Executive Summary
BACKGROUND, DRIVERS, PURPOSE, OBJECTIVES

The City of Missoula has owned and operated the wastewater utility since 1962. Throughout its operation, the utility has been well managed, maintained and currently has one of the lowest sewer rates in the state. Over the past 20 years, the City has completed a number of planning, design, and construction projects that have continued the City’s investment in its wastewater facilities.

Drivers

- Assess current and future capacities of the collection system and recommend improvements for identified deficiencies
- Develop and provide a collection system model as a planning tool for the City
- Assess the existing WWTP hydraulic and treatment capacity for current and future flows, loads, and permit requirements using process modeling
- Develop WWTP treatment and disposal alternatives to meet future flow, load, and permit requirements
- Provide an updated CIP for collection and treatment systems

Purpose

The Wastewater Facility Plan provides the foundation and guidance for identification of needed maintenance and upgrade projects for the collection system and wastewater treatment plant in the fulfillment of the utility strategic goals.

The Plan helps prioritize projects to be completed within the next five years and identify areas that will require further study in the context of actual future conditions before implementation within ten or fifteen years.

Objectives

- Develop planning values for future wastewater flows and loads based on historical wastewater data and population growth projections provided by the City of Missoula
- Provide an updated CIP for collection and treatment systems

Background

<table>
<thead>
<tr>
<th>Year</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>Sewer main jetting and root cutting program initiated, 210 miles annually</td>
</tr>
<tr>
<td>2000</td>
<td>24 Lift station upgrades or additions</td>
</tr>
<tr>
<td>2000-2019</td>
<td>$17 million upgrade (provided nutrient removal for a capacity up to 12 mgd)</td>
</tr>
<tr>
<td>2001</td>
<td>Implementation of annual collection and STEP tank maintenance program</td>
</tr>
<tr>
<td>2002</td>
<td>Solid handling upgrades</td>
</tr>
<tr>
<td>2004</td>
<td>Hybrid poplar demonstration project and expansion to full size</td>
</tr>
<tr>
<td>2006</td>
<td>Missoula Wastewater Treatment Plant Odor Characterization Study</td>
</tr>
<tr>
<td>2008</td>
<td>Biosolids Evaluation for the City of Missoula Wastewater Treatment Plant</td>
</tr>
<tr>
<td>2009</td>
<td>Solids handling upgrades</td>
</tr>
<tr>
<td>2010</td>
<td>Sewer collection main installation in Rattlesnake area</td>
</tr>
<tr>
<td>2012</td>
<td>Missoula Wastewater Facilities Plan Update – focused on treatment only</td>
</tr>
<tr>
<td>2014</td>
<td>Headworks upgrade including influent flow measurement, TWAS odor control installation, effluent measurement upgrade, addition of septage receiving station</td>
</tr>
<tr>
<td>2016</td>
<td>Compost Facility evaluation, purchase, and transitional facility</td>
</tr>
<tr>
<td>2018</td>
<td>Manhole and sewer main repair as needed; 80 manholes and 40 miles of sewer main annually</td>
</tr>
<tr>
<td>2019</td>
<td>Installation of Co-generation facility for digester gas</td>
</tr>
<tr>
<td>On-Going</td>
<td>Comprehensive Wastewater Facilities Plan</td>
</tr>
</tbody>
</table>
Population
The current and future population estimates were based on the City's 2015 Long Range Transportation Plan. Available GIS data was used to distinguish between residential and non-residential (commercial, industrial) populations. Estimates were developed and used as a base for wastewater flow and load projections.

Regulatory Requirements
- WWTP discharge is permitted through MDEQ.
- The plant has been meeting all limits with few exceptions.
- There are no regulatory concerns for the near future.
- MDEQ may develop stricter nutrient limits within the next decade.
- Alternatives addressing treatment for stricter nutrient limits were explored in this Facility Plan.

