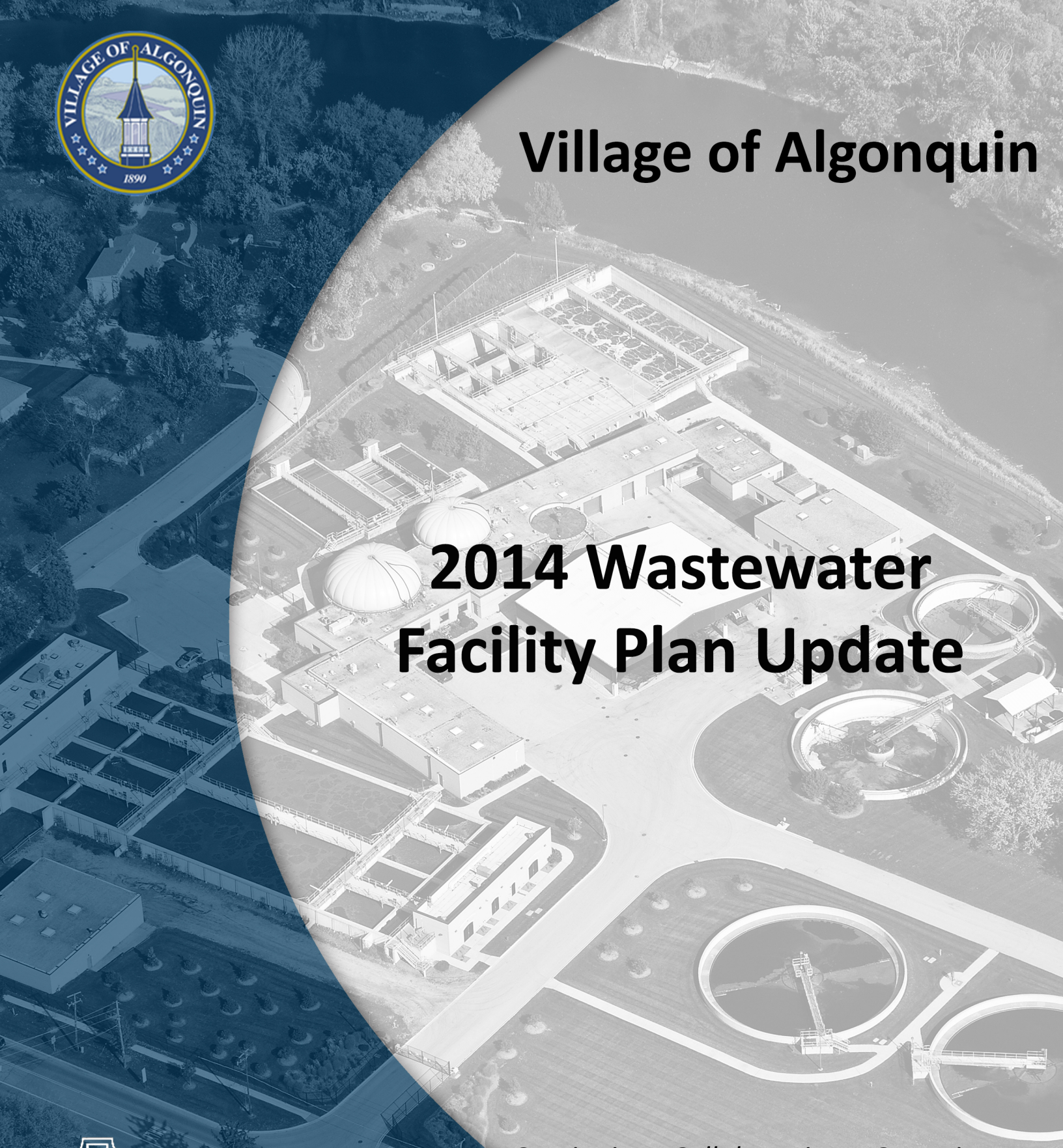
Village of Algonquin



2014 Wastewater Facility Plan Update

Continuity • Collaboration • Commitment

June 2015

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EXECUTIVE SUMMARY

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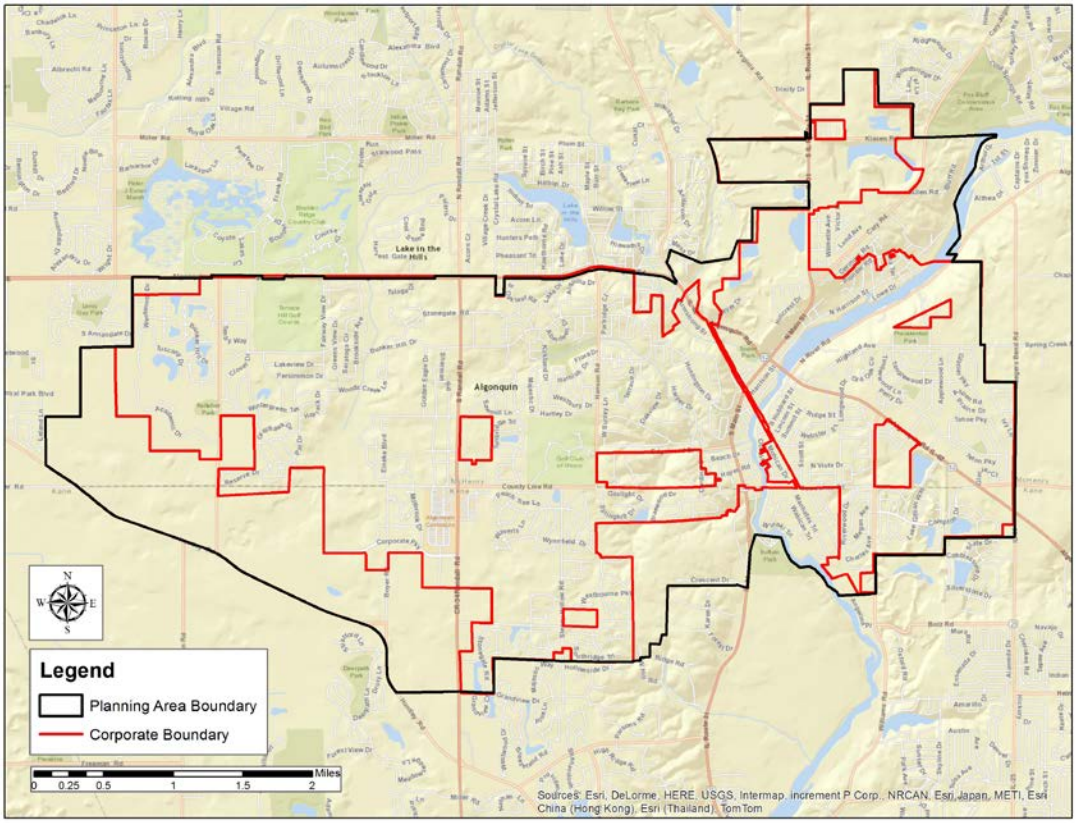
INTRODUCTION AND BACKGROUND

The Village of Algonquin, located along the Fox River in McHenry County, provides wastewater collection and treatment services to the entire Village. The Algonquin Facility Planning Area (FPA) is shown in Exhibit 1 and includes approximately 10,940 acres.

Exhibit 1: Village of Algonquin Facility Planning Area



The existing Algonquin wastewater treatment facility was first expanded in 1975 and operates under the requirements of NPDES Permit No. IL0023329. Through multiple expansions over the past 40 years, the WWTF is designed to treat an average daily flow of 5.0 MGD.

An update to the wastewater facility planning report was completed in 2005 to reflect the future land use map adopted within the Village's then current Comprehensive Plan. Population projections for the 2005 Wastewater Facility Plan Update were prepared based on that Comprehensive Plan and called for phased expansions to the treatment facility up to an ultimate average daily flow capacity of 8 MGD.

