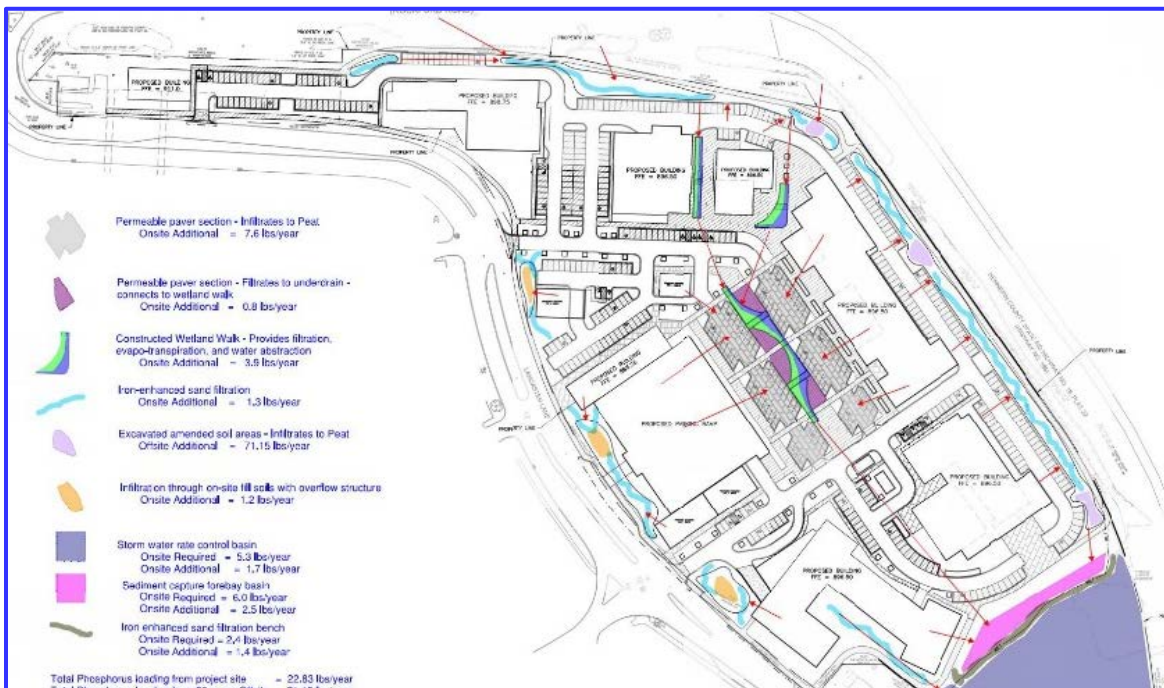


# Agora Development

## Enhanced Stormwater

## Treatment Summary



To: Bassett Creek Watershed Management Commission & City of Plymouth

From: Solution Blue, Inc.

Date: 08-10-16



# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

## Project Introduction

The Agora project is a redevelopment of the existing Four Seasons shopping mall at Hwy 169 and Rockford Road in Plymouth. Rock Hill Management's vision for the site is to create a vibrant and inspiring community where people can live, work, stay and play. Throughout the site there will be places for area residents to gather, exercise and also relax. The project will include 80,000 sq ft of retail, two hotels, a senior housing apartment with 120 dwelling units and an increase amount of green space.

Currently, the site is almost 100% impervious and covered with a bituminous surface. The proposed development incorporates a wetland pond, walking paths, infiltration basins, native plantings, tree trenches and a central "Wetland-Walk" plaza that can accommodate larger events such as outdoor movies, concerts and farmers' markets.

Per the "Minimal Impact Design Standards (MIDS)" flexible treatment options, the site will be required to achieve rate control to existing conditions, provide non-degradation of suspended solids, removal of 60% Phosphorus, and provide volume abstraction to the extent practicable due to the poor site soil conditions with regard to infiltration. The proposed plan will achieve these regulations by enhancing an existing wetland into a stormwater wetland feature with a forebay that includes an iron-enhanced sand filter bench, infiltration practices at locations where applicable, filtration practices in swales and permeable pavements, and through pollutant uptake and removal via wetland plantings and harvesting. Additionally, the project team would like to explore discussions with Bassett Creek Watershed District to enhance the stormwater Best Management Practices on-site to contribute to phosphorus reductions to adjacent regional systems including Northwood Lake. If a successful public/private partnership can be established, significant nutrient loading reductions to the regional watershed can be achieved.

