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BCWMC 3-21-19

FEASIBILITY REPORT

2020 CRANE LAKE IMPROVEMENT PROJECT (WATER QUALITY IMPROVEMENTS TO BE INCORPORATION INTO 2019 RIDGEDALE DRIVE RECONSTRUCTION PROJECT)

MINNETONKA, MN

FEBRUARY 22, 2019, UPDATED MARCH 14, 2019

Prepared for:
Bassett Creek Watershed Management Commission
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BCWMC CIP NO. CL-3

CITY PROJECT NO. 19501
WSB PROJECT NO. R-010557-000

STORMWATER MANAGEMENT FEASIBILITY

2020 CRANE LAKE IMPROVEMENT PROJECT
(WATER QUALITY IMPROVEMENTS TO BE INCORPORATION INTO
2019 RIDGEDALE DRIVE RECONSTRUCTION PROJECT)

Completed for
Bassett Creek Watershed Management Commission and City of Minnetonka

February 22, 2019, Updated March 14, 2019

Prepared By:

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.

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I. INTRODUCTION AND PURPOSE

This document has been prepared to identify, evaluate and determine the feasibility of implementing selected stormwater management improvements that the Basset Creek Watershed Management Commission (BCWMC) could undertake, in partnership with the City of Minnetonka, as part of the 2019 Ridgedale Drive Reconstruction Project **(See figure 1)** to provide stormwater treatment for untreated runoff currently directed to Crane Lake.

A previously completed analysis (Completed on September 10, 2018) evaluated Best Management Practice (BMP) options for providing additional removal of phosphorus (TP), suspended solids (TSS), and chlorides from runoff from upstream watersheds that currently receive treatment within the project area as well as those that currently receive no treatment. **(See Figure 3)**

Relative to the removal of phosphorus and suspended sediment, this study indicated that in areas that currently receive treatment, although increased pollutant removal could be provided by implementing additional BMP's in these areas, the level of treatment currently provided by the existing treatment systems is high, and the installation of the additional treatment BMP's upstream or downstream of the existing BMP's will provide only limited additional benefit. For this reason, the City of Minnetonka has determined it does not wish to pursue the construction of additional BMP's in the currently treated watershed areas, and no additional evaluation of these alternatives have been included in this document.

The previous study also evaluated BMP options for chloride removal in both the treated and untreated watersheds, using the sanitary sewer for disposal of chloride contaminated effluent when concentrations exceed selected thresholds. The City has contacted the Metropolitan Council Environmental Services (MCES) about the feasibility of implementing this alternative and is expecting to obtain a response from them regarding the viability of this option in May of 2019.The MCES has established a "chlorides team" to review all sources of chlorides in the sewer system and present findings to their executive team in the spring of 2019. Based on information/input provided to date by MCES and Bassett Creek Watershed managers, the City has determined it will not be further considering these options as part of this project, but may pursue chloride management options in the future as part of a separate study and or project.

Based on the above findings, the scope of work of this feasibility study has been limited to Identifying, evaluating and determining the feasibility of implementing selected storm water management improvements that could be constructed as part of the 2019 Ridgedale Drive Reconstruction Project and that could provide treatment for runoff generated from currently untreated watershed areas.

This study aligns with the Bassett Creek Watershed Management Plan and the Watershed's goals and policies contained in Section 4 of the Watershed Management Plan. Specifically, some of the goals being achieved with this project from Section 4.1 are listed here:

- Manage the surface water resources of the watershed to meet or exceed state standards and BCWMC water quality goals for wetlands, lakes, and streams.
- Protect and enhance fish and wildlife habitat in the BCWMC.
- Increase the quality and quantity of wetlands in the BCWMC
- Raise awareness of the BCWMC's existence and its role in protecting and improving water quality, minimizing flooding, and preserving the watershed's ecological functions and aesthetics

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II. BACKGROUND

The 2019 Ridgedale Drive Reconstruction Project consists of the reconstruction and reconfiguration of Ridgedale Drive from its intersection with Plymouth Road on the southwest corner of the Ridgedale shopping center, then east and north to its intersection with I-394 on the northeast side of the shopping center. **(Figure 1)**

The current preferred alternative will change the roadway from an undivided multiple lane section to a single lane section with a landscape median and replace major intersections with roundabouts. This design will also reduce the amount of impervious surface over the project area by approximately two acres. These modifications alone will reduce TSS, TP, and chlorides loadings that reach adjacent BMPs and Crane Lake. These benefits to water quality will be achieved as part of this City funded project without any participation by the BCWMC.