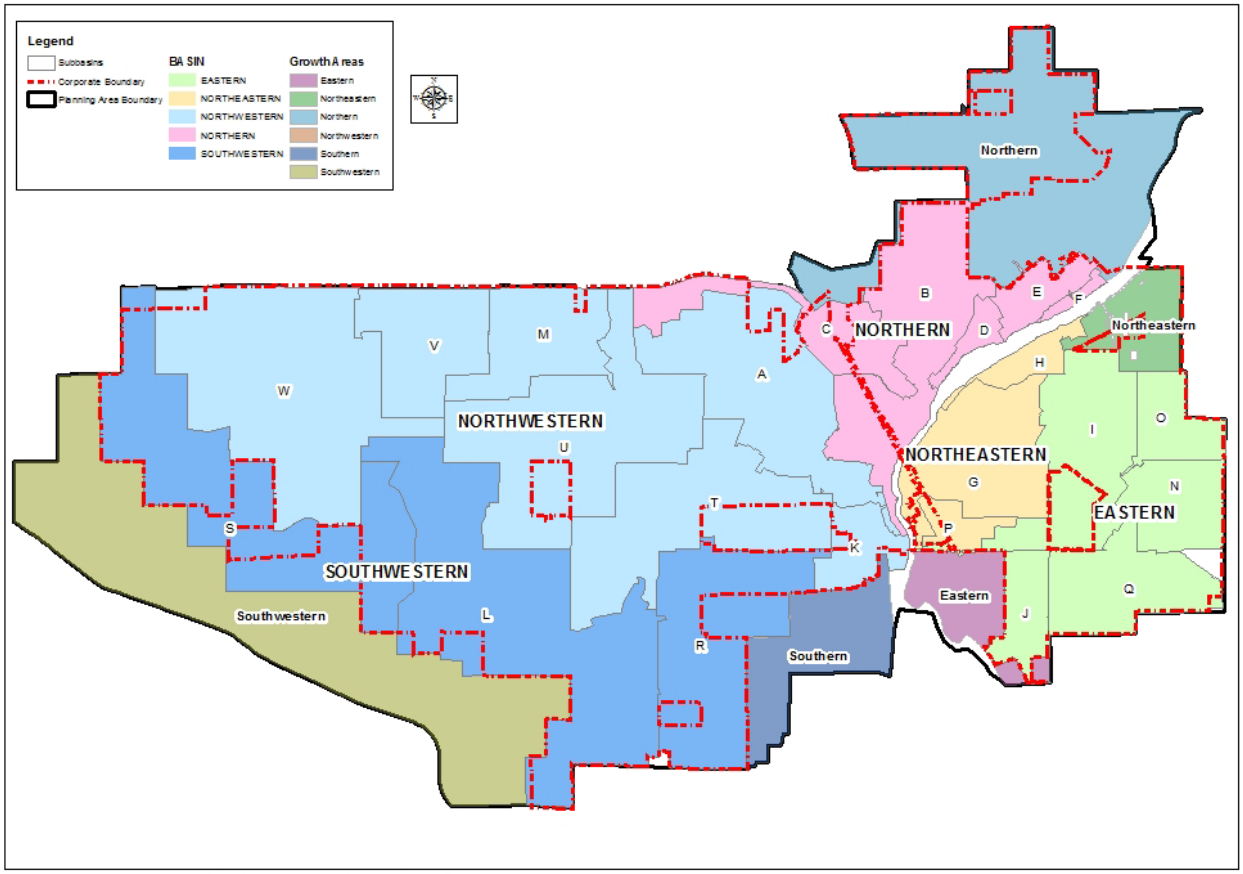
The slowdown of the housing market in the mid-2000's drastically changed the community's outlook on future development and the Comprehensive Plan was modified to reflect current economic conditions and long-term growth projections. The 2005 facility planning report is now

10 years old and an update is needed to reflect modifications made in the now current Comprehensive Plan and to revise population and wastewater flow projections accordingly.

WASTEWATER DRAINAGE BASINS

The areas within the Algonquin FPA were divided into five wastewater drainage basins for facilities planning purposes as shown in Exhibit 2.

Exhibit 2: Village of Algonquin Drainage Basins



These drainage basins were delineated based on existing collection system sewers, lift stations, and force mains. Each drainage basin was further delineated into sub-basins. This level of allocation allows for a focused evaluation of different areas of the collection system. The project team also allocated Growth Areas. The Growth Areas are identified as the areas outside of the existing Drainage Basin boundaries but within the Algonquin FPA boundary.

POPULATION AND WASTEWATER FLOW PROJECTIONS

Analysis of current and future wastewater production is often done on the basis of "population equivalents" or PE which provides a common basis for residential and non-residential demands to be analyzed. One PE is equivalent to the water consumed or wastewater produced by one

resident, as determined by historic water usage data. The total current PE for the Village of Algonquin is 35,491 PE.

The Village's Community Development Department was consulted as part of this facilities planning effort to determine proposed and potential development within the Village of Algonquin service area. Development identified by the Department indicates that the Village of Algonquin population equivalents will grow from the current 35,491 PE to approximately 47,879 PE (for an average flow of 4.42 MGD) in the next ten years. It is also projected that the ultimate service population equivalents at full build-out of the Algonquin FPA will reach approximately 74,459 PE (for an average flow of 7.08 MGD).

Current and projected population equivalents at build-out of the entire Algonquin FPA are summarized in Table 1.

