Emails regarding any agenda item are welcomed. Please email contactcouncil@winnetka.org, and your email will be relayed to the Council members. Emails for the Tuesday Council meeting must be received by Monday at 4 p.m. Any email may be subject to disclosure under the Freedom of Information Act.

Winnetka Village Council
SPECIAL MEETING
Village Hall
510 Green Bay Road
Tuesday, April 28, 2015
7:00 p.m.

AGENDA

1) Call to Order
2) Pledge of Allegiance
3) Quorum
   a) May 5, 2015 Regular Meeting
   b) May 12, 2015 Study Session
   c) May 19, 2015 Regular Meeting
4) Approval of Agenda
5) Consent Agenda: None.
6) Stormwater Report
   a) Willow Road Stormwater Tunnel and Area Drainage Improvements – Review Point #2 3

   Due to the size of the related agenda materials, only the Executive Summary and Staff Agenda Report are included with the packet. All other related materials are posted as individual files, some of which are very large and make take time to download. The complete electronic materials are available for download at both:

- http://www.villageofwinnetka.org/departments/public-works/stormwater-management/willow-road-stadi-project/
- http://www.winnetkastormwaterplan.com/stormwater-management-program/willow-rd-stadi-project/

Complete hard copy materials are also available for inspection at the following locations:

- Winnetka Village Hall, 2nd Floor Administration (510 Green Bay Road)
- Winnetka Public Works Yards (1390 Willow Road)
- Winnetka-Northfield Public Library, Reference Desk (768 Oak Street)

7) Ordinances and Resolutions: None.
8) Public Comment

9) Old Business: None.

10) New Business: None.

11) Appointments

12) Reports

13) Executive Session

14) Adjournment

NOTICE

All agenda materials are available at villageofwinnetka.org (Government > Council Information > Agenda Packets & Minutes); the Reference Desk at the Winnetka Library; or in the Manager's Office at Village Hall (2nd floor).

Broadcasts of the Village Council meetings are televised on Channel 10 and AT&T Uverse Channel 99 every night at 7 PM**.** Webcasts of the meeting may also be viewed on the Internet via a link on the Village's web site: http://winn-media.com/videos/

The Village of Winnetka, in compliance with the Americans with Disabilities Act, requests that all persons with disabilities who require certain accommodations to allow them to observe and/or participate in this meeting or have questions about the accessibility of the meeting or facilities, contact the Village ADA Coordinator – Megan Pierce, at 510 Green Bay Road, Winnetka, Illinois 60093, 847-716-3543; T.D.D. 847-501-6041.

Agenda Item Executive Summary

Title: Willow Road Stormwater Tunnel and Area Drainage Improvements – Review Point #2

Presenter: Steven M. Saunders, Director of Public Works/Village Engineer

Agenda Date: 04/28/2015

Consent: [ ] YES [✔] NO

[ ] Ordinance
[ ] Resolution
[ ] Bid Authorization/Award
[✔] Policy Direction
[ ] Informational Only

Item History:

On January 21, 2014, the Village awarded a contract to MWH Americas, Inc. to provide engineering services for the proposed Willow Road Stormwater Tunnel and Area Drainage Improvements (STADI) project. This project would combine multiple stormwater system improvements into a single project with a 2012 cost estimate of $34.6 million. This project would include benefits to the North Willow Road, South Willow Road, Provident Avenue, Cherry Street Outlet, and the Winnetka Avenue Underpass Study areas for the 100-year design storm event.

Executive Summary:

MWH's contract was structured with discrete decision points, without obligating the Village to complete engineering services in their entirety for the project. This allows the Village to advance the project on a step-by-step basis, with intermediate review points for Council approval. Review Point #1 occurred in June, 2014, upon completion of Concept Review, Permit Plan, and Hydrologic/Hydraulic Model Verification. At Review Point #1, the Council authorized MWH to proceed with Preliminary Engineering, including Phase I field investigations, a water quality monitoring program, completion of design plans and documents to the 30% stage, preparation of draft regulatory permit applications, and an updated Opinion of Probable Construction Cost (OPCC). The Preliminary Design Report has been completed and is attached.

MWH has estimated the total project cost at $58,473,000 in 2015 dollars. The previous cost estimate, developed by CBBEL in fall of 2012, was $34,597,912, in 2012 dollars. The current estimate is significantly higher than the conceptual estimate, and the Preliminary Design Report indicates several reasons for this, including the advanced level of information now available for design, a longer tunnel section to reduce disruption to Willow Road, significant increases in certain construction costs, including large-diameter concrete pipe and trucking, and a radically changed approach to water quality from the original concept conceptual.

MWH and staff have evaluated a variety of potential options that may reduce the cost of the project, which are included in the attached agenda report. The project design contract timeline anticipates that the next key step is to complete the draft permit applications and submit them to the respective review agencies. This is because the time schedule associated with the permit application, review, and approval, is approximately 12 months. A reasonable approach at this time is to proceed with submitting the permit applications so that the respective agencies can commence their reviews, but not to proceed with additional design services at this time so the Village can perform a thorough independent peer review of the project work to date (including cost estimates), and to evaluate construction phasing and financing options. If a peer review is to be considered, it should be completed by an independent qualified engineering firm that has not previously been involved in the project.

Recommendation:

1. Authorize MWH to complete environmental permits and submit them to the respective regulatory agencies;
2. Direct staff to prepare further technical and financial analysis of a phased implementation approach for the proposed project, and;
3. Direct staff to engage an independent professional engineering firm to perform a detailed third-party peer review of the proposed project, in one or more specific reports.

Attachments:

- Agenda Report
- Preliminary Design Report
  a. Volume 1
  b. Volume 2
- United States EPA Alternative Disinfection Methods Fact Sheet Peracetic Acid

Agenda Report

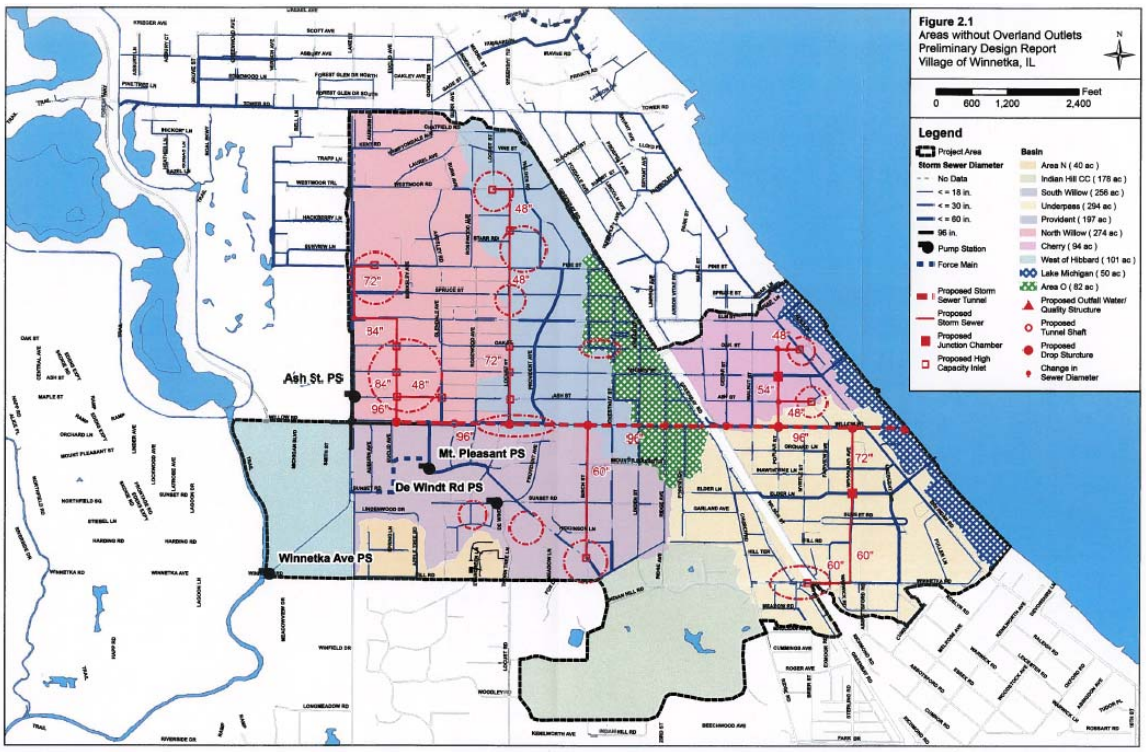
Subject: **Willow Road Stormwater Tunnel and Area Drainage Improvements – Review Point #2**

Prepared By: Steven M. Saunders, Director of Public Works/Village Engineer

Date: April 23, 2015

BACKGROUND

On January 21, 2014, the Village awarded a contract to MWH Americas, Inc. to provide engineering services for the proposed Willow Road Stormwater Tunnel and Area Drainage Improvements (STADI) project. This project would combine multiple stormwater system improvements into a single project with a 2012 cost estimate of $34.6 million. This project would include benefits to the North Willow Road, South Willow Road, Provident Avenue, Cherry Street Outlet, and the Winnetka Avenue Underpass Study areas for the 100-year design storm event.



