

## **Proposal for Superior Street Reconstruction Hot Water System Design**

**Project No.: 1525**


**Bid Number: 16-0214**

**Submitted by Ever-Green Energy in partnership with LHB and Arrowhead Consulting and Testing**

**March 23, 2016**



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Andrew Kasid, Executive Vice President, CFO  
Ever-Green Energy, Inc.



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## 1. Introduction

The City of Duluth (City) is in the planning phase of design and development for the Superior Street reconstruction. As part of this effort, the City is in need of a qualified design engineer for a European thin-walled, steel hot water piping system that would be installed for Duluth Energy Systems (DES). The European design standard for this style of hot water system requires designing the piping system comprehensively, evaluating the expansion dynamics of the steel piping system, the alarm wire monitoring system, the insulation, and the protective exterior shell as a complete system. The right consultant for the City will have extensive experience designing and constructing thin-walled, steel hot water piping systems according to the European design standards in the upper Midwest, and will have a broad-range of expertise on the operation and maintenance of thin-walled, steel hot water piping systems. The right consultant will also have a strong working relationship with LHB and the DES operations team, and a comprehensive understanding of their preferences for how the thin-walled, steel hot water systems operate. Lastly, the right partner for the City will have extensive experience converting customers of steam-based district heating systems to hot water district heating systems.

With decades of experience in designing and operating hot water systems, Ever-Green Energy (Ever-Green) is the right partner for the City. As a recognized leader in the design, construction, implementation, operation, and management of reliable hot water district energy systems, Ever-Green approaches each system with a focus on the needs of system customers and efficient, reliable delivery of energy. The Ever-Green design development process involves early engagement with operations staff to establish an effective system basis of design. As the engineer and operator of the largest thin-walled, steel hot water district energy system in North America, we understand better than any other firm how impactful certain design decisions can be on system reliability and cost effectiveness. Our design process balances initial construction costs with long-term system maintainability, delivering a system design that enables cost-effective construction and system operation.

**As the engineer and operator of the largest thin walled, steel hot water district energy system in North America, we understand better than any other firm how impactful certain design decisions can be on system reliability and cost effectiveness.**

## 2. Introduction to the Project Team

The Project Team will be led by Ever-Green, with Arrowhead Consulting and Testing, Inc. (Arrowhead) acting as sub-consultant on asbestos abatement. This project team will guide the City through this phase of the project leveraging our unique expertise and a strong track record of hot water distribution system implementation.

### 2.1. Ever-Green Energy, Inc.

Ever-Green is one of the country's premier energy system experts, with decades of experience in developing, operating, and managing community energy systems. We have applied this unique combination of technical expertise and operations experience to help a wide variety of utilities advance their operations and achieve higher levels of efficiency and sustainability.

Ever-Green operates and manages North America's largest hot water district energy system, utilizing 40 trench miles of steel pipe distribution to serve nearly 200 customers in downtown Saint Paul. This system was



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converted from steam distribution, allowing the system to gain significant efficiencies as well as incorporate renewable fuel sources. System owners and managers from around the world have come to Saint Paul to learn from these advancements and have sought out the Ever-Green team to guide them through their own steam to hot water conversions. Ever-Green's experience with hot water piping has made us a go-to expert for this approach to distribution, sharing our best practices with systems in transition at Stanford University, Ottawa, Canada, and most recently Pittsburgh, PA. We have also led development of new hot water systems, ranging from low to high temperature, in Minneapolis, MN, Juneau, AK, Washington DC, and Montpelier, VT.

The Ever-Green team has developed a systematic approach to designing distribution systems that takes into account the up-front capital costs, long-term usage, and ongoing maintenance needs. These piping systems need to be highly reliable, easy to maintain, and durable. Additionally, these systems have advanced leak detection systems that can save money and system disruptions. Ever-Green is an industry leader in the design and operation of this highly critical leak detection system.

Ever-Green has industry-leading operations, engineering, and technical depth, which has helped our system operations succeed. Our systems are able to diversify energy options and grow their customer bases by having long-term plans to guide their work. We apply decades of experiences and best practices combined with customized solutions that meet the unique needs of our customers. We will work side-by-side with our partners to make sure the process is straight-forward and cost-efficient, and the outcomes exceed their expectations.

In addition to the systems operated, managed, and maintained by Ever-Green, our company has recently provided engineering or system advancement services to the following clients: the United States Department of Energy, the Minnesota Division of Energy Resources (MN), Abbott Northwestern Hospital (MN), Destination Medical Center (MN), Bemidji State University (MN), Stanford University (CA), Arlington County (VA), Public Works and Government Services Canada (Canada), Hennepin County (MN), Lincoln Electric (NE), Saint Paul Port Authority (MN), Honolulu Seawater Air Conditioning (HI), City of Montpelier (VT), Burlington District Energy (VT), City of Bloomington, (MN), City of Rochester (NY), Miami-Dade County (FL), Ramsey County (MN) on behalf of the Rice Creek Commons project, and Prospect Park 2020 Partners (MN) on behalf of the University Avenue District Project.