Table 1: Residential and Non-Residential Population Projections

Description	Total PE
Existing Residential PE	30,046
Future Residential PE Growth	25,318
Total Projected Residential PE	**55,364**
Existing Non-Residential PE	5,445
Future Non-Residential PE Growth	13,651
Total Projected Non-Residential PE	**19,096**
Total Projected System PE	**74,459**

The current and projected wastewater flows and pollutant loadings are summarized in Table 2.

Table 2: Projected Wastewater Flows and Pollutant Loadings

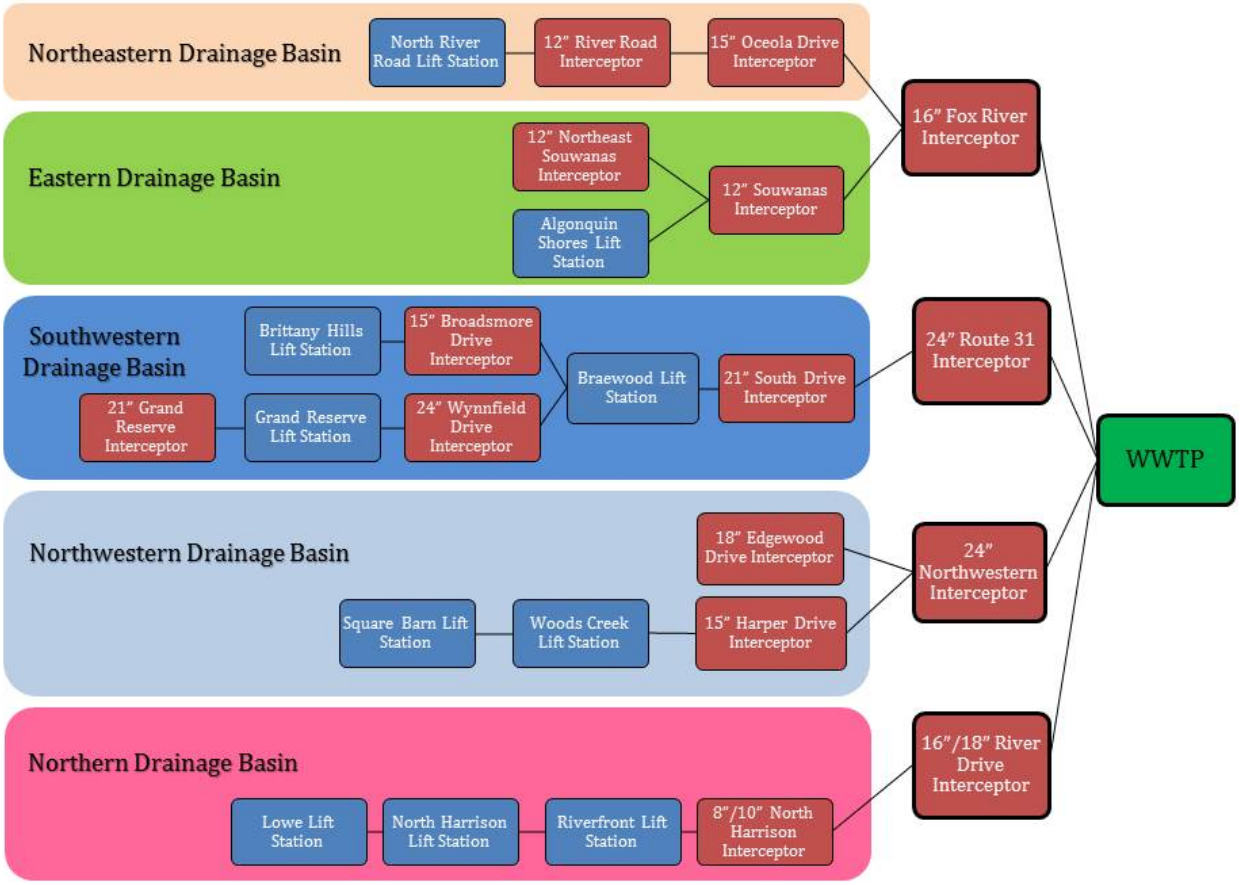
Condition	PE	Average Flow (MGD)	BOD_5 (lbs/day)	TSS (lbs/day)
Current (2013) Loading	35,491	3.18	4,334	4,985
5-Year Planned Development	39,469	3.58	6,710	7,894
10-Year Planned Development	47,879	4.42	8,140	9,576
Ultimate Build-out	74,459	7.08	11,058	12,778

Based on an estimated future Design Average Flow of 7.08 MGD, the projected utilization of the facility will surpass the treatment facility's current hydraulic rating of 5.0 MGD.

