FEASIBILITY REPORT
2016 STREET RECONSTRUCTION

INTRODUCTION

The purpose of this report is to determine the feasibility of improving the following described streets by regrading, base reconstruction, necessary curb and gutter reconstruction, and resurfacing:

Darling Drive - 186 feet east of the center line of North Burlington Avenue to Grand Avenue extended
Hagge Street - Tower Street to Diagonal Road
Schaap Drive - 1st Avenue Southwest to 1st Avenue Southwest

This report has been prepared pursuant to the Council resolution of December 14, 2015 and updates the feasibility report previously prepared on the proposed improvement and presented to Council on May 11, 2015. A single bid was received on the improvement as presented in the previous report and ordered by the City Council on May 26, 2015. The amount that the bid was over the estimated amount used in the previous report is cause to re-initiate the improvement process. This report includes a revision and options in the proposed pavement structure and updated estimates reflecting recent pricing.

The improvement has not been petitioned for and needs to proceed as a Council initiated improvement project. See Maps A, B, and C for the location of the subject streets.

PROJECT NEED

All of the subject streets are residential streets constructed with flexible pavement (bituminous surface with either bituminous or aggregate base) and are concrete curb and guttered. All abutting land uses are residential, including multifamily, or institutional. The width and year of construction of the streets are as follows:

Darling Drive from 186' to 312' east of North Burlington Avenue (Darling Dr. W): 36 feet wide, constructed in 1987
Darling Drive from 312' east of North Burlington Avenue to Grand Avenue extended (Darling Dr. E): 36 feet wide, surfaced in 1997
Hagge Street: 30 feet wide, constructed in 1972
Schaap Drive within Eckerson 1st Addition (Schaap Dr 1): 36 feet wide, surfaced in 1993
Schaap Drive within Eckerson 2nd Addition (Schaap Dr 2): 36 feet wide, initial surface placed in 1995

All of the street segments, except the easterly 354 feet of Darling Drive, have met or exceeded the 20 year design life. The easterly portion of Darling Drive failed to meet the 20 year design life by 1 year.

The composition of the existing pavement structure of each of the street segments is as follows:

Segment	Fabric Layer	Drainable Base Layer	Edge Tile	Aggregate Base Depth	Surfacing Depth
Darling Dr. W	-	-	Yes	9 inches	2.5 inches
Darling Dr. E	Yes	-	Yes	9 inches	2.5 inches
Hagge Street	-	-	-	4 inches[1]	2.0 inches
Schaap Dr. 1	-	-	-	9 inches	2.5 inches
Schaap Dr. 2	Yes	-	-	9 inches	2.5 inches

[1]Bituminous Base

The streets' bituminous pavement no longer has the properties necessary to fulfill its function. The loss of the bituminous pavement qualities needed to sustain durable surfacing is generally due to material fatigue as well as material degradation. Fatigue develops from the accumulation of the minute deflections that occur with each wheel loading and is accelerated over time as natural factors reduce the pavement's ductility. These factors ultimately limit the usable life of the surfacing regardless of other factors or deficiencies affecting the total pavement structure. Seasonally saturated soil conditions contribute to a weakening of the subgrade and aggregate base, or in the case of Hagge Street, stripping of the binder oil from the bituminous base. The weakening of the subgrade and base reduces the load bearing capability of the total pavement structure to the point that it will no longer support normal loadings without excessive deflection and ultimately failure. The effects of this weakening are typically recognized by surface deformation and extensive "map" or "an alligator pattern" cracking. Severe occurrences of this condition resulting from frost melt are commonly referred to as "frost boils". The results of this condition may be found throughout the length of the subject streets. On those street segments that do not include geotextile fabric beneath the aggregate base, seasonal saturation aggravates the blending of the subgrade clay soils and aggregate bases which permanently reduces the strength and function of the base. The combination of factors has deteriorated the total bituminous pavement structure of the streets to the point they no longer are able to provide an acceptable level of service.

It is recommended that the existing pavement structure (base and surfacing) be removed and replaced as part of a street reconstruction in order to restore the total pavement system. In general, the existing curb and gutter may remain in place. Sections of dislocated concrete curb and gutter should be removed and replaced as necessary to maintain reasonable water flow, with a performance goal of containing any ponding water within the width of the concrete gutter.

