Item 5Aii
BCWMC 9-19-13

City of Golden Valley
7800 Golden Valley Road • Golden Valley, MN 55427
(763) 593-8030

FEASIBILITY Report

April 5, 2013

Briarwood/Dawnview Water Quality Improvement Project

City of Golden Valley
Hennepin County, Minnesota

WSB Project No. 2032-04

WSB & Associates, Inc.
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FEASIBILITY REPORT

BRIARWOOD/DAWNVIEW WATER QUALITY IMPROVEMENT PROJECT

For:

City of Golden Valley

April 5, 2013

Prepared By:

WSB & Associates, Inc.
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Minneapolis, MN 55416
(763) 541-4800
(763) 541-1700 (Fax)

CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Todd Hubmer

Todd Hubmer, P.E. Reg. No. 24043

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SECTION I

I. INTRODUCTION, BACKGROUND, AND PURPOSE

This feasibility study evaluates options to improve the quality of water discharged into Bassett Creek from a 184 acre subwatershed. This subwatershed is generally located east of Highway 100 and north of Duluth Street in the City of Golden Valley (see ***Figure 1***).

This watershed currently discharges an estimated 90 acre feet of untreated stormwater annually into Bassett Creek. The pollutant loading for this watershed is estimated to be 40,800 pounds of Total Suspended Solids a year and 131 pounds of Total Phosphorus a year. There is no additional upstream stormwater treatment provided within this predominantly single family residential watershed.

The City of Golden Valley and the Bassett Creek Watershed Management Commission (BCWMC) have completed a preliminary review of stormwater runoff treatment opportunities in this subwatershed. They have identified a parcel currently owned by the City at the south end of the subwatershed that could be suitable for this purpose. This report presents the results of an investigation into potential options available to treat stormwater runoff from this subwatershed, utilizing the identified open space.

The remaining sections of this report outline the procedures and methods followed to identify the available alternatives and estimate of costs, and provide a recommended improvement alternative to achieve the goals of the study. Additional information on the topography, soils, land use, land cover, and other information is included on ***Figures 1-8*** and ***Tables 1-6***.

II. PROCEDURES AND METHODS FOLLOWED

As part of the development of this feasibility report, the following activities were undertaken:

1. **Background Information**

   As part of this activity, a meeting was held with City staff to obtain background information on the project and more fully develop the objectives and potential concerns related to implementation. Elevations, floodplain location, wetland locations, storm sewer locations, soils, and other information we obtained from the City's geographic information database.

2. **Wetland Delineation Survey**

   A preliminary wetland delineation and survey of wetland types in the project area was completed. This information was gathered to identify areas that may not be suitable for construction of improvements. Additionally, the extent to which mitigation may be needed was determined. Please be advised that the wetland delineation completed as part of this activity could not be verified or approved by permitting agencies due to the time of year the work was completed. However, the approximate wetland boundaries that were defined should be suitable for feasibility report purposes.

3. **Identify Improvement Options**

   Based on a review and analysis of the information provided by the City staff, background information, and results of the wetland delineations five options for potential improvements were identified along with a preliminary estimate of cost.

4. **Select Recommended Improvement Option**

   Upon review of identified options, City staff provided input on the options they found the most beneficial. Based on this discussion, the most cost effective feasible alternative was selected and a more refined design was completed.

5. **Estimated Benefits and Costs**

   Pollutant reduction estimates for ponding and raingarden were based on P8 modeling and PondNet modeling. Pollutant removal for treatment manholes were based on typical rates defined by the manufacturer. Cost estimates were based on site conditions and recent costs for type improvements.

III. ALTERNATIVES CONSIDERED AND COST ESTIMATES

Five alternatives are identified to improve the quality of water discharged from the Briarwood/Dawnview watershed. These options are outlined below:

Option 1: Construct Stormwater Treatment Manholes

Construct low-flow diversion structures and grit chamber manholes at three locations to remove coarse sediment and floatables from stormwater runoff prior to discharging into Bassett Creek (***Figure 4***).

Outlined below are the approximate annual benefits of the improvement along with its estimated cost:

- Anticipated to remove 20-30% (8,000 pounds) of total suspended solids
- Anticipated to remove 2-5% (4.6 pounds) of the total
- Anticipated to have no significant benefit to reduce peak runoff rates
- Cost to construct three structural treatment system manholes is approximately $403,000 see ***Table 1*** for a detailed cost breakdown.

The primary disadvantages to this option are the significant cost and the ongoing annual maintenance activities that would be required to hydro-vacuumed removal of the accumulated sediment, which may be contaminated with PAH's, from the treatment manholes multiple times a year. Treatment manholes are typically designed for much smaller tributary areas; therefore additional maintenance will be warranted for this system.

The advantage to this option is no additional land footprint is required and there is an anticipated significant decrease in total suspended solids.

Option 2: Construct Raingarden

Construct a shallow raingarden (***Figure 5***).

Outlined below are the approximate annual benefits of the improvement along with its estimated cost:

- Anticipated to remove 93% (1000 pounds) of the total suspended solids from 5 acre tributary drainage area
- Anticipated to remove 93% (3 pounds) of the total phosphorus from 5 acre drainage area
- Anticipated to remove 2.0 acre-feet of stormwater runoff volume from 5 acre drainage area annually.

- Cost to construct raingarden is approximately $105,000 see ***Table 2*** for a detailed cost breakdown.

Although the rain garden has predicted high removal rates, the tributary area is small, only 2.7% of the total watershed. In addition, the ongoing maintenance of the rain garden would include the annual removal and replacement of the vegetation and the removal of accumulated sediment from the raingarden every three to five years.

Option 3: Construct stormwater retention and treatment pond with dead pool storage.

Construct a retention and treatment pond (***Figure 6***).

Outlined below are the approximate annual benefits of the improvement along with its estimated cost:

- Anticipated to remove 53% (21,600 pounds) of the total suspended solids
- Anticipated to remove 27% (35 pounds) of the total phosphorus
- Anticipated to remove 1.0 acre-foot of stormwater runoff volume through evaporation and seepage on an annual basis.
- Cost to construct stormwater retention and treatment pond is approximately $187,000 see ***Table 3*** for a detailed cost breakdown and ***Table 4*** for estimated pond areas and volumes.