COLLECTION SYSTEM

The current and projected population equivalents in each drainage basin were used to estimate current and future peak wastewater flows in the main trunk sewers in the Village's collection system. Exhibit 3 shows the collection system in schematic form.

Exhibit 3: Village of Algonquin Collection System



It was found that most of the existing trunk interceptors have sufficient capacity to convey the current peak flows. In-depth analysis was performed in previous sanitary sewer studies of the Northern and Eastern Drainage Basins. Those studies identified that under peak flow and the 10-year I/I conditions, the majority of the trunk sewers within the Northern and Eastern Drainage Basins are overloaded. In addition to those sewers in the Northern and Eastern Drainage Basins, the 10-inch Huntington Drive sewer and 12-inch High Hill Park sewer in the Northwestern Drainage Basin and the 21-inch Grand Reserve sewer in the Southwestern Drainage Basin, will become overloaded in the future based on preliminary sewer capacity analysis.

Probable costs for the Northern and Eastern Interceptors necessary to relieve overloaded conditions in those basins are summarized in Table 3.

Table 3: Probable Capital Costs – Collection System

Description	Probable Cost
Northern Interceptor (30-inch sewer from the Algonquin WWTF to Northern Growth Area)	$ 9,908,000
Eastern Interceptor (Upsized sewer from Fox River Interceptor to Eastern Growth Area)	6,859,000
Total Capital Costs	**$ 16,767,000**

CAPACITY MANAGEMENT, OPERATIONS AND MAINTENANCE PROGRAM (CMOM)

It is also likely that Algonquin's NPDES permit will require the Village to develop, implement and submit to the IEPA a Capacity, Management, Operations, and Maintenance (CMOM) program. The purpose of the CMOM will be to work towards the goals of eliminating sanitary sewer overflows or basement backups and ensuring that overflow or backups, when they do occur, do not cause or contribute to violations of applicable standards or cause impairment in any adjacent receiving water.

While not included in the Village's current NPDES permit, the Village has already implemented several components of a CMOM program into their scheduled operations, such as televising, cleaning, and lining of sanitary sewers. Section 3 should be consulted for a more detailed list of CMOM program elements and the recommended funding for a CMOM program.

LIFT STATIONS

The Village of Algonquin owns and operates ten lift stations. Pump drawdown tests were conducted at several of the lift stations to assess the ability of the existing pumping equipment to meet current and future flow conditions. Two methods were used to perform the drawdown tests as six of the seven lift stations tested have flow meters installed.

Manual pump drawdown tests consist of timing the wet well fill and draw cycles, and for the known wet well volume, computing the average flow into the wet well and the average pumping rate. The second method involved using flow measured by the installed flow meters. The computed pumping rate is then compared to each pump's rated capacity to determine whether the pumps are operating as intended by the design, or if they are under- or over-performing. Depending on the severity of the disparity between rated and observed pumping rates, conclusions were drawn and recommendations made (see Section 4). Significant deviations could be a result of a worn pump impeller, varying motor speed, partially obstructed pump discharge or force main piping, or an improperly designed installation.

Two trials were conducted at each lift station running each pump individually. The results of the pump drawdown tests are summarized in Table 4.

Table 4: Lift Station Testing Results

Lift Station	Pump Unit Rated Capacity (gpm)	Rated Capacity, Two Pumps (gpm)	Pump 1 Test (gpm)	Tolerance from Rated Capacity	Pump 2 Test (gpm)	Tolerance from Rated Capacity	Pump 3 Test (gpm)	Tolerance from Rated Capacity
Algonquin Shores	300	520	360	20%	275	-8%	345	15%
Grand Reserve	600	830	500	-17%	485	-19%	475	-21%
Brittany Hills	80	n/a					n/a	n/a
Braewood	750	1550	995	33%	1020	36%	1040	39%
North River Road*	400	n/a	not tested	-	not tested	-	n/a	n/a
Lowe	80	n/a	165	106%	200	150%	n/a	n/a
North Harrison*	400	n/a	not tested	-	not tested	-	n/a	n/a
Riverfront*	400	n/a	not tested	-	not tested	-	n/a	n/a
Square Barn	68	n/a	41	-40%	46	-32%	n/a	n/a
Woods Creek	650	830	605	-7%	620	-5%	off line	-

Conclusions drawn and recommendations made as a result of these pump drawdown tests at each lift station are discussed in Section 4.

WASTEWATER TREATMENT FACILITY

The Algonquin WWTF provides screening, primary clarification, secondary biological treatment, final clarification and ultraviolet disinfection of the wastewater. The Village also operates a solids handling process to thicken, stabilize, dewater, and store biosolids.