The project area is almost entirely within the Bassett Creek Watershed and governed by stormwater rules promulgated by the Bassett Creek Watershed Management Commission (BCWMC). For linear reconstruction projects in this area that have a net reduction in impervious surface area, which is the case for this project, the Bassett Creek Watershed as well as City of Minnetonka rules do not require any additional storm water management features or improvements be integrated into the design. However, the incorporation of best reasonable storm water treatment technologies is encouraged if it is reasonable and practical to do so by these agencies and is desired by the owners of this project.

A review of soil information for the area indicate native soils generally have low infiltration potential. These conditions limit use of some BMP options that otherwise might be considered.

A 2016 water quality monitoring report for Crane Lake, prepared by the Bassett Creek Watershed Management Commission, indicates that for 2016, Crane Lake did meet MPCA and BCWMC water quality standards for chlorophyll a and total phosphorus, but does not meet applicable Minnesota Pollution Control Agency (MPCA) water quality standards for chlorides.

Water quality in Crane Lake has been monitored since 1977. Based on the information provided by the BCWMC, from 1977 to 2001, summer averages (June through September) of total phosphorus, chlorophyll a, and Secchi disc depth regularly failed to meet BCWMC/MPCA standards but have generally met standards since 2004. Total phosphorus and chlorophyll a concentrations have met the standard each year since 2004. Water clarity, measured by Secchi disc depth, has met the standard all years since 2004—except 2016 when dense plants restricted Secchi disc visibility. Chloride concentrations, which may impact the lake's zooplankton, were observed to increase over that time, with more recent concentrations found to be close to or slightly exceeding the 230mg/l chronic threshold level for impairment. Samples collected in July 2018 also found chloride concentrations in the south treatment pond of 450 mg/l.

Trend analyses, completed by the BCWMC, also show improvements in water quality over the last 20 years as measured by decreases in summer average total phosphorus and chlorophyll a concentrations, but these trends were not deemed statistically significant (95 percent confidence level). This analysis also indicated there has been no change in Secchi disc depth.

III. WATER QUALITY TREATMENT PROVIDED BY EXISTING SYSTEM

Runoff from the Ridgedale shopping center parking lot, is directed to either Ridgedale pond, or a pond on the northeast side of the shopping center where physical and biological processes provide treatment for the runoff. Runoff from areas along Ridgedale Drive downstream of this area direct runoff into small pretreatment ponds adjacent to a downstream lake/wetland referred to as Crane Lake. **(See figure 2)**

Information on the ability of Ridgedale Pond as well as the pond on the northeast side of the shopping center to treat stormwater from the watershed areas that direct runoff to the ponds was previously analyzed and provided in a report entitled *Crane Lake Water Quality and Sub-Watershed Assessment*. This report was prepared by Barr Engineering for the Bassett Creek Watershed Management Commission and dated June 2017. This report/study also included the development of a P8 water quality model for the area and information from this model was used in our evaluation of alternatives.

In addition to using the above information, an inspection and survey of Ridgedale pond was completed in 2018 (pond located on south side of shopping center) reflecting it has an average depth of approximately 5 feet, and approximately 20 acre-feet of dead-pool storage available to enhance treatment. This information was consistent with that included in the P8 model that was previously completed.

The P8 water quality analysis of the watershed and pond completed by the Bassett Creek Watershed Management Commission predicts the pond in its existing condition removes approximately 94% of the Total suspended solids (TSS) and 72% of the total phosphorus (TP) directed to it from the surrounding watershed. These removal percentages are on the high end of removal rates that can be achieved by BMPS that primarily use physical and biological removal mechanisms to provide treatment.

Monitoring data for Crane Lake completed by the Bassett Creek Watershed also indicated the in-lake Chloride concentration for the Basin was typically above 200 mg/l, and periodically exceeded the chronic threshold value for impairment of 230 mg/l. Chloride impairment has been identified as a significant concern by the Watershed. Based on a sample of water collected in early July 2018, The treatment pond on the south side of the shopping center was observed to have in-basin chloride concentrations of 450 mg/l. Under existing conditions, limited if any removal of chlorides is projected to be provided by the removal mechanisms present in the pond due to the soluble nature of this pollutant.

In addition to the above drainage areas that receive treatment by the two ponds, on the southeast side of Ridgedale, that is south and east of Ridgedale drive is a 13.3-acre watershed that directs untreated stormwater runoff to a downstream storm sewer that discharges this runoff directly into Crane lake. Except for treatment that a shallow ditch may provide for a small area in the watershed, no treatment is provided for runoff from this watershed at the current time**. (See figure 4)**

A. WATER QUALITY TREATMENT REQUIRED TO MEET CURRENT STANDARDS

No additional treatment is required for this project as the amount of impervious surface will be reduced as part of this project; however, providing additional treatment is encouraged if it is reasonable and practical to do so and desired by the owner of the project.

