RBWMO FEASIBILITY STUDY REPORT

January 2024

Prepared for:

Richfield Bloomington Watershed Mgmt. Org.

1901 E 66th Street

Richfield, MN 55423

WSB PROJECT NO. 023182-000

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Executive Summary

This feasibility report identifies projects to meet the goals of the RBWMO with respect to water quality, water quantity, and watershed-wide ecological integrity. The report and its findings were informed by existing information provided by the RBWMO.

A kickoff meeting with WSB and RBWMO staff was held on-site at RBWMO lakes to familiarize the project team with the waterbodies and adjacent areas. During this meeting anecdotal evidence of issues within each lake, past projects within the watershed, and goals for each basin were discussed.

Existing data was gathered as part of the literature review and level 1 data assessment. Generally, this data included municipal and WMO comprehensive plans, existing water quality models for each municipality, water quality monitoring data, and any available fisheries data for each lake. Where existing data may have been deficient, future data collection studies were recommended in the Improvements section of this report.

Using the data sources described above, total phosphorus (TP) loading estimates for both external and internal sources were developed. P8 models were used to provide estimates for external watershed loads (existing P8 models were used for lakes within the City of Richfield, new P8 models were created for lakes within the City of Bloomington). Watershed TP loading and removals were visualized using GIS to inform loading hotspots and removal deficiencies across each lake's watershed. To determine TP loading from upstream lakes, a response model was generated for each lake that incorporates lake characteristics, water quality monitoring data, and output from the P8 models. Internal loading from invasive rough fish, anoxic sediment release, and invasive species senescence was estimated based on data available for each lake.

Based on these loading estimates, conceptual projects were identified. These potential projects are divided into two groups, internal and external projects (BMPs), and are organized for each targeted waterbody. Potential projects include further data collection studies as well as implementation projects. High-level cost estimates are provided for each project.

This report is sectioned by each lake within the RBWMO boundary. In each lake section, a summary profile of the lake's existing conditions, water quality and loading estimates and figures are presented. In the Improvements section of the report, potential projects are listed by each lake and project type. An invasive fish management plan with specific steps appropriate to each water body is included.

Introduction

The Richfield-Bloomington Watershed Management Organization (RBWMO) was formed in 1983 through a joint powers agreement between the cities of Richfield and Bloomington. Located entirely within Hennepin County, the RBWMO covers 7.55 square miles; approximately 4.25 square miles are within the City of Richfield, and the remaining 3.3 square miles are within the City of Bloomington. The RBWMO is fully developed, and projected land use changes for 2030 are not expected to significantly alter drainage patterns and watershed characteristics.

There are four public waters within the RBWMO: Richfield Lake, Wood Lake, Smith Pond Lake, and Wright's Lake. These basins and their respective watersheds are shown in Figure 1. There are no major creeks or rivers within the watershed and most stormwater is conveyed by municipal storm sewer systems in the southeasterly direction before discharging into the Minnesota River (outside of the RBWMO).

In the RBWMO's Comprehensive Watershed Management Plan (2018-2027), seven issues were identified as priorities within the watershed with accompanying goals and strategies to guide implementation. The seven issues are presented in order of priority:

Issue 1: Surface water quality and management strategies

Issue 2: Water quantity and volume management

Issue 3: Redevelopment opportunities and strategies

Issue 4: Public education and outreach

Issue 5: Wetland protection

Issue 6: Invasive species strategies and management

Issue 7: Standardizing wellhead protection strategies

The purpose of this feasibility study is to address these issues by assessing hydraulic and biotic interventions that improve water quality and biotic integrity within the RBWMO's boundaries. This feasibility study will help assist in management decisions within the RBWMO and identify priority projects, technologies, or studies that will protect, enhance, and restore surface water quality.

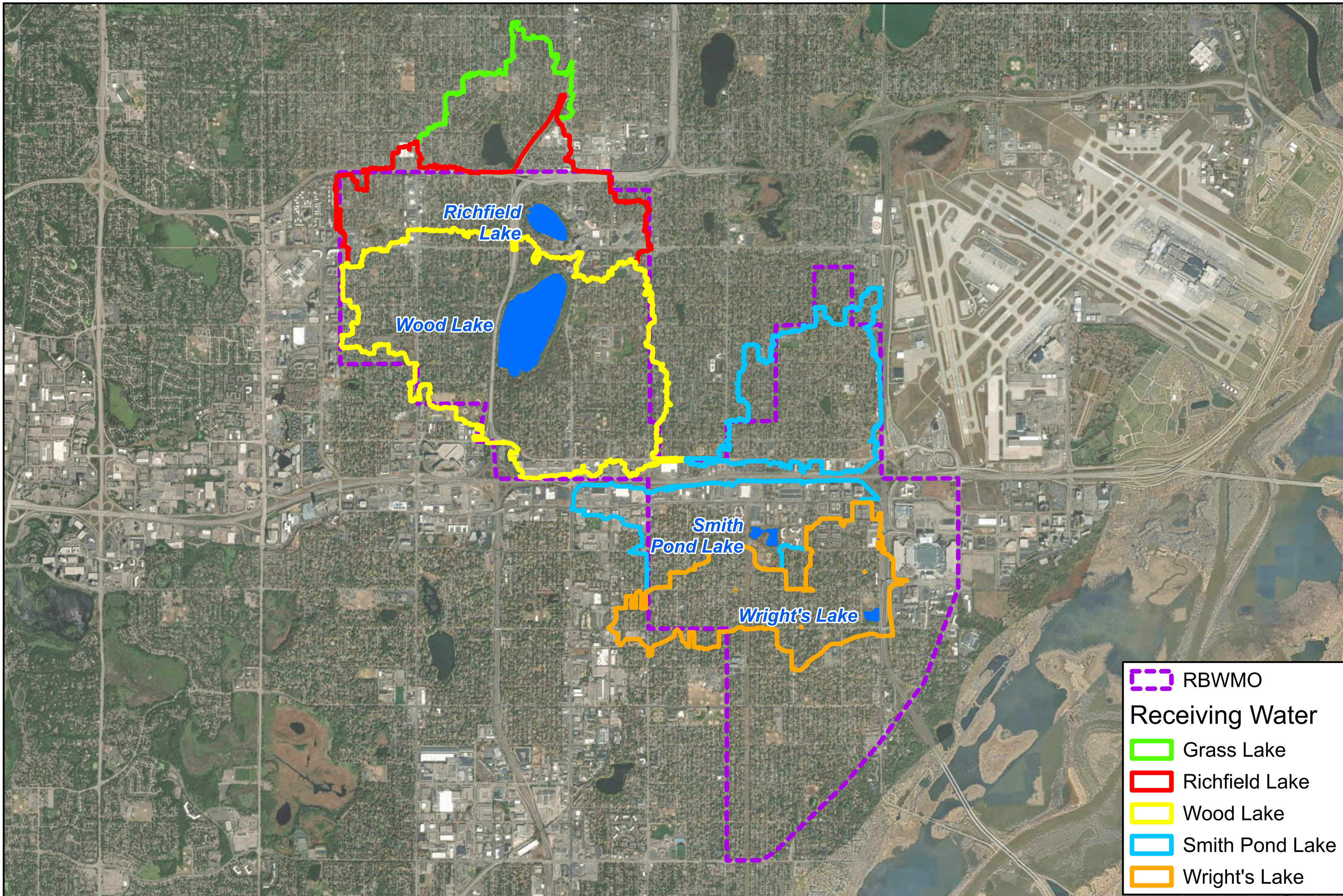

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Figure 1 - RBWMO Boundary and Drainage

RBWMO Feasibility Study

N

0 4,500 Feet

1 inch = 4,500 feet

General Invasive Fish Management Plan

The four water bodies described in this study share numerous characteristics in terms of invasive fish management needs to construct an effective plan customized for each one. With the data available, it is difficult to prescribe specific recommendations. Therefore, several topics generally discussed in invasive fish management plans are described below in general for Richfield Lake, Wood Lake, Smith Pond, and Wright's Lake. Analysis that can be made from what can be observed or modeled about the water bodies at this point are explained in more detail within each area's allotted section.

Cost Benefit Analysis of Options Considered:

We are basing our cost-benefit analysis on a high level of assumptions. A determination of the need for management of goldfish or carp in RBWMO water bodies would be dependent on a study of the lake's population. Cost effectiveness of goldfish or carp management would increase if bundled together with lake level reductions needed for other recommended projects.

Projected Effective Life of Proposed Activities:

If ageing analysis showed that the goldfish recruit to the population infrequently, the effective life would be projected to be longer. If significant population reduction occurred in conjunction with native fish repopulation efforts, recruitment would likely happen less frequently and increase the effective life of these proposed activities. Reintroductions of goldfish could happen frequently due to anthropogenic influences (pet release). Preventing these releases from the public would be difficult.

Plan for Monitoring Surface Water Quality to Assess Projects' Actual Nutrient Reduction Impacts:

Samples should be collected and analyzed during growing season months for at least one year before fish reduction efforts take place. This monitoring plan should continue for at least 5 years following goldfish removal. Nutrient reduction impacts due to goldfish management projects alone would likely take several years to be significant enough to attribute to the reduction of goldfish in RBWMO water bodies. Therefore, it is recommended that goldfish reduction efforts (if present in ecologically harmful densities) be grouped with other recommended projects to take advantage of lake level augmentation that can help reduce fish populations.

Methods to Estimate Adult and Juvenile Fish Populations:

WSB recommends conducting boat electrofishing surveys to determine a catch per unit effort (CPUE) value. This data would be collected over at least three survey days consisting of at least three transects. This method has been relatively accurate for estimating common carp populations (Bajer and Sorensen, 2012) without investing heavily in a robust mark and recapture survey. However, goldfish are anticipated to be the species of concern. Therefore, this relationship used to estimate carp populations may not be accurate enough to be confident in the population estimate.

Mark and recapture population estimation methods could be investigated. This involves marking a sample of goldfish in one or more initial surveys. Following the marking period, recaptures that occur during biomass reduction efforts could be powerful enough to make accurate estimates of the goldfish in each lake. This method, however, is lengthy and expensive and still is based on assumptions based on a sufficient marked population as well as a sufficient number of recaptured fish to make the estimates.

Data from goldfish infested lakes are progressing with both boat electrofishing CPUE and removal numbers which could serve as a worthy comparison to data collected from RBWMO water bodies. This comparison could be used in a decision-making process to determine the value of efforts to reduce the population. These surveys should be conducted annually until management tasks are completed and every other year after that. Size structures for goldfish should be analyzed annually to track changes in the population.

Identified or Assumed Nursery Areas:

The numerous bays and backwater forebays in Richfield Lake and Wood Lake with numerous floating cattail bogs present the most likely spawning areas for goldfish between these two lakes. The shallow areas on the northwest areas of Smith Pond would be the most likely nursery areas due to the shoreline abundance and submerged vegetation. The cattail fringe around Wright Lake would be the most likely areas of goldfish spawning. To confirm these assumptions, daily observations of shorelines would be required to notice these relatively small fish exhibiting spawning activities.

Methods to Track Fish Movement:

Currently there are no empirical methods of tracking goldfish movement within or outside RBWMO water bodies. A study would need to be conducted to understand this better. This could incorporate passive integrated transponder (PIT) tag antennas that could monitor movement of goldfish between connected water bodies if PIT tags were implanted during electrofishing surveys.

Proposed Actions to Limit Recruitment and Movement:

If a study determined goldfish movement between water bodies is occurring, development of a barrier could be addressed. This could be in the form of multiple structural barriers or low voltage electrical barriers impeding movement from outside the lake. Management of the native fisheries present in the lake could be manipulated through habitat improvements and stocking. Native fish, like bluegill sunfish, can be effective predators of cyprinid species' eggs and larvae and can limit recruitment if their populations are sufficient (Poole and Bajer, 2019).

Richfield Lake

Summary

Richfield Lake, located in the City of Richfield, is approximately 29 acres with an average depth of 4 ft. The lake is also classified as a type 3 wetland. A type 3 wetland is an inland shallow freshwater marsh. The lake's TSI score in 2018 ranges from 70 to 85, which means the lake is hypereutrophic (RBWMO 2018 CWMP). This may result in heavy algal blooms in the water body in the summer and dense macrophyte bed. However, given its type 3 wetland designation, these conditions may be normal for this type of basin.

Richfield Lake receives runoff water from a 1,270 acre watershed. Approximately 76% of this area is located in the City of Richfield and RBWMO's jurisdiction, and the remaining 24% is within the City of Minneapolis and Minnehaha Creek Watershed District's jurisdiction (runoff from Grass Lake).

Richfield Lake has no formal fisheries data available. Anecdotal public sightings of goldfish have occurred, and with the connection to Wood Lake which has had confirmed sightings opens the possibility for goldfish to make their way back and forth from Richfield Lake. The lake appears to provide abundant refugia like woody debris and aquatic structure as well as forebays that could provide spawning habitat for goldfish. Due to the lake's shallow nature, low dissolved oxygen conditions are likely to occur, especially during winter months. This would present challenges to prevent winter kills of sensitive native fish such as bluegill sunfish.

Submerged aquatic vegetation was present, but the species makeup in the lake is not well understood. Invasive curly-leaf pondweed could contribute to TP loading if present.

In the following Figure 2, the watershed of Richfield Lake is shown in with its storm sewer network (pipes ≥ 18”) and approximate boundaries for the 100-year inundation level.