## Stormwater Philosophy

Stormwater and water management stewardship contribute to a healthy community where residents and visitors are encouraged to acknowledge and interact with their surrounding environment. In this development, stormwater management is layered into green spaces where it is displayed as an amenity space and place making, rather than hidden or managed as often-neglected ponds, underground tanks & rain gardens. These layered "green infrastructure" systems range from highly designed hard-edged stormwater features to more natural wetland-style filtration basins. By combining gathering space, walkways, walls and other site features with stormwater systems, the design intends to create managed spaces that celebrate water as an integral component of place making and healthy communities.



# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

As the project team began exploring the opportunities and challenges of redeveloping this complex site, we identified a unique opportunity to celebrate sustainable stormwater management as a key project identifier.

The City of Plymouth and the Bassett Creek Watershed Management Commission (BCWMC) commissioned the development of this Feasibility Study to select an approach for water quality improvements for the North Branch subwatershed south of County Road 9 and west of Northwood Lake. The goal of the project was to evaluate a suite of Best Management Practices (BMPs) and/or capital projects to reduce total suspended solids and phosphorus loading with a target load reduction of 73 pounds of phosphorus per year.

In July of 2012, the Four Seasons Mall Water Quality Improvement Feasibility Report was published and several potential options were identified including:

- A. Regional water quality ponding improvements within basin NB07 including wetland mitigation
- B. Water quality ponding improvements on the City of New Hope's outlot east of Highway 169
- C. Alum treatment, including the possibility of an alum dosing plant, near pond NB07
- D. Wetland restoration and habitat improvement under Minnesota Rule 8420.0420 Subp. 9.
- E. Stream restoration from Lancaster Lane to the west
- F. Flow restriction at the outlet of Pond NB07 to improve the water quality function of the pond
- G. A partnership with the Four Season Mall Property to develop improvements that meet the BCWMC goals and development requirements of the City as well as identify additional areas that may increase pollutant reductions.

The ultimate goal of the project was to develop a project or a suite of projects to reduce 73 pounds/year or more of phosphorus loading to Northwood Lake. From the seven projects that were initially chosen as potential candidates for reaching a goal of 73 lb/year removal of phosphorus from the North Branch subwatershed in Plymouth. This list was refined into two scenarios through field investigations and coordination between the City of Plymouth and other government agencies. The scenarios presented in the Feasibility study are watershed ponding and stream restoration (scenario 1) and stormwater collection and alum injection (scenario 2).

Both scenarios were predicted to be effective at reaching the 73 lb/year phosphorus removal goal. Scenario 1 removes a total of 105 lbs of phosphorus per year and had a total then (2012) construction cost estimate of \$939,831. The 30-year lifecycle cost for scenario 1 is \$1,068,667. Scenario 2 was predicted to remove a total of 89 pounds of phosphorus per year and had a then (2012) cost estimate of \$1,205,826. The 30-year lifecycle cost of scenario 2 was estimated to be \$1,853,345.

It is our understanding that the Capital Improvement project based on Scenario 1 was chosen and initial preparations to proceed with Scenario 1 have been initiated.

