



HURON-CLINTON  
**metroparks**

Willow Metropark  
Stormwater Management Plan

September 2019



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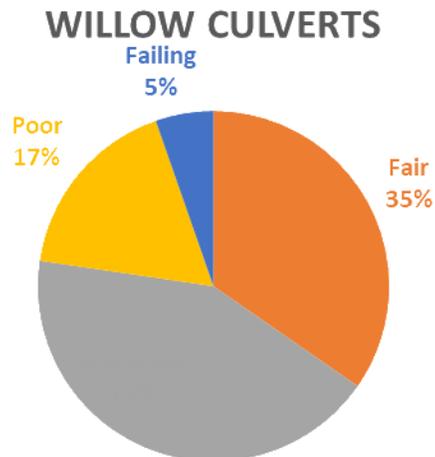
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## Willow Metropark Stormwater Structure Recommendations

Table 1. Summary of Willow Culvert Inspection and Maintenance Needs

Culvert Rating	Number of Culverts	Culverts Needing Immediate Cleanout	Culverts Needing Future Cleanout	Culverts Needing Replacement or Repair
New	0	0	0	0
Fair	26	1	3	0
Moderate	32	1	10	0
Poor	13	5*	4*	13
Failing	4	1*	2*	4
<b>Total:</b>	75	8*	19	17
<b>Repair Cost:</b>		<b>\$358</b>	<b>\$2,979</b>	<b>\$162,201</b>

\*Culvert may be replaced before it can be cleaned out.



Left: Failing culvert in Willow. Right: Proportion of culverts in each condition category.

Table 2. Individual Culvert Replacement Costs

Culvert ID	Diameter (in)	Length (ft)	Condition	Maintenance Need	Cost Opinion
CUL-WIL-001	10	9	Fair	Future Cleanout	\$32
CUL-WIL-005	36	28	Fair	Future Cleanout	\$209
CUL-WIL-006	30	32	Fair	Immediate Cleanout	\$190
CUL-WIL-007	12	30	Moderate	Future Cleanout	\$105
CUL-WIL-008	12	31	Moderate	Future Cleanout	\$107
CUL-WIL-012	20	55	Poor	Replacement	\$8,277
CUL-WIL-014	12	21	Poor	Replacement	\$2,601
CUL-WIL-016	60	64	Fair	Future Cleanout	\$1,594
CUL-WIL-017	18	50	Moderate	Future Cleanout	\$199
CUL-WIL-021	10	48	Moderate	Future Cleanout	\$169
CUL-WIL-022*	12	18	Poor	Replacement	\$2,303
CUL-WIL-023	6	21	Moderate	Future Cleanout	\$74
CUL-WIL-024*	12	21	Poor	Replacement	\$2,577
CUL-WIL-026*	12	20	Poor	Replacement	\$2,517
CUL-WIL-037*	18	31	Poor	Replacement	\$4,706
CUL-WIL-038*	10	33	Poor	Replacement	\$3,255
CUL-WIL-040	12	35	Moderate	Future Cleanout	\$122
CUL-WIL-041*	24	29	Failing	Replacement	\$5,786
CUL-WIL-042*	12	21	Poor	Replacement	\$2,588
CUL-WIL-043	24	17	Moderate	Future Cleanout	\$85
CUL-WIL-048*	96	58	Failing	Replacement	\$45,075
CUL-WIL-049	8	48	Moderate	Immediate Cleanout	\$168
CUL-WIL-050*	12	37	Poor	Replacement	\$4,582
CUL-WIL-055	12	45	Moderate	Future Cleanout	\$158
CUL-WIL-060	36	150	Poor	Replacement	\$45,146
CUL-WIL-061	12	21	Poor	Replacement	\$2,637
CUL-WIL-068	12	16	Moderate	Future Cleanout	\$55
CUL-WIL-069	12	20	Moderate	Future Cleanout	\$68
CUL-WIL-070*	12	17	Poor	Replacement	\$2,130
CUL-WIL-072	12	26	Failing	Replacement	\$3,192
CUL-WIL-073*	8	81	Poor	Replacement	\$8,102
CUL-WIL-075*	14	134	Failing	Replacement	\$16,725
<b>Total:</b>					<b>\$165,538</b>

\*Culvert may be replaced before it needs to be cleaned out.

Table 3. Individual Stormwater Gravity Main Replacement Costs

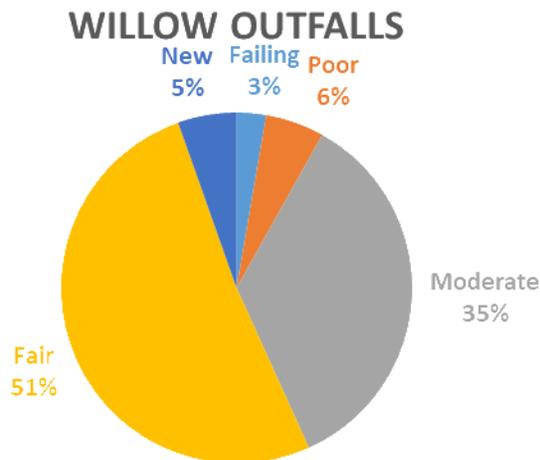
Stormwater Gravity Main ID	Diameter (in)	Length (ft)	Maintenance Need	Cost Opinion
STG-WIL-0001 <sup>^</sup>	15	49	Full Liner	\$3,638
STG-WIL-0002 <sup>^</sup>	15	53	Complete Replacement	\$8,630
STG-WIL-0003 <sup>^</sup>	15	59	Monitor Closely	\$0
STG-WIL-0004 <sup>^</sup>	12	143	Full Liner	\$7,165
STG-WIL-0006 <sup>^</sup>	15	160	Spot Liner(s)	\$5,000
STG-WIL-0007 <sup>^</sup>	10	123	Spot Liner(s), Cutting and Grouting	\$5,713
STG-WIL-0008 <sup>^</sup>	18	200	Cutting and Grouting	\$9,336
STG-WIL-0009 <sup>^</sup>	15	147	Spot Liner(s), Cutting and Grouting	\$10,263
STG-WIL-0010 <sup>^</sup>	12	196	Cutting and Grouting	\$5,401
STG-WIL-0011 <sup>^</sup>	24	121	Full Liner	\$18,210
STG-WIL-0012 <sup>^</sup>	30	261	Full Liner	\$52,280
STG-WIL-0015! <sup>^</sup>	12	37	Complete Replacement	\$6,405
STG-WIL-0016 <sup>^</sup>	18	235	Cutting and Grouting	\$10,973
STG-WIL-0018 <sup>^</sup>	30	146	Spot Liner(s)	\$10,000
STG-WIL-0019 <sup>^</sup>	30	193	Cutting and Grouting	\$18,018
STG-WIL-0020 <sup>^</sup>	30	244	Spot Liner(s)	\$20,000
STG-WIL-0022 <sup>^</sup>	12	169	Cutting and Grouting	\$4,656
STG-WIL-0026 <sup>^</sup>	15	152	Cutting and Grouting	\$5,434
STG-WIL-0027 <sup>^</sup>	15	74	Full Liner	\$5,550
STG-WIL-0028 <sup>^</sup>	10	107	Cutting and Grouting	\$2,434
STG-WIL-0033 <sup>^</sup>	12	166	Full Liner, Lateral Connection Repair	\$12,780
STG-WIL-0051 <sup>^</sup>	12	88	Monitor Closely	\$0
STG-WIL-0066 <sup>^</sup>	10	111	Spot Liner(s), Cutting and Grouting	\$5,442
STG-WIL-0069 <sup>^</sup>	18	84	Monitor Closely	\$0
STG-WIL-0071 <sup>^</sup>	12	157	Complete Replacement	\$25,325
STG-WIL-0072! <sup>^</sup>	18	119	Complete Replacement	\$23,244
STG-WIL-0073 <sup>^</sup>	12	90	Complete Replacement	\$14,884
STG-WIL-0075 <sup>^</sup>	12	121	Spot Liner(s), Cutting and Grouting, Monitor Closely	\$7,322
STG-WIL-0085 <sup>^</sup>	15	48	Full Liner	\$3,570
STG-WIL-0086 <sup>^</sup>	24	23	Spot Liner(s)	\$8,000
<b>Total:</b>				<b>\$309,673</b>