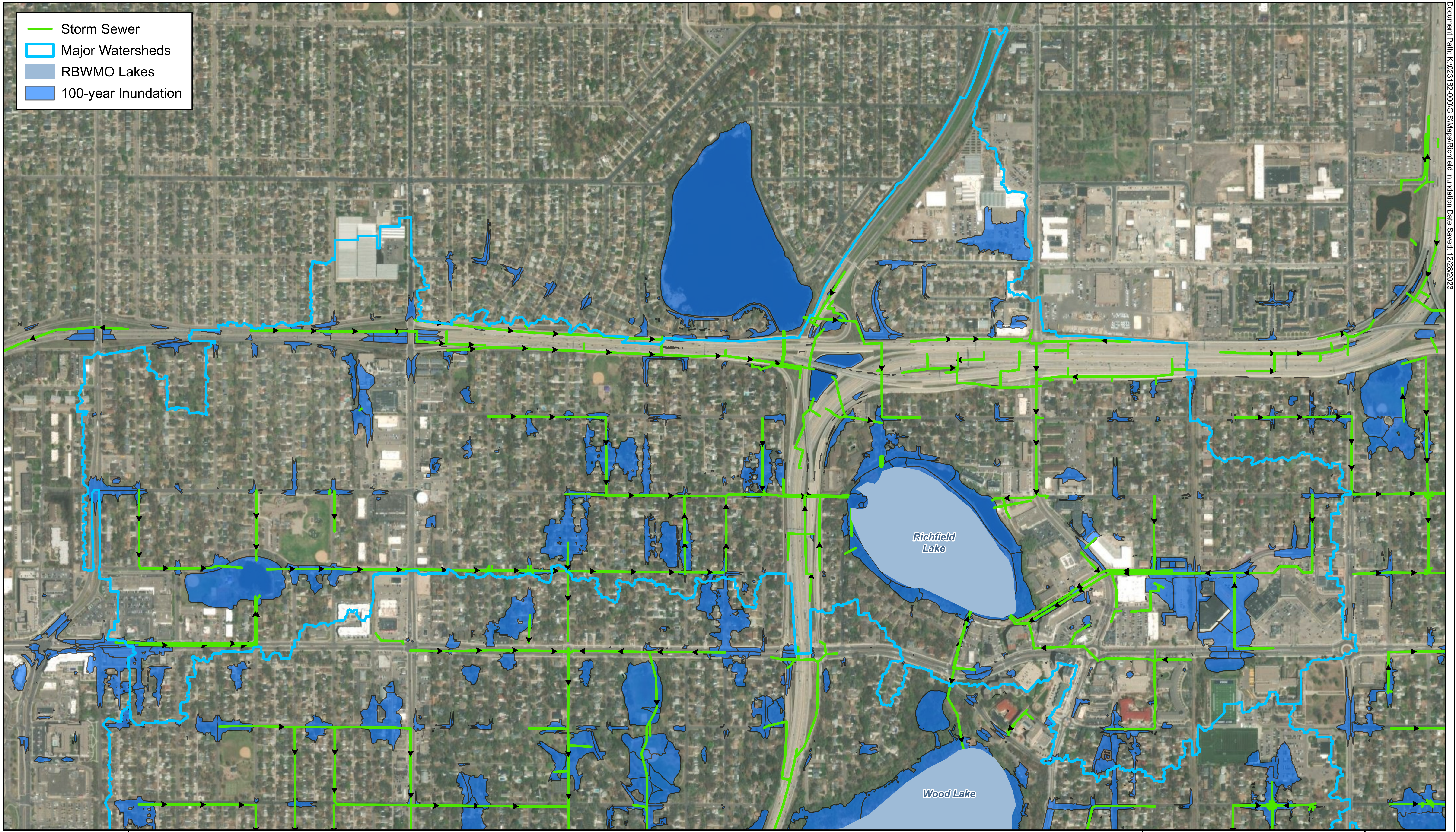


Figure 2 - Richfield Lake Subwatershed Inundation

RBWMO Feasibility Study

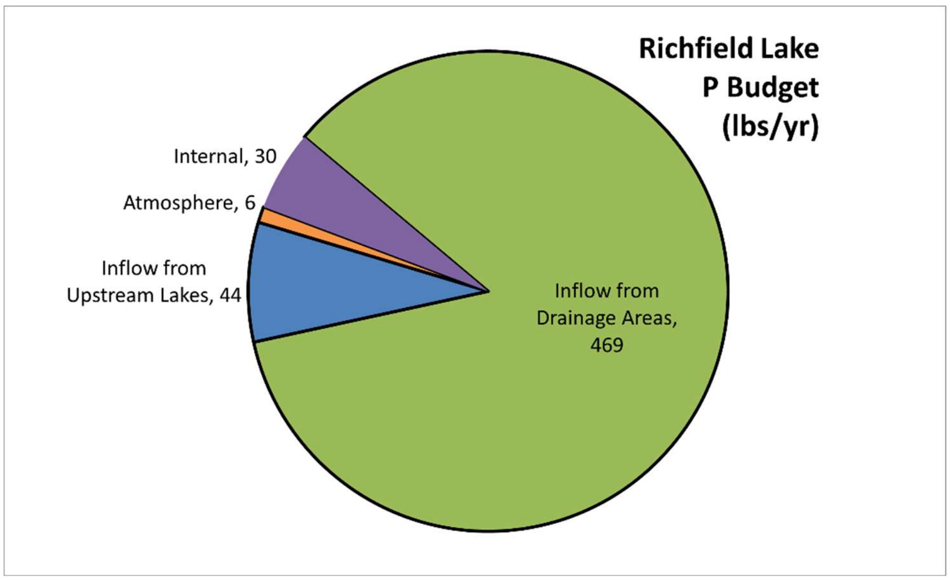
N 0 750 Feet

1 inch = 750 feet

Water Quality

Water quality monitoring data from 2009-2019 and P8 modeling results were used to inform a response model to estimate total phosphorus loading within Richfield Lake. The following Figure 3 shows the existing estimated annual loading into the water body. For Richfield Lake, inflows from upstream lakes include flows from Grass Lake. Flows from stormwater ponds (Sheridan Pond) were accounted for within the inflow from drainage areas category. The internal loading in the response model was calculated based on an empirical relationship between lake surface area and typical sediment release rates. Loading due to rough fish was not incorporated into the response model due to the high-level nature of the rough fish population estimates that are presented in this report.

Figure 3: Richfield Lake P Budget



Water quality modeling in the existing P8 model was analyzed to estimate average annual loading and average percent total phosphorus removal across the subwatershed of Richfield Lake. The following figures (Figure 4, Figure 5) show the modeled estimate for existing loading and removal conditions within the subwatershed of the lake.

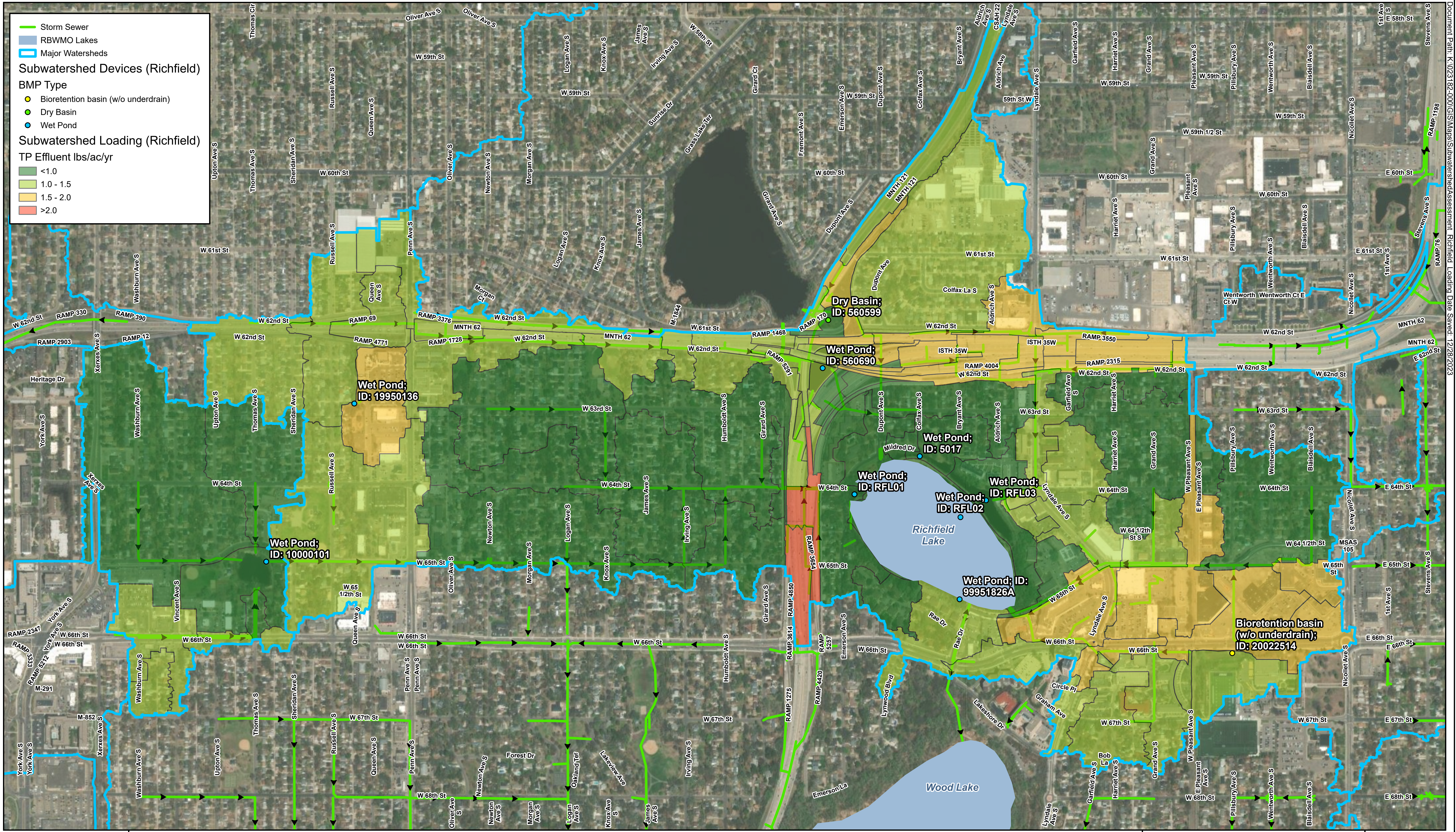


Figure 4 - Richfield Lake
Existing Subwatershed Phosphorus Loading
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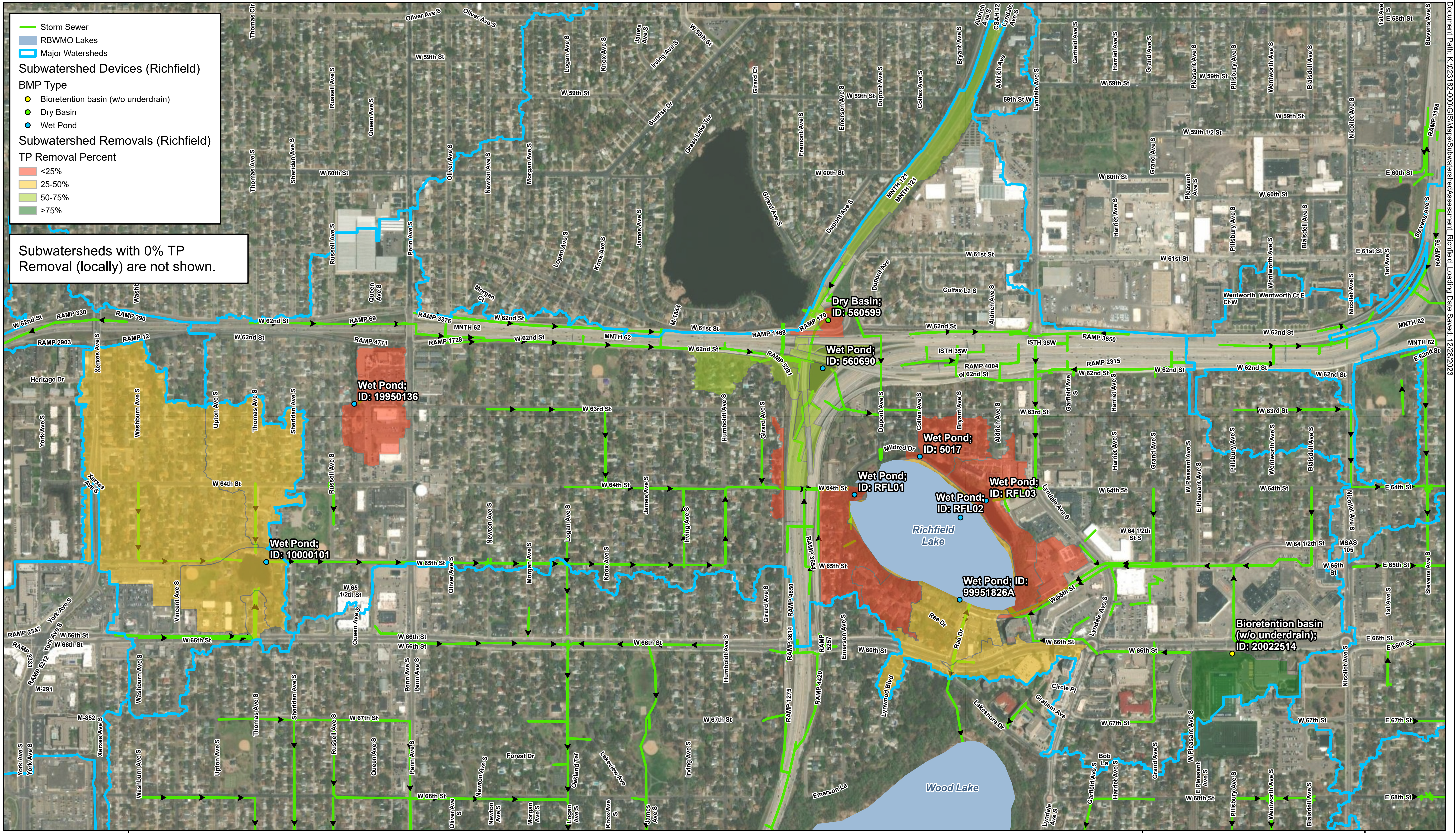

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Figure 5 - Richfield Lake
Existing Subwatershed Phosphorus Removals

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The granularity of the P8 model allowed for loading and removal analysis of the forebays of Richfield Lake. The following Table 1 summarizes inflow and removals of total suspended solids and total phosphorus. The Device ID corresponds to devices within P8 model M1, and the Device Description corresponds to the forebay's given name on the as-built (Appendix A).

Table 1: Richfield Lake Loading by Section

Device ID	Device Description	TSS Inflow (lbs./yr.)	TSS Removal (lbs./yr.)	TP Inflow (lbs./yr.)	TP Removal (lbs./yr.)
RFL02	Main Basin	52,116	39,658	442	144
RFL03	Pond 6	108,195	56,888	548	110
5017	Pond 5	55,823	20,578	346	35
5016	Pond 4	55,218	0	344	0
90000073A	Channel between Pond 3 and Pond 4	55,078	0	343	0
RFL01	Pond 2 and Pond 3	42,520	16,420	171	19
99951826A	Pond 1 and Pond 7	39,074	0	21	9

Richfield Specific Invasive Fish Management Plan Notes

Potential Nutrient Reductions of Internal TP loading:

Table 2 illustrates three potential scenarios that could exist in Richfield Lake in terms of loading from different biomass densities of goldfish.

Table 2

Biomass Level (carp)	Lake biomass (kg/ha)	Littoral area (acres)	TP load (lbs./yr.)
High	200	29	139.6
Moderate	100	29	50.4
Low	40	29	20.2

Reduction or elimination of goldfish in Richfield could result in between 20 and 140 lbs./yr. or more, depending on goldfish density.

Expected Water Quality Outcomes:

Results of modeling the sources of TP to Richfield Lake show that most of the budget is due to external sources. This suggests a moderate to low level of goldfish contribution to the internal loading of Richfield. Even if goldfish abundance is high, a reduction in the goldfish in Richfield Lake alone would likely have relatively lower overall impacts to the water quality compared to other projects.

Description of Known Interconnectedness of Waterbodies:

Richfield Lake receives water from Grass Lake to the north and is connected to Wood Lake to the south. Wood Lake has confirmed goldfish presence, so it is likely that individuals have the ability to move between the two water bodies. No other water bodies are connected to Richfield Lake that would be of concern in terms of nursery areas for goldfish or carp.

Proposed Actions to Reduce Adult Fish Populations:

The expanse of refugia in the form of forebays and island shorelines allows goldfish to escape many typical forms of fish harvest, like seine netting. Aggregations may be forming in late fall and early spring which could be targeted with an electrofishing boat and block nets to prevent escape. Baited box net traps have been found to be effective tools in training goldfish to aggregate within a trap area and then trapped by quickly raising nets walls around the aggregation. There is also a potential for stocking large piscivores like northern pike to prey on the adult goldfish present in the lake. If this is not effective at reducing goldfish populations, adults can be removed through lake drawdowns over winter months to induce low enough dissolved oxygen to kill most or all fish in the lake. This could be done in conjunction with lake drawdowns needed for other projects such as sediment excavations. Application of rotenone in small pools remaining could further ensure most or all remaining fish populations are killed off.