The advantage to the retention pond is the high total suspended solids and total phosphorus removal percentages. Maintenance frequency is estimated typically at 20 year intervals with an annual vegetation management plan, which is greatly reduced in comparison to option 1. The disadvantage to this option is the additional land area that is required.

The approximate high water level of the proposed pond is 845.0. Based on the LiDAR data, the low property east of the pond appears to be at elevation 846.0. It will be necessary to survey this property prior to constructing the pond to verify adequate freeboard is provided.

Option 4: Construct iron-enhanced filtration system.

Construct a gravity-fed, enhanced filtration system (***Figure 7***).

Outlined below are the approximate annual benefits of the improvement along with its estimated cost:

- Anticipated to remove 30% (8000 lbs) of the total suspended solids
- Anticipated to remove 20% (26 lbs) of the total phosphorus

- Anticipated to remove 0.2 acre-foot of stormwater runoff volume through evaporation and seepage on an annual basis.
- Cost to construct the iron enhanced filter is approximately $178,000 see ***Table 5*** for a detailed cost breakdown.

Several issues outlined below may limit the effectiveness of an iron-enhanced filtration system at this location:

- The large area tributary to this feature could clog the filter media in a short period of time. The drainage area discharging to this location (184-acres) far exceeds the maximum drainage area for filtration systems (5-acres) that is outlined in Minnesota Stormwater Manual. Additionally, there is no pretreatment provided upstream of the filter system, which is recommended, in particular for such a large drainage area.
- Iron-enhanced filters must be periodically exposed to oxygen in order to retain phosphorus beyond what would be removed by a non-enhanced filter. If groundwater or other sustained (base) flows are directed to the iron-enhanced filter, it will not be effective. Given the large tributary area of 184-acres, there is a high risk that a base flow could exist. This could negatively affect or eliminate the benefits of the iron-enhanced filter.
- It is expected that the typical lifespan of the iron enhanced filter system is up to 20 years. However, with the limited pretreatment of this option the lifespan of the iron enhanced filter system should be expected to be less than 20 years and would require routine monitoring to determine when the filtration system becomes ineffective and would require replacement.

Option 5: Construct stormwater retention and treatment pond with dead pool storage and iron-enhanced filtration system.

Construct a retention and treatment pond as outlined in Option 3, but replace portion of pond with a gravity-fed, enhanced filtration system (***Figure 8***). A berm separating the filtration system from the pond and a draintile system placed under the filter media would be constructed to facilitate drainage through the filter. Feeding the filter system with a pump would add approximately $40,000 to the option’s costs, and was not considered due to cost constraints.

Outlined below are the approximate annual benefits of the improvement along with its estimated cost:

- Anticipated to remove 70% (29,600 lbs) of the total suspended solids
- Anticipated to remove 55% (94 lbs) of the total phosphorus from runoff
- Anticipated to remove 1.0 acre-foot of stormwater runoff volume through evaporation and seepage on an annual basis.

- Cost to construct the pond with an iron enhanced filter is approximately $234,000 see ***Table 6*** for a detailed cost breakdown.

This option provides the greatest environmental benefit to the Creek. However, similar to option 4, tributary area and sustained base flows are drawbacks to this option. Since runoff would be treated by a pond prior to filtration, it is reasonable to expect that a larger drainage area could be treated by this filter. Nonetheless, it is unlikely that the filter could function for more than a few years if the entire 184-acre area is treated by the filter. In addition, maintenance to the pond area would be typically occurring every 20 years to remove the accumulated sediment along with the replacement of the iron enhanced filter system material. Further monitoring would be required to ensure the effectiveness of the filter system.

An annual summary of the costs and performance of each option is provided in the following table:

Option	Improvement Description	Estimated Project Cost	Estimated Annual Maintenance Cost ($/yr)	Estimated TSS Removal (ton/yr)	Annualized TSS Removal ($/ton)*	Estimated TP Removal (lbs/yr)	Annualized TP Removal ($/ton)*
1	Stormwater Treatment Manholes	$403,000.00	$2,000.00	4.0	$3,176.81-$3,602.74	4.6	$2,762.44-$3,132.82
2	Raingarden	$105,000.00	$2,000.00	0.5	$13,494.46-$16,901.90	3	$2,249.08-$2,816.98
3	Treatment Pond	$186,700.00	$4,000.00	10.8	$1,213.75-$1,529.25	35	$374.53-$471.88
4	Iron Enhanced Filters	$178,000.00	$2,500.00	4.0	$2,354.76-$2,887.17	26	$362.27-$444.18
5	Pond with Iron Enhanced Filters	$234,000.00	$5,000.00	14.8	$1,107.98-$1,395.77	94	$174.45-$219.76

* Annualized cost range is based on the estimated maintenance cost and an annual inflation increase of 3% to 4% over the expected lifespan of the improvement of 50 years.

Estimated maintenance costs are based on typical maintenance costs experienced for similar improvement projects. Estimated cost, not adjusted for inflation, is added to the total estimated maintenance costs, adjusted for range of inflation rated of 3% and 4%, distrusted over the anticipated lifespan of 50 years. The annualized removal costs are based on the sum of the estimated cost and the anticipated maintenance costs distributed over the next 50 years and divided by the estimated pounds of pollutant removed.

IV. RECOMMENDATION

The option that has the greatest environmental benefit is **Option 5**. This option will have an estimated annual removal efficiency of 14.8 tons of Total Suspended Solids, at an estimated annualized cost of $1,110 to $1,400 a ton and 94 pounds of Total Phosphorus, at estimated annualized cost of $175 to $220 a pound. However, this option exceeded the original allocated funds for the project of $180,000. Conversely, based on this study and discussions of with the Commission, they have determined that Option 5, at $235,000, will provide the most effective treatment for the Creek.

The Commission also desires to monitor the improvement performance and long term life expectancy of the iron enhanced filtration system. A monitoring plan will be developed as part of the overall improvement project to evaluate the effectiveness and life expectancy.