<sup>^</sup>Televised, !High Priority

Table 4. Summary of Willow Outfall Inspection and Maintenance Needs

Outfall Rating	Number of Outfalls	Outfalls Needing Immediate Cleanout	Outfalls Needing Future Cleanout	Outfalls Needing Replacement or Repair
New	2	0	0	0
Fair	19	0	3	0
Moderate	13	0	4	0
Poor	2	1*	1*	2
Failing	1	0	1*	1
<b>Total:</b>	37	1*	9*	3
<b>Repair Cost:</b>		<b>\$0</b>	<b>\$1,300</b>	<b>\$22,500</b>

\*Outfall may be replaced before it needs to be cleaned out.



Left: Proportion of outfalls in each condition category. Right: Severely damaged outfall in failing condition in Willow.

Table 5. Individual Outfall Replacement Costs

Outfall ID	Diameter (in)	Condition	Maintenance Need	Cost Opinion
SDC-WIL-014	6	Moderate	Future Cleanout	\$175
SDC-WIL-006	8	Fair	Future Cleanout	\$175
SDC-WIL-008	12	Moderate	Future Cleanout	\$175
SDC-WIL-010	12	Poor	Replacement	\$6,250
SDC-WIL-034	12	Moderate	Future Cleanout	\$175
SDC-WIL-035	12	Moderate	Future Cleanout	\$175
SDC-WIL-004	15	Fair	Future Cleanout	\$175
SDC-WIL-001	24	Fair	Future Cleanout	\$250
SDC-WIL-005	24	Poor	Replacement	\$10,000
SDC-WIL-003	12	Failing	Replacement	\$6,250
<b>Total:</b>				<b>\$23,800</b>

\*Outfall may be replaced before it needs to be cleaned out.

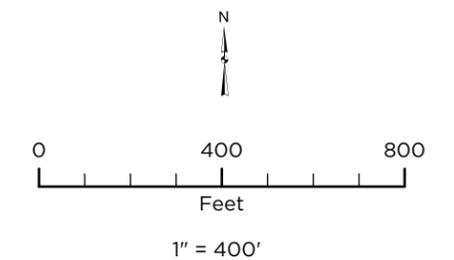
# Stormwater Structure Ratings

Willow Metropark

Map Sheet: 7 of 48



<b>Outfalls</b> (Field Rating)	<b>Gravity Main</b> (Pipe Rating Index)
■ Failing	1
■ Poor	2
■ Moderate	3
■ Fair	4
■ New	5
<b>Culverts</b> (Field Rating)	■ Gravity Main (Other)
■ Failing	■ Culvert (Other)
■ Poor	<b>Roads</b>
■ Moderate	○ Roads
■ Fair	⊞ Park Boundary
■ New	
■ (Not Rated)	



Source: Data provided by Huron-Clinton Metroparks, State of Michigan, OHM Advisors, NearMap and ESRI. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl.

Map Published: October 23, 2019



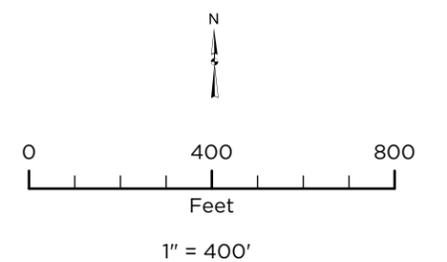
# Stormwater Structure Ratings

## Willow Metropark

Map Sheet: 8 of 48



<b>Outfalls</b> (Field Rating)	<b>Gravity Main</b> (Pipe Rating Index)
Failing	1
Poor	2
Moderate	3
Fair	4
New	5
<b>Culverts</b> (Field Rating)	Gravity Main (Other)
Failing	Culvert (Other)
Poor	<b>Roads</b>
Moderate	Roads
Fair	Park Boundary
New	
(Not Rated)	



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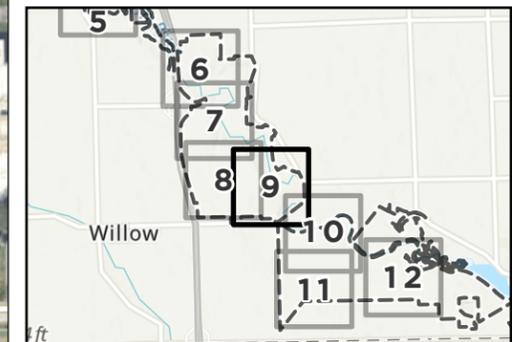
Map Published: October 23, 2019



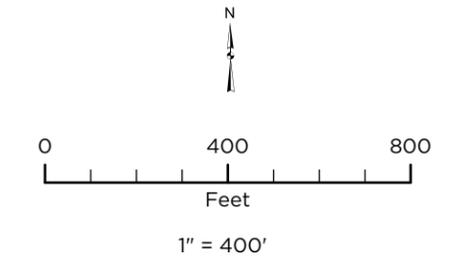
# Stormwater Structure Ratings

Willow Metropark

Map Sheet: 9 of 48



<b>Outfalls</b> (Field Rating)	<b>Gravity Main</b> (Pipe Rating Index)
<ul style="list-style-type: none"> <li><span style="color: red;">■</span> Failing</li> <li><span style="color: orange;">■</span> Poor</li> <li><span style="color: yellow;">■</span> Moderate</li> <li><span style="color: lightgreen;">■</span> Fair</li> <li><span style="color: green;">■</span> New</li> </ul>	<ul style="list-style-type: none"> <li><span style="border: 1px solid yellow; width: 10px; height: 10px; display: inline-block;"></span> 1</li> <li><span style="border: 1px solid orange; width: 10px; height: 10px; display: inline-block;"></span> 2</li> <li><span style="border: 1px solid red; width: 10px; height: 10px; display: inline-block;"></span> 3</li> <li><span style="border: 1px solid darkred; width: 10px; height: 10px; display: inline-block;"></span> 4</li> <li><span style="border: 1px solid darkred; width: 10px; height: 10px; display: inline-block;"></span> 5</li> </ul>
<b>Culverts</b> (Field Rating)	<b>Gravity Main (Other)</b>
<ul style="list-style-type: none"> <li><span style="border-bottom: 2px solid red; width: 20px; display: inline-block;"></span> Failing</li> <li><span style="border-bottom: 2px solid orange; width: 20px; display: inline-block;"></span> Poor</li> <li><span style="border-bottom: 2px solid yellow; width: 20px; display: inline-block;"></span> Moderate</li> <li><span style="border-bottom: 2px solid lightgreen; width: 20px; display: inline-block;"></span> Fair</li> <li><span style="border-bottom: 2px solid green; width: 20px; display: inline-block;"></span> New</li> <li><span style="border-bottom: 2px solid green; width: 20px; display: inline-block;"></span> (Not Rated)</li> </ul>	<span style="border-bottom: 2px solid green; width: 20px; display: inline-block;"></span> Culvert (Other)
<b>Roads</b>	<b>Roads</b>
<span style="border-bottom: 2px solid white; width: 20px; display: inline-block;"></span> Roads	<span style="border-bottom: 2px dashed white; width: 20px; display: inline-block;"></span> Park Boundary