Influent wastewater flow and pollutant loading data at the Algonquin WWTF was reviewed for the past 3 years. Current flows and loads are well within the treatment capabilities of the existing wastewater treatment plant.

The Algonquin WWTF has been expanded over several phases. The most recent expansion, Phase 6, was completed in 2008 and expanded the plant's hydraulic capacity to 5 MGD and incorporated biological nutrient removal (BNR). The Village's current NPDES Permit includes a 1 mg/L monthly average total phosphorus limit which is consistently met through the BNR process enhanced by chemical polishing when necessary.

The various improvements necessary at the Algonquin WWTF were identified by the project team and segregated into three categories, including:

- Existing Treatment Facility Critical Needs
- Existing Treatment Facility Rehabilitation
- As-Needed Improvements

Existing Treatment Facility Critical Needs

The projects identified as a critical need are to:

- Address water hammer in the Influent Screening Building
- Convert the ungrounded electrical system to high resistance ground
- Replace biological process membrane diffusers
- Replace biological process instrumentation
- Improve aerobic digestion automation capabilities and instrumentation
- Replace the gravity belt thickener
- Replace the Sludge Handling Building roof

The improvements and equipment identified above should be addressed to ensure the continued reliability of the existing treatment plant and to provide uninterrupted and effective treatment. Probable costs associated with these improvements are summarized in Table 5.

Table 5: Probable Capital Costs – Treatment Facility Critical Needs

Critical Needs Improvement	Probable Cost
Influent Screening Improvements – Correct water hammer	$ 2,000
Convert the ungrounded electrical system to high resistance ground	80,000
New Side Biological Process Improvements – Instrumentation and Membrane Diffuser Replacement	532,000
Integrate automation capabilities & instrumentation into the aerobic digestion aeration system	108,000
Replace Gravity Belt Thickener	460,000
Replace Sludge Handling Building Roof	200,000
Construction Subtotal	**$ 1,382,000**
Bonds & Insurance, Overhead & Profit	239,200
Contingency (20%)	324,300
Engineering (15%)	391,900
Probable Capital Cost – Critical Needs	**$ 2,237,400**

Existing Treatment Facility Rehabilitation Needs

It is not anticipated that the existing treatment facility will reach full capacity for at least another 10 years. However, there is equipment that will be reaching the end of its useful service life in the interim. These improvements are discussed in Section 5 and include:

- Raw Sewage Pump Station Improvements
- Primary Clarifier Rehabilitation
- UV System Replacement

This equipment should be replaced to ensure the continued reliability of the existing treatment plant to provide uninterrupted and effective treatment. Probable costs associated with these improvements are summarized in Table 6.

Table 6: Probable Capital Costs – Treatment Facility Rehabilitation Needs

Rehabilitation Needs	Probable Cost
Raw Sewage Pump Station Improvements	$ 28,500
Primary Clarifier Rehabilitation	150,000
UV System Replacement	1,218,200
Construction Subtotal	**$ 1,396,700**
Bonds & Insurance, Overhead & Profit	241,600
Contingency (20%)	327,600
Engineering (15%)	294,800
Probable Capital Cost – Rehabilitation Needs	**$ 2,260,000**

Existing Treatment Facility As-Needed Improvements

The following improvements are recommended to address operations staff concerns or nuisance items, but are not immediate needs and can be completed as funding allows.

Table 7: Probable Capital Costs – Treatment Facility As-Needed Improvements

As-Needed Improvements	Probable Cost
Influent Screening Improvements – Odor Control	$ 1,000
Chemical Building Improvements	5,000
Final Clarifier (60-ft) Erosion Issue	2,000
Primary Sludge Pump Improvements	56,000
Other Electrical Improvements	260,000
Influent Screening Improvements – Odor Control	1,000
Construction Subtotal	**$ 324,000**
Bonds & Insurance, Overhead & Profit	65,000
Contingency (20%)	76,100
Engineering (15%)	68,500
Probable Capital Cost – As-Needed Improvements	**$ 524,700**

WASTEWATER TREATMENT FACILITY ALTERNATIVES

Based on information gathered by the project team, certain treatment and capacity issues identified in previous Sections required further evaluation. The issues include expansion needs, biosolids treatment facilities, nutrient removal, and non-potable water opportunities.