TABLES

Briarwood/Dawnview Water Quality Improvement Project
Feasibility Study
City of Golden Valley

Table 1
3/7/2013
WSB Project No. 2032-04

Estimated Treatment Manholes Engineering Costs		
Item No.	**Item Description**	**Estimated Cost**
1	Project Design	$ 15,000.00
2	Project Permitting	$ 8,000.00
3	Project Bidding	$ 5,000.00
4	Construction Observation	$ 10,000.00
5	15% Contingency	$ 24,708.00
	Total:	**$ 62,708.00**

Option 1 - Estimated Treatment Manholes Construction Costs					
Item No.	**Item Description**	**Units**	**Estimated Unit Price**	**Estimated Quantity**	**Estimated Dollar Amount**
1	MOBILIZATION	LUMP SUM	$10,000.00	1	$10,000.00
2	STORMWATER TREATMENT MANHOLE	EACH	$100,000.00	3	$300,000.00
3	BYPASS MANHOLE	EACH	$2,500.00	3	$7,500.00
4	RC PIPE SEWER DESIGN 3006 CLASS III	LIN FT	$100.00	200	$20,000.00
5	CONNECT TO EXISTING STORM SEWER	EACH	$1,000.00	3	$3,000.00
				Total:	**$340,500.00**

Total Estimated Project Cost, including 15% Contingency, $403,208.00

Briarwood/Dawnview Water Quality Improvement Project
Feasibility Study
City of Golden Valley

Table 2
3/7/2013
WSB Project No. 2032-04

Estimated Raingarden Engineering Costs		
Item No.	**Item Description**	**Estimated Cost**
1	Project Design	$ 15,000.00
2	Project Permitting	$ 8,000.00
3	Project Bidding	$ 5,000.00
4	Construction Observation	$ 10,000.00
5	15% Contingency	$ 24,708.00
	Total:	**$ 62,708.00**

Option 2 - Estimated Raingarden Construction Costs					
Item No.	**Item Description**	**Units**	**Estimated Unit Price**	**Estimated Quantity**	**Estimated Dollar Amount**
1	MOBILIZATION	LUMP SUM	$10,000.00	1	$10,000.00
2	CLEARING & GRUBBING	ACRE	$6,000.00	1	$6,000.00
3	EXCAVATION	CU YD	$10.00	250	$2,500.00
4	FIELDSTONE RIP RAP CLASS IV	TON	$65.00	10	$650.00
5	RC PIPE APRON W/ TRASH GUARD	EACH	$1,500.00	1	$1,500.00
6	RC PIPE SEWER DESIGN 3006 CLASS III	LIN FT	$100.00	175	$17,500.00
7	CONNECT TO EXISTING STORM SEWER	EACH	$1,000.00	2	$2,000.00
8	TURF ESTABLISHMENT AND TREE REPLACEMENT	ACRE	$2,500.00	0.2	$500.00
9	TRAIL REPAIR	SQ YD	$70.00	20	$1,400.00
				Total:	**$42,050.00**

Total Estimated Project Cost, including 15% Contingency, $104,758.00

Briarwood/Dawnview Water Quality Improvement Project
Feasibility Study
City of Golden Valley

Table 3
3/7/2013
WSB Project No. 2032-04

Estimated Treatment Pond Engineering Costs		
Item No.	**Item Description**	**Estimated Cost**
1	Project Design	$ 15,000.00
2	Project Permitting	$ 8,000.00
3	Project Bidding	$ 5,000.00
4	Construction Observation	$ 10,000.00
5	15% Contingency	$ 24,708.00
	Total:	**$ 62,708.00**

Option 3 - Estimated Treatment Pond Construction Costs					
Item No.	**Item Description**	**Units**	**Estimated Unit Price**	**Estimated Quantity**	**Estimated Dollar Amount**
1	MOBILIZATION	LUMP SUM	$10,000.00	1	$10,000.00
2	CLEARING & GRUBBING	ACRE	$6,000.00	4	$24,000.00
3	EXCAVATION	CU YD	$10.00	4900	$49,000.00
4	FIELDSTONE RIP RAP CLASS IV	TON	$65.00	50	$3,250.00
5	RC PIPE APRON W/ TRASH GUARD	EACH	$1,500.00	3	$4,500.00
6	RC PIPE SEWER DESIGN 3006 CLASS III	LIN FT	$100.00	200	$20,000.00
7	CONNECT TO EXISTING STORM SEWER	EACH	$1,000.00	3	$3,000.00
8	TURF ESTABLISHMENT AND TREE REPLACEMENT	ACRE	$2,500.00	2	$5,000.00
9	TRAIL REPAIR	SQ YD	$70.00	75	$5,250.00
				Total:	**$124,000.00**

Total Estimated Project Cost, including 15% Contingency, $186,708.00

Briarwood/Dawnview Water Quality Improvement Project

City of Golden Valley

Table 4
3/7/2013
WSB Project No. 2032-04

Proposed Briarwood Park Pond Area and Volume		
Elevation	Pond area (Sq.Ft.)	Pond Volume (Cu.Ft.)
845	29030	27453
844	25875	24335
843	22795	21323
842	19850	15725
841	11600	10963
840	10325	9720
839	9115	8558
838	8000	8000
Total Area (Sq.Ft.)	29030	-
Total Volume (Cu.Yd.)	-	4669
Total Volume (Ac.Ft.)	-	3

Briarwood/Dawnview Water Quality Improvement Project
Feasibility Study
City of Golden Valley

Table 5
3/7/2013
WSB Project No. 2032-04

Estimated Iron-Enhanced Filtration System Engineering Costs		
Item No.	**Item Description**	**Estimated Cost**
1	Project Design	$ 15,000.00
2	Project Permitting	$ 8,000.00
3	Project Bidding	$ 5,000.00
4	Construction Observation	$ 10,000.00
5	15% Contingency	$ 24,708.00
	Total:	**$ 62,708.00**

Option 4 - Estimated Iron-Enhanced Filtration System Construction Costs					
Item No.	**Item Description**	**Units**	**Estimated Unit Price**	**Estimated Quantity**	**Estimated Dollar Amount**
1	MOBILIZATION	LUMP SUM	$10,000.00	1	$10,000.00
2	CLEARING & GRUBBING	ACRE	$6,000.00	2	$12,000.00
3	EXCAVATION	CU YD	$10.00	1000	$10,000.00
4	FIELDSTONE RIP RAP CLASS IV	TON	$65.00	50	$3,250.00
5	RC PIPE APRON W/ TRASH GUARD	EACH	$1,500.00	2	$3,000.00
6	RC PIPE SEWER DESIGN 3006 CLASS III	LIN FT	$100.00	200	$20,000.00
7	CONNECT TO EXISTING STORM SEWER	EACH	$1,000.00	3	$3,000.00
8	TURF ESTABLISHMENT AND TREE REPLACEMENT	ACRE	$2,500.00	2	$5,000.00
9	TRAIL REPAIR	SQ YD	$70.00	40	$2,800.00
10	FILTRATION MEDIA	LS	$10,000.00	1	$10,000.00
11	STORM SEWER	LF	$30.00	1000	$30,000.00
12	OUTLET STRUCTURE	EACH	$1,500.00	1	$1,500.00
13	DRAINTILE SYSTEM	EACH	$5,000.00	1	$5,000.00
				Total:	**$115,550.00**