## **2.2. Arrowhead Consulting and Testing, Inc.**

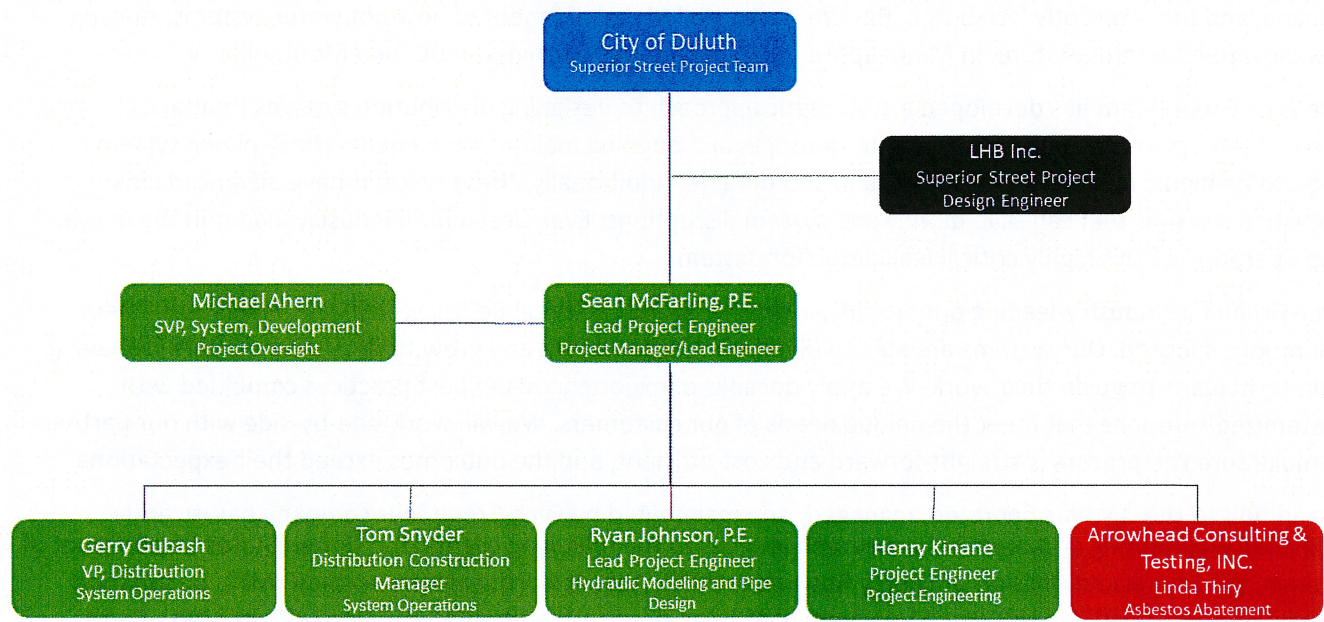
Arrowhead is an industrial hygiene-consulting firm providing asbestos consulting services to industrial, educational, institutional, commercial and residential clientele. Linda Thiry directs the asbestos program. She has 30 years of hands-on experience in the environmental and industrial hygiene field. Arrowhead maintains a Minnesota Department of Health Contractor License (License #AC614) for asbestos abatement project oversight. Arrowhead's field personnel are professional trained and licensed and adhere to strict quality control guidelines that meet or exceed current government criteria. Asbestos personnel are accredited (under EPA-AHERA) and Minnesota licensed as building inspectors, project designers, management planners, contractor supervisors, and air monitoring technicians. All Arrowhead personnel are National Institute for Occupational Safety and Health (NIOSH) 582 trained. The Arrowhead laboratory participates in the American Industrial Hygiene Association (AIHA) Asbestos Analyst Testing (AAT) Program under laboratory identification number 152007. Analysts are board approved by AIHA, and hold individual identification numbers.



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## Project Organizational Structure

The organizational structure for the Project Team is provided below. Ever-Green will operate as the prime contract holder with the City. Arrowhead will operate as a sub-consultant to Ever-Green. Resumes for key Project Team members are included in Appendix 2.



## 3. Work Plan

Ever-Green will utilize its experience designing, implementing, and constructing thin-walled, steel hot water piping systems to provide the City with the highest quality system design. Additionally, because of our extensive experience operating thin-walled, steel hot water district energy systems, the design will consider the long-term operations and maintenance requirements.

Ever-Green and LHB recently completed a pilot design project for the western four blocks of Superior Street to set a baseline for the entire Superior Street hot water district energy system design. Through this process we were able to establish a working relationship with the LHB design team and an efficient process for system design. Our proposed work plan for design of the remaining system will build on that process and will involve the following:

**Ever-Green and LHB recently completed a pilot design project for the western four blocks of Superior Street to set a baseline for the entire Superior Street hot water district energy system design.**

### 3.1. Project Coordination

The project coordination efforts undertaken during the pilot design between Ever-Green and LHB helped to streamline the design process and avoid unnecessary complications or duplicated efforts. Throughout the



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proposed design process, Ever-Green will meet and coordinate with LHB, DES operations staff, and the City to maintain a design process that is efficient and effective, while providing DES with world-class system design.

## 3.2. Preliminary Design

During preliminary design, Ever-Green will coordinate with LHB, DES, and the City to identify operational constraints such as operating temperature, pressures, and proximity to other utilities within the street. As the operator of DES, Ever-Green has a unique understanding of the operations of the system, thus reducing the amount of time needed from LHB and the City to relate these constraints to another consultant. Identifying and clarifying the operational constraints for the hot water system will help the team expedite the design process. As these operational constraints will affect decisions made during the design process, they must be clarified prior to the commencement of detailed design.

Once the operational constraints are identified and clarified, Ever-Green will revise the existing flow model that it has already developed so that the pipe sizes in the design meet the requirements of DES operations, and take into consideration any system expansions that have been discussed.

Following the flow model updates, LHB will identify a preliminary horizontal alignment and vertical profile for the hot water pipe that will allow for the footprint of hot water piping. As part of this process, Ever-Green will review the alignment and profile, and will provide recommendations based on the design constraints of the thin-walled hot water piping system. A portion of preliminary design will also include coordination with the other utilities in Superior Street to address potential conflicts and come to mutually agreeable solutions.

The preliminary design will be reviewed by Ever-Green's operations and engineering teams in Saint Paul and Duluth to eliminate any long-term operations or maintenance issues early in the design process.

The preliminary design (50% complete) will then be submitted to the City for staff review. The first review meeting with the City will be held at this time to address any initial issues or concerns.

## 3.3. Initial Detailed Design

Following the 50% submittal review by the City, LHB, and Ever-Green will revise the preliminary alignment and profile to address the comments provided. During initial detailed design, Ever-Green will identify the hot water service entry and temporary steam to hot water interface locations. Ever-Green will also perform preliminary thermal expansion calculations and design to provide adequate compensation for the thin-walled, steel hot water piping.

Once the preliminary thermal expansion design is completed, Ever-Green will work with our Saint Paul and Duluth Operations staff to identify the most operationally practical locations for system isolation valves, drains, and vents. Throughout initial detailed design, Ever-Green will coordinate with LHB and the local utilities to mitigate conflicts between the proposed hot water pipe and other facilities located in Superior Street. Ever-Green operations and engineering staff in Saint Paul and Duluth will again review the completed initial design as part of our standard quality control process.

The initial detailed design will result in 75% complete plans, which will be submitted to the City for review. The second review meeting will be held at this time to allow for course corrections as necessary.