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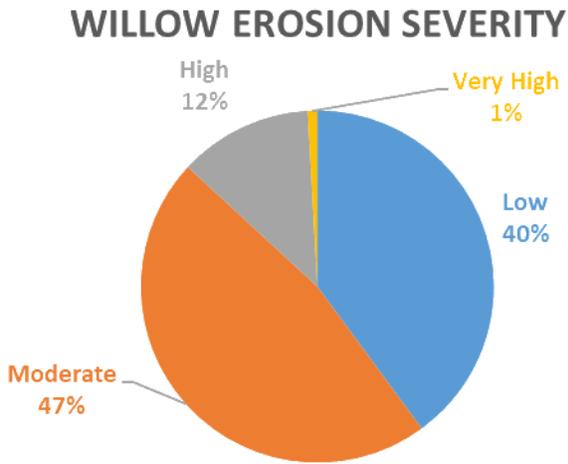
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl.

Map Published: October 23, 2019

## Willow Metropark Streambank Summary and Recommendations

Table 6. Streambank Inspection Summary

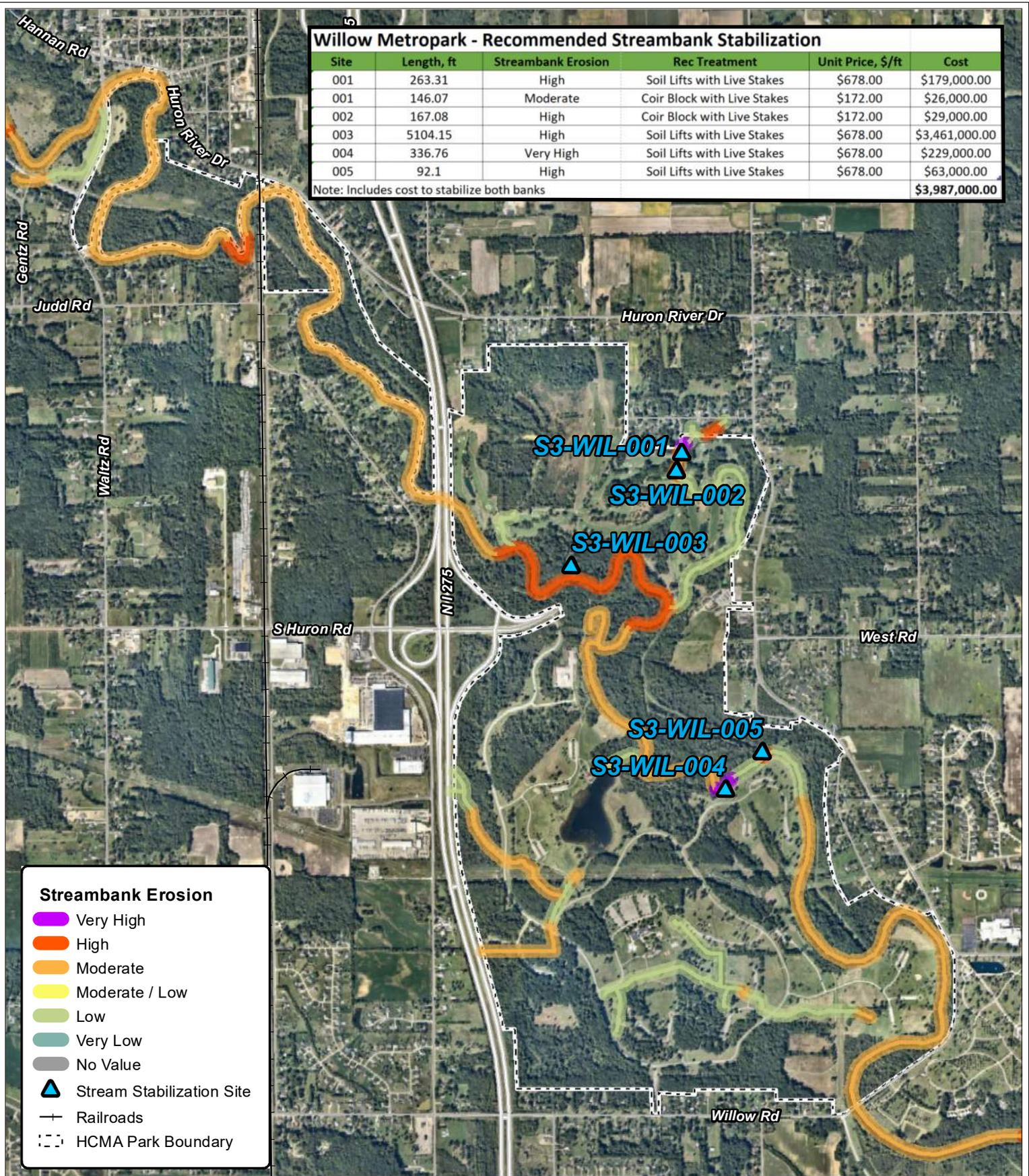
Erosion Condition	Feet of Streambank (miles)	Cost of Restoration
Very High	414 (0.08)	\$228,323
High	5,806 (1.10)	\$3,730,320
Moderate	22,240 (4.21)	\$25,124
Low	18,915 (3.58)	
Very Low	0 (0)	
<b>Total:</b>	<b>47,375 (8.97)</b>	<b>\$3,983,767</b>



*Left: Proportion of stream in each erosion category. Right: High erosion on a bank next to a path in Willow Metropark.*

### Willow Metropark - Recommended Streambank Stabilization

Site	Length, ft	Streambank Erosion	Rec Treatment	Unit Price, \$/ft	Cost
001	263.31	High	Soil Lifts with Live Stakes	\$678.00	\$179,000.00
001	146.07	Moderate	Coir Block with Live Stakes	\$172.00	\$26,000.00
002	167.08	Moderate	Coir Block with Live Stakes	\$172.00	\$29,000.00
003	5104.15	High	Soil Lifts with Live Stakes	\$678.00	\$3,461,000.00
004	336.76	Very High	Soil Lifts with Live Stakes	\$678.00	\$229,000.00
005	92.1	High	Soil Lifts with Live Stakes	\$678.00	\$63,000.00
Note: Includes cost to stabilize both banks					<b>\$3,987,000.00</b>



#### Streambank Erosion

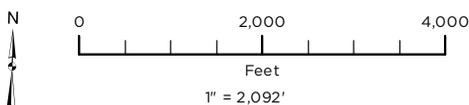
- Very High
- High
- Moderate
- Moderate / Low
- Low
- Very Low
- No Value
- ▲ Stream Stabilization Site
- Railroads
- HCMA Park Boundary

## Willow Metropark Streambank Stabilization Siting

Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

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Map Published: September 25, 2019



**Site-001**

Length: 263.31 ft  
Recommended Treatment: Soil Lifts with Live Stakes  
Construction Cost: \$179,000

Length: 146.07 ft  
Recommended Treatment: Coir Block with Live Stakes  
Construction Cost: \$26,000

**S3-WIL-001 & 002**

**Streambank Erosion**

-  Very High
-  High
-  Moderate
-  Moderate / Low
-  Low
-  Very Low
-  No Value
-  Stream Stabilization Site
-  Roads
-  HCMA Park Boundary

