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HOSTS



OPTIMIZING OPERATIONS AND MAINTENANCE OF LID BMPS

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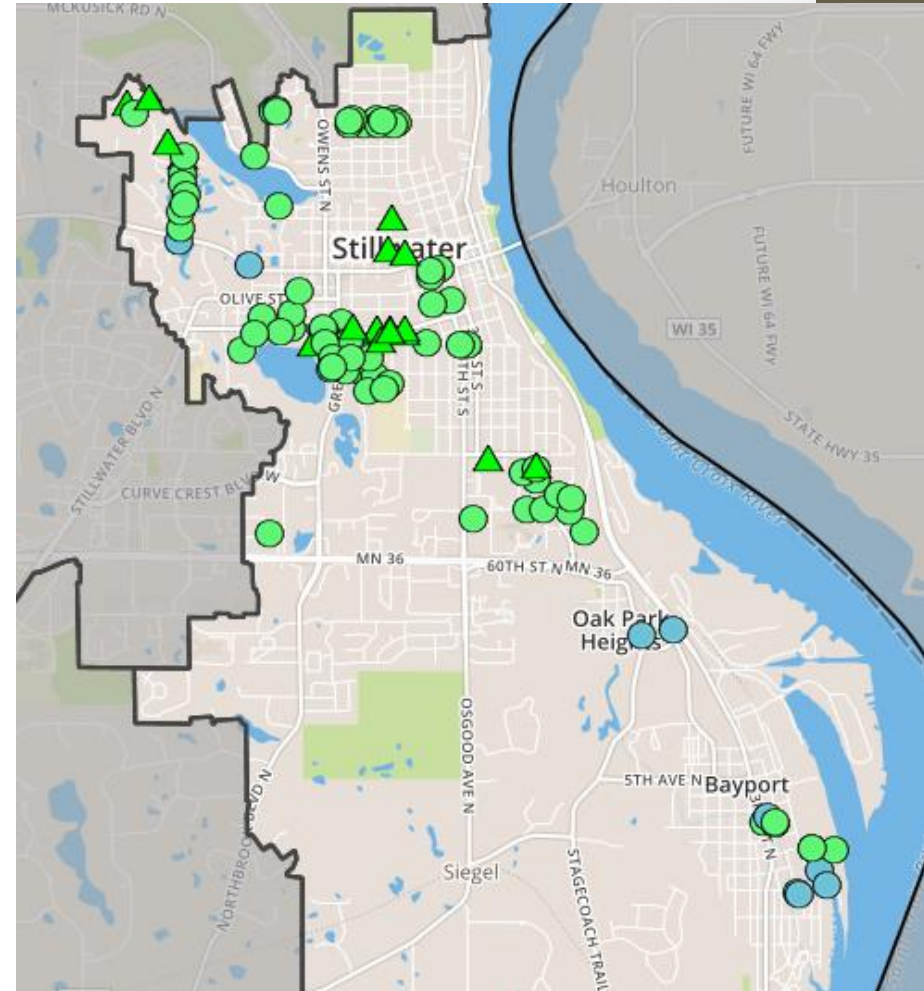
WASHINGTON
CONSERVATION
DISTRICT



operations and maintenance

MSCWMO Development and TMDL BMPs

- Create or fully reconstruct 560 m² impervious surface
- MIDS- 25 mm or 12.5 mm
- Retrofit bioretention basins each year to address TMDLs.
- Annual inspections of 111 bioretention BMPs.



Development and TMDL BMPs

- Volume reduction required on projects disturbing 0.4 hectare or more of land
- New development and redevelopment
- Annual inspections
300+ BMPs



Geospacial Tracking & Inspections

There's An App For That!

