
Automatic bar screen – spare scraper comb and lower bearing assembly	\$6,942
Sieve drum concentrator booster pump	\$2,101
Repaired chemical room heater	\$1,949
New SCADA console	\$1,032
North moyno gear box rebuild	\$1,548
New autoclave for permit required laboratory analysis	\$6,925
Churne balls for Primary Header Emergency Response Plan (should it need to be executed)	\$6,050
Input cards for membrane train PLCs	\$1,522
Repair membrane chemical room HVAC system e-stop	\$1,303
Spare W3 – used for reuse of plant effluent (permeate)	\$6,907
Backflow preventor repair	\$1,750
UV system modification change order	\$1,810
Total repair expenses >\$1,000	\$215,075
Total repair expenses <\$1,000	\$60,739

Exhibit A-10 (continued)

Jacobs TCRWWTP repair expenses summary

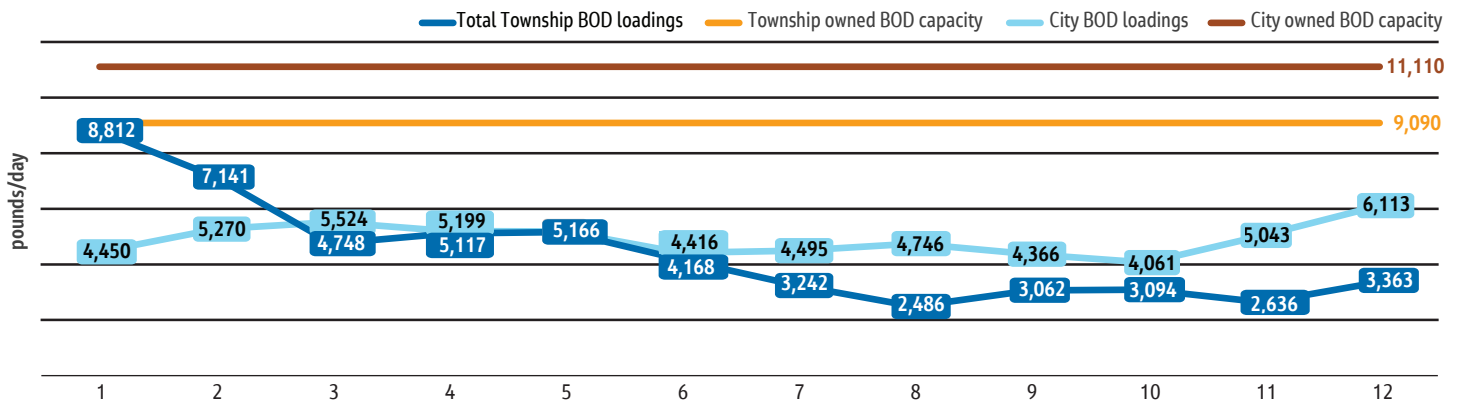
Item	Estimated expense	Comments
Commission approved CIP Items for 2020-2021		
Front Street, Birchwood and Bay Street Lift Station Condition Assessment and Engineering Study (CIP 1000)	\$30,000	Request for Proposals (RFP) to be issued.
Engineering study pertaining to the facility plan (CIP 1019)	\$54,600	Partial scope of work – \$16,000 – task 1, and part of tasks 2 and 3 awarded to Hubbell, Roth and Clark, Inc.; \$8,900 – additional scope added to Task 1 to evaluate replacement of the 8 primary clarifiers with 2 circular clarifiers; \$2,200 – additional cost to evaluate primary header condition by excavating areas of concern and performing ultrasonic testing; \$27,500 – additional cost to determine if primary tanks should be refurbished or replaced, and a related cost comparison – complete for facility headworks.
UV system and related structure modification (CIP 1018)	\$236,000	EGLE issued ACO to execute modifications. This project will allow time to save funds for the system upgrade, also included in the ACO, estimated to cost \$3,500,000 – modifications complete May 2021.
Screw pump #1 repair	\$249,851	Complete July 6, 2021 – City Commission approved the City pay \$249,851.07 of the repair expense. total repair expense was \$389,851.07.
One scour air blower overhauled (CIP 1073) – first blower replaced August 2019, second blower replaced August 2020	\$45,000	City has agreement with Aerzen (the vendor of the scour air blowers) to overhaul one scour air blower per year. There are three more blowers to replace. The cost will increase by 4% each year – complete for 2020.
Digester 3 reconditioning (CIP 948)	\$916,409	Expenses will be incurred in fiscal years 2019-2020 and 2020-2021 – complete.
Membrane replacement (CIP 890) and membrane gate replacement (CIP 786)	\$890,000	Eighth train of new membranes installed-October 2020-CIP 890 is complete. Note: second membrane replacement project is in the City's CIP to commence in 2025-2026.
Total 2020-2021	\$2,421,860	

Exhibit A-11

Total average BOD Loadings

Traverse City and Grand Traverse County Townships- Daily Average BOD Loadings (lbs/day) 2020-2021												
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Garfield Township	3,172	3,358	3,461	3,125	3,414	3,051	3,091	3,251	2,846	2,471	3,252	3,765
Peninsula Township	54	56	58	50	51	49	49	48	49	48	55	65
Elmwood Township	383	548	469	498	568	464	403	418	361	320	425	541
Acme Township	542	655	582	684	471	356	454	399	425	455	556	584
East Bay Township	300	654	955	842	677	496	498	631	685	768	756	1,157
Traverse City	8,812	7,141	4,748	5,117	5,166	4,168	3,242	2,486	3,062	3,094	2,636	3,363

Traverse City and Grand Traverse County Townships- Total Daily Average BOD Loadings (lbs/day) 2020-2021												
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Total Township BOD Loadings	4,450	5,270	5,524	5,199	5,182	4,416	4,495	4,746	4,366	4,061	5,043	6,113
Township Owned BOD Capacity	9,090	9,090	9,090	9,090	9,090	9,090	9,090	9,090	9,090	9,090	9,090	9,090
City BOD Loadings	8,812	7,141	4,748	5,117	5,166	4,168	3,242	2,486	3,062	3,094	2,636	3,363
City Owned BOD Capacity	11,110	11,110	11,110	11,110	11,110	11,110	11,110	11,110	11,110	11,110	11,110	11,110



Starting in July 2019, we believe high water levels were resulting in an increase in inflow and infiltration, which is diluting the plant influent BOD concentration and skewing the City's BOD loading. For this reason, the plant influent BOD loadings from July 2020 through January 2021 were calculated using the average BOD concentrations for these months for the 5 years prior to 2019. City staff are actively addressing infiltration and inflow. In May 2020, the crack in the sewer pipe along Front Street was repaired. In September 2020, the Front Street lift station passive bypass isolation gate was installed and locked in the closed position. In addition, the City is in the process of identifying and addressing illegal storm water connections.

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