The proposed improvements consist of an 8-foot diameter storm sewer underneath Willow Road running from approximately Glendale Avenue to Lake Michigan, as well as construction of additional storm sewers connected to the tunnel, and construction of a

below ground outlet structure to manage water quality, control water velocity and prevent erosion. The project concept also includes possible implementation of distributed water quality measures in the form of structural and non-structural Best Management Practices (BMPs) such as rain gardens, bio-swales, permeable pavements, catch basin inserts, oil & grit separators, etc. to control water quality impairments as close to their sources as possible.

When MWH's contract was awarded, the project was at the preliminary, conceptual engineering stage, and a significant amount of engineering was required to bring the project to the stage where construction contracts can be executed. Importantly, there were and are also many questions about the project to be answered, permits to be acquired, and decisions to be made by the Village, before construction contracts can be awarded. Therefore, the engineering contract was structured to recognize these questions and decision points, without obligating the Village to complete engineering services in their entirety for the project. Structuring the contract in this way allows the Village to advance the project on a step-by-step basis, with intermediate review points for Council approval before advancing to the next phase. Review Point #1 occurred in June, 2014, upon completion of Concept Review, Permit Plan, and Hydrologic/Hydraulic Model Verification.

At Review Point #1, MWH focused on four key points: 1) the project is viable and models have been verified; 2) other options were considered, but they do not provide 100-year flood protection; 3) protection of natural assets and water quality management; and 4) next steps required to further 30% engineering design and permit applications. MWH confirmed that the Village's flood protection criterion is 100-year level protection and that modeling demonstrated that the Tunnel is a reasonable approach, and is also the only option available to meet this level of performance. An overview of alternatives was provided that addressed the constraints the Village faces in terms of storing, conveying, and discharging stormwater runoff. MWH reviewed an analysis of "westward" options which revealed that none of these choices offers sufficient storage capacity, even with the use of aggressive green infrastructure.

MWH believes that a multi-tiered process will be necessary to manage water quality, including source control (local Best Management Practices and public education), low flow management (existing infrastructure and flow diversions), distributed treatment, and discharge management at the Lake Michigan outfall. MWH has confirmed the Tunnel will require a combination of green and grey infrastructure to manage both the flow and quality of water for the Village.

In conclusion, MWH stated the Willow Road STADI project can achieve the desired flood risk reduction. The Council authorized MWH to proceed with the preliminary engineering and permitting tasks in Phase 1 as outlined in the original scope of services. In addition, the Council authorized MWH to proceed with development and implementation of a supplemental water quality sampling and analysis.

PRELIMINARY ENGINEERING

Subsequent to this direction from the Council, MWH initiated the scope of work associated with Preliminary Engineering, including Phase I field investigations, a water quality monitoring program, completion of design plans and documents to the 30% stage, preparation of draft regulatory permit applications, and an updated Opinion of Probable Construction Cost (OPCC).

Phase 1 Field Investigations. MWH gathered supplemental data needed to support critical permitting and preliminary engineering activities, using field surveys to document conditions and locate critical utilities along the proposed sewer alignments and geotechnical investigations to provide subsurface and soil data for the evaluation of construction methods for individual sewer segments. Specific work activities included:

- Performing field surveys for planimetric depiction and digital terrain model (DTM) creation;
- Obtaining invert elevations for select drainage and sewerage, structures at critical connection or conflict points;
- Creating base sheets showing project mapping (topographic planimetrics, DTM, and profile) along the proposed improvement alignments;
- Performing soil borings to provide information needed for evaluation of open cut and tunneling construction options;
- Documenting sub-surface conditions with standard boring logs;
- Collecting samples at five boring sites for environmental screening of parameters that may impact soil disposal characteristics;
- Analyzing the geotechnical investigation results and preparing a generalized geotechnical profile along the proposed tunnel and open cut sewer alignments. The analysis results and profile will be considered in the final evaluation of construction options for various sewer segments.

Water Quality Monitoring Program.
MWH implemented a program to gather flow and water quality data at four locations in the Village's separate storm sewer system. Results from the water quality monitoring program are being used to develop a water quality management plan for the project. Specific activities included:

- Procuring and installing automated water sampling equipment, temporary flow monitoring equipment, and rain gauges to gather water quality at four locations in the Village;
- Obtaining wet-weather and dry-weather sample sets during September, October and November of 2014.
- Obtaining grab-samples during Spring 2015 to analyze the effect of snowmelt on stormwater quality;
- Contracting with a testing laboratory to analyze of the samples and provide written results;

- Compile sampling results to document water quality.

After evaluating the laboratory results, MWH has determined that for many parameters, our stormwater did not exceed associated Illinois water quality standards, including Hexavalent Chromium, Fluoride, Nitrite, Cyanide, Arsenic, Barium, Cadmium, Silver, Zinc, and Lead. However, some parameters had at least one result that exceeded applicable Illinois water quality standards, including Sulfate, Total Dissolved Solids, Chloride, Mercury, Phenols, Oil & Grease, Copper, Manganese, nutrients such as Phosphorus, Nitrate, and Ammonia, and bacteria such as Fecal Coliform and E. Coli. Detailed sample results are appended to Volume 1 and have been used to develop the water quality management plan described below and in Appendix D of MWH's Preliminary Design report.

Preliminary (30%) Design.

MWH prepared preliminary design drawings for the proposed outfall and storm sewer improvements to advance critical permitting activities and provide a refined basis for overall planning of design and construction activities associated with the proposed stormwater tunnel and area drainage improvements. Specific activities included:

- Preparation of a set of 30% preliminary design drawings and a list of special provisions expected to be required in the final bidding packages for the projects;
- Preparation of approximately 62 preliminary plan and profile drawings showing the proposed configuration and horizontal and vertical alignment of the proposed storm sewer improvements. Open cut drawings are prepared at a horizontal scale of 1"=20'. Tunnel drawings are prepared at a horizontal scale of 1"=50';
- Conducting a hydraulic design analysis of the proposed outfall structure and major junction/diversion structures using Computational Fluid Dynamics (CFD) modeling to analyze flow rates and velocities through the structure. Using results from the analysis, develop a preliminary site plan and layout for the new structure at the lake front;
- Development of basic structural design criteria and preliminary type, size, and location layouts for the proposed outfall structure and major junction or diversion structures. The layouts will be incorporated into the 30% drawing set as preliminary structure drawings;
- Preparing a Class 4 OPCC using the preliminary drawing set as the basis for the preparation of an Association for the Advancement of Cost Engineering (AACE) Class 4 OPCC. The OPCC will provide a high level indication of overall project costs given refinements made to the original project concept and improved geotechnical, permitting and survey information.

Permitting.

Finally, MWH has advanced permitting efforts to the point of preparing draft permit applications as follows:

- Preparing a draft Joint Permit Application to the Illinois Environmental Protection Agency (IEPA), Illinois Department of Natural Resources (IDNR), and US Army

Corps of Engineers (USACOE) for the proposed new stormwater outfall to Lake Michigan. Steps involved in this process are as follows:

- Compile, document and review available water quality data for stormwater discharges from Winnetka and for Lake Michigan. The IEPA 401 Water Quality Certification will be a key regulatory hurdle in the permit process;
- Prepare the initial Joint Permit Application to IEPA, IDNR, and USACOE for the construction of a new stormwater outfall to Lake Michigan;
- Prepare a Water Quality Management Plan to document the measures that the Village will incorporate into its stormwater system to meet the water quality standards and anti-degradation criteria that will apply to the new discharge;
- Estimate pollutant loadings at the existing discharge points from the project area for specific design-storm events and use the results to project peak and average loadings under current conditions;
- Document the likely water quality discharge standards for both Lake Michigan and the Skokie River;
- Assess available technologies for meeting the discharge standards;
- Develop a water quality management strategy for the project that includes consideration of private stormwater best management practices (BMPs), BMPs or stormwater treatment facilities constructed at distributed locations within the storm sewer system and within the public right-of-way, and/or end-of-pipe treatment measures;
- Estimate pollutant loadings at existing and proposed discharge points within the proposed storm sewer system improvements with and without consideration of the water quality management measures proposed;
- Document the estimated impact of the proposed storm sewer improvements on pollutant loadings to Lake Michigan with and without the proposed water quality management measures;
- Compile results from the analyses into a project-specific Water Quality Management Plan for submittal with the Joint Permit Application.