Wood Lake

Summary

Wood Lake is located in the City of Richfield and has similar TSI scores (70-85) to Richfield Lake. Wood Lake is about 115.6 acres with an average depth of 4 feet. The lake is also classified as a type 4 wetland which is an inland deep freshwater marsh. As with Richfield Lake, Wood Lake's wetland designation may warrant the TSI scores documented.

Wood Lake receives runoff water from a 1,306-acre watershed. 100% of this area is located in the City of Richfield and RBWMO's jurisdiction.

Goldfish have been sighted in the past at least as far back as 2014. According to the Wood Lake Facebook page, a small effort to net some goldfish was not seen as effective. Introduction of potential predators of goldfish eggs and larvae (bluegill sunfish) and juveniles (largemouth bass) was attempted to manage the populations. Empirical results of the effectiveness of those efforts are unknown.

With free-floating and rooted cattails bogs, refugia is abundant for goldfish to survive. Abundant areas for spawning in aquatic vegetation exist and would support recruitment of goldfish. The shallow nature of the lake presents a likelihood of low dissolved oxygen especially in later winter months.

In the following Figure 6, the watershed of Wood Lake is shown in with its storm sewer network (pipes ≥ 18") and approximate boundaries for the 100-year inundation level.

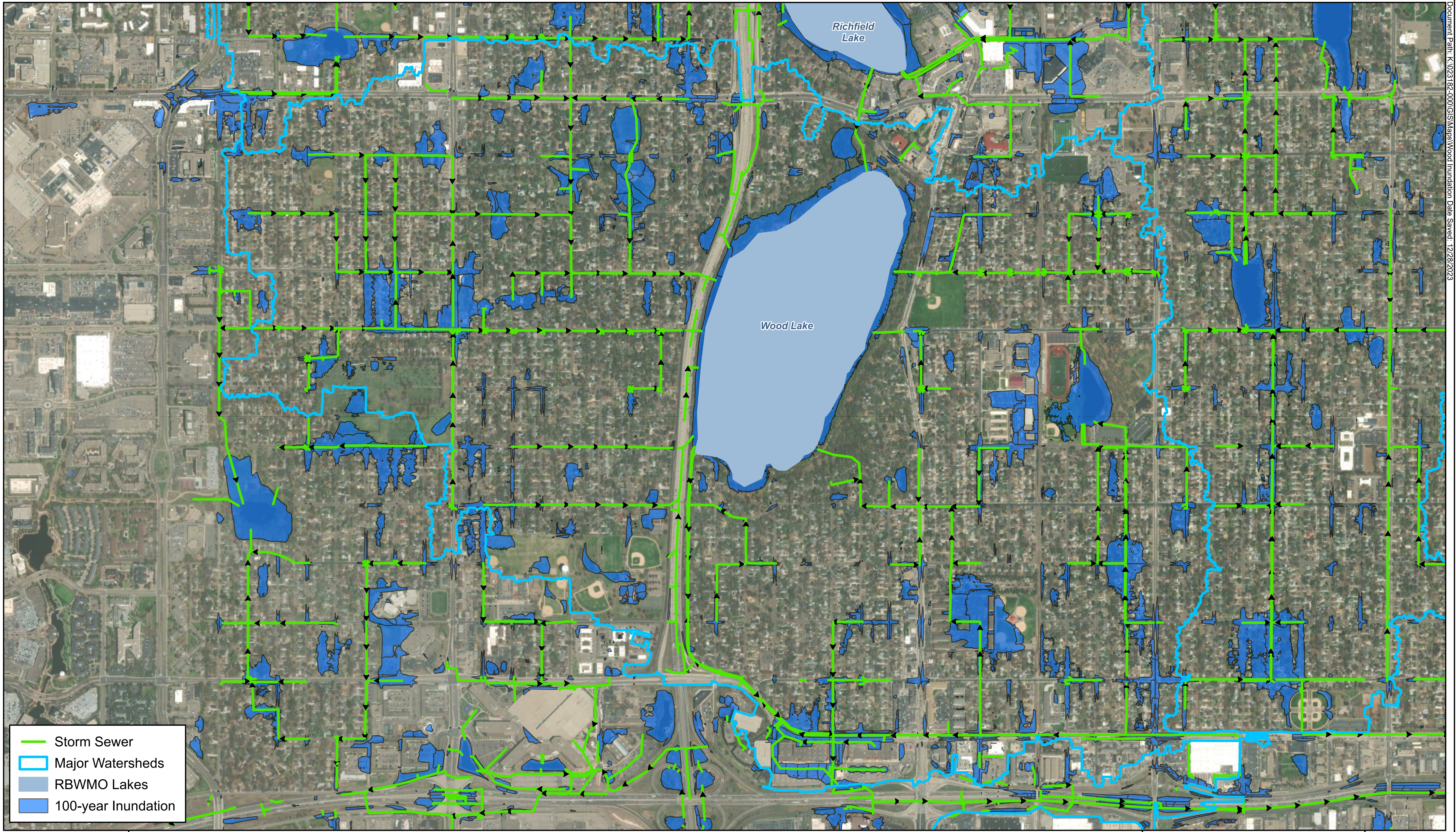

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Figure 6 - Wood Lake
Subwatershed Inundation

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N

0 1,000 Feet
1 inch = 1,000 feet

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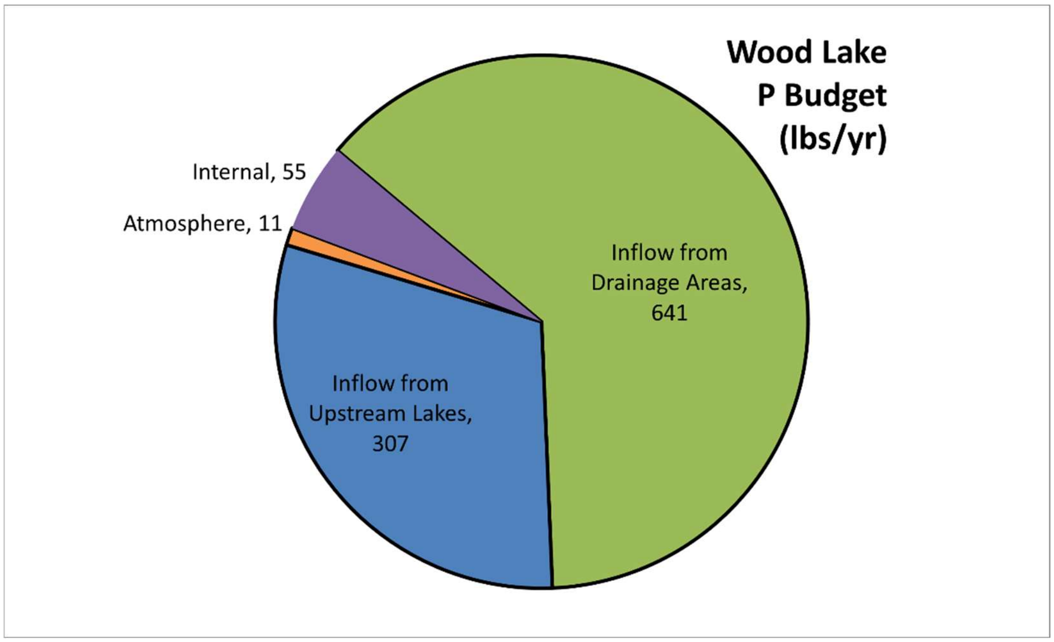
Water Quality

Water quality monitoring data from 2009-2019 and P8 modeling results were used to inform a response model to estimate total phosphorus loading within Wood Lake. The following Figure 7 shows the existing estimated annual loading into the water body. For Wood Lake, inflows from upstream lakes include modeled flows (P8) from Richfield Lake. Flows from stormwater ponds (Augsburg Pond) were accounted for within the Inflow from Drainage Areas category. The internal loading in the response model was calculated based on an empirical relationship between lake surface area and typical sediment release rates. Loading due to rough fish was not incorporated into the response model due to the high-level nature of the rough fish population estimates that are presented in this report.

Figure 7: Wood Lake P Budget



Water quality modeling in the existing P8 model was analyzed to estimate average annual loading and average percent total phosphorus removal across the subwatershed of Wood Lake. The following figures (Figure 8, Figure 9) show the modeled estimate for existing loading and removal conditions within the subwatershed of the lake.

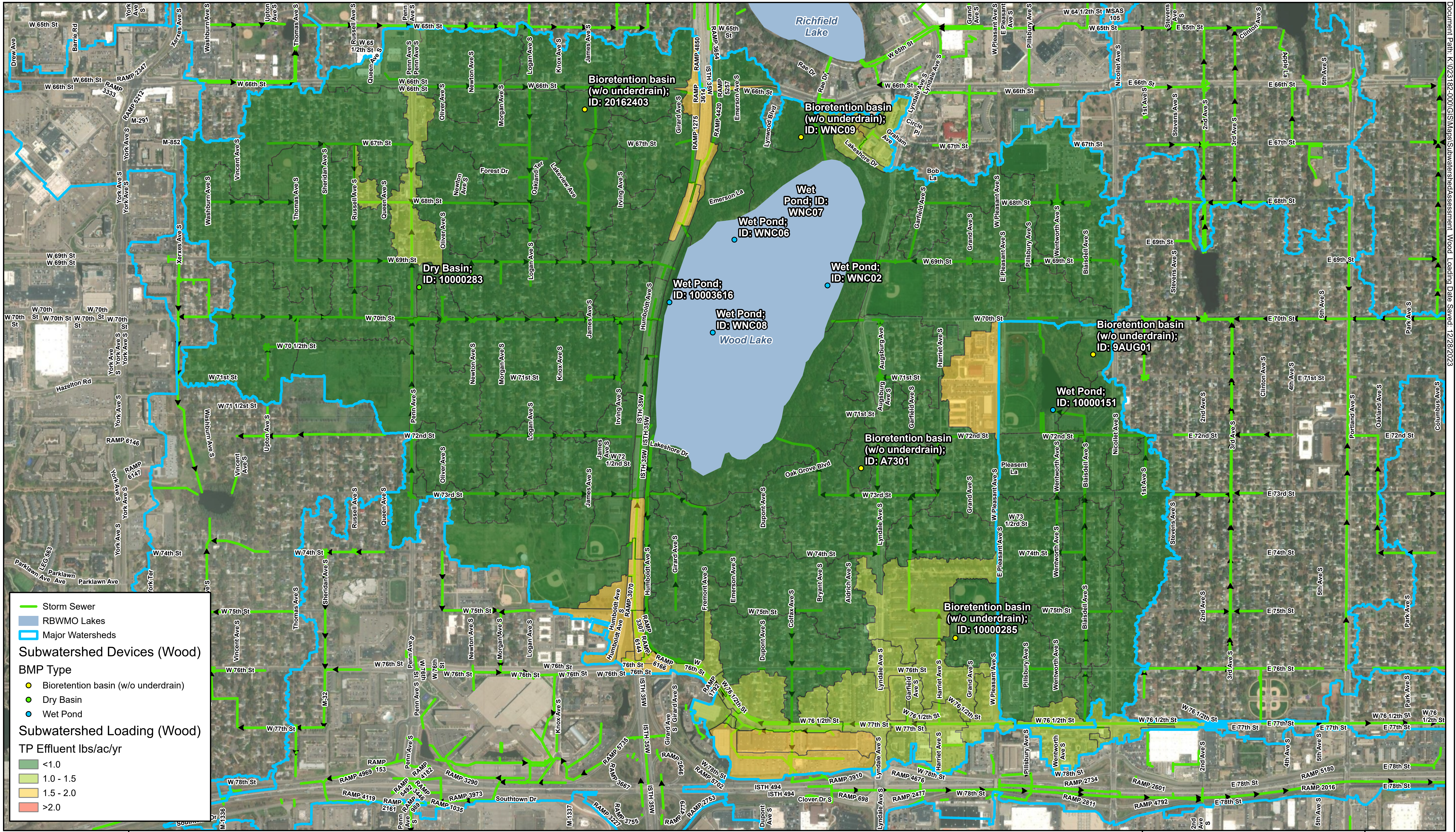


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Figure 8 - Wood Lake
Existing Subwatershed Phosphorus Loading

RBWMO Feasibility Study

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Feet
1 inch = 1,000 feet

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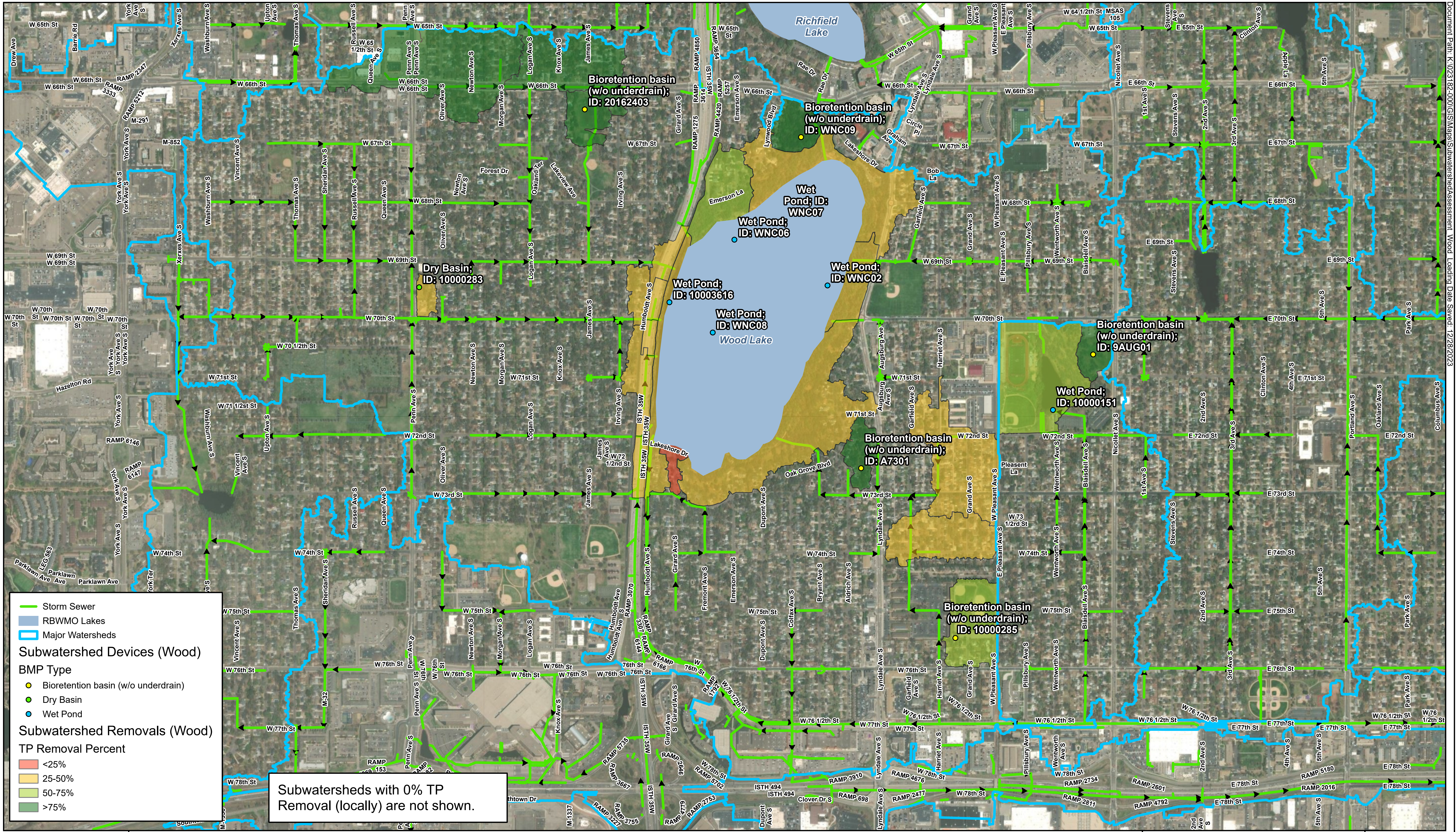

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Figure 9 - Wood Lake
Existing Subwatershed Phosphorus Removals

RBWMO Feasibility Study

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0 1,000 Feet
1 inch = 1,000 feet

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The granularity of the P8 model allowed for loading and removal analysis of the different areas (including forebays) of Wood Lake. The following Table 3 summarizes inflow and removals of total suspended solids and total phosphorus. Appendix A shows a map of the Device IDs in Wood Lake.

