Milwaukee
Water Works

Feasibility Report
Regarding the Request for Enhanced Water Service
from
The Village of Greendale

October 5, 2011

Introduction

The Village of Greendale (Greendale) has been a valued customer of the Milwaukee Water Works (MWW) since 1964. Recent improvements made to the Milwaukee Water Works distribution system have increased water flows and pressures available at the connection points where water enters the Greendale system. Greendale has formally requested that MWW commit to a level of water service higher than that guaranteed prior to the distribution system upgrades, and higher than typically provided to wholesale customers. In accordance with the requirements of File 080457, "Substitute resolution establishing terms and conditions by which the City of Milwaukee will provide water service to neighboring communities", a resolution was submitted to the Milwaukee Common Council relative to Greendale's request. This report is prepared as directed by that resolution, 110589, "Resolution directing the MWW, the Legislative Reference Bureau and the Department of City Development to prepare analyses relating to a water service agreement and requesting submission of a report by Greendale".

Background

Greendale is an existing wholesale customer of MWW. A 30-year contract for water service was signed in 1964, followed by a 10-year agreement in 1997. A new agreement is currently being drafted; how this matter is resolved will impact the final form of that agreement. Information about the Greendale Water Utility, taken from the 2010 Annual Report to the Public Service Commission of Wisconsin, is shown in Appendix A to this report. Greendale currently receives water through three connection points to MWW's distribution system. These are at S. 60th Street and W. Edgerton Avenue, S. 68th Street at W. Edgerton Avenue, and S. 43rd Street at W. College Avenue. At these points, water is metered by MWW and sold to the Greendale Water Utility which owns and operates their own utility for the benefit of their customers.

MWW has been working to improve pressures and flows of water in the southwest part of our service area. Preliminary engineering commenced in 2004 and construction of various projects continues today.

These distribution system improvements include changing the supply side of the connection points to Greendale from the Riverside Pressure District to the Southwest Pressure District. This change, initiated by MWW, will increase the water pressure available at Greendale's connection points.

The increased water pressure that will be available at the connection points translates into higher water flow rates and this may allow Greendale to reduce the amount of water stored and pumped by their utility. The utility may be able to decommission an existing ground storage reservoir and pumping station, thus avoiding the operation and maintenance costs, and possibly future replacement costs, associated with those facilities. In addition, Greendale Water Utility needs to replace an existing elevated water storage tank, located northeast of the intersection of Tower Road and Euston Street, that has reached the end of its useful life. With increased water flows, Greendale may be able to construct a smaller elevated tank at less expense than they would have otherwise constructed.

Water System Capacity

The maximum day demand, peak hour demand, and fire flow requirements for a water service area are factors in determining the sizing of pumps and water mains, and the amount of stored water that is needed. (Maximum day demand is less than peak hour demand, which is less than fire flow requirements.) These are flow rates presented in million gallons per day (mgd). The values for these flow rates are different for each community and can change as water use patterns change, e.g., with new development or if a large water user comes into or leaves a service area.

Greendale reports these water system characteristics:

Maximum Day Demand	3.5 mgd
Peak Hour Demand	5.25 mgd
Fire Flow Requirement	8.5 mgd

In retail service areas, the MWW owns, operates and maintains the water distribution system and directly bills all customers of the retail service area including those of another municipality. Greenfield, Hales Corners, St. Francis and a small portion of Franklin have retail service from the MWW. Water mains in the retail service area are typically designed (or the designs of others are approved) by the MWW prior to construction. By having control over the water distribution system, the MWW is able to assure fire flow capacity throughout the retail service area.

In wholesale service areas, it is the utility purchasing the water from the MWW that owns, operates and maintains their water distribution system. A wholesale community makes decisions about land use and development which might impact the characteristics of water usage patterns in the service area and it is the wholesale utility that determines necessary sizes for pumps and pipes. A wholesale utility bills its own customers. The Greendale Water Utility is a wholesale customer of the MWW. For typical wholesale customers, the MWW's approach is to commit to providing water to meet the maximum day demand for the customer's service area. In this situation, the wholesale water utility is responsible for designing and maintaining their water system to provide peak hour and fire flow requirements to their customers that are approved by them.

Analysis

Greendale has formally requested that MWW provide their peak hour demand of 5.25 mgd. MWW has the capacity to provide 5.25 mgd, but typically guarantees only maximum day demand to wholesale customers. The matter to be addressed is if the request to guarantee this enhanced service level should be granted. Per Public Service Commission of Wisconsin, once water service has been offered it may not be withdrawn.

The "enhanced" service level requested is not an increase in the volume of water provided, but rather is an increase in the instantaneous flow rate of water that would be guaranteed to Greendale. Based upon fire flow testing and hydraulic modeling results, 5.25 mgd will be available at Greendale's connection points when they are changed to the Southwest Pressure District. There are no additional improvements required. Therefore, there is no corresponding "additional cost" attributable to Greendale for the provision of this enhanced level of service. If MWW incurs additional operating and/or maintenance costs resulting from the enhanced level of service (for example, additional electricity for pumping) these costs will be recovered in future rate cases as increases to the rate that Greendale pays to MWW for water.

There are short and long term benefits to Greendale if this request is granted. Information provided to MWW by Greendale and documents posted on the Village of Greendale website (see Appendix B to this report) present information on the potential benefits to Greendale if MWW guarantees the 5.25 mgd requested by Greendale. These documents were reviewed to create the following table which represents the MWW's understanding of possible benefits to Greendale.

Greendale Facilities	3.5 mgd Provided by MWW	5.25 mgd Provided by MWW	Significance to Greendale of Enhanced Service Level
Elevated storage tank required?	Yes	Yes	n/a
Existing elevated storage tank adequate?	No	No	n/a
Size of replacement elevated storage tank	1,250,000 gal	750,000 gal	One time savings of approximately $2 million
Existing ground storage reservoir #1 needed?	Yes	No	Ongoing savings for operation and maintenance; avoidance of future replacement cost
Existing ground storage reservoir #2 needed?	Yes	No	Ongoing savings for operation and maintenance; avoidance of future replacement cost
Existing booster pumping station needed?	Yes	No	Ongoing savings for operation and maintenance; avoidance of future replacement cost

Without a guarantee that this 5.25. mgd flow rate will be available into the future, Greendale will be required to construct their water system improvements for a 3.5 mgd flow rate, and will not be able to avail themselves of the potential savings associated with guaranteed higher flow rates.

There are considerations for Milwaukee related to a guarantee to provide this enhanced service level in perpetuity and there are unknown risks associated with that commitment. MWW would always have to reserve a total of 5.25 mgd of capacity for Greendale, not 3.5 mgd. Relatively speaking, 1.75 mgd is a small amount of MWW's present system capacity and a very small amount of available treatment capacity. However, future improvements that MWW may desire to make in our own distribution system would have to take into account the additional 1.75 mgd reserved for Greendale. It would also have to be taken into account as any future requests for expanded water service to areas south and west of Milwaukee are evaluated. For reasons of public health and safety, and per the rules of the Public Service Commission of Wisconsin, MWW would never be able to withdraw this level of service once it has been offered.

Summary

The Village of Greendale is requesting that the Milwaukee Water Works guarantee that 5.25 mgd of water will be available to them. If the request is granted, reduced water storage and pumping needs for their utility will create an opportunity for short and long term financial savings. If the request is not granted, Greendale will be guaranteed 3.5 mgd and they will not be able to benefit from the financial savings related to their distribution system.

MWW is able to provide the additional capacity requested at no cost and with little or no impact on MWW's overall water system. However, such a guarantee will have to be considered in all future decision-making related to water service in the southern part of MWW's service area.

Prepared by C. Lewis, Milwaukee Water Works, October 6, 2011

Appendix A

Greendale Water Utility

Data from 2010 Annual Report to the Public Service Commission of Wisconsin

Revenue	$1.465 million
Operating expenses	$1.603 million
Net operating income	($138.038)
Net utility plant	$6.072 million
Rate of return	-5.76%
Water purchased from Milwaukee Water Works	410,302,000 gallons $674,224
Water mains in service	63.54 miles
Hydrants	585
Water meters	5,069
Full time employees	4

Kaempfer & Associates, Inc.
Consulting Engineers
650 East Jackson St. P.O. Box 150
Oconto Falls, Wisconsin 54154
(920) 846-3932 Fax (920) 846-8319

DATE: March 31, 2011 E164-04.01

TO: Todd Michaels, Manager
Village of Greendale

FROM: Chris Kaempfer, P.E.

PROJECT: Elevated Storage Tank Replacement

RE: Recommended Plan

The Village of Greendale must replace the existing elevated storage tank. The issues that must be addressed as the project proceeds are:

- Where should the new elevated storage tank be located?
- What size elevated storage tank should be constructed?
- What style elevated storage tank should be constructed?

The new elevated storage tank can be constructed at the site of the existing elevated storage tank, or it can be constructed at a new site. The Village will need to consider the advantages and disadvantages of each alternative and select a site.

The size of the elevated storage tank will depend on the level of service that the Milwaukee Water Works is willing to provide to the Village. The minimum size elevated storage tank would be 500,000 gallons and the maximum size would be 1,250,000 gallons.

The style of the tank will depend on the capacity of the tank and the desired esthetics of the elevated storage tank. There are four (4) styles of elevated storage tanks that would be applicable for this application.