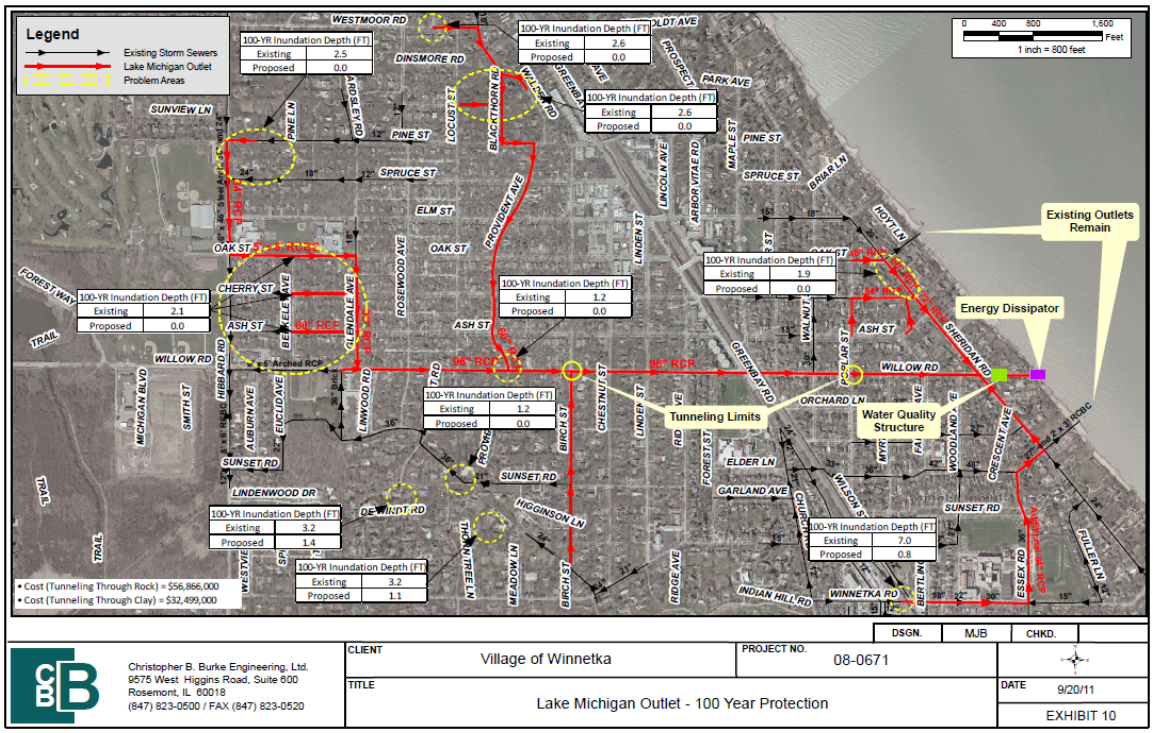
- Prepare and submit an initial application to the Metropolitan Water Reclamation District (MWRDGC) requesting approval for the proposed new stormwater outfall to Lake Michigan. It is assumed that the materials contained in the Joint Permit Application will be suitable for submittal to the MWRDGC with minimal modification;
- Prepare and submit an initial application to the Union Pacific Railroad (UPRR) for the construction of a 96-inch diameter storm sewer across the railroad right-of-way at Willow Road. The application to the railroad will consist of the completed forms and preliminary (30%) design drawings for the portion of the new sewer crossing the railroad right-of-way.

REVIEW POINT #2 – PRELIMINARY DESIGN REPORT

MWH's contract was structured so that at the completion of preliminary engineering activities, MWH was to provide a Preliminary Design Report that documents the results of their activities and allows the Village to discuss the project at a further level of detail. MWH has completed the scope of work associated with Preliminary Design and produced the 2-volume Preliminary Design Report shown in **Attachment #1**. Several aspects of MWH's design work warrant further discussion.

Design Considerations

First, there are a number of design and construction considerations that affect project cost and constructability. The initial project layout conceived by Christopher B. Burke Engineering, Ltd. (CBBEL) is shown below:



As engineering has progressed, several modifications were developed to reduce project disruption along Willow Road and Sheridan Road, reduce the overall length of storm sewer, maintain the existing stormwater conveyance system at key locations, and avoid a conflict with an existing MWRD interceptor under Sheridan Road.

Specifically, MWH has proposed extending the tunneling portion of the project. Previously, CBBEL proposed tunneling the project for a minimal length, 3,300 feet, between Birch Street (west of Green Bay Road) and Poplar Street (east of Green Bay Road). The remainder of the storm sewer under Willow Road was to be installed using open cut methods. MWH is proposing to tunnel the entire 8,500-foot length of storm

sewer under Willow Road, from Berkeley Avenue on the west to Lake Michigan on the east.

Water Quality Management Program

In addition, the water quality data obtained in Fall 2014, and additional discussions with the Illinois EPA, have informed the Water Quality Management Plan and Draft Permit Applications. Based on the specific water quality sampling data, the primary pollutants of concern that drive the scope and type of treatment to be provided are bacteria, nutrients, metals, and suspended solids/oil & grease.

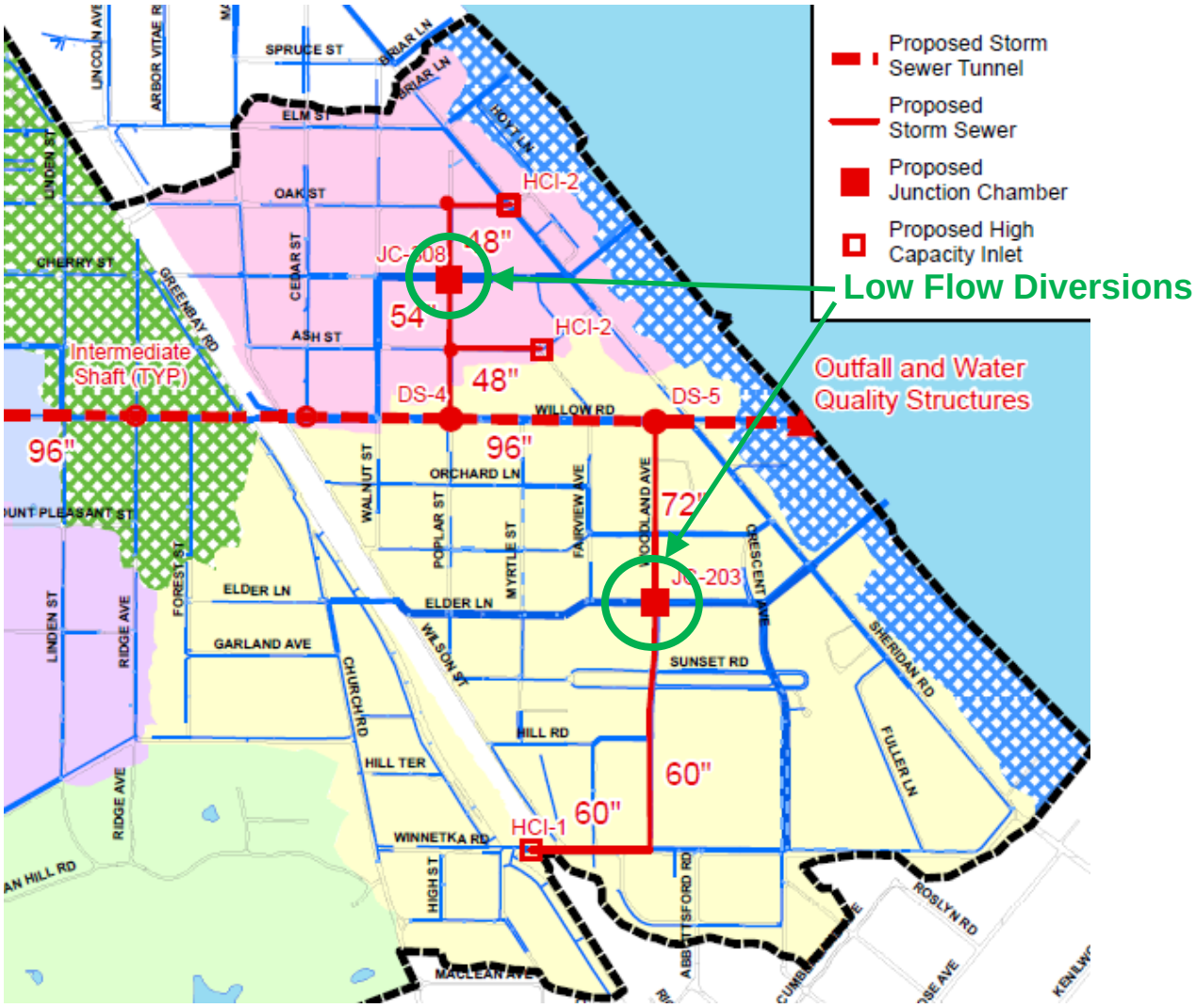
In their conceptual engineering plan, MWH anticipated providing stormwater treatment at distributed locations throughout the project areas with the belief that providing multiple smaller, localized treatment locations would be more cost-effective than providing significant end-of-pipe treatment. However, after evaluating the specific level and type of treatment needed, and comparing this with the large inlet flows that need to be accommodated to provide protection against the 1% chance storm, it became apparent that the current level of technology would necessitate significant bypassing of the treatment systems during larger storms. As a result, MWH has developed a water quality management plan that provides for significant treatment at the end-of-pipe for bacteria, phosphorus, metals, and suspended solids/oil & grease.

The water quality management plan relies on a tiered approach of:

1) Source control measures. This refers to actions taken by the Village to eliminate or reduce stormwater pollution at the source. Examples include continued sanitary sewer maintenance and illicit discharge/cross connection elimination, ordinance controls such as the ban on coal tar-based sealants, housekeeping measures such as street sweeping and catch basin cleaning, and public education measures.

2) Distributed Stormwater Best Management Practices (BMP's). There are some areas where BMP's could potentially be implemented to reduce peak flows and pollutant loadings from larger roofed areas and parking surfaces at an institutional or commercial scale.