IV. OPTIONS FOR PROVIDING STORMWATER TREATMENT FOR UNTREATED RUNOFF

Three treatment options have been identified that have the potential to improve the quality of water currently discharged from the untreated watershed prior to its discharge into Crane Lake. **Figure 4** shows the proposed location of these treatment options**.**

If should be noted that as part of each of these options, a separate storm sewer will need to be constructed to isolate and collect only the runoff from this untreated area, and then convey this runoff to a treatment system prior to discharge into Crane Lake. The cost for this storm sewer is estimated at $265,000. A with a breakdown of the cost for this system provided in **Table 1.**

It is not anticipated that contamination will be encountered base on review of MPCA's "What's in my Neighborhood" as well as review with City Staff. However, when excavating in areas where fill was present, there is always a chance something could be encountered. Costs associated with contamination have not been included at this time.

A listing of the treatment options that were identified along with the cost and benefits related to these improvements is provided below:

1) INSTALL UNDERGROUND TREATMENT IN HOTEL PARKING LOT TO PROVIDE TREATMENT PRIOR TO DISCHARGE TO CRANE LAKE.

Description of Option: This option involves providing treatment for runoff from the untreated watershed using land on the east side of the parking lot located north of the hotel adjacent to Crane Lake.

The BMP would likely consist of an underground storage system to improve stormwater treatment prior to discharge into Crane Lake. Construction of these improvements would require reconstruction of a portion of the existing parking lot in order to allow for installation of the underground treatment. This system would allow for easy access so that the City could regularly complete maintenance to ensure the system continues to function as designed. However, the fact that the BMP would be located on private property would make the coordination of ongoing maintenance less desirable (even if in an easement).

Provided the City of Minnetonka can obtain the right to use this property for this purpose, the construction of an underground treatment system could be feasible in this area. It is important to note that an easement would need to be obtained from the property owner. The cost estimate shown does not include easement costs. The treatment system being located on private property would likely eliminate public education opportunities with this option.

Benefits provided: Based on an untreated influent loading for TSS of 4800 pounds/year and for TP of 17.9 pounds/year, with the BMP option described above, removal efficiencies for TSS and TP based on this design are estimated at 59% for TSS and 35% for TP. **(See Table 5)**

Estimated Cost: The estimated project cost to construct this improvement option including the untreated watershed collection system is estimated at $472,027. A breakdown of this cost estimate is provided in **Table 2.**

Life Cycle Cost: Based on a BMP cost of $206,500 and annual maintenance costs of $5,000/year, and a 30-year life expectancy, the life cycle cost for this improvement is estimated at $11,900 per year, and the cost per pound of TSS and TP removed is estimated at $4.20 per pound for TSS and $1,920 per pound for TP removed. Please be advised no cost for purchase or use of land has been factored into this computation.

2) INSTALL UNDERGROUND TREATMENT IN NEW PARK TO BE CONSTUCTED EAST OF RIDGEDALE DRIVE ADJACENT TO CRANE LAKE.

Description of Option: To make use of available public land in the area, this option proposes to construct an underground treatment under a proposed public park that will be constructed in conjunction with the Ridgedale Drive Project. The treatment area, to be constructed on the West side of Crane lake, was sized and configured in such a manner to allow it to be integrated into the park components of this project in such a manner that will allow for both this stormwater use, as well as proposed park uses.

The underground storage system would be installed to improve stormwater treatment prior to discharge to Crane Lake. This system would allow for easy access so that the City could regularly complete maintenance to ensure the system continues to function as designed. The preliminary thought is to use an 84" pipes isolator/pretreatment row and then 60" pipes for the remaining storage.

This option is located entirely on City of Minnetonka property. As an added benefit, it is anticipated that educational kiosks can be incorporated with this project due to its location in the park area. This aligns with the City and Watershed goals of education related to stormwater management.

Benefits provided: This option (2) will provide 0.28 ac-ft of dead pool storage (the first 0.45 inches of runoff from the untreated watershed). Based on P8 modelling results, this underground storage area will be able to remove 35% of the TP and 59% of the TSS directed to it from the untreated watershed of 13.3 acres. **(See Table 5)**

Estimated Cost: The estimated project cost for this improvement option including the untreated watershed collection system is estimated at $500,027. A breakdown of this cost estimate is provided in **Table 3.**

Life Cycle Cost: Based on a BMP cost of $234,500 and annual maintenance costs of $5,000/year, and a 30-year life expectancy, the life cycle cost for this improvement is estimated at $12,800 per year, and the cost per pound of TSS and TP removed is estimated at $4.50 per pound for TSS and $2,060 per pound for TP removed.