Total Estimated Project Cost, including 15% Contingency, **$178,258.00**

Briarwood/Dawnview Water Quality Improvement Project
Feasibility Study
City of Golden Valley

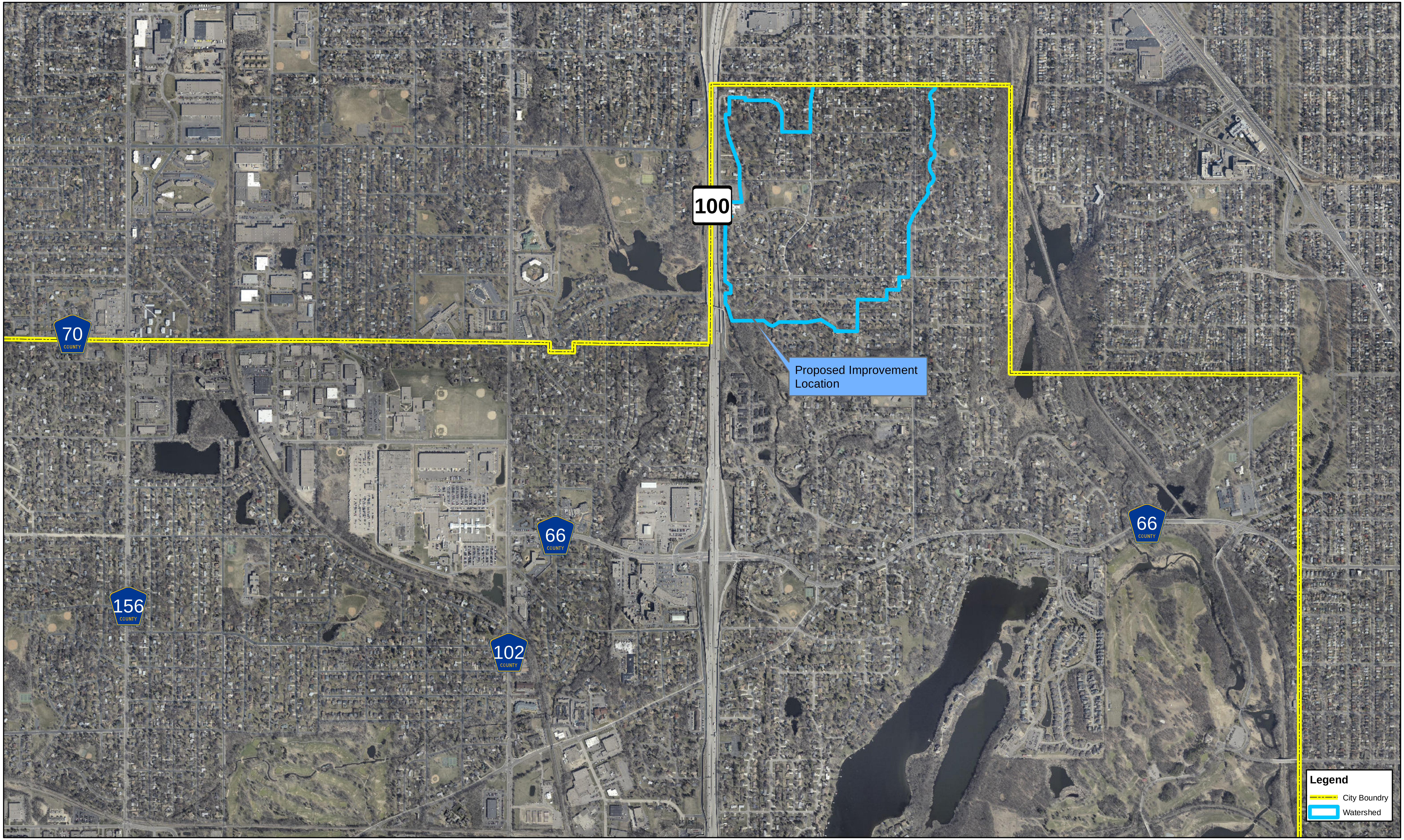
Table 6
2/28/2013
WSB Project No. 2032-04

Estimated Treatment Pond with Iron-Enhanced Filtration System Engineering Costs		
Item No.	**Item Description**	**Estimated Cost**
1	Project Design	$ 15,000.00
2	Project Permitting	$ 8,000.00
3	Project Bidding	$ 5,000.00
4	Construction Observation	$ 10,000.00
5	15% Contingency	$ 24,708.00
	Total:	**$ 62,708.00**

Option 5 - Estimated Treatment Pond with Iron-Enhanced Filtration System Construction Costs					
Item No.	**Item Description**	**Units**	**Estimated Unit Price**	**Estimated Quantity**	**Estimated Dollar Amount**
1	MOBILIZATION	LUMP SUM	$10,000.00	1	$10,000.00
2	CLEARING & GRUBBING	ACRE	$6,000.00	4	$24,000.00
3	EXCAVATION	CU YD	$10.00	4900	$49,000.00
4	FIELDSTONE RIP RAP CLASS IV	TON	$65.00	50	$3,250.00
5	RC PIPE APRON W/ TRASH GUARD	EACH	$1,500.00	3	$4,500.00
6	RC PIPE SEWER DESIGN 3006 CLASS III	LIN FT	$100.00	200	$20,000.00
7	CONNECT TO EXISTING STORM SEWER	EACH	$1,000.00	3	$3,000.00
8	TURF ESTABLISHMENT AND TREE REPLACEMENT	ACRE	$2,500.00	2	$5,000.00
9	TRAIL REPAIR	SQ YD	$70.00	75	$5,250.00
10	FILTRATION MEDIA	LS	$10,000.00	1	$10,000.00
11	STORM SEWER	LF	$30.00	1000	$30,000.00
12	OUTLET STRUCTURE	EACH	$1,500.00	1	$1,500.00
13	DRAINTILE SYSTEM	EACH	$5,000.00	1	$5,000.00
				Total:	**$170,500.00**