Existing Conditions

The Greendale Water System is served by a single elevated storage tank. The tank is located northeast of the intersection of Tower Road and Euston Street in the central portion of the Village. The tank site is surrounded by single-family and multi-family development as shown in Figure 1. The elevated storage tank is located on a 100-foot square site. The existing site has poor access for operation and maintenance. Access to the tank is provided through a permanent egress/ingress easement as shown in Figure 2.

The tank was constructed in 1937. The tank is a 50-foot diameter double ellipsoid supported by eight steel columns and a 6-foot diameter riser. The tank is 110 feet high with an overflow elevation of 912 feet above mean sea level (MSL). The operating range of the tank is 19 feet and the head range is 33.5 feet.

Fig. 1 Land Use at Present
Elevated Storage Tank Site

J:\Greendale\E164-04.01\Fig. 01 EST Site_Area Mapping w_ Photo.DWG, 3/31/2011 8:25:48 AM, 1:2, WB

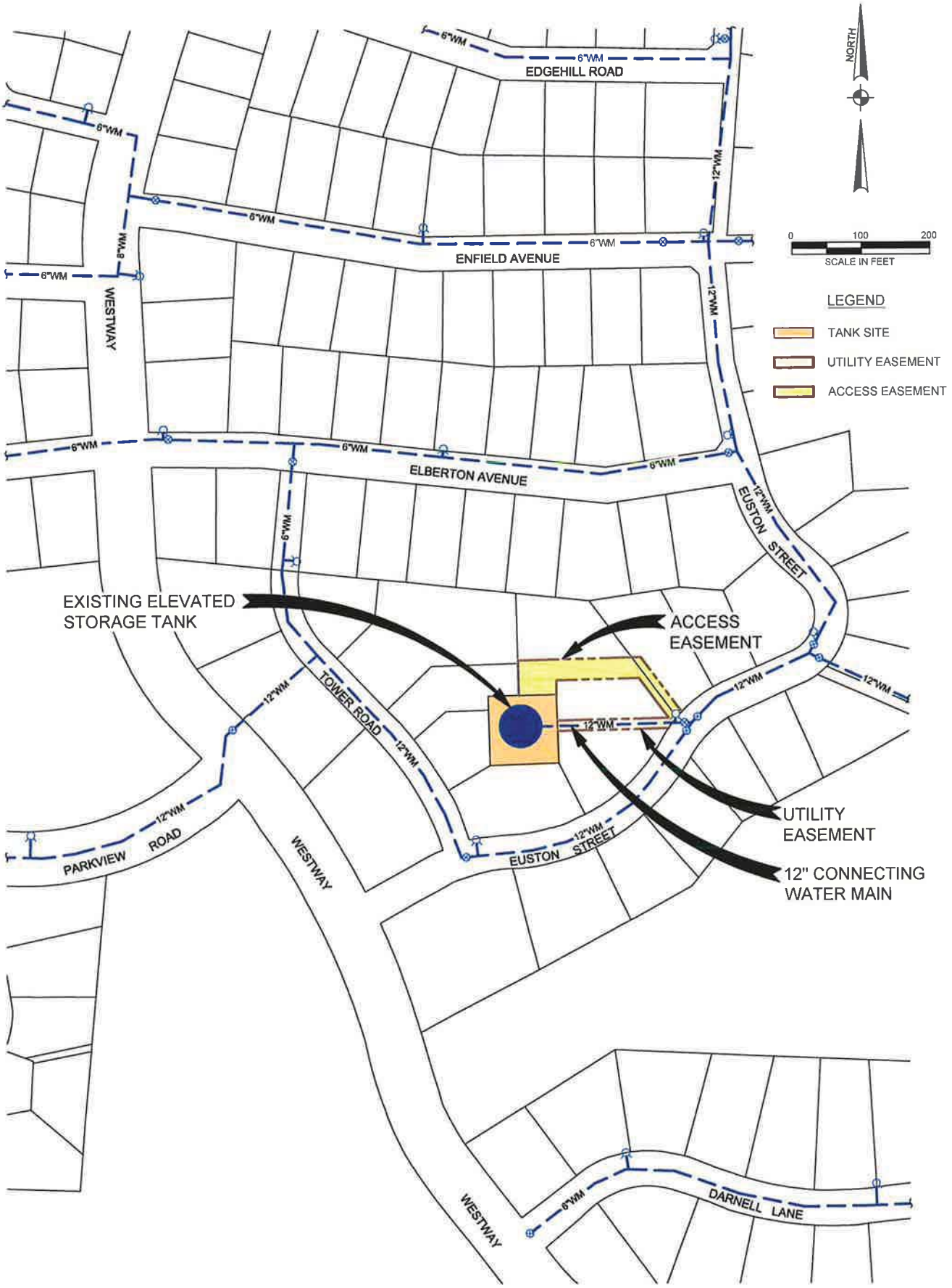


Fig. 2 Present Elevated Storage Tank Site

J:\Greendale\E164-04.01\Fig. 02 EST Site_Area Mapping (3-30-11).DWG, 3/31/2011 8:26:18 AM, 1:2, WB

The cathodic protection system that was installed in the elevated storage tank was removed in 2009. The elevated storage tank was last painted in 1987. Paint samples were obtained from the elevated storage tank in August of 2008 and February of 2010 for analytical testing to determine the content of cadmium, chromium, and lead. The test results indicated the elevated storage tank does not have cadmium, chromium, or lead base paint. A 12-inch diameter main connects the elevated storage tank to the distribution system. The connecting water main is located in a 15-foot wide utility easement.

The elevated storage tank is in very poor condition. Leaks have occurred where the 6-foot diameter riser connects to the bottom of the elevated storage tank as shown in Figure 3 and Figure 4. Liquid Engineering, Inc. installed a flexible coating system in the interior of the tank in 2001 to temporarily seal a leak. The water utility staff identified a leak in December of 2009 that resulted from a failure of the temporary flexible coating system. CB&I repaired the leak in April of 2010. CB&I performed a series of spot welds to repair the leak.

An inspection and structural evaluation of the elevated storage tank was performed in April of 2010. The coating system was found to be in fair to poor condition. The results of the structural evaluation indicate the tank is suitable for short-term service but should be replaced for long-term service. A copy of the structural evaluation report is included in Attachment 1. The elevated storage tank has exceeded the typical service life for a steel tank of this type and should be replaced as soon as possible.

Site Alternatives

The new elevated storage tank can be constructed at the site of the existing elevated storage tank or it can be constructed on a new site. The existing elevated storage tank would need to be demolished for either alternative. There is a suitable Village-owned site for the new elevated storage tank at the intersection of Parkview Road and Westway. The locations of the existing site and the alternative site are shown in Figure 5. The alternative site would be approximately 1.80 acres. The existing site is approximately 0.23 acres. Both sites are at the same elevation.

Ideally, the new elevated storage tank would be constructed and placed in service before the existing elevated storage tank would be demolished. Demolishing the existing elevated storage tank after a new elevated storage tank is constructed on the existing site would be $12,000-$15,000 more expensive than demolishing the existing elevated storage tank with the new elevated storage tank constructed on a new site.

The site of the existing elevated storage tank is extremely small and access to the site is very limited. It will be necessary to obtain construction easements for demolition of the existing elevated storage tank and for construction of the new elevated storage tank from the five (5) adjacent property owners. The area needed for access is shown in Figure 6. The existing site may not be adequate for construction of a larger elevated storage tank. It may be necessary to acquire additional property for construction of the new elevated storage tank at the existing site. Site and easement acquisition costs for the existing site could be $30,000 to $50,000 for appraisals and legal services.