2016 Inspection Results - Microsoft Excel

2016 Inspection Results																																			
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1	Practice I	Practice I	Practice I	Practice I	Practice I	Current P	Current P	Current P	Inspection	Di	M	M	SH	IS NOW	Comments	Pre-	Inlets	Inlet Maintenance	Hydr.	Hydraulic Functio	Vege	Vegetative Man.	Mulc	Mulc	Over	Over	Struc	Struc	Latitude	Longitude	the_geom				
2	Riverside Park West	1	4	MSCVM	CITY OF I 294 3RD : BAYPOF	7/21/2016	1	1	1	1	1	1	1	1	1	Standing water	2	1	1	Standing water	7	Barely any plants	4	1	1	1	1	1	45.0171	-92.7753	POINT (45.0170664003642 -92.77524				
3	309 2nd A	10/1/2011	1	4	MSCVM	UN CHAF 293 N 3RD BAYPOF	7/21/2016	1	1	1	1	1	1	1	1	1	Standing water and areas without pla	2	1	1	Standing water an	7	1	1	1	1	1	1	45.0188	-92.7796	POINT (45.018784166478 -92.779627				
4	327 Harrik	7/1/2014	3	67	MSCVM	CITY OF I 216 4TH S STILLWA	6/13/2016	3	1	1	1	1	1	1	1	3	All Good	2	3	Sediment is clogging	2	2	Garden us overr	1	1	1	1	1	45.0583	-92.8142	POINT (45.058305295058 -92.814156				
5	294 3rd St N Infiltrati	7/21/2016	1	15	MSCVM	CITY OF I 294 3RD : BAYPOF	7/21/2016	1	1	1	1	1	1	1	1	1	Entire basin is underwater.	2	1	1	Entire basin is unc	1	1	1	1	1	1	1	45.0156	-92.7745	POINT (45.01564230816 -92.774507				
6	294 3rd St N Infiltrati	7/21/2016	1	15	MSCVM	CITY OF I 294 3RD : BAYPOF	7/21/2016	1	1	1	1	1	1	1	1	1	Standing water in entire basin.	2	1	1	Standing water in	1	1	1	1	1	1	1	45.0148	-92.7738	POINT (45.014754827603 -92.773790				
7	922 Abbo	11/5/2011	3	67	MSCVM	CARROL 922 ABBI STILLWA	6/9/2016	3	1	1	1	1	1	1	1	1	1	9	Sod has built up and i	2	1	1	1	1	1	1	1	45.0493	-92.8181	POINT (45.049254716008 -92.818002					
8	620 Eagle Ridge Tra	7/21/2016	1	4	MSCVM	HANDRA 620 EAGL STILLWA	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	The basin has standing water over 6	2	1	1	1	1	1	1	1	45.0612	-92.8336	POINT (45.061241258797 -92.833560					
9	Valley Rid	7/21/2016	1	23	MSCVM	VALLEY F 6020 91ST PARKLA	7/21/2016	2	1	1	1	1	1	1	1	1	1	5	1	Standing water in basin.	2	1	1	1	1	1	1	1	45.0365	-92.8226	POINT (45.03647 -92.826008)				
10	324 Wilkir	5/31/2012	1	4	MSCVM	SEVERIN 324 WILKI STILLWA	6/13/2016	3	1	1	1	1	1	1	1	1	All Good	2	9	Remove plants and w	2	2	1	1	1	1	1	1	45.0649	-92.8152	POINT (45.064851817324 -92.8151545				
11	Willard and 6th St. R.	7/21/2016	1	4	MSCVM	WEBER K 418 WILLA STILLWA	7/8/2016	2	1	1	1	1	1	1	1	1	All Good	2	3	Sediment and plant d	2	2	1	1	1	1	1	1	45.0502	-92.8109	POINT (45.050217530457 -92.810912				
12	716 Willard	7/1/2014	3	67	MSCVM	FRANK F 716 WILLA STILLWA	6/13/2016	3	1	1	1	1	1	1	1	1	1	1	1	Third photo is of sediment and wate	2	3	Sediment and debris i	2	1	1	1	1	45.0504	-92.8152	POINT (45.05034745684801 -92.8152				
13	2nd Avenue N Baypr	7/21/2016	1	23	MSCVM	O	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	Standing water throughout basin.	2	4	Sediment needs to be	1	1	1	1	1	45.0189	-92.7787	POINT (45.018865006361 -92.778650				
14	410 Rice S	7/1/2014	3	67	MSCVM	MCKINNI 410 RICE STILLWA	6/13/2016	3	1	1	1	1	1	1	1	1	1	1	1	Raingarden is on a steep slope.	2	3	Sediment has clogge	2	1	1	1	1	45.0566	-92.8131	POINT (45.0566039575882 -92.812395				
15	824 Greel	11/5/2011	1	23	MSCVM	O	6/9/2016	3	1	1	1	1	1	1	1	1	1	1	1	Looks like no water enters raingarde	2	9	There is no inlet for w	2	1	1	1	1	45.0487	-92.8197	POINT (45.04866774 -92.81973066)				
16	Anderson Building 1	7/21/2016	1	15	MSCVM	ANDERS 100 FOUR BAYPOF	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	Sediment needs to be	2	4	7	There are barely	1	1	1	1	45.0141	-92.7765	POINT (45.014052089729 -92.776505				
17	Eagle Ridge North o	7/21/2016	1	4	MSCVM	CITY OF I 216 4TH S STILLWA	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	Deep standing water and cattails in t	2	1	1	1	1	1	1	1	45.06	-92.8333	POINT (45.059390142025 -92.833333				