Table 3: Wood Lake Loading by Section

Device ID	**TSS Inflow (lbs./yr.)**	**TSS Removal (lbs./yr.)**	**TP Inflow (lbs./yr.)**	**TP Removal (lbs./yr.)**
WNC08	41,396	20,151	668	73
10003616	160,848	126,551	531	244
WNC07	68,786	62,355	543	164
WNC02	33,342	25,973	133	53
WNC06	574	568	2	1
WNC09	177	176	1	1

Invasive Fish Management Plan

Table 4 illustrates three potential scenarios that could exist in Wood Lake.

Table 4

Biomass Level (carp)	Lake biomass (kg/ha)	Littoral area (acres)	TP load (lbs./yr.)
High	200	45	71.1
Moderate	100	45	35.6
Low	40	45	14.2

Reduction or elimination of goldfish in Wood Lake could result in between 14 and 71 lbs./yr. or more, depending on goldfish density.

Expected Water Quality Outcomes:

Results of modeling the sources of TP to Wood Lake show that most of the budget is due to external sources. This suggests a moderate to low level of goldfish contribution to the internal loading of Wood Lake. If goldfish populations are near or above the High level (200 kg/ha), then water quality impacts may be detected. A reduction in the goldfish in Richfield Lake would show minimal impacts on the water quality unless found to be in abundance above the high level modeled in the table above.

Description of Known Interconnectedness of Waterbodies:

Wood Lake receives water from Richfield Lake to the north and is connected to Augsburg Park to the east. Similar studies have shown infrequent movements of goldfish between lakes, although it is possible.

Proposed Actions to Reduce Adult Fish Populations:

The expanse of refugia in the form of forebays and island shorelines allows goldfish to escape many typical forms of fish harvest, like seine netting. Aggregations may be forming in late fall and early spring which could be targeted with an electrofishing boat and block nets to prevent escape. Baited box net traps have been found to be effective tools in training goldfish to aggregate within a trap area and then trapped by quickly raising nets walls around the aggregation. There is also a potential for stocking large piscivores like northern pike to prey on the adult goldfish present in the lake. Finally, adults can be removed through lake drawdowns over winter months to induce low enough dissolved oxygen to kill most or all fish in the lake. This could be done in conjunction with lake drawdowns needed for other projects such as sediment excavations. Application of rotenone in small pools remaining could further ensure most or all remaining fish populations are killed off.

Smith Pond Lake

Summary

Smith Pond Lake (or Smith Pond), located in Bloomington, Minnesota is about 7 acres and has an average depth of 8 feet with a maximum depth of 16 feet. Smith's Pond is stocked annually by the Minnesota Department of Natural Resources (MDNR) with Bluegills and Black Crappies. Fisheries in the lake also includes black bullheads, hybrid sunfish, pumpkinseed, and brook stickleback. Shoreline and prairie habitat has been restored around the lake to help protect water quality and improve habitat for fish. Water quality data is collected for Smith's Pond by the City of Bloomington. Applying the TSI calculations to data collected, Smith Pond Lake has relatively high TSI scores ranging from 51 to 60 for the past six years, as shown on Graph 3-1. TSI scores ranging from 51 – 60 represent eutrophic to hyper-eutrophic conditions within Smith Pond.

Smith Pond receives runoff water from a 977-acre watershed. Approximately 47% of this area is located in the City of Bloomington, and the remaining 53% is within the City of Richfield (discharge from Wilson Pond (Richfield) is routed to Smith Pond).

Fisheries data that exists is outdated but does show that some species can survive and with continued stocking of native fish by the DNR offers opportunities for control of rough fish recruitment. The area of the lake near the fishing pier shows greater depths and could support more oxygen sensitive species to survive. At the time of the field visit, water clarity was relatively good and submerged aquatic vegetation was evident around the fishing pier. This could provide forage and refugia for native fish.

Goldfish have been seen on numerous occasions, especially near the fishing pier. Although the overall biomass of goldfish in the lake is unknown, their presence and length estimates (4-6 inches) suggest they can survive multiple years.

In the following Figure 10, the watershed of Smith Pond is shown in with its storm sewer network (pipes ≥ 18") and approximate boundaries for the 100-year inundation level.

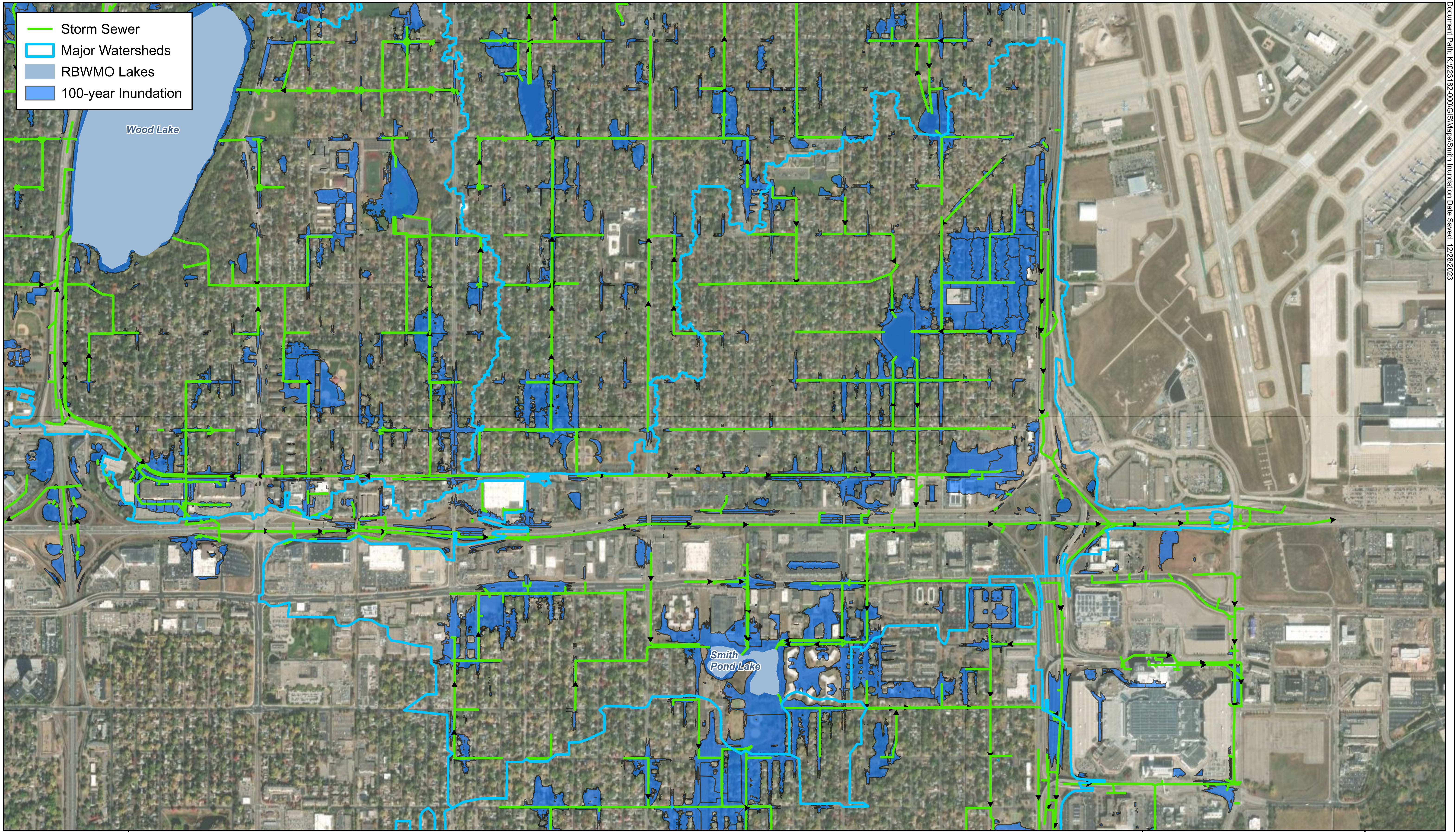

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Figure 10 - Smith Pond Lake
Subwatershed Inundation

RBWMO Feasibility Study

N

0 1,200 Feet

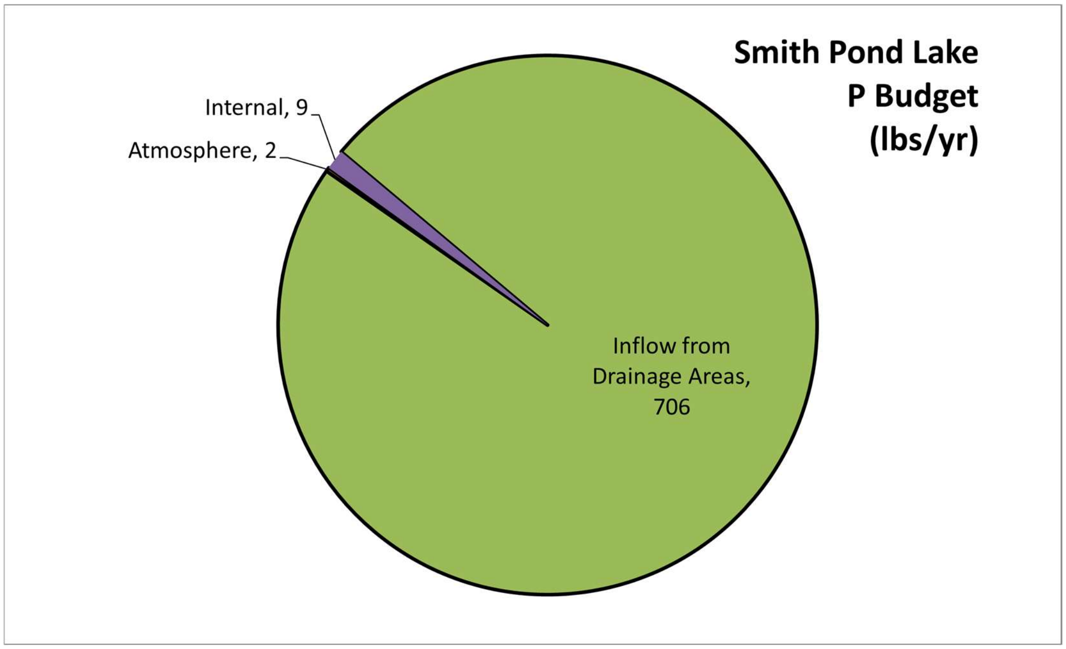
1 inch = 1,200 feet

wsb

Water Quality

Water quality monitoring data from 2014-2021 and P8 modeling results were used to inform a response model to estimate total phosphorus loading within Smith Pond. The following Figure 11 shows the existing estimated annual loading into the water body. For Smith Pond, inflows from drainage areas include flows from Wilson Pond (City of Richfield) in addition to direct runoff from its watershed in the City of Bloomington. The internal loading in the response model was calculated based on an empirical relationship between lake surface area and typical sediment release rates. Loading due to rough fish was not incorporated into the response model due to the high-level nature of the rough fish population estimates that are presented in this report.

Figure 11: Smith Pond Lake P Budget



The existing P8 model for Smith Pond had not accounted for stormwater contributed from the City of Richfield's Wilson Pond. An existing P8 model from the City of Richfield (model M4) was used for modeling flow and loading from the City of Richfield to Smith Pond.

A new P8 model was created to represent the City of Bloomington's direct drainage to Smith Pond due to concerns surrounding the granularity and ability to interpret meaningful results from the existing P8 model.

The two aforementioned models were then merged into one P8 model for Smith Pond to more accurately model flow, loading, and removals from the lake's subwatershed, including Wilson Pond. The following figures (Figure 12, Figure 13) show the modeled estimate for existing loading and removal conditions within the subwatershed of the lake.