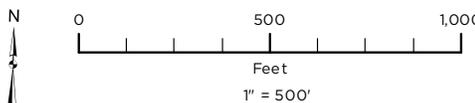


**Willow Metropark  
Streambank Stabilization Siting**

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**Site-003 CRITICAL**

Length: 5,104.15 ft  
Recommended Treatment: Soil Lifts with Live Stakes  
Construction Cost: \$3,461,000

**S3-WIL-003**

**Streambank Erosion**

- █ Very High
- █ High
- █ Moderate
- █ Moderate / Low
- █ Low
- █ Very Low
- █ No Value
- ▲ Stream Stabilization Site
- Roads
- HCMA Park Boundary



**S3-WIL-003**

Metro Parks Bike Path

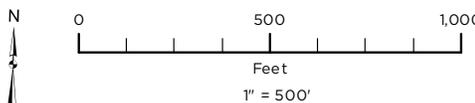
S Interloop Rd

**INFRASTRUCTURE IMPACTED BY VERY HIGH EROSION INDICATES CRITICAL CONDITION**



Interloop

# Willow Metropark Streambank Stabilization Siting



Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

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**Site-004 CRITICAL**

Length: 336.76 ft  
Recommended Treatment: Soil Lifts with Live Stakes  
Construction Cost: \$229,000

**S3-WIL-004 & 005**

**Streambank Erosion**

- █ Very High
- █ High
- █ Moderate
- █ Moderate / Low
- █ Low
- █ Very Low
- █ No Value
- ▲ Stream Stabilization Site
- Roads
- HCMA Park Boundary



**S3-WIL-005**

**S3-WIL-004**

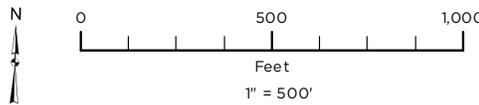
**INFRASTRUCTURE IMPACTED BY VERY HIGH EROSION INDICATES CRITICAL CONDITION**



**Site-005 CRITICAL**

Length: 92.10 ft  
Recommended Treatment: Soil Lifts with Live Stakes  
Construction Cost: \$63,000

# Willow Metropark Streambank Stabilization Siting



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## Willow Metropark Shoreline Summary and Recommendations

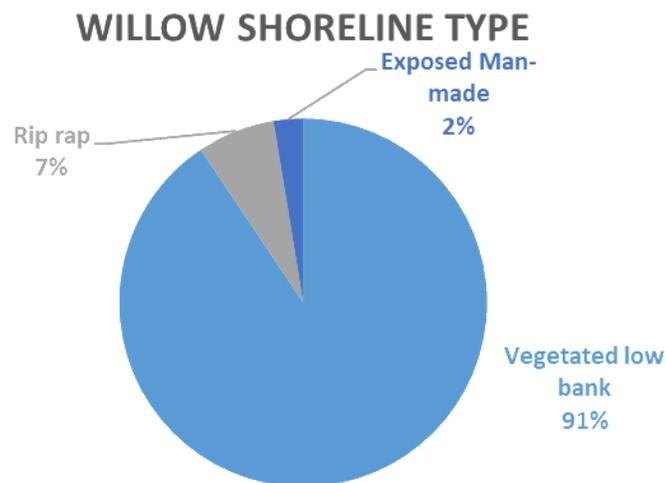


*Minor slumping in Willow Metropark.*

Table 7. Shoreline Inspection Summary

Erosion Condition	Length of Shoreline (ft)
Major	0.0
Minor	2,630.72
None	1,785.18
<b>Total:</b>	<b>4,415.90</b>
<b>Restoration Cost:</b>	<b>\$2,463</b>

All of the shoreline represented in Willow Metropark is part of Washago Pond.



*Proportion of each shoreline type present in Willow Metropark.*

**Site-001**

Length: 307.86 Ft

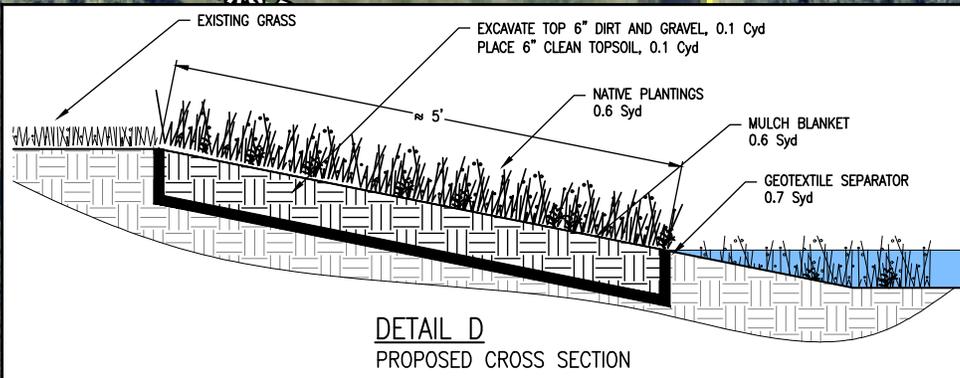
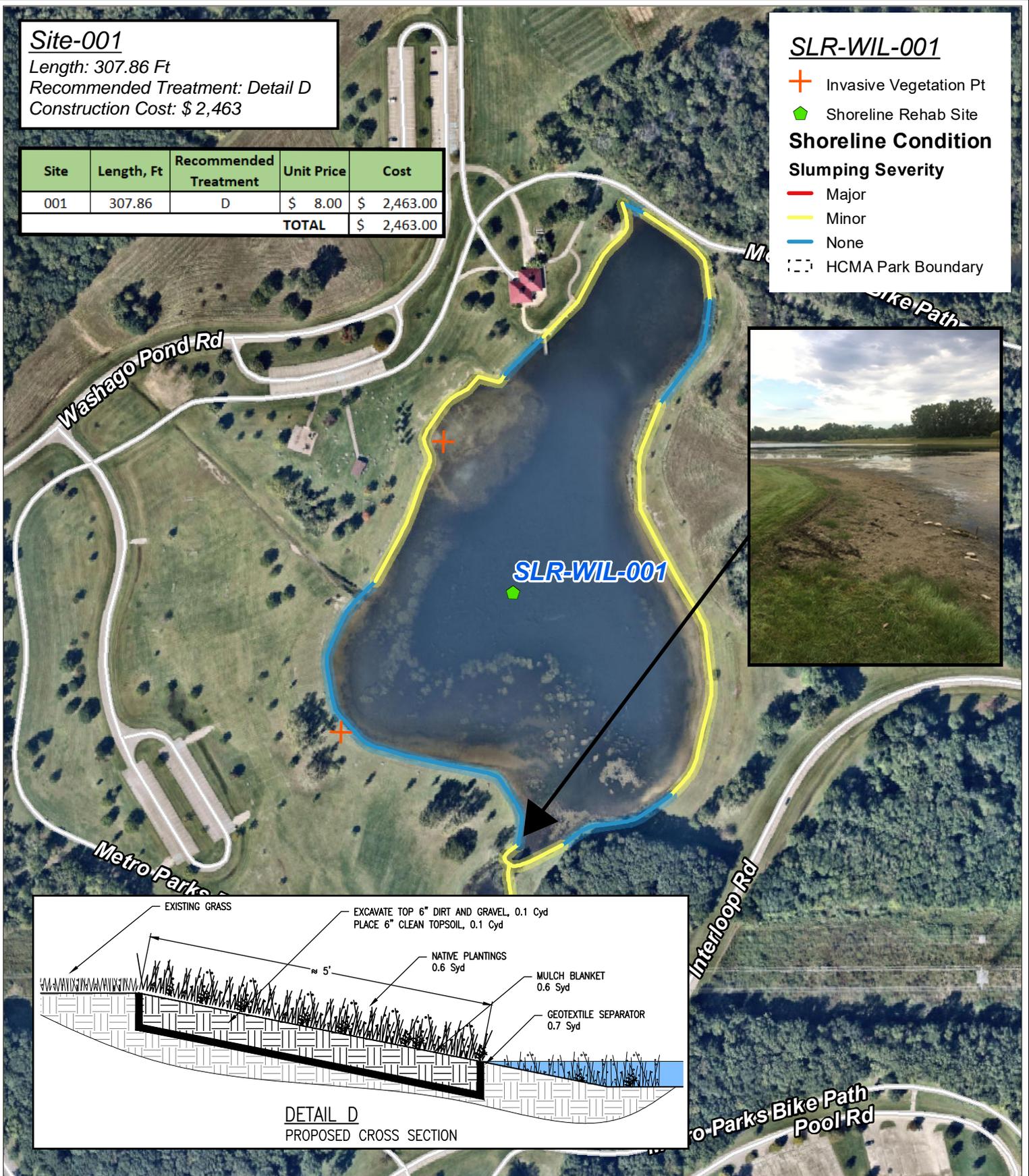
Recommended Treatment: Detail D