Fig. 3 Elevated Storage Tank Leak Location

Fig. 4 Elevated Storage Tank Leak

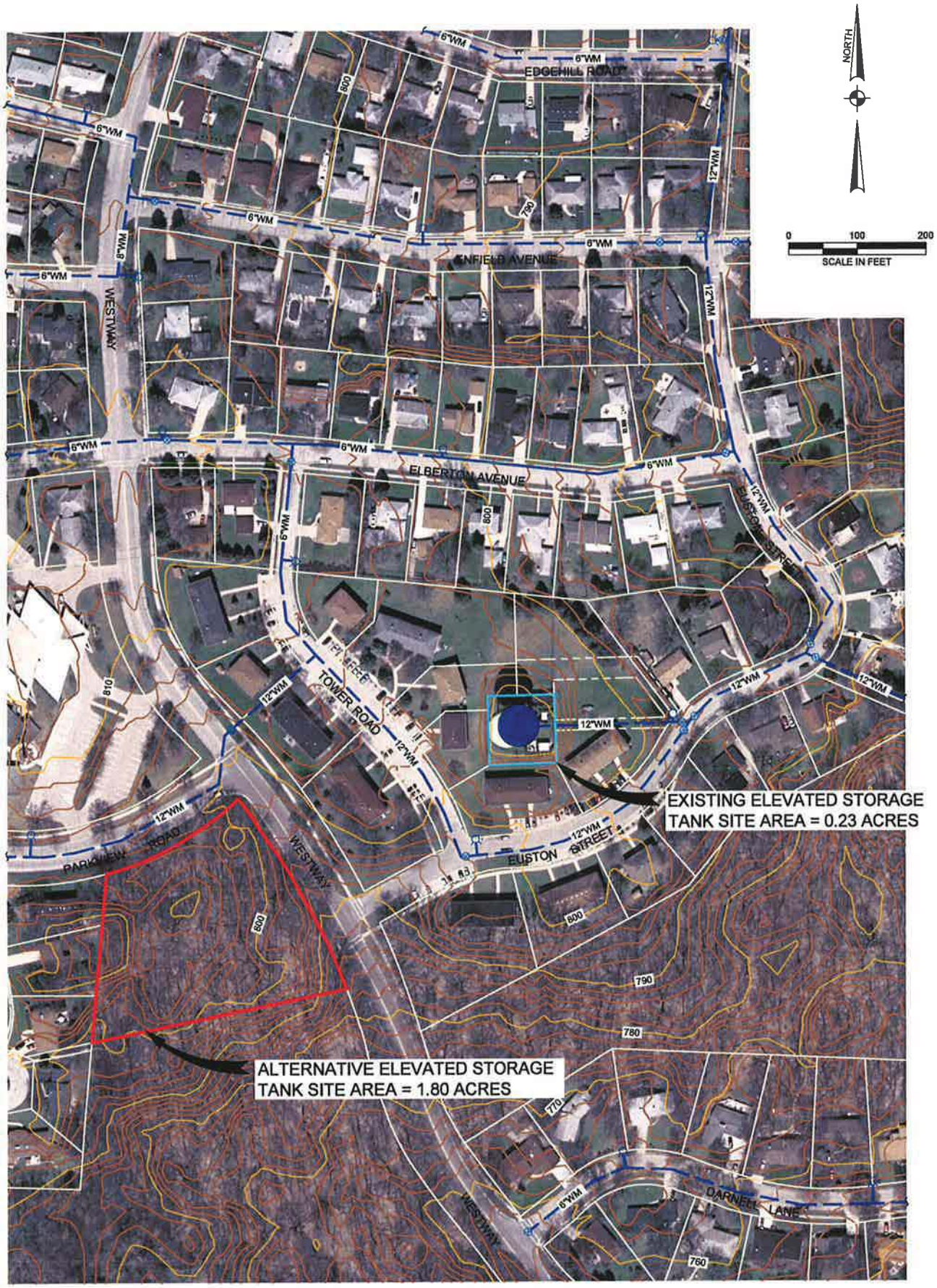


Fig. 5 Elevated Storage Tank Sites

J:\Greendale\E164-04.01\Fig. 05 EST Site_Area Mapping w_ Photo.DWG, 3/31/2011 8:27:28 AM, 1:2, WB

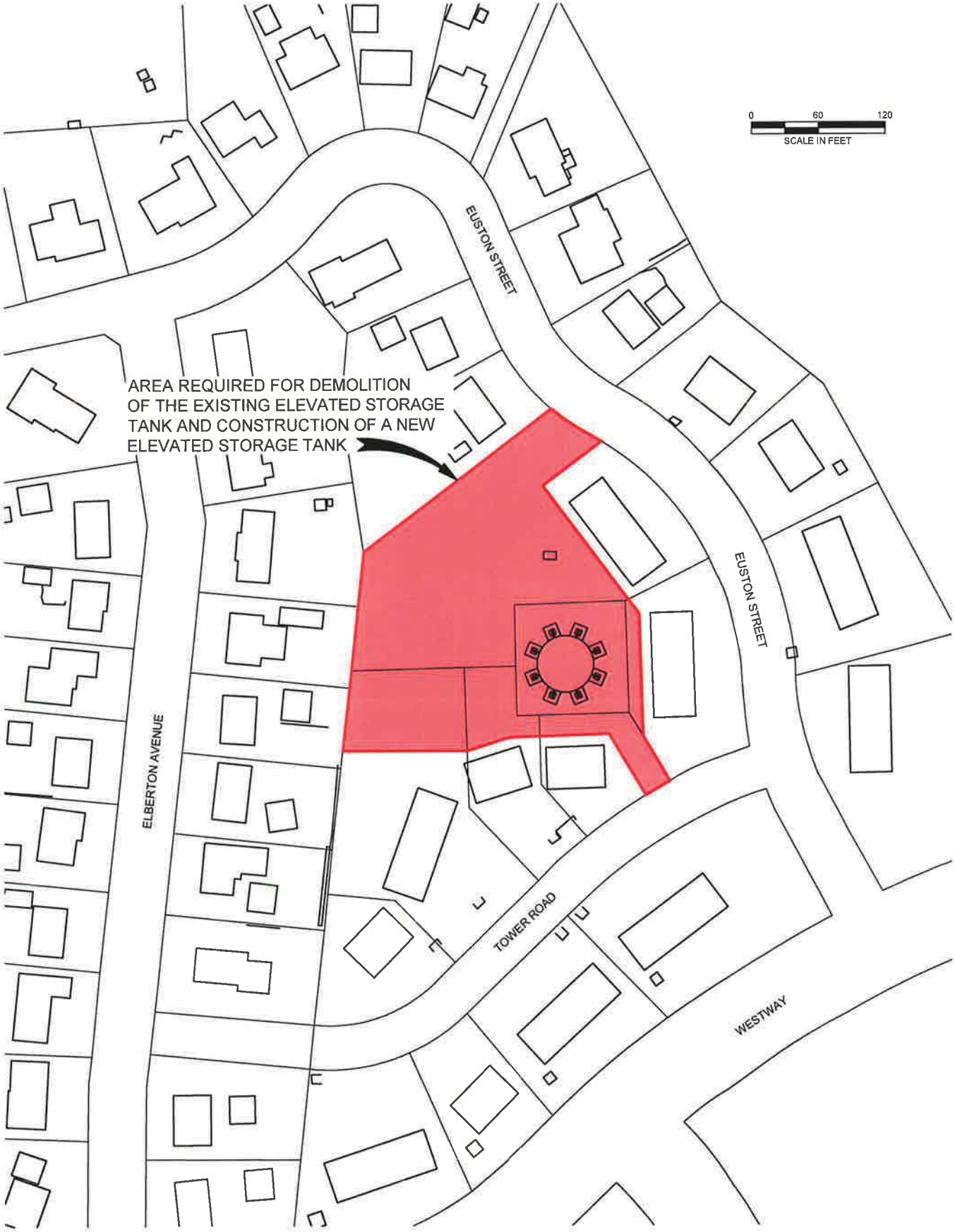


Fig. 6 Demolition and Construction Access Requirements

J:\Greendale\E164-04.01\Fig. 06 Demolition and Construction Access Requirements.dwg, 3/31/2011 3:35:57 PM, 1:2, WB

It will be more expensive to construct a new elevated storage tank on the existing site. The cost difference would depend on the size of the elevated storage tank. The existing 12-inch diameter water main could be used to connect the new elevated storage tank to the water distribution system or it may be necessary to replace the existing water main with a larger water main if a larger tank is constructed. It will also be more expensive to operate and maintain a new elevated storage tank on the existing site. Painting the elevated storage tank during construction and in the future will be difficult due to the close proximity of the adjacent residential development.

The alternative site would be approximately 1.80 acres. The property is owned by the Village so it would not be necessary to acquire the site or obtain any easements. It would be adjacent to three (3) residential properties on the west, roadways on the north and east, and woods on the south. Approximately one acre of wooded area would be affected by construction of the elevated storage tank. There would be adequate area on the site for construction equipment and materials. Painting the elevated storage tank during construction and in the future would be much easier on the alternate site. The elevated storage tank would be over 150 feet from the nearest house. A driveway would be constructed to provide adequate access to the elevated storage tank. A new 16-inch diameter water main would be constructed from the elevated storage tank to the existing 12-inch diameter water main in Parkview Road. It will be less expensive to operate and maintain a new elevated storage tank on the alternative site. The difference in cost will depend on the size of the elevated storage tank. The difference will increase as the size of the elevated storage tank increases.

Tank Size

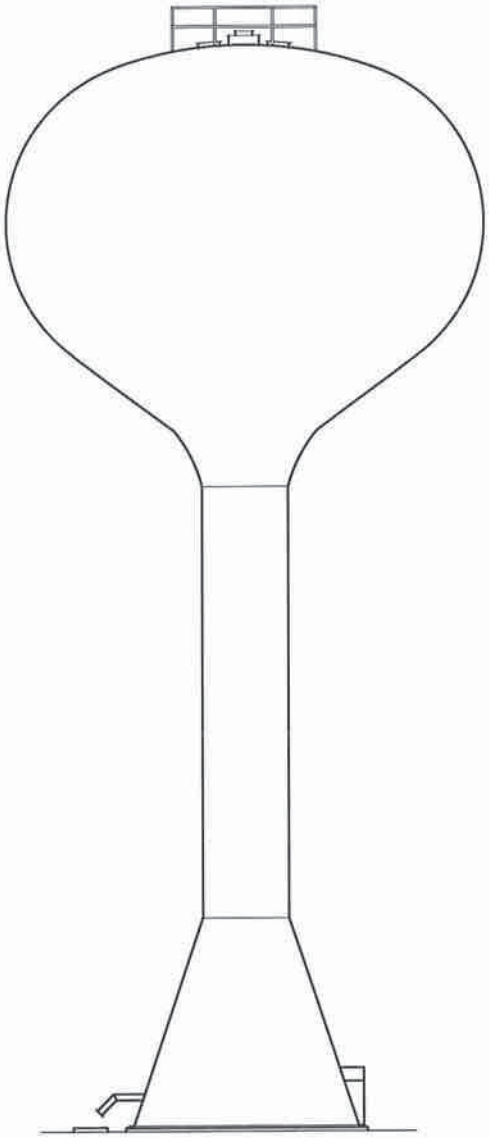
The size of the elevated storage tank will depend on the level of service provided by the MWW. The minimum size elevated storage tank would be 500,000 gallons. The minimum size elevated storage tank would be needed if the MWW provided a flow rate that was equal to the maximum day demand plus the design fire flow of 3,500 gpm. The maximum size elevated storage tank would be needed if the MWW only provided a flow rate that was equal to the maximum daily demand. We recommend that the Village of Greendale obtain a new Water Service Agreement with the MWW for a flow rate equal to the maximum day demand plus fire flow. This will minimize the size of the new elevated storage tank.