PAVEMENT DESIGN

The City's Assessment Ordinance provides that residential streets shall be of "5 ton" design and that collector streets (including commercial and industrial access streets) shall be of "9 ton" design. Although the terminology "5 ton" or "9 ton" design reflects what might be considered outdated pavement design methodology, the intent of the standard is clear in defining that the pavement of residential streets should reflect the adjacent residential land use rather than being designed to

potentially serve a collector or arterial function. A residential street design would therefore typically account for traffic consisting of predominately automobiles and light trucks together with minor quantities of trucks and buses to reflect normal residential services such as garbage hauling, school busing, and deliveries. Schaap Drive and Hagge Street are subject to only such traffic and can be designed accordingly. Darling Drive is projected to gain additional through traffic upon completion of Grand Avenue. Based on a traffic study recently completed for the City, the increase in traffic warrants additional pavement structure which is proposed to be provided with an increase in surface thickness as presented in the following sections.

Pavement Type

As previously noted, the existing pavement on all three streets consists of bituminous surfacing and gravel or bituminous bases. As also indicated, this pavement type relies on the strength of the base in addition to the surfacing to distribute a wheel load (weight) over a large enough area of the underlying soils to minimize the deflection in the pavement surface so that it can withstand years of traffic before it fails. Based on the history of early failure of this pavement type throughout the community and the nature of soils and gravel in the area, it was found to be cost effective to implement steps to enhance subsurface drainage of the pavement system. The drainage improvements do not reduce the reliance on the gravel base but are intended to ensure maximum performance through yearly cycles, particularly the spring melting period when the moisture from melting frost tends to be trapped in and just below the aggregate bases. Relatively sharp increases in the cost of base materials being used warrants consideration of changes in the pavement type being utilized for local low volume streets.

Concrete pavement is considered a rigid pavement. A wheel load is, in general, distributed over a large area within the concrete surface reducing reliance on the strength of the aggregate base and underlying soils. While such an explanation may be an over simplification of the dynamics occurring within a pavement system, it is intended to describe the fundamental difference in the pavement types that allows for exploration of cost effectively utilizing concrete pavements for low volume streets. Other factors that can not be disregarded in designing a concrete pavement system include the transfer of wheel loads between pavement panels, wheel loadings at the outer edges of panels, pavement warping and size fluctuations that occur during temperature changes, and interactions occurring at the interface of panels (pavement joints). While these factors can not be disregarded in use of concrete pavement for low volume roads, the extent of the measures needed to satisfactorily address them tends to diminish as the volume of traffic, particularly that of heavy trucks, decreases.

The selection of pavement type for relatively low volume roads could be argued to be subjective given the irregular local performance history of certain pavement types. Life cycle cost analyses which include consideration of initial and maintenance costs can be formulated to provide a reasonable recommendation on roadways that deteriorate in a manner having somewhat of a relationship to traffic loadings. Life expectancies of 20 years for bituminous and 35 years for concrete pavements prior to the need for a minimal structural improvement are commonly used in such analyses. Lower volume streets in Worthington have historically shown a much wider range of usable lives. Residential bituminous streets have functionally performed from as little as 10 years to over 50 years. Very specific changes in design have been initiated to address those deficiencies that have been identified with poor performance of bituminous pavements and a life expectancy of

at least 20 years now appears to be a practical expectation. Residential concrete streets other than those subject to certain aggregate failures or detrimental material reactions have performed well in the community and are commonly found to be over 50 years old. It is important to note that the provisions of the City's Assessment Ordinance relating to street reconstruction establish a 20 year design life for bituminous pavements and a 35 year design life for concrete pavements. Assessments for reconstruction are prorated to the design life should the street fail to achieve the design life.

Some consideration in selection of pavement type may also include the length of time required to return the street to full traffic use. Concrete paving will require up to 10 additional days for pavement placement and curing prior to through traffic being allowed on the street. Since curbing is involved at certain locations in either pavement option, traffic entering the street from driveways affected by the curb replacement will be restricted for approximately 7 additional days.