3) Flow management and stormwater treatment. For low-volume flows, up to about a 50%-chance storm, flows from the western watershed will not be diverted into the proposed tunnel, but rather will continue to flow through the existing drainage system westward to the Skokie River. Low-volume flows, up to about a 50%-chance storm, from the eastern watershed will be preferentially diverted from the Cherry Street and Elder Lane storm sewers to the tunnel, and through the end of pipe treatment system, before being discharged to Lake Michigan. Currently, all stormwater from the eastern watershed discharges to Lake Michigan without treatment. This situation is illustrated in the following figure:

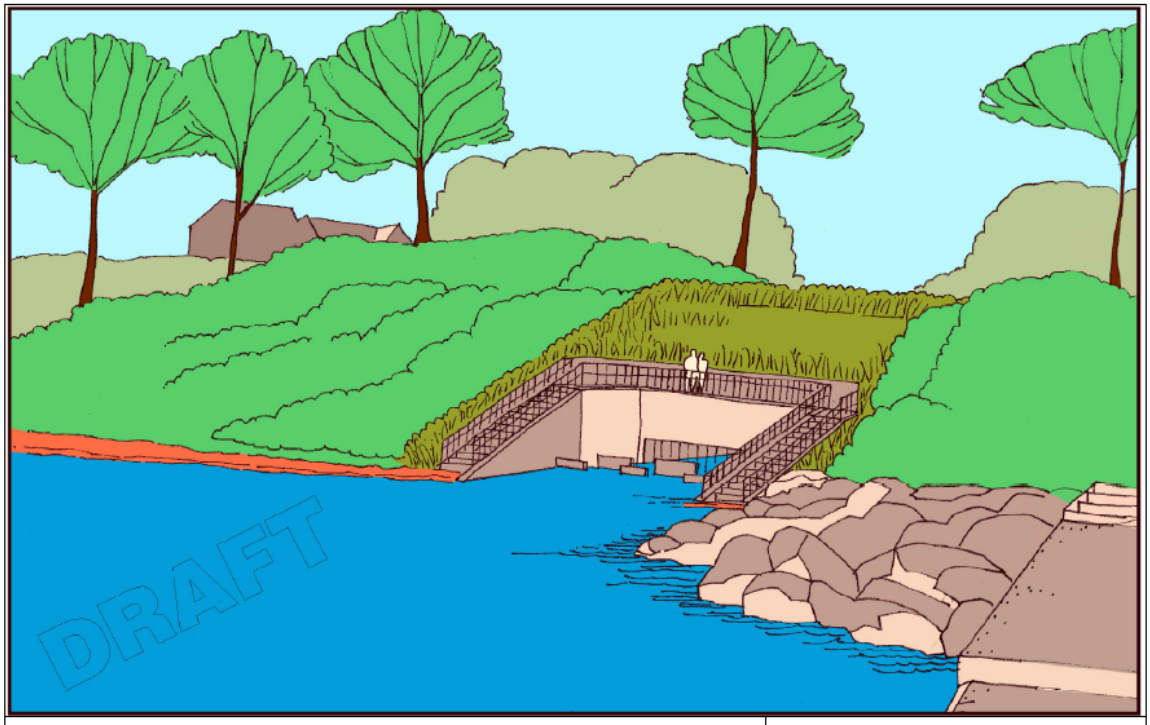


For larger storms beyond the 50%-chance storm, runoff from the western watershed will enter the tunnel and flow east to Lake Michigan through the treatment system. The structure provides for a treatment capacity of about 16 cubic feet per second. Flows beyond this level will bypass the treatment facility. However, the tunnel is proposed to be equipped with a gate, so that discharge from the pipe can be controlled, and the roughly 9.8 acre-feet of latent storage capacity in the tunnel can be used to hold water and release it through the treatment system at a reduced rate. This approach allows for treatment of flows up to about a 50% chance storm, which accounts for approximately 70% of the total discharge for a typical water year. Further, this strategy will allow the project to reduce annual pollutant loadings of key compounds including chlorides, oil & grease, bacteria, and phosphorus, below current levels.

End-of-pipe treatment is to be achieved by using a combination of a cartridge filter system for phosphorus and suspended solids removal, and peracetic acid for bacteria reduction. The cartridge filter system, described in Appendix D of the Preliminary Design Report, will consist of 325 individual cartridge filter units installed in a 24-foot by 50-foot below-ground treatment chamber. These cartridges will need to be replaced every 1-

2 years to maintain effective treatment capacity, at an estimated cost of $75,000 per year plus labor and disposal costs. Bacteria reduction will be accomplished by treatment with peracetic acid (PAA), a mixture of acetic acid, hydrogen peroxide, and water. Use of PAA is increasing as a final disinfectant for effluent from wastewater treatment facilities, and it is also being increasingly investigated and considered as a treatment for stormwater discharges. The US Environmental Protection Agency published a case study, shown in Attachment #2 indicating that PAA provides excellent bacterial disinfection, over relatively short (~10 minute) contact times, without high residual disinfectant levels or toxic by-products associated with disinfectants such as Chlorine.

Treatment would be achieved in a below-ground structure located at the east end of Willow Road. This structure will also serve as a velocity and erosion control structure, and is shown graphically in the following figures:

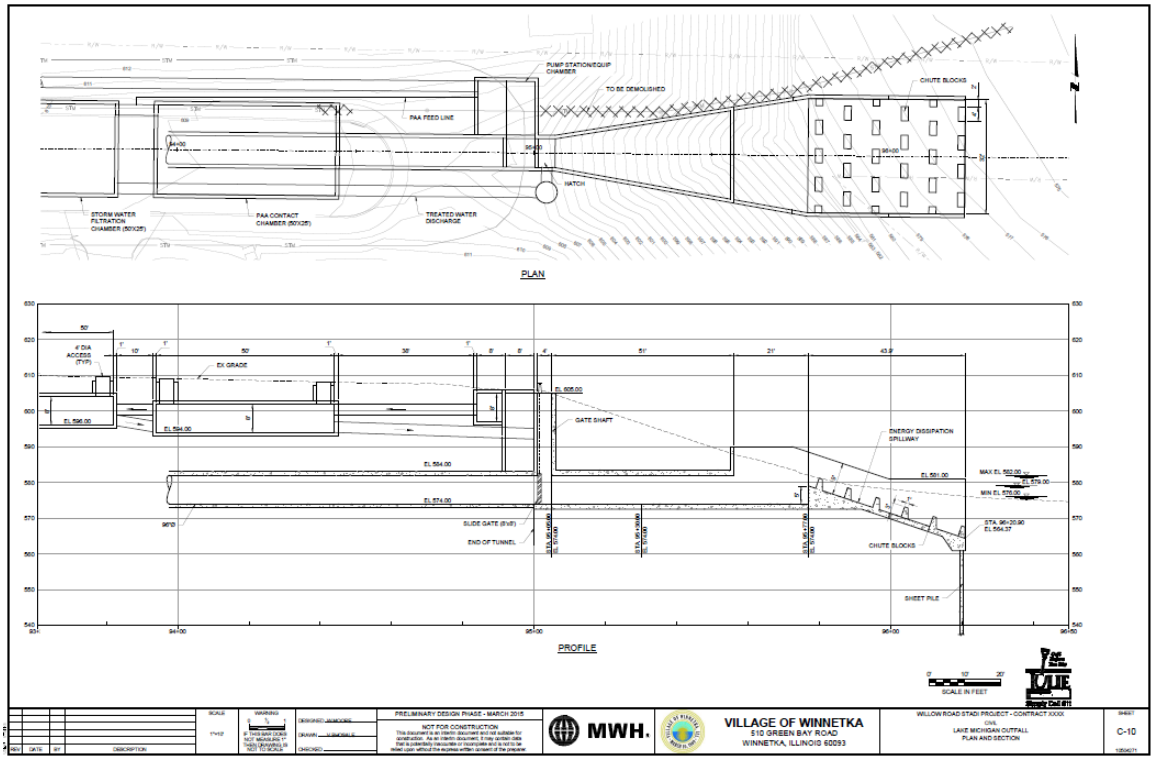


Drawing Not To Scale

MWH

March 2015

Figure 3.4
Outfall Rendering - Viewed fom Lake Michigan
Proposed Willow Road STADI Project
Village of Winnetka
Cook County, Illinois



This outfall structure design is driven by project requirements including discharge volume and velocity control, erosion control, and water treatment requirements; however aesthetic, construction, and safety considerations are also extremely important to adjacent residents and other stakeholders and regulatory agencies. Staff has had initial discussions with neighboring property owners to identify design concerns, and has prepared this preliminary design with these concerns in mind. However, this preliminary design will need to be thoroughly discussed with adjacent property owners, regulatory agencies, and other stakeholders. Should the Village Council direct staff to advance permit applications for this project, staff will schedule necessary discussions with neighbors and other stakeholders so that the final design includes their input.

Estimated Project Cost

Finally, MWH has prepared a Class 4 OPCC for the project. The ACCE uses a classification system to define expectations related to project cost estimates developed at various stages of design. Typically, Class 4 OPPCs are developed when design is 10% to 40% complete, and are used for preliminary budget approval. MWH's approach to cost estimating uses detail from the detailed soil borings and ground surveys. In addition, unit costs for certain key items were developed using a "bottom up" approach, using actual material costs, equipment costs, labor rates, and productivity.

MWH has estimated the total project cost at $58,473,000 in 2015 dollars. The previous cost estimate, developed by CBBEL in fall of 2012, was $34,597,912, in 2012 dollars. The current estimate is obviously significantly higher than the conceptual estimate, and according to MWH there are several reasons for this, as described below.