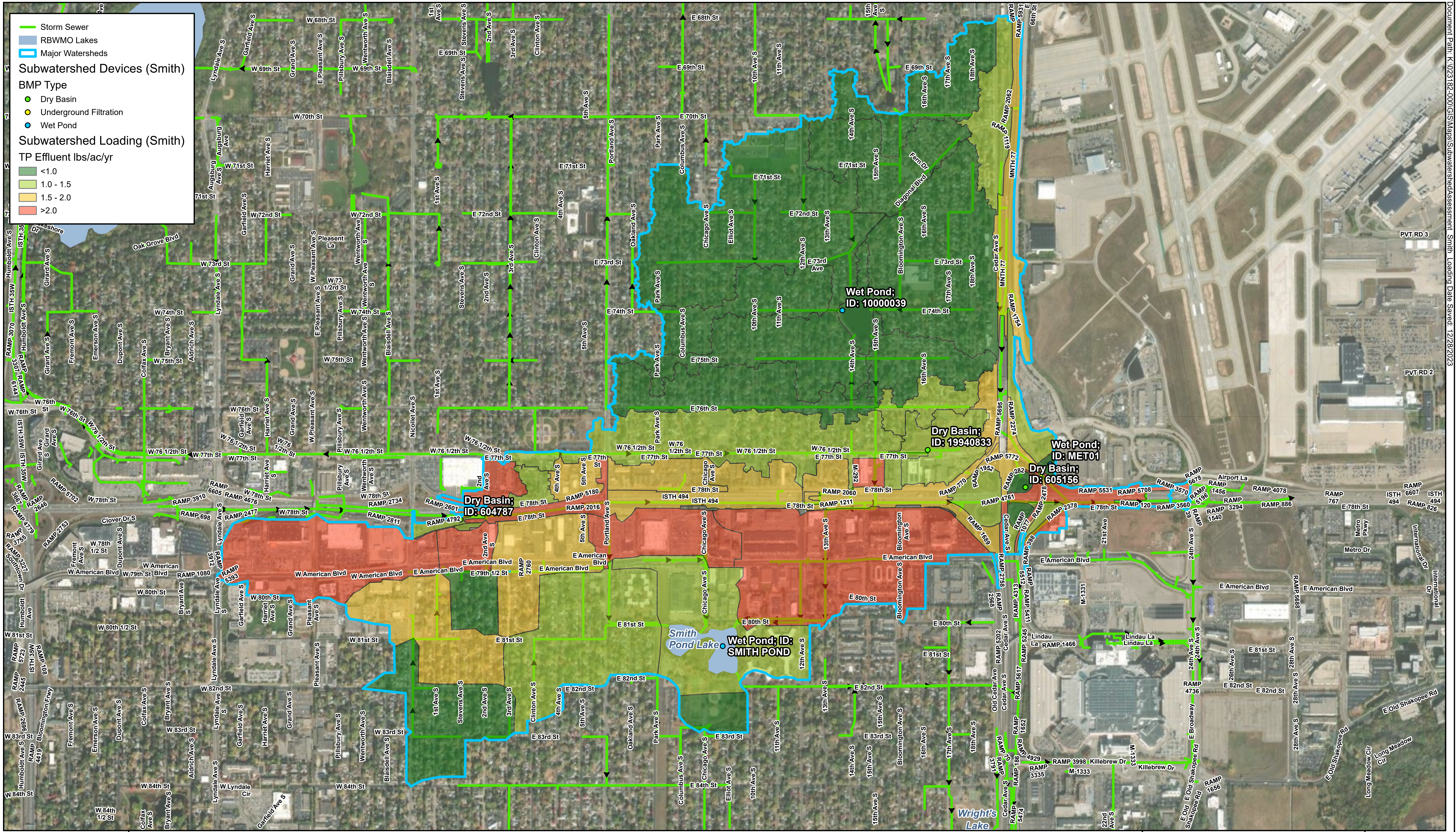


Figure 12 - Smith Pond Lake
Existing Subwatershed Phosphorus Loading

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1 inch = 1,200 feet

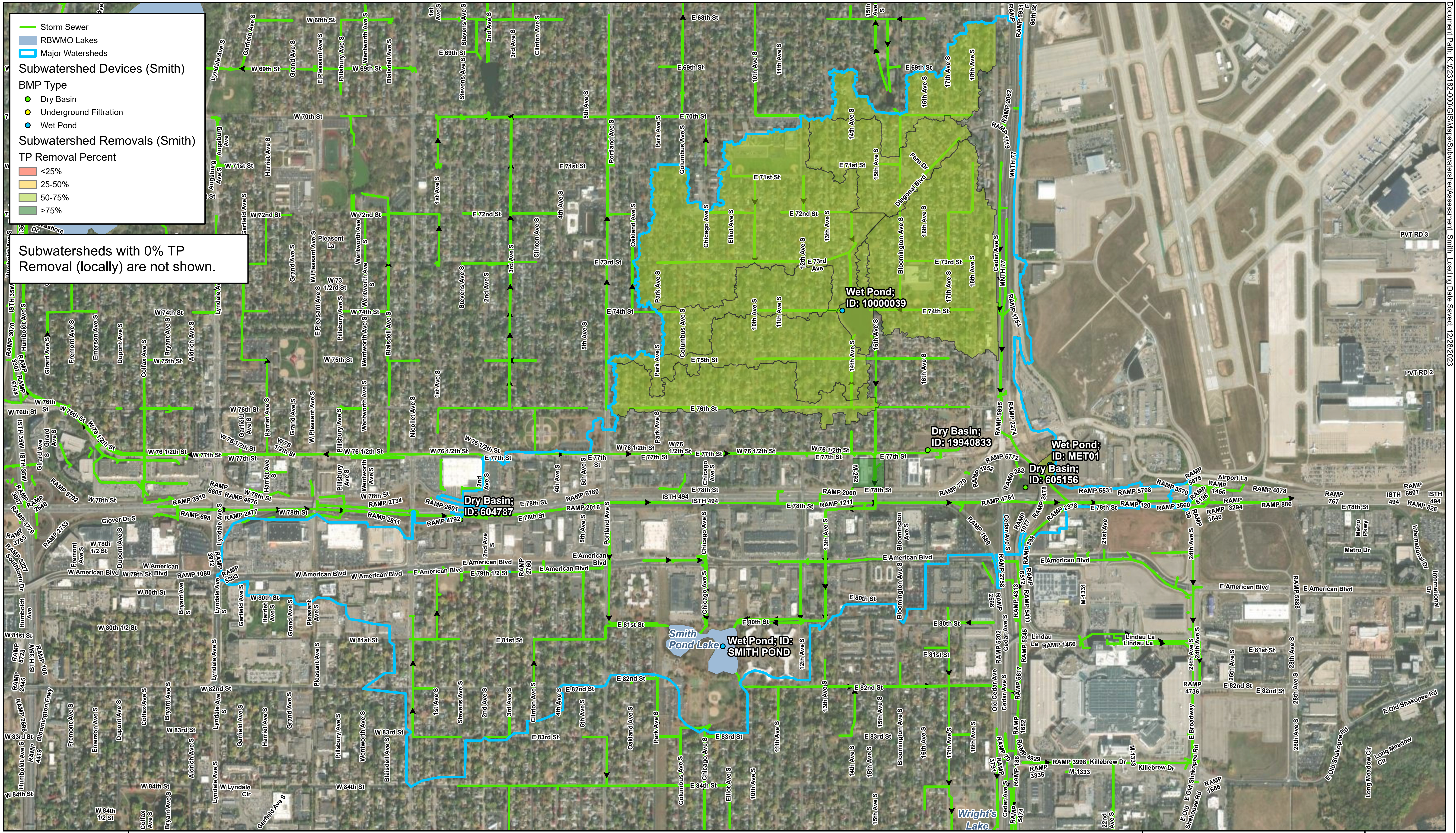

Figure 13 - Smith Pond Lake
Existing Subwatershed Phosphorus Removals

RBWMO Feasibility Study

N
0 1,200 Feet
1 inch = 1,200 feet

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Invasive Fish Management Plan

Table 5 illustrates three potential scenarios that could exist in Smith Pond.

Table 5

Biomass Level (carp)	Lake biomass (kg/ha)	Littoral area (acres)	TP load (lbs./yr.)
High	200	7.8	27.1
Moderate	100	7.8	13.6
Low	40	7.8	5.4

Reduction or elimination of goldfish in Smith Pond could result in between 5 and 27 lbs./yr. or more, depending on goldfish density.

Expected Water Quality Outcomes:

Smith Pond showed some of the best water quality of surveyed lakes and ponds in Bloomington in 2009. It is unlikely that reduction of goldfish in the deeper basin to the southeast would show improvement in water quality. If goldfish were reduced in the shallower areas to the north and west, water quality could improve more notably. However, it is likely that goldfish in the deeper areas could infiltrate shallower areas devoid of goldfish due to removal efforts, potentially deeming the efforts futile.

Description of Known Interconnectedness of Waterbodies:

Smith Pond has no connection to other water bodies of concern. It receives water from storm sewers along 494 but is not connected to other water bodies that would serve as a more appropriate nursery lake. Studies from similar systems have shown little evidence of consistent movement between water bodies, so the concern for spread or access to other water bodies of concern to the management of the goldfish population is minimal. Accessible storm sewers can serve as refugia, however.

Proposed Actions to Reduce Adult Fish Populations:

Due to the nature of confirmed goldfish near the fishing pier that seem to aggregate because residents may be feeding them, cast netting could be an effective method to remove adults. The shallow nature of the north and western areas could benefit from the use of baited box net traps to remove some adult goldfish. Finally, assuming no large sunken debris, a small-mesh seine net could be pulled through the southeastern area and landed on the shoreline to remove aggregated adult goldfish. Smith Pond can likely support large piscivorous fish like northern pike or largemouth bass. Stocking these species could reduce some of the adult goldfish.

Wright’s Lake

Summary

Wright’s Lake, located in the City of Bloomington, is 4.2 acres large with an average depth of approximately 7.5 feet and a maximum depth of 9 feet. Although missing on the MPCA’s website, the City of Bloomington has two and a half years of water quality sufficient monitoring data to calculate TSI scores. Historically, it is known that this lake has poor water quality. The TSI values are in the 70’s which translates to the lake being hypereutrophic with possible heavy algae blooms in the summer and dense macrophyte beds.

Wright’s Lake receives runoff water from a 607-acre watershed. 100% of this area is located in the City of Bloomington and RBWMO’s jurisdiction.

Little is known about the fisheries in Wright’s Lake. The shape and depth of the lake opens opportunities for drawdown and chemical treatment of the lake for potential goldfish populations. As mentioned above, the lake has the potential to support dense beds of macrophyte which could provide refugia for fish. The shoreline is mostly fringed with cattails but would likely be out of range for goldfish to seek refuge if the lake was drawn down.

In the following Figure 14, the watershed of Wright’s Lake is shown in with its storm sewer network (pipes ≥ 18”) and approximate boundaries for the 100-year inundation level.

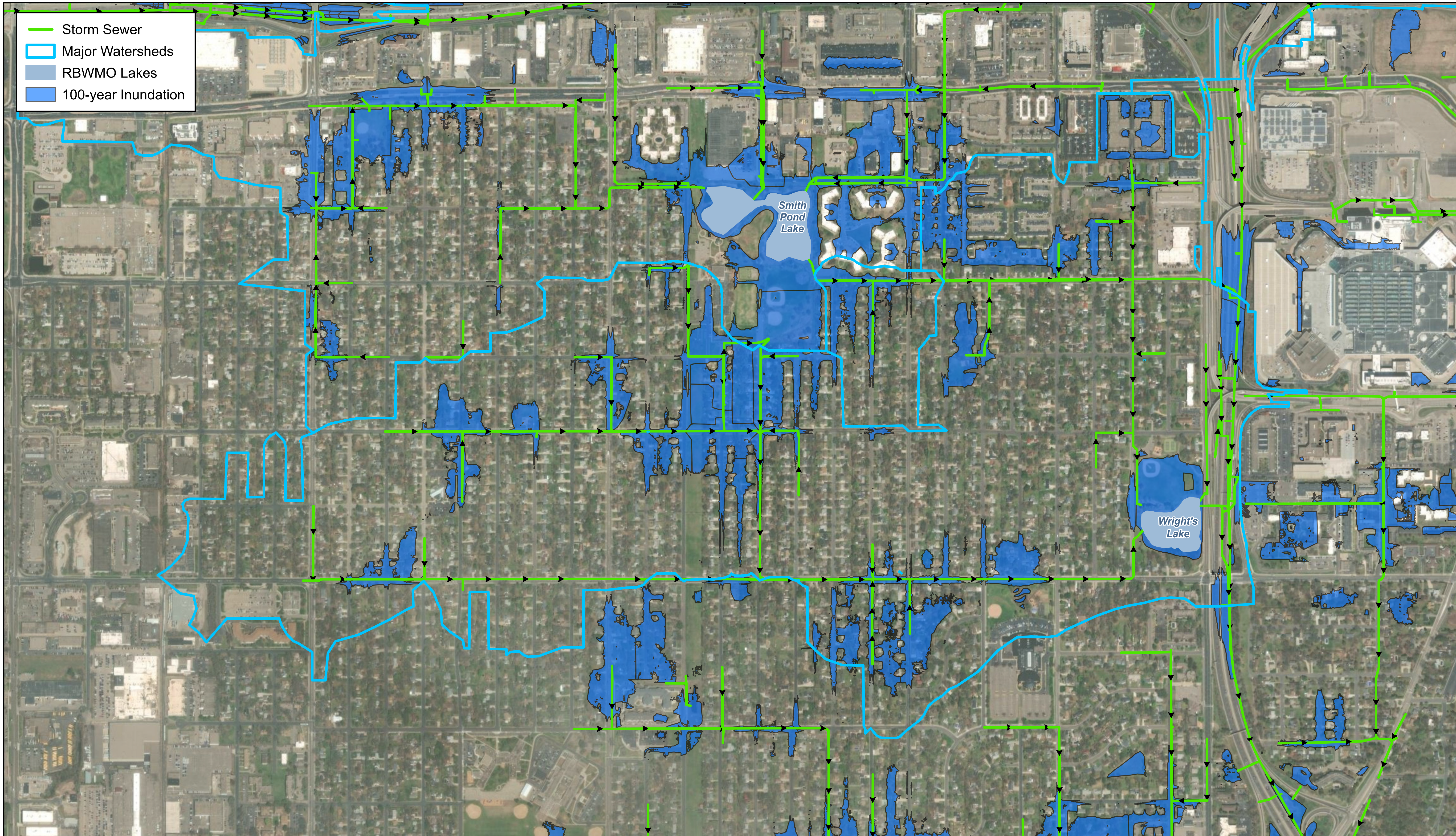

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Figure 14 - Wright's Lake Subwatershed Inundation

RBWMO Feasibility Study

N

0 800 Feet

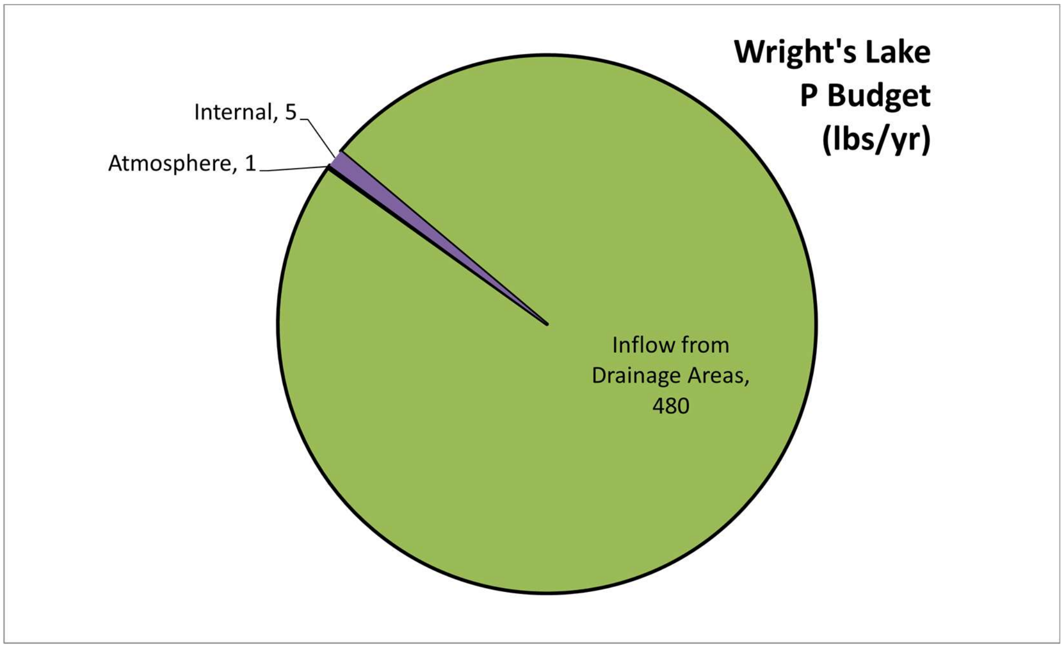
1 inch = 800 feet

wsb

Water Quality

Water quality monitoring data from 2014-2021 and P8 modeling results were used to inform a response model to estimate total phosphorus loading within Wright's Lake. The following Figure 15 shows the existing estimated annual loading into the water body. Smith Pond does not discharge into Wright's Lake; thus, there are no upstream water bodies that discharge into Wright's Lake. The internal loading in the response model was calculated based on an empirical relationship between lake surface area and typical sediment release rates. Loading due to rough fish was not incorporated into the response model due to the high-level nature of the rough fish population estimates that are presented in this report.

Figure 15: Wright's Lake P Budget



A new P8 model was created to represent the City of Bloomington's direct drainage to Wright's Lake due to concerns surrounding the granularity and ability to interpret meaningful results from the existing P8 model. The following figures (Figure 16, Figure 17) show the modeled estimate for existing loading and removal conditions within the subwatershed of the lake.