3) INSTALL UNDERGROUND TREATMENT (OPTION 2) PLUS A FILTRATION/INFILTRATION SYSTEM TO PROVIDE ADDITIONAL TREATMENT.

Description of Option: As part of this option, water would be pumped from the dead pool treatment area within the underground stormwater treatment area (described in Option 2) and discharged into a filtration/infiltration garden, where additional treatment could be provided**. (see figure 4)**

The secondary filtration/infiltration feature of this option fits into the vision developed by the City and the park design team. The location and size of these features was laid out to meet the needs of the park. The approximate size of the filtration/infiltration area is 1250 square feet with a depth estimated to range between 3 and 6 inches deep. The goal is to draw the underground tank down in 48 to 72 hours. The pump is anticipated to discharge between 0.05 and 0.07 cfs to accommodate the 48 to 72-hour drawdown. The filtration/infiltration system will be designed to be an amenity to the park. A filtration rate of 1.6 in/hr through the media is assumed. The plan is to install a valve on the draintile of the filtration system. If construction reveals soils will allow for

some infiltration valve can be closed. If soils end up not being suitable the system will operate mainly as a filtration system (valve open). Based on borings it is not anticipated that infiltration is very likely but we don't want to eliminate that option at this time.

This option is located entirely on City of Minnetonka property. As an added benefit, it is anticipated that educational kiosks can be incorporated with this project due to its location in the park area. This aligns with the City and Watershed goals of education related to stormwater management.

Benefits provided: This treatment system (combines Option 2 and 3) and is estimated to increase the removal of TSS from 59% to 72-75% and TP from 35% to 47-60%. **(See Table 5)**

Estimated Cost: The estimated project cost for this improvement option including the untreated watershed collection system is estimated at $582,837. A breakdown of this cost estimate is provided in **Table 4.**

Life Cycle Cost: Based on a BMP cost of $317,310 and annual maintenance costs of $5,000/year, and a 30-year life expectancy, the life cycle cost for this improvement is estimated at $17,200 per year, and the cost per pound of TSS and TP removed is estimated at $4.80-$5.00 per pound for TSS and $1,600-$2,050 per pound for TP removed.

V. RECOMMENDATIONS

An in-depth review of the above options was completed by stakeholders that included representatives from City of Minnetonka Engineer, Public Works, and Parks and Recreation Department, property owners in the area, and residents within the city having an interest in the planning of the park. During this review, it was determined that relative to the implementation of option 1, it would be difficult to acquire a portion of the Hotel parking lot for this purpose without resistance from the property owner as well as costs of obtaining the easement. Discussions with the City of Minnetonka Parks and Recreation Department and other stake holders indicated that they would be interested in integrating option 2 or 3 into their park plans. Both options 2 and 3 include educational kiosks regarding the stormwater treatment in the park as an added benefit to allow park users to observe and better understand the design and function of stormwater treatment systems.

Based on the above information, as well as information collected during a design charrette that was held as part of the development of the park plan for this area, it was determined that Option 3 could be implemented, and more specifically, it is recommended that a BMP with the following elements be constructed: 1) Underground treatment area having approximately 12,250 cubic feet of dead pool storage, and 2) discharge of pretreated water to a filtration/infiltration system.

Permitting needs for the recommended improvements include a DNR Work in Public Waters Permit for the high flow outlet to Crane Lake from the underground storage system since the elevation is proposed to be at 920.0 (below the OHW of 920.4). The outlet from the filtration/infiltration area is estimated to be at 923.0 which is above the OHW. In addition, the City is planning on removing accumulated sediment and debris at the existing outfall to Crane Lake as part of the larger Ridgedale Drive project so a DNR Work in Public Waters Permit waters permit will be needed for that as well. Both the new outlet and the sediment clean out are located directly adjacent to one another. The sediment will be tested and disposed of according to MPCA guidance. A WCA (Wetland Conservation Act) no loss permit and an Army Corps general permit will be obtained for the sediment removal work.