Construction Cost: \$ 2,463

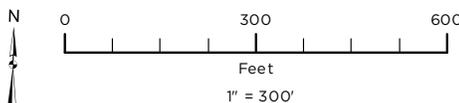
Site	Length, Ft	Recommended Treatment	Unit Price	Cost
001	307.86	D	\$ 8.00	\$ 2,463.00
<b>TOTAL</b>				<b>\$ 2,463.00</b>

**SLR-WIL-001**

- + Invasive Vegetation Pt
- ◆ Shoreline Rehab Site
- Shoreline Condition**
- Slumping Severity**
- Major
- Minor
- None
- HCMA Park Boundary



**Willow Metropark (Washago Pond)  
Shoreline Rehab Siting**



Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

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## Willow Metropark Green Infrastructure Recommendations

In Willow, the green infrastructure practices listed in Table 1 are recommended to improve water quality and ameliorate flooding issues in the park where feasible. These practices are also outlined on the attached green infrastructure maps.

Table 8. Willow Green Infrastructure Recommendations

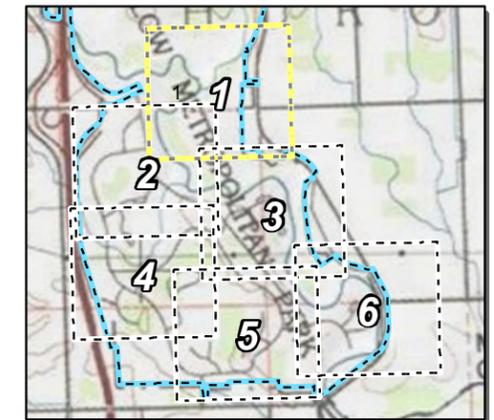
Site ID	Site	Practice Type	Treatment Surface Area (ft <sup>2</sup> )	Cost Opinion	Cost per sq ft of Treatment Area (\$/ft <sup>2</sup> )
GI-WIL-01	Shelter H	Naturalized Swale	1,022	\$1,737	\$1.70
GI-WIL-02	Shelter H	Stormwater Treatment Wetland	14,609	\$161,674	\$11.07
GI-WIL-03	Shelter D	Naturalized Swale	1,997	\$3,395	\$1.70
GI-WIL-04	Shelter D	Bioswale	4,114	\$49,063	\$11.93
GI-WIL-05	Shelter E	Naturalized Swale	2,152	\$3,658	\$1.70
GI-WIL-06	Sledding Hill	Naturalized Swale	1,091	\$1,855	\$1.70
GI-WIL-07	Indian Ridge	Native Prairie	51,862	\$60,506	\$1.17
GI-WIL-08	Elder Creek	Naturalized Swale	2,086	\$3,546	\$1.70
GI-WIL-09	Elder Creek	Naturalized Swale	2,220	\$3,774	\$1.70
GI-WIL-10	Toll	Naturalized Swale	7,350	\$12,495	\$1.70
GI-WIL-11	Toll	Naturalized Swale	5,356	\$9,105	\$1.70
GI-WIL-12	Toll	Stormwater Treatment Wetland	5,000	\$56,189	\$11.24
GI-WIL-13	Shelter G	Naturalized Swale	9,844	\$16,735	\$1.70
GI-WIL-14	Activity Center	Naturalized Swale	6,955	\$11,824	\$1.70
GI-WIL-15	Activity Center	Porous Pavement	44,284	\$1,104,476	\$24.94

Site ID	Site	Practice Type	Treatment Surface Area (ft <sup>2</sup> )	Cost Opinion	Cost per sq ft of Treatment Area (\$/ft <sup>2</sup> )
GI-WIL-16	Washago Pond SW	Naturalized Swale	2,194	\$3,730	\$1.70
GI-WIL-17	Washago Pond SW	Naturalized Swale	8,211	\$13,959	\$1.70
GI-WIL-18	Shelter A	Naturalized Swale	14,979	\$25,464	\$1.70
GI-WIL-19	Shelter A	Naturalized Swale	15,730	\$26,741	\$1.70
GI-WIL-20	Bike and Boat Rental	Naturalized Swale	2,753	\$4,680	\$1.70
GI-WIL-21	Bike and Boat Rental	Naturalized Swale	3,598	\$6,117	\$1.70
GI-WIL-22	Bike and Boat Rental	Naturalized Swale	7,309	\$12,425	\$1.70
GI-WIL-23	Service Area	Stormwater Treatment Wetland	9,281	\$103,185	\$11.12
GI-WIL-24	Driving Range	Naturalized Swale	3,023	\$5,139	\$1.70
GI-WIL-25	Driving Range	Bioswale	2,400	\$23,487	\$9.79
GI-WIL-26	Driving Range	Bioswale	2,920	\$27,618	\$9.46
GI-WIL-27	Shelter H	Naturalized Swale	3,617	\$6,149	\$1.70
GI-WIL-28	Shelter H	Naturalized Swale	1,164	\$1,979	\$1.70
GI-WIL-29	Shelter H	Naturalized Swale	1,489	\$ 2,531	\$1.70
GI-WIL-30	Indian Ridge	Pavement Removal	25,136	\$137,410	\$5.47
GI-WIL-31	Service Area	Native Prairie	29,070	\$33,915	\$1.17
GI-WIL-32	Washago Pond SW	Pavement Removal	23,352	\$127,658	\$5.47
GI-WIL-33	Shelter C	Pavement Removal	24,056	\$131,506	\$5.47
GI-WIL-34	Shelter H	Pavement Removal	7,000	\$38,267	\$5.47
GI-WIL-35	Shelter H	Pavement Removal	37,484	\$204,913	\$5.47
<b>Total:</b>			<b>384,705</b>	<b>\$1,500,032</b>	

# Willow Metropark

Green Infrastructure  
Recommendation Areas

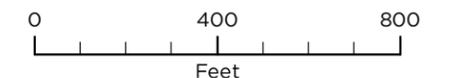
Area: 1 of 6



## Recommendation Area

### GSI Type

- Bioswale (2)
- Native Prairie (1)
- Naturalized Swale (1)
- Stormwater Treatment Wetland (1)
- Stormwater Gravity Main
- Culvert (6)
- HCMA Park Boundary
- Roads