First, MWH explains that the project estimates were prepared using different methodologies, and based on significantly different levels of available information. The original CBBEL OPCC was prepared at the conceptual design stage of the project and was based primarily on quantity estimates for major construction items and typical unit prices for those items. A more detailed evaluation of the costs for the tunneling portion of the project was developed with the assistance of a tunneling contractor and incorporated into the overall estimate. A contingency was included in the 2012 estimate based on allowances of 15% on the tunnel portion of the project and 20% on the remainder of the project. Costs for engineering design, construction observation, permitting, and project management were calculated as percentages of the construction total (including contingency) to yield the total estimated project cost. The OPCC presented in MWH's Preliminary Design Report is based on the results of preliminary design activities and consideration of site-specific conditions throughout the project area. In addition, select unit costs have been developed based on a "bottom-up" consideration of costs for materials, equipment, labor, and productivity. Individual estimates were developed for various segments of the overall project and combined to generate the costs for the overall project. As the MWH estimate is still based on preliminary design information, contingencies are included to account for design details that are yet to be developed as well as possible variations in the design. Based on the additional analysis of factors that can impact tunneling costs completed by MWH, the contingency for the tunnel portion has been reduced to 10%. A contingency of 20% has been maintained for the open cut part of the project to account for possible variations in design required to accommodate conflicts with existing infrastructure and provide for future development of details related to roadway restoration.

Second, as MWH has advanced and developed the project design through preliminary engineering and months of additional study, they have proposed decreasing the "open cut" storm sewer portion of the project and increasing the tunnel portion, to significantly reduce the impact of construction on Willow Road. MWH's experience has shown that when the full costs of excavation, installation, restoration, and disruption associated with installation of large diameter storm sewer at depths greater than 15-20 feet are considered, tunneling is cost competitive with open cut construction. The preliminary design analysis completed to date has confirmed that the proposed Willow Road storm sewer east of Birch Street must be constructed at depths in this range or greater to avoid a conflict with an existing Metropolitan Water Reclamation District of Greater Chicago (MWRD) interceptor in Sheridan Road and allow for drainage of the Winnetka Road underpass. The previous estimate, based on the belief that the new storm sewer could be constructed above the interceptor, did not consider the cost of constructing this full run of sewer at the depth required.

Third, in the time that elapsed between 2012 and 2015, there has been a significant increase in certain construction costs, including large-diameter concrete pipe and trucking. Pricing information provided by material suppliers in the Chicago area indicates that current material costs for large diameter reinforced concrete sewer pipe delivered to a job site have increased significantly in the past 1-2 years. For example, the cost per foot of 36" storm sewer in 2010 had bids ranging from $59 to $95 per linear foot. In their

2012 estimate, CBBEL used $85 per foot. However, a survey of 2014 bid prices indicated unit prices averaging $170 per foot for 36” concrete pipe. This is double the price from the 2012 estimate. Similar increases have been observed for other pipe diameters.

In addition, MWH has explained that the productivity of contractors installing large diameter pipe in Winnetka will be constrained by the narrow streets. Discussions with contractors, using 30% detailed design documents, showing utility locations, proposed pipe depths, street widths, etc., indicate that average productivity for large diameter sewer installation may be as low as 40 feet per day, thereby increasing the costs of overall sewer construction.

Total sewer construction costs for the project are driven primarily by the length and diameter of sewer required, and the cost per foot to procure the pipe, excavate the trench, install the pipe and related structures, and restore the work area. While the total amount of storm sewer required under the MWH Preliminary Design has been reduced through adjustments in proposed sewer alignments to approximately 24,750 feet of storm sewer (about a 6,000 foot reduction) the cost per foot for sewer construction (including tunneling) associated with the MWH Preliminary Design is approximately $1,371 per foot while the overall unit cost associated with the 2012 estimate is $609 per foot.

Finally, as MWH has advanced design, evaluated existing water quality data, and discussed water quality goals, standards and requirements with the Illinois EPA, the proposed approach to water quality has radically changed from the conceptual project approach. The 2012 EOPC had a cost of $94,000 for the water quality treatment. The concept plan was to convey the low flow from the upstream tributary areas to the Skokie River, where it flows now, and provide some water quality improvements at storm sewer catchment/inlet locations in various areas. As currently designed, the project proposes to treat runoff from the area east of the railroad tracks that currently is tributary to Lake Michigan at the end of the tunnel project.

Based on water quality discussions with regulatory agencies, consideration of the elevation at which the proposed Willow Road storm sewer would need to be constructed to avoid the MWRD interceptor in Sheridan Road, review of the design conditions at the outfall during peak flow periods, and evaluation of aesthetic impacts, an alternative design was developed by MWH to include energy dissipation, flow control, and filtration/disinfection of low flows. The extent of the outfall/water quality structure required to achieve these objectives is significantly greater than the structure included in the 2012 Plan and includes an energy dissipation apron at the shoreline, a gate structure for flow control, a pumping facility for conveyance of flows from the tunnel treatment chambers, and a two stage (filtration, disinfection) treatment system. Efforts have been made to minimize disruption in the vicinity of adjacent properties, but significant temporary support of excavation, and surface excavation are anticipated at the east end of Willow Road. Costs for construction of the outfall/water quality structure included in the MWH Preliminary Design are anticipated to be more than $4 million.

In an effort to try to determine why there is such a discrepancy between the current and previous cost estimates, Village staff has asked CBBEL to update their 2012 OPCC, using current construction costs, but using the same methodology and level of detail that was used in 2012. That cost estimate is shown alongside the current MWH OPCC in the following table, and reflects different market conditions, particularly for open-cut (i.e. non-tunneled) installation of large storm sewer.

WILLOW ROAD STORMWATER TUNNEL AND AREA DRAINAGE IMPROVEMENTS PROJECT
COMPARISON OF COSTS ESTIMATES

	CBBEL Feasibility Study (Sept 2012)	CBBEL Feasibility Study (Adj to 2015 dollars)	MWH Preliminary Design - Tunnel: Berkeley to Lake - Willow Road Shafts	Difference between MWH Preliminary Design and CBBEL Feasibility Study (Adj to 2015)	Percent of Total Difference in Costs
Mobilization, Traffic Control Costs	$ 1,515,000	$ 1,850,000	$ 2,568,595	$ 718,595	11%
Sewer Construction Costs	$ 18,595,870	$ 29,735,400	$ 33,931,286	$ 4,195,886	62%
Total Storm Sewer Length	30550	30550	24746		
Sewer Construction Cost/Foot	$ 609	$ 973	$ 1,371		
Tunnel Costs	*$ 9,540,870*	*$ 10,320,000*	*$ 23,423,180*		
Tunnel Length	3300	3300	8502		
Tunnel Costs/Foot	$ 2,891	$ 3,127	$ 2,755		
Open Cut Costs	*$ 9,055,000*	*$ 19,415,400*	*$ 10,508,106*		
Open Cut Lenth	27250	27250	16244		
Open Cut Costs/Foot	$ 332	$ 712	$ 647		
Roadway/Surface Restoration	$ 5,651,225	$ 6,620,969	$ 3,919,054	$ (2,701,915)	-40%
Restoration Length	27250	27250	16244		
Restoration Costs/Foot	$ 207	$ 243	$ 241		
Outfall Structure Cost	$ 239,000	$ 350,000	$ 4,030,100	$ 3,680,100	55%
Utility Relocation Cost	$ 200,000	$ 250,000	$ 1,587,660	$ 1,337,660	20%
Subtotal Cost	$ 26,201,095	$ 38,806,369	$ 46,036,695		
Contingency	$ 4,763,176	$ 7,535,274	$ 6,387,839	$ (1,147,435)	-17%
Contingency %	18%	15% for tunnel & 20% other	13.9%		
Total Estimated Costs	**$ 30,964,271**	**$ 46,341,643**	**$ 52,424,534**		
Design Engineering (4.5%)	$ 1,393,392	$ 2,082,584	$ 2,305,000		
Construction Observation (4.5%)	$ 1,393,392	$ 2,082,584	$ 2,359,104		
Permitting (1%)	$ 309,643	$ 463,416	$ 524,245		
Feasibility Studies (actual)	$ 37,750	$ 37,750	$ 37,750		
Material Testing	$ 35,000	$ 35,000	$ 35,000		
Project Management 1.5%	$ 464,464	$ 695,125	$ 786,368		
Subtotal Engineering/management	$ 3,633,641	$ 5,396,459	$ 6,047,467	$ 651,008	10%
Estimated Total Project Cost	***$ 34,597,912***	***$ 51,738,102***	***$ 58,472,001***	***$ 6,733,899***	***100%***

FINANCIAL DISCUSSION – COST REDUCTION

MWH and staff have evaluated a variety of potential options that may reduce the cost of the project. The key cost drivers on the project are the total length of storm sewer, the amount of sewer to be tunneled, and the diameter of the storm sewer, therefore cost reduction measures are focused in these areas.

<u>Reduced Design Storm</u>

The project was originally conceived and designed to provide sufficient conveyance capacity to provide flood risk reduction against a 1% annual chance storm (100-year storm). Because the critical design storm is a high-volume, short duration (2-hour) event, this design protection level requires conveyance of very high peak flows, and, consequently, very large diameter storm sewers. Staff requested that MWH re-evaluate the project modeling to determine what cost reductions might be achieved by designing for a 2% annual chance (50-year) storm instead. MWH's evaluation indicates that the lower design level would reduce peak design flows, allowing for installation of slightly smaller diameter pipes in many locations. The reduced pipe sizes produce an estimated project cost reduction of $4 to $5 million. While reducing the design storm event will still provide equivalent flood risk reduction for up to a 2% chance event, designing to the 2% chance storm still provides significant relief in most key areas. The change in flood risk reduction between the 2% chance design the 1% chance design is negligible in most

project areas, except for the area of Berkeley Avenue between Ash and Oak, and the Winnetka Avenue Underpass area. In these areas, using the 2% chance storm for design would increase predicted post-project flood depths by 0.4 feet (5") and 1.3 feet (15") respectively should a 1% chance storm occur. However, it should be noted that this would still provide significant flood reduction from existing conditions in these areas. "If the Village Council is inclined to further evaluate this option, staff and MWH should perform a detailed evaluation of its potential impact on the capacity and effectiveness of the Village's stormwater utility system to detain and convey stormwater out of the Village, including how many homes would be affected by the change in predicted flood depths, and whether other measures to flood-protect homes might be cost effective in these areas.