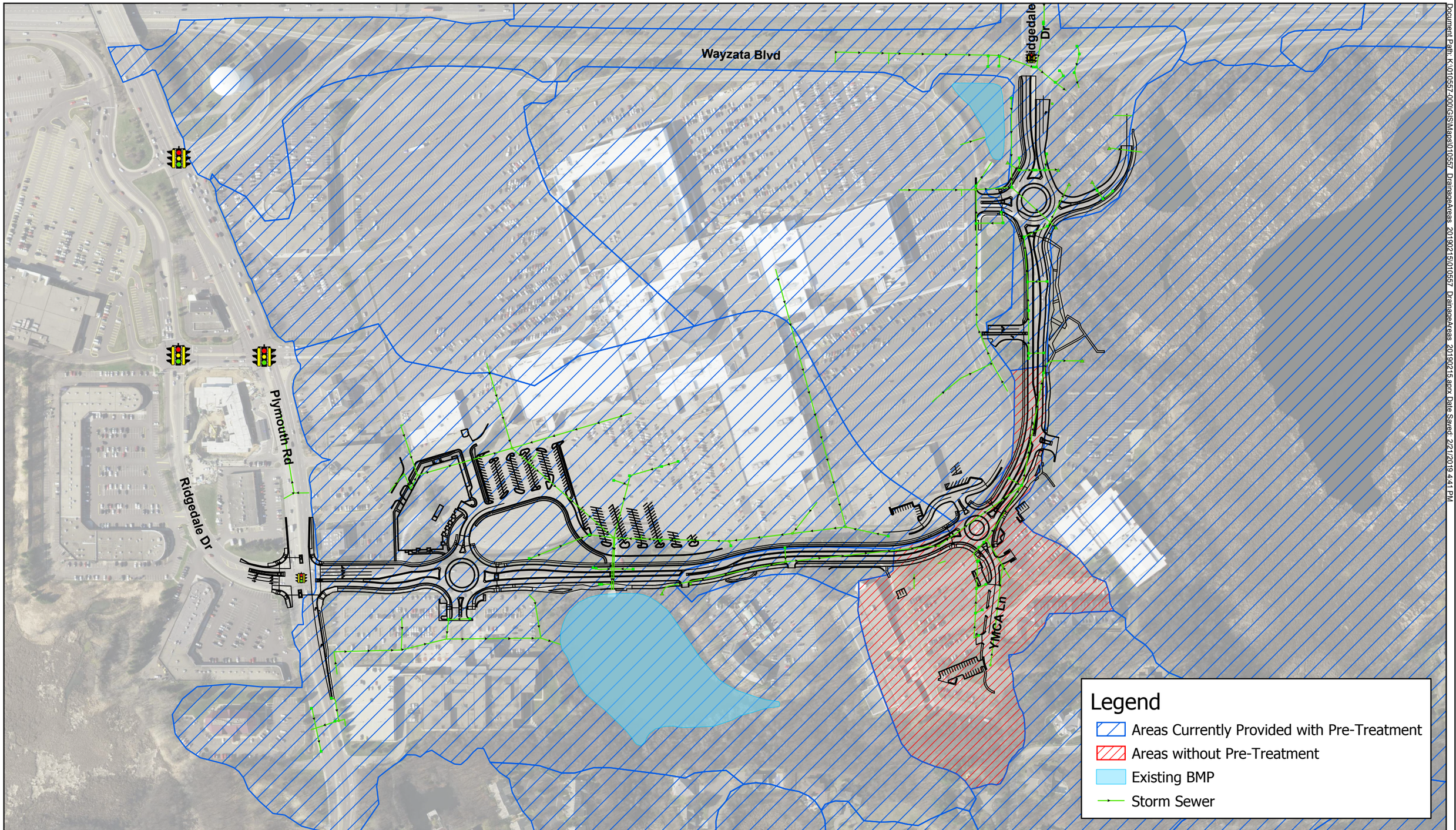
FIGURES

CITY OF MINNETONKA

Figure 1: Preferred Alternative
Ridgedale Drive Improvements (S.A.P. 142-153-008)
City of Minnetonka, Minnesota