Tank Style

There are four (4) tank styles that are suitable for the size elevated storage tank that will be needed by the Village of Greendale. The four (4) styles of tanks are shown in Figures 7, 8, 9, and 10.

The single pedestal style elevated storage tank is most suitable for capacities of up to 750,000 gallons. It has the lowest painting costs of the steel tanks. This is the most common style of tank for the small size range.

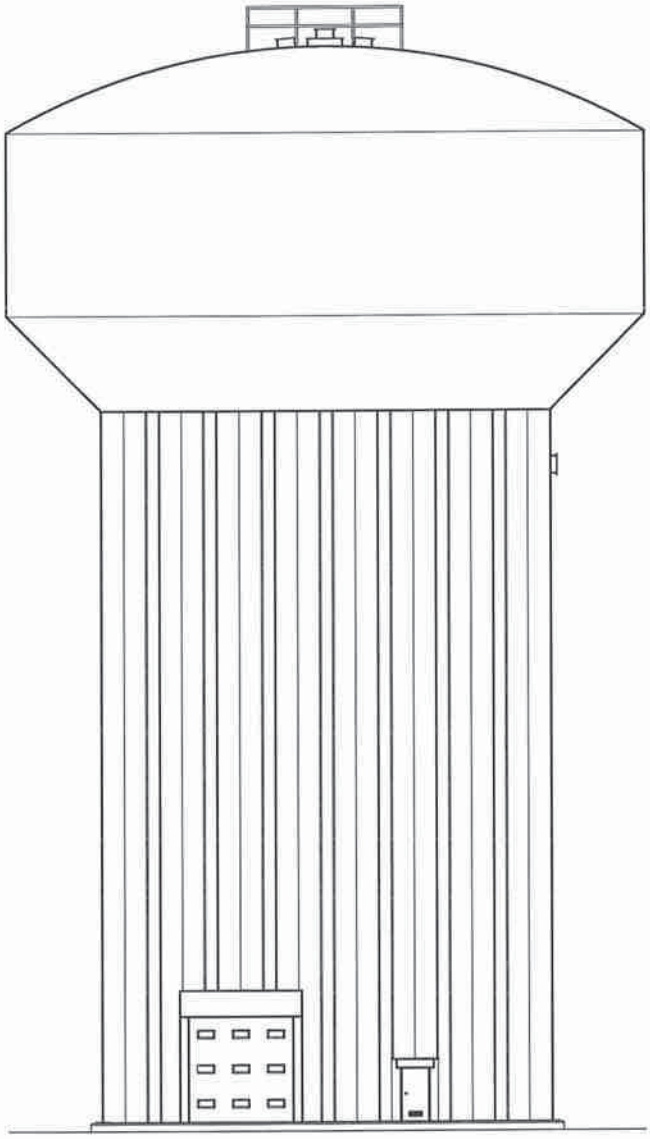
The fluted pillar style elevated storage tank is most suitable for capacities of 750,000 to 2,500,000 gallons. It has the highest painting costs of the steel tanks. The interior can be used for storage of equipment and materials. This is the most common style of tank for the large size range.



ELEVATION
NTS

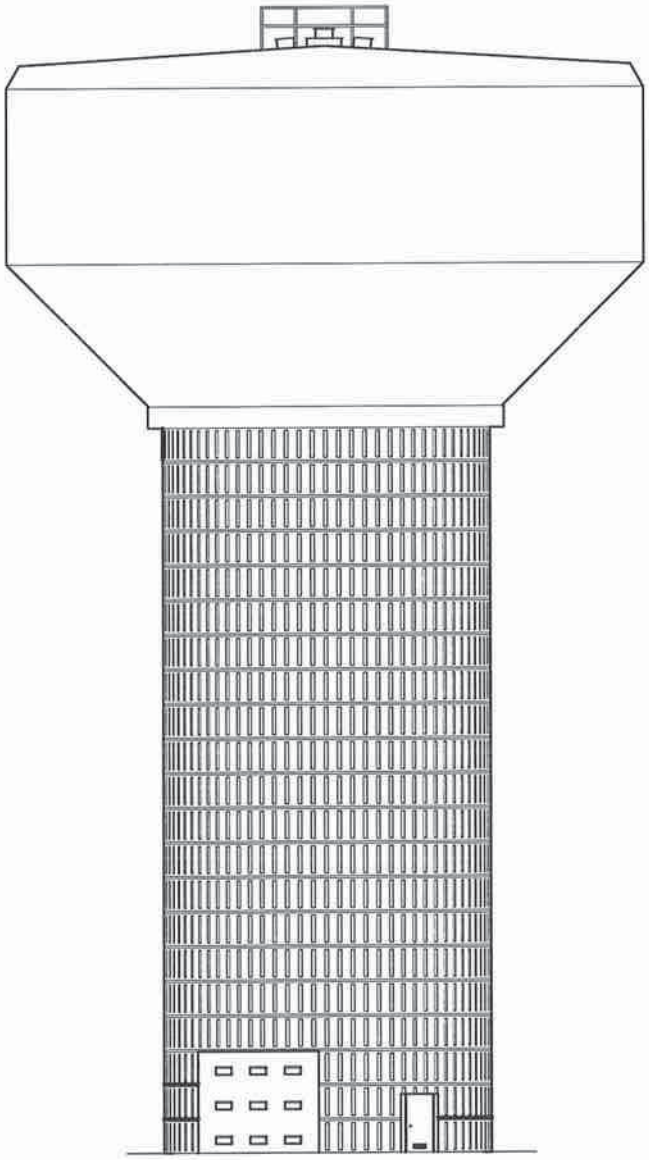
J:\Greendale\E164-04.01\Fig. 07 Single Ped.dwg, 3/31/2011 8:28:17 AM, 1:2, WB

Fig. 7 Single Pedestal Elevated Storage Tank



ELEVATION
NTS

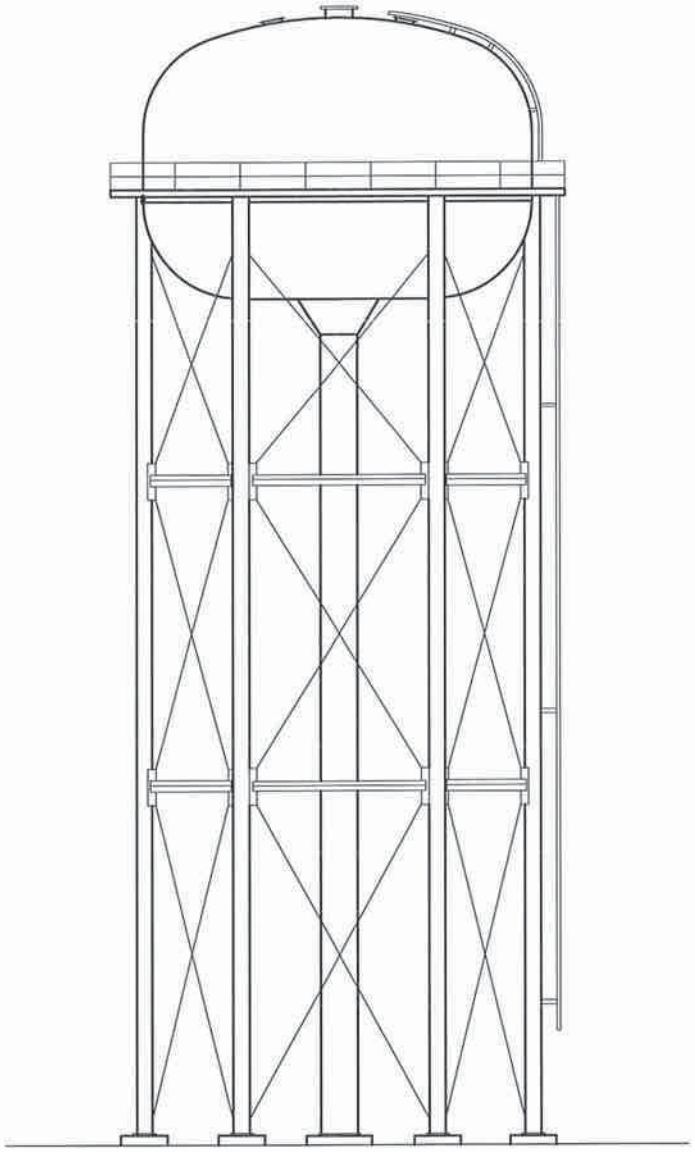
Fig. 8 Fluted Pillar Elevated Storage Tank



ELEVATION
NTS

J:\Greendale\E164-04.01\Fig. 09 Composite.dwg, 3/31/2011 8:28:27 AM, 1:2,
WB

Fig. 9 Composite Elevated Storage Tank



ELEVATION
NTS

Fig. 10 Multi-Column Elevated Storage Tank

J:\Greendale\E164-04.01\Fig. 10 Multi-Column.dwg, 3/31/2011 8:28:32 AM, 1:2, WB

The composite style elevated storage tank is suitable for capacities of 500,000 to 2,500,000 gallons. It has a concrete pedestal and a steel tank which minimizes painting costs. The interior can be used for storage of equipment and materials. The composite tank is more expensive to construct than the steel tanks, but it has lower operating and maintenance costs. The composite style is becoming a widely used type of tank.