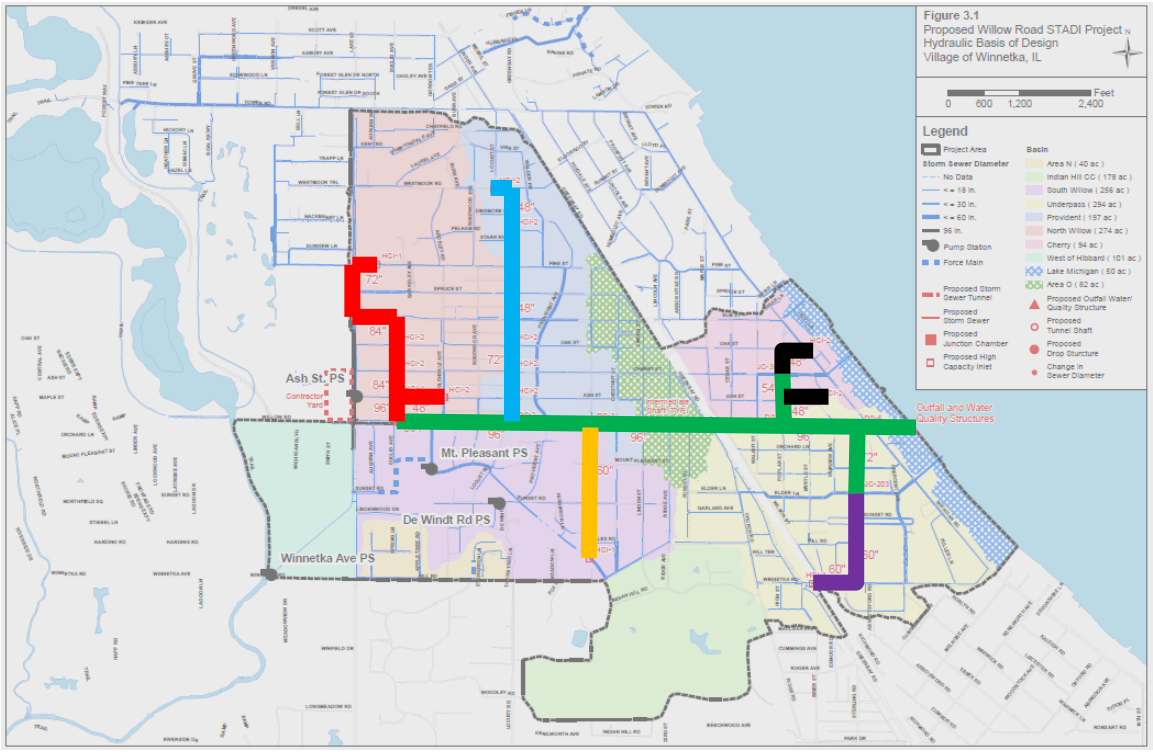
Detention or Peak Reduction

Because the storm sewer must be sufficiently large to pass large peak flows, staff asked MWH to evaluate the effectiveness and feasibility of providing intermediate detention facilities to store floodwaters in the upper portions of the drainage areas. This would reduce the peak flows from larger storms, allowing construction of smaller-diameter storm sewers and reducing cost. MWH's evaluation indicated that while there are several locations where some detention could be provided (including open space between Skokie School and Washburne School, Duke Childs Field, the Indian Hill Golf Club, and the Village parking lot near Green Bay Road and Winnetka Avenue) detention constructed in these locations would likely be limited in volume, reducing its effectiveness as a peak attenuation approach. Further, detention in these areas would most probably need to be placed underground, resulting in high costs per acre-foot. These factors would likely offset any potential savings associated with the associated reductions in pipe diameter achieved by peak attenuation.

Project Reduction/Phasing

In addition to storm sewer diameter, a major cost driver is the total length of storm sewer to be constructed in the project. While MWH has evaluated project routing to reduce the overall length of storm sewer from the previous conceptual routing, the project still includes construction of over 24,000 feet of large-diameter storm sewer in order to meet the project objectives. Further significant reductions in storm sewer length could be accomplished by phasing the project, or by eliminating portions of the project. The following figure presents the proposed project as designed, with a project cost of $58.5 million.

[Remainder of page intentionally left blank]



- Segment A includes the main "backbone" pipe under Willow Road, from Berkeley Avenue to Lake Michigan, the associated outfall/treatment structure, and low-flow diversion connections from existing storm sewers under Elder Lane and Cherry Street to provide water quality treatment;
- Segment B consists of proposed new storm sewer under Berkeley and Hibbard to serve the "tree street" area of western Winnetka;
- Segment C consists of proposed new storm sewer under Birch Street to serve areas of southwestern Winnetka;
- Segment D consists of proposed storm sewer to serve the Winnetka Avenue Underpass area;
- Segment E consists of proposed storm sewer to serve Ash Street, Cherry Street, and Oak Street west of Sheridan Road;
- Segment F consists of new storm sewer under Locust Street From Willow Road north to Westmoor Road.

In order to construct the project for a reduced initial cost, the Village could consider constructing segments A, B, and C, to provide the "backbone" infrastructure of the project, and bring prompt flood risk reduction to areas most at risk of widespread structure flooding. Segments D, E, and F could be phased for possible future construction at a later date, or eliminated from the project, or a combination thereof.

Item	Cost
Proposed project with all segments	$52,425,000 (construction cost less soft costs)
Less Segment D, underpass area	($2,500,000)
Less Segment E, Ash, Cherry, Oak near Sheridan	($1,500,000)
Less Segment F, Locust from Willow to Westmoor	($4,435,000)
Adjusted project construction cost	$43,990,000
Project soft costs (engineering, permitting, construction management, etc.)	$5,457,000
Adjusted project total cost	$49,447,000

Obviously, confirmation of the cost estimates is critically important to ensure that the Village is able to plan any changes to the existing structure of the financing of the stormwater utility. At the Council's direction, staff will evaluate options in this regard and, in conjunction with the results of the independent peer review on the cost estimates discussed below, provide the Council with recommended alternatives, if necessary.

POSSIBLE NEXT STEPS

MWH's contract with the Village anticipates that upon completion of this Review Point #2, the Village can either:

- Direct MWH to proceed with additional activities in accordance with the current scope, schedule, and budget;
- Negotiate a revised scope, schedule, and budget for additional tasks and direct MWH to proceed with the revised scope; or
- Suspend services pending further direction from the Village.

Permit Application Submittal. It does not appear prudent at this time to simply advance the project without an independent review of the cost estimates and related issues. However, simply suspending work on the project also does not serve the long-term interests of the Village, given the persistence and severity of flood risk in widespread areas of the Village.

The project design contract timeline anticipates that the next key step is to complete the draft permit applications and submit them to the respective review agencies. This is because the time schedule associated with the permit application, review, and approval, is approximately 12 months. A reasonable approach at this time is to proceed with submitting the permit applications so that the respective agencies can commence their reviews, but not to proceed with additional design services at this time. Rather, a the Village should undertake a thorough independent review of the project work to date (including cost estimates), and should evaluate construction phasing and financing

options available to refine the project so that the Village's stormwater utility can provide significant flood risk reduction in the Village.

There are several benefits to this approach. First, despite several discussions with the Illinois EPA, permitting and water quality aspects still key feasibility aspects of the project. While the EPA has helpfully engaged in these discussions, they have also been very clear that they will need a full permit application with all necessary details before they will be able to begin officially reviewing the project. Feasibility will ultimately rest on permitability, and there is no way to ascertain this feasibility until the completion of the permit process is reached. This process is estimated to take 12 or more months from time of submittal, so submitting at this time will begin that process and allow the project to move forward, without significant additional expenditure for engineering.

MWH has estimated a cost of $100,000 to $125,000 for advancing the project through permitting in this manner. It is important to note that these next steps are just that – next steps in what is likely to be a lengthy permitting process. This work would complete the preparation of permit applications that can be submitted based on the preliminary design, and provides for a reasonable amount of time responding to comments from the permitting agencies. This does not, however guarantee obtaining permits for the project nor does it obligate the Village to proceed with the project if a permit is granted. The goal of these next steps is to get a more detailed indication from the permitting agencies as to what they will require/expect as the basis for issuing a permit. The STADI Project is a unique project. As a result, there is no easy "go-by" for the Village, its consultants, or the permitting agencies.