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## 3.4. Final Detailed Design

Final detailed design of the project will be primarily related to making the final plan revisions and addressing the remaining utility conflicts so that all of the facilities may coexist in the Superior Street right-of-way. Utility coordination and revisions will continue through this phase, but are anticipated to be minimal. During final detailed design, Ever-Green will implement a moisture detection strategy that will enable identification of any potential leaks in the pipe over the course of its operation. This moisture detection design will be based on Ever-Green's 30+ years of experience operating the thin-walled, steel hot water system in St. Paul.

This phase of the design will also identify the number and size of conduits and locations of hand-hole boxes for a DES metering communications system, as well as preparation of the construction specifications, details, and appendices.

Ever-Green operations and engineering staff will perform a quality control review during final detailed design as well, providing insight and recommendations based on their experience operating and maintaining thin-walled, steel hot water systems.

The final detailed design phase will result in the submission of 90% plans to the City for review. The third and final review meeting will be held at this time to get City acceptance of the design, and authorization to proceed with completing the plans, construction specifications, and the bidding process.

## 3.5. Bidding Documents Coordination

Coordination of bidding documents will encompass the final revisions to the plans and specifications for the thin-walled, steel hot water piping system to be incorporated into the documents being prepared by LHB. In this phase, Ever-Green will also provide a final cost estimate and bid item list for LHB to use in the bidding process. Ever-Green's operations and engineering teams in Duluth and Saint Paul will perform a final quality control review of the final deliverables.

## Work Plan Hours

A tabulated version of the work plan and estimated budget hours for each task and subtask is shown below.



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Table 1 – Tabulated work plan

Activity	Hours	Activity	Hours
<b>Distribution HW Piping Design</b>	<b>475</b>	<b>Final Detailed Design</b>	<b>122</b>
Project Coordination Meetings	54	Asbestos Abatement Planning	16
<b>Preliminary Design</b>	<b>57</b>	Design Revisions	32
Customer Conversion Standards	8	Utility Conflict Review/Revisions	32
Operational Constraints Identified	3	Remote Station Locations	6
Flow Model Revisions & Pipe Size Review	4	Wire Looping Strategy	8
Preliminary Alignment Review	8	Monitoring System Strategy	10
Preliminary Vertical Profile Review	8	Handhole Locations	8
Preliminary Utility Coordination Review	12	Conduit Layout	4
Operations & Engineering Review	6	Operations & Engineering Review	6
<b>50% Design Submittal*</b>		<b>90% Design Submittal*</b>	
City Staff Review Meeting #1*	8	City Staff Review Meeting #3*	8
<b>Initial Detailed Design</b>	<b>136</b>	<b>Bidding Documents Coordination</b>	<b>86</b>
Utility/PW Revisions	16	Hot Water Piping Special Provisions	12
Service Entry Locations/Interface Determination	18	Appendices	8
Preliminary Thermal Expansion Design	18	Hot Water Construction Details	8
Preliminary Valve Locations Determination	8	Final Cost Estimate	20
Horizontal Utility Conflict Coordination	24	Final Plan Revisions	
Soils Conditions Considerations	2	Operations & Engineering Review	32
Groundwater Considerations	2	<b>Final Plan &amp; Specifications Submittal to LHB*</b>	<b>6</b>
Drain/Vent Locations	8	<b>Plans &amp; Specification Submittal to MSAS*</b>	
Vertical Utility Conflict Coordination	24	<b>Bidding Support</b>	<b>20</b>
Operations & Engineering Review	8	Clarifications to Questions	12
<b>75% Design Submittal*</b>		Addenda	8
City Staff Review Meeting #2*	8		

## Optional Services

### Switchover Coordination Planning

DES will be required to maintain service to customers throughout the reconstruction of Superior Street. Ever-Green, utilizing its vast operations and maintenance experience in performing similar steam to hot water conversions, could prepare a coordination plan for this effort. This plan could include temporary energy transfer station planning, engineering design, switchover sequencing, and customer assistance to enable DES to assure



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that customer needs are fulfilled throughout this project. This service is not part of the base scope, but could be provided if this service is requested by the City.

## *Construction Monitoring*

Proper installation of thin-walled, steel hot water piping systems requires continuous field oversight of the entire piping system construction, including welding, insulation, alarm wire systems, and the protective exterior shell. Monitoring must be performed by individuals that have experience with the construction of thin-walled, steel hot water piping systems, and understand how these systems operate. Failure to properly install these systems can result in extensive repair costs that far exceed the original system construction costs. Ever-Green could also provide site inspection services during construction, if requested by the City, but it is not included in this base proposal.

## 4. Schedule

To achieve the project goals and timeline the preliminary schedule for project milestones is:

- 50% Design Submittal – June 9, 2016
- City Staff Review Meeting #1 – June 16, 2016
- 75% Design Submittal – August 30, 2016
- City Staff Review Meeting #2 – September 1, 2016
- 90% Design Submittal – October 3, 2016
- City Staff Review Meeting #3 – October 17, 2016
- Final Plan & Specifications Submittal to LHB – November 21, 2016
- Plans & Specifications Submittal to MSAS – December 1, 2016

## 5. References

District Energy Saint Paul  
Michael Burns  
SVP, Operations  
76 W. Kellogg Boulevard  
St. Paul, MN 55102  
651-925-8132  
[Michael.burns@districtenergy.com](mailto:Michael.burns@districtenergy.com)

Energy Park Utility Company  
Peter Klein  
Vice President – Finance  
380 St. Peter Street, Suite 850  
Saint Paul, MN 55102  
651-204-6211  
[pmk@sppa.com](mailto:pmk@sppa.com)

District Heat Montpelier  
Jessie Baker  
Assistant City Manager  
39 Main Street  
Montpelier, VT 05602  
802-262-6250  
[jbaker@montpelier-vt.org](mailto:jbaker@montpelier-vt.org)

Stanford University  
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Project Manager  
3145 Porter Drive  
Palo Alto, CA 94304  
650-725-5498  
[jkearney@stanford.edu](mailto:jkearney@stanford.edu)



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## 6. Appendix 1 - Projects

### *Duluth Energy Systems – Operations and Management – System Master Planning (Duluth, MN)*

**Client Name:** City of Duluth, Duluth Energy Systems (local government municipality, municipal utility)

**Contact:** Dave Montgomery (Chief Administrative Officer), 218-730-5039, 411 West 1st St, Duluth MN 55802



**Ever-Green Energy's Role:** Ever-Green serves as the system operator and manager, which was further supported during this effort by engineering analysis, research, customer engagement, community engagement, financial modeling, reporting, and implementation plan development. Ever-Green also recently participated in a pilot hot water design project with LHB, Inc.