Existing Treatment Facility Hydraulic Expansion

Current and projected wastewater flows and pollutant loadings at the Algonquin WWTF are summarized in Table 2. The treatment facility has sufficient hydraulic capacity to support proposed and planned development throughout those areas currently incorporated within the Village. It is only as the Village expands beyond the current corporate boundary and begins development within the Growth Areas that the hydraulic treatment capacity of the plant will be exceeded and expansion be required.

The Village's ultimate goal is to continue using the existing infrastructure, when determined feasible, while expanding the capacity of the plant to meet the community's long-term needs. The probable capital cost for the Phase 7 Expansion of the Algonquin WWTF is approximately $35.5 million, not including expansion of the digestion complex.

Table 8: Probable Capital Costs – Phase 7 WWTF Expansion

Item	Probable Cost
Headworks	$ 6,992,500
Primary Clarifier	4,173,000
Biological Process	6,897,980
Final Clarifier	2,659,450
UV Disinfection	1,218,200
Construction Subtotal	**$ 21,941,130**
Bonds & Insurance, Overhead & Profit	3,796,000
Contingency @ 20%	5,147,500
Engineering @ 15%	4,632,700
Probable Capital Costs – Phase 7 WWTF Expansion	**$ 35,517,400**

Biosolids Handling Facilities

The biosolids handling facilities will also require expansion as the treatment plant's hydraulic capacity increases. The project team evaluated alternatives for expanding both the aerobic digestion and anaerobic digestion processes. The alternatives were evaluated on both economic and non-economic factors. Expansion of the aerobic digestion facilities was found to be the higher ranked alternative; however, both alternatives should be revisited during design as conditions change.

Based on an evaluation of current conditions, expansion or adjustment to the Village's current operation of the digestion process was required in order to fully stabilize the anticipated solids to be received at the current design average flow of 5 MGD. Evaluation of the alternatives and based upon Village's operational preferences, it was determined that the capacity of the aerobic digestion process should be increased in order to provide adequate stabilization of the biosolids. Probable costs associated with these improvements are summarized in Table 9.

Table 9: Probable Capital Costs – Aerobic Digestion Short-Term Alternative

Description	Probable Cost
Aerobic Digestion Improvements	$ 1,243,700
Splitter Improvements	144,400
Construction Subtotal	**$ 1,388,100**
Bonds & Insurance, Overhead & Profit	240,200
Contingency @ 20%	325,700
Engineering @ 15%	293,100
Probable Capital Cost - Aerobic Digestion	**$ 2,247,100**

Other solids handling processes, including sludge thickening and dewatering, were also identified by the Village for additional evaluation. In order to provide redundant units and to accommodate the projected sludge loading, the project team evaluated rehabilitation of the existing sludge handling building versus construction of a new solids handling building in a new location.

Rehabilitation of the existing sludge handling building would include new equipment as well as redundant units. Installation of additional equipment without expansion of the building's footprint will require that the truck bay be eliminated and all dewatered sludge conveyed directly to the sludge storage building. Probable costs associated with these improvements are summarized in Table 10.

Table 10: Probable Capital Costs – Sludge Handling Building Rehabilitation

Description	Probable Cost
Sludge Handling Building Rehabilitation	$ 4,235,300
Construction Subtotal	**$ 4,235,300**
Bonds & Insurance, Overhead & Profit	732,900
Contingency @ 20%	993,700
Engineering @ 15%	894,300
Probable Capital Cost	**$ 6,856,200**

The probable capital cost for a new sludge handling building is approximately $11.0 million, not including land acquisition costs. The current plant site does not have available space for construction of a new solids handling facility at this time. The existing solids handling building has available space for thickening and dewatering equipment up to a plant capacity of 7.0 MGD. Beyond 7.0 MGD, the Village should consider construction of a new solids handling building. Based upon the wastewater flow projections presented in Section 2, the Village should not expect this to occur for at least 20 years. The currently existing and/or proposed equipment will by then have exceeded, or will be approaching the end of its service life.

Nutrient Removal

The Illinois EPA will be implementing additional nutrient removal requirements for phosphorus and total nitrogen within the next ten years. TAI has reviewed the operations of the existing plant with respect to future regulations and has determined that, while the plant is currently capable of meeting some of the pending requirements, changes to plant operations may be necessary in order to meet the rest of the proposed effluent limits. Specifically, the Village may need to install tertiary filtration to meet more stringent total phosphorus limits.

Non-Potable Water System

In order to provide energy efficiencies and expand upon Algonquin's green initiative, the Village wishes to expand their non-potable water system at the plant. The project team evaluated several alternatives and prefers an appropriately sized hydro-pneumatic tank for non-potable use to store final effluent and control the non-potable water pumps. Non-potable water would be distributed to equipment through an expanded non-potable water distribution system.