N
0 300
Feet
1 inch = 300 feet

wsb



CITY OF MINNETONKA

Figure 2: Subwatersheds Served by Ridgedale Drive Drainage System

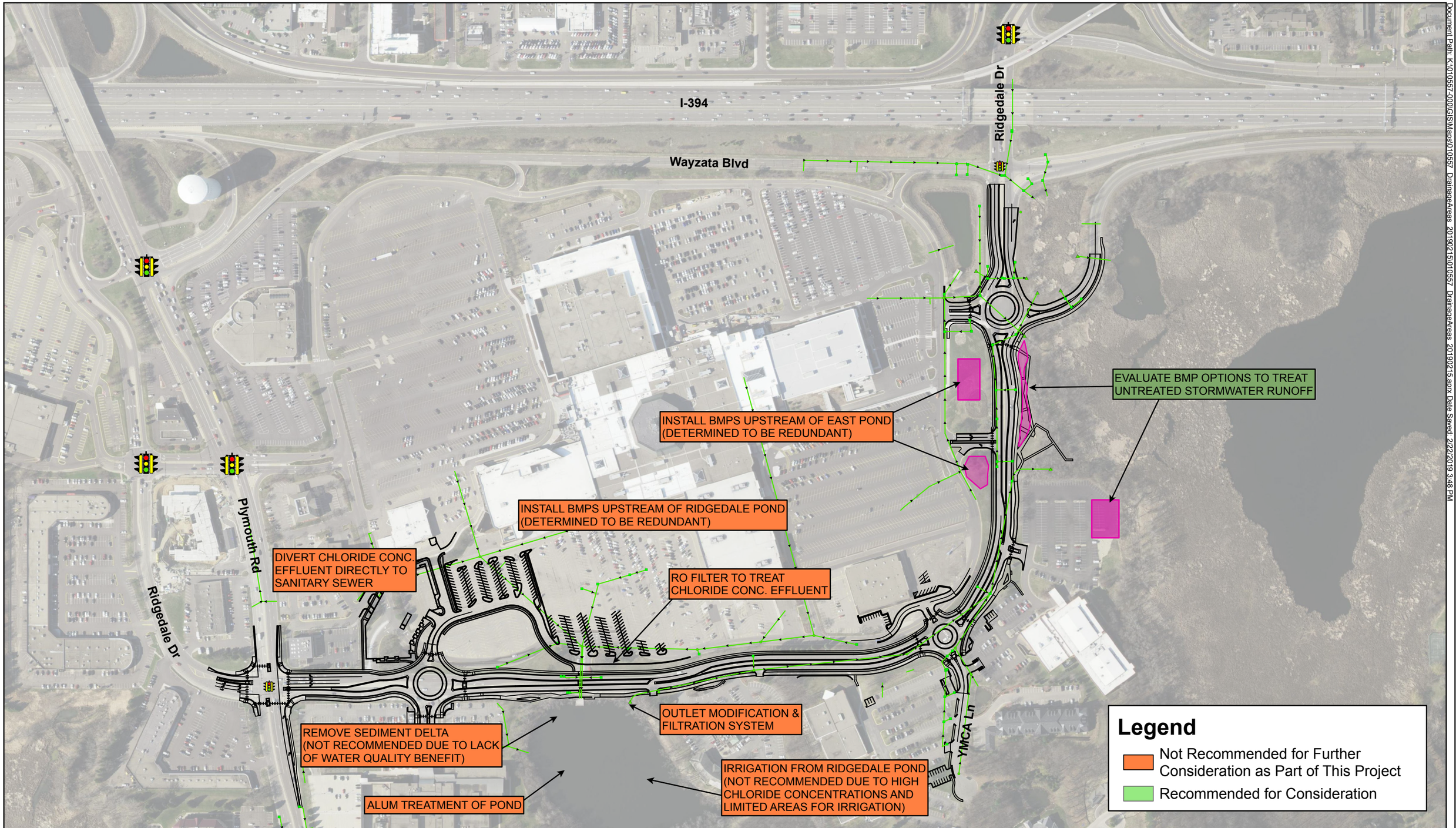
Ridgedale Drive Improvements (S.A.P. 142-153-008)
City of Minnetonka, Minnesota