Wastewater Flows
2017 Wastewater Flows:
- Based on WWTP Influent for 2015-2017
- Expressed as per capita values for residential & non-residential population

2037 Wastewater Flows:
- Based on projected 2037 population and 2017 per capita flow

Residential Flow:
- 2017 Per Capita: 60 gpd
- 2017 Average: 4.08 mgd
- 2037 Average: 6.94 mgd

Non-Residential Flow:
- Per Capita: 27 gpd
- 2017 Average: 1.53 mgd
- 2037 Average: 2.59 mgd

Infiltration:
- 2017 Average: 1.66 mgd
- 2037 Average: 1.66 mgd

Influent Flow:
- Overall Per Capita: 83 gpd
- 2017 Average: 7.27 mgd
- 2037 Average: 11.2 mgd

BASIS OF PLANNING

Study Area
It was assumed that by 2037, the City would serve all residents within the 2037 wastewater service area.
**EXISTING COLLECTION SYSTEM DESCRIPTION & ANALYSIS RESULTS**

Missoula Wastewater Collection System

### Collection System by the Numbers

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Active STEP Systems</td>
<td>1,420</td>
</tr>
<tr>
<td>Active Community Tanks</td>
<td>13</td>
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<tr>
<td>STEP System Cleaning Frequency</td>
<td>12</td>
</tr>
<tr>
<td>Annual Sewer Main Repairs</td>
<td>42</td>
</tr>
<tr>
<td>Annual Manhole Repairs/Replacement</td>
<td>78</td>
</tr>
<tr>
<td>Annual Sewer Main Cleaning</td>
<td>210</td>
</tr>
</tbody>
</table>

### Capacity Analysis

Overall, the existing collection system mains and lift stations are adequately sized to convey the average day and maximum day flows. A few deficiencies exist at maximum day conditions:

- Capacity deficient mains: less than 5%
- Lift stations recommended for capacity monitoring: 3

Model results identify potential trouble spots to be included in future field study and planning.

#### Gravity Main Capacities at 2017 Maximum Day Conditions

- **Adequate:** 50% - 100% full
- **Deficient:** 75% - 100% full
- **Deficient:** > 100% full

#### Development

1. **Riverfront Triangle** - Residential / Commercial
2. **ROAM Student Living** - Residential / Commercial
3. **Millsite** - Residential / Commercial
4. **Mercantile/Residence Inn** - Commercial
5. **Linda Vista Estates** - Residential
6. **Hilview Way** - Residential

**Near-Term Developments Evaluated**

Six near-term developments were considered in conjunction with the 2017 collection system model to identify potential near-term capacity issues associated with these developments. Overall, the existing collection system is adequately sized to accommodate these developments.
2037 COLLECTION SYSTEM ANALYSIS & RECOMMENDATIONS

2037 Wastewater Collection System - Modeled Mains
A schematic collection system was modeled, consisting of about 62 miles of trunk mains with diameters of 12 inches and larger. The 24 lift stations included in the model were selected based on size and location.

Modeled Capacity
Overall, gravity mains are adequately sized for 2037 conditions, with deficiencies only increasing by 1% when compared to 2017. Model results identify capacity issues that need to be monitored and addressed as the City is growing. Lift station capacity is predicted to be affected more strongly, with seven lift stations recommended for capacity monitoring.

Near-Term Costs
Included in CIP

Long-Term Costs
Long term costs will depend on the outcome of additional recommended studies and have not been determined yet.

Legend
- 2037 Wastewater Service Area
- 2017 Active Wastewater Account Area
- Parcels
- Missoula International Airport
- Modeled Mains
  - Gravity Main
  - Force Main
  - STEP Main
  - New 2037 Mains
  - New South Central Collection System West Reserve Lift Station
  - Upsize 1,450 feet of the 30-inch north interceptor with 36-inch pipe in Clark Fork Lane
  - Upsize 1,310 feet of the 36-inch south interceptor crossing the Clark Fork River with 42-inch pipe crossing the Clark Fork River
  - Upsize 3,300 feet of 15-inch gravity main with 18-inch pipe upstream of the Caras Park Lift Station
  - Upsize 1,450 feet of 15-inch gravity main with 18-inch pipe upstream of the Caras Park Lift Station
  - Upsize 1,130 feet of the 30-inch north interceptor with 36-inch pipe in Clark Fork Lane
  - Upsize 1,210 feet of 12-inch gravity main to 15-inch pipe in 24th Avenue
  - Upsize 385 feet of 15-inch gravity main to 18-inch pipe in Lower Miller Creek Road
  - Upsize 385 feet of 15-inch gravity main to 18-inch pipe in 24th Avenue
  - Connect Linda Vista Golf Course Lift Station force main to the Reserve Street Lift Station force main
  - Upsize 2,210 feet of 12-inch gravity main to 15-inch pipe in 24th Avenue
  - Upsize 385 feet of 15-inch gravity main to 18-inch pipe in Lower Miller Creek Road
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Gravity Main Capacities at 2037 Maximum Day Conditions
- Adequate 94%
- Deficient and not Recommended for Upsizing 2%
- Deficient and Recommended for Upsizing 4%