18	Eagle Ridge South c	7/21/2016	1	4	MSCVM	CITY OF I 216 4TH S STILLWA	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	There is deep standing water in the r.	2	1	1	1	1	1	1	1	45.0594	-92.8334	POINT (45.059380070698 -92.833411				
19	750 Amur	10/1/2011	1	4	MSCVM	CARLSO 750 AMU STILLWA	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	1	3	Sediment has collect	2	1	1	1	1	1	45.0625	-92.8269	POINT (45.062459460687 -92.82693				
20	505 Wilkir	5/31/2012	1	4	MSCVM	ALLEN K 505 V WIL STILLWA	6/13/2016	3	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment has accum	2	1	1	1	1	45.0646	-92.8168	POINT (45.06459360685401 -92.8168				
21	1308 Pine	11/5/2011	1	4	MSCVM	TUMA TH 1308 PINE STILLWA	6/9/2016	3	1	1	1	1	1	1	1	1	1	1	1	1	3	Homeowner says he	2	1	1	1	1	1	45.0512	-92.8236	POINT (45.05117257981001 -92.82355				
22	703 Pine	7/1/2014	3	67	MSCVM	LAMANN 703 PINE STILLWA	6/10/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment and debris i	2	1	1	1	1	45.0509	-92.8155	POINT (45.050908356558 -92.815535				
23	1055 Amu	10/1/2011	1	4	MSCVM	OSTER J 1055 AML STILLWA	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment in rock inlet	2	1	1	1	1	45.0654	-92.8253	POINT (45.065380765986 -92.82528				
24	Beyer Rai	6/15/2011	1	4	MSCVM	BEYER A 904 CHUR STILLWA	7/21/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Debris and weeds shc	2	1	1	1	1	45.0484	-92.8172	POINT (45.048442463331 -92.817186				
25	Riverside Park East	7/21/2016	1	4	MSCVM	CITY OF I 294 3RD : BAYPOF	7/21/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	3	7	Large empty are.	1	1	1	1	45.017	-92.7731	POINT (45.016964254269 -92.773139				
26	401 Wilkir	5/31/2012	1	4	MSCVM	THOMPS 401 V WIL STILLWA	6/13/2016	3	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment has accum	2	1	1	1	1	45.0646	-92.8154	POINT (45.064584214295 -92.815402				
27	821 Pine S	7/1/2014	3	67	MSCVM	ULRICH L 821 PINE STILLWA	6/10/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment and debris i	2	1	1	1	1	45.0509	-92.8177	POINT (45.050918726121 -92.8177271				
28	Lake St C	7/21/2016	1	4	MSCVM	CITY OF I 16455 20T LAKE ST	7/19/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Flood should be clear	2	1	1	1	1	44.9199	-92.7731	POINT (44.919921641404 -92.7731192				
29	Chestnut and 4th St.	7/21/2016	1	4	MSCVM	SIMONE I 120 CHEE STILLWA	7/8/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	3	Sediment piling up on	2	1	1	1	1	45.0551	-92.8097	POINT (45.055094644729 -92.809693				
30	241 2nd A	10/1/2011	1	4	MSCVM	R & D LAI 1101 LECU STILLWA	7/21/2016	1	1	1	1	1	1	1	1	1	1	1	1	1	2	4	7	Small bare area i	1	1	1	1	45.0187	-92.7787	POINT (45.018722280795 -92.778737				
31	704 Pine	7/1/2014	3	67	MSCVM	FITZSIMF 704 PINE STILLWA	6/10/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Debris and sediment	2	1	1	1	1	45.0511	-92.8155	POINT (45.05114407932 -92.8155243				
32	1034 Eagle	7/21/2016	1	67	MSCVM	MONTAK 1034 EAG STILLWA	7/22/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	3	Sediment is killing tur	2	1	1	1	1	45.0658	-92.8388	POINT (45.065839743171 -92.838757				
33	1015 5th S	5/31/2012	1	4	MSCVM	SHIMOT I 1015 N 5TH STILLWA	6/13/2016	3	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment has accum	2	1	1	1	1	45.0646	-92.8137	POINT (45.064621403133 -92.8136650				
34	604 Pine	7/1/2014	3	67	MSCVM	GANAPE 604 PINE STILLWA	6/10/2016	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	Sediment and debris i	2	1	1	1	1	45.0511	-92.8143	POINT (45.051139536637 -92.8143093				
35	701 Greeley St W Rai	7/21/2016	1	4	MSCVM	O	6/9/2016	3	1	1	1	1	1	1	1	1	1	1	1	1	2	5	Sod in the inlet has di	2	1	1	1	1	45.0502	-92.819	POINT (45.05021074 -92.81902215)				
36	Willard and 4th St. R.	7/21/2016	1	4																															