The multi-column style elevated storage tank is suitable for all capacities. It is the least costly tank to construct and painting costs are similar to the single pedestal style tank. This style of tank was widely used in the past until it was replaced in popularity by the single pedestal and fluted column tank styles, which were more aesthetically pleasing to a majority of people.

Attachment 1

Structural Evaluation Report

STRASS-MAGUIRE & ASSOCIATES, INC.

6512 West Mequon Road • Mequon, WI 53092 • Tel: 262/242-5050 • Fax: 262/242-5055

April 26, 2010

Mr. Don Heikkila, P.E.
Kampfer & Associates, Inc
PO Box 150
650 Jackson St.
Oconto Falls, WI 54154

Re: Village of Greendale Elevated Storage Tank
Strass-Maguire & Associates Inc. Project No. 10-039

Dear Don:

This letter is to provide our opinions regarding the structural conditions of the elevated water storage tank observed on April 22, 2010. A visual assessment of the tank is required because of tank leaks and corrosion of the tank and supporting structure.

Observations:
Lavern L. Nall, P.E., Strass-Maguire & Associates, Inc., Jeffrey Colker, Jr. and Thomas Tefelske, P.E. Metallurgical Associates, Inc. observed and tested the tank plate thickness at various locations. Metallurgical Associates, Inc. prepared a report to summarize the plate thickness evaluation.

John Fischer, CBI, welded repairs to the leaking 72" diameter riser at the joint with the tank bottom circle plate. The cracks in the riser are along the angle vertex of the flange that connects by rivets to the circle plate. The design thickness of the riser is 1/4" thick steel and the circle plate is 5/8". The riser thickness in line with the weld repairs is about 1/8" and one measurement adjacent to a 10" long horizontal built-up weld is 0.018". The two-man lift equipment used to weld and observe the riser was in close proximity to horizontal rod bracing and we were not able to get access to the entire circumference of the riser for the purpose of measuring steel thickness.

Measurements of the circle plate, designed to be 5/8" thick, indicate that the thickness exceeds 0.450", limiting thickness measurement allowed by the test equipment. The tank plate located 2'-8" from the standpipe measures 0.39" thick where the design thickness is 7/16"(0.4375").

Measurements of the plate thickness at six locations located about 4'-6" above the walkway, on the vertical side of the tank, indicate an existing average plate thickness of 0.346 and minimum thickness of 0.312" where the design thickness is 3/8"(0.375").

Three measurements taken from the ladder on the topside of the tank indicate remaining thickness of steel that is at least 95 per cent of the original thickness.

Visual observation of the tank interior was limited to peering from the hatch located about 17 ft. above the walkway. There is no interior ladder and there was water in the bottom 5 ft. of the tank at the time of this observation. It appears that numerous rivet heads are corroded and there is staining of the coating emanating from the horizontal joints where there are apparent leaks in the protective coating. The 3/4" diameter horizontal "spider rods" exhibit corrosion.

There is corrosion of steel column splice connections and wind-bracing rods. The extent of corrosion to connections and bracing rods is not measurable.

We understand that CBI continued to weld cracks at the riser connection on April 23, 2010 and that more cracks developed adjacent to the welds and in a circumferential direction.

Analysis:
Eight columns and rivet connections between the columns and the tank are designed to support the entire gravity load of the tank. The riser does not support vertical load of the tank but it must contain water pressure due to the head of water in the tank.

Water pressure induced tension stress in the riser requires a minimum plate thickness that is less than about 25 per cent of the original thickness. Observed failure of the riser plate is due to corrosion and thermal movement and not necessarily water pressure. The lining, steel coating on the interior surface, has evidently failed in the immediate area of the connection between the tank bottom circle plate and the 1/4" standpipe plate where the standpipe is angled to form the connection flange.

Differential thermal movement caused by a difference in length and temperature between the eight support columns and the riser is estimated by analysis to be 3/8". Variables include ambient air temperature and water temperature. Relative vertical movement of the tank with respect to the riser will cause excessive bending stress and flexing in the riser plate and circle plate. Building up the plate thickness with weld where it fails will make the joint stiffer and this will to some extent hasten the formation of cracks by making the joint less flexible.

Conclusions:
The corrosion of the tank and supporting structure has diminished the material thickness and this increases stress on the plates and structure. The remaining steel thickness and condition of visually observed structure appears adequate for the continued short-term use of the tank. Frequent visual inspections are recommended to monitor the tank for any unforeseen cracks, substantially increased leakage, or conditions that may affect the structural adequacy of the tank or supporting structure.

Leaks in the vicinity of the top of the riser are expected to occur. The leaks and further corrosion of the riser will worsen at what is expected to be a manageable rate.

If there are any questions concerning this report please feel free to contact the undersigned.

Sincerely,
Strass-Maguire & Associates, Inc.
Professional Engineers

Lavern L. Nall, P.E., S.E.
President

MAI METALLURGICAL ASSOCIATES, INC.

April 23, 2010

Mr. Lavern Nall
Strass-McGuire & Associates
6512 W. Mequon Rd
Mequon, WI 53092

Subject: **Ultrasonic Thickness Evaluation of an Approximately 400,000 Gallon Elevated Water Storage Tank Located at Approximately 7200 W. Euston Street, Greendale, WI**

Reference: **MAI Report No. 210-2-168**

Dear Mr. Nall:

On April 22, 2010, Jeffrey Colker, Jr. and Thomas Tefelske of Metallurgical Associates, Inc. performed an ultrasonic thickness evaluation of an approximately 400,000 gallon elevated water storage tank located at approximately 7200 W. Euston Street in Greendale, WI. This tank had developed a leak in the vicinity of the junction of the vertical stand pipe and the bottom of the tank, which was weld repaired prior to our inspection. The areas selected for evaluation were per your instruction.

The tank wall thicknesses and the standpipe thicknesses in the vicinity of the weld repair were determined using a Krautkramer-Branson Model CL204 ultrasonic thickness gage. An approximately 1/4" diameter transducer with plastic delay line was used, which permits the thickness measurement of materials in the range of approximately 0.010" to 0.450". Six measurements were taken approximately 4 feet above the catwalk around the tank circumference, which range from 0.312" to 0.358" as shown in Table 1. Three additional measurements were taken adjacent to the vertical ladder on the tank, which range from 0.262" at the top of the safety cage, to 0.187" midway between the top of the safety cage and the top of the ladder, to 0.178" at the top of the ladder. This thickness variation is consistent with the use of different thickness plates towards the top of the tank during the initial fabrication. Additional measurements were also taken adjacent to the weld repair, where the remaining stand pipe thickness is as low as 0.018".

These results indicate that significant wall thinning has occurred in the vicinity of the leak at the junction of the vertical stand pipe and the bottom of the tank that is consistent with corrosion of the inside surface. Unless these areas can be protected from corrosion by application of a continuous and crack-free barrier coating, such as a paint or sealant, these areas will continue to corrode and result in additional leaks. If required, Metallurgical Associates could perform additional ultrasonic thickness measurements around the stand pipe circumference and along its length to determine the extent of the corrosion.

Metallurgical Associates is accredited by the American Association for Laboratory Accreditation (A2LA) in the areas of failure analysis, scanning electron and light microscopy, Energy Dispersive Spectroscopy, chemical analyses, hardness and microhardness testing, metallography, and nondestructive testing. A copy of our scope of accreditation is available upon request. Test results outside of these areas are not to be considered to be within the scope of our accreditation. If you have any questions, please call.

Respectfully,

Thomas C. Tefelske

Thomas C. Tefelske, P.E.
President
ASNT Level III Inspector
(Certificate 24618)

Enclosures

Table 1

Ultrasonic Thickness Evaluation

Location	Ultrasonic Thickness, inch
Tank approximately 4 feet above cat walk (1)	
At support column 1	0.350
Just to left of support column 2	0.355
Midway between support columns 2 and 3	0.312
Midway between support columns 5 and 6	0.351
Midway between support columns 6 and 7	0.352
Midway between support columns 7 and 8	0.358
Adjacent to Vertical Ladder on Tank	
At top of safety cage	0.262
Midway between top of safety cage and top of ladder	0.187
At top of ladder	0.178
Adjacent to repair weld at junction of vertical stand pipe and bottom of tank	
Just to left of repair weld	0.142
Just to right of repair weld	0.018
Approximately 1-1/2" to right of repair weld	0.125
Tank bottom plate away from repair weld	0.395

(1): Support columns numbered clockwise looking from top of tank. Column 8 is at the south side of the tank and has the access ladder.

Kaempfer & Associates, Inc.

Consulting Engineers

650 East Jackson St. P.O. Box 150
Oconto Falls, Wisconsin 54154
(920) 846-3932 Fax (920) 846-8319

DATE: May 2, 2011 E164-04.01

TO: Todd Michaels, Manager
Village of Greendale

FROM: Chris Kaempfer, P.E.

PROJECT: Elevated Storage Tank Replacement

RE: Preliminary Project Cost Estimate

The Village of Greendale must replace the existing 410,000 gallon elevated storage tank. The minimum size elevated storage tank that would be constructed to replace the existing elevated storage tank would be 500,000 gallons. The maximum size elevated storage tank that would be constructed to replace the existing elevated storage tank would be 1,250,000 gallons. The final size of the elevated storage tank that will be required to replace the existing elevated storage tank will be determined by the level of service provided by Milwaukee Water Works (MWW).