**Scope:** Duluth Energy Systems is the City-owned steam plant that provides heating and cooling service to downtown Duluth and Canal Park. Ever-Green works closely with the City of Duluth as the operator and manager of this community energy system. Together, these teams are planning important updates to this system, in an effort to save energy and prepare this system for another 80 years of service. The City of Duluth commissioned Ever-Green Energy (manager of the Duluth Steam system) to prepare a Five-Year Master Plan. This Master Plan has been serving as a guideline for improving the community energy system with a focus on (1) the efficiency of the system, (2) enhancing environmental stewardship for Duluth Steam operations, (3) maintaining or improving cost competitiveness, and (4) identifying opportunities for growth and advancement.

**Advisory Council and Community Engagement Process:** During the development of this plan, Ever-Green staff concurrently participated in the City of Duluth's Local Energy Action Plan process, which included citizen, business, academic, non-profit and advocacy, and government stakeholders. For the targeted feasibility analysis for the plan, the primary stakeholders were the City of Duluth (as system owner), St. Louis County, building owners and operators (customers), local businesses, and the University of MN Duluth.

**Stakeholders:** City of Duluth, St. Louis County, Duluth Chamber of Commerce, Duluth Port Authority, Local Energy Action Plan steering committee, Sierra Club, Ecolibrium3, and LHB Inc.

#### **Goals and Objectives:**

- Create a comprehensive plan to modernize the energy system in a cost-effective manner that meets the current and future needs of users.
- Examine and recommend growth opportunities for the system.
- Identify energy savings, plant efficiencies, and renewable alternatives that would improve the overall environmental profile of the system.

**Challenges and Solutions:** The system is in transition from a management and operational perspective and it was critical that the study recommendations be practical, readily implemented, and will modernize the system to the overall benefit of the City of Duluth and the end users. All of this needs to be accomplished with a moderate budget, so prioritization is key. Over the past two years, the focus has been on pilot hot water customer development, efficiency improvements, carbon reduction (through reduction of coal, plant and distribution improvements), steam to hot water transition, and future renewable integration.



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## *District Energy and District Cooling St. Paul (Saint Paul, MN)*

**Client Name:** District Energy St. Paul and District Cooling St. Paul (private, 501(c)3 non-profit)

**Contact:** Mark Rancone (Board Chairperson/VP Roseville Properties), 651-633-6312, 2575 Fairview Ave North, Suite 250, Roseville MN 55113

**Scope:** District Energy St. Paul is North America's largest hot water district energy system, providing reliable heating services to over 32 million square feet of diverse building space in downtown Saint Paul. Converted from steam to hot water in 1983, this system has grown from 40 to nearly 200 buildings, including commercial, multi-family residential, hospitals, government, hotels, entertainment and sporting venues, and historic structures. Leadership in customer service, reliability, efficiency and affordability has earned the system two International District Energy Association System of the Year awards, a global sustainability award from the International Energy Agency, and Champion City recognition from the United Nations Environment Program. Among its accolades, this system is known for its high reliability standards, system monitoring, and advanced distribution leak detection. By planning ahead and identifying potential issues before they become a problem, Ever-Green's team helps this local utility maintain quality of service and manage system maintenance to deal with short and long-term priorities.

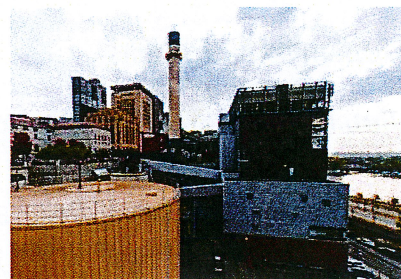
**Ever-Green Energy's Role:** Ever-Green is the service provider to District Energy St. Paul, providing comprehensive operation and management services (production, distribution, customer service), energy engineering and project management, as well as business operations, outreach, and education, and other general services.

**Advisory Council and Community Engagement Process:** District Energy St. Paul has undergone numerous advisory council and community engagement processes since originally transitioning through a public-private partnership in 1979. Higher profile stakeholder processes were completed for the steam-hot water transition in 1983, the cooling system addition in 1993, the addition of thermal tanks and plants at both Kellogg Avenue and 10th Street, the addition of the cogeneration facility, and the participation in the utility relocation efforts for the Green Line Corridor, which included customer and community engagement through three construction seasons.

**Goals and Objectives:** The system is currently focused on the following improvements:

- Increased system efficiency, with a focus on supporting customer efforts to improve building performance through system controls and new technology applications.
- Reduced carbon profile (exceeds national averages through biomass and combined heat and power).
- System growth to areas throughout Saint Paul, either as system extensions or through the development of energy islands

**Challenges and Solutions:** Over the past thirty years, District Energy Saint Paul has grown and advanced to meet the ever-changing needs of downtown Saint Paul. Through changes in building ownership, closure and repurposing of buildings, implementation of light rail transit, and the development of a science and sustainability district, Ever-Green has worked directly with the local community, business leaders and the local government agencies to advance the integrated energy model for Saint Paul in a cost effective, efficient and environmentally sustainable manner.





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## *Green Line Light Rail Utility Relocation and Transmission Planning (Saint Paul, MN)*

**Client:** District Energy and District Cooling St. Paul

**Ever-Green Energy's Role:** Ever-Green managed the initial planning, utility coordination with other major infrastructure utilities and the Metro Transit planning office, design and engineering of both the removal and installation of critical sections of distribution piping within downtown Saint Paul, design and engineering of a 5 ½ mile transmission extension, construction and construction oversight, and mitigation of overall customer impacts.

### **Project Summary**

**University Avenue Extension:** The planned extension of the main system in parallel with the light rail construction would have doubled the size of the current Saint Paul system and saved the project almost 40% in construction costs. The transmission extension was planned, designed, engineered, and incorporated into the overall construction plan for utilities and light rail, but funding was not finalized to extend the entire 5.2 mile stretch. To preserve the potential for district heating in these areas, our engineers designed and oversaw installation of two casing pipes that are still slated for use in an eventual energy system development for this area.