Inspections

Maintenance Priority

- A= Continue Annual Maintenance
- B= Aesthetics (weeding, inlet clean-out, invasive plant management)
- C= Restore partially functioning BMP (replacing plants, mulching, minor grading)



BMP Grading System

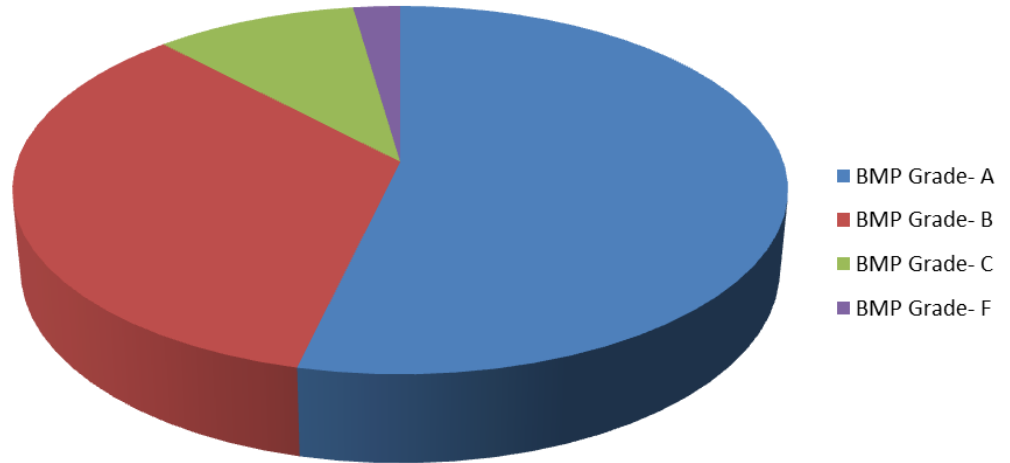
- D= Restore non-functioning BMP (full restoration)