Bituminous Pavement Option

It is proposed that Schaap Drive and Hagge Street be reconstructed utilizing a residential street section consisting of 2.5" of bituminous surfacing and 9" of aggregate base. The surfacing on Darling Drive would be increased to 3.5". It is recommended that the aggregate base be a single layer of drainable material which is a change from former pavement recommendations. The recently revised Minnesota Department of Transportation construction specifications now include standards for a Drainable Stable Base (DSB) material which is reported to cost less to produce and be easier to handle than the Open Graded Aggregate Base (OGAB) previously used in only the lower 4" of the aggregate base. The DSB is also intended to accommodate paving equipment better than OGAB allowing it be used for the complete depth of the base eliminating the alternating placement of drainable and Class 5 (gravel) base which has been associated with increased construction costs. The stability of DSB through a wide range of moisture conditions also warrants reducing the minimum depth of bituminous surfacing for residential streets from 3" as recommended in recent years to 2.5".

Use of the drainable base material together with proper edge drain tiles will yield free drainage of that base material and intercept free water rising from below that layer. As evident in the Darling Drive E and Schaap Drive 2 street segments, the edge drains without the drainable base layer do not provide the drainage needed to prevent saturation and resulting weakening of the pavement structure. Geotextile reinforcement fabric would also be installed in conjunction with the aggregate base. The geotextile fabric will reduce the migration of the subgrade clay into the drainable base material and reinforce the subgrade material (clay) during the spring transitional period when frost is melting out of the soil and the subgrade's bearing strength is the weakest. Due to the need to remove the existing aggregate base in the bituminous pavement option, it is not feasible to utilize any existing fabric or edge drain tiles on Darling Drive or Schaap Drive.

Concrete Pavement Option

It is proposed that Schaap Drive and Hagge Street be reconstructed utilizing a residential street section consisting of 6" of concrete surfacing and 4" of aggregate base. The surfacing on Darling Drive would be increased to 6.5" to address the additional traffic. The 4" of aggregate tends serves as a platform for constructing the concrete surfacing and to minimize migration of underlying soils

through the pavement joints rather than a significant structural component of the pavement system. This pavement system is similar to that found in concrete streets throughout the community constructed prior to 1995. Although it would be recommended that higher volume concrete streets, particularly those subject to heavy truck traffic, incorporate a drainable base and subsurface drainage, using the proposed concrete pavement section offers a significantly lower cost than a section incorporating a drainable base and subsurface drainage. The fabric and/or edge drain tiles currently in place on segments of Darling Drive and Schaap Drive will be able to remain utilizing the concrete pavement option. Consideration may be given to the proposed concrete pavement section as a reasonable alternative to a bituminous pavement.

Utilizing concrete pavement to reconstruct a street has certain significant disadvantages when perpetuating the existing curb and gutter. Sections of curb and gutter that are displaced to the extent that water ponds beyond the concrete gutter will be replaced, however, the gutter surface will remain somewhat uneven along the majority of the street. The uneven gutter surface will tend to reflect into the new street surface because the gutters act as the outside form in the concrete paving operation. In other words, the ride of street is not likely to be as smooth as it would be with complete curb and gutter replacement.

A second disadvantage is that the curb and gutter will not become a contiguous part of the concrete pavement system as it would with complete curb and gutter replacement. Movement of the curb and gutter that is different from that of the pavement should be expected. The additional support of the outer edge of the concrete pavement panel provided by structurally contiguous curb and gutter will also not be provided. An alternate to having the curb and gutter structurally isolated from the street pavement would be to drill and secure steel bars into the existing curb and gutter that would extend into the pavement being poured. Drilling the bars poses a certain risk of damaging sections of the existing curb and gutter. The cost for installing the connecting steel bars will increase the total street reconstruction costs by approximately 4% and increase the estimated assessment rates between 15.6% (Schaap Drive) to 34.9% (Hagge Street). Higher costs will be incurred if curb and gutter is damaged during installation. Drilling in the bars is not being proposed given the benefits, costs and risks.

Various manholes are located along each street. The type of castings (frame and lid) in place on these manholes do not vary in height as the pavement is lifted by frost action or other changes in the volume of the underlying soil. The affects of the differential movements at manholes in bituminous pavement is less significant than in concrete pavements due to the flexibility of the pavement. It is common for castings in bituminous pavements to have a fixed height and are typically only adjusted as needed for pavement replacement. In concrete pavements the movement at manholes reflects movement of the concrete panel(s) around the manhole. The affects of the movement in concrete pavement is that the castings are essentially lifted off of the manhole when soils expand which can be detrimental to the pavement and/or manhole and/or utility the manhole is located on. If the concrete pavement option is chosen, it is proposed that all the manhole castings be replaced with variable height (telescoping castings). The relatively low cost of adjusting manholes is, by practice, assigned as an assessment rate determining cost. Due to the high cost of replacing each casting, currently estimated at $1,560 more than only adjusting the casting, and the variable number of manholes within each street it is proposed that the incremental cost for replacing castings be designated as a non-assessable cost.

RELATED IMPROVEMENTS

Darling Drive

The catch basins and storm sewer lead under Darling Drive located approximately 470 feet east of North Burlington Avenue have been dislocated by frost action. It is proposed that the catch basins and lead be removed and reinstalled. Reinstallation will include use of granular backfill tapered up to the roadbed to minimize the affects of frost. The estimated cost for reinstalling the catch basins and lead including engineering and contingencies is $44,350 if the bituminous pavement option is selected or $51,350 if the concrete pavement option is selected. The additional costs under the concrete pavement option is largely associated with removal and replacement of geotextile fabric and edge drain tiles that would be included as part of the bituminous pavement option but is not part of the concrete pavement option as previously presented. This work is not included in the Darling Drive Street improvement cost and would be funded from storm water utility revenue. The 2016 Storm Water Utility budget includes $31,900 for the work. The remaining costs of $12,450 or $19,450 will be funded from the $25,000 budgeted in the 2016 Storm Water Utility budget for unanticipated storm water problems.

Hagge Street

The existing catch basins located approximately 280 feet west of Diagonal Road are the large box structure with a large curb opening. This type of catch basin tends to be subject to failure, difficult to maintain, and subject to internal blockage due to the lack of debris screening. It is recommended that these catch basins be removed and replaced with standard drainage structures. The estimated cost for replacing the two catch basins is $13,400 including engineering and contingencies. This work is not included in the Hagge Street improvement cost and would be funded from storm water utility revenue. The 2016 Storm Water Utility budget includes $17,490 for the work.

The sanitary sewer and water mains within Hagge Street were reconstructed in 2006 in anticipation of the street reconstruction. The 2016 Sanitary Sewer and Water Utility funds include a budget for pavement restoration associated with these projects that is not within the scope of necessary street improvements. This includes the replacement of sidewalks, driveways, and curb and gutter removed as part of the utility work. The estimated costs for the sanitary sewer and water main related restoration work, including engineering and contingencies, are $3,100 and $6,000 respectively. These costs are below the budgets of $3,720 for sanitary sewer work restoration and $6,710 for water main work restoration.

The pedestrian ramp located on the north side of Hagge Street at Diagonal Road is too steep to be compliant with the standards established for the Americans with Disabilities Act (ADA). The sidewalk along Hagge Street and Diagonal Road will need to be removed and replaced for an adequate length to achieve the appropriate slope. Removal of a tree will also be required due to the encroachment of its trunk and roots. The total estimated cost for this work is $14,100. The cost for this work is included in the total street improvement cost but is not included in the determination of the assessment rate.

Schaap Drive

The existing pedestrian ramps on Schaap Drive at each of its intersections with 1st Avenue SW do not comply with the specifics of current Americans with Disabilities Act (ADA) standards although the ramps do include tactile warning (truncated dome) panels. The lip between the street gutter and the ramp is steeper and/or higher than permitted under the ADA standards. Many of the truncated domes on the composite panels have been sheared off and therefore the panels should also be replaced with cast iron panels which have been found to be the only reasonably durable type of panels. The total estimated cost for this work is $16,050. The cost for this work is included in the total street improvement cost but is not included in the determination of the assessment rate.

COSTS AND FINANCE

In general, the distribution of assessable costs for the project is proposed as outlined in the City's Assessment Ordinance.

City share will include all costs for reconstruction of the center 24 feet of pavement with the costs for reconstructing the remaining width of pavement and for curb and gutter reconstruction being assessed to the benefitted properties. Side yard lot allowances and intersecting public right-of-way frontages are also a city share of the project.

The following provides the estimated costs, city share, assessments receivable, and assessment rates for the street improvements:

BITUMINOUS PAVEMENT OPTION
Darling Drive

City share for non-assessable costs[1]	$122,853.78	
City share of assessable costs	$0.00	
Total city share	$122,853.78	(82.3%)
Assessments receivable	$26,396.22	(17.7%)
TOTAL COST	$149,250.00	

The estimated base assessment rate is **$38.59/ft**
The estimated reduced assessment rate is **$36.66/ft**

[1] City share for non-assessable costs includes $107,350.00 for the center 24 feet, $950.00 for salvaging aggregate base material, $8,554.31 for lot allowances, $771.88 for the frontages of public right-of-way, $3,900 for additional pavement depth and $1,327.63 for reduced assessments rates.

Hagge

City share for non-assessable costs[1]	$211,805.73	
City share of assessable costs	$0.00	
Total city share	$211,805.73	(88.6%)
Assessments receivable	$27,144.27	(11.4%)
TOTAL COST	$238,950.00	

The estimated assessment rate is **$18.37/ft**

[1] City share for non-assessable costs includes $187,850.00 for the center 24 feet, $3,150 for salvaging aggregate base material, $5,537.59 for lot allowances, $14,100 for replacing pedestrian ramps and $1,168.13 for the frontages of public right-of-way.

Schaap Drive

City share for non-assessable costs[1]	$210,107.83	
City share of assessable costs	$0.00	
Total city share	$210,107.83	(73.8%)
Assessments receivable	$74,392.17	(26.2%)
TOTAL COST	$284,500.00	

The estimated assessment rate is **$38.71/ft**

[1] City share for non-assessable costs includes $186,200.00 for the center 24 feet, $3,600 for salvaging aggregate base material, $4,257.84 for lot allowances, and $16,050 for replacing pedestrian ramps.

Total Improvement

The following provides the estimated costs, city share, assessments receivable, and assessment rates for the street and alley improvements:

City share for non-assessable costs	$544,767.34	
City share of assessable costs	$0.00	
Total city share	$544,767.34	(81.0%)
Assessments receivable	$127,932.66	(19.0%)
TOTAL COST	$672,700.00	

CONCRETE PAVEMENT OPTION

Darling Drive

City share for non-assessable costs[1]	$136,711.47	
City share of assessable costs	$0.00	
Total city share	$136,711.47	(82.3%)
Assessments receivable	$29,388.53	(17.7%)
TOTAL COST	$166,100.00	

The estimated base assessment rate is **$42.97/ft**
The estimated reduced assessment rate is **$40.82/ft**

[1] City share for non-assessable costs includes $110,000.00 for the center 24 feet, $950.00 for salvaging aggregate base material, $2,300.00 for incremental casting costs, $9,524.04 for lot allowances, $859.38 for the frontages of public right-of-way, $11,600 for additional pavement depth and $1,478.10 for reduced assessments rates.

Hagge

City share for non-assessable costs[1]	$294,514.12	
City share of assessable costs	$0.00	
Total city share	$294,514.12	(90.2%)
Assessments receivable	$32,035.88	(9.8%)
TOTAL COST	$326,550.00	

The estimated assessment rate is **$21.68/ft**

[1] City share for non-assessable costs includes $248,350.00 for the center 24 feet, $3,150 for salvaging aggregate base material, $21,000 for incremental casting costs, $6,535.50 for lot allowances, $14,100 for replacing pedestrian ramps and $1,378.63 for the frontages of public right-of-way.

Schaap Drive

City share for non-assessable costs[1]	$258,190.59	
City share of assessable costs	$0.00	
Total city share	$258,190.59	(73.4%)
Assessments receivable	$93,309.41	(26.6%)
TOTAL COST	$351,500.00	

The estimated assessment rate is **$48.55/ft**

[1] City share for non-assessable costs includes $225,650.00 for the center 24 feet, $1,800 for salvaging aggregate base material, $9,350 for incremental casting costs, $5,340.56 for lot allowances, and $16,050 for replacing pedestrian ramps.

The following provides the estimated costs, city share, assessments receivable, and assessment rates for the street and alley improvements:

City share for non-assessable costs	$689,416.18	
City share of assessable costs	$0.00	
Total city share	$689,416.18	(81.7%)
Assessments receivable	$154,733.82	(18.3%)
TOTAL COST	$844,150.00	

Provided the project addressed in this report is combined with the 2016 Grand Avenue street extension for funding, it is proposed that the 2016 street reconstruction project be initially financed by PIR bonding with 401 Construction Fund reserves being temporarily utilized until bond proceeds are received. Revenues from special assessments levied as a result of the project along with the annual special tax levy required to recover the city share of the project would be utilized for bond repayment.

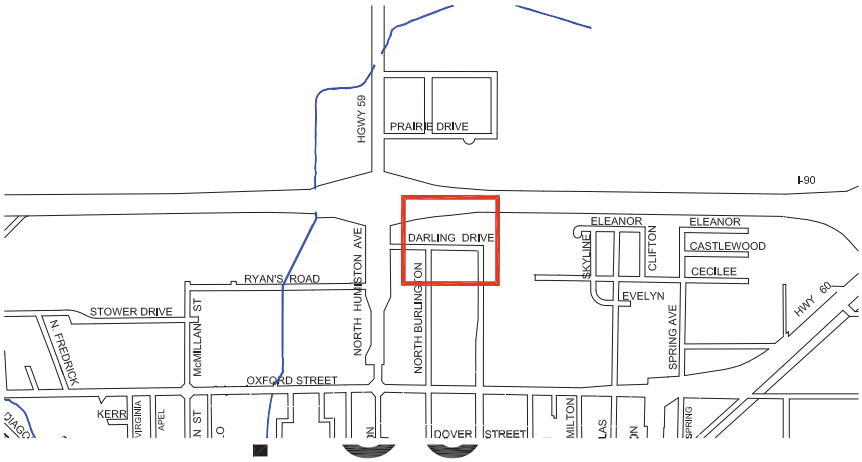
CONTRACT COMBINATION WITH OTHER IMPROVEMENTS

In addition to completion of the related work previously identified, it is recommended that this project be combined with any other similar bituminous work approved to be undertaken in 2016 should the bituminous option be selected. Should the concrete option be selected, it may be advantageous for this project to be bid separate from other projects to maximize the potential for a wider range of construction firms to be interested in under taking the project.

CONCLUSION

The proposed reconstruction of the subject streets, using either pavement option, is a feasible way and cost effective means of re-establishing the necessary integrity of the streets with an all season hard surfaced pavement.

It is recommended that the choice of pavement type be determined at the improvement hearing based on consideration of life cycle value, construction duration, and the projected disadvantages in utilizing concrete pavement in the reconstruction of the subject streets.



31-0605-400

31-0605-300

31-0608-000

Reduced Rate

DARLING DRIVE

Reduced Rate

31-1526-500

31-0611-000

Proposed

Davis

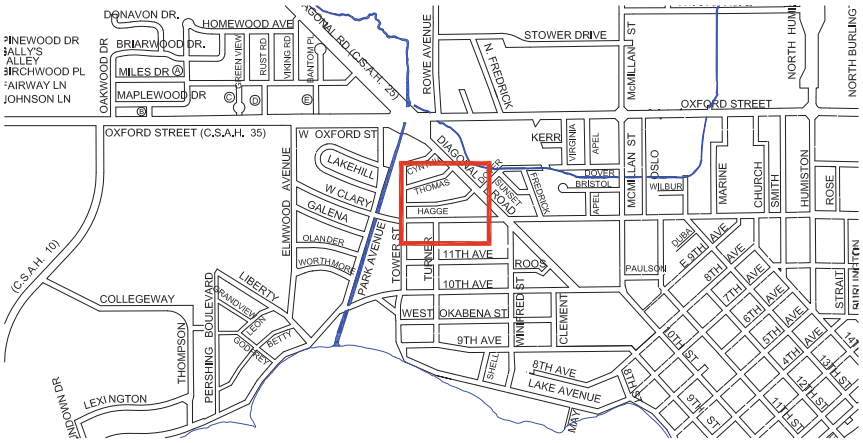
Addition

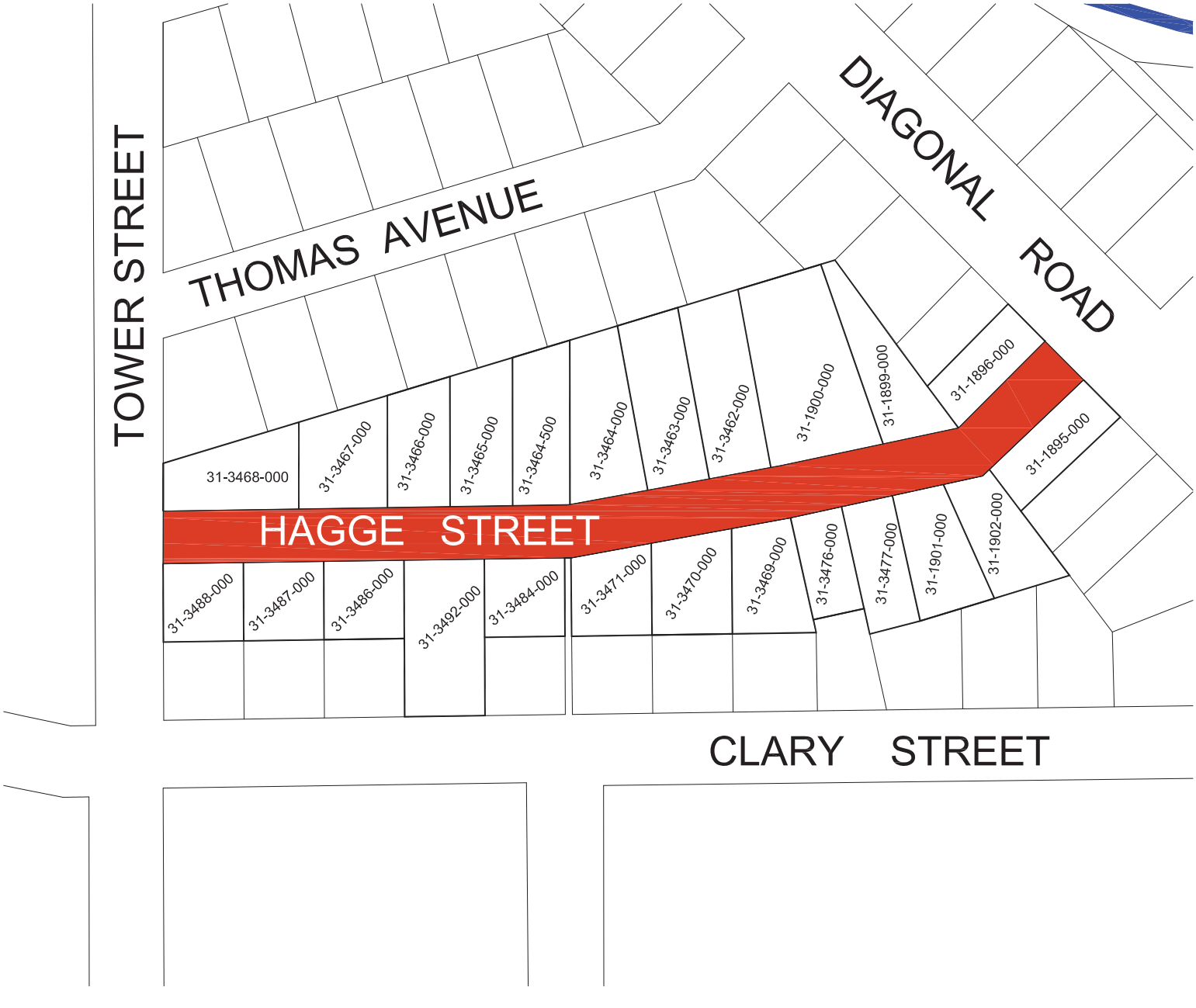
N BURLINGTON AVE

GRAND AVENUE

PROPOSED IMPROVEMENT

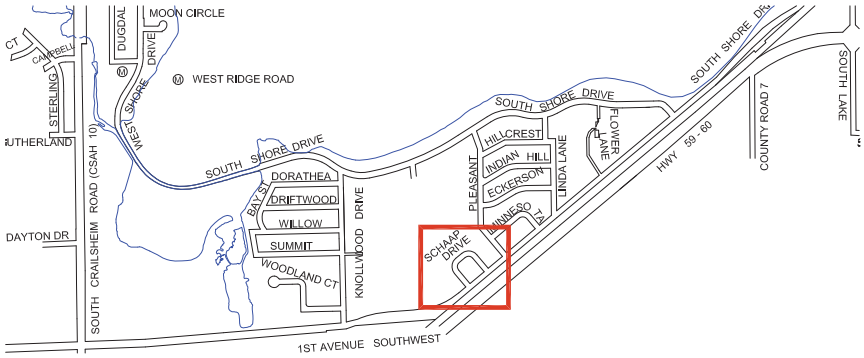
MAP A

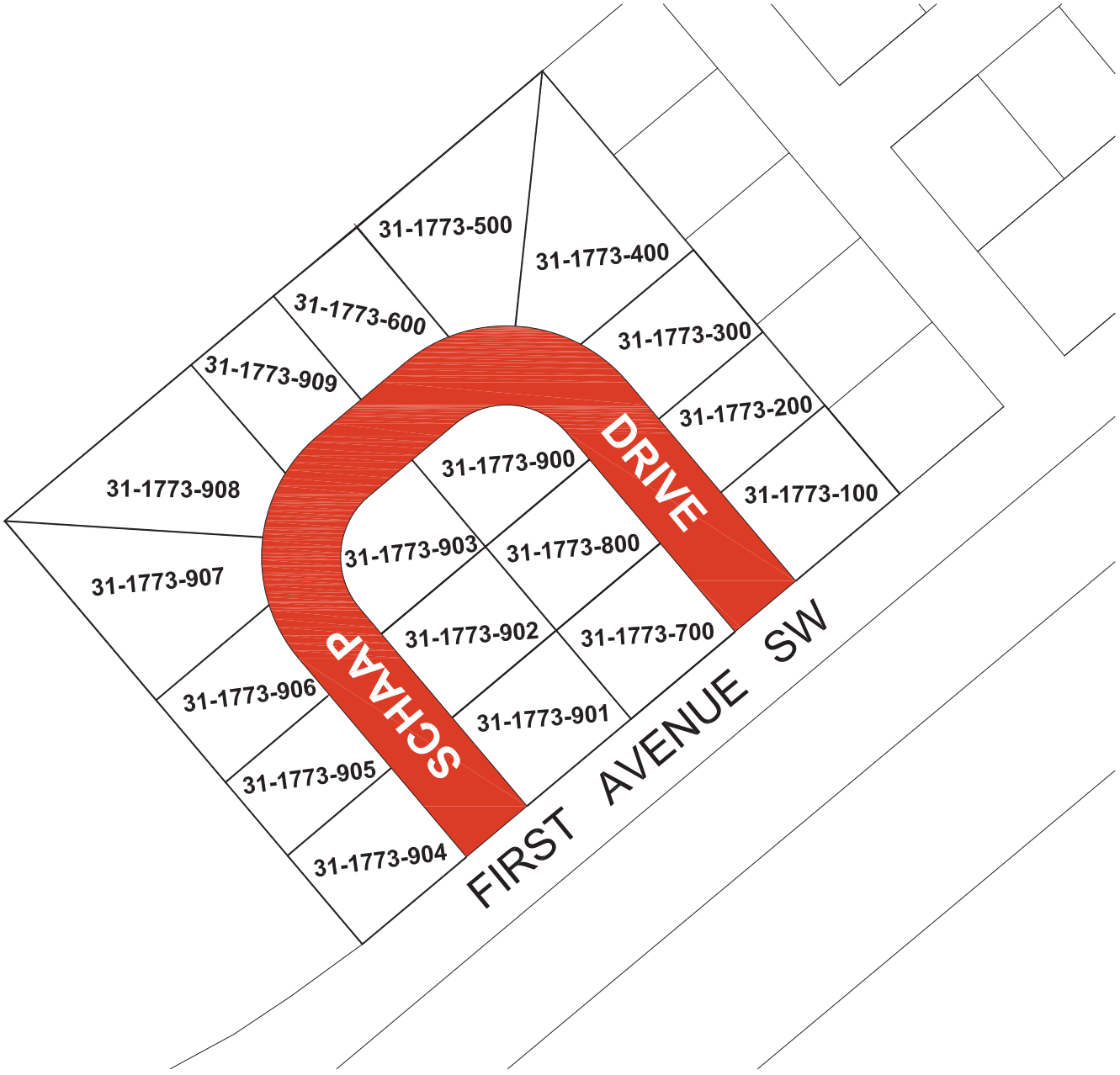




PROPOSED IMPROVEMENT

MAP B





PROPOSED IMPROVEMENT

MAP C