**Utility Relocation:** Over the course of 5 years, our team worked with construction teams, major utilities, Metro Transit planning staff, customers, the community, and other stakeholders to relocate major heating and cooling distribution infrastructure through Saint Paul's central business district. This work required significant planning, engineering, construction, and overall coordination to ensure that the distribution system maintained quality service throughout the transition and was improved at the conclusion of the work. Nearly four miles of pipe was replaced as part of this effort.

**Distribution and Information System Upgrades:** The planned development of a light rail line through the central business district offered the opportunity for District Energy to upgrade the data lines. Our engineers and distribution team recently completed an intensive, multi-year project focused on relocating existing district heating and cooling distribution piping infrastructure during the construction of this light rail line. This complex project included removal of 1983 vintage copper and smaller fiber optic communication lines and subsequent replacement with new fiber optic communication cable. These new fiber optic lines provide crucial, real-time leak detection, communication between meters and the central plant, and important data connections for local and state units of government.

**Technologies Considered:** Hot water district heating

**Project Milestones:** Utility relocation, system upgrades, and the transmission exploration were completed in 2012.



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## *Stanford University: Steam to Hot Water Transition (Stanford, CA)*

**Client:** Stanford University

**Ever-Green Energy's Role:** Owner's Consultant; Engineering Review, Construction Training

**Project Summary:** Stanford University has a strong commitment to energy efficiency and sustainability. As part of a comprehensive plan to reduce fossil fuels and energy consumption, the campus transitioned over 100,000 feet of district heating pipe from steam to hot water. Ever-Green shared thirty years of experience in installing hot water pipe, transferring the benefits of our methods for trenching, installation, leak detection, fiber co-locating and other best practices. Ever-Green provided ongoing project development support to the University.

**Distribution Focus:** Ever-Green trained Stanford University's civil engineering team on the design standards that were needed for the hot water distribution system. Ever-Green also established the standard specifications for the hot water system, along with the system construction standards. Both in Saint Paul and in Palo Alto, Ever-Green trained Stanford staff, construction staff and engineering teams on the proper design and installation of the hot water piping systems, including the alarm wire system. Ever-Green performed cold-eye reviews of the hot water design to verify that the system would be constructed as required for efficient operation.

**Project Goals:** When completed, the current set of projects anticipated under the SESI program will reduce campus greenhouse gas emissions by 50%, save 18% of campus potable water, open up the energy supply platform to future technologies, enable the campus to better manage its power portfolio, and yield utilities savings.

**Project Milestones:** The project was completed in 2015 and is now in full operation.

**Innovative Campus Smart Grid Solutions:** Hot water district heating, combined heating and cooling, water conservation and recovery





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## *Energy Park Utility Company: Four-Pipe Distribution System Upgrade (Saint Paul, MN)*

**Client:** Saint Paul Port Authority

**Ever-Green Energy's Role:** System operation and management since 1997. Since 2008, Ever-Green Energy has led the system advancement, including the completion of financing packages, extension of customer contracts, pre-construction engineering, and various plant improvements for production efficiency.

**Project Summary:** Energy Park Utility Company (EPUC) is the energy operation that serves the 218-acre Energy Park community in Saint Paul, MN. Home to manufacturers, commercial/office buildings, schools, health clinics, a hotel, and residential units, Energy Park is one of the nation's first "Urban Villages." Since 1980, EPUC has provided heating and cooling services to the majority of the buildings within Energy Park. Prior to the four-pipe conversion the system could only provide hot water for heating to customers in the winter and chilled water for cooling to customers in the summer.



**Distribution Focus:** The four- pipe conversion and upgrade of the system allows customers to receive heating and cooling services throughout the year, improving the overall energy services and experience for customers while optimizing the efficiency of this district system. Construction included the installation of distribution lines, take-offs, the conversion of customers' mechanical rooms to optimize system connections, and an expansion of the chilled water system. A notable development for this project was the use of PEX pipe for the distribution lines. PEX is a growing alternative for district energy distribution, serving as an effective material approach that can significantly reduce project costs for owners, developers, and end users.

**Technologies Applied:** District heating, district cooling, free cooling, PEX integration

### **Project Goals:**

- Provide simultaneous heating and cooling services
- Grow the customer base
- Improve system management

**Milestones:** Construction began in the summer of 2012 and work was completed in April 2014.



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## 7. Appendix 2 – Resumes

### *Michael Ahern, Senior Vice President of System Development*

Michael Ahern has 23 years of experience in development, construction, operation, and management of industrial and energy systems. He has managed the development, construction and start-up of over one billion dollars of energy systems. Since joining the Ever-Green team he has led the development of systems throughout the United States and Canada. Four of the recently completed feasibility studies led by Michael are moving forward with system implementation.

- Executive responsibility for strategic business growth and management of Ever-Green Energy's System Development Group.
- Coordinated multi-stakeholder investment and management structures for district energy system developments. Leads project teams through design engineering, construction planning, permitting, easement obtainment, project and business development, and system start-up.
- Energy Park Utility Company. Led design, development, financing, construction and start-up of the transformation of an existing district energy system to meet the changing needs of its customers. The three year, \$12 million system advancement included conversion from two to four pipe distribution for heating and cooling, expansion of the cooling system to include free cooling capabilities and enhanced winter cooling capacity.
- Duluth Energy Systems Led the development of a Master Plan for the advancement of the Duluth Steam system. Developed an implementation plan for integrating biofuels and transitioning the system from steam to hot water
- District Heat Montpelier. Led the system design and development support team. Support included distribution system design, customer contract sales, organizational structuring, financial modeling, staff training, start-up and commissioning services, and ongoing operation advisory services.
- Public Works & Government Services Canada, Ottawa, Canada. Supporting the transformation of five district energy systems from steam to hot water through a public-private partnership.