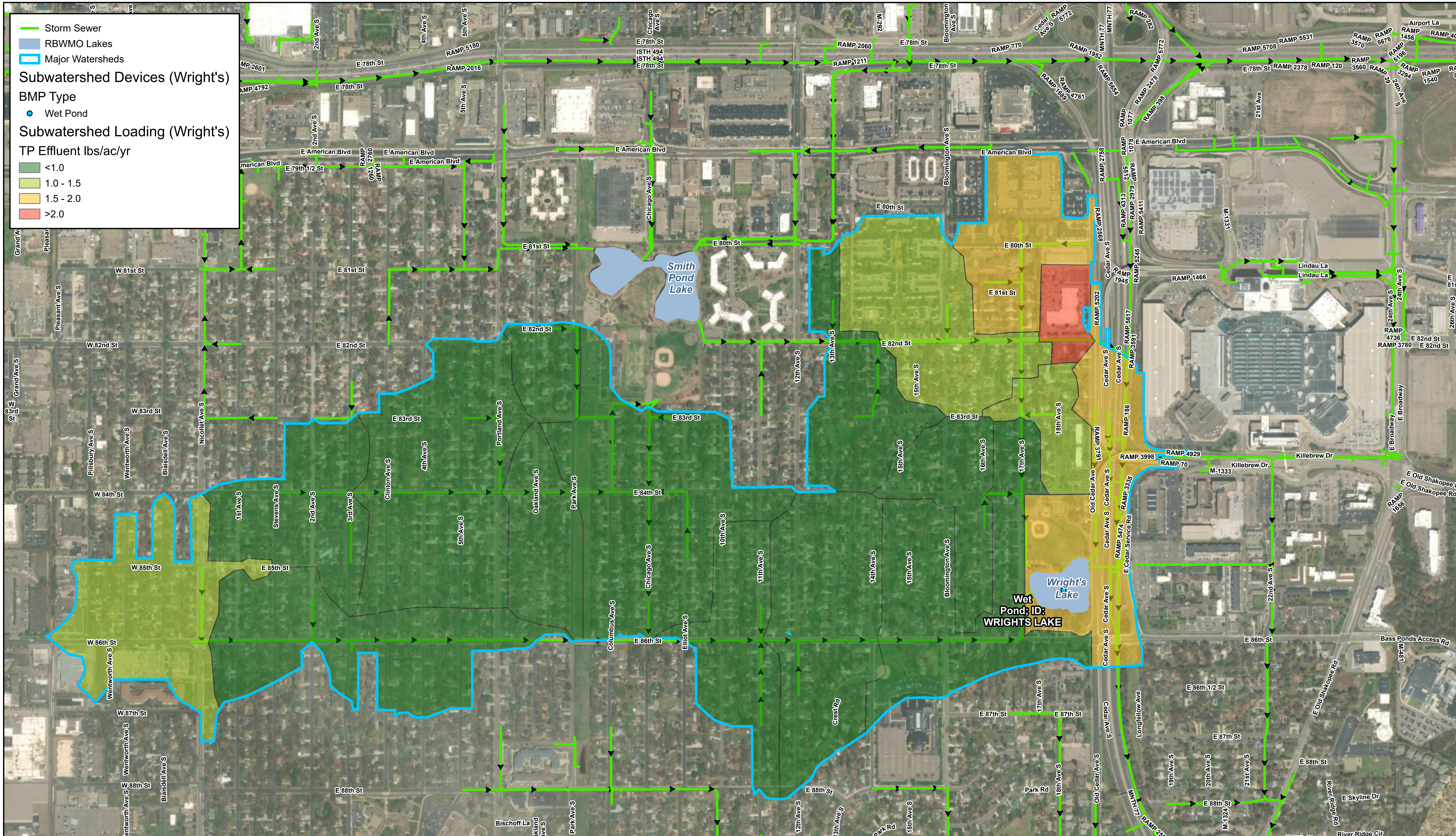


Figure 16 - Wright's Lake
Existing Subwatershed Phosphorus Loading

RBWMO Feasibility Study

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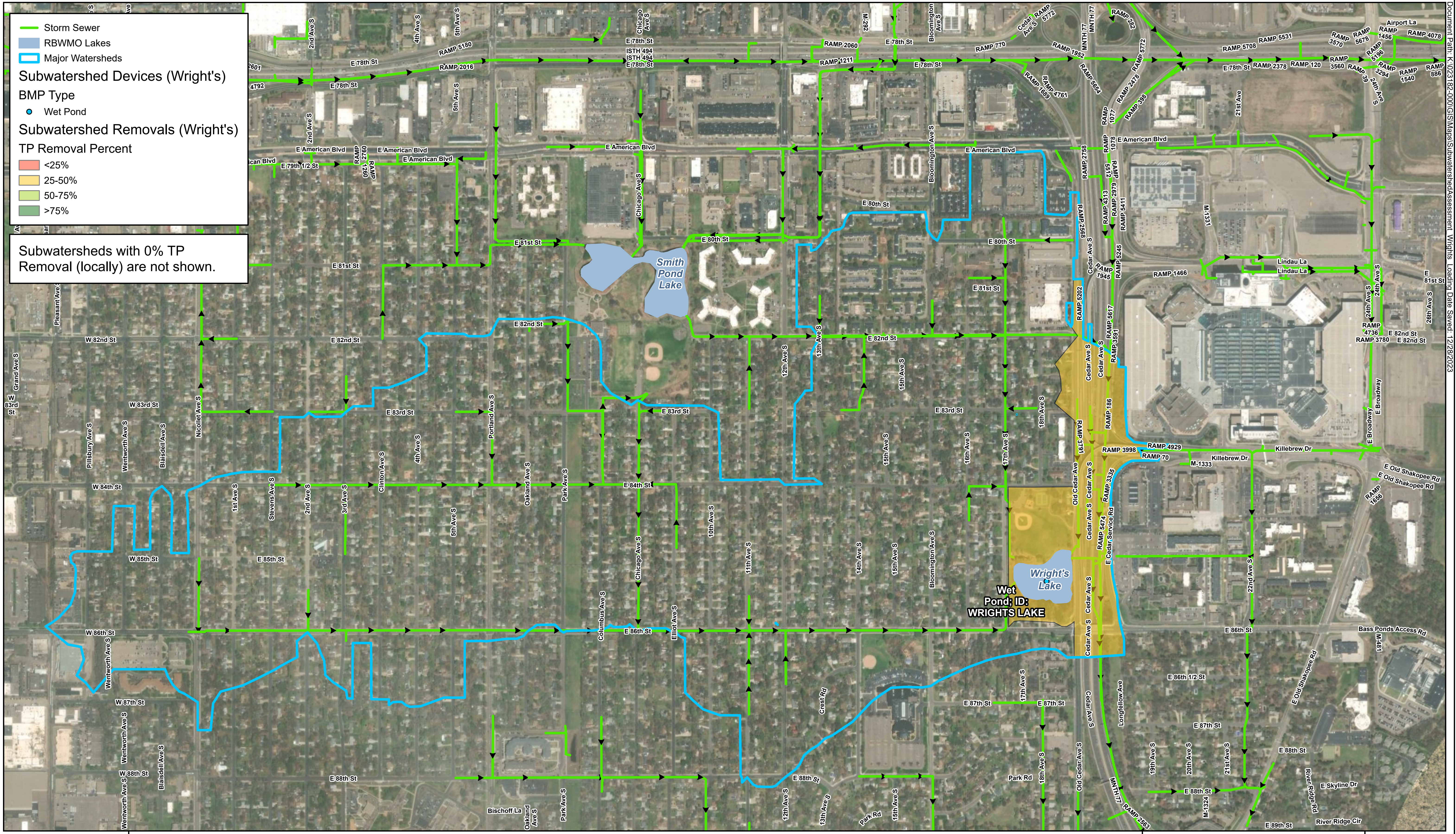

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Figure 17 - Wright's Lake
Existing Subwatershed Phosphorus Removals

RBWMO Feasibility Study

N

0 800 Feet

1 inch = 800 feet

Invasive Fish Management Plan

Table 6 illustrates three potential scenarios that could exist in Wright's Lake.

Table 6

Biomass Level (carp)	Lake biomass (kg/ha)	Littoral area (acres)	TP load (lbs./yr.)
High	200	4.2	14.6
Moderate	100	4.2	7.3
Low	40	4.2	2.9

Reduction or elimination of goldfish in Wright's Lake could result in between 3 and 15 lbs./yr. or more, depending on goldfish density.

Expected Water Quality Outcomes:

It is likely that most of the TP budget is due to external sources to Wright's Lake. This suggests a moderate to low level of goldfish contribution to the internal loading of Wright's Lake. If goldfish populations are found to be near or above the High level (200 kg/ha), then water quality impacts may be able to be detected. A reduction in the goldfish in Wright's Lake likely would show minimal impacts on the water quality unless found to be in abundance above the high level modeled in the table above.

Description of Known Interconnectedness of Waterbodies:

Wright's Lake is not connected to Smith Pond upstream to the northwest, but it does receive water from storm sewers but is not connected to other water bodies that would serve as a more appropriate nursery lake. It does connect to Long Meadow Lake approximately 1 mile away via storm sewer pipes. However, the likelihood that goldfish are moving from Long Meadow into Wright's is low. Studies from similar systems have shown little evidence of consistent movement between water bodies, so the concern for spread or access to other water bodies of concern to the management of the goldfish population is minimal.

Proposed Actions to Reduce Adult Fish Populations:

The likely best method to reduce any goldfish populations in Wright's Lake would be to drain the lake in lake fall, spot any adults in remaining pools, and then allow the lake bottom to freeze. This would allow for other management of the lake simultaneously and present the best situation for stocking native fish following lake refill. A small amount of spot rotenone treatments to kill any remaining fish not physically accessible could further ensure successful lake fish kill.

Improvements

Some recommended improvements are prefaced by the need for more information on the existing conditions of watersheds. Table 7 shows recommended data collection studies that, when completed, will provide better insight into the scope and feasibility of improvements for each lake.

Table 7: Data Collection Studies

ID	Project Name	Description	Estimated Capital Cost
27	MnDRAM Wetland Assessments		$ 30,000
28	Invasive Species Management Plan	Boat electrofishing, ageing analysis, trap nets, PIT stations	$ 45,000
29	Lake Phosphorus Release and Alum Dosing Feasibility Study	Focus of Richfield, Wood, and Wright's Lakes	$ 65,000
30	Target Street Sweeping Program		$ 45,000
31	Conduct water quality monitoring for major water bodies		$ 40,000
32	Feasibility studies to address pollutant loading issues identified by City-wide water quality modeling	Focus on Commercial Areas	$ 30,000
33	Feasibility studies to address potential flood risk and water quantity issues identified by hydrology and hydraulic modeling	Focus on Wilson Pond, MnDOT ROW (I494)	$ 35,000

Potential structural/non-structural projects were identified for each subwatershed aiming to reduce external pollutant loading and, in some instances, offer a potential secondary benefit of reducing flood risk within each subwatershed. Each of these projects is briefly described in Table 8. Each project location is also shown in Figures 18-21.

Potential projects were selected based on existing watershed loading and removal estimates, storm sewer trunklines, contributing draining area, surrounding land use and ownership, and opportunity for partnership.

A simplified water quality model was created for potential projects with the MIDS calculator. Total phosphorus removal was estimated based on drainage area, approximate impervious cover, and project type. Due to project type and uncertainties in scope, TP removal estimates for several projects were not calculated.

High-level cost estimates were prepared for each project. The cost estimates were based on conceptual designs and pollutant removal potential in each project's location. Potential costs from utility conflicts, right-of-way acquisition, agreements, and any site contamination/remediation were not considered in these concept-level costs. A more detailed cost analysis should be performed for each project to determine actual cost feasibility beyond this concept-level review.

Table 8: Potential Projects (External)

Lake	Map ID	Project Name	Description	TP Removal Potential (lbs/yr)	Estimated Capital Cost
Richfield	1	Richfield Lake Forebays	7 Forebay ponds constructed in 2008 around lake perimeter. Detailed survey is needed to quantify sediment volume to remove. Cost assumes forebays 60% of as-built volume (20,000 cy).	TBD - complete forebay maintenance study	$1,350,000
	2	Sheridan Pond Outlet Filter	Sheridan Pond was previously dredged. Ongoing maintenance as-needed and implement outlet filter.	TBD	$750,000
	3	Lyndale Ave & W 65th St	Underground Chamber / Filtration / Flood Storage, potential inundation conflict, assume 12k cu-ft storage within ROW.	6	$270,000
	4	Penn Ave & W 65th St	Underground Chamber / Filtration downstream of Sheridan Pond. Receives additional drainage from Commercial areas on 65th & Penn. Assumes 15K cu-ft of storage within ROW.	8	$340,000
	5	Madison Park	Underground Chamber / Filtration; Assumes 38K cu-ft of storage in park (0.5in of runoff from watershed).	8	$850,000
	6	Hub Commercial Area	Underground Chamber / Filtration / Flood Storage; Parking Lot Improvements; Assumes 40K cu-ft of storage in ROW or attainable through private development partnership (0.5in of runoff from watershed).	14	$880,000
Wood	7	Augsburg Park	Greenspace opportunities; Estimate for a reuse system or infiltration trenches combined with existing LS outlet.	TBD - complete reuse study	$700,000
	8	Augsburg Park Library	Greenspace opportunities; Partner with Hennepin Co Library; assumes 36K cu-ft of Storage in Park (0.5in of runoff from watershed).	8	$790,000
	9	Lyndale Field	Greenspace opportunities; estimate for a reuse system or infiltration trenches pumping from Wood Lake Forebay.	TBD - complete reuse study	$1,250,000
	10	Fairwood Park	Greenspace opportunities; assume 36K cu-ft of Storage in Park (0.5in of runoff from 20 ac watershed); potential inundation conflict.	8	$1,230,000

	11	Park (Newton Ave & W 68th St)	Bioretention BMP; assumes 15K cu-ft of Storage in Park (0.5in of runoff from watershed); potential inundation conflict.	4	$340,000
	12	Wood Lake Forebays	2 Forebay ponds constructed in 2000 around lake perimeter. Detailed survey needed to quantify sediment volume to remove. Cost assumes 50% of as-built volume (23,000 cy).	TBD - complete forebay maintenance study	$1,550,000
	13	Nicollet Ave S	Underground system, flood risk reduction; partner with Hennepin County to determine available ROW or potential project scope (Nicollet Ave Reconstruction); potential inundation conflict.	TBD - determine potential project scope with Hennepin County	TBD
Smith	14	Wilson Pond to Smith (I494)	I494 trunkline modification; partner with MnDOT to determine ROW or potential project scope.	TBD - determine potential project scope with MnDOT	TBD
	15	Commercial Area (American Blvd)	Underground Chamber / Filtration / Flood Storage; assumes 90K cu-ft of storage potential in commercial parking area (0.5in of runoff from 50 ac watershed).	30	$2,050,000
	16	Hunt Electric South Parking Lot	Parking lot improvements; assumes 25K cu-ft of storage in commercial parking area (0.5in of runoff from 10 ac watershed).	8	$410,000
	17	Utility Corridor	Greenspace opportunities (bioretention basin, pretreatment); assume 27K cu-ft of storage potential in greenspace.	10	$190,000
	18	Dar Al-Farooq Greenspace	Greenspace opportunities (reuse system or infiltration trenches).	4	$850,000
	19	Inlets to Smith Pond (East)	Trash Pollution BMP (StormTrap, TrashTrap, or similar)	-	$150,000
	19	Inlets to Smith Pond (Center)	Trash Pollution BMP (StormTrap, TrashTrap, or similar)	-	$150,000
	19	Inlets to Smith Pond (West)	Trash Pollution BMP (StormTrap, TrashTrap, or similar)	-	$150,000
	20	Wilson Pond	Maintenance; 3 Forebays in NW, center, and NE corners. Detailed Survey needed to quantify sediment volume to remove. Cost assumes forebays 50% of as-built volume (3,000 cy).	TBD - complete forebay maintenance study	$200,000

Wright's	21	Wright's Lake Forebay	Maintenance; forebay historic failure, improving hydraulics, and expanding volume.	TBD - complete forebay maintenance study	$340,000
	22	Wright's Lake Park	Greenspace opportunities (reuse system or infiltration trenches); assume 20K cu-ft storage.	4	$850,000
	23	Seven Hills Prep Academy	Greenspace opportunities; assume 30K cu-ft of storage in park (0.1in of runoff from watershed).	14	$660,000
	24	Wright's Lake	Alum Treatment	-	TBD
	25	Utility Corridor (North)	Greenspace opportunities within utility corridor; 75K cu-ft of storage in greenspace (0.15in of runoff from 123ac watershed).	36	$530,000
	25	Utility Corridor (South)	Greenspace opportunities within utility corridor; 75K cu-ft of storage in greenspace (0.2in of runoff from 93ac watershed).	32	$530,000
	26	Wright's Lake Perimeter	Vegetation buffer improvements.	2	TBD

Potential projects that aim to improve or study internal loading within each basin were also identified, shown in Table 9. Cost estimates are provided based on high-level review of each project's scope and benefit potential.