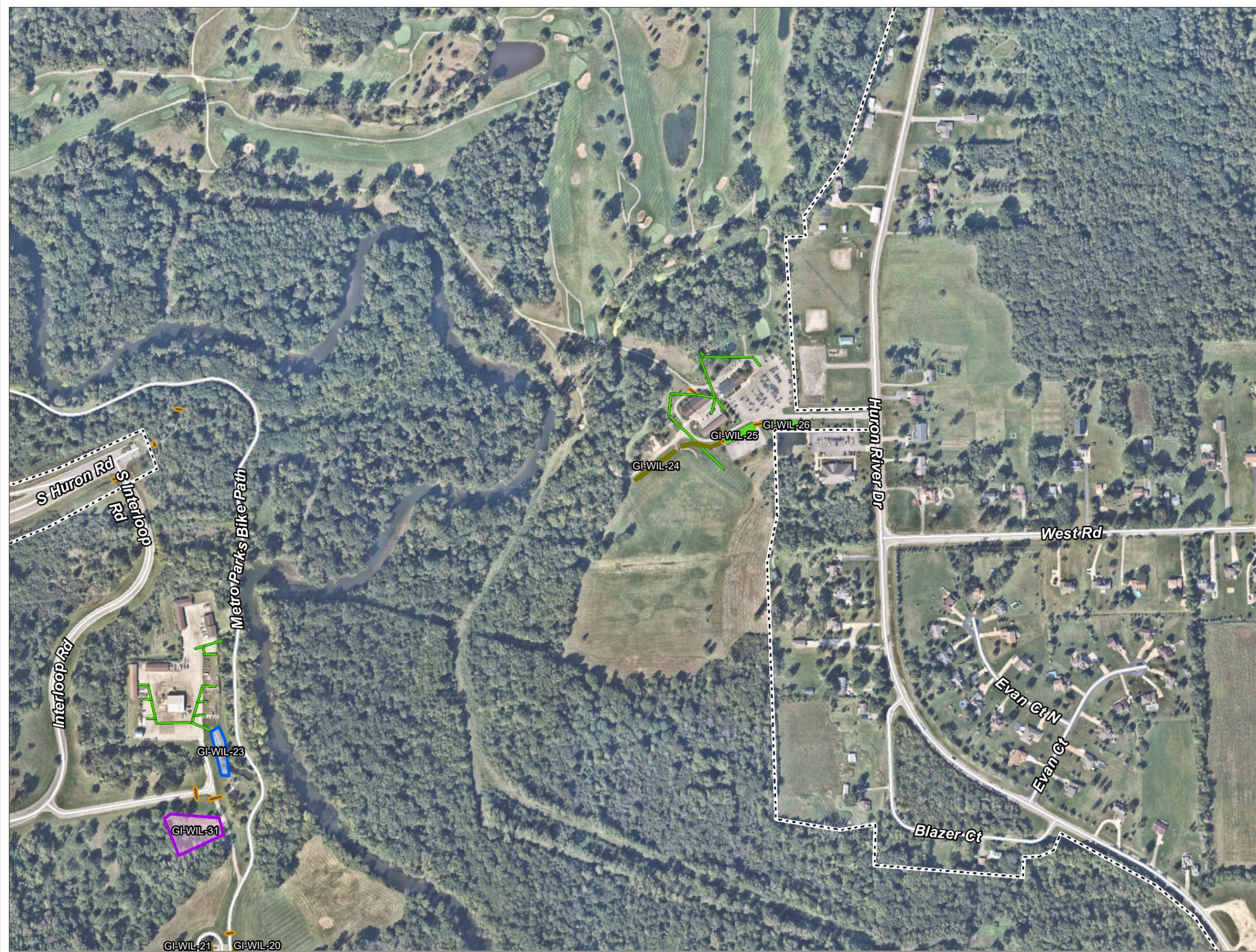


1" = 400'

Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

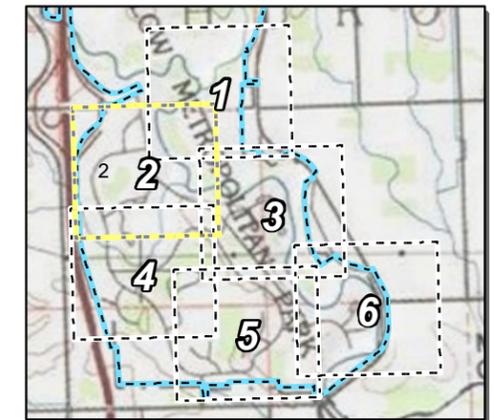
Map Published: October 1, 2019



# Willow Metropark

Green Infrastructure  
Recommendation Areas

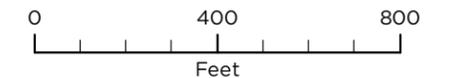
Area: 2 of 6



## Recommendation Area

### GSI Type

- Native Prairie (1)
- Naturalized Swale (5)
- Stormwater Treatment Wetland (1)
- Stormwater Gravity Main
- Culvert (11)
- HCMA Park Boundary
- Roads



1" = 400'

Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

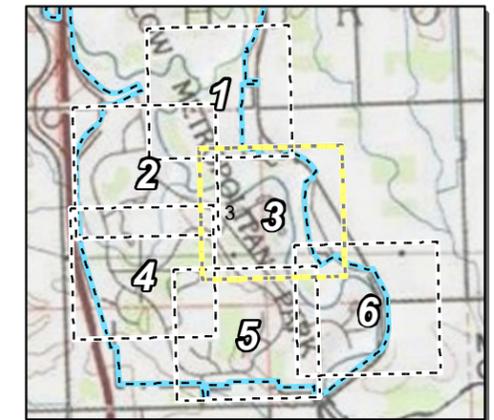
Map Published: October 1, 2019



# Willow Metropark

Green Infrastructure  
Recommendation Areas

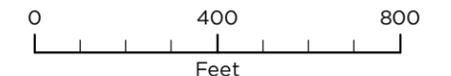
Area: 3 of 6



## Recommendation Area

### GSI Type

- Naturalized Swale (6)
- Stormwater Treatment Wetland (1)
- Pavement Removal (2)
- Stormwater Gravity Main
- Culvert (5)
- HCMA Park Boundary
- Roads



1" = 400'

Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

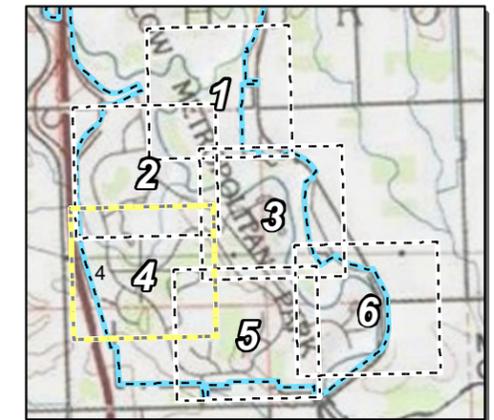
Map Published: October 1, 2019



# Willow Metropark

Green Infrastructure Recommendation Areas

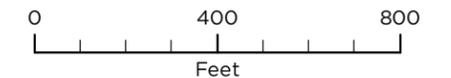
Area: 4 of 6



## Recommendation Area

### GSI Type

- Naturalized Swale (5)
- Porous Pavement (1)
- Pavement Removal (1)
- Stormwater Gravity Main
- Culvert (15)
- HCMA Park Boundary
- Roads



1" = 400'

Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

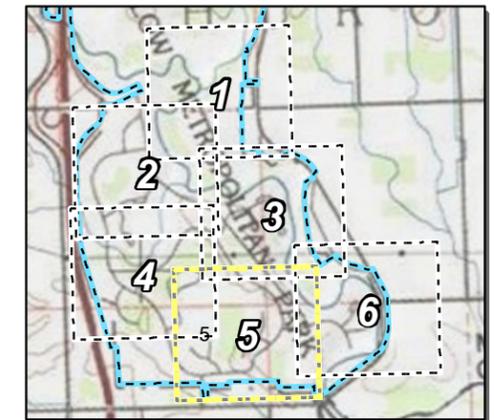
Map Published: October 1, 2019



# Willow Metropark

Green Infrastructure Recommendation Areas

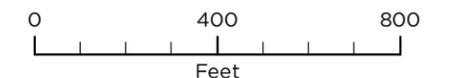
Area: 5 of 6



## Recommendation Area

### GSI Type

- Native Prairie (1)
- Naturalized Swale (5)
- Porous Pavement (1)
- Stormwater Treatment Wetland (1)
- Pavement Removal (2)
- Stormwater Gravity Main
- Culvert (31)
- HCMA Park Boundary
- Roads



1" = 400'

Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

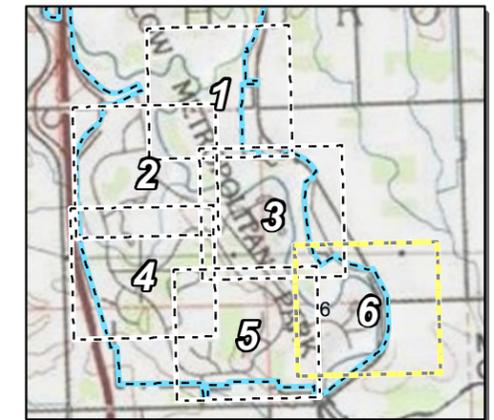
Map Published: October 1, 2019



# Willow Metropark

Green Infrastructure  
Recommendation Areas

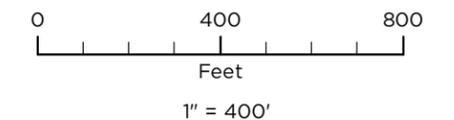
Area: 6 of 6



### Recommendation Area

#### GSI Type

- Bioswale (1)
- Naturalized Swale (3)
- Pavement Removal (1)
- Stormwater Gravity Main
- Culvert (15)
- HCMA Park Boundary
- Roads



Source: Data provided by OHM Advisors, Huron Clinton Metroparks and Near Map. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

Map Published: October 1, 2019



## Willow Metropark Recommendation Prioritization

Each table in this section is prioritized, with the most urgent projects listed first. Projects with **red** Site IDs need immediate attention. Projects with **green** Site IDs can be accomplished by HCMA staff. **Bold** projects may be eligible for grant funding. Underlined projects may be good volunteer or education opportunities. All other projects will likely require annual budget allocations to complete.

Table 9. Willow Culvert Repair Priorities

Culvert ID	Diameter (in)	Length (ft)	Condition	Maintenance Need	Cost Opinion
CUL-WIL-048	96	58	Failing	Replacement	\$45,075
CUL-WIL-075	14	134	Failing	Replacement	\$16,725
CUL-WIL-041	24	29	Failing	Replacement	\$5,786
CUL-WIL-072	12	26	Failing	Replacement	\$3,192
CUL-WIL-060	36	150	Poor	Replacement	\$45,146
CUL-WIL-012	20	55	Poor	Replacement	\$8,277
CUL-WIL-037	18	31	Poor	Replacement	\$4,706
CUL-WIL-050	12	37	Poor	Replacement	\$4,582
CUL-WIL-073	8	81	Poor	Replacement	\$8,102
CUL-WIL-038	10	33	Poor	Replacement	\$3,255
CUL-WIL-014	12	21	Poor	Replacement	\$2,601
CUL-WIL-024	12	21	Poor	Replacement	\$2,577
CUL-WIL-042	12	21	Poor	Replacement	\$2,588
CUL-WIL-061	12	21	Poor	Replacement	\$2,637
CUL-WIL-026	12	20	Poor	Replacement	\$2,517
CUL-WIL-022	12	18	Poor	Replacement	\$2,303
CUL-WIL-070	12	17	Poor	Replacement	\$2,130
CUL-WIL-016	60	64	Fair	Future Cleanout	\$1,594
<b>CUL-WIL-049</b>	8	48	Moderate	Immediate Cleanout	\$168
<b>CUL-WIL-006</b>	30	32	Fair	Immediate Cleanout	\$190
<b>CUL-WIL-017</b>	18	50	Moderate	Future Cleanout	\$199
<b>CUL-WIL-043</b>	24	17	Moderate	Future Cleanout	\$85
<b>CUL-WIL-055</b>	12	45	Moderate	Future Cleanout	\$158
<b>CUL-WIL-040</b>	12	35	Moderate	Future Cleanout	\$122
<b>CUL-WIL-021</b>	10	48	Moderate	Future Cleanout	\$169
<b>CUL-WIL-008</b>	12	31	Moderate	Future Cleanout	\$107
<b>CUL-WIL-007</b>	12	30	Moderate	Future Cleanout	\$105
<b>CUL-WIL-069</b>	12	20	Moderate	Future Cleanout	\$68
<b>CUL-WIL-068</b>	12	16	Moderate	Future Cleanout	\$55
<b>CUL-WIL-023</b>	6	21	Moderate	Future Cleanout	\$74
<b>CUL-WIL-005</b>	36	28	Fair	Future Cleanout	\$209

CUL-WIL-001	10	9	Fair	Future Cleanout	\$32
<b>Total:</b>					<b>\$165,538</b>

Table 10. Willow Outfall Repair Priorities

Outfall ID	Diameter (in)	Condition	Maintenance Need	Cost Opinion
SDC-WIL-003	12	Failing	Replacement	\$6,250
SDC-WIL-010	12	Poor	Replacement	\$6,250
SDC-WIL-005	24	Poor	Replacement	\$10,000
SDC-WIL-014	6	Moderate	Future Cleanout	\$175
SDC-WIL-008	12	Moderate	Future Cleanout	\$175
SDC-WIL-034	12	Moderate	Future Cleanout	\$175
SDC-WIL-035	12	Moderate	Future Cleanout	\$175
SDC-WIL-006	8	Fair	Future Cleanout	\$175
SDC-WIL-004	15	Fair	Future Cleanout	\$175
SDC-WIL-001	24	Fair	Future Cleanout	\$250
<b>Total:</b>				<b>\$23,800</b>

Table 11. Willow Stormwater Gravity Main Repair Priorities

Stormwater Gravity Main ID	Diameter (in)	Length (ft)	Maintenance Need	Cost Opinion
STG-WIL-0072	18	119	Complete Replacement	\$23,244
STG-WIL-0015	12	37	Complete Replacement	\$6,405
STG-WIL-0012	30	261	Full Liner	\$52,280
STG-WIL-0011	24	121	Full Liner	\$18,210
STG-WIL-0033	12	166	Full Liner, Lateral Connection Repair	\$12,780
STG-WIL-0071	12	157	Complete Replacement	\$25,325
STG-WIL-0004	12	143	Full Liner	\$7,165
STG-WIL-0027	15	74	Full Liner	\$5,550
STG-WIL-0073	12	90	Complete Replacement	\$14,884
STG-WIL-0002	15	53	Complete Replacement	\$8,630
STG-WIL-0001	15	49	Full Liner	\$3,638
STG-WIL-0085	15	48	Full Liner	\$3,570
STG-WIL-0020	30	244	Spot Liner(s)	\$20,000
STG-WIL-0018	30	146	Spot Liner(s)	\$10,000
STG-WIL-0006	15	160	Spot Liner(s)	\$5,000
STG-WIL-0009	15	147	Spot Liner(s), Cutting and Grouting	\$10,263
STG-WIL-0075	12	121	Spot Liner(s), Cutting and Grouting, Monitor Closely	\$7,322
STG-WIL-0086	24	23	Spot Liner(s)	\$8,000