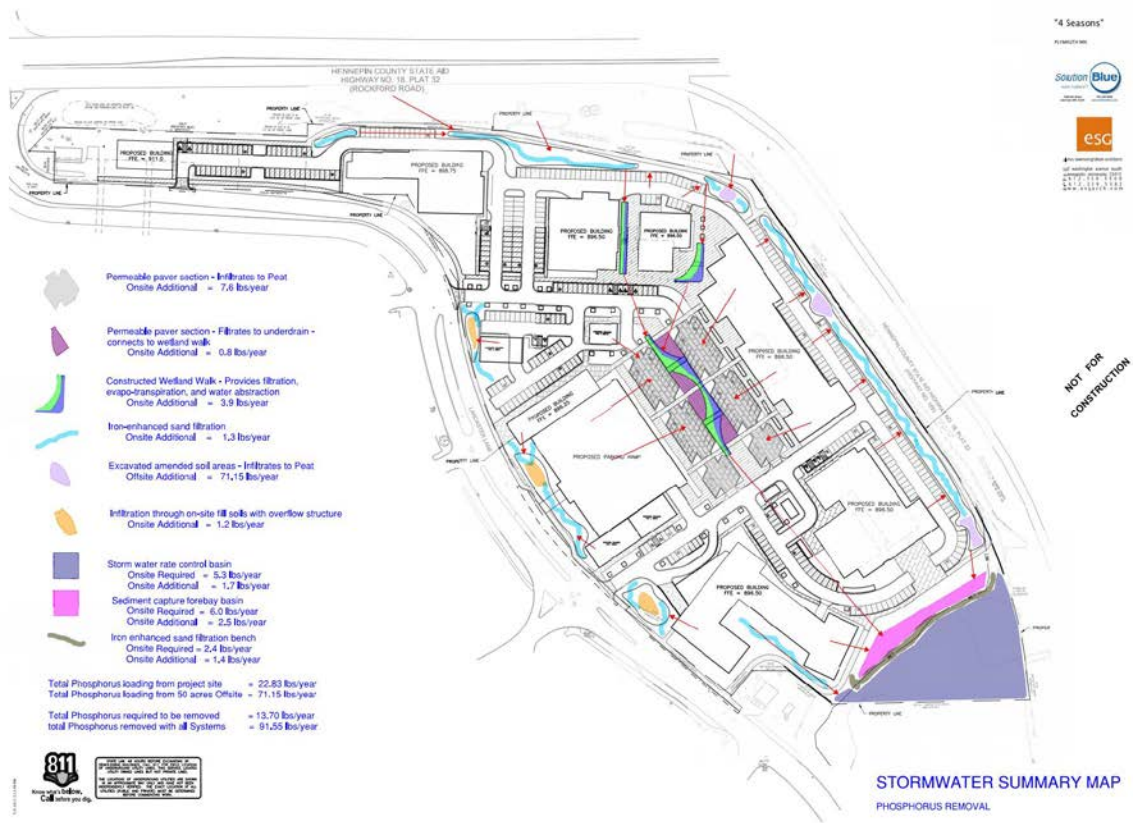
# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

## Public/Private Partnership

At this time, Rock Hill Management (RHM) would like to explore a partnership with the Four Seasons Mall Property and City of Plymouth/BCWD to develop improvements that can contribute to the water quality improvement desired by regional stakeholders.

RHM is willing to explore constructing enhanced stormwater features that help meet the objectives of the Four Season Mall Water Quality Feasibility Report. RHM, in partnership with the City of Plymouth, would like to request that a portion of the funding previously allocated to Scenario I be redirected to the enhanced stormwater treatment amenities on the Agora Site.

## Treatment Summary



# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

## Required Onsite Treatment

The required stormwater regulations for the redevelopment of the Agora project will utilize the Minimal Impact Design Standards (MIDS) flexible treatment options guidance. The project site has several feet of clay/fill soils that have minimal to no infiltration capacity. The site conditions fall to MIDS guidance flexible treatment option 2 that requires the project site to remove 60% of total phosphorus of the developed site and stormwater abstraction to the extent practicable.

The upstream stormwater flow will be conveyed by pipe to the downstream stormwater basin. Prior to discharge to the stormwater basin, the water will receive pretreatment by SAFL baffles and sump manholes. The downstream stormwater control for the site will be a two cell stormwater basin. The initial cell (forebay) is a sedimentation forebay that will allow particulate settlement. The second cell is a larger rate control basin that will also allow sediment settlement. In between the two cells is an iron-enhanced filtration bench. This bench, along with the forebay and large basin, provides the 60% phosphorus removal and controls the rate of release to meet existing conditions.



<b>Total Phosphorus loading of the project site</b>	=	<b>22.83 lbs/year</b>
Phosphorus removal by Forebay	=	6.00
Phosphorus removal by Iron-Enhanced bench	=	2.40
Phosphorus removal by rate control basin	=	5.30
<b>Total Phosphorus removal</b>	=	<b>13.70 lbs/year (60%)</b>

# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

## Additional Onsite Treatment

Additional treatment practices that exceeds the requirements needed for the redevelopment of this property may include permeable pavement infiltration with amended soils, wetland walk treatment, vegetation removal, iron-enhanced filtration swales, shallow bio-infiltration basins, and tree trenches. These additional devices will provide further benefit to the on-site stormwater as well as treat and infiltrate a nominal amount of off-site drainage. These practices will increase phosphorus removal, provide substantial stormwater abstraction, and further improve the stormwater rate control.