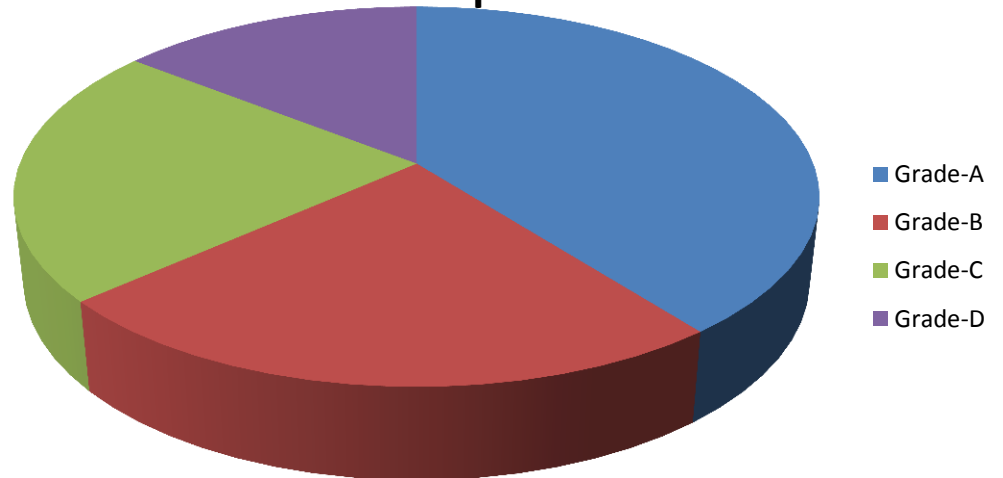
How are we doing?



RWMWD 2016 Inspection Results



MSCWMO 2016 Inspection Results



RWMWD Pilot Program

Two Projects

- Little Canada Bioretention Basins
 - 57 bioretention basins
 - 250 ft² (18.5-23.2 m²)
 - Ranged from 2-12 years old
 - No prior routine maintenance
- Living Streets
 - 31 Bioretention Basins
 - 200 ft² (18.5-23.2 m²) each
 - Newly installed
 - More formal plantings



RWMWD Program Results Summary

	Living St 2013	Living St 2014	Little Canada 2013	Little Canada 2014
Starting Grade	A	A	C	A
Avg Size	200	200	250	250
Total Hours	79	77.75	232.5	173
Total Cost	\$6,668	\$6,601	\$20,498	\$16,317
Avg cost/ garden	\$222	\$220	\$359	\$286
Avg time/garden	2.6	2.6	4.1	3.0

MSCWMO Program

Stillwater TMDL and Street Reconstruction BMPs

- 104 Bioretention Basins
 - 250 square feet
- 10% 2-5 years old
- 90% 5-12 years old
- Complaint driven maintenance.



MSCWMO Program Results Summary

	2015	2016	2017
Median Starting Grade	C+	C+	B
Total Number of Raingardens	111	104	104
Total Hours	416	480	232.5
Total Cost*	\$15,808	\$18,240	\$8,835
Avg cost/garden	\$141	\$175	\$84
Avg time/garden	3.7	4.6	2.2

*Calculated based on \$38 per hour

MSCWMO Program Results Details

Minnesota Conservation Corps Crew

- 13 crew days in 2015 and 2016
- Time includes mulching in 2015 and 2016.
- Sod inlet replacement in 2015.
- Plant replacements and watering in 2016.



Inspection Example

Constructed 2008

Inspections starting in 2013



Date	Maintenance Needed	Maintenance Priority	Pre-Treatment Maintenance Required	Inlets Maintenance Required	Inlet Maintenance Comment	Vegetative Management Required	Vegetative Management Comment	Mulching Required
11/18/2013	Yes	C Partially Functioning	Yes	Remove Sediment	Sediment has built up and stormwater is bypassing.	Weeding	Very weedy. Weeding needed.	No
9/9/2014	Yes	D Nonfunctional	Yes	Remove Sediment	Inlet sod is blocking water from entering the basin.	Weeding	Raingarden is becoming overgrown, weeding is necessary.	No
8/25/2015	Yes	D Nonfunctional	Yes	Remove Sediment	Sod is prohibiting water from entering the basin. Remove sod and lower inlet elevation and placing new sod.	Weeding	Weeding needed on the west side of the basin. Plant replacement needed on the east side of the basin. Needs 20 additional plants.	1 Inch Thick