Long-term costs will depend on the outcome of additional recommended studies and have not been determined yet.
EXISTING WASTEWATER TREATMENT PLANT EVALUATION FOR 2017 AND 2037 CONDITIONS

The Missoula Wastewater Treatment Plant has been in this location since its construction in 1962 as a simple primary treatment system. Since then, the plant has grown through multiple upgrades into a nutrient removal plant capable of consistently meeting current MPDES effluent limits. The majority of the effluent is discharged to the Clark Fork River. A portion is diverted during the irrigation season to irrigate a hybrid poplar plantation and provide resource recovery.

Hydraulic Capacity

The hydraulic capacity of the existing plant overall is adequate to treat 2037 average and maximum month flows. While the design hydraulic capacity of the plant is lower than the projected 2037 peak hour flows, hydraulic calculations show that only a few pinch points will require upgrades to increase overall plant hydraulic capacity for the projected 2037 flows.

Influent lift pumps capacity - currently being addressed
Smaller primary effluent lift pump capacity - address within 5 years
UV disinfection system hydraulic capacity - address within 5 years
UV disinfection system treatment capacity - address within 5 years
WAS thickening equipment age - address within 5 years
Side 2 clarifier hydraulic capacity for 2037 - re-evaluate in 10 years

Treatment Capacity

Current plant performance was determined based on available effluent and process data. Future plant performance was approximated using BioWin modeling. The existing plant has ample capacity for treatment of conventional pollutants (BOD, TSS) through 2037. Potential changes in operational strategies and planning for process upgrades will need to begin when flows and loads increase to about half of the projected 2037 values or about 9.2 mgd.

Near-Term

Process Equipment Improvements Timeline

Longer-Term

- Influent lift pumps capacity
- Smaller primary effluent lift pump capacity
- UV disinfection system hydraulic capacity
- UV disinfection system treatment capacity
- WAS thickening equipment age
- Side 2 clarifier hydraulic capacity for 2037
FUTURE TREATMENT PLANT ALTERNATIVE ANALYSIS & RECOMMENDATIONS

Evaluation Matrix for Alternative Development

The drivers for long-term process upgrades are increases in influent flows and loads and future permit limits. Both are unknown at this time. A combination of drivers was used to develop alternatives. In addition, alternatives to replace aging and underperforming equipment were developed.

Evaluation Scenarios

<table>
<thead>
<tr>
<th>Efficient Quality Conditions</th>
<th>Flow and Load Conditions</th>
<th>2037 Process Alternatives</th>
<th>2037 Hydraulic Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Nutrient Limits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stricter Nutrient Limits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluation Scenarios:

- Current Nutrient Limits
- Stricter Nutrient Limits
- Other

Number of Developed Alternatives:

- Process Alternatives: 6
- Discharge Alternatives: 2
- Equipment Alternatives: 6

Alternative Evaluation Criteria

- PROCESS PERFORMANCE: Treatment capacity of process alternatives as determined by BioWin modeling, specifically for nutrient removal
- FEASIBILITY: Constructability, integration into existing plant, public perception
- COST: Capital cost and power and consumables costs in addition to existing O&M costs

Evaluation Scenarios:

- Current Nutrient Limits
- Stricter Nutrient Limits
- Other

Evaluation Scenarios:

- 2037 Process Alternatives for Current Nutrient Limits
- 2037 Process Alternatives for Stricter Nutrient Limits