### **Additional Experience**

#### **Corval Group, Executive Vice President, Saint Paul, MN**

- President of construction operations and business development activities of a \$170+ million engineering and construction organization with operations across North America.
- Responsible for leading growth, strategy, mergers and acquisitions, and business development
- Led the national and international growth of construction into the following markets: Southwest (Las Vegas, NV); Northwest (Billings, MT; Helena, MT; Beulah, ND); Gulf Coast (Baton Rouge, LA; Port Arthur, TX); Canada (Saskatoon, SK)

### **Education and Specialized Training**

University of Notre Dame – B.S., Business Finance (International Business Minor)



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## *Sean McFarling, P.E., Lead Project Engineer*

Sean McFarling has more than five years of experience in the planning, design, implementation, project management, construction, and operation of community energy systems. He has been instrumental in the repurposing of existing systems (Energy Park Utility Company), implementation of new systems (District Heat Montpelier), and continued success and expansion of the existing systems (District Energy St. Paul) managed by Ever-Green Energy. Before coming to Ever-Green Energy, Sean worked in the traditional civil engineering field with experience in the design and construction of municipal systems, bridges, and planning. Sean is a licensed Professional Engineer in Minnesota, Vermont, and Maine.

- Leads project management, planning, and engineering for community energy systems.
- District Energy St. Paul. As Lead Project Engineer, responsible for project management and engineering for customer expansion and large system maintenance projects. Responsibilities include horizontal and vertical alignment design; pipe stress analysis and expansion compensation, valve, drain, and vent locations; valve chamber reconstruction projects; project-related system shutdown planning and execution. Planning and potential customer building evaluations for future system expansions utilizing waste heat resources.
- Rice Creek Commons. As Assistant Project Manager, had responsibility for the consultant oversight, project planning, and technical component inclusion for energy master planning effort for a 400+ acre site being redeveloped by Ramsey County. Worked with client Ramsey County to find local solutions to provide sustainable and environmentally conscious energy solutions, including planning for the utilization of an existing groundwater treatment system for energy capture for the residential areas of the development.
- Hennepin County Energy Recovery Center. As Engineering Project Manager, was responsible for engineering construction oversight for compliance to the construction documents, startup and commissioning planning and execution for implementation of the snowmelt system serving local light rail transit hub. Project included mechanical systems and piping to feed the more than 50 miles of PEX tubing for the snowmelt system in the transit center concrete.
- District Heat Montpelier. As Lead Project Engineer, served as Engineer of Record for the design of the hot water distribution system for the capitol city of Vermont; distribution system startup and commissioning planning and execution oversight. Responsibilities include horizontal and vertical alignment design; pipe stress analysis and expansion compensation, valve, drain, and vent locations; distribution system startup and commissioning planning and execution.
- Energy Park District Energy. As Project Manager was responsible for the construction project management, engineering design, and material procurement for the conversion of the Energy Park district energy system from a two pipe system to a four pipe, hot and chilled water, system. Responsible for the management of engineering consultants for the energy production and customer conversion design, in addition to, being the Engineer of Record for the design of the distribution system during the design phase.

## **Education and Specialized Training**

University of Minnesota-Bachelors of Civil Engineering

University of St. Thomas-Specialized Training, Mini-Masters of Project Management



# Proposal for Superior Street Reconstruction Hot Water System Design

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## ***Gerry Gubash, Distribution Services Manager***

Gerry Gubash has over 25 years of experience in district energy distribution systems, technical communications systems, customer mechanical system interface, and building mechanical operations. He is a specialist in leak detection technology and distribution system repair. Gubash has been instrumental in advancing District Energy St. Paul's leak notification system, as well as consulting on projects and systems for Ever-Green Energy.

- Responsibility for District Energy St. Paul thermal distribution system and technical communications systems including new construction, maintenance, and repair.
- Oversees team that ensure satisfactory connection standards for customer mechanical system interface and new customer connections for hot water and chilled water services.
- Provides overall scheduling and budget control for construction, maintenance, and repair projects to ensure distribution system reliability with minimal system shut-down periods and limited impact to working personnel.
- Works with distribution team to evaluate and analyze distribution system performance, identifying problems and operational trends. Provides reports for distribution system projects including budget estimates, cost projections, job cost reports, construction, maintenance and repair schedules. Reviews system operations and provide improvement recommendations for system reliability or operating efficiency.
- Works with Construction Manager to schedule distribution projects impacting customers. Establishes schedules, contingency plans, and contracts to minimize customer impact.
- Manages team on-call system to ensure appropriate response to Gopher State One-Call locate requests and customer service requests.
- Maximizes leak detection and leak locating technology to improve system reliability through scheduled planned maintenance, reducing the number of emergency repairs.
- Formerly served as project manager on repair jobs. Helped to field construct high-density polyethylene pipe jackets and coordinate temporary service equipment during repairs.

## **Additional Experience**

### **CB Richard Ellis, Chief Building Engineer, Bloomington, MN**

- Supervised engineering staff that was responsible for 300,000 square foot of property in downtown Saint Paul. Implemented preventative maintenance plan, capital projects, and budget planning. Oversaw the mechanical operations for buildings, including properties connected to District Energy St. Paul heating and cooling services.

### **Stuart Corporation, Building Operations Coordinator, Bloomington, MN**

- Supervised engineering staff responsible for 5 commercial sites and 30 apartment complexes. Responsible for preventative maintenance plans, capital projects, budget planning, and mechanical operations related to heating and cooling.

## **Education and Specialized Training**

Saint Paul College, Electromechanical Technology



# Proposal for Superior Street Reconstruction Hot Water System Design

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## *Tom Snyder, Construction Manager*

Tom Snyder has 11 years of experience in district energy distribution system construction and commercial construction.

- Provides project management for new construction, repair, and upgrade projects for the District Energy St. Paul's hot water and chilled water distribution systems including valves, underground vaults, tunnels, substations, communication conduit, and customer connection mechanical systems.
- Prepares contract documents for bid and contributes as necessary to design preparation by Ever-Green Energy engineers. Ensures all project designs meet distribution standards for long term system performance. Performs material take-off for project work.
- Provides contract administration requirements including contract preparation, progress and final payment request processing, submittal register and submittal processing, testing compliance, change orders, contractor lien waivers, etc. Resolve construction issues as required.
- Provides field oversight to ensure contractor compliance with design drawings, specifications, budget requirements, distribution standards of quality, and schedule. Coordinates contractor work with City officials, subcontractors and Ever-Green Energy customers. Administer contracts to secure record documentation is secured including submittals, as-built record drawings, testing results, etc.
- Plans and coordinates distribution system shut downs including customer service requirements, plant operations, and staffing of distribution personnel for system repairs and new service connection work.
- Provides oversight for the distribution system preventative maintenance program and other distribution department records. Oversees the seasonal shunt program requirements. Provides records management for system customer impact records, budget spreadsheets, vault status, fixed assets, and equipment assets including vehicles. Schedules tradesworker staff to ensure work is completed in accordance with equipment manufacturers' requirements.
- Provides technical oversight for the Mt. Airy substation and the backup support for the distribution system pipe monitoring programs.
- Provides technical backup for leak detection monitoring and analysis systems.
- Supervises the distribution department tradesworker staff in daily work including preventative maintenance, and scheduling for locate work, materials management and other distribution department functions. Work with the department safety coordinator to ensure safety reviews are conducted.
- Provides customer service as necessary to ensure that mechanical system interface equipment operates as designed. Assist customers and their contractors in analyzing and correcting system problems.