2015 Weed Control, Inlet
sod replacement, Weed
Control, Plant
Replacement, Mulching,
Inlet sod watering.

2016 Annual Maintenance

2017 Annual Maintenance

Date	Maintenance Needed	Maintenance Priority	Pre-Treatment Maintenance Required	Inlets Maintenance Required	Inlet Maintenance Comment	Vegetative Management Required	Vegetative Management Comment	Mulching Required
8/25/2015	Yes	D Nonfunctional	Yes	Remove Sediment	Sod is prohibiting water from entering the basin. Remove sod and lower inlet elevation and placing new sod.	Weeding	Weeding needed on the west side of the basin. Plant replacement needed on the east side of the basin. Needs 20 additional plants.	2 Inch Thick
7/8/2016	Yes	B Aesthetics	No	No	No	Plants	20 Additional plants needed.	No
7/11/2017	No							

Reducing the Maintenance Burden



Reducing the Maintenance Burden

Inlets

- Rock Inlets: 1 hour per maintenance visit.
- 46 hours in 2016 picking rock.



Reducing the Maintenance Burden

Rain Guardian—Turret

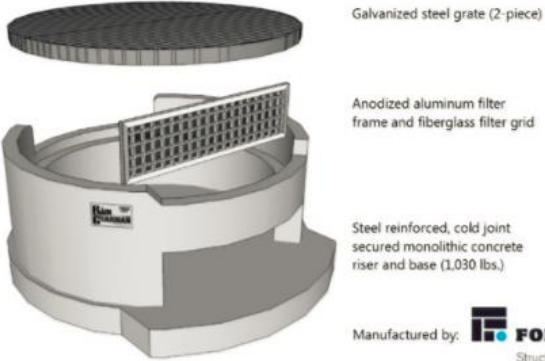
Standard exterior dimensions:

46" x 50" base, 19.5" total height

Turret prices:

Light-Duty Rated (541 lb. concentrated load)—Contact ACD

Heavy-Duty Rated (2,456 lb. concentrated load)—Contact ACD



Manufactured by: **FORTERRA**
Structural & Specialty



Rain Guardian—Bunker

Standard exterior dimensions:

51.25"L x 20"W x 15.75"H

Bunker price:

Light-Duty Rated (316 lb. concentrated load)—Contact ACD



Reducing the Maintenance Burden

Forebays



MDR Watershed 63,000 m²

Year 4 = 13 m² sediment



Reducing the Maintenance Burden

Spring Clean Up

- 45%-55% of annual maintenance time
- Annual Spring Raingarden Clean Up in 2018
 - 59 volunteers
 - 80 raingardens maintained.
 - Fun community event!
- Partnership with Lake Associations and Local Nonprofit.



Reducing the Maintenance Burden

Quantity of Raingardens to Actively Maintain



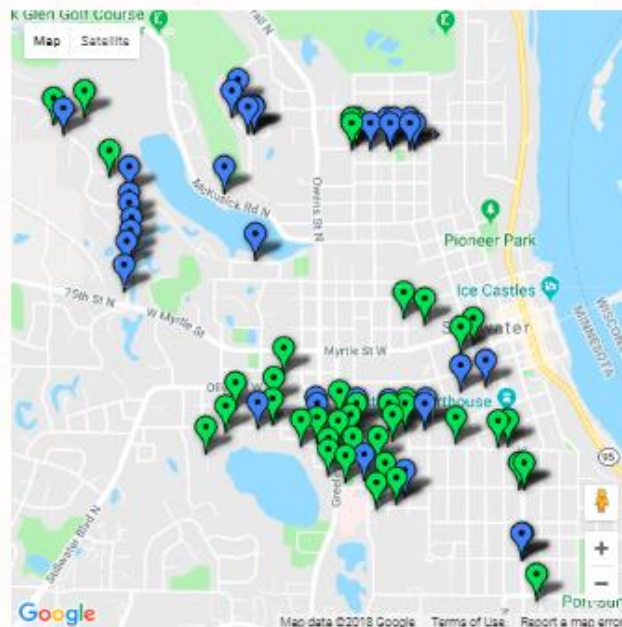
Since 2006, citizens and local government partners have installed more than 1000 raingardens in Washington County to protect our lakes, rivers and streams! Raingardens catch runoff from a rooftop, driveway or street and soak it into the ground before it can reach a storm sewer or nearby waterway. Raingardens also beautify our local communities and provide habitat for pollinators.