<b>Total Phosphorus loading of the project site</b>	=	<b>22.83 lbs/year</b>
Phosphorus removal by additional systems	=	14.80 lbs/year (upstream of BMPs Below)
Phosphorus removal by Forebay	=	2.50 lbs/year
Phosphorus removal by Iron-Enhanced bench	=	1.40 lbs/year
Phosphorus removal by rate control basin	=	1.70 lbs/year
<b>Total Phosphorus removal</b>	=	<b>20.40 lbs/year (89%)</b>

# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

## Treatment of Offsite water

Additional treatment practices within the proposed project limits may be designed to accept and handle off-site drainage. The additional treatment practices may include a constructed wetland, amended soils to allow infiltration, and a large peat layer that acts as a large storage basin. The additional treatment practices will require amending existing clay/fill soils to an acceptable filtration soil media from finished grade to a buried peat layer that will be accepting of large volumes of water. The constructed wetland can be a feature that will be highly visible and can provide continuous water circulation. The wetland walk will abstract water and phosphorus through plant uptake and fall vegetation removal.



<b>Total Phosphorus loading of the project site</b>	=	<b>22.83 lbs/year</b>
<b>Total Phosphorus loading of offsite drainage</b>	=	<b>71.15 lbs/year</b>
Phosphorus removal by additional systems	=	14.80 lbs/year (upstream of BMPs Below)
Phosphorus removal by Infiltration to Peat	=	71.15 lbs/year
Phosphorus removal by Forebay	=	2.50 lbs/year
Phosphorus removal by Iron-Enhanced bench	=	1.40 lbs/year
Phosphorus removal by rate control basin	=	1.70 lbs/year
<b>Total Phosphorus removal</b>	=	<b>91.55 lbs/year (97%)</b>

# AGORA DEVELOPMENT - ENHANCED STORMWATER TREATMENT SUMMARY, AUGUST 2016

## Construction Cost Estimates

### Required On Site Treatment

<ul style="list-style-type: none"> <li>• SAFL Baffle (2)</li> <li>• Pond w/ Forebay with Iron enhanced Bench</li> </ul>	13.7 lbs/yr Phosphorus Removal
Construction Cost Estimate	\$375,000
Cost/ lbs Phosphorus removal	\$27,370

### Additional Treatment of Onsite and Offsite Waters

<ul style="list-style-type: none"> <li>• Permeable Pavers in Plaza w/ Sand Filter</li> <li>• Wetland Walk Vegetation removal</li> <li>• Wetland Walk engineered Soils w/ Recirculation</li> <li>• Infiltration Basins on West side</li> <li>• Bioswales on East Side</li> </ul>	77.85 lbs/yr Phosphorus Removal
Construction Cost Estimate	\$1,059,000
Cost/ lbs Phosphorus removal	\$13,600