IMPLEMENTATION PLAN

In consideration of the remaining service life of the existing facilities, priorities identified by Village operations staff, and projected growth through the Algonquin FPA, the phased Implementation Plan for this 2014 Facility Plan Update is summarized in Table 11. The scheduling of the improvements are initial estimates employed for planning purposes.

The aerobic digestion capacity upgrades are a critical improvement and the solids handling building improvements are recommended to take place at the same time to reduce overall construction costs. The Phase 7 WWTF Expansion and the Northern and Eastern Interceptor parallel sewers are not anticipated to be required until at least the year 2025 based upon the growth projections discussed in Section 2. Scheduling for the Phase 7 WWTF Expansion and interceptor sewer capacity upgrades will become known with greater certainty over time as actual development throughout the Algonquin FPA occurs.

The various improvements recommended for rehabilitation of the existing plant could be implemented as part of the aerobic digestion and solids handling building improvements. Those improvements that have been identified as critical needs should be implemented as soon as possible.

Table 11: Phased Implementation Plan

Description	Probable Capital Costs ($ millions)						
	2015	2016	2017	2018	2019	2020 to 2029	2030 to 2039
TREATMENT FACILITY							
Critical Needs	$1.24[1]						
Rehabilitation / Replacement				$ 2.11			
As Needed Projects					$ 0.49		
Aerobic Digestion Improvements	$0.165[2]	$ 2.10					
Sludge Handling Building	$0.45[2]	$ 6.41					
Phase 7 WWTF Expansion							$41.4
COLLECTION SYSTEM							
Northern Interceptor Sewer							$ 9.91
Eastern Interceptor Sewer							$ 6.86
Annual rehab / replacement	$ 2.3	$ 2.3	$ 2.3	$ 2.3	$ 2.3	$ 23.0	$ 23.0
LIFT STATIONS							
Annual rehab / replacement	$ 0.23	$ 0.23	$ 0.23	$ 0.23	$ 0.23	$ 2.26	$ 2.26
TOTAL PROBABLE CAPITAL COSTS	$4.37	$11.1	$ 2.53	$ 4.64	$3.02	$ 25.3	$83.4

Note: Probable costs are presented above in 2015 dollars and do not account for future inflation. Over the past 10 years, ENR cost indexes have inflated at an equivalent annual compound rate of 3%.

(1) Capital cost for Critical Needs projects reduced as aerobic digestion and solids handling building are scheduled simultaneously.

(2) Design Engineering to be completed in 2015.

USER RATES AND PROJECT FUNDING

The project team reviewed the Village's fiscal year 2014/2015 sewer budget and found that the total expenditures and debt service equate to $3,723,500 which exceed the sewer user fee revenues of $2,754,500. In additional to operation and maintenance costs, it is also recommended that the Village address replacement costs for the collection system, lift stations, and wastewater treatment facility. The annual operation and maintenance and replacement costs are estimated to be $8,945,500 for FY 2014/2015. It is important to invest replacement funds into an account or back into the system on an annual basis. Replacement costs are determined based on the value of the equipment or structures and the service life associated with that component.

Three scenarios were evaluated using a fiscal model developed specifically for the Village.

1. Baseline Fiscal Model – utilizing the Village's current rate structure which is not currently under an annual increase to fund OM&R
2. Full Cost of Service – increasing the Village's existing sewer rate in order to fully fund the full cost of service, including OM&R
3. Partial Replacement Funding – increasing the Village's existing sewer rate in order to establish a balanced budget but excluding replacement costs into the overall budget

All scenarios incorporated a 3% increase to OM&R costs to account for inflation. The fiscal model also incorporated the current annual debt service of the 2006 Bond as well as the proposed annual repayment of the IEPA loan to be secured for the Aerobic Digestion and Sludge Handling Building Improvements.

Evaluation of the above three scenarios indicated that the Village's current rate structure is not sustainable to fully fund OM&R; fully funding OM&R requires an immediate sewer fee increase from $3.81 per 1,000 gallons water sold to $12.88 per 1,000 gallons water sold, or a 238% increase; and in order to establish a balanced budget, not including replacement costs would require an immediate sewer rate increase from $3.81 per 1,000 gallons to $5.75 per 1,000 gallons, a 51% increase. All immediate sewer rate increases would be followed by a 3.1% annual increase to account for inflation.

More detailed discussion of the fiscal model scenarios and computations are provided in Section 9 and Appendix 4, respectively.