Stormwater Gravity Main ID	Diameter (in)	Length (ft)	Maintenance Need	Cost Opinion
STG-WIL-0007	10	123	Spot Liner(s), Cutting and Grouting	\$5,713
STG-WIL-0066	10	111	Spot Liner(s), Cutting and Grouting	\$5,442
STG-WIL-0019	30	193	Cutting and Grouting	\$18,018
STG-WIL-0016	18	235	Cutting and Grouting	\$10,973
STG-WIL-0008	18	200	Cutting and Grouting	\$9,336
STG-WIL-0026	15	152	Cutting and Grouting	\$5,434
STG-WIL-0010	12	196	Cutting and Grouting	\$5,401
STG-WIL-0022	12	169	Cutting and Grouting	\$4,656
STG-WIL-0028	10	107	Cutting and Grouting	\$2,434
STG-WIL-0069	18	84	Monitor Closely	\$0
STG-WIL-0003	15	59	Monitor Closely	\$0
STG-WIL-0051	12	88	Monitor Closely	\$0
<b>Total:</b>				<b>\$309,673</b>

Table 12. Willow Green Infrastructure Installation Priorities

Site ID	Site	Practice Type	Treatment Surface Area (ft <sup>2</sup> )	Cost Opinion	Cost per sq ft of Treatment Area (\$/ft <sup>2</sup> )
<u>GI-WIL-29</u>	<u>Shelter H</u>	<u>Naturalized Swale</u>	<u>1,489</u>	<u>\$ 2,531</u>	<u>\$1.70</u>
<u>GI-WIL-28</u>	<u>Shelter H</u>	<u>Naturalized Swale</u>	<u>1,164</u>	<u>\$1,979</u>	<u>\$1.70</u>
<u>GI-WIL-06</u>	<u>Sledding Hill</u>	<u>Naturalized Swale</u>	<u>1,091</u>	<u>\$1,855</u>	<u>\$1.70</u>
<u>GI-WIL-01</u>	<u>Shelter H</u>	<u>Naturalized Swale</u>	<u>1,022</u>	<u>\$1,737</u>	<u>\$1.70</u>
GI-WIL-07	Indian Ridge	Native Prairie	51,862	\$60,506	\$1.17
GI-WIL-31	Service Area	Native Prairie	29,070	\$33,915	\$1.17
GI-WIL-19	Shelter A	Naturalized Swale	15,730	\$26,741	\$1.70
GI-WIL-18	Shelter A	Naturalized Swale	14,979	\$25,464	\$1.70
GI-WIL-13	Shelter G	Naturalized Swale	9,844	\$16,735	\$1.70
GI-WIL-17	Washago Pond SW	Naturalized Swale	8,211	\$13,959	\$1.70

Site ID	Site	Practice Type	Treatment Surface Area (ft <sup>2</sup> )	Cost Opinion	Cost per sq ft of Treatment Area (\$/ft <sup>2</sup> )
GI-WIL-10	Toll	Naturalized Swale	7,350	\$12,495	\$1.70
GI-WIL-22	Bike and Boat Rental	Naturalized Swale	7,309	\$12,425	\$1.70
GI-WIL-14	Activity Center	Naturalized Swale	6,955	\$11,824	\$1.70
GI-WIL-11	Toll	Naturalized Swale	5,356	\$9,105	\$1.70
GI-WIL-27	Shelter H	Naturalized Swale	3,617	\$6,149	\$1.70
GI-WIL-21	Bike and Boat Rental	Naturalized Swale	3,598	\$6,117	\$1.70
GI-WIL-24	Driving Range	Naturalized Swale	3,023	\$5,139	\$1.70
GI-WIL-20	Bike and Boat Rental	Naturalized Swale	2,753	\$4,680	\$1.70
GI-WIL-09	Elder Creek	Naturalized Swale	2,220	\$3,774	\$1.70
GI-WIL-16	Washago Pond SW	Naturalized Swale	2,194	\$3,730	\$1.70
GI-WIL-05	Shelter E	Naturalized Swale	2,152	\$3,658	\$1.70
GI-WIL-08	Elder Creek	Naturalized Swale	2,086	\$3,546	\$1.70
GI-WIL-03	Shelter D	Naturalized Swale	1,997	\$3,395	\$1.70
GI-WIL-04	Shelter D	Bioswale	4,114	\$49,063	\$11.93
GI-WIL-26	Driving Range	Bioswale	2,920	\$27,618	\$9.46
GI-WIL-25	Driving Range	Bioswale	2,400	\$23,487	\$9.79
GI-WIL-02	Shelter H	Stormwater Treatment Wetland	14,609	\$161,674	\$11.07
GI-WIL-23	Service Area	Stormwater Treatment Wetland	9,281	\$103,185	\$11.12
GI-WIL-12	Toll	Stormwater Treatment Wetland	5,000	\$56,189	\$11.24

Site ID	Site	Practice Type	Treatment Surface Area (ft <sup>2</sup> )	Cost Opinion	Cost per sq ft of Treatment Area (\$/ft <sup>2</sup> )
GI-WIL-35	Shelter H	Pavement Removal	37,484	\$204,913	\$5.47
GI-WIL-30	Indian Ridge	Pavement Removal	25,136	\$137,410	\$5.47
GI-WIL-33	Shelter C	Pavement Removal	24,056	\$131,506	\$5.47
GI-WIL-32	Washago Pond SW	Pavement Removal	23,352	\$127,658	\$5.47
GI-WIL-34	Shelter H	Pavement Removal	7,000	\$38,267	\$5.47
GI-WIL-15	Activity Center	Porous Pavement	44,284	\$1,104,476	\$24.94
<b>Total:</b>			<b>384,705</b>	<b>\$1,500,032</b>	

Table 13. Willow Stream Stabilization Priorities

Stream Stabilization Site ID	Length (ft)	Erosion Severity	Recommended Treatment	Unit Cost (\$/ft)	Cost Opinion
<u>S3-WIL-002</u>	<u>167.08</u>	<u>High</u>	<u>Coir Block with Live Stakes</u>	<u>\$172</u>	<u>\$29,000</u>
<u>S3-WIL-001.2</u>	<u>146.07</u>	<u>Moderate</u>	<u>Coir Block with Live Stakes</u>	<u>\$172</u>	<u>\$26,000</u>
S3-WIL-004	336.76	Very High	Soil Lifts with Live Stakes	\$678	\$229,000
S3-WIL-003	5,104.15	High	Soil Lifts with Live Stakes	\$678	\$3,461,000
S3-WIL-001.1	263.31	High	Soil Lifts with Live Stakes	\$678	\$179,000
S3-WIL-005	92.10	High	Soil Lifts with Live Stakes	\$678	\$63,000
<b>Total:</b>					<b>\$3,987,000</b>

Table 14. Willow Shoreline Rehabilitation Priorities

Shoreline Restoration Site ID	Length (ft)	Recommended Treatment	Unit Cost (\$/ft)	Cost Opinion
SLR-WIL-001	307.86	D (Excavation, Soil Replacement, and Plant Restoration)	\$8	\$2,463