## **Additional Experience**

**National building Contractors, Project Manager, Saint Paul, MN**

- Managed multi-million dollar commercial construction projects across the United States.

## **Education and Specialized Training**

St. Cloud State University, Bachelor of Science in Business/Real Estate, emphasis in building and construction



# Proposal for Superior Street Reconstruction Hot Water System Design

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## ***Ryan Johnson, P.E., Lead Project Engineer***

Ryan Johnson has led engineering and design efforts for district heating, district cooling, and cogeneration systems operated and managed by Ever-Green, as well as other operating systems across the country. Johnson has expertise in equipment sizing, customer building and system load calculations, economic analysis, and technical reports.

- Hydraulic modeling and pipe stress analysis of District Cooling St. Paul, District Heating St. Paul, Duluth Steam, Energy Park Utility Company, and Ever-Green Energy consulting clients.
- Assistant Project Manager for Energy Park Utility Company conversion from a 2-pipe to a 4-pipe district energy system enabling year-round heating and cooling, improved system reliability, increased customer satisfaction, and additional energy efficiency. Managed cost analysis and design for the mechanical rooms of 24 customer buildings on the system. Assisted with system commissioning, testing, and start-up of systems in each customer building, as well as the primary energy center.
- Primary team member for the development of the Duluth Steam Master Plan, now under implementation.
- Study coordinator for Duluth Steam's initial Canal Park analysis for converting from a district steam system to a hot water district energy system. The report included equipment sizing, customer building and system load calculations, and economic analysis.
- Analyzes customer connectivity compatibility by surveying customer mechanical specifications through site visits and drawing review. Utilized data to complete life-cycle cost analysis and financial modeling for customers. Collaborated to complete this work for large-scale, complex projects in Crystal City, VA, Minneapolis, MN, and an energy island in Saint Paul, MN.
- Project manager for District Energy St. Paul and District Cooling St. Paul distribution and plant projects.

## **Additional Experience**

### **University of Washington**

Calculated building loads, load projections, and analyzed phasing of installation of hot water pipe. Design and estimation of piping costs in multiple scenarios, associated drawings, building load identification.

### **MIT Hot Water System Extension Review**

Review design for extending a hot water network to include 12 additional customers and a loop. Developed a hydraulic model to analyze the impact of improved delta T on pipe sizing and the actual need for a looped system. Reviewed pipe manufactures and provided a technical recommendation. Prepared economic analysis of heat exchangers and piping system.

### **District Cooling and Heating Distribution System Design and Hydraulic Analysis**

Developed distribution system design concepts for a district cooling and heating system serving a university campus as well as commercial, retail and residential buildings in Sacramento, California. Prepared distribution system layout, hydraulic model, pipe sizing, distribution AutoCAD drawings and distribution cost estimates.

## **Education and Specialized Training**

University of Minnesota Duluth - B.S. in Mechanical Engineering Technology



# Proposal for Superior Street Reconstruction Hot Water System Design

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## ***Henry Kinane, Project Engineer***

Henry Kinane joined the Ever-Green Energy team in 2015 to support the growing engineering team supporting Ever-Green Energy operations, engineering projects, and system development.

- Currently serving as a project engineer for the replacement of a cooling tower to serve the District Energy St. Paul cooling system in downtown Saint Paul.
- Serving as project engineer for the Pittsburgh Allegheny County Thermal Master Plan Development, which includes advancement of an existing district energy system, increasing its customer base, integration of renewable energy sources, business structure redevelopment, and system optimization.
- Assisted with the semi-annual fall maintenance outage for the St. Paul Cogeneration facility, serving as operations support.
- Providing operations support to the newly acquired Milwaukee Regional Medical Center Thermal Operations, currently under construction for new production assets to serve this health care campus, which includes a Level 1 Adult and Pediatric Trauma center.
- Served as project engineer for the District Energy St. Paul distribution team's repair of a major distribution vault for the downtown heating and cooling system.

## **Additional Experience**

### **Xcel Energy, Mechanical Engineering Intern, Burnsville, MN**

- Assist professional engineers and other power plant personnel in the planning of day-to-operations and maintenance of a coal- and gas-fired generating station
- Experience in: Project management, budgeting, team collaboration, boiler inspections, reading and revising piping and instrumentation diagrams, and using the Maximo asset management system

### **Mate Precision Tooling, Production Design Engineering Intern, Anoka, MN**

- Design tooling for CNC punch presses, create and revise technical drawings using SolidWorks. Oversee that manufactured prototype tooling meets spec and makes changes when necessary
- Experience in: Solidworks, PDMWE, geometric dimensioning and tolerancing, open communication with the machinists, assemblers, and shop workers manufacturing the designed tooling

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## **Education and Specialized Training**

University of St. Thomas – B.S. in Mechanical Engineering



# Proposal for Superior Street Reconstruction Hot Water System Design

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## *Ingvar K. Larsson, Senior Engineer*

Ingvar Larsson is an engineer with more than 25 years of experience in the fields of district heating, district cooling, and combined heat and power in Sweden and North America. For Ever-Green he has contributed his expertise in study, design, development, and optimization of district energy systems including District Energy St. Paul, District Cooling St. Paul, St. Paul Cogeneration, Duluth Steam, Energy Park Utility Company, and District Heat Montpelier.