VOLUNTEER TO "ADOPT-A-RAINGARDEN" IN YOUR NEIGHBORHOOD TODAY!

Adopting a raingarden is a great way to build community, keep your neighborhood looking spiffy, protect your local lakes and rivers, and get fresh air and exercise!

HERE'S WHAT YOU'LL NEED TO DO

1. Use the map to find a raingarden in need of love and [sign-up using our on-line form](#)
 - We'll contact you in a few days to drop off materials and answer any questions you might have.
2. Visit your garden 2-3 times per year to weed, thin plants, pick up litter, and remove built-up sediment in the inlet.
3. Contact us if you notice any major problems with the garden, such as water not draining more than 48 hours after it rains.



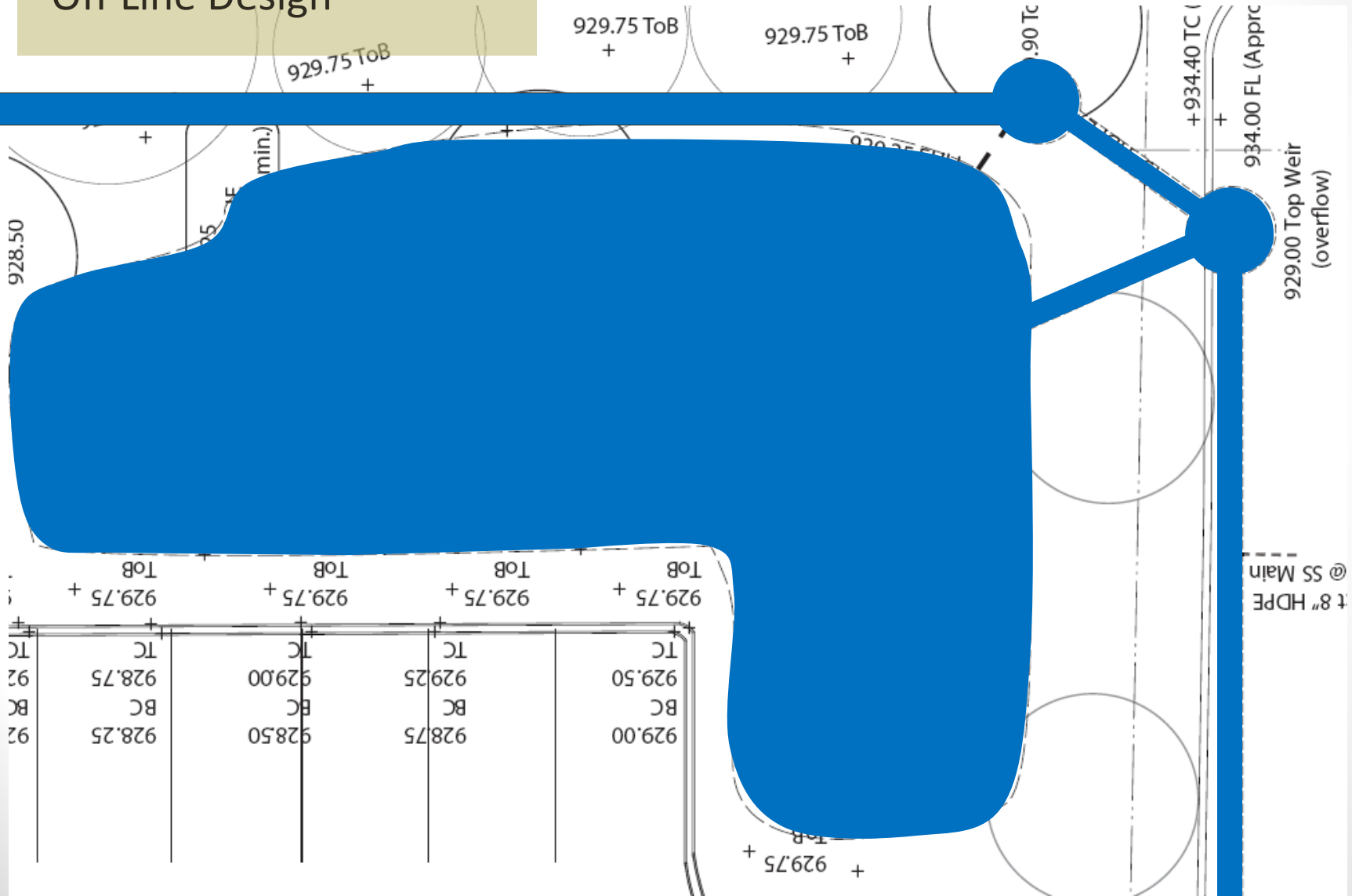
BLUE = ADOPT ME!