N

0 350 Feet

1 inch = 300 feet

wsb



CITY OF MINNETONKA

Figure 3: Water Quality Treatment Options

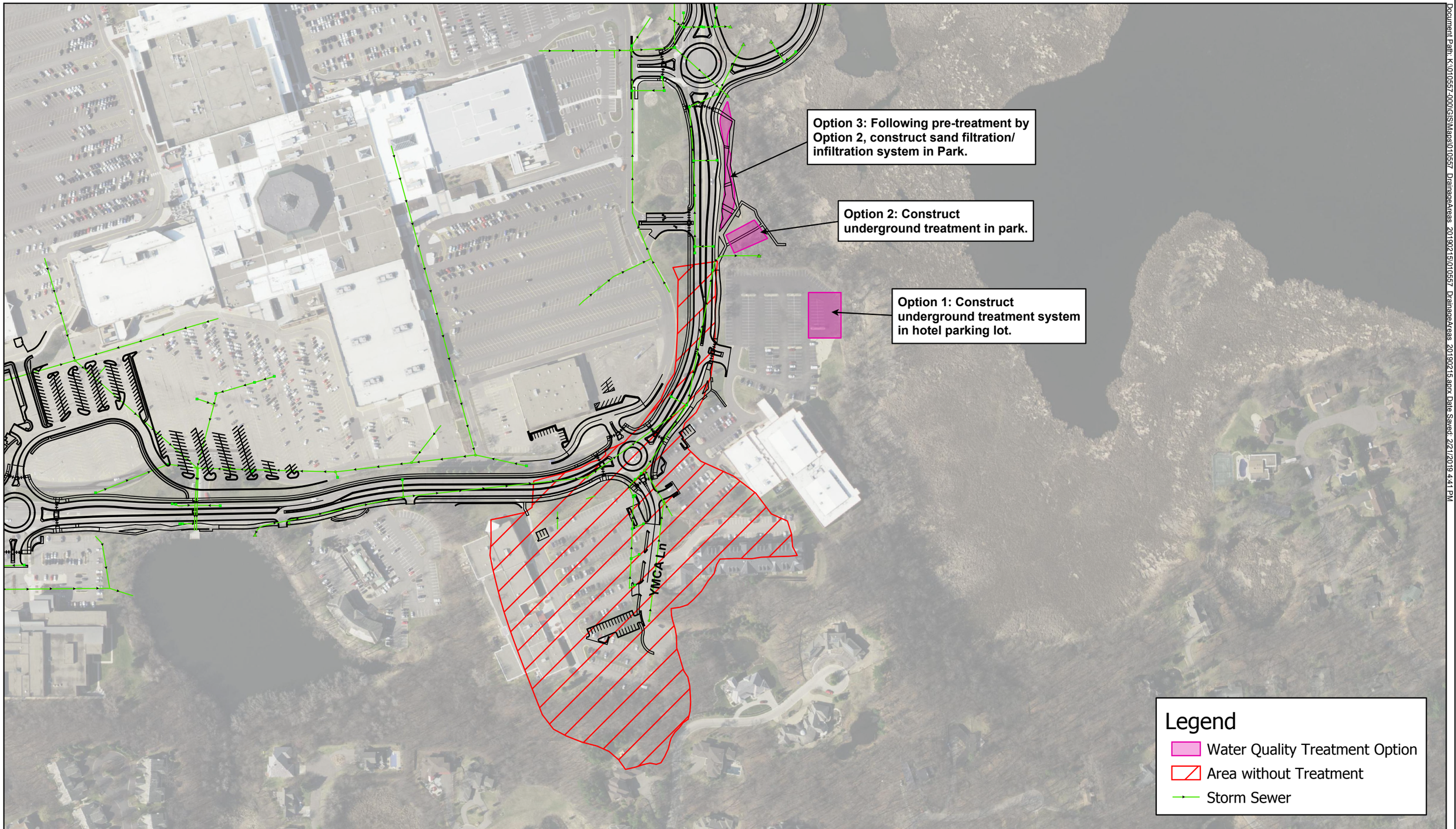
Ridgedale Drive Improvements (S.A.P. 142-153-008)
City of Minnetonka, Minnesota

N

0 300 Feet

1 inch = 300 feet

wsb



CITY OF MINNETONKA

Figure 4: Untreated Subwatershed and Treatment Options

Ridgedale Drive Improvements (S.A.P. 142-153-008)
City of Minnetonka, Minnesota

N

0 250 Feet
1 inch = 250 feet

wsb

TABLES

Table 1: Cost Estimate: Storm Sewer Collection System for Untreated Drainage Area (For Use in Options 1, 2, or 3)

Description	Units	Quantity	Unit Price	Total
DES. SPEC 1	EACH	9	$1,200	$10,800
DES. SPEC 4	EACH	1	$10,000	$10,000
48-4020	LIN FT	47.5	$450	$21,375
60-4020	LIN FT	19.6	$650	$12,740
72-4020	LIN FT	21.3	$850	$18,105
84-4020	LIN FT	5.2	$1,000	$5,200
CASTINGS	EACH	18	$650	$11,700
CONNECT TO EX STORM SEWER	EACH	1	$750	$750
15" RCP CL V	LIN FT	584	$45	$26,280
24" RCP CL III	LIN FT	142	$65	$9,230
27" RCP CL III	LIN FT	670	$75	$50,250
30" RCP CL III	LIN FT	141	$80	$11,280
30" RCP APRON	EACH	1	$700	$700
RIPRAP CL III	CY	13	$85	$1,105
GEOTEX. TYPE 4	SQ YD	42	$4	$147
SUB TOTAL				$189,662
Engineer, Legal, Admin, Permitting (25%)				$47,416
Contingency (15%)				$28,449
COST FOR STORMSEWER COLLECTION STYSTEM				**$265,527**