Table 9: Potential Projects (Internal)

Lake	ID	Project Name	Description	Estimated Capital Cost
Richfield	34	Chemically Treat Deep Pools		$ 15,000
	35	Physical Removal		$ 20,000
	36	Biocontrol (fish Stocking)		$ 7,500
	37	Alum Treating Littoral Sediments	Determine after sediment release rate study	TBD
Wood	38	Chemically Treat Deep Pools		$ 15,000
	39	Physical Removal		$ 20,000
	40	Biocontrol (fish Stocking)		$ 6,000
	41	Alum Treating Littoral Sediments	Determine after sediment release rate study	TBD
Smith	42	Chemically Treat Deep Pools	Rotenone Application	$ 15,000

	43	Physical Removal		$ 20,000
	44	Biocontrol (fish Stocking)	DNR Grants	TBD
Wright's	45	Chemically Treat Deep Pools	Rotenone Application	$ 15,000
	46	Physical Removal		$ 20,000
	47	Biocontrol (fish Stocking)		$ 7,500
	48	Alum Treating Littoral Sediments	Determine after sediment release rate study	TBD

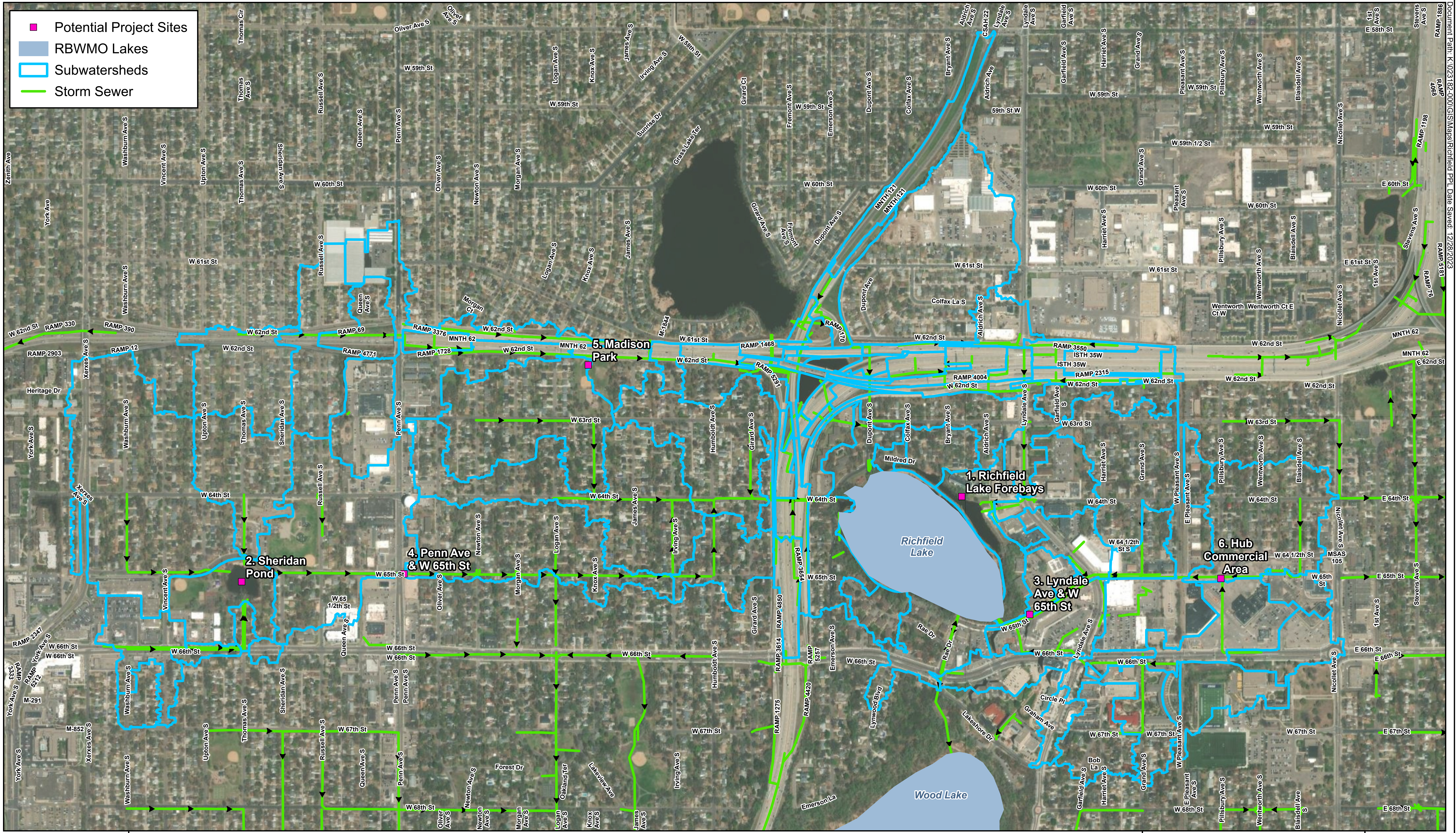

Figure 18 - Richfield Lake Potential Projects

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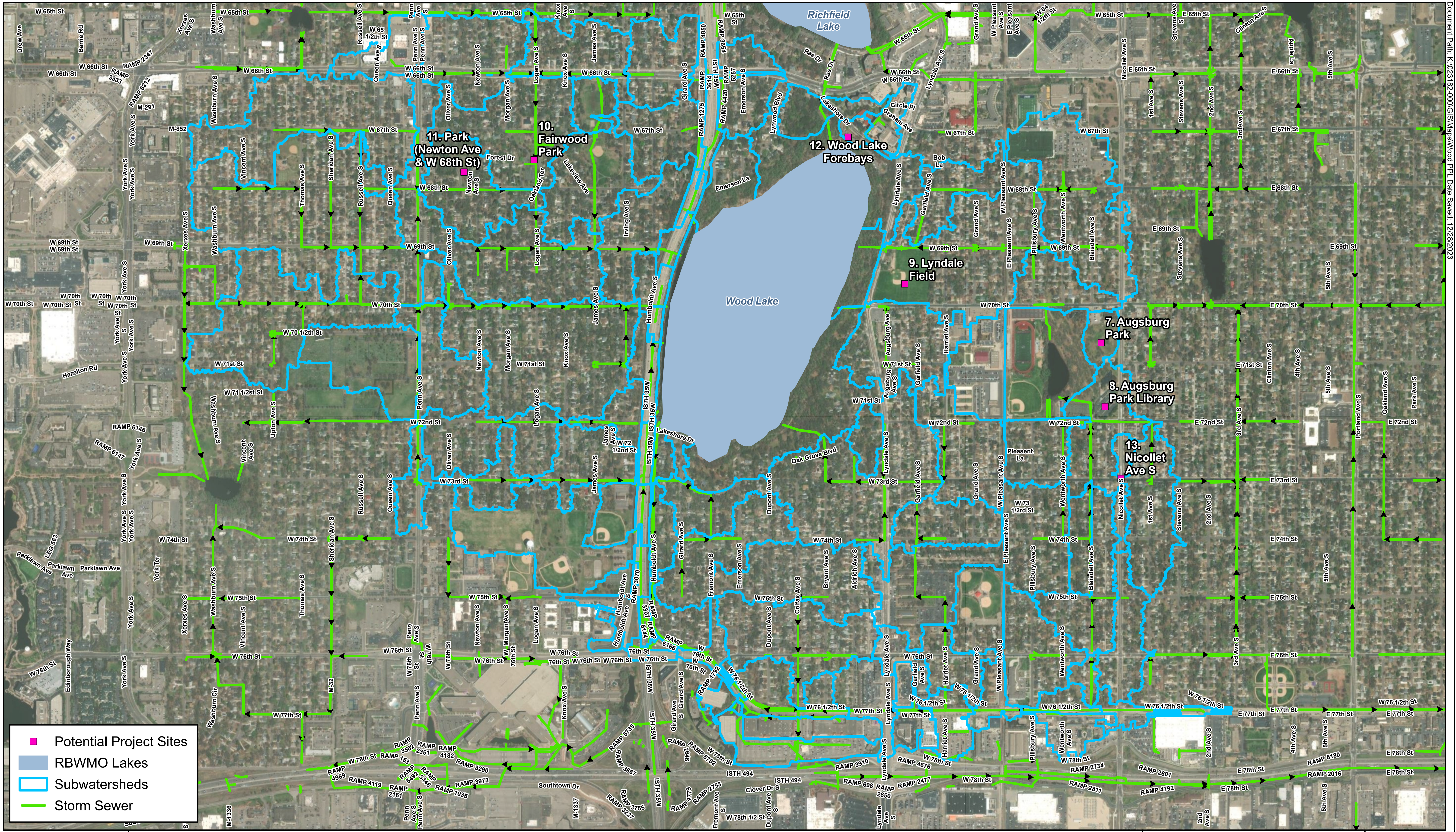

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Figure 19 - Wood Lake Potential Projects

RBWMO Feasibility Study

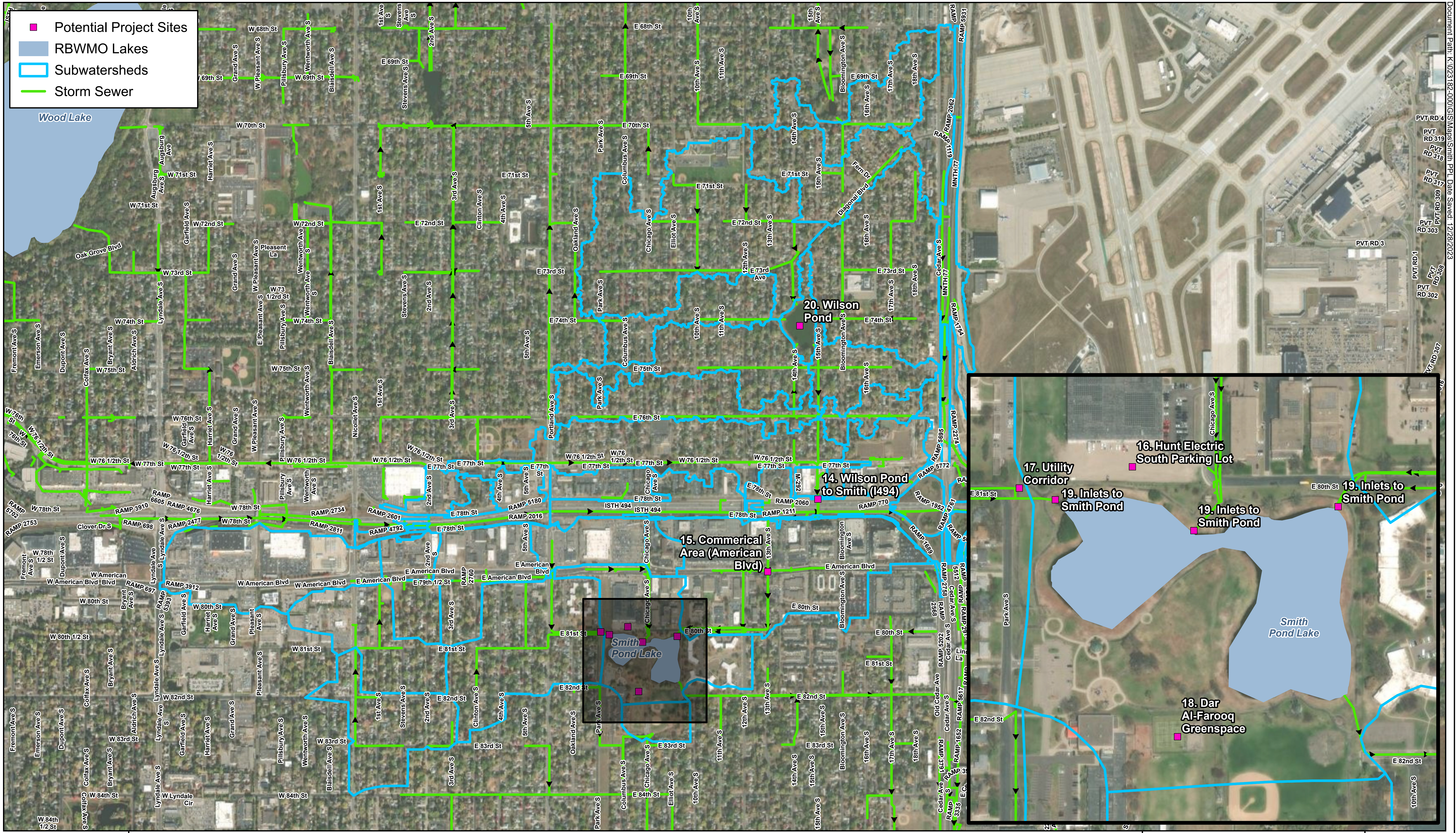

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Figure 20 - Smith Pond Lake Potential Projects