GREEN = ADOPTED

Construction Standards

Off Line Design

Off Line Design



Construction Standards

Off Line Design

Off Line Design



Reducing Future Non-Functional BMPs

Construction Standards

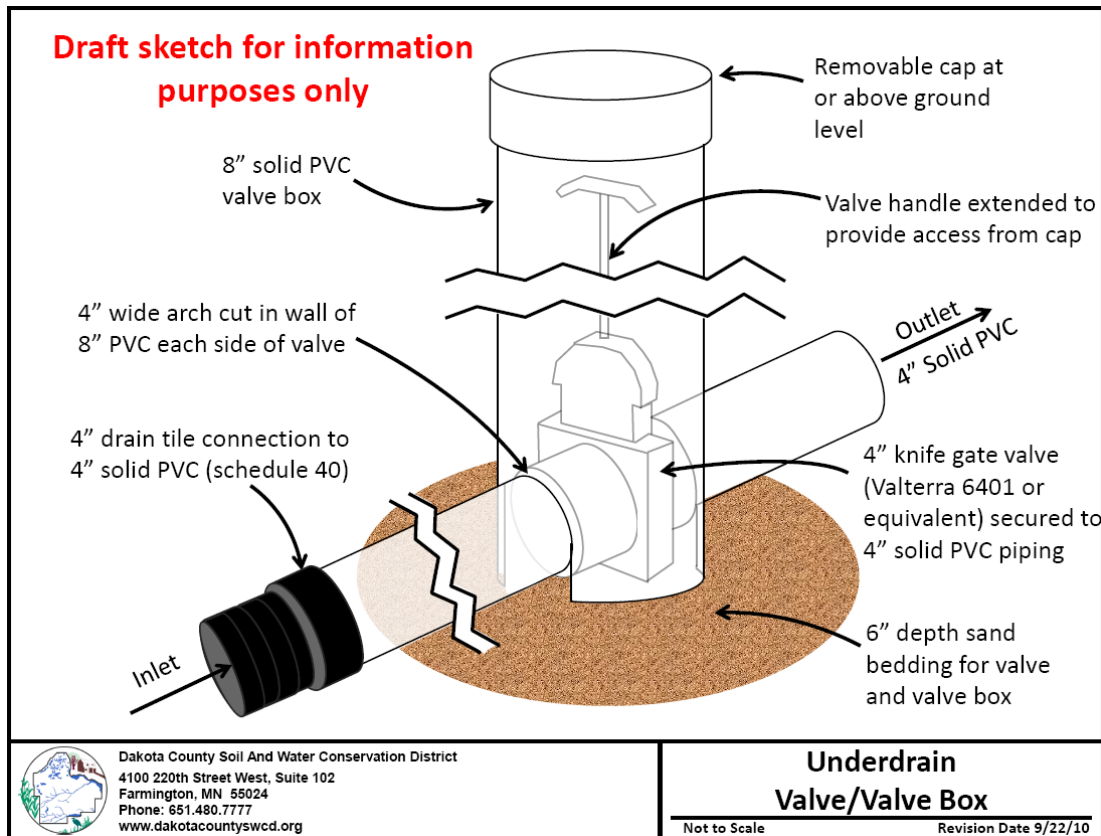
Excavation within 3.0' of final grade prohibited until contributing drainage area is fully stabilized.



Reducing Future Non-Functional BMPs

Underdrains with Gate Valves

Underdrain suspended 1.0' off the bottom of excavation bedded in bioretention soil media with gate valve



OPTIMIZING OPERATIONS AND MAINTENANCE OF LID BMPS

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