Total Estimated Project Cost, including 15% Contingency, **$233,208.00**

FIGURES



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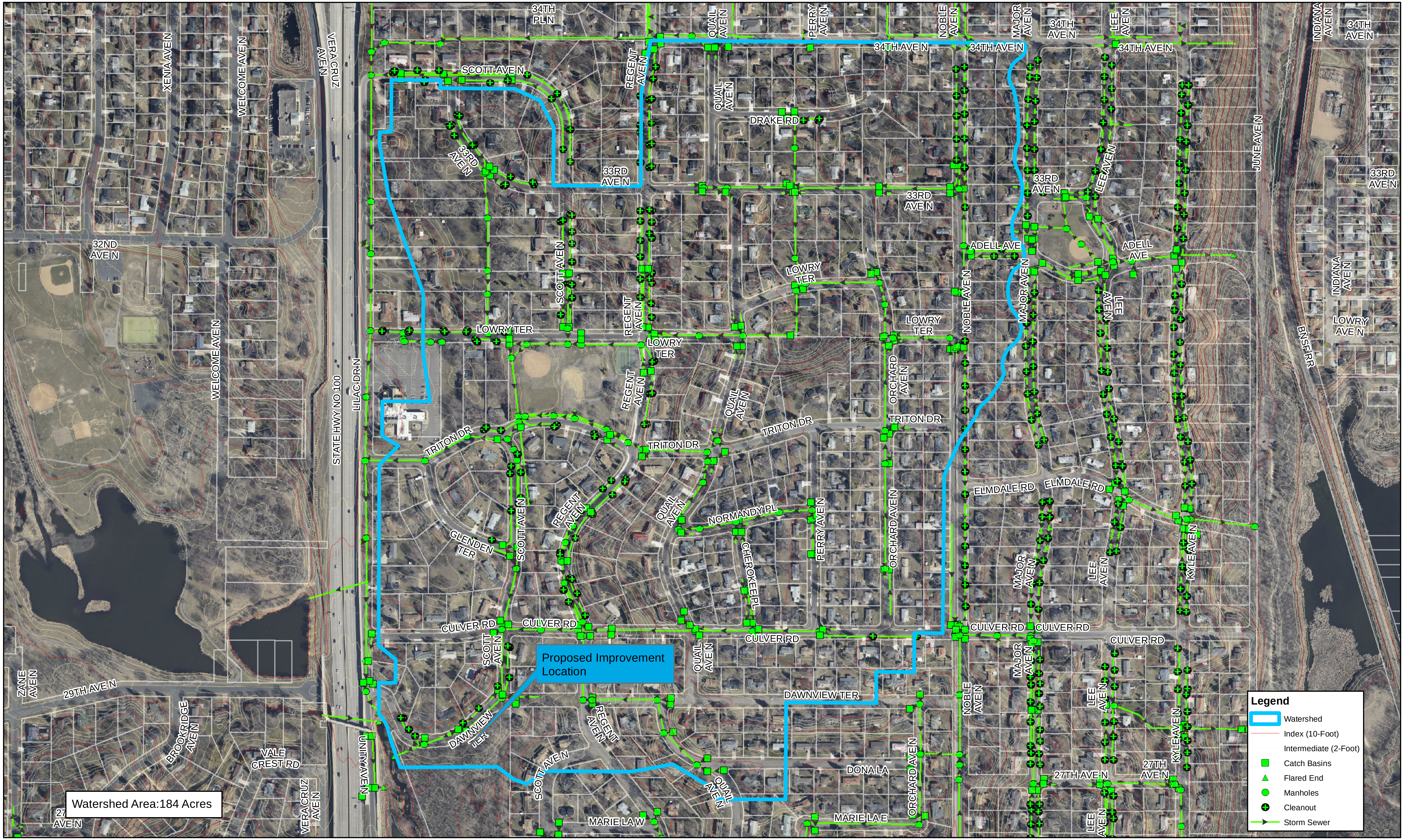
Briarwood/Dawnview Water Quality Improvement Project
Project Location Map
City of Golden Valley, MN

Figure 1

WSB & Associates, Inc.



Briarwood/Dawnview Water Quality Improvement Project
Watershed, Storm Sewer, & Topography
City of Golden Valley, MN