Comparison of Alternatives:

- 2037 Process Alternatives for Current Nutrient Limits
  - Capital Cost: $0.26 million - $7.47 million
  - Additional Annual O&M Cost: $0 – $124,000

- 2037 Process Alternatives for Stricter Nutrient Limits
  - Capital Cost: $11.8 million - $52.2 million
  - Additional Annual O&M Cost: $61,000 – $375,000

Recommendations

With few exceptions, the existing WWTP equipment is adequate for providing reliable service through the planning period. With the diversion of irrigation water to the poplar farm, overall permit compliance with nutrient limits is predicted to be achievable until flows and loads reach about half of the projected 2037 levels. Planning for nutrient removal upgrades should begin as triggered by conditions summarized below.

Ongoing

- Monitor the Montana 303(d) list for any new impairment listings for the Clark Fork River

2020-2024

- Replacement/modification of equipment as scheduled on the Missoula CIP

2022

- Check the MDEQ schedule for TMDL development to see if the Middle Clark Fork is included for development of new nutrient TMDLs; call DEQ staff to confirm; repeat 5 years later if not listed

Trigger Event 1:

- MDEQ listing of Clark Fork for Nutrient TMDL development
  - Establish ongoing communication with appropriate MDEQ personnel to be well-informed on progress and permit implications of new TMDLs
  - Check on Circular DEQ-12B and current Variance nutrient limits
  - Evaluate the value of a river study for showing impact of WWTP influent on river quality to be used in application for individual variance

Trigger Event 2:

- Annual average flows are nearing 9.2 mgd or 2027
  - Evaluate the plant’s nutrient removal performance
  - Re-evaluate projected growth rates and associated rates of increase in plant flow and load

Trigger Event 1 and/or 2 or 2027

- Begin planning for plant upgrades to ensure continued adequate nutrient removal capacity
  - Select a nutrient treatment upgrade strategy and initiate the funding/pre-design/design process

Near-Term Costs

Included in CIP

Long-Term Costs

- 2037 Process Alternatives for Current Nutrient Limits
  - Capital Cost: $0.26 million - $7.47 million
  - Additional Annual O&M Cost: $0 – $124,000

- 2037 Process Alternatives for Stricter Nutrient Limits
  - Capital Cost: $11.8 million - $52.2 million
  - Additional Annual O&M Cost: $61,000 – $375,000
CAPITAL IMPROVEMENTS PLAN, 2020-2024

This CIP includes items recommended by the Facility Plan, as well as items developed by the City. Collection system improvements were based on a combination of known issues and deficiencies identified in the Facility Plan.

### Capital Improvements

<table>
<thead>
<tr>
<th>Total</th>
<th>FY20 ¹</th>
<th>FY21</th>
<th>FY22</th>
<th>FY23</th>
<th>FY24</th>
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<tbody>
<tr>
<td>CIP</td>
<td>Sewer Development Fund</td>
<td>CIP</td>
<td>Sewer Development Fund</td>
<td>CIP</td>
<td>Sewer Development Fund</td>
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<td>------------------------</td>
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<tr>
<td>Wastewater Lab Expansion</td>
<td>$295,000</td>
<td>$295,000</td>
<td></td>
<td></td>
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<tr>
<td>Influent Pump Replacement</td>
<td>$204,545</td>
<td>$100,000</td>
<td>$53,500</td>
<td></td>
<td>$53,045</td>
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<tr>
<td>Wastewater Facility Roof Replacement</td>
<td>$150,000</td>
<td>$150,000</td>
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<tr>
<td>UV Lamp Upgrade</td>
<td>$156,560</td>
<td></td>
<td>$156,560</td>
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<tr>
<td>Primary Effluent Overflow Basin Adjustable Weir</td>
<td>$82,400</td>
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<td>$82,400</td>
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<tr>
<td>Atlas Copco Compressor Replacement</td>
<td></td>
<td></td>
<td></td>
<td>$41,200</td>
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<tr>
<td>Side 2 Primary Effluent Lift Pump</td>
<td>$114,577</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UV Level Control Gates</td>
<td></td>
<td></td>
<td>$380,706</td>
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<tr>
<td>Miscellaneous Improvements</td>
<td>$1,035,071</td>
<td>$269,502</td>
<td>$323,750</td>
<td>$169,373</td>
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<td>60’ Effluent Pipe</td>
<td>$257,884</td>
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<td>$257,884</td>
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<tr>
<td>Thickening and Solids Handling Upgrade</td>
<td>$1,946,700</td>
<td></td>
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<td>$1,946,700</td>
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<tr>
<td>Treatment Plant Total</td>
<td>$4,644,643</td>
<td>$519,502</td>
<td>$295,000</td>
<td>$2,510,110</td>
<td>$735,204</td>
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<td>Toilet Screen</td>
<td>$355,000</td>
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<td>$355,000</td>
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<tr>
<td>Replace #350 Cat Loader (not leased)</td>
<td>$248,000</td>
<td>$248,000</td>
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<tr>
<td>Miscellaneous Improvements</td>
<td>$90,300</td>
<td>$80,000</td>
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<td>$10,300</td>
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<tr>
<td>Garden City Compost Phase 2</td>
<td>$4,713,369</td>
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<td>$458,945</td>
<td>$3,545,353</td>
<td>$709,071</td>
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<tr>
<td>Garden City Compost Total</td>
<td>$15,155,670</td>
<td>$2,251,060</td>
<td>$1,139,000</td>
<td>$2,154,698</td>
<td>$910,005</td>
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</tbody>
</table>