Table 2: Cost Estimate: Underground Treatment in Hotel Parking Lot (Option 1)

Description	Units	Quantity	Unit Price	Total
DEWATERING	LS	1	$7,500	$7,500
UNDERGROUND STORAGE	LS	1	$140,000	$140,000
SUB TOTAL				$147,500
Engineer, Legal, Admin, Permitting (25%)				$36,875
Contingency (15%)				$22,125
COST FOR BMP				**$206,500**
COST FOR STORMSEWER COLLECTION SYSTEM				**$265,527**
TOTAL PROJECT COST				**$472,027**

***Does not include easement acquisition or replacement cost.**

Table 3: Cost Estimate: Underground Treatment in Park (Option 2)

Description	Units	Quantity	Unit Price	Total
DEWATERING	LS	1	$7,500	$7,500
UNDERGROUND STORAGE	LS	1	$140,000	$140,000
EDUCATIONAL KIOSKS	LS	1	$20,000	$20,000
SUB TOTAL				$167,500
Engineer, Legal, Admin, Permitting (25%)				$41,875
Contingency (15%)				$25,125
COST FOR BMP*				**$234,500**
COST FOR STORMSEWER COLLECTION SYSTEM				**$265,527**
TOTAL PROJECT COST				**$500,027**

Table 4: Cost Estimate: Underground Treatment in Park and Secondary Filtration/ Infiltration System (Option 3)

Description	Units	Quantity	Unit Price	Total
DEWATERING	LS	1	$7,500	$7,500
UNDERGROUND STORAGE	LS	1	$140,000	$140,000
4” PVC FORCE MAIN	LF	25	$50	$1,250
CONSTRUCT LIFT STATION	LS	1	$40,000	$40,000
6” PERF PE PIPE DRAIN	LF	120	$20	$2,400
GRANULAR FILTER MOD	CY	175	$65	$11,375
COURSE FILTER AGGREGATE MOD (CV)	CY	75	$55	$4,125
EDUCATIONAL KIOSKS	LS	1	$20,000	$20,000
SUB TOTAL				$226,650
Engineer, Legal, Admin, Permitting (25%)				$56,663
Contingency (15%)				$33,998
COST FOR BMP				**$317,310**
COST FOR STORMSEWER COLLECTION SYSTEM				**$265,527**
TOTAL PROJECT COST				**$582,837**

Table 5: Features, Costs, and Benefits of Improvement Options

BMP Improvement Options	Watershed Area (ac)	Targeted Pollutants	Raw Loading (lb/yr)	Existing Removal %	Proposed Removal %[3]	Estimated Pollutant Removal (lb/year)[3]	Estimated Total Project Cost	Annualized 30-Year Life Cycle Cost (for BMP only)	BMP's Cost per lb of Pollutant Removed
1. Construct underground treatment system in hotel parking lot	13.3	TSS	4800	0	59	2854	$472,027.00	$11,900.00[1]	$4.20
		TP	17.9	0	35	6.2			$1,920
2. Construct underground treatment system in park	13.3	TSS	4800	0	59	2854	$500,027.00	$12,800.00[1]	$4.50
		TP	17.9	0	35	6.2			$2,060
3. Construct underground treatment system in park plus secondary filtration/infiltration system	13.3	TSS	4800	0	72 to 75	3434 to 3599[4]	$582,837.00	$17,200.00[2]	$4.80-$5.00
		TP	17.9	0	47 to 60	8.4 to 10.7[4]			$1,600-$2,050

[1]Assumes a 30-year maintenance cost of $150,000 (annual maintenance cost of $5,000 to clean the underground structure) – estimated costs are in 2019 dollars.
[2]Assumes a 30-year maintenance cost of $200,000 (annual maintenance cost of $5,000 to clean the underground structure and full replacement of filtration media twice at $25,000 per replacement) - estimated costs are in 2019 dollars.
[3]Treating the 13.3 acre, untreated drainage area (7.28 acres of impervious, 6.02 acres of pervious). The watershed's P8 model was provided and used by WSB to model and evaluate the BMP improvement options. The estimates shown were derived from P8.
[4]Based on anticipated soil conditions, filtration is more likely than infiltration, which is the lesser of the two numbers shown.