- Extensive applied knowledge in design, construction, system start up, financial analysis, greenhouse gas modeling, technical and business management of district heating and cooling systems.
- Experience with the design, purchase, installation and commissioning of absorption chillers, electric chillers, combined chiller and heat pumps, chilled water storages and deep water cooling systems.
- Experience with the design and installation of steam, hot water, and chilled water distribution piping and customer connections. Senior engineer overseeing the development of District Cooling St. Paul, the chilled water cooling system that serves 60% of downtown Saint Paul including multi-family residential, commercial, industrial, and large institutional customers.
- Senior engineer overseeing the development of the renewable energy combined heat and power project, St. Paul Cogeneration, utilizing clean urban waste wood. The Cogeneration plant was designed to increase the fuel efficiency and effectiveness of District Heating St. Paul and to provide an environmentally sound energy source to the local electric provider as well as the heating customers.
- Senior engineer overseeing the development and implementation of satellite production facilities for the District Cooling St. Paul system including 10<sup>th</sup> Street chiller plant and Regions Hospital supplementary generation facility.

## **Additional Experience**

### **Telge Energi AB, Project Manager, Södertälje, Sweden**

Conducted feasibility study, design, purchase, construction and commissioning of a district cooling system with deep lake water-cooling with a potential cooling capacity of 17,000 ton. Conducted feasibility study, design and construction of the first district cooling system in Sweden. The system was initially designed for about 5,700 tons utilizing heat pumps and a chilled water storage.

### **EMR/Canmet, Ottawa, Canada**

Technology transfer of Swedish district energy experience. Energy plans and technical, economic and environmental feasibility studies regarding district energy for several cities in Canada. Evaluation and design of building connections, distribution systems for hot water and steam, steam and hot water boilers utilizing wood waste, peat, coal, oil, and waste, solar energy plant, large heat pumps, solid fuel fired, combined heat and power, hot water storage, emission reduction measures, and energy plan for the city.

## **Education and Specialized Training**

Fyrisskolan (Uppsala, Sweden) - B.S. in Mechanical Engineering

Royal Swedish Institute of Technology (Kungliga Tekniska Högskolan, KTH), Stockholm, Sweden - Mechanical Engineer (M.Sc) Specialization: Heat and Power



# Proposal for Superior Street Reconstruction Hot Water System Design

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## **Linda Thiry**

**Owner Arrowhead Consulting & Testing, Inc.**

### **Industrial Hygienist**

**For Duluth Energy Systems project, Linda brings:**

Extensive experience providing asbestos management services including the execution and development of job specifications

Extensive experience providing asbestos inspection services

### **Education**

BS, Chemistry  
University of Minnesota - Duluth,  
1986

### **Certification /Training**

40-hour OSHA HAZWOPER Emergency-Response-Level training (2005) and eight-hour annual updates (2006-2016)

Certified and Minnesota Licensed Asbestos Inspector (2001) and annual eight-hour refreshers (2002-2015)

Certified and Minnesota Licensed Asbestos Supervisor (1989) and annual eight-hour refreshers (1990-2015)

Certified and Minnesota Licensed Asbestos Project Designer (1994) and annual eight-hour refreshers (1995-2015)

Linda Thiry is founder of Arrowhead Consulting & Testing, Inc. Linda has over 30 years of experience in the asbestos field and holds licenses in all asbestos disciplines including asbestos supervisor, project designer, and inspector. She has authored and reviewed thousands of documents including asbestos project design, asbestos inspection survey reports, and asbestos project reports.

## **Relevant Experience**

### **School Demolition Project**

- Asbestos and Hazardous Waste Project Supervisor from May 2012 to September 2012

Linda assisted a School District with the development of a hazardous materials removal project specification for the demolition of a 100-year old school. Her responsibilities included assisting with the asbestos inspection and hazardous materials inventory, developing project specification for the removal of hazardous materials, managing the removal of the hazardous waste, and assisting with the site closure. The project involved coordination with the Minnesota Pollution Control Agency, and other agencies on the disposal of the waste.

### **Demolition of Process Equipment**

- Project Manager Asbestos Abatement April 2005 to April 2006

Linda assisted a northern Minnesota mining company with demolition of major process equipment. Her responsibilities included inspecting impacted building components for asbestos-containing materials and other hazardous materials, assisting with preparation of plans and specifications, preparation of project documents, including a design, work in progress status reports and a final report. Linda also managed on-site activities, including asbestos abatement oversight, air monitoring of removal, and collection of other suspect hazardous materials as demolition progressed.

### **Northern Paper Industry**

- Asbestos/ Hazardous Materials Consultant from November 1999 to present
- Arrowhead is currently under contract to manage, provide site supervision and air monitoring, sample collection, and documentation for the abatement of asbestos in a northern Minnesota paper mill. Arrowhead provides the client with documentation, required project data and 24-hour emergency response services.







# Proposal for Superior Street Reconstruction Hot Water System Design

## 1. Fees

The Project Team proposes to complete this proposed scope of work at a fee of \$99,457. Costs are broken out as follows:

ITEM	Subtotal	Expenses	Total
Project Coordination & Meetings <sup>1</sup>	\$ 11,230	\$ 1,123	\$ 12,353
Preliminary Design <sup>1</sup>	\$ 10,315	\$ 1,032	\$ 11,347
Initial Detailed Design <sup>1</sup>	\$ 22,800	\$ 2,280	\$ 25,080
Final Detailed Design <sup>1,2</sup>	\$ 25,350	\$ 2,535	\$ 27,885
Bidding Document Coordination <sup>1</sup>	\$ 17,220	\$ 1,722	\$ 18,942
Bidding Support	\$ 3,500	\$ 350	\$ 3,850
<b>TOTAL</b>			<b>\$ 99,457</b>
<sup>1</sup> Includes travel for one in-person meeting with LHB and City Staff for key project personnel.			
<sup>2</sup> Includes \$5,000 for asbestos abatement sub-consultant.			

Labor assignment is as follows

ITEM	Expected Hours
<b>Project Coordination</b>	
Michael Ahern	16
Sean McFarling	20
Phil Bourne	8
Rich Gacek	2
Gerry Gubash	2
Tom Snyder	2
Tom Anderson	2
Henry Kinane	2
<b>Preliminary Design</b>	
Sean McFarling	22
Phil Bourne	29
Gerry Gubash	2
Henry Kinane	2
Ingvar Larsson	2
<b>Initial Detailed Design</b>	
Sean McFarling	78
Phil Bourne	49
Gerry Gubash	5
Tom Snyder	2
Ingvar Larsson	2