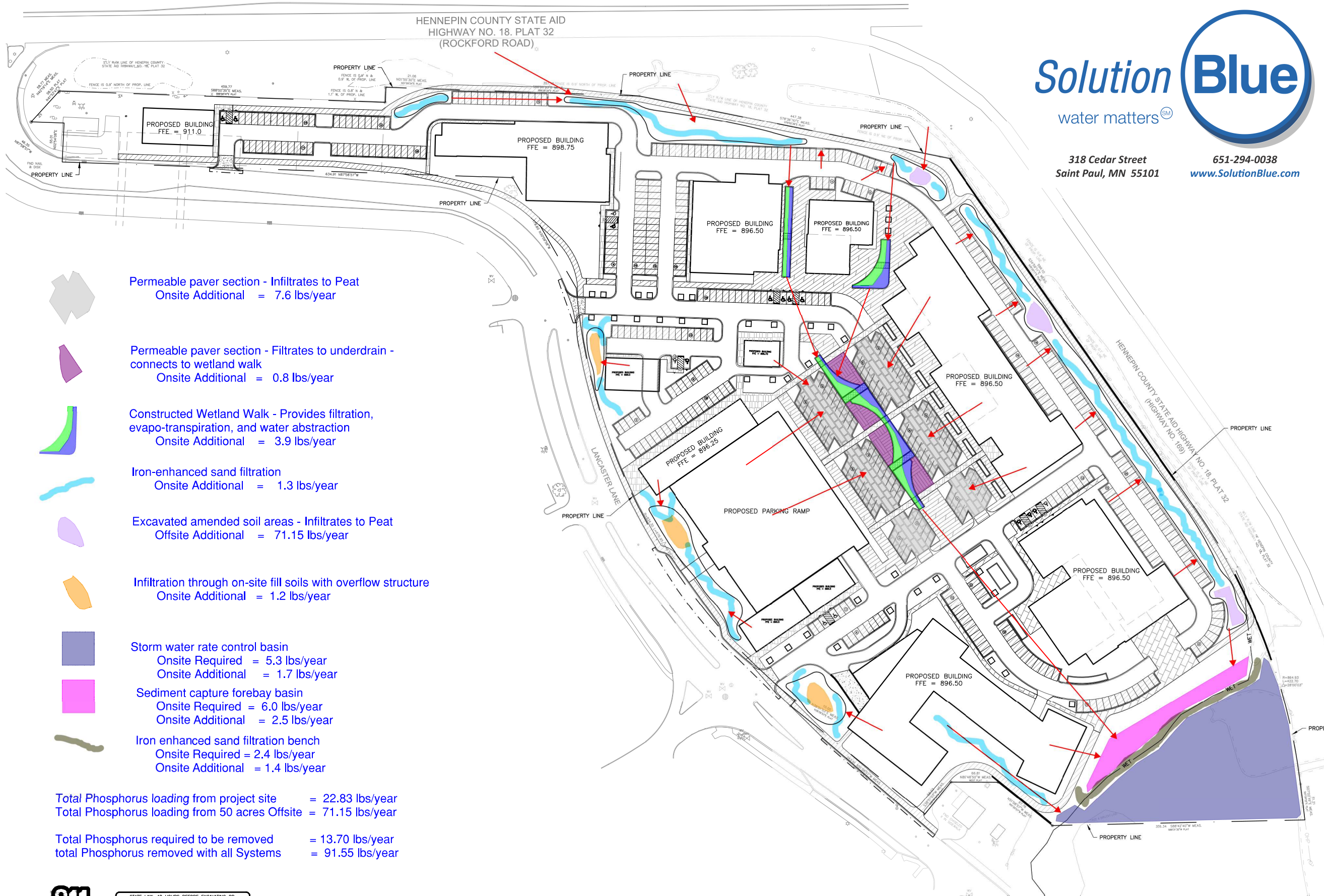


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NOT FOR CONSTRUCTION

Permeable paver section - Infiltrates to Peat  
Onsite Additional = 7.6 lbs/year

Permeable paver section - Filtrates to underdrain - connects to wetland walk  
Onsite Additional = 0.8 lbs/year

Constructed Wetland Walk - Provides filtration, evapo-transpiration, and water abstraction  
Onsite Additional = 3.9 lbs/year

Iron-enhanced sand filtration  
Onsite Additional = 1.3 lbs/year

Excavated amended soil areas - Infiltrates to Peat  
Offsite Additional = 71.15 lbs/year

Infiltration through on-site fill soils with overflow structure  
Onsite Additional = 1.2 lbs/year

Storm water rate control basin  
Onsite Required = 5.3 lbs/year  
Onsite Additional = 1.7 lbs/year

Sediment capture forebay basin  
Onsite Required = 6.0 lbs/year  
Onsite Additional = 2.5 lbs/year

Iron enhanced sand filtration bench  
Onsite Required = 2.4 lbs/year  
Onsite Additional = 1.4 lbs/year

Total Phosphorus loading from project site = 22.83 lbs/year  
Total Phosphorus loading from 50 acres Offsite = 71.15 lbs/year

Total Phosphorus required to be removed = 13.70 lbs/year  
total Phosphorus removed with all Systems = 91.55 lbs/year



Know what's below.  
Call before you dig.

STATE LAW: 48 HOURS BEFORE EXCAVATING OR DEMOLISHING BUILDINGS, CALL 811 FOR FIELD LOCATION OF UNDERGROUND UTILITY LINES. THIS SERVICE LOCATES UTILITY OWNED LINES BUT NOT PRIVATE LINES.  
THE LOCATIONS OF UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED. THE EXACT LOCATION OF ALL UTILITIES (PUBLIC AND PRIVATE) MUST BE DETERMINED BEFORE COMMENCING WORK.

### STORMWATER SUMMARY MAP

PHOSPHORUS REMOVAL