The cost of the project cannot be estimated until the level of service provided by MWW is determined, the site for the elevated storage tank is selected, soil exploration work is performed, and the style of elevated storage tank is selected. It is, however, possible to determine a preliminary cost range for the project using average cost data and a preliminary site layout for the minimum size elevated storage tank and the maximum size elevated storage tank that could be used at each site.

A preliminary site arrangement for a 500,000 gallon elevated storage tank at the existing site is shown in Figure 1. The site layout is based on a 500,000 gallon elevated storage tank with a tank diameter of 60 feet. A 12-foot wide paved driveway with three parking spaces would be provided for access to the elevated storage tank for routine operation and maintenance. The existing electric service would be reused for the new elevated storage tank. A 12-inch water main would be provided to connect the elevated storage tank to the 12-inch water main in Euston Street. A fire hydrant would be provided on the connecting water main to drain the elevated storage tank.

The project would require acquisition of approximately 0.53 acres of additional property from one of the adjacent property owners. It would be necessary to obtain temporary easements for construction of the new elevated storage tank and demolition of the old elevated storage tank from five of the adjacent property owners. It would be possible to abandon the existing water main easement and abandon the site of the old elevated storage tank after the old elevated storage tank was demolished. The project cost for a new 500,000 gallon elevated storage tank at the existing site is estimated to be $2,121,100. Details of the cost estimate are summarized in Table 1.

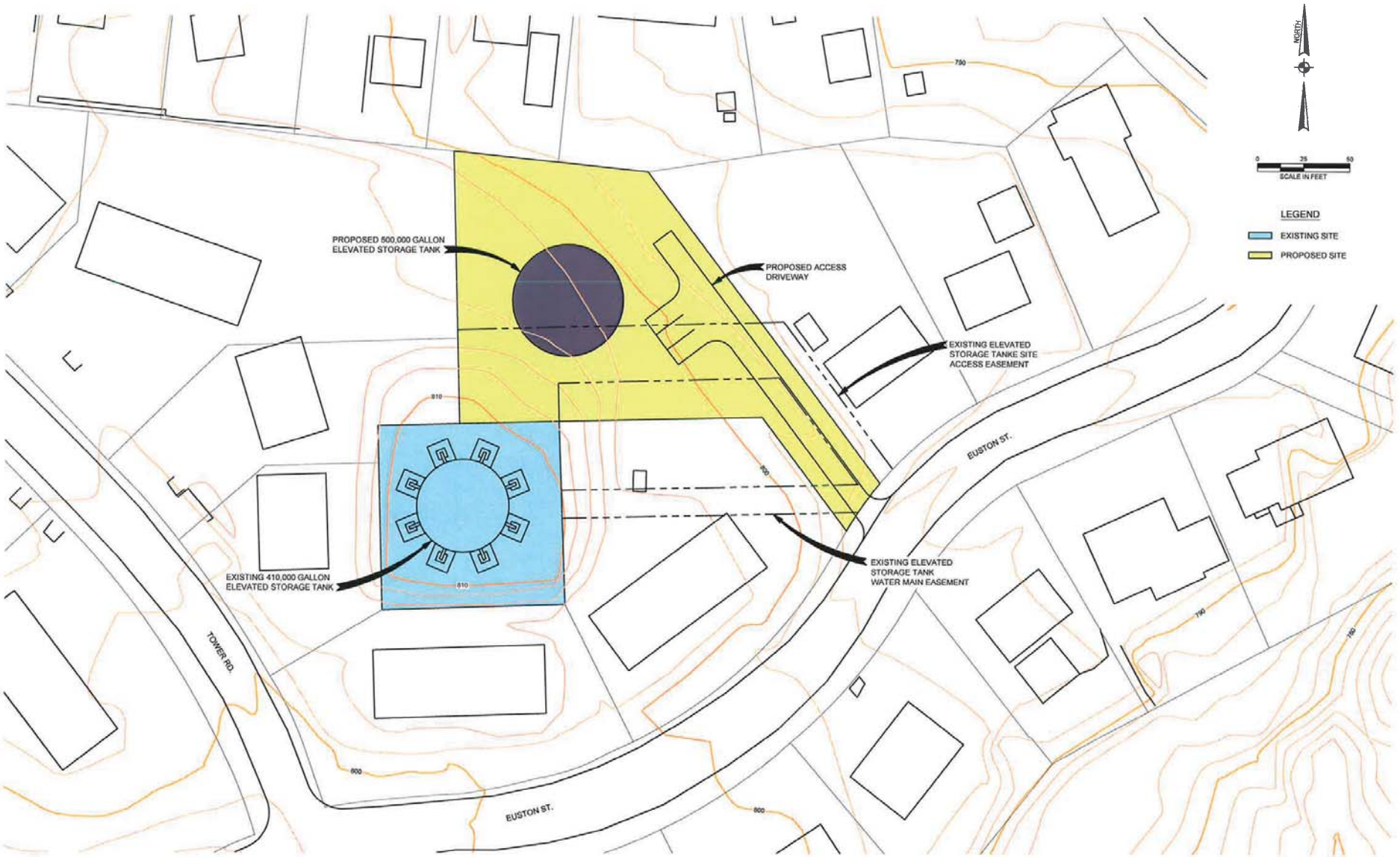


Fig. 1 Preliminary Arrangement for a 500,000 Gallon Elevated Storage Tank at the Existing Site

J:\Greendale\E164-04-0115-5-11 EST SITE OPTIONS AND SIZES.dwg, 6/6/2011 8:26:48 AM, 1:2, WB

Table 1 Preliminary Project Cost Estimate for 500,000 Gallon Elevated Storage Tank at the Existing Site

Item	Description	Construction Costs Existing Site Unit Cost	Construction Costs Existing Site Total Cost
500,000 gallon Elevated Storage Tank			
Unit Price Work Items			
1A	530 - square yards of roadway pavement, including bituminous concrete, base coarse, and subbase course	$35	$18,550
2A	400 - square feet of 4-inch concrete sidewalk	$10	$4,000
3A	600 - lineal feet of chain link fence	$20	$12,000
4A	1 - 20-foot wide swing gate and appurtenances	$600	$600
Lump Sump Work Items			
5A	Provide 500,000 gallon elevated storage tank structure and related items		$1,230,000
6A	Provide Containment for Painting		$75,000
7A	Demolish existing elevated storage tank		$90,000
8A	Demolish existing chain link fence		$2,000
9A	Provide outside piping		$71,000
10A	Provide sitework		$52,000
11A	Provide landscaping		$15,000
12A	Provide electrical work		$25,000
13A	Provide cathodic protection system		$12,000
14A	Provide all other work for construction of the elevated storage tank		$80,450
General Project Allowance			
15A	Allowance for providing Electrical Service		--
Site and Easement Acquisition			
16A	Appraisals		$20,000
17A	Legal Services		$30,000
18A	Land Acquisition		$20,000
19A	Easement Acquisition		$10,000
	TOTAL CONSTRUCTION COSTS, Items 1A through 19A		$1,767,600
	ENGINEERING AND PROJECT CONTINGENCIES		$353,500
	TOTAL COST		$2,121,100

A preliminary site arrangement for a 1,250,000 gallon elevated storage tank at the existing site is shown in Figure 2. The site layout is based on a 1,250,000 gallon elevated storage tank with a tank diameter of 90 feet. A 12-foot wide paved driveway with three parking spaces would be provided for access to the elevated storage tank for routine operation and maintenance. The existing electric service would be reused for the new elevated storage tank. A 20-inch water main would be provided to connect the elevated storage tank to the 12-inch water main in Euston Street. A fire hydrant would be provided on the connecting water main to drain the elevated storage tank.

The project would require acquisition of approximately 0.70 acres of additional property from three of the adjacent property owners. It would be necessary to obtain temporary easements for construction of the new elevated storage tank and demolition of the old elevated storage tank from five of the adjacent property owners. It would be possible to abandon the existing water main easement after the old elevated storage tank was demolished. It would not be possible to abandon the site of the old elevated storage tank after the old elevated storage tank was demolished. The project cost for a new 1,250,000 gallon elevated storage tank at the existing site is estimated to be $4,288,300. Details of the cost estimate are summarized in Table 2.