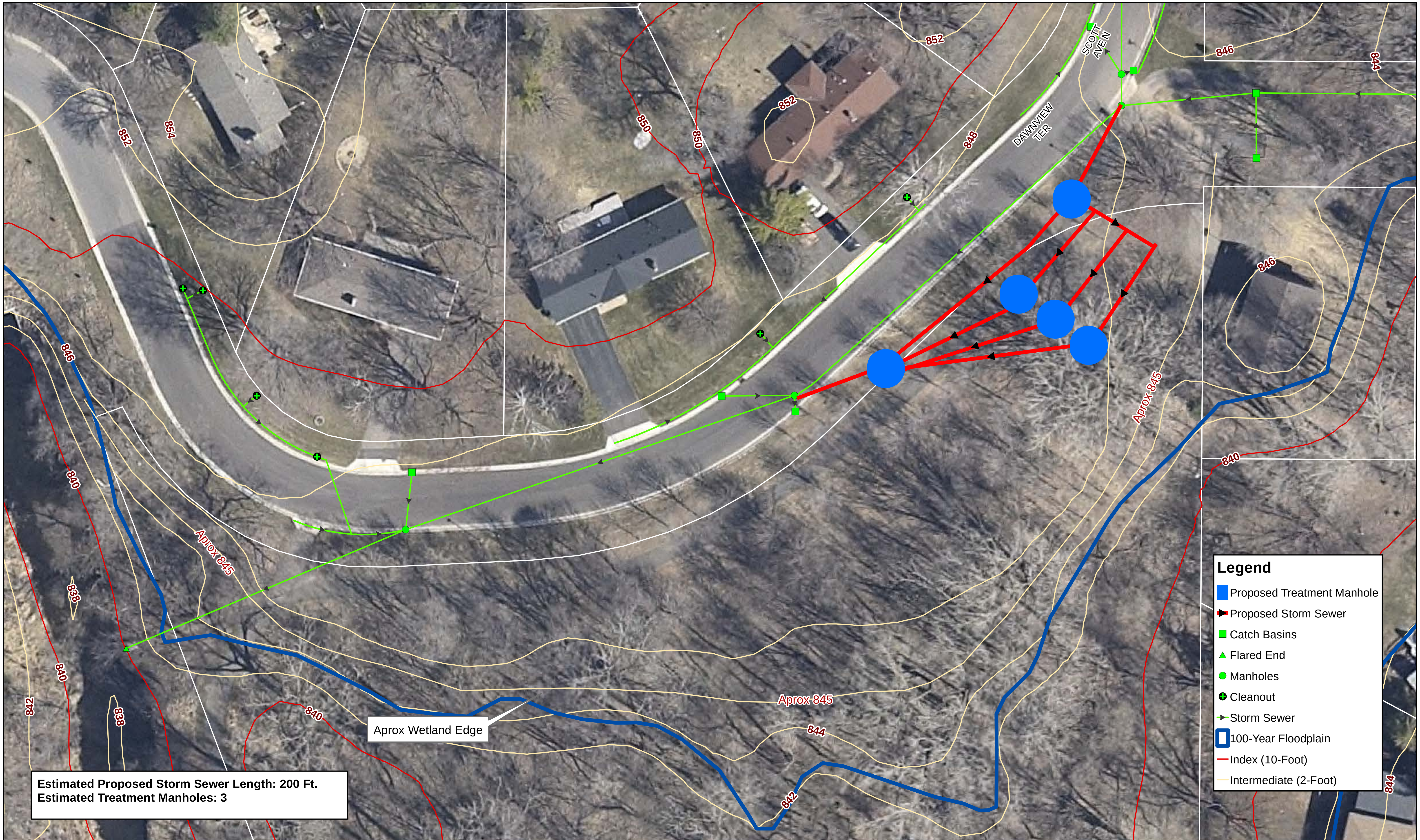
Figure 2

N
1 inch = 378 feet

Briarwood/Dawnview Water Quality Improvement Project
Existing Conditions
City of Golden Valley, MN

Figure 3

N
1 inch = 60 feet



Briarwood/Dawnview Water Quality Improvement Project
Proposed Treatment Manhole Location
City of Golden Valley, MN

Figure 4

N
1 inch = 41 feet

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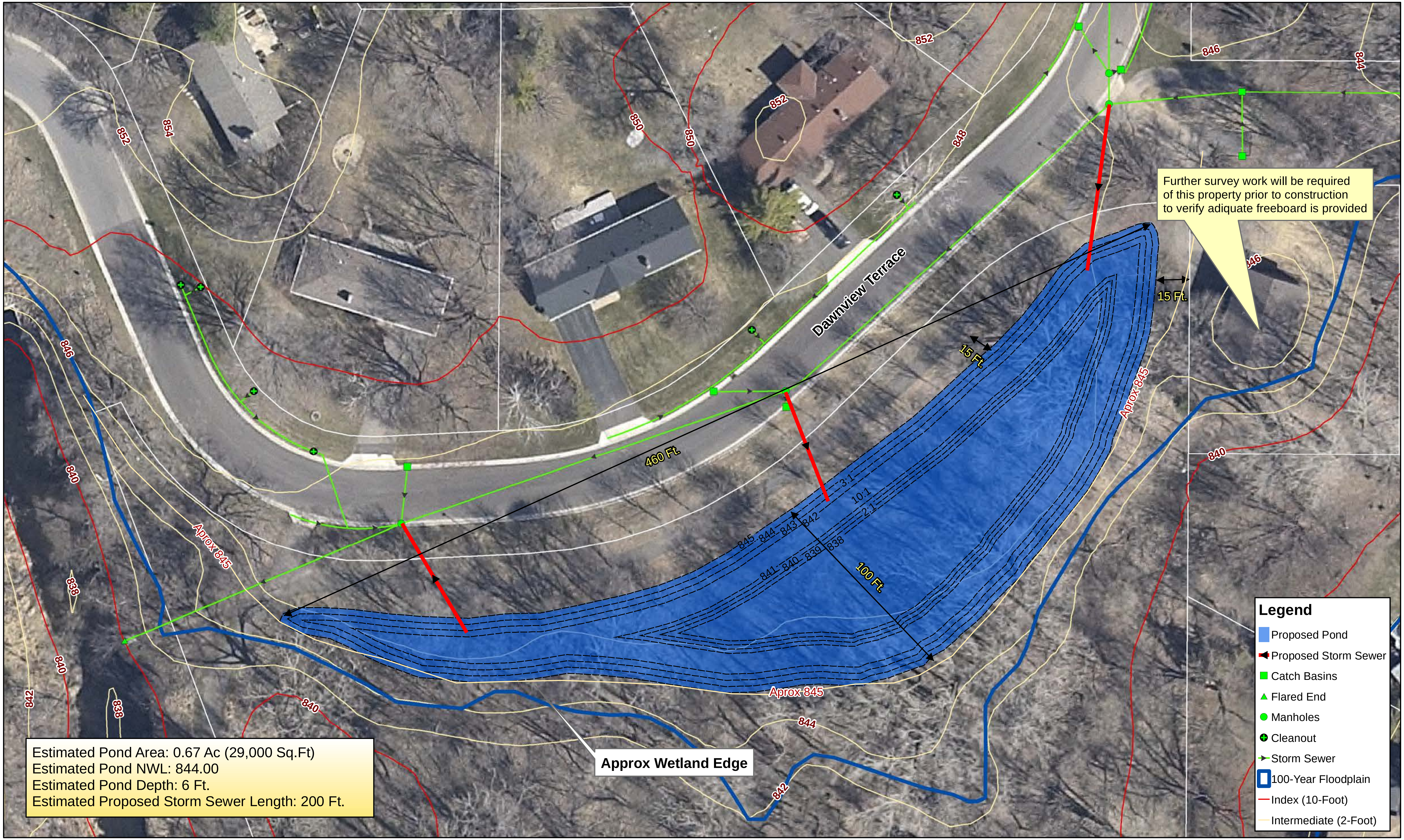
Briarwood/Dawnview Water Quality Improvement Project
Proposed Raingarden Location
City of Golden Valley, MN

Figure 5

WSB & Associates, Inc.