MWH has identified the following next steps in the permitting process:

1. Prepare Permits for Submittal to Reviewing Agencies - $33,000
   a. Task 1.1 – Host an informational meeting (1/2 day) with selected NGO's to allow them to ask questions and solicit their input/concerns regarding the project.
   b. Task 1.2 – Modify elements of the project plan (e.g., Water Quality Management Plan, Outfall Structure) to address NGO Comments as appropriate. We believe that this will be important prior to the submittal of our permit, especially for the IEPA.
   c. Task 1.3 - Update permit materials and submit. These will clearly be initial permitting materials based on the preliminary design. The permitting agencies will almost certainly request additional information or analysis that has not yet been developed. However, we would hope to learn from this submittal: (1) Whether our WQ management approach is reasonable? (2) Whether a load reduction, number of exceedance, or mixing zone approach will be used to evaluate water quality compliance? (3) What additional data or analysis is needed? (4) Do other agencies have any major issues with the project design?

2. Allowance for Follow-up with Permitting Agencies - $20,000

At this time, for this unique proposed discharge to Lake Michigan, we are not sure what agencies will request/require in terms of additional permitting information or studies. For now, we've budgeted for one follow-up meeting each with IEPA and MWRD, as well as 60 hours of staff time to respond to agency comments.

3. Project Management - $12,000
   Project Management costs include time for internal review and coordination, attendance at 6 bi-weekly progress meetings over a 3-4 month period, one briefing with staff and council members, invoicing and progress report.

A general estimate for these three activities is $65,000.

4. Optional Modeling/Process Development –
   It is anticipated that the IEPA may ask for additional detail related to aspects of the proposed water quality management plan. Specific activities that we believe would provide additional support for the plan include:
   - Enhancement/re-calibration of the existing hydrologic/hydraulic model to support continuous simulations of runoff and discharge (assume 5-6 weeks of effort to update the hydrology, add controls, and re-calibrate)
   - Development of additional details/research regarding the proposed stormwater treatment system.

The scope and cost for these items could vary, but $40,000 - $50,000 is a reasonable budget for next steps. With consideration of all these items, a ballpark estimate would be in the range of $100,000 to $125,000.

Items that are specifically not included in these estimates are:
- If necessary, mixing zone/dispersion modeling at the Lake outfall
- If necessary, additional water quality monitoring the IEPA may request
- If necessary, revisions to the relief sewer/tunnel design to address IEPA comments or concerns

If any of these additional services become necessary, an amended scope of work will need to be developed, and reviewed and approved by the Village Council.

<u>Further Evaluation and Independent Peer Review.</u> While the permitting agencies are reviewing the permit submittal, the Village should continue to evaluate the design, scope and financing of the project. Evaluations should include whether the project ought to be constructed in part or in full and to a 100-year design or something less. The evaluations should also include an independent peer review of current cost estimates for the project.

If a peer review is to be considered, it should be completed by an independent qualified engineering firm that has not previously been involved in the project. The project review should consist of the following general scope, to be further developed should the Village Council concur:

- Review of Previous Engineering and Supporting Data. The consultant shall review the initial Flood Risk Reduction Study, prepared by Christopher B. Burke Engineering, and the Willow Road Tunnel Feasibility Study Report, prepared by Village staff, to develop an understanding of and to become familiar with the studies that formed the starting point for MWH's contractual scope of work. The consultant shall review the hydrologic and hydraulic modeling used to generate initial project design, cost estimates, and details. Any data and/or assumptions that appear to be questionable, not industry standards, or not within acceptable hydrologic/hydraulic modeling methods and parameters shall be noted and discussed in the Peer Review Summary.

- Review of Concept Review and Permitting Plan. The consultant shall review all Review Point #1 documents, including the data, assumptions, methods, calculations, and conclusions. The consultant shall review the hydrologic and hydraulic modeling used to generate project design and details. Any data and/or assumptions that appear to be questionable, not industry standards, or not within acceptable hydrologic/hydraulic modeling methods and parameters shall be noted and discussed in the Peer Review Summary.

- Review of Preliminary Design Report. The consultant shall review Review Point #2 documents, including the data, assumptions, methods, calculations, designs, drawings, estimates, and conclusions. The consultant shall review the hydrologic and hydraulic modeling used to generate project scope and details. Any data and/or assumptions that appear to be questionable, not industry standards, or not within acceptable hydrologic/hydraulic modeling methods and parameters shall be noted and discussed in the Peer Review Summary. Particular attention shall be given to methods, assumptions, and calculations used to develop and prepare the Opinion of Probable Construction Cost.

- Summary Peer Review Analysis and Conclusions. The consultant shall prepare a written draft report and commentary on the studies performed and shall make recommendations concerning the accuracy, reasonableness, and feasibility of the project work. The consultant shall comment on the need for refinement of data, study or design assumptions, or other factors that would bear on the feasibility, development, design, and cost of the STADI Project.

The peer review could also be divided to provide a more tailored review of the cost estimates that could be completed in a relatively short timeframe. Additional peer review on some or all of the other items listed above could also be conducted.

Recommendation:

1. Authorize MWH to complete environmental permits and submit them to the respective regulatory agencies;
2. Direct staff to prepare further technical and financial analysis of a phased implementation approach for the proposed project, and;

3. Direct staff to engage an independent professional engineering firm to perform a detailed independent peer review of the proposed project, in one or more specific reports**.**

Attachments:

1. Preliminary Design Report
    a. Volume 1
    b. Volume 2
2. United States Environmental Protection Agency Alternative Disinfection Methods Fact Sheet: Peracetic Acid

United States Environmental Protection Agency
September 2012

Alternative Disinfection Methods Fact Sheet: Peracetic Acid

DESCRIPTION

Disinfection is considered to be the primary mechanism for the inactivation/destruction of pathogenic organisms to prevent the spread of waterborne diseases to downstream users and the environment. It is important that wastewater be adequately treated prior to disinfection in order for any disinfectant to be effective. Table 1 lists some common microorganisms found in domestic wastewater and the diseases associated with them.

Table 1: Infection Agents Potentially Present In Untreated Domestic Wastewater

ORGANISM	RELATED DISEASE
Bacteria:	
Escherchia coli	Gastroenteritis (enterotoxigenic)
Leptospira (spp.)	Leptospirosis
Salmonella (2,100 serotypes)	Salmonellosis
Salmonella typhi	Typhoid fever
Shigella (4Spp.)	Shigelloisis (bacillary dysentery)
Vibrio Cholerae	Cholera
Protozoa:	
Balantidium Coili	Balantidiasi
Cryptosporidium (Parvum)	Cryptosporidiosis
Entamoeba histolytica	Amebiasis (amoebic dysentery)

Table 1: Continued

Giardia Lamblia	Giardiasis
Helminthes:	
Ascaris lumbricoides	Ascariasis
T. Solium	Taeniasis
Trichiura trichiura	Taeniasis
Viruses:	
Enteroviruses (72 types) e.g. Polio, Echo, Coxsackie	Gastroenteritis, heart abnormalities, meningitis
Hepatitis A	Infectious Hepatitis
Norwalk Virus	Gastroenteritis
Rotavirus	Gastroenteritis

Source: Adapated from Crites and Tchobanoglous,1998

The effectiveness of a Peracetic Acid (PAA) disinfection system depends on the characteristics of the wastewater, the concentration of PAA, the amount of time the microorganisms are exposed to the PAA, and the reactor configuration. For any one treatment plant, disinfection success is directly related to the concentration of colloidal and particulate constituents in the wastewater. PAA is a strong oxidant and virucide.

The mechanisms of disinfection using PAA include:

- Direct oxidation/destruction of the cell wall with leakage of cellular constituents outside of the cell.

Choosing a suitable disinfectant for a treatment facility is dependent on the following criteria:

- Ability to penetrate and destroy infectious agents under normal operating conditions.
- Absence of toxic residuals and mutagenic or Carcinogenic compounds after disinfection.
- Safe and easy handling, storage, and shipping.

When PAA decomposes in water, the free radicals hydrogen peroxyl (HO_2) and hydroxyl (OH) that are formed have great oxidizing capacity and play an active role in the disinfection process. It is generally believed that the bacteria are destroyed because of protoplasmic oxidation resulting in cell wall disintegration (cell lysis). The effectiveness of disinfection depends on the susceptibility of the target organisms, the contact time, and the concentration of the PAA.

APPLICABILITY

To reach high levels of disinfection of wastewaters, the concern about the formation of halogenated disinfection byproducts (DBPs) has become more and more of an issue. The need for an economical and relatively simple retrofit to an existing wastewater treatment facility has become apparent. The use of peroxygen chemical compounds has been practiced for years in Europe, but in the last several years water treatment companies have been considering the use of peracetic acid (PAA) as an alternative to halogenated disinfection chemicals (such as chlorine based products).

Peracetic acid is an equilibrium mixture of acetic acid and hydrogen peroxide and water $CH_3COOH + H_2O_2 \leftrightarrow CH_3COOOH + H_2O$. Commercially available PAA has a stabilizer to increase its storage life. The problem is to demonstrate that the use of PAA is: An effective disinfection compound that does not generate harmful DBPs; A more rapid acting disinfectant than chlorine based disinfectants; That PAA can be economically retrofitted and/or work in series with an existing disinfection system; That PAA dissipates rapidly and does not generate harmful disinfectant byproducts even if overdosed.

RESULTS

Some of the results of the actual study using PAA as a disinfectant are shown in Table 2.