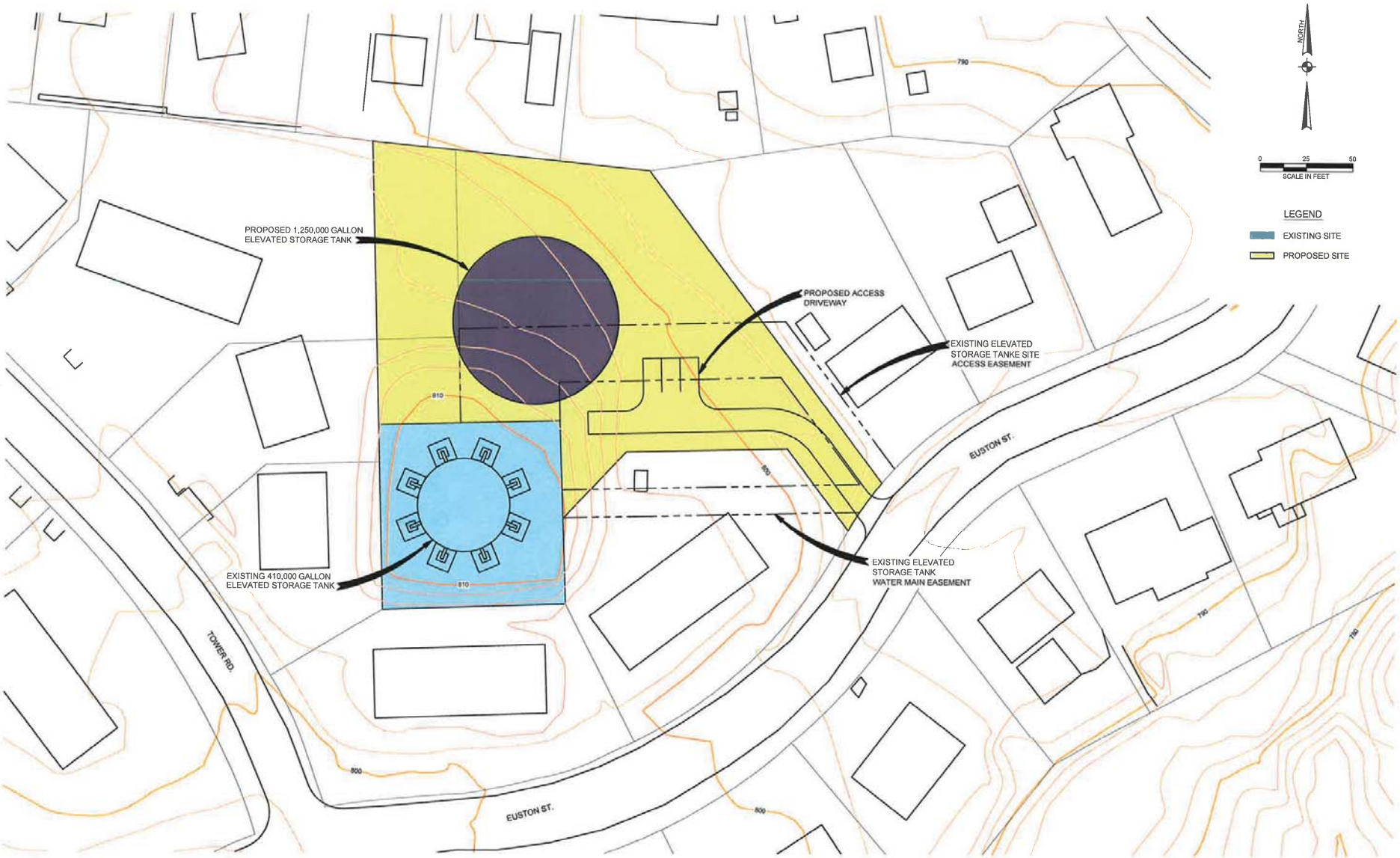


Fig. 2 Preliminary Arrangement for a 1,250,000 Gallon Elevated Storage Tank at the Existing Site

Table 2 Preliminary Project Cost Estimate for 1,250,000 Gallon Elevated Storage Tank at the Existing Site

Item	Description	Construction Costs Existing Site Unit Cost	Construction Costs Existing Site Total Cost
1,250,000 gallon Elevated Storage Tank			
Unit Price Work Items			
1B	530 - square yards of roadway pavement, including bituminous concrete, base coarse, and subbase course	$35	$18,550
2B	400 - square feet of 4-inch concrete sidewalk	$10	$4,000
3B	600 - lineal feet of chain link fence	$20	$12,000
4B	1 - 20-foot wide swing gate and appurtenances	$600	$600
Lump Sump Work Items			
5B	Provide 1,250,000 gallon elevated storage tank structure and related items		$2,860,000
6B	Provide Containment for Painting		$100,000
7B	Demolish existing elevated storage tank		$90,000
8B	Demolish existing chain link fence		$2,000
9B	Provide outside piping		$128,000
10B	Provide sitework		$52,000
11B	Provide landscaping		$15,000
12B	Provide electrical work		$30,000
13B	Provide cathodic protection system		$15,000
14B	Provide all other work for construction of the elevated storage tank		$166,450
General Project Allowance			
15B	Allowance for providing Electrical Service		--
Site and Easement Acquisition			
16B	Appraisals		$20,000
17B	Legal Services		$30,000
18B	Land Acquisition		$20,000
19B	Easement Acquisition		$10,000
	TOTAL CONSTRUCTION COSTS, Items 1B through 19B		$3,573,600
	ENGINEERING AND PROJECT CONTINGENCIES		$714,700
	TOTAL COST		$4,288,300

A preliminary site arrangement for a 500,000 gallon elevated storage tank at the proposed new site is shown in Figure 3. The site layout is based on a 500,000 gallon elevated storage tank with a tank diameter of 60 feet. A 12-foot wide paved driveway with three parking spaces would be provided for access to the elevated storage tank for routine operation and maintenance. An electric service would be installed for the new elevated storage tank. A 12-inch water main would be provided to connect the elevated storage tank to the 12-inch water main in Parkview Road. A fire hydrant would be provided on the connecting water main to drain the elevated storage tank.

The project would require acquisition of 1.80 acres of Village owned property for use by the Water Utility. Approximately 50 percent of the site would be disturbed during construction. It would be necessary to obtain temporary easements for demolition of the existing elevated storage tank from five of the adjacent property owners. It would be possible to abandon the existing water main easement and abandon the site of the old elevated storage tank after the old elevated storage tank was demolished. The project cost for a new 500,000 gallon elevated storage tank at the proposed new site is estimated to be $1,910,000. Details of the cost estimate are summarized in Table 3.

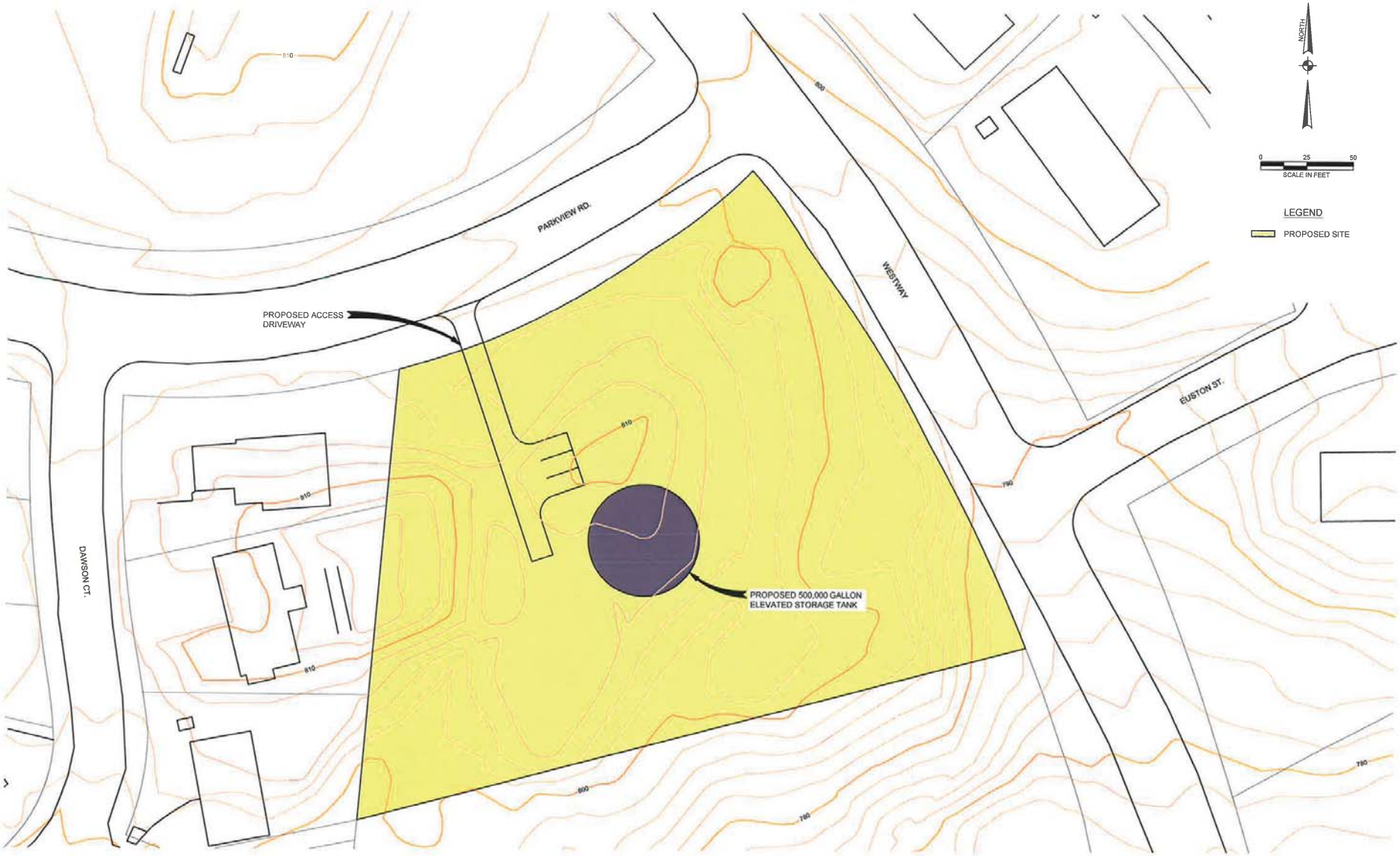


Fig. 3 Preliminary Arrangement for a 500,000 Gallon Elevated Storage Tank at the Proposed New Site

J:\Greendale\E164-04.0115-5-11 EST SITE OPTIONS AND SIZES.dwg, 6/6/2011 8:27:09 AM, 1:2, WB