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Briarwood/Dawnview Water Quality Improvement Project
Proposed Pond Location
City of Golden Valley, MN

Figure 6

N
1 inch = 41 feet

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Briarwood/Dawnview Water Quality Improvement Project
Enhanced Filter Location
City of Golden Valley, MN

Figure 7

N
1 inch = 41 feet

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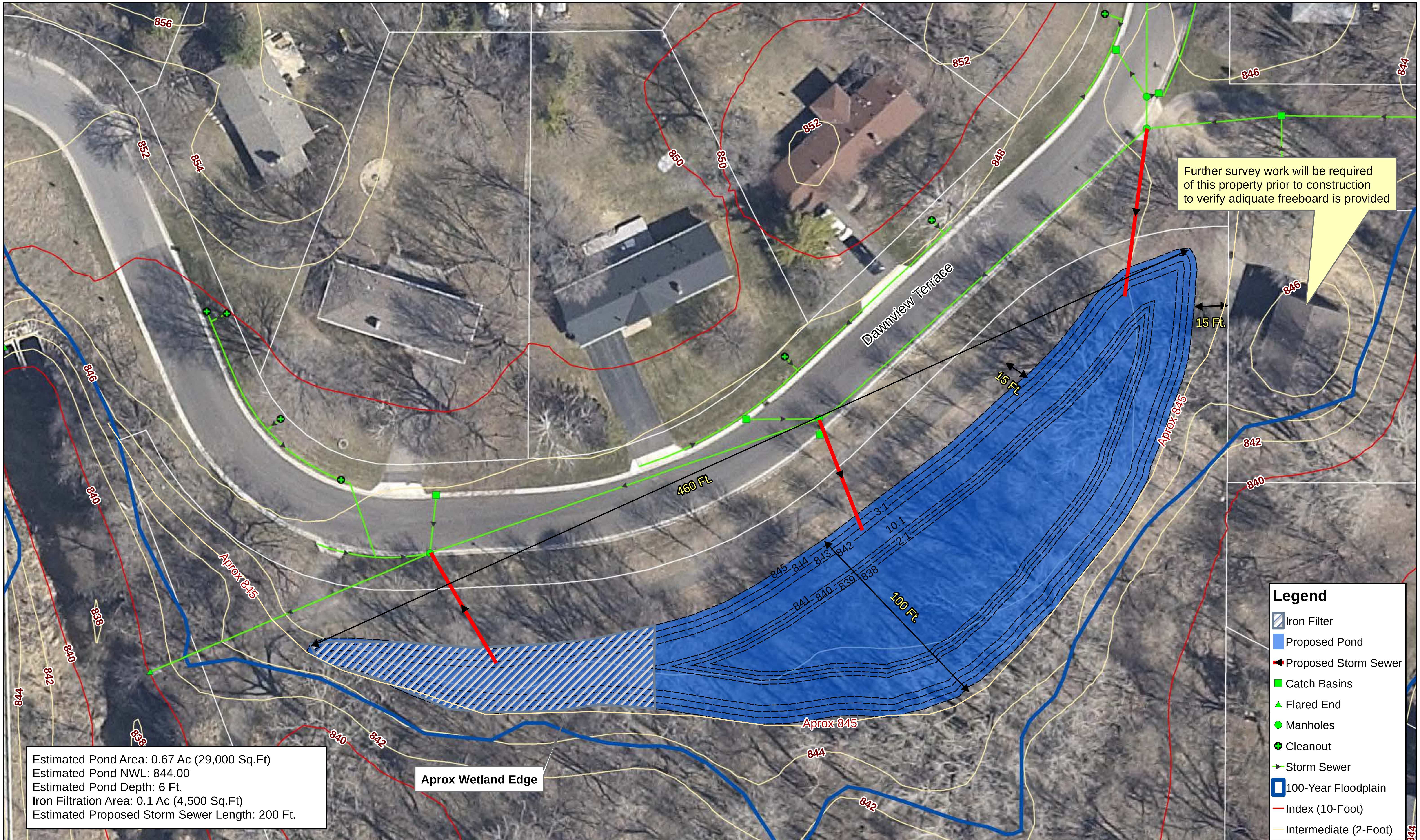
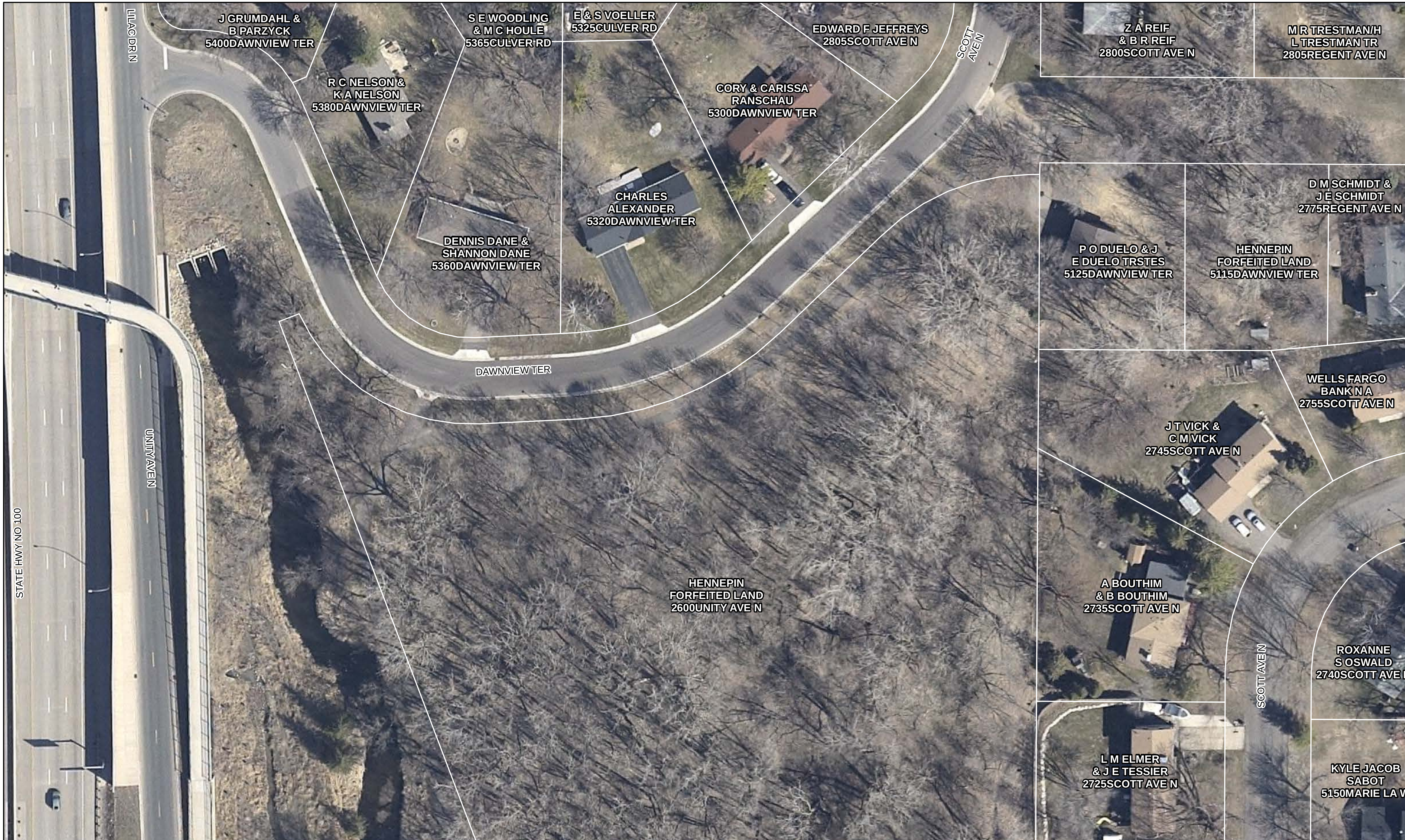