Table 2: Residual PAA and Related Fecal Coliform Counts in the Contact Basins

Sample Point	Average PAA Residual (ppm)	Fecal Coliform (cfu/100ml)
Secondary Effluent	not applicable	48,000
1	0.9	13,680
2a	0.6	4,040
2b	0.5	3,620
3a	0.3	2,600
3b	0.2	2,340
4a	0.1	1,800
4b	0.1	1,480
5	0	580

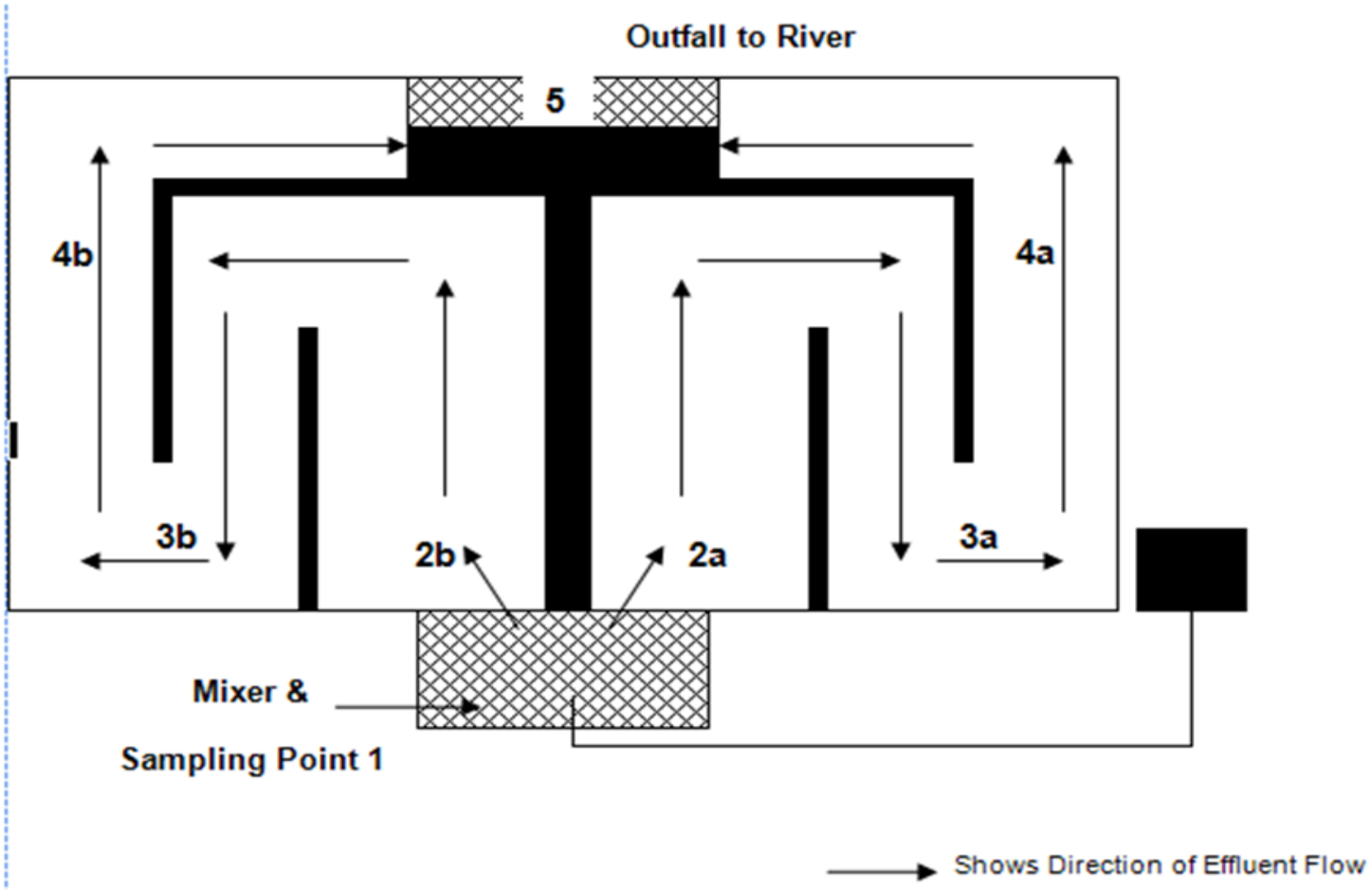


Figure 1: Disinfection Schematic

The results of these tests indicate that PAA is a fast acting disinfectant. As shown in Table 3, the initial fecal coliform counts were reduced 10 fold within the first 8-10 minutes estimated residence time after contact with the product (sample points 2a and 2b). Additionally, all PAA was consumed prior to discharge (sample point 5), demonstrating the lack of persistence of the PAA.

Table 3: Residual PAA in contact tanks and river outfall at a 5 ppm dose rate

Sample Point	Average PAA Residual (ppm)
1	n/a
2a	1.26
2b	1.21
3a	
3b	
4a	
4b	
5	
Outfall at River	.42

During the 5 ppm dose test, the flow rate of the effluent increased to 5678 m^3 / day which decreased the residence time to one hour. The PAA dose rate was verified to give a dose rate of 5 ppm; however, the highest number recorded during this test was 1.26 ppm. A sample at the mixer could not be obtained. The PAA decomposed rapidly with 0.42 ppm detected at the outfall. The purpose of the 5 ppm test was for river water testing; therefore no intermediate samples were taken. The final test was a repeat of the 1 ppm test that was performed in 2002. The results of this 1 ppm dose are shown in the Table 4 below:

Table 4: Residual PAA in contact tanks and river outfall at a 1 ppm dose rate

Sample Point	Average PAA Residual (ppm)
1	n/a
2a	0.8
2b	0.9
3a	0.3
3b	0.4
4a	0.25
4b	0.25
5	0
Outfall at River	0

During the 1 ppm dose study, the flow rate of the effluent varied from 2271 to 4542 m^3/day. This gave a residence time of between 67 and 133 minutes. All of the PAA was consumed before the wastewater reached the Huron River. These results are similar to the ones from the same test performed in 2002.

CASE STUDY: Frankfort, KY

The Frankfort, KY wastewater treatment plant evaluated PAA for use as a temporary disinfectant during an upgrade of their existing wastewater disinfection system (ozone). In 1980 the Frankfort wastewater treatment plant converted from chlorine gas to ozone for disinfection.

The plant was then upgraded from a 6.6 MGD plant to its current capacity of 9.9 MGD. In 2005 the decision was made to build a new higher capacity ozone generator in response to the higher capacity of the plant. Replacing the ozone generator necessitated a temporary disinfection technology during the 6 months between shut-down of the old generator and start-up of the new one.

After evaluating several disinfection technologies, including sodium hypochlorite and sodium bisulfite, the city went out to bid for a disinfection technology and PAA was chosen. This was the first commercial use of PAA for wastewater disinfection in the United States.

- The wastewater traveled through a static mixer and a disinfection chamber with a 26 minute contact time at permit flow. (See Figure 1).
- The target dose rate was automatically held constant based on the final effluent flow.
- Peracetic acid residuals at the discharge point were determined via a Chemetrics K-7905 test kit by Frankfort laboratory personnel.
- Bacterial analyses were performed daily by Frankfort laboratory personnel via the filtration method.
- BOD and pH analyses were taken daily by Frankfort laboratory personnel.

RESULTS OF THE CASE STUDY

- Within design flow conditions PAA 12% peracetic acid solution was effective at controlling fecal coliforms and E. coli. at a target dose of 0.7 ppm

- Effluent treated with PAA passed acute toxicity tests for Ceriodaphnia dubia.

- Treatments costs with PAA were competitive to disinfection with sodium hypochlorite and sodium bisulfite.

- Residual PAA in the wastewater at discharge was less than 1 ppm thereby eliminating the need of a neutralization step.

- No measurable effect was observed by Frankfort laboratory personnel on pH and BOD by the use of PAA for disinfection.

COSTS

Peracetic acid is applied to the wastewater process from a bulk or intermediate storage vessel directly into the wastewater. Typically a pump is used to transfer the PAA from the storage vessel into the secondary effluent. Good dispersion/mixing can improve the effectiveness of the amount of PAA added. The injection rate is controlled by proportional flow control from a 4-20 mA signal sent from the wastewater utility effluent flow measurement. Most systems in the USA receive PAA in containers not larger than 300 gallon one-way disposable totes. The single most expensive item (for tote systems) is a flow paced pump skid that cost less than $50,000 for a 50 MGD facility at 4 ppm PAA.

REFFERENCES

Gehr, R., Wagner, M., Veerasubramanian, P., Payment, P., Disinfection efficiency of Peracetic acid, UV and ozone after enhanced primary treatment of municipal wastewater. Water Res. 37, 4573-4586.

Kitis, M., 2004. Disinfection of wastewater with Peracetic acid: a review. Environ. Int. 30, 47-55.

Metcalf & Eddy, Inc. 1991. Wastewater Engineering: Treatment, Disposal and Reuse. 3d ed. The McGraw-Hill Companies. New York, New York.

US EPA, 1999. Combined sewer overflow technology fact sheet. Chlorine disinfection. EPA 832-F-99-034. Office of Water, Washington, DC.

Some of the information presented in this fact sheet was provided by the manufacture or vendor and could not be verified by EPA. The mention of trade names, specific vendors, or products does not represent an actual or presumed endorsement, preference, or acceptance by the U.S. EPA or Federal Government. Stated results, conclusions, usage, or practices do not necessarily represent the views or policies of the U.S. EPA.

US Environmental protection Agency

Office of Wastewater Management

EPA 832-F-12-030