Table 3 Preliminary Project Cost Estimate for 500,000 Gallon Elevated Storage Tank at the Proposed New Site

Item	Description	Construction Costs Existing Site Unit Cost	Construction Costs Existing Site Total Cost
500,000 gallon Elevated Storage Tank			
Unit Price Work Items			
1A	300 - square yards of roadway pavement, including bituminous concrete, base coarse, and subbase course	$35	$10,500
2A	400 - square feet of 4-inch concrete sidewalk	$10	$4,000
3A	600 - lineal feet of chain link fence	$20	$12,000
4A	1 - 20-foot wide swing gate and appurtenances	$600	$600
Lump Sump Work Items			
5A	Provide 500,000 gallon elevated storage tank structure and related items		$1,145,000
6A	Provide Containment for Painting		$75,000
7A	Demolish existing elevated storage tank		$78,000
8A	Demolish existing chain link fence		$2,000
9A	Provide outside piping		$70,000
10A	Provide sitework		$62,000
11A	Provide landscaping		$15,000
12A	Provide electrical work		$25,000
13A	Provide cathodic protection system		$12,000
14A	Provide all other work for construction of the elevated storage tank		$75,600
General Project Allowance			
15A	Allowance for providing Electrical Service		$5,000
Site and Easement Acquisition			
16A	Appraisals		--
17A	Legal Services		--
18A	Land Acquisition		--
19A	Easement Acquisition		--
	TOTAL CONSTRUCTION COSTS, Items 1A through 19A		$1,591,700
	ENGINEERING AND PROJECT CONTINGENCIES		$318,300
	TOTAL COST		$1,910,000

A preliminary site arrangement for a 1,250,000 gallon elevated storage tank at the proposed new site is shown in Figure 4. The site layout is based on a 1,250,000 gallon elevated storage tank with a tank diameter of 90 feet. A 12-foot wide paved driveway with three parking spaces would be provided for access to the elevated storage tank for routine operation and maintenance. An electric service would be installed for the new elevated storage tank. A 20-inch water main would be provided to connect the elevated storage tank to the 12-inch water main in Parkview Road. A fire hydrant would be provided on the connecting water main to drain the elevated storage tank.

The project would require acquisition of 1.80 acres of Village owned property for use by the Water Utility. Approximately 60 percent of the site would be disturbed during construction. It would be necessary to obtain temporary easements for demolition of the existing elevated storage tank from five of the adjacent property owners. It would be possible to abandon the existing water main easement and abandon the site of the old elevated storage tank after the old elevated storage tank was demolished. The project cost for a new 1,250,000 gallon elevated storage tank at the proposed new site is estimated to be $3,836,500. Details of the cost estimate are summarized in Table 4.

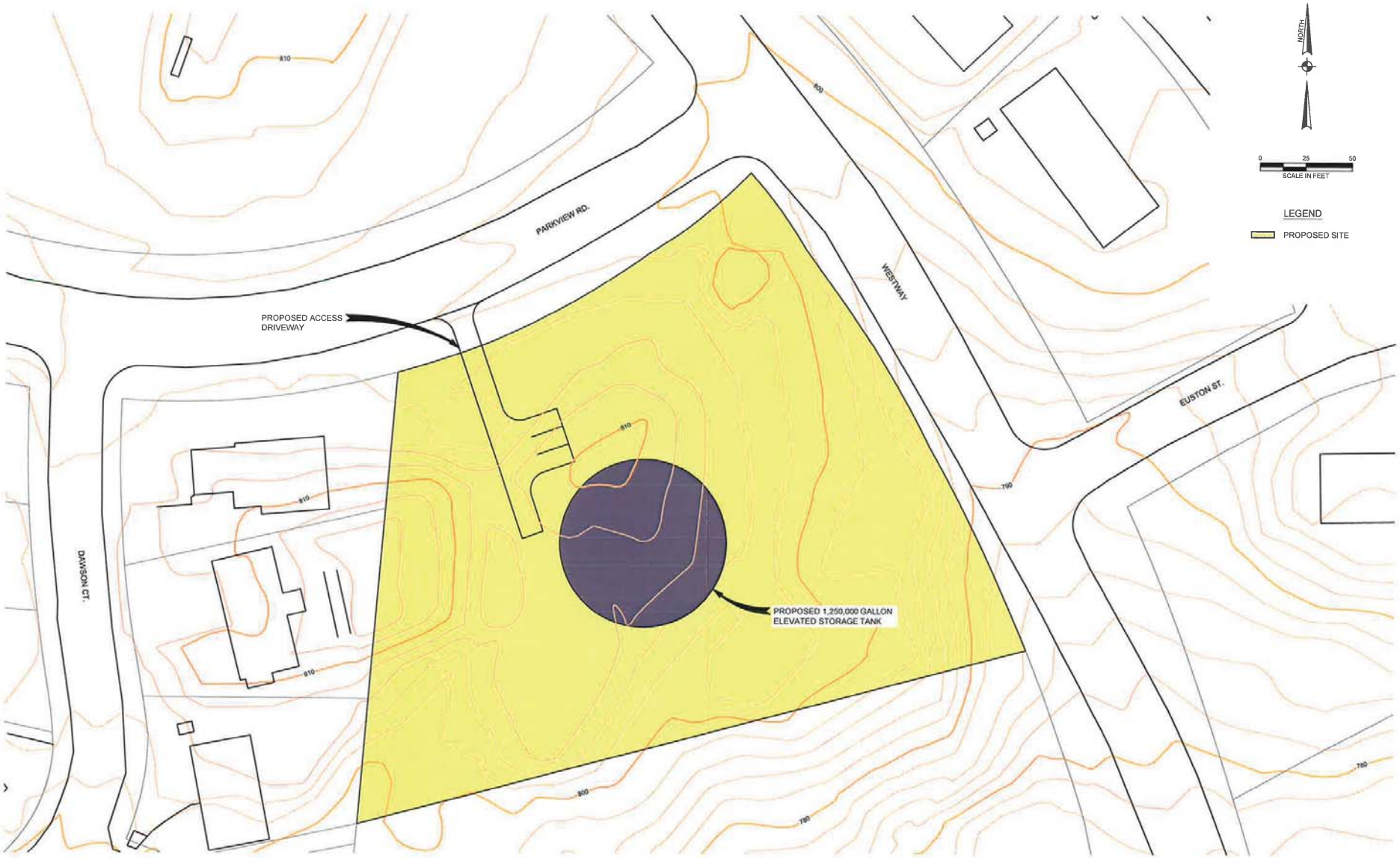


Fig. 4 Preliminary Arrangement for a 1,250,000 Gallon Elevated Storage Tank at the Proposed New Site

J:\Greendale\E164 04 01\5-5-11 EST SITE OPTIONS AND SIZES.dwg, 6/6/2011 8:27:18 AM, 1:2, WB

Table 4 Preliminary Project Cost Estimate for 1,250,000 Gallon Elevated Storage Tank at the Proposed New Site

Item	Description	Construction Costs Existing Site Unit Cost	Construction Costs Existing Site Total Cost
1,250,000 gallon Elevated Storage Tank			
Unit Price Work Items			
1B	300 - square yards of roadway pavement, including bituminous concrete, base coarse, and subbase course	$35	$10,500
2B	400 - square feet of 4-inch concrete sidewalk	$10	$4,000
3B	600 - lineal feet of chain link fence	$20	$12,000
4B	1 - 20-foot wide swing gate and appurtenances	$600	$600
Lump Sump Work Items			
5B	Provide 1,250,000 gallon elevated storage tank structure and related items		$2,600,000
6B	Provide Containment for Painting		$100,000
7B	Demolish existing elevated storage tank		$78,000
8B	Demolish existing chain link fence		$2,000
9B	Provide outside piping		$111,000
10B	Provide sitework		$62,000
11B	Provide landscaping		$15,000
12B	Provide electrical work		$30,000
13B	Provide cathodic protection system		$15,000
14B	Provide all other work for construction of the elevated storage tank		$152,000
General Project Allowance			
15B	Allowance for providing Electrical Service		$5,000
Site and Easement Acquisition			
16B	Appraisals		--
17B	Legal Services		--
18B	Land Acquisition		--
19B	Easement Acquisition		--
	TOTAL CONSTRUCTION COSTS, Items 1B through 19B		$3,197,100
	ENGINEERING AND PROJECT CONTINGENCIES		$639,400
	TOTAL COST		$3,836,500

Summary

The estimated project cost for constructing a new elevated storage tank at the site of the existing elevated storage tank range from $2,121,100 for a 500,000 gallon elevated storage tank to $4,288,300 for a 1,250,000 gallon elevated storage tank. The estimated project cost for constructing a new elevated storage tank at the proposed new site range from $1,910,000 for a 500,000 gallon elevated storage tank to $3,836,500 for a 1,250,000 gallon elevated storage tank. The costs are summarized in Table 5.

Table 5 Summary of Elevated Storage Tank Project Costs

Item	Location Existing Site	Location New Site
500,000 Gallon Elevated Storage Tank	$2,121,100	$1,910,000
1,250,000 Gallon Elevated Storage Tank	$4,288,300	$3,836,500

Constructing a new elevated storage tank at the site of the existing elevated storage tank is estimated to cost between $200,000 to $450,000 more than constructing a new elevated storage tank at the proposed new site. The actual cost difference will depend on the size of the elevated storage tank, the soil bearing capacity at the site, and the style of the elevated storage tank.

CK:jlb
K:\E164\04\01\MEM\MICHAELS.2.doc