RBWMO Feasibility Study

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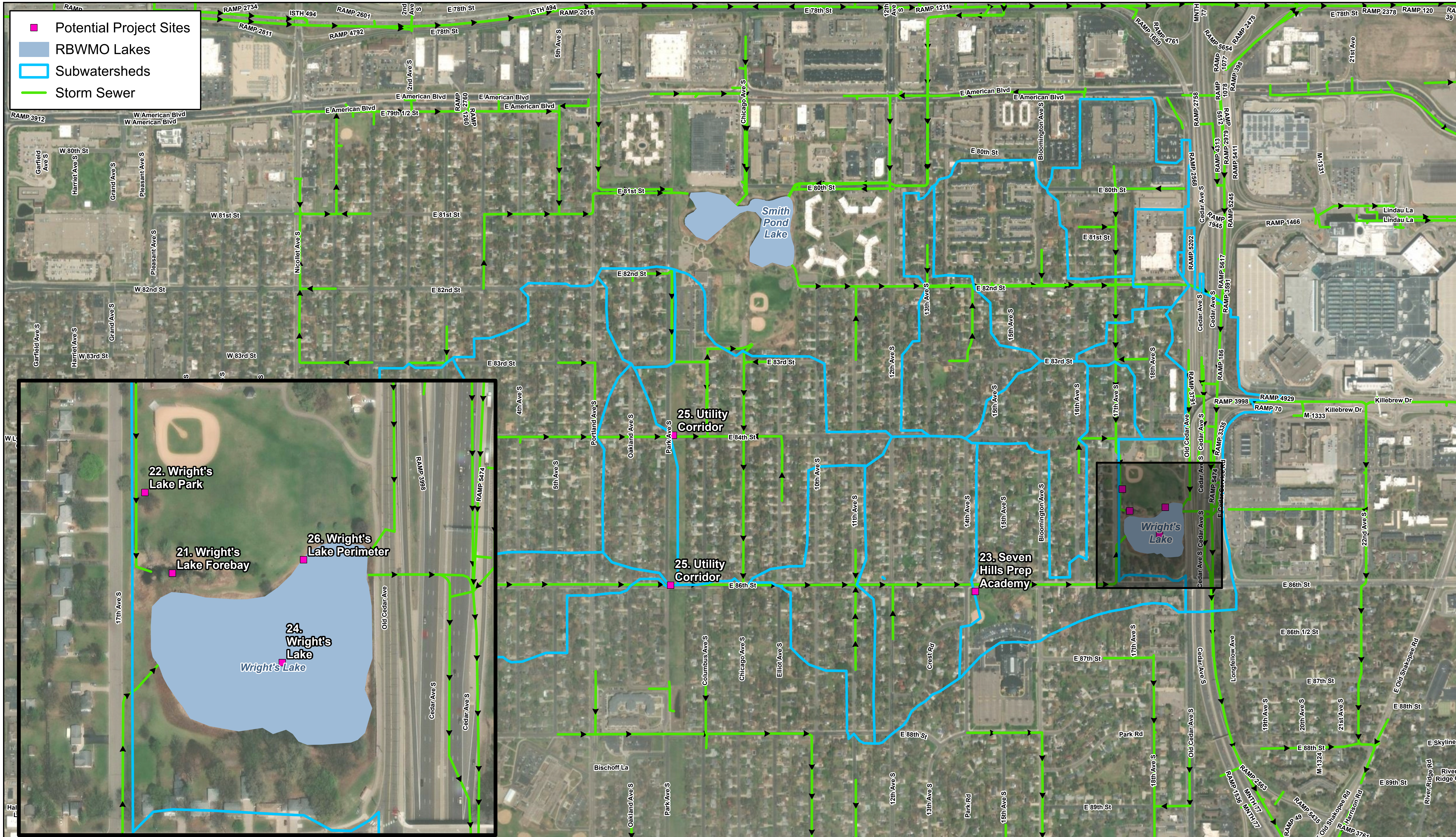

Figure 21 - Wright's Lake Potential Projects

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Funding

Funding sources vary by project type and potential partnerships. In addition to stormwater utility funds, funds may be secured through grants or cost-sharing programs through project partnerships (MnDOT, Hennepin County, Richfield, Bloomington, Private). A list of funding sources with associated information on applications, award amounts, and eligibility is shown in Table 10.

It is recommended to maintain flexibility in project planning in order to adapt to potential grant and/or partnership funding sources as they become available.

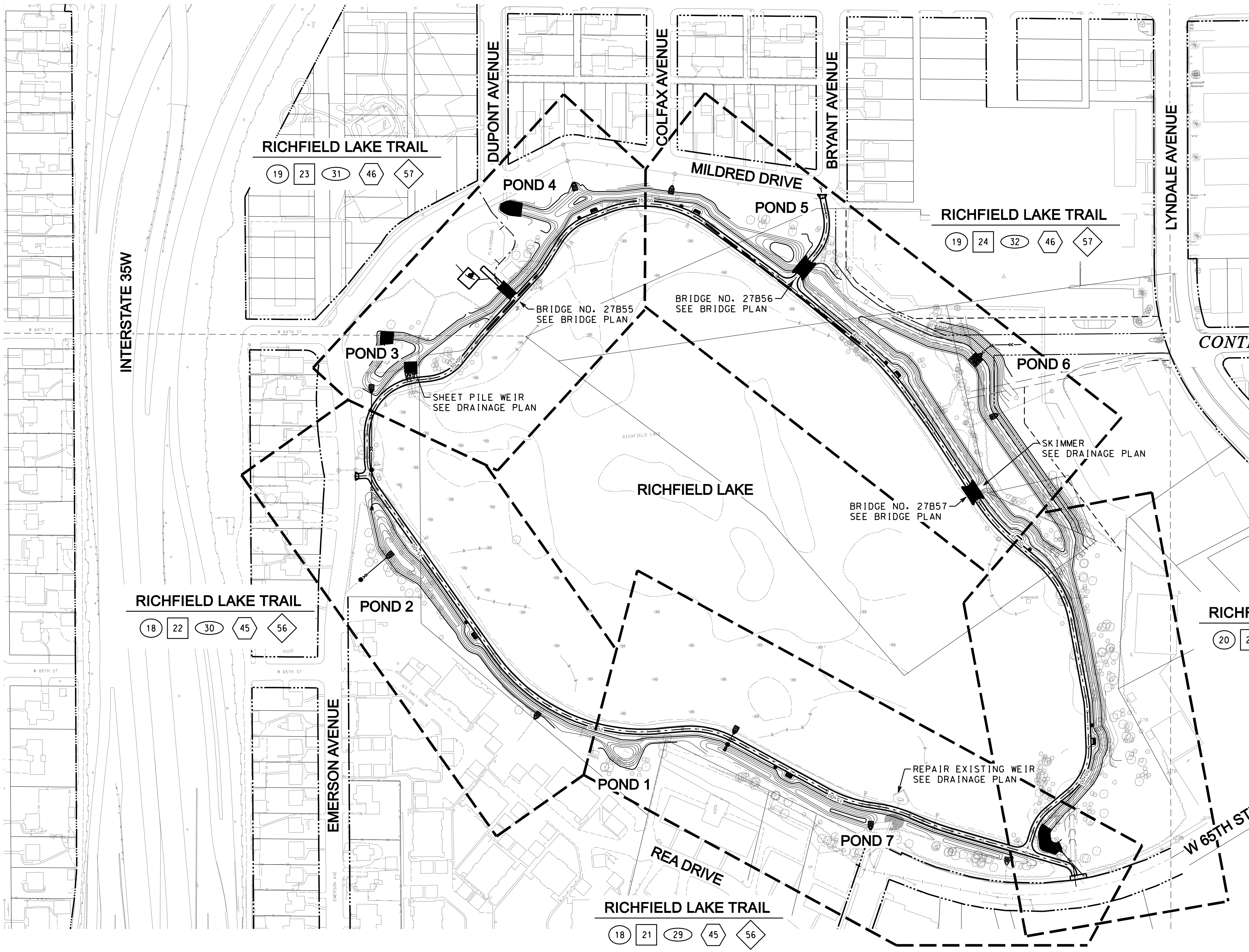
Table 10: Funding Sources

	Application Window	Award Window	Funding Cycle	Amounts	Eligibility
BWSR Clean Water Fund	Application open July-August	December	Every 2 years	Competitive: $100K-500K with min 25% match.	Projects must be on an approved stormwater plan, focus on water quality improvements.
BWSR Watershed Based Implementation Funding	N/A	N/A	Every 2 years	$114,644 (2025)	Projects must be identified in the watershed management plan.
MPCA Point Source Implementation Grant	Application open July 1-31, MPCA PPL due in June	Construction in spring/summer of the year following the grant award.	Every year	Competitive: 80% of eligible costs, up to $7 million	Must be approved on MPCA's project priority list (approval due in June).
MPCA Implementation for Stormwater Resilience	Application due April 11	FY24	New	Competitive: max $5 million with min 10% match.	Increase resilience to impacts of climate change.
DNR Flood Hazard Mitigation	Application due June 1	Costs must be incurred and paid before reimbursement can be made.	Every year	Competitive: 50% of eligible costs, up to $150K.	Projects including flood damage reduction studies for planning and implementing structural and non-structural measures.
DNR Conservation Partners Legacy Grant Program (CPL)	August-September	December	Every year	Competitive: $5K-500K, 10% match required.	The CPL program is habitat-focused. Grant activities include the enhancement, restoration, or protection of forests, wetlands, prairies, and habitat for fish, game, or wildlife in Minnesota.

Lessard-Sams Outdoor Heritage Council (LSOHC)	May	July (following year)	Every year	Minimum request $500K, otherwise directed to Conservation Partners Legacy Program.	Projects that relate to the restoration, protection, and enhancement of wetlands, prairies, forests, and habitat for fish, game, and wildlife, and that prevent forest fragmentation, encourage forest consolidation, and expand restored native prairie.
Hennepin County Natural Resources Grant (Opportunity Grant)	Rolling	Rolling	Every year	Competitive: Typical funding amount of $25K-50K; maximum funding amount of $50K. No match required.	Ideal for larger projects seeking to leverage multiple funding sources from more than one partner. Ideal for projects identified in the watershed management plan.
Hennepin County Natural Resources Grant (Aquatic Invasive Species Prevention Grant)	November-January	March	Every year	Typical project awards will range from $5,000 to $25,000, with a maximum project award of $50,000. No match required.	Prevention activities: early detection, pathway analysis, education, decontamination, water access re-design, research, management, other.
Legislative-Citizen Commission on Minnesota Resources (LCCMR)	January-March. Pre-application before this deadline.	July	Every year	Competitive: no match required.	Categories include foundational natural resource data and information; water resources; environmental education; aquatic and terrestrial invasive species; air quality, climate change, and renewable energy; methods to protect or restore land, water, and habitat; land acquisition, habitat, and recreation; and small projects (under $250K).

Appendix A

Richfield Lake Trail



CONTRACTOR: VEIT SPECIALTY CONTRACTING AND WASTE MANAGEMENT

** RECORD DRAWING 2008 **

RECORD DRAWING

INFORMATION IS FURNISHED WITHOUT WARRANTY AS TO ACCURACY. USERS SHOULD FIELD VERIFY LOCATIONS AND ELEVATIONS.

THIS DRAWING IS OUR RECORD KNOWLEDGE OF THE PROJECT AS CONSTRUCTED

PETER R. WILLENBRING, P.E. – PROJECT ENGINEER, WSB & ASSOCIATES

STEVE CRAWFORD – CONSTRUCTION OBSERVER, WSB & ASSOCIATES

JULY 2008

LEGEND

SHEET NO.	DESCRIPTION
(XXX)	MISCELLANEOUS REMOVALS
[XX]	CONSTRUCTION PLAN & PROFILE
(XXX) oval	DRAINAGE AND SUPERELEVATION PLAN
⬡ XXX	TURF ESTABLISHMENT & EROSION CONTROL
◇ XX	LANDSCAPING PLAN

Date Printed: 8/8/2008
WSB Filename: k:\0532-10\cad\record plan\532gl-1.dgn

NO.	DATE	BY	CHK	REVISIONS

Design By: NEH/TAW
Plan By: CWK/TAW
Checked By: RCH
Approved By: PRW

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

CERTIFIED BY [signature] LICENSED PROFESSIONAL ENGINEER – PETE WILLENBRING, PE

DATE: 09/20/07 LIC. NO: 15998

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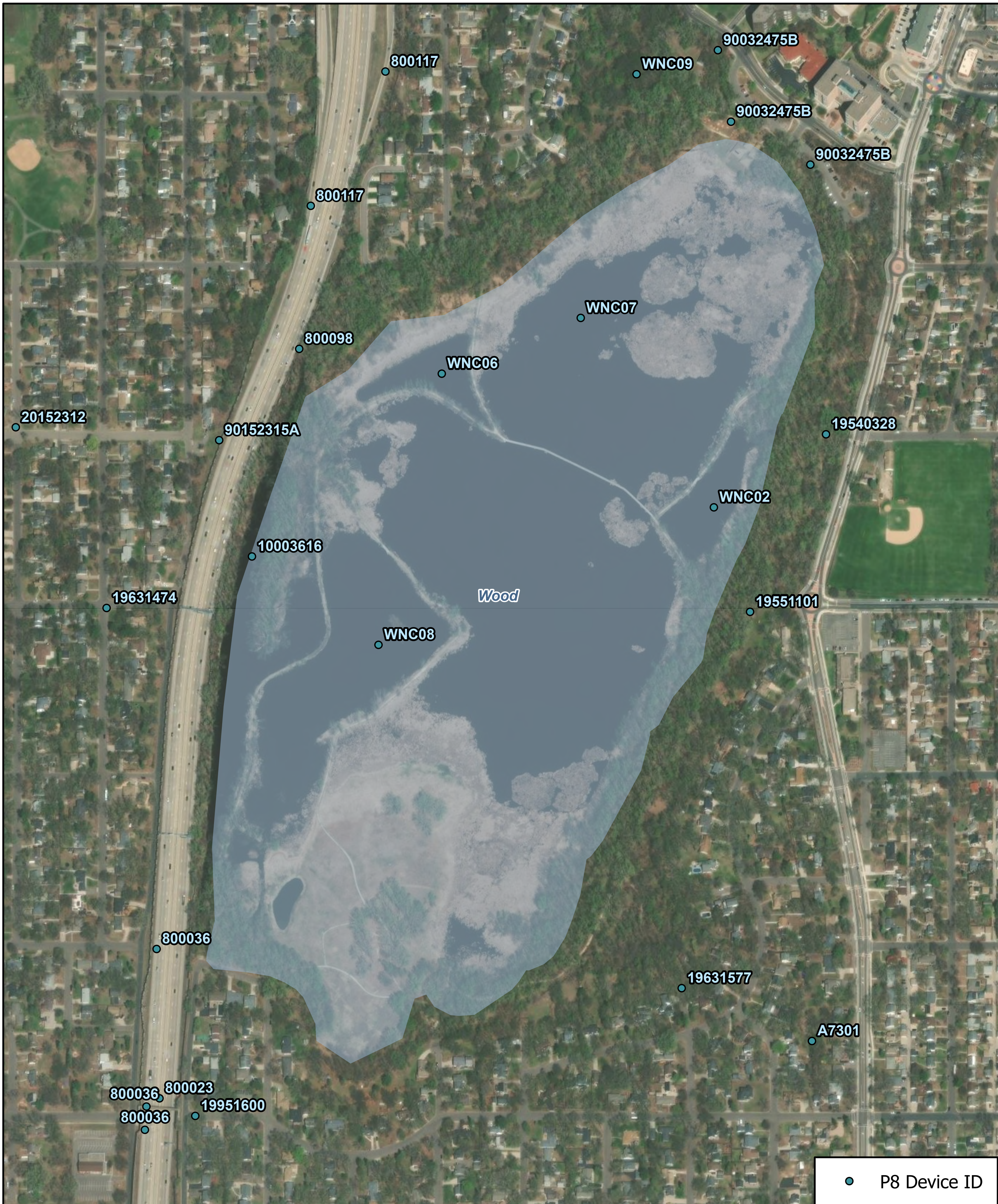
CITY OF RICHFIELD

Richfield Lake Improvements
City of Richfield, Minnesota

CITY OF RICHFIELD, MINNESOTA

GENERAL LAYOUT
S.P. 2782-292 (TH 35W) CITY PROJ. NO. 5300 - 1

SHEET 2 OF 72 SHEETS



Wood Lake Device IDs

RBWMO Feasibility Study

N

0 500 Feet

1 inch = 500 feet

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