### Collection System Immediate Priorities

<table>
<thead>
<tr>
<th>Collection System Immediate Priorities</th>
<th>University FM Replacement</th>
<th>DSA Building Sewer Extension (W. Broadway &amp; Maple)</th>
<th>Reserve St LS Replacement</th>
<th>Grant Cr LS Improvements</th>
<th>Momont #2 LS Replacement</th>
<th>Southpointe/Marias STEP Decommissioning</th>
<th>Lamerous Ln &amp; Birdie Ct STEP Decommissioning</th>
<th>Maloney Ranch/Bigfork Rd STEP Decommissioning</th>
<th>DJ Drive/Linda Vista Blvd STEP Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$284,000</td>
<td>$336,000</td>
<td>$1,038,000</td>
<td>$488,290</td>
<td>$638,178</td>
<td>$180,860</td>
<td>$306,157</td>
<td>$239,395</td>
<td>$282,836</td>
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<tr>
<td>Cost Projection Factor (3% / year) ¹</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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</table>
| ¹ Estimates of probable cost in 2019 dollars. Costs presented include the cost projection factor of 3% inflation per year.

### Collection System Longer Term Priorities

<table>
<thead>
<tr>
<th>Collection System Longer Term Priorities</th>
<th>Fort Missoula Lift Station Rehabilitation</th>
<th>Upstream of Momont #1 LS Gravity Main Upsizing</th>
<th>East Broadway LS Force Main Extension</th>
<th>River Front Triangle Main Upsizing</th>
<th>South Ave Gravity Main Extension</th>
<th>Infiltration-Inflow Study</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>$193,084</td>
<td>$1,248,910</td>
<td>$1,174,900</td>
<td>$175,100</td>
<td>$412,000</td>
<td>$103,000</td>
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<tr>
<td>Cost Projection Factor (3% / year) ¹</td>
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<td></td>
<td>$399,466</td>
<td>$775,434</td>
<td>$424,629</td>
<td>$824,280</td>
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### Annual Needs

<table>
<thead>
<tr>
<th>Annual Needs</th>
<th>Sewer Main Rehabilitation Program ¹</th>
<th>Miscellaneous System Improvements</th>
<th>Collection System Total</th>
<th>Total</th>
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<tbody>
<tr>
<td></td>
<td>$6,727,737</td>
<td>$1,327,284</td>
<td>$15,155,670</td>
<td>$25,206,982</td>
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</tbody>
</table>
| ¹ Estimates of probable cost in 2019 dollars. Costs presented include the cost projection factor of 3% inflation per year.

Fiscal year 2020 from July 2019 – June 2020

Assumes 0.5% of total collection system (1.6 miles of gravity main) replacement per year at a cost of $150 per lineal foot.