Briarwood/Dawnview Water Quality Improvement Project
Proposed Pond and Enhanced Filter Location
City of Golden Valley, MN

Figure 8

N

1 inch = 41 feet



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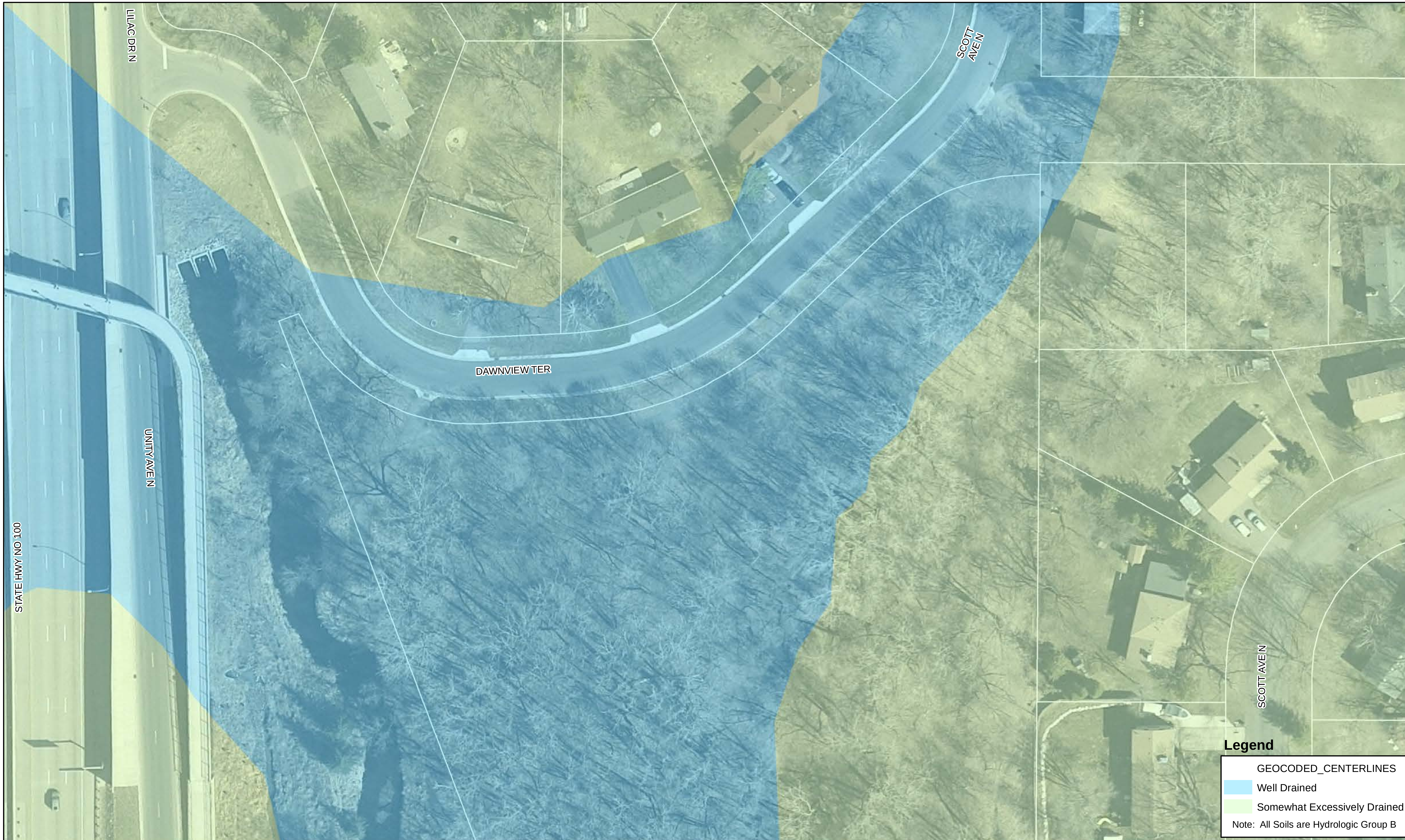
Briarwood/Dawnview Water Quality Improvement Project
Property Owner & Address Information
City of Golden Valley, MN

Figure 9

N
1 inch = 60 feet

WSB & Associates, Inc.



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Briarwood/Dawnview Water Quality Improvement Project
Soil Drainage
City of Golden Valley, MN

Figure 10

N
1 inch = 60 feet

